3-1-2006

Justification for Class III Permit Modification March 2006 SWMU 101 Operable Unit 1295 Building 9926/9926A Septic System and Seepage Pit (Coyote Test Field)

Sandia National Laboratories/NM

Sandia National Laboratories

Justification for Class III Permit Modification

March 2006

SWMU 101
Operable Unit 1295
Building 9926/9926A Septic System and Seepage Pit (Coyote Test Field)

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.

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

Sandia National Laboratories

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

EGIS Environmental Geographic Information System

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, 2005	**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)

Sandia National Laboratories

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

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	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	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.

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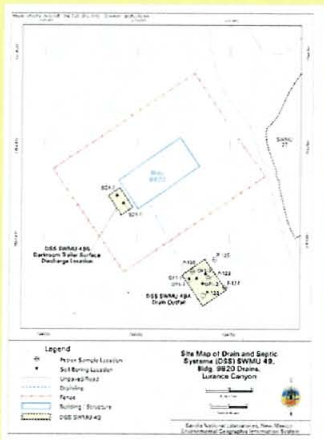

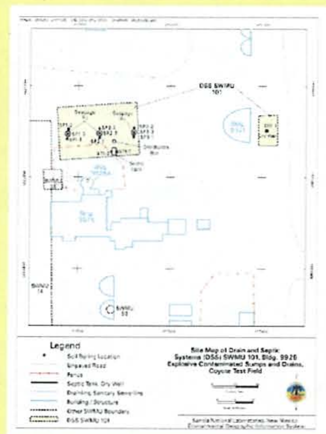

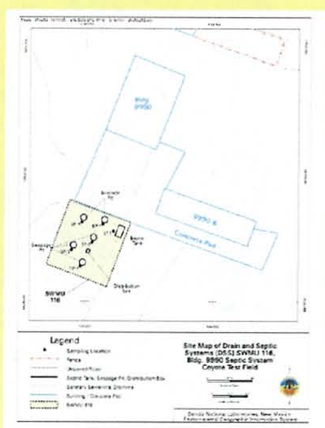

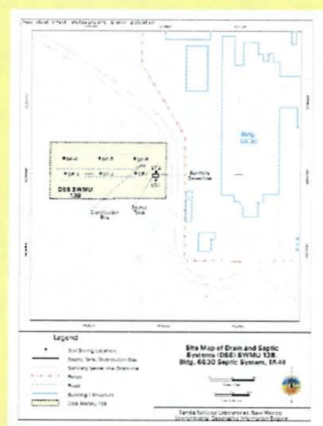

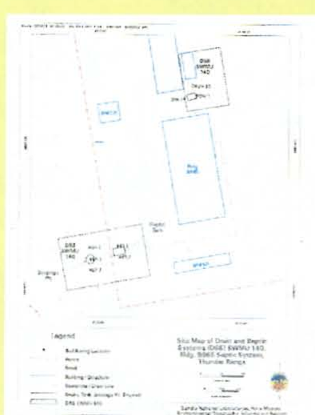

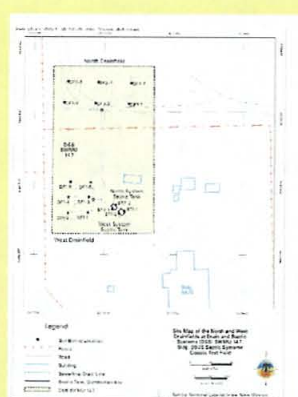

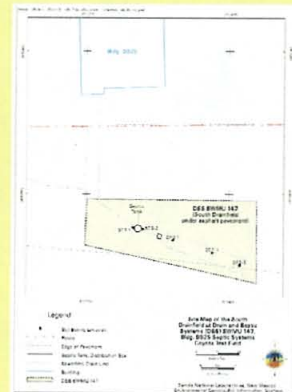

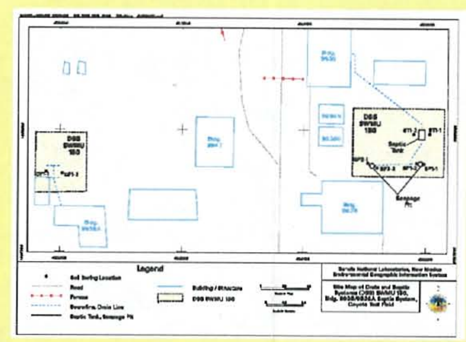

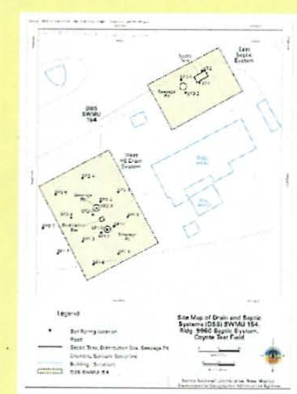

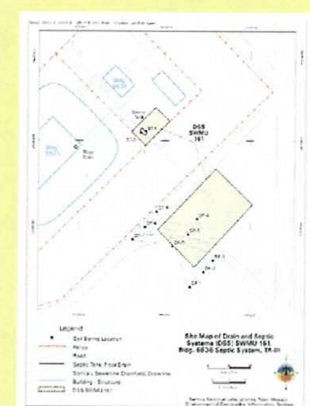

Drilling groundwater monitoring well CTF-MW3 west of SWMU 149

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 101
Operable Unit 1295
Building 9926/9926A Septic System and Seepage Pit (Coyote Test Field)

NFA Submitted July 1996
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NFA

ER/REQ'C3R

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

JUL 19 [illegible]

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)

cc w/o enclosure:
B. Oms, DOE/KAO
B. Hoditschek, NMED
B. Sweeney, NMED
D. Fate, SNL, MS 1148
C. Lojek, SNL, MS 1148
F. Nimick, SNL, MS 1147
T. Roybal, SNL, MS 1147
M. Davis, SNL, MS 1147

PROPOSAL FOR NO FURTHER ACTION ENVIRONMENTAL RESTORATION PROJECT

SITE 101, EXPLOSIVE CONTAMINATED SUMPS, DRAINS (BUILDING 9926) 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 101, Explosive Contaminated Sumps, Drains (Building 9926)

Sandia National Laboratories/New Mexico (SNL/NM) is proposing a no further action (NFA) decision based on confirmatory sampling for Environmental Restoration (ER) Site 101, Explosive Contaminated Sumps, Drains (Building 9926), Operable Unit (OU) 1295. ER Site 101 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 101 is based primarily on 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). If no SNL/NM or other relevant 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 taken from 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 101 soil sample analytical data indicate that concentrations of COCs at this site are less than (1) SNL/NM or other applicable background limits, or (2) proposed Subpart S or other action levels, or (3) derived risk assessment action levels.

ER Site 101 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 101 is located in the Coyote Test Field on KAFB and is approximately 0.3 miles east of Technical Area III (TA III). Access to the site is provided by paved and graded dirt roads that extend southwest from Lovelace Road, and north from Magazine Road (Figure 1-1). ER Site 101 consists of the immediate area around the three seepage pits and septic tank north of Building 9926, and also includes the Building 9921 drywell (Figure 1-2). The site encompasses approximately 0.13 acres of flat-lying land at an average mean elevation of 5,460 feet above mean sea level (AMSL).

The surficial geology at ER Site 101 is characterized by a veneer of aeolian sediments that are underlain by alluvial fan or alluvial deposits. 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 5,060 feet AMSL at this location, so depth to ground-water is approximately 400 feet. Local groundwater flow is believed to be in a generally west to northwest direction in the vicinity of this site (SNL/NM March 1995). The nearest production wells are northwest of the site and include KAFB-2, KAFB-4, KAFB-7, and KAFB-8 which are approximately 3.9 to 5.4 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. These wells are located approximately 0.7 miles southwest of ER Site 101 (SNL/NM June 1995).

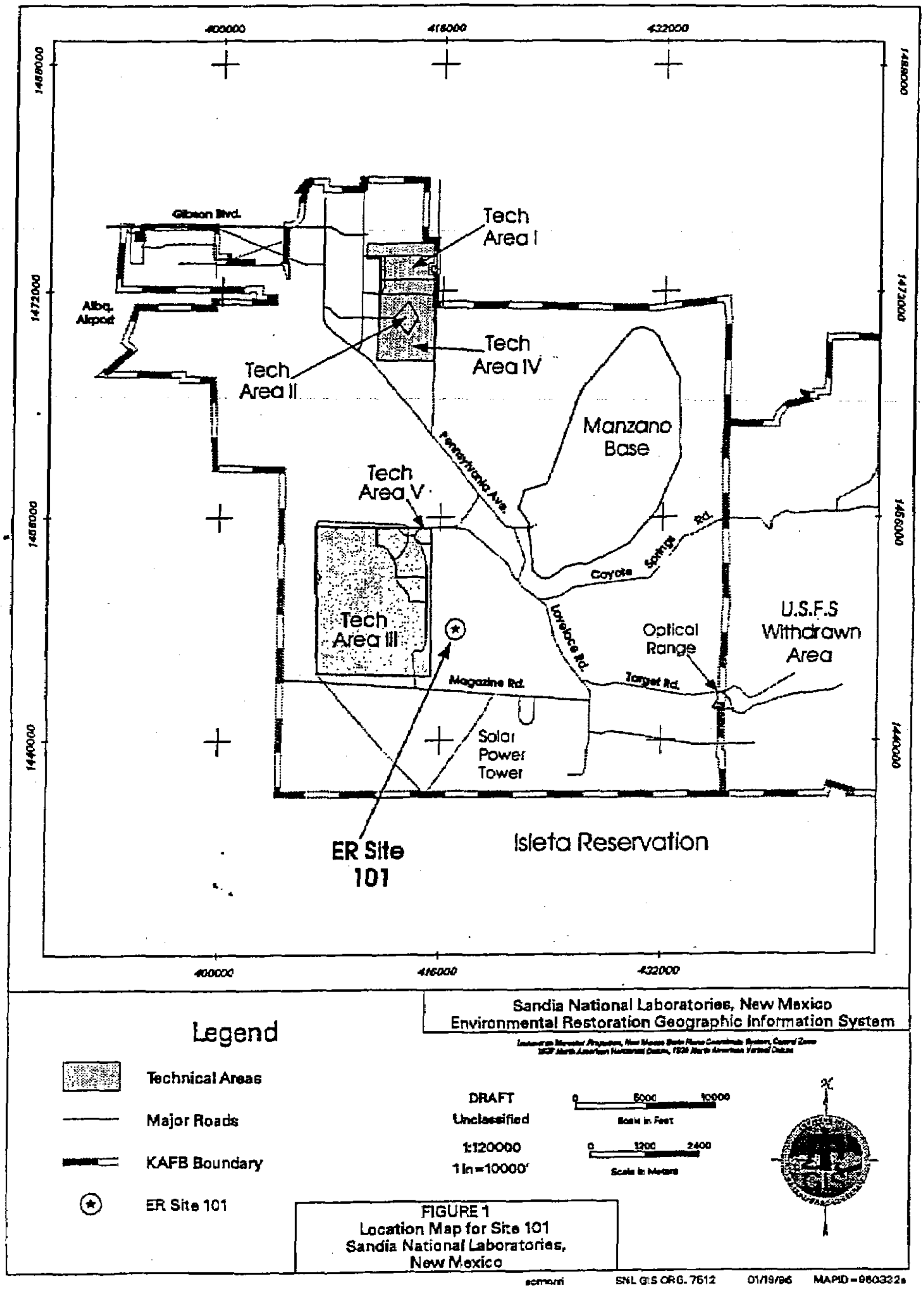

Figure 1-1: ER Site 101 Location Map

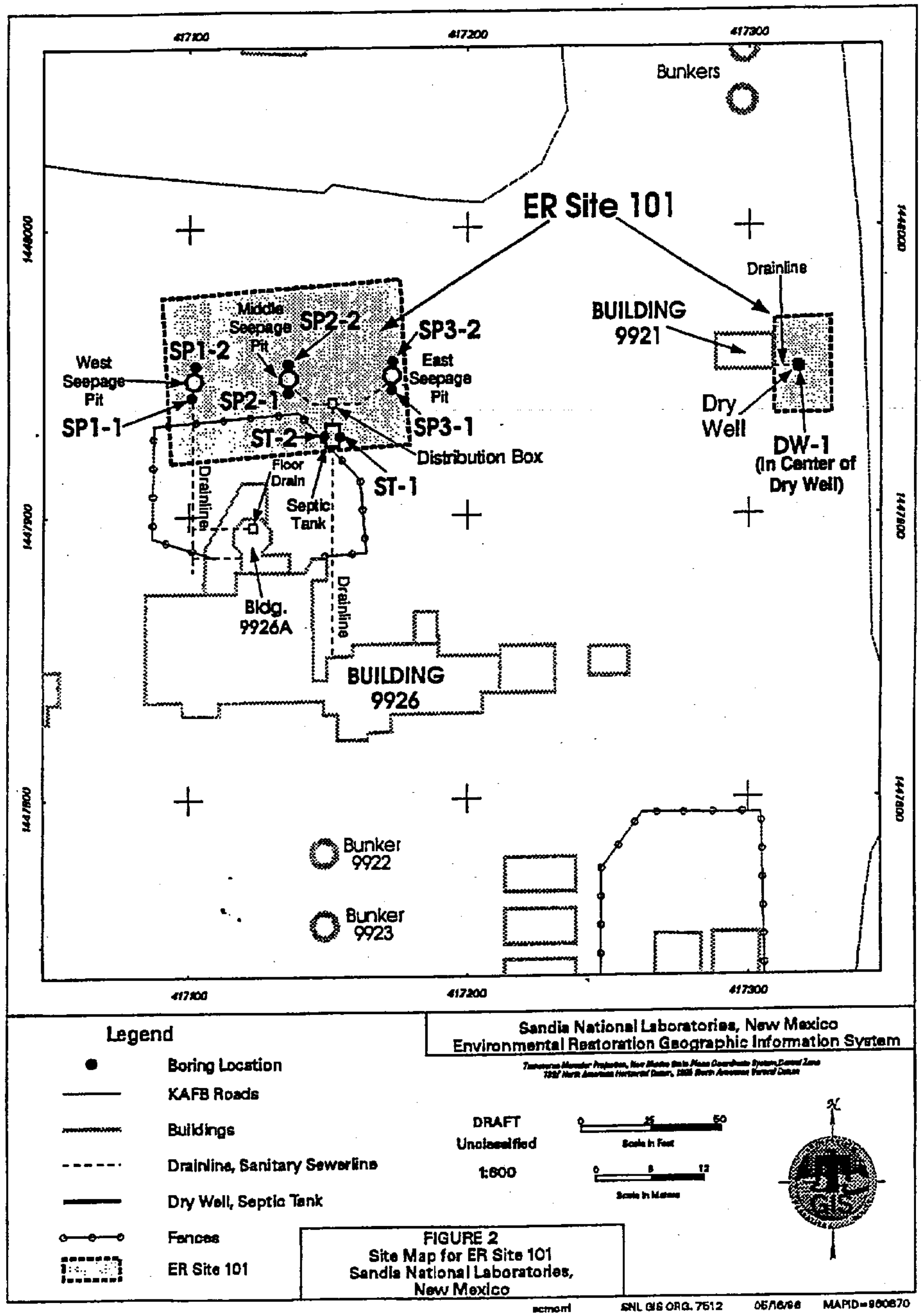

Figure 1-2: ER Site 101 Site Map

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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 101, 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 site operational history. The following sources of information, hierarchically listed with respect to assigned validity, were used to evaluate ER Site 101:

- Confirmatory subsurface soil sampling conducted in September and October 1994, and January 1995 (SNL/NM September 1994 and January 1995b);
- 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 in 1992 and 1994 (SNL/NM June 1993);
- RCRA Facilities 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 Geographic Information System (GIS) data; and
- The RCRA Facility Assessment (RFA) report (EPA April 1987).

2.2 Previous Audits, Inspections, and Findings

ER Site 101 was first listed as a potential release site in the Comprehensive Environmental Assessment and Response Program (CEARP) report (DOE September 1987), which noted (incorrectly) that Building 9920 had two septic tanks with drainfields that may have been contaminated with residual high explosives and small quantities of solvents. Building 9920 is at ER Site 146 (immediately west of ER Site 101), and there is only one septic tank, and no drainfield, at ER Site 101.

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 1994.

The original wing of Building 9926 was constructed in 1960 and was expanded in 1967 with the addition of the Shock Wave Studies Laboratory and the semi-attached explosives room, designated Building 9926A (Figure 2-2). There are two restrooms in the two sections of Building 9926, which, along with indoor floor drains and sinks, discharge to an 875 gallon septic tank and 2 seepage pits 5 feet in diameter and 16 feet below grade. The original wing of Building 9926 contained a darkroom and a chemical laboratory. The darkroom had a floor drain and sink that may have received photoprocessing waste solutions. The laboratory had a fume hood sink, which may have discharged solvents such as methanol, TCE, and toluene to the septic system. Other cleaning fluids were used in small quantities, probably less than 0.5 gal per year per substance, and include hydrochloric, nitric, and sulfuric acids, acetone, and isopropyl alcohol. The Building 9926 septic system was removed from service by June 1991 when the TA-3 sewer system was constructed (SNL/NM June 1991).

Building 9926A is used for exploding 5 pound charges for shock wave studies, and explosive tests have involved the use of cadmium sulfide. Building 9926A has a floor drain that discharged to a separate seepage pit located west of the other two; this seepage pit is also 5 feet in diameter and is 12 feet below grade (Figure 2-2). The Building 9926A floor drain system reportedly never functioned properly, and the room is dry swept rather than hosed down.

In addition, a small explosives storage igloo, designated Building 9921, is located northeast of Building 9926. Explosives handled in the building include nitroguanidine and PETN. Building 9921 contains an explosive room with a sink which discharged to a drywell located 8 feet east of the southeast corner of the building (Figure 2-2).

3. EVALUATION OF RELEVANT EVIDENCE

3.1 Unit Characteristics

There are no safeguards inherent in the drain systems from Buildings 9926, 9926A, or 9921, 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 9926 septic tank and seepage pits when the septic system was active. Hazardous wastes were not managed or contained at ER Site 101.

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 around the seepage pits and septic tanks in September and October 1994 (SNL/NM September 1994), or beneath the drywell in January 1995 (SNL/NM January 1995b).

3.4 Results of Previous Sampling/Surveys

A sludge sample was collected from the ER Site 101 septic tank in August 1992 and was analyzed for selected radionuclide constituents. The brief narrative report for that sample indicated that "...no parameters were detected that exceeded U.S. Department of Energy derived concentration guidelines or the investigation levels established during this investigation." (SNL/NM June 1993). Apparently no liquid fraction remained in the tank when the sample was collected. The analytical results of this sample are presented in Appendix A.1.

A second round of septic tank sludge samples were collected for waste characterization purposes in April 1994 and were analyzed for volatile organic compounds (VOCs), explosives, cyanide, and RCRA total and Toxicity Characteristic Leaching Procedure (TCLP) metals. Trace concentrations of seven VOC compounds were identified in the material. Explosive compounds and cyanide were not detected. All eight RCRA metals were detected in two separate samples of the sludge, but only one out of eight metals was detected in the TCLP-derived leachate from two samples of the same material. The analytical results of the second round of septic tank samples are presented in Appendix A.2.

A third round of waste characterization sludge samples were collected in November 1994 and were analyzed for semivolatile organic compounds (SVOCs), isotopic uranium, and tritium. No SVOCs were detected. Low activity levels of the three isotopic uranium radionucludes and tritium were detected in the material. The analytical results of the third round of septic tank sludge characterization samples are also presented in Appendix A.2.

A geophysical survey using a magnetic locator was performed at the site in March 1994 to attempt to locate the Building 9921 drywell (Lamb 1994). An area approximately 20 feet south of Building 9921 was identified as the possible location of the unit, but the actual location was later determined with a backhoe to be east of the building (SNL/NM January 1995a). No attempt was made to use geophysical techniques to identify areas with high moisture content, since discharges of significant volumes of effluent did not occur at this site.

The passive soil-gas survey conducted in June and July 1994 used PETREX™ sampling tubes to identify any releases of VOCs and SVOCs from the seepage pit that may have occurred. A PETREX™ tube soil-gas survey is a semi-quantitative screening procedure that can be used to identify many volatile and semivolatile organic compounds. 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).

Thirty-four PETREX™ tube samplers were placed in a grid pattern that covered the area around the seepage pits and septic tank, and also covered the area between the seepage pits and the unpaved site access road which lies about 30 feet north of the seepage pits (SNL/NM June 1994). Aliphatic and/or BTEX compounds at potentially detectable concentrations were identified in soil gas at 6 of the 34 sampling locations. Five out of six of these locations were in or next to the access road, and the sixth location was between the road and the central seepage pit. PCE was also identified in soil-gas above 100,000 ion counts in one of the five roadway locations. Significant levels of VOCs in soil-gas were not detected in PETREX™ tubes placed closest to the seepage pits or septic tank. A map showing the PETREX™ tube sampling locations, and the analytical results of the ER Site 101 passive soil gas survey, are presented in Appendix A.3.

3.5 Assessment of Gaps in Information

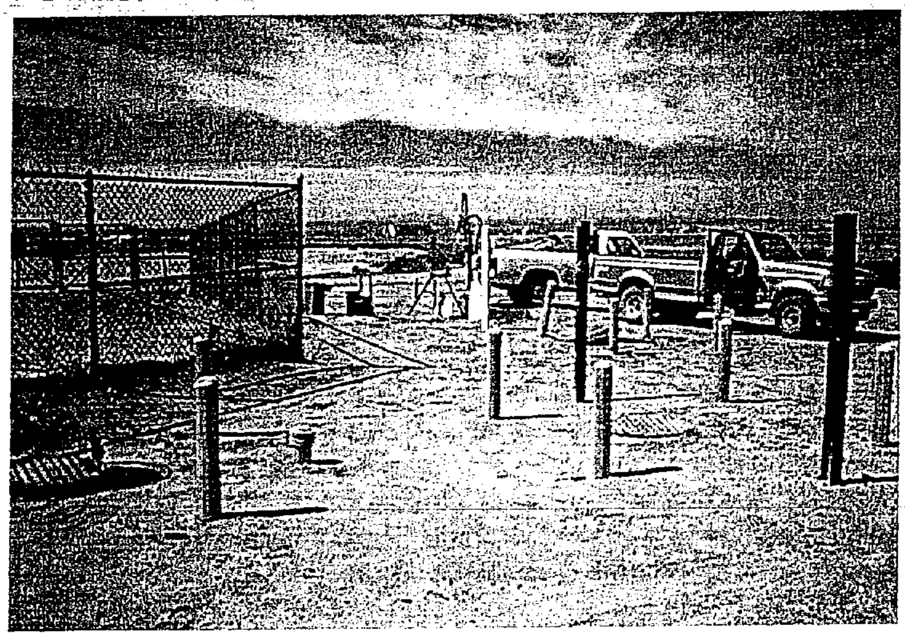
The most recent material in the tank was not necessarily representative of all discharges to the unit that have occurred since it was put into service in 1960. The analytical results of the various rounds of septic tank sampling were used, along with process knowledge and other available information, to help identify the most likely COCs that might be found in soils surrounding the septic tank and seepage pits, and beneath the drywell, 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 September and October 1994 and January 1995 (discussed below) are sufficient to determine whether releases of COCs occurred at the site.

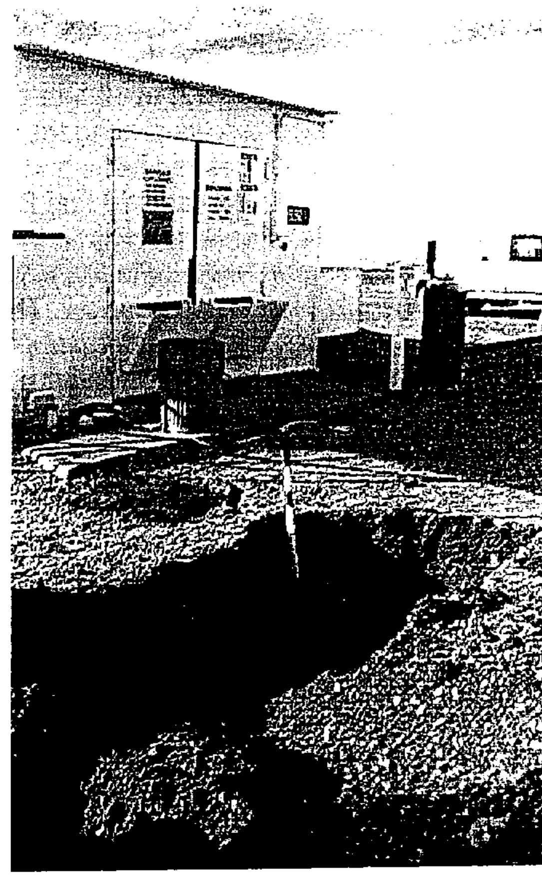
3.6 Confirmatory Sampling

Although the likelihood of hazardous waste releases at ER Site 101 was considered low, confirmatory soil sampling was conducted to determine whether COCs above background or detectable levels were released at this site. Samples were collected from the area immediately around the three seepage pits and the septic tank in September and October 1994 (SNL/NM September 1994) (Figure 1-2). This sampling operation is shown in the upper photograph of Figure 3-3. In January 1995 a backhoe was used to determine the precise location, dimensions, and depth of the Building 9921 drywell, which had no surface expression. The drywell excavation operation is shown in the lower photograph of Figure 3-3. Once this small drywell was located, soil samples were collected directly beneath it from a single borehole located in the center of the unit (SNL/NM January 1995a and 1995b). 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 1994).

Soil samples were collected from two borings located on opposite sides of the three seepage pits, and on opposite sides of the septic tank, in September and October 1994 (Figure 2-2). In each seepage pit boring two depth intervals were sampled, the first starting at the bottom of the seepage pit, and the second at 10 feet below the top of the first sampling interval. The shallow and deep sampling intervals around the west seepage pit started at 12 and 22 feet below ground surface (BGS) respectively, and shallow and deep intervals around the middle and east seepage pits started at 16 and 26 feet BGS respectively. In each of the two septic tank borings, one depth interval starting at the bottom of the septic tank (9 feet BGS) was sampled (SNL/NM September 1994). Finally, in January 1995 soil samples were collected from one borehole directly beneath the drywell. The shallow sampling interval started at the bottom of the drywell at 4 feet BGS, and the deeper interval started at 10 feet below the top of the upper interval, or 14 feet BGS (SNL/NM January 1995b). 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.



Collecting soil samples around the ER Site 101 Seepage Pits north of Building 9926 with the Geoprobe sampling equipment. 10/3/94.



Excavation of the Building 9921 drywell to determine the location and depth of the drywell gravel. 1/11/95. View looking north-west.

Figure 3-1 : ER Site 101 Photographs

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, one or two more two-foot sampling runs were completed at each interval 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.

Seepage pit and septic tank samples were analyzed for VOCs, SVOCs, cyanide, RCRA metals, and hexavalent chromium by an offsite commercial laboratory. Drywell samples were analyzed by an offsite commercial laboratory for VOCs, SVOCs, and RCRA metals. Samples were shipped to the offsite commercial laboratories by an overnight delivery service. Additional soil samples were collected from the seepage pits and septic tank sampling intervals and were submitted to the SNL/NM ER field laboratory (field laboratory) for TNT analyses using a field screening immunoassay technique, and soil pH determinations. TNT-screen samples were also collected from both of the drywell sampling intervals and were submitted to the field lab for analysis. Also, to determine if radionuclides were released from past activities at this site, two composite samples were collected from the west seepage pit shallow and deep sampling intervals, and two more composite samples were collected from the middle and east seepage pit shallow and deep intervals. These composite samples were analyzed by an offsite commercial laboratory for isotopic uranium, and were screened for other radionuclides using SNL/NM in-house gamma spectroscopy. Soil samples were also collected from the drywell intervals and were analyzed by an offsite commercial laboratory for isotopic uranium and tritium, 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.

Table 3-1
ER Site 101: 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
West seepage pit	VOCs	2	12', 22'	4		9/28,29/94
	SVOCs	2	12', 22'	4		
	RCRA metals + Cr^{6+}	2	12', 22'	4		
	Cyanide	2	12', 22'	4		
	TNT screen	2	12', 22'	4		
	Soil pH	2	12', 22'	4		
	Iso. uranium composite	2	12', 22'	2		
	Gamma spec. composite	2	12', 22'	2		
Middle and east seepage pits	VOCs	4	16', 26'	8	1	9/29/94 - 10/3/94
	SVOCs	4	16', 26'	8	1	
	RCRA metals + Cr^{6+}	4	16', 26'	8	1	
	Cyanide	4	16', 26'	8	1	
	TNT screen	4	16', 26'	8	1	
	Soil pH	4	16', 26'	8	1	
	Iso. uranium composite	4	16', 26'	2		
	Gamma spec. composite	4	12', 22'	2		
Septic tank	VOCs	2	9'	2		10/3/94
	SVOCs	2	9'	2		
	RCRA metals + Cr^{6+}	2	9'	2		
	Cyanide	2	9'	2		
	TNT screen	2	9'	2		
	Soil pH	2	9'	2		
Building 9921 drywell	VOCs	2	4', 14'	2		1/11/95
	SVOCs	2	4', 14'	2		
	RCRA metals	2	4', 14'	2		
	TNT screen	2	4', 14'	2		
	Isotopic uranium	2	4', 14'	2		
	Tritium	2	4', 14'	2		
	Gamma spectroscopy	2	4', 14'	2		

Notes
Cr^{6+} = Hexavalent chromium
Iso. = Isotopic
RCRA = Resource Conservatio
Spec. = Spectroscopy
SVOCs = Semivolatile organic c
VOCs = Volatile organic compo
TNT = Trinitrotoluene

↑ GAMMA SPEC SPLS COLLECTED 7/6/95 (APP A.4)

Quality assurance/quality control (QA/QC) samples collected during this effort consisted of one set of duplicate soil samples from one of the shallow sampling intervals in the center seepage pit (Figure 1-2) and one set of aqueous equipment rinsate samples that were analyzed for most of the same non-radiologic constituents as the other seepage pit soil samples. No significant concentrations of COCs were detected in the equipment blank samples, and the concentrations of constituents detected in the duplicate soil sample were in good agreement with those detected in the equivalent field sample from the same interval. Also, soil trip blank samples were included with each of the three shipments of ER Site 101 seepage pit and septic tank soil samples to the offsite laboratory and were analyzed for VOCs only. Three or more of the following compounds were detected in each of the trip blanks: acetone, 2-hexanone, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), methylene chloride, and toluene. These common laboratory contaminants were either not detected, or were found in lower concentrations in the site samples than the trip blanks. Soil used for the trip blanks 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.

A summary of all constituents detected by either commercial laboratory analyses or by the SNL/NM field laboratory in these confirmatory samples is 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.4 through A.9. 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 October 1994).

3.7 Risk Analysis

As shown in Table 3-4, tritium was detected in soil moisture from the shallow interval drywell sample at an activity level of 490 picocuries per liter (pCi/L), and was not detected in the deep interval sample from beneath this unit. Background tritium activity levels in SNL/NM soils were not evaluated as part of the SNL/NM background study completed in March 1996 (IT March 1996). The soil moisture contained in shallow soil samples such as these represents either infiltrated precipitation, or water discharged from the Building 9921 sink to the drywell. It is therefore appropriate to compare the tritium activity level detected in the sample soil moisture to naturally occurring tritium levels found in precipitation or drinking water samples. The tritium activity level of 490 pCi/L detected in this sample was compared to and was found to be slightly above the naturally occurring tritium activity range of 100 to 300 pCi/L found in precipitation samples collected from locations throughout the U.S., and 100 to 400 pCi/L in drinking water samples collected from locations around the country (EPA October 1993). A risk assessment was therefore performed to further evaluate this tritium activity level. The risk calculation was designed to produce a conservatively large estimate of radiation dose to counter uncertainties in the soil analytical data.

Table 3-2

ER Site 101

Summary of Organic and Other Constituents, and pH Measurements in Confirmatory Soil Samples Collected Around the Seepage Pits, Septic Tank, and Drywell

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	VOCs Method 8240						SVOCs Method 8270		Cyanide Method 9010/ 9012	TNT Screen Colorimetric method based on EPA 8515	Units	Soil pH ASTM Method 4972 (pH units)
						Acetone	2-Hexanone	MEK	MIBK	Meth. Chloride	Toluene	Phenanthrene	Chrysene				
Seepage Pits Soil Samples:																	
017943-1,2	Soil	Field	9/28/94	SP1-1	12	ND	ND	ND	ND	2 J	ND	ND	ND	ND	ND	ug/kg	8.3
017945-1,2	Soil	Field	9/29/94	SP1-1	22	ND	ND	ND	ND	1.9 J	ND	ND	ND	1,200	ND	ug/kg	8.3
017946-1,2	Soil	Field	9/29/94	SP1-2	12	ND	ND	ND	ND	2.3 J	ND	ND	ND	710	ND	ug/kg	8.5
017947-1,2	Soil	Field	9/29/94	SP1-2	22	ND	ND	ND	ND	2.3 J	ND	ND	ND	ND	ND	ug/kg	8.4
017948-1,2	Soil	Field	9/29/94	SP2-1	16	ND	ND	ND	ND	2.8 J	ND	ND	ND	ND	ND	ug/kg	8.2
017950-1,2	Soil	Dupl.	9/29/94	SPD2-1	16	ND	ND	ND	ND	3.1 J	ND	ND	ND	ND	ND	ug/kg	8
017949-1,2	Soil	Field	9/29/94	SP2-1	26	ND	ND	ND	ND	2.7 J	ND	ND	ND	ND	ND	ug/kg	8.6
017952-1,2	Soil	Field	10/3/94	SP2-2	16	7.9 J	ND	ND	ND	1.6 J	2.4 J	ND	ND	ND	ND	ug/kg	7.8
017953-1,2	Soil	Field	10/3/94	SP2-2	26	ND	ND	ND	ND	1.9 J	8.2	ND	ND	ND	ND	ug/kg	7.9
017956-1,2	Soil	Field	10/3/94	SP3-1	16	ND	ND	ND	ND	1.8 J	11	ND	ND	ND	ND	ug/kg	7.6
017957-1,2	Soil	Field	10/3/94	SP3-1	26	ND	ND	ND	ND	1.2 J	ND	ND	ND	ND	ND	ug/kg	7.9
017958-1,2	Soil	Field	10/3/94	SP3-2	16	7.3 J	ND	ND	ND	1.1 J	5	ND	ND	ND	ND	ug/kg	7.6
017959-1,2	Soil	Field	10/3/94	SP3-2	26	5 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ug/kg	7.8
017944-1	Soil	TB	9/28/94	Site 101	NA	11	ND	ND	ND	4.7 J	1.3 J	NS	ND	NS	NS	ug/kg	NS
017951-1	Soil	TB	9/29/94	Site 101	NA	ND	2.1 J	ND	1.2 J	4 J	ND	NS	ND	NS	NS	ug/kg	NS
Septic Tank Soil Samples:																	
017954-1,2	Soil	Field	10/3/94	ST-1	9	7.7 J	ND	ND	ND	1.5 J	6.1	34 J	42 J	ND	ND	ug/kg	7.7
017955-1,2	Soil	Field	10/3/94	ST-2	9	6.6 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ug/kg	8
017960-1	Soil	TB	10/3/94	Site 101	NA	25	ND	3 J	ND	2.5 J	2.3 J	NS	NS	NS	NS	ug/kg	NS
017965-1,2,4	Water	EB	10/4/94	Site 101	NA	6.6 J	ND	ND	ND	1.2 J	ND	ND	ND	ND	NS	ug/L	NS

Table 3-2, concluded:

ER Site 101
Summary of Organic and Other Constituents, and pH Measurements in Confirmatory Soil Samples
Collected Around the Seepage Pits, Septic Tank, and Drywell

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	VOCs Method 8240						SVOCs Method 8270		Cyanide Method 9010/ 9012	TNT Screen Colorimetric method based on EPA 8515	Units	Soil pH ASTM Method 4972 (pH units)
						Acetone	2-Hexanone	MEK	MIBK	Meth. Chloride	Toluene	Phenanthrene	Chrysene				
Drywell Soil Samples:																	
018907-1,2	Soil	Field	1/11/95	DW-1	4	6.8 J	ND	ND	ND	1.7 J	ND	ND	ND	NS	ND	ug/kg	NS
018908-1,2	Soil	Field	1/11/95	DW-1	14	14	ND	ND	ND	1.5 J	ND	ND	ND	NS	ND	ug/kg	NS
Laboratory Reporting Limit For Soil						10	10	10	10	5	5	330	330	500	1,000	ug/kg	
Laboratory Reporting Limit For Water						10	10	10	10	5	5	10	10	10	NA	ug/L	
Proposed Subpart S Action Level For Soil						8E+06	None	5E+07	4E+06	9E+04	2E+07	2.4E+07	9.6E+03	2E+06	4E+04	ug/kg	

Notes
Dupl. = Duplicate soil sample
EB = Equipment rinsate blank
fbgs = feet below ground surface
J = Result is detected below the reporting limit or is an estimated concentration.
MEK = Methyl ethyl ketone, or 2-Butanone
Meth. chloride = Methylene chloride
MIBK = Methyl isobutyl ketone, or 4-methyl-2-pentanone
NA = Not applicable
ND = Not detected
NS = No sample
SVOCs = Semivolatile organic compounds
TB = Trip blank
TNT = Trinotrotoluene
VOCs = Volatile organic compounds

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Table 3-3

ER Site 101

Summary of RCRA Metals and Hexavalent Chromium in Confirmatory Soil Samples
Collected Around the Seepage Pits, Septic Tank, and Drywell

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	RCRA Metals, Methods 6010 and 7471								Other Metals: Cr^{6+} Method 7196	Units
						As	Ba	Cd	Cr, total	Pb	Hg	Se	Ag		
Seepage Pits Soil Samples:															
017943-2	Soil	Field	9/28/94	SP1-1	12	2.7	112	ND	8.2	7.2	ND	0.58	ND	ND	mg/kg
017945-2	Soil	Field	9/29/94	SP1-1	22	2.4	52.6	ND	7.8	6.1	ND	ND	ND	ND	mg/kg
017946-2	Soil	Field	9/29/94	SP1-2	12	2.3	88.1	ND	23.6	6.4	ND	ND	ND	ND	mg/kg
017947-2	Soil	Field	9/29/94	SP1-2	22	2.1	51.7	ND	8.3	7.3	ND	ND	ND	ND	mg/kg
017948-2	Soil	Field	9/29/94	SP2-1	16	3	85.8	ND	8.7	5.7	ND	ND	ND	ND	mg/kg
017950-2	Soil	Dupl.	9/29/94	SPD2-1	16	3.2	79.6	ND	8.8	7.1	ND	ND	ND	ND	mg/kg
017949-2	Soil	Field	9/29/94	SP2-1	26	2.3	59.1	ND	9.2	6.6	ND	ND	ND	ND	mg/kg
017952-2	Soil	Field	10/3/94	SP2-2	16	2.6	115	ND	9.1	5.6	ND	ND	ND	ND	mg/kg
017953-2	Soil	Field	10/3/94	SP2-2	26	2.4	73.3	ND	8.9	6.6	ND	ND	ND	ND	mg/kg
017956-2	Soil	Field	10/3/94	SP3-1	16	3.1	80.4	ND	7.3	9.9	ND	1.3	ND	ND	mg/kg
017957-2	Soil	Field	10/3/94	SP3-1	26	2.2	97.8	ND	7.9	6.3	ND	ND	ND	ND	mg/kg
017958-2	Soil	Field	10/3/94	SP3-2	16	2	90.5	ND	9.5	5.4	ND	ND	ND	ND	mg/kg
017959-2	Soil	Field	10/3/94	SP3-2	26	2.1	58.3	ND	18.1	6.1	ND	ND	ND	ND	mg/kg
Septic Tank Soil and QA Samples:															
017954-2	Soil	Field	10/3/94	ST-1	9	2.8	96.4	ND	8.8	7.1	ND	ND	ND	ND	mg/kg
017955-2	Soil	Field	10/3/94	ST-2	9	2.8	150	ND	9.8	9.3	ND	ND	ND	ND	mg/kg
017965-3	Water	EB	10/4/94	Site 101	NA	ND	0.01	ND	0.0051 J	0.0037	ND	ND	ND	NS	mg/L
Drywell Soil Samples:															
018907-2	Soil	Field	1/11/95	DW-1	4	2.5	114	ND	5.3	4.4 J	ND	ND	ND	NS	mg/kg
018908-2	Soil	Field	1/11/95	DW-1	14	2.4	131	ND	6.7	5.1	ND	ND	ND	NS	mg/kg
Laboratory Reporting Limit For Soil						1	1	0.5	1	5	0.1	0.5	1	0.05 - 0.1	mg/kg
Laboratory Reporting Limit For Water						0.01	0.01	0.005	0.01	0.003	0.0002	0.005	0.01	NA	mg/L
Number of SNL/NM Background Soil Sample Analyses *						15	727	1,740	647	536	1,724	2,134	2,302	393	NA
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	0.02-<2.5	mg/kg
SNL/NM Soil Background UTL or 95th Percentile *						7	214	0.9	15.9	11.8	<0.1	<1.0	<1.0	<2.5	mg/kg
Proposed Subpart S Action Level For Soil						0.50	6,000	80	80,000 **	400 ***	20	400	400	400 **	mg/kg

Table 3-3, concluded:

ER Site 101
Summary of RCRA Metals and Hexavalent Chromium in Confirmatory Soil Samples Collected Around the Seepage Pits, Septic Tank, and Drywell

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.
Be = Beryllium. Beryllium background concentrations presented above are based on analyses of surface and subsurface samples collected in the Southwest, CTF, and Offsite 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.
Cr^{6+} = Hexavalent chromium. Hexavalent chromium background concentrations presented above are based on analyses of surface and subsurface soil samples collected in the Southwest area.
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.

CTF = Coyote Test Field
Dupl. = Duplicate soil sample
EB = Equipment rinsate blank
fbgs = Feet below ground surface
J = Result is detected below the reporting limit or is an estimated concentration.
NA = Not applicable
ND = Not detected
QA = Quality assurance
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 101
Summary of Isotopic Uranium and Tritium in Confirmatory Soil Samples
Collected Around the Seepage Pits and Drywell

Sample Number	Sampl Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	Isotopic Uranium Method EPI A-011B for seepage pit samples, and Method HASL-300 for drywell samples (pCi/g) 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 *	D.L.
Seepage Pits Composite Soil Samples:																	
023854-1	Soil	Compos.	9/28/94	SP1-1/2	12	0.864	0.125	0.09	0.036 J	0.020	0.09	0.83	0.121	0.09			
023855-1	Soil	Compos.	9/29/94	SP1-1/2	22	0.646	0.115	0.09	0.031 J	0.022	0.09	0.663	0.116	0.09			
023856-1	Soil	Compos.	9/29/94	SP2,3-1/2	16	0.623	0.1	0.09	0.034 J	0.02	0.09	0.547	0.092	0.09			
023857-1	Soil	Compos.	10/3/94	SP2,3-1/2	26	1.73	0.245	0.09	0.066 J	0.0391	0.09	1.65	0.237	0.09			
Drywell Soil Samples:																	
018907-4,5	Soil	Field	1/11/95	DW-1	4	1.1	0.19	0.039	0.052	0.032	0.013	1	0.17	0.034	490	190	300
018908-4,5	Soil	Field	1/11/95	DW-1	14	1	0.24	0.13	0.011	0.047	0.095	1	0.23	0.075	ND	150	250
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 238 background concentrations presented above are based on analyses of surface and subsurface soil samples collected in the Southwest area.

Compos. = Composite
CTF = Coyote Test Field
fbgs = Feet below ground surface
J = Result is detected below the reporting limit or is an estimated concentration.
M.D.A. = Minimum detectable activity
ND = Not detected
pCi/g = Picocuries per gram
pCi/L = Picocuries per liter
U = Undefined for SNL/NM soils
UTL = Upper Tolerance Limit
* Error = +- 2 sigma uncertainty
** IT March 1996
*** EPA October 1993

The PIP in Appendix J, Section 1.3.6 stipulates that, for the purpose of computing media action levels, the total radiation dose at a site should not be greater than 15 millirem/year (mrem/yr) (SNL/NM February 1995). 15 mrem/yr is also the maximum annual effective dose for all pathways that is being considered in the preliminary staff working draft of the EPA Radiation Site Cleanup regulation (EPA 1994). Therefore,

- if the dose estimate is unacceptable (greater than 15 mrem/yr), further investigation and remediation may be needed; or
- if the dose estimate is acceptable, the potential for health hazards at the site is extremely low, and further remedial actions are not needed.

The dose estimate for the tritium activity level cited above was computed using methods and equations promulgated in proposed Subpart S documentation (EPA July 1990). Accordingly, all calculations were based on the very conservative assumption that the receptor dose from radionuclides results from ingestion of 0.2 grams per day of contaminated soil for each of the 365 days in a year.

Calculation of radionuclide doses requires values of dose conversion factors for internal radiation from ingestion [(DCF(i)], which are used to convert radionuclide activities (in units of picocuries per gram [pCi/g]) into effective dose equivalents (in units of mrem/yr). A published DCF(i) value was found for tritium (0.000000063 [6.3E-08] mrem/pCi) (Gilbert et al., 1989); this DCF(i) value was used in the risk calculation.

To assure that the computed doses were conservatively large, the maximum observed activity of tritium detected at this site (490 pCi/L) was employed in the risk calculation. Analytical results for tritium in soil moisture are reported by the laboratory in units of pCi/L, and must be converted to units of pCi/g for the risk calculation presented below. The following conversion calculation was used:

Specified by the laboratory: 750 grams of sample, 7.4% by weight soil moisture in sample, tritium result of 490 pCi/L in soil moisture (SNL/NM January 1995c)

(1) 490 pCi/L x 1 L/1000 g = 0.49 pCi/g of soil moisture;

(2) 750 grams of sample x 0.074 = 55.5 g of soil moisture in sample;

(3) 55.5 g of soil moisture x 0.49 pCi/g in soil moisture = 27.19 pCi of tritium activity in the 750 g soil sample; and

(4) 27.19 pCi in 750 g of soil sample = 0.036 pCi/g for drywell soil

Following proposed Subpart S methodology, the equation and parameter values used to calculate the summed radiation dose were:

$$DOSE = \sum[DSR(i) \times S(i)]$$

where: DOSE = total effective dose equivalent (mrem/yr);
DSR(i) = dose-to-soil concentration ratio for the i^{th} radionuclide = I x DCF(i), where:
I = soil ingestion rate = 0.2 grams/day = 73 grams/year; and
DCF(i) = internal radiation dose conversion factor for the ith radionuclide (mrem/pCi),
S(i) = soil concentration of the ith radionuclide (pCi/g)

The results of the radionuclide risk calculations show that the radiation dose (1.7E-07 mrem/yr) from the highest tritium activity detected (490 pCi/L, or 0.036 pCi/g) is much less than 15 mrem/yr. Therefore, the site is considered to be risk-free in terms of radionuclide contamination.

3.8 Rationale for Pursuing a Risk-Based NFA Decision

As discussed in Section 3.4, the passive soil gas survey identified potentially detectable concentrations of aliphatic and BTEX compounds at 6 of the 34 PETREX™ soil-gas sampling locations at this site. PCE was also identified in soil-gas above 100,000 ion counts at one of the six locations. Potentially detectable levels of VOCs in the soil were detected only at PETREX™ locations in or near the dirt access road to the site or in areas used for vehicle parking. Significant levels of VOCs in soil-gas were not detected in PETREX™ tubes placed closest to the seepage pits or septic tank, and SVOCs were not detected in soil gas at any of the sampling locations. Confirmatory soil samples were not collected in road or parking areas where VOCs (mainly BTEX) were identified in PETREX™ tubes because it was apparent that the compounds (if present in soils) originated from vehicles using at the site, rather than from the seepage pits or septic tank.

Confirmatory soil sampling around the seepage pits and septic tank, and beneath the drywell 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 three VOC compounds (acetone, methylene chloride, and toluene), which are common laboratory contaminants, were detected in soil samples collected from this site. Two SVOC constituents (phenanthrene and chrysene) were detected at below reporting limit concentrations in one of the soil samples collected next to the septic tank, and no SVOC compounds were found in any of the other samples collected at this site. The detected concentrations of phenanthrene and chrysene were well below proposed Subpart S action levels for these compounds. Cyanide was detected in one of the shallow and one of the deep interval soil samples collected around the west seepage pit at concentrations of 1,200 and 710 micrograms per kilogram (ug/kg) respectively. These concentrations are much lower than the proposed Subpart S action level of 2,000,000 ug/kg for this constituent. Cyanide was not identified in any of the other seepage pit or septic tank soil samples. TNT was not detected in any of the seepage pit, septic tank, and drywell soil samples, and soil pH measurements of material collected from the seepage pits and septic tank sampling intervals ranged from neutral to slightly alkaline.

As shown on Table 3-3, soil sample analytical results indicate that the nine metals that were targeted in the Site 101 investigation were either (1) not detected, or (2) were detected in concentrations below the background UTL or 95th percentile concentrations presented in the draft SNL/NM study of naturally-occurring constituents (IT March 1996), or (3) were less than the proposed Subpart S action levels for these metals.

Isotopic uranium activity levels that were detected in the soil samples were found to be below the corresponding 95th percentile background activity levels presented in the IT March 1996 report for those radionuclides (Table 3-4). The tritium activity level detected in the drywell shallow interval sample was determined to result in a radiation dose much lower than the maximum acceptable radiation dose of 15 mrem/yr at a site presented in the PIP (SNL/NM February 1995). Also, the gamma spectroscopy semi-qualitative screening of shallow and deep interval composite soil samples did not indicate the presence of contamination from other radionuclides in soils at this site (Appendices A.4 through A.9).

Finally, the ER Site 101 septic tank contents were removed and the tank was cleaned in November 1995 (SNL/NM November 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 had been 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 101, 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 seepage pits and septic tank, and beneath the drywell, SNL/NM has demonstrated that hazardous waste or COCs were not released from this SWMU into the environment (Criterion 5 of Section 1.2), and the site does not pose a threat to human health or the environment. Therefore, ER Site 101 is recommended for an NFA determination.

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Appendix A

OU 1295, Site 101
Results of Previous Sampling and Surveys

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Appendix A.1

ER Site 101
Summary of Constituents Detected in 1992 Septic Tank Samples

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ER Site 101
Summary of Constituents Detected in 1992 Septic Tank Samples

Buildings 9926 and 9920
Coyote Test Field
Sample ID No. SNLA008592
Tank ID No. NRN

On August 18, 1992, a sludge sample was collected from the septic tank serving Buildings 9926 and 9920 for radiochemical analysis. During review of the radiological data, no parameters were detected that exceeded U.S. Department of Energy derived concentration guidelines or the investigation levels established during this investigation.

Appendix A.1, concluded:

ER Site 101
Summary of Constituents Detected in 1992 Septic Tank Samples

Results of Septic Tank Analyses (Sludge Sample)			
Building No./Area:	9926/9920 CTF		
Tank ID No.:	NRN		
Date Sampled:	8/18/92		
Sample ID No.:	SNLA008592		
Analytical Parameter	Measured Concentration	± 2 Sigma Uncertainty	Units
Gross Alpha	2E+1	2E+1	pCi/g
Gross Beta	1E+1	2E+1	pCi/g
Gross Alpha	1E+1	1E+1	pCi/g
Gross Beta	1E+1	2E+1	pCi/g
Gross Alpha	1E+1	1E+1	pCi/g
Gross Beta	1E+1	2E+1	pCi/g
Gross Alpha	1E+1	1E+1	pCi/g
Gross Beta	2E+1	2E+1	pCi/g
Tritium	2E+02	3E+02	pCi/L
Bismuth-214	<0.0313 (<0.0235)	NA	pCi/mL
Cesium-137	0.00598 (<0.00750)	0.00329	pCi/mL
Potassium-40	1.21 (<0.223)	0.0922	pCi/mL
Lead-212	0.0524 (<0.0130)	0.00818	pCi/mL
Lead-214	0.0557 (<0.0195)	0.00895	pCi/mL
Radium-226	0.181 (<0.143)	0.0841	pCi/mL
Thorium-234	0.177 (<0.111)	0.0751	pCi/mL
Thallium-208	0.0145 (<0.00999)	0.00414	pCi/mL

ND = Not Detected
NA = Not Applicable
Note: Values in parenthesis are measurements reported by Enseco/RMAL in pCi/g (wet weight).

Appendix A.2

ER Site 101
Summary of Constituents in 1994 Septic Tank Samples

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Appendix A.2

ER Site 101
Summary of Constituents in 1994 Septic Tank Samples

Sample Number	Sample Matrix	Sample Type	Sample Date	Method	Compound Name	Result	Detection Limit	+- 2 Sigma Uncertainty	Units
April 1994 Samples:									
015448-9	Sludge	Field	4/14/94	8240 (VOCs)	Acetone	0.41	0.02	NA	mg/kg
				8240 (VOCs)	2-Butanone	0.11	0.010	NA	mg/kg
				8240 (VOCs)	Carbon Disulfide	0.011	0.010	NA	mg/kg
				8240 (VOCs)	Ethyl Benzene	0.005 J	0.010	NA	mg/kg
				8240 (VOCs)	Methylene Chloride	.009 J B	0.010	NA	mg/kg
				8240 (VOCs)	Toluene	0.005 J	0.010	NA	mg/kg
				8240 (VOCs)	Xylenes (Total)	0.018	0.010	NA	mg/kg
015448-10	Sludge	Dupl.	4/14/94	8240 (VOCs)	Acetone	0.17	0.050	NA	mg/kg
				8240 (VOCs)	2-Butanone	0.050	0.050	NA	mg/kg
				8240 (VOCs)	Carbon Disulfide	0.008 J	0.025	NA	mg/kg
				8240 (VOCs)	Methylene Chloride	0.016 J B	0.050	NA	mg/kg
				8240 (VOCs)	Toluene	0.010 J	0.025	NA	mg/kg
				8240 (VOCs)	Xylenes (Total)	0.019 J	0.025	NA	mg/kg
015448-11	Sludge	Field	4/14/94	6010	Arsenic	6.0	1.7	NA	mg/kg
				6010	Barium	110	3.4	NA	mg/kg
				6010	Cadmium	19	0.85	NA	mg/kg
				6010	Chromium	26	3.4	NA	mg/kg
				6010	Lead	65	6.8	NA	mg/kg
				7470	Mercury	1.6	0.10	NA	mg/kg
				6010	Selenium	2.4	0.17	NA	mg/kg
				6010	Silver	5.7	1.7	NA	mg/kg
015448-12	Sludge	Dupl.	4/14/94	6010	Arsenic	12	2.7	NA	mg/kg
				6010	Barium	390	5.4	NA	mg/kg
				6010	Cadmium	54	1.4	NA	mg/kg
				6010	Chromium	62	5.4	NA	mg/kg
				6010	Lead	320	11	NA	mg/kg
				7470	Mercury	2.6	0.12	NA	mg/kg
				6010	Selenium	6.9	1.4	NA	mg/kg
				6010	Silver	14	2.7	NA	mg/kg
015448-13	Sludge	Field	4/14/94	TCLP/6010	Arsenic	ND	0.1	NA	mg/L
				TCLP/6010	Barium	1.9	0.02	NA	mg/L
				TCLP/6010	Cadmium	ND	0.005	NA	mg/L
				TCLP/6010	Chromium	ND	0.02	NA	mg/L
				TCLP/6010	Lead	ND	0.04	NA	mg/L
				TCLP/7470	Mercury	ND	0.0002	NA	mg/L
				TCLP/6010	Selenium	ND	0.1	NA	mg/L
				TCLP/6010	Silver	ND	0.01	NA	mg/L

Appendix A.2, concluded:

ER Site 101
Summary of Constituents in 1994 Septic Tank Samples

Sample Number	Sample Matrix	Sample Type	Sample Date	Method	Compound Name	Result	Detection Limit	+- 2 Sigma Uncertainty	Units
April 1994 Samples, continued:									
015448-14	Sludge	Dupl.	4/14/94	TCLP/6010	Arsenic	ND	0.1	NA	mg/L
				TCLP/6010	Barium	1.9	0.02	NA	mg/L
				TCLP/6010	Cadmium	ND	0.005	NA	mg/L
				TCLP/6010	Chromium	ND	0.02	NA	mg/L
				TCLP/6010	Lead	ND	0.04	NA	mg/L
				TCLP/7470	Mercury	ND	0.0002	NA	mg/L
				TCLP/6010	Selenium	ND	0.1	NA	mg/L
				TCLP/6010	Silver	ND	0.01	NA	mg/L
015448-19	Sludge	Field	4/14/94	8330	12 explos. compounds	ND	1.25	NA	mg/kg
015448-20	Sludge	Dupl.	4/14/94	8330	12 explos. compounds	ND	1.25	NA	mg/kg
015448-15	Sludge	Field	4/14/94	9012	Cyanide	ND	8.7	NA	mg/kg
015448-16	Sludge	Dupl.	4/14/94	9012	Cyanide	ND	8.7	NA	mg/kg
November 1994 Samples:									
018422-1	Sludge	Field	11/2/94	8270	SVOCs	ND	33-170	NA	mg/kg
018422-2	Sludge	Field	11/2/94		Uranium Series:				
				Gamma Spec.	Uranium-238	0.452	NP	0.192	pCi/mL
				Gamma Spec.	Thorium-234	0.453	NP	0.192	pCi/mL
				Gamma Spec.	Radium-226	0.292	NP	0.317	pCi/mL
					Thorium Series:				
				Gamma Spec.	Thorium-232	0.08	NP	0.054	pCi/mL
				Gamma Spec.	Radium-228	0.08	NP	0.054	pCi/mL
				Gamma Spec.	Thorium-228	0.041	NP	0.025	pCi/mL
				Gamma Spec.	Radium-224	0.492	NP	0.296	pCi/mL
				Gamma Spec.	Lead-212	0.041	NP	0.025	pCi/mL
					Other Radionuclides:				
				Gamma Spec.	Potassium-40	0.382	NP	0.193	pCi/mL
018422-3	Sludge	Field	11/2/94	HASL-300	Uranium-238	11	0.03	1.3	pCi/g
				HASL-300	Uranium-235	0.52	0.013	0.12	pCi/g
				HASL-300	Uranium-233/234	20	0.035	2.3	pCi/g
018422-3	Sludge	Field	11/2/94	EPA-600 906.0	Tritium	2400	2400	1500	pCi/L

Notes

B = Compound detected in the laboratory blank.
Dupl. = Duplicate
Explos. = Explosives
J = Result is detected below the reporting limit or is an estimated concentration.
mg/L = Milligrams per liter
mg/kg = Milligrams per kilogram
NA = Not applicable
ND = Not detected
NP = Not provided by laboratory
pCi/g = Picocuries per gram
pCi/L = Picocuries per liter
pCi/mL = Picocuries per milliliter
Spec. = Spectroscopy
SVOCs = Semivolatile organic compounds
TCLP = Toxicity Characteristic Leaching Procedure
VOCs = Volatile organic compounds

p:\stlftabl\S101tank.xls

Appendix A.3

ER Site 101
Summary of 1994 PETREX™ Passive Soil-Gas Survey Results

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Appendix A.3

ER Site 101
Summary of 1994 PETREX™ Passive Soil-Gas Survey Results

PETREX Relative Soil Gas Response Values
(in ion counts)
STD SITE 101

	Sample	PCE	TCE	BTEX	Aliphatics
Phase I Sampling					
	162	ND	ND	2324	16666
	163	ND	ND	20331	ND
	164	2492	ND	8162	5397
	165	4056	ND	339458	239108
	166	1530	ND	29994	11405
	167	ND	ND	201640	233076
	168	ND	ND	10834	20532
	169	8672	ND	16141	14023
	170	ND	ND	41158	10765
	171	ND	ND	9210	8146
	172	ND	ND	5188	ND
	173	16400	ND	73461	48914
	174	ND	ND	3804	ND
	175	ND	ND	ND	1554
	176	1622140	ND	527401	238820
	177	ND	ND	9767720	1970596
	178	ND	ND	8618820	854316
	179	ND	ND	1300874	367030
	180	ND	ND	100563	25296
	D-1168	1547	ND	1033	1026
	* 900	ND	ND	4553	6219
	* 901	ND	ND	4732	ND
Phase II Sampling	574	ND	ND	13936	7966
	575	ND	ND	2505	ND
	576	ND	ND	9274	5042
	577	ND	ND	14888	8386
	578	ND	ND	2057	1379
	579	1160	ND	2055	4025
	580	ND	ND	2132	474
	581	ND	ND	ND	421
	582	ND	ND	ND	485
	583	ND	ND	46796	44924
	584	ND	ND	28181	66457
	585	ND	ND	47184	75269
	586	ND	ND	36723	27587
	587	ND	ND	30296	44163
	588	ND	ND	10621	29455

Appendix A.3 concluded:

ER Site 101
Summary of 1994 PETREX[TM] Passive Soil-Gas Survey Results

PETREX Relative Soil Gas Response Values
(in ion counts)
STD SITE 101

Sample	PCE	TCE	BTEX	Aliphatics
* 900	ND	ND	ND	ND
* 901	ND	ND	ND	ND
D-2575	ND	ND	5,857	1,034
D-2583	ND	ND	50,395	42,573

PCE - Tetrachloroethene
Indicator Mass Peak(s) 164

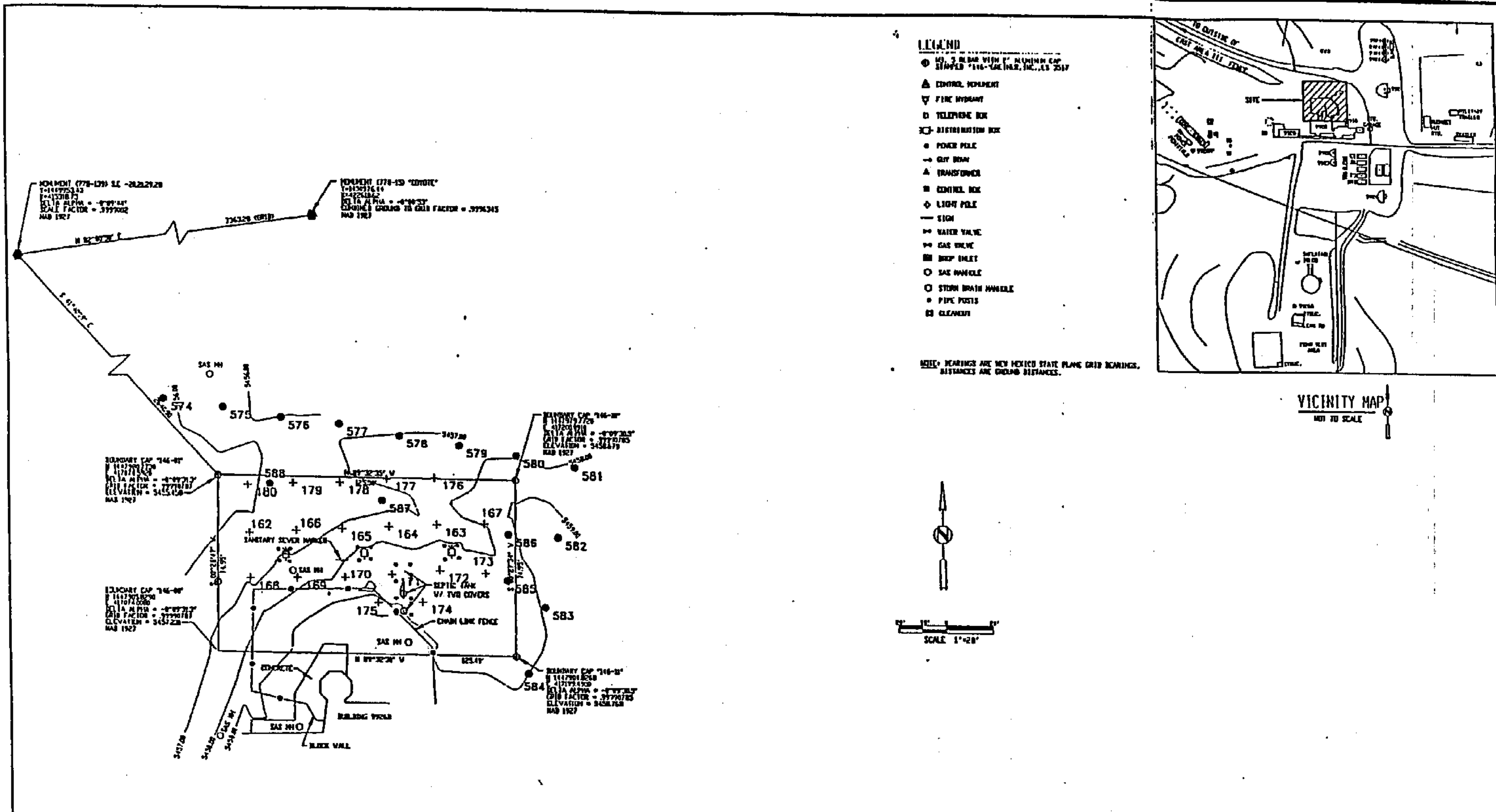
TCE - Trichloroethene
Indicator Mass Peak(s) 130

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



Drawn By: JCS	Project #: 2096-101
Checked By:	Date: 5/23/1995
Project Manager: JOG	File Name: 101_1.dwg

NERI Northeast Research Institute LLC
805 Portal Street
Suite 100
Lakewood, Colorado 80215
(303) 238-0090

Sandia National Laboratories

STD Site 101
Albuquerque, New Mexico

PETREX ENVIRONMENTAL TECHNOLOGIES

LEGEND

Features:
- + PETREX Sample Location (PHASE I)
- ● PETREX Sample Location (PHASE II)

Sample Locations

Plate 8

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Appendix A.4

ER Site 101
Gamma Spectroscopy Screening Results for the West Seepage Pit
Shallow Interval Composite Soil Sample

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ER Site 101
Gamma Spectroscopy Screening Results for the West Seepage Pit
Shallow Interval Composite Soil Sample

```
*************************************************************************
*                  Sandia National Laboratories
*    Radiation Protection Sample Diagnostics Program (881 Laboratory)
*                     7-06-95   5:38:12 PM
*************************************************************************
*
* Analyzed by: Steven Cole 7/7/95     Reviewed by: [signature] 7/7/95
*************************************************************************

Customer              : SANDERS/RANKIN (7582)
Customer Sample ID    : 023854-1A / 101SP-12'
Lab Sample ID         : 50051501

Sample Description    : MARINELLI SOIL SAMPLE
Sample Type           : Solid
Sample Geometry       : 2SMAR
Sample Quantity       :    993.000  gram
Sample Date/Time      :   7-06-95   9:45:00 AM
Acquire Start Date    :   7-06-95   5:00:54 PM
Detector Name         : LAB02
Elapsed Live Time     :    1800 seconds
Elapsed Real Time     :    1801 seconds

Comments:
*************************************************************************
```

Nuclide	Activity (pCi/gram)	2S Error	MDA
U-238	Not Detected	--------	4.30
TH-234	Not Detected	--------	9.48E-01
U-234	Not Detected	--------	1.57E+01
RA-226	5.30E-01	5.63E-01	8.91E-01
PB-214	4.39E-01	8.81E-02	7.70E-02
BI-214	4.44E-01	8.84E-02	6.88E-02
PB-210	Not Detected	--------	3.98E+02
TH-232	3.67E-01	1.92E-01	2.72E-01
RA-228	2.68E-01	1.99E-01	3.03E-01
AC-228	Not Detected	--------	2.40E-01
TH-228	5.30E-01	2.81E-01	6.25E-01
RA-224	1.18	3.46E-01	5.52E-01
PB-212	5.04E-01	1.23E-01	5.20E-02
BI-212	Not Detected	--------	6.67E-01
TL-208	4.60E-01	1.06E-01	9.22E-02
U-235	Not Detected	--------	3.05E-01
TH-231	Not Detected	--------	7.33E-01
PA-231	Not Detected	--------	1.35
AC-227	Not Detected	--------	2.16
TH-227	Not Detected	--------	4.39E-01
RA-223	Not Detected	--------	2.40E-01
RN-219	Not Detected	--------	3.39E-01
PB-211	Not Detected	--------	7.66E-01
TL-207	Not Detected	--------	1.66E+01
AM-241	Not Detected	--------	6.88E-01
PU-239	Not Detected	--------	3.67E+02
NP-237	Not Detected	--------	4.71E-01
PA-233	Not Detected	--------	7.32E-02
TH-229	Not Detected	--------	3.40E-01

Appendix A.4, concluded:

ER Site 101
Gamma Spectroscopy Screening Results for the West Seepage Pit
Shallow Interval Composite Soil Sample

[Summary Report] - Sample ID: 50051501

Nuclide	Activity (pCi/gram)	2S Error	MDA
AG-110m	Not Detected	--------	3.89E-02
AR-41	Not Detected	--------	8.96E-01
BA-133	Not Detected	--------	7.35E-02
BA-140	Not Detected	--------	1.39E-01
CD-109	Not Detected	--------	1.56
CD-115	Not Detected	--------	8.43E-02
CE-139	Not Detected	--------	3.72E-02
CE-141	Not Detected	--------	6.73E-02
CE-144	Not Detected	--------	3.02E-01
CO-56	Not Detected	--------	4.27E-02
CO-57	Not Detected	--------	4.01E-02
CO-58	Not Detected	--------	4.03E-02
CO-60	Not Detected	--------	5.06E-02
CR-51	Not Detected	--------	2.84E-01
CS-134	Not Detected	--------	6.34E-02
CS-137	Not Detected	--------	4.25E-02
CU-64	Not Detected	--------	1.25E+01
EU-152	Not Detected	--------	3.13E-01
EU-154	Not Detected	--------	2.19E-01
EU-155	Not Detected	--------	1.82E-01
FE-59	Not Detected	--------	9.83E-02
GD-153	Not Detected	--------	1.33E-01
HG-203	Not Detected	--------	3.70E-02
I-131	Not Detected	--------	3.58E-02
IN-115m	Not Detected	--------	2.47E-01
IR-192	Not Detected	--------	3.50E-02
K-40	1.30E+01	1.91	2.91E-01
LA-140	Not Detected	--------	4.55E-02
MN-54	Not Detected	--------	4.34E-02
MN-56	Not Detected	--------	3.24E-01
MO-99	Not Detected	--------	3.33E-01
NA-22	Not Detected	--------	5.57E-02
NA-24	Not Detected	--------	6.61E-02
NB-95	Not Detected	--------	2.10E-01
ND-147	Not Detected	--------	2.58E-01
NI-57	Not Detected	--------	7.24E-02
BE-7	Not Detected	--------	3.12E-01
RU-103	Not Detected	--------	3.28E-02
RU-106	Not Detected	--------	3.73E-01
SB-122	Not Detected	--------	5.29E-02
SB-124	Not Detected	--------	3.96E-02
SB-125	Not Detected	--------	9.16E-02
SC-46	Not Detected	--------	6.56E-02
SR-85	Not Detected	--------	4.51E-02
TA-182	Not Detected	--------	1.96E-01
TA-183	Not Detected	--------	6.21E-01
TE-132	Not Detected	--------	3.67E-02
TL-201	Not Detected	--------	2.13E-01
XE-133	Not Detected	--------	1.82E-01
Y-88	Not Detected	--------	4.01E-02
ZN-65	Not Detected	--------	1.32E-01
ZR-95	Not Detected	--------	7.55E-02

Appendix A.5

ER Site 101
Gamma Spectroscopy Screening Results for the West Seepage Pit
Deep Interval Composite Soil Sample

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ER Site 101
Gamma Spectroscopy Screening Results for the West Seepage Pit
Deep Interval Composite Soil Sample

```
*************************************************************************
*                  Sandia National Laboratories                         *
*   Radiation Protection Sample Diagnostics Program [881 Laboratory]    *
*                     7-06-95   6:22:08 PM                              *
*************************************************************************
*                                                                       *
* Analyzed by: [signature] 7/7/95     Reviewed by: [signature] 7/7/95   *
*************************************************************************

Customer              : SANDERS/RANKIN (7582)
Customer Sample ID    : 023855-1A /101SP - 22'
Lab Sample ID         : 50051502

Sample Description    : MARINELLI SOIL SAMPLE
Sample Type           : Solid
Sample Geometry       : 2SMAR
Sample Quantity       :   984.000   gram
Sample Date/Time      :   7-06-95   9:55:00 AM
Acquire Start Date    :   7-06-95   5:48:40 PM
Detector Name         : LAB02
Elapsed Live Time     :   1800 seconds
Elapsed Real Time     :   1801 seconds

Comments:
*************************************************************************
```

Nuclide	Activity (pCi/gram)	2S Error	MDA
U-238	Not Detected	--------	4.44
TH-234	Not Detected	--------	9.87E-01
U-234	Not Detected	--------	1.63E+01
RA-226	1.37	7.33E-01	1.09
PB-214	4.94E-01	1.11E-01	1.12E-01
BI-214	3.90E-01	9.00E-02	9.08E-02
PB-210	Not Detected	--------	3.96E+02
TH-232	3.70E-01	1.79E-01	2.50E-01
RA-228	3.15E-01	1.69E-01	2.37E-01
AC-228	Not Detected	--------	2.43E-01
TH-228	5.70E-01	2.76E-01	5.79E-01
RA-224	1.39	3.76E-01	5.75E-01
PB-212	5.06E-01	1.07E-01	5.33E-02
BI-212	7.63E-01	2.93E-01	3.40E-01
TL-208	4.73E-01	1.12E-01	1.04E-01
U-235	Not Detected	--------	2.94E-01
TH-231	Not Detected	--------	7.81E-01
PA-231	Not Detected	--------	1.40
AC-227	Not Detected	--------	2.20
TH-227	Not Detected	--------	4.39E-01
RA-223	Not Detected	--------	2.47E-01
RN-219	Not Detected	--------	3.55E-01
PB-211	Not Detected	--------	8.18E-01
TL-207	Not Detected	--------	1.81E+01
AM-241	Not Detected	--------	6.86E-01
PU-239	Not Detected	--------	3.69E+02
NP-237	Not Detected	--------	4.99E-01
PA-233	Not Detected	--------	7.72E-02
TH-229	Not Detected	--------	3.74E-01

Appendix A.5, concluded:

ER Site 101
Gamma Spectroscopy Screening Results for the West Seepage Pit
Deep Interval Composite Soil Sample

[Summary Report] - Sample ID: 50051502

Nuclide	Activity (pCi/gram)	2S Error	MDA
AG-110m	Not Detected	--------	3.89E-02
AR-41	Not Detected	--------	1.12
BA-133	Not Detected	--------	7.88E-02
BA-140	Not Detected	--------	1.30E-01
CD-109	Not Detected	--------	1.69
CD-115	Not Detected	--------	8.78E-02
CE-139	Not Detected	--------	3.96E-02
CE-141	Not Detected	--------	6.65E-02
CE-144	Not Detected	--------	3.16E-01
CO-56	Not Detected	--------	4.22E-02
CO-57	Not Detected	--------	3.95E-02
CO-58	Not Detected	--------	4.49E-02
CO-60	Not Detected	--------	5.01E-02
CR-51	Not Detected	--------	2.90E-01
CS-134	Not Detected	--------	6.27E-02
CS-137	Not Detected	--------	4.48E-02
CU-64	Not Detected	--------	1.25E+01
EU-152	Not Detected	--------	3.01E-01
EU-154	Not Detected	--------	2.35E-01
EU-155	Not Detected	--------	1.90E-01
FE-59	Not Detected	--------	9.12E-02
GD-153	Not Detected	--------	1.43E-01
HG-203	Not Detected	--------	3.68E-02
I-131	Not Detected	--------	3.84E-02
IN-115m	Not Detected	--------	2.81E-01
IR-192	Not Detected	--------	3.52E-02
K-40	1.24E+01	1.84	4.05E-01
LA-140	Not Detected	--------	5.29E-02
MN-54	Not Detected	--------	4.24E-02
MN-56	Not Detected	--------	3.80E-01
MO-99	Not Detected	--------	3.64E-01
NA-22	Not Detected	--------	5.73E-02
NA-24	Not Detected	--------	6.04E-02
NB-95	Not Detected	--------	2.12E-01
ND-147	Not Detected	--------	2.76E-01
NI-57	Not Detected	--------	7.59E-02
BE-7	Not Detected	--------	3.06E-01
RU-103	Not Detected	--------	3.80E-02
RU-106	Not Detected	--------	3.40E-01
SB-122	Not Detected	--------	4.71E-02
SB-124	Not Detected	--------	4.02E-02
SB-125	Not Detected	--------	1.03E-01
SC-46	Not Detected	--------	7.14E-02
SR-85	Not Detected	--------	4.59E-02
TA-182	Not Detected	--------	2.14E-01
TA-183	Not Detected	--------	6.22E-01
TE-132	Not Detected	--------	3.68E-02
TL-201	Not Detected	--------	2.31E-01
XE-133	Not Detected	--------	1.81E-01
Y-88	Not Detected	--------	3.50E-02
ZN-65	Not Detected	--------	1.35E-01
ZR-95	Not Detected	--------	7.63E-02

Appendix A.6

ER Site 101
Gamma Spectroscopy Screening Results for the Middle and East Seepage Pit Shallow Interval Composite Soil Sample

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ER Site 101
Gamma Spectroscopy Screening Results for the Middle and East Seepage Pit
Shallow Interval Composite Soil Sample

```
*****************************************************************************
*                       Sandia National Laboratories                        *
*  Radiation Protection Sample Diagnostics Program [881 Laboratory]         *
*                          7-06-95  7:03:14 PM                              *
*****************************************************************************
*                                                                           *
* Analyzed by: Cole 7/7/95 Reviewed by: 7/7/95                              *
*****************************************************************************

Customer               : SANDERS/RANKIN (7582)
Customer Sample ID     : 023856-1A/101SP 16'
Lab Sample ID          : 50051503

Sample Description     : MARINELLI SOIL SAMPLE
Sample Type            : Solid
Sample Geometry        : 2SMAR
Sample Quantity        :  1070.000  gram
Sample Date/Time       :  7-06-95  10:30:00 AM
Acquire Start Date     :  7-06-95   6:28:58 PM
Detector Name          : LAB02
Elapsed Live Time      :   1800 seconds
Elapsed Real Time      :   1801 seconds

Comments:
*****************************************************************************
```

Nuclide	Activity (pCi/gram)	2S Error	MDA
U-238	Not Detected	--------	3.83
TH-234	Not Detected	--------	8.67E-01
U-234	Not Detected	--------	1.45E+01
RA-226	1.15	5.15E-01	7.23E-01
PB-214	4.32E-01	8.51E-02	6.05E-02
BI-214	4.08E-01	8.11E-02	6.23E-02
PB-210	Not Detected	--------	3.72E+02
TH-232	5.86E-01	2.04E-01	2.55E-01
RA-228	3.86E-01	1.53E-01	1.89E-01
AC-228	Not Detected	--------	2.25E-01
TH-228	Not Detected	--------	8.63E-01
RA-224	1.09	3.09E-01	4.68E-01
PB-212	3.88E-01	8.55E-02	4.12E-02
BI-212	Not Detected	--------	5.87E-01
TL-208	3.83E-01	1.01E-01	1.06E-01
U-235	Not Detected	--------	2.83E-01
TH-231	Not Detected	--------	6.60E-01
PA-231	Not Detected	--------	1.20
AC-227	Not Detected	--------	2.07
TH-227	Not Detected	--------	3.77E-01
RA-223	Not Detected	--------	2.18E-01
RN-219	Not Detected	--------	3.03E-01
PB-211	Not Detected	--------	7.21E-01
TL-207	Not Detected	--------	1.48E+01
AM-241	Not Detected	--------	6.20E-01
PU-239	Not Detected	--------	3.28E+02
NP-237	Not Detected	--------	4.14E-01
PA-233	Not Detected	--------	6.65E-02
TH-229	Not Detected	--------	3.17E-01

ER Site 101
Gamma Spectroscopy Screening Results for the Middle and East Seepage Pit
Shallow Interval Composite Soil Sample

[Summary Report] - Sample ID: 50051503

Nuclide	Activity (pCi/gram)	2S Error	MDA
AG-110m	Not Detected	--------	3.79E-02
AR-41	Not Detected	--------	1.09
BA-133	Not Detected	--------	6.92E-02
BA-140	Not Detected	--------	1.21E-01
CD-109	Not Detected	--------	1.37
CD-115	Not Detected	--------	8.28E-02
CE-139	Not Detected	--------	3.49E-02
CE-141	Not Detected	--------	6.32E-02
CE-144	Not Detected	--------	2.90E-01
CO-56	Not Detected	--------	4.07E-02
CO-57	Not Detected	--------	3.62E-02
CO-58	Not Detected	--------	3.66E-02
CO-60	Not Detected	--------	4.18E-02
CR-51	Not Detected	--------	2.71E-01
CS-134	Not Detected	--------	5.89E-02
CS-137	Not Detected	--------	4.27E-02
CU-64	Not Detected	--------	1.45E+01
EU-152	Not Detected	--------	2.85E-01
EU-154	Not Detected	--------	1.90E-01
EU-155	Not Detected	--------	1.71E-01
FE-59	Not Detected	--------	8.20E-02
GD-153	Not Detected	--------	1.22E-01
HG-203	Not Detected	--------	3.31E-02
I-131	Not Detected	--------	3.18E-02
IN-115m	Not Detected	--------	2.69E-01
IR-192	Not Detected	--------	3.27E-02
K-40	1.21E+01	1.77	2.56E-01
LA-140	Not Detected	--------	4.46E-02
MN-54	Not Detected	--------	3.86E-02
MN-56	Not Detected	--------	3.74E-01
MO-99	Not Detected	--------	3.00E-01
NA-22	Not Detected	--------	5.12E-02
NA-24	Not Detected	--------	5.68E-02
NB-95	Not Detected	--------	1.83E-01
ND-147	Not Detected	--------	2.29E-01
NI-57	Not Detected	--------	7.16E-02
BE-7	Not Detected	--------	2.75E-01
RU-103	Not Detected	--------	3.14E-02
RU-106	Not Detected	--------	3.07E-01
SB-122	Not Detected	--------	4.83E-02
SB-124	Not Detected	--------	3.56E-02
SB-125	Not Detected	--------	9.19E-02
SC-46	Not Detected	--------	6.56E-02
SR-85	Not Detected	--------	4.38E-02
TA-182	Not Detected	--------	1.91E-01
TA-183	Not Detected	--------	5.62E-01
TE-132	Not Detected	--------	3.26E-02
TL-201	Not Detected	--------	2.12E-01
XE-133	Not Detected	--------	1.55E-01
Y-88	Not Detected	--------	3.06E-02
ZN-65	Not Detected	--------	1.28E-01
ZR-95	Not Detected	--------	6.77E-02

Appendix A.7

ER Site 101
Gamma Spectroscopy Screening Results for the Middle and East Seepage Pit Deep Interval Composite Soil Sample

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ER Site 101
Gamma Spectroscopy Screening Results for the Middle and East Seepage Pit
Deep Interval Composite Soil Sample

```
***************************************************************************
*                   Sandia National Laboratories                          *
*    Radiation Protection Sample Diagnostics Program [881 Laboratory]     *
*                       7-06-95  7:43:15 PM                               *
***************************************************************************
*                                                                         *
* Analyzed by: [signature] 7/7/95    Reviewed by: [signature] 7/7/95      *
***************************************************************************

Customer              : SANDERS/RANKIN (7582)
Customer Sample ID    : 023857-1A/101SP-26'
Lab Sample ID         : 50051504

Sample Description    : MARINELLI SOIL SAMPLE
Sample Type           : Solid
Sample Geometry       : 2SMAR
Sample Quantity       :   923.000  gram
Sample Date/Time      :  7-06-95  10:35:00 AM
Acquire Start Date    :  7-06-95   7:09:34 PM
Detector Name         : LAB02
Elapsed Live Time     :   1800 seconds
Elapsed Real Time     :   1801 seconds

Comments:
***************************************************************************
```

Nuclide	Activity (pCi/gram)	2S Error	MDA
U-238	Not Detected	--------	4.52
TH-234	Not Detected	--------	9.95E-01
U-234	Not Detected	--------	1.53E+01
RA-226	9.65E-01	5.08E-01	7.37E-01
PB-214	5.36E-01	1.08E-01	8.69E-02
BI-214	4.41E-01	9.27E-02	7.99E-02
PB-210	Not Detected	--------	4.00E+02
TH-232	4.89E-01	1.63E-01	1.84E-01
RA-228	4.87E-01	1.78E-01	2.09E-01
AC-228	Not Detected	--------	2.79E-01
TH-228	Not Detected	--------	9.91E-01
RA-224	Not Detected	--------	5.24E-01
PB-212	5.35E-01	1.13E-01	5.00E-02
BI-212	5.29E-01	3.53E-01	5.21E-01
TL-208	5.15E-01	1.18E-01	1.04E-01
U-235	Not Detected	--------	3.17E-01
TH-231	Not Detected	--------	7.78E-01
PA-231	Not Detected	--------	1.38
AC-227	Not Detected	--------	2.33
TH-227	Not Detected	--------	4.72E-01
RA-223	Not Detected	--------	2.50E-01
RN-219	Not Detected	--------	3.67E-01
PB-211	Not Detected	--------	8.35E-01
TL-207	Not Detected	--------	1.94E+01
AM-241	Not Detected	--------	7.40E-01
PU-239	Not Detected	--------	3.75E+02
NP-237	Not Detected	--------	4.91E-01
PA-233	Not Detected	--------	7.53E-02
TH-229	Not Detected	--------	3.70E-01

ER Site 101
Gamma Spectroscopy Screening Results for the Middle and East Seepage Pit
Deep Interval Composite Soil Sample

[Summary Report] - Sample ID: 50051504

Nuclide	Activity (pCi/gram)	2S Error	MDA
AG-110m	Not Detected	--------	4.18E-02
AR-41	Not Detected	--------	1.63
BA-133	Not Detected	--------	8.23E-02
BA-140	Not Detected	--------	1.42E-01
CD-109	Not Detected	--------	1.64
CD-115	Not Detected	--------	8.94E-02
CE-139	Not Detected	--------	3.88E-02
CE-141	Not Detected	--------	7.15E-02
CE-144	Not Detected	--------	3.23E-01
CO-56	Not Detected	--------	4.93E-02
CO-57	Not Detected	--------	4.11E-02
CO-58	Not Detected	--------	4.38E-02
CO-60	Not Detected	--------	5.03E-02
CR-51	Not Detected	--------	2.91E-01
CS-134	Not Detected	--------	6.40E-02
CS-137	Not Detected	--------	4.88E-02
CU-64	Not Detected	--------	1.67E+01
EU-152	Not Detected	--------	3.40E-01
EU-154	Not Detected	--------	2.44E-01
EU-155	Not Detected	--------	1.82E-01
FE-59	Not Detected	--------	9.85E-02
GD-153	Not Detected	--------	1.44E-01
HG-203	Not Detected	--------	4.00E-02
I-131	Not Detected	--------	3.67E-02
IN-115m	Not Detected	--------	3.15E-01
IR-192	Not Detected	--------	3.48E-02
K-40	1.34E+01	1.98	4.04E-01
LA-140	Not Detected	--------	6.55E-02
MN-54	Not Detected	--------	4.81E-02
MN-56	Not Detected	--------	5.32E-01
MO-99	Not Detected	--------	3.44E-01
NA-22	Not Detected	--------	5.85E-02
NA-24	Not Detected	--------	7.32E-02
NB-95	Not Detected	--------	2.29E-01
ND-147	Not Detected	--------	2.65E-01
NI-57	Not Detected	--------	8.04E-02
BE-7	Not Detected	--------	3.26E-01
RU-103	Not Detected	--------	3.77E-02
RU-106	Not Detected	--------	4.35E-01
SB-122	Not Detected	--------	5.49E-02
SB-124	Not Detected	--------	4.29E-02
SB-125	Not Detected	--------	1.07E-01
SC-46	Not Detected	--------	6.65E-02
SR-85	Not Detected	--------	4.55E-02
TA-182	Not Detected	--------	1.97E-01
TA-183	Not Detected	--------	6.73E-01
TE-132	Not Detected	--------	3.86E-02
TL-201	Not Detected	--------	2.46E-01
XE-133	Not Detected	--------	1.88E-01
Y-88	Not Detected	--------	3.35E-02
ZN-65	Not Detected	--------	1.34E-01
ZR-95	Not Detected	--------	7.40E-02

Appendix A.8

ER Site 101
Gamma Spectroscopy Screening Results for the Drywell Shallow Interval Soil Sample

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ER Site 101
Gamma Spectroscopy Screening Results for the Drywell
Shallow Interval Soil Sample

```
*************************************************************************
*                    Sandia National Laboratories                       *
*    Radiation Protection Sample Diagnostics Program [881 Laboratory]   *
*                       1-12-95   6:27:23 PM                            *
*************************************************************************
*
* Analyzed by:  [signature] 1/13/95     Reviewed by: [signature] 1/13/95
*************************************************************************

Customer             : B.GALLOWAY/McLAUGHLIN(7582/SMO)
Customer Sample ID   : 018907-03
Lab Sample ID        : 50003505

Sample Description   : MARINELLI SOLID SAMPLE
Sample Type          : Solid
Sample Geometry      : 1SMAR
Sample Quantity      :   746.000   Gram
Sample Date/Time     :  1-11-95    1:30:00 PM
Acquire Start Date   :  1-12-95    5:50:35 PM
Detector Name        : LAB01
Elapsed Live Time    :   1800 seconds
Elapsed Real Time    :   1801 seconds

Comments:

*************************************************************************
```

Nuclide	Activity (pCi/Gram)	2S Error	MDA
U-238	Not Detected	--------	2.20
TH-234	6.68E-01	2.96E-01	5.31E-01
U-234	Not Detected	--------	5.72E+01
RA-226	8.57E-01	3.52E-01	5.17E-01
PB-214	4.50E-01	1.30E-01	4.72E-02
BI-214	5.44E-01	1.06E-01	5.51E-02
PB-210	Not Detected	--------	5.57E+02
TH-232	6.00E-01	2.13E-01	1.41E-01
RA-228	6.15E-01	1.89E-01	1.92E-01
AC-228	6.95E-01	1.70E-01	1.18E-01
TH-228	4.09E-01	2.68E-01	4.76E-01
RA-224	4.71E-01	2.64E-01	4.32E-01
PB-212	5.60E-01	1.76E-01	4.03E-02
BI-212	7.69E-01	2.91E-01	3.94E-01
TL-208	5.27E-01	1.18E-01	7.66E-02
U-235	Not Detected	--------	2.94E-01
TH-231	Not Detected	--------	7.33E-01
PA-231	Not Detected	--------	1.33
AC-227	Not Detected	--------	2.05
TH-227	Not Detected	--------	4.26E-01
RA-223	Not Detected	--------	2.40E-01
RN-219	Not Detected	--------	3.17E-01
PB-211	Not Detected	--------	7.70E-01
TL-207	Not Detected	--------	2.27E+01
AM-241	Not Detected	--------	3.12E-01
PU-239	~~1.60E+02~~	~~9.83E+01~~	~~2.02E+02~~ not detected [initials] 1/13/95
NP-237	Not Detected	--------	2.48E-01
PA-233	Not Detected	--------	7.12E-02
TH-229	Not Detected	--------	3.70E-01

ER Site 101
Gamma Spectroscopy Screening Results for the Drywell
Shallow Interval Soil Sample

[Summary Report] - Sample ID: 50003505

Nuclide	Activity (pCi/Gram)	2S Error	MDA
AG-110m	Not Detected	--------	5.02E-02
AR-41	Not Detected	--------	3.60E+03
BA-133	Not Detected	--------	6.97E-02
BA-140	Not Detected	--------	1.62E-01
CD-109	~~6.07E-01~~	~~5.08E-01~~	~~1.00E+01~~ Not detected 1/13/9
CD-115	Not Detected	--------	1.17E-01
CE-139	Not Detected	--------	3.59E-02
CE-141	Not Detected	--------	6.96E-02
CE-144	Not Detected	--------	3.10E-01
CO-56	Not Detected	--------	5.55E-02
CO-57	Not Detected	--------	4.21E-02
CO-58	Not Detected	--------	5.14E-02
CO-60	Not Detected	--------	6.36E-02
CR-51	Not Detected	--------	2.70E-01
CS-134	Not Detected	--------	5.78E-02
CS-137	Not Detected	--------	5.56E-02
CU-64	Not Detected	--------	6.92E+01
EU-152	Not Detected	--------	3.82E-01
EU-154	Not Detected	--------	2.58E-01
EU-155	Not Detected	--------	1.86E-01
FE-59	Not Detected	--------	1.35E-01
GD-153	Not Detected	--------	1.38E-01
HG-203	Not Detected	--------	3.25E-02
I-131	Not Detected	--------	3.85E-02
IN-115m	Not Detected	--------	6.74
IR-192	Not Detected	--------	3.38E-02
K-40	1.56E+01	2.36	3.58E-01
LA-140	Not Detected	--------	1.18E-01
MN-54	Not Detected	--------	5.60E-02
MN-56	Not Detected	--------	1.21E+02
MO-99	Not Detected	--------	5.38E-01
NA-22	Not Detected	--------	7.22E-02
NA-24	Not Detected	--------	2.48E-01
NB-95	Not Detected	--------	2.41E-01
ND-147	Not Detected	--------	3.21E-01
NI-57	Not Detected	--------	1.63E-01
BE-7	Not Detected	--------	3.40E-01
RU-103	Not Detected	--------	4.01E-02
RU-106	Not Detected	--------	3.86E-01
SB-122	Not Detected	--------	7.97E-02
SB-124	Not Detected	--------	4.49E-02
SB-125	Not Detected	--------	1.13E-01
SC-46	Not Detected	--------	8.86E-02
SR-85	Not Detected	--------	4.80E-02
TA-182	Not Detected	--------	2.60E-01
TA-183	Not Detected	--------	3.16E-01
TE-132	Not Detected	--------	3.97E-02
TL-201	Not Detected	--------	1.77E-01
XE-133	Not Detected	--------	2.10E-01
Y-88	Not Detected	--------	6.67E-02
ZN-65	Not Detected	--------	1.66E-01
ZR-95	Not Detected	--------	9.70E-02

Appendix A.9

ER Site 101
Gamma Spectroscopy Screening Results for the Drywell Deep Interval Soil Sample

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ER Site 101
Gamma Spectroscopy Screening Results for the Drywell
Deep Interval Soil Sample

```
************************************************************************
*                   Sandia National Laboratories                       *
*    Radiation Protection Sample Diagnostics Program [881 Laboratory]  *
*                      1-12-95  7:15:00 PM                             *
************************************************************************
*                                                                      *
* Analyzed by:            1/13/95  Reviewed by:             1/13/95    *
************************************************************************

Customer              : B.GALLOWAY/McLAUGHLIN(7582/SMO)
Customer Sample ID    : 018908-03
Lab Sample ID         : 50003506

Sample Description    : MARINELLI SOLID SAMPLE
Sample Type           : Solid
Sample Geometry       : 1SMAR
Sample Quantity       :   745.000  Gram
Sample Date/Time      :  1-11-95   2:00:00 PM
Acquire Start Date    :  1-12-95   6:37:59 PM
Detector Name         : LAB01
Elapsed Live Time     :   1800 seconds
Elapsed Real Time     :   1801 seconds

Comments:

************************************************************************
```

Nuclide	Activity (pCi/Gram)	2S Error	MDA
U-238	Not Detected	--------	2.29
TH-234	8.08E-01	3.35E-01	5.55E-01
U-234	Not Detected	--------	5.92E+01
RA-226	1.25	4.52E-01	5.30E-01
PB-214	6.32E-01	1.76E-01	4.92E-02
BI-214	6.44E-01	1.21E-01	6.00E-02
PB-210	Not Detected	--------	5.76E+02
TH-232	6.33E-01	2.13E-01	1.47E-01
RA-228	8.99E-01	2.35E-01	1.91E-01
AC-228	7.29E-01	1.69E-01	1.28E-01
TH-228	8.02E-01	3.68E-01	4.79E-01
RA-224	5.57E-01	3.15E-01	4.34E-01
PB-212	5.75E-01	1.80E-01	4.05E-02
BI-212	6.43E-01	2.92E-01	4.02E-01
TL-208	6.37E-01	1.36E-01	8.47E-02
U-235	Not Detected	--------	3.20E-01
TH-231	Not Detected	--------	7.49E-01
PA-231	Not Detected	--------	1.41
AC-227	Not Detected	--------	2.19
TH-227	Not Detected	--------	4.38E-01
RA-223	Not Detected	--------	2.46E-01
RN-219	Not Detected	--------	3.45E-01
PB-211	Not Detected	--------	8.49E-01
TL-207	Not Detected	--------	2.22E+01
AM-241	Not Detected	--------	3.11E-01
~~PU-239~~	~~1.75E+02~~	~~1.02E+02~~	~~2.24E+02~~ Not detected 1/13
NP-237	Not Detected	--------	2.65E-01
PA-233	Not Detected	--------	7.50E-02
TH-229	Not Detected	--------	3.96E-01

Appendix A.9, concluded:

ER Site 101
Gamma Spectroscopy Screening Results for the Drywell
Deep Interval Soil Sample

[Summary Report] - Sample ID: 50003506

Nuclide	Activity (pCi/Gram)	2S Error	MDA
AG-110m	Not Detected	--------	4.40E-02
AR-41	Not Detected	--------	4.30E+03
BA-133	Not Detected	--------	7.79E-02
BA-140	Not Detected	--------	1.59E-01
~~CD-109~~	~~6.88E-01~~	~~6.33E-01~~	~~1.05~~ not detected
CD-115	Not Detected	--------	1.22E-01
CE-139	Not Detected	--------	3.76E-02
CE-141	Not Detected	--------	7.25E-02
CE-144	Not Detected	--------	3.19E-01
CO-56	Not Detected	--------	5.96E-02
CO-57	Not Detected	--------	4.45E-02
CO-58	Not Detected	--------	5.55E-02
CO-60	Not Detected	--------	7.23E-02
CR-51	Not Detected	--------	2.80E-01
CS-134	Not Detected	--------	6.03E-02
CS-137	Not Detected	--------	5.35E-02
CU-64	Not Detected	--------	6.88E+01
EU-152	Not Detected	--------	4.04E-01
EU-154	Not Detected	--------	2.85E-01
EU-155	Not Detected	--------	1.93E-01
FE-59	Not Detected	--------	1.22E-01
GD-153	Not Detected	--------	1.45E-01
HG-203	Not Detected	--------	3.41E-02
I-131	Not Detected	--------	4.12E-02
IN-115m	Not Detected	--------	7.26
IR-192	Not Detected	--------	3.43E-02
K-40	1.50E+01	2.29	3.94E-01
LA-140	Not Detected	--------	1.18E-01
MN-54	Not Detected	--------	6.06E-02
MN-56	Not Detected	--------	1.40E+02
MO-99	Not Detected	--------	5.82E-01
NA-22	Not Detected	--------	7.55E-02
NA-24	Not Detected	--------	2.55E-01
NB-95	Not Detected	--------	2.48E-01
ND-147	Not Detected	--------	3.08E-01
NI-57	Not Detected	--------	1.60E-01
BE-7	Not Detected	--------	3.44E-01
RU-103	Not Detected	--------	3.94E-02
RU-106	Not Detected	--------	4.26E-01
SB-122	Not Detected	--------	8.06E-02
SB-124	Not Detected	--------	4.45E-02
SB-125	Not Detected	--------	1.17E-01
SC-46	Not Detected	--------	9.15E-02
SR-85	Not Detected	--------	4.93E-02
TA-182	Not Detected	--------	2.68E-01
TA-183	Not Detected	--------	3.15E-01
TE-132	Not Detected	--------	4.29E-02
TL-201	Not Detected	--------	1.92E-01
XE-133	Not Detected	--------	2.22E-01
Y-88	Not Detected	--------	7.10E-02
ZN-65	Not Detected	--------	1.71E-01
ZR-95	Not Detected	--------	1.00E-01

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.

146430

TABLE OF CONTENTS

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:

General Comments

"...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

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

GARY E. JOHNSON
GOVERNOR

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.

constructed in 1958 and was not occupied after 1988. As documented in the NFA proposal, significant or potentially harmful concentrations of VOCs or other COCs were not detected in any of the soil samples collected at this site.

Also, an EPA contractor recently collected two active soil gas samples from a borehole within five ft of the former outfall location. The ER Site 49 site map has also been revised to show the active soil gas sample location and is provided in Attachment A of the site-specific portion of this submittal. Attachment B of the site-specific portion of this submittal provides active soil gas sample analytical results. One sample was collected at 10 ft bgs, and the second was collected at the subsurface refusal depth of 17.5 ft. This shallow refusal depth likely indicates shallow bedrock at this site. A total of 9 out of 49 VOC compounds were detected in the shallow soil gas sample from this location. Concentrations of individual constituents ranged from 0.57 (J) to 6.4 (J) parts per billion by volume (ppbv), and 25.27 ppbv of total VOCs were detected in the sample. A total of 11 out of 49 VOC compounds were detected in the deeper soil gas sample. Concentrations of individual constituents ranged from 0.34 (J) to 31 ppbv, and 50.29 ppbv of total VOCs in soil gas were detected in the deeper sample. These soil gas concentrations are approximately three orders of magnitude less than the NMED Ground Water Quality Bureau guideline remediation goal of 10 parts per million by volume (ppmv) total VOCs in soils where groundwater has or might be affected. This guideline remediation goal is stated in Comment 9 in a letter from Ronald Kern (NMED-OB) to Beth Oms (DOE Kirtland Area Office) entitled "Comments on the Voluntary Corrective Measures Plan for the Chemical Waste Landfill," dated July 16, 1996. Therefore, the DOE/SNL do not believe that groundwater monitoring is necessary or justified at this site.

ER Site 101, Explosive Contaminated Sumps, Drains (Building 9926)

ER Site 101 consists of two seepage pits, an 875-gal septic tank, and a distribution box that serviced Building 9926, the Shock Wave Studies Laboratory; one seepage pit that serviced Building 9926A; and a drywell that serviced Building 9921, and an explosives storage igloo. Constructed in 1960, Building 9926 is in use today, but the septic system was abandoned in 1991 when the facility was connected to the TA-3 sewer system. The Building 9926A septic system reportedly never functioned properly and was reportedly never used; the NFA proposal does not mention the status of the septic system. The Building 9921 sink and drywell are apparently still in use.

Hazardous materials used at Building 9926 include photo-processing chemicals, solvents (methanol, TCE, toluene, acetone and isopropyl alcohol), as well as hydrochloric, nitric, and sulfuric acid. HE (e.g., nitroguanidine, PETN) and cadmium sulfide were handled at Building 9921 and were used in explosives tests at Building 9926A. Once in the soil column, these contaminants may have migrated to the water table through the process of vapor-phase transport or in solution with discharged wastewater. Sandia estimates depth to ground water to be approximately 450 ft (ER Site Summary Information Sheets).

2.3 Historical Operations

16. Figure 1-2 is apparently misreferenced as Figure 2-2. Also see General Comment 1.

Response: The NMED is correct. Figure 1-2 is misreferenced as 2-2 several times on page 2-2. Also, see response to General Comment 1.

Site-Specific Comments

17. The Septic Tanks and Drainfields RFI Work Plan indicates that ER Site 101 is the drywell at Building 9920. Additionally, ER Site 146 is described as the septic system at Buildings 9926 and 9926A. The June 1996 Proposal for NFA and ER Site Summary Sheets (December 1994) indicate that ER Site 101 comprises the drywell at Building 9921, the industrial wastewater seepage pits at Building 9926A, as well as the septic tank, distribution box, and two seepage pits at Building 9926. Sandia must explain the discrepancies between the Work Plan and the NFA proposal; this must include the disposition of the drywell at Building 9920.

Response: The RFI Work Plan is incorrect. ER Site 146 encompasses a very small (4- by 4-ft) drywell on the south side of Building 9920, which lies about 50 ft west of Buildings 9926/9926A. ER Site 101 includes the drywell serving a sink in the very small Building 9921 and the septic tank, distribution box, and two seepage pits serving Building 9926. It also includes the single industrial wastewater seepage pit connected to Building 9926A. Building 9926A (also known as the "boom box") is a small (12-ft-diameter) hexagonal-shaped room that was added to the north side of Building 9926.

18. The text on page 2-2 states that, "Building 9926A is used for exploding 5 pound shock wave studies, and explosive tests have involved the use of cadmium sulfide." Is Building 9926A currently used for explosive testing? If so, these tests must be discussed. Additionally, tests involving the use of cadmium sulfide must also be discussed in more detail. All available information regarding the Building 9926A septic system must be provided to the HRMB, even if it was not used much.

Also, see General Comment 4.

Response: According to Mr. Paul Johnson, who has been associated with this facility for 15 years, Building (Room) 9926A is currently approved for explosives testing use but has not actually been used since 1995. Also, Johnson could not that recall that any cadmium sulfide was used since he began working at the facility. All additional pertinent information available for the Building 9926A seepage pit system was included in the ER Site 101 NFA proposal. As a point of clarification, the seepage pit serving Building 9926A is not a septic system; rather, it is a single seepage pit connected to the floor drain in Building 9926A.

19. Sandia must include information on the effluent discharge rate for this facility, as well as the total estimated discharge over the lifetime of operations at the facility.

Response: Estimated effluent volumes discharged to the Building 9926 septic system range from 120 to 1,200 gallons per day, although no historical records are available to verify this estimate. The floor drain in Building 9926A reportedly never functioned properly, and the room is dry-swept rather than hosed down. An inspection of the "boom box" (Building 9926A) on October 14, 1998, confirmed that the floor drain was sealed with a metal plate. Johnson also stated that, in his years at the facility, he has never seen Building 9926A washed down.

Site-Specific Comments

3.4 The Results of Previous Sampling/Surveys

20. ***Sandia must complete boreholes at or near PETREX SVS locations 165 and 176, and install active or passive soil-vapor monitoring systems at both the surface and bottom of the boreholes. Also see General Comments 5 and 11.***

Response: The PETREX passive SVS was conducted at this site solely as a reconnaissance tool to identify possible additional locations beyond those in the immediate vicinity of the effluent release points at which significant COC concentrations may be present and at which soil samples should be collected. In the DOE/SNL's opinion, no additional locations were identified as a result of the PETREX SVS that required soil sampling. 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. The boring on the north side of the middle seepage pit (location SP2-2 on Figure 2) was located within about 10 ft of PETREX location 165, and no significant VOC or other COC concentrations were identified in samples from that boring. Significant VOC concentrations were not detected in any of the original 17 VOC soil samples collected on either side of the three seepage pits, next to the septic tank, and in the center of the small Building 9921 drywell. Also, six additional VOC soil samples were collected from borings drilled directly beneath the center of the three seepage pits at this site. Analytical results for these additional seepage pit samples have been added to the analytical data summary tables submitted with the ER Site 101 NFA proposal and are provided in Attachment C of the site-specific portion of this submittal. The ER Site 101 map has also been revised to reflect these additional sample locations and is provided in Attachment A. As the NMED indicates in General Comment 2, the highest COC concentrations are most likely located along a vertical axis beneath the center of the disposal structure. Significant VOC concentrations were not detected in any of these additional samples. Soil sampling at this site has been sufficient to demonstrate that COC concentrations that could pose a threat to human health or the environment are not present at ER Site 101, and the DOE/SNL see no reason or justification for additional soil gas sampling at this site.

Also see responses to General Comments 5 and 11.

However, in order to bring the ER Site 101 NFA approval process to a conclusion, the DOE/SNL will collect two additional VOC soil samples at PETREX location 176, which is about 28 ft away from the closest previous soil sampling location at this site. These two samples will be analyzed for VOCs. The ion count values detected in the PETREX sampler at location 176 indicate that potentially detectable concentrations of perchloroethylene (PCE), benzene, toluene, ethylbenzene, and xylenes (BTEX), and aliphatic compounds may be present in soils at that location. As before, soil samples will be collected from either the top or the bottom (as the NMED prefers) of same two depth intervals that were previously sampled in other boreholes at this site (at 16 to 20 ft and at 26 to 30 ft). If subsurface refusal is encountered before the deep sampling interval is reached, the soil from the bottom of the borehole will be sampled. If VOCs are detected in these additional samples, the concentrations will be compared to risk-based action levels that are determined for those VOCs, when the risk assessment methodology is finalized and approved by the NMED.

Site-Specific Comments

3.6 Confirmatory Sampling

21. **Data collection - see General Comments 2, 6, 8, 9 and 11.**

Response: See response to General Comments 2, 6, 8, 9 and 11.

22. **Figure 3.1 is apparently misreferenced as Figure 3-3.**

Response: The NMED is correct. Figure 3-1 is misreferenced as 3-3 on page 3-5.

23. ***Tables 3-2 and 3-3 show that the concentration of some organics (toluene, cyanide) increases with depth at various locations (SP1, SP2, and SP3). This indicates that the vertical extent of contamination may not yet be determined. Additional soil-vapor sampling must be conducted to determine the vertical extent of VOC contamination at these locations (see comment 20).***

Response: Significant concentrations of VOCs have not been detected in any of the 23 VOC soil samples collected at the effluent release points at this site. The DOE/SNL, therefore, believe that additional soil gas sampling is unjustified and unnecessary at this site. Also, cyanide was detected at concentrations of 0.71 and 1.2 parts per million in 2 of the 22 samples that were analyzed for cyanide from this site. Cyanide concentrations detected in these samples are four orders of magnitude less than the very conservative ecological risk preliminary remediation goal calculated for cyanide in soil. Also, 6 of the 22 cyanide soil samples were collected from boreholes drilled through the center of the three seepage pits at this site. No cyanide was detected in any of these samples. Therefore, the DOE/SNL does not believe that additional sampling for VOCs or cyanide is justified or necessary at this site.

ER Site 116, Building 9990 Septic System

ER Site 116 comprises the 750-gal septic tank, distribution box, and four seepage pits that serviced Building 9990, the Electroexplosive Research Facility. The facility was constructed in 1969 and used for explosives testing until 1986. The facility was used for other than explosives testing from 1986-1994 (activities undefined in the NFA). Reportedly, there has been no significant activity at Building 9990 since 1994.

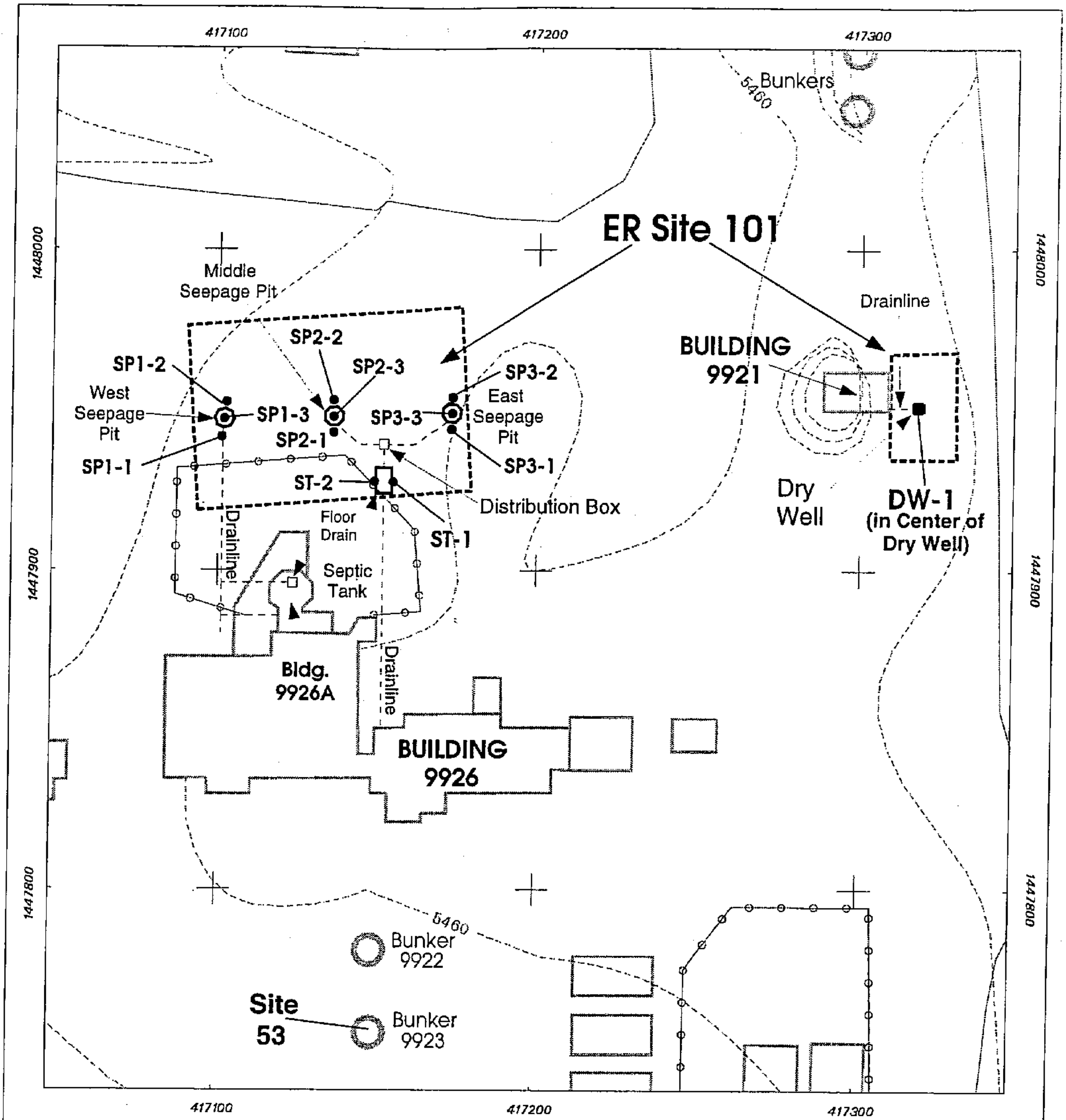
Hazardous materials that were reportedly discharged or leaked/spilled at the site include photo-processing chemicals (Cd, Cr^{+6}, CN, and Ag), polychlorinated biphenyls (PCBs), methylene chloride (CH_2Cl_2), and copper sulfate ($CuSO_4$). Sandia does not report HE or depleted uranium (DU) as potential contaminants, even though they were used in tests at the site. Once in the soil column, contaminants may have migrated to the water table through the process of vapor-phase transport or in solution with discharged wastewater. Sandia estimates the depth to ground water to be only 52 ft.

24. **Sandia states (page 2-2):**

",,,[There is] a potential for surficial fragments of depleted uranium (DU) around this site. Assessing and cleaning up DU surface contamination from explosive testing in the vicinity of Building 9990 is not included as part of OU 1295 assessment activities for ER Site 116 septic

ATTACHMENT A

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



Legend

- Boring Location
- KAFB Roads
- Buildings
- Surface Drainage
- 2-Foot Contour
- Drainline, Sanitary Sewerline
- Dry Well, Septic Tank
- Fences
- ER Site 101

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

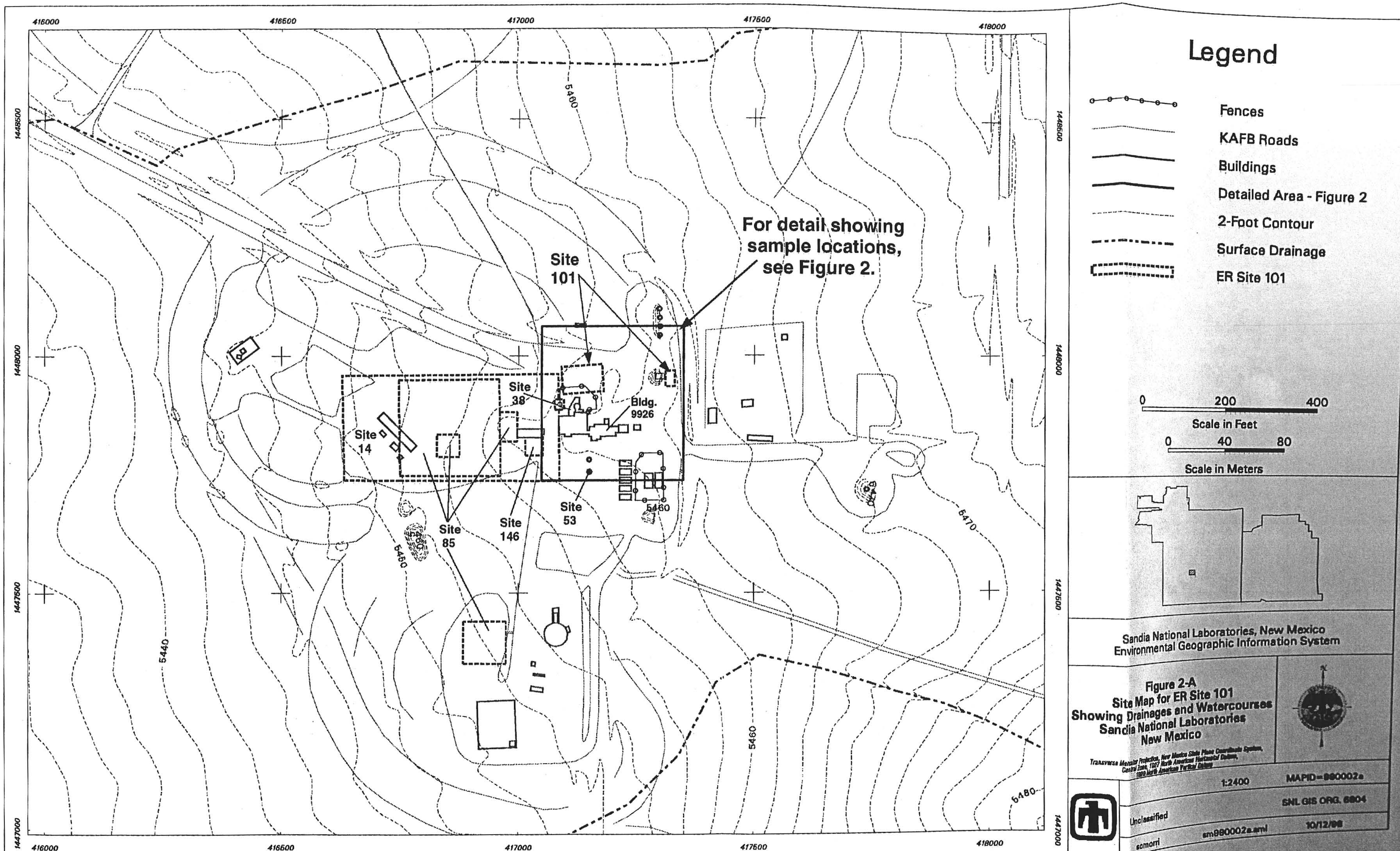
0 25 50
Scale in Feet

0 6 12
Scale in Meters

N

FIGURE 2
Site Map for ER Site 101
Sandia National Laboratories,
New Mexico

scmorri SNL GIS ORG. 6804 10/22/98 MAPID=990002


416000
416500
417000
417500
418000
1448500
1448000
1447500
1447000
5460
5440
5470
5480
For detail showing sample locations, see Figure 2.
Site 101
Site 38
Bldg. 9926
Site 14
Site 85
Site 146
Site 53
Legend
Fences
KAFB Roads
Buildings
Detailed Area - Figure 2
2-Foot Contour
Surface Drainage
ER Site 101
0 200 400
Scale in Feet
0 40 80
Scale in Meters
Sandia National Laboratories, New Mexico
Environmental Geographic Information System
Figure 2-A
Site Map for ER Site 101
Showing Drainages and Watercourses
Sandia National Laboratories
New Mexico
1:2400
Unclassified
SNL GIS ORG. 6804
10/12/98

RSI

ATTACHMENT C

SUMMARY DATA TABLES
SWMUs 101, 141, 151, AND 160

Table 2

ER Site 101
Summary of Organic and Other Constituents, and pH Measurements in Confirmatory Soil Samples Collected Around the Seepage Pits, Septic Tank, and Drywell

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	VOCs Method 8240/8260							SVOCs Method 8270		Cyanide Method 9010/ 9012	TNT Screen (1994 spls.) or EPA 8330 (1998 spls.)	Units	Soil pH ASTM Method 4972 (pH units)
						Acetone	Chloro-methane	2-Hexa-none	MEK	MIBK	Meth. Chloride	Toluene	Phenan-threne	Chrysene				
West Seepage Pit (SP-1), Borings on Each Side of Unit:																		
017943-1,2	Soil	Field	9/28/94	SP1-1	12	ND	ND	ND	ND	ND	2 J	ND	ND	ND	ND	ND	ug/kg	8.3
017945-1,2	Soil	Field	9/29/94	SP1-1	22	ND	ND	ND	ND	ND	1.9 J	ND	ND	ND	1,200	ND	ug/kg	8.3
017946-1,2	Soil	Field	9/29/94	SP1-2	12	ND	ND	ND	ND	ND	2.3 J	ND	ND	ND	710	ND	ug/kg	8.5
017947-1,2	Soil	Field	9/29/94	SP1-2	22	ND	ND	ND	ND	ND	2.3 J	ND	ND	ND	ND	ND	ug/kg	8.4
West Seepage Pit, Boring Through Center of Unit:																		
037097-1,2	Soil	Field	1/20/98	SP1-3	12	ND	ND	ND	ND	ND	1.1 J,B	ND	---	---	ND	ND	ug/kg	---
037098-1,2	Soil	Field	1/20/98	SP1-3	22	ND	3.7	ND	ND	ND	2 J,B	ND	---	---	ND	ND	ug/kg	---
037099-1,2	Soil	Dupl.	1/20/98	SP1-3	22	ND	ND	ND	ND	ND	2.4 J,B	ND	---	---	ND	ND	ug/kg	---
Middle Seepage Pit (SP-2), Borings on Each Side of Unit:																		
017948-1,2	Soil	Field	9/29/94	SP2-1	16	ND	ND	ND	ND	ND	2.8 J	ND	ND	ND	ND	ND	ug/kg	8.2
017950-1,2	Soil	Dupl.	9/29/94	SPD2-1	16	ND	ND	ND	ND	ND	3.1 J	ND	ND	ND	ND	ND	ug/kg	8
017949-1,2	Soil	Field	9/29/94	SP2-1	26	ND	ND	ND	ND	ND	2.7 J	ND	ND	ND	ND	ND	ug/kg	8.6
017952-1,2	Soil	Field	10/3/94	SP2-2	16	7.9 J	ND	ND	ND	ND	1.6 J	2.4 J	ND	ND	ND	ND	ug/kg	7.8
017953-1,2	Soil	Field	10/3/94	SP2-2	26	ND	ND	ND	ND	ND	1.9 J	8.2	ND	ND	ND	ND	ug/kg	7.9
Middle Seepage Pit, Boring Through Center of Unit:																		
037100-1,2	Soil	Field	1/21/98	SP2-3	16	ND	ND	ND	ND	ND	7.8 B	ND	---	---	ND	ND	ug/kg	---
Note: no deep sample in this borehole due to subsurface refusal.																		

C4425-2

Table 2, continued:

ER Site 101
Summary of Organic and Other Constituents, and pH Measurements in Confirmatory Soil Samples Collected Around the Seepage Pits, Septic Tank, and Drywell

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	VOCs Method 8240/8260 Acetone	Chloro-methane	2-Hexa-none	MEK	MIBK	Meth. Chloride	Toluene	SVOCs Method 8270 Phenan-threne	Chrysene	Cyanide Method 9010/9012	TNT Screen (1994 spls.) or EPA 8330 (1998 spls.)	Units	Soil pH ASTM Method 4972 (pH units)
East Seepage Pit (SP-3), Borings on Each Side of Unit:																		
017956-1,2	Soil	Field	10/3/94	SP3-1	16	ND	ND	ND	ND	ND	1.8 J	11	ND	ND	ND	ND	ug/kg	7.6
017957-1,2	Soil	Field	10/3/94	SP3-1	26	ND	ND	ND	ND	ND	1.2 J	ND	ND	ND	ND	ND	ug/kg	7.9
017958-1,2	Soil	Field	10/3/94	SP3-2	16	7.3 J	ND	ND	ND	ND	1.1 J	5	ND	ND	ND	ND	ug/kg	7.6
017959-1,2	Soil	Field	10/3/94	SP3-2	26	5 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ug/kg	7.8
017944-1	Soil	TB	9/28/94	Site 101	NA	11	ND	ND	ND	ND	4.7 J	1.3 J	---	---	---	---	ug/kg	---
017951-1	Soil	TB	9/29/94	Site 101	NA	ND	ND	2.1 J	ND	1.2 J	4 J	ND	---	---	---	---	ug/kg	---
East Seepage Pit, Boring Through Center of Unit:																		
037101-1,2	Soil	Field	1/21/98	SP3-3	16	ND	ND	ND	ND	ND	7.6 B	ND	---	---	ND	ND	ug/kg	---
037102-1,2	Soil	Field	1/21/98	SP3-3	26	ND	8.3	ND	ND	ND	8.8 B	ND	---	---	ND	ND	ug/kg	---
Septic Tank Soil Samples:																		
017954-1,2	Soil	Field	10/3/94	ST-1	9	7.7 J	ND	ND	ND	ND	1.5 J	6.1	34 J	42 J	ND	ND	ug/kg	7.7
017955-1,2	Soil	Field	10/3/94	ST-2	9	6.6 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ug/kg	8
017960-1	Soil	TB	10/3/94	Site 101	NA	25	ND	ND	3 J	ND	2.5 J	2.3 J	NS	NS	NS	NS	ug/kg	---
017965-1,2,4	Water	EB	10/4/94	Site 101	NA	6.6 J	ND	ND	ND	ND	1.2 J	ND	ND	ND	ND	NS	ug/L	---
Drywell Soil Samples:																		
018907-1,2	Soil	Field	1/11/95	DW-1	4	6.8 J	ND	ND	ND	ND	1.7 J	ND	ND	ND	NS	ND	ug/kg	---
018908-1,2	Soil	Field	1/11/95	DW-1	14	14	ND	ND	ND	ND	1.5 J	ND	ND	ND	NS	ND	ug/kg	---
Reporting Limit For Soil (1994 samples, to QARV)						10	10	10	10	10	5	5	330	330	500	1,000	ug/kg	
Reporting Limit For Soil (1998 samples, to GEL)						10	2	5	5	5	5	2	NA	NA	462-482	5.21-11.1	ug/kg	
Reporting Limit For Water (1994 samples, to QARV)						10	10	10	10	10	5	5	10	10	10	NA	ug/L	
Proposed Subpart S Action Level For Soil						8E+06	None	None	5E+07	4E+06	9E+04	2E+07	2.4E+07	9.6E+03	2E+06	4E+04	ug/kg	

Table 2, concluded:

ER Site 101
Summary of Organic and Other Constituents, and pH Measurements in Confirmatory Soil Samples Collected Around the Seepage Pits, Septic Tank, and Drywell

<u>Notes</u>
Dupl. = Duplicate soil sample
EB = Equipment rinsate blank
fbgs = feet below ground surface
GEL = General Engineering Laboratory
J = Result is detected below the reporting limit or is an estimated concentration.
MEK = Methyl ethyl ketone, or 2-Butanone
Meth. chloride = Methylene chloride
MIBK = Methyl isobutyl ketone, or 4-methyl-2-pentanone
NA = Not applicable
ND = Not detected
NS = No sample
QARV = Quanterra laboratory in Arvada, CO
SVOCs = Semivolatile organic compounds
TB = Trip blank
TNT = Trinotrotoluene
VOCs = Volatile organic compounds

--- Indicates that no sample was collected, or a sample was collected but was not analyzed for the particular analyte.

Ta[illegible]

ER Site 101

Summary of RCRA Metals and Hexavalent Chromium in Confirmatory Soil Samples Collected Around the Seepage Pits, Septic Tank, and Drywell

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: Cr^{6+} Method 7196	Units
West Seepage Pit (SP-1), Borings on Each Side of Unit:															
017943-2	Soil	Field	9/28/94	SP1-1	12	2.7	112	ND	8.2	7.2	ND	0.58	ND	ND	mg/kg
017945-2	Soil	Field	9/29/94	SP1-1	22	2.4	52.6	ND	7.8	6.1	ND	ND	ND	ND	mg/kg
017946-2	Soil	Field	9/29/94	SP1-2	12	2.3	88.1	ND	23.6	6.4	ND	ND	ND	ND	mg/kg
017947-2	Soil	Field	9/29/94	SP1-2	22	2.1	51.7	ND	8.3	7.3	ND	ND	ND	ND	mg/kg
West Seepage Pit, Boring Through Center of Unit:															
037097-2	Soil	Field	1/20/98	SP1-3	12	3.17	125	0.446 J,B	8.17	5.16	ND	ND	2.34	---	mg/kg
037098-2	Soil	Field	1/20/98	SP1-3	22	2.62	52	0.35 J	6.53	4.27	ND	ND	0.167 J	---	mg/kg
037099-2	Soil	Dupl.	1/20/98	SP1-3	22	2.14	125	0.323 J	7.79	3.9	ND	ND	0.154 J	---	mg/kg
Center Seepage Pit (SP-2), Borings on Each Side of Unit:															
017948-2	Soil	Field	9/29/94	SP2-1	16	3	85.8	ND	8.7	5.7	ND	ND	ND	ND	mg/kg
017950-2	Soil	Dupl.	9/29/94	SPD2-1	16	3.2	79.6	ND	8.8	7.1	ND	ND	ND	ND	mg/kg
017949-2	Soil	Field	9/29/94	SP2-1	26	2.3	59.1	ND	9.2	6.6	ND	ND	ND	ND	mg/kg
017952-2	Soil	Field	10/3/94	SP2-2	16	2.6	115	ND	9.1	5.6	ND	ND	ND	ND	mg/kg
017953-2	Soil	Field	10/3/94	SP2-2	26	2.4	73.3	ND	8.9	6.6	ND	ND	ND	ND	mg/kg
Center Seepage Pit, Boring Through Center of Unit:															
037100-2	Soil	Field	1/21/98	SP2-3	16	2.76	52.2	0.249 J	6.21	4.4	ND	0.16 J	0.119 J	---	mg/kg
Note: no deep samples in this borehole; refusal encountered.															
East Seepage Pit (SP-3), Borings on Each Side of Unit:															
017956-2	Soil	Field	10/3/94	SP3-1	16	3.1	80.4	ND	7.3	9.9	ND	1.3	ND	ND	mg/kg
017957-2	Soil	Field	10/3/94	SP3-1	26	2.2	97.8	ND	7.9	6.3	ND	ND	ND	ND	mg/kg
017958-2	Soil	Field	10/3/94	SP3-2	16	2	90.5	ND	9.5	5.4	ND	ND	ND	ND	mg/kg
017959-2	Soil	Field	10/3/94	SP3-2	26	2.1	58.3	ND	18.1	6.1	ND	ND	ND	ND	mg/kg
East Seepage Pit (SP-3), Boring Through Center of Unit:															
037101-2	Soil	Field	1/21/98	SP3-3	16	2.41	95	0.404 J	7.32	3.9	ND	0.182 J	0.121 J	---	mg/kg
037102-2	Soil	Field	1/21/98	SP3-3	26	2.23	90.8	0.324 J	7.27	4.56	ND	0.264 J	0.0939 J	---	mg/kg

Table 3, Continued

ER Site 101

Summary of RCRA Metals and Hexavalent Chromium in Confirmatory Soil Samples Collected Around the Seepage Pits, Septic Tank, and Drywell

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: Cr^{6+} Method 7196	Units
Septic Tank Soil and QA Samples:															
017954-2	Soil	Field	10/3/94	ST-1	9	2.8	96.4	ND	8.8	7.1	ND	ND	ND	ND	mg/kg
017955-2	Soil	Field	10/3/94	ST-2	9	2.8	150	ND	9.8	9.3	ND	ND	ND	ND	mg/kg
017965-3	Water	EB	10/4/94	Site 101	NA	ND	0.01	ND	0.0051 J	0.0037	ND	ND	ND	---	mg/L
Drywell Soil Samples:															
018907-2	Soil	Field	1/11/95	DW-1	4	2.5	114	ND	5.3	4.4 J	ND	ND	ND	---	mg/kg
018908-2	Soil	Field	1/11/95	DW-1	14	2.4	131	ND	6.7	5.1	ND	ND	ND	---	mg/kg
Reporting Limit For Soil (1994 samples)						1	1	0.5	1	5	0.1	0.5	1	0.05 - 0.1	mg/kg
Reporting Limit For Soil (1998 samples)						0.5	0.5	0.5	0.5	0.5	0.033	0.5	0.5	NA	mg/kg
Laboratory Reporting Limit For Water (1994 samples)						0.01	0.01	0.005	0.01	0.003	0.0002	0.005	0.01	NA	mg/L
Number of SNL/NM Background Soil Sample Analyses *						15	727	1,740	647	536	1,724	2,134	2,302	393	NA
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	0.02-<2.5	mg/kg
SNL/NM Soil Background UTL or 95th Percentile *						7	214	0.9	15.9	11.8	<0.1	<1.0	<1.0	1	mg/kg
Proposed Subpart S Action Level For Soil						0.50	6,000	80	80,000 **	400 ***	20	400	400	400 **	mg/kg

ER Site 101

Summary of RCRA Metals and Hexavalent Chromium in Confirmatory Soil Samples Collected Around the Seepage Pits, Septic Tank, and Drywell

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.
Be = Beryllium. Beryllium background concentrations presented above are based on analyses of surface and subsurface samples collected in the Southwest, CTF, and Offsite 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.
Cr^{6+} = Hexavalent chromium. Hexavalent chromium background concentrations presented above are based on analyses of surface and subsurface soil samples collected in the Southwest area.
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.

CTF = Coyote Test Field
Dupl. = Duplicate soil sample
EB = Equipment rinsate blank
fbgs = Feet below ground surface
J = Result is detected below the reporting limit or is an estimated concentration.
NA = Not applicable
ND = Not detected
QA = Quality assurance
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)

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)
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J. Pavletich, SNL MS 1087
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M. J. Davis, SNL, MS 1089
ESHSEC Records Center, MS 1087

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 101, BUILDING 9926 EXPLOSIVE CONTAMINATED SUMPS AND DRAINS, COYOTE TEST FIELD

June 2005

United States Department of Energy
Sandia Site Office

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Annex

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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
AOP	Administrative Operating Procedure
BCF	bioconcentration factor
bgs	below ground surface
CAC	Corrective Action Complete
COC	constituent of concern
COPEC	constituent of potential ecological concern
CTF	Coyote Test Field
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
GEL	General Engineering Laboratories, Inc.
HE	high explosive(s)
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HQ	hazard quotient
HRMB	Hazardous and Radioactive Materials Bureau
HWB	Hazardous Waste Bureau
IRIS	Integrated Risk Information System
KAFB	Kirtland Air Force Base
LOAEL	lowest-observed-adverse-effect level
MDA	minimum detectable activity
mrem	millirem
NFA	No Further Action
NMED	New Mexico Environment Department
NOAEL	no-observed-adverse-effect level
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
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

ACRONYMS AND ABBREVIATIONS (Concluded)

TNT	trinitrotoluene
TOP	Technical Operating Procedure
VOC	volatile organic compound
yr	year

1.0 INTRODUCTION

1.1 Investigation History

Solid Waste Management Unit (SWMU) 101 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 101 (SNL/NM June 1996). In January 1998, as part of a five site sampling comparison study required by the NMED (Dinwiddie January 1998), additional samples were collected at Drain and Septic Systems (DSS) SWMU 101 from boreholes drilled through the center of, and beneath, the three seepage pits at this site. The analytical results were submitted to the NMED, and were evaluated and summarized in an internal NMED report (McDonald November 1998). In June 1998, the NMED-Hazardous and Radioactive Materials Bureau (HRMB) responded with a Request for Supplemental Information (RSI) on the NFA proposal which required the following:

- Finalized location and site maps
- The drilling and sampling of additional soil borings drilled through the center of, and beneath the seepage pits
- Updated data tables including such information as: sample identification numbers, analyses performed by off-site laboratories, analytical methods, method detection limits (MDLs) or practical quantitation limits (PQLs), New Mexico/ U.S. Environmental Protection Agency (EPA) maximum contaminant limits (MCLs), and approved upper tolerance limits (UTLs) or 95th percentile values for comparison
- The investigation of a potential soil-vapor plume indicated by PETREX™ passive soil-vapor survey data, and additional soil-vapor sampling to determine the extent of volatile organic compound (VOC) contamination located in the seepage pit area (NMED June 1998)

SNL/NM responded to the RSI in November 1998 (SNL/NM November 1998). The SNL/NM response to the SWMU 101 comments consisted of the following:

- Submit final and revised versions of the site maps
- Collect soil samples and submit analytical results of the soil borings drilled through the center of the seepage pits
- Submit amended data tables
- Complete a revised risk screening assessment in accordance with current risk assessment procedures, after all required sampling had been completed at the site

SNL/NM also stated that the PETREX™ soil-vapor data was 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 stated that additional soil-vapor sampling for VOCs and cyanide was not necessary because significant concentrations of VOCs were not detected in the 23 VOC samples collected at the effluent release points and cyanide concentrations detected in the samples were four orders of magnitude less than the conservative ecological risk preliminary remediation goals (SNL/NM November 1998). Finally, additional site-specific information requested by the NMED was provided as part of this RSI response.

At that time, negotiations were being conducted to define a technical and decision-making approach to complete environmental assessment and characterization work at the original 22 SWMUs and at 61 other DSS Area of Concern (AOC) sites at SNL/NM. 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). Technical details for 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 SWMUs were combined into the AOC site investigation procedures 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. 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. DSS SWMU 101 was not one of the sites selected for deep soil-vapor well sampling or any other additional work. No additional soil sampling was performed at SWMU 101 after the boring through the center of the seepage pit was completed in January 1998.

In January 2005, SNL/NM contacted the NMED/Hazardous Waste Bureau (HWB) regarding the need for collection of additional VOC samples from the PETREX passive soil-vapor sampling location at SWMU 101. The NMED/HWB responded that no additional sampling would be required (Cooper February 2005).

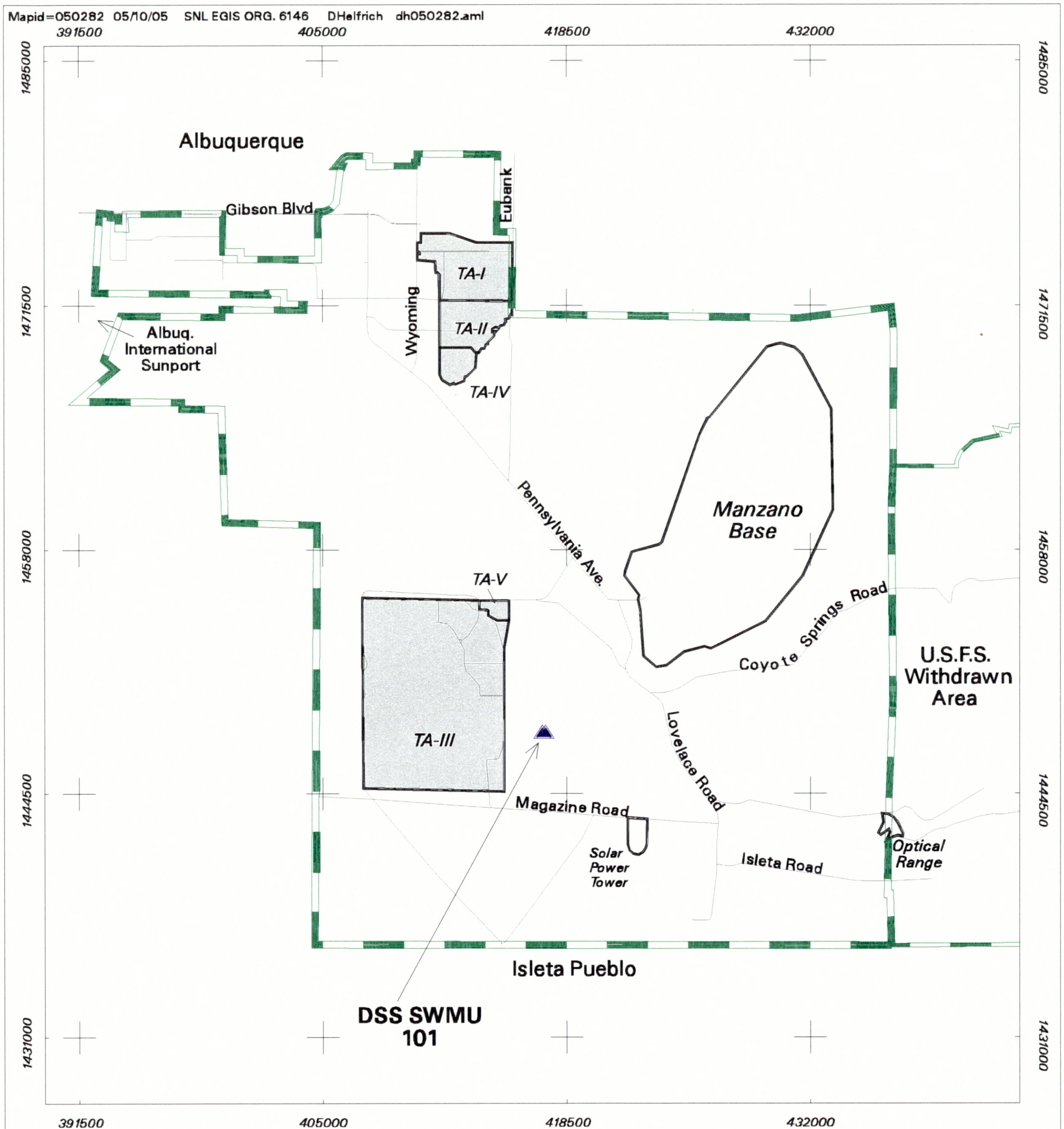
1.2 Remaining RSI Requirement

The remaining requirement to fulfill the June 1998 RSI for SWMU 101 that is addressed in this RSI response is:

- 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 this RSI response.

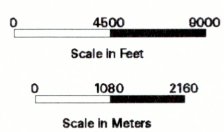
Mapid=050282 05/10/05 SNL EGIS ORG. 6146 DHelfrich dh050282.aml



Legend

- ▲ DSS SWMU 101
- Major Road
- KAFB Boundary
- USFS Withdrawn Area Boundary
- SNL Technical Area

Figure 1.2-1
Location Map of Drain and Septic Systems (DSS) SWMU 101, Bldg. 9926 Explosive Contaminated Sumps and Drains, Coyote Test Field



Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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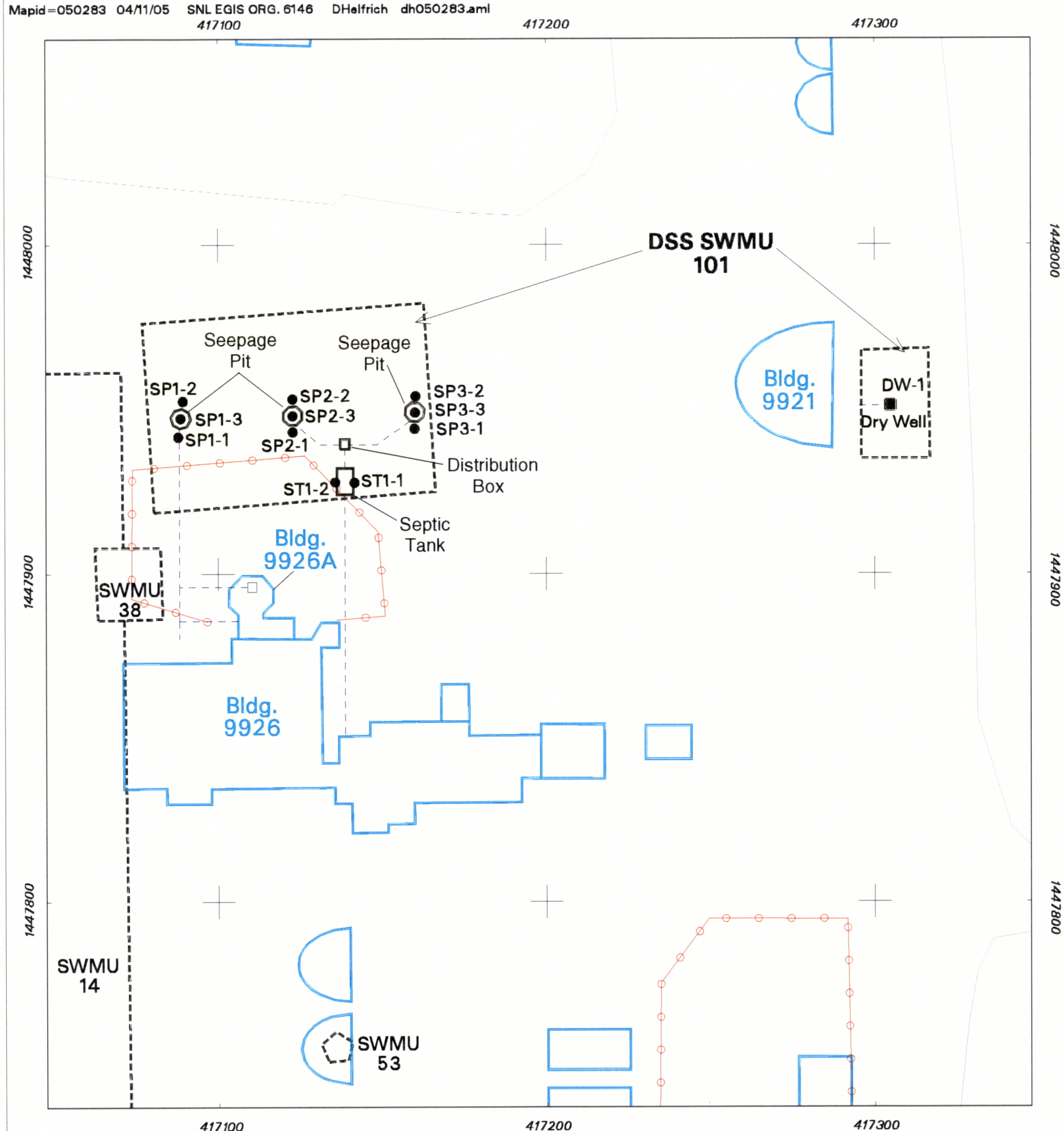
Mapid=050283 04/11/05 SNL EGIS ORG. 6146 DHelfrich dh050283.aml



Legend

- Soil Boring Location
- Unpaved Road
- Fence
- Septic Tank, Dry Well
- Drainline, Sanitary Sewerline
- Building / Structure
- Other SWMU Boundary
- DSS SWMU 101

Figure 1.2-2
Site Map of Drain and Septic Systems (DSS) SWMU 101, Bldg. 9926 Explosive Contaminated Sumps and Drains, Coyote Test Field

Scale in Feet: 0, 25, 50
Scale in Meters: 0, 6, 12

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2.0 RISK ASSESSMENT REPORT FOR DSS SWMU 101

2.1 Site Description and History

DSS SWMU 101, the Building 9926 Explosive Contaminated Sumps and Drains at SNL/NM, is located in the Coyote Test Field (CTF) area on federally owned land controlled by Kirtland Air Force Base (KAFB) and permitted to the U.S. Department of Energy (DOE). The abandoned system consisted of an 850-gallon septic tank and distribution box connected to two seepage pits that serviced Building 9926, the Shock Wave Studies Laboratory, one seepage pit that serviced Building 9926A, and a drywell that serviced both Building 9921 and an explosives storage igloo. Available information indicates that Building 9926 was constructed in 1960 and was expanded in 1967 with the addition of the Shock Wave Studies Laboratory and the semi-attached explosive room, designated Building 9926A (SNL/NM March 2003). It is assumed that the septic system was also constructed during this time period. By June 1991, the septic system discharges were routed to the City of Albuquerque sanitary sewer system (Jones June 1991). The old septic system line was disconnected and capped, and the system was abandoned in place concurrent with this change (Romero September 2003). Waste in the septic tank was removed and managed according to SNL/NM policy. The empty and decontaminated septic tank was inspected by the NMED on December 15, 1995, and a closure form was signed (SNL/NM January 1996). The septic tank was then backfilled with clean, native soil from the area in late 1995 or early 1996.

Environmental concern about DSS SWMU 101 is based upon the potential for the release of constituents of concern (COCs) in effluent discharged to the environment via the seepage pits and drywell 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 2,000 feet southwest of the site and terminates in the playa just west of KAFB. No springs or perennial surface-water bodies are located within 2 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 101 is unpaved with some native vegetation, and no storm sewers are used to direct surface water away from the site.

DSS SWMU 101 lies at an average elevation of approximately 5,460 feet above mean sea level. The groundwater beneath the site occurs in unconfined conditions in essentially unconsolidated silts, sands, and gravels. Groundwater is approximately 420 feet below ground surface (bgs). Groundwater flow is thought to be to the northwest in this area (SNL/NM April 2004). The nearest groundwater monitoring well (CTF-MW3) is approximately 0.5 miles southeast of the site in the central portion of the CTF. The nearest production wells are north of the site and include KAFB-4 and KAFB-11, which are located approximately 4.2 miles northwest and north of the site, respectively.

2.2 Data Quality Objectives

Soil sampling was conducted in 1994, 1995, and 1998 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 101 was effluent discharged to the environment from the seepage pits and the drywell at this site.

During September and October 1994 and January 1995, soil samples were collected using a Geoprobe™ at DSS SWMU 101 from boreholes drilled adjacent to the septic tank and seepage pits, and from one borehole drilled through the center of the drywell. The seepage pit sampling

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

DSS SWMU 101 Sampling Area(s)	Potential COC Source	Number of Sampling Locations	Sample Density (samples/acre)	Sampling Location Rationale
Soil adjacent to, and beneath, the two septic system seepage pits, and the Building 9926A seepage pit	Effluent discharged to the environment from the seepage pits	9	NA	Evaluate potential COC releases to the environment from effluent discharged from the seepage pits
Soil beneath the septic system drywell	Effluent discharged to the environment from the drywell	1	NA	Evaluate potential COC releases to the environment from effluent discharged from the drywell
Soil adjacent to, and beneath, the 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

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

intervals started at 12 and 22 feet bgs in the west seepage pit boring, and at 16 and 26 feet bgs in the middle and east seepage pit borings. The septic tank borehole sampling intervals started 9 feet bgs and the drywell sampling interval started at 4 and 14 feet bgs. In January 1998, additional soil samples required by NMED (Dinwiddie January 1998) were collected from boreholes drilled through the center of the three seepage pits located at SWMU 101. Samples were collected at 12 and 22 feet bgs in the west seepage pit borehole and at 16 and 26 feet bgs in the east seepage pit borehole. Only one soil sample was collected at 16 feet bgs in the middle seepage pit borehole. No deep (26-foot) sample was collected at this borehole due to subsurface refusal. 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.

During the 1994 sampling event, seepage pit and septic tank soil samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), RCRA metals, hexavalent chromium, cyanide, isotopic uranium, and radionuclides by gamma spectroscopy. In January 1995 drywell soil samples were collected and analyzed for VOCs, SVOCs, RCRA metals, tritium, isotopic uranium, and radionuclides by gamma spectroscopy. The samples were analyzed by off-site laboratories (Quanterra Environmental Services [QES] and Thermo Analytical Inc./Eberline Laboratories [TMA]) and the on-site Radiation Protection Sample Diagnostics (RPSD) Laboratory. Samples were also screened for trinitrotoluene (TNT) at the on-site Environmental Restoration (ER) Chemistry Laboratory. No TNT was detected, therefore these TNT samples are not used in the risk assessment analysis.

In January 1998, as part of a five site sampling comparison study required by NMED (Dinwiddie January 1998), additional samples were collected from boreholes drilled through the center of the three seepage pits at this site. These samples were analyzed for VOCs, high explosive (HE) compounds, RCRA metals, cyanide, and radionuclides by gamma spectroscopy by an off-site laboratory (General Engineering Laboratories, Inc. [GEL]) and at the on-site RPSD Laboratory. Table 2.2-3 summarizes the analytical methods and data quality requirements from the RFI Work Plan (SNL/NM March 1993) and the SAP for the RFI of septic tanks and drainfields (IT March 1994). The analytical results for these additional samples were submitted to NMED (SNL/NM November 1998), and were evaluated and summarized in an internal NMED report (McDonald November 1998).

QA/QC samples were collected during the sampling effort according to the ER Project Quality Assurance Project Plan. The QA/QC samples consisted of three trip blanks (for VOCs only), two field duplicates, and two sets of equipment blanks. No significant QA/QC problems were identified in the QA/QC samples.

All of the DSS SWMU 101 soil sample results were verified/validated by SNL/NM. The off-site laboratory results from QES, TMA, and GEL 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.

Table 2.2-2
Number of Confirmatory Soil and QA/QC Samples Collected from DSS SWMU 101

Sample Type	VOCs	SVOCs	HE	RCRA Metals	Hexavalent Chromium	Total Cyanide	Isotopic Uranium	Tritium	Gamma Spectroscopy Radionuclides
Confirmatory	21	16	5	21	14	19	6	2	9
Duplicates	2	1	1	2	1	2	0	0	0
EBs and TBs[a]	4	1	0	1	0	1	0	0	0
Total Samples	27	18	6	24	15	22	6	2	9
Analytical Laboratory	GEL, QES	QES	GEL	GEL, QES	QES	GEL, QES	TMA	TMA	RPSD

[a]TBs for VOCs only.
DSS = Drain and Septic Systems.
EB = Equipment blank.
GEL = General Engineering Laboratories, Inc.
HE = High explosive(s).
QA/QC = Quality assurance/quality control.
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.
VOC = Volatile organic compound.

Table 2.2-3
Summary of Data Quality Requirements for DSS SWMU 101

Analytical Method[a]	Data Quality Level	GEL	QES	TMA	RPSD
VOCs EPA Method 8260	Defensible	5	16	None	None
SVOCs EPA Method 8270	Defensible	None	16	None	None
HE EPA Method 8330	Defensible	5	None	None	None
RCRA Metals EPA Method 6000/7000	Defensible	5	16	None	None
Hexavalent Chromium EPA Method 7196A	Defensible	None	14	None	None
Total Cyanide EPA Method 9012A	Defensible	5	14	None	None
Isotopic Uranium HASL-300	Defensible	None	None	6	None
Tritium EPA Method 906.0 or equivalent	Defensible	None	None	2	None
Gamma Spectroscopy Radionuclides EPA Method 901.1	Defensible	None	None	None	6

Note: The number of samples does not include composite samples or 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.
GEL = General Engineering Laboratories, Inc.
HASL = Health and Safety Lab Method.
HE = High explosive(s).
QA/QC = Quality assurance/quality control.
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.
TMA = Thermo Analytical Inc./Eberline.
VOC = Volatile organic compound.

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 101 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 101, 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 101 were evaluated using laboratory analyses of the soil samples. The analytical requirements included analyses for VOCs, SVOCs, HE compounds, RCRA metals, hexavalent chromium, 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 101.

2.3.3 Rate of Contaminant Migration

The seepage pits and drywell at DSS SWMU 101 were deactivated in the early 1990s when Building 9926 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 seepage pits and drywell 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 seepage pits and drywell 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 101.

2.3.4 Extent of Contamination

Subsurface soil samples were collected from boreholes drilled at 12 locations beneath, and adjacent to, the effluent release points and areas (septic tank, seepage pits, and drywell) at DSS SWMU 101 to assess whether releases of effluent from the septic system caused any environmental contamination.

The 1994 and 1998 soil samples collected from the boreholes located beneath, and adjacent to, the seepage pits were collected at sampling depths starting at 12 and 22 feet bgs in the west seepage pit borehole, and at 16 and 26 feet bgs in the middle and east seepage pit boreholes. The 1994 and 1995 soil samples collected from the boreholes located adjacent to the septic tank and beneath the drywell were collected at sampling depths starting 9, 4, and 14 feet bgs, respectively. Sampling intervals started at the depths at which effluent discharged from the septic tank, seepage pits, and drywell would have entered the subsurface environment at the site. This sampling procedure was required by NMED regulators and has been used at numerous 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 of COCs.

2.4 Comparison of COCs to Background Screening 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, 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 through 2.4-4.

Nonradiological inorganic constituents that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, are not included in this risk assessment (EPA 1989). Both radiological and nonradiological COCs are evaluated. The nonradiological COCs included in the risk assessment consist of both inorganic and organic compounds.

Tables 2.4-1 and 2.4-2 list the nonradiological COCs for the human health and ecological risk assessments at DSS SWMU 101, respectively. Tables 2.4-3 and 2.4-4 list the radiological COCs for the human health and ecological risk assessments, respectively. All tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997). Section 2.6.4.2 discusses the results presented in Tables 2.4-1 and 2.4-3; Sections 2.7.2.1 and 2.7.2.2 discuss the results presented in Tables 2.4-2 and 2.4-4.

2.5 Fate and Transport

The primary releases of COCs at DSS SWMU 101 were to the subsurface soil resulting from the discharge of effluent from the Building 9926 septic system. 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 considered to be of potential significance as transport mechanisms at this site. Because the septic system is no longer active, additional water infiltration is not expected. Infiltration of precipitation is essentially nonexistent at DSS SWMU 101, as virtually all of the moisture either drains away from the site or evaporates. Because groundwater at this site is approximately 420 feet bgs, the potential for COCs to reach groundwater through the unsaturated zone above the water table is extremely low.

The COCs at DSS SWMU 101 include both inorganic and organic constituents. The inorganic COCs include both radiological and nonradiological 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. Radiological COCs will undergo decay to stable isotopes or radioactive daughter elements. However, because of the long half-lives of the radiological COCs (uranium-235 and uranium-238), the aridity of the environment at this site, and the lack of potential contact with biota, none of these mechanisms are expected to result in significant losses or transformations of the inorganic COCs.

The organic COCs at DSS SWMU 101 are VOCs and SVOCs. Organic constituents 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.

Table 2.4-1
Nonradiological COCs for Human Health Risk Assessment at DSS SWMU 101 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	3.2	4.4	Yes	44[c]	--	**Yes**
Barium	150	214	Yes	170[d]	--	**Yes**
Cadmium	0.446 J	0.9	Yes	64[c]	--	**Yes**
Chromium, total	23.6	15.9	**No**	16[c]	--	No
Chromium VI	0.05[e]	1	Yes	16[c]	--	No
Cyanide	1.2	NC	**No**	NC	--	**Unknown**
Lead	9.9	11.8	Yes	49[c]	--	**Yes**
Mercury	0.05[e]	<0.1	Yes	5,500[c]	--	**Yes**
Selenium	1.3	<1	**No**	800[f]	--	**Yes**
Silver	2.34	<1	**No**	0.5[c]	--	No
Organic						
Acetone	0.014	NA	**NA**	0.69[g]	-0.24[g]	No
Chloromethane	0.0083	NA	**NA**	1.8[h]	0.91[i]	No
Chrysene	0.165[e]	NA	**NA**	18,000[j]	5.91[j]	**Yes**
Methylene Chloride	0.0088 J	NA	**NA**	5[g]	1.25[g]	No
Phenanthrene	0.165[e]	NA	**NA**	23,800[c]	4.63[c]	**Yes**
Toluene	0.011	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]Lyman et al. 1982.
[i]Howard 1989.
[j]Micromedex 1998.

Table 2.4-1 (Concluded)
Nonradiological COCs for Human Health Risk Assessment at DSS SWMU 101 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
Nonradiological COCs for Ecological Risk Assessment at DSS SWMU 101 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

COC	Maximum Concentration (Samples ≤ 5 ft bgs) (mg/kg)	SNL/NM Background Concentration (mg/kg)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Log K_{ow} (for organic COCs)	Bioaccumulator?[b] (BCF >40, Log K_{ow} >4)
Inorganic						
Arsenic	2.5	4.4	Yes	44[c]	--	**Yes**
Barium	114	214	Yes	170[d]	--	**Yes**
Cadmium	0.25[e]	0.9	Yes	64[c]	--	**Yes**
Chromium, total	5.3	15.9	Yes	16[c]	--	No
Lead	4.4 J	11.8	Yes	49[c]	--	**Yes**
Mercury	0.05[e]	<0.1	Yes	5,500[c]	--	**Yes**
Selenium	0.25[e]	<1	Yes	800[f]	--	**Yes**
Silver	0.5[e]	<1	Yes	0.5[c]	--	No
Organic						
Acetone	0.0068 J	NA	**NA**	0.69[g]	-0.24[g]	No
Methylene Chloride	0.0017 J	NA	**NA**	5[g]	1.25[g]	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.

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

Table 2.4-3
Radiological COCs for Human Health Risk Assessment at DSS SWMU 101 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 (0.0556)	0.079	Yes	3,000[d]	**Yes**
Thorium-232	0.633	1.01	Yes	3,000[d]	**Yes**
Tritium	**0.0245**	0.021[e]	**No**	NA	No
Uranium-235	**ND (0.320)**	0.16	**No**	900[d]	**Yes**
Uranium-238	**ND (4.52)**	1.4	**No**	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.

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.

Table 2.4-4
Radiological COCs for Ecological Risk Assessment at DSS SWMU 101 with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC	Maximum Activity (Samples ≤ 5 ft bgs) (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 (0.0556)	0.079	Yes	3,000[d]	**Yes**
Thorium-232	0.600	1.01	Yes	3,000[d]	**Yes**
Tritium	**0.0245**	0.021[e]	**No**	NA	No
Uranium-235	**ND (0.294)**	0.16	**No**	900[d]	**Yes**
Uranium-238	**ND (2.20)**	1.4	**No**	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 = 0.021 pCi/g assuming a soil density of 1 gram/cubic centimeter and 5 percent soil moisture.

BCF = Bioconcentration factor.
bgs = Below ground surface.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
ft = Foot (feet).
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.

Table 2.5-1 summarizes the fate and transport processes that can occur at DSS SWMU 101. COCs at this site include organic analytes as well as radiological and nonradiological inorganic analytes. Wind, surface water, and biota are considered to be of low significance as potential transport mechanisms at this site. Significant leaching into the subsurface soil is unlikely, and leaching into the groundwater at this site is highly unlikely. The potential for transformation of COCs is low, and loss through decay of the radiological COCs is insignificant because of their long half-lives.

Table 2.5-1
Summary of Fate and Transport at DSS SWMU 101

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 the DOE to determine whether further evaluation and potential site cleanup are required. Nonradiological COC risk values also are compared to background risk so that an incremental risk can be calculated.
Step 7.	Uncertainties of the above steps are addressed.

2.6.2 Step 1. Site Data

Section 2.1 of this risk assessment provides the site description and history for DSS SWMU 101. 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 101 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. 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 DSS SWMU 101 is approximately 420 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 DSS SWMU 101.

Pathway Identification

Nonradiological Constituents	Radiological Constituents
Soil ingestion	Soil ingestion
Inhalation (dust)	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 nonradiological COCs were compared to the approved SNL/NM maximum screening levels for this area. The SNL/NM maximum background concentration was selected to provide the background screen in Table 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 did not have either a quantifiable or calculated background screening level were considered in further risk assessment analyses.

For the radiological COCs that exceed the SNL/NM background screening levels, background values were subtracted from the individual maximum radionuclide concentrations. Those that do not exceed these background levels are not carried any further in the risk assessment. This

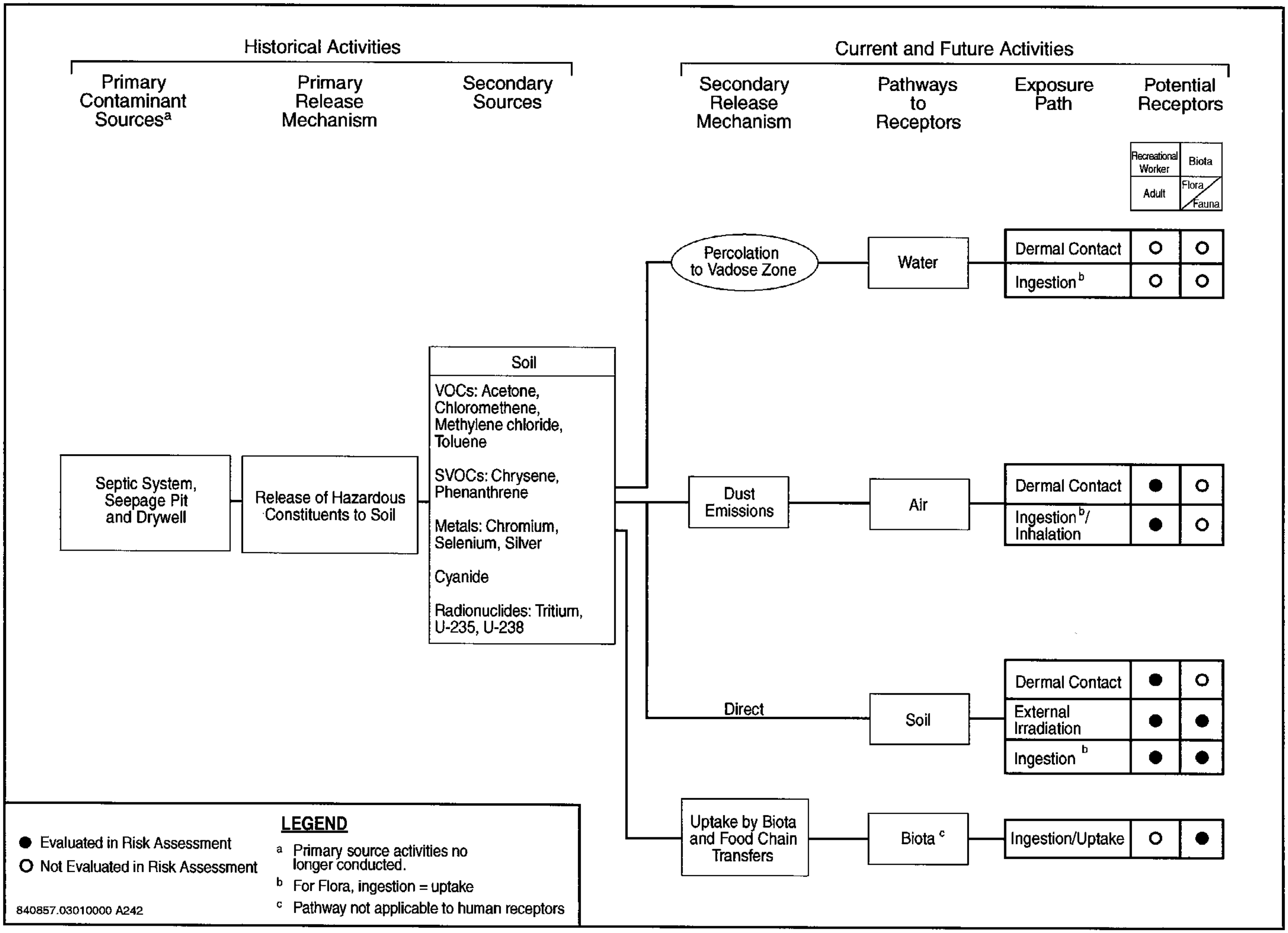

Figure 2.6.3-1

Conceptual Site Model Flow Diagram for DSS SWMU 101, Building 9926 Explosive Contaminated Sumps and Drains

approach is consistent with DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE 1993). Radiological COCs that do not have background screening values and were detected above the analytical minimum detectable activity (MDA) are carried through the risk assessment at the maximum levels. The resultant radiological COCs remaining after this step are referred to as background-adjusted radiological COCs.

2.6.4.2 Results

Tables 2.4-1 and 2.4-3 show the DSS SWMU 101 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 (chromium, selenium, and silver) 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 the background value. Six nonradiological COCs are organic compounds that do not have corresponding background screening values.

For the radiological COCs, three constituents (tritium, uranium-235, and uranium-238) had detections or MDA values greater than the background screening levels. The greater of either the maximum detection or the highest MDA is conservatively used in the risk assessment.

2.6.5 Step 4. Identification of Toxicological Parameters

Tables 2.6.5-1 and 2.6.5-2 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 Health Effects Assessment Summary Tables (HEAST) (EPA 1997a), EPA Region 6 electronic database (EPA 2004b), the Risk Assessment Information System (ORNL 2003), and the Technical Background Document for Development of Soil Screening Levels (NMED February 2004). Dose conversion factors (DCFs) used in determining the excess TEDE values for radiological COCs for the individual pathways are the default values provided in the RESRAD computer code (Yu et al. 1993a) as developed in the following documents:

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

Table 2.6.5-1
Toxicological Parameter Values for DSS SWMU 101 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								
Chromium, total	1.5E+0[c]	L	--	--	--	--	D	0.01[d]
Cyanide	2E-2[c]	M	--	--	--	--	D	0.1[d]
Selenium	5E-3[c]	H	--	--	--	--	D	0.01[d]
Silver	5E-3[c]	L	--	--	--	--	D	0.01[d]
Organic								
Acetone	1E-1[c]	L	1E-1[e]	--	--	--	D	0.01[f]
Chrysene	--	--	--	--	7.3E-3[e]	3.1E-3[e]	B2	0.13[d]
Chloromethane	--	--	2.6E-2[c]	M	1.3E-2[g]	6.3E-3[g]	C	0.1[d]
Methylene Chloride	6E-2[c]	M	8.6E-1[g]	--	7.5E-3[c]	1.6E-3[c]	B2	0.1[d]
Phenanthrene[h]	3E-1[c]	L	3E-1[e]	--	--	--	D	0.1[d]
Toluene	2E-1[c]	M	1.1E-1[c]	M	--	--	D	0.1[d]

[a]Confidence associated with IRIS (EPA 2004a) database values. Confidence: L = low, M = medium, H = high.
[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989) taken from IRIS (EPA 2004a):
- A = Human carcinogen.
- B2 = Probable human carcinogen. Sufficient evidence in animals and inadequate or no evidence in humans.
- C = Possible human carcinogen.
- D = Not classifiable as to human carcinogenicity.

[c]Toxicological parameter values from IRIS electronic database (EPA 2004a).
[d]Toxicological parameter values from NMED February 2004.
[e]Toxicological parameter values from EPA Region 6 electronic database (EPA 2004b).
[f]Toxicological parameter values from Risk Assessment Information System (ORNL 2003).
[g]Toxicological parameter values from HEAST (EPA 1997a).
[h]Anthracene used as a surrogate.

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
Toxicological Parameter Values for DSS SWMU 101 Radiological COCs
Obtained from RESRAD Risk Coefficients[a]

COC	SF_o (1/pCi)	SF_{inh} (1/pCi)	SF_{ev} (g/pCi-yr)	Cancer Class[b]
Tritium	7.2E-14	9.6E-14	0.00E+0	A
Uranium-235	4.70E-11	1.30E-08	2.70E-07	A
Uranium-238	6.20E-11	1.20E-08	6.60E-08	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 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 for the industrial and residential land-use scenarios. The incremental TEDE and estimated incremental cancer risk are provided for the background-adjusted radiological COCs for both industrial and residential land-use scenarios.

2.6.6.1 Exposure Assessment

Annex A provides the equations and parameter input values used to calculate intake values and subsequent HI and excess cancer risk values for the individual exposure pathways. The 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. Parameters reflect the reasonable maximum exposure (RME) approach advocated by the RAGS (EPA 1989). For radiological COCs, the coded equations provided in RESRAD computer code are used to estimate the incremental TEDE and cancer risk for individual exposure pathways. Further discussion of this process is provided in the "Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD" (Yu et al. 1993a). Although the designated land-use scenario for this site is industrial, risk and TEDE values for a residential land-use scenario are also presented.

2.6.6.2 Risk Characterization

Table 2.6.6-1 shows an HI of 0.00 for the DSS SWMU 101 nonradiological COCs and an estimated excess cancer risk of 6E-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 quantified estimated excess cancer risk for the SWMU 101 associated background constituents under the designated industrial land-use scenario.

For the radiological COCs, contribution from the direct gamma exposure pathway is included. For the industrial land-use scenario, a TEDE is calculated for an individual on the site that results in an incremental TEDE of 0.11 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 101 for the industrial land use is well below this guideline. The estimated excess cancer risk is 9.4E-7.

The HI is 0.00 with an estimated excess cancer risk of 1E-7 for the nonradiological COCs under the residential land-use scenario (Table 2.6.6-1). The numbers in the table include exposure from soil ingestion, dermal contact, and dust inhalation. Although the EPA (1991) guidelines generally recommend that inhalation not be included in a residential land-use scenario, this pathway is included because of the potential for soil in Albuquerque, New Mexico, to be eroded and for dust to be present in predominantly residential areas. Based upon the nature of local soil, other exposure pathways are not evaluated (see Annex A). Table 2.6.6-2 shows an HI of 0.00 and no quantified estimated excess cancer risk for the associated background constituents at DSS SWMU 101 under the residential land-use scenario.

For the radiological COCs, the incremental TEDE for the residential land-use scenario is 0.27 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 101 for the residential land-use scenario is well below this guideline. Consequently, SWMU 101 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 2.7E-6. 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.

Table 2.6.6-1
Risk Assessment Values for DSS SWMU 101 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					
Chromium, total	23.6	0.00	--	0.00	--
Cyanide	1.2	0.00	--	0.00	--
Selenium	1.3	0.00	--	0.00	--
Silver	2.34	0.00	--	0.00	--
Organic					
Acetone	0.014	0.00	--	0.00	--
Chloromethane	0.0083	0.00	3E-9	0.00	7E-9
Chrysene	0.165[b]	0.00	8E-10	0.00	3E-9
Methylene Chloride	0.0088 J	0.00	6E-8	0.00	1E-7
Phenanthrene	0.165[b]	0.00	--	0.00	--
Toluene	0.011	0.00	--	0.00	--
Total		0.00	6E-8	0.00	1E-7

[a]EPA 1989.
[b]Nondetected concentration (i.e., one-half the 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 = Concentration was qualified as an estimated value.
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 101 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
Chromium, total	15.9	0.00	--	0.00	--
Cyanide	NC	--	--	--	--
Selenium	<1	--	--	--	--
Silver	<1	--	--	--	--
Total		0.00	--	0.00	--

[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 nonradiological COCs under the industrial land-use scenario, the HI is 0.00 (lower than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). The 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 below the suggested acceptable risk value. This assessment also determines risks by evaluating background concentrations of the potential nonradiological COCs for both the industrial and residential land-use scenarios. The incremental risk is determined by subtracting risk associated with background from potential COC risk. These numbers are not rounded before the difference is determined and therefore may appear to be inconsistent with numbers presented in tables and within the text. For conservatism, the background constituents that do not have quantified background concentrations are assumed to have a hazard quotient (HQ) of 0.00. The incremental HI is 0.00 and the estimated incremental cancer risk is 6.10E-8 for the industrial land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs considering an industrial land-use scenario.

For the radiological COCs under the industrial land-use scenario, the incremental TEDE is 0.11 mrem/yr, which is significantly lower than EPA's numerical guideline of 15 mrem/yr (EPA 1997b). The estimated incremental excess cancer risk is 9.4E-7.

For the nonradiological COCs under the residential land-use scenario, the calculated HI is 0.00, which is below the numerical guideline. The excess cancer risk is 1E-7. 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. The incremental HI is 0.00 and the estimated incremental cancer risk is 1.31E-7 for the residential land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs under a residential land-use scenario.

The incremental TEDE for a residential land-use scenario from the radiological components is 0.27 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 2.7E-6.

2.6.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at DSS SWMU 101 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 presented 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. Therefore, there is no uncertainty associated with the data quality used to perform the risk assessment at SWMU 101.

Because of the location, history, and future land use, there is low uncertainty in the land-use scenario and the potentially affected populations that were considered in performing the risk assessment analysis. Based upon the COCs found in near-surface soil and the location and physical characteristics of the site, there is low uncertainty in the exposure pathways relevant to the analysis.

An RME approach is used to calculate the risk assessment values. Specifically, the parameter values in the calculations are conservative and calculated intakes may be overestimated. Maximum measured values of COC concentrations are used to provide conservative results.

Table 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 Region 6 (EPA 2004b), 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 the nonradiological COCs are within the acceptable range for human health under both the industrial and residential land-use scenarios compared to established numerical guidance. For the radiological COCs, the conclusion of the risk assessment is that potential effects on human health for both the industrial and residential land-use scenarios are within guidelines and represent only a small fraction of the estimated 360 mrem/yr received by the average U.S. population (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 101 contains identified COCs consisting of organic, inorganic, and radiological compounds. Because of the location of the site, the designated industrial land-use scenario, and the nature of contamination, potential exposure pathways identified for this site include soil ingestion, dermal contact, and dust inhalation for chemical COCs and soil ingestion, dust inhalation, and direct gamma exposure for radionuclides. The same exposure pathways are applied to the residential land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for the nonradiological COCs show that for the industrial land-use scenario the HI (0.00) is significantly lower than 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 an industrial land-use scenario (Bearzi January 2001). The incremental HI is 0.00 and the incremental excess cancer risk is 6.10E-8 for the industrial land-use scenario. These incremental risk calculations indicate insignificant risk to human health for the industrial land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for the nonradiological COCs show that for the residential land-use scenario the HI (0.00) is also below the accepted numerical guidance from the EPA. The estimated excess cancer risk is 1E-7. Thus, excess cancer risk is below the acceptable risk value provided by the NMED for a residential land-use scenario (Bearzi January 2001). The incremental HI is 0.00 and the incremental excess cancer risk is 1.31E-7 for the residential land-use scenario. These incremental risk calculations indicate insignificant risk to human health for the residential land-use scenario.

The incremental TEDE and corresponding estimated cancer risk from the radiological COCs are much lower than EPA guidance values. The estimated TEDE is 0.11 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 9.4E-7 for the industrial land-use scenario. Furthermore, the incremental TEDE for the residential land-use scenario that results from a complete loss of institutional control is 0.27 mrem/yr with an associated risk of 2.7E-6. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, DSS SWMU 101 is eligible for unrestricted radiological release.

The summation of the nonradiological and radiological carcinogenic risks is tabulated in Table 2.6.9-1.

Uncertainties associated with the calculations are considered small relative to the conservatism of this risk assessment analysis. Therefore, it is concluded that DSS SWMU 101 poses insignificant risk to human health under both the industrial and residential land-use scenarios.

Table 2.6.9-1
Summation of Incremental Nonradiological and Radiological Risks from
DSS SWMU 101, Building 9926 Explosive Contaminated Sumps and Drains Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	6.10E-8	9.4E-7	1.0E-6
Residential	1.31E-7	2.7E-6	2.8E-6

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

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 101. A component of the NMED Risk-Based Decision Tree (NMED March 1998a) is to conduct an ecological 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. Initial components of NMED's decision tree (a discussion of DQOs, data assessment, and evaluations of bioaccumulation as well as fate and transport potential) are addressed in previous sections of this report. Following the completion of the scoping assessment, a determination is made as to whether a more detailed examination of potential ecological risk is necessary. If deemed necessary, the scoping assessment proceeds to a risk assessment whereby a more quantitative estimate of ecological risk is conducted. Although this assessment is conservative in the estimation of ecological risks, ecological relevance and professional judgment are also used as recommended by the EPA (1998) to ensure that predicted exposures of selected ecological receptors reflect those reasonably expected to occur at the site.

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 and a comparison of maximum detected concentrations to background concentrations, examination of bioaccumulation potential, and 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 (Tables 2.4-2 and 2.4-4), constituents in soil within the 0- to 5-foot depth interval that are identified as COPECs for this site include the following:

- Acetone
- Methylene chloride
- Tritium
- Uranium-235
- Uranium-238

2.7.2.2 Bioaccumulation

Among the COPECs listed in Section 2.7.2.1, the following are considered to have bioaccumulation potential in aquatic environments (Section 2.4, Tables 2.4-2 and 2.4-4):

- Uranium-235
- Uranium-238

However, as directed by the NMED (March 1998a), bioaccumulation for inorganic constituents is assessed exclusively based upon maximum reported bioconcentration factors (BCFs) for aquatic species. Because only aquatic BCFs are used to evaluate the bioaccumulation potential for metals, bioaccumulation in terrestrial species is likely to be overpredicted.

2.7.2.3 Fate and Transport Potential

The potential for the COPECs to migrate from the source of contamination to other media or biota is discussed in Section 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 COPECs at this site. Degradation, transformation, and radiological decay of the COPECs are also 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 may be associated with DSS SWMU 101 and that COPECs also exist at the site. As a consequence, a detailed ecological risk assessment is deemed necessary to predict the potential level of ecological risk associated with the site.

2.7.3 Risk Assessment

As concluded in Section 2.7.2.4, both complete ecological pathways and COPECs are associated with this site. The ecological risk assessment performed for the site involves a quantitative estimate of current ecological risks using exposure models in association with exposure parameters and toxicity information obtained from the literature. The estimation of potential ecological risks is conservative to ensure that ecological risks are not underpredicted.

Components within the risk assessment include the following:

- Problem Formulation—sets the stage for the evaluation of potential exposure and risk.
- Exposure Estimation—provides a quantitative estimate of potential exposure.
- Ecological Effects Evaluation—presents benchmarks used to gauge the toxicity of COPECs to specific receptors.
- Risk Characterization—characterizes the ecological risk associated with exposure of the receptors to environmental media at the site.
- Uncertainty Assessment—discusses uncertainties associated with the estimation of exposure and risk.
- Risk Interpretation—evaluates ecological risk in terms of HQs and ecological significance.
- Risk Assessment Scientific/Management Decision Point—presents the decision to risk managers based upon the results of the risk assessment.

2.7.3.1 Problem Formulation

Problem formulation is the initial stage of the risk assessment that provides the introduction to the risk evaluation process. Components that are addressed in this section include a discussion of ecological pathways and the ecological setting, identification of COPECs, and selection of ecological receptors. The conceptual model, ecological food webs, and ecological endpoints (other components commonly addressed in an ecological risk assessment) are presented in "Predictive Ecological Risk Assessment Methodology, Environmental Restoration Program, Sandia National Laboratories, New Mexico" (IT July 1998) and are not duplicated here.

<u>Ecological Pathways and Setting</u>

DSS SWMU 101 is less than 1 acre in size. The site is located in an area dominated by grassland habitat. The site is unpaved and open to use by wildlife. No threatened or endangered species exist at this site (IT February 1995), and no surface-water bodies, seeps, or springs are associated with the site.

Complete ecological pathways may exist at this site through the exposure of plants and wildlife to COPECs in the soil. It is assumed that direct uptake of COPECs from soil is the major route of exposure for plants and that exposure of plants to wind-blown soil is minor. Exposure modeling for the wildlife receptors is limited to the food and soil ingestion pathways and external radiation. Because of the lack of surface water at this site, exposure to COPECs through the ingestion of surface water is considered insignificant. Inhalation and dermal contact also are considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Groundwater is not expected to be affected by COCs at this site.

COPECs

Discharge of effluent from the Building 9926 septic system is the primary source of COPECs at DSS SWMU 101. All COPECs identified for this site are listed in Section 2.7.2. The COPECs include both radiological and nonradiological analytes. The analytes were screened against background concentrations and those that exceeded the approved SNL/NM background screening levels (Dinwiddie September 1997) for the CTF area are considered to be COPECs. All organic analytes detected in the soil at depths up to 5 feet bgs and inorganic constituents with uncertain background levels are retained as COPECs. Nonradiological inorganic constituents that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, are not included in this risk assessment as set forth by the EPA (1989). In order to provide conservatism, this ecological risk assessment is based upon the maximum concentrations of the COPECs measured in the upper 5 feet of soil at this site. Tables 2.4-2 and 2.4-4 present the maximum concentrations for the COPECs at SWMU 101.

Ecological Receptors

A nonspecific perennial plant is selected as the receptor to represent plant species at the site (IT July 1998). Vascular plants are the principal primary producers at the site and are key to the diversity and productivity of the wildlife community associated with the site. The deer mouse (*Peromyscus maniculatus*) and the burrowing owl (*Speotyto cunicularia*) are used to represent wildlife use. Because of its opportunistic food habits, the deer mouse is used to represent a mammalian herbivore, omnivore, and insectivore. The burrowing owl represents a top predator at this site. The burrowing owl is present at SNL/NM and is designated a species of management concern by the U.S. Fish and Wildlife Service in Region 2, which includes the state of New Mexico (USFWS September 1995).

2.7.3.2 Exposure Estimation

For nonradiological COPECs, direct uptake from the soil is considered the only significant route of exposure for terrestrial plants. Exposure modeling for the wildlife receptors is limited to food and soil ingestion pathways. Inhalation and dermal contact are considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Drinking water is also considered an insignificant pathway because of the lack of surface water at this site. The deer mouse is modeled under three dietary regimes: as an herbivore (100 percent of its diet as plant material), as an omnivore (50 percent of its diet as plants and 50 percent as soil invertebrates), and as an insectivore (100 percent of its diet as soil invertebrates). The burrowing owl is modeled as a strict predator on small mammals (100 percent of its diet as deer mice). Because the exposure in the burrowing owl from a diet consisting of equal parts of herbivorous, omnivorous, and insectivorous mice would be equivalent to the exposure consisting of only omnivorous mice, the diet of the burrowing owl is modeled with intake of omnivorous mice only. Both species are modeled with soil ingestion comprising 2 percent of the total dietary intake. Table 2.7.3-1 presents the species-specific factors used in modeling exposures in the wildlife receptors. Justification for use of the factors presented in this table is described in the ecological risk assessment methodology document (IT July 1998).

Although home range is also included in this table, exposures for this risk assessment are modeled using an area use factor of 1.0, implying that all food items and soil ingested come from the site being investigated. The maximum COPEC concentrations measured in the upper 5 feet of soil are used to conservatively estimate potential exposures and risks to plants and wildlife at this site.

For the radiological dose-rate calculations, the deer mouse is modeled as an herbivore (100 percent of its diet as plants), and the burrowing owl is modeled as a strict predator on small mammals (100 percent of its diet as deer mice). Both are modeled with soil ingestion comprising 2 percent of the total dietary intake. Receptors are exposed to radiation both internally and externally from tritium, uranium-235, and uranium-238. Internal and external dose rates to the deer mouse and the burrowing owl are approximated using modified dose-rate models from the DOE (1995) as presented in the ecological risk assessment methodology document for the SNL/NM ER Project (IT July 1998). Radionuclide-dependent data for the dose-rate calculations were obtained from Baker and Soldat (1992). The external dose-rate model examines the total-body dose rate to a receptor residing in soil exposed to radionuclides. The soil surrounding the receptor is assumed to be an infinite medium uniformly contaminated with gamma-emitting radionuclides. The external dose-rate model is the same for both the deer mouse and the burrowing owl. The internal total-body dose-rate model assumes that a fraction of the radionuclide concentration ingested by a receptor is absorbed by the body and concentrated at the center of a spherical body shape. This provides for a conservative estimate for absorbed dose. This concentrated radiation source at the center of the body of the receptor is assumed to be a "point" source. Radiation emitted from this point source is absorbed by the body tissues to contribute to the absorbed dose. Alpha and beta emitters are assumed to transfer 100 percent of their energy to the receptor as they pass through tissues. Gamma-emitting radionuclides transfer only a fraction of their energy to the tissues because gamma rays interact less with matter than do beta or alpha emitters. The external and internal dose-rate results are summed to calculate a total dose rate from exposure to tritium, uranium-235, and uranium-238 in soil.

Table 2.7.3-2 provides the transfer factors used in modeling the concentrations of COPECs through the food chain. Table 2.7.3-3 presents maximum concentrations in soil and derived concentrations in tissues of the various food chain elements that are used to model dietary exposures for each of the wildlife receptors.

Table 2.7.3-1
Exposure Factors for Ecological Receptors at DSS SWMU 101

Receptor Species	Class/Order	Trophic Level	Body Weight (kg)[a]	Food Intake Rate (kg/day)[b]	Dietary Composition[c]	Home Range (acres)
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Herbivore	2.39E-2[d]	3.72E-3	Plants: 100% (+ Soil at 2% of intake)	2.7E-1[e]
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Omnivore	2.39E-2[d]	3.72E-3	Plants: 50% Invertebrates: 50% (+ Soil at 2% of intake)	2.7E-1[e]
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Insectivore	2.39E-2[d]	3.72E-3	Invertebrates: 100% (+ Soil at 2% of intake)	2.7E-1[e]
Burrowing owl (*Speotyto cunicularia*)	Aves/ Strigiformes	Carnivore	1.55E-1[f]	1.73E-2	Rodents: 100% (+ Soil at 2% of intake)	3.5E+1[g]

[a]Body weights are in kg wet weight.
[b]Food intake rates are estimated from the allometric equations presented in Nagy (1987). Units are kg dry weight per day.
[c]Dietary compositions are generalized for modeling purposes. Default soil intake value of 2 percent of food intake.
[d]Silva and Downing 1995.
[e]EPA (1993), based upon the average home range measured in semiarid shrubland in Idaho.
[f]Dunning 1993.
[g]Haug et al. 1993.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
kg = Kilogram(s).
SWMU = Solid Waste Management Unit.

Table 2.7.3-2
Transfer Factors Used in Exposure Models for COPECs at DSS SWMU 101

COPEC	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Organic[a]			
Acetone	5.3E+1	1.3E+1	1.0E-8
Methylene Chloride	7.3E+0	1.5E+1	3.6E-7

[a]Soil-to-plant and food-to-muscle transfer factors from equations developed in Travis and Arms (1988). Soil-to-invertebrate transfer factors from equations developed in Connell and Markwell (1990). All three equations based upon relationship of the transfer factor to the Log K_{ow} value of compound.

COPEC = Constituent of potential ecological concern.
DSS = Drain and Septic Systems.
K_{ow} = Octanol-water partition coefficient.
Log = Logarithm (base 10).
SWMU = Solid Waste Management Unit.

Table 2.7.3-3
Media Concentrations[a] for COPECs at DSS SWMU 101

COPEC	Soil (Maximum)[a]	Plant Foliage[b]	Soil Invertebrate[b]	Deer Mouse Tissues[c]
Organic				
Acetone	6.8E-3	3.6E-1	8.7E-2	7.3E-9
Methylene Chloride	1.7E-3	1.2E-2	2.6E-2	2.2E-8

[a]In milligrams per kilogram. All biotic media are based upon dry weight of the media. Soil concentration measurements are assumed to have been based upon dry weight. Values have been rounded to two significant digits after calculation.
[b]Product of the soil concentration and the corresponding transfer factor.
[c]Based upon the deer mouse with an omnivorous diet. Product of the average concentration ingested in food and soil times the food-to-muscle transfer factor times a wet weight-dry weight conversion factor of 3.125 (EPA 1993).

COPEC = Constituent of potential ecological concern.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
SWMU = Solid Waste Management Unit.

2.7.3.3 *Ecological Effects Evaluation*

Table 2.7.3-4 shows benchmark toxicity values for the plant and wildlife receptors. For plants, the benchmark soil concentrations are based upon the lowest-observed-adverse-effect level (LOAEL). For wildlife, the toxicity benchmarks are based upon the no-observed-adverse-effect level (NOAEL) for chronic oral exposure in a taxonomically similar test species. Sufficient toxicity information was not available to estimate the LOAELs or NOAELs for some COPECs.

The benchmark used for exposure of terrestrial receptors to radiation is 0.1 rad/day. This value has been recommended by the International Atomic Energy Agency (IAEA 1992) for the protection of terrestrial populations. Because plants and insects are less sensitive to radiation than vertebrates (Whicker and Schultz 1982), the dose of 0.1 rad/day should also protect other groups within the terrestrial habitat of DSS SWMU 101.

2.7.3.4 *Risk Characterization*

Maximum concentrations in soil and estimated dietary exposures are compared to plant and wildlife benchmark values, respectively. Table 2.7.3-5 presents the results of these comparisons. HQs are used to quantify the comparison with benchmarks for plant and wildlife exposure.

None of the HQs exceed unity for any of the receptors evaluated. Because of a lack of sufficient toxicity information, the HQ for plants and the burrowing owl could not be determined for either of the organic COPECs detected. As directed by the NMED, HIs are calculated for each of the receptors (the HI is the sum of chemical-specific HQs for all pathways for a given receptor). Total HIs are less than unity for all of the receptors, with a maximum HI of 1.0E-3 for the insectivorous deer mouse.

Tables 2.7.3-6 and 2.7.3-7 summarize the internal and external dose-rate model results for tritium, uranium-235, and uranium-238 for the deer mouse and burrowing owl, respectively. The total radiation dose rate to the deer mouse is predicted to be 3.6E-4 rad/day and that for the burrowing owl is 3.5E-4 rad/day. The dose rates for the deer mouse and the burrowing owl are lower than the benchmark of 0.1 rad/day.

2.7.3.5 *Uncertainty Assessment*

Many uncertainties are associated with the characterization of ecological risks at DSS SWMU 101. These uncertainties result from assumptions used in calculating risk that may overestimate or underestimate true risk presented at the site. For this risk assessment, assumptions are made that are more likely to overestimate exposures and risk rather than to underestimate them. These conservative assumptions are used to be more protective of the ecological resources potentially affected by the site. Conservatisms incorporated into this risk assessment include the use of maximum analyte concentrations measured in soil samples to evaluate risk, the use of wildlife toxicity benchmarks based upon NOAEL values, and the incorporation of strict herbivorous and strict insectivorous diets for predicting the extreme HQ

Table 2.7.3-4
Toxicity Benchmarks for Ecological Receptors at DSS SWMU 101

COPEC	Plant Benchmark[a,b]	Mammalian NOAELs			Avian NOAELs		
		Mammalian Test Species[c,d]	Test Species NOAEL[d,e]	Deer Mouse NOAEL[e,f]	Avian Test Species[d]	Test Species NOAEL[d,e]	Burrowing Owl NOAEL[e,g]
Organic							
Acetone	--	rat	10	19.6	--	--	--
Methylene Chloride	--	rat	5.85	11.4	--	--	--

[a]In mg/kg soil dry weight.
[b]Efroymson et al. 1997.
[c]Body weights (in kg) for the NOAEL conversion are as follows: lab rat, 0.350.
[d]Sample et al. 1996, except where noted.
[e]In mg/kg body weight per day.
[f]Based upon NOAEL conversion methodology presented in Sample et al. (1996), using a deer mouse body weight of 0.0239 kg and a mammalian scaling factor of 0.25.
[g]Based upon NOAEL conversion methodology presented in Sample et al. (1996). The avian scaling factor of 0.0 was used, making the NOAEL independent of body weight.

COPEC = Constituent of potential ecological concern.
DSS = Drain and Septic Systems.
kg = Kilogram(s).
mg = Milligram(s).
NOAEL = No-observed-adverse-effect level.
SWMU = Solid Waste Management Unit.
-- = Insufficient toxicity data.

Table 2.7.3-5
HQs for Ecological Receptors at DSS SWMU 101

COPEC	Plant HQ	Deer Mouse HQ (Herbivorous)	Deer Mouse HQ (Omnivorous)	Deer Mouse HQ (Insectivorous)	Burrowing Owl HQ
Organic					
Acetone	--	2.9E-3	1.8E-3	6.9E-4	--
Methylene Chloride	--	1.7E-4	2.6E-4	3.5E-4	--
HI[a]	--	3.1E-3	2.0E-3	1.0E-3	--

[a]The HI is the sum of individual HQs.
COPEC = Constituent of potential ecological concern.
DSS = Drain and Septic Systems.
HI = Hazard index.
HQ = Hazard quotient.
SWMU = Solid Waste Management Unit.
-- = Insufficient toxicity data available for risk estimation purposes.

Table 2.7.3-6
Total Dose Rates for Deer Mice Exposed to Radionuclides at DSS SWMU 101

Radionuclide	Maximum Activity (pCi/g)	Total Dose (rad/day)
Tritium	**0.0245**	7.9E-8
Uranium-235	**ND (0.294)**	8.0E-6
Uranium-238	**ND (2.2)**	3.6E-4
Total Dose		3.6E-4

Note: **Bold** indicates the COCs that exceed background screening values.
DSS = Drain and Septic Systems.
MDA = Minimum detectable activity.
ND ( ) = Not detected, but the MDA (shown in parentheses) exceeds background activity.
pCi/g = Picocurie(s) per gram.
SWMU = Solid Waste Management Unit.

Table 2.7.3-7
Total Dose Rates for Burrowing Owls Exposed to Radionuclides at DSS SWMU 101

Radionuclide	Maximum Activity (pCi/g)	Total Dose (rad/day)
Tritium	**0.0245**	2.8E-8
Uranium-235	**ND (0.294)**	6.1E-6
Uranium-238	**ND (2.2)**	3.5E-4
Total Dose		3.5E-4

Note: **Bold** indicates the COCs that exceed background screening values.
DSS = Drain and Septic Systems.
MDA = Minimum detectable activity.
ND ( ) = Not detected, but the MDA (shown in parentheses) exceeds background activity.
pCi/g = Picocurie(s) per gram.
SWMU = Solid Waste Management Unit.

values for the deer mouse. Each of these uncertainties, which are consistent among each of the site-specific ecological risk assessments, is discussed in greater detail in the uncertainty section of the ecological risk assessment methodology document for the SNL/NM ER Project (IT July 1998).

Uncertainties associated with the estimation of risk to ecological receptors following exposure to tritium, uranium-235, and uranium-238 are primarily related to those inherent in the radionuclide-specific data. Radionuclide-dependent data are measured values that have their associated errors. The dose-rate models used for these calculations are based upon conservative estimates of receptor shape, radiation absorption by body tissues, and intake parameters. The goal is to provide a realistic but conservative estimate of a receptor's internal and external exposure to radionuclides in soil. These dose estimates are conservatively based upon detection limits of the two radionuclides, neither of which was detected at the site.

2.7.3.6 *Risk Interpretation*

Ecological risks associated with DSS SWMU 101 are estimated through a risk assessment that incorporates site-specific information when available. All HQ and HI values predicted for the COPECs at this site are found to be less than unity. Analysis of the uncertainties associated with these predicted values indicate that they are more likely to overestimate actual risk rather than underestimate it. Based upon this final analysis, the potential for ecological risks associated with DSS SWMU 101 is expected to be very low.

2.7.3.7 *Risk Assessment Scientific/Management Decision Point*

After potential ecological risks associated with the site have been assessed, a decision is made regarding whether the site should be recommended for Corrective Action Complete (CAC) without controls (NMED April 2004) or whether additional data should be collected to more thoroughly assess actual ecological risk at the site. With respect to this site, ecological risks are predicted to be very low. The scientific/management decision is to recommend this site for CAC without controls.

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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 CAC without controls (NMED April 2004) is recommended for DSS SWMU 101 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 all HQ and HI values for the COPECs at this site are less than unity.

3.2 Criterion

Based upon the evidence provided in Section 3.1, a determination of CAC without controls (NMED April 2004) is recommended for DSS SWMU 101. 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 101
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):

$$I_s = \frac{C_s * IR * EF * ED * \left(\frac{1}{VF} \, or \, \frac{1}{PEF} \right)}{BW * AT}$$

where:

I_s = Intake of contaminant from soil inhalation (mg/kg-day)
C_s = Chemical concentration in soil (mg/kg)
IR = Inhalation rate (cubic meters [m^3]/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
VF = soil-to-air volatilization factor (m^3/kg)
PEF = particulate emission factor (m^3/kg)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

Soil Dermal Contact

$$D_a = \frac{C_s * CF * SA * AF * ABS * EF * ED}{BW * AT}$$

where:

D_a = Absorbed dose (mg/kg-day)
C_s = Chemical concentration in soil (mg/kg)
CF = Conversion factor (1E-6 kg/mg)
SA = Skin surface area available for contact (cm^2/event)
AF = Soil to skin adherence factor (mg/cm^2)
ABS = Absorption factor (unitless)
EF = Exposure frequency (events/year)

ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

Groundwater Ingestion

A receptor can ingest water by drinking it or through using household water for cooking. An estimate of intake from ingesting water will be calculated as follows (EPA August 1997):

$$I_w = \frac{C_w * IR * EF * ED}{BW * AT}$$

where:

I_w = Intake of contaminant from water ingestion (mg/kg/day)
C_w = Chemical concentration in water (mg/liter [L])
IR = Ingestion rate (L/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

Groundwater Inhalation

The amount of a constituent taken into the body via exposure to volatilization from showering or other household water uses will be evaluated using the concentration of the constituent in the water source (EPA 1991 and 1992). An estimate of intake from volatile inhalation from groundwater will be calculated as follows (EPA 1991):

$$I_w = \frac{C_w * K * IR_i * EF * ED}{BW * AT}$$

where:

I_w = Intake of volatile in water from inhalation (mg/kg/day)
C_w = Chemical concentration in water (mg/L)
K = volatilization factor (0.5 L/m^3)
IR_i = Inhalation rate (m^3/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged—days)

For volatile compounds, volatilization from groundwater can be an important exposure pathway from showering and other household uses of groundwater. This exposure pathway will only be evaluated for organic chemicals with a Henry's Law constant greater than $1x10^{-5}$ and with a molecular weight of 200 grams/mole or less (EPA 1991).

Tables 2 and 3 show the default parameter values suggested for use by SNL/NM at SWMUs, based upon the selected land-use scenarios for nonradiological and radiological COCs, respectively. References are given at the end of the table indicating the source for the chosen parameter values. SNL/NM uses default values that are consistent with both regulatory guidance and the RME approach. Therefore, the values chosen will, in general, provide a conservative estimate of the actual risk parameter. These parameter values are suggested for use for the various exposure pathways, based upon the assumption that a particular site has no unusual characteristics that contradict the default assumptions. For sites for which the assumptions are not valid, the parameter values will be modified and documented.

Summary

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

Table 2
Default Nonradiological Exposure Parameter Values for Various Land-Use scenarios

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure Frequency (day/yr)	250[a,b]	8.7 (4 hr/wk for 52 wk/yr)[a,b]	350[a,b]
Exposure Duration (yr)	25[a,b,c]	30[a,b,c]	30[a,b,c]
Body Weight (kg)	70[a,b,c]	70 Adult[a,b,c] 15 Child[a,b,c]	70 Adult[a,b,c] 15 Child[a,b,c]
Averaging Time (days) for Carcinogenic Compounds (= 70 yr x 365 day/yr) 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 2000).
[b]Risk Assessment Guidance for Superfund, Vol. 1, Part B (EPA 1991).
[c]Exposure Factors Handbook (EPA August 1997).
ED = Exposure duration.
EPA = U.S. Environmental Protection Agency.
hr = Hour(s).
kg = Kilogram(s).
m = Meter(s).
mg = Milligram(s).
NA = Not available.
wk = Week(s).
yr = Year(s).

Table 3
Default Radiological Exposure Parameter Values for Various Land-Use scenarios

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure Frequency	8 hr/day for 250 day/yr	4 hr/wk for 52 wk/yr	365 day/yr
Exposure Duration (yr)	25[a,b]	30[a,b]	30[a,b]
Body Weight (kg)	70 Adult[a,b]	70 Adult[a,b]	70 Adult[a,b]
Soil Ingestion Pathway			
Ingestion Rate	100 mg/day[c]	100 mg/day[c]	100 mg/day[c]
Averaging Time (days) (= 30 yr x 365 day/yr)	10,950[d]	10,950[d]	10,950[d]
Inhalation Pathway			
Inhalation Rate (m^3/yr)	7,300[d,e]	10,950[e]	7,300[d,e]
Mass Loading for Inhalation g/m^3	1.36 E-5[d]	1.36 E-5 [d]	1.36 E-5 [d]
Food Ingestion Pathway			
Ingestion Rate, Leafy Vegetables (kg/yr)	NA	NA	16.5[c]
Ingestion Rate, Fruits, Non-Leafy Vegetables & Grain (kg/yr)	NA	NA	101.8[b]
Fraction Ingested	NA	NA	0.25[b,d]

[a]Risk Assessment Guidance for Superfund, Vol. 1, Part B (EPA 1991).
[b]Exposure Factors Handbook (EPA August 1997).
[c]EPA Region VI guidance (EPA 1996).
[d]For radionuclides, RESRAD (ANL 1993).
[e]SNL/NM (February 1998).
EPA = U.S. Environmental Protection Agency.
g = Gram(s)
hr = Hour(s).
kg = Kilogram(s).
m = Meter(s).
mg = Milligram(s).
NA = Not applicable.
wk = Week(s).
yr = Year(s).

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