9-1-2005

Justification for Class III Permit Modification September 2005, SWMU 152, au 1295 Building 9950 Septic System, Coyote Test Field

Sandia National Laboratories/NM

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

Sandia National Laboratories

Drain and Septic Systems - Solid Waste Management Units (SWMUs) 137, 146, 148, 152, and 153

EGIS — Environmental Geographic Information System

Environmental Restoration Project

Site History

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

SWMU Number	Site Name	Location	Year Bldg and System Built	Year Drain or Septic System Abandoned	Year(s) Septic Tank Effluent Sampled	Year Septic Tank Pumped For the last Time	Year Septic Tank Inspected and Closure Forms Signed
137	Bldg 6540/6542 Septic Systems	TA-III	1959 (north septic tank); 1975 (south septic tank)	1991	1992, 1994	Unknown (north tank removed in 1995); 1996 (south septic tank backfilled)	1995
146	Bldg 9920 Drain System	Coyote Test Field	1958	~1980	No septic tank at this site	NA	NA
148	Bldg 9927 Septic System	Coyote Test Field	1962	1991	1992, 1994, 1995	1995/1996 (backfilled)	1995
152	Bldg 9950 Septic System	Coyote Test Field	1964	1991	1992, 1994	1996 (backfilled)	1996
153	Bldg 9956 Septic System	Coyote Test Field	1969 (east septic system); 1988 (west septic system)	1993	1992 (east septic tank); 1994, 1995 (east and west septic tank)	1995/1996 (backfilled)	1995.

Depth to Groundwater

Depth to groundwater at the five sites is as follows:

SWMU Number	Site Name	Location	Groundwater Depth (ft bgs)
137	Bldg 6540/6542 Septic System	TA-III	480
146	Bldg 9920 Drain System	Coyote Test Field	420
148	Bldg 9927 Septic System	Coyote Test Field	355
152	Bldg 9950 Septic System	Coyote Test Field	460
153	Bldg 9956 Septic System	Coyote Test Field	470

Constituents of Concern

- VOCs
- SVOCs
- Metals
- Cyanide
- Radionuclides

Investigation

- All these SWMUs were selected by NMED for passive soil vapor sampling to screen for VOCs and SVOCs. No significant contamination was identified at any of the five sites.
- A backhoe was used to positively locate buried components (drainfield drain lines, drywells) for placement of soil vapor samplers, and soil borings.
- Soil samples were collected from directly beneath drainfield drain lines, seepage pits, and septic tanks to determine if COCs were released to the environment from drain systems.
- A 150-ft-deep, active soil-vapor monitoring well with vapor sampling ports at 5, 20, 70, 100, and 150-ft bgs, was installed at SWMU 137 for active soil vapor sampling to screen for VOCs. VOC concentrations were significantly lower than the 10 ppmv action level established by NMED.

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

SWMU 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	Active Soil Vapor Monitor Well Installation and Sampling
137	Bldg 6540/6542 Septic Systems	1994	1990, 1994, 1995	North System: Drainfield-5,15 Septic Tank-9; South system Drainfield-7, 17 Septic Tank-11	1994	2003
146	Bldg 9920 Drain System	None	1995	Drywell: 4, 14	1994	None
148	Bldg 9927 Septic System	None	1994	Seepage Pit: 14, 24 Septic Tank: 12	1994	None
152	Bldg 9950 Septic System	1994	1994, 1995	Drainfield: 5, 15 Septic Tank: 9	1994	None
153	Bldg 9956 Septic System	1994	1994, 1995	West System: Drainfield--6, 16 Septic Tank-8; East System Seepage Pits-8, 18 Septic Tank: 8	1994	None

Summary of Data Used for NFA Justification

- Soil samples were analyzed at on- and off-site laboratories for VOCs, SVOCs, PCBs, HE compounds, metals, cyanide, isotopic uranium, tritium, and radionuclides by gamma spectroscopy.
- There were detections of VOCs at all five sites; SVOCs were detected at SWMUs 137, and 146.
- Arsenic was detected at concentrations above the background value at SWMUs 137, 148, and 152. Total chromium was at concentrations above the background value at SWMU 153. Barium and silver were detected at concentrations above the background values at SWMU 137, and lead was detected at concentrations above the background value at SWMU 153. No other metals were detected at concentrations above the background values.
- Cyanide was detected above the MDL at SWMUs 137 and 153.
- Thorium-232 was detected at an activity slightly above the background activity at all five sites. The MDAs for U-235 and U-238 exceeded background activities at SWMUs 137, 146, 152, and 153. The MDA for tritium exceeded the background activity at SWMU 148.
- All confirmatory soil sample analytical results for each site were used for characterization, for performing the risk screening assessment, and as justification for the NFA proposal.

Recommended Future Land Use

- Industrial land use was established for these five 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 numbers, it was necessary to perform risk assessments for these five sites. The risk assessment analysis evaluated the potential for adverse health effects for the industrial and residential land-use scenarios.
- The maximum concentration value for lead was 27.3 J mg/kg at SWMU 153; this exceeds the background value. The EPA intentionally does not provide any human health toxicological data on lead; therefore, no risk parameter values could be calculated. The NMED guidance for lead screening concentrations for construction and industrial land-use scenarios are 750 and 1,500 mg/kg, respectively. The EPA screening guidance value for a residential land-use scenario is 400 mg/kg. The maximum concentration for lead at this site is less than all the screening values; therefore, lead was eliminated from further consideration in the human health risk assessment.
- The non-radiological total human health HIs and estimated excess cancer risks for the five sites are below NMED guidelines for the residential land-use scenarios.
- For SWMU 152, 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.
- The human health TEDEs for industrial land-use scenarios ranged from 5.7E-2 to 2.9E-8 mrem/yr, all of which are substantially below the EPA numerical guideline of 15 mrem/yr. The human health TEDEs for residential land-use scenarios ranged from 1.9E-5 to 0.15 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 a complete ecological pathway for each of the five sites was not associated with the respective COPECs for that site. Thus, a more detailed ecological risk assessment to predict the level of risk was not deemed necessary for these sites.
- In conclusion, human health and ecological risks are acceptable per NMED guidance. Thus, these sites are proposed for CAC without institutional controls.

The total HIs and excess cancer risk values for a residential land-use scenario for the nonradiological COCs at the five SWMUs are as follows:

SWMU Number	SWMU Name	Residential Land-Use Scenario: Hazard Index	Residential Land-Use Scenario: Excess Cancer Risk
137	Bldg 6540/6542 Septic System	0.90	1E-7 Total
146	Bldg 9920 Drain System	0.00	3E-8 Total
148	Bldg 9927 Septic System	0.39	3E-8 Total
152	Bldg 9950 Septic System	0.37	2E-5 Total[a] /9.06E-6 Incremental
153	Bldg 9956 Septic System	0.00	6E-8 Total
NMED Guidance		≤ 1	<1E-5

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

For More Information Contact

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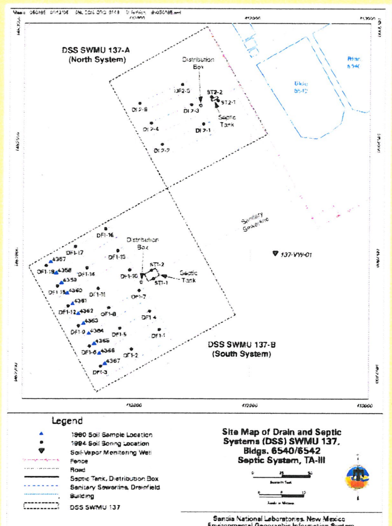
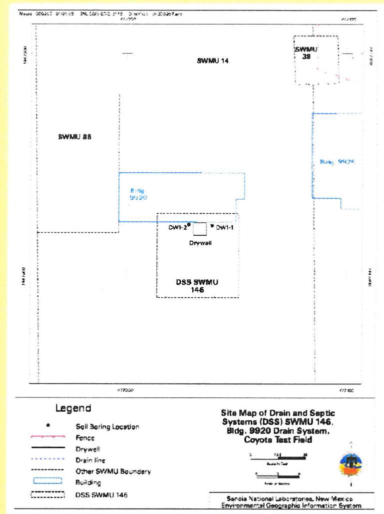
This work supported by the
United States Department of Energy
under contract DE-AC04-94185000.

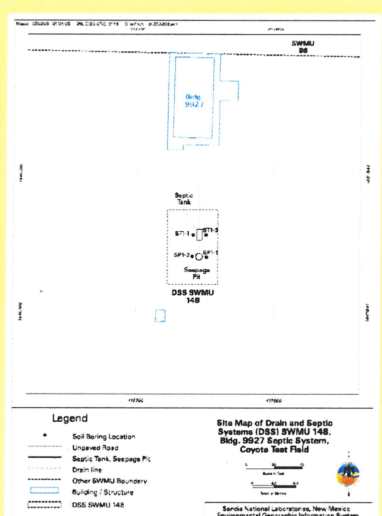
Sandia National Laboratories

Drain and Septic Systems - Solid Waste Management Units (SWMUs) 137, 146, 148, 152, and 153

Environmental Restoration Project



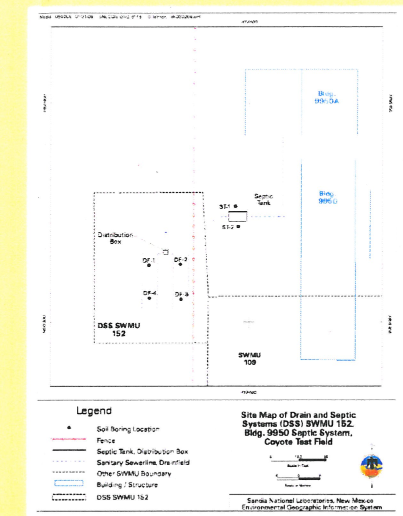


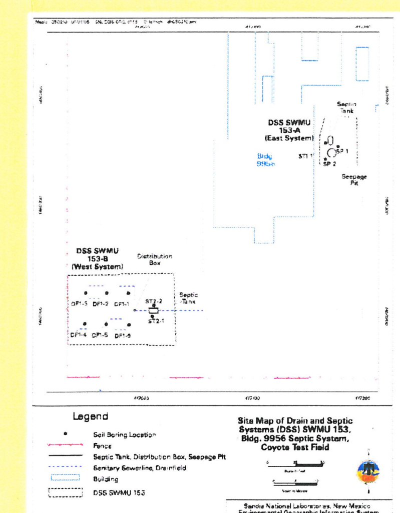


Collecting soil samples with the Geoprobe

System drainline terminating at the seepage pit.

Platform and Geoprobe sampling equipment used to collect soil samples from beneath the center of the seepage pit.





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Justification for Class III Permit Modification

September 2005

SWMU 152
OU 1295
Building 9950 Septic System, Coyote Test Field

NFA Submitted January 1997

RSI Submitted September 1999

NOD Submitted March 2005

Environmental
Restoration
Project

United States Department of Energy
Sandia Site Office

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

NFA

Department of Energy
Albuquerque Operations Office
Kirtland Area Office
P.O. Box 5400
Albuquerque, New Mexico 87115
JAN 30 1997

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

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

Dear Mr. Garcia:

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

OU 1295	
Site 137	Building 6540/6542 Septic System
Site 140	Building 9965 Septic System
Site 150	Building 9939/9939A Septic System
Site 152	Building 9950 Septic System
Site 153	Building 9956 Septic System
OU 1335	
Site 86	Firing Site (Building 9927)
Site 90	Beryllium Firing Site (Thunder Range)(Active)
Site 115	Firing Site (Building 9930)(Active)
Site 191	Equus Red

Ecological risk assessments are not included with these proposals, but will be submitted as addenda following an agreement between NMED and DOE regarding how these assessments will be conducted and presented.

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

Sincerely,

George K. Laskar

Michael J. Zamorski
for Acting Area Manager

Enclosures

cc w/enclosures:
T. Trujillo, ERD
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C. Lojek, 6681, MS 1147
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E. Mignardot, 6685, MS 1148
M. Davis, 7511, MS 1147

FEB 3 1997

PROPOSAL FOR NO FURTHER ACTION
Environmental Restoration Project

Site 152, Building 9950 Septic System
Operable Unit 1295
January 1997

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

Prepared for the
Department of Energy

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1.0 INTRODUCTION

1.1 ER Site 152, Building 9950 Septic System

Sandia National Laboratories/New Mexico (SNL/NM) is proposing a no further action (NFA) decision based on confirmatory sampling for Environmental Restoration (ER) Site 152, Building 9950 Septic System, Operable Unit (OU) 1295. ER Site 152 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 an NFA decision based on confirmatory sampling was prepared using the process presented in Section 4.5.3 of the SNL/NM Program Implementation Plan (SNL/NM February 1995). It follows guidance documented in Title 40, Code of Federal Regulations (CFR), Part 264.514(a) (2) that states NFAs "must contain information demonstrating that there are no releases of hazardous waste (including hazardous constituents) from solid waste management units (SWMU) at the facility that may pose a threat to human health or the environment" (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 152 is based primarily on analytical results of confirmatory soil samples collected at the site. Concentrations of site-specific constituents of concern (COC) detected in the soil samples were first compared to background 95th percentile or upper tolerance limit (UTL) concentrations of COCs found in SNL/NM soils (IT March 1996) or other relevant background limits. If no SNL/NM background limit was available for a particular COC, or if the COC concentration exceeded the SNL/NM or other relevant background limit, then the constituent concentration was compared to the proposed 40 CFR Part 264 Subpart S (Subpart S) or other relevant soil action level for the compound (EPA July 1990).

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

- NFA Criterion 1: The site cannot be located or has been found not to exist, is a duplicate potential release site (PRS), or is located within and therefore investigated as part of another PRS.
- NFA Criterion 2: The site has never been used for the management (that is, generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents or other Comprehensive Environmental Response, Compensation, and Liability Act (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 152 soil sample analytical data indicate that concentrations of COCs detected in soils at this site are less than (1) SNL/NM or other applicable background concentrations, or (2) proposed Subpart S or other action levels. Thus ER Site 152 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, 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 152 is located 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 approximately 1.1 miles from the turn-off to TA III from Lovelace Road (Figure 1-1). ER Site 152 includes the area around the drainfield serving a 750-gallon septic tank west of Building 9950 (Figure 1-2). The drainfield consists of four PVC drain lines 25 feet in length (SNL/NM August 1994). The site encompasses approximately 0.08 acres of flat-lying land at an elevation of 5,485 feet above mean sea level (amsl).

The surficial geology at ER Site 152 is characterized by alluvial fan deposits (SNL/NM March 1996a). These heterogeneous deposits contain poorly sorted, laterally and vertically discontinuous sand, silt, and gravel beds. Based on drilling records of similar deposits at KAFB, the alluvial fan materials are highly heterogeneous, and are composed primarily of medium to fine silty sands with frequent coarse sand, gravel, and cobble lenses. The alluvial fan deposits probably extend to the water-table. Vegetation consists predominantly of grasses including grama, muhly, dropseed, and galleta. Shrubs commonly associated with the grasslands include sand sage, winter fat, saltbrush, and rabbitbush. Cacti are common, and include cholla, pincushion, strawberry, and prickly pear (SNL/NM March 1993).

The water-table elevation is approximately 4,950 feet amsl at this location, so depth to groundwater is approximately 535 feet. Local groundwater flow is believed to be in a generally west to northwest direction in the vicinity of this site (SNL/NM March 1996a). The nearest production wells are northwest of the site and include KAFB-1, 2, 4, 7, and 14, which are approximately 4 to 5 miles away. The nearest groundwater monitoring wells to the site are the group of wells installed around the Chemical Waste Landfill in the southeast corner of TA III and MWL-BW1 in the Mixed Waste Landfill in the center of TA III. These wells are located, respectively, approximately 1 mile southwest and northwest of ER Site 152 (SNL/NM August 1996).

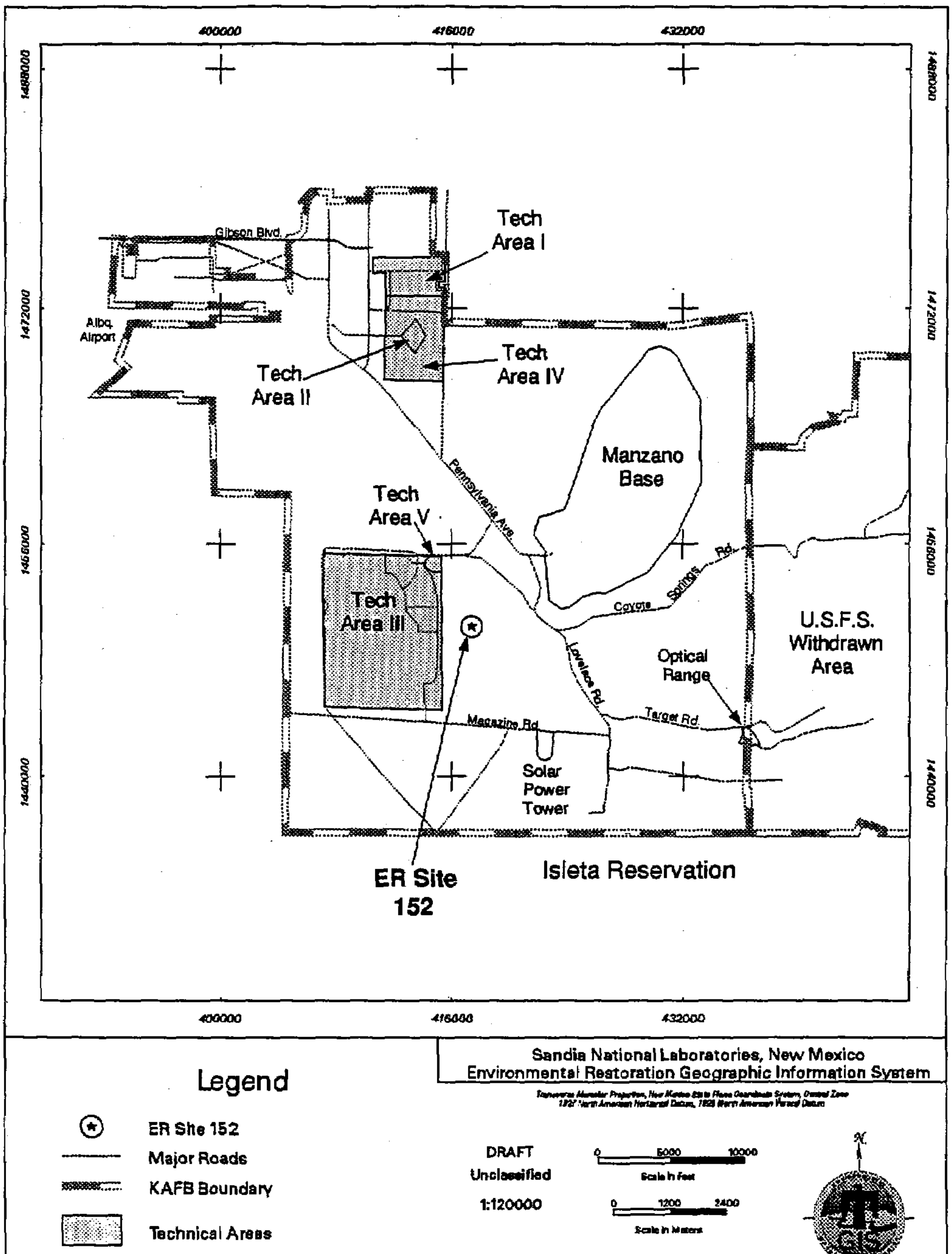

FIGURE 1-1
Location Map for Site 152
Sandia National Laboratories, New Mexico

dehelfr SNL GIS ORG. 7612 08/20/96 MAPID=961158a

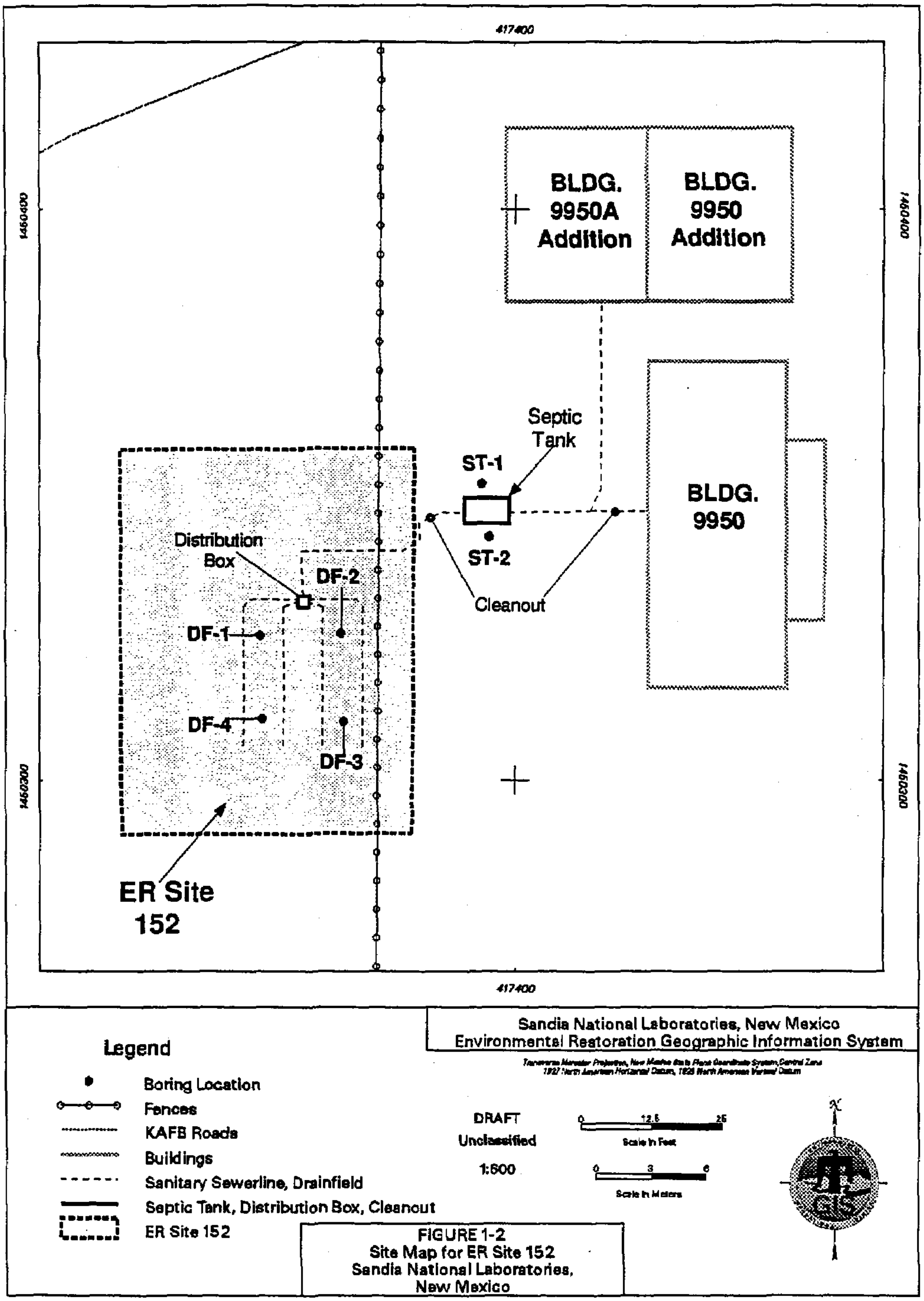

FIGURE 1-2
Site Map for ER Site 152
Sandia National Laboratories,
New Mexico

2.0 HISTORY OF THE SWMU

2.1 Sources of Supporting Information

In preparing the confirmatory sampling NFA proposal for ER Site 152, available background information was reviewed to quantify potential releases and to select analytes for the soil sampling.

Background information was collected from SNL/NM Facilities Engineering drawings and interviews with employees familiar with the site operational history. The following sources of information, hierarchically listed with respect to degree of importance, were used to evaluate ER Site 152:

- Confirmatory subsurface soil sampling conducted in November 1994, January 1995, and October 1995 (SNL/NM November 1994a, January 1995a, October 1995a and October 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 (SNL/NM June 1993) and 1994 (SNL/NM May 1994);
- Approved RFI Work Plan and addenda for OU 1295, Septic Tanks and Drainfields (SNL/NM March 1993, November 1994b, December 1994, January 1995b, March 1995a, March 1995b, and May 1995; and EPA September 1994, January 1995, and March 1995);
- Photographs and field notes collected at the site by SNL/NM ER staff;
- SNL/NM Facilities Engineering building drawings (SNL/NM October 1965);
- SNL/NM Geographic Information System data; and
- The RCRA Facility Assessment (RFA) report (EPA April 1987).

2.2 Previous Audits, Inspections, and Findings

ER Site 152 was first listed as a potential release site in the RFA report to the EPA in 1987 (EPA April 1987). This report contained a generic statement about this and many other SNL/NM septic systems where sanitary and industrial wastes may have been discharged during past operations. This SWMU was included in the RFA report as Site 79, along with other septic and drain systems at SNL/NM. All the sites included in Site 79 are now designated by individual SWMU numbers.

2.3 Historical Operations

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

Building 9950, the Materials Test Facility, was constructed in the early 1960s and used as an explosives test facility until 1969. Prior to 1969, Building 9950 conducted explosives testing using beryllium, cadmium, lead, mercury, nitroguanidine, Baratol, cyclo-trimethylene trinitramine (RDX), and cyclotetramethylene tetranitramine (HMX). It is not known whether explosive compounds were handled inside the building in preparing the tests or whether there was a potential for these constituents to be introduced to the septic system. The explosive testing was conducted at two locations 200 feet southwest of Building 9950 and on the roof of Building 9950. Any potential surface contamination from this testing is being investigated as part of the OU 1335 site characterization process for ER Site 109 (SNL/NM March 1996b).

The building contained a darkroom, and photographic chemicals were discharged in the sink prior to 1974. Alcohol, kerosene, acetone, and methyl ethyl ketone (MEK) were used to clean parts but were reportedly never discharged into the septic system. Polychlorinated biphenyl (PCB)-contaminated capacitors were removed from Building 9950 in 1978. No mention was made of any leaks or spills from the capacitors.

The original description of the septic system reported in the RFI indicated that the site included a septic tank, seepage pit, and a drainfield. Further investigation showed that only a septic tank and drainfield are present at this site.

The septic system is no longer active. Building 9950, as of 1993, is connected to an extension of the City of Albuquerque sanitary sewer system (SNL/NM July 1993).

3.0 EVALUATION OF RELEVANT EVIDENCE

3.1 Unit Characteristics

There are no safeguards inherent in the drain systems from Buildings 9950 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 9950 septic tank and drainfield when the septic system was active. Hazardous wastes were not managed or contained at ER Site 152.

3.3 Presence or Absence of Visual Evidence

No visible evidence of soil discoloration, staining, or odors indicating residual contamination was observed when: (1) the drainfield was located and partially excavated with the backhoe in August 1994 (SNL/NM August 1994), and (2) soil samples were collected in the drainfield and around the septic tank in November 1994, January 1995, and October 1995 (SNL/NM November 1994a, January 1995a, October 1995a and October 1995b).

3.4 Results of Previous Sampling/Surveys

Sludge and aqueous samples were collected from the ER Site 152 septic tank in July 1992. The aqueous sample was analyzed for volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), pesticides, PCBs, metals, selected radionuclide constituents, and several miscellaneous analytes. Three VOCs were identified (1,2-dichloroethene [total], trichloroethene [TCE], and methylene chloride), and one SVOC was identified (phenol). No pesticides or PCBs were detected. Several metals, phenolic compounds, oil and grease, and radionuclides were detected. The sludge sample was analyzed for metals, gross alpha/beta, and selected radionuclide constituents. Several metals and radionuclides were detected. The analytical results of these samples are presented in Appendix A.1.

A second round of septic tank sludge samples were collected in May 1994 (SNL/NM May 1994) for waste characterization purposes and were analyzed for VOCs, SVOCs, total and Toxicity Characteristic Leaching Procedure (TCLP) RCRA metals, beryllium, hexavalent chromium, phenolics, explosive compounds, isotopic uranium, and gamma spectroscopy radionuclides. One VOC was identified (TCE), and three SVOCs were identified (phenol, 4-methylphenol, and bis [2-ethylhexyl] phthalate). Concentrations of a number of metals were detected in the total metals analysis. However, in the TCLP RCRA metals analysis identified only barium. Hexavalent chromium was detected at a level below the reporting limit. Low levels of phenolics were identified. No explosive compounds were detected. Uranium isotopes were detected in the isotopic uranium analysis. The only radionuclide identified in the gamma spectroscopy analysis was potassium 40.

Septic tank liquid samples were also collected in May 1994 (SNL/NM May 1994) for waste characterization purposes. They were analyzed for VOCs, phenolics, explosive compounds, cyanide, RCRA metals, tritium, isotopic uranium, and gamma spectroscopy radionuclides. Three VOCs were identified (acetone, 1,2-dichloroethene, and TCE). No phenolics, explosive compounds, or cyanide were detected. Several RCRA metals were detected. Uranium isotopes were detected in the isotopic uranium analysis. Tritium was detected at an activity level of 870 picocuries per liter (pCi/L). No radionuclides were identified in the gamma spectroscopy analysis. The analytical results from the sampling of the septic tank in May 1994 are presented in Appendix A.2.

A geophysical survey using Geonics™ Model EM-31 and EM-38 ground conductivity meter was performed at the site in June 1994 to attempt to locate the drainfield. The technique was not successful in delineating the drainfield. A possible shallow plume of higher moisture content was identified west of the distribution box in an area that is mostly north and west of the drainlines in the drainfield (Lamb 1994, SNL/NM August 1994).

A passive soil-gas survey was conducted in the area of the drainfield in June and November 1994 using PETREX™ sampling tubes to identify any releases of VOCs and SVOCs that may have occurred from the drainfield (SNL/NM June 1994 and November 1994c). A PETREX™ soil-gas survey is a semiquantitative screening procedure that can be used to identify many volatile and semivolatile organic compounds. This technique may be used to guide VOC and SVOC site investigations. The advantages of this sampling methodology are that large areas can be surveyed at relatively low cost, the technique is highly sensitive to organic vapors, and the result produces a measure of soil vapor chemistry over a two- to three-week period rather than at one point in time. Each PETREX™ soil-gas sampler consists of two activated-charcoal coated wires housed in a reusable glass test tube container. At each sampling location, sample tubes are buried in an inverted position so that the mouth of the sampler is about 1 foot below grade. Samplers are left in place for a two- to three-week period, and are then removed from the ground and sent to the manufacturer, Northeast Research Institute (NERI), for analysis using thermal desorption-gas chromatography/mass spectrometry. The analytical laboratory reports all sample results in terms of "ion counts" instead of concentrations, and identifies those samples that contain compounds above the PETREX™ technique detection limits. In NERI's experience, levels below 100,000 ion counts for a single compound (such as perchloroethene [PCE] or TCE) and 200,000 ion counts for mixtures (such as benzene, toluene, ethyl benzene, and xylene [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).

Eighteen PETREX™ tube samplers were placed, in two phases, in a grid pattern that covered the drainfield and septic tank area at this site (SNL/NM June 1994 and November 1994c). A map showing the tube sampling locations and the analytical results of the ER Site 152 passive soil gas survey is presented in Appendix A.3. No significant levels of PCE, BTEX, or aliphatic compounds were identified in the survey. However, the soil-gas survey identified potentially detectable levels of TCE at three locations (sample numbers 188, 191, and 595) in the drainfield. Two of the locations were near the north end of the drainfield, and the other location was in the southern part of the drainfield. Subsequent confirmatory soil samples that were collected near these PETREX™ sample locations and analyzed for VOCs and SVOCs did not detect any of these constituents.

3.5 Assessment of Gaps in Information

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

3.6 Confirmatory Sampling

Although the likelihood of significant releases of hazardous constituents at ER Site 152 was considered low, confirmatory soil sampling was conducted to determine whether COCs above background or action levels were released via the septic system at this site. A backhoe was used in August 1994 to determine the location, dimensions, and depth of the drainfield, which had no surface expression (SNL/NM August 1994). Once the drainfield was located, soil samples were collected from boreholes within the drainfield, and from either side of the septic tank (SNL/NM November 1994a, January 1995a, October 1995a, and October 1995b). There were significant difficulties in obtaining the deep interval soil samples at two locations in the drainfield. The Geoprobe™ met refusal at 5 to 11.5 feet in three tries at and near DF-3. No deep interval soil samples were collected at sample location DF-3. It also was not possible to obtain the deep interval soil sample from DF-4; the Geoprobe™ met refusal at 10 to 10.5 feet in two tries at and near the DF-4 location. In later sampling events in January 1995 and October 1995, using a larger Geoprobe™ unit, enough soil was collected from the deep interval at DF-4 for a PCB analysis and a radiological composite sample. Because of the difficulty in collecting samples at the 15-foot interval and because the samples collected in November 1994 did not identify COCs above detection limits or background concentrations in the drainfield, no other samples were collected at the deep interval at DF-4 for analysis. Additional efforts during these subsequent sampling events to collect samples from the deep interval at DF-3 were unsuccessful. With these two exceptions, the confirmatory soil sampling program was performed in accordance with the rationale and procedures described in the Septic Tank and Drainfields (ADS-1295) approved RFI Work Plan (SNL/NM March 1993) and addenda to the Work Plan developed during the OU 1295 project approval process (SNL/NM November 1994b and 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.

Confirmatory soil samples were collected from one boring on either side of the septic tank, and from four borings located in the middle and near the far ends of the two pairs of drainfield lateral lines. For septic tank borings, samples were collected from one interval in each borehole starting at the outside bottom of the tank, which was measured to be 9 feet below ground

Table 3-1
ER Site 152: Confirmatory Sampling Summary Table

Sampling Location	Parameters	Number of Borehole Locations	Top of Interval at Each Location	Total Number of Investigative Samples	Total Number of Duplicate Samples	Date(s) Samples Collected
Drainfield	VOCs	4	5', 15'	6*		11/1-2/94
	SVOCs	4	5', 15'	6*		"
	TNT screen	4	5', 15'	6*		"
	High explosives	4	5', 15'	6*		"
	RCRA metals + Be, Cr^{6+}	4	5', 15'	6*		"
	Gamma spec. composite	4	5', 15'	2		"
	Isotopic uranium composite	4	5', 15'	2		"
	Cyanide	4	5', 15'	6*		1/26/95
	PCBs	4	5',15'	7*	1	"
	Tritium composite	4	5', 15'	2		10/19/95
Septic tank	VOCs	2	9'	2	1	11/2/94
	SVOCs	2	9'	2	1	"
	TNT screen	2	9'	2	1	"
	High Explosives	2	9'	2	1	"
	RCRA metals + Be, Cr^{6+}	2	9'	2	1	"
	Cyanide	2	9'	2	1	"
	PCBs	2	9'	2		1/26/95
	Tritium composite	2	9'	1		10/16/95

Notes
* = deep interval soil samples could not be retrieved at location DF-3, not all samples could be retrieved at DF-4
Be = Beryllium
Cr^{6+} = Hexavalent chromium
PCBs = polychlorinated biphenyls
RCRA = Resource Conservation and Recovery Act
Spec. = Spectroscopy
SVOCs = Semivolatile organic compounds
TNT = Trinitrotoluene
VOCs = Volatile organic compounds

surface (bgs) at this site. For about half of the drainfield borings, samples were collected from two intervals in each borehole. The top of the shallow interval started at the bottom of the drain line trenches which were 5 feet bgs on average at this site, and the lower (deep) interval started at 10 feet below the top of the upper interval, or 15 feet bgs.

The Geoprobe™ sampling system was used to collect subsurface soil samples at this site. The upper photograph in Figure 3-1 shows the soil sampling operation in the drainfield. 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 2 feet in order to fill the 2-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 7 inches were cut off. Both ends of the 7-inch section of filled sleeve were immediately capped with a Teflon membrane and rubber end cap, sealed with tape, and placed in an ice-filled cooler at the site. The soil in this section of sleeve was submitted for a VOC analysis. Soil from the remainder of the sleeve was then emptied into a decontaminated mixing bowl. Following this, additional 2-foot sampling runs were completed in order to recover enough soil to satisfy sample volume requirements for the interval. Soil recovered from these additional runs was also emptied into the mixing bowl and blended with soil from the first sampling run. The soil was then transferred from the bowl into sample containers using a decontaminated plastic spatula.

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

Quality assurance/quality control (QA/QC) samples collected during this effort consisted of one set of duplicate soil samples, a set of equipment blanks, and a trip blank. The duplicate soil samples included a sample from the shallow sampling interval in DF-1 (Figure 1-2) analyzed for PCBs and a set of duplicate soil samples from borehole ST-1 near the septic tank analyzed for VOCs, SVOCs, cyanide, explosive compounds, and TNT. No SVOCs, cyanide, PCBs, explosive compounds, or TNT were detected in any of the soil samples at ER Site 152. Trace levels of two VOCs, acetone and methylene chloride, were detected in the duplicate soil sample from the septic tank.

A set of aqueous equipment rinsate samples was collected following completion of the first soil sampling at the site; the samples were analyzed for VOCs, SVOCs, cyanide, RCRA metals, and beryllium. Trace levels of the common laboratory contaminants acetone and methylene

Collecting soil samples in the Building 9950 drainfield with the Geoprobe™, November 1, 1994. View looking south.

Building 9950 septic tank septage removal and cleaning operation, January 9, 1996. View looking northwest.

Figure 3-1. ER Site 152 Photographs

chloride were detected in the equipment blank, but no SVOCs or cyanide were identified. Trace levels of two metals (chromium and lead) were also identified in the metals equipment blank.

A trip blank was included with the set of soil samples shipped to the laboratory in November 1994; it was analyzed for VOCs only. Two common VOC laboratory contaminants were detected in the trip blank (acetone and methylene chloride). These common laboratory contaminants were either not detected, or were found in about the same concentration in the soil characterization samples. 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 slightly contaminated.

Summaries of all constituents detected by commercial laboratory analyses and the TNT screening measurements completed by the SNL/NM field laboratory for these confirmatory samples are presented in Tables 3-2, 3-3, and 3-4. Results of the SNL/NM in-house gamma spectroscopy composite soil sample screening for other radionuclides are presented in Appendices A.4 through A.5. Complete soil sample analytical data packages are archived in the SNL/NM Environmental Operations Records Center and are readily available for review and verification (SNL/NM November 1994d, January 1995c, and October 1995c).

3.7 Rationale for Pursuing a Confirmatory Sampling NFA Decision

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

Confirmatory soil sampling around the septic tank and in the drainfield did not identify any residual COCs indicating past discharges that could pose a threat to human health or the environment. As shown in Table 3-2, only below-reporting-limit concentrations of two VOC compounds (acetone and methylene chloride), which are common laboratory contaminants, were detected in soil samples collected from this site. SVOCs, cyanide, PCBs, explosive compounds, and TNT were not detected.

As shown in Table 3-3, septic tank and drainfield soil sample analytical results indicate that nine of the ten metals that were targeted in the Site 152 investigation were either (1) not detected, or (2) were detected in concentrations below the background UTL or 95th percentile concentrations presented in the SNL/NM study of naturally-occurring constituents (IT March 1996).

In one case the remaining metal, arsenic, exceeded the SNL/NM soil background UTL of 7 milligrams per kilogram (mg/kg). The deep interval sample from borehole DF-1 contained 7.9 mg/kg. Although this value exceeds the UTL, a risk analysis is not being completed for this analyte because the arsenic in this sample is considered to be naturally occurring. This statement is made for the following reasons: (1) There is no history of arsenic use at this site; (2) No arsenic was detected in the septic tank samples; (3) Although the concentration of

Table 3-2

ER Site 152
Summary of Organic and Other Constituents in Confirmatory Soil Samples
Collected Around the Septic Tank and in the Drainfield

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	VOCs Method 8240 Acetone	VOCs Method 8240 Methylene Chloride	SVOCs Method 8270	Cyanide Method 9010/9012	PCBs Method 8080	HE Method 8330	TNT Screen Colorimetric Method Based on EPA 8515	Units
Septic Tank Soil Samples:													
018162-1,2/018954-1	Soil	Field	11/2/94, 1/26/95	ST-1	9	ND	3.3 J	ND	ND	ND	ND	ND	ug/kg
018163-1	Soil	Dupl.	11/2/94	STD-1	9	9.6 J	2.5 J	ND	ND	NS	ND	ND	ug/kg
018164-1,2/018953-1	Soil	Field	11/2/94, 1/26/95	ST-2	9	4.5 J	2.3 J	ND	ND	ND	ND	ND	ug/kg
Drainfield Soil and QA Samples:													
018160-1,2/018948-1	Soil	Field	11/2/94	DF-1	5	7.6 J	3.7 J	ND	ND	ND	ND	ND	ug/kg
018949-1	Soil	Dupl.	1/26/95	DFD-1	5	NS	NS	NS	NS	ND	NS	NS	ug/kg
018161-1,2/018950-1	Soil	Field	11/2/94, 1/26/95	DF-1	15	ND	4 J	ND	ND	ND	ND	ND	ug/kg
018158-1,2/018946-1	Soil	Field	11/2/94, 1/26/95	DF-2	5	4.3 J	2.8 J	ND	ND	ND	ND	ND	ug/kg
018159-1,2/018947-1	Soil	Field	11/2/94, 1/26/95	DF-2	15	ND	3.3 J	ND	ND	ND	ND	ND	ug/kg
018155-1,2/018945-1	Soil	Field	11/2/94, 1/26/95	DF-3	5	8.7 J	3.2 J	ND	ND	ND	ND	ND	ug/kg
018157-1,2/018951-1	Soil	Field	11/2/94, 1/26/95	DF-4	5	ND	3 J	ND	ND	ND	ND	ND	ug/kg
018952-1	Soil	Field	1/26/95	DF-4	15	NS	NS	NS	NS	ND	NS	NS	ug/kg
018165-1,2,4	Water	EB	11/2/94	Site 152	NA	1.9 J	3 B,J	ND	ND	NS	NS	NS	ug/L
018154-1	Soil	TB	11/1/94	Site 152	NA	9.6 J	3.8 J	NS	NS	NS	NS	NS	ug/kg
Laboratory Detection Limit for Soil						10	5	330 or 1,600	500	33	250-2,200	1,000	ug/kg
Laboratory Detection Limit for Water						10	5	10-50	10	NA	NA	NA	ug/L
Proposed Subpart S Action Level For Soil						8E+06	9E+04	NA	2E+06	1E+03	NA	4E+04	ug/kg

Notes:
B = Compound detected in associated blank sample
Dupl. = Duplicate soil sample
EB = Equipment blank
fbgs = feet below ground surface
HE = High explosives
J = Result is detected below the reporting limit or is an estimated concentration.
NA = Not applicable
ND = Not detected
NS = No sample collected
PCBs = Polychlorinated biphenyls
QA = Quality assurance
SVOCs = Semivolatile organic compounds
TB = Trip blank
TNT = Trinitrotoluene
ug/kg = Micrograms per kilogram
ug/L = Micrograms per liter
VOCs = Volatile organic compounds

Table 3-3

ER Site 152
Summary of RCRA Metals, Beryllium, and Hexavalent Chromium in Confirmatory Soil Samples
Collected Around the Septic Tank and in the Drainfield

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	RCRA Metals, Methods 6010 and 7471: As	Ba	Cd	Cr, total	Pb	Hg	Se	Ag	Other Metals Be-Method 6010 Cr^{6+}-Method 7196: Be	Cr^{6+}	Units
Septic Tank Soil Samples:																
018162-2	Soil	Field	11/2/94	ST-1	9	3	63.9	ND	11.7	4.1 J	ND	ND	ND	0.24	ND	mg/kg
018164-2	Soil	Dupl.	11/2/94	STD-1	9	2.7	63.7	ND	9.5	ND	ND	ND	ND	0.3	ND	mg/kg
018163-2	Soil	Field	11/2/94	ST-2	9	3.2	113	ND	7.9	ND	ND	ND	ND	0.27	ND	mg/kg
Drainfield Soil and QA Samples:																
018160-2	Soil	Field	11/2/94	DF-1	5	3	88.4	ND	10.3	5.6 J	ND	ND	ND	0.44	ND	mg/kg
018161-2	Soil	Field	11/2/94	DF-1	15	7.9	60.7	ND	9.3	8	ND	ND	ND	0.39	ND	mg/kg
018158-2	Soil	Field	11/2/94	DF-2	5	2.7	75.5	ND	6.9	4.6 J	ND	ND	ND	0.26	ND	mg/kg
018159-2	Soil	Field	11/2/94	DF-2	15	3	60.6	ND	11.7	3.5 J	ND	ND	ND	0.21	ND	mg/kg
018155-2	Soil	Field	11/1/94	DF-3	5	3.2	56.9	ND	9.7	3.7 J	ND	ND	ND	0.33	ND	mg/kg
018157-2	Soil	Field	11/2/94	DF-4	5	2.1	80.8	ND	11	ND	ND	ND	ND	0.21	ND	mg/kg
018165-3	Water	EB	11/2/94	Site 152	NA	ND	ND	ND	0.01 J	0.0032	ND	ND	ND	ND	NS	mg/L
Laboratory Detection Limit For Soil						1	1	0.5	1	5	0.1	0.5	1	0.2	0.05	mg/kg
Laboratory Detection Limit for Water						0.01	0.01	0.005	0.01	0.003	0.0002	0.005	0.01	0.002	NA	mg/L
Number of SNL/NM Background Soil Sample Analyses *						15	727	1,740	647	536	1,724	2,134	2,302	887	393	NA
SNL/NM Soil Background Concentration 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	0.1 - 1.6	0.02-<2.5	mg/kg
SNL/NM Soil Background UTL or 95th Percentile Concentration*						7	214	0.9	15.9	11.8	<0.1	<1.0	<1.0	0.65	<2.5	mg/kg
Proposed Subpart S Action Level For Soil						0.50	6,000	80	80,000 **	400 ***	20	400	400	0.2	400 **	mg/kg

Table 3-3, concluded:

ER Site 152
Summary of RCRA Metals, Beryllium, and Hexavalent Chromium in Confirmatory Soil Samples
Collected Around the Septic Tank and in the Drainfield

Notes:

As = Arsenic. Arsenic background concentrations presented above are based on analyses of subsurface soil samples collected in the Coyote Test Field (CTF) area.
Ba = Barium. Barium background concentrations presented above are based on analyses of subsurface soil samples collected in the Southwest and CTF areas.
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.

Dupl. = Duplicate soil sample
EB = Equipment blank
fbgs = Feet below ground surface
J = Result is detected below the reporting limit or is an estimated concentration.
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
NA = Not applicable
ND = Not detected
NS = No sample
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)

Table 3-4

ER Site 152
Summary of Isotopic Uranium and Tritium in Confirmatory Soil Samples
Collected Around the Septic Tank and in the Drainfield

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	Isotopic Uranium Method EPI A-011B for 1994 samples *Method LAL-91-SOP-0108 for 1995 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 LAL-91-SOP-0066 (pCi/L) Result	Error *	M.D.A.
Septic Tank Soil Samples:																	
026162-1	Soil	Compos.	10/16/95	ST-1/2	9										ND	170	100
Drainfield Soil Samples:																	
023874-1	Soil	Compos.	11/2/94	DF-1/2/3/4	5	0.700	0.113	0.09	ND	0.023	0.09	0.544	0.095	0.09			
023875-1	Soil	Compos.	11/2/94	DF-1/2/4	15	0.474	0.137	0.09	ND	0.042	0.09	0.486	0.139	0.09			
026165-1	Soil	Compos.	10/19/95	DF-1/2/3/4	5										110	190	110
026166-1	Soil	Compos.	10/19/95	DF-1/2/4	15										ND	160	100
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:

...nd concentrations presented above are based on analyses of surface and subsurface soil samples collected in the

...oncentrations presented above are based on analyses of surface and subsurface soil samples collected in the

...oncentrations presented above are based on analyses of surface and subsurface soil samples collected in the

NOTE: APPARENT ERROR ON THIS TABLE. 2 ISOTOPIC URANIUM SAMPLES COLLECTED 7/20/95 (NOT 11/2/94 AS SHOWN ON THIS TABLE), SENT TO GEL/EPI ONLY, & ~~NOT LAS AS SUGGESTED BY METHOD NOTE ON THIS TABLE~~ MRS 1/27/08

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

arsenic exceeds the UTL, it is within the range of background values (2.1 to 7.9 mg/kg) for the subsurface samples of the Coyote Test Field Area Group, which was used as the reference group for arsenic; and (4) This concentration also falls within the range of background values (0.033 to 17 mg/kg) reported in the Sandia background study for another group of subsurface samples from the North/Tijeras/Southwest/Offsite Area Group (IT March 1996).

As shown in Table 3-4, the results of the isotopic uranium analysis were all below the 95th percentile background activity levels. Tritium was not detected in soil moisture from the composite sample collected near the septic tank or in the composite sample collected from the drainfield deep interval (Table 3-4). Tritium was detected in soil moisture from the drainfield composite shallow sample at an activity level of 110 pCi/L. However, the detection occurred at the laboratory minimum detectable activity level with potential error greater than the reported value itself. Background tritium activity levels for SNL/NM soils were not reported in the IT background report (IT March 1996). The soil moisture contained in soil samples such as these represents either infiltrated precipitation or water discharged from Building 9950 to the drainfield. 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 110 pCi/L detected in the drainfield sample was therefore compared to and found to be within 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). This comparison indicates that tritium is not present above natural background levels in soil moisture beneath the drainfield at this site.

The gamma spectroscopy semiqualitative screening of composite samples from the drainfield shallow and deep sampling intervals did not indicate any concentrations of other radionuclides in soils at this site that would indicate introduced contamination or contamination above background levels (Appendices A.4 and A.5).

Finally, the ER Site 152 septic tank contents were removed and the tank was cleaned in January 1996 (SNL/NM January 1996a). This activity is displayed in the lower photograph of Figure 3-1. The tank was then inspected by a representative of the New Mexico Environment Department (NMED) to verify that the tank contents had been removed and the tank closed in accordance with applicable State of New Mexico regulations (SNL/NM January 1996b).

4.0 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 152, and that additional investigations are unwarranted and unnecessary. Based on archival information and chemical and radiological analytical results of soil samples collected next to the septic tank and in the drainfield, SNL/NM has demonstrated that any contaminants present at this site pose an acceptable level of risk under current and projected future land use (Criterion 5 of Section 1.2). Therefore, ER Site 152 is recommended for an NFA determination.

Ecological risk has not been specifically addressed in this NFA. However, the RCRA metals, isotopic uranium, and tritium were either not detected or were detected in concentrations that were judged to be within SNL/NM or other background concentrations. Also, only trace levels of two VOCs were identified, and these levels are probably the result of laboratory contamination. This information suggests that there is an acceptable level of ecological risk at this site, and no further assessment of ecological risk is planned for ER Site 152.

5.0 REFERENCES

5.1 ER Site 152 References

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Sandia National Laboratories/New Mexico (SNL/NM), May 1994, Field Log #0080, Page 16, 5/19/94, Field notes for ER Site 152 second round septic tank sampling.

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Appendix A

OU 1295, Site 152
Results of Previous Sampling and Surveys

Appendix A.1

ER Site 152
Summary of Constituents in the 1992 Septic Tank Samples

ER Site 152
Summary of Constituents in the 1992 Septic Tank Samples

Building 9950
Coyote Test Field
Sample ID No. SNLA008432
Tank ID No. AD89044R

On July 21, 1992, aqueous and sludge samples were collected from the inactive septic tank serving Building 9950. Analytical results of concern are noted below.

- Trichloroethene (TCE) was detected in the aqueous sample at a level of 0.180 mg/L, which exceeds the New Mexico Water Quality Control Commission discharge limit (NMDL) of 0.1 mg/L, the City of Albuquerque (COA) discharge limit of 5.0 mg/L, and the Resource Conservation and Recovery Act (RCRA) toxicity characteristic (TC) limit of 0.5 mg/L.

- Methylene chloride was detected in the aqueous sample at a level of 0.18 mg/L, which exceeds the NMDL of 0.1 mg/L.

- Phenol was detected in the aqueous sample at a level of 0.011 mg/L, and total phenolic compounds were detected in the aqueous sample at a level of 0.15 mg/L. These values exceed NMDLs of 0.005 mg/L for each.

- Chromium was detected in the aqueous sample at a level of 0.13 mg/L, which exceeds the NMDL of 0.05 mg/L.

- Silver was detected in the aqueous sample at a level of 0.37 mg/L, which exceeds the NMDL of 0.05 mg/L.

No other parameters were detected in the aqueous fractions above NMDLs, COA discharge limits, or RCRA TC limits that identify hazardous waste.

During review of the radiological data, no parameters were detected that exceed U.S. Department of Energy derived concentration guideline limits or the investigation levels established during this investigation.

ER Site 152
Summary of Constituents in the 1992 Septic Tank Samples

Results of Septic Tank Analyses
(LIQUID SAMPLES)

Building No./Area:	9950 CTF
Tank ID No.:	AD89044R
Date Sampled:	7/21/92
Sample ID No.:	SNLA-008432

Analytical Parameter	Measured Concentration	State Discharge Limit	COA Discharge Limit	Comments
Volatile Organics (EPA 624)	(mg/l)	(mg/l)	(mg/l)	
1,2-Dichloroethene (total)	0.21	NR	NR	
Methylene Chloride	0.18	0.1	(TTO=5.0)	Exceeds State Limit
Trichloroethene	12	0.1	(TTO=5.0)	Exceeds State and COA Limits: Exceeds RCRA TC limit of 0.5 mg/L
Semivolatile Organics (EPA 625)	(mg/l)	(mg/l)	(mg/l)	
Phenol	0.011	0.005	(TTO=5.0)	Exceeds State Limit
Pesticides (EPA 608)	(mg/l)	(mg/l)	(mg/l)	
None detected above laboratory		NR	(TTO=5.0)	
reporting limits.				
PCBs (EPA 608)	(mg/l)	(mg/l)	(mg/l)	
None detected above laboratory		0.001	(TTO=5.0)	
reporting limits.				
Metals	(mg/l)	(mg/l)	(mg/l)	
Arsenic	ND (0.0050)	0.1	2.0	
Barium	0.055	1.0	20.0	
Cadmium	0.001	0.01	2.8	
Chromium	0.13	0.05	20.0	Exceeds State Limit
Copper	0.1	1.0	16.5	
Lead	0.024	0.05	3.2	
Manganese	0.088	0.20	20.0	
Mercury	0.00049	0.002	0.1	
Nickel	—	NR	12.0	Not analyzed
Selenium	ND (.02)	0.05	2.0	
Silver	0.37	0.05	5.0	Exceeds State Limit
Thallium	ND (0.025)	NR	NR	
Zinc	0.35	10.0	28.0	
Uranium	ND (0.007)	5.0	NR	
Miscellaneous Analytes	(mg/l)	(mg/l)	(mg/l)	
Phenolic Compounds	0.15	0.005	4.0	Exceeds State Limit
Nitrates/Nitrites	ND (0.10)	10.0	NR	
Formaldehyde	ND (0.50)	NR	260.0	
Fluoride	ND (0.10)	1.6	180.0	
Cyanide	ND (0.01)	0.2	8.0	
Oil and Grease	23.7	NR	150.0	
Radiological Analyses	(pCi/l)	(pCi/l)	(pCi/l)	
Radium 226	0.4 +/- 0.2	30.0	NR	
Radium 228	0 +/- 3	30.0	NR	
Gross Alpha	0 +/- 20	NR	NR	
Gross Beta	100 +/- 40	NR	NR	
Tritium	-30 +/- 606	NR	NR	

NR = Not Regulated; ND(#.#) = Not Detected (Reporting Limit); TC = Toxicity Characteristic of Hazardous Waste

Note: City and State Discharge Limits are for comparison purposes only. City limits apply to discharge of sanitary effluent and not septic tank waste. State limits apply to effluent discharged onto or below the surface of the ground.

References - City of Albuquerque NM Sewer Use and Wastewater Control Ordinance (1990), Section 8-6-3, and New Mexico Water Quality Control Commission Regulations (1988), Section 3-100.

ER Site 152
Summary of Constituents in the 1992 Septic Tank Samples

Results of Septic Tank Analyses (Sludge Sample)			
Building No./Area:	9950 CTF		
Tank ID No.:	AD89044R		
Date Sampled:	7/21/92		
Sample ID No.:	SNLA008432		
Analytical Parameter	Measured Concentration	± 2 Sigma Uncertainty	Units
Water Content	88.0	NA	%
Arsenic	ND (0.50)	NA	mg/kg
Barium	33.4	NA	mg/kg
Cadmium	3.0	NA	mg/kg
Chromium	32.8	NA	mg/kg
Copper	88.1	NA	mg/kg
Lead	31.8	NA	mg/kg
Manganese	11.5	NA	mg/kg
Mercury	0.20	NA	mg/kg
Nickel	—	NA	mg/kg
Selenium	ND (1.0)	NA	mg/kg
Silver	161	NA	mg/kg
Thallium	ND (0.50)	NA	mg/kg
Zinc	203	NA	mg/kg
Gross Alpha	39	17	pCi/g
Gross Beta	26	17	pCi/g
Gross Alpha	24	14	pCi/g
Gross Beta	33	22	pCi/g
Gross Alpha	9	11	pCi/g
Gross Beta	38	22	pCi/g
Gross Alpha	34	17	pCi/g
Gross Beta	49	27	pCi/g
Tritium	-30	606	pCi/L
Bismuth-214	<0.0242 (<13.8)	NA	pCi/mL
Cesium-137	0.00714 (<5.41)	0.00261	pCi/mL
Potassium-40	0.556 (<154)	0.0659	pCi/mL
Lead-212	0.0168 (<15.2)	0.00413	pCi/mL
Lead-214	0.00324 (<16.4)	0.00628	pCi/mL
Radium-226	0.1203 (<134)	0.0546	pCi/mL
Thorium-234	<0.167 (<78.8)	NA	pCi/mL
Thallium-208	0.00667 (<8.26)	0.00258	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 152
Summary of Constituents in the 1994 Septic Tank Samples

Appendix A.2

ER Site 152
Summary of Constituents in 1994 Septic Tank Samples

Sample Number	Sample Matrix	Sample Type	Sample Date	Method	Compound Name	Result	Detection Limit or M.D.A.	+- 2 Sigma Uncertainty	Units
ludge Septage Samples:									
015468-7	Sludge	Field	5/19/94	8240 (VOCs)	Trichloroethene	2,200	120	NA	mg/kg
015468-10	Sludge	Field	5/19/94	8270 (SVOCs)	Phenol	1.4 J	3.3	NA	mg/kg
				8270 (SVOCs)	4-Methylphenol	26	3.3	NA	mg/kg
				8270 (SVOCs)	bis(2-Ethylhexyl) phthalate	5.8	3.3	NA	mg/kg
015468-9	Sludge	Field	5/19/94	TCLP/6010	Arsenic	ND	0.1	NA	mg/L
				TCLP/6010	Barium	0.3 B	0.01	NA	mg/L
				TCLP/6010	Cadmium	ND	0.005	NA	mg/L
				TCLP/6010	Chromium	ND	0.01	NA	mg/L
				TCLP/6010	Lead	ND	0.05	NA	mg/L
				TCLP/7470	Mercury	ND	0.0004	NA	mg/L
				TCLP/6010	Selenium	ND	0.2	NA	mg/L
				TCLP/6010	Silver	ND	0.01	NA	mg/L
015468-8	Sludge	Field	5/19/94	6010	Arsenic	ND	10	NA	mg/kg
				6010	Barium	8.3	1	NA	mg/kg
				6010	Beryllium	ND	0.2	NA	mg/kg
				6010	Cadmium	1.1	0.5	NA	mg/kg
				6010	Chromium	4.6	1	NA	mg/kg
				6010	Lead	19.6	5	NA	mg/kg
				7470	Mercury	0.24	0.1	NA	mg/kg
				6010	Selenium	ND	0.5	NA	mg/kg
				6010	Silver	51.3	1	NA	mg/kg
)15468-11	Sludge	Field	5/19/94	7196	Chromium (VI)	0.010 J	0.025	NA	mg/kg
015468-9	Sludge	Field	5/19/94	HPLC	14 explosive compounds	ND	0.25 - 2.2	NA	ug/g
015468-8				9010/9012	Cyanide	ND	0.5	NA	mg/kg
015468-8	Sludge	Field	5/19/94	9065	Phenolics	9.2	1	NA	mg/kg
)15468-14	Sludge	Field	5/19/94	HASL-300	Uranium 238	2.9	0.023	0.35	pCi/g
				HASL-300	Uranium 235	0.12	0.031	0.046	pCi/g
				HASL-300	Uranium 233/234	6.6	0.023	0.7	pCi/g
)15468-16	Sludge	Field	5/19/94	Gamma Spec.	Potassium 40	1.04	NR	0.271	pCi/g

Appendix A.2, concluded:

ER Site 152
Summary of Constituents in 1994 Septic Tank Samples

Sample Number	Sample Matrix	Sample Type	Sample Date	Method	Compound Name	Result	Detection Limit or M.D.A.	+- 2 Sigma Uncertainty	Units
.iquid Septage Samples:									
015468-1	Liquid	Field	5/19/94	8240 (VOCs)	Acetone	14 BJ	20	NA	ug/L
				8240 (VOCs)	1,2-Dichloroethene	9.5 J	10	NA	ug/L
				8240 (VOCs)	Trichloroethene	250	10	NA	ug/L
015468-2	Liquid	Field	5/19/94	9065	Phenolics	ND	0.01	NA	mg/L
015468-3	Liquid	Field	5/19/94	HPLC	14 Explosive Compounds	ND	0.02 - 0.84	NA	ug/L
015468-4	Liquid	Field	5/19/94	9012	Cyanide	ND	0.01	NA	mg/L
015468-6	Liquid	Field	5/19/94	6010	Arsenic	ND	0.01	NA	mg/L
				6010	Barium	0.064	0.01	NA	mg/L
				6010	Cadmium	0.005	0.005	NA	mg/L
				6010	Chromium	0.024	0.01	NA	mg/L
				6010	Lead	0.0043 B	0.003	NA	mg/L
				6010	Selenium	ND	0.005	NA	mg/L
				6010	Silver	0.012	0.01	NA	mg/L
015468-5	Liquid	Field	5/19/94	7470	Mercury	ND	0.0002	NA	mg/L
)15468-12	Liquid	Field	5/19/94	EPA H-01	Tritium	870	250	170	pCi/L
)15468-13	Liquid	Field	5/19/94	HASL-300	Uranium 238	0.42	0.031	0.14	pCi/L
				HASL-300	Uranium 235	ND	0.031	0.022	pCi/L
				HASL-300	Uranium 233/234	0.61	0.069	0.18	pCi/L
)15468-15	Liquid	Field	5/19/94	Gamma Spec.	73 radionuclides	NV	0.008-21.6	NR	pCi/L

lotes
= Compound detected in the laboratory blank.
IPLC = High performance liquid chromatography
= Result is detected below the reporting limit or is an estimated concentration.
I.D.A. = Minimum Detectable Activity
ıg/kg = Milligrams per kilogram
ıg/L = Milligrams per liter
A = Not Applicable
D = Not detected
R = Not reported by laboratory

NV = No values reported (results were ND, short half-life, or not significant)
pCi/g = Picocuries per gram
pCi/L = Picocuries per liter
Spec. = Spectroscopy
SVOCs = Semivolatile organic compounds
TCLP = Toxicity Characteristic Leaching Procedure
ug/g = micrograms per gram
ug/L = micrograms per liter
VOCs = Volatile organic compounds

Appendix A.3

ER Site 152
Summary of 1994 PETREX™ Passive Soil-Gas Survey Results

ER Site 152
Summary of 1994 PETREX™ Passive Soil-Gas Survey Results

Table 15
PETREX Relative Soil Gas Response Values
(in ion counts)
STD SITE 152

	Sample	PCE	TCE	BTEX	Aliphatics
Phase I Sampling	185	ND	7485	2103	900
	186	ND	ND	16899	6539
	187	ND	78672	6880	5705
	188	ND	199377	18010	41033
	189	ND	9860	8986	899
	190	ND	ND	6586	41131
	191	ND	106385	3223	9774
	192	ND	55249	8980	27726
	193	ND	ND	4493	933
	194	ND	ND	13865	18058
	195	2316	ND	10180	35933
	D-1190	ND	ND	ND	21473
	* 900	ND	ND	4553	6219
	* 901	ND	ND	4732	ND
Phase II Sampling	589	ND	ND	3,301	ND
	590	ND	ND	3,159	2,093
	591	ND	ND	4,458	4,309
	592	ND	30,639	21,930	47,242
	593	ND	ND	15,402	63,353
	594	ND	5,903	24,624	17,919
	595	ND	146,291	15,462	17,616
	* 900	ND	ND	ND	ND
	* 901	ND	ND	ND	ND

PCE - Tetrachloroethene
Indicator Mass Peak(s) 164

TCE - Trichloroethene
Indicator Mass Peak(s) 130

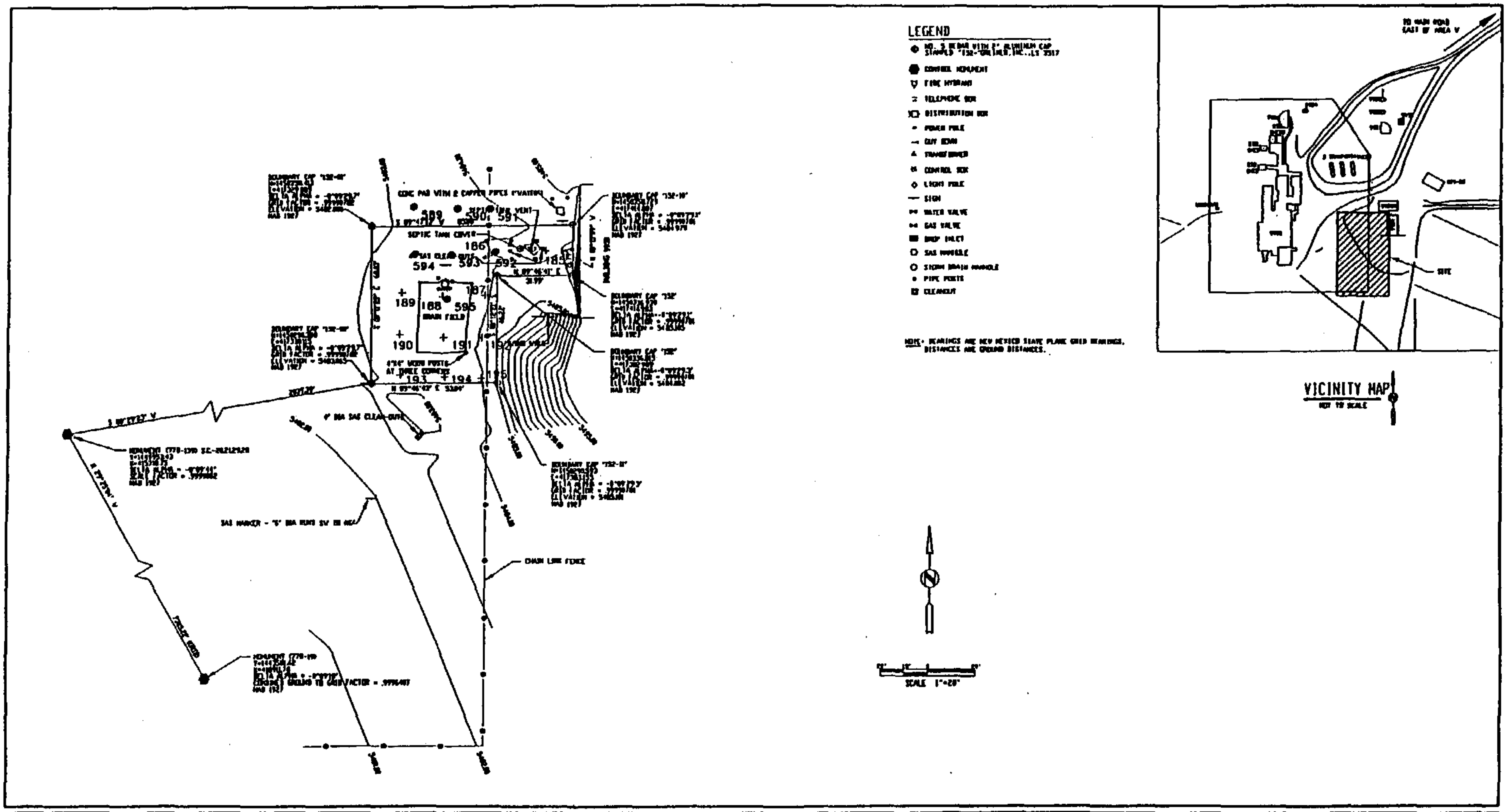
BTEX - Benzene, Toluene, Ethylbenzene/Xylene(s)
Indicator Mass Peak(s) 78, 92, 106

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

ER Site 152
Summary of 1994 PETREX™ Passive Soil-Gas Survey Results



NER Northeast Research Institute LLC 605 Parfet Street Suite 100 Lakewood, Colorado 80215 (303) 238-0090	Drawn By: JCS	Project #: 2098-152	Sandia National Laboratories	LEGEND	Sample Locations
	Checked By:	Date: 5/23/1995	STD Site 152 Albuquerque, New Mexico	Features: + PETREX Sample Location (PHASE I) ● PETREX Sample Location (PHASE II)	
	Project Manager: JOG	File Name: 152_1.dwg			Plate 11

Appendix A.4

ER Site 152
Gamma Spectroscopy Screening Results for the Drainfield
Shallow Interval Composite Soil Sample

ER Site 152
Gamma Spectroscopy Screening Results for the Drainfield Shallow Interval Composite Soil Sample

```
*********************************************************************
*                  Sandia National Laboratories                     *
*  Radiation Protection Sample Diagnostics Program [881 Laboratory] *
*                      7-21-95   4:47:57 AM                         *
*********************************************************************
*                                                                   *
* Analyzed by: [signature] 7/21/95      Reviewed by: [signature] 7/21/95 *
*********************************************************************
```

Customer : GALLOWAY/D.BISWELL (7582/SMO)
Customer Sample ID : 023874-1A
Lab Sample ID : 50057507

Sample Description : MARINELLI SOIL SAMPLE
Sample Type : Solid
Sample Geometry : 1SMAR
Sample Quantity : 970.000 gram
Sample Date/Time : 7-20-95 12:40:00 PM
Acquire Start Date : 7-21-95 4:14:07 AM
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	--------	1.51
TH-234	5.92E-01	3.16E-01	4.66E-01
U-234	Not Detected	--------	1.46E+01
RA-226	9.81E-01	5.36E-01	7.95E-01
PB-214	4.28E-01	9.77E-02	9.99E-02
BI-214	3.84E-01	8.05E-02	7.01E-02
PB-210	Not Detected	--------	8.85E-01
TH-232	4.85E-01	1.69E-01	2.08E-01
RA-228	4.38E-01	1.78E-01	2.29E-01
AC-228	Not Detected	--------	2.35E-01
TH-228	3.88E-01	2.42E-01	5.64E-01
RA-224	1.20	3.65E-01	5.32E-01
PB-212	4.26E-01	1.05E-01	4.75E-02
BI-212	4.29E-01	2.81E-01	4.12E-01
TL-208	4.07E-01	1.03E-01	1.05E-01
U-235	Not Detected	--------	2.85E-01
TH-231	Not Detected	--------	5.45E-01
PA-231	Not Detected	--------	1.57
AC-227	Not Detected	--------	2.07
TH-227	Not Detected	--------	4.01E-01
RA-223	Not Detected	--------	1.81E-01
RN-219	Not Detected	--------	3.34E-01
PB-211	Not Detected	--------	8.25E-01
TL-207	Not Detected	--------	1.66E+01
AM-241	Not Detected	--------	1.98E-01
PU-239	Not Detected	--------	3.19E+02
NP-237	Not Detected	--------	3.50E-01
PA-233	Not Detected	--------	7.78E-02
TH-229	Not Detected	--------	2.96E-01

Appendix A.4, concluded:

ER Site 152
Gamma Spectroscopy Screening Results for the Drainfield Shallow Interval Composite Soil Sample

[Summary Report] - Sample ID: 50057507

Nuclide	Activity (pCi/gram)	2S Error	MDA
AG-110m	Not Detected	--------	3.65E-02
AR-41	Not Detected	--------	2.19E+01
BA-133	Not Detected	--------	7.64E-02
BA-140	Not Detected	--------	1.34E-01
CD-109	Not Detected	--------	7.48E-01
CD-115	Not Detected	--------	9.27E-02
CE-139	Not Detected	--------	3.90E-02
CE-141	Not Detected	--------	6.56E-02
CE-144	Not Detected	--------	2.89E-01
CO-56	Not Detected	--------	4.41E-02
CO-57	Not Detected	--------	3.59E-02
CO-58	Not Detected	--------	3.91E-02
CO-60	Not Detected	--------	4.98E-02
CR-51	Not Detected	--------	3.07E-01
CS-134	Not Detected	--------	6.19E-02
CS-137	Not Detected	--------	4.30E-02
CU-64	Not Detected	--------	2.48E+01
EU-152	Not Detected	--------	3.19E-01
EU-154	Not Detected	--------	2.20E-01
EU-155	Not Detected	--------	1.50E-01
FE-59	Not Detected	--------	8.52E-02
GD-153	Not Detected	--------	1.22E-01
HG-203	Not Detected	--------	3.53E-02
I-131	Not Detected	--------	3.61E-02
IN-115m	Not Detected	--------	8.79E-01
IR-192	Not Detected	--------	3.65E-02
K-40	1.57E+01	2.25	3.70E-01
LA-140	Not Detected	--------	6.18E-02
MN-54	Not Detected	--------	4.35E-02
MN-56	Not Detected	--------	3.11
MO-99	Not Detected	--------	3.83E-01
NA-22	Not Detected	--------	5.64E-02
NA-24	Not Detected	--------	8.46E-02
NB-95	Not Detected	--------	2.11E-01
ND-147	Not Detected	--------	2.33E-01
NI-57	Not Detected	--------	8.32E-02
BE-7	Not Detected	--------	2.90E-01
RU-103	Not Detected	--------	3.60E-02
RU-106	Not Detected	--------	3.55E-01
SB-122	Not Detected	--------	5.98E-02
SB-124	Not Detected	--------	4.22E-02
SB-125	Not Detected	--------	1.06E-01
SC-46	Not Detected	--------	6.48E-02
SR-85	Not Detected	--------	4.42E-02
TA-182	Not Detected	--------	1.93E-01
TA-183	Not Detected	--------	1.84E-01
TE-132	Not Detected	--------	4.06E-02
TL-201	Not Detected	--------	1.24E-01
V-48	Not Detected	--------	4.77E-02
XE-133	Not Detected	--------	1.61E-01
Y-88	Not Detected	--------	3.89E-02
ZN-65	Not Detected	--------	1.24E-01
ZR-95	Not Detected	--------	7.06E-02

Appendix A.5

ER Site 152
Gamma Spectroscopy Screening Results for the Drainfield
Deep Interval Composite Soil Sample

ER Site 152
Gamma Spectroscopy Screening Results for the Drainfield Deep Interval Composite Soil Sample

```
***********************************************************************
*                  Sandia National Laboratories                       *
*   Radiation Protection Sample Diagnostics Program (881 Laboratory)  *
*                     7-21-95  5:27:56 AM                             *
***********************************************************************
*                                                                     *
* Analyzed by: [signature] 7/21/95     Reviewed by: [signature] 7/21/95 *
***********************************************************************
```

Customer : GALLOWAY/D.BISWELL (7582/SMO)
Customer Sample ID : 023875-1A
Lab Sample ID : 50057508

Sample Description : MARINELLI SOIL SAMPLE
Sample Type : Solid
Sample Geometry : 1SMAR
Sample Quantity : 982.000 gram
Sample Date/Time : 7-20-95 12:50:00 PM
Acquire Start Date : 7-21-95 4:54:12 AM
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	--------	1.56
TH-234	Not Detected	--------	4.46E-01
U-234	Not Detected	--------	1.48E+01
RA-226	9.09E-01	5.32E-01	7.97E-01
PB-214	4.72E-01	9.18E-02	6.84E-02
BI-214	3.59E-01	8.07E-02	7.91E-02
PB-210	Not Detected	--------	1.00
TH-232	4.94E-01	1.98E-01	2.66E-01
RA-228	3.84E-01	1.72E-01	2.31E-01
AC-228	3.92E-01	1.24E-01	1.41E-01
TH-228	Not Detected	--------	1.12
RA-224	1.18	3.43E-01	5.06E-01
PB-212	4.20E-01	1.06E-01	5.18E-02
BI-212	3.95E-01	2.40E-01	3.40E-01
TL-208	3.80E-01	9.39E-02	9.11E-02
U-235	Not Detected	--------	2.74E-01
TH-231	Not Detected	--------	5.45E-01
PA-231	Not Detected	--------	1.56
AC-227	Not Detected	--------	2.06
TH-227	Not Detected	--------	4.08E-01
RA-223	Not Detected	--------	1.81E-01
RN-219	Not Detected	--------	2.30E-01
PB-211	Not Detected	--------	8.54E-01
TL-207	Not Detected	--------	1.76E+01
AM-241	Not Detected	--------	1.93E-01
PU-239	Not Detected	--------	3.14E+02
NP-237	Not Detected	--------	1.93E-01
PA-233	Not Detected	--------	7.34E-02
TH-229	Not Detected	--------	2.87E-01

Appendix A.5, concluded:

ER Site 152
Gamma Spectroscopy Screening Results for the Drainfield Deep Interval Composite Soil Sample

[Summary Report] - Sample ID: 50057508

Nuclide	Activity (pCi/gram)	2S Error	MDA
AG-110m	Not Detected	--------	3.66E-02
AR-41	Not Detected	--------	2.59E+01
BA-133	Not Detected	--------	7.48E-02
BA-140	Not Detected	--------	1.28E-01
CD-109	Not Detected	--------	6.63E-01
CD-115	Not Detected	--------	8.96E-02
CE-139	Not Detected	--------	3.81E-02
CE-141	Not Detected	--------	6.21E-02
CE-144	Not Detected	--------	2.81E-01
CO-56	Not Detected	--------	4.75E-02
CO-57	Not Detected	--------	3.55E-02
CO-58	Not Detected	--------	3.88E-02
CO-60	Not Detected	--------	5.11E-02
CR-51	Not Detected	--------	2.99E-01
CS-134	Not Detected	--------	6.01E-02
CS-137	Not Detected	--------	4.17E-02
CU-64	Not Detected	--------	2.20E+01
EU-152	Not Detected	--------	3.25E-01
EU-154	Not Detected	--------	2.02E-01
EU-155	Not Detected	--------	1.46E-01
FE-59	Not Detected	--------	9.11E-02
GD-153	Not Detected	--------	1.19E-01
HG-203	Not Detected	--------	3.55E-02
I-131	Not Detected	--------	3.55E-02
IN-115m	Not Detected	--------	9.13E-01
IR-192	Not Detected	--------	3.52E-02
K-40	1.40E+01	2.03	3.48E-01
LA-140	Not Detected	--------	5.62E-02
MN-54	Not Detected	--------	4.17E-02
MN-56	Not Detected	--------	3.83
MO-99	Not Detected	--------	3.69E-01
NA-22	Not Detected	--------	5.21E-02
NA-24	Not Detected	--------	9.19E-02
NB-95	Not Detected	--------	2.16E-01
ND-147	Not Detected	--------	2.32E-01
NI-57	Not Detected	--------	8.45E-02
BE-7	Not Detected	--------	2.89E-01
RU-103	Not Detected	--------	3.38E-02
RU-106	Not Detected	--------	3.28E-01
SB-122	Not Detected	--------	6.40E-02
SB-124	Not Detected	--------	4.13E-02
SB-125	Not Detected	--------	1.00E-01
SC-46	Not Detected	--------	6.49E-02
SR-85	Not Detected	--------	4.25E-02
TA-182	Not Detected	--------	1.90E-01
TA-183	Not Detected	--------	1.81E-01
TE-132	Not Detected	--------	3.96E-02
TL-201	Not Detected	--------	1.26E-01
V-48	Not Detected	--------	4.75E-02
XE-133	Not Detected	--------	1.60E-01
Y-88	Not Detected	--------	2.78E-02
ZN-65	Not Detected	--------	1.28E-01
ZR-95	Not Detected	--------	6.70E-02

RSI

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

SEP 15 [illegible]

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

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

Dear Mr. Bearzi:

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

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

Sincerely,

Michael J. Zamorski
Area Manager

Enclosure

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

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

BC 165844

Sandia National Laboratories
Albuquerque, New Mexico
September 1999

Environmental Restoration Project
Responses to NMED Request for Supplemental Information
No Further Action Proposals (6th Round)
Dated January 1997

INTRODUCTION

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

The following two operable units (OU) and nine Environmental Restoration (ER) Sites were included in the January 1997 NFA proposals:

- OU 1295
  - ER Site 137, Building 6540/6542 Septic System
  - ER Site 140, Building 9965 Septic System
  - ER Site 150, Building 9939/9939A Septic System
  - ER Site 152, Building 9950 Septic System
  - ER Site 153, Building 9956 Septic System
- OU 1335
  - ER Site 86, Firing Site (Building 9927) (Active)
  - ER Site 90, Beryllium Firing Site (Thunder Range) (Active)
  - ER Site 115, Firing Site (Building 9930) (Active)
  - ER Site 191, Equus Red

TABLE OF CONTENTS

Site-Specific Comments

ER Site 152, Building 9950 Septic System

ER Site 152 is not appropriate for NFA petition.

1. **The maps shown in Figures 1-1 and 1-2 are labeled "draft". See general comment 1.**

   Response: Replacement Figures 1-1 and 1-2 without the word "draft" are provided in Attachment G.

2. **Table 3-2 – See general comment 4.**

   Response: Soil samples taken from ER Site 152 in late 1994 were analyzed by an off-site commercial laboratory (Quanterra in Arvada, Colorado) for organic constituents, including volatile organic compounds using EPA Method 8240, semivolatile organic compounds using EPA Method 8270, polychlorinated biphenyls using EPA Method 8080, and high explosives compounds using EPA Method 8330. The analytical reports from the laboratory included only the reporting limits (practical quantitation limits) and did not include the method detection limits. Tables containing a complete list of the volatile organic compound, semivolatile organic compound, polychlorinated biphenyl, and high explosives constituents analyzed for in these samples and their respective reporting limits are provided in Attachment H.

3. **Please provide an estimate of waste volume or mass, and the total volume or mass of liquids discharged. Also, please provide the size of the lines (for example, 4" pipe).**

   Response: The Work Plan states that the estimated effluent discharge rates from the entire Materials Test Facility (which includes both Buildings 9950 and 9956) to the single Building 9950 septic system (ER Site 152) and the two Building 9956 septic systems (ER Site 153) may have ranged from 60 to 900 gallons per day. This estimate is based on the number of full- and part-time people who, it was estimated, worked at the facility, which was constructed in about 1964. Therefore, based on the estimated length of time that the three septic systems at the Materials Test Facility (includes both ER Sites 152 and 153) were in operation (1964 to approximately 1992, or approximately 29 years), and assuming a 5 day-per-week, 50 week-per-year operation, the total amount of effluent discharged from the facility would have ranged from 435,000 to 6,525,000 gallons.

   Historical engineering drawings maintained by Sandia National Laboratories/New Mexico indicate that the drain line from Building 9950 to the septic tank was a 4-inch diameter pipe. The drain field drain lines were physically located with a backhoe and were determined to consist of 4-inch diameter perforated PVC.

Site-Specific Comments

4. **See general comment 8.**

   Response: Sandia National Laboratories/New Mexico recognizes that this and other potential deep groundwater environmental restoration and non-environmental restoration septic and drain system sites may be candidates for additional deep soil vapor sampling, and perhaps groundwater monitoring, in accordance with procedures specified in the sampling and analysis plan. It will not be determined whether additional work will be required at this site until all shallow soil sampling and shallow passive soil gas surveys are completed at the approximately 101 non-environmental restoration septic and drain system sites currently thought to exist at Sandia National Laboratories/New Mexico.

ATTACHMENT G

ER SITE 152
REVISED FIGURES 1-1 AND 1-2

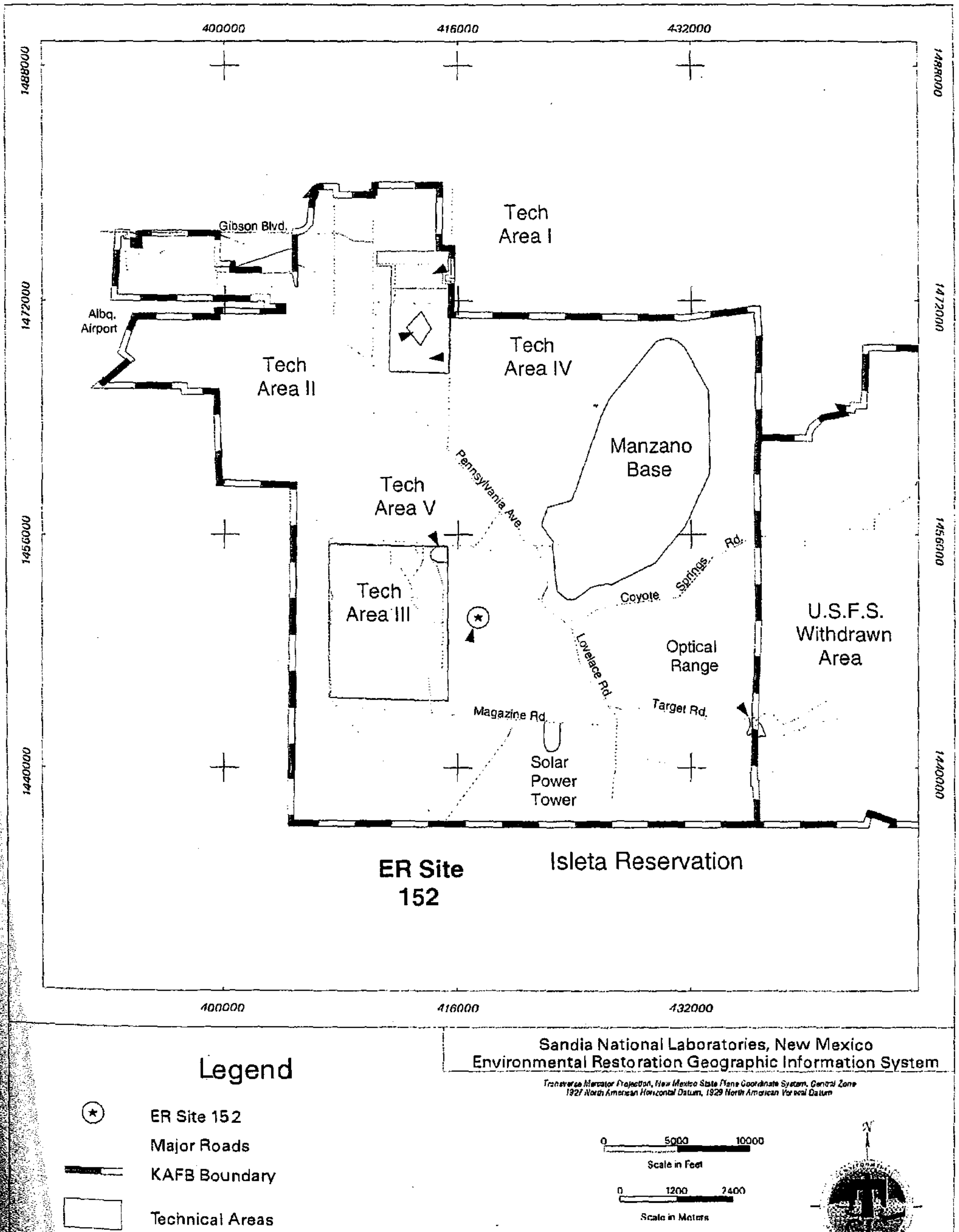


FIGURE 1-1
Location Map for Site 152
Sandia National Laboratories,
New Mexico

sm990710.pri dahelfr SNL GIS ORG. 7512 08/20/96 MAPID=961158a

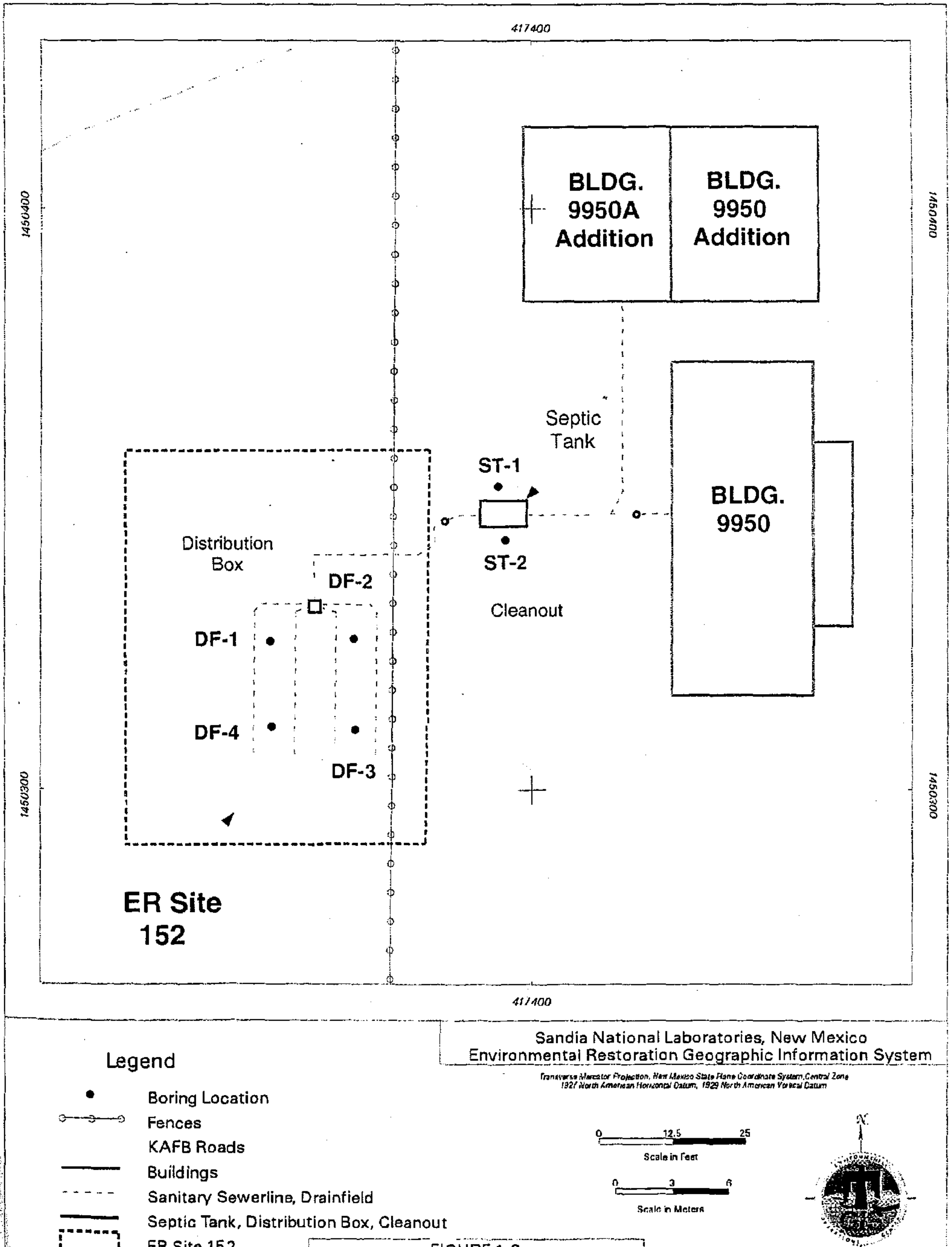


FIGURE 1-2
Site Map for ER Site 152
Sandia National Laboratories,
New Mexico

sm990711.pri dahelfr SNL GIS ORG. 7512 08/20/96 MAPID=961158

ATTACHMENT H

ER SITE 152
SUPPLEMENTAL TABLES 3-2A THROUGH 3-2D

Specific Comments

Table 3-2A
Summary of VOC Analytical Detection Limits
Used for ER Site 152 Soil Sampling, November 1994
(Off-site laboratory)

Analyte	Reporting Limit (µg/kg)
Acetone	10
Benzene	5
Bromodichloromethane	5
Bromoform	5
Bromomethane	10
2-butanone	10
Carbon disulfide	5
Carbon tetrachloride	5
Chlorobenzene	5
Chloroethane	10
Chloroform	5
Chloromethane	10
Dibromochloromethane	5
1,1-dichloroethane	5
1,2-dichloroethane	5
1,1-dichloroethene	5
1,2-dichloroethene	5
1,2-dichloropropane	5
cis-1,3-dichloropropene	5
trans-1,3-dichloropropene	5
Ethyl benzene	5
2-hexanone	10
Methylene chloride	5
4-methyl-2-pentanone	10
Styrene	5
1,1,2,2-tetrachloroethane	5
Tetrachloroethene	5
Toluene	5
1,1,1-trichloroethane	5
1,1,2-trichloroethane	5
Trichloroethene	5
Vinyl acetate	10
Vinyl chloride	10
Xylene	5

µg/kg = Microgram(s) per kilogram.
VOC = Volatile organic compound.

Table 3-2B
Summary of SVOC Analytical Detection Limits
Used for ER Site 152 Soil Sampling, November 1994
(Off-site laboratory)

Analyte	Reporting Limit (µg/kg)
Acenaphthene	330
Acenaphthylene	330
Anthracene	330
Benzo(a)anthracene	330
Benzo(a)pyrene	330
Benzo(b)fluoranthene	330
Benzo(ghi)perylene	330
Benzo(k)fluoranthene	330
Benzoic acid	1600
Benzyl alcohol	330
4-bromophenyl phenyl ether	330
Butylbenzyl phthalate	330
Carbazole	330
4-chloro-3-methylphenol	330
4-chlorobenzenamine	330
bis(2-chloroethoxy)methane	330
bis(2-chloroethyl)ether	330
2-chloronaphthalene	330
2-chlorophenol	330
4-chlorophenyl phenyl ether	330
Chrysene	330
o-cresol	330
Dibenz(a,h)anthracene	330
Dibenzofuran	330
1,2-dichlorobenzene	330
1,3-dichlorobenzene	330
1,4-dichlorobenzene	330
3,3'-dichlorobenzidine	660
2,2'-dichlorodiisopropyl ether	330
2,4-dichlorphenol	330
Diethylphthalate	330
2,4-dimethylphenol	330
Dimethylphthalate	330
Di-n-butyl phthalate	330
Dinitro-o-cresol	1600
2,4-dinitrophenol	1600
2,4-dinitrotoluene	330
2,6-dinitrotoluene	330

Refer to footnotes at end of table.

Specific Comments

Table 3-2B (Concluded)
Summary of SVOC Analytical Detection Limits
Used for ER Site 152 Soil Sampling, November 1994
(Off-site laboratory)

Analyte	Reporting Limit (µg/kg)
Di-n-octyl phthalate	330
bis(2-ethylhexyl)phthalate	330
Fluoranthene	330
Fluorene	330
Hexachlorobenzene	330
Hexachlorobutadiene	330
Hexachlorocyclopentadiene	330
Hexachloroethane	330
Indeno(1,2,3-c,d)pyrene	330
Isophorone	330
2-methylnaphthalene	330
4-methylphenol	330
Naphthalene	330
2-nitroaniline	1600
3-nitroaniline	1600
4-nitroaniline	1600
Nitrobenzene	330
2-nitrophenol	330
4-nitrophenol	1600
n-nitrosodiphenylamine	330
n-nitrosodipropylamine	330
Pentachlorophenol	1600
Phenanthrene	330
Phenol	330
Pyrene	330
1,2,4-trichlorobenzene	330
2,4,5-trichlorophenol	1600
2,4,6-trichlorophenol	330

µg/kg = Microgram(s) per kilogram.
SVOC = Semivolatile organic compound.

Table 3-2C
Summary of HE Analytical Detection Limits
Used for ER Site 152 Confirmatory Soil Sampling, November 1994
(Off-site laboratory)

Compound	Reporting Limit (µg/kg)
4-amino-2,6-dinitrotoluene	250
2-amino-4,6-dinitrotoluene	250
1,3-dinitrobenzene	250
2,4-dinitrotoluene	250
2,6-dinitrotoluene	260
HMX	2,200
Nitro-benzene	260
2-nitrotoluene	250
3-nitrotoluene	250
4-nitrotoluene	250
RDX	1,000
Tetryl	650
1,3,5-trinitrobenzene	250
2,4,6-trinitrotoluene	250

HE = High explosive(s).
HMX = Cyclotetramethylene tetranitramine.
µg/kg = Microgram(s) per kilogram.
RDX = Cyclo-1,3,5-trimethylene-2,4,6-trinitramine.
Tetryl = 2,4,6-trinitrophenylmethylnitramine.

Table 3-2D
Summary of PCB Analytical Detection Limits
Used for ER Site 152 Confirmatory Soil Sampling, January 1995
(Off-site laboratory)

Compound	Reporting Limit (µg/kg)
Aroclor 1260	33
Aroclor 1254	33
Aroclor 1221	33
Aroclor 1232	33
Aroclor 1248	33
Aroclor 1016	33
Aroclor 1242	33

µg/kg = Microgram(s) per kilogram.
PCB = Polychlorinated biphenyl.

NOD

ESH SEC

NNSA National Nuclear Security Administration

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

MAR 2 3 2005

cc: Dick Fate, Carolyn D., MS

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 Solid Waste Management Unit (SWMU) Assessment Reports and Proposals for Corrective Action Complete (CAC) for Drain and Septic Systems (DSS) Sites 1081 and 1092. DOE is also submitting responses to the Request for Supplemental Information (RSI) for SWMUs 137, 146, 148, 152, and 153 at Sandia National Laboratories, New Mexico, EPA ID No. NM5890110518. These documents are compiled as DSS Round 8 and CAC (formerly No further Action [NFA]) Batch 26.

This submittal includes descriptions of the site characterization work and risk assessments for DSS Area of Concern (AOC) Sites 1081 and 1092, and SWMUs 137, 146, 148, 152, and 153. The risk assessments conclude that for these seven sites: (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.

Based on the information provided, DOE and Sandia are requesting a determination of Corrective Action Complete without controls for these DSS sites.

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

INFORMATION COPY

SHEARS #340823

Sincerely,

Patty Wagner
Manager

Enclosure

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

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

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 152, BUILDING 9950 SEPTIC SYSTEM, COYOTE TEST FIELD

March 2005

United States Department of Energy
Sandia Site Office

TABLE OF CONTENTS

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LIST OF FIGURES

Figure

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LIST OF TABLES

Table

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LIST OF ANNEXES

Annex

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ACRONYMS AND ABBREVIATIONS

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

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1.0 INTRODUCTION

1.1 Investigation History

Solid Waste Management Unit (SWMU) 152 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 January 1997, an NFA proposal was submitted to the NMED for SWMU 152 (SNL/NM January 1997). In June 1999, the NMED Hazardous and Radioactive Materials Bureau (HRMB) responded with a Request for Supplemental Information (RSI) on the NFA proposal that required finalized location and site maps, updated data tables, additional information on the volume of liquid discharged at the site, and also noted that the septic system at this site could pose a threat to groundwater (NMED June 1999).

SNL/NM responded to the RSI in September 1999 and submitted revised maps, amended data tables, and additional information about the estimated volume of liquid discharged at the site. SNL/NM also acknowledged that the site was a potential candidate for deep soil-vapor sampling, and perhaps groundwater monitoring as well (SNL/NM September 1999).

At that time, negotiations were being conducted to define a technical and decision-making approach to complete environmental assessment and characterization work at the 22 SWMUs, and at 61 other Drain and Septic Systems (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 in February 2002 (Moats February 2002).

Because of the physical similarity of the SWMUs and 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 1999 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 SWMUs and AOC sites were ranked in order to select sites for deep soil-vapor well installation and sampling. SWMU 152 was not one of the sites selected for deep soil-vapor monitoring, well sampling, or any other additional work.

1.2 Remaining RSI Requirements for DSS SWMU 152

The remaining requirement from the June 1999 RSI for DSS SWMU 152 is addressed in this RSI response:

- Submit a revised risk assessment incorporating 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. Because the site description and operational history were provided in the initial NFA proposal (SNL/NM January 1997), the information is only summarized in the risk assessment presented in Chapter 2.0.

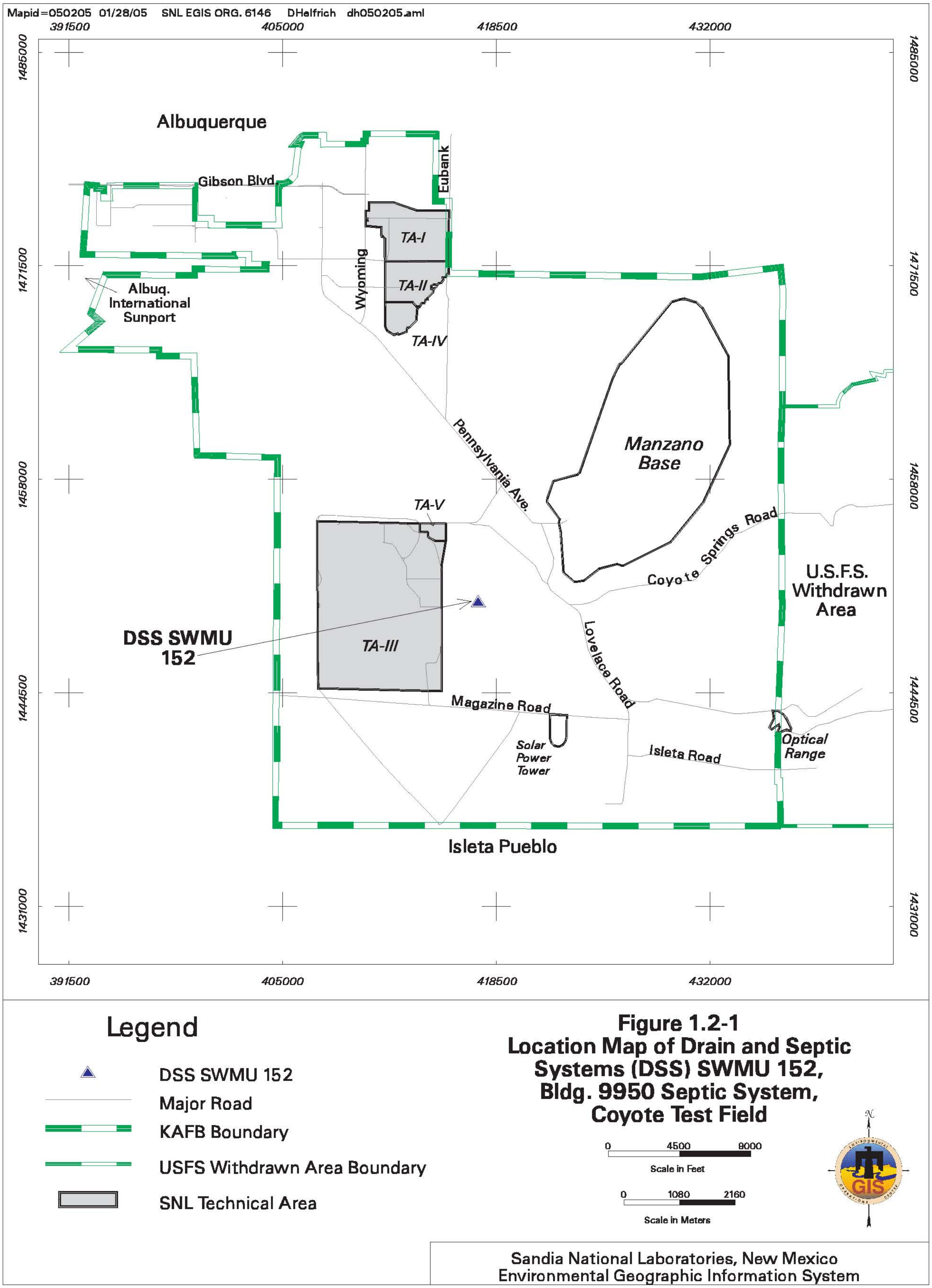

Figure 1.2-1
Location Map of Drain and Septic Systems (DSS) SWMU 152, Bldg. 9950 Septic System, Coyote Test Field

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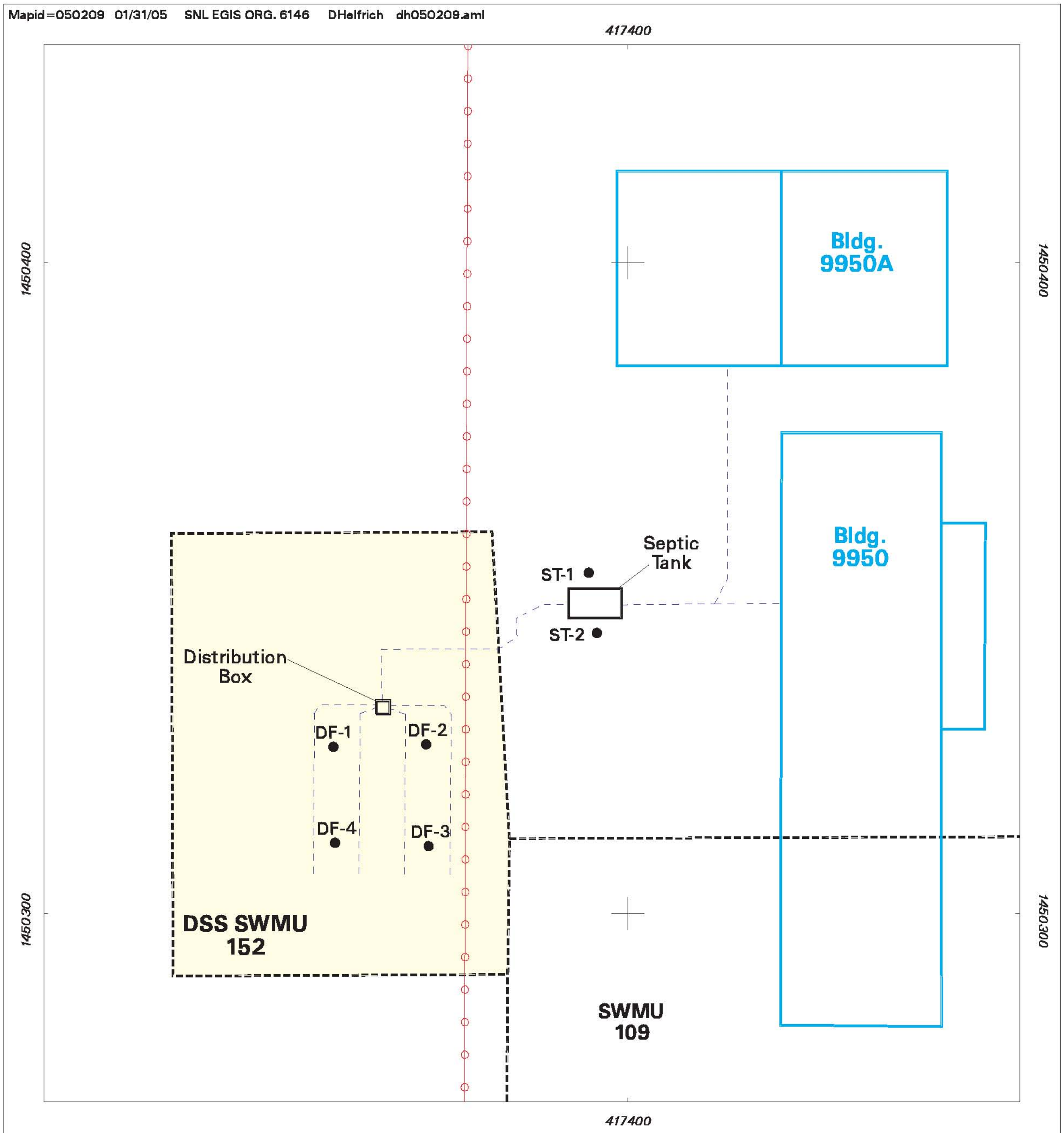
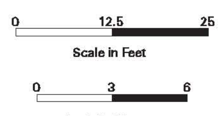


Legend

- Soil Boring Location
- Fence
- Septic Tank, Distribution Box
- Sanitary Sewerline, Drainfield
- Other SWMU Boundary
- Building / Structure
- DSS SWMU 152

Figure 1.2-2
Site Map of Drain and Septic Systems (DSS) SWMU 152, Bldg. 9950 Septic System, Coyote Test Field



Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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2.0 RISK ASSESSMENT REPORT FOR DSS SWMU 152

2.1 Site Description and History

DSS SWMU 152, the Building 9950 Septic System at SNL/NM, is located in the Coyote Test Field, east of SNL/NM Technical Area (TA)-III, on federally owned land controlled by Kirtland Air Force Base (KAFB) and permitted to the U.S. Department of Energy (DOE). SWMU 152 consists of a 750-gallon septic tank that discharged to four, approximately 25-foot-long drain lines (Figure 1.2-2). Available information indicates that Building 9950 was constructed in 1964 (SNL/NM March 2003), and it is assumed that the septic system was constructed about that time. In 1991, septic system discharges were routed to the City of Albuquerque sanitary sewer system (Jones June 1991). The septic system line was disconnected and capped, and the system was abandoned in place concurrent with this change (Romero September 2003). The empty and decontaminated septic tank was inspected by the NMED on January 26, 1996, and a closure form was signed (SNL/NM January 1996). The septic tank was backfilled with clean, native soil from the area in early 1996.

Environmental concern about DSS SWMU 152 is based upon the potential for the release of constituents of concern (COCs) in effluent discharged to the environment via the septic system at this site. Because operational records were not available, the investigation was planned to be consistent with other DSS site investigations and to sample for possible COCs that may have been released during facility operations.

The ground surface in the vicinity of the site is flat or slopes slightly to the west. The closest major drainage lies approximately 1.0 mile south of the site and terminates in the playa just west of KAFB. No springs or perennial surface-water bodies are located within 1.6 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 152 is unpaved with some native vegetation, and no storm sewers are used to direct surface water away from the site.

DSS SWMU 152 lies at an average elevation of approximately 5,485 feet above mean sea level. The groundwater beneath the site occurs in unconfined conditions in essentially unconsolidated silts, sands, and gravels. Groundwater is approximately 460 feet below ground surface (bgs). Groundwater flow is thought to be to the west-northwest in this area (SNL/NM April 2004). The nearest groundwater monitoring well (TAV-MW3) is approximately 4,000 feet northwest of the site and east of TA-V. The nearest production wells are northwest and north of the site and include KAFB-4 and KAFB-11, which are approximately 3.9 and 3.8 miles away, respectively.

2.2 Data Quality Objectives

Soil sampling was conducted in 1994 and 1995 in accordance with the rationale and procedures described in the approved Septic Tanks and Drainfields (ADS [Activity Data Sheet]-1295) Resource Conservation and Recovery Act (RCRA) 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 152 was effluent discharged to the environment from the septic tank and drainfield at this site.

Table 2.2-1
Summary of Sampling Performed to Meet DQOs

DSS SWMU 152 Sampling Areas	Potential COC Source	Number of Sampling Locations	Sample Density (samples/acre)	Sampling Location Rationale
Soil adjacent to, and beneath, the septic system septic tank	Effluent discharged to the environment from the septic tank	2	NA	Evaluate potential COC releases to the environment from effluent discharged from the septic tank
Soil beneath the septic system drainfield	Effluent discharged to the environment from the drainfield	4	NA	Evaluate potential COC releases to the environment from effluent discharged from the drainfield

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

Using a Geoprobe™, the soil samples were collected from two 3- or 4-foot-long sampling intervals at six borehole locations at DSS SWMU 152. Sampling intervals started at 5 and 15 feet bgs in each of the four drainfield boreholes, and at 9 feet bgs in the two boreholes adjacent to the septic tank. Soil samples were collected using procedures described in the RFI Work Plan (SNL/NM March 1993) and the RFI SAP (IT March 1994). Table 2.2-2 summarizes the types of confirmatory and quality assurance (QA)/quality control (QC) samples collected at the site to meet the data quality objectives (DQOs) and the laboratories that performed the analyses.

Table 2.2-2
Number of Confirmatory Soil and QA/QC Samples Collected from DSS SWMU 152

Sample Type	VOCs	SVOCs	PCBs	HE	RCRA Metals plus Beryllium	Hexavalent Chromium	Cyanide	Isotopic Uranium	Tritium	Gamma Spectroscopy Radionuclides
Confirmatory	8	8	9	8	8	8	8	2	3	2
Duplicates	1	1	1	1	1	1	1	0	0	0
EBs and TBs[a]	2	1	0	0	1	0	1	0	0	0
Total Samples	11	10	10	9	10	9	10	2	3	2
Analytical Laboratory	QES	QES	QES	QES	QES	QES	QES	GEL	LAS	RPSD

[a]TBs for VOCs only.
DSS = Drain and Septic Systems.
EB = Equipment blank.
GEL = General Engineering Laboratory, Inc.
HE = High explosive(s).
LAS = Lockheed Analytical Services.
PCB = Polychlorinated biphenyl.
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.
VOC = Volatile organic compound.

The soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), high explosive (HE) compounds, RCRA metals plus beryllium and hexavalent chromium, cyanide, isotopic uranium, tritium, and radionuclides by gamma spectroscopy. The samples were analyzed by off-site laboratories (Quanterra Environmental Services [QES], Lockheed Analytical Services [LAS], and General Engineering Laboratories, Inc. [GEL]) and at the on-site SNL/NM Radiation Protection Sample Diagnostics (RPSD) Laboratory. Samples were also screened for trinitrotoluene (TNT) at the on-site Environmental Restoration Chemistry Laboratory. No TNT was detected and these TNT samples were not used in the risk assessment analysis. Table 2.2-3 summarizes the analytical methods and the data quality requirements.

Table 2.2-3
Summary of Data Quality Requirements for DSS SWMU 152

Analytical Method[a]	Data Quality Level	QES	LAS	GEL	RPSD
VOCs EPA Method 8260	Defensible	8	None	None	None
SVOCs EPA Method 8270	Defensible	8	None	None	None
PCBs EPA Method 8082	Defensible	9	None	None	None
HE EPA Method 8330	Defensible	8	None	None	None
RCRA Metals plus Beryllium and Hexavalent Chromium EPA Method 6000/7000	Defensible	8	None	None	None
Cyanide EPA Method 9010/9012	Defensible	8	None	None	None
Isotopic Uranium Methods LAL-91-SOP-0108 (LAS) and EPI A-011B (GEL)	Defensible	None	None	2	None
Tritium LAL-91-SOP-0066	Defensible	None	3	None	None
Gamma Spectroscopy Radionuclides EPA Method 901.1	Defensible	None	None	None	2

Note: The number of samples does not include QA/QC samples such as duplicates, trip blanks, and equipment blanks.
[a]EPA November 1986.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
GEL = General Engineering Laboratories, Inc.
HE = High explosive(s).
LAS = Lockheed Analytical Services.
PCB = Polychlorinated biphenyl.
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.
VOC = Volatile organic compound.

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

All of the DSS SWMU 152 soil sample results were verified/validated by SNL/NM. The off-site laboratory results from QES, LAS, 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 the RSI response. Therefore, the DQOs have been fulfilled.

2.3 Determination of Nature, Rate, and Extent of Contamination

2.3.1 Introduction

The determination of the nature, migration rate, and extent of contamination at DSS SWMU 152 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, and soil sampling. The DQOs contained in the RFI Work Plan (SNL/NM March 1993), the 1994 SAP (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 152, which is presented in this risk assessment. 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 152 were evaluated using laboratory analyses of the soil samples. The analytical requirements included analyses for VOCs, SVOCs, PCBs, HE, RCRA metals plus beryllium and 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 any potential degradation products at SWMU 152.

2.3.3 Rate of Contaminant Migration

The septic system at DSS SWMU 152 was deactivated in 1991 when Building 9950 was connected to an extension of the City of Albuquerque sanitary sewer system. The migration rate of COCs that may have been introduced into the subsurface via the septic system at this site was therefore dependent upon the volume of aqueous effluent discharged to the environment from this system when it was operational. Any migration of COCs from this site after use of the septic system was discontinued has been predominantly dependent upon precipitation. However, it is highly unlikely that sufficient precipitation has fallen on the site to reach the depth at which COCs may have been discharged to the subsurface from this system. Analytical data generated from the soil sampling conducted at the site are adequate to characterize the rate of COC migration at SWMU 152.

2.3.4 Extent of Contamination

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

The soil samples were collected at sampling depths starting at 5 and 15 feet bgs in the four drainfield boreholes, and at 9 feet bgs in two boreholes adjacent to the septic tank. Sampling intervals started at the depths at which effluent discharged from the drainfield drain lines and from the base of the septic tank if it had leaked would have entered the subsurface environment at the site. This sampling procedure was required by NMED regulators, and similar sampling procedures have been used at numerous other DSS-type sites at SNL/NM. The soil samples are considered to be representative of the soil potentially contaminated with the COCs at this site and are sufficient to determine the vertical extent of COCs.

2.4 Comparison of COCs to Background Levels

Site history and characterization activities are used to identify potential COCs. This DSS SWMU 152 RSI response and request for a determination of Corrective Action Complete (CAC) without controls describes the identification of COCs and the sampling that was conducted in order to determine the concentration levels of those COCs across the site. Generally, COCs evaluated in this risk assessment include all detected organic and all inorganic and radiological COCs for which samples were analyzed. When the detection limit of an organic compound is too high (i.e., could possibly cause an adverse effect to human health or the environment), the compound is retained. Nondetected organic compounds not included in this assessment were determined to have detection limits low enough to ensure protection of human health and the environment. In order to provide conservatism in this risk assessment, the calculation uses only the maximum concentration value of each COC found for the entire site. The SNL/NM maximum background concentration (Dinwiddie September 1997) was selected to provide the background screen listed in Tables 2.4-1 and 2.4-2.

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

Table 2.4-1 lists the nonradiological COCs and Table 2.4-2 lists the radiological COCs for the human health risk assessment at DSS SWMU 152. All samples were collected from depths of 5 feet bgs or greater; therefore, evaluation of ecological risk was not performed. Both tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997). Section 2.6.4 discusses the results presented in Tables 2.4-1 and 2.4-2.

Table 2.4-1
Nonradiological COCs for Human Health Risk Assessment at DSS SWMU 152 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	7.9	4.4	**No**	44[c]	--	**Yes**
Barium	113	214	Yes	170[d]	--	**Yes**
Beryllium	0.44	0.65	Yes	19[c]	--	No
Cadmium	0.25[e]	0.9	Yes	64[c]	--	**Yes**
Chromium, total	11.7	15.9	Yes	16[c]	--	No
Chromium VI	0.025[e]	1	Yes	16[c]	--	No
Cyanide	0.25[e]	NC	**Unknown**	NC	--	**Unknown**
Lead	8.0	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	0.0096 J	NA	**NA**	0.69[g]	0.24[g]	No
Methylene Chloride	0.004 J	NA	**NA**	5.0[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 1998.
[c]Yanicak March 1997.
[d]Neumann 1976.
[e]Nondetected concentration (i.e., one-half the maximum detected limit is greater than the maximum detected concentration).
[f]Callahan et al. 1979.
[g]Howard 1990.
BCF = Bioconcentration factor.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
J = Estimated concentration.

Table 2.4-1 (Concluded)
Nonradiological COCs for Human Health Risk Assessment at DSS SWMU 152 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

K_{ow}	= Octanol-water partition coefficient.
Log	= Logarithm (base 10).
mg/kg	= Milligram(s) per kilogram.
NA	= Not applicable.
NC	= Not calculated.
NMED	= New Mexico Environment Department.
SNL/NM	= Sandia National Laboratories/New Mexico.
SWMU	= Solid Waste Management Unit.
--	= Information not available.

Table 2.4-2
Radiological COCs for Human Health Risk Assessment at DSS SWMU 152 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 (0.0430)	0.079	Yes	3,000[d]	**Yes**
Thorium-232	0.494	1.01	Yes	3,000[d]	**Yes**
Tritium	0.0055	0.021[e]	Yes	NA	No
Uranium-235	**ND (0.285)**	0.16	**No**	900[d]	**Yes**
Uranium-238	**ND (1.56)**	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 1998.
[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.
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.

2.5 Fate and Transport

The primary releases of COCs at DSS SWMU 152 were to the subsurface soil resulting from the discharge of effluents from the Building 9950 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 infiltration of water is not expected. Infiltration of precipitation is essentially nonexistent at SWMU 152, as virtually all of the moisture either drains away from the site or evaporates. Because groundwater at this site is approximately 460 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 152 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 152 are limited to acetone and methylene chloride. Organic COCs may be degraded through photolysis, hydrolysis, and biotransformation. Photolysis requires light and therefore takes place in the air, at the ground surface, or in surface water. Hydrolysis includes chemical transformations in water and may occur in the soil solution. Biotransformation (i.e., transformation caused by plants, animals, and microorganisms) may occur; however, biological activity may be limited by the arid environment at this site. Because of the depth of the COCs in the soil, the loss of acetone and methylene chloride through volatilization is expected to be minimal.

Table 2.5-1 summarizes the fate and transport processes that can occur at DSS SWMU 152. The COCs at this site include both radiological and nonradiological inorganic analytes as well as organic analytes. Wind, surface water, and biota are considered to be of low significance as potential transport mechanisms at this site. Significant leaching into the subsurface soil is unlikely, and leaching into the groundwater at this site is highly unlikely. The potential for transformation of COCs is low, 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 152

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 to moderate

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 provides the site description and history for DSS SWMU 152. 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 152 has been designated with a future land-use scenario of industrial (DOE et al. September 1995) (see Annex A for default exposure pathways and parameters). However, the residential land-use scenario is also considered in the pathway analysis. Because of the location and characteristics of the potential contaminants, the primary pathway for human exposure is considered to be soil ingestion for the nonradiological COCs and direct gamma exposure for the radiological COCs. The inhalation pathway for both nonradiological and radiological COCs is included because the potential exists to inhale dust and volatiles. Soil ingestion is included for the radiological COCs as well. The dermal pathway is included for the nonradiological COCs because of the potential for the receptor to be exposed to contaminated soil. No water pathways to the groundwater are considered. Depth to groundwater at SWMU 152 is approximately 460 feet bgs. No intake routes through plant, meat, or milk ingestion are considered appropriate for either the industrial or residential land-use scenarios. Figure 2.6.3-1 shows the conceptual site model flow diagram for SWMU 152.

Pathway Identification

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

2.6.4 Step 3. Background Screening Procedure

This section discusses Step 3, the background screening procedure, which compares the maximum COC concentration to the background screening level. The methodology and results are described in the following sections.

2.6.4.1 Methodology

Maximum concentrations of nonradiological COCs are 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 that do not have either a quantifiable or calculated background screening level are considered in further risk assessment analyses.

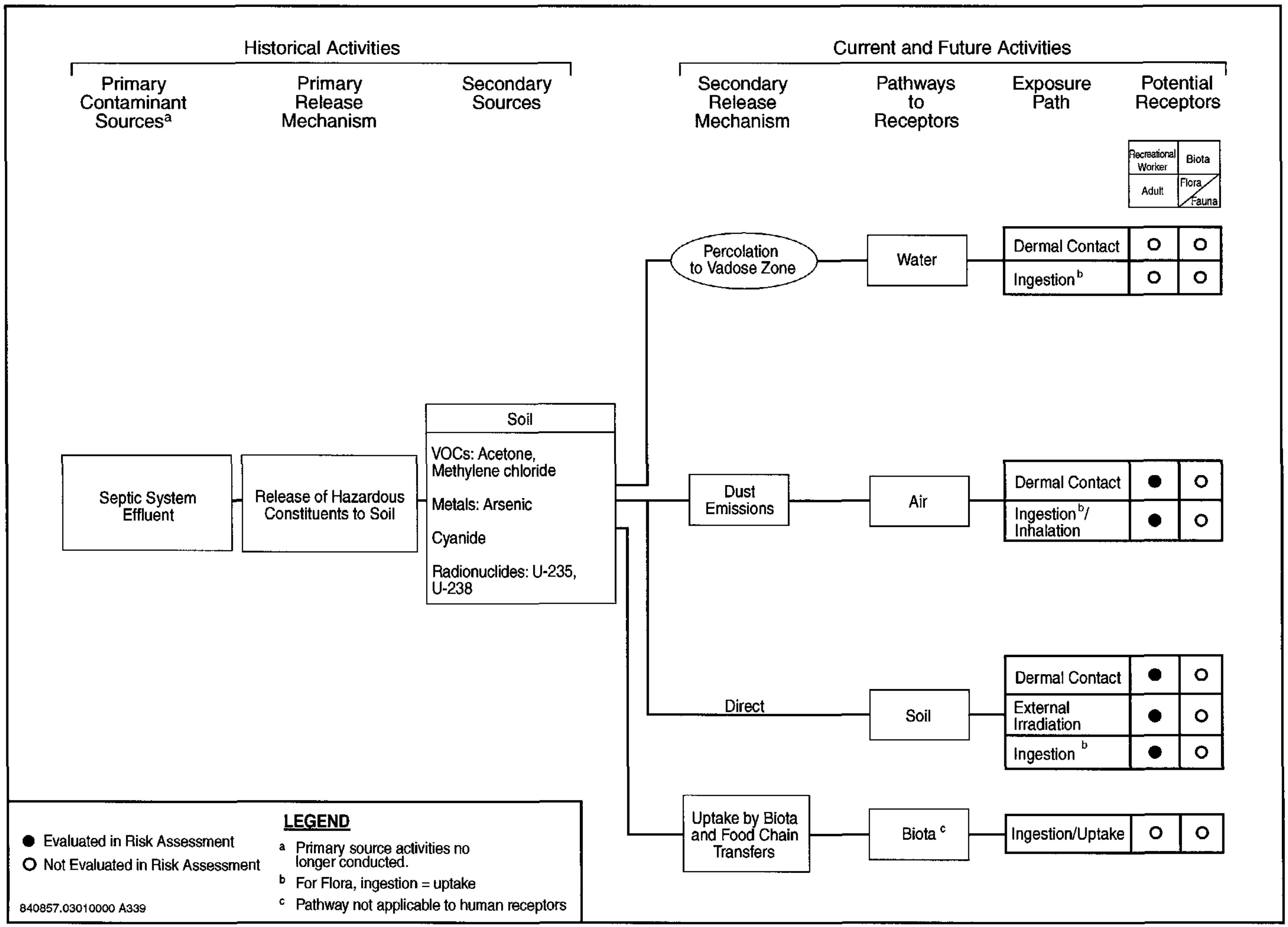

Figure 2.6.3-1

Conceptual Site Model Flow Diagram for DSS SWMU 152, Building 9950 Septic System

For radiological COCs that exceed the SNL/NM background screening levels, background values are subtracted from the individual maximum radionuclide concentrations. Those that do not exceed these background levels are not carried any further in the risk assessment. This approach is consistent with DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE 1993). Radiological COCs that do not have a background value and are 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 2.4-2 show the DSS SWMU 152 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, one constituent, arsenic, was measured at a concentration greater than the background screening value. One constituent, cyanide, does not have a quantified background screening concentration; therefore it is unknown whether this COC exceeds background. Two constituents are organic compounds that do not have corresponding background screening values.

For the radiological COCs, two constituents (uranium-235 and uranium-238) exhibited MDAs greater than their background screening levels.

2.6.5 Step 4. Identification of Toxicological Parameters

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

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

Table 2.6.5-1
Toxicological Parameter Values for DSS SWMU 152 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								
Arsenic	3E-4[c]	M	--	--	1.5E+0[c]	1.5E+1[c]	A	0.03[d]
Cyanide	2E-2[c]	M	--	--	--	--	D	0.1[d]
Organic								
Acetone	1E-1[c]	L	1E-1[e]	--	--	--	D	0.01[f]
Methylene Chloride	6E-2[c]	M	8.6E-1[g]	--	7.5E-3[c]	1.6E-3[c]	B2	0.1[d]

[a]Confidence associated with IRIS (EPA 2004a) database values. Confidence: L = low, M = medium.
[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.
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 (EPA 2004b).
[f]Toxicological parameter values from Risk Assessment Information System (ORNL 2003).
[g]Toxicological parameter values from HEAST (EPA 1997a).
ABS = Gastrointestinal absorption coefficient.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
HEAST = Health Effects Assessment Summary Tables.
IRIS = Integrated Risk Information System.
mg/kg-d = Milligram(s) per kilogram-day.
$(mg/kg\text{-}d)^{-1}$ = Per milligram per kilogram-day.
NMED = New Mexico Environment Department.
RfD_{inh} = Inhalation chronic reference dose.
RfD_o = Oral chronic reference dose.
SF_{inh} = Inhalation slope factor.
SF_o = Oral slope factor.
SWMU = Solid Waste Management Unit.
-- = Information not available.

Table 2.6.5-2
Radiological Toxicological Parameter Values for DSS SWMU 152 COCs
Obtained from RESRAD Risk Coefficients[a]

COC	SF_o (1/pCi)	SF_{inh} (1/pCi)	SF_{ev} (g/pCi-yr)	Cancer Class[b]
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 the industrial and residential land-use scenarios.

2.6.6.1 Exposure Assessment

Annex A provides the equations and parameter input values used in calculating intake values and subsequent HI and excess cancer risk values for the individual exposure pathways. The annex shows parameters for both industrial and residential land-use scenarios. The equations for nonradiological COCs are based upon the Risk Assessment Guidance for Superfund (RAGS) (EPA 1989). Parameters are based upon information from the RAGS (EPA 1989), the Technical Background Document for Development of Soil Screening Levels (NMED February 2004), as well as other EPA and NMED guidance documents, and reflect the reasonable maximum exposure (RME) approach advocated by the RAGS (EPA 1989). For the radiological COCs, the coded equation provided in RESRAD computer code is 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 0.03 for the DSS SWMU 152 nonradiological COCs and an estimated excess cancer risk of 5E-6 for the designated industrial land-use scenario. The numbers presented include exposure from soil ingestion, dermal contact, and dust and volatile inhalation for nonradiological COCs. Table 2.6.6-2 shows an HI of 0.02 and an estimated excess cancer risk of 3E-6 for the SWMU 152 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 was calculated that results in an incremental TEDE of 2.1E-2 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 152 for the industrial land-use scenario is well below this guideline. The estimated excess cancer risk is 1.9E-7.

For the nonradiological COCs under the residential land-use scenario, the HI is 0.37 with an estimated excess cancer risk of 2E-5 (Table 2.6.6-1). The numbers in the table include exposure from soil ingestion, dermal contact, and dust and volatile inhalation. Although the EPA (1991) guidelines generally recommend that inhalation not be included in a residential land-use scenario, this pathway is included because of the potential for soil in Albuquerque, New Mexico, to be eroded and for dust to be present in predominantly residential areas. Because of the nature of the local soil, other exposure pathways are not considered (see Annex A). Table 2.6.6-2 shows an HI of 0.20 and an estimated excess cancer risk of 1E-5 for the DSS SWMU 152 associated background constituents under the residential land-use scenario.

For the radiological COCs, the incremental TEDE for the residential land-use scenario is 5.3E-2 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 152 for the residential land-use scenario is well below this guideline. Consequently, SWMU 152 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 5.5E-7. 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, Summary.

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 152 Nonradiological COCs

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Arsenic	7.9	0.03	5E-6	0.37	2E-5
Cyanide	0.25[b]	0.00	--	0.00	--
Organic					
Acetone	0.0096 J	0.00	--	0.00	--
Methylene Chloride	0.004 J	0.00	3E-8	0.00	5E-8
Total		**0.03**	**5E-6**	**0.37**	**2E-5**

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

Table 2.6.6-2
Risk Assessment Values for DSS SWMU 152 Nonradiological Background Constituents

COC	Background Concentration[a] (mg/kg)	Industrial Land-Use Scenario[b]		Residential Land-Use Scenario[b]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	4.4	0.02	3E-6	0.20	1E-5
Cyanide	NC	--	--	--	--
Total		**0.02**	**3E-6**	**0.20**	**1E-5**

[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 available.

For the nonradiological COCs under the industrial land-use scenario, the HI is 0.03 (less than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). The estimated excess cancer risk is 5E-6. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. This assessment also determines risks considering background concentrations of the potential nonradiological COCs for both the industrial and residential land-use scenarios. Assuming the industrial land-use scenario, there is neither a quantifiable HI nor an excess cancer risk for nonradiological COCs. The incremental risk is determined by subtracting risk associated with background from potential COC risk. These numbers are not rounded before the difference is determined and therefore may appear to be inconsistent with numbers presented in tables and within the text. For conservatism, the background constituents that do not have quantified background screening concentrations are assumed to have a hazard quotient of 0.00. The incremental HI is 0.01 and the estimated incremental excess cancer risk is 2.23E-6 for the industrial land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs under an industrial land-use scenario.

For the radiological COCs under the industrial land-use scenario, the incremental TEDE is 2.1E-2 mrem/yr, which is significantly lower than the EPA's numerical guideline of 15 mrem/yr (EPA 1997b). The estimated incremental excess cancer risk is 1.9E-7.

The calculated HI for the nonradiological COCs under the residential land-use scenario is 0.37, which is below numerical guidance. The estimated excess cancer risk is 2E-5. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is slightly above the suggested acceptable risk value. The incremental HI is 0.16 and the estimated incremental cancer risk is 9.06E-6 for the residential land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs under the residential land-use scenario.

The incremental TEDE for a residential land-use scenario from the radiological components is 5.3E-2 mrem/yr, which is significantly lower than the numerical guideline of 75 mrem/yr suggested in the SNL/NM "RESRAD Input Parameter Assumptions and Justification" (SNL/NM February 1998). The estimated incremental excess cancer risk is 5.5E-7.

2.6.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at DSS SWMU 152 is based upon an initial conceptual model that was validated with sampling conducted at the site. The sampling was implemented in accordance with procedures and DQOs in the 1993 Work Plan (SNL/NM March 1993), the SAP for the RFI of the septic tanks and drainfields (IT March 1994), and subsequent negotiations with the NMED/HRMB. The data from soil samples collected at effluent release points are representative of potential COC releases to the site. The analytical requirements and results satisfy the DQOs, and data quality was verified/validated in accordance with SNL/NM procedures in place at the time the sampling was conducted. Therefore, there is no uncertainty associated with the data quality used to perform the risk assessment at SWMU 152.

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

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

Table 2.6.5-1 shows the uncertainties (confidence levels) in nonradiological toxicological parameter values. There is a combination of estimated values and values from the IRIS (EPA 2004a), HEAST (EPA 1997a), EPA 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 the industrial land-use scenario compared to established numerical guidance.

For the radiological COCs, the conclusion of the risk assessment is that potential effects on human health for both the industrial and residential land-use scenarios are below background and represent only a small fraction of the estimated 360 mrem/yr received by the average U.S. population (NCRP 1987).

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

2.6.9 Summary

DSS SWMU 152 contains identified COCs consisting of some inorganic, organic, 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 and volatile inhalation for chemical COCs, and soil ingestion, dust inhalation, and direct gamma exposure for radionuclides. The same exposure pathways are applied to the residential land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for the nonradiological COCs show that for the industrial land-use scenario the HI (0.03) is significantly lower than the accepted numerical guidance from the EPA. The estimated excess cancer risk is 5E-6; thus, excess cancer risk is also below the acceptable risk value provided by the NMED for an industrial land-use scenario (Bearzi January 2001). The incremental HI is 0.01 and the estimated incremental excess cancer risk is 2.23E-6 for the industrial land-use scenario. The 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 (0.37) is below the accepted numerical guidance from the EPA. The estimated excess cancer risk is 2E-5. Thus, excess cancer risk is slightly above the acceptable risk value provided by the NMED for a residential land-use scenario (Bearzi January 2001). The incremental HI is 0.16 and the estimated incremental excess cancer risk is 9.06E-6 for the residential land-use scenario. The 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 2.1E-2 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 1.9E-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 5.3E-2 mrem/yr with an associated incremental excess cancer risk of 5.5E-7. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, DSS SWMU 152 is eligible for unrestricted radiological release.

The excess cancer risk from the nonradiological and radiological COCs should be summed to provide risk estimates for persons exposed to both types of carcinogenic contaminants, as noted in OSWER Directive No. 9200.4-18 (EPA 1997b). The summation of the nonradiological and radiological carcinogenic risks is tabulated in Table 2.6.9-1.

Table 2.6.9-1
Summation of Incremental Nonradiological and Radiological Risks from
DSS SWMU 152, Building 9950 Septic System Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	2.23E-6	1.9E-7	2.4E-6
Residential	9.06E-6	5.5E-7	9.6E-6

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

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

2.7 Ecological Risk Assessment

2.7.1 Introduction

This section addresses the ecological risks associated with exposure to constituents of potential ecological concern (COPECs) in the soil at DSS SWMU 152. A component of the NMED Risk-Based Decision Tree in the "RPMP [RCRA Permits Management Program] Document Requirement Guide" (NMED March 1998) is to conduct an ecological risk assessment that corresponds with that presented in the EPA's Ecological RAGS (EPA 1997c). The current methodology is tiered and contains an initial scoping assessment followed by a more detailed risk assessment if warranted by the results of the scoping assessment. Initial components of NMED's decision tree (a discussion of DQOs, data assessment, and evaluations of bioaccumulation as well as fate and transport potential) are addressed in previous sections of this report. At the end of the scoping assessment, a determination is made as to whether a more detailed examination of potential ecological risk is necessary.

2.7.2 Scoping Assessment

The scoping assessment focuses primarily on the likelihood of exposure of biota at, or adjacent to, the site to constituents associated with site activities. Included in this section are an evaluation of existing data with respect to the existence of complete ecological exposure pathways, an evaluation of bioaccumulation potential, and a summary of fate and transport potential. A scoping risk-management decision (Section 2.7.2.4) summarizes the scoping results and assesses the need for further examination of potential ecological impacts.

2.7.2.1 Data Assessment

As indicated in Section 2.4, all COCs at DSS SWMU 152 are at depths of 5 feet bgs or greater. Therefore, no complete ecological exposure pathways exist at this site, and no COCs are considered to be COPECs.

2.7.2.2 Bioaccumulation

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

2.7.2.3 Fate and Transport Potential

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

2.7.2.4 Scoping Risk-Management Decision

Based upon information gathered through the scoping assessment, it is concluded that complete ecological pathways are not associated with COCs at DSS SWMU 152. Therefore, no COPECs exist at the site, and a more detailed risk assessment is not deemed necessary to predict the potential level of ecological risk associated with the site.

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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 152 for the following reasons:

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

3.2 Criterion

Based upon the evidence provided in Chapter 2.0, a determination of CAC without controls (NMED April 2004) is recommended for DSS SWMU 152. This is consistent with the NMED's NFA Criterion 5, which states, "the SWMU/AOC [Area of Concern] 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 1998).

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ANNEX A
DSS SWMU 152
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)

= C x (CR x EFD/BW/AT) x Toxicity Effect (1)

where;

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

For nonradiological 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 December 2000).
[b]Risk Assessment Guidance for Superfund, Vol. 1, Part B (EPA 1991).
[c]Exposure Factors Handbook (EPA August 1997).
ED = Exposure duration.
EPA = U.S. Environmental Protection Agency.
hr = Hour(s).
kg = Kilogram(s).
m = Meter(s).
mg = Milligram(s).
NA = Not available.
wk = Week(s).
yr = Year(s).

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

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure Frequency	8 hr/day for 250 day/yr	4 hr/wk for 52 wk/yr	365 day/yr
Exposure Duration (yr)	25[a,b]	30[a,b]	30[a,b]
Body Weight (kg)	70 Adult[a,b]	70 Adult[a,b]	70 Adult[a,b]
Soil Ingestion Pathway			
Ingestion Rate	100 mg/day[c]	100 mg/day[c]	100 mg/day[c]
Averaging Time (days) (= 30 yr x 365 day/yr)	10,950[d]	10,950[d]	10,950[d]
Inhalation Pathway			
Inhalation Rate (m^3/yr)	7,300[d,e]	10,950[e]	7,300[d,e]
Mass Loading for Inhalation g/m^3	1.36 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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JUSTIFICATION FOR CLASS III
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2005 SWMU 152 OPERABLE UNIT 1295
BUILDING 9950 SEPTIC SYSTEM
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