9-1-2005

Justification for Class III Permit Modification September 2005 SWMU 137 OU 1295 Building 6540/6542 Septic System at Technical Area III

Sandia National Laboratories/NM

Sandia National Laboratories

Justification for Class III Permit Modification

September 2005

SWMU 137
OU 1295
Building 6540/6542 Septic System at Technical Area III

NFA Submitted January 1997

RSI Submitted September 1999

Soil Vapor Well Sample Results Submitted November 2003

RSI 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.

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

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

Sandia National Laboratories

Environmental Restoration Project

Site History

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

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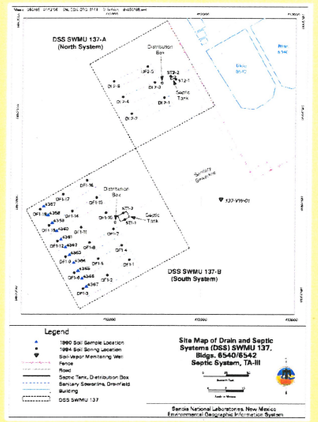
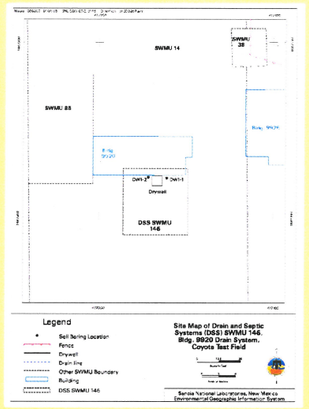
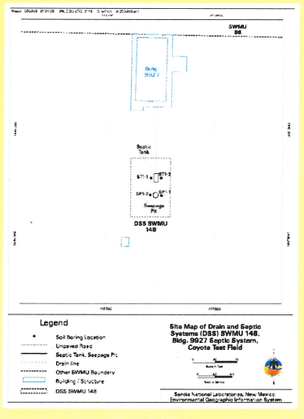
This work supported by the
United States Department of Energy
under contract DE-AC04-94185000.

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

Environmental Restoration Project



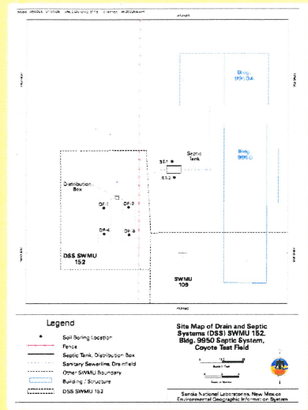


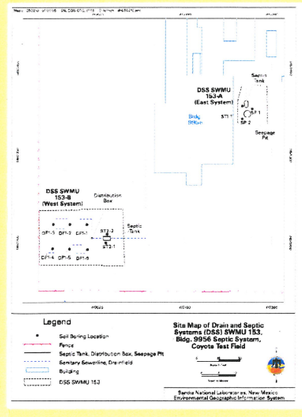


Collecting soil samples with the Geoprobe

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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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. Lasker

Michael J. Zamorski
Acting Area Manager

Enclosures

cc w/enclosures:
T. Trujillo, ERD
W. Cox, 6681, MS 1147
J. Parker, NMED-AIP
R. Kern, NMED-AIP
D. Neleigh, EPA, Region 6 (2 copies)

cc w/o enclosure:
B. Oms, KAO
S. Dinwiddie, NMED
S. Kruse, NMED
D. Fate, 6685, MS 1148
C. Lojek, 6681, MS 1147
F. Nimick, 6682, MS 1147
E. Mignardot, 6685, MS 1148
M. Davis, 7511, MS 1147

PROPOSAL FOR
NO FURTHER ACTION
Environmental Restoration Project

Site 137, Building 6540/6542 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 137, Building 6540/6542 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 137, Building 6540/6542 Septic System, Operable Unit (OU) 1295. ER Site 137 is listed in the Hazardous and Solid Waste Amendments (HSWA) Module IV (EPA August 1993) of the SNL/NM Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Facility Permit (NM5890110518-1) (EPA August 1992).

1.2 SNL/NM Administrative NFA Process

This proposal for a determination of a NFA decision based on confirmatory sampling was prepared using the process presented in Section 4.5.3 of the SNL/NM Program Implementation Plan (SNL/NM February 1995). It follows guidance proposed in Title 40, Code of Federal Regulations (CFR), Part 264.514(a) (2), which states that NFA proposals "... 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 137 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 or other relevant background limit was available, or if the COC concentration exceeded the background limit, then the concentration was compared to the proposed 40 CFR Part 264 Subpart S (Subpart S) or other relevant soil action level for the particular compound (EPA July 1990, October 1993, and July 1994). If the COC concentration exceeded both the background limit (if such a limit was available) and the relevant action level for that compound, then a risk assessment was performed. The highest concentration of the particular COC identified at the site was then compared to the derived risk assessment action level to determine if the COC concentration at the site poses a significant health risk.

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

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

- NFA Criterion 2: The site has never been used for the management (that is, generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/or constituents or other 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 137 soil sample analytical data indicate that concentrations of COCs at this site are less than (1) SNL/NM or other applicable background limits, or (2) proposed Subpart S or other action levels, or (3) derived risk assessment action levels. Thus, ER Site 137 is being proposed for a 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 137 is located on KAFB and is in the northeastern portion of SNL/NM Technical Area III (TA III). Access to the site is provided by a paved road that extends approximately 0.5 miles in a southwesterly direction from the entrance to TA-III (Figure 1-1). ER Site 137 consists of two contiguous areas that encompass two septic tank and drainfield systems located southwest of Building 6540/6542 (Figure 1-2). The northern system (designated ER Site 137-A on Figure 1-2) consisted of a 2.5-foot by 6-foot steel septic tank (SNL/NM July 1995) that has since been removed from the site, and six 4-inch diameter by 50-foot long parallel clay tile drainlines that were buried about 3 feet below the ground surface (bgs) (SNL/NM September 1994). The southern system (designated ER Site 137-B on Figure 1-2) consisted of a 7-foot wide by 11-foot long concrete septic tank (SNL/NM August 1995) and twelve 4-inch diameter by 70-feet long parallel clay tile drainlines buried about 5-feet bgs (SNL/NM September 1994). The two portions of ER Site 137 encompass a total of approximately 0.52 acres of flat-lying land at an average mean elevation of 5,403 feet above mean sea level (amsl).

The surficial geology at ER Site 137 is characterized by a veneer of aeolian sediments that are underlain by Upper Santa Fe Group alluvial fan deposits that interfinger with sediments of the ancestral Rio Grande west of the site. The alluvial fan materials originated from the Manzanita Mountains east of ER Site 137, and typically consist of moderate to high (sand + gravel)/(silt + clay) ratio, are poorly sorted, and exhibit moderately connected lenticular bedding. Individual beds range from 1 to 5 feet thick with a preferred east-west orientation, and have moderate to low hydraulic conductivities. These alluvial fan sediments extend eastward from the site to a north-south boundary line that is coincident with the Sandia fault and the southern extension of the Tijeras fault (SNL/NM March 1996). 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 4,927 feet amsl at this location (SNL/NM March 1996), so depth to groundwater beneath the site is approximately 476 feet. Local groundwater flow is believed to be in a generally westerly direction in the vicinity of this site (SNL/NM March 1996). The nearest production wells are northwest of the site and include KAFB-1, 2, 4, 7, and 14, which are approximately 3.0 to 5.0 miles away. The nearest groundwater monitoring wells to the site are the group of wells installed around the Mixed Waste Landfill in the north-central portion of TA-III. These wells are located approximately 1,300 to 1,500 feet west of ER Site 137 (SNL/NM August 1996).

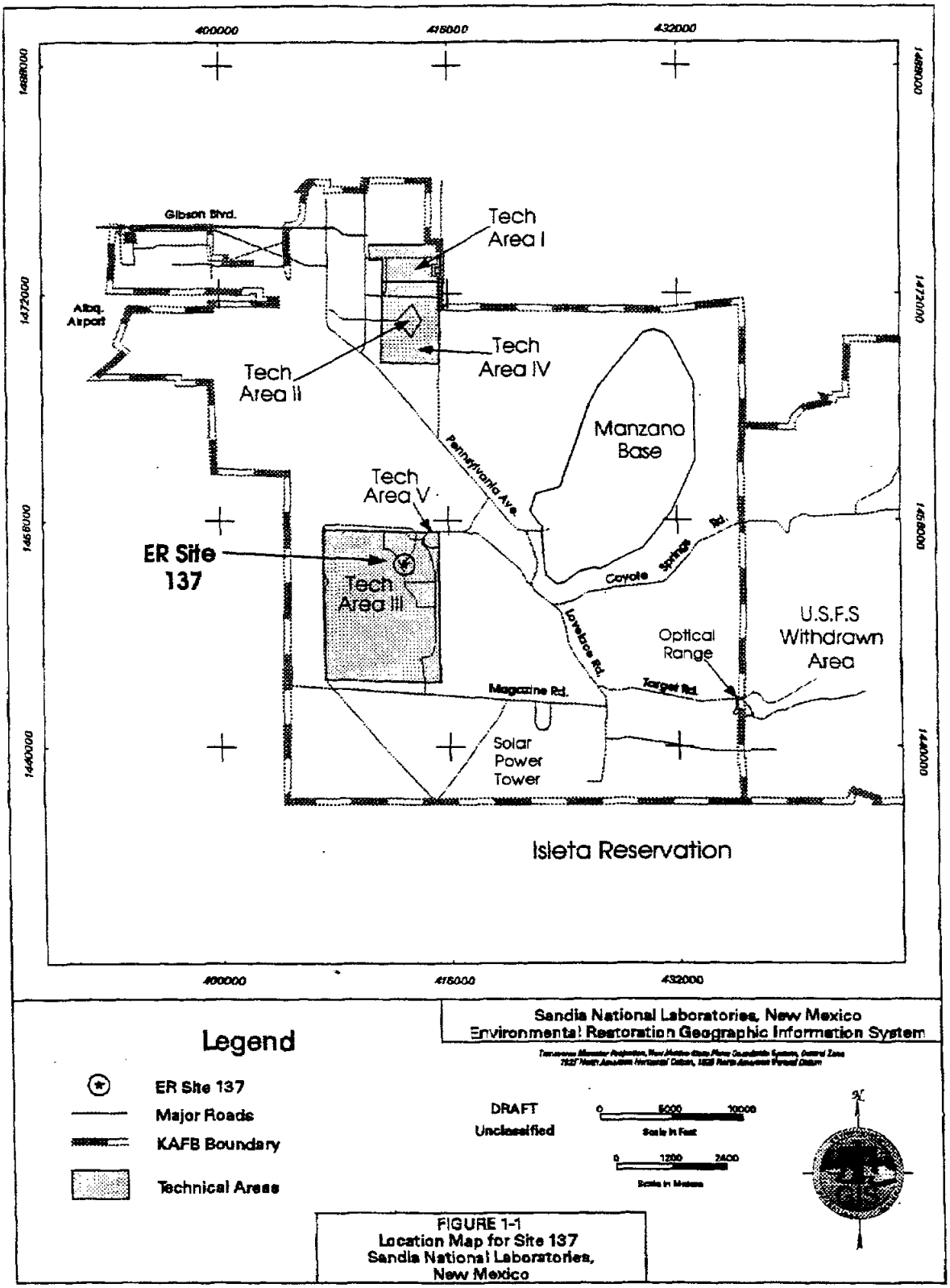
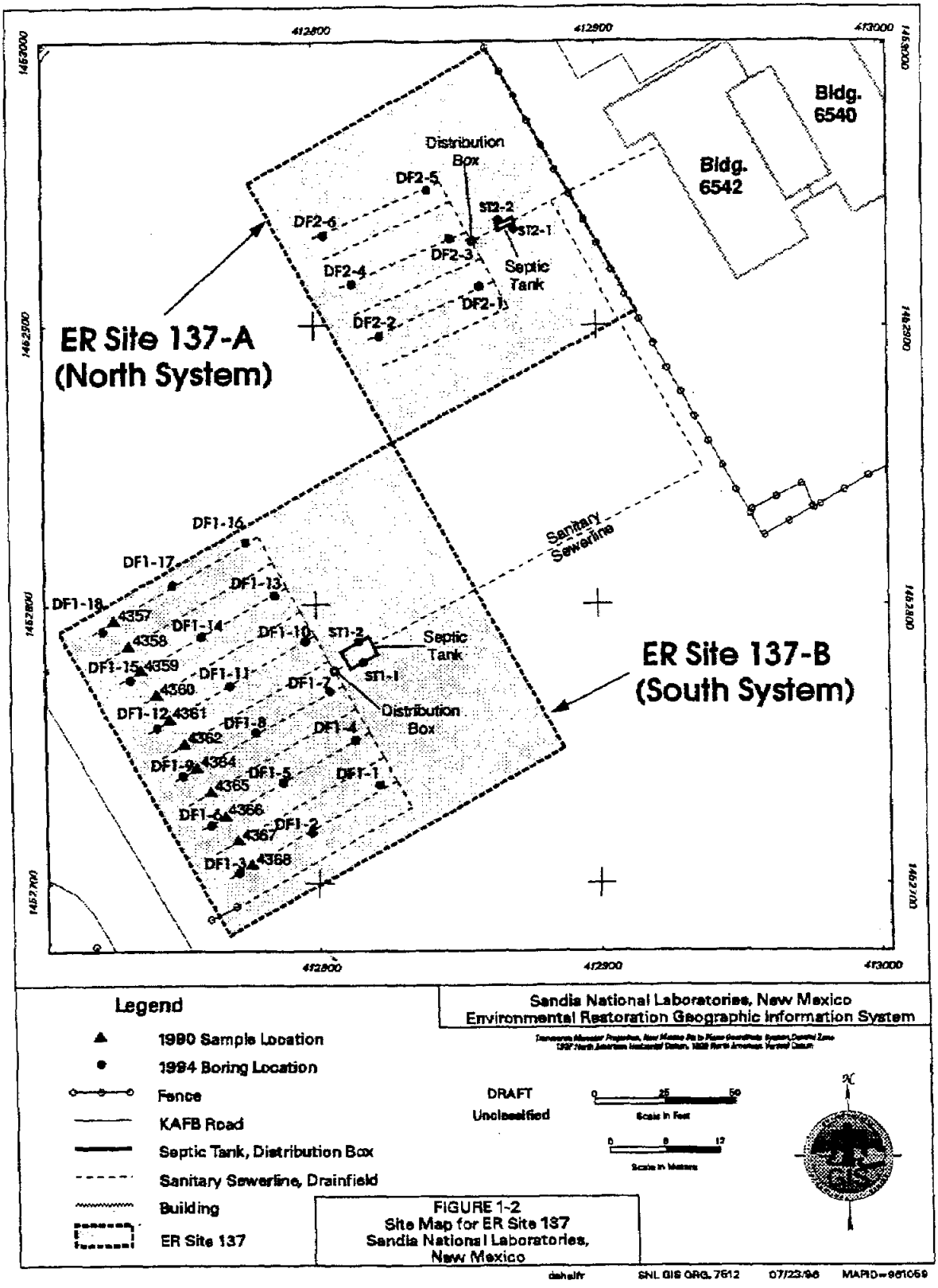


FIGURE 1-1
Location Map for Site 137
Sandia National Laboratories,
New Mexico


412800
412900
413000
1463000
1462900
1462800
1457700
Bldg. 6540
Bldg. 6542
Distribution Box
DF2-5
DF2-6
ST2-2
ST2-1
DF2-3
Septic Tank
DF2-4
DF2-1
DF2-2
ER Site 137-A (North System)
Sanitary Sewerline
DF1-16
DF1-17
DF1-13
DF1-18
4357
DF1-14
4358
DF1-10
ST1-2
Septic Tank
DF1-15
4359
DF1-11
4360
DF1-7
ST1-1
DF1-12
4361
Distribution Box
DF1-8
DF1-4
4362
DF1-9
4364
DF1-5
DF1-1
4365
DF1-6
4366
DF1-2
4367
DF1-3
4368
ER Site 137-B (South System)
Legend
1990 Sample Location
1994 Boring Location
Fence
KAFB Road
Septic Tank, Distribution Box
Sanitary Sewerline, Drainfield
Building
ER Site 137
Sandia National Laboratories, New Mexico
Environmental Restoration Geographic Information System
DRAFT
Unclassified
0 25 50
Scale in Feet
0 8 17
Scale in Meters
N
GIS
FIGURE 1-2
Site Map for ER Site 137
Sandia National Laboratories, New Mexico
dshelfr
SNL GIS ORG. 7612
07/23/96
MAP ID=961059

2.0 HISTORY OF THE SWMU

2.1 Sources of Supporting Information

In preparing the confirmatory sampling NFA proposal for ER Site 137, available background information was reviewed to quantify potential releases and to select analytes for the soil sampling.

Background information was collected from SNL/NM Facilities Engineering drawings and interviews with employees familiar with the site operational history. The following sources of information, hierarchically listed with respect to assigned validity, were used to evaluate ER Site 137:

- Confirmatory subsurface soil sampling conducted in November 1990 (IT February 1991), November and December 1994 (SNL/NM November 1994a), and October 1995 (SNL/NM October 1995a);
- Two survey reports, including a geophysical survey (Lamb 1994), and a passive soil gas survey (NERI June 1995);
- Results of samples collected from the north and south septic tanks in 1992 (SNL/NM June 1993), 1994 (SNL/NM June 1994a), and 1995 (SNL/NM October 1995a);
- SNL/NM Geographic Information System data.
- Approved RFI Work Plan for OU 1295, Septic Tanks and Drainfields (SNL/NM March 1993), and addenda (EPA September 1994, SNL/NM November 1994b and December 1994b, EPA January 1995, SNL/NM January 1995, March 1995a and March 1995b, EPA March 1995, and SNL/NM May 1995);
- Photographs and field notes collected at the site by SNL/NM ER staff;
- SNL/NM Facilities Engineering building drawings.

2.2 Previous Audits, Inspections, and Findings

ER Site 137 was first listed as a potential release site in Module IV of the SNL/NM Hazardous Waste Management Facility permit issued in August 1993 (EPA August 1993).

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 6540/6542 was constructed in 1959 to house instrumentation for the short rocket sled track, the centrifuge, and high-explosive test facilities; the north septic system was installed at this time. The building contained bathroom facilities from the time of the original construction. In the mid-1960s a darkroom was constructed to develop black and white and high-speed color photographs of various experiments. The darkroom was in use from 1966 until 1989. Approximately 5 gallons each of spent fixer and developer solutions from the darkroom were discharged to the septic system every two to three months. At one time, small quantities of trichloroethene (TCE) were used for cleaning parts; the amount of TCE used and the method of disposal are unknown. Estimated effluent discharge rates range between 60 and 800 gallons/day.

An SNL/NM Facilities Engineering drawing dated April 4, 1975 (SNL/NM April 1975) shows that only the north septic system was present at the facility in April 1975. It is therefore apparent that the south septic system was installed sometime after 1975 to replace the under-sized north system. It is assumed that the north system was abandoned when the south septic system was constructed after 1975, and that the south system was abandoned shortly after Building 6540/6542 was connected to an extension of the City of Albuquerque sanitary sewer line into TA-III that was being constructed west of the building in November 1990 (IT February 1991). An SNL/NM memo dated July 26, 1993 contains a list of TA-III septic tanks removed from service with the construction of the TA-III sanitary sewer system; the Building 6540/6542 tank is included in the list (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 6540/6542 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 6540/6542 septic tanks and drainfields when the septic systems were active. Hazardous wastes were not managed or contained at ER Site 137.

3.3 Presence or Absence of Visual Evidence

Field notes recorded during the November 1990 sampling event from the south system drainfield indicate that the six samples collected from northern portion of the drainfield were dry and exhibited no unusual odors or discoloration. The notes also indicate that the five samples collected from around the southern portion of the drainfield were moist with vegetation matter and dark material around rocks, especially the samples from locations 4367 and 4368 on Figure 1-2 (IT February 1991). No visible evidence of soil discoloration, staining, or odors indicating residual contamination was observed when soil samples were collected in the north and south system drainfields and around the septic tanks with the Geoprobe™ in November and December 1994 (SNL/NM November 1994a). Also, soil surrounding the north system septic tank was partially excavated in July 1995, and the tank was completely removed from the ground in October 1995 (SNL/NM July 1995 and October 1995a); the removal operation is shown in the top photograph of Figure 3-1. The tank was found to be constructed of steel that was very degraded and rusted through, and had apparently not been capable of containing liquid effluent for some period of time. Again, no evidence of contamination was noted in soil from around and under the tank when it was removed from the ground.

3.4 Results of Previous Sampling/Surveys

Multiple rounds of samples have been collected from the Building 6540/6542 septic tanks. The results of the individual sampling events from the north system tank will be summarized first, followed by a discussion of the south system sample analytical results.

North System Septic Tank Samples

A sludge sample was collected from the north system septic tank in August 1992 and was analyzed for selected radionuclide constituents. Low activity levels of several radionuclide constituents were detected in the material (SNL/NM June 1993). Although not specifically stated in the report, it is apparent that no liquid was present in the tank at the time of sampling because the analytical summary table for the north tank sludge sample (presented in Appendix A.1) shows that a tritium analysis was not performed because the sample was dry.

Removing the degraded steel septic tank from the Building 6540/6542 north septic system with the backhoe. October 18, 1995. View looking southeast.

Building 6540/6542 south system septic tank septage removal and cleaning operation. January 11, 1996. View looking southwest.

Figure 3-1. ER Site 137 Photographs

A second round of dry sludge/soil samples were collected for waste characterization purposes in June 1994; no liquid was present in the tank at the time of sampling (SNL/NM June 1994a). The sludge/soil samples were analyzed for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), the eight RCRA total and Toxicity Characteristic Leaching Procedure (TCLP) metals, hexavalent chromium, and cyanide (SNL/NM June 1994a). Low concentrations of 1 VOC and 12 SVOC compounds were identified in the material. All eight RCRA metals (including 371 milligrams per kilogram [mg/kg] of silver) were detected in the total metals analysis of the sludge/soil, but only two of the eight metals (barium and cadmium) were also detected in the TCLP-derived leachate from the material. Hexavalent chromium and cyanide were not detected in the material. The analytical results of the June 1994 north system septic tank samples are presented in Appendix A.2.

A third set of waste characterization samples was collected from the bottom of the north system tank in October 1995 when the tank was removed from the ground. The dry sludge consisted of a 2-inch thick layer of decomposed humus-like material mixed with dirt from around the tank (SNL/NM October 1995a). These dry sludge samples were analyzed for isotopic uranium and tritium by a commercial laboratory, and were also screened for other radionuclides by SNL/NM in-house gamma spectroscopy. Tritium was not detected, and anomalous activity levels of isotopic uranium or other radionuclides were not identified in the material relative to the radionuclide background activity levels for SNL/NM soils (IT March 1996). The results of this final round of north septic tank sludge/soil samples are also presented in Appendix A.2. Also, additional confirmatory samples of the soil from approximately 2 feet below the bottom of the septic tank were collected immediately after the tank was removed from the ground in October 1995 to determine if COCs had escaped from the degraded tank (SNL/NM October 1995a). The results of these soil samples are summarized in Section 3.6.

South System Septic Tank Samples

A sludge sample was collected from the south system septic tank in August 1992 and was analyzed for selected radionuclide constituents. No liquid sample was collected at this time. Low activity levels of several radionuclide constituents were detected in the sludge (SNL/NM June 1993). The analytical results of this 1992 south system septic tank sample are presented in Appendix A.1.

A second round of both liquid and sludge samples were collected for waste characterization purposes in June 1994 (SNL/NM June 1994a). They were analyzed for VOCs, SVOCs (sludge sample only), RCRA total and TCLP (sludge sample only) metals, hexavalent chromium, cyanide, isotopic uranium, tritium (liquid sample only), and gamma spectroscopy radionuclides. Low concentrations of several VOC and SVOC compounds were identified in the liquid and/or sludge. A number of RCRA total metals were identified in the liquid and sludge (including 372 mg/kg of silver in the sludge), but only two out of eight of these metals (barium and silver) were detected in the TCLP-derived leachate from the sludge. Hexavalent chromium and cyanide were not detected in the liquid or sludge. Very low levels of isotopic uranium and several other radionuclides detected by gamma spectroscopy were found in the material. In addition, 440 picocuries per liter (pCi/L) of tritium was detected in the liquid septage fraction, and was considered also to be representative of the highly liquid sludge fraction. The analytical results of the June 1994 south septic tank samples are also presented in Appendix A.2.

Other Sampling/Surveys

Two geophysical surveys using Geonics™ Model EM-31 and EM-38 ground conductivity meters were performed at the site in June 1994, and two areas of low conductivity (indicating possible areas of disturbed soils) were identified in the suspected areas of the two ER Site 137 drainfields (Lamb 1994). Geophysical techniques were not used to precisely determine the drainfield locations; actual locations of the two drainfields (Figure 1-2) were later determined using a backhoe (SNL/NM September 1994).

A passive soil-gas survey conducted in the two drainfield areas in May and June 1994 used PETREX™ sampling tubes to identify any releases of VOCs and SVOCs from the drainfield that may have occurred (SNL/NM May 1994). A PETREX™ tube soil-gas survey is a semi-quantitative screening procedure that can be used to identify many VOCs and SVOCs, and 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, ethylbenzene/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).

Fourteen PETREX™ tube samplers (numbers 224 through 237) were placed in a grid pattern that covered the north drainfield area, and 22 samplers (numbers 238 through 259) were placed in a grid pattern that covered the south drainfield area at this site (SNL/NM May 1994). A map showing the ER Site 137 PETREX™ tube sampling locations and the analytical results of the ER Site 137 passive soil gas survey are included in Appendix A.3. Significant concentrations of PCE or TCE were not detected in soil gas at any of the 36 PETREX™ sampling locations at this site. BTEX and/or aliphatic compounds at potentially detectable concentrations were identified at only 1 (location number 231) of the 14 north drainfield locations. However, except for trace levels of laboratory-introduced contaminants, VOCs and SVOCs were not detected in shallow or deep interval soil samples collected from the two nearest boreholes, which were within 18 and 25 feet of location 231, or in any of the other north drainfield soil samples. The BTEX compounds identified in soil gas at location 231 could have originated from vehicles driven over or parked on the site.

Potentially detectable BTEX and/or aliphatic compounds were also identified at only 1 (location number 255) of the 22 south drainfield sampling locations. Again, except for laboratory-introduced contaminants, VOCs and SVOCs were not detected in shallow or deep interval soil samples collected from a borehole within about 7 feet of this PETREX™ location, or in any of the other south drainfield soil samples collected at this site.

3.5 Assessment of Gaps in Information

The most recent material in the septic tanks was not necessarily representative of all discharges to the units that have occurred since they were put into service starting in 1959. The analytical results of the various rounds of septic tank sampling were used, along with process knowledge and other available information, to help identify the most likely COCs that might be found in soils surrounding the septic tanks and beneath the drainfields, and to help select the types of analyses to be performed on soil samples collected from the site. While the history of past releases at the site is incomplete, analytical data from soil samples collected in November 1990, November/December 1994, and October 1995 (discussed below) are sufficient to determine whether releases of COCs occurred at the site.

3.6 Confirmatory Sampling

Soil sampling at ER Site 137 was conducted in 1990, 1994, and 1995 to determine whether COCs above background or action levels were released at this site. The confirmatory soil sampling program was performed in accordance with the rationale and procedures described in the approved Septic Tanks and Drainfields (ADS-1295) RFI Work Plan (SNL/NM March 1993) and ER Site 137-pertinent addenda to the Work Plan (referenced in bullet item #4 in Section 2.1 above) developed during the OU 1295 project approval process (EPA September 1994, SNL/NM November 1994b and December 1994b, EPA January 1995, SNL/NM January 1995, March 1995a and March 1995b, EPA March 1995, and SNL/NM May 1995). A summary of the types of samples, number of sample locations, sample depths, and analytical requirements for the confirmatory soil samples collected at this site is presented in Table 3-1.

In November 1990, construction activities for the City of Albuquerque sanitary sewer extension into TA-III were taking place west of Building 6540/6542. These activities included digging a trench for the new sewer line that intercepted the western end of the ER Site 137 south system drainfield, cutting through and exposing the western ends of the 12 drainlines in this drainfield.

While the trench was open, soil samples were collected from immediately around and beneath 11 of the 12 exposed drainlines (IT February 1991). The 11 sampling locations are shown and designated by triangular symbols on Figure 1-2. Soil sample numbers 4357 through 4362 were collected from next to the six northern drainlines, and samples 4364 through 4368 were collected from next to five of the six southern lines. An aliquot of soil from each of the six discrete samples 4357 through 4362 from the northern part of the drainfield were then composited into one sample (composite #1), and aliquots of soil from each of the five discrete samples 4364 through 4368 from the southern portion of the drainfield were composited into a second composite sample (composite #2). These two composite samples were analyzed for SVOC compounds and the eight RCRA total metals.

No SVOC compounds or anomalous concentrations of any of the eight metals were identified in composite sample #1 from the northern part of the drainfield. Composite soil sample #2 from the southern part of the drainfield contained only one SVOC compound (diethyl phthalate at

Table 3-1
ER Site 137: Confirmatory Soil Sampling Summary Table

Sampling Location	Analytical Parameters	Number of Sample or Borehole Locations	Top of Sampling Intervals at Each Boring Location	Total Number of Investigative Samples	Total Number of Duplicate Samples	Date(s) Samples Collected
1994 North System	VOCs	6	5', 15'	12	1	12/8,12/94
Drainfield Soil	SVOCs	6	5', 15'	12	1	"
Samples	RCRA metals + Cr^{6+}	6	5', 15'	12	1	"
	Cyanide	6	5', 15'	12	1	"
	Isotopic uranium comp.	6	5', 15'	2		"
	Tritium composite	6	5', 15'	2		"
	Gamma spec. composite	6	5', 15'	2		"
1994 North System	VOCs	2	9'	2		12/12/94
Septic Tank Soil	SVOCs	2	9'	2		"
Samples	RCRA metals + Cr^{6+}	2	9'	2		"
	Cyanide	2	9'	2		"
1995 Soil Samples	VOCs	1	11'	1		10/18/95
Beneath the North	SVOCs	1	11'	1		"
System Septic Tank	RCRA metals + Cr^{6+}	1	11'	1		"
	Isotopic uranium	1	11'	1		"
	Tritium	1	11'	1		"
	Gamma spectroscopy	1	11'	1		"
1990 South System	SVOCs composite	11	7'	2		11/5/90
Drainfield Soil	RCRA metals composite	11	7'	2		"
Samples	Silver only	5	7'	5		"
1994 South System	VOCs	18	7', 17'	36	4	12/5-8/94
Drainfield Soil	SVOCs	18	7', 17'	36	4	"
Samples	RCRA metals + Cr^{6+}	18	7', 17'	36	4	"
	Cyanide	18	7', 17'	36	4	"
	Isotopic uranium comp.	18	7', 17'	2		"
	Tritium composite	18	7', 17'	2		"
	Gamma spec. composite	18	7', 17'	2		"
1994 South System	VOCs	2	11'	2		11/30/94 &
Septic Tank Soil	SVOCs	2	11'	2		12/5/94
Samples	RCRA metals + Cr^{6+}	2	11'	2		"
	Cyanide	2	11'	2		"

Notes
Comp. = Composite
Cr^{6+} = Hexavalent chromium
RCRA = Resource Conservation and Recovery Act
Spec. = Spectroscopy
SVOCs = Semivolatile organic compounds
VOCs = Volatile organic compounds

0.5 mg/kg, which is a common laboratory-introduced contaminant), and also contained 191 mg/kg of silver (IT February 1991). As a result of the relatively high silver concentration in composite sample #2, the five individual samples from which the composite was taken were each analyzed for silver; these analyses are discussed in Section 3.7. A report that describes and summarizes results of this sampling event was included as Attachment H in SNL/NM November 1994b.

A backhoe was used in September 1994 to determine the precise location, dimensions, and drainline depths of the two ER Site 137 drainfields, which had no surface expression (SNL/NM September 1994). Once the drainfields were located, soil samples were collected in November and December 1994 from boreholes in each of the two drainfields, and from either side of the two septic tanks at this site (SNL/NM November 1994a).

As shown on Figure 1-2, soil samples were collected from one boring on either side of and within 1 foot of the outside of each of the two septic tanks to determine if COCs had been released from a leaking or failed unit. Samples were also collected from six borings located next to and near the ends of alternating north system drainfield lateral lines, and from 18 locations near each end and at the midpoint of alternating south drainfield system drainlines (Figure 1-2). As shown in Table 3-1 above, the septic tank boring samples were collected from one interval in each borehole starting at the outside bottom of the tank, which was 9 feet bgs for the north system tank, and 11 feet bgs for the south system tank. For drainfield borings, samples were collected from two intervals in each borehole. The top of the north system shallow interval started at the bottom of the drain line trenches (average of 5 feet bgs), and the lower (deep) interval started at 10 feet below the top of the upper interval, or 15 feet bgs. For the south system drainfield, the shallow interval started at the bottom of the drainline trenches at 7 feet bgs, and the deep sampling interval started at 10 feet below the upper interval, or 17 feet bgs.

The Geoprobe™ sampling system was used to collect subsurface soil samples at this site. The Geoprobe™ sampling tool was fitted with a butyl acetate (BA) sampling sleeve and was then hydraulically driven to the top of the designated sampling depth. The sampling tool was opened and driven an additional 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, one or two more 2-foot sampling runs were then completed at each interval in order to recover enough soil to satisfy sample volume requirements for other analyses from 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.

Soil samples collected next to the septic tanks and in the drainfields were analyzed for VOCs, SVOCs, cyanide, RCRA metals, hexavalent chromium, and cyanide by an off-site commercial laboratory. Also, to determine if radionuclides were released from past activities at this site, composite samples were collected from shallow and deep sampling intervals in both the north and south system drainfields. These samples were analyzed by an off-site commercial laboratory for isotopic uranium and tritium, and were also screened for other radionuclides using SNL/NM in-house gamma spectroscopy. Samples were shipped to the off-site commercial laboratories by an overnight delivery service. 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 the late 1994 sampling effort included one set of duplicate soil samples from the shallow sampling interval at the north system drainfield borehole DF2-1 (Figure 1-2) and four sets of duplicate samples from the south system drainfield. South system drainfield duplicate samples were collected from the shallow sampling intervals in boreholes DF1-4, 13, and 14, and from the deep interval in borehole DF1-13 (Figure 1-2). Concentrations of organic and inorganic constituents detected in the duplicate soil samples were for the most part in good agreement with those detected in the equivalent field samples from the same intervals. Two soil trip blank samples were included with shipments of ER Site 137 VOC soil samples to the off-site laboratory and were analyzed for VOCs only. As shown in Table 3-2, acetone, methyl ethyl ketone (MEK), methylene chloride, and toluene were detected in the trip blanks. These common laboratory contaminants were either not detected, or were for the most part found in lower concentrations in the site samples compared to the trip blanks. Soil used for the trip blanks was prepared by heating the material, and then transferring it immediately to the sample container. This heating process drives off any residual organic compounds (if present) and soil moisture that may be contained in the material. It is thought that when the soil trip blank container was opened at the laboratory, it immediately adsorbed both moisture and VOCs present in the laboratory atmosphere and therefore became contaminated.

A final set of ER Site 137 soil samples was collected from directly beneath the north system septic tank when it was removed from the ground on October 18, 1995 (SNL/NM October 1995a). These samples were collected to determine if significant concentrations of COCs had leaked from the degraded tank into surrounding soils. They were analyzed for VOCs, SVOCs, RCRA metals, hexavalent chromium, isotopic uranium, and tritium, and were also screened for other radionuclides using SNL/NM in-house gamma spectroscopy.

Summaries of constituents analyzed for and detected by commercial laboratory analyses in the 1990, 1994, and 1995 confirmatory soil and associated QA samples are presented in Tables 3-2, 3-3, and 3-4. Results of the SNL/NM in-house gamma spectroscopy soil sample screenings for other radionuclides are presented in Appendices A.4 through A.8. Complete soil and septic tank septage sample analytical data packages for samples collected in 1994 and 1995 are archived in the SNL/NM Environmental Operations Records Center and are readily available for review and verification (SNL/NM June 1994b, December 1994a, and October 1995b).

Table 3-2

ER Site 137
Summary of Organic and Other Constituents in Confirmatory Soil Samples
Collected Around and Beneath the Two Septic Tanks, and in the Two Drainfields

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Fig. 1-2)	Top of Sample Interval (fbgs)	VOCs Method 8240					SVOCs Method 8270				Cyanide	Units
						Acetone	MEK	MIBK	Meth. Chloride	Toluene	Diethyl phthalate	BEHP	2-4 Dichloro-phenol	Di-n-butyl phthalate	Method 9010/9012	
December 1994 North Drainfield Soil and QA Samples:																
018816-1,2	Soil	Field	12/12/94	DF2-1	5	10	ND	ND	3 J	ND	ND	ND	ND	ND	ND	ug/kg
018818-1,2	Soil	Dupl.	12/12/94	DFD2-1	5	12	ND	ND	3.2 J	ND	ND	ND	ND	ND	ND	ug/kg
018817-1,2	Soil	Field	12/12/94	DF2-1	15	16	ND	ND	3.4 J	ND	ND	ND	ND	ND	ND	ug/kg
018806-1,2	Soil	Field	12/8/94	DF2-2	5	15 B	ND	ND	6.3 B	ND	ND	ND	ND	ND	ND	ug/kg
018807-1,2	Soil	Field	12/8/94	DF2-2	15	7.9 B,J	ND	ND	3.5 B,J	2 B,J	ND	ND	ND	ND	ND	ug/kg
018814-1,2	Soil	Field	12/8/94	DF2-3	5	3.8 B,J	ND	ND	6.6 B	ND	ND	ND	ND	ND	ND	ug/kg
018815-1,2	Soil	Field	12/8/94	DF2-3	15	4.6 B,J	ND	ND	6.4 B	ND	ND	ND	ND	ND	ND	ug/kg
018808-1,2	Soil	Field	12/8/94	DF2-4	5	5 B,J	ND	ND	6.2 B	ND	ND	ND	ND	ND	ND	ug/kg
018809-1,2	Soil	Field	12/8/94	DF2-4	15	12 B	ND	ND	6.8 B	ND	ND	ND	ND	ND	ND	ug/kg
018812-1,2	Soil	Field	12/8/94	DF2-5	5	8.5 B,J	ND	ND	6.4 B	ND	ND	ND	ND	ND	ND	ug/kg
018813-1,2	Soil	Field	12/8/94	DF2-5	15	4.5 B,J	ND	ND	6.1 B	ND	ND	ND	ND	ND	ND	ug/kg
018810-1,2	Soil	Field	12/8/94	DF2-6	5	2.8 B,J	ND	ND	6.9 B	ND	ND	ND	ND	ND	ND	ug/kg
018811-1,2	Soil	Field	12/8/94	DF2-6	15	6.1 B,J	ND	ND	6.7 B	ND	ND	ND	ND	ND	ND	ug/kg
021288-1	Soil	TB	12/8/94	Site 137	NA	49 B	21	ND	13 B	2 J	NT	NT	NT	NT	NT	ug/kg
December 1994 North Septic Tank Soil Samples:																
018819-1,2	Soil	Field	12/12/94	ST2-1	9	2.3 J	ND	ND	2.9 J	ND	ND	ND	ND	ND	ND	ug/kg
018820-1,2	Soil	Field	12/12/94	ST2-2	9	15	ND	ND	3 J	ND	ND	ND	ND	ND	ND	ug/kg
October 1995 Soil Samples From Beneath the North Septic Tank:																
026085-1	Soil	Field	10/18/95	Below ST2	11	ND	ND	ND	ND	ND	NT	NT	NT	NT	NT	ug/kg
026085-2	Soil	Field	10/18/95	Below ST2	11	NT	NT	NT	NT	NT	ND	ND	ND	ND	NT	ug/kg
026085-6	Soil	TB	10/18/95	Site 137	NA	7.3 J	ND	ND	1.1 J	ND	NT	NT	NT	NT	NT	ug/kg

Table 3-2, continued:

ER Site 137
Summary of Organic and Other Constituents in Confirmatory Soil Samples
Collected Around and Beneath the Two Septic Tanks, and in the Two Drainfields

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Fig. 1-2)	Top of Sample Interval (fbgs)	VOCs Method 8240					SVOCs Method 8270				Cyanide	Units
						Acetone	MEK	MIBK	Meth. Chloride	Toluene	Diethyl phthalate	BEHP	2-4 Dichloro-phenol	Di-n-butyl phthalate	Method 9010/9012	
November 1990 South Drainfield Soil Samples:																
4357-4362	Soil	Compos.	11/5/90	4357-4362	7	NT	NT	NT	NT	NT	ND	ND	ND	ND	NT	ug/kg
4364-4368	Soil	Compos.	11/5/90	4364-4368	7	NT	NT	NT	NT	NT	500	ND	ND	ND	NT	ug/kg
December 1994 South Drainfield Soil and QA Samples:																
018765-1,2	Soil	Field	12/5/94	DF1-1	7	18 B	ND	3.3 J	5.5 B	ND	ND	ND	ND	ND	ND	ug/kg
018766-1,2	Soil	Field	12/5/94	DF1-1	17	15 B	ND	ND	6.9 B	ND	ND	ND	ND	ND	ND	ug/kg
018767-1,2	Soil	Field	12/5/94	DF1-2	7	ND	ND	ND	5.6 B	ND	ND	ND	ND	ND	ND	ug/kg
018768-1,2	Soil	Field	12/5/94	DF1-2	17	ND	ND	ND	6.7 B	ND	ND	ND	ND	ND	ND	ug/kg
018769-1,2	Soil	Field	12/5/94	DF1-3	7	9.7 B,J	ND	ND	6 B	ND	ND	ND	ND	ND	ND	ug/kg
018770-1,2	Soil	Field	12/5/94	DF1-3	17	ND	ND	ND	5.3 B	ND	ND	ND	ND	770	ND	ug/kg
018775-1,2	Soil	Field	12/5/94	DF1-4	7	ND	ND	ND	6.3 B	ND	ND	ND	ND	35 J	ND	ug/kg
018776-1,2	Soil	Dupl.	12/5/94	DFD1-4	7	11 B	ND	ND	6.2 B	ND	ND	ND	ND	63 J	ND	ug/kg
018777-1,2	Soil	Field	12/5/94	DF1-4	17	8.9 J	ND	ND	4.7 B,J	1.3 J	ND	ND	ND	ND	ND	ug/kg
018773-1,2	Soil	Field	12/5/94	DF1-5	7	ND	ND	4.8 J	7.3 B	ND	ND	ND	ND	ND	ND	ug/kg
018774-1,2	Soil	Field	12/5/94	DF1-5	17	ND	ND	ND	5.6 B	ND	ND	ND	330	160 J	ND	ug/kg
018771-1,2	Soil	Field	12/5/94	DF1-6	7	ND	ND	ND	6.8 B	ND	ND	ND	ND	ND	ND	ug/kg
018772-1,2	Soil	Field	12/5/94	DF1-6	17	14 B	ND	2 J	6.7 B	ND	ND	56 J	ND	ND	ND	ug/kg
018782-1,2	Soil	Field	12/6/94	DF1-7	7	23 B	ND	ND	5.3 B	ND	ND	ND	ND	ND	ND	ug/kg
018783-1,2	Soil	Field	12/6/94	DF1-7	17	23 B	ND	ND	5.4 B	ND	ND	ND	ND	ND	ND	ug/kg
018780-1,2	Soil	Field	12/6/94	DF1-8	7	15 B	ND	ND	5.1 B	ND	ND	ND	ND	ND	ND	ug/kg
018781-1,2	Soil	Field	12/6/94	DF1-8	17	16 B	ND	ND	4.8 B,J	ND	ND	ND	ND	ND	920	ug/kg
018778-1,2	Soil	Field	12/6/94	DF1-9	7	5.3 B,J	ND	ND	5.4 B	ND	ND	ND	ND	250 B,J	ND	ug/kg
018779-1,2	Soil	Field	12/6/94	DF1-9	17	23 B	ND	ND	5.4 B	ND	ND	ND	ND	ND	ND	ug/kg
018784-1,2	Soil	Field	12/6/94	DF1-10	7	22 B	ND	ND	5.1 B	ND	ND	ND	ND	ND	ND	ug/kg
018785-1,2	Soil	Field	12/6/94	DF1-10	17	15 B	ND	ND	5.2 B	ND	ND	ND	ND	ND	ND	ug/kg

Table 3-2, continued:

ER Site 137
Summary of Organic and Other Constituents in Confirmatory Soil Samples
Collected Around and Beneath the Two Septic Tanks, and in the Two Drainfields

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Fig. 1-2)	Top of Sample Interval (fbgs)	VOCs Method 8240					SVOCs Method 8270				Cyanide Method 9010/9012	Units
						Acetone	MEK	MIBK	Meth. Chloride	Toluene	Diethyl phthalate	BEHP	2-4 Dichloro-phenol	Di-n-butyl phthalate		
December 1994 South Drainfield Soil and QA Samples, continued:																
018786-1,2	Soil	Field	12/6/94	DF1-11	7	22 B	ND	ND	5.2 B	ND	ND	ND	ND	ND	ND	ug/kg
018787-1,2	Soil	Field	12/6/94	DF1-11	17	13 B	ND	ND	5 B	ND	ND	ND	ND	ND	ND	ug/kg
018788-1,2	Soil	Field	12/6/94	DF1-12	7	15 B	ND	ND	5.5 B	ND	ND	ND	ND	ND	ND	ug/kg
018789-1,2	Soil	Field	12/6/94	DF1-12	17	8.8 B,J	ND	ND	5.4 B	ND	ND	ND	ND	ND	ND	ug/kg
018790-1	Soil	TB	12/6/94	Site 137	NA	66	62	ND	16 B	1.6 J	NT	NT	NT	NT	NT	ug/kg
018791-1,2	Soil	Field	12/7/94	DF1-13	7	8.8 B,J	ND	ND	4.9 B,J	ND	ND	ND	ND	ND	ND	ug/kg
018793-1,2	Soil	Dupl.	12/7/94	DFD1-13	7	13 B	ND	ND	3.9 B,J	ND	ND	ND	ND	ND	ND	ug/kg
018792-1,2	Soil	Field	12/7/94	DF1-13	17	18 B	ND	ND	4.6 B,J	ND	ND	ND	ND	ND	ND	ug/kg
018794-1,2	Soil	Dupl.	12/7/94	DFD1-13	17	21 B	ND	ND	4 B,J	ND	ND	ND	ND	ND	ND	ug/kg
018795-1,2	Soil	Field	12/7/94	DF1-14	7	6 B,J	ND	ND	3.7 B,J	ND	ND	ND	ND	ND	ND	ug/kg
018796-1,2	Soil	Dupl.	12/7/94	DFD1-14	7	11 B	ND	ND	3.7 B,J	ND	ND	ND	ND	ND	ND	ug/kg
018797-1,2	Soil	Field	12/7/94	DF1-14	17	9.3 B,J	ND	ND	4.2 B,J	ND	ND	ND	ND	ND	ND	ug/kg
018798-1,2	Soil	Field	12/7/94	DF1-15	7	4.5 B,J	ND	ND	4.1 B,J	ND	ND	ND	ND	ND	ND	ug/kg
018799-1,2	Soil	Field	12/7/94	DF1-15	17	5.2 B,J	ND	ND	3.9 B,J	ND	ND	ND	ND	ND	ND	ug/kg
018804-1,2	Soil	Field	12/8/94	DF1-16	7	3 B,J	ND	ND	4.8 B,J	ND	ND	ND	ND	ND	ND	ug/kg
018805-1,2	Soil	Field	12/8/94	DF1-16	17	3.1 B,J	ND	ND	5.5 B	ND	ND	35 J	ND	ND	ND	ug/kg
018802-1,2	Soil	Field	12/7/94	DF1-17	7	13 B	ND	ND	3.6 B,J	2.3 J	ND	ND	ND	120 J	ND	ug/kg
018803-1,2	Soil	Field	12/7/94	DF1-17	17	3.8 B,J	ND	ND	3.9 B,J	ND	ND	ND	ND	ND	ND	ug/kg
018800-1,2	Soil	Field	12/7/94	DF1-18	7	6.8 B,J	ND	ND	4.2 B,J	1.3 J	ND	ND	ND	ND	ND	ug/kg
018801-1,2	Soil	Field	12/7/94	DF1-18	17	7.6 B,J	ND	ND	4.1 B,J	ND	ND	ND	ND	ND	ND	ug/kg
November, December 1994 South Septic Tank Soil Samples:																
018763-1,2	Soil	Field	11/30/94	ST1-1	11	19 B	ND	ND	ND	ND	ND	ND	ND	ND	ND	ug/kg
018764-1,2	Soil	Field	12/5/94	ST1-2	11	9.6 B,J	ND	ND	7.1 B	2.4 J	ND	ND	ND	ND	ND	ug/kg
Laboratory Reporting Limit For 1994 Soil Samples						10	10	10	5	5	330	330	330	330	500-1,000	ug/kg
Laboratory Reporting Limit For 1995 Soil Samples						10 or 11	10 or 11	10 or 11	5 or 5.4	5 or 5.4	730	730	730	730	NT	ug/kg
Proposed Subpart S Action Level For Soil						8E+06	5E+07	4E+06	9E+04	2E+07	6E+07	5E+04	2E+05	8E+06	2E+06	ug/kg

Table 3-2, concluded:

ER Site 137
Summary of Organic and Other Constituents in Confirmatory Soil Samples
Collected Around and Beneath the Two Septic Tanks, and in the Two Drainfields

Notes:
B = Compound detected in associated blank sample
BEHP = Bis(2-Ethylhexyl)phthalate
Dupl. = Duplicate soil sample
fbgs = feet below ground surface
J = Result is detected below the reporting limit or is an estimated concentration.
MEK = Methyl ethyl ketone
Meth. chloride = Methylene chloride
MIBK = 4-Methyl-2-pentanone
NA = Not applicable
ND = Not detected
NT = Not tested (sample either not collected, or not tested for a particular analyte or group of analytes)
QA = Quality assurance
SVOCs = Semivolatile organic compounds
TB = Trip blank
ug/kg = Micrograms per kilogram
VOCs = Volatile organic compounds

Table 3-3

ER Site 137
Summary of RCRA Metals and Hexavalent Chromium in Confirmatory Soil Samples
Collected Around and Beneath the Two Septic Tanks, and in the Two Drainfields

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Fig. 1-2)	Top of Sample Interval (fbgs)	RCRA Metals, Methods 6010 and 7471								Other Metals: Cr^{6+} Method 7196	Units
						As	Ba	Cd	Cr, total	Pb	Hg	Se	Ag		
1994 North Drainfield Soil Samples:															
018816-2	Soil	Field	12/12/94	DF2-1	5	3.8	119	ND	10.6	6.1	ND	ND	4.2	ND G	mg/kg
018818-2	Soil	Dupl.	12/12/94	DFD2-1	5	2.9	137	ND	9.5	5.5	ND	ND	18	ND G	mg/kg
018817-2	Soil	Field	12/12/94	DF2-1	15	2.7	100	ND	10.1	5.6	ND	ND	5.4	ND G	mg/kg
018806-2	Soil	Field	12/8/94	DF2-2	5	4.1	82.9	ND	8.9	5.1	ND	ND	0.8 J	ND	mg/kg
018807-2	Soil	Field	12/8/94	DF2-2	15	3	133	ND	8.3	6	ND	ND	ND	ND	mg/kg
018814-2	Soil	Field	12/8/94	DF2-3	5	3.9	153	ND	7.3	5.3	ND	ND	3.2	ND	mg/kg
018815-2	Soil	Field	12/8/94	DF2-3	15	6.2	94.6	ND	8.7	6.2	ND	ND	5.8	ND	mg/kg
018808-2	Soil	Field	12/8/94	DF2-4	5	3.5	172	ND	6.9	4.1 J	ND	ND	34.9	ND	mg/kg
018809-2	Soil	Field	12/8/94	DF2-4	15	3.9	129	ND	10.7	6.6	ND	ND	0.41 J	ND	mg/kg
018812-2	Soil	Field	12/8/94	DF2-5	5	3.3	58.9	ND	7.5	5	ND	ND	12.5	ND	mg/kg
018813-2	Soil	Field	12/8/94	DF2-5	15	2.9	113	ND	8.8	4.8 J	ND	ND	39.5	ND	mg/kg
018810-2	Soil	Field	12/8/94	DF2-6	5	3.3	74.9	ND	8.2	6.1	ND	ND	0.9 J	ND	mg/kg
018811-2	Soil	Field	12/8/94	DF2-6	15	3.3	98.8	ND	8.7	5.7	ND	ND	ND	ND	mg/kg
1994 North Septic Tank Soil Samples:															
018819-2	Soil	Field	12/12/94	ST2-1	9	2.4	136	ND	10.2	5.6	ND	ND	ND	ND	mg/kg
018820-2	Soil	Field	12/12/94	ST2-2	9	2.6	126	ND	8	3.7 J	ND	ND	ND	ND G	mg/kg
1995 Soil Sample Beneath the North Septic Tank:															
026085-2	Soil	Field	10/18/95	Below ST2	11	2.4	120	ND	7.7	4.2	ND	0.86 J	2.4	ND	mg/kg

Table 3-3, continued:

ER Site 137

Summary of RCRA Metals and Hexavalent Chromium in Confirmatory Soil Samples

Collected Around and Beneath the Two Septic Tanks, and in the Two Drainfields

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Fig. 1-2)	Top of Sample Interval (fbgs)	RCRA Metals, Methods 6010 and 7471								Other Metals: Cr^{6+} Method 7196	Units
						As	Ba	Cd	Cr, total	Pb	Hg	Se	Ag		
November 1990 South Drainfield Soil Samples:															
4357-4362	Soil	Compos.	11/5/90	4357-4362	7	0.6	130	ND	4.5	3.6	ND	ND	0.73	NT	mg/kg
4364-4368	Soil	Compos.	11/5/90	4364-4368	7	0.61	101	ND	2.7	2.7	0.05	ND	191	NT	mg/kg
4364	Soil	Field	11/5/90	4364	7	NT	NT	NT	NT	NT	NT	NT	38	NT	mg/kg
4365	Soil	Field	11/5/90	4365	7	NT	NT	NT	NT	NT	NT	NT	1,170	NT	mg/kg
4366	Soil	Field	11/5/90	4366	7	NT	NT	NT	NT	NT	NT	NT	8.6	NT	mg/kg
4367	Soil	Field	11/5/90	4367	7	NT	NT	NT	NT	NT	NT	NT	920	NT	mg/kg
4368	Soil	Field	11/5/90	4368	7	NT	NT	NT	NT	NT	NT	NT	8.8	NT	mg/kg
December 1994 South Drainfield Soil Samples:															
018765-2	Soil	Field	12/5/94	DF1-1	7	3.3	198	ND	11.3	6.1	ND	ND	11.2	ND	mg/kg
018766-2	Soil	Field	12/5/94	DF1-1	17	2.3	56.1	ND	8.5	3.9 J	ND	ND	3.8	ND	mg/kg
018767-2	Soil	Field	12/5/94	DF1-2	7	3.4	126	ND	10.1	6.1	ND	ND	40.9	ND	mg/kg
018768-2	Soil	Field	12/5/94	DF1-2	17	2.3	86.5	ND	11.4	3 J	ND	ND	0.83 J	ND	mg/kg
018769-2	Soil	Field	12/5/94	DF1-3	7	3.2	145	ND	10.7	4.9 J	ND	ND	2.8	ND	mg/kg
018770-2	Soil	Field	12/5/94	DF1-3	17	2.9	85.9	ND	9.9	5.6	ND	ND	0.75 J	ND	mg/kg
018775-2	Soil	Field	12/5/94	DF1-4	7	3.3	197	ND	11	5	ND	ND	10.6	ND	mg/kg
018776-2	Soil	Dupl.	12/5/94	DFD1-4	7	2.9	241	ND	9.1	4.2 J	ND	ND	4	ND	mg/kg
018777-2	Soil	Field	12/5/94	DF1-4	17	1.7	57.3	ND	6.2	ND	ND	ND	0.43 J	ND	mg/kg
018773-2	Soil	Field	12/5/94	DF1-5	7	3.4	107	ND	10.2	5.4	ND	ND	5.2	ND	mg/kg
018774-2	Soil	Field	12/5/94	DF1-5	17	2.5	55.2	ND	8.4	3.5 J	ND	ND	ND	ND	mg/kg
018771-2	Soil	Field	12/5/94	DF1-6	7	3.4	224	ND	8.4	4.8 J	ND	ND	1.5	ND	mg/kg
018772-2	Soil	Field	12/5/94	DF1-6	17	2.2	124	ND	12.8	4.6 J	ND	ND	ND	ND	mg/kg
018782-2	Soil	Field	12/6/94	DF1-7	7	3.4	158	ND	7.1	4.6 J	ND	ND	ND	ND	mg/kg
018783-2	Soil	Field	12/6/94	DF1-7	17	2.6	76.7	0.73	12	3.7 J	ND	ND	ND	ND	mg/kg

Table 3-3, continued:

ER Site 137

Summary of RCRA Metals and Hexavalent Chromium in Confirmatory Soil Samples

Collected Around and Beneath the Two Septic Tanks, and in the Two Drainfields

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Fig. 1-2)	Top of Sample Interval (fbgs)	RCRA Metals, Methods 6010 and 7471								Other Metals: Cr^{6+} Method 7196	Units
						As	Ba	Cd	Cr, total	Pb	Hg	Se	Ag		
December 1994 South Drainfield Soil Samples, continued:															
018780-2	Soil	Field	12/6/94	DF1-8	7	3.6	205	ND	6.2	4.6 J	ND	ND	0.51 J	ND	mg/kg
018781-2	Soil	Field	12/6/94	DF1-8	17	2.6	78.9	ND	12.8	4.7 J	ND	ND	1.1	ND	mg/kg
018778-2	Soil	Field	12/6/94	DF1-9	7	3.4	108	ND	7	6.3	ND	ND	ND	ND	mg/kg
018779-2	Soil	Field	12/6/94	DF1-9	17	1.8	49.8	ND	5.5	3.3 J	ND	ND	ND	ND	mg/kg
018784-2	Soil	Field	12/6/94	DF1-10	7	3.4	174	ND	7.2	7	ND	ND	ND	ND	mg/kg
018785-2	Soil	Field	12/6/94	DF1-10	17	2.4	107	ND	5.5	4.7 J	ND	ND	ND	ND	mg/kg
018786-2	Soil	Field	12/6/94	DF1-11	7	3.2	136	ND	6.5	4.5 J	ND	ND	ND	ND	mg/kg
018787-2	Soil	Field	12/6/94	DF1-11	17	1.9	44.3	ND	5	3.6 J	ND	ND	ND	ND	mg/kg
018788-2	Soil	Field	12/6/94	DF1-12	7	2.5	144	ND	6.9	4.9 J	ND	ND	ND	ND	mg/kg
018789-2	Soil	Field	12/6/94	DF1-12	17	2.6	52.8	ND	4.8	3.9 J	ND	ND	ND	ND	mg/kg
018791-2	Soil	Field	12/7/94	DF1-13	7	2.6	99.6	0.5	5.6	4.1 J	ND	ND	6	ND	mg/kg
018793-2	Soil	Dupl.	12/7/94	DFD1-13	7	3	105	0.54	6.4	5.3	ND	ND	4.7	ND	mg/kg
018792-2	Soil	Field	12/7/94	DF1-13	17	2.4	59.1	ND	9.2	3.6 J	ND	ND	5.4	ND	mg/kg
018794-2	Soil	Dupl.	12/7/94	DFD1-13	17	1.8	97.1	ND	25.7	ND	ND	ND	5	ND	mg/kg
018795-2	Soil	Field	12/7/94	DF1-14	7	1.9	60.7	ND	4.5	4.1 J	ND	ND	ND	ND	mg/kg
018796-2	Soil	Dupl.	12/7/94	DFD1-14	7	1.5	69.2	ND	4.9	3.8 J	ND	ND	ND	ND	mg/kg
018797-2	Soil	Field	12/7/94	DF1-14	17	2.9	74.4	ND	8.2	4.7 J	ND	ND	ND	ND	mg/kg
018798-2	Soil	Field	12/7/94	DF1-15	7	2.5	74.2	ND	5.1	3.9 J	ND	ND	ND	ND	mg/kg
018799-2	Soil	Field	12/7/94	DF1-15	17	2	96.6	ND	46.7	3.5 J	ND	ND	ND	ND	mg/kg

Table 3-3, continued:

ER Site 137

Summary of RCRA Metals and Hexavalent Chromium in Confirmatory Soil Samples

Collected Around and Beneath the Two Septic Tanks, and in the Two Drainfields

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Fig. 1-2)	Top of Sample Interval (lbgs)	RCRA Metals, Methods 6010 and 7471								Other Metals: Cr^{6+} Method 7196	Units
						As	Ba	Cd	Cr, total	Pb	Hg	Se	Ag		
December 1994 South Drainfield Soil Samples, continued:															
018804-2	Soil	Field	12/8/94	DF1-16	7	3.7	166	ND	6	5.3	ND	ND	31.3	ND	mg/kg
018805-2	Soil	Field	12/8/94	DF1-16	17	2.4	56.6	ND	7	3.7 J	ND	ND	ND	ND	mg/kg
018802-2	Soil	Field	12/7/94	DF1-17	7	3.6	120	ND	5.7	6.5	ND	ND	ND	ND	mg/kg
018803-2	Soil	Field	12/7/94	DF1-17	17	2	70.4	ND	5.4	4.6 J	ND	ND	ND	ND	mg/kg
018800-2	Soil	Field	12/7/94	DF1-18	7	3	157	ND	7.5	3.9 J	ND	ND	ND	ND	mg/kg
018801-2	Soil	Field	12/7/94	DF1-18	17	1.9	53.4	ND	5.1	3.5 J	ND	ND	ND	ND	mg/kg
December 1994 South Septic Tank Soil Samples:															
018763-2	Soil	Field	11/30/94	ST1-1	11	3.3	93.6	ND	10.5	4.1 J	ND	ND	ND	ND	mg/kg
018764-2	Soil	Field	12/5/94	ST1-2	11	2.8	235	ND	7	4 J	ND	ND	ND	ND	mg/kg
Laboratory Reporting Limit For 1990 Soil Samples						0.1	1	0.25	1	1	0.04	0.1	0.5	NT	mg/kg
Laboratory Reporting Limit For 1994 Soil Samples						1	1	0.5	1	5	0.1	0.5	1	0.05 - 0.1	mg/kg
Laboratory Reporting Limit For 1995 Soil Samples						2.2	44	1.1	2.2	0.66	0.1	1.1	2.2	0.2	mg/kg
Number of SNL/NM Background Soil Sample Analyses *						15	727	1,740	647	536	1,724	2,134	2,302	393	NA
SNL/NM Soil Background Range *						2.1-7.9	0.5-495	0.0027-6.2	0.5-31.4	0.75-103	0.0001-0.68	0.037-17.2	0.0016-8.7	0.02-<2.5	mg/kg
SNL/NM Soil Background UTL or 95th Percentile *						7	214	0.9	15.9	11.8	<0.1	<1.0	<1.0	<2.5	mg/kg
Proposed Subpart S Action Level For Soil						0.50	6,000	80	80,000 **	400 ***	20	400	400	400 **	mg/kg

Table 3-3, concluded:

ER Site 137

Summary of RCRA Metals and Hexavalent Chromium in Confirmatory Soil Samples

Collected Around and Beneath the Two Septic Tanks, and in the Two Drainfields

Notes:

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

Ba = Barium. Barium background concentrations presented above are based on analyses of subsurface soil samples collected in the Southwest and CTF areas.

Cd = Cadmium. Cadmium background concentrations presented above are based on analyses of subsurface soil samples collected in the North, Tijeras, Southwest, CTF, and Offsite areas.

Cr = Chromium. Chromium background concentrations presented above are based on analyses of subsurface soil samples collected in the Southwest area.

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.

Compos. = Composite sample

Dupl. = Duplicate soil sample

fbgs = Feet below ground surface

G = Raised detection limit due to sample dilution

J = Result is detected below the reporting limit or is an estimated concentration.

mg/kg = Milligrams per kilogram

ND = Not detected

NT = Not tested (sample either not collected, or not tested for a particular analyte or group of analytes)

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 137
Summary of Isotopic Uranium and Tritium in Confirmatory Soil Samples Collected Around and Beneath the Two Septic Tanks, and in the Two Drainfields

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample (Fig. 1-2)	Top of Sample (fbgs)	Isotopic Uranium Method HASL-300 (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 Methods EPA-600 906.0 (1994 samples), LAL-91-SOP-0108 and LAL-91-SOP-0067 (1995 samples) (pCi/L) Result	Error *	M.D.A.
1994 North Drainfield Soil Samples:																	
018806-5	Soil	Composite	12/8/94	DF2-1/6	5	0.91	0.15	0.055	ND	0.022	0.036	0.97	0.15	0.046			
018807-5	Soil	Composite	12/8/94	DF2-1/6	15	0.94	0.15	0.03	0.031	0.022	0.022	0.85	0.14	0.046			
018806-4	Soil	Composite	12/8/94	DF2-1/6	5										ND	150	270
018807-4	Soil	Composite	12/8/94	DF2-1/6	15										ND	150	270
1995 Soil Sample Beneath the North Septic Tank:																	
026085-3	Soil	Field	10/18/95	Below ST2	11	0.462	0.052	0.014	0.029	0.012	0.009	0.499	0.054	0.009	ND	150	71
1994 South Drainfield Soil Samples:																	
018765-5	Soil	Composite	12/5/94	DF1-1/18	7	0.84	0.14	0.038	0.024	0.02	0.022	0.88	0.15	0.048			
018766-5	Soil	Composite	12/5/94	DF1-1/18	17	1	0.16	0.033	ND	0.016	0.031	0.94	0.15	0.04			
018765-4	Soil	Composite	12/5/94	DF1-1/18	7										ND	150	270
018766-4	Soil	Composite	12/5/94	DF1-1/18	17										ND	150	270
Number of SNL/NM Background Soil Sample Analyses **						14			283			90			U		
SNL/NM Soil Background Range **						0.44-<5.02			0.004-3			0.153-2.3			U		
SNL/NM Soil Background 95th Percentile **						<5.02			0.16			1.4			U		
Nationwide Tritium Range in Precipation and Drinking Water ***						NA			NA			NA			100-400		

Notes:

U-233 = Uranium 233

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

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

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

fbgs = Feet below ground surface
M.D.A. = Minimum detectable activity
ND = Not detected

pCi/g = Picocuries per gram
pCi/L = Picocuries per liter
U = Undefined for SNL/NM soils

* Error = +- 2 sigma uncertainty
** IT March 1996
*** EPA October 1993

3.7 Risk Analysis

Barium, total chromium, and silver were detected in some ER Site 137 soil samples at concentrations greater than the applicable SNL/NM background concentrations for these metals, and silver was also detected in two of the 1990 south drainfield samples at levels greater than the proposed Subpart S action level of 400 mg/kg for silver (Table 3-3). Because the highest level of silver detected is greater than 1/10 of the proposed Subpart S action level, the site failed the Subpart S screening criteria. Only those contaminants detected at concentrations above the applicable background levels (barium, total chromium, and silver) are included in the risk assessment analysis.

Silver was detected at a concentration of 2.4 mg/kg in the October 1995 soil sample from beneath the north septic tank, and was not detected in two samples collected in 1994 from either side of the same tank. Silver was detected in 11 of the 13 soil samples from the north system drainfield at concentrations ranging from 0.41 to 39.5 mg/kg. Eight of the 11 samples contained silver above the Southwest area background 95th percentile concentration of less than 1 mg/kg (IT March 1996), but all detected concentrations were substantially below 400 mg/kg.

Silver was not detected in the two samples collected in 1994 from either side of the south tank. Forty soil samples were collected from shallow and deep intervals in the south drainfield in 1994, and silver was detected in 18 of the 40 samples up to a concentration of 40.9 mg/kg. Also, as described above, the composite sample collected in 1990 from the southern part of the south drainfield, and three of the five discrete samples from the southern part of the drainfield contained silver between 1 and 400 mg/kg. The other two discreet samples (numbers 4365 and 4367 on Figure 1-2) contained 1,170 and 920 mg/kg of silver, respectively, which are above the proposed Subpart S action level of 400 mg/kg.

Barium was detected in all 60 of the 1990, 1994, and 1995 north and south system soil samples analyzed for barium (Table 3-3). No barium concentrations above the Southwest area background UTL of 214 mg/kg were detected in any of the 16 north system soil samples. Barium above the background UTL was detected in only 3 of the 44 south system soil samples. The three samples included the sample from the north side of the septic tank (location ST1-2 on Figure 1-2), the duplicate sample from the shallow interval in borehole DF1-4, and the shallow interval sample from borehole DF1-6 (Figure 1-2), which contained 235, 241, and 224 mg/kg of barium, respectively.

Chromium was detected in all 60 of the 1990, 1994, and 1995 north and south system soil samples analyzed for chromium (Table 3-3). In addition, all of the 58 north and south septic tank and drainfield soil samples collected in 1994 and 1995 were analyzed for hexavalent chromium and none was detected, so it is apparent that all chromium detected in these samples is in the trivalent form. No chromium concentrations above the Southwest area background UTL of 15.9 mg/kg were detected in any of the 16 north system soil samples. Chromium above the background UTL was detected in only 2 of the 44 south system soil samples. These included the deep interval sample from borehole DF1-15 and the duplicate

sample from the deep interval in borehole DF1-13 (Figure 1-2), which contained 46.7 and 25.7 mg/kg of chromium, respectively. However, the equivalent deep interval field sample from the DF1-13 contained only 9.2 mg/kg of chromium.

Risk Characterization

The highest barium, trivalent chromium, and silver concentrations (241, 46.7, and 1,170 mg/kg, respectively) found at this site were used in the risk calculations in order to produce a conservative estimate of risk to counter uncertainties in the soil analytical data. Although the site has a designated industrial land-use scenario, the risk values for a residential land-use scenario are presented to show the potential for risk to human health under the more restrictive land-use scenario. EPA generally recommends that the inhalation pathway not be included in a residential land-use scenario because a typical residential site normally would be considered to be covered with vegetation (EPA 1991), but this pathway is considered because of the potential for soil at KAFB to be a dust source due to erosion, or possibly construction or excavation activities. However, there are no inhalation pathway toxicity values for barium, chromium, and silver, so no risk analysis was done for this pathway. Therefore, for purposes of this risk assessment, it is assumed that oral ingestion of the three metals in soil will be the most likely exposure route for COCs at this site. Long-term ingestion of COCs is, in fact, considered highly unlikely because the COCs at ER Site 137 were discharged directly from drainlines into subsurface rather than surface soils. Contact with COCs is therefore unlikely, but is nonetheless possible for brief periods if contaminated soils are exposed or brought to the surface by excavation activities.

The general equation for calculating potential ingestion of chemicals in soil is shown below, and is taken from the Risk Assessment Guidance for Superfund: Volume 1 (EPA 1989 and 1991):

$$\text{Intake (mg/kg-day)} = \frac{CS \times IR \times EF \times FI \times ED \times (10^{-6}\ kg/mg)}{BW \times AT}$$

where

Intake = total intake of the particular COC, expressed as mg/kg of body weight per day;

- CS = chemical concentration in soil (mg/kg);
- IR = ingestion rate: 200 mg/day (residential scenario);
- EF = exposure frequency: 350 days/year);
- FI = fraction ingested; default to 1;
- ED = exposure duration: 30 years;
- BW = body weight: 16 kg for 6 years, then 70 kg for 24 years, or a weighted average of 59.2 kg (residential scenario), and
- AT = averaging time: ED x 350 days/year, or 10,500 days (for non-carcinogenic effects).

Using the above formula and as shown in Table 3-5, intake of barium, trivalent chromium, and silver is calculated to be 0.0008, 0.0002, and 0.004 mg/kg-day, respectively.

The final step of the risk evaluation process is to calculate the potential toxicity effects for the three COCs at this site. None of the COCs is classified as a carcinogen, so cancer risk will not

be evaluated. The toxic effect is evaluated by calculating a Hazard Index (HI) for each of the three metals, and then summing the individual HIs into a total HI. HI is defined in EPA 1989 as

HI = intake/RfD

where

intake = the total intake of the particular COC, as calculated above, and

RfD = the Reference Dose for each of the COCs (EPA March 1996).

The values used to calculate the individual HIs for barium, trivalent chromium, and silver are shown in Table 3-5. As shown on the table, the total of the individual HIs (residential scenario) for the highest concentrations of barium, trivalent chromium, and silver detected at this site is calculated to be 0.8, which is less than the maximum HI of 1.0 recommended by EPA (EPA 1989). We therefore conclude that the maximum concentration of the three COCs detected at this site will not pose a significant risk to human health or the environment.

Table 3-5
ER Site 137: Values Used for the Toxicological Risk Calculation

COC Name	Highest COC concentration detected at the site (mg/kg)	Intake (mg/kg-day)	RfD_o (mg/kg-day)	RfD confi-dence	HI	Slope Factor (carcinogens)	Data Source
Barium	241	0.0008	7E-02	medium	0.0	None	EPA March 1996
Trivalent chromium	46.7	0.0002	1E+00	low	0.0	None	EPA March 1996
Silver	1,170	0.004	5E-03	low	0.8	None	EPA March 1996
Total HI for all COCs					**0.8**		

Notes
HI = Hazard Index
mg/kg = Milligrams per kilogram
RfD_o= Reference dose for oral ingestion intake

Uncertainty Discussion

The risk analysis shows that the calculated risk assessment values are lower than the applicable numerical standard (HI of 1) established by the EPA. The uncertainty in this conclusion is also considered to be small. Because of the location and history of the site, there is low uncertainty in the designated land-use scenario and the potentially affected populations that were considered in making the risk assessment analysis. A Reasonable Maximum Exposure (RME) approach was used to calculate the risk assessment values, which means that the factors used in the intake and HI calculations were conservative, and that the calculated intakes are likely overestimates. Maximum measured values of the concentrations of the COCs were used to provide conservative results. Because the COCs in the septic system effluent

were discharged to subsurface rather than surface soils, assumptions made about the exposure pathways are uncertain and are likely overestimates for purposes of the analysis.

Table 3-5 also shows the uncertainties in the toxicological reference dose values. Because of the conservative nature of the RME approach, the uncertainties in the toxicological values are not expected to be of high enough concern to change the conclusion from the risk assessment analysis. The overall uncertainty in all of the steps in the risk assessment process is therefore considered to be not significant with respect to the conclusion reached.

Risk Summary

Site history and process knowledge suggest that relatively minor amounts of COCs (primarily silver) were released to the environment via the Building 6540/6542 septic system. Because of the location of the site on KAFB, the designated land-use scenario, and the nature of the contamination, the potential exposure pathways identified for this site include soil ingestion and dust inhalation of chemical constituents. However, there are no inhalation pathway toxicity values for barium, chromium, and silver, so no risk analysis was performed to evaluate this pathway. As discussed above, ingestion or inhalation of COCs other than for a brief period of time (from construction or excavation activities) is considered very unlikely. Nonetheless, using primarily conservative assumptions and employing a RME approach to the risk assessment, the calculations show that for the residential land-use scenario, the total HI is 0.8, and the three COCs are not classified as carcinogens. It is therefore concluded that this site does not have significant potential to affect human health under either a residential (or industrial) land-use scenario.

Ecological risk has not been addressed in this NFA proposal because the ecological risk analysis for ER Site 137 has not been estimated at this time. Site-wide ecological risk analyses are being conducted and the relevant analysis for this site will be presented when available. However, analytical results of samples that have been collected suggest that concentrations of COCs identified at this site will not result in a significant level of ecological risk.

3.8 Rationale for Pursuing a Confirmatory Sampling NFA Decision

As discussed in Section 3.4, the passive soil-gas survey did not indicate any anomalies or areas of VOC or SVOC contamination in the two drainfield areas of this site.

As shown in Table 3-2, only low concentrations of four VOC compounds (acetone, methyl isobutyl ketone, methylene chloride, and toluene), which are common laboratory contaminants, were detected in soil samples collected from this site. These four VOCs were also detected in associated soil trip blanks shipped with the samples, and are believed to be artifacts of laboratory contamination. A low concentration of one SVOC (diethyl phthalate) was detected in one of the two 1990 composite samples from the south drainfield, and near or below-reporting limit concentrations of three other SVOCs (bis[2-ethylhexyl]phthalate, 2-4 dichlorophenol, and di-n-butyl phthalate) were detected in a few of the 1994 soil samples from the south drainfield shallow and deep sampling intervals. Also, all detected concentrations of VOCs and SVOCs were much less than the proposed Subpart S action levels for the respective compounds. Cyanide was detected at a near-reporting-limit concentration of 920 micrograms per kilogram (µg/kg) in one deep interval soil sample from the south drainfield. This concentration is much lower than the proposed Subpart S soil action level of 2,000,000 ug/kg for cyanide (EPA July 1990).

As shown on Table 3-3, soil sample analytical results indicate that, except for silver from two of the 1990 sampling locations, the nine metals that were targeted in the Site 137 investigation were either (1) not detected, or (2) were detected in concentrations below the background UTL or 95th percentile concentrations presented in the SNL/NM study of naturally-occurring constituents (IT March 1996), or (3) were less than the proposed Subpart S action levels for these metals. Also, as discussed in Section 3.7 above, the risk assessment calculations using the highest concentrations of the three metals (barium, trivalent chromium, and silver) that were identified at above-background concentrations at this site demonstrates that these metals will not pose a significant risk to human health or the environment.

Isotopic uranium activity levels detected in the shallow and deep interval composite soil samples from the north and south drainfields, and in the grab sample from beneath the north septic tank, were found to be below the corresponding 95th percentile background activity levels presented in the IT March 1996 report for those radionuclides (Table 3-4). Tritium was not detected in soil moisture from any of these three samples. Also, the gamma spectroscopy semiqualitative screening of the composite soil samples from north and south drainfield shallow and deep sampling intervals, and from directly beneath the north septic tank, did not indicate the presence of contamination from other radionuclides in soils at this location (Appendices A.4 through A.8).

As discussed in Section 3.3 above, the north system septic tank was uncovered and removed from the site on October 18, 1995. Approximately 2 inches of dark humus-like material was found at the bottom of the tank, and was assumed to represent decomposed septage. This material was transferred from the degraded tank into drums before the tank was removed from the ground and disposed of (SNL/NM October 1995a). The south system septic tank contents were removed and the tank was thoroughly cleaned in January 1996 (SNL/NM January 1996a). The septage removal and cleaning operation is shown in the bottom photograph of Figure 3-1. The empty and clean tank was then inspected by a representative of the New Mexico Environment Department (NMED) to verify that the tank contents had been removed and the tank had been closed in accordance with applicable State of New Mexico regulations (SNL/NM 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 137, and that additional investigations are unwarranted and unnecessary. Based on archival information and chemical and radiological analytical results of soil samples collected next to and beneath the two septic tanks, and beneath the two drainfields at this site, SNL/NM has demonstrated that hazardous waste or COCs that were released from this SWMU into the environment pose an acceptable level of risk under current and projected future land use (Criterion 5 of Section 1.2), and the site does not pose a threat to human health or the environment. ER Site 137 is therefore recommended for an NFA determination.

5.0 REFERENCES

5.1 ER Site 137 References

IT Corporation (IT), February 1991, "Results of Building 6540 Drain Field Analyses," Summary report for November 1990 soil sampling at the south system drainfield by IT Corporation, IT project number 301181.13.01, Albuquerque, New Mexico, February 20, 1991.

Sandia National Laboratories/New Mexico (SNL/NM), April 1975, Facilites Engineering drawing #93748 dated April 4, 1975 showing only the north drainfield (and not the south drainfield) at the facility in 1975.

Sandia National Laboratories/New Mexico (SNL/NM), May 1994, Field Log #0080, Pages 20, 36, and 52, 5/25/94, 6/15/94 and 7/7/94, Field notes for ER Site 137 passive soil gas survey.

Sandia National Laboratories/New Mexico (SNL/NM), June 1994a, Field Log #0080, Page 26, June 1, 1994, Field notes for the 2nd round sampling of ER Site 137 north and south system septic tank contents.

Sandia National Laboratories/New Mexico (SNL/NM), June 1994b, Environmental Operations Records Center, Record Number ER/1295-137/DAT, Analytical reports for ER Site 137 septic tank septage sampling on June 1, 1994, Chain of Custody Numbers 118, 119, 120, 121, 122, 123, and 2667.

Sandia National Laboratories/New Mexico (SNL/NM), September 1994, Field Log #0096, Pages 25-27, 9/7/94, Field notes for ER Site 137 north and south system drainfield excavation.

Sandia National Laboratories/New Mexico (SNL/NM), November 1994a, Field Log #0096, Pages 125-139, 11/30/94 - 12/12/94, Field notes for ER Site 137 south and north systems soil sampling with the Geoprobe™ sampling equipment.

Sandia National Laboratories/New Mexico (SNL/NM), December 1994a, Environmental Operations Records Center, Record Number ER/1295-137/DAT, Analytical reports for ER Site 137 septic tank and drainfield soil sampling from November 30 to December 12, 1994, Chain of Custody Numbers 2169, 2276, 2279, 2281, and 2282.

Sandia National Laboratories/New Mexico (SNL/NM), July 1995, Field Log #0139, Pages 1, 1A, and 1B, July 31, 1995, Field notes for ER Site 137 north system septic tank initial excavation activities.

Sandia National Laboratories/New Mexico (SNL/NM), August 1995, Field Log #0139, Pages 2-4, August 1, 1995, Field notes for ER Site 137 south system initial septic tank excavation activities.

Sandia National Laboratories/New Mexico (SNL/NM), October 1995a, Field Log #0139, Pages 135-143, October 18, 1995, Field notes for the ER Site 137 north system septic tank removal operation, and sampling of sludge/soil in the tank bottom, and the soil beneath the tank.

Sandia National Laboratories/New Mexico (SNL/NM), October 1995b, Environmental Operations Records Center, Record Number ER/1295-137/DAT, Analytical reports for sampling of the ER Site 137 north system septic tank septage (soil/sludge), and the soil beneath the septic tank on October 18, 1995, Chain of Custody Numbers 4437, 4438, and 4441.

Sandia National Laboratories/New Mexico (SNL/NM), January 1996a, Field Log #0147, Pages 139-146, 1/11/96, Field notes for the ER Site 137 south system septic tank septage removal and cleaning operation.

Sandia National Laboratories/New Mexico (SNL/NM), January 1996b, Field Log #0147, Pages 189, 190, and 192, 1/26/96, Field notes for the NMED empty tank verification inspection for the ER Site 137 south septic tank.

5.2 Other References

Department of Energy (DOE), Albuquerque Operations Office, Environmental Safety and Health Division, Environmental Program Branch, September 1987, draft "Comprehensive Environmental Assessment and Response Program (CEARP) Phase 1: Installation Assessment, Sandia National Laboratories, Albuquerque," Department of Energy, Albuquerque Operations Office, Albuquerque, New Mexico.

IT Corporation (IT), March 1994, "Sampling and Analysis Plan for Shallow Subsurface Soil Sampling, RCRA Facility Investigation of Septic Tanks and Drainfields (OU 1295)," IT Corporation, Albuquerque, New Mexico.

IT Corporation (IT), March 1996, "Background Concentrations of Constituents of Concern to the Sandia National Laboratories/New Mexico Environmental Restoration Project and the Kirtland Air Force Base Installation Restoration Program," IT Corporation, Albuquerque, New Mexico.

Lamb Associates, Inc. (Lamb), 1994, "Geophysical Surveys at 23 Sites, Septic Tanks and Drainfields, ADS #1295", Lamb Associates, Inc., Albuquerque, NM.

New Mexico Environment Department (NMED), November 1995, "Environmental Restoration Document of Understanding," Santa Fe, New Mexico, November 16, 1995.

Northeast Research Institute (NERI), June 1995, "PETREX™ Soil Gas Survey Results Conducted at Various Sites of the Septic Tanks and Drainfields Operating Units, Sandia National Laboratories," Albuquerque, New Mexico, Northeast Research Institute, Lakewood, Colorado.

Sandia National Laboratories/New Mexico (SNL/NM), March 1993, "Septic Tanks and Drainfields (ADS-1295) RCRA Facility Investigation Work Plan," Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), June 1993, "Sandia National Laboratories/New Mexico Septic Tank Monitoring Report, 1992 Report," Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), July 1993, Memo from Joe Jones to Bob Galloway listing the septic tanks that were removed from service with the construction of the Technical Area 3 sanitary sewer system, SNL ER Sites, July 26, 1993.

Sandia National Laboratories/New Mexico (SNL/NM), November 1994b, "Septic Tanks and Drainfields RFI Work Plan, Comment Responses to USEPA Notice of Deficiency, November 1994," SNL/NM's initial response to the EPA Notice of Deficiency (NOD) regarding the March 1993 OU 1295 RFI Work Plan.

Sandia National Laboratories/New Mexico (SNL/NM), December 1994b, memo (via fax) from EPA to SNL/NM titled "Sandia National Laboratories, Septic Tanks and Drainfields RFI Workplan, December 1994." Memo addresses additional technical issues and questions regarding the SNL/NM November 1994 NOD response document.

Sandia National Laboratories/New Mexico (SNL/NM), January 1995, "SNL/DOE Response to EPA Issue Paper, Septic Tanks and Drainfields RFI Work Plan, January 26, 1995," memo from SNL/NM to EPA responding to technical issues and questions posed by the EPA in the January 9, 1995 "Issue Paper." Memo conveyed to EPA under DOE/KAO cover letter dated February 13, 1995.

Sandia National Laboratories/New Mexico (SNL/NM), February 1995, "Program Implementation Plan for Albuquerque Potential Release Sites," Sandia National Laboratories Environmental Restoration Program, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), March 1995a, Letter with attachments dated March 14, 1995 from SNL/NM to EPA (via fax) clarifying the number of samples and types of analyses used to characterize the OU 1295 ER sites.

Sandia National Laboratories/New Mexico (SNL/NM), March 1995b, Letter dated March 17, 1995 from SNL/NM to EPA describing proposed procedures for additional soil sampling at OU 1295 ER Sites 49 and 144.

Sandia National Laboratories/New Mexico (SNL/NM), May 1995, Letter with attachments (drainfield borehole maps) dated May 11, 1995 from SNL/NM to EPA explaining number, spacing, and locations of boreholes used to characterize each of the OU 1295 drainfields in late 1994 and early 1995.

Sandia National Laboratories/New Mexico (SNL/NM), March 1996, "Site-Wide Hydrogeologic Characterization Project, Calendar Year 1995 Annual Report," Sandia National Laboratories Environmental Restoration Project, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), August 1996, SNL ER Sites, "Air Force IRP Sites and Well Locations at Kirtland Air Force Base," SNL Geographic Information System Map # 961160, August 21, 1996.

U.S. Environmental Protection Agency (EPA), April 1987, "Final RCRA Facility Assessment Report of Solid Waste Management Units at Sandia National Laboratories, Albuquerque, New Mexico," Contract No. 68-01-7038, EPA Region VI.

U.S. Environmental Protection Agency (EPA), December 1987, "Hazardous Waste; Codification Rule for 1984 RCRA Amendments; Final Rule," *Federal Register*, Vol. 52, Title 40, Parts 144, 264, 265, 270, and 27, Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1989, Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, EPA/540-1089/002, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C.

U.S. Environmental Protection Agency (EPA), July 1990, "Corrective Action for Solid Waste Management Units (SWMU) at Hazardous Waste Management Facilities, Proposed Rule," *Federal Register*, Vol. 55, Title 40, Parts 264, 265, 270, and 271.

U.S. Environmental Protection Agency (EPA), 1991, Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part B), EPA/540/R-92/003, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C.

U.S. Environmental Protection Agency (EPA), August 1992, "Hazardous Waste Management Facility Permit No. NM5890110518-1," EPA Region VI, issued to Sandia National Laboratories, Albuquerque, New Mexico.

U.S. Environmental Protection Agency (EPA), August 1993, "Module IV of RCRA Permit No. NM5890110518-1," EPA Region VI, issued to Sandia National Laboratories, Albuquerque, New Mexico.

U.S. Environmental Protection Agency (EPA), October 1993, "Environmental Radiation Data Report 73, January-March 1993," Report Number EPA 402-R-93-092, National Air and Radiation Environmental Laboratory, Montgomery, Alabama.

U.S. Environmental Protection Agency (EPA), July 1994, "Guidance on Residential Lead-Based Paint, Lead-Contaminated Dust, and Lead-Contaminated Soil," Memorandum from Lynn R. Goldman, M.D., USEPA Assistant Administrator to EPA Regional Directors.

U.S. Environmental Protection Agency (EPA), September 1994, "Notice of Deficiency, Sandia National Laboratories, Septic Tanks and Drainfields RFI Work Plan," Letter)dated September 15, 1994 from EPA to DOE/AO.

U.S. Environmental Protection Agency (EPA), January 1995, "Issue Paper, Septic Tanks and Drainfields RFI Work Plan", memo (via fax) dated January 9, 1995 from EPA to DOE/KAO posing additional technical questions about information presented in the SNL/NM November 1994 Notice of Deficiency (NOD) response document.

U.S. Environmental Protection Agency (EPA), March 1995, Letter dated March 31, 1995 from EPA to DOE/AL approving the March 1993 OU 1295 RFI Work Plan and follow-up addenda, and specifying a few additional conditions and requirements.

U.S. Environmental Protection Agency (EPA), March 1996, Integrated Risk Information System (IRIS) database, EPA Office of Environmental Criteria and Assessment Office, Cincinnati, OH.

Appendix A

OU 1295, Site 137
Results of Previous Sampling and Surveys

Appendix A.1

ER Site 137
Summary of Constituents Detected in 1992 Septic Tank Samples

Note: The text and tables included in Appendix A.1 have been taken directly from the Sandia National Laboratories/New Mexico Septic Tank Monitoring Report, 1992 Report" (SNL/NM March 1993), and have not been altered from their original form. Unresolved discrepancies and errors contained in the text and tables addressing the Building 6540/6542 septic tank samples include:

1) The text indicates that ^{226}Radium was measured at 1.29 pCi/mL and ^{212}Lead was measured at 0.155 pCi/L in the north tank sludge, whereas the table summarizing the analytical results for the north tank sludge sample indicates activity levels of 0.129 and 0.466 pCi/L for ^{226}Radium and ^{212}Lead, respectively.

2) "Acentium" is listed on the north tank table. This is a typographical error, and is most likely actinium

Appendix A.1

ER Site 137
Summary of Constituents Detected in 1992 Septic Tank Samples

Buildings 6540 and 6542, North and South Tanks
Area 3
Sample ID No. SNLA008582 and SNLA008583
Tank ID No. AD 8900R

On July 29, 1992, sludge samples were collected from the northern and southern septic tanks serving Buildings 6540 and 6542. During review of the sludge radiochemistry data, the following items were noted:

North Tank

- ^{226}Ra was measured at 1.29 pCi/mL and ^{214}Pb was measured at 0.405 pCi/mL, which are above the respective investigation levels (IL) calculated during this monitoring effort. These are progeny of naturally occurring ^{238}U, and the findings suggest elevated levels of ^{238}U exist at this location. The ^{214}Pb level was less than 0.1 percent of the U.S. Department of Energy (DOE) derived concentration guideline (DCG) constraints.

- ^{212}Pb was measured at 0.155 pCi/mL, ^{212}Bi was measured at 0.357 pCi/mL, and ^{208}Tl was measured at 0.139 pCi/mL, which are above the respective ILs. ^{212}Bi and ^{212}Pb levels were within DOE DCG constraints.

South Tank

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

Appendix A.1, continued:

ER Site 137
Summary of Constituents Detected in 1992 Septic Tank Samples

Results of Septic Tank Analyses (Sludge Sample)			
Building No./Area:	**6540/42 N TANK A-3** (NORTH SYSTEM TANK)		
Tank ID No.:	**AD89009R**		
Date Sampled:	**7/29/92**		
Sample ID No.:	**SNLA008582**		
Analytical Parameter	**Measured Concentration**	**± 2 Sigma Uncertainty**	**Units**
Gross Alpha	1E+1	2E+1	pCi/g
Gross Beta	1E+1	5E+1	pCi/g
Gross Alpha	1E+1	2E+1	pCi/g
Gross Beta	-2E+1	4E+1	pCi/g
Gross Alpha	0E+1	2E+1	pCi/g
Gross Beta	-3E+1	4E+1	pCi/g
Gross Alpha	2E+1	2E+1	pCi/g
Gross Beta	-1E+1	4E+1	pCi/g
Tritium	Dry sample. No H3 analysis performed.		
Acentium	0.499	0.0354	pCi/mL
Bismuth-212	0.357	0.0465	pCi/mL
Bismuth-214	0.369	0.0188	pCi/mL
Cesium-137	0.0478	0.00685	pCi/mL
Potassium-40	0.108	0.312	pCi/mL
Lead-212	0.466	0.0236	pCi/mL
Lead-214	0.405	0.0227	pCi/mL
Radium-226	0.129	0.189	pCi/mL
Thorium-234	1.52	0.156	pCi/mL
Thallium-208	0.139	0.00884	pCi/mL

ND = Not Detected
NA = Not Applicable

Appendix A.1, concluded:

ER Site 137
Summary of Constituents Detected in 1992 Septic Tank Samples

Results of Septic Tank Analyses (Sludge Sample)			
Building No./Area:	**6540/42 S TANK A-3** (SOUTH SYSTEM TANK)		
Tank ID No.:	**AD89009R**		
Date Sampled:	**7/29/92**		
Sample ID No.:	**SNLA008583**		
Analytical Parameter	**Measured Concentration**	**± 2 Sigma Uncertainty**	**Units**
Gross Alpha	2E+0	2E+1	pCi/g
Gross Beta	-2E+0	5E+1	pCi/g
Gross Alpha	2E+0	20.000000	pCi/g
Gross Beta	3E+1	50.000000	pCi/g
Gross Alpha	8E+0	2E+1	pCi/g
Gross Beta	3E+1	4E+1	pCi/g
Gross Alpha	-1E+0	2E+1	pCi/g
Gross Beta	3E+1	4E+1	pCi/g
Tritium	-1E+02	3E+02	pCi/L
Bismuth-214	<0.0319	NA	pCi/mL
Cesium-137	0.00519	0.00310	pCi/mL
Potassium-40	0.810	0.00908	pCi/mL
Lead-212	0.0271	0.00028	pCi/mL
Lead-214	0.0372	0.00715	pCi/mL
Radium-226	0.479	0.0732	pCi/mL
Thorium-234	0.437	0.0596	pCi/mL
Thallium-208	0.0138	0.00392	pCi/mL

ND = Not Detected
NA = Not Applicable

Appendix A.2

ER Site 137
Summary of Constituents in 1994 and 1995 Septic Tank Septage Samples

Sample Number	Sample Matrix	Sample Type	Sample Date	Method	Compound Name	Result	Det. Limit or M.D.A.	Error *	Units
NORTH SYSTEM SAMPLES:									
June 1994 North Septic Tank Samples:									
015474-1	Sludge/soil	Field	6/1/94	8240 (VOCs)	Methylene chloride	0.21 B,J	0.5	NA	mg/kg
015474-5	Sludge/soil	Field	6/1/94	8270 (SVOCs)	Fluorene	1.5 J	6.6	NA	mg/kg
				8270 (SVOCs)	Phenanthrene	25	6.6	NA	mg/kg
				8270 (SVOCs)	Anthracene	5.6 J	6.6	NA	mg/kg
				8270 (SVOCs)	Fluoranthene	52	6.6	NA	mg/kg
				8270 (SVOCs)	Pyrene	39	6.6	NA	mg/kg
				8270 (SVOCs)	Benzo(a)anthracene	23	6.6	NA	mg/kg
				8270 (SVOCs)	Bis(2-Ethylhexyl) phthalate	3.2 J	6.6	NA	mg/kg
				8270 (SVOCs)	Chrysene	25	6.6	NA	mg/kg
				8270 (SVOCs)	Benzo(b)fluoranthene	25	6.6	NA	mg/kg
				8270 (SVOCs)	Benzo(k)fluoranthene	14	6.6	NA	mg/kg
				8270 (SVOCs)	Benzo(a)pyrene	16	6.6	NA	mg/kg
				8270 (SVOCs)	Indeno(1,2,3-cd)pyrene	10	6.6	NA	mg/kg
015474-3	Sludge/soil	Field	6/1/94	6010	Arsenic	28 J	50	NA	mg/kg
				6010	Barium	106	5	NA	mg/kg
				6010	Cadmium	3.9	2.5	NA	mg/kg
				6010	Chromium	27.8	5	NA	mg/kg
				6010	Lead	48.8	25	NA	mg/kg
				7471	Mercury	0.24	0.1	NA	mg/kg
				6010	Selenium	90.9 J	100	NA	mg/kg
				6010	Silver	371	5	NA	mg/kg
015474-4	Sludge/soil	Field	6/1/94	TCLP/6010	Arsenic	ND	0.2	NA	mg/L
				TCLP/6010	Barium	0.19 B	0.02	NA	mg/L
				TCLP/6010	Cadmium	0.011	0.01	NA	mg/L
				TCLP/6010	Chromium	ND	0.02	NA	mg/L
				TCLP/6010	Lead	ND	0.1	NA	mg/L
				TCLP/7470	Mercury	ND	0.0002	NA	mg/L
				TCLP/6010	Selenium	ND	0.4	NA	mg/L
				TCLP/6010	Silver	ND	0.02	NA	mg/L
015474-2	Sludge/soil	Field	6/1/94	7196	Hexavalent chromium	ND	0.05	NA	mg/kg
015474-3	Sludge/soil	Field	6/1/94	9010/9012	Cyanide	ND	0.05	NA	mg/kg
October 1995 North Septic Tank Samples:									
026084-1	Sludge/soil	Field	10/18/95	LAL-91-SOP-0108	Uranium 238	0.90	0.015	0.11	pCi/g
				LAL-91-SOP-0108	Uranium 235	0.062	0.014	0.029	pCi/g
				LAL-91-SOP-0108	Uranium 233/234	1.50	0.020	0.15	pCi/g
026084-1	Sludge/soil	Field	10/18/95	LAL-91-SOP-0067	Tritium	ND	200	220	pCi/L

Appendix A.2

ER Site 137
Summary of Constituents Detected in 1994 and 1995 Septic Tank Septage Samples

Appendix A.2, continued:

ER Site 137
Summary of Constituents in 1994 and 1995 Septic Tank Septage Samples

Sample Number	Sample Matrix	Sample Type	Sample Date	Method	Compound Name	Result	Det. Limit or M.D.A.	Error *	Units
October 1995 North Septic Tank Samples, continued:									
026084-3	Sludge/soil	Field	10/18/95		Uranium Series:				
				Gamma Spec.	Radium-226	0.64	0.62	0.41	pCi/g
				Gamma Spec.	Lead-214	0.24	0.05	0.05	pCi/g
				Gamma Spec.	Bismuth-214	0.23	0.05	0.05	pCi/g
					Thorium Series:				
				Gamma Spec.	Thorium-232	0.18	0.14	0.09	pCi/g
				Gamma Spec.	Radium-228	0.21	0.14	0.1	pCi/g
				Gamma Spec.	Lead-212	0.26	0.04	0.08	pCi/g
				Gamma Spec.	Bismuth-212	0.24	0.26	0.17	pCi/g
					Other Radionuclides:				
				Gamma Spec.	Cesium-137	0.03	0.02	0.02	pCi/g
				Gamma Spec.	Potassium-40	5.86	0.32	0.9	pCi/g
SOUTH SYSTEM SAMPLES:									
June 1994 South Septic Tank Samples:									
015943-1	Liquid	Field	6/1/94	8240 (VOCs)	1,1-Dichloroethane	54	25	NA	ug/L
				8240 (VOCs)	Methylene chloride	10 B,J	25	NA	ug/L
015943-7	Sludge	Field	6/1/94	8240 (VOCs)	1,1-Dichloroethane	8.3	0.5	NA	mg/kg
				8240 (VOCs)	Trichloroethene	4.9	0.5	NA	mg/kg
				8240 (VOCs)	Toluene	0.84	0.5	NA	mg/kg
				8240 (VOCs)	Xylenes (total)	1.5	0.5	NA	mg/kg
015943-8	Sludge	Field	6/1/94	8270 (SVOCs)	Phenol	2.8 J	13	NA	mg/kg
				8270 (SVOCs)	4-Methylphenol	5.9 J	13	NA	mg/kg
				8270 (SVOCs)	Bis(2-Ethylhexyl) phthalate	5 J	13	NA	mg/kg
015943-2	Liquid	Field	6/1/94	6010	Barium	0.034	0.01	NA	mg/L
				6010	Cadmium	ND	0.005	NA	mg/L
				6010	Chromium	ND	0.01	NA	mg/L
				6010	Silver	0.0064 J	0.01	NA	mg/L
				6010	Arsenic	ND	0.01	NA	mg/L
				6010	Lead	ND	0.003	NA	mg/L
				6010	Selenium	ND	0.021	NA	mg/L
015943-3	Liquid	Field	6/1/94	7470	Mercury	0.00013 J	0.0002	NA	mg/L
015943-6	Liquid	Field	6/1/94	7196	Hexavalent Chromium	ND	0.01	NA	mg/L
015943-5	Liquid	Dupl.	6/1/94	7196	Hexavalent Chromium	ND	0.01	NA	mg/L
015943-10	Sludge	Field	6/1/94	6010	Arsenic	ND	10	NA	mg/kg
				6010	Barium	70.8	1	NA	mg/kg
				6010	Cadmium	2.7	0.5	NA	mg/kg
				6010	Chromium	7.8	1	NA	mg/kg
				6010	Lead	40.6	5	NA	mg/kg
				6010	Selenium	ND	20	NA	mg/kg
				6010	Silver	372	1	NA	mg/kg
				7471	Mercury	0.21	0.1	NA	mg/kg
015943-9	Sludge	Field	6/1/94	7196	Hexavalent Chromium	ND	0.5	NA	mg/kg

Appendix A.2, concluded:

ER Site 137
Summary of Constituents in 1994 and 1995 Septic Tank Septage Samples

Sample Number	Sample Matrix	Sample Type	Sample Date	Method	Compound Name	Result	Det. Limit or M.D.A.	Error *	Units
June 1994 South Septic Tank Samples, continued:									
015943-11	Sludge	Field	6/1/94	TCLP/6010	Arsenic	ND	0.2	NA	mg/L
				TCLP/6010	Barium	0.96 B	0.02	NA	mg/L
				TCLP/6010	Cadmium	ND	0.01	NA	mg/L
				TCLP/6010	Chromium	ND	0.02	NA	mg/L
				TCLP/6010	Lead	ND	0.1	NA	mg/L
				TCLP/6010	Selenium	ND	0.4	NA	mg/L
				TCLP/6010	Silver	0.012 J	0.02	NA	mg/L
				TCLP/7471	Mercury	ND	0.0002	NA	mg/L
015943-4	Liquid	Field	6/1/94	9012	Cyanide	ND	0.01	NA	mg/L
015943-10	Sludge	Field	6/1/94	9010/9012	Cyanide	ND	0.5	NA	mg/kg
015943-13	Liquid	Field	6/1/94	HASL-300	Uranium 238	0.21	0.057	0.09	pCi/L
				HASL-300	Uranium 235	0.024	0.022	0.028	pCi/L
				HASL-300	Uranium 233/234	0.53	0.022	0.16	pCi/L
015943-12	Sludge	Field	6/1/94	HASL-300	Uranium 238	0.99	0.019	0.13	pCi/g
				HASL-300	Uranium 235	0.032	0.019	0.02	pCi/g
				HASL-300	Uranium 233/234	1.9	0.007	0.22	pCi/g
015943-14	Liquid	Field	6/1/94	EPA-600 906.0	Tritium	440	290	180	pCi/L
015943-15	Liquid	Field	6/1/94	Gamma Spec.	Multiple Radionuclides	ND	0.008-5.72	NR	pCi/g
015943-16	Sludge	Field	6/1/94		Thorium Series:				
				Gamma Spec.	Thorium-228	0.05	NR	0.042	pCi/g
					Other Radionuclides:				
				Gamma Spec.	Cesium 137	0.04	NR	0.022	pCi/g
				Gamma Spec.	Potassium 40	1.33	NR	0.27	pCi/g
				Gamma Spec.	Strontium-85	0.01	NR	0.009	pCi/g

Notes

B = Compound detected in asociated blank sample
Det. = Detection
J = Result is detected below the reporting limit or is an estimated concentration.
M.D.A. = Minimum detectable activity
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
ug/L = micrograms per liter
NA = Not Applicable
ND = Not Detected
NR = Not reported by laboratory
pCi/g = Picocuries per gram
pCi/L = Picocuries per liter
pCi/mL = Picocuries per milliliter
SVOCs = Semivolatile organic compounds
TCLP = Toxicity Characteristic Leaching Procedure
VOCs = Volatile organic compounds
* Error = plus or minus 2 sigma uncertainty

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Appendix A.3

ER Site 137
Summary of 1994 PETREX™ Passive Soil-Gas Survey Results

Appendix A.3

ER Site 137
Summary of 1994 PETREX™ Passive Soil-Gas Survey Results

PETREX Relative Soil Gas Response Values
(in ion counts)
STD SITE 137

Sample	PCE	TCE	BTEX	Aliphatics
224	ND	ND	10151	60921
226	ND	ND	3193	10456
227	ND	ND	140901	29858
228	1162	ND	37124	48426
229	ND	ND	ND	ND
230	ND	ND	2499	2484
231	7329	ND	1413324	568239
232	ND	ND	ND	10971
233	ND	ND	1197	10357
234	ND	ND	3156	7098
235	ND	ND	6221	4561
236	ND	ND	ND	ND
237	ND	ND	4620	1751
238	2648	ND	1944	72368
239	1295	ND	12988	30551
240	1134	3524	18266	23522
241	ND	1967	5456	2908
242	ND	ND	3949	25813
243	ND	1253	12322	3186
244	1308	ND	7505	5250
245	1233	1360	21181	8582
246	ND	ND	ND	15537
247	2410	ND	29768	19176
248	ND	ND	19540	23251
249	2030	1322	45421	97158
250	ND	ND	ND	ND
251	ND	ND	29025	12489
252	ND	ND	40978	28417
253	ND	ND	2332	1961
254	ND	ND	1186	3809
255	ND	ND	661793	91690
256	8397	ND	63286	72999
257	ND	ND	65497	29015
258	5811	2452	65422	107875
259	ND	ND	5092	31024
D-1224	ND	ND	27346	44317
D-1236	ND	ND	ND	4072
D-1246	ND	ND	3554	8792

Appendix A.3, continued:

ER Site 137
Summary of 1994 PETREX™ Passive Soil-Gas Survey Results

PETREX Relative Soil Gas Response Values
(in ion counts)
STD SITE 137

D-1250	ND	ND	3897	3262
* 900	ND	ND	4553	6219
* 901	ND	ND	4732	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

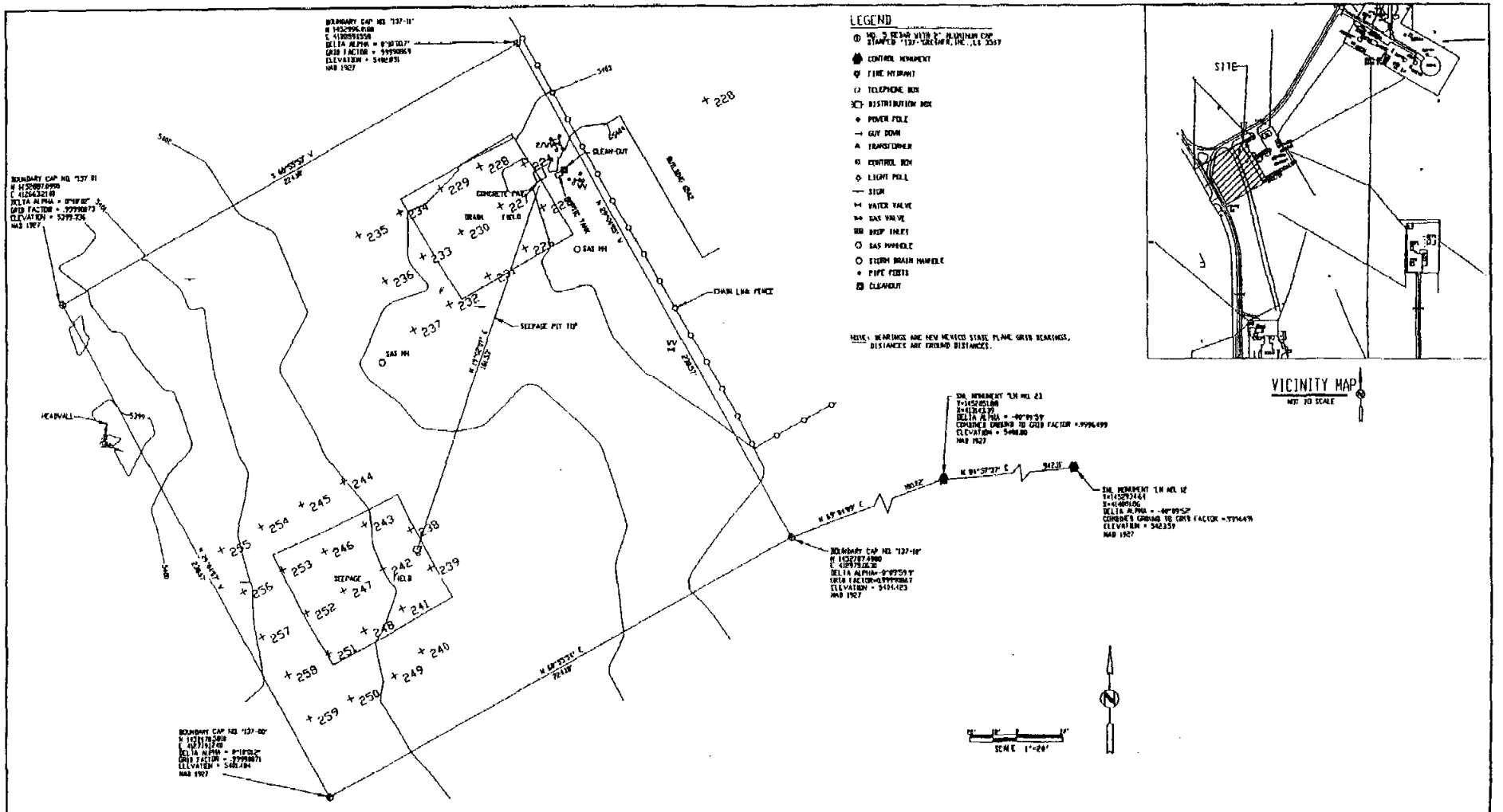
D - Duplicate Sample
Sample numbers in thousands duplicate of sample numbers in hundreds

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

Appendix concluded:

ER Site 137

1994 PETREX™ Passive Soil-Gas Survey Sample Location Map



Northeast Research Institute LLC 903 Parfet Street Suite 100 Lakewood, Colorado 80215 (303) 238-0030	Drawn By: JCS Checked By: Project Manager: JOG	Project #: 2096-137 Date: 5/23/1995 File Name: a161pl.dwg	Sandia National Laboratories STD Site 137 Albuquerque, New Mexico PETREX FINGERPRINT TECHNOLOGY	LEGEND Features: + PETREX Sample Location	Sample Locations Plate 15

Appendix A.4

ER Site 137
Gamma Spectroscopy Screening Results for the North Drainfield
Shallow Interval Composite Soil Sample

Appendix A.4

ER Site 137
Gamma Spectroscopy Screening Results for the North Drainfield
Shallow Interval Composite Soil Sample

```
**********************************************************************
*                    Sandia National Laboratories                    *
*     Radiation Protection Sample Diagnostics Program [881 Laboratory]*
*                        1-09-95  4:36:55 PM                         *
**********************************************************************
*                                                                    *
* Analyzed by: Joseph Cal 1/10/95 Reviewed by:  1/10/95              *
**********************************************************************

Customer            : B.GALLOWAY/E.RANKIN (7582/SMO)
Customer Sample ID  : 018806-03
Lab Sample ID       : 50002003

Sample Description  : MARINELLI SOLID SAMPLE
Sample Type         : Solid
Sample Geometry     : 1SMAR
Sample Quantity     :   772.000  Gram
Sample Date/Time    : 12-08-94  11:15:00 AM
Acquire Start Date  :  1-07-95   6:35:02 AM
Detector Name       : LAB01
Elapsed Live Time   :   3600 seconds
Elapsed Real Time   :   3602 seconds

Comments:
```

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

Nuclide	Activity (pCi/Gram)	2S Error	MDA
U-238	8.63E-01	4.68E-01	9.92E-01
TH-234	8.55E-01	3.03E-01	3.80E-01
U-234	Not Detected	--------	4.01E+01
RA-226	1.07	3.39E-01	3.56E-01
PB-214	5.43E-01	1.47E-01	3.43E-02
BI-214	5.84E-01	1.00E-01	4.07E-02
PB-210	Not Detected	--------	3.70E+02
TH-232	5.99E-01	1.87E-01	1.01E-01
RA-228	6.93E-01	1.61E-01	1.23E-01
AC-228	7.37E-01	1.40E-01	7.34E-02
TH-228	5.39E-01	2.38E-01	3.58E-01
RA-224	3.90E-01	1.99E-01	3.19E-01
PB-212	5.43E-01	1.68E-01	2.94E-02
BI-212	7.08E-01	2.20E-01	2.92E-01
TL-208	5.68E-01	1.08E-01	5.62E-02
U-235	Not Detected	--------	2.09E-01
TH-231	Not Detected	--------	5.15E-01
PA-231	Not Detected	--------	9.30E-01
AC-227	Not Detected	--------	1.46
TH-227	Not Detected	--------	2.89E-01
RA-223	Not Detected	--------	9.50E-01
RN-219	Not Detected	--------	2.13E-01
PB-211	Not Detected	--------	5.35E-01
TL-207	Not Detected	--------	1.39E+01
AM-241	Not Detected	--------	2.15E-01
PU-239	Not Detected	--------	2.47E+02
NP-237	Not Detected	--------	1.86E-01
PA-233	Not Detected	--------	4.72E-02
TH-229	Not Detected	--------	2.54E-01

Appendix A.4, concluded:

ER Site 137
Gamma Spectroscopy Screening Results for the North Drainfield
Shallow Interval Composite Soil Sample

[Summary Report] - Sample ID: 50002003

Nuclide	Activity (pCi/Gram)	2S Error	MDA
AG-110m	Not Detected	--------	3.32E-02
AR-41	Not Detected	--------	1.00E+26
BA-133	Not Detected	--------	5.23E-02
BA-140	Not Detected	--------	4.79E-01
CD-109	Not Detected	--------	6.92E-01
CD-115	Not Detected	--------	5.96E+02
CE-139	Not Detected	--------	2.86E-02
CE-141	Not Detected	--------	8.65E-02
CE-144	Not Detected	--------	2.29E-01
CO-56	Not Detected	--------	3.22E-02
CO-57	Not Detected	--------	3.12E-02
CO-58	Not Detected	--------	4.57E-02
CO-60	Not Detected	--------	4.21E-02
CR-51	Not Detected	--------	3.75E-01
CS-134	Not Detected	--------	3.65E-02
CS-137	Not Detected	--------	3.41E-02
CU-64	Not Detected	--------	7.58E+17
EU-152	Not Detected	--------	2.53E-01
EU-154	Not Detected	--------	1.82E-01
EU-155	Not Detected	--------	1.30E-01
FE-59	Not Detected	--------	1.20E-01
GD-153	Not Detected	--------	1.02E-01
HG-203	Not Detected	--------	3.44E-02
I-131	Not Detected	--------	3.24E-01
IN-115m	Not Detected	--------	1.00E+26
IR-192	Not Detected	--------	2.83E-02
K-40	1.43E+01	2.05	2.24E-01
LA-140	Not Detected	--------	9.16E+03
MN-54	Not Detected	--------	3.86E-02
MN-56	Not Detected	--------	1.00E+26
MO-99	Not Detected	--------	4.91E+02
NA-22	Not Detected	--------	4.70E-02
NA-24	Not Detected	--------	8.49E+12
NB-95	Not Detected	--------	4.00E+01
ND-147	Not Detected	--------	1.18
NI-57	Not Detected	--------	6.16E+04
BE-7	Not Detected	--------	3.31E-01
RU-103	Not Detected	--------	4.15E-02
RU-106	Not Detected	--------	2.87E-01
SB-122	Not Detected	--------	7.29E+01
SB-124	Not Detected	--------	3.95E-02
SB-125	Not Detected	--------	7.37E-02
SC-46	Not Detected	--------	7.33E-02
SR-85	Not Detected	--------	4.73E-02
TA-182	Not Detected	--------	1.99E-01
TA-183	Not Detected	--------	1.07E+01
TE-132	Not Detected	--------	1.24E+01
TL-201	Not Detected	--------	8.65E+01
XE-133	Not Detected	--------	1.28E+03
Y-88	Not Detected	--------	4.48E-02
ZN-65	Not Detected	--------	1.16E-01
ZR-95	Not Detected	--------	7.93E-02

Appendix A.5

ER Site 137
Gamma Spectroscopy Screening Results for the North Drainfield
Deep Interval Composite Soil Sample

Appendix A.5

ER Site 137
Gamma Spectroscopy Screening Results for the North Drainfield
Deep Interval Composite Soil Sample

```
**********************************************************************
*                  Sandia National Laboratories                      *
*    Radiation Protection Sample Diagnostics Program [881 Laboratory]  *
*                       1-09-95  4:47:17 PM                          *
**********************************************************************
*                                                                    *
* Analyzed by: Glenn Cole 1/10/95 Reviewed by:  1/18/95              *
**********************************************************************

Customer           : B.GALLOWAY/E.RANKIN (7582/SMO)
Customer Sample ID : 018807-03
Lab Sample ID      : 50002004

Sample Description : MARINELLI SOLID SAMPLE
Sample Type        : Solid
Sample Geometry    : 1SMAR
Sample Quantity    :   847.000  Gram
Sample Date/Time   : 12-08-94  11:50:00 AM
Acquire Start Date :  1-07-95   7:56:41 AM
Detector Name      : LAB01
Elapsed Live Time  :   3600 seconds
Elapsed Real Time  :   3602 seconds

Comments:
```

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Nuclide	Activity (pCi/Gram)	2S Error	MDA
U-238	Not Detected	--------	1.46
TH-234	7.50E-01	2.79E-01	3.55E-01
U-234	Not Detected	--------	3.91E+01
RA-226	1.11	3.43E-01	3.32E-01
PB-214	5.51E-01	1.49E-01	3.24E-02
BI-214	5.98E-01	1.01E-01	3.74E-02
PB-210	Not Detected	--------	3.45E+02
TH-232	5.24E-01	1.66E-01	9.61E-02
RA-228	6.19E-01	1.44E-01	1.25E-01
AC-228	6.98E-01	1.32E-01	7.28E-02
TH-228	4.87E-01	2.20E-01	3.33E-01
RA-224	4.91E-01	2.14E-01	2.92E-01
PB-212	5.76E-01	1.76E-01	2.70E-02
BI-212	7.46E-01	2.14E-01	2.69E-01
TL-208	5.52E-01	1.05E-01	5.19E-02
U-235	Not Detected	--------	1.96E-01
~~TH-231~~	~~3.52E-01~~	~~1.30E-01~~	~~2.60E-01~~ not detected 1/10/95
PA-231	Not Detected	--------	8.86E-01
AC-227	Not Detected	--------	1.39
TH-227	Not Detected	--------	2.81E-01
RA-223	Not Detected	--------	9.11E-01
RN-219	Not Detected	--------	2.05E-01
PB-211	Not Detected	--------	5.50E-01
TL-207	Not Detected	--------	1.34E+01
AM-241	Not Detected	--------	2.01E-01
PU-239	Not Detected	--------	1.48E+02
NP-237	Not Detected	--------	1.72E-01
PA-233	Not Detected	--------	4.53E-02
TH-229	Not Detected	--------	2.44E-01

Appendix A.5, concluded:

ER Site 137
Gamma Spectroscopy Screening Results for the North Drainfield
Deep Interval Composite Soil Sample

[Summary Report] - Sample ID: 50002004

Nuclide	Activity (pCi/Gram)	2S Error	MDA
AG-110m	Not Detected	--------	3.18E-02
AR-41	Not Detected	--------	1.00E+26
BA-133	Not Detected	--------	5.04E-02
BA-140	Not Detected	--------	4.79E-01
CD-109	~~2.00E-01~~	~~4.75E-01~~	~~6.41E-01~~ not detected 1/10/95
CD-115	Not Detected	--------	5.64E+02
CE-139	Not Detected	--------	2.70E-02
CE-141	Not Detected	--------	8.29E-02
CE-144	Not Detected	--------	2.14E-01
CO-56	Not Detected	--------	4.73E-02
CO-57	Not Detected	--------	2.89E-02
CO-58	Not Detected	--------	4.14E-02
CO-60	Not Detected	--------	3.96E-02
CR-51	Not Detected	--------	3.69E-01
CS-134	Not Detected	--------	3.36E-02
CS-137	Not Detected	--------	3.39E-02
CU-64	Not Detected	--------	7.35E+17
EU-152	Not Detected	--------	2.39E-01
EU-154	Not Detected	--------	1.73E-01
EU-155	Not Detected	--------	1.24E-01
FE-59	Not Detected	--------	1.06E-01
GD-153	Not Detected	--------	9.52E-02
HG-203	Not Detected	--------	3.21E-02
I-131	Not Detected	--------	2.83E-01
IN-115m	Not Detected	--------	1.00E+26
IR-192	Not Detected	--------	2.80E-02
K-40	1.50E+01	2.15	1.95E-01
LA-140	Not Detected	--------	8.87E+03
MN-54	~~2.00E-02~~	~~1.06E-02~~	~~1.97E-02~~ not detected 1/10/95
MN-56	Not Detected	--------	1.00E+26
MO-99	Not Detected	--------	4.63E+02
NA-22	Not Detected	--------	4.17E-02
NA-24	Not Detected	--------	8.35E+12
NB-95	~~1.05E+01~~	~~7.67~~	~~1.45E+01~~ not detected 1/10/95
ND-147	Not Detected	--------	1.13
NI-57	Not Detected	--------	6.34E+04
BE-7	Not Detected	--------	2.97E-01
RU-103	Not Detected	--------	3.99E-02
RU-106	Not Detected	--------	2.86E-01
SB-122	Not Detected	--------	7.28E+01
SB-124	Not Detected	--------	3.61E-02
SB-125	Not Detected	--------	6.95E-02
SC-46	Not Detected	--------	6.87E-02
SR-85	Not Detected	--------	4.43E-02
TA-182	Not Detected	--------	1.89E-01
TA-183	Not Detected	--------	1.00E+01
TE-132	Not Detected	--------	1.17E+01
TL-201	Not Detected	--------	8.31E+01
XE-133	Not Detected	--------	1.23E+03
Y-88	Not Detected	--------	4.11E-02
ZN-65	Not Detected	--------	1.05E-01
ZR-95	Not Detected	--------	8.11E-02

Appendix A.6

ER Site 137
Gamma Spectroscopy Screening Results for the South Drainfield
Shallow Interval Composite Soil Sample

Appendix A.6

ER Site 137
Gamma Spectroscopy Screening Results for the South Drainfield
Shallow Interval Composite Soil Sample

```
**********************************************************************
*                    Sandia National Laboratories                    *
*    Radiation Protection Sample Diagnostics Program [881 Laboratory]*
*                        1-09-95  4:15:20 PM                         *
**********************************************************************
*                                                                    *
* Analyzed by: Steven Cole 1/10/95   Reviewed by:  1/10/95           *
**********************************************************************

Customer            : B.GALLOWAY/E.RANKIN (7582/SMO)
Customer Sample ID  : 018765-03
Lab Sample ID       : 50002001

Sample Description  : MARINELLI SOLID SAMPLE
Sample Type         : Solid
Sample Geometry     : 1SMAR
Sample Quantity     :   612.000  Gram
Sample Date/Time    : 12-05-94  10:10:00 AM
Acquire Start Date  :  1-07-95   3:51:14 AM
Detector Name       : LAB01
Elapsed Live Time   :   3600 seconds
Elapsed Real Time   :   3602 seconds

Comments:
```

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****

Nuclide	Activity (pCi/Gram)	2S Error	MDA
U-238	Not Detected	--------	1.73
TH-234	1.00	3.89E-01	4.48E-01
U-234	Not Detected	--------	4.58E+01
RA-226	1.30	4.10E-01	4.10E-01
PB-214	5.72E-01	1.56E-01	4.34E-02
BI-214	6.17E-01	1.08E-01	4.94E-02
PB-210	Not Detected	--------	4.50E+02
TH-232	5.77E-01	1.86E-01	1.23E-01
RA-228	7.90E-01	1.85E-01	1.47E-01
AC-228	7.76E-01	1.53E-01	9.15E-02
TH-228	3.35E-01	2.16E-01	4.10E-01
RA-224	3.68E-01	2.12E-01	3.42E-01
PB-212	5.90E-01	1.84E-01	3.18E-02
BI-212	8.19E-01	2.49E-01	3.06E-01
TL-208	5.85E-01	1.16E-01	6.69E-02
U-235	Not Detected	--------	2.39E-01
~~TH-231~~	~~3.21E-01~~	~~1.76E-01~~	~~3.35E-01~~ not detected 1/10/95
PA-231	Not Detected	--------	1.07
AC-227	Not Detected	--------	1.68
TH-227	Not Detected	--------	3.34E-01
RA-223	Not Detected	--------	1.34
RN-219	Not Detected	--------	2.51E-01
PB-211	Not Detected	--------	6.19E-01
TL-207	Not Detected	--------	1.59E+01
AM-241	Not Detected	--------	2.44E-01
~~PU-239~~	~~1.00E+02~~	~~8.39E+01~~	~~1.73E+02~~ not detected 1/10/95
NP-237	Not Detected	--------	2.18E-01
PA-233	Not Detected	--------	5.70E-02
TH-229	Not Detected	--------	2.96E-01

Appendix A.6, concluded:

ER Site 137
Gamma Spectroscopy Screening Results for the South Drainfield
Shallow Interval Composite Soil Sample

[Summary Report] - Sample ID: 50002001

Nuclide	Activity (pCi/Gram)	2S Error	MDA
AG-110m	Not Detected	--------	4.13E-02
AR-41	Not Detected	--------	1.00E+26
BA-133	Not Detected	--------	6.18E-02
BA-140	Not Detected	--------	6.85E-01
CD-109	~~2.24E-01~~	~~4.79E-01~~	~~8.22E-01~~ Not detected 1/10/95
CD-115	Not Detected	--------	1.70E+03
CE-139	Not Detected	--------	3.31E-02
CE-141	Not Detected	--------	1.06E-01
CE-144	Not Detected	--------	2.65E-01
CO-56	Not Detected	--------	3.70E-02
CO-57	Not Detected	--------	3.52E-02
CO-58	Not Detected	--------	5.00E-02
CO-60	Not Detected	--------	5.21E-02
CR-51	Not Detected	--------	4.99E-01
CS-134	Not Detected	--------	4.38E-02
CS-137	Not Detected	--------	4.29E-02
CU-64	Not Detected	--------	4.35E+19
EU-152	Not Detected	--------	3.05E-01
EU-154	Not Detected	--------	2.03E-01
EU-155	Not Detected	--------	1.49E-01
FE-59	Not Detected	--------	1.41E-01
GD-153	Not Detected	--------	1.18E-01
HG-203	Not Detected	--------	4.20E-02
I-131	Not Detected	--------	4.82E-01
IN-115m	Not Detected	--------	1.00E+26
IR-192	Not Detected	--------	3.51E-02
K-40	1.60E+01	2.32	2.70E-01
LA-140	Not Detected	--------	3.55E+04
MN-54	Not Detected	--------	4.73E-02
MN-56	Not Detected	--------	1.00E+26
MO-99	Not Detected	--------	1.22E+03
NA-22	Not Detected	--------	6.08E-02
NA-24	Not Detected	--------	2.73E+14
NB-95	Not Detected	--------	8.14E+01
ND-147	Not Detected	--------	1.70
NI-57	Not Detected	--------	2.91E+05
BE-7	Not Detected	--------	3.95E-01
RU-103	Not Detected	--------	5.35E-02
RU-106	Not Detected	--------	3.47E-01
SB-122	Not Detected	--------	1.89E+02
SB-124	Not Detected	--------	4.96E-02
SB-125	Not Detected	--------	8.85E-02
SC-46	Not Detected	--------	9.07E-02
SR-85	Not Detected	--------	5.72E-02
TA-182	Not Detected	--------	2.48E-01
TA-183	Not Detected	--------	1.80E+01
TE-132	Not Detected	--------	2.60E+01
TL-201	Not Detected	--------	1.95E+02
XE-133	Not Detected	--------	3.80E+03
Y-88	Not Detected	--------	5.99E-02
ZN-65	Not Detected	--------	1.37E-01
ZR-95	Not Detected	--------	9.79E-02

Appendix A.7

ER Site 137
Gamma Spectroscopy Screening Results for the South Drainfield
Deep Interval Composite Soil Sample

Appendix A.7

ER Site 137
Gamma Spectroscopy Screening Results for the South Drainfield
Deep Interval Composite Soil Sample

```
**********************************************************************
*                    Sandia National Laboratories                    *
*     Radiation Protection Sample Diagnostics Program [881 Laboratory]*
*                         1-09-95  4:02:39 PM                        *
**********************************************************************
*
* Analyzed by: James J Cole 1/10/95   Reviewed by:  1/10/95          *
**********************************************************************

Customer          : B.GALLOWAY/E.RANKIN (7582/SMO)
Customer Sample ID : 018766-03
Lab Sample ID     : 50002002

Sample Description : MARINELLI SOLID SAMPLE
Sample Type       : Solid
Sample Geometry   : 1SMAR
Sample Quantity   :  1001.000  Gram
Sample Date/Time  : 12-05-94  10:40:00 AM
Acquire Start Date :  1-07-95   5:13:02 AM
Detector Name     : LAB01
Elapsed Live Time  :   3600 seconds
Elapsed Real Time  :   3602 seconds

Comments:
```

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Nuclide	Activity (pCi/Gram)	2S Error	MDA
U-238	6.02E-01	3.67E-01	8.11E-01
TH-234	4.17E-01	2.50E-01	3.16E-01
U-234	Not Detected	--------	3.17E+01
RA-226	6.53E-01	2.26E-01	2.88E-01
PB-214	4.30E-01	1.18E-01	2.83E-02
BI-214	4.64E-01	7.93E-02	3.28E-02
PB-210	Not Detected	--------	3.03E+02
TH-232	4.32E-01	1.37E-01	8.24E-02
RA-228	5.41E-01	1.23E-01	1.03E-01
AC-228	5.51E-01	1.06E-01	6.51E-02
TH-228	3.99E-01	1.83E-01	2.81E-01
RA-224	3.63E-01	2.09E-01	2.49E-01
PB-212	4.33E-01	1.33E-01	2.31E-02
BI-212	6.12E-01	1.77E-01	2.16E-01
TL-208	4.04E-01	7.86E-02	4.62E-02
U-235	Not Detected	--------	1.69E-01
TH-231	~~1.78E-01~~	~~1.31E-01~~	~~2.36E-01~~ not detected JJC 1/10/95
PA-231	Not Detected	--------	7.51E-01
AC-227	Not Detected	--------	1.19
TH-227	Not Detected	--------	2.26E-01
RA-223	Not Detected	--------	9.28E-01
RN-219	Not Detected	--------	1.71E-01
PB-211	Not Detected	--------	4.40E-01
TL-207	Not Detected	--------	1.13E+01
AM-241	Not Detected	--------	1.74E-01
PU-239	Not Detected	--------	1.26E+02
NP-237	Not Detected	--------	1.52E-01
PA-233	Not Detected	--------	3.79E-02
TH-229	Not Detected	--------	2.16E-01

Appendix A.7, concluded:

ER Site 137
Gamma Spectroscopy Screening Results for the South Drainfield
Deep Interval Composite Soil Sample

[Summary Report] - Sample ID: 50002002

Nuclide	Activity (pCi/Gram)	2S Error	MDA
AG-110m	Not Detected	--------	2.70E-02
AR-41	Not Detected	--------	1.00E+26
BA-133	Not Detected	--------	4.12E-02
BA-140	Not Detected	--------	4.60E-01
CD-109	Not Detected	--------	5.47E-01
CD-115	Not Detected	--------	1.17E+03
CE-139	Not Detected	--------	2.41E-02
CE-141	Not Detected	--------	7.59E-02
CE-144	Not Detected	--------	1.89E-01
CO-56	Not Detected	--------	2.55E-02
CO-57	Not Detected	--------	2.53E-02
CO-58	Not Detected	--------	3.66E-02
CO-60	Not Detected	--------	3.35E-02
CR-51	Not Detected	--------	3.32E-01
CS-134	Not Detected	--------	2.84E-02
CS-137	Not Detected	--------	2.87E-02
CU-64	Not Detected	--------	2.85E+19
EU-152	Not Detected	--------	2.09E-01
EU-154	Not Detected	--------	1.37E-01
EU-155	Not Detected	--------	1.07E-01
FE-59	Not Detected	--------	1.12E-01
GD-153	Not Detected	--------	8.72E-02
HG-203	Not Detected	--------	2.97E-02
I-131	Not Detected	--------	3.05E-01
IN-115m	Not Detected	--------	1.00E+26
IR-192	Not Detected	--------	2.41E-02
K-40	1.46E+01	2.07	1.70E-01
LA-140	Not Detected	--------	2.58E+04
MN-54	Not Detected	--------	3.22E-02
MN-56	Not Detected	--------	1.00E+26
MO-99	Not Detected	--------	8.47E+02
NA-22	Not Detected	--------	3.88E-02
NA-24	Not Detected	--------	1.84E+14
NB-95	Not Detected	--------	5.55E+01
ND-147	Not Detected	--------	1.15
NI-57	Not Detected	--------	1.92E+05
BE-7	Not Detected	--------	2.70E-01
RU-103	Not Detected	--------	3.62E-02
RU-106	Not Detected	--------	2.22E-01
SB-122	Not Detected	--------	1.38E+02
SB-124	Not Detected	--------	3.21E-02
SB-125	Not Detected	--------	6.12E-02
SC-46	Not Detected	--------	6.02E-02
SR-85	Not Detected	--------	3.79E-02
TA-182	Not Detected	--------	1.67E-01
TA-183	Not Detected	--------	1.29E+01
TE-132	Not Detected	--------	1.79E+01
TL-201	Not Detected	--------	1.37E+02
XE-133	Not Detected	--------	2.70E+03
Y-88	Not Detected	--------	3.54E-02
ZN-65	Not Detected	--------	9.22E-02
ZR-95	Not Detected	--------	7.00E-02

Appendix A.8

ER Site 137
Gamma Spectroscopy Screening Results for the Soil Sample
Collected Beneath the North System Septic Tank

ER Site 137
Gamma Spectroscopy Screening Results for the Soil Sample
Collected Beneath the North System Septic Tank

```
**********************************************************************
*                    Sandia National Laboratories                    *
*     Radiation Protection Sample Diagnostics Program [881 Laboratory]*
*                      10-20-95 10:08:38 PM                          *
**********************************************************************
*                                                                    *
* Analyzed by:                  10/24/95  Reviewed by:   10/24/95    *
**********************************************************************

Customer            : B.GALLOWAY/E.RANKIN (7582/SMO)
Customer Sample ID  : 026085-05
Lab Sample ID       : 50085202

Sample Description  : MARINELLI SOIL SAMPLE
Sample Type         : Solid
Sample Geometry     : 2SMAR
Sample Quantity     :   907.000  gram
Sample Date/Time    : 10-18-95   1:15:00 PM
Acquire Start Date  : 10-20-95   8:25:36 PM
Detector Name       : LAB02
Elapsed Live Time   :   6000 seconds
Elapsed Real Time   :   6003 seconds

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

Nuclide	Activity (pCi/gram)	2S Error	MDA
U-238	Not Detected	--------	2.25
TH-234	Not Detected	--------	5.42E-01
U-234	Not Detected	--------	3.75E-01
RA-226	8.13E-01	3.17E-01	4.42E-01
PB-214	4.49E-01	7.65E-02	4.98E-02
BI-214	4.48E-01	7.56E-02	5.87E-02
PB-210	Not Detected	--------	3.54E+02
TH-232	4.16E-01	1.30E-01	1.62E-01
RA-228	4.78E-01	2.80E-01	1.02E-01
AC-228	4.61E-01	1.02E-01	1.01E-01
TH-228	4.56E-01	1.66E-01	3.52E-01
RA-224	5.36E-01	2.60E-01	2.49E-01
PB-212	4.43E-01	7.94E-02	2.83E-02
BI-212	4.41E-01	2.05E-01	2.92E-01
TL-208	4.05E-01	7.61E-02	6.09E-02
U-235	Not Detected	--------	1.73E-01
TH-231	Not Detected	--------	3.98E-01
PA-231	Not Detected	--------	9.55E-01
AC-227	Not Detected	--------	1.20
TH-227	Not Detected	--------	2.40E-01
RA-223	Not Detected	--------	1.44E-01
RN-219	Not Detected	--------	3.41E-01
PB-211	Not Detected	--------	4.58E-01
TL-207	Not Detected	--------	9.26
AM-241	Not Detected	--------	3.86E-01
PU-239	Not Detected	--------	1.98E+02
NP-237	Not Detected	--------	2.54E-01
PA-233	Not Detected	--------	4.09E-02
TH-229	Not Detected	--------	2.02E-01

Appendix A.8, concluded:

ER Site 137
Gamma Spectroscopy Screening Results for the Soil Sample
Collected Beneath the North System Septic Tank

[Summary Report] - Sample ID: 50085202

Nuclide	Activity (pCi/gram)	2S Error	MDA
AG-110m	Not Detected	--------	2.08E-02
AR-41	Not Detected	--------	4.57E+07
BA-133	Not Detected	--------	4.12E-02
BA-140	Not Detected	--------	8.31E-02
CD-109	Not Detected	--------	8.65E-01
CD-115	Not Detected	--------	9.33E-02
CE-139	Not Detected	--------	2.12E-02
CE-141	Not Detected	--------	4.04E-02
CE-144	Not Detected	--------	1.74E-01
CO-56	Not Detected	--------	2.60E-02
CO-57	Not Detected	--------	2.31E-02
CO-58	Not Detected	--------	2.26E-02
CO-60	Not Detected	--------	2.61E-02
CR-51	Not Detected	--------	1.64E-01
CS-134	Not Detected	--------	3.69E-02
CS-137	Not Detected	--------	2.47E-02
CU-64	Not Detected	--------	1.15E+02
EU-152	Not Detected	--------	1.83E-01
EU-154	Not Detected	--------	1.27E-01
EU-155	Not Detected	--------	1.00E-01
FE-59	Not Detected	--------	5.18E-02
GD-153	Not Detected	--------	7.97E-02
HG-203	Not Detected	--------	2.08E-02
I-131	Not Detected	--------	2.32E-02
IN-115m	Not Detected	--------	2.61E+02
IR-192	Not Detected	--------	1.93E-02
K-40	1.15E+01	1.59	2.73E-01
LA-140	Not Detected	--------	6.49E-02
MN-54	Not Detected	--------	2.36E-02
MN-56	Not Detected	--------	8.81E+04
MO-99	Not Detected	--------	3.21E-01
NA-22	Not Detected	--------	2.92E-02
NA-24	Not Detected	--------	3.16E-01
NB-95	Not Detected	--------	1.73E-01
ND-147	Not Detected	--------	1.57E-01
NI-57	Not Detected	--------	9.57E-02
BE-7	Not Detected	--------	1.74E-01
RU-103	Not Detected	--------	2.01E-02
RU-106	Not Detected	--------	2.00E-01
SB-122	Not Detected	--------	5.04E-02
SB-124	Not Detected	--------	2.38E-02
SB-125	Not Detected	--------	5.80E-02
SC-46	Not Detected	--------	3.73E-02
SR-85	Not Detected	--------	2.62E-02
TA-182	Not Detected	--------	1.10E-01
TA-183	Not Detected	--------	4.59E-01
TE-132	Not Detected	--------	3.18E-02
TL-201	Not Detected	--------	1.83E-01
V-48	Not Detected	--------	2.74E-02
XE-133	Not Detected	--------	1.80E-01
Y-88	Not Detected	--------	1.98E-02
ZN-65	Not Detected	--------	7.42E-02
ZR-95	Not Detected	--------	4.15E-02

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

SEP 15 1998

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,

George K. Lasker

for Michael J. Zamorski
Area Manager

Enclosure

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

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

Sandia National Laboratories
Albuquerque, New Mexico
September 1999

Environmental Restoration Project
Responses to NMED Request for Supplemental Information
No Further Action Proposals (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

This response document is organized on the first level by OU number and on the second level by ER site number. Each OU section restates the New Mexico Environment Department comments (in **bold** font) in the same order in which they were provided in the call for response to comments. Following each comment, the word "Response" introduces the reply (in normal font style) of the U.S. Department of Energy/Sandia National Laboratories/New Mexico. Responses to general technical comments begin on page 4 and responses to site-specific technical comments begin on page 7. Additional supporting information for the site-specific comments is included in the attachments that follow each OU section. Changes to previously submitted text or tables are provided with redline/strikeout indicators and are labeled "Revised." Changes to previously submitted figures are not provided with redline/strikeout indicators but are labeled "Revised." Newly submitted information (including text, tables, and figures) is labeled "Supplemental."

TABLE OF CONTENTS

RESPONSES TO COMMENTS ON NO FURTHER ACTION PROPOSALS JANUARY 1997 (6TH ROUND)

GENERAL COMMENTS

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

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

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

   Response: All tables will be completed as requested.

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

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

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

   Response: The additional information will be provided for those specific NFAs for which such information has been requested as part of this Request for Supplemental

Information. J-coded data will be reported as detects, as previously agreed to between the U.S. Department of Energy, Sandia National Laboratories/New Mexico and the Hazardous and Radioactive Materials Bureau.

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

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

6. **To ensure that appropriate background levels are utilized, Area or Super Groups need to be specified for all NFA proposals. The background levels shown in the tables and discussed in the text of some NFA proposals are not approved values.**

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

7. **Composite sample results and analyses of TCLP/EP Toxicity constituents are not acceptable for the purpose of site characterization.**

   Response: Where samples have been composited for site characterization, the U.S. Department of Energy and Sandia National Laboratories/New Mexico will confer with Mr. Will Moats of the Hazardous and Radioactive Materials Bureau to designate locations and analytes for additional discrete samples. Compositing and toxicity characteristic leaching procedure/extraction procedure were used to guide assessment activities and are used to add to the total picture of nature and extent at the individual sites, rather than as a sole basis for evaluation.

8. **Because they are designed to discharge liquids, all septic systems are a potential threat to ground water. Even if concentrations of contaminants in the unsaturated zone are low, it has been demonstrated that large septic systems (such as those at TA-5) can cause ground-water contamination at depths of as much as 500 ft. In recognition of this, the threat to ground water posed by smaller septic systems can not be ignored by the HRMB.**

   In most cases, DOE/SNL can only speculate as to the volume of wastes and the total volume of liquids that may have been discharged into a small septic system. Over 20-30 year periods, the larger discharge rates reported for some of these smaller septic systems appear to be sufficient to drive contaminated liquids to the water. Additionally, a number of small septic systems are located in canyon or pediment areas where the unsaturated zone is made up chiefly of permeable gravel, sand, and potentially permeable fractured bedrock, and where ground water is relatively shallow. There is certainly potential in these cases that hazardous constituents (such

as VOC's and cyanide) can cause ground water to become contaminated to unacceptable levels.

Therefore, HRMB will not approve NFA status for any septic systems without ground-water characterization, unless the agency can gain confidence that such approvals will be protective of human health and the environment. The only way that HRMB can achieve such confidence is for DOE/SNL to conduct a study of a sample population of septic systems. HRMB wishes to negotiate a technical and decision-making approach for such a study, so that this issue can be resolved and significant progress can be achieved in a timely manner.

Response: It is anticipated that the recently negotiated characterization strategy for the remaining septic systems will provide the basis upon which to evaluate the impacts that these units may have had on the groundwater. This strategy is detailed in "Sampling and Analysis Plan (SAP) for Characterizing and Assessing Potential Releases to the Environment from Septic and Other Miscellaneous Drain Systems at Sandia National Laboratories/New Mexico" (May 1999). This sampling and analysis plan is currently in the process of being transmitted to New Mexico Environment Department for final signature approval.

Site-Specific Comments

SPECIFIC COMMENTS

OU 1295

ER Site 137, Building 6540/6542 Septic System

ER Site 137 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: Revised Figures 1-1 and 1-2 are provided without the word "draft" in Attachment A.

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

   Response: Soil samples taken from ER Site 137 in 1994 were analyzed by an off-site commercial laboratory (Quanterra in Arvada, Colorado) for organic constituents, including volatile organic compounds, using EPA Method 8240, and semivolatile organic compounds using EPA Method 8270. The analytical report 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 and semivolatile organic compound constituents for which these samples were analyzed and their respective reporting limits are provided in Attachment B.

3. **Cyanide must be included in the risk assessment.**

   Response: Cyanide was detected at one location at the site at a concentration of 920 micrograms per kilogram (µg/kg) but was not included in the risk assessment section of the ER Site 137 NFA proposal. The risk screening assessment methodology used to evaluate potential human health and ecological risk at Sandia National Laboratories/ New Mexico environmental restoration sites has changed considerably since the NFA proposal for ER Site 137 was written in January 1997. It is also possible that additional deep soil vapor sampling, and perhaps even groundwater monitoring, may be required at this site in the future, in accordance with procedures specified in the "Sampling and Analysis Plan for Characterizing and Assessing Potential Releases to the Environment From Septic and Other Miscellaneous Drain Systems at Sandia National Laboratories/ New Mexico." This sampling and analysis plan is currently in the final stages of review and approval by representatives of the New Mexico Environment Department, Sandia National Laboratories/New Mexico, and the U.S. Department of Energy. The risk screening assessment for this site will be conducted again when all sampling has been completed at the site and will follow the most current risk assessment procedures in place at the time the new evaluation is completed.

Site-Specific Comments

4. See general comment 8.

Response: Sandia National Laboratories/New Mexico recognizes that this and other potential deep groundwater environmental restoration septic and drain system sites may be candidates for deep soil vapor sampling and perhaps for groundwater monitoring in accordance with procedures specified in the sampling and analysis plan. However, 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.

Site-Specific Comments

ER Site 140, Building 9965 Septic System

ER Site 140 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 C.

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

   Response: Soil samples and an associated aqueous equipment blank sample taken from ER Site 140 in late 1994 and early 1995 were analyzed by an off-site commercial laboratory (Quanterra in Arvada, Colorado) for organic constituents, including volatile organic compounds using EPA Method 8240 and semivolatile organic compounds using EPA Method 8270. The analytical report 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 and semivolatile organic compound constituents for which these samples were analyzed and their respective reporting limits are provided in Attachment D.

3. **Cyanide and selenium must be evaluated in a risk assessment.**

   Response: Cyanide was detected at concentrations of 1,200 to 1,800 µg/kg in three soil samples from three boring locations at the site. Selenium was also detected at concentrations of 4.5 and 4.6 mg/kg at two boring locations; these selenium concentrations are above the maximum approved background concentration of 1 mg/kg. A risk screening assessment was not completed for ER Site 140 because all concentrations of constituents of concern at the site were detected at less than their respective Resource Conservation and Recovery Act proposed Subpart S action levels. However, the risk screening assessment methodology has changed considerably since the NFA proposal for ER Site 140 was written in January 1997. It is also possible that additional deep soil vapor sampling, and perhaps even groundwater monitoring, may be required at this site in the future, in accordance with procedures specified in the sampling and analysis plan. This sampling and analysis plan is currently in the final stages of review and approval by representatives of the New Mexico Environment Department, Sandia National Laboratories/New Mexico, and the U.S. Department of Energy. The risk screening assessment for this site will be conducted again when all sampling has been completed at the site and will follow the most current risk assessment procedures in place at the time the new evaluation is completed.

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 for 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.

5. **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). How deep is the seepage pit?**

Response: The "Septic Tanks and Drainfields (ADS-1295), RCRA Facility Investigation Work Plan" (hereinafter referred to as the Work Plan), which was completed in March 1993, states that effluent discharge rates from Building 9965 were estimated to range from 10 to 500 gallons per day. This suggested effluent rate was based on the number of full- and part-time people who, it was estimated, worked in Building 9965 since it was constructed in 1965. Based on the estimated length of time the building septic and drain systems were in operation (1965 to approximately 1992, or approximately 28 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 70,000 to 3,500,000 gallons.

Historical engineering drawings maintained by Sandia National Laboratories/New Mexico indicate that the drain line from Building 9965 to the septic tank and seepage pit southwest of the building was constructed of 4-inch diameter vitrified clay pipe. Engineering drawings also indicate that the drain line from the building to the drywell on the northeastern corner of the building consisted of 2-inch diameter pipe.

The top of the aggregate in the southwest seepage pit was 8 feet below ground surface prior to sampling. Engineering drawings from Sandia National Laboratories/New Mexico facilities indicated that the aggregate layer in the bottom of the typical seepage pit constructed at Sandia National Laboratories/New Mexico was approximately 3 feet thick. It was, therefore, assumed that the aggregate layer in the seepage pit at this site was 3 feet thick. This would result in a total depth of the seepage pit of 11 feet below ground surface. The base of the aggregate in the drywell northeast of Building 9965 was determined through backhoe excavation to be 8 feet below ground surface.

6. **A deep sample was not collected at the seepage pit (the maximum sampling depth was only 11 ft) because of tool refusal. Ground-water monitor wells may need to be installed at this site.**

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 for 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.

Site-Specific Comments

ER Site 150, Building 9939/9939A Septic System

ER Site 150 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 E.

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

   Response: Soil samples taken from ER Site 150 in early 1995 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, and polychlorinated biphenyls using EPA Method 8080. 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, and polychlorinated biphenyl constituents for which these samples were analyzed, and their respective reporting limits are provided in Attachment F.

3. **See general comment 8.**

   Response: See response to Specific Comment 5 below.

4. **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), and the depths of the two seepage pits and the drainfield lines.**

   Response: The Work Plan states that Building 9939 was built in 1967, but was not operated until 1977. Building 9939A was constructed sometime between 1977 and 1979. The Work Plan also states that estimated effluent discharge rates ranged from 20 to 400 gallons per day based on the number of full- and part-time people who, it was estimated, worked at the facility. Therefore, based on the estimated length of time the Building 9939 septic system, and the Building 9939A drainfield were in operation (no earlier than 1977 to approximately 1992, or approximately 16 years), and assuming a 5 day-per-week, 50 week-per-year operation (probably an overestimate for this facility), the total amount of effluent discharged from the facility would have ranged from 80,000 to 1,600,000 gallons.

   Historical engineering drawings maintained by Sandia National Laboratories/New Mexico indicate that the drain lines from Building 9939 to the septic tank and seepage pits southeast of the building were constructed of 4-inch diameter pipe. The depth below ground surface to the top of the aggregate in the two seepage pits was 5 feet below ground surface. Engineering drawings from Sandia National Laboratories/New Mexico facilities

indicated that the aggregate layer in the bottom of the typical seepage pit constructed at Sandia National Laboratories/New Mexico was about 3 feet thick. It was, therefore, assumed that the aggregate layer in the seepage pits at this site were 3 feet thick. This would result in an assumed bottom of the aggregate layer and seepage pit at 8 feet below ground surface.

A backhoe was used to pinpoint the physical location of the drain lines of the small drain field serving Building 9939A, and it was determined that the lines were constructed of 4-inch diameter cast iron and were buried approximately 2.5 feet below ground surface.

5. **A deep sample was not collected at the seepage pit (the maximum sampling depth was only 8 ft) or the drainfield (the maximum sampling depth was only 4 ft).. Ground-water monitor wells may need to be installed at this site.**

Response: Soil samples were collected to a maximum depth of 8 feet below ground surface, which is the top of the very shallow subsurface bedrock at this site. In accordance with the sampling and analysis plan, ER Site 150 qualifies as a potential shallow groundwater site. Therefore, the "trigger levels" of constituents of concern for soil samples from potential shallow groundwater sites presented in the sampling and analysis plan were reviewed to determine whether concentrations of constituents of concern detected in any of the ER Site 150 soil samples exceeded any "trigger levels," and no exceedances were identified. Therefore, no additional characterization work is required and the NFA petition for ER Site 150 should be granted.

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.

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.

Site-Specific Comments

ER Site 153, Building 9956 Septic System

ER Site 153 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 I.

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

   Response: Soil samples taken from ER Site 153 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, and high explosive 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, and high explosives constituents for which these samples were analyzed and their respective reporting limits are provided in Attachment J.

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), and the depths of the East and West tanks.**

   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.

   The septic system on the east side of Building 9956 consisted of a septic tank and seepage pit. Historical engineering drawings maintained by Sandia National Laboratories/New Mexico indicate that the drain line from Building 9956 to the septic tank and seepage pit was a 3-inch diameter cast iron pipe. The bottom of the east system septic tank as measured in the field was 8 feet below ground surface.

   The septic system southwest of Building 9956 consisted of a septic tank and a drain field. The drain field drain lines were physically located with a backhoe. They consisted of 4-inch diameter perforated polyvinyl chloride, and were buried an average of 4 feet below

ground surface. The bottom of the west system septic tank as measured in the field was 8 feet below ground surface.

4. **See general comment 8.**

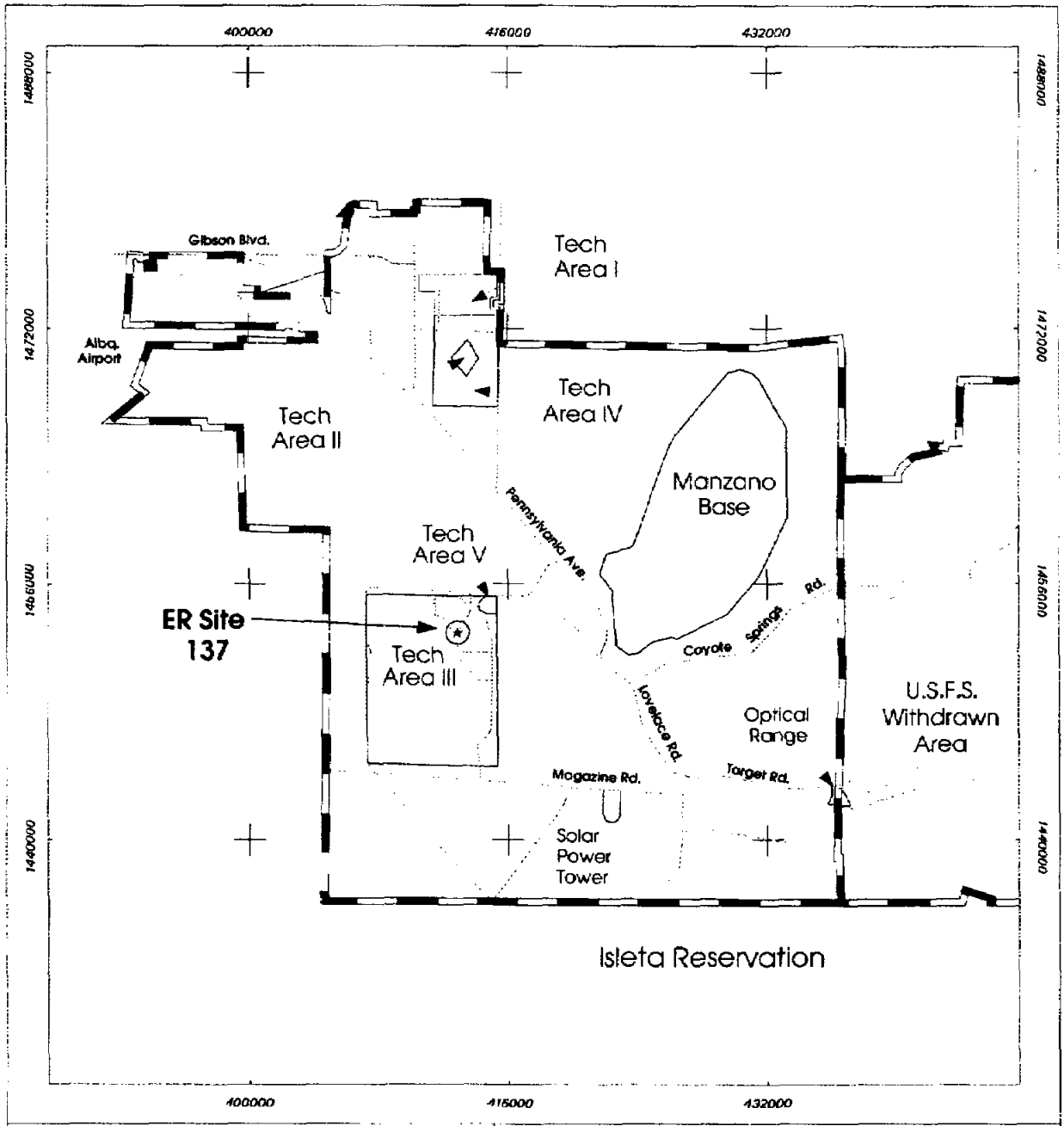
Response: Sandia National Laboratories/New Mexico recognizes that this and other potential deep groundwater environmental restoration and non-environmental restoration septic and drain system sites may be candidates for additional deep soil vapor sampling, and perhaps groundwater monitoring, in accordance 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.

5. **Cyanide must be evaluated in a risk assessment.**

Response: Cyanide was detected at a concentration of 3,700 µg/kg at one boring location in the west system drain field. A risk screening assessment was not completed for ER Site 153 because all constituent of concern concentrations at the site were detected at less than their respective Resource Conservation and Recovery Act proposed Subpart S action levels. However, the risk screening assessment methodology has changed considerably since the NFA proposal for ER Site 153 was written in January 1997. It is also possible that additional deep soil vapor sampling, and perhaps even groundwater monitoring, may be required at this site in the future, in accordance with procedures specified in the sampling and analysis plan. This sampling and analysis plan is currently in the final stages of review and approval by representatives of the New Mexico Environment Department, Sandia National Laboratories/New Mexico, and the U.S. Department of Energy. The risk screening assessment for this site will be conducted again when all sampling has been completed at the site and will follow the most current risk assessment procedures in place at the time the new evaluation is completed.

ATTACHMENT A

ER SITE 137
REVISED FIGURES 1-1 AND 1-2



Legend

- ER Site 137
- Major Roads
- KAFB Boundary
- Technical Areas

Sandia National Laboratories, New Mexico
Environmental Restoration Geographic Information System

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

0 5000 10000
Scale in Feet

0 1200 2400
Scale in Meters

N

FIGURE 1-1
Location Map for Site 137
Sandia National Laboratories,
New Mexico

sm990697.prl scmorri SNL GIS ORG. 7512 05/20/96 MAPID=960982

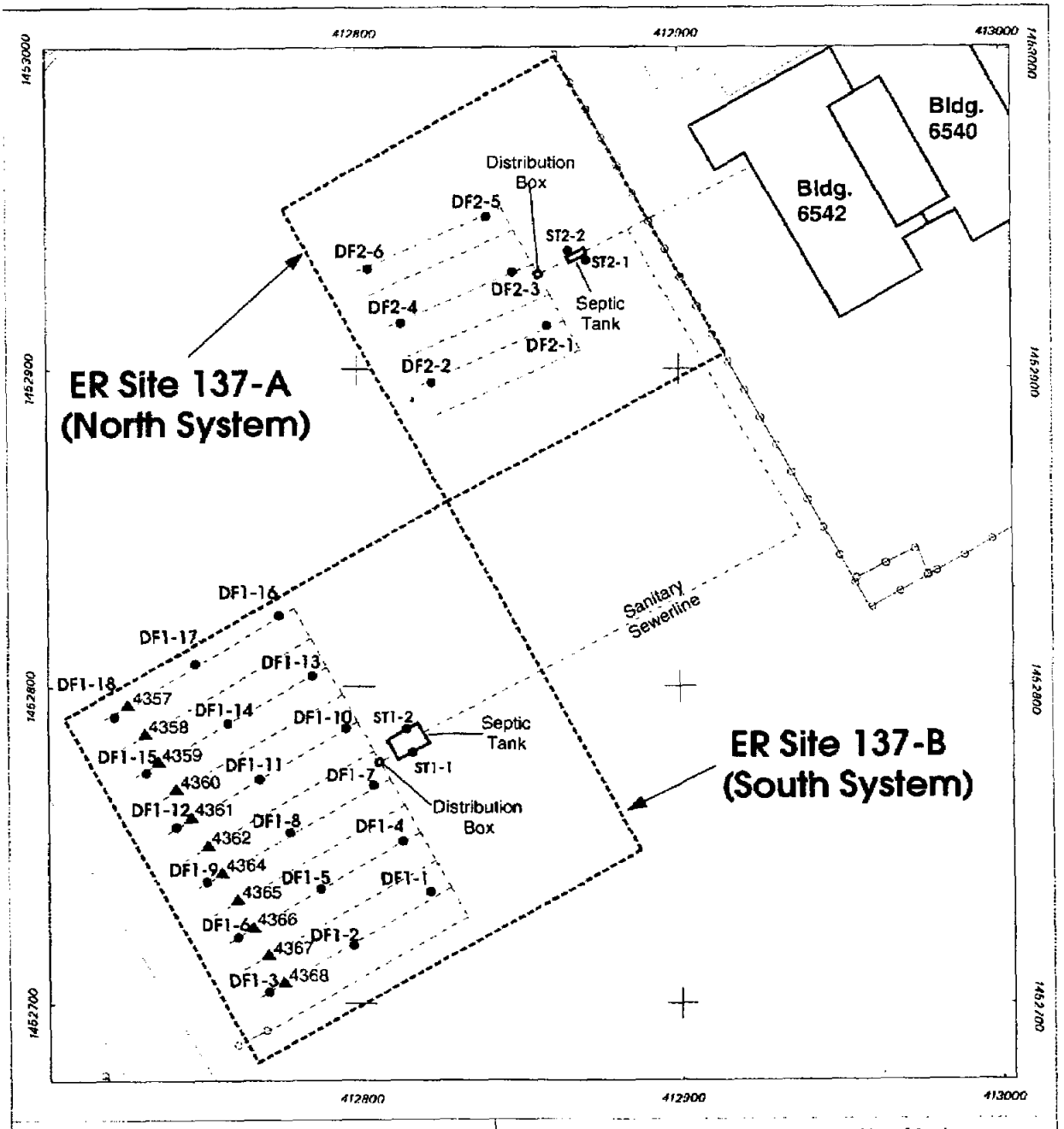


FIGURE 1-2
Site Map for ER Site 137
Sandia National Laboratories,
New Mexico

sm990696.prl dahelfr SNL GIS ORG. 7612 07/23/96 MAPID = 961059

ATTACHMENT B

ER SITE 137
SUPPLEMENTAL TABLES 3-2A AND 3-2B

Table 3-2A
Summary of VOC Analytical Detection
Limits Used for ER Site 137 Soil Sampling, November and December 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 137 Soil Sampling, November and December 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
Di-n-octyl phthalate	330

Refer to footnotes at end of table.

Table 3-2B (Concluded)
Summary of SVOC Analytical Detection
Limits Used for ER Site 137 Soil Sampling, November and December 1994
(Off-site laboratory)

Analyte	Reporting Limit (µg/kg)
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.

From

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

NOV 24 2003

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

cc: Dick Fate
MS D462
ESH5EC Records Center

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

Dear Mr. Kieling,

Enclosed is one of two NMED copies of the Drain and Septic Systems (DSS) Soil Vapor Well Sample Results at Sandia National Laboratories, New Mexico, EPA ID No. NM5890110518. Per our verbal agreement, the second NMED copy is being sent directly to the Albuquerque Group Manager.

The soil vapor well design and sampling requirements were specified in the "Sampling and Analysis Plan for Characterizing and Assessing Potential Releases to the Environment from Septic and Other Miscellaneous Drain Systems at Sandia National Laboratories/New Mexico" (SAP). This SAP was approved by the NMED on January 28, 2000. All fieldwork was completed in September 2003, and the data has been reviewed and compiled for your review. With the submittal of this data, all sampling obligations for DSS sites under the SAP have been satisfied.

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

Sincerely,

Karen L. Boardman
Manager

Enclosure

cc w/enclosure:
L. King, EPA, Region 6 (2 copies, via Certified Mail)
W. Moats, NMED-HWB (via Certified Mail)
M. Gardipe, ERD-AIP
C. Voorhees, NMED-OB (Santa Fe)
D. Bierley, NMED-OB

cc w/o enclosure:
K. Thomas, EPA, Region 6
S. Martin, NMED-HWB
F. Nimick, SNL, MS 1089
D. Stockham, SNL, MS 1087
P. Freshour, SNL, MS 1087
M. Sanders, SNL, MS 1087
A. Blumberg, SNL, MS 0141

Sandia National Laboratories
Operated for the U.S. Department of Energy by
Sandia Corporation

Albuquerque, New Mexico 87185-1089

date: October 27, 2003

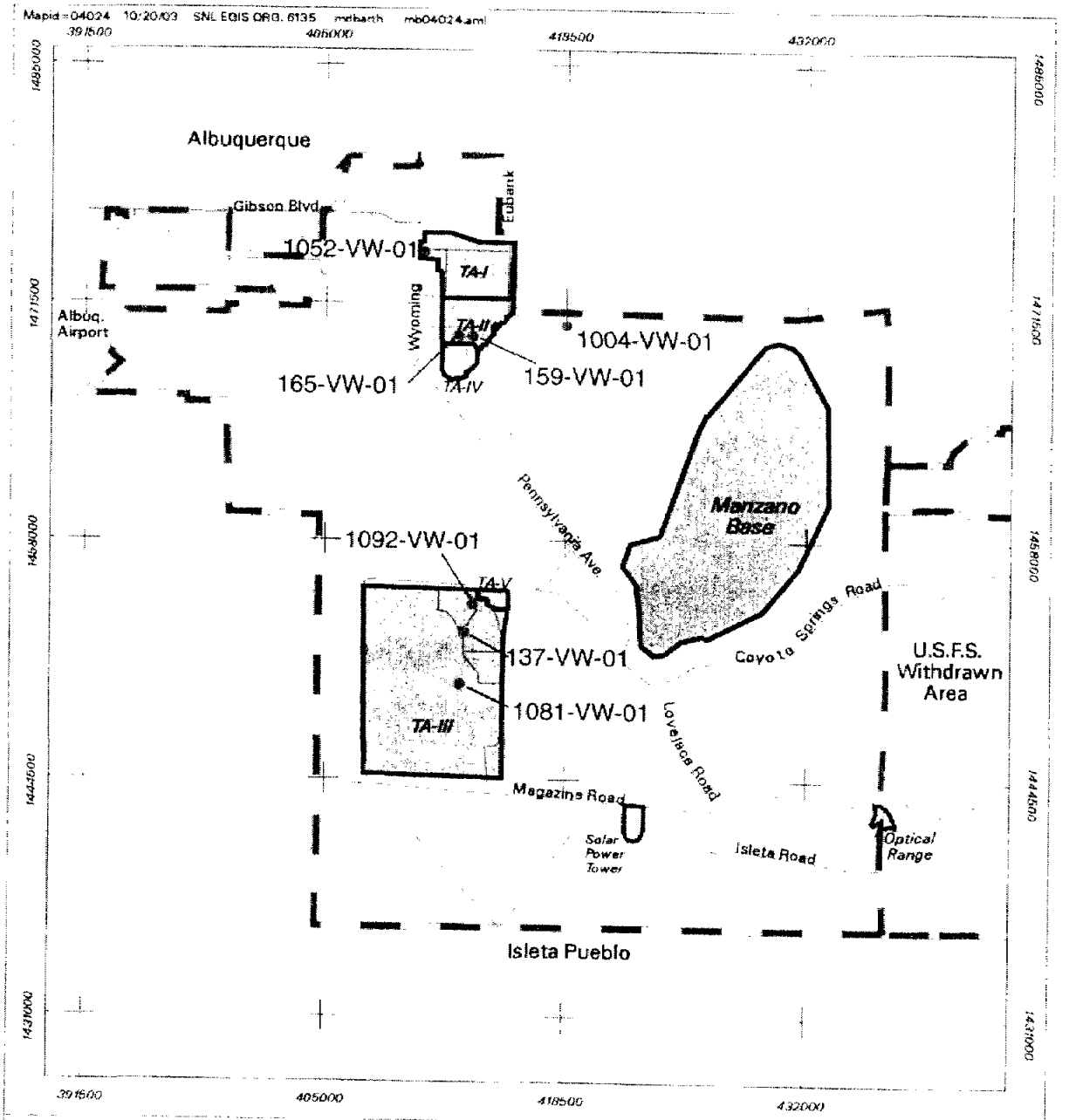
to: Peter B. Davies, MS-0701 (6100)

from: Fran Nimick, MS-1089 (6101)

subject: Drain and Septic Systems (DSS) Soil Vapor Well Sample Results

A 150-ft-deep vadose zone soil vapor (SV) monitoring well was installed at each of seven individual DSS sites in May and June 2003. The well locations are shown on Figure 1. These wells were required by the New Mexico Environment Department (NMED) as part of the environmental characterization of DSS sites at Sandia National Laboratories/New Mexico (SNL/NM). The sites where these wells were installed were selected jointly by NMED regulators and SNL/NM Environmental Restoration (ER) project personnel based on the results of previous environmental characterization work completed at the sites, and in accordance with requirements and parameters described in the "Sampling and Analysis Plan for Characterizing and Assessing Potential Releases to the Environment from Septic and Other Miscellaneous Drain Systems at Sandia National Laboratories/New Mexico" (SAP). This SAP was formally approved by the NMED on January 28, 2000.

The SV well design and sampling requirements were specified in the SAP. SV well sampling ports were completed in each well at 5, 20, 70, 100, and 150 ft below ground surface. As specified in the SAP, a minimum of three months were allowed to elapse to allow for the dissipation of short-term, near-borehole disequilibrium conditions that may have been introduced during drilling before samples were collected from the wells. A total of 37 soil vapor samples (five from each of the seven wells, plus two duplicate samples) were collected using standard active soil vapor sample collection techniques on September 9 and 10, 2003. These samples were submitted to an off-site commercial laboratory for total volatile organic compound (VOC) analyses using U.S. Environmental Protection Agency (EPA) Method TO-14A. The analytical results were provided to SNL/NM several weeks later, and were reviewed using standard data validation procedures. No significant quality problems were found with the data.



Legend

- DSS Soil Vapor Well Location
- Major Road
- KAFB Boundary
- SNL Technical Area (TA)

Figure 1
Location Map of the Drain and Septic Systems (DSS) Soil Vapor Wells, Installed May and June 2003

0 4500 9000
Scale in Feet
0 1080 2160
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

The total VOC analytical results for the SV samples from each sampling interval are summarized in Table 1 below, and the analytical report summary pages showing individual compounds detected in the samples are provided as Attachment A.

Table 1. DSS Soil Vapor Well Total VOC Analytical Results (ppmv)

SWMU or DSS Site Number	Well Name	5 ft Depth	20 ft Depth	70 ft Depth	100 ft Depth	150 ft Depth	150 ft. Depth (duplicate sample)
137	137-VW-01	0.004	0.001	0.005	0.052	0.018	None
159	159-VW-01	0.057	0.101	0.421	0.851	0.965	0.995
165	165-VW-01	0.029	0.031	0.053	0.367	0.332	None
1004	1004-VW-01	0.001	0.004	0.003	0.005	0.003	None
1052	1052-VW-01	0.069	0.066	0.100	0.169	0.147	None
1081	1081-VW-01	0.023	0.001	0.018	0.005	0.006	0.008
1092	1092-VW-01	2.418	1.377	0.716	0.529	0.394	None

DSS = Drain and Septic Systems.
ft = Feet.
ppmv = Parts per million by volume.
SWMU = Solid Waste Management Unit.
VOC = Volatile organic compound(s).
VW = Vapor well.

The SAP specifies that any site at which the total VOC concentration in the 150-foot depth sample exceeds 10 ppmv would require groundwater monitoring, and also requires that additional DSS sites be selected for deep soil vapor wells. Conversely, if the 10 ppmv action level was not exceeded in any 150-ft. deep sample, then no additional soil vapor or groundwater wells would be required. Therefore, since the total VOC concentration did not exceed 10 ppmv total VOCs in any of the samples collected from the seven SV wells, it is expected at this point that no additional SV or groundwater monitoring wells will be required at these or other DSS sites.

If you have any questions regarding this submission, please contact either Dwight Stockham at 844-5493, or Mike Sanders at 284-2478.

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Attachment A

DSS Soil Vapor Well Sample Analytical Summary Reports

EXECUTIVE SUMMARY - Detection Highlights

E3I150159

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
063060-001/137-VW-01-5-SV 09/09/03 10:40 001				
Dichlorodifluoromethane	0.53 J	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon disulfide	2.6 J	10	ppb(v/v)	EPA-21 TO-14A
Toluene	0.75 J	2.0	ppb(v/v)	EPA-21 TO-14A
063061-001/137-VW-01-20-SV 09/09/03 10:45 002				
1,1,1-Trichloroethane	0.80 J	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	0.68 J	2.0	ppb(v/v)	EPA-21 TO-14A
063062-001/137-VW-01-70-SV 09/09/03 10:50 003				
Dichlorodifluoromethane	0.51 J	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,1-Trichloroethane	2.2	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	0.88 J	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	1.7 J	2.0	ppb(v/v)	EPA-21 TO-14A
063063-001/137-VW-01-100-SV 09/09/03 10:55 004				
Dichlorodifluoromethane	0.51 J	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon disulfide	3.6 J	10	ppb(v/v)	EPA-21 TO-14A
1,1,1-Trichloroethane	2.2	2.0	ppb(v/v)	EPA-21 TO-14A
Benzene	2.0	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	1.4 J	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	4.7	2.0	ppb(v/v)	EPA-21 TO-14A
Ethylbenzene	7.8	2.0	ppb(v/v)	EPA-21 TO-14A
m-Xylene & p-Xylene	21	2.0	ppb(v/v)	EPA-21 TO-14A
o-Xylene	5.9	2.0	ppb(v/v)	EPA-21 TO-14A
4-Ethyltoluene	1.9 J	2.0	ppb(v/v)	EPA-21 TO-14A
1,2,4-Trimethylbenzene	1.4 J	2.0	ppb(v/v)	EPA-21 TO-14A
063064-001/137-VW-01-150-SV 09/09/03 11:00 005				
Dichlorodifluoromethane	0.56 J	2.0	ppb(v/v)	EPA-21 TO-14A
Acetone	4.9 J	10	ppb(v/v)	EPA-21 TO-14A
2-Butanone (MEK)	4.9 J	10	ppb(v/v)	EPA-21 TO-14A
1,1,1-Trichloroethane	1.9 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	2.7	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	2.5	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	0.74 J	2.0	ppb(v/v)	EPA-21 TO-14A

EXECUTIVE SUMMARY - Detection Highlights

E3I150174

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
063076-001/159-VW-01-5-SV 09/09/03 14:00 001				
Dichlorodifluoromethane	0.70 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	1.7 J	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	29	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	1.4 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	24	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	0.67 J	2.0	ppb(v/v)	EPA-21 TO-14A
063077-001/159-VW-01-20-SV 09/09/03 14:05 002				
Dichlorodifluoromethane	0.94 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	2.1	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	57	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	2.4	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	37	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	1.7 J	2.0	ppb(v/v)	EPA-21 TO-14A
063078-001/159-VW-01-70-SV 09/09/03 14:10 003				
Dichlorodifluoromethane	2.5	2.0	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	7.7	2.0	ppb(v/v)	EPA-21 TO-14A
1,1-Dichloroethene	1.3 J	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	250	2.0	ppb(v/v)	EPA-21 TO-14A
Acetone	2.8 J	10	ppb(v/v)	EPA-21 TO-14A
Chloroform	1.9 J	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	11	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	140	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	2.6	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	1.2 J	2.0	ppb(v/v)	EPA-21 TO-14A
063079-001/159-VW-01-100-SV 09/09/03 14:15 004				
Dichlorodifluoromethane	4.8	2.0	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	19	2.0	ppb(v/v)	EPA-21 TO-14A
1,1-Dichloroethene	2.5	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	480	2.0	ppb(v/v)	EPA-21 TO-14A
Acetone	3.1 J	10	ppb(v/v)	EPA-21 TO-14A
Chloroform	2.6	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	14	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	320	2.0	ppb(v/v)	EPA-21 TO-14A

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EXECUTIVE SUMMARY - Detection Highlights

E3I150174

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
063079-001/159-VW-01-100-SV 09/09/03 14:15 004				
Toluene	3.0	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	1.6 J	2.0	ppb(v/v)	EPA-21 TO-14A
063080-001/159-VW-01-150-SV 09/09/03 14:20 005				
Dichlorodifluoromethane	4.4	4.1	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	18	4.1	ppb(v/v)	EPA-21 TO-14A
1,1-Dichloroethene	2.3 J	4.1	ppb(v/v)	EPA-21 TO-14A
Carbon disulfide	11 J	20	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	440	4.1	ppb(v/v)	EPA-21 TO-14A
Acetone	6.7 J	20	ppb(v/v)	EPA-21 TO-14A
2-Butanone (MEK)	31	20	ppb(v/v)	EPA-21 TO-14A
Chloroform	2.0 J	4.1	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	7.2	4.1	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	440	4.1	ppb(v/v)	EPA-21 TO-14A
Toluene	1.4 J	4.1	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	1.4 J	4.1	ppb(v/v)	EPA-21 TO-14A
063081-001/159-VW-01-150-DU 09/09/03 14:25 006				
Dichlorodifluoromethane	4.3	4.0	ppb(v/v)	EPA-21 TO-14A
Chloromethane	2.1 J	8.0	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	18	4.0	ppb(v/v)	EPA-21 TO-14A
1,1-Dichloroethene	2.1 J	4.0	ppb(v/v)	EPA-21 TO-14A
Carbon disulfide	4.4 J	20	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	440	4.0	ppb(v/v)	EPA-21 TO-14A
Acetone	7.7 J	20	ppb(v/v)	EPA-21 TO-14A
2-Butanone (MEK)	54	20	ppb(v/v)	EPA-21 TO-14A
Chloroform	2.0 J	4.0	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	6.9	4.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	450	4.0	ppb(v/v)	EPA-21 TO-14A
Toluene	2.0 J	4.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	1.6 J	4.0	ppb(v/v)	EPA-21 TO-14A

EXECUTIVE SUMMARY - Detection Highlights

E3I150176

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
063082-001/165-VW-01-5-SV 09/09/03 13:10 001				
Dichlorodifluoromethane	0.51 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	1.5 J	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon disulfide	3.8 J	10	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	10	2.0	ppb(v/v)	EPA-21 TO-14A
Acetone	4.0 J	10	ppb(v/v)	EPA-21 TO-14A
Chloroform	6.9	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	0.60 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	1.7 J	2.0	ppb(v/v)	EPA-21 TO-14A
063083-001/165-VW-01-20-SV 09/09/03 13:15 002				
Trichlorofluoromethane	0.85 J	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	8.2	2.0	ppb(v/v)	EPA-21 TO-14A
Chloroform	17	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	1.0 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	3.4	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	0.63 J	2.0	ppb(v/v)	EPA-21 TO-14A
063084-001/165-VW-01-70-SV 09/09/03 13:20 003				
Dichlorodifluoromethane	0.57 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	0.58 J	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	8.3	2.0	ppb(v/v)	EPA-21 TO-14A
Acetone	15	10	ppb(v/v)	EPA-21 TO-14A
Methylene chloride	1.7 J	2.0	ppb(v/v)	EPA-21 TO-14A
Chloroform	21	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	3.4	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	2.9	2.0	ppb(v/v)	EPA-21 TO-14A
063085-001/165-VW-01-100-SV 09/09/03 13:25 004				
Dichlorodifluoromethane	1.1 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	4.4	2.0	ppb(v/v)	EPA-21 TO-14A
1,1-Dichloroethene	0.93 J	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	170	2.0	ppb(v/v)	EPA-21 TO-14A
Acetone	3.4 J	10	ppb(v/v)	EPA-21 TO-14A
Methylene chloride	8.0	2.0	ppb(v/v)	EPA-21 TO-14A
Chloroform	140	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	8.1	2.0	ppb(v/v)	EPA-21 TO-14A

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EXECUTIVE SUMMARY - Detection Highlights

E3I150176

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
063085-001/165-VW-01-100-SV 09/09/03 13:25 004				
Trichloroethene	26	2.0	ppb(v/v)	EPA-21 TO-14A
Bromodichloromethane	2.1	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	1.6 J	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	1.4 J	2.0	ppb(v/v)	EPA-21 TO-14A
063086-001/165-VW-01-150-SV 09/09/03 13:30 005				
Dichlorodifluoromethane	1.1 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	3.4	2.0	ppb(v/v)	EPA-21 TO-14A
1,1-Dichloroethene	0.88 J	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	170	2.0	ppb(v/v)	EPA-21 TO-14A
Acetone	3.4 J	10	ppb(v/v)	EPA-21 TO-14A
Methylene chloride	14	2.0	ppb(v/v)	EPA-21 TO-14A
Chloroform	120	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	6.9	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	8.2	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	2.8	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	1.5 J	2.0	ppb(v/v)	EPA-21 TO-14A

EXECUTIVE SUMMARY - Detection Highlights

E3I150189

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
063087-001/1004-VW-01-5-SV 09/09/03 12:30 001				
Toluene	1.4 J	2.0	ppb(v/v)	EPA-21 TO-14A
063088-001/1004-VW-01-20-SV 09/09/03 12:35 002				
Dichlorodifluoromethane	0.51 J	2.0	ppb(v/v)	EPA-21 TO-14A
Acetone	2.0 J	10	ppb(v/v)	EPA-21 TO-14A
Toluene	1.5 J	2.0	ppb(v/v)	EPA-21 TO-14A
063089-001/1004-VW-01-70-SV 09/09/03 12:40 003				
Trichlorofluoromethane	0.73 J	2.0	ppb(v/v)	EPA-21 TO-14A
Chloroform	0.82 J	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	1.7 J	2.0	ppb(v/v)	EPA-21 TO-14A
063090-001/1004-VW-01-100-SV 09/09/03 12:45 004				
Trichlorofluoromethane	0.99 J	2.0	ppb(v/v)	EPA-21 TO-14A
Acetone	2.8 J	10	ppb(v/v)	EPA-21 TO-14A
Toluene	1.3 J	2.0	ppb(v/v)	EPA-21 TO-14A
063091-001/1004-VW-01-150-SV 09/09/03 12:50 005				
Trichloroethene	0.52 J	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	2.4	2.0	ppb(v/v)	EPA-21 TO-14A

EXECUTIVE SUMMARY - Detection Highlights

E3I150194

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
063092-001/1052-VW-01-5-SV 09/10/03 07:35 001				
Dichlorodifluoromethane	2.2	2.0	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	15	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	1.4 J	2.0	ppb(v/v)	EPA-21 TO-14A
Chloroform	3.5	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	3.5	2.0	ppb(v/v)	EPA-21 TO-14A
Benzene	0.90 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	11	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	1.0 J	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	31	2.0	ppb(v/v)	EPA-21 TO-14A
063093-001/1052-VW-01-20-SV 09/10/03 07:40 002				
Dichlorodifluoromethane	1.5 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	8.1	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	0.89 J	2.0	ppb(v/v)	EPA-21 TO-14A
Chloroform	2.7	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	1.4 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	11	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	1.8 J	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	39	2.0	ppb(v/v)	EPA-21 TO-14A
063094-001/1052-VW-01-70-SV 09/10/03 07:45 003				
Dichlorodifluoromethane	2.3	2.0	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	13	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	1.7 J	2.0	ppb(v/v)	EPA-21 TO-14A
Acetone	6.2 J	10	ppb(v/v)	EPA-21 TO-14A
Chloroform	5.4	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	2.6	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	15	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	11	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	43	2.0	ppb(v/v)	EPA-21 TO-14A
063095-001/1052-VW-01-100-SV 09/10/03 07:50 004				
Dichlorodifluoromethane	6.6	2.0	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	44	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	4.5	2.0	ppb(v/v)	EPA-21 TO-14A
Acetone	5.9 J	10	ppb(v/v)	EPA-21 TO-14A

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EXECUTIVE SUMMARY - Detection Highlights

E3I150194

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
063095-001/1052-VW-01-100-SV 09/10/03 07:50 004				
Chloroform	16	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	9.5	2.0	ppb(v/v)	EPA-21 TO-14A
Benzene	0.88 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	21	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	11	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	50	2.0	ppb(v/v)	EPA-21 TO-14A
063096-001/1052-VW-01-150-SV 09/10/03 07:55 005				
Dichlorodifluoromethane	7.5	2.0	ppb(v/v)	EPA-21 TO-14A
Trichlorofluoromethane	41	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon disulfide	6.6 J	10	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	4.0	2.0	ppb(v/v)	EPA-21 TO-14A
Chloroform	23	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon tetrachloride	16	2.0	ppb(v/v)	EPA-21 TO-14A
Benzene	1.1 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	18	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	4.5	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	25	2.0	ppb(v/v)	EPA-21 TO-14A

EXECUTIVE SUMMARY - Detection Highlights

E3I150164

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
063065-001/1081-VW-01-5-SV 09/09/03 11:25 001				
Dichlorodifluoromethane	0.50 J	2.0	ppb(v/v)	EPA-21 TO-14A
Chloromethane	1.4 J	4.0	ppb(v/v)	EPA-21 TO-14A
Chloroethane	2.0 J	4.0	ppb(v/v)	EPA-21 TO-14A
Carbon disulfide	7.3 J	10	ppb(v/v)	EPA-21 TO-14A
Acetone	8.5 J	10	ppb(v/v)	EPA-21 TO-14A
Benzene	1.3 J	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	2.4	2.0	ppb(v/v)	EPA-21 TO-14A
063066-001/1081-VW-01-20-SV 09/09/03 11:30 002				
Dichlorodifluoromethane	0.51 J	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	0.89 J	2.0	ppb(v/v)	EPA-21 TO-14A
063067-001/1081-VW-01-70-SV 09/09/03 11:35 003				
Dichlorodifluoromethane	0.55 J	2.0	ppb(v/v)	EPA-21 TO-14A
Benzene	3.9	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	13	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	0.78 J	2.0	ppb(v/v)	EPA-21 TO-14A
063068-001/1081-VW-01-100-SV 09/09/03 11:40 004				
Dichlorodifluoromethane	0.59 J	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	3.3	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	0.89 J	2.0	ppb(v/v)	EPA-21 TO-14A
063069-001/1081-VW-01-150-SV 09/09/03 11:45 005				
Dichlorodifluoromethane	0.55 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	1.1 J	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	3.1	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	1.0 J	2.0	ppb(v/v)	EPA-21 TO-14A
063070-001/1081-VW-01-150-DU 09/09/03 11:50 006				
Dichlorodifluoromethane	0.60 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	0.54 J	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	3.6	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	1.2 J	2.0	ppb(v/v)	EPA-21 TO-14A
m-Xylene & p-Xylene	1.5 J	2.0	ppb(v/v)	EPA-21 TO-14A
o-Xylene	0.66 J	2.0	ppb(v/v)	EPA-21 TO-14A

EXECUTIVE SUMMARY - Detection Highlights

E3I150169

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
063071-001/1092-VW-01-5-SV 09/09/03 09:05 001				
1,1,2-Trichloro-1,2,2-trifluoroethane	93	16	ppb(v/v)	EPA-21 TO-14A
Chloroform	8.1 J	16	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	2300	16	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	17	16	ppb(v/v)	EPA-21 TO-14A
063072-001/1092-VW-01-20-SV 09/09/03 09:10 002				
1,1,2-Trichloro-1,2,2-trifluoroethane	58	7.9	ppb(v/v)	EPA-21 TO-14A
Chloroform	5.0 J	7.9	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	1300	7.9	ppb(v/v)	EPA-21 TO-14A
Toluene	4.1 J	7.9	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	10	7.9	ppb(v/v)	EPA-21 TO-14A
063073-001/1092-VW-01-70-SV 09/09/03 09:15 003				
1,1,2-Trichloro-1,2,2-trifluoroethane	28	6.1	ppb(v/v)	EPA-21 TO-14A
Acetone	8.9 J	31	ppb(v/v)	EPA-21 TO-14A
2-Butanone (MEK)	8.0 J	31	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	650	6.1	ppb(v/v)	EPA-21 TO-14A
Toluene	16	6.1	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	5.2 J	6.1	ppb(v/v)	EPA-21 TO-14A
063074-001/1092-VW-01-100-SV 09/09/03 09:20 004				
1,1,2-Trichloro-1,2,2-trifluoroethane	14	3.9	ppb(v/v)	EPA-21 TO-14A
Acetone	9.0 J	20	ppb(v/v)	EPA-21 TO-14A
2-Butanone (MEK)	12 J	20	ppb(v/v)	EPA-21 TO-14A
Chloroform	1.9 J	3.9	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	480	3.9	ppb(v/v)	EPA-21 TO-14A
Toluene	8.2	3.9	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	3.8 J	3.9	ppb(v/v)	EPA-21 TO-14A
063075-001/1092-VW-01-150-SV 09/09/03 09:25 005				
Trichlorofluoromethane	0.54 J	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,2-Trichloro-1,2,2-trifluoroethane	8.1	2.0	ppb(v/v)	EPA-21 TO-14A
2-Butanone (MEK)	9.2 J	10	ppb(v/v)	EPA-21 TO-14A
Chloroform	1.6 J	2.0	ppb(v/v)	EPA-21 TO-14A

(Continued on next page)

EXECUTIVE SUMMARY - Detection Highlights

E3I150169

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
063075-001/1092-VW-01-150-SV 09/09/03 09:25 005				
Trichloroethene	370	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	2.1	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	2.8	2.0	ppb(v/v)	EPA-21 TO-14A

ESFISEC

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

MAR 2 3 2005

cc: Distribute 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 # 340833

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 137, BUILDINGS 6540/6542 SEPTIC SYSTEM AT TECHNICAL AREA III

March 2005

United States Department of Energy
Sandia Site Office

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ACRONYMS AND ABBREVIATIONS

AOC	Area(s) of Concern
AOP	Administrative Operating Procedure
bgs	below ground surface
CAC	Corrective Action Complete
COC	constituent of concern
COPEC	constituent of potential ecological concern
DCF	dose conversion factor
DOE	U.S. Department of Energy
DQO	data quality objective
DSS	Drain and Septic Systems
ENCO	ENCOTEC Laboratory
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FIP	Field Implementation Plan
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
kg	kilogram(s)
LAS	Lockheed Analytical Services
MDA	minimum detectable activity
mg	milligram(s)
mrem	millirem
NFA	no further action
NMED	New Mexico Environment Department
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
ppmv	parts per million by volume
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
TMA	Thermo Analytical Inc./Eberline Laboratories

ACRONYMS AND ABBREVIATIONS (Concluded)

TOP	Technical Operating Procedure
UCL	upper confidence limit
VOC	volatile organic compound
yr	year

1.0 INTRODUCTION

1.1 Investigation History

Solid Waste Management Unit (SWMU) 137 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 137 (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, revised analytical tables that included complete analyte lists and method detection limits for the analytes, estimates of effluent volumes discharged to the system, and a revised risk assessment, which includes cyanide (NMED June 1999). The NMED/HRMB also stated that no NFA would be approved without groundwater characterization, unless the agency gained confidence that such approvals would be protective of human health and the environment after SNL/NM conducted a study of a sample population of septic systems (NMED June 1999).

SNL/NM responded to the RSI in September 1999 and submitted revised maps, amended data tables, and committed to completing a revised risk assessment in accordance with current procedures, once all required sampling had been completed at the site (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 these 22 SWMUs, and at 61 other Drain and Septic Systems (DSS) Areas 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 sites were specified in a follow-up Field Implementation Plan (FIP) (SNL/NM November 2001), which was also approved by the NMED in February 2002 (Moats February 2002).

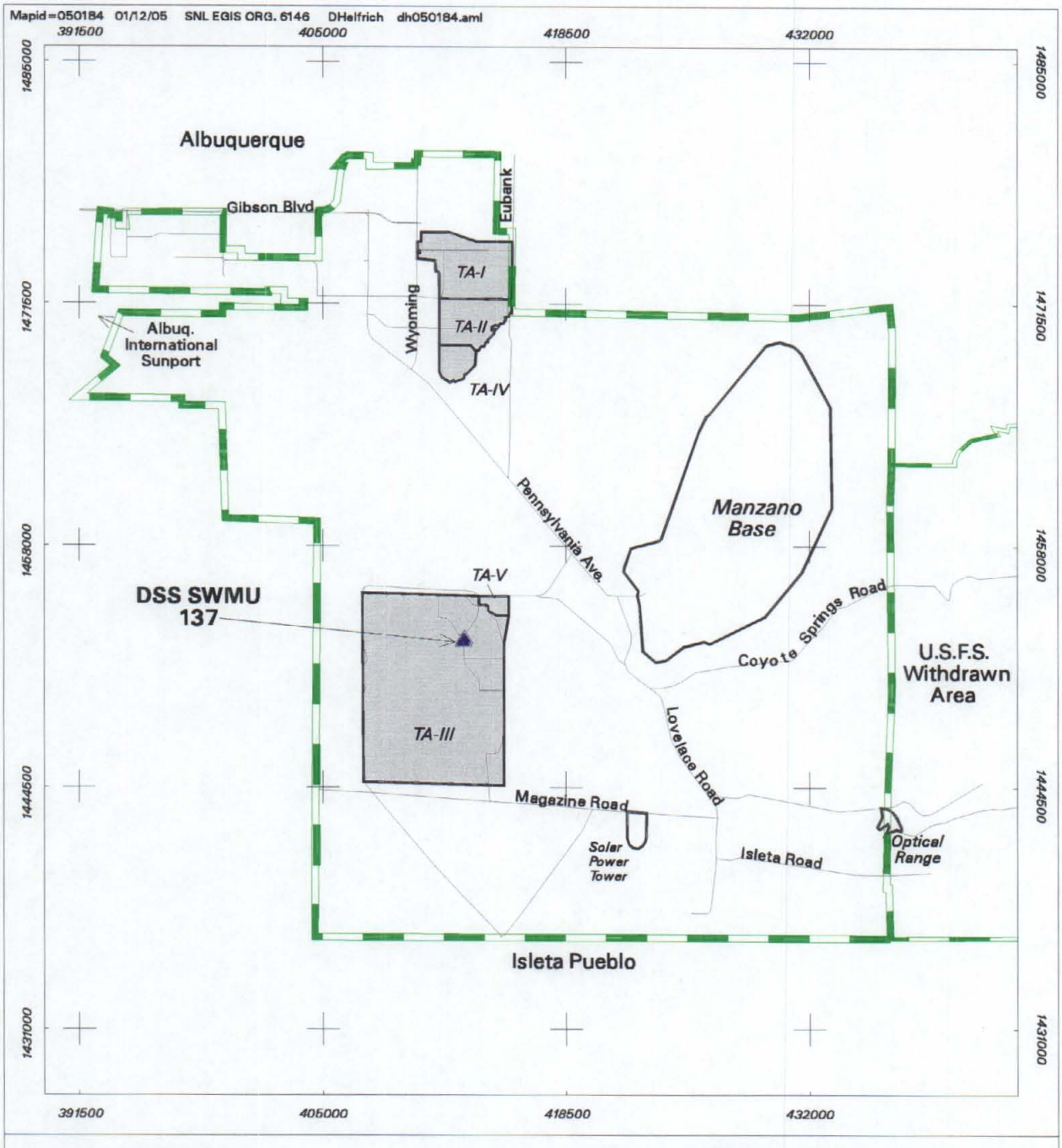
Because of the physical similarity of the SWMUs and the AOC sites, and because the same characterization procedures were used for both, the 22 SWMUs were combined into the AOC site investigation procedures covered under the SAP (SNL/NM October 1999). Shallow subsurface soil and soil-vapor sampling investigations were completed at the AOC sites by November 2002. The data were evaluated and the SWMUs and AOC sites were ranked in order to select candidate sites for deep soil-vapor wells. In April 2003, DSS SWMU 137 was one of seven sites selected for deep soil-vapor well installation and sampling. The well was installed at the site in May 2003 and soil-vapor samples were collected in September 2003. The results for all seven DSS deep soil-vapor wells were summarized and submitted to the NMED in October 2003 (SNL/NM October 2003). After reviewing the results, the NMED notified SNL/NM that no additional deep soil-vapor wells or soil-vapor sampling would be required at the SNL/NM DSS sites (Kieling December 2003).

1.2 Remaining RSI Requirements for DSS SWMU 137

The following remaining requirements from the June 1999 RSI are addressed in this RSI response:

- Submit additional well construction and the sample results for the active soil-vapor monitoring well at DSS SWMU 137
- Submit a revised risk assessment incorporating all available soil data

A general location map (Figure 1.2-1) and an updated site location map showing the soil sampling and soil-vapor monitoring well locations (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 briefly summarized in the risk assessment in Chapter 3.0.



Legend

- DSS SWMU 137
- Major Road
- KAFB Boundary
- USFS Withdrawn Area Boundary
- SNL Technical Area

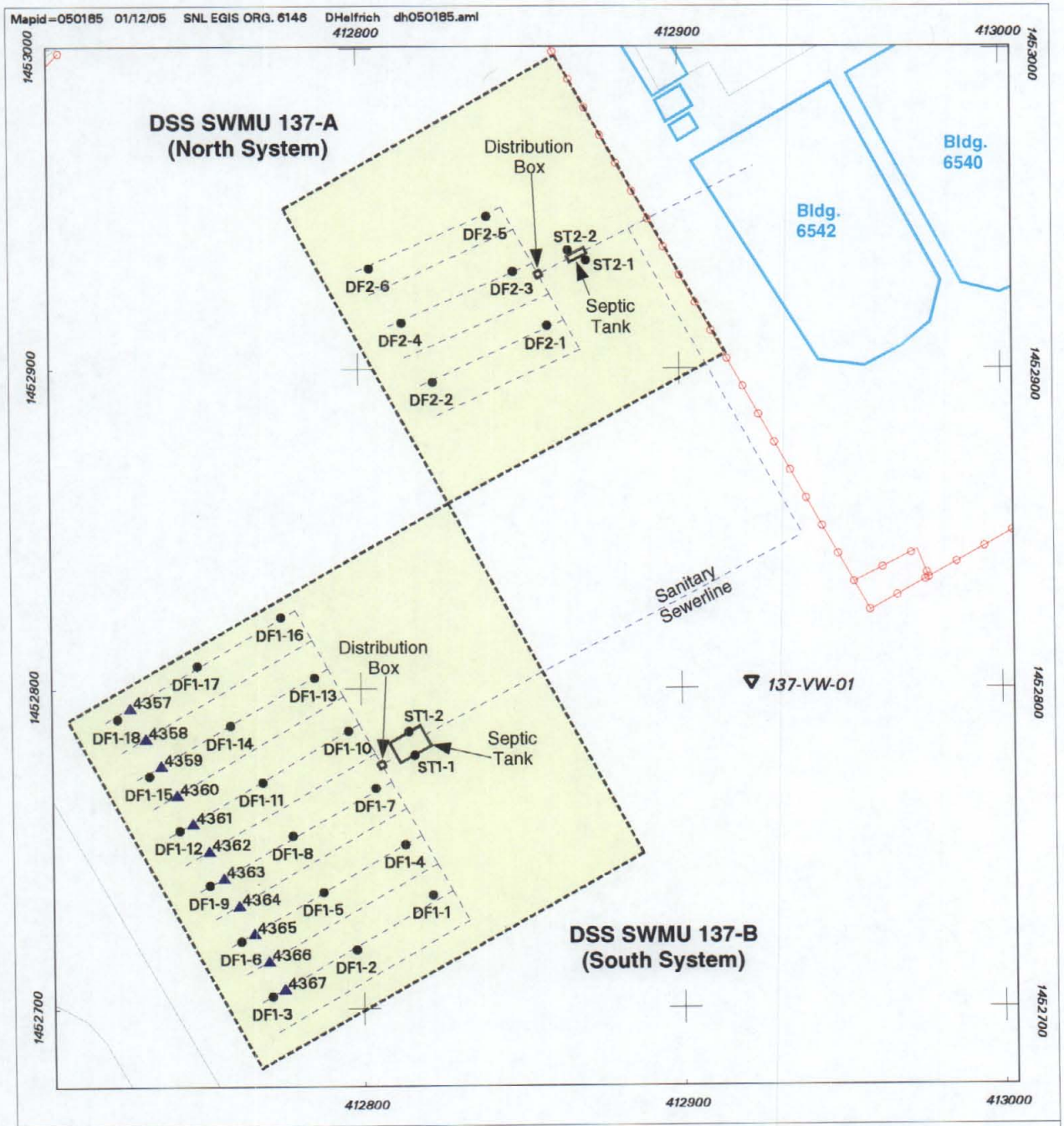
Figure 1.2-1
Location Map of Drain and Septic Systems (DSS) SWMU 137, Bldgs. 6540/6542 Septic System, TA-III

0 4500 9000
Scale in Feet

0 1080 2160
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

840857.03010000 A335



Legend

- 1990 Soil Sample Location
- 1994 Soil Boring Location
- Soil-Vapor Monitoring Well
- Fence
- Road
- Septic Tank, Distribution Box
- Sanitary Sewerline, Drainfield
- Building
- DSS SWMU 137

Figure 1.2-2
Site Map of Drain and Septic Systems (DSS) SWMU 137, Bldgs. 6540/6542 Septic System, TA-III

0 25 50
Scale in Feet

0 6 12
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

840857.03010000 A334

2.0 ACTIVE SOIL-VAPOR SAMPLING AT DSS SWMU 137

2.1 Active Soil-Vapor Sampling Methodology

Active soil-vapor sampling typically involves directly pumping soil-vapor from the subsurface for analysis. Vapor collection can be accomplished either by simple open-pipe systems analogous to groundwater monitoring wells screened in the interval of interest or through sophisticated "down hole" systems with individual inlet port and collection tube sets placed at multiple sampling intervals. The extracted soil-vapor can be analyzed immediately, collected on adsorbent media, or collected into special canisters for later laboratory analysis.

2.2 Active Soil-Vapor Sampling Results for DSS SWMU 137

In May 2003, as part of the DSS investigation, a Flexible Liner Underground Technologies (FLUTe™) soil-vapor monitoring well was installed at a location selected by the NMED at DSS SWMU 137 (Figure 1.2-2). This soil-vapor well was constructed in accordance with deep soil-vapor well design specifications in the SAP (SNL/NM October 1999). Soil-vapor well 137-VW-01 was 150 feet deep with vapor sampling ports at depths of 5, 20, 70, 100, and 150 feet below ground surface (bgs). After installation, subsurface conditions were allowed to equilibrate for over three months before the well was sampled on September 9, 2003. Soil-vapor samples from each of the five sampling depths were collected in special canisters and sent to an off-site laboratory for analysis. Total volatile organic compound (VOC) soil-vapor concentrations ranged from a low of 0.0015 parts per million by volume (ppmv) in the 20-foot-bgs sample to a maximum of 0.0524 ppmv in the 100-foot-bgs sample. The analytical results and data validation report for these samples are presented in Annex A.

In accordance with previous agreements with the NMED (SNL/NM October 1999), because the total VOC concentration in the 150-foot-bgs sample from this well was less than 10 ppmv, no additional soil-vapor sampling from this well and no additional soil-vapor or groundwater monitoring wells were required by the NMED at this site (Kieling December 2003).

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3.0 RISK ASSESSMENT REPORT FOR DSS SWMU 137

3.1 Site Description and History

DSS SWMU 137, the Buildings 6540/6542 Septic System at SNL/NM, is located in 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 137 consists of two abandoned septic systems. A northern system consisted of a steel septic tank that discharged to a drainfield with six, 50-foot-long drain lines (Figure 1.2-2). Sometime after 1975, the northern system was abandoned and a larger system was installed to the south that had a cast concrete septic tank that discharged to a drainfield with 12, 70-foot-long drain lines. Available information indicates that Building 6540 was constructed in 1954 and Building 6542 was constructed in 1956 (SNL/NM March 2003); it is assumed that the northern septic system was constructed about 1954. In 1991, septic system discharges were routed to the City of Albuquerque sanitary sewer system (Jones June 1991). The southern septic system line was disconnected and capped, and the system was abandoned in place concurrent with this change (Romero September 2003). The northern steel septic tank was excavated and found to be in a very degraded condition, and the remains of this tank were removed on October 18, 1995. Waste in the southern (newer) septic tank was removed and managed according to SNL/NM policy in early January 1996. 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 then backfilled with clean, native soil from the area in early 1996.

Environmental concern about DSS SWMU 137 is based upon the potential for the release of constituents of concern (COCs) in effluent discharged to the environment via the septic systems at this site. Because operational records were not available, the investigation was planned to be consistent with other OU 1295 SWMU 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 is the Arroyo del Coyote, located approximately 1.2 miles northeast of the site. No springs or perennial surface-water bodies are located within 2 miles of the site. Average annual rainfall in the SNL/NM and KAFB area, as measured at Albuquerque International Sunport, is 8.1 inches (NOAA 1990). Surface-water runoff in the vicinity of the site is minor because the surface is flat or slopes slightly to the west. 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 137 is unpaved with some native vegetation, and no storm sewers are used to direct surface water away from the site.

DSS SWMU 137 lies at an average elevation of approximately 5,403 feet above mean sea level. The groundwater beneath the site occurs in unconfined conditions in essentially unconsolidated silts, sands, and gravels. The depth to groundwater is approximately 480 feet bgs. Groundwater flow is thought to be to the west in this area (SNL/NM March 2002). The nearest groundwater monitoring wells are approximately 1,200 feet southwest of the site at the Mixed Waste Landfill. The nearest production wells are north of the site and include KAFB-4 and KAFB-11, which are approximately 3.1 and 3.5 miles northwest and northeast of the site, respectively.

3.2 Data Quality Objectives

Soil sampling was conducted in 1990, 1994, and 1995 in accordance with the rationale and procedures described in the approved "Septic Tanks and Drainfields (ADS [Activity Data Sheet]-1295) RCRA [Resource Conservation and Recovery Act] Facility Investigation [RFI] Work Plan" (SNL/NM March 1993), the SAP for the RFI of the septic tanks and drainfields (IT March 1994), and subsequent site-specific addenda to the Work Plan prepared in response to 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 3.2-1 summarizes the rationale for determining the sampling locations at this site. The source of potential COCs at DSS SWMU 137 was effluent discharged to the environment from the septic tanks and drainfields at this site.

Soil samples were collected using two different methods at DSS SWMU 137. In 1990, soil samples were collected using hand-sampling tools from a trench excavated across the southern drainfield. The 1990 samples were collected at the depth of the drainline piping exposed in the trench (an average of 7 feet bgs). In 1994, soil samples were collected in boreholes drilled in the drainfields and adjacent to the septic tanks using a Geoprobe™. The 1994 drainfield sampling intervals started at 5 and 15 feet bgs in each of the northern drainfield borings, and at 7 and 17 feet bgs in the southern drainfield borings. The 1994 septic tank borehole sampling intervals started at 9 and 11 feet bgs at depths equal to the base of both the northern and southern septic tanks, respectively. Grab samples were collected under the northern septic tank at a depth of 11 feet bgs when it was removed in 1995. Table 3.2-2 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.

The soil samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), RCRA metals, hexavalent chromium, cyanide, isotopic uranium, tritium, and radionuclides by gamma spectroscopy. The samples were analyzed by off-site laboratories (ENCOTEC Laboratory [ENCO], Lockheed Analytical Services [LAS], Quanterra Environmental Services [QES], and Thermo Analytical Inc./Eberline Laboratories [TMA]) and at the on-site Radiation Protection Sample Diagnostics (RPSD) Laboratory. Table 3.2-3 summarizes the analytical methods and the data quality requirements based upon the subsequently developed OU 1295 SAP (SNL/NM October 1999) and FIP (SNL/NM November 2001).

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 three trip blanks (for VOCs only) and five field duplicates. No significant problems were identified in the QA/QC samples.

Table 3.2-1
Summary of Sampling Performed to Meet DQOs

DSS SWMU 137 Sampling Areas	Potential COC Source	Number of Sampling Locations	Sample Density (samples/acre)	Sampling Location Rationale
Soil beneath the northern septic system drainfield	Effluent discharged to the environment from the northern drainfield	6	NA	Evaluate potential COC releases to the environment from effluent discharged from the northern drainfield
Soil adjacent to, and beneath, the northern septic tank	Effluent discharged to the environment from the northern septic tank	3 (includes one sample collected under the tank when it was removed)	NA	Evaluate potential COC releases to the environment from effluent discharged from the northern septic tank
Soil beneath the southern septic system drainfield	Effluent discharged to the environment from the southern drainfield	29	NA	Evaluate potential COC releases to the environment from effluent discharged from the southern drainfield
Soil adjacent to the southern septic tank	Effluent discharged to the environment from the southern septic tank	2	NA	Evaluate potential COC releases to the environment from effluent discharged from the southern septic tank

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

Table 3.2-2
Number of Confirmatory Soil and QA/QC Samples Collected from DSS SWMU 137

Sample Type	VOCs	SVOCs	RCRA Metals	Silver Only	Hexavalent Chromium	Total Cyanide	Isotopic Uranium	Tritium	Gamma Spectroscopy Radionuclides
Confirmatory	53	55	55	5	53	52	5	5	5
Duplicates	5	5	5	0	5	5	0	0	0
EBs and TBs[a]	3	0	0	0	0	0	0	0	0
Total Samples	58	60	60	5	58	57	5	5	5
Analytical Laboratory	LAS, QES	LAS, QES	ENCO, LAS, QES	ENCO	LAS, QES	LAS, QES	TMA	TMA	RPSD

[a]TBs for VOCs only.
DSS = Drain and Septic Systems.
EB = Equipment blank.
ENCO = ENCOTEC Laboratory.
LAS = Lockheed Analytical Services.
QA/QC = Quality assurance/quality control.
QES = Quanterra Environmental Services.
RCRA = Resource Conservation and Recovery Act.
RPSD = Radiation Protection Sample Diagnostics Laboratory.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
TB = Trip blank.
TMA = Thermo Analytical Inc./Eberline.
VOC = Volatile organic compound.

Table 3.2-3
Summary of Data Quality Requirements for DSS SWMU 137

Analytical Method[a]	Data Quality Level	ENCO	QES	LAS	TMA	RPSD
VOCs EPA Method 8260	Defensible	None	52	1	None	None
SVOCs EPA Method 8270	Defensible	2	52	1	None	None
RCRA Metals EPA Method 6000/7000	Defensible	2	52	1	None	None
Silver only EPA Method 6000/7000	Defensible	5	None	None	None	None
Hexavalent Chromium EPA Method 7196A	Defensible	None	52	1	None	None
Total Cyanide EPA Method 9012A	Defensible	None	52	None	None	None
Isotopic Uranium HASL-300	Defensible	None	None	None	5	None
Tritium EPA Method 906.0 or equivalent	Defensible	None	None	None	5	None
Gamma Spectroscopy Radionuclides EPA Method 901.1	Defensible	None	None	None	None	5

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.
ENCO = ENCOTEC Laboratory.
EPA = U.S. Environmental Protection Agency.
HASL = Health and Safety Laboratory.
LAS = Lockheed Analytical Services.
QA/QC = Quality assurance/quality control.
QES = Quanterra Environmental Services.
RCRA = Resource Conservation and Recovery Act.
RPSD = Radiation Protection Sample Diagnostics Laboratory.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
TMA = Thermo Analytical Inc./Eberline.
VOC = Volatile organic compound.

All of the DSS SWMU 137 soil sample results were verified/validated by SNL/NM. The off-site laboratory results from ENCO, LAS, QES, and TMA were reviewed according to "Verification and Validation of Chemical and Radiochemical Data," Technical Operating Procedure (TOP) 94-03, Rev. 0 (SNL/NM July 1994) or earlier ER Project Administrative Operating Procedures (AOPs). The gamma spectroscopy data from the RPSD Laboratory were reviewed according to "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 2 (SNL/NM July 1996) or an earlier procedure. The reviews confirmed that the analytical data are defensible and therefore acceptable for use in the RSI response. Therefore, the DQOs have been fulfilled.

3.3 Determination of Nature, Rate, and Extent of Contamination

3.3.1 *Introduction*

The determination of the nature, migration rate, and extent of contamination at DSS SWMU 137 is based upon an initial conceptual model validated with confirmatory sampling at the site. The initial conceptual model was developed from archival site research, site inspections, soil sampling, and passive and active soil-vapor 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 137, which is presented in this chapter. The quality of the data specifically used to determine the nature, migration rate, and extent of contamination is described in the following sections.

3.3.2 Nature of Contamination

Both the nature of contamination and the potential for the degradation of COCs at DSS SWMU 137 were evaluated using laboratory analyses of the soil samples. The analytical requirements included analyses for VOCs, SVOCs, RCRA metals, hexavalent chromium, cyanide, isotopic uranium, tritium, and radionuclides by gamma spectroscopy. The analytes and methods listed in Tables 3.2-2 and 3.2-3 are appropriate to characterize the COCs and any potential degradation products at SWMU 137.

3.3.3 Rate of Contaminant Migration

The septic system at DSS SWMU 137 was deactivated in the early 1990s when Buildings 6540 and 6542 were 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 systems at this site was therefore dependent upon the volume of aqueous effluent discharged to the environment from these systems when they were operational. Any migration of COCs from this site after use of the septic systems 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 these systems. Analytical data generated from the soil sampling conducted at the site are adequate to characterize the rate of COC migration at SWMU 137.

3.3.4 Extent of Contamination

Subsurface soil samples were collected from 40 sample locations beneath the effluent release areas (septic tanks and drainfields) at the site to assess whether releases of effluent from the septic systems caused any environmental contamination.

The soil samples were collected at sampling depths starting at 5 and 15 feet bgs in the northern drainfield area, 7 and 17 feet bgs in the southern drainfield, 9 feet bgs in boreholes adjacent to the northern septic tank, 11 feet bgs in boreholes adjacent to the southern septic tank, and

11 feet bgs for grab samples collected beneath the northern system septic tank in 1995. Sampling intervals started at the depths at which effluent discharged from the drainfield drain lines and septic tanks 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.

3.4 Comparison of COCs to Background Levels

Site history and characterization activities are used to identify potential COCs. Section 3.2 describes the identification of COCs and the sampling that was conducted in order to determine the concentration levels of those COCs at SWMU 137. 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 3.4-1 and 3.4-2.

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 3.4-1 lists the nonradiological COCs and Table 3.4-2 lists the radiological COCs included in the human health risk assessment at DSS SWMU 137. All samples were collected from depths of greater than 5 feet bgs; therefore, evaluation of ecological risk was not performed. Both tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997). Section 3.6.4.2 discusses the results presented in Tables 3.4-1 and 3.4-2.

3.5 Fate and Transport

The primary releases of COCs at DSS SWMU 137 were to the subsurface soil resulting from the discharge of effluents from the Buildings 6540/6542 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 seepage pits are no longer active, additional infiltration of water is not expected. Infiltration of precipitation is essentially nonexistent at SWMU 137, as virtually all of the moisture either drains away from the site or evaporates. Because groundwater at this site is approximately 480 feet bgs, the potential for COCs to reach groundwater through the unsaturated zone above the water table is extremely low.

Table 3.4-1
Nonradiological COCs for Human Health Risk Assessment at DSS SWMU 137 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

COC	Maximum Concentration (All Samples) (mg/kg)	SNL/NM Background Concentration (mg/kg)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Log K_{ow} (for organic COCs)	Bioaccumulator?[b] (BCF>40, Log K_{ow}>4)
Inorganic						
Arsenic	6.2	4.4	**No**	44[c]	--	**Yes**
Barium	241	214	**No**	170[d]	--	**Yes**
Cadmium	0.73	0.9	Yes	64[c]	--	**Yes**
Chromium, total	46.7	15.9	**No**	16[c]	--	No
Chromium VI	0.1[e]	1	Yes	16[c]	--	No
Cyanide	920	NC	**Unknown**	NC	--	**Unknown**
Lead	7.0	11.8	Yes	49[c]	--	**Yes**
Mercury	0.05	<0.1	Yes	5,500[c]	--	**Yes**
Selenium	0.86 J	<1	Yes	800[f]	--	**Yes**
Silver	1,170	<1	**No**	0.5[c]	--	No
Organic						
Acetone	0.023	NA	**NA**	0.69[g]	-0.24[g]	No
2,4-Dichlorophenol	0.33	NA	**NA**	214[h]	2.15[h]	**Yes**
Diethylphthalate	0.5	NA	**NA**	117[h]	2.47[h]	**Yes**
Di-n-butylphthalate	0.77	NA	**NA**	6,761[h]	4.61[i]	**Yes**
bis(2-Ethylhexyl) phthalate	0.165[e]	NA	**NA**	851[h]	7.6[i]	**Yes**
Methyl isobutyl ketone	0.005[e]	NA	**NA**	5[i]	1.19[i]	No
Methylene chloride	0.0073	NA	**NA**	5.0[g]	1.25[g]	No
Toluene	0.0027[e]	NA	**NA**	10.7[c]	2.69[c]	No

Note: **Bold** indicates the COCs that exceed the background screening values and/or are bioaccumulators.
[a]Dinwiddie September 1997, Southwest Area Supergroup.
[b]NMED March 1998.
[c]Yanicak March 1997.

Table 3.4-1 (Concluded)
Nonradiological COCs for Human Health Risk Assessment at DSS SWMU 137 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

[d]Neumann 1976.
[e]Nondetected concentration (i.e., one-half the maximum detection limit is greater than the maximum detected concentration).
[f]Callahan et al. 1979.
[g]Howard 1990.
[h]Howard 1989.
[i]Micromedex 1998.

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

Table 3.4-2
Radiological COCs for Human Health Risk Assessment at DSS SWMU 137 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 (0.0429)	0.079	Yes	3,000[d]	**Yes**
Thorium-232	0.599	1.01	Yes	3,000[d]	**Yes**
Tritium	ND (0.014)	0.021[e]	Yes	NA	No
Uranium-235	**ND (0.239)**	0.16	**No**	900[d]	**Yes**
Uranium-238	**ND (2.26)**	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.
BCF = Bioconcentration factor.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
MDA = Minimum detectable activity.
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.

The COCs at DSS SWMU 137 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 137 are limited to VOCs and SVOCs. Organic COCs may be degraded through photolysis, hydrolysis, and biotransformation. Photolysis requires light and therefore takes place in the air, at the ground surface, or in surface water. Hydrolysis includes chemical transformations in water and may occur in the soil solution. Biotransformation (i.e., transformation caused by plants, animals, and microorganisms) may occur; however, biological activity may be limited by the arid environment at this site. Because of the depth of the COCs in the soil, the loss of VOCs through volatilization is expected to be minimal.

Table 3.5-1 summarizes the fate and transport processes that can occur at DSS SWMU 137. 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 the long half-lives.

Table 3.5-1
Summary of Fate and Transport at DSS SWMU 137

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.

3.6 Human Health Risk Assessment

3.6.1 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.

3.6.2 Step 1. Site Data

Section 3.1 of this chapter provides the site description and history for DSS SWMU 137. Section 3.2 presents a comparison of results to DQOs. Section 3.3 discusses the nature, rate, and extent of contamination.

3.6.3 Step 2. Pathway Identification

DSS SWMU 137 has been designated with a future land-use scenario of industrial (DOE et al. September 1995) (see Annex B 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 137 is approximately 480 feet bgs. No intake routes through plant, meat, or milk ingestion are considered appropriate for either the industrial or residential land-use scenarios. Figure 3.6.3-1 shows the conceptual site model flow diagram for SWMU 137.

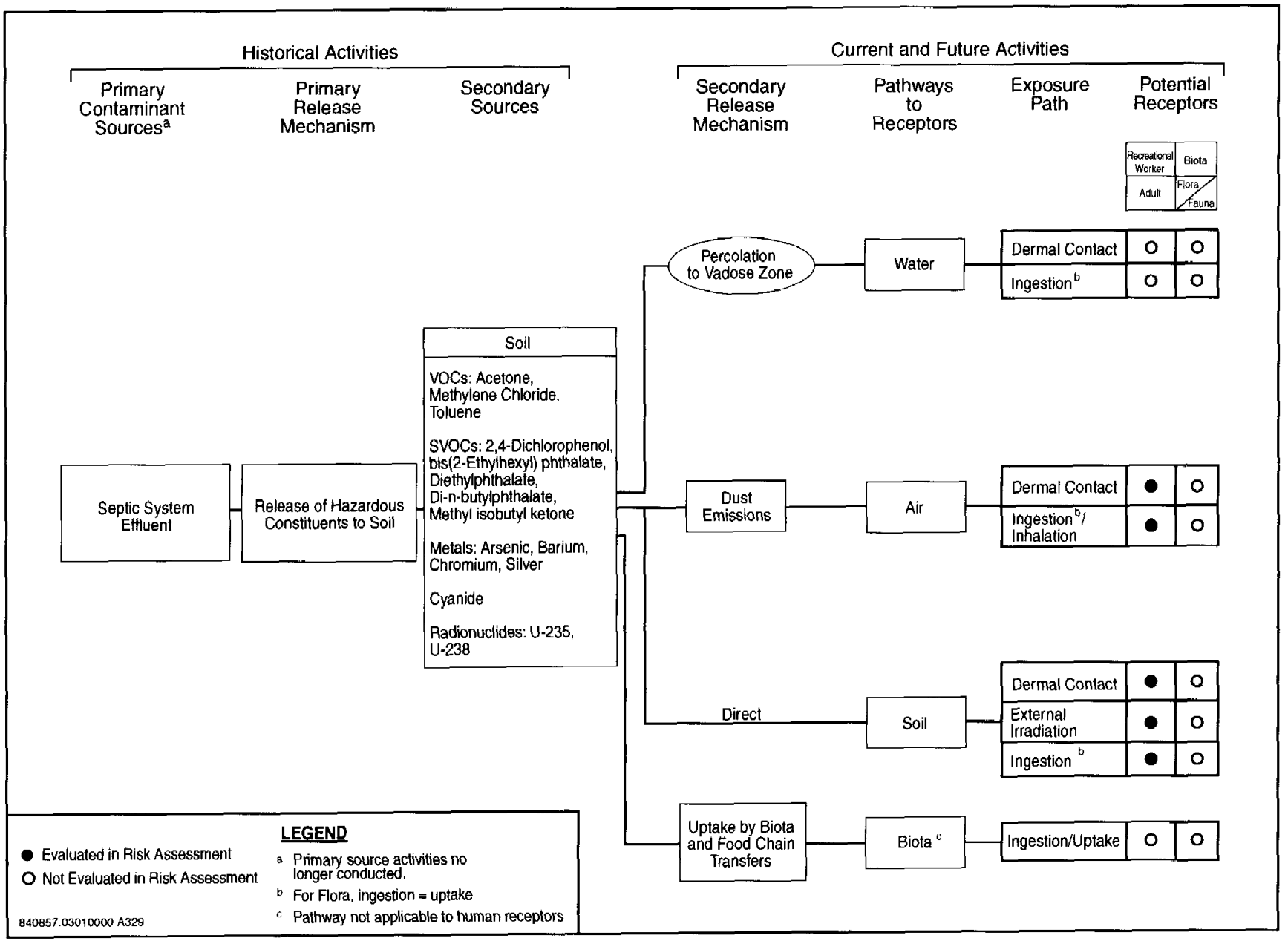

Figure 3.6.3-1

Conceptual Site Model Flow Diagram for DSS SWMU 137, Buildings 6540/6542 Septic System

Pathway Identification

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

3.6.4 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.

3.6.4.1 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 3.4-1 and used to calculate risk attributable to background in Section 3.6.6.2. Only the COCs that were detected above the corresponding SNL/NM maximum background screening levels or that do not have either a quantifiable or calculated background screening level are considered in further risk assessment analyses.

For radiological COCs that exceed the SNL/NM background screening levels, background values are subtracted from the individual maximum radionuclide concentrations. Those that do not exceed these background levels are not carried any further in the risk assessment. This approach is consistent with DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE 1993). Radiological COCs that do not have a background value and 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.

3.6.4.2 Results

Tables 3.4-1 and 3.4-2 show the DSS SWMU 137 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, four metals were measured at concentrations greater than the background screening values. One constituent (cyanide) does not have a quantified background screening concentration; therefore it is unknown whether this COC exceeds background. Eight 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 the background screening levels.

3.6.5 Step 4. Identification of Toxicological Parameters

Tables 3.6.5-1 (nonradiological) and 3.6.5-2 (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 3.6.5-1 were obtained from the Integrated Risk Information System (IRIS) (EPA 2004a), the Health Effects Assessment Summary Tables (HEAST) (EPA 1997a), EPA Region 6 (EPA 2004b), Risk Assessment Information System (ORNL 2003), and the Technical Background Document for Development of Soil Screening Levels (NMED February 2004). Dose conversion factors (DCFs) used in determining the excess TEDE values for radiological COCs for the individual pathways 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).

3.6.6 Step 5. Exposure Assessment and Risk Characterization

Section 3.6.6.1 describes the exposure assessment for this risk assessment. Section 3.6.6.2 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.

3.6.6.1 Exposure Assessment

Annex B 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

Table 3.6.5-1
Toxicological Parameter Values for DSS SWMU 137 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]
Barium	7E-2[c]	M	1.4E-4[e]	--	--	--	D	0.01[d]
Chromium, total	1.5E+0[c]	L	--	--	--	--	D	0.01[d]
Cyanide	2E-2[c]	M	--	--	--	--	D	0.1[d]
Silver	5E-3[c]	L	--	--	--	--	D	0.01[d]
Organic								
Acetone	1E-1[c]	L	1E-1[f]	--	--	--	D	0.01[g]
2,4-Dichlorophenol	3E-3[c]	L	3E-3[f]	--	--	--	--	0.1[d]
Diethylphthalate	8E-1[c]	L	8E-01[f]	--	--	--	D	0.1[d]
Di-n-butylphthalate	1E-1[c]	L	1E-1[f]	--	--	--	D	0.1[d]
bis(2-Ethylhexyl) phthalate	2E-2[f]	--	2E-2[f]	--	1.4E-2[f]	1.4E-2[f]	--	0.01[g]
Methyl isobutyl ketone	8E-2[e]	--	2.3E-2[e]	--	--	--	--	0.01[g]
Methylene chloride	6E-2[c]	M	8.6E-1[e]	--	7.5E-3[c]	1.6E-3[c]	B2	0.1[d]
Toluene	2E-1[c]	M	1.1E-1[c]	M	--	--	D	0.1[d]

[a]Confidence associated with IRIS (EPA 2004a) database values. Confidence: L = low, M = medium.
[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 HEAST (EPA 1997a).
[f]Toxicological parameter values from EPA Region 6 (EPA 2004b).
[g]Toxicological parameter values from Risk Assessment Information System (ORNL 2003).
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.

Table 3.6.5-1 (Concluded)
Toxicological Parameter Values for DSS SWMU 137 Nonradiological COCs

IRIS = Integrated Risk Information System.
mg/kg-d = Milligram(s) per kilogram-day.
(mg/kg-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 3.6.5-2
Radiological Toxicological Parameter Values for DSS SWMU 137 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.

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.

3.6.6.2 Risk Characterization

Table 3.6.6-1 shows an HI of 0.35 for the DSS SWMU 137 nonradiological COCs and a total estimated excess cancer risk of 4E-6 for the designated industrial land-use scenario. The numbers presented include exposure from soil ingestion, dermal contact, and dust and volatile inhalation for nonradiological COCs. Table 3.6.6-2 shows an HI of 0.02 and an estimated excess cancer risk of 3E-6 for the SWMU 137 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 3.4E-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 SWMU 137 for the industrial land-use scenario is well below this guideline. The estimated excess cancer risk is 3.0E-7.

For the nonradiological COCs under the residential land-use scenario, the HI is 4.16 with an estimated excess cancer risk of 2E-5 (Table 3.6.6-1). 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

Table 3.6.6-1
Risk Assessment Values for DSS SWMU 137 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	6.2	0.02	4E-6	0.29	2E-5
Barium	241	0.00	--	0.05	--
Chromium, total	46.7	0.00	--	0.00	--
Cyanide	920	0.07	--	0.75	--
Silver	1,170	0.24	--	3.08	--
Organic					
Acetone	0.023	0.00	--	0.00	--
2,4-Dichlorophenol	0.33	0.00	--	0.00	--
Diethylphthalate	0.5	0.00	--	0.00	--
Di-n-butylphthalate	0.77	0.00	--	0.00	--
bis(2-Ethylhexyl) phthalate	0.165[b]	0.00	9E-10	0.00	4E-9
Methyl isobutyl ketone	0.005[b]	0.00	--	0.00	--
Methylene chloride	0.0073	0.00	5E-8	0.00	1E-7
Toluene	0.0027[b]	0.00	--	0.00	--
Total		**0.35**	**4E-6**	**4.16**	**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.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
-- = Information not available.

Table 3.6.6-2
Risk Assessment Values for DSS SWMU 137 Nonradiological Background Constituents

COC	Background Concentration[a] (mg/kg)	Industrial Land-Use Scenario[b]		Residential Land-Use Scenario[b]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	4.4	0.02	3E-6	0.20	1E-5
Barium	214	0.00	--	0.04	--
Chromium, total	15.9	0.00	--	0.00	--
Cyanide	NC	--	--	--	--
Silver	<1	--	--	--	--
Total		**0.02**	**3E-6**	**0.24**	**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.

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 B). Table 3.6.6-2 shows an HI of 0.24 and an estimated excess cancer risk of 1E-5 for the SWMU 137 associated background constituents under the residential land-use scenario.

For the radiological COCs, the incremental TEDE for the residential land-use scenario is 8.6E-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 137 for the residential land-use scenario is well below this guideline. Consequently, SWMU 137 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 8.7E-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 3.6.9.

3.6.7 Step 6. Comparison of Risk Values to Numerical Guidelines

The human health risk assessment analysis evaluates the potential for adverse health effects for both the industrial (the designated land-use scenario for this site) and residential land-use scenarios.

For the nonradiological COCs under the industrial land-use scenario, the HI is 0.35 (less than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). The estimated excess cancer risk is 4E-6. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. This assessment also determines risks considering background concentrations of the potential nonradiological COCs for both the industrial and residential land-use scenarios. The incremental risk is determined by subtracting risk associated with background from potential COC risk. These numbers are not rounded before the difference is determined and therefore may appear to be inconsistent with numbers presented in tables and within the text. For conservatism, the background constituents that do not have quantified background screening concentrations are assumed to have a hazard quotient of 0.00. The incremental HI is 0.33 and the estimated incremental excess cancer risk is 1.18E-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 3.4E-2 mrem/yr, which is significantly lower than EPA's numerical guideline of 15 mrem/yr (EPA 1997b). The estimated incremental excess cancer risk is 3.0E-7.

The calculated HI for the nonradiological COCs under the residential land-use scenario is 4.16, which is above 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 3.92 and the estimated incremental cancer risk is 4.73E-6 for the residential land-use scenario. The estimated incremental cancer 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 8.6E-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 excess cancer risk is 8.7E-7.

3.6.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at DSS SWMU 137 was based upon an initial conceptual model that was validated with sampling conducted at the site. The sampling was implemented in accordance with procedures and DQOs in the RFI Work Plan (SNL/NM March 1993), the SAP for the RFI of 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 137.

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 3.6.5-1 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), Technical Background Document for Development of Soil Screening Levels (NMED February 2004), and the Risk Assessment Information System (ORNL 2003). 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 6, 9, and 3 (EPA 2004b, EPA 2002a, EPA 2002b). Because of the conservative nature of the RME approach, uncertainties in toxicological values are not expected to change the conclusion from the risk assessment analysis.

Although both the HI and estimated excess cancer risk are above the NMED guidelines for the residential land-use scenario, maximum concentrations were used in the risk calculation. Because the site has been adequately characterized, average concentrations are more representative of actual site conditions. Using the upper confidence limit (UCL) of the mean concentrations for arsenic, cyanide, and silver, the main contributors to excess cancer risk and hazards (summarized in Annex C), reduces the total HI and estimated excess cancer risk to 0.90 and 1E-7, respectively. The incremental HI and excess cancer risk are reduced to 0.86 and 1.05E-7, respectively. The UCL of the mean concentrations for cyanide and silver are 177 and 267 milligrams (mg)/kilogram (kg), respectively. The UCL of the mean concentration for arsenic (3.0 mg/kg) is below background. Therefore, arsenic is eliminated from further evaluation. Thus, by using realistic concentrations in the risk calculations that more accurately depict actual site conditions, both the total and incremental HI and excess cancer risk are below NMED guidelines.

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.

3.6.9 Summary

DSS SWMU 137 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 (0.35) is significantly lower than the accepted numerical guidance from the EPA. The estimated excess cancer risk is 4E-6; thus, excess cancer risk is also below the acceptable risk value provided by the NMED for an industrial land-use scenario (Bearzi January 2001). The incremental HI is 0.33 and the estimated incremental excess cancer risk is 1.18E-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 (4.16) is above the accepted numerical guidance from the EPA. The estimated excess cancer risk is 2E-5. Thus, excess cancer risk is slightly above the acceptable risk value provided by the NMED for a residential land-use scenario (Bearzi January 2001). The incremental HI is 3.92 and the estimated incremental excess cancer risk is 4.73E-6 for the residential land-use scenario. The estimated incremental excess cancer risk calculations indicate insignificant risk to human health for the residential land-use scenario.

Although both the HI and estimated excess cancer risk are above the NMED guidelines for the residential land-use scenario, maximum concentrations were used in the risk calculation. Because the site has been adequately characterized, average concentrations are more representative of actual site conditions. Using the UCL of the mean concentrations for arsenic (3.0 mg/kg), cyanide (177 mg/kg), and silver (267 mg/kg), the main contributors to excess cancer risk and hazards (summarized in Annex C), reduces the total HI and estimated excess cancer risk to 0.90 and 1E-7, respectively. The incremental HI and excess cancer risk are reduced to 0.86 and 1.05E-7, respectively. The UCL for arsenic is below background; therefore, arsenic is eliminated from further evaluation. Thus, by using realistic concentrations in the risk calculations that more accurately depict actual site conditions, both the total and incremental HI and excess cancer risk are below NMED guidelines.

The incremental TEDE and corresponding estimated cancer risk from radiological COCs are much lower than EPA guidance values. The estimated TEDE is 3.4E-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 3.0E-7 for the industrial land-use scenario. Furthermore, the incremental TEDE for the residential land-use scenario that results from a complete loss of institutional control is 8.6E-2 mrem/yr with an associated estimated incremental excess cancer risk of 8.7E-7. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, DSS SWMU 137 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 3.6.9-1.

Table 3.6.9-1
Summation of Incremental Nonradiological and Radiological Risks from
DSS SWMU 137, Buildings 6540/6542 Septic System Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	1.18E-6	3.0E-7	1.5E-6
Residential	4.73E-6	8.7E-7	5.6E-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.

3.7 Ecological Risk Assessment

3.7.1 Introduction

This section addresses the ecological risks associated with exposure to constituents of potential ecological concern (COPECs) in the soil at DSS SWMU 137. 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 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.

3.7.2 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 3.7.2.4) summarizes the scoping results and assesses the need for further examination of potential ecological impacts.

3.7.2.1 Data Assessment

As indicated in Section 3.4, all COCs at DSS SWMU 137 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.

3.7.2.2 *Bioaccumulation*

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

3.7.2.3 *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 3.5. As noted in Table 3.5-1 (Section 3.5), 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.

3.7.2.4 *Scoping Risk-Management Decision*

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

4.0 RECOMMENDATION FOR CORRECTIVE ACTION COMPLETE WITHOUT CONTROLS DETERMINATION

4.1 Rationale

Based upon field investigation data and the human health and ecological risk assessment analyses, a determination of Corrective Action Complete (CAC) without controls is recommended for DSS SWMU 137 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.

4.2 Criterion

Based upon the evidence provided in the risk assessment (Chapter 3.0), a determination of CAC without controls (NMED April 2004) is recommended for DSS SWMU 137. 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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5.0 REFERENCES

Baker, D.A., and J.K. Soldat, 1992. "Methods for Estimating Doses to Organisms from Radioactive Materials Released into the Aquatic Environment," PNL-8150, Pacific Northwest Laboratory, Richland, Washington.

Bearzi, J. (New Mexico Environment Department/Hazardous Waste Bureau), January 2000. Letter to M.J. Zamorski (U.S. Department of Energy) and L. Shephard (Sandia National Laboratories/New Mexico) approving the "Sampling and Analysis Plan for Characterizing and Assessing Potential Releases to the Environment for Septic and Other Miscellaneous Drain System at Sandia National Laboratories/New Mexico," January 28, 2000.

Bearzi, J.P. (New Mexico Environment Department), January 2001. Memorandum to RCRA-Regulated Facilities, "Risk-Based Screening Levels for RCRA Corrective Action Sites in New Mexico," Hazardous Waste Bureau, New Mexico Environment Department, Santa Fe, New Mexico. January 23, 2001.

Callahan, M.A., M.W. Slimak, N.W. Gabel, I.P. May, C.F. Fowler, J.R. Freed, P. Jennings, R.L. Durfee, F.C. Whitmore, B. Maestri, W.R. Mabey, B.R. Holt, and C. Gould, 1979. "Water-Related Environmental Fate of 129 Priority Pollutants," EPA-440/4-79-029, Office of Water and Waste Management, Office of Water Planning and Standards, U.S. Environmental Protection Agency, Washington, D.C.

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

DOE, see U.S. Department of Energy.

EPA, see U.S. Environmental Protection Agency.

Howard, P.H., 1989. Volume I: "Large Production and Priority Pollutants," *Handbook of Environmental Fate and Exposure Data for Organic Chemicals*, Lewis Publishers, Inc., Chelsea, Michigan.

Howard, P.H., 1990. Volume II: "Solvents," *Handbook of Environmental Fate and Exposure Data for Organic Chemicals*, Lewis Publishers, Inc. Chelsea, Michigan.

IT, see IT Corporation.

IT Corporation (IT), March 1994. "Sampling and Analysis Plan for Shallow Subsurface Soil Sampling, RCRA Facility Investigation of Septic Tanks and Drainfields (OU 1295)," IT Corporation, Albuquerque, New Mexico.

Jones, J. (Sandia National Laboratories/New Mexico), June 1991. Internal memorandum to D. Dionne listing the septic tanks that were removed from service with the construction of the Area III sanitary sewer system. June 21, 1991.

Kieling, J.E. (New Mexico Environment Department/Hazardous Waste Bureau), December 2003. Letter to K.L. Boardman (Sandia Site Office, National Nuclear Security Administration) and P.B. Davies (Sandia National Laboratories/New Mexico), regarding "Environmental Restoration Project Drain and Septic Systems (DSS) Soil Vapor Well Sample Results; Dated November 2003."

Kocher, D.C. 1983. "Dose-Rate Conversion Factors for External Exposure to Photon Emitters in Soil," *Health Physics,* Vol. 28, pp. 193–205.

Micromedex, Inc., 1998, Hazardous Substances Databank.

Moats, W. (New Mexico Environment Department/Hazardous Waste Bureau), February 2002. Letter to M.J. Zamorski (U.S. Department of Energy) and P. Davies (Sandia National Laboratories/New Mexico) approving the "Field Implementation Plan, Characterization of Non-Environmental Restoration Drain and Septic Systems." February 21, 2002.

National Council on Radiation Protection and Measurements (NCRP), 1987. "Exposure of the Population in the United States and Canada from Natural Background Radiation," NCRP Report No. 94, National Council on Radiation Protection and Measurements, Bethesda, Maryland.

National Oceanic and Atmospheric Administration (NOAA), 1990. "Local Climatological Data, Annual Summary with Comparative Data," Albuquerque, New Mexico.

NCRP, see National Council on Radiation Protection and Measurements.

Neumann, G., 1976. "Concentration Factors for Stable Metals and Radionuclides in Fish, Mussels and Crustaceans—A Literature Survey," Report 85-04-24, National Swedish Environmental Protection Board.

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

New Mexico Environment Department (NMED), June 1999. "Request for Supplemental Information – Proposals for No Further Action, January 1997, 6th Round." New Mexico Environment Department, Santa Fe, New Mexico. June 9, 1999.

New Mexico Environment Department (NMED), February 2004. "Technical Background Document for Development of Soil Screening Levels, Revision 2," Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, New Mexico Environment Department, Santa Fe, New Mexico.

New Mexico Environment Department (NMED), April 2004. "Compliance Order on Consent Pursuant to New Mexico Hazardous Waste Act § 74-4-10," New Mexico Environment Department, Santa Fe, New Mexico. April 29, 2004.

NMED, see New Mexico Environment Department.

NOAA, see National Oceanographic and Atmospheric Administration.

Oak Ridge National Laboratory (ORNL), 2003. "Risk Assessment Information System," electronic database maintained by Oak Ridge National Laboratory, Oak Ridge, Tennessee.

ORNL, see Oak Ridge National Laboratory.

Romero, T. (Sandia National Laboratories/New Mexico), September 2003. Internal communication to M. Sanders stating that during the connection of septic systems to the new City of Albuquerque sewer system, the old systems were disconnected and the lines capped. September 16, 2003.

Sandia National Laboratories/New Mexico (SNL/NM), March 1993. "Septic Tanks and Drainfields (ADS-1295) RCRA Facility Investigation Work Plan," Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), July 1994. "Verification and Validation of Chemical and Radiochemical Data," Technical Operating Procedure (TOP) 94-03, Rev. 0, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), January 1996. "Septic Tank Closure Book III: Logbook #0147, November 8, 1995 to January 26, 1996," Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), March 1996. "Site-Wide Hydrogeologic Characterization Project, Calendar Year 1995 Annual Report," Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), July 1996. "Laboratory Data Review Guidelines," Radiation Protection Diagnostics Procedure No. RPSD-02-11, Issue No. 2, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), January 1997. "Proposal for No Further Action, Environmental Restoration Project Site 137, Building 6540/6542 Septic System, Operable Unit 1295," Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), February 1998. "RESRAD Input Parameter Assumptions and Justification," Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), September 1999. "Environmental Restoration Project Response to NMED Request for Supplemental Information, No Further Action Proposals (6th Round) Dated January 1997." Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), October 1999. "Sampling and Analysis Plan for Characterizing and Assessing Potential Releases to the Environment From Septic and Other Miscellaneous Drain Systems at Sandia National Laboratories/New Mexico," Sandia National Laboratories, Albuquerque, New Mexico. October 19, 1999.

Sandia National Laboratories/New Mexico (SNL/NM), November 2001. "Field Implementation Plan, Characterization of Non-Environmental Restoration Drain and Septic Systems," Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), March 2002. "Annual Groundwater Monitoring Report, Fiscal Year 2000," Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), March 2003. Database printout provided by SNL/NM Facilities Engineering showing the year that numerous SNL/NM buildings were constructed, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), October 2003. Letter from Karen L. Boardman (NNSA) to John Kieling (NMED/HRMB) titled "Drain and Septic Systems (DSS) Soil Vapor Well Sample Results," Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico. November 24, 2003

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

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

U.S. Department of Energy (DOE), 1988. "External Dose-Rate Conversion Factors for Calculation of Dose to the Public," DOE/EH-0070, Assistant Secretary for Environment, Safety and Health, U.S. Department of Energy, Washington, D.C.

U.S. Department of Energy (DOE), 1993. "Radiation Protection of the Public and the Environment," DOE Order 5400.5, U.S. Department of Energy, Washington, D.C.

U.S. Department of Energy (DOE), U.S. Air Force, and U.S. Forest Service, September 1995. "Workbook: Future Use Management Area 2," prepared by the Future Use Logistics and Support Working Group in cooperation with U.S. Department of Energy Affiliates, the U.S. Air Force, and the U.S. Forest Service.

U.S. Environmental Protection Agency (EPA), November 1986. "Test Methods for Evaluating Solid Waste," 3rd ed., Update 3, SW-846, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1988. "Federal Guidance Report No. 11, Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," Office of Radiation Programs, U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1989. "Risk Assessment Guidance for Superfund, Vol. I: Human Health Evaluation Manual," EPA/540-1089/002, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1991. "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part B)," Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1997a. "Health Effects Assessment Summary Tables (HEAST), FY 1997 Update," EPA-540-R-97-036, Office of Research and Development and Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1997b. "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination," OSWER Directive No. 9200.4-18, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1997c. "Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risks," Interim Final, U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 2002a. "Region 9 Preliminary Remediation Goals (PRGs) 2002," electronic database maintained by Region 9, U.S. Environmental Protection Agency, San Francisco, California.

U.S. Environmental Protection Agency (EPA), 2002b. "Risk-Based Concentration Table," electronic database maintained by Region 3, U.S. Environmental Protection Agency, Philadelphia, Pennsylvania.

U.S. Environmental Protection Agency (EPA), 2004a. Integrated Risk Information System (IRIS) electronic database, maintained by the U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 2004b. "Region 6 Preliminary Remediation Goals (PRGs) 2004," electronic database maintained by Region 6, U.S. Environmental Protection Agency, Dallas, Texas.

Whicker, F.W., and V. Schultz, 1982. *Radioecology: Nuclear Energy and the Environment*, Volume II, CRC Press, Boca Raton, Florida.

Yanicak, S. (Oversight Bureau, Department of Energy, New Mexico Environment Department), March 1997. Letter to M. Johansen (DOE/AIP/POC Los Alamos National Laboratory), "(Tentative) list of constituents of potential ecological concern (COPECs) which are considered to be bioconcentrators and/or biomagnifiers." March 3, 1997.

Yu, C., A.J. Zielen, J.-J. Cheng, Y.C. Yuan, L.G. Jones, D.J. LePoire, Y.Y. Wang, C.O. Loureiro, E. Gnanapragasam, E. Faillace, A. Wallo III, W.A. Williams, and H. Peterson, 1993a. "Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD," Version 5.0. Environmental Assessment Division, Argonne National Laboratory, Argonne, Illinois.

Yu, C., C. Loureiro, J.-J. Cheng, L.G. Jones, Y.Y. Wang, Y.P. Chia, and E. Faillace, 1993b. "Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil," ANL/EAIS-8, Argonne National Laboratory, Argonne, Illinois.

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ANNEX A
DSS SWMU 137
Soil-Vapor Monitoring Well 137-VW-01
Analytical Results and Data Validation Report

SEVERN TRENT STL

Analytical Report

EXECUTIVE SUMMARY - Detection Highlights

E3I150159

PARAMETER	RESULT	REPORTING LIMIT	UNITS	ANALYTICAL METHOD
063060-001/137-VW-01-5-SV 09/09/03 10:40 001				
Dichlorodifluoromethane	0.53 J	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon disulfide	2.6 J	10	ppb(v/v)	EPA-21 TO-14A
Toluene	0.75 J	2.0	ppb(v/v)	EPA-21 TO-14A
063061-001/137-VW-01-20-SV 09/09/03 10:45 002				
1,1,1-Trichloroethane	0.80 J	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	0.68 J	2.0	ppb(v/v)	EPA-21 TO-14A
063062-001/137-VW-01-70-SV 09/09/03 10:50 003				
Dichlorodifluoromethane	0.51 J	2.0	ppb(v/v)	EPA-21 TO-14A
1,1,1-Trichloroethane	2.2	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	0.88 J	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	1.7 J	2.0	ppb(v/v)	EPA-21 TO-14A
063063-001/137-VW-01-100-SV 09/09/03 10:55 004				
Dichlorodifluoromethane	0.51 J	2.0	ppb(v/v)	EPA-21 TO-14A
Carbon disulfide	3.6 J	10	ppb(v/v)	EPA-21 TO-14A
1,1,1-Trichloroethane	2.2	2.0	ppb(v/v)	EPA-21 TO-14A
Benzene	2.0	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	1.4 J	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	4.7	2.0	ppb(v/v)	EPA-21 TO-14A
Ethylbenzene	7.8	2.0	ppb(v/v)	EPA-21 TO-14A
m-Xylene & p-Xylene	21	2.0	ppb(v/v)	EPA-21 TO-14A
o-Xylene	5.9	2.0	ppb(v/v)	EPA-21 TO-14A
4-Ethyltoluene	1.9 J	2.0	ppb(v/v)	EPA-21 TO-14A
1,2,4-Trimethylbenzene	1.4 J	2.0	ppb(v/v)	EPA-21 TO-14A
063064-001/137-VW-01-150-SV 09/09/03 11:00 005				
Dichlorodifluoromethane	0.56 J	2.0	ppb(v/v)	EPA-21 TO-14A
Acetone	4.9 J	10	ppb(v/v)	EPA-21 TO-14A
2-Butanone (MEK)	4.9 J	10	ppb(v/v)	EPA-21 TO-14A
1,1,1-Trichloroethane	1.9 J	2.0	ppb(v/v)	EPA-21 TO-14A
Trichloroethene	2.7	2.0	ppb(v/v)	EPA-21 TO-14A
Toluene	2.5	2.0	ppb(v/v)	EPA-21 TO-14A
Tetrachloroethene	0.74 J	2.0	ppb(v/v)	EPA-21 TO-14A

ANALYTICAL METHODS SUMMARY

E3I150159

PARAMETER	ANALYTICAL METHOD
Volatile Organics by TO-14A	EPA-21 TO-14A

References:

EPA-21 "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air", Second Edition, EPA/625/R-96/010b, January 1999

SAMPLE SUMMARY

E3I150159

WO #	SAMPLE#	CLIENT SAMPLE ID	SAMPLED DATE	SAMP TIME
F0C3F	001	063060-001/137-VW-01-5-SV	09/09/03	10:40
F0C3J	002	063061-001/137-VW-01-20-SV	09/09/03	10:45
F0C3K	003	063062-001/137-VW-01-70-SV	09/09/03	10:50
F0C3L	004	063063-001/137-VW-01-100-SV	09/09/03	10:55
F0C3N	005	063064-001/137-VW-01-150-SV	09/09/03	11:00

NOTE(S) :

- The analytical results of the samples listed above are presented on the following pages.
- All calculations are performed before rounding to avoid round-off errors in calculated results.
- Results noted as "ND" were not detected at or above the stated limit.
- This report must not be reproduced, except in full, without the written approval of the laboratory.
- Results for the following parameters are never reported on a dry weight basis: color, corrosivity, density, flashpoint, ignitability, layers, odor, paint filter test, pH, porosity pressure, reactivity, redox potential, specific gravity, spot tests, solids, solubility, temperature, viscosity, and weight.

SANDIA NATIONAL LABORATORIES

Client Sample ID: 063060-001/137-VW-01-5-SV

GC/MS Volatiles

Lot-Sample #...: E3I150159-001 Work Order #...: F0C3F1AC Matrix.....: AIR
Date Sampled...: 09/09/03 Date Received..: 09/12/03
Prep Date.....: 09/15/03 Analysis Date..: 09/15/03
Prep Batch #...: 3261409 Analysis Time..: 15:04
Dilution Factor: 1
Analyst ID.....: 117751 Instrument ID..: MSA
Method.....: EPA-21 TO-14A

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Dichlorodifluoromethane	**0.53 J**	**2.0**	**ppb(v/v)**	**0.50**
Chloromethane	ND	4.0	ppb(v/v)	1.0
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	2.0	ppb(v/v)	0.80
Vinyl chloride	ND	2.0	ppb(v/v)	0.80
Bromomethane	ND	2.0	ppb(v/v)	1.0
Chloroethane	ND	4.0	ppb(v/v)	0.80
Trichlorofluoromethane	ND	2.0	ppb(v/v)	0.50
1,1-Dichloroethene	ND	2.0	ppb(v/v)	0.50
Carbon disulfide	**2.6 J**	**10**	**ppb(v/v)**	**2.0**
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.0	ppb(v/v)	0.50
Acetone	ND	10	ppb(v/v)	2.0
Methylene chloride	ND	2.0	ppb(v/v)	0.80
trans-1,2-Dichloroethene	ND	2.0	ppb(v/v)	0.50
1,1-Dichloroethane	ND	2.0	ppb(v/v)	0.50
Vinyl acetate	ND	10	ppb(v/v)	2.0
cis-1,2-Dichloroethene	ND	2.0	ppb(v/v)	0.80
2-Butanone (MEK)	ND	10	ppb(v/v)	2.0
Chloroform	ND	2.0	ppb(v/v)	0.80
1,1,1-Trichloroethane	ND	2.0	ppb(v/v)	0.50
Carbon tetrachloride	ND	2.0	ppb(v/v)	0.50
Benzene	ND	2.0	ppb(v/v)	0.80
1,2-Dichloroethane	ND	2.0	ppb(v/v)	0.80
Trichloroethene	ND	2.0	ppb(v/v)	0.50
1,2-Dichloropropane	ND	2.0	ppb(v/v)	0.80
Bromodichloromethane	ND	2.0	ppb(v/v)	0.80
cis-1,3-Dichloropropene	ND	2.0	ppb(v/v)	0.50
4-Methyl-2-pentanone (MIBK)	ND	10	ppb(v/v)	2.0
Toluene	**0.75 J**	**2.0**	**ppb(v/v)**	**0.50**
trans-1,3-Dichloropropene	ND	2.0	ppb(v/v)	0.80
1,1,2-Trichloroethane	ND	2.0	ppb(v/v)	0.60
Tetrachloroethene	ND	2.0	ppb(v/v)	0.60
2-Hexanone	ND	10	ppb(v/v)	1.0
Dibromochloromethane	ND	2.0	ppb(v/v)	0.50
1,2-Dibromoethane (EDB)	ND	2.0	ppb(v/v)	0.50

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SANDIA NATIONAL LABORATORIES

Client Sample ID: 063060-001/137-VW-01-5-SV

GC/MS Volatiles

Lot-Sample #...: E3I150159-001 Work Order #...: F0C3F1AC Matrix.....: AIR

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Chlorobenzene	ND	2.0	ppb(v/v)	0.50
Ethylbenzene	ND	2.0	ppb(v/v)	0.50
m-Xylene & p-Xylene	ND	2.0	ppb(v/v)	1.0
o-Xylene	ND	2.0	ppb(v/v)	0.60
Styrene	ND	2.0	ppb(v/v)	0.60
Bromoform	ND	2.0	ppb(v/v)	0.50
1,1,2,2-Tetrachloroethane	ND	2.0	ppb(v/v)	0.50
Benzyl chloride	ND	10	ppb(v/v)	0.80
4-Ethyltoluene	ND	2.0	ppb(v/v)	0.70
1,3,5-Trimethylbenzene	ND	2.0	ppb(v/v)	0.80
1,2,4-Trimethylbenzene	ND	2.0	ppb(v/v)	0.80
1,3-Dichlorobenzene	ND	2.0	ppb(v/v)	0.70
1,4-Dichlorobenzene	ND	2.0	ppb(v/v)	0.80
1,2-Dichlorobenzene	ND	2.0	ppb(v/v)	0.80
1,2,4-Trichloro-benzene	ND	5.0	ppb(v/v)	1.0
Hexachlorobutadiene	ND	4.0	ppb(v/v)	1.0

NOTE(S):

J Estimated result. Result is less than RL.

SANDIA NATIONAL LABORATORIES

Client Sample ID: 063061-001/137-VW-01-20-SV

GC/MS Volatiles

Lot-Sample #...: E3I150159-002	**Work Order #...:** F0C3J1AC	**Matrix.....:** AIR	
Date Sampled...: 09/09/03	**Date Received..:** 09/12/03		
Prep Date.....: 09/15/03	**Analysis Date..:** 09/15/03		
Prep Batch #...: 3261409	**Analysis Time..:** 22:41		
Dilution Factor: 1			
Analyst ID.....: 117751	**Instrument ID..:** MSA		
	Method.....: EPA-21 TO-14A		

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Dichlorodifluoromethane	ND	2.0	ppb(v/v)	0.50
Chloromethane	ND	4.0	ppb(v/v)	1.0
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	2.0	ppb(v/v)	0.80
Vinyl chloride	ND	2.0	ppb(v/v)	0.80
Bromomethane	ND	2.0	ppb(v/v)	1.0
Chloroethane	ND	4.0	ppb(v/v)	0.80
Trichlorofluoromethane	ND	2.0	ppb(v/v)	0.50
1,1-Dichloroethene	ND	2.0	ppb(v/v)	0.50
Carbon disulfide	ND	10	ppb(v/v)	2.0
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.0	ppb(v/v)	0.50
Acetone	ND	10	ppb(v/v)	2.0
Methylene chloride	ND	2.0	ppb(v/v)	0.80
trans-1,2-Dichloroethene	ND	2.0	ppb(v/v)	0.50
1,1-Dichloroethane	ND	2.0	ppb(v/v)	0.50
Vinyl acetate	ND	10	ppb(v/v)	2.0
cis-1,2-Dichloroethene	ND	2.0	ppb(v/v)	0.80
2-Butanone (MEK)	ND	10	ppb(v/v)	2.0
Chloroform	ND	2.0	ppb(v/v)	0.80
1,1,1-Trichloroethane	**0.80 J**	**2.0**	**ppb(v/v)**	**0.50**
Carbon tetrachloride	ND	2.0	ppb(v/v)	0.50
Benzene	ND	2.0	ppb(v/v)	0.80
1,2-Dichloroethane	ND	2.0	ppb(v/v)	0.80
Trichloroethene	ND	2.0	ppb(v/v)	0.50
1,2-Dichloropropane	ND	2.0	ppb(v/v)	0.80
Bromodichloromethane	ND	2.0	ppb(v/v)	0.80
cis-1,3-Dichloropropene	ND	2.0	ppb(v/v)	0.50
4-Methyl-2-pentanone (MIBK)	ND	10	ppb(v/v)	2.0
Toluene	**0.68 J**	**2.0**	**ppb(v/v)**	**0.50**
trans-1,3-Dichloropropene	ND	2.0	ppb(v/v)	0.80
1,1,2-Trichloroethane	ND	2.0	ppb(v/v)	0.60
Tetrachloroethene	ND	2.0	ppb(v/v)	0.60
2-Hexanone	ND	10	ppb(v/v)	1.0
Dibromochloromethane	ND	2.0	ppb(v/v)	0.50
1,2-Dibromoethane (EDB)	ND	2.0	ppb(v/v)	0.50

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SANDIA NATIONAL LABORATORIES

Client Sample ID: 063061-001/137-VW-01-20-SV

GC/MS Volatiles

Lot-Sample #...: E3I150159-002 Work Order #...: F0C3J1AC Matrix.....: AIR

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Chlorobenzene	ND	2.0	ppb(v/v)	0.50
Ethylbenzene	ND	2.0	ppb(v/v)	0.50
m-Xylene & p-Xylene	ND	2.0	ppb(v/v)	1.0
o-Xylene	ND	2.0	ppb(v/v)	0.60
Styrene	ND	2.0	ppb(v/v)	0.60
Bromoform	ND	2.0	ppb(v/v)	0.50
1,1,2,2-Tetrachloroethane	ND	2.0	ppb(v/v)	0.50
Benzyl chloride	ND	10	ppb(v/v)	0.80
4-Ethyltoluene	ND	2.0	ppb(v/v)	0.70
1,3,5-Trimethylbenzene	ND	2.0	ppb(v/v)	0.80
1,2,4-Trimethylbenzene	ND	2.0	ppb(v/v)	0.80
1,3-Dichlorobenzene	ND	2.0	ppb(v/v)	0.70
1,4-Dichlorobenzene	ND	2.0	ppb(v/v)	0.80
1,2-Dichlorobenzene	ND	2.0	ppb(v/v)	0.80
1,2,4-Trichloro-benzene	ND	5.0	ppb(v/v)	1.0
Hexachlorobutadiene	ND	4.0	ppb(v/v)	1.0

NOTE(S):

J Estimated result. Result is less than RL.

SANDIA NATIONAL LABORATORIES

Client Sample ID: 063062-001/137-VW-01-70-SV

GC/MS Volatiles

Lot-Sample #...: E3I150159-003	Work Order #...: F0C3K1AC	Matrix.....: AIR	
Date Sampled...: 09/09/03	Date Received..: 09/12/03		
Prep Date.....: 09/15/03	Analysis Date..: 09/15/03		
Prep Batch #...: 3261409	Analysis Time..: 16:17		
Dilution Factor: 1			
Analyst ID.....: 117751	Instrument ID..: MSA		
	Method.....: EPA-21 TO-14A		

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Dichlorodifluoromethane	**0.51 J**	**2.0**	**ppb(v/v)**	**0.50**
Chloromethane	ND	4.0	ppb(v/v)	1.0
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	2.0	ppb(v/v)	0.80
Vinyl chloride	ND	2.0	ppb(v/v)	0.80
Bromomethane	ND	2.0	ppb(v/v)	1.0
Chloroethane	ND	4.0	ppb(v/v)	0.80
Trichlorofluoromethane	ND	2.0	ppb(v/v)	0.50
1,1-Dichloroethene	ND	2.0	ppb(v/v)	0.50
Carbon disulfide	ND	10	ppb(v/v)	2.0
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.0	ppb(v/v)	0.50
Acetone	ND	10	ppb(v/v)	2.0
Methylene chloride	ND	2.0	ppb(v/v)	0.80
trans-1,2-Dichloroethene	ND	2.0	ppb(v/v)	0.50
1,1-Dichloroethane	ND	2.0	ppb(v/v)	0.50
Vinyl acetate	ND	10	ppb(v/v)	2.0
cis-1,2-Dichloroethene	ND	2.0	ppb(v/v)	0.80
2-Butanone (MEK)	ND	10	ppb(v/v)	2.0
Chloroform	ND	2.0	ppb(v/v)	0.80
1,1,1-Trichloroethane	**2.2**	**2.0**	**ppb(v/v)**	**0.50**
Carbon tetrachloride	ND	2.0	ppb(v/v)	0.50
Benzene	ND	2.0	ppb(v/v)	0.80
1,2-Dichloroethane	ND	2.0	ppb(v/v)	0.80
Trichloroethene	**0.88 J**	**2.0**	**ppb(v/v)**	**0.50**
1,2-Dichloropropane	ND	2.0	ppb(v/v)	0.80
Bromodichloromethane	ND	2.0	ppb(v/v)	0.80
cis-1,3-Dichloropropene	ND	2.0	ppb(v/v)	0.50
4-Methyl-2-pentanone (MIBK)	ND	10	ppb(v/v)	2.0
Toluene	**1.7 J**	**2.0**	**ppb(v/v)**	**0.50**
trans-1,3-Dichloropropene	ND	2.0	ppb(v/v)	0.80
1,1,2-Trichloroethane	ND	2.0	ppb(v/v)	0.60
Tetrachloroethene	ND	2.0	ppb(v/v)	0.60
2-Hexanone	ND	10	ppb(v/v)	1.0
Dibromochloromethane	ND	2.0	ppb(v/v)	0.50
1,2-Dibromoethane (EDB)	ND	2.0	ppb(v/v)	0.50

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SANDIA NATIONAL LABORATORIES

Client Sample ID: 063062-001/137-VW-01-70-SV

GC/MS Volatiles

Lot-Sample #...: E3I150159-003 Work Order #...: F0C3K1AC Matrix.....: AIR

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Chlorobenzene	ND	2.0	ppb(v/v)	0.50
Ethylbenzene	ND	2.0	ppb(v/v)	0.50
m-Xylene & p-Xylene	ND	2.0	ppb(v/v)	1.0
o-Xylene	ND	2.0	ppb(v/v)	0.60
Styrene	ND	2.0	ppb(v/v)	0.60
Bromoform	ND	2.0	ppb(v/v)	0.50
1,1,2,2-Tetrachloroethane	ND	2.0	ppb(v/v)	0.50
Benzyl chloride	ND	10	ppb(v/v)	0.80
4-Ethyltoluene	ND	2.0	ppb(v/v)	0.70
1,3,5-Trimethylbenzene	ND	2.0	ppb(v/v)	0.80
1,2,4-Trimethylbenzene	ND	2.0	ppb(v/v)	0.80
1,3-Dichlorobenzene	ND	2.0	ppb(v/v)	0.70
1,4-Dichlorobenzene	ND	2.0	ppb(v/v)	0.80
1,2-Dichlorobenzene	ND	2.0	ppb(v/v)	0.80
1,2,4-Trichloro-benzene	ND	5.0	ppb(v/v)	1.0
Hexachlorobutadiene	ND	4.0	ppb(v/v)	1.0

NOTE(S):

J Estimated result. Result is less than RL.

SANDIA NATIONAL LABORATORIES

Client Sample ID: 063063-001/137-VW-01-100-SV

GC/MS Volatiles

Lot-Sample #...: E3I150159-004 Work Order #...: F0C3L1AC Matrix.....: AIR
Date Sampled...: 09/09/03 Date Received..: 09/12/03
Prep Date.....: 09/15/03 Analysis Date..: 09/15/03
Prep Batch #...: 3261409 Analysis Time..: 17:23
Dilution Factor: 1
Analyst ID.....: 117751 Instrument ID..: MSA
Method.....: EPA-21 TO-14A

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Dichlorodifluoromethane	**0.51 J**	**2.0**	**ppb(v/v)**	**0.50**
Chloromethane	ND	4.0	ppb(v/v)	1.0
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	2.0	ppb(v/v)	0.80
Vinyl chloride	ND	2.0	ppb(v/v)	0.80
Bromomethane	ND	2.0	ppb(v/v)	1.0
Chloroethane	ND	4.0	ppb(v/v)	0.80
Trichlorofluoromethane	ND	2.0	ppb(v/v)	0.50
1,1-Dichloroethene	ND	2.0	ppb(v/v)	0.50
Carbon disulfide	**3.6 J**	**10**	**ppb(v/v)**	**2.0**
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.0	ppb(v/v)	0.50
Acetone	ND	10	ppb(v/v)	2.0
Methylene chloride	ND	2.0	ppb(v/v)	0.80
trans-1,2-Dichloroethene	ND	2.0	ppb(v/v)	0.50
1,1-Dichloroethane	ND	2.0	ppb(v/v)	0.50
Vinyl acetate	ND	10	ppb(v/v)	2.0
cis-1,2-Dichloroethene	ND	2.0	ppb(v/v)	0.80
2-Butanone (MEK)	ND	10	ppb(v/v)	2.0
Chloroform	ND	2.0	ppb(v/v)	0.80
1,1,1-Trichloroethane	**2.2**	**2.0**	**ppb(v/v)**	**0.50**
Carbon tetrachloride	ND	2.0	ppb(v/v)	0.50
Benzene	**2.0**	**2.0**	**ppb(v/v)**	**0.80**
1,2-Dichloroethane	ND	2.0	ppb(v/v)	0.80
Trichloroethene	**1.4 J**	**2.0**	**ppb(v/v)**	**0.50**
1,2-Dichloropropane	ND	2.0	ppb(v/v)	0.80
Bromodichloromethane	ND	2.0	ppb(v/v)	0.80
cis-1,3-Dichloropropene	ND	2.0	ppb(v/v)	0.50
4-Methyl-2-pentanone (MIBK)	ND	10	ppb(v/v)	2.0
Toluene	**4.7**	**2.0**	**ppb(v/v)**	**0.50**
trans-1,3-Dichloropropene	ND	2.0	ppb(v/v)	0.80
1,1,2-Trichloroethane	ND	2.0	ppb(v/v)	0.60
Tetrachloroethene	ND	2.0	ppb(v/v)	0.60
2-Hexanone	ND	10	ppb(v/v)	1.0
Dibromochloromethane	ND	2.0	ppb(v/v)	0.50
1,2-Dibromoethane (EDB)	ND	2.0	ppb(v/v)	0.50

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SANDIA NATIONAL LABORATORIES

Client Sample ID: 063063-001/137-VW-01-100-SV

GC/MS Volatiles

Lot-Sample #...: E3I150159-004 Work Order #...: F0C3L1AC Matrix.....: AIR

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Chlorobenzene	ND	2.0	ppb(v/v)	0.50
Ethylbenzene	**7.8**	**2.0**	**ppb(v/v)**	**0.50**
m-Xylene & p-Xylene	**21**	**2.0**	**ppb(v/v)**	**1.0**
o-Xylene	**5.9**	**2.0**	**ppb(v/v)**	**0.60**
Styrene	ND	2.0	ppb(v/v)	0.60
Bromoform	ND	2.0	ppb(v/v)	0.50
1,1,2,2-Tetrachloroethane	ND	2.0	ppb(v/v)	0.50
Benzyl chloride	ND	10	ppb(v/v)	0.80
4-Ethyltoluene	**1.9 J**	**2.0**	**ppb(v/v)**	**0.70**
1,3,5-Trimethylbenzene	ND	2.0	ppb(v/v)	0.80
1,2,4-Trimethylbenzene	**1.4 J**	**2.0**	**ppb(v/v)**	**0.80**
1,3-Dichlorobenzene	ND	2.0	ppb(v/v)	0.70
1,4-Dichlorobenzene	ND	2.0	ppb(v/v)	0.80
1,2-Dichlorobenzene	ND	2.0	ppb(v/v)	0.80
1,2,4-Trichloro-benzene	ND	5.0	ppb(v/v)	1.0
Hexachlorobutadiene	ND	4.0	ppb(v/v)	1.0

NOTE(S):

J Estimated result. Result is less than RL.

SANDIA NATIONAL LABORATORIES

Client Sample ID: 063064-001/137-VW-01-150-SV

GC/MS Volatiles

Lot-Sample #...: E3I150159-005	Work Order #...: F0C3N1AC	Matrix.....: AIR
Date Sampled...: 09/09/03	Date Received..: 09/12/03	
Prep Date.....: 09/15/03	Analysis Date..: 09/15/03	
Prep Batch #...: 3261409	Analysis Time..: 17:56	
Dilution Factor: 1		
Analyst ID.....: 117751	Instrument ID..: MSA	
	Method.....: EPA-21 TO-14A	

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Dichlorodifluoromethane	**0.56 J**	**2.0**	**ppb(v/v)**	**0.50**
Chloromethane	ND	4.0	ppb(v/v)	1.0
1,2-Dichloro-1,1,2,2-tetrafluoroethane	ND	2.0	ppb(v/v)	0.80
Vinyl chloride	ND	2.0	ppb(v/v)	0.80
Bromomethane	ND	2.0	ppb(v/v)	1.0
Chloroethane	ND	4.0	ppb(v/v)	0.80
Trichlorofluoromethane	ND	2.0	ppb(v/v)	0.50
1,1-Dichloroethene	ND	2.0	ppb(v/v)	0.50
Carbon disulfide	ND	10	ppb(v/v)	2.0
1,1,2-Trichloro-1,2,2-trifluoroethane	ND	2.0	ppb(v/v)	0.50
Acetone	**4.9 J**	**10**	**ppb(v/v)**	**2.0**
Methylene chloride	ND	2.0	ppb(v/v)	0.80
trans-1,2-Dichloroethene	ND	2.0	ppb(v/v)	0.50
1,1-Dichloroethane	ND	2.0	ppb(v/v)	0.50
Vinyl acetate	ND	10	ppb(v/v)	2.0
cis-1,2-Dichloroethene	ND	2.0	ppb(v/v)	0.80
2-Butanone (MEK)	**4.9 J**	**10**	**ppb(v/v)**	**2.0**
Chloroform	ND	2.0	ppb(v/v)	0.80
1,1,1-Trichloroethane	**1.9 J**	**2.0**	**ppb(v/v)**	**0.50**
Carbon tetrachloride	ND	2.0	ppb(v/v)	0.50
Benzene	ND	2.0	ppb(v/v)	0.80
1,2-Dichloroethane	ND	2.0	ppb(v/v)	0.80
Trichloroethene	**2.7**	**2.0**	**ppb(v/v)**	**0.50**
1,2-Dichloropropane	ND	2.0	ppb(v/v)	0.80
Bromodichloromethane	ND	2.0	ppb(v/v)	0.80
cis-1,3-Dichloropropene	ND	2.0	ppb(v/v)	0.50
4-Methyl-2-pentanone (MIBK)	ND	10	ppb(v/v)	2.0
Toluene	**2.5**	**2.0**	**ppb(v/v)**	**0.50**
trans-1,3-Dichloropropene	ND	2.0	ppb(v/v)	0.80
1,1,2-Trichloroethane	ND	2.0	ppb(v/v)	0.60
Tetrachloroethene	**0.74 J**	**2.0**	**ppb(v/v)**	**0.60**
2-Hexanone	ND	10	ppb(v/v)	1.0
Dibromochloromethane	ND	2.0	ppb(v/v)	0.50
1,2-Dibromoethane (EDB)	ND	2.0	ppb(v/v)	0.50

(Continued on next page)

SANDIA NATIONAL LABORATORIES

Client Sample ID: 063064-001/137-VW-01-150-SV

GC/MS Volatiles

Lot-Sample #...: E3I150159-005 Work Order #...: F0C3N1AC Matrix.....: AIR

PARAMETER	RESULT	REPORTING LIMIT	UNITS	MDL
Chlorobenzene	ND	2.0	ppb(v/v)	0.50
Ethylbenzene	ND	2.0	ppb(v/v)	0.50
m-Xylene & p-Xylene	ND	2.0	ppb(v/v)	1.0
o-Xylene	ND	2.0	ppb(v/v)	0.60
Styrene	ND	2.0	ppb(v/v)	0.60
Bromoform	ND	2.0	ppb(v/v)	0.50
1,1,2,2-Tetrachloroethane	ND	2.0	ppb(v/v)	0.50
Benzyl chloride	ND	10	ppb(v/v)	0.80
4-Ethyltoluene	ND	2.0	ppb(v/v)	0.70
1,3,5-Trimethylbenzene	ND	2.0	ppb(v/v)	0.80
1,2,4-Trimethylbenzene	ND	2.0	ppb(v/v)	0.80
1,3-Dichlorobenzene	ND	2.0	ppb(v/v)	0.70
1,4-Dichlorobenzene	ND	2.0	ppb(v/v)	0.80
1,2-Dichlorobenzene	ND	2.0	ppb(v/v)	0.80
1,2,4-Trichloro-benzene	ND	5.0	ppb(v/v)	1.0
Hexachlorobutadiene	ND	4.0	ppb(v/v)	1.0

NOTE(S):

J Estimated result. Result is less than RL.

The remaining portions of this report:

- **QA/QC;**
- **137-VW-01 Extended Raw Data,**

are available through the SNL/NM Environmental Safety & Health and Security Record Center

RECORDS CENTER CODE: _____

SMO ANALYTICAL DATA ROUTING FORM

PROJECT NAME: DSS-NFA
PROJECT/TASK: 7223_02.02.01
SNL TASK LEADER: Collins
ORG/MS/CF0#: 6133/1087/CF023-03
SMO PROJECT LEAD: Palencia
SAMPLE SHIP DATE: 9/10/2003

ARCOC	LAB	LAB ID	PRELIM DATE	FINAL DATE	EDD	EDD ON Q	Cust CD	RC CD
606757	STCA	E3I150159		9/24/2003	X	X	X	K

DATA PACKAGE TAT:		RUSH	X	NORMAL
CORRECTIONS REQUESTED BY/DATE:				
PROBLEM #/DATE CORRECTION RECEIVED:				
CVR COMPLETED BY/DATE:	L Herrera		09-25-03	
FINAL TRANSMITTED TO/DATE:	M Saavedra		09-25-03	
SENT TO VALIDATION BY/DATE:	J. Conn		09/25/03	
REVISIONS REQUESTED/REVISIONS RECEIVED (DATE):				
VALIDATION COMPLETED BY/DATE:	K. Lambert		09/26/03	
COPY TO WM BY/DATE:				
CD REQUESTED BY/DATE	J. Conn		09/26/03	
CD RECEIVED BY/DATE				
TO ERDMS OR RECORDS CENTER BY/DATE:	J. Conn		09/30/03	

COMMENTS:

Sample Findings Summary

Site: DSS-NFA **AR/COC:** 606757 **Data Type:** Organic

Analysis met QC acceptance criteria. No data will be qualified.

Validated By: Kevin McLaughlin **Date:** 09/26/03

Data Validation Qualifiers and Descriptive Flags*

Note: Qualifiers may be used in conjunction with descriptive flags (e.g., J,A; UJ,P; U,B)

Qualifiers	Comment
J	The associated value is an estimated quantity.
J1	The method requirements for sample preservation/temperature were not met for the sample analysis. The associated value is an estimated quantity.
J2	The holding time was exceeded for the associated sample analysis. The associated value is an estimated quantity.
UJ	The analyte was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
U	The associated result is less than ten times the concentration in any blank and is determined to be non-detect. The analyte is a common laboratory contaminant.
U1	The associated result is less than five times the concentration in any blank and is determined to be non-detect.
R	The data are unusable for their intended purpose. The analyte may or may not be present. (Note: Resampling and reanalysis is necessary for verification.)

Descriptive Flags	
A	Laboratory accuracy and/or bias measurements for the associated Laboratory Control Sample and/or duplicate (LCS/LCSD) do not meet acceptance criteria.
A1	Laboratory accuracy and/or bias measurements for the associated Surrogate Spike do not meet acceptance criteria.
A2	Laboratory accuracy and/or bias measurements for the associated Matrix Spike and/or duplicate (MS/MSD) do not meet acceptance criteria.
A3	Insufficient quality control data to determine laboratory accuracy.
B	Analyte present in laboratory method blank
B1	Analyte present in trip blank.
B2	Analyte present in equipment blank.
B3	Analyte present in calibration blank.
P	Laboratory precision measurements for the Laboratory Control Sample and duplicate (LCS/LCSD) do not meet acceptance criteria.
P1	Laboratory precision measurements for the Matrix Spike Sample and associated duplicate (MS/MSD) do not meet acceptance criteria
P2	Insufficient quality control data to determine laboratory precision.

* This is not a definitive list. Other qualifiers are potentially available, see TOP 94-03.

Updated: September 14, 1999

Beginning January 2000

Application of Data Validation Qualifiers to Data Tables

Laboratory Qualifier	Application to Data Tables
Laboratory Qualifier	
J	J (Reporting Limit)
U	ND (Detection Limit)
None	Detected concentration; See Data Validation Report
Laboratory Descriptive Flag	
B	Analyte concentration; See Data Validation Report, analyte present in method blank
Data Validation Qualifier	
J (Estimated quantity)	J* * - See Data Validation Report
UJ (Analyzed for but not detected; associated value is an estimate and may be inaccurate or imprecise)	ND (Detection Limit J); See Data Validation Report
U (Analyzed for but not detected)	ND (Reporting Limit or Reported Value if > Reporting Limit); See Data Validation Report
R (Data unusable)	R* * - See Data Validation Report
N (Presumptive evidence of the presence of the material)	Detected concentration(N); See Data Validation Report
NJ (Presumptive evidence of the presence of the material at an estimated quantity)	Detected concentration (NJ); See Data Validation Report
None (Data conforms to QC requirements)	Use Laboratory Qualifier

Note: Both the laboratory and data validation qualifiers are required to assure the data is correctly qualified. The descriptive flags are meant to assist the user in understanding the qualification of the data and in writing up the results of the data validation process. They are not for incorporation into the data tables.

Analytical Quality Associates, Inc.
616 Maxine NE
Albuquerque, NM 87123
Phone: 505-299-5201
Fax: 505-299-6744
Email: minteer@aol.com

MEMORANDUM

DATE: September 26, 2003

TO: File

FROM: Kevin Lambert

SUBJECT: Organic Data Review and Validation – SNL
DSS-NFA, AR/COC No. 606757, SDG No. E31150159 (STCA), and Project/Task No. 7223.02.02.01

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. Data are evaluated using SNL/NM ER Project AOP 00-03.

Summary

All samples were prepared and analyzed with accepted procedures using method EPA21 TO-14A. All compounds were successfully analyzed. No problems were identified with the data package that result in the qualification of data.

Data are acceptable and QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times

All samples were analyzed within the prescribed holding times.

Calibration

The initial calibration and continuing calibration data met QC acceptance criteria except as follows.

The calibration RF for chloromethane (0.089) was < the specified minimum RF (0.10). However, the calibration RSD and CCV %D for chloromethane met QC acceptance criteria. Associated sample results were non-detect (ND) and as a result based on professional judgment no data will be qualified.

The calibration RSD for benzyl chloride (29%) and bromoform (25%) were > 20% but $\leq$ 40%. Associated sample results were ND and as a result based on professional judgment no data will be qualified.

Blanks

No target analytes were detected in the blanks.

Surrogates

Surrogate assessment is not required for this analysis.

Internal Standards

Internal standards data met QC acceptance criteria.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)

MS/MSD is not required. The LCS/LCSD is used to assess accuracy and precision.

Laboratory Control Sample (LCS)

The LCS/LCSD met QC acceptance criteria.

Detection Limits/Dilutions

All detection limits were properly reported; no dilutions were required

Other QC

No equipment blank (EB), trip blank (TB) or field duplicate pair was submitted on the ARCOC.

No other specific issues were identified which affect data quality.

Data Validation Summary

Site/Project: DSS-NFA Project/Task #: 7.223.02.02.01 # of Samples: 5 Matrix: soil/gas (air)

AR/COC #: 606757 Laboratory Sample IDs: E3I150154-001 to -005

Laboratory: STCA

SDG #: E3I150154

QC Element	Analysis									
	~~TO-14A~~ Organics				Inorganics				RAD	Other
	VOC	SVOC	Pesticide/ PCB	HPLC (HE)	ICP/AES	GFAA/ AA	CVAA (Hg)	CN		
1. Holding Times/Preservation	✓									
2. Calibrations	✓									
3. Method Blanks	✓									
4. MS/MSD	NA									
5. Laboratory Control Samples	✓				NA					
6. Replicates										
7. Surrogates	NA									
8. Internal Standards	✓									
9. TCL Compound Identification	✓									
10. ICP Interference Check Sample										
11. ICP Serial Dilution										
12. Carrier/Chemical Tracer Recoveries										
13. Other QC	NA									

J = Estimated
U = Not Detected
UJ = Not Detected, Estimated
R = Unusable

Check (√) = Acceptable
Shaded Cells = Not Applicable (also "NA")
NP = Not Provided
Other: _____

Reviewed By: Karen A. Lambert Date: 9-26-03

Volatile Organics (TO-14)

Site/Project: DSS - NFA AR/COC #: 606757 # of Samples: 5 Matrix: AIR

Laboratory: STLA Laboratory Report #: E3I150154 Laboratory Sample IDs: E3I150154-001 to -005

Methods: EPA 21 (TO-14A) (1) (2) Batch #s: 3261409

IS	CAS #	Name	TCL	Min. RF	Intercept	Calib. RF >.05	Calib. RSD/ R^2 <20% / 0.99	COV %D 20%	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Trip Blanks
1	74-87-3	Chloromethane	✓	0.10	NA	0.039	✓	✓	✓									
1	74-83-9	Bromomethane	✓	0.10		✓	✓											
1	75-01-4	vinyl chloride	✓	0.10		✓	✓											
1	75-00-3	Chloroethane	✓	0.01		✓	✓			✓	✓	✓						
1	75-09-2	methylene chloride (10xblk)	✓	0.01		✓	✓											
1	67-64-1	acetone (10xblk)	✓	0.01		✓	✓			✓	✓	✓						
1	75-35-4	1,1-dichloroethene	✓	0.20		✓	✓											
1	75-34-3	1,1-dichloroethane	✓	0.10		✓	✓											
1	67-66-3	Chloroform	✓	0.20		✓	✓											
1	107-06-2	1,2-dichloroethane	✓	0.10		✓	✓											
1	78-93-3	2-butanone (10xblk)	✓	0.01		✓	✓											
2	71-55-6	1,1,1-trichloroethane	✓	0.10		✓	✓											
2	56-23-5	carbon tetrachloride	✓	0.10		✓	✓											
2	78-87-5	1,2-dichloropropane	✓	0.01		✓	✓											
2	10061-01-5	cis-1,3-dichloropropene	✓	0.20		✓	✓			✓	✓	✓						
2	79-01-6	Trichloroethene	✓	0.30		✓	✓											
2	79-00-5	1,1,2-trichloroethane	✓	0.10		✓	✓											
2	71-43-2	Benzene	✓	0.50		✓	✓											
2	10061-02-6	trans-1,3-dichloropropene	✓	0.10		✓	✓											
3	108-10-1	4-methyl-2-pentanone	✓	0.10		✓	✓											
3	127-18-4	Tetrachloroethene	✓	0.20		✓	✓			✓	✓	✓						
3	79-34-5	1,1,2,2-tetrachloroethane	✓	0.30		✓	✓			✓	✓	✓						
3	108-88-3	toluene(10xblk)	✓	0.40		✓	✓											
3	108-90-7	Chlorobenzene	✓	0.50		✓	✓											
3	100-41-4	Ethylbenzene	✓	0.10		✓	✓											
3	100-42-5	Styrene	✓	0.30		✓	✓											
	107-05-01	Allyl chloride																
	100-44-7	Benzyl chloride	✓			✓	29											
	106-93-4	1,2-dibromoethane	✓			✓	✓											
	95-50-1	1,2-dichlorobenzene	✓			✓	✓											
	541-73-1	1,3-dichlorobenzene	✓			✓	✓											
	106-46-7	1,4-dichlorobenzene	✓			✓	✓											
	75-71-8	dichlorodifluoromethane	✓		✓	✓	✓	✓	✓									

Notes: Shaded rows are RCRA compounds.

Comments: NA - Not Applicable

(1) Calib RF < min RF for chloromethane, RSD & CCV %D met QC criteria, Sample result ND, N. data will be qualified

(2) ~~CCV %D~~ RSD RAL > 20 but < 40 for benzyl chloride & bromoform, Sample result ND, N. data will be qualified

Reviewed By: Karen A Lambert Date: 9-26-03

Volatile Organics (TO-14)

Site/Project: _____ AR/COC #: 606757 # of Samples: _____ Matrix: _____

Laboratory: _____ Laboratory Report #: _____ Laboratory Sample IDs: _____

Methods: _____ Batch #s: _____

IS	CAS #	Name	TCL	Min. RF	Intercept	Calib. RF >.05	Calib. RSD/ R² <20%/ 0.99	CCV %D 20%	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Trip Blanks		
	76-14-2	1,2-dichloro-1,1,2,2-tetrafluoroethane	✓		NA	✓	✓	✓	✓											
	156-59-2	cis-1,2-dichloroethene	✓			✓	✓													
	156-60-5	trans-1,2-dichloroethene	✓			✓	✓													
	87-68-3	hexachlorobutadiene	✓			✓	✓													
	120-82-1	1,2,4-trichlorobenzene	✓			✓	✓													
	75-15-0	carbon disulfide	✓			✓	✓													
	75-69-4	trichlorofluoromethane	✓			✓	✓													
	95-63-6	1,2,4-trimethylbenzene	✓			✓	✓													
	108-67-8	1,3,5-trimethylbenzene	✓			✓	✓													
	76-13-1	1,1,2-trichloro-1,2,2-trifluoroethane	✓			✓	✓													
	136777-61-2	m-, p-xylene	✓			✓	✓													
	95-47-6	o-xylene	✓			✓	✓													
	622-96-8	4-ethyltoluene	✓			✓	✓													
	108-05-4	vinyl acetate	✓			✓	✓													
	75-27-4	bromodichloromethane	✓			✓	✓													
	591-78-6	2-hexanone	✓			✓	✓													
	124-48-1	dibromochloromethane	✓			✓	✓	✓	✓											
	75-25-2	bromoform	✓		↓	✓	25	↓	↓											
	64-17-5	ethanol																		
	67-56-1	methanol																		
	80-62-6	methyl methacrylate																		
	141-78-6	ethyl acetate																		
	107-02-8	acrolein																		
	75-05-8	acetonitrile																		
	67-63-0	isopropanol																		
	107-13-1	acrylonitrile																		
	123-91-1	1,4,-dioxane																		

N/A

Notes: Shaded rows are RCRA compounds.

Comments:

Volatile Organics (TO-14)

Site/Project: _____ AR/COC #: 606754 Batch #s: _____

Laboratory: _____ Laboratory Report #: _____ # of Samples: _____ Matrix: _____

Surrogate Recovery and Internal Standard Outliers (TO-14)

Sample	SMC 1	SMC 2	SMC 3	IS 1 area	IS 1 RT	IS 2 area	IS 2 RT	IS 3 area	IS 3 RT
						Met			
		N/A							
						Criteria			

SMC 1: 4-Bromofluorobenzene
SMC 2: 1,2-Dichloroethane-d4
SMC 3: Toluene-d8

IS 1: Bromochloromethane
IS 2: 1,4-Difluorobenzene
IS 3: Chlorobenzene-d5

Comments:

CONTRACT LABORATORY
ANALYSIS REQUEST AND CHAIN OF CUSTODY

Internal Lab

Batch No. N/A

SMO Use

AR/COC 606757

Dept. No./Mail Stop:	6132/1089	Date Samples Shipped:	9/10/03	Project/Task No.:	7223.02.02.01
Project/Task Manager:	Mike Sanders	Carrier/Waybill No.	26418	SMO Authorization:	SMO PO 21673
Project Name:	DSS Soil Vapor Well Sampling	Lab Contact:	Mark Loeb(800)333-3305	Contract #:	
Record Center Code:		Lab Destination:	Severn Trent St.Louis		
Logbook Ref. No.:		SMO Contact/Phone:	Pam Puissant(505)844-3185		
Service Order No.	CF023-03	Send Report to SMO:	Wendy Palencia(505)844-3132		
Location	Tech Area 3				
Building	Room				

☐ Waste Characterization
-Send preliminary/copy report to:

☐ Released by COC No.:
☐ Validation Required

Bill To: Sandia National Labs (Accounts Payable)
P.O. Box 5800 MS 0154
Albuquerque, NM 87185-0154

Reference LOV(available at SMO)

Sample No.-Fraction	ER Sample ID or Sample Location Detail	Pump Depth (ft)	ER Site No.	Date/Time(hr) Collected	Sample Matrix	Container Type	Container Volume	Preserv-ative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
063060-001	137-VW-01-5-SV	5		9-9-03/1040	SG	SC	6L	none	G	SA	TO-14 summa#0102	
063061-001	137-VW-01-20-SV	20		9-9-03/1045	SG	SC	6L	none	G	SA	TO-14 summa#93276	
063062-001	137-VW-01-70-SV	70		9-9-03/1050	SG	SC	6L	none	G	SA	TO-14 summa#60-A	
063063-001	137-VW-01-100-SV	100		9-9-03/1055	SG	SC	6L	none	G	SA	TO-14 summa#12261	
063064-001	137-VW-01-150-SV	150		9-9-03/1100	SG	SC	6L	none	G	SA	TO-14 summa#02856	

RMMA ☐ Yes ☑ No Ref. No.

Sample Disposal ☐ Return to Client ☑ Disposal by lab

Turnaround Time ☐ 7 Day ☑ 15 Day ☐ 30 Day ☐ Negotiated TAT

Return Samples By:

Sample Tracking Smo Use
Date Entered(mm/dd/yy) 09/11/03
Entered by: JAC
QC Inits. RJL

Special Instructions/QC Requirements
EDD ☑ Yes ☐ No
Level C Package ☑ Yes ☐ No
*Send report to:
Mike Sanders
Dept.6132 Mail stop 1089
505-284-2478
Tim Jackson Mail stop 1087
505-284-2547
*Please list as separate report.

Abnormal Conditions on Receipt

Lab Use

Sample Team Members	Name	Signature	Init	Company/Organization/Phone/Cellular
	J Lee		JDL	Weston Solutions 6134 (505-284-3309)

1.Relinquished by		Org. 6134	Date 9/10/03	Time 0814	4.Relinquished by	Org.	Date	Time
1. Received by	SMO	Org. 6133	Date 9/10/03	Time 0814	4. Received by	Org.	Date	Time
2.Relinquished by	SMO	Org. 6133	Date 9/10/03	Time	5.Relinquished by	Org.	Date	Time
2. Received by		Org.	Date	Time	5. Received by	Org.	Date	Time
3.Relinquished by		Org.	Date	Time	6.Relinquished by	Org.	Date	Time
3. Received by		Org.	Date	Time	6. Received by	Org.	Date	Time

Contract Verification Review (CVR)

Project Leader Collins | Project Name DSS-NFA | Case No. 7223_02.02.01

AR/COC No. 606757 | Analytical Lab GEL | SDG No. E3I150159

In the tables below, mark any information that is missing or incorrect and give an explanation.

1.0 Analysis Request and Chain of Custody Record and Log-In Information

Line No.	Item	Complete? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? No
1.1	All items on COC complete - data entry clerk initialed and dated	X				
1.2	Container type(s) correct for analyses requested	X				
1.3	Sample volume adequate for # and types of analyses requested	X				
1.4	Preservative correct for analyses requested	X				
1.5	Custody records continuous and complete	X				
1.6	Lab sample number(s) provided and SNL sample number(s) cross referenced and correct	X				
1.7	Date samples received	X				
1.8	Condition upon receipt information provided	X				

2.0 Analytical Laboratory Report

Line No.	Item	Complete? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? No
2.1	Data reviewed, signature	X				
2.2	Method reference number(s) complete and correct	X				
2.3	QC analysis and acceptance limits provided (MB, LCS, Replicate)	X				
2.4	Matrix spike/matrix spike duplicate data provided (if requested)	X				
2.5	Detection limits provided: PQL and MDL (or IDL), MDA and L_c	X				
2.6	QC batch numbers provided	X				
2.7	Dilution factors provided and all dilution levels reported	X				
2.8	Data reported in appropriate units and using correct significant figures	X				
2.9	Radiochemistry analysis uncertainty (2 sigma error) and tracer recovery (if applicable) reported	N/A				
2.10	Narrative provided	X				
2.11	TAT met	X				
2.12	Hold times met	X				
2.13	Contractual qualifiers provided	X				
2.14	All requested result and TIC (if requested) data provided	X				

Contract Verification Review (Continued)

3.0 Data Quality Evaluation

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1 Are reporting units appropriate for the matrix and meet contract specified or project-specific requirements? Inorganics and metals reported as ppm (mg/liter or mg/Kg)? Tritium reported in picocuries per liter with percent moisture for soil samples? Units consistent between QC samples and sample data	X		
3.2 Quantitation limit met for all samples	X		
3.3 Accuracy a) Laboratory control samples accuracy reported and met for all samples	X		
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique	N/A		
c) Matrix spike recovery data reported and met	N/A		
3.4 Precision a) Replicate sample precision reported and met for all inorganic and radiochemistry samples	N/A		
b) Matrix spike duplicate RPD data reported and met for all organic samples	N/A		
3.5 Blank data a) Method or reagent blank data reported and met for all samples	X		
b) Sampling blank (e.g., field, trip, and equipment) data reported and met	N/A		
3.6 Contractual qualifiers provided: "J"- estimated quantity; "B"-analyte found in method blank above the MDL for organic or above the PQL for inorganic; "U"- analyte undetected (results are below the MDL, IDL, or MDA (radiochemical)); "H"-analysis done beyond the holding time	X		
3.7 Narrative addresses planchet flaming for gross alpha/beta	N/A		
3.8 Narrative included, correct, and complete	X		
3.9 Second column confirmation data provided for methods 8330 (high explosives) and 8082 (pesticides/PCBs)	N/A		

Contract Verification Review (Continued)

4.0 Calibration and Validation Documentation

Item	Yes	No	Comments
4.1 GC/MS (8260, 8270, etc.)			
a) 12-hour tune check provided	X		
b) Initial calibration provided	X		
c) Continuing calibration provided	X		
d) Internal standard performance data provided	X		
e) Instrument run logs provided	X		
4.2 GC/HPLC (8330 and 8010 and 8082)			
a) Initial calibration provided	N/A		
b) Continuing calibration provided	N/A		
c) Instrument run logs provided	N/A		
4.3 Inorganics (metals)			
a) Initial calibration provided	N/A		
b) Continuing calibration provided	N/A		
c) ICP interference check sample data provided	N/A		
d) ICP serial dilution provided	N/A		
e) Instrument run logs provided	N/A		
4.4 Radiochemistry			
a) Instrument run logs provided	N/A		

Contract Verification Review (Concluded)

5.0 Problem Resolution

Summarize the findings in the table below. List only samples/fractions for which deficiencies have been noted.

Sample/Fraction No.	Analysis	Problems/Comments/Resolutions

Were deficiencies unresolved? Yes (No)

Based on the review, this data package is complete. (Yes) No

If no, provide: nonconformance report or correction request number _____ and date correction request was submitted_____

Reviewed by:_____ Date: 09/25/03 Closed by:_____ Date:_____

DSS Vapor Wells SUMMA CANNISTER LOG

J Lee 505-284-3309 R Lynch 505-844-4013

	SERIAL #	DATE RCVD	DATE TESTED	VAC (") @ DATE USED	VAC AFTER SAMPLING (in Hg @ 400cc)	DATE RETD TO SMO AFTER SAMPLING
			FOR INITIAL VAC (in Hg @ 400cc)			
	9340B	9-4-03	4-4-03	26 9-9-03		9-10-03
	04340			25		
	12341			25		
	12607			22		
	A-331			24		
	12843			26		
	93102			26		
	93124			26		
	A-174			25		
	12592			26		
	93243			25		
	9118B			25		
	93227			25		
	0060			25		
	12485			25		
	A-239			25		
	12166			26		
	12167			26		
	04164			25		
	GL0101			25		
	0102			25		
	60-A			26		
	93276			26		
	12261			25		
	93108			26		
	04751			26		
	0117			26		
	A-277			26		
	02856			25		
	12184			26		
	93040			25		
	12631			25		
*	0182			20		
	93058B			24		
	~~18260~~					
	12620			24		
*	9339B			18		

October 13, 2003

ADDITIONAL/SUPPORTING DATA

CAN BE VIEWED BY CLICKING ON THE WEBFILE SHARE (WFS LINK)

ENVIRONMENTAL, SAFETY, HEALTH AND SECURITY (ES&H and Security) RECORD CENTER

FOR ASSISTANCE CALL

844-4688

ANNEX B
DSS SWMU 137
Exposure Pathway Discussion for
Chemical and Radionuclide Contamination

ANNEX B
EXPOSURE PATHWAY DISCUSSION FOR CHEMICAL AND RADIONUCLIDE CONTAMINATION

Introduction

Sandia National Laboratories/New Mexico (SNL/NM) uses a default set of exposure routes and associated default parameter values developed for each future land-use designation being considered for SNL/NM Environmental Restoration (ER) Project sites. This default set of exposure scenarios and parameter values are invoked for risk assessments unless site-specific information suggests other parameter values. Because many SNL/NM solid waste management units (SWMUs) have similar types of contamination and physical settings, SNL/NM believes that the risk assessment analyses at these sites can be similar. A default set of exposure scenarios and parameter values facilitates the risk assessments and subsequent review.

The default exposure routes and parameter values used are those that SNL/NM views as resulting in a Reasonable Maximum Exposure (RME) value. Subject to comments and recommendations by the U.S. Environmental Protection Agency (EPA) Region VI and New Mexico Environment Department (NMED), SNL/NM will use these default exposure routes and parameter values in future risk assessments.

At SNL/NM, all SWMUs exist within the boundaries of the Kirtland Air Force Base. Approximately 240 potential waste and release sites have been identified where hazardous, radiological, or mixed materials may have been released to the environment. Evaluation and characterization activities have occurred at all of these sites to varying degrees. Among other documents, the SNL/NM ER draft Environmental Assessment (DOE 1996) presents a summary of the hydrogeology of the sites and the biological resources present. When evaluating potential human health risk the current or reasonably foreseeable land use negotiated and approved for the specific SWMU/AOC, aggregate, or watershed will be used. The following references generally document these land uses: *Workbook: Future Use Management Area 2 (DOE et al. September 1995); Workbook: Future Use Management Area 1 (DOE et al. October 1995); Workbook: Future Use Management Areas 3, 4, 5, and 6 (DOE and USAF January 1996); Workbook: Future Use Management Area 7 (DOE and USAF March 1996)*. At this time, all SNL/NM SWMUs have been tentatively designated for either industrial or recreational future land use. The NMED has also requested that risk calculations be performed based upon a residential land-use scenario. Therefore, all three land-use scenarios will be addressed in this document.

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

- Ingestion of contaminated drinking water
- Ingestion of contaminated soil

- Ingestion of contaminated fish and shellfish
- Ingestion of contaminated fruits and vegetables
- Ingestion of contaminated meat, eggs, and dairy products
- Ingestion of contaminated surface water while swimming
- Dermal contact with chemicals in water
- Dermal contact with chemicals in soil
- Inhalation of airborne compounds (vapor phase or particulate)
- External exposure to penetrating radiation (immersion in contaminated air; immersion in contaminated water; and exposure from ground surfaces with photon-emitting radionuclides)

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

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

- Ingestion of contaminated fish and shellfish
- Ingestion of contaminated fruits and vegetables
- Ingestion of contaminated meat, eggs, and dairy products
- Ingestion of contaminated surface water while swimming
- Dermal contact with chemicals in water

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

Based upon this evaluation, for future risk assessments the exposure routes that will be considered are shown in Table 1.

Table 1
Exposure Pathways Considered for Various Land-Use Scenarios

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

Equations and Default Parameter Values for Identified Exposure Routes

In general, SNL/NM expects that ingestion of compounds in drinking water and soil will be the more significant exposure routes for chemicals; external exposure to radiation may also be significant for radionuclides. All of the above routes will, however, be considered for their appropriate land-use scenarios. The general equation for calculating potential intakes via these routes is shown below. The equations are taken from "Assessing Human Health Risks Posed by Chemicals: Screening-Level Risk Assessment" (NMED March 2000) and "Technical Background Document for Development of Soil Screening Levels" (NMED December 2000). Equations from both documents are based upon the "Risk Assessment Guidance for Superfund" (RAGS): Volume 1 (EPA 1989, 1991). These general equations also apply to calculating potential intakes for radionuclides. A more in-depth discussion of the equations used in performing radiological pathway analyses with the RESRAD code may be found in the RESRAD Manual (ANL 1993). RESRAD is the only code designated by the U.S. Department of Energy (DOE) in DOE Order 5400.5 for the evaluation of radioactively contaminated sites (DOE 1993). The Nuclear Regulatory Commission (NRC) has approved the use of RESRAD for dose evaluation by licensees involved in decommissioning, NRC staff evaluation of waste disposal requests, and dose evaluation of sites being reviewed by NRC staff. EPA Science Advisory Board reviewed the RESRAD model. EPA used RESRAD in their rulemaking on radiation site cleanup regulations. RESRAD code has been verified, undergone several benchmarking analyses, and been included in the International Atomic Energy Agency's VAMP and BIOMOVS II projects to compare environmental transport models.

Also shown are the default values SNL/NM ER will use in RME risk assessment calculations for industrial, recreational, and residential land-use scenarios, based upon EPA and other governmental agency guidance. The pathways and values for chemical contaminants are discussed first, followed by those for radionuclide contaminants. RESRAD input parameters that are left as the default values provided with the code are not discussed. Further information relating to these parameters may be found in the RESRAD Manual (ANL 1993) or by directly accessing the RESRAD websites at: http://web.ead.anl.gov/resrad/home2/ or http://web.ead.anl.gov/resrad/documents/.

Generic Equation for Calculation of Risk Parameter Values

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

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

where;

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

For nonradiological constituents of concern (COCs), the total risk/dose (either cancer risk or HI) is the sum of the risks/doses for all of the site-specific exposure pathways and contaminants. For radionuclides, the calculated radiation exposure, expressed as TEDE is compared directly to the exposure guidelines of 15 millirem per year (mrem/year) for industrial and recreational future use and 75 mrem/year for the unlikely event that institutional control of the site is lost and the site is used for residential purposes (EPA 1997).

The evaluation of the carcinogenic health hazard produces a quantitative estimate for excess cancer risk resulting from the COCs present at the site. This estimate is evaluated for determination of further action by comparison of the quantitative estimate with the potentially acceptable risk of 1E-5 for nonradiological carcinogens. The evaluation of the noncarcinogenic health hazard produces a quantitative estimate (i.e., the HI) for the toxicity resulting from the COCs present at the site. This estimate is evaluated for determination of further action by comparison of this quantitative estimate with the EPA standard HI of unity (1). The evaluation of the health hazard from radioactive compounds produces a quantitative estimate of doses resulting from the COCs present at the site. This estimated dose is used to calculate an assumed risk. However, this calculated risk is presented for illustration purposes only, not to determine compliance with regulations.

The specific equations used for the individual exposure pathways can be found in RAGS (EPA 1989) and are outlined below. The RESRAD Manual (ANL 1993) describes similar equations for the calculation of radiological exposures.

Soil Ingestion

A receptor can ingest soil or dust directly by working in the contaminated soil. Indirect ingestion can occur from sources such as unwashed hands introducing contaminated soil to food that is then eaten. An estimate of intake from ingesting soil will be calculated as follows:

$$I_s = \frac{C_s * IR * CF * EF * ED}{BW * AT}$$

where:

I_s = Intake of contaminant from soil ingestion (milligrams [mg]/kilogram [kg]-day)
C_s = Chemical concentration in soil (mg/kg)
IR = Ingestion rate (mg soil/day)
CF = Conversion factor (1E-6 kg/mg)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

It should be noted that it is conservatively assumed that the receptor only ingests soil from the contaminated source.

Soil Inhalation

A receptor can inhale soil or dust directly by working in the contaminated soil. An estimate of intake from inhaling soil will be calculated as follows (EPA August 1997):

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

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).

References

ANL, see Argonne National Laboratory.

Argonne National Laboratory (ANL), 1993. *Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD*, Version 5.0, ANL/EAD/LD-2, Argonne National Laboratory, Argonne, IL.

DOE, see U.S. Department of Energy.

DOE and USAF, see U.S. Department of Energy and U.S. Air Force.

EPA, see U.S. Environmental Protection Agency.

New Mexico Environment Department (NMED), March 2000. "Assessing Human Health Risks Posed by Chemical: Screening-level Risk Assessment," Hazardous and Radioactive Materials Bureau, NMED, March 6, 2000.

New Mexico Environment Department (NMED), December 2000. "Technical Background Document for Development of Soil Screening Levels," Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, December 18, 2000.

Sandia National Laboratories/New Mexico (SNL/NM), February 1998. "RESRAD Input Parameter Assumptions and Justification," Sandia National Laboratories/New Mexico Environmental Restoration Project, Albuquerque, New Mexico.

U.S. Department of Energy (DOE), 1993. DOE Order 5400.5, "Radiation Protection of the Public and the Environment," U.S. Department of Energy, Washington, D.C.

U.S. Department of Energy (DOE), 1996. "Environmental Assessment of the Environmental Restoration Project at Sandia National Laboratories/New Mexico," U.S. Department of Energy, Kirtland Area Office.

U.S. Department of Energy, U.S. Air Force, and U.S. Forest Service, September 1995. "Workbook: Future Use Management Area 2," prepared by the Future Use Logistics and Support Working Group in cooperation with U.S. Department of Energy Affiliates, the U.S. Air Force, and the U.S. Forest Service.

U.S. Department of Energy, U.S. Air Force, and U.S. Forest Service, October 1995. "Workbook: Future Use Management Area 1," prepared by the Future Use Logistics and Support Working Group in cooperation with U.S. Department of Energy Affiliates, the U.S. Air Force, and the U.S. Forest Service.

U.S. Department of Energy and U.S. Air Force (DOE and USAF), January 1996. "Workbook: Future Use Management Areas 3,4,5,and 6," prepared by the Future Use Logistics and Support Working Group in cooperation with U.S. Department of Energy Affiliates, and the U.S. Air Force.

U.S. Department of Energy and U.S. Air Force (DOE and USAF), March 1996. "Workbook: Future Use Management Area 7," prepared by the Future Use Logistics and Support Working Group in cooperation with U.S. Department of Energy Affiliates and the U.S. Air Force.

U.S. Environmental Protection Agency (EPA), 1989. "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual," EPA/540-1089/002, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1991. "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part B)," EPA/540/R-92/003, U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1992. "Dermal Exposure Assessment: Principles and Applications," EPA/600/8-91/011B, Office of Research and Development, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1996. "Soil Screening Guidance: Technical Background Document," EPA/540/1295/128, Office of Solid Waste and Emergency Response, Washington, D.C.

U.S. Environmental Protection Agency (EPA), August 1997. *Exposure Factors Handbook*, EPA/600/8-89/043, U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1997. (OSWER No. 9200.4-18) *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination*, U.S. EPA Office of Radiation and Indoor Air, Washington D.C, August 1997.

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ANNEX C
DSS SWMU 137
Calculation of the Upper Confidence Limits of Mean Concentrations

ANNEX C
CALCULATION OF THE UPPER CONFIDENCE LIMITS OF MEAN CONCENTRATIONS

For conservatism, Sandia National Laboratories/New Mexico uses the maximum concentration of the constituents of concern (COCs) for initial risk calculation. If the maximum concentrations produce risk above New Mexico Environment Department (NMED) guidelines, conservatism with this approach is evaluated and, if appropriate, a more realistic approach is applied. When the site has been adequately characterized, an estimate of the mean concentration of the COCs is more representative of actual site conditions. The NMED has proposed the use of the 95, 97.5, or 99% upper confidence limit (UCL) of the mean (depending upon the variants of the data set) to represent average concentrations at a site (NMED December 2000). The UCL is calculated according to NMED guidance (Tharp June 2002) using the U.S. Environmental Protection Agency ProUCL program (EPA April 2002). Attached are the outputs from that program and the calculated UCLs used in the risk analysis.

References

EPA, see U.S. Environmental Protection Agency.

New Mexico Environment Department (NMED), December 2000. "Technical Background Document for Development of Soil Screening Levels," Hazardous Waste Bureau and Ground Water Quality Bureau Voluntary Remediation Program, New Mexico Environment Department, Santa Fe, New Mexico. December 18, 2000.

NMED, see New Mexico Environment Department.

Tharp, T. (Weston Solutions, Inc.), June 2002. *Personal communication* with K. Olsen (Hazardous Waste Bureau, New Mexico Environment Department). June 12, 2002.

U.S. Environmental Protection Agency (EPA), April 2002. *ProUCL User's Guide*, U.S. Environmental Protection Agency, Washington, D.C.

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ATTACHMENT

SWMU 137 Human Health		
Summary Statistics for	Arsenic	
Number of Samples	60	
Minimum	0.6	
Maximum	6.2	
Mean	2.815167	
Median	2.9	
Standard Deviation	0.861338	
Variance	0.741903	
Coefficient of Variation	0.305963	
Skewness	0.457436	
Lilliefors Test Statisitic	0.159498	
Lilliefors 5% Critical Value	0.114382	
Data not Lognormal at 5% Significance Level		
Data are Normal: Use Student's-t UCL		
95% UCL (Assuming Normal Data)		
Student's-t	3.000989	
95% UCL (Adjusted for Skewness)		
Adjusted-CLT	3.005088	
Modified-t	3.002084	
95% Non-parametric UCL		
CLT	2.998072	
Jackknife	3.000989	
Standard Bootstrap	2.999254	
Bootstrap-t	3.013791	
Chebyshev (Mean, Std)	3.299869	

SWMU 137 Human Health		
Summary Statistics for	Cyanide	
Number of Samples	57	
Minimum	0.5	
Maximum	920	
Mean	16.63158	
Median	0.5	
Standard Deviation	121.7908	
Variance	14832.99	
Coefficient of Variation	7.322862	
Skewness	7.549834	
Lilliefors Test Statisitic	0.535143	
Lilliefors 5% Critical Value	0.117354	
Data not Lognormal at 5% Significance Level		
Data not Normal: Try Non-parametric UCL		
99% UCL (Assuming Normal Data)		
Student's-t	55.2635	
99% UCL (Adjusted for Skewness)		
Adjusted-CLT	85.94864	
Modified-t	57.9521	
99% Non-parametric UCL		
CLT	54.15924	
Jackknife	55.2635	
Standard Bootstrap	54.28563	
Bootstrap-t	1.#INF	
Chebyshev (Mean, Std)	177.1388	

SWMU 137 Human Health		
Summary Statistics for	Silver	
Number of Samples	65	
Minimum	0.41	
Maximum	1170	
Mean	40.23323	
Median	0.75	
Stancarc Deviation	183.4818	
Variance	33665.58	
Coefficient of Variation	4.560455	
Skewness	5.541334	
Lilliefors Test Statisitic	0.247585	
Lilliefors 5% Critical Value	0.109895	
Data not Lognormal at 5% Significance Level		
Data not Normal: Try Non-parametric UCL		
99 % UCL (Assuming Normal Data)		
Student's-t	94.53494	
99 % UCL (Adjusted for Skewness)		
Adjusted-CLT	124.0013	
Modified-t	97.14195	
99 % Non-parametric UCL		
CLT	93.17653	
Jackknife	94.53494	
Standard Bootstrap	91.51795	
Bootstrap-t	769.5346	
Chebyshev (Mean, Std)	266.6737	