3-1-2005

Justification for Class III Permit Modification March 2005 DSS Site 1083 Operable Unit 1295 Building 6570 Septic System at Technical Area III

Sandia National Laboratories/NM

Drain and Septic Systems (DSS) Area of Concern (AOC) Sites 1006, 1007, 1010, 1015 1020, 1024, 1028, 1029, 1083, 1086, 1108, and 1110

This work supported by the United States Department of Energy under contract DE-AC04-94AL85000.

Sandia National Laboratories

Environmental Restoration Project

Site Histories

Drain and septic system site histories for the twelve DSS AOCs are as follows:

AOC Site Number	Site Name	Location	Year Bldg. and System Built	Year Drain or Septic System Abandoned	Year(s) Septic Tank Effluent Sampled	Year Septic Tank Pumped For the Last Time
1006	Bldg 6741 Septic System	TA-III	1968	1994	1992, 1995	1996
1007	Bldg 6730 Septic System	TA-III	1964	Early 1990s	1992, 1995	1996
1010	Bldg 6536 Septic System and Seepage Pit	TA-III	1967	1991	1990/1991, 1992, 1995	1996
1015	Former MO 231-234 Septic System	TA-V	1988	1991	1990/1991, 1992, 1995	1996
1020	MO-146, MO-235, T-40 Septic System	TA-III	1978	1991	1990/1991, 1995	1996
1024	MO 242-245 Septic System	TA-III	1976	1991	1990/1991, 1992, 1995	1996
1028	Bldg 6560 Septic System and Seepage Pit	TA-III	1955	1991	1990/1991, 1992, 1995	1996
1029	Bldg 6584 North Septic System	TA-III	1963	1991	1990/1991, 1992, 1995	1996
1083	Bldg 6570 Septic System	TA-III	1956	1991	1990/1991	Unknown (backfilled before 1995)
1086	Bldg 6523 Septic System	TA-III	1954	1991	1990/1991	Unknown (backfilled before 1995)
1108	Bldg 6531 Seepage Pits	TA-III	1960	1991	No septic tank at this site.	NA
1110	Bldg 6536 Drain System	TA-III	1967	Early 1990s?	No septic tank at this site.	NA

Depth to Groundwater

Depth to groundwater at these twelve AOC sites is as follows:

DSS Site Number	Site Name	Location	Groundwater Depth (ft bgs)
1006	Bldg 6741 Septic System	TA-III	460
1007	Bldg 6730 Septic System	TA-III	465
1010	Bldg 6536 Septic System and Seepage Pit	TA-III	487
1015	Former MO 231-234 Septic System	TA-V	496
1020	MO-146, MO-235, T-40 Septic System	TA-III	487
1024	MO 242-245 Septic System	TA-III	485
1028	Bldg 6560 Septic System and Seepage Pit	TA-III	482
1029	Bldg 6584 North Septic System	TA-III	482
1083	Bldg 6570 Septic System	TA-III	493
1086	Bldg 6523 Septic System	TA-III	492
1108	Bldg 6531 Seepage Pits	TA-III	483
1110	Bldg 6536 Drain System	TA-III	480

Constituents of Concern

- VOCs, SVOCs, PCBs, HE compounds, metals, cyanide, and radionuclides.

Investigations

- A backhoe was used to positively locate buried components (drainfield drain lines, drywells) for placement of soil-vapor samplers and soil borings.
- Passive soil-vapor samples were collected in drainfield and seepage pit areas to screen for VOCs.
- Soil samples were collected from directly beneath drainfield drain lines, seepage pits, and drywells to determine if COCs were released to the environment from drain systems.

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

DSS Site Number	Site Name	Buried Components (Drain Lines, Drywells) Located With A Backhoe	Soil Sampling Beneath Drainlines, Seepage Pits, Drywells	Type(s) of Drain System, and Soil Sampling Depths (ft bgs)	Passive Soil Vapor Sampling
1006	Bldg 6741 Septic System	1997	1998, 1999	Drainfield: 7, 12	2002
1007	Bldg 6730 Septic System	1997	1998, 1999	Drainfield: 4.5, 9.5	2002
1010	Bldg 6536 Septic System and Seepage Pit	None	2002	Septic System Seepage Pit: 15, 20 2nd Seepage Pit: 23, 28	2002
1015	Former MO 231-234 Septic System	1995	1998, 1999	Drainfield: 5, 10	None
1020	MO-146, MO-235, T-40 Septic System	1997	1998, 1999	Drainfield: 5.5, 10.5	None
1024	MO 242-245 Septic System	1997	1998, 1999	Drainfield: 5, 10	None
1028	Bldg 6560 Septic System and Seepage Pit	None	2002	Septic System Seepage Pit: 14, 19 2nd Seepage Pit: 7, 12	2002
1029	Bldg 6584 North Septic System	1997	1998, 1999	Drainfield: 5, 10	2002
1083	Bldg 6570 Septic System	2002	2002	Seepage Pit: 9, 14	2002
1086	Bldg 6523 Septic System	2003	2002	Seepage Pit: 10, 15	None
1108	Bldg 6531 Seepage Pits	None	2002	Seepage Pits: 10, 15	2002
1110	Bldg 6536 Drain System	1997	2002	Drain Pipe: 10, 15, 20	None

Summary of Data Used for NFA Justification

- Seven of the twelve DSS sites were selected by NMED for passive soil-vapor sampling to screen for VOCs, and no significant VOC contamination was identified at any of the seven sites.
- Soil samples were analyzed at on- and off-site laboratories for VOCs, SVOCs, PCBs, HE compounds, metals, cyanide, gross alpha/beta activity, and radionuclides by gamma spectroscopy.
- Very low levels of VOCs were detected at eleven sites, SVOCs and PCBs were detected at seven sites, and cyanide was identified at six of the sites. HE compounds were not detected at any of these sites.
- Arsenic was detected above background at six sites, and barium was detected above background at one site. No other metals were detected above background concentrations.
- Either U-235 or U-238 was detected at an activity slightly above the background activity at three of the twelve sites and, although not detected, the MDA for one or both of these two radionuclides exceeded background levels at five sites. Gross alpha activity was slightly above background in one sample from one of the twelve sites, and gross beta activity was below background in all samples from the twelve sites.
- All confirmatory soil sample analytical results were used for characterizing the sites, for performing the risk screening assessments, and as justification for the NFA proposals for these sites.

Recommended Future Land Use

- Industrial land use was established for these twelve DSS AOC sites.

Results of Risk Analysis

- Risk assessment results for the residential scenario are calculated per NMED risk assessment guidance as presented in "Supplemental Risk Document Supporting Class 3 Permit Modification Process" (SNL October 2003).
- 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 twelve DSS sites. The risk assessment analyses evaluated the potential for adverse health effects for the residential land-use scenario.
- As shown in the table below, the total HIs and estimated excess cancer risks for six of the twelve DSS sites are below NMED guidelines for the residential land-use scenario.
- For five additional sites, the HIs are below the residential guideline, but the total estimated excess cancer risks are slightly above the residential guideline. However, the incremental excess cancer risk values for these five sites are below the NMED residential guideline.
- For one of the twelve sites (DSS Site 1029), the total HI and estimated excess cancer risk are slightly above the NMED guidelines for the residential land-use scenario due to an isolated detection of asphalt-like SVOCs in a single sample. With the removal of these SVOCs from the risk assessment, the incremental values are below the residential scenario guideline.
- The residential land-use scenario TEDEs ranged from none to 0.18 mrem/yr, all of which are substantially below the EPA guideline of 75 mrem/yr. Therefore, these DSS sites are eligible for unrestricted radiological release.
- Using the SNL predictive ecological risk assessment methodology, four of the twelve AOCs were evaluated for ecological risk based on the depth of the available data (i.e., 0 to 5 feet bgs). The ecological risk for all of these sites is acceptable.
- In conclusion, human health and ecological risks are acceptable per NMED guidance. Thus, these sites are proposed for CAC without institutional controls.

Residential land use scenario risk assessment values for COCs at the twelve AOCs are as follows:

DSS Site Number	DSS Site Name	Residential Land Use Scenario	
		Hazard Index	Excess Cancer Risk
1006	Bldg 6741 Septic System	0.26	1E-5 Total/2.62E-7 Incremental
1007	Bldg 6730 Septic System	0.22	1E-5 Total/7.72E-7 Incremental
1010	Bldg 6536 Septic System and Seepage Pit	0.00	2E-9
1015	Former MO 231-234 Septic Systems	0.23	1E-5 Total/1.29E-6 Incremental
1020	MO-146, MO-235, T-40 Septic System	0.00	none
1024	MO 242-245 Septic System	0.21	1E-5 Total/3.65E-7 Incremental
1028	Bldg 6560 Septic System and Seepage Pit	0.00	8E-10
1029	Bldg 6584 North Septic System	2.17 Total/0.06 Incremental (after removal of asphalt-like SVOCs)	8E-5 Total/2.93E-6 Incremental (after removal of asphalt-like SVOCs)
1083	Bldg 6570 Septic System	0.00	2E-9
1086	Bldg 6523 Septic System	0.00	2E-9
1108	Bldg 6531 Seepage Pits	0.26	1E-5 Total/2.98E-6 Incremental
1110	Bldg 6536 Drain System	0.00	3E-9
NMED Guidance		≤1	<1E-5

For More Information Contact

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

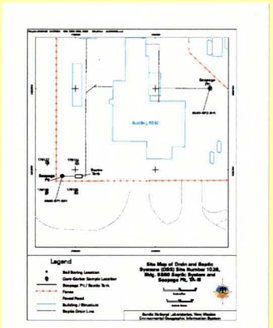
Sandia National Laboratories
Environmental Restoration Project
Task Leader: Brenda Langkopf
Telephone (505) 284-3272

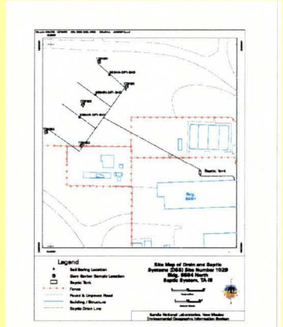
Drain and Septic Systems (DSS) Area of Concern (AOC) Sites 1028, 1029, 1083, 1086, 1108, and 1110

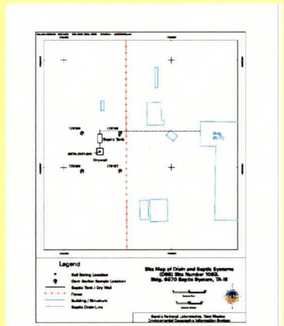
This work supported by the United States Department of Energy under contract DE-AC04-94AL85000.

Sandia National Laboratories

Environmental Restoration Project



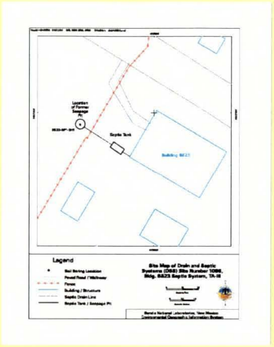


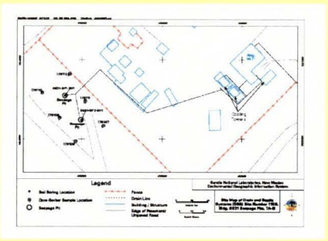


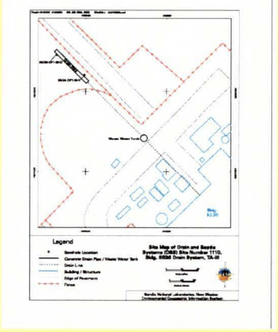
Collecting soil samples with the Geoprobe.

Subsurface soil recovered for analyses.

Seepage pit demolition and backfilling.







For More Information Contact

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

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

Sandia National Laboratories

Justification for Class III Permit Modification

March 2005

DSS Site 1083
Operable Unit 1295
Building 6570 Septic System at Technical Area III

NFA (SWMU Assessment Report) Submitted June 2004

Environmental
Restoration
Project

United States Department of Energy
Sandia Site Office

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

NFA

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

JUN 1 8 2004

CERTIFIED MAIL-RETURN RECEIPT REQUESTED

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

Dear Mr. Kieling,

On behalf of the Department of Energy (DOE) and Sandia Corporation, DOE is submitting the enclosed Solid Waste Management Unit (SWMU) Assessment Reports and Proposals for No Further Action (NFA) for Drain and Septic Systems (DSS) Sites 1010, 1028, 1083, and 1086. DOE is also submitting the Request for Supplemental Information (RSI) responses for SWMUs 48, 135, 136, 159, 165, 166, and 167; and a soil vapor summary report for Technical Area II at Sandia National Laboratories, New Mexico, EPA ID No. NM5890110518. These documents are compiled as DSS Round 5 and NFA Batch 23.

On April 29, 2004, the final Compliance Order on Consent (Consent Order) for Sandia National Laboratories was issued, replacing the HSWA Module as the sole enforceable mechanism for corrective action. The enclosed SWMU Assessment Reports/NFA Proposals and RSI responses were in the final stage of preparation when the Order was issued; thus, the enclosed documents contain language related to a NFA determination. We are requesting, consistent with the terminology in the Consent Order, an NMED determination of corrective action complete for each of these DSS sites.

This submittal includes descriptions of the site characterization work and risk assessments for DSS Sites 1010, 1028, 1083, and 1086, and SWMUs 48, 135, 136, 159, 165, 166, and 167. The risk assessments conclude that for these eleven 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.

Sincerely,

Patty Wagner
Manager

Enclosure

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

cc w/o enclosure:
J. Bearzi, NMED-HWB
K. Thomas, EPA, Region 6
F. Nimick, SNL, MS 1089
D. Stockham, SNL, MS 1087
P. Freshour, SNL, MS 1087
M. Sanders, SNL, MS 1087
R. Methvin, SNL MS 1089
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

SWMU ASSESSMENT REPORT AND PROPOSAL FOR NO FURTHER ACTION DRAIN AND SEPTIC SYSTEMS SITE 1083, BUILDING 6570 SEPTIC SYSTEM

June 2004

United States Department of Energy
Sandia Site Office

TABLE OF CONTENTS

TABLE OF CONTENTS (Concluded)

LIST OF FIGURES

Figure

This page intentionally left blank.

LIST OF TABLES

Table

LIST OF TABLES (Concluded)

Table

LIST OF ANNEXES

Annex

This page intentionally left blank.

ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
AOP	Administrative Operating Procedure
BA	butyl acetate
bgs	below ground surface
COC	constituent of concern
DSS	Drain and Septic Systems
EB	equipment blank
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FIP	Field Implementation Plan
GS	Gore-Sorber™
HE	high explosive(s)
HI	hazard index
HWB	Hazardous Waste Bureau
KAFB	Kirtland Air Force Base
kg	kilogram(s)
µg	microgram(s)
MDA	minimum detectable activity
MDL	method detection limit
mg	milligram(s)
mrem	millirem
ND	nondetect
NFA	no further action
NMED	New Mexico Environment Department
OU	Operable Unit
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
RPSD	Radiation Protection Sample Diagnostics
SAP	Sampling and Analysis Plan
SNL/NM	Sandia National Laboratories/New Mexico
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TA	Technical Area
TB	trip blank
TEDE	total effective dose equivalent
TOP	Technical Operating Procedure
VOC	volatile organic compound
yr	year(s)

This page intentionally left blank.

1.0 PROJECT BACKGROUND

Environmental characterization of Sandia National Laboratories/New Mexico (SNL/NM) drain and septic systems (DSS) started in the early 1990s. These units consist of either septic systems (one or more septic tanks plumbed to either drainfields or seepage pits), or other types of miscellaneous drain units without septic tanks (including drywells or french drains, seepage pits, and surface outfalls). Initially, 23 of these sites were designated as Solid Waste Management Units (SWMUs) under Operable Unit (OU) 1295, Septic Tanks and Drainfields. Characterization work at 22 of these 23 SWMUs has taken place since 1994 as part of SNL/NM Environmental Restoration (ER) Project activities. The twenty-third site did not require any characterization, and an administrative proposal for no further action (NFA) was granted in July 1995.

Numerous other DSS sites that were not designated as SWMUs were also present throughout SNL/NM. An initial list of these non-SWMU sites was compiled and summarized in an SNL/NM document dated July 8, 1996; the list included a total of 101 sites, facilities, or systems (Bleakly July 1996). For tracking purposes, each of these 101 individual DSS sites was designated with a unique four-digit site identification number starting with 1001. This numbering scheme was devised to clearly differentiate these non-SWMU sites from existing SNL/NM SWMUs, which have been designated by one- to three-digit numbers. As work progressed on the DSS site evaluation project, it became apparent that the original 1996 list was in need of field verification and updating. This process included researching SNL/NM's extensive library of facilities engineering drawings and conducting field-verification inspections jointly with SNL/NM ER personnel and New Mexico Environment Department (NMED)/Hazardous Waste Bureau (HWB) regulatory staff from July 1999 through January 2000. The goals of this additional work included the following:

- Determine to the degree possible whether each of the 101 systems included on the 1996 list was still in existence, or had ever existed.
- For systems confirmed or believed to exist, determine the exact or apparent locations and components of those systems (septic tanks, drainfields, seepage pits, etc.).
- Identify which systems would, or would not, need initial shallow investigation work as required by the NMED.
- For systems requiring characterization, determine the specific types of shallow characterization work (including passive soil-vapor sampling and/or shallow soil borings) that would be required by the NMED.

A number of additional drain systems were identified from the engineering drawings and field inspection work. It was also determined that some of the sites on the 1996 list actually contained more than one individual drain or septic system that had been combined under one four-digit site number. In order to reduce confusion, a decision was made to assign each individual system its own unique four-digit number. A new site list containing a total of 121 individual DSS sites was generated in 2000. Of these 121 sites, NMED required environmental assessment work at a total of 61. No characterization was required at the remaining 60 sites because the sites either were found not to exist, were the responsibility of

other non-SNL/NM organizations, were already designated as individual SWMUs, or were considered by the NMED to pose no threat to human health or the environment. Subsequent backhoe excavation at DSS Site 1091 confirmed that the system did not exist, which decreased the number of DSS sites requiring characterization to 60.

Concurrent with the field inspection and site identification work, NMED/HWB and SNL/NM ER Project technical personnel worked together to reach consensus on a staged approach and specific procedures that would be used to characterize the DSS sites, as well as the remaining OU 1295 Septic Tanks and Drainfield SWMUs that had not been approved for NFA. These procedures are described in detail in the "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" (SNL/NM October 1999), which was approved by the NMED/HWB on January 28, 2000 (Bearzi January 2000). A follow-on document, "Field Implementation Plan [FIP], Characterization of Non-Environmental Restoration Drain and Septic Systems" (SNL/NM November 2001), was then written to formally document the updated DSS site list and the specific site characterization work required by the NMED for each of the 60 DSS sites. The FIP was approved by the NMED in February 2002 (Moats February 2002).

2.0 DSS SITE 1083: BUILDING 6570 SEPTIC SYSTEM

2.1 Summary

The SNL/NM ER Project conducted an assessment of DSS Site 1083, the Building 6570 Septic System. There are no known or specific environmental concerns at this site. The assessment was conducted to determine whether environmental contamination was released to the environment via the septic system present at the site. This report presents the results of the assessment and, based upon the findings, recommends a risk-based proposal for NFA for DSS Site 1083. This NFA proposal provides documentation that the site was sufficiently characterized, that no significant releases of contaminants to the environment occurred via the Building 6570 Septic System, and that it does not pose a threat to human health or the environment under either industrial or residential land-use scenarios. Current operations at the site are conducted in accordance with applicable laws and regulations that are protective of the environment and effluent discharges from Building 6750 are now directed to the City of Albuquerque sewer system.

Review and analysis of all relevant data for DSS Site 1083 indicate that concentrations of constituents of concern (COCs) at this site were found to be below applicable risk assessment action levels. Thus, DSS Site 1083 is proposed for an NFA decision based upon sampling data demonstrating that COCs released from the site into the environment pose an acceptable level of risk under current and projected future land uses as set forth by 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).

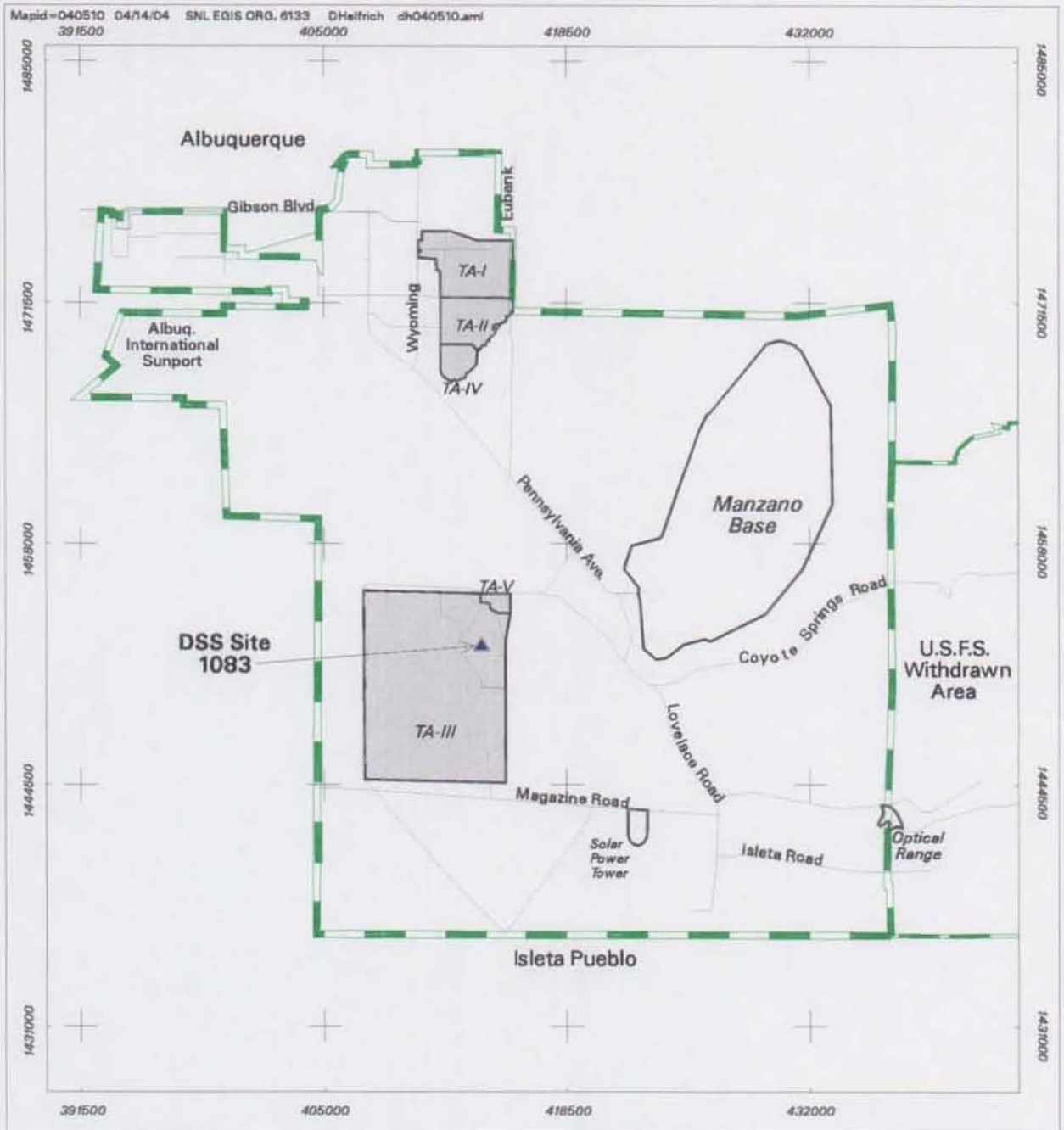
2.2 Site Description and Operational History

2.2.1 Site Description

DSS Site 1083 is located in SNL/NM Technical Area (TA)-III on federally owned land controlled by Kirtland Air Force Base (KAFB) and permitted to the U.S. Department of Energy (Figure 2.2.1-1). The site is located approximately 100 feet west of Building 6570. The abandoned septic system consisted of a septic tank that emptied to a drywell (Figure 2.2.1-2). Construction details are based upon site inspections and backhoe excavations of the system.

The surface geology at DSS Site 1083 is characterized by a veneer of aeolian sediments underlain by Upper Santa Fe Group alluvial fan deposits that interfinger with sediments of the ancestral Rio Grande west of the site. These deposits extend to, and probably far below, the water table at this site. The alluvial fan materials originated in the Manzanita Mountains east of DSS Site 1083 typically consist of a mixture of silts, sands, and gravels that are poorly sorted, and exhibit moderately connected lenticular bedding. Individual beds range from 1 to 5 feet in thickness with a preferred east-west orientation and have moderate to low hydraulic conductivities (SNL/NM March 1996). Site vegetation primarily consists of desert grasses, shrubs, and cacti.

This page intentionally left blank.



Legend

- DSS Site 1083
- Major Road
- KAFB Boundary
- USFS Withdrawn Area Boundary
- SNL Technical Area

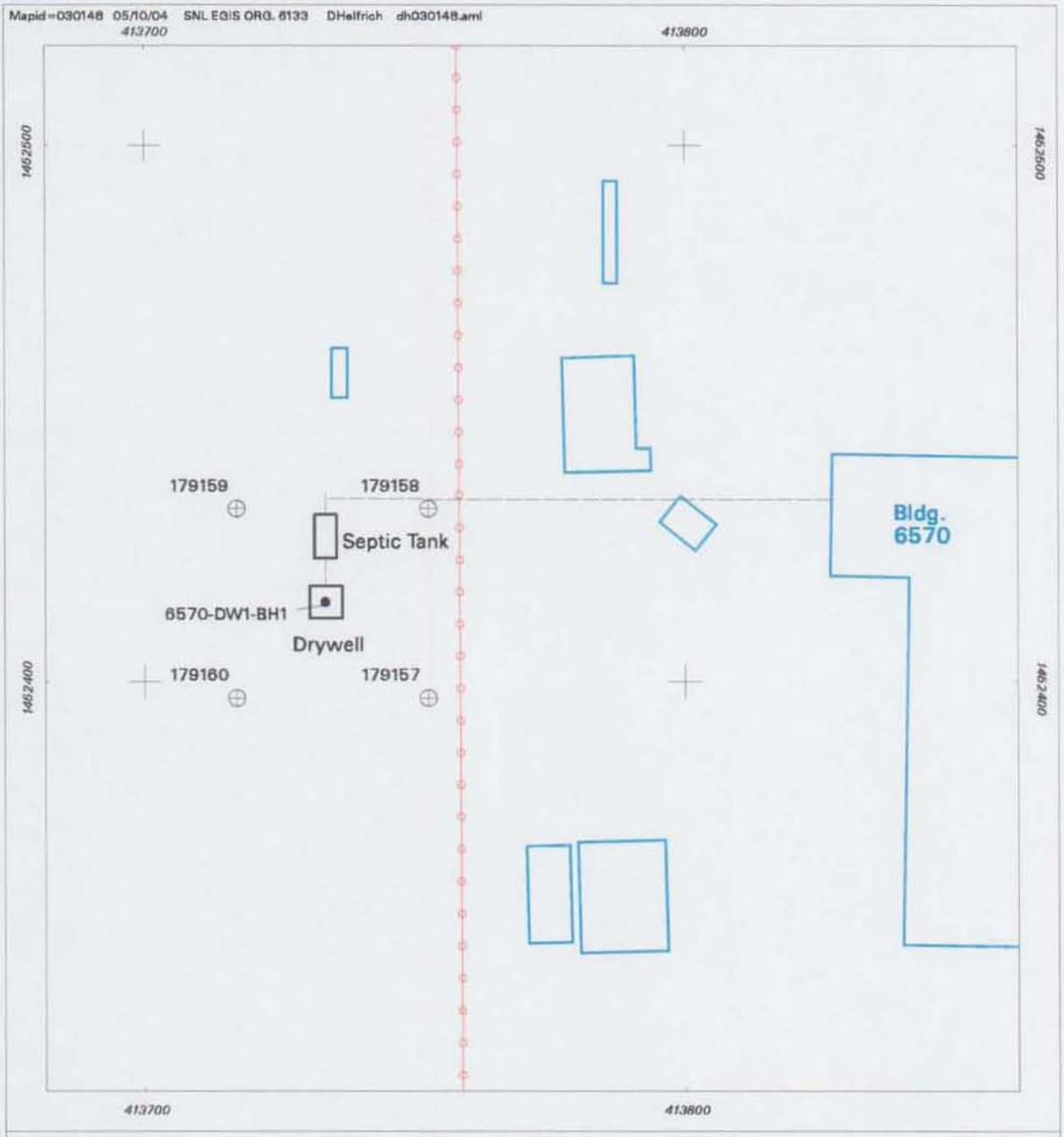
Figure 2.2.1-1
Location Map of Drain and Septic Systems (DSS) Site Number 1083, Bldg. 6570 Septic System, TA-III

0 4500 9000
Scale in Feet

0 1080 2160
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

840857.03010000 A135



Legend

- Soil Boring Location
- Gore-Sorber Sample Location
- Septic Tank / Dry Well
- Fence
- Building / Structure
- Septic Drain Line

Figure 2.2.1-2
Site Map of Drain and Septic Systems (DSS) Site Number 1083, Bldg. 6570 Septic System, TA-III

0 15 30
Scale in Feet

0 3.6 7.2
Scale in Meters

N

GIS

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

840857.03010000 A150

The ground surface in the vicinity of the site is flat to very slightly sloping to the west. The closest major drainage is the Arroyo del Coyote, located approximately 1.3 miles northeast of the site. No perennial surface-water bodies are present in the vicinity 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). Infiltration of precipitation is almost nonexistent as virtually all of the moisture subsequently undergoes evapotranspiration. The estimates of evapotranspiration rates for the KAFB area range from 95 to 99 percent of the annual rainfall (SNL/NM March 1996).

The site lies at an average elevation of approximately 5,416 feet above mean sea level (SNL/NM April 2003). Depth to groundwater is approximately 493 feet below ground surface (bgs) at the site. Groundwater flow is thought to be generally to the west in this area (SNL/NM March 2002). The production wells nearest to DSS Site 1083 are KAFB-4, approximately 3.2 miles to the northwest and KAFB-11, approximately 3.5 miles to the northeast. The nearest groundwater monitoring wells are approximately 2,500 feet west of the site.

2.2.2 Operational History

Available information indicates that Building 6570 was constructed in 1956 (SNL/NM March 2003), and it is assumed the septic system was constructed at the same time. Building 6570 is currently known as the Dynamic Shock Test Facility (SNL/NM March 2003). Because operational records are not available, the site investigation was planned to be consistent with other DSS site investigations and to sample for the COCs most commonly found at similar facilities.

In June 1991, Building 6570 was connected to an extension of the City of Albuquerque sanitary sewer system (Jones June 1991). The old septic system line was disconnected and capped, and the system was abandoned in place concurrent with this change (Romero September 2003).

2.3 Land Use

2.3.1 Current Land Use

The current land use for DSS Site1083 is industrial.

2.3.2 Future/Proposed Land Use

The projected future land use for DSS Site 1083 is industrial (DOE et al. September 1995).

This page intentionally left blank.

3.0 INVESTIGATORY ACTIVITIES

3.1 Summary

Four assessment investigations have been conducted at this site. In late 1990 or early 1991, waste characterization samples were collected from the septic tank (Investigation 1). In March 2002 and December 2003, a backhoe was used to physically locate the buried drywell and septic tank at the site (Investigation 2). In late April and early May 2002, a passive soil-vapor survey was conducted to determine whether areas of significant volatile organic compound (VOC) contamination were present in the soil around the drywell (Investigation 3). In September 2002, near-surface soil samples were collected from one boring drilled through the center of, and beneath, the drywell (Investigation 4). Investigations 2, 3, and 4 were required by the NMED/HWB to adequately characterize the site and were conducted in accordance with procedures presented in the SAP (SNL/NM October 1999) and FIP (SNL/NM November 2001) described in Chapter 1.0. These investigations are discussed in the following sections.

3.2 Investigation 1—Septic Tank Sampling

Investigation 1 consisted of sampling efforts to characterize the waste contents of all SNL/NM septic tanks for chemical and radiological contamination. The primary goal of the sampling was to identify types and concentrations of potential contaminants in the waste within the tanks so that the appropriate waste disposal and remedial activities could be planned.

In December 1990 or January 1991, as part of the SNL/NM Septic System Monitoring Program, aqueous and sludge samples were collected from the Building 6570 septic tank (SNL/NM April 1991). Aqueous samples were analyzed at an off-site laboratory for VOCs, total metals, phenolic compounds, nitrates/nitrites, oil and grease, and for gross alpha/beta activity. The analytical results are presented in Annex A. A fraction of each sample was also submitted to the SNL/NM Radiation Protection Sample Diagnostics (RPSD) Laboratory for gamma spectroscopy analysis prior to off-site release.

3.3 Investigation 2—Backhoe Excavation

On March 11, 2002, a backhoe was used to determine the location, dimensions, and average depth of the DSS Site 1083 septic system drywell (Figure 3.3-1). A 4-inch, cast iron drain pipe was located connecting the Building 6570 septic tank to a 6- by 6- by 6-foot aggregate-filled drywell as shown in Figure 3.3-2. No visible evidence of stained or discolored soil or odors indicating residual contamination was observed during the excavation. No samples were collected during the backhoe excavation at the site.

No records were found to indicate that the septic tank at DSS Site 1083 had been sampled after late 1990 or early 1991 or if it had been pumped out. It was also unknown whether the tank was still intact, as no surface expression of the unit was found at the site. Therefore, a backhoe was used on December 2, 2003, to attempt to uncover and locate the tank. The remains of the cast concrete tank were found, and it was determined at that time that the top of the unit had been removed, and the tank had been cleaned out and backfilled with soil at some point in the past.

This page intentionally left blank.

Figure 3.3-1
Backhoe excavation at DSS Site 1083, Building 6570. The drywell was located between the yellow posts. View to the southeast. March 11, 2002

Figure 3.3-2
DSS Site 1083, Building 6570 drywell. The end of the 4-inch, cast iron drain pipe, which extended from septic tank to the drywell, is shown. View to the north.
March 11, 2002

3.4 Investigation 3—Passive Soil-Vapor Sampling

In April and May 2002, a passive soil-vapor survey was conducted in the Building 6570 Septic System area. This survey was required at this site by NMED/HWB regulators and was conducted to determine whether significant VOC contamination was present in the soil at the site.

3.4.1 Passive Soil-Vapor Sampling Methodology

A Gore-Sorber™ (GS) passive soil-vapor survey is a qualitative screening procedure that can be used to identify many VOCs present in the vapor phase in soil. The technique is highly sensitive to organic vapors, and the result produces a qualitative measure of organic soil vapor chemistry over a two- to three-week period rather than at one point in time.

Each GS soil-vapor sampler consists of a 1-foot-long, 0.25-inch-diameter tube of waterproof, vapor-permeable fabric containing 40 milligrams (mg) of absorbent material. At each sampling location, a 3-foot-deep by 1.5-inch-diameter borehole was drilled with the Geoprobe™. A sample identification tag and location string were attached to the GS sampler and lowered into the open borehole to a depth of 1 to 2 feet bgs. The location string was attached to a numbered pin flag at the surface. A cork was placed in the borehole above the sampler as a seal, and the upper 1 foot of the borehole, from the cork to the ground surface, was backfilled with site soil.

The vapor samplers were left in the ground for approximately two weeks before retrieval. After retrieval, each sampler was individually placed into a pre-cleaned jar, sealed, and sent to W.L. Gore and Associates for analysis by thermal desorption and gas chromatography using a modified U.S. Environmental Protection Agency (EPA) Method 8260. Analytical results for the VOCs of interest are reported as mass (expressed in micrograms [µg]) of the individual VOCs absorbed by the sampler while it was in the ground (Gore June 2002). All samples were documented and handled in accordance with applicable SNL/NM operating procedures.

3.4.2 Soil-Vapor Survey Results and Conclusions

A total of four GS passive soil-vapor samplers were placed in the septic system area of the site (Figure 2.2.1-2). Samplers were installed at the site on April 29, 2002, and were retrieved on May 14, 2002. Sample locations are designated by the same six-digit sample number both on Figure 2.2.1-2 and in the analytical results tables presented in Annex B.

As shown in the analytical results tables in Annex B, the GS samplers were analyzed for a total of 30 individual or groups of VOCs, including trichloroethene, tetrachloroethene, cis- and trans-dichloroethene, and benzene/toluene/ethylbenzene/xylene. Low to trace-level (but quantifiable) amounts of 10 individual or groups of VOCs were detected in the GS samplers installed at this site. The analytical results indicated there were no areas of significant VOC contamination at the site that would require additional characterization.

3.5 Investigation 4—Soil Sampling

Once the system was located, soil sampling was conducted in accordance with the rationale and procedures in the SAP (SNL/NM October 1999) approved by the NMED. On September 3, 2002, soil samples were collected from one drywell borehole. The soil boring location is shown on Figure 2.2.1-2. A summary of the borehole, sample depths, sample analyses, analytical methods, laboratories, and sample date is presented in Table 3.5-1.

3.5.1 Soil Sampling Methodology

An auger drill rig was used to sample the borehole at two depth intervals. In the borehole drilled through the center of the drywell, the shallow sample interval started at the base of the gravel aggregate, and the lower (deep) interval started 5 feet below the top of the upper interval. Once the auger rig had reached the top of the sampling interval, a 3- or 4-foot-long by 1.5-inch inside diameter Geoprobe™ sampling tube lined with a butyl acetate (BA) sampling sleeve was inserted into the borehole and hydraulically driven downward 3 or 4 feet to fill the tube with soil.

Once the sample tube was retrieved from the borehole, the sample for VOC analysis was immediately collected by slicing off a 3- to 4-inch section from the lower end of the BA sleeve and capping the section ends with Teflon® film, then a rubber end cap, and finally sealing the tube with tape.

For the non-VOC analyses, the soil remaining in the BA liner was emptied into a decontaminated mixing bowl, and aliquots of soil were transferred into appropriate sample containers for analysis. On occasion, the amount of soil recovered in the first sampling run was insufficient for sample volume requirements. In this case, additional sampling runs were completed until an adequate soil volume was recovered. Soil recovered from these additional runs was emptied into the mixing bowl and blended with the soil already collected. Aliquots of the blended soil were then transferred into sample containers and submitted for analysis.

All samples were documented and handled in accordance with applicable SNL/NM operating procedures and transported to on- and off-site laboratories for analysis.

3.5.2 Soil Sampling Results and Conclusions

Analytical results for the soil samples collected at DSS Site 1083 are presented and discussed in this section.

VOCs

VOC analytical results for the two soil samples and one duplicate soil sample collected from the drywell borehole are summarized in Table 3.5.2-1. Method detection limits (MDLs) for the VOC soil analyses are presented in Table 3.5.2-2. Only one VOC, 2-butanone, was detected in the duplicate sample collected at 9 feet bgs and in the 14-foot-bgs sample from the borehole. This compound was not detected in the associated trip blank (TB). It is a common laboratory contaminant and may not indicate soil contamination at this site.

Table 3.5-1
Summary of Area Sampled, Analytical Methods, and Laboratories Used for
DSS Site 1083, Building 6570 Septic System Soil Samples

Sampling Area	Number of Borehole Locations	Top of Sampling Intervals in each Borehole (ft bgs)	Total Number of Soil Samples	Analytical Parameters and EPA Methods[a]	Analytical Laboratory	Date Samples Collected
Drywell	1	9, 14	2 +1 Duplicate	VOCs EPA Method 8260	GEL	09-03-02
	1	9, 14	2 +1 Duplicate	SVOCs EPA Method 8270	GEL	09-03-02
	1	9, 14	2 +1 Duplicate	PCBs EPA Method 8082	GEL	09-03-02
	1	9, 14	2 +1 Duplicate	HE Compounds EPA Method 8330	GEL	09-03-02
	1	9, 14	2 +1 Duplicate	RCRA Metals EPA Methods 6000/7000	GEL	09-03-02
	1	9, 14	2 +1 Duplicate	Hexavalent Chromium EPA Method 7196A	GEL	09-03-02
	1	9, 14	2 +1 Duplicate	Total Cyanide EPA Method 9012A	GEL	09-03-02
	1	9, 14	2 +1 Duplicate	Gamma Spectroscopy EPA Method 901.1	RPSD	09-03-02
	1	9, 14	2 +1 Duplicate	Gross Alpha/Beta Activity EPA Method 900.0	GEL	09-03-02

[a]EPA November 1986.
bgs = Below ground surface.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
ft = Foot (feet).
GEL = General Engineering Laboratories, Inc.
HE = High explosive(s).
PCB = Polychlorinated biphenyl.
RCRA = Resource Conservation and Recovery Act.
RPSD = Radiation Protection Sample Diagnostics Laboratory.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.

Table 3.5.2-1
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, VOC Analytical Results
September 2002
(Off-Site Laboratory)

Sample Attributes			VOCs (EPA Method 8260[a]) (µg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	2-Butanone
605667	6570-DW1-BH1-9-S	9	ND (3.9)
605667	6570-DW1-BH1-9-DU	9	**13.6 J**
605667	6570-DW1-BH1-14-S	14	**7.27 J**
Quality Assurance/Quality Control Samples (µg/L)			
605667	6589-6600-SP2-TB[c]	NA	ND (2.31)

Note: Values in **bold** represent detected analytes.
[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
[c]ER sample ID reflects the final site for VOC samples included in this shipment.
BH = Borehole.
DSS = Drain and Septic Systems.
DU = Duplicate sample.
DW = Drywell.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J = Estimated concentration.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the MDL, shown in parentheses.
S = Soil sample.
SP = Seepage pit.
TB = Trip blank.
VOC = Volatile organic compound.

Table 3.5.2-2
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, VOC Analytical MDLs
September 2002
(Off-Site Laboratory)

Analyte	EPA Method 8260[a] Detection Limit (µg/kg)
Acetone	3.45–3.59
Benzene	0.441–0.459
Bromodichloromethane	0.48–0.5
Bromoform	0.48–0.5
Bromomethane	0.49–0.51
2-Butanone	3.67–3.82
Carbon disulfide	2.31–2.41
Carbon tetrachloride	0.48–0.5
Chlorobenzene	0.402–0.418
Chloroethane	0.794–0.827
Chloroform	0.51–0.531
Chloromethane	0.363–0.378
Dibromochloromethane	0.49–0.51
1,1-Dichloroethane	0.461–0.48
1,2-Dichloroethane	0.422–0.439
1,1-Dichloroethene	0.49–0.51
cis-1,2-Dichloroethene	0.461–0.48
trans-1,2-Dichloroethene	0.52–0.541
1,2-Dichloropropane	0.471–0.49
cis-1,3-Dichloropropene	0.422–0.439
trans-1,3-Dichloropropene	0.245–0.255
Ethylbenzene	0.373–0.388
2-Hexanone	3.7–3.85
Methylene chloride	1.32–1.38
4-Methyl-2-pentanone	3.95–4.11
Styrene	0.382–0.398
1,1,2,2-Tetrachloroethane	0.892–0.929
Tetrachloroethene	0.373–0.388
Toluene	0.333–0.347
1,1,1-Trichloroethane	0.52–0.541
1,1,2-Trichloroethane	0.529–0.551
Trichloroethene	0.441–0.459
Vinyl acetate	1.75–1.82
Vinyl chloride	0.549–0.571
Xylene	0.382–0.398

[a]EPA November 1986.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
VOC = Volatile organic compound.

SVOCs

Semivolatile organic compound (SVOC) analytical results for the two soil samples and one duplicate soil sample collected from the drywell borehole are summarized in Table 3.5.2-3. MDLs for the SVOC soil analyses are presented in Table 3.5.2-4. Only one SVOC, bis(2-ethylhexyl) phthalate, was detected in the three samples collected from the borehole. This compound is a common laboratory contaminant as well as a component found in plastics and may not indicate soil contamination at this site.

PCBs

Polychlorinated biphenyl (PCB) analytical results for the two soil samples and one duplicate soil sample collected from the drywell borehole are summarized in Table 3.5.2-5. MDLs for the PCB soil analyses are presented in Table 3.5.2-6. No PCBs were detected in the soil samples collected from the site.

HE Compounds

High explosive (HE) compound analytical results for the two soil samples and one duplicate soil sample collected from the drywell borehole are summarized in Table 3.5.2-7. MDLs for the HE soil analyses are presented in Table 3.5.2-8. No HE compounds were detected in the soil samples collected from the site.

RCRA Metals and Hexavalent Chromium

Resource Conservation and Recovery Act (RCRA) metals and hexavalent chromium analytical results for the two soil samples and one duplicate soil sample collected from the drywell borehole are summarized in Table 3.5.2-9. MDLs for the metals in soil analyses are presented in Table 3.5.2-10. None of the metal concentrations detected in the samples exceed the corresponding NMED-approved background concentrations.

Total Cyanide

Total cyanide analytical results for the two soil samples and one duplicate soil sample collected from the drywell borehole are summarized in Table 3.5.2-11. MDLs for the cyanide soil analyses are presented in Table 3.5.2-12. Cyanide was detected in all three samples collected from the site.

Radionuclides

Analytical results for the gamma spectroscopy analysis of the two soil samples and one duplicate soil sample collected from the drywell borehole are summarized in Table 3.5.2-13. Uranium-235 was detected in the 9-foot-bgs sample from the borehole. Although not detected in the duplicate soil sample, the minimum detectable activity (MDA) for uranium-235 was exceeded in this sample because the standard gamma spectroscopy count time for soil samples (6,000 seconds) was not sufficient to reach the NMED-approved background activity

Table 3.5.2-3
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, SVOC Analytical Results
September 2002
(Off-Site Laboratory)

Sample Attributes			SVOCs (EPA Method 8270[a]) (µg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	bis(2-Ethylhexyl) phthalate
605667	6570-DW1-BH1-9-S	9	**82 J (333)**
605667	6570-DW1-BH1-9-DU	9	**89.2 J (333)**
605667	6570-DW1-BH1-14-S	14	**78.7 J (333)**

Note: Values in **bold** represent detected analytes.
[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
BH = Borehole.
DSS = Drain and Septic Systems.
DU = Duplicate sample.
DW = Drywell.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The reported value is greater than or equal to the MDL but is less than the practical quantitation limit, shown in parentheses.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
S = Soil sample.
SVOC = Semivolatile organic compound.

Table 3.5.2-4
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, SVOC Analytical MDLs
September 2002
(Off-Site Laboratory)

Analyte	EPA Method 8270[a] Detection Limit (µg/kg)
Acenaphthene	8
Acenaphthylene	16.7
Anthracene	16.7
Benzo(a)anthracene	16.7
Benzo(a)pyrene	16.7
Benzo(b)fluoranthene	16.7
Benzo(g,h,i)perylene	16.7
Benzo(k)fluoranthene	16.7
4-Bromophenyl phenyl ether	34
Butylbenzyl phthalate	28.7
Carbazole	16.7
4-Chlorobenzenamine	167
bis(2-Chloroethoxy)methane	12.3
bis(2-Chloroethyl)ether	37.3
bis-Chloroisopropyl ether	11
4-Chloro-3-methylphenol	167
2-Chloronaphthalene	13.7
2-Chlorophenol	15.3
4-Chlorophenyl phenyl ether	19.7
Chrysene	16.7
o-Cresol	26
Dibenz[a,h]anthracene	16.7
Dibenzofuran	17
1,2-Dichlorobenzene	10
1,3-Dichlorobenzene	11.3
1,4-Dichlorobenzene	15.7
3,3'-Dichlorobenzidine	167
2,4-Dichlorophenol	20.7
Diethylphthalate	17.7
2,4-Dimethylphenol	167
Dimethylphthalate	18.3
Di-n-butyl phthalate	24
Dinitro-o-cresol	167
2,4-Dinitrophenol	167
2,4-Dinitrotoluene	25.3
2,6-Dinitrotoluene	33.3
Di-n-octyl phthalate	30.3
Diphenyl amine	22.3
bis(2-Ethylhexyl) phthalate	30
Fluoranthene	16.7
Fluorene	4

Refer to footnotes at end of table.

Table 3.5.2-4 (Concluded)
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, SVOC Analytical MDLs
September 2002
(Off-Site Laboratory)

Analyte	EPA Method 8270[a] Detection Limit (µg/kg)
Hexachlorobenzene	20
Hexachlorobutadiene	12.7
Hexachlorocyclopentadiene	167
Hexachlorobutadiene	12.7
Hexachlorocyclopentadiene	167
Hexachloroethane	22
Indeno(1,2,3-cd)pyrene	16.7
Isophorone	16
2-Methylnaphthalene	16.7
4-Methylphenol	33.3
Naphthalene	16.7
2-Nitroaniline	167
3-Nitroaniline	167
4-Nitroaniline	37
Nitrobenzene	20.3
2-Nitrophenol	17
4-Nitrophenol	167
n-Nitrosodipropylamine	22.7
Pentachlorophenol	167
Phenanthrene	16.7
Phenol	12.7
Pyrene	16.7
1,2,4-Trichlorobenzene	12.7
2,4,5-Trichlorophenol	17.3
2,4,6-Trichlorophenol	27.3

[a]EPA November 1986.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
SVOC = Semivolatile organic compound.

Table 3.5.2-5
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, PCB Analytical Results
September 2002
(Off-Site Laboratory)

Sample Attributes			PCBs (EPA Method 8082[a]) (µg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	
605667	6570-DW1-BH1-9-S	9	ND
605667	6570-DW1-BH1-9-DU	9	ND
605667	6570-DW1-BH1-14-S	14	ND

[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
BH = Borehole.
DSS = Drain and Septic Systems.
DU = Duplicate sample.
DW = Drywell.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
ND = Not detected.
PCB = Polychlorinated biphenyl.
S = Soil sample.

Table 3.5.2-6
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, PCB Analytical MDLs
September 2002
(Off-Site Laboratory)

Analyte	EPA Method 8082[a] Detection Limit (µg/kg)
Aroclor-1016	1
Aroclor-1221	2.82
Aroclor-1232	1.67
Aroclor-1242	1.67
Aroclor-1248	1
Aroclor-1254	0.5
Aroclor-1260	1

[a]EPA November 1986.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
PCB = Polychlorinated biphenyl.

Table 3.5.2-7
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, HE Compound Analytical Results
September 2002
(Off-Site Laboratory)

Sample Attributes			HE (EPA Method 8330[a]) (µg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	
605667	6570-DW1-BH1-9-S	9	ND
605667	6570-DW1-BH1-9-DU	9	ND
605667	6570-DW1-BH1-14-S	14	ND

[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
BH = Borehole.
DSS = Drain and Septic Systems.
DU = Duplicate sample.
DW = Drywell.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
HE = High explosive(s).
ID = Identification.
µg/kg = Microgram(s) per kilogram.
ND = Not detected.
S = Soil sample.

Table 3.5.2-8
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, HE Compound Analytical MDLs
September 2002
(Off-Site Laboratory)

Analyte	EPA Method 8330[a] Detection Limit (µg/kg)
2-Amino-4,6-dinitrotoluene	18.1
4-Amino-2,6-dinitrotoluene	34.1
1,3-Dinitrobenzene	34.1
2,4-Dinitrotoluene	55
2,6-Dinitrotoluene	48
HMX	48
Nitrobenzene	48
2-Nitrotoluene	24
3-Nitrotoluene	24
4-Nitrotoluene	24
RDX	48
Tetryl	22.1
1,3,5-Trinitrobenzene	29
2,4,6-Trinitrotoluene	48

[a]EPA November 1986.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
HE = High explosive(s).
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.
Tetryl = Methyl-2,4,6-trinitrophenylnitramine.

Table 3.5.2-9
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, Metals Analytical Results
September 2002
(Off-Site Laboratory)

Sample Attributes			Metals (EPA Method 6000/7000/7196[a]) (mg/kg)								
Record Number[b]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium	Chromium (VI)	Lead	Mercury	Selenium	Silver
605667	6570-DW1-BH1-9-S	9	2.99	130 J	0.199 J (0.472)	9.84	ND (0.052)	5.6	0.0227	ND (0.153)	ND (0.0851)
605667	6570-DW1-BH1-9-DU	9	3.45	170 J	0.224 J (0.472)	11.3	ND (0.0533)	6.49	0.00701 J (0.00965)	ND (0.153)	ND (0.0851)
605667	6570-DW1-BH1-14-S	14	2.39	45.6 J	0.159 J (0.495)	13.1	ND (0.0529)	3.14	0.00929	ND (0.16)	ND (0.0893)
Background Concentration—Southwest Area Supergroup[c]			4.4	214	0.9	15.9	1	11.8	<0.1	<1	<1

[a]EPA November 1986.

[b]Analysis request/chain-of-custody record.

[c]Dinwiddie September 1997.

BH = Borehole.
DSS = Drain and Septic Systems.
DU = Duplicate sample.
DW = Drywell.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J = Analytical result was qualified as an estimated value.
J ( ) = The reported value is greater than or equal to the MDL but is less than the practical quantitation limit, shown in parentheses.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.
ND ( ) = Not detected above the MDL, shown in parentheses.
S = Soil sample.

Table 3.5.2-10
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, Metals Analytical MDLs
September 2002
(Off-Site Laboratory)

Analyte	EPA Method 6000/7000/7196A[a] Detection Limit (mg/kg)
Arsenic	0.195–0.204
Barium	0.0629–0.066
Cadmium	0.0451–0.0473
Chromium	0.152–0.16
Chromium (VI)	0.052–0.0533
Lead	0.268–0.281
Mercury	0.000862–0.000962
Selenium	0.153–0.16
Silver	0.0851–0.0893

[a]EPA November 1986.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.

Table 3.5.2-11
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, Total Cyanide Analytical Results
September 2002
(Off-Site Laboratory)

Sample Attributes			Total Cyanide (EPA Method 9012[a]) (mg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	Total Cyanide
605667	6570-DW1-BH1-9-S	9	**0.0848 J (0.227)**
605667	6570-DW1-BH1-9-DU	9	**5.08**
605667	6570-DW1-BH1-14-S	14	**0.0509 J (0.208)**

Note: Values in **bold** represent detected analytes.
[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
BH = Borehole.
DSS = Drain and Septic Systems.
DU = Duplicate.
DW = Drywell.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The reported value is greater than or equal to the MDL but is less than the practical quantitation limit, shown in parentheses.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.
S = Soil sample.

Table 3.5.2-12
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, Total Cyanide Analytical MDLs
September 2002
(Off-Site Laboratory)

Analyte	EPA Method 9012[a] Detection Limit (mg/kg)
Total Cyanide	0.035–0.0381

[a]EPA November 1986.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.

Table 3.5.2-13
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, Gamma Spectroscopy Analytical Results
September 2002
(On-Site Laboratory)

Sample Attributes			Activity (EPA Method 901.1[a]) (pCi/g)							
Record Number[b]	ER Sample ID	Sample Depth (ft)	Cesium-137		Thorium-232		Uranium-235		Uranium-238	
			Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
605747	6570-DW1-BH1-9-S	9	ND (0.03)	--	0.786	0.382	**0.211**	0.195	ND (0.783)	--
605747	6570-DW1-BH1-9-DU	9	ND (0.0272)	--	0.727	0.343	**ND (0.213)**	--	ND (0.693)	--
605747	6570-DW1-BH1-14-S	14	ND (0.0217)	--	0.487	0.248	0.128	0.136	ND (0.529)	--
Background Activity—Southwest Area Supergroup[d]			0.079	NA	1.01	NA	0.16	NA	1.4	NA

Note: Values in **bold** exceed background soil activities.
[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
[c]Two standard deviations about the mean detected activity.
[d]Dinwiddie September 1997.
BH = Borehole.
DSS = Drain and Septic Systems.
DU = Duplicate sample.
DW = Drywell.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
MDA = Minimum detectable activity.
NA = Not applicable.
ND ( ) = Not detected above the MDA, shown in parentheses.
ND ( ) = Not detected, but the MDA (shown in parentheses) exceeds background activity.
pCi/g = Picocurie(s) per gram.
S = Soil sample.
-- = Error not calculated for nondetect results.

established for SNL/NM soils. Even though the MDA may be slightly elevated, the value is still very low, and the risk assessment outcome for the site is not significantly impacted by its use.

Gross Alpha/Beta Activity

Gross alpha/beta analytical results for the two soil samples and one duplicate sample collected from the drywell borehole are summarized in Table 3.5.2-14. No gross alpha or beta activity was detected above the New Mexico-established background levels (Miller September 2003) in any of the samples. These results indicate no significant levels of radioactive material are present in the soil at the site.

3.5.3 Soil Sampling Quality Assurance/Quality Control Samples and Data Validation Results

Throughout the DSS Project, quality assurance/quality control samples were collected at an approximate frequency of 1 per 20 field samples. These included duplicate, equipment blank (EB), and TB samples. Typically, samples were shipped to the laboratory in batches of up to 20 samples, so that any one shipment might contain samples from several sites. Aqueous EB samples were collected at an approximate frequency of 1 per 20 site samples. The EB samples were analyzed for the same analytical suite as the soil samples in that shipment. The analytical results for the EB samples appear only on the data tables for the site where they were collected. However, the results were used in the data validation process for all the samples in that batch.

Aqueous TB samples, for VOC analysis only, were included in every sample cooler containing VOC soil samples. The analytical results for the TB samples appear on the VOC data tables for the sites in that shipment. The results were used in the data validation process for all the samples in that batch. No VOCs were detected in the TB for DSS Site 1083 (Table 3.5.2-1).

As shown in Tables 3.5.2-1, 3.5.2-3, 3.5.2-5, 3.5.2-7, 3.5.2-9, 3.5.2-11, 3.5.2-13 and 3.5.2-14, to assess the precision and repeatability of sampling and analytical procedures, duplicate soil samples (designated 'DU') were collected and analyzed at the off-site laboratory for VOCs, SVOCs, PCBs, HE compounds, RCRA metals, hexavalent chromium, total cyanide, radionuclides by gamma spectroscopy, and gross alpha/beta activity. The results are summarized as follows:

- Concentrations of the VOC 2-butanone in the primary and duplicate samples from the 9-foot-bgs interval were nondetect (ND) and 13.6 J µg/kilogram (kg), respectively. Because 2-butanone is a common laboratory contaminant, the variance in the results of the two samples may reflect changing conditions in the laboratory environment when the two samples were being analyzed.

- The SVOC bis(2-ethylhexyl) phthalate was detected at similar concentrations of 82 J in the primary soil sample and 89.2 J in the duplicate soil sample.

- Concentrations of both PCBs and HE compounds in the primary and duplicate samples from the borehole were ND.

Table 3.5.2-14
Summary of DSS Site 1083, Building 6570 Septic System
Confirmatory Soil Sampling, Gross Alpha/Beta Activity Analytical Results
September 2002
(Off-Site Laboratory)

Sample Attributes			Activity (EPA Method 900.0[a]) (pCi/g)			
			Gross Alpha		Gross Beta	
Record Number[b]	ER Sample ID	Sample Depth (ft)	Result	Error[c]	Result	Error[c]
605667	6570/1083-DW1-BH1-9-S	9	12.3	1.99	20.8	2.14
605667	6570/1083-DW1-BH1-9-DU	9	11.3	1.83	23	2.07
605667	6570/1083-DW1-BH1-14-S	14	7.21	1.65	22.3	2.87
Background Activity[d]			17.4	NA	35.4	NA

[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
[c]Two standard deviations about the mean detected activity.
[d]Miller September 2003.
BH = Borehole.
DSS = Drain and Septic Systems.
DU = Duplicate sample.
DW = Drywell.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.
S = Soil sample.

- Concentrations of the RCRA metals arsenic, barium, cadmium, chromium, and lead detected in the primary and duplicate samples were similar, and were within 25 percent of each other. Concentrations of mercury in the primary sample (0.0227 mg/kg) was approximately 3.2 times the amount in the duplicate (0.00701 J mg/kg). Hexavalent chromium, selenium, and silver were not detected in either the primary or the duplicate sample.

- The concentration of total cyanide in the primary (0.0848 J mg/kg) and duplicate (5.08 mg/kg) samples were very dissimilar, with the duplicate having approximately 60 times more cyanide than the primary sample.

- The gamma spectroscopy results and the gross alpha/beta activity results for both the original and duplicate samples are comparable.

All laboratory data were reviewed and verified/validated according to "Verification and Validation of Chemical and Radiochemical Data," Technical Operating Procedure (TOP) 94-03, Rev. 0 (SNL/NM July 1994) or SNL/NM ER Project "Data Validation Procedure for Chemical and Radiochemical Data," Administrative Operating Procedure (AOP) 00-03 (SNL/NM December 1999). In addition, SNL/NM Department 7713 (RPSD Laboratory) reviewed all gamma spectroscopy results according to "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 02 (SNL/NM July 1996). Annex C contains the data validation

reports for the samples collected at this site. The data are acceptable for use in this NFA proposal.

3.6 Site Sampling Data Gaps

Analytical data from the site assessment were sufficient for characterizing the nature and extent of possible COC releases. There are no further data gaps regarding characterization of DSS Site 1083.

4.0 CONCEPTUAL SITE MODEL

The conceptual site model for DSS Site 1083, the Building 6570 Septic System, is based upon the COCs identified in the soil samples collected from beneath the drywell at this site. This section summarizes the nature and extent of contamination and the environmental fate of the COCs.

4.1 Nature and Extent of Contamination

Potential COCs at DSS Site 1083 are VOCs, SVOCs, PCBs, HE compounds, cyanide, RCRA metals, hexavalent chromium, and radionuclides. One VOC, one SVOC, and cyanide were detected in the soil samples collected at the site. There were no PCBs, HE compounds, or hexavalent chromium detected in any of the soil samples collected at this site. None of the eight RCRA metals were detected at concentrations above the approved maximum background concentrations for SNL/NM Southwest Area Supergroup soils (Dinwiddie September 1997) or above the nonquantified background concentrations. When a metal concentration exceeded its maximum background screening value, or had no quantified background value, it was considered further in the risk assessment process. Uranium-235 was detected in the 9-foot-bgs sample at a level exceeding the corresponding background level. In addition, the MDA for one of the uranium-235 analyses exceeds the background activity. Finally, no gross alpha/beta activity was detected above the New Mexico-established background levels.

4.2 Environmental Fate

Potential COCs may have been released into the vadose zone via aqueous effluent discharged from the septic system and drywell. Possible secondary release mechanisms include the uptake of COCs that may have been released into the soil beneath the drywell (Figure 4.2-1). The depth to groundwater at the site (approximately 493 feet bgs) most likely precludes migration of potential COCs into the groundwater system. The potential pathways to receptors include soil ingestion, dermal contact, and inhalation, which could occur as a result of receptor exposure to contaminated subsurface soil at the site. No intake routes through plant, meat, or milk ingestion are considered appropriate for either the industrial or residential land-use scenarios. Annex D provides additional discussion on the fate and transport of COCs at DSS Site 1083.

Table 4.2-1 summarizes the potential COCs for DSS Site 1083. All potential COCs were retained in the conceptual model and were evaluated in both the human health and ecological risk assessments. The current and future land use for DSS Site 1083 is industrial (DOE et al. September 1995).

The potential human receptors at the site are considered to be an industrial worker and resident. The exposure routes for the receptors are dermal contact and ingestion/inhalation; however, these are realistic possibilities only if contaminated soil is excavated at the site. The major exposure route modeled in the human health risk assessment is soil ingestion for COCs. The inhalation pathway is included because of the potential to inhale dust and volatiles. The

This page intentionally left blank.

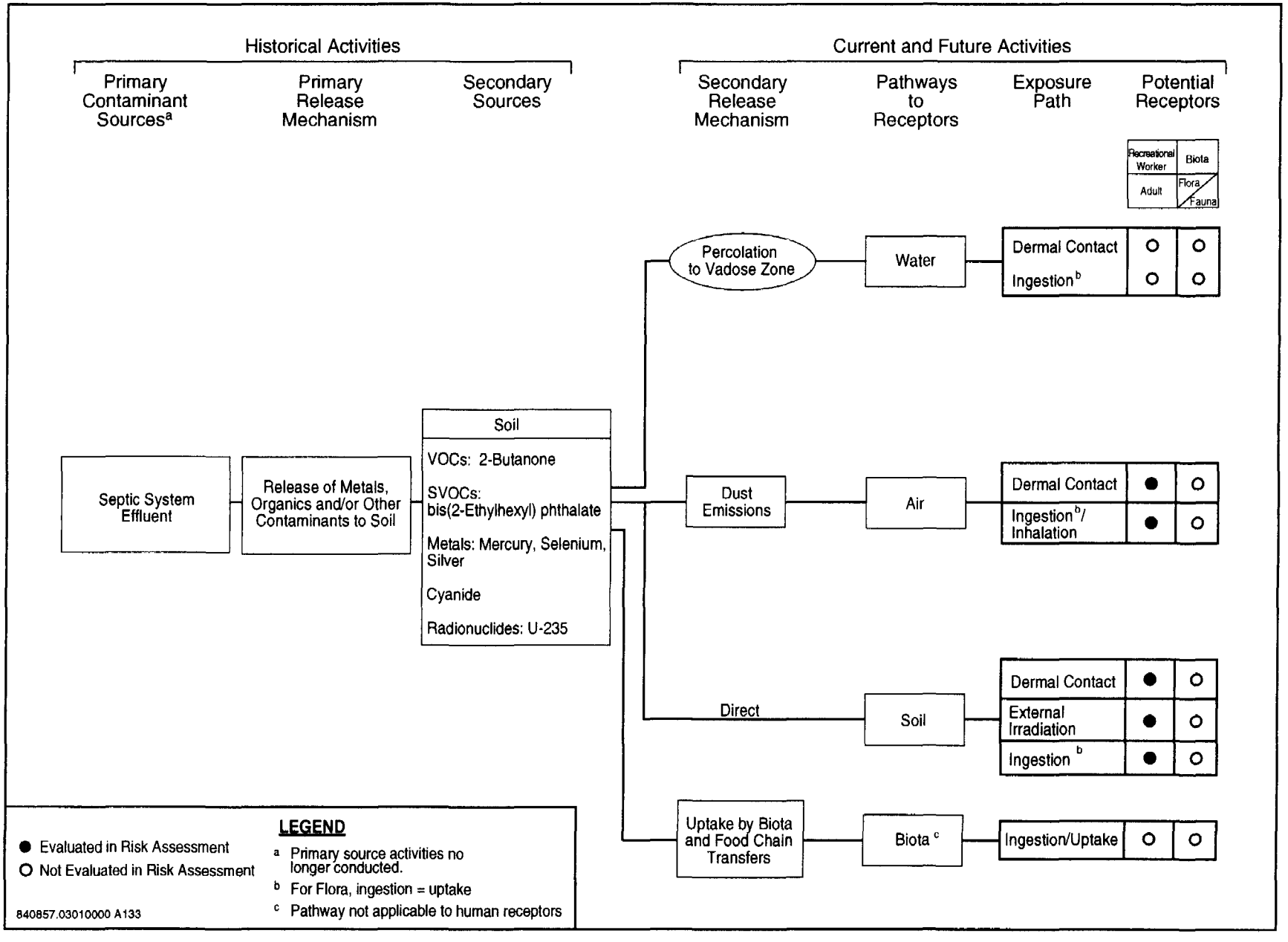


Figure 4.2-1

Conceptual Site Model Flow Diagram for DSS Site 1083, Building 6570 Septic System

Table 4.2-1
Summary of Potential COCs for DSS Site 1083, Building 6570 Septic System

COC Type		Number of Samples[a]	COCs Detected or with Concentrations Greater than Background or Nonquantified Background	Maximum Background Limit/Southwest Area Supergroup[b] (mg/kg)	Maximum Concentration[c] (All Samples) (mg/kg)	Average Concentration[d] (mg/kg)	Number of Samples Where COCs Detected or with Concentrations Greater than Background or Nonquantified Background[e]
VOCs		3	2-butanone	NA	0.0136 J	0.00761	2
SVOCs		3	bis(2-Ethylhexyl) phthalate	NA	0.0892 J	0.0833	3
PCBs		3	None	NA	NA	NA	None
HE Compounds		3	None	NA	NA	NA	None
RCRA Metals		3	Mercury	NQ	0.0227	0.0130	None
		3	Selenium	NQ	ND (0.16)	0.0777	None
		3	Silver	NQ	ND (0.0893)	0.0433	None
Hexavalent Chromium		3	None	1	NA	NA	None
Cyanide		3	Cyanide	NQ	5.08	1.739	3
Radionuclides (pCi/g)	Gamma Spectroscopy	3	Uranium-235	0.16	0.211	NC[f]	2
	Gross Alpha	3	None	NA	NA	NA	None
	Gross Beta	3	None	NA	NA	NA	None

[a]Number of samples includes duplicates and splits.

[b]Dinwiddie September 1997.

[c]Maximum concentration is either the maximum amount detected, or if nothing was detected, the maximum MDL or MDA above background or nonquantified background.

[d]Average concentration includes all samples except blanks. The average is calculated as the sum of detected amounts and one-half of the MDLs for nondetect results, divided by the number of samples.

[e]See appropriate data table for sample locations.

[f]An average MDA is not calculated because of the variability in instrument counting error and the number of reported nondetect activities for gamma spectroscopy.

COC = Constituent of concern.
DSS = Drain and Septic Systems.
HE = High explosive(s).
J = Estimated concentration.
MDA = Minimum detectable activity.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
NC = Not calculated.
ND ( ) = Not detected above the MDL, shown in parentheses.
NQ = Nonquantified background value.
PCB = Polychlorinated biphenyl.
pCi/g = Picocurie(s) per gram.
RCRA = Resource Conservation and Recovery Act.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.

dermal pathway is included because of the potential for receptors to be exposed to the contaminated soil.

No pathways to groundwater and no intake routes through flora or fauna are considered appropriate for either the industrial or residential land-use scenarios. Annex D provides additional discussion of the exposure routes and receptors at DSS Site 1083.

4.3 Site Assessment

Site assessment at DSS Site 1083 included risk assessments for both human health and ecological risk. This section briefly summarizes the site assessment results, and Annex D discusses the risk assessment performed for DSS Site 1083 in more detail.

4.3.1 Summary

The site assessment concluded that DSS Site 1083 poses no significant threat to human health under either the industrial or residential land-use scenarios. Ecological risks were found to be insignificant because no pathways exist.

4.3.2 Risk Assessments

Risk assessments were performed for both human health and ecological risk at DSS Site 1083. This section summarizes the results.

4.3.2.1 Human Health

DSS Site 1083 has been recommended for an industrial land-use scenario (DOE et al. September 1995). Because 2-butanone, bis(2-ethylhexyl) phthalate, mercury, selenium, silver, cyanide, and uranium-235 are present above background or have nonquantified background levels, it was necessary to perform a human health risk assessment analysis for the site, which included these COCs. Annex D provides a complete discussion of the risk assessment process, results, and uncertainties. The risk assessment process provides a quantitative evaluation of the potential adverse human health effects from constituents in the site's soil by calculating the hazard index (HI) and excess cancer risk for both industrial and residential land-use scenarios.

The HI calculated for the COCs at DSS Site 1083 is 0.00 for the industrial land-use scenario, which is less than the numerical standard of 1.0 suggested by risk assessment guidance (EPA 1989). The incremental HI risk, determined by subtracting risk associated with background from potential nonradiological COC risk (without rounding), is 0.00. The estimated excess cancer risk for DSS Site 1083 COCs for an industrial land-use scenario is 5E-10. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. The incremental estimated excess cancer risk is 4.65E-10. Both the incremental HI and excess cancer risk are below NMED guidelines.

The HI calculated for the COCs at DSS Site 1083 is 0.00 for the residential land-use scenario, which is less than the numerical standard of 1.0 suggested by risk assessment guidance (EPA 1989). The incremental HI risk, determined by subtracting risk associated with background from potential nonradiological COC risk (without rounding), is 0.00. The estimated excess cancer risk for DSS Site 1083 COCs is 2E-9 for a residential land-use scenario. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. The estimated incremental excess cancer risk is 2.02E-9. Both the incremental HI and incremental excess cancer risk are below NMED guidelines.

The incremental total effective dose equivalent (TEDE) and corresponding estimated cancer risk from radiological COCs are much less than EPA guidance values; the estimated TEDE is 7.6E-3 millirem (mrem)/year (yr) for the industrial land-use scenario, which is much less than the EPA's numerical guidance of 15 mrem/yr (EPA 1997a). The corresponding incremental estimated cancer risk value is 9.0E-8 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 2.0E-2 mrem/yr with an associated risk of 2.7E-7. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, DSS Site 1083 is eligible for unrestricted radiological release.

The nonradiological and radiological carcinogenic risks are tabulated and summed in Table 4.3.2-1.

Table 4.3.2-1
Summation of Incremental Radiological and Nonradiological Risks from DSS Site 1083, Building 6570 Septic System Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	4.65E-10	9.0E-8	9.0E-8
Residential	2.02E-9	2.7E-7	2.7E-7

DSS = Drain and Septic Systems.

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.

4.3.2.2 Ecological

An ecological assessment that corresponds with the procedures in the EPA's Ecological Risk Assessment Guidance for Superfund (EPA 1997b) also was performed as set forth by the NMED Risk-Based Decision Tree in the "RPMP Document Requirement Guide" (NMED March 1998). An early step in the evaluation compared COC concentrations and identified potentially bioaccumulative constituents (see Annex D, Sections IV, VII.2, and VII.2.1). This methodology also required developing a site conceptual model and a food web model, as well as selecting ecological receptors, as presented in "Predictive Ecological Risk Assessment Methodology, Environmental Restoration Program, Sandia National Laboratories, New Mexico" (IT July 1998). The risk assessment also includes the estimation of exposure and ecological risk.

All COCs at DSS Site 1083 are located at depths greater than 5 feet bgs. Therefore, no complete ecological pathways exist at this site, and a more detailed ecological risk assessment is not necessary.

4.4 Baseline Risk Assessments

This section discusses the baseline risk assessments for human health and ecological risk.

4.4.1 Human Health

Because the results of the human health risk assessment summarized in Section 4.3.2.1 indicate that DSS Site 1083 poses insignificant risk to human health under both the industrial and residential land-use scenarios, a baseline human health risk assessment is not required for this site.

4.4.2 Ecological

Because the results of the ecological risk assessment summarized in Section 4.3.2.2 indicate that no complete pathways exist at DSS Site 1083, a baseline ecological risk assessment is not required for the site.

5.0 NO FURTHER ACTION PROPOSAL

5.1 Rationale

Based upon field investigation data and the human health and ecological risk assessment analyses, an NFA decision is recommended for DSS Site 1083 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.

5.2 Criterion

Based upon the evidence provided in Section 5.1, DSS Site 1083 is proposed for an NFA decision according to Criterion 5, which states, "the SWMU/AOC has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use" (NMED March 1998).

This page intentionally left blank.

6.0 REFERENCES

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 Systems 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.

Bleakly, D. (Sandia National Laboratories/New Mexico), July 1996. Memorandum, "List of Non-ER Septic/Drain Systems for the Sites Identified Through the Septic System Inventory Program." July 8, 1996.

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.

Gore, see Gore, W.L. and Associates.

Gore, W.L. and Associates (Gore), June 2002. "Gore-Sorber Screening Survey Final Report, Non-ER Drain and Septic, Kirtland AFB, NM," W.L. Gore Production Order Number 10960025, Sandia National Laboratories, Albuquerque, New Mexico. June 6, 2002

IT, see IT Corporation.

IT Corporation (IT), July 1998. "Predictive Ecological Risk Assessment Methodology, Environmental Restoration Program, Sandia National Laboratories, New Mexico," 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.

Miller, M. (Sandia National Laboratories/New Mexico), September 2003. Memorandum to F.B. Nimick (Sandia National Laboratories/New Mexico), regarding "State of New Mexico Background for Gross Alpha/Beta Assays in Soil Samples." September 12, 2003.

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

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.

NMED, see New Mexico Environment Department.

NOAA, see National Oceanic and Atmospheric Administration.

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), April 1991. "Sandia National Laboratories Septic Tank Characterization Summary Tables of Analytical Results for Detected Parameters, Technical Area III and Coyote Canyon Test Field, April 1991," 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), 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), February 1998. "RESRAD Input Parameter Assumptions and Justification," 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), December 1999. "Data Validation Procedure for Chemical and Radiochemical Data," Administrative Operating Procedure (AOP) 00-03, Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico.

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 2001," 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), April 2003. "DSS Sites Mean Elevation Report," GIS Group, Environmental Restoration Department, Sandia National Laboratories, Albuquerque, New Mexico.

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

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

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), 1989. "Risk Assessment Guidance for Superfund, Vol. 1: Human Health Evaluation Manual," EPA/540/1-89/002, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

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

This page intentionally left blank.

ANNEX A
DSS Site 1083
Septic Tank Sampling Results

4-17-91

Results of septic tank sampling conducted between 12/18/90 and 1/8/91 for buildings noted.

DBDionne

4-17-91

Nick Durand,

For your information.

David Dionne

TABLE 9

SUMMARY OF ANALYTICAL RESULTS FOR DETECTED PARAMETERS
TECHNICAL AREA III AND COYOTE CANYON TEST FIELD
SEPTIC TANK SAMPLING

BUILDING 6570

SAMPLE NUMBERS SNLA004883, SNLA004884

Parameter	Results	Units
VOLATILE ORGANICS		
1,2-Dichloroethene*	880	µg/l
INORGANICS		
Oil and Grease	2.4	mg/l
Nitrates/Nitrites	1.5	mg/l
Phenolics	0.27	mg/l
METALS		
Barium	0.49	mg/l
Cadmium	0.011	mg/l
Copper	0.081	mg/l
Lead	0.027	mg/l
Manganese	0.050	mg/l
Mercury	0.00034	mg/l
Zinc	1.2	mg/l
RADIOLOGICAL		
Gross Alpha	7.8	pCi/l
Gross Beta	13	pCi/l

*Not on total toxic organic list

ANNEX B
DSS Site 1083
Gore-Sorber™ Passive Soil-Vapor Survey Analytical Results

W. L. GORE & ASSOCIATES, INC.

100 CHESAPEAKE BLVD., P.O. BOX 10 • ELKTON, MARYLAND 21922-0010 • PHONE: 410/392-7600
FAX: 410/506-4780

GORE-SORBER® Screening Survey
Final Report

Non-ER Drain & Septic
Kirtland AFB, NM

June 6, 2002

Prepared For:
Sandia National Laboratories
Mail Stop 0719, 1515 Eubank, SE
Albuquerque, NM 87123

W.L. Gore & Associates, Inc.

Written/Submitted by:
Jay W. Hodny, Ph.D., Project Manager

Reviewed/Approved by:
Jim E. Whetzel, Project Manager

Analytical Data Reviewed by:
Jim E. Whetzel, Chemist

I:\MAPPING\PROJECTS\10960025\020606R.DOC

GORE-SORBER® Screening Survey
Final Report

REPORT DATE: June 6, 2002 **AUTHOR:** JWH

SITE INFORMATION

Site Reference: Non-ER Drain & Septic, Kirtland AFB, NM
Customer Purchase Order Number: 28518
Gore Production Order Number: 10960025 **Gore Site Code:** CCT, CCX

FIELD PROCEDURES

 # Modules shipped: 142
Installation Date(s): 4/23,24,25,26,29,30/2002; 5/1,6/2002
 # Modules Installed: 135
Field work performed by: Sandia National Laboratories

Retrieval date(s): 5/8,9,10,14,15,16,21/2002
 # Modules Retrieved: 131
 # Modules Lost in Field: 4
 # Modules Not Returned: 1

Exposure Time: ~15 [days]
 # Trip Blanks Returned: 3
 # Unused Modules Returned: 3

Date/Time Received by Gore: 5/17/2002 @ 2:00 PM; 5/24/2002@1:30PM **By:** MM
Chain of Custody Form attached: √
Chain of Custody discrepancies: None
Comments:
Modules #179227, -228, and -229 were identified as trip blanks.
Modules #179137, -138, -140, and -141 were not retrieved and considered lost from the field.
Module #179231 was not returned.
Modules #179230, 232, and –233 were returned unused.

GORE-SORBER® Screening Survey
Final Report

ANALYTICAL PROCEDURES

W.L. Gore & Associates' Screening Module Laboratory operates under the guidelines of its Quality Assurance Manual, Operating Procedures and Methods. The quality assurance program is consistent with Good Laboratory Practices (GLP) and ISO Guide 25, "General Requirements for the Competence of Calibration and Testing Laboratories", third edition, 1990.

Instrumentation consists of state of the art gas chromatographs equipped with mass selective detectors, coupled with automated thermal desorption units. Sample preparation simply involves cutting the tip off the bottom of the sample module and transferring one or more exposed sorbent containers (sorbers, each containing 40mg of a suitable granular adsorbent) to a thermal desorption tube for analysis. Sorbers remain clean and protected from dirt, soil, and ground water by the insertion/retrieval cord, and require no further sample preparation.

Analytical Method Quality Assurance:
The analytical method employed is a modified EPA method 8260/8270. Before each run sequence, two instrument blanks, a sorber containing 5µg BFB (Bromofluorobenzene), and a method blank are analyzed. The BFB mass spectra must meet the criteria set forth in the method before samples can be analyzed. A method blank and a sorber containing BFB is also analyzed after every 30 samples and/or trip blanks. Standards containing the selected target compounds at three calibration levels of 5, 20, and 50µg are analyzed at the beginning of each run. The criterion for each target compound is less than 35% RSD (relative standard deviation). If this criterion is not met for any target compound, the analyst has the option of generating second- or third-order standard curves, as appropriate. A second-source reference standard, at a level of 10µg per target compound, is analyzed after every ten samples and/or trip blanks, and at the end of the run sequence. Positive identification of target compounds is determined by 1) the presence of the target ion and at least two secondary ions; 2) retention time versus reference standard; and, 3) the analyst's judgment.

NOTE: All data have been archived. Any replicate sorbers not used in the initial analysis will be discarded fifteen (15) days from the date of analysis.

Laboratory analysis: thermal desorption, gas chromatography, mass selective detection
Instrument ID: # 2 **Chemist:** JW
Compounds/mixtures requested: Gore Standard VOC/SVOC Target Compounds (A1)
Deviations from Standard Method: None
Comments: Soil vapor analytes and abbreviations are tabulated in the Data Table Key (page 6).
Module #179091 was returned and noted as damaged, no carbonaceous sorbers; therefore, target compound masses reported in data table cannot be compared to the mass data from the other modules directly.
Module #179101, no identification tag was returned with this module.

GORE-SORBER® Screening Survey
Final Report

DATA TABULATION

 # CONTOUR MAPS ENCLOSED: No contour maps were generated.

NOTE: All data values presented in Appendix A represent masses of compound(s) desorbed from the GORE-SORBER Screening Modules received and analyzed by W.L. Gore & Associates, Inc., as identified in the Chain of Custody (Appendix A). The measurement traceability and instrument performance are reproducible and accurate for the measurement process documented. Semi-quantitation of the compound mass is based on either a single-level (QA Level 1) or three-level (QA Level 2) standard calibration.

General Comments:

- This survey reports soil gas mass levels present in the vapor phase. Vapors are subject to a variety of attenuation factors during migration away from the source concentration to the module. Thus, mass levels reported from the module will often be less than concentrations reported in soil and groundwater matrix data. In most instances, the soil gas masses reported on the modules compare favorably with concentrations reported in the soil or groundwater (e.g., where soil gas levels are reported at greater levels relative to other sampled locations on the site, matrix data should reveal the same pattern, and vice versa). However, due to a variety of factors, a perfect comparison between matrix data and soil gas levels can rarely be achieved.
- Soil gas signals reported by this method cannot be identified specifically to soil adsorbed, groundwater, and/or free-product contamination. The soil gas signal reported from each module can evolve from all of these sources. Differentiation between soil and groundwater contamination can only be achieved with prior knowledge of the site history (i.e., the site is known to have groundwater contamination only).
- QA/QC trip blank modules were provided to document potential exposures that were not part of the soil gas signal of interest (i.e., impact during module shipment, installation and retrieval, and storage). The trip blanks are identically manufactured and packaged soil gas modules to those modules placed in the subsurface. However, the trip blanks remain unopened during all phases of the soil gas survey. Levels reported on the trip blanks may indicate potential impact to modules other than the contaminant source of interest.

GORE-SORBER® Screening Survey
Final Report

- Unresolved peak envelopes (UPEs) are represented as a series of compound peaks clustered together around a central gas chromatograph elution time in the total ion chromatogram. Typically, UPEs are indicative of complex fluid mixtures that are present in the subsurface. UPEs observed early in the chromatogram are considered to indicate the presence of more volatile fluids, while UPEs observed later in the chromatogram may indicate the presence of less volatile fluids. Multiple UPEs may indicate the presence of multiple complex fluids.

Project Specific Comments:

- Stacked total ion chromatograms (TICs) are included in Appendix A. The six-digit serial number of each module is incorporated into the TIC identification (e.g.: 123456S.D represents module #123456).
- No target compounds were detected on the trip blanks and/or the method blanks. Thus, target analyte levels reported for the field-installed modules that exceed trip and method blank levels, and the analyte method detection limit, have a high probability of originating from on-site sources.
- A small subset of modules was placed at each of several site locations; therefore no contour mapping was performed. Larger and more comprehensive soil gas surveys may be warranted at the individual sites where elevated soil gas levels were observed.

GORE-SORBER® Screening Survey
Final Report

KEY TO DATA TABLE
Non-ER Drain & Septic, Kirtland AFB, NM

UNITS

µg	micrograms (per sorber), reported for compounds
MDL	method detection limit
bdl	below detection limit
nd	non-detect

ANALYTES

BTEX	combined masses of benzene, toluene, ethylbenzene and total xylenes (Gasoline Range Aromatics)
BENZ	benzene
TOL	toluene
EtBENZ	ethylbenzene
mpXYL	m-, p-xylene
oXYL	o-xylene
C11,C13&C15	combined masses of undecane, tridecane, and pentadecane (C11+C13+C15) (Diesel Range Alkanes)
UNDEC	undecane
TRIDEC	tridecane
PENTADEC	pentadecane
TMBs	combined masses of 1,3,5-trimethylbenzene and 1,2,4-trimethylbenzene
135TMB	1,3,5-trimethylbenzene
124TMB	1,2,4-trimethylbenzene
ct12DCE	cis- & trans-1,2-dichloroethene
t12DCE	trans-1,2-dichloroethene
c12DCE	cis-1,2-dichloroethene
NAPH&2-MN	combined masses of naphthalene and 2-methyl naphthalene
NAPH	naphthalene
2MeNAPH	2-methyl naphthalene
MTBE	methyl t-butyl ether
11DCA	1,1-dichloroethane
$CHCl_3$	chloroform
111TCA	1,1,1-trichloroethane
12DCA	1,2-dichloroethane
CCl_4	carbon tetrachloride
TCE	trichloroethene
OCT	octane
PCE	tetrachloroethene
ClBENZ	chlorobenzene
14DCB	1,4-dichlorobenzene

BLANKS

TBn	unexposed trip blanks, travels with the exposed modules
method blank	QA/QC module, documents analytical conditions during analysis

APPENDIX A:

1. CHAIN OF CUSTODY
2. DATA TABLE
3. STACKED TOTAL ION CHROMATOGRAMS

GORE-SORBER® Screening Survey Chain of Custody

For W.L. Gore & Associates use only
Production Order # 10960025

W. L. Gore & Associates, Inc., Survey Products Group
100 Chesapeake Boulevard • Elkton, Maryland 21921 • Tel: (410) 392-7600 • Fax (410) 506-4780

Instructions: Customer must complete ALL shaded cells

Customer Name: SANDIA NATIONAL LABS	Site Name: NON-ER DUAIN+ SEPTIC
Address: ACCOUNTS PAYABLE MS0154	Site Address: ~~KIVL 2ND~~ AFB, NM KIRTLAND
P.O.BOX 5130	
ALBUQUERQUE NM 87185 U.S.A.	Project Manager: MIKE SANDERS
Phone: 505-284-3303	Customer Project No.:
FAX: 505-284-2616	Customer P.O. #: 28518 Quote #: 211946

Serial # of Modules Shipped			# of Modules for Installation 135 # of Trip Blanks 7		
# 179087 - # 179144	#179087 - #179134	Total Modules Shipped: 142 Pieces			
# 179150 - # 179233	#179135 - #179136	Total Modules Received: 142 Pieces			
# - #	#179139 - #	Total Modules Installed: 135 Pieces			
# - #	#179142 - #179144	Serial # of Trip Blanks (*Client Decides*)	#	#	
- #	#179150 - #179151	#171227	#	#	
- #	# - #	#	#	#	
# - #	# - #	#	#	#	
# - #	# - #	#	#	#	
# - #	# - #	#	#	#	
# - #	# - #	#	#	#	
Prepared By: Suzanne Wit		#	#	#	
Verified By: Mary Ann Murphy		#	#	#	

Installation Performed By:
Name (*please print*): GILBERT QUINTANA
Company/Affiliation: SNL/NM

Installation Method(s) (*circle those that apply*):
Slide Hammer Hammer Drill Auger
Other: GEOPROBE

Installation Start Date and Time: 4/23/02 1081ST : (AM) PM
Installation Complete Date and Time: 5/6/02 1094 01 : (AM) PM

Retrieval Performed By:
Name (*please print*): GILBERT QUINTANA
Company/Affiliation:1 SNL/NM

Total Modules Retrieved: _____ Pieces
Total Modules Lost in Field: _____ Pieces
Total Unused Modules Returned: _____ Pieces

Retrieval Start Date and Time: 5/8/02 / / : AM PM
Retrieval Complete Date and Time: / / : AM PM

	Date	Time		Date	Time
Relinquished By: Suzanne Wit Affiliation: W.L. Gore & Associates, Inc	3-4-02	12:00	Received By: Mike Sander Affiliation: Sandia / ER	3-6-02	
Relinquished By: William J Richey Affiliation: 6135	5-14-02	12:58	Received By: Affiliation:	Date	Time
Relinquished By: Affiliation:	Date	Time	Received By: Mary Ann Murphy Affiliation: W.L. Gore & Associates, Inc.	5/7/02	14:00

GORE-SORBER® Screening Survey Chain of Custody

For W.L. Gore & Associates use only
Production Order # 10960025

W. L. Gore & Associates, Inc., Survey Products Group
100 Chesapeake Boulevard • Elkton, Maryland 21921 • Tel: (410) 392-7600 • Fax (410) 506-4780

Instructions: Customer must complete ALL shaded cells

Customer Name: SANDIA NATIONAL LABS	Site Name: NON-ER DUAIN+ SEPTIC
Address: ACCOUNTS PAYABLE MS0154	Site Address: ~~KIVL 2ND~~ AFB, NM KIRTLAND
P.O.BOX 5130	
ALBUQUERQUE NM 87185 U.S.A.	Project Manager: MIKE SANDERS
Phone: 505-284-3303	Customer Project No.:
FAX: 505-284-2616	Customer P.O. #: 28518 Quote #: 211946

Serial # of Modules Shipped				# of Modules for Installation 135 # of Trip Blanks 7		
# 179087 - # 179144		#179152 - #179187		Total Modules Shipped: 142 Pieces		
# 179150 - # 179233		#179188 - #179226		Total Modules Received: 142 Pieces		
# - #		# - #		Total Modules Installed: 135 Pieces		
# - #		# - #		Serial # of Trip Blanks (*Client Decides*)	#	#
- #		# - #		#179228	#	#
- #		# - #		#179229	#	#
# - #		# - #		#	#	#
# - #		# - #		#	#	#
# - #		# - #		#	#	#
# - #		# - #		#	#	#
Prepared By: Clarence Ivy				#	#	#
Verified By: Mary Ann Wright				#	#	#

Installation Performed By:
Name (*please print*): GILBERT QUINTANA
Company/Affiliation: SNL/NM

Installation Method(s) (*circle those that apply*):
Slide Hammer Hammer Drill Auger
Other: GEOPROBE

Installation Start Date and Time: 4/23/02 1081ST : (AM) PM
Installation Complete Date and Time: 5/6/02 1094 01 : (AM) PM

Retrieval Performed By:
Name (*please print*): GILBERT QUINTANA
Company/Affiliation: SNL/NM

Total Modules Retrieved: 74 Pieces
Total Modules Lost in Field: 4 Pieces
Total Unused Modules Returned: 63 Pieces

Retrieval Start Date and Time: 5/8/02 / / : AM PM
Retrieval Complete Date and Time: / / : AM PM

	Date	Time		Date	Time
Relinquished By: Clarence Ivy Affiliation: W.L. Gore & Associates, Inc.	3-4-02	12:00	Received By: Mike Sanders Affiliation: Sandia, 6133	3-7-02	
Relinquished By: William J. Delaney Affiliation: Sandia NL, 6135	5-21-02	0935	Received By: Affiliation:	Date	Time
Relinquished By: Affiliation	Date	Time	Received By: Mary Ann Wright Affiliation: W.L. Gore & Associates, Inc.	5-24-02	13:30

GORE-SORBER® Screening Survey Installation and Retrieval Log

SITE NAME & LOCATION

LINE #	MODULE #	INSTALLATION DATE/TIME	RETRIEVAL DATE/TIME	EVIDENCE OF LIQUID HYDROCARBONS (LPH) or HYDROCARBON ODOR (Check as appropriate)			MODULE IN WATER (check one)		COMMENTS
				LPH	ODOR	NONE	YES	NO	
1.	179087	4/23/02, 0815	05-08-02, 0800					✓	1001/898-GS-5
2.	179088	0822							GS-3
3.	179089	0830							GS-2
4.	179090	0840							GS-1
5.	179091 ✓	0852						✓	GS-4
6.	179092	0952	0830					✓	1052/803-GS-1
7.	179093	1000							-4
8.	179094	1010							-3
9.	179095	1018						✓	-2
10.	179096	1135	0900						1030/6587- -5
11.	179097	1151							-6
12.	179098	1238							-4
13.	179099	1247							-3
14.	179100	1254							-2
15.	179101	1309							-1
16.	179102	1347	0920						1082/6620- -4
	179103	1355							
18.	179104	1404							
19.	179105 ✓	1431							-3
20.	179106	1440							-2
21.	179107	4/24/02, 0848	5-9-02, 0930						1109/6531- -5
22.	179108	0853							-6
23.	179109	0900							-4
24.	179110	0907							-2
25.	179111	0916							-3
26.	179112	0936							-1
27.	179113	4/25/02, 0746	5-10-02, 0812						1027/6530- -5
28.	179114	0754							-2
29.	179115	0800							-3
30.	179116	0810							-4
31.	179117	0818	0917						-1
32.	179118	0915	5-10-02, 0925						1010/6536- 5
33.	179119	0922							6
34.	179120	0931							4
35.	179121	0942							2
36.	179122	0947							1
37.	179123	0956	1002						3
38.	179124	1026	5-10-02, 1013						1028/6560- 1
39.	179125	1043							4
40.	179126	1052							3
41.	179127	1103	1041						
42.	179128	1420	5-10-02, 1045						1026/6501-

GORE-SORBER® Screening Survey Installation and Retrieval Log

SITE NAME & LOCATION

LINE #	MODULE #	INSTALLATION DATE/TIME	RETRIEVAL DATE/TIME	EVIDENCE OF LIQUID HYDROCARBONS (LPH) or HYDROCARBON ODOR (Check as appropriate) LPH	ODOR	NONE	MODULE IN WATER (check one) YES	NO	COMMENTS	
43.	179129	4/25/02, 1428	5-10-02, 1047						1026/6504-65-	3
44.	179130	1437	5-10-02, 1051						↓	1
45.	179131	1442	5-10-02, 1053						1025/6504-	1
46.	179132	1446	↓						↓	2
47.	179133	↓ 1504	5-10-02, 11:06						↓	3
48.	179134	4/26/02, 0905	5-10-02, 1247						1093/6584-	1
49.	179135	0914	↓ 1254						↓	4
50.	179136	0930	5-10-02, 1305						↓	2
51.	179137	0938	Lost						↓	3
52.	179138	0948	Lost						↓	5
53.	179139	1018	5-10-02, 1322						1031/6600-	2
54.	179140	1026	Lost						↓	3
55.	179141	1030	Lost						↓	4
56.	179142	1038	5-10-02, 1343						↓	1
57.	179143	1136	5-10-02, 11:36						276/829X-	2
	179144	1142	↓						↓	3
	179150	1150	↓						↓	4
0.	179151	↓ 1155	5-10-02, 11:54						↓	1
61.	179152	4/29/02, 0814	5-14-02, 09:42						1084/6505-	1
62.	179153	0822	↓						↓	5
63.	179154	0829	↓						↓	3
64.	179155	0903	↓						↓	2
65.	179156	0845	5-14-02, 1021						↓	4
66.	179157	0930	05-14-02, 0949						1083/6570-	4
67.	179158	0939	↓						↓	1
68.	179159	0940	↓						↓	2
69.	179160	0948	↓ 0940						↓	3
70.	179161	1050	05-14-02, 1025						1032/6610-	1
71.	179162	1100	↓						↓	2
72.	179163	1110	↓						↓	4
73.	179164	1114	↓						↓	3
74.	179165	1120	↓						↓	5
75.	179166	1126	05-14-02, 11:03						↓	6
76.	179167	1222	05-14-02, 11:06						1120/6643-	2
77.	179168	1230	↓						↓	3
78.	179169	1237	↓						↓	4
79.	179170	1242	05-14-02, 11:32						↓	1
80.	179171	1320	5-14-02 - 0844						1034/6710-	4
	179172	1325	↓ 0917						↓	3
82.	179173	1332	↓ 0851						↓	2
83.	179174	1340	↓ 0855						↓	1
84.	179175	↓ 1423	5-14-02, 0814						1035/6715-	4

5
33

GORE-SORBER® Screening Survey Installation and Retrieval Log

SITE NAME & LOCATION

Page 3 of 4

LINE #	MODULE #	INSTALLATION DATE/TIME	RETRIEVAL DATE/TIME	EVIDENCE OF LIQUID HYDROCARBONS (LPH) or HYDROCARBON ODOR (Check as appropriate) LPH	ODOR	NONE	MODULE IN WATER (check one) YES	NO	COMMENTS	
85.	179176	4/29/02, 1431							1035/6715-65-3	
86.	179177	1440								2
87.	179178	1445	5-14-02 0837							1
88.	179179	4/30/02, 0910	5-15-02 0842						1003/915-	3
89.	179180	0919								2
90.	179181	0926								1
91.	179182	0937								4
92.	179183	0943								5
93.	179184	0947	5-15-02, 0912							6
94.	179185	1108	5-15-02, 1146						1007/6730-	4
95.	179186	1113								3
96.	179187	1119								2
97.	179188	1132								5
98.	179189	1140	5-15-02 1213							1
99.	179190	1238	5-15-02 10:09						1029/6584N-	1
100.	179191	1250								-2
	179192	1300								-3
102.	179193	1313								-
103.	179194	1318	5-15-02, 1032							-
104.	179195	1445	5-15-02 10:05						1006/6741-	5
105.	179196	1450								3
106.	179197	1455								4
107.	179198	1502								2
108.	179199	1508	5-15-02, 1143							1
109.	179200	1525	5-15-02, 1039						1087/6743-	2
110.	179201	1530								3
111.	179202	1534								4
112.	179203	1540	5-15-02, 1059						-	1
113.	179204	5/1/02, 0822	5-16-02, 0801						1008/6750	3
114.	179205	0835								4
115.	179206	0843								1
116.	179207	0851	5-16-02, 0832							2
117.	179208	0944	5-16-02, 0841						1004/6569-	2
118.	179209	0952								4
119.	179210	1000								3
120.	179211	1009								5
121.	179212	1016	5-16-02, 0907							1
122.	179213	1110	5-16-02, 1105						1095/9938-	3
123.	179214	1116								2
124.	179215	1122	5-16-02, 11:21							1
125.	179216	1205	5-16-02-0931						1094/LFR-	-
126.	179217	1218	5-16-02-0935							

GORE-SORBER® Screening Survey Installation and Retrieval Log

SITE NAME & LOCATION

4 of 4

LINE #	MODULE #	INSTALLATION DATE/TIME	RETRIEVAL DATE/TIME	EVIDENCE OF LIQUID HYDROCARBONS (LPH) or HYDROCARBON ODOR (Check as appropriate)			MODULE IN WATER (check one)		COMMENTS
				LPH	ODOR	NONE	YES	NO	
127.	179218	5/1/02, 1225	5-16-02, 0942						1094/LAR-65-3
128.	179219	1231	5-16-02, 0950						↓ -4
129.	179220	5/6/02, 0850	5-21-01, 07:57						1081/6650 -1
130.	179221	0857							-3
131.	179222	0909							-2
132.	179223	0918							-4
133.	179224	0926							-6
134.	179225	0933	↓						-5
135.	179226	0940	5-21-01, 0851						-7
136.	179227								
137.	179228								
138.	179229								
139.	179230								
140.	179231								
141.	179232								
142.	179233								
143.									
144.									
145.									
146.									
147.									
148.									
149.									
150.									
151.									
152.									
153.									
154.									
155.									
156.									
157.									
158.									
159.									
160.									
161.									
162.									
163.									
164.									
165.									
166.									
167.									
168.									

GORE SORBER SCREENING SURVEY ANALYTICAL RESULTS
SANDIA NATIONAL LABS, ALBUQUERQUE, NM
GORE STANDARD TARGET VOCs/SVOCs (A1)
NON-ER DRAIN AND SEPTIC, KIRTLAND AFB, NM
SITES CCT AND CCX - PRODUCTION ORDER #10960025

DATE ANALYZED	SAMPLE NAME	BTEX, ug	BENZ, ug	TOL, ug	EtBENZ, ug	mpXYL, ug	oXYL, ug	C11, C13, &C15, ug	UNDEC, ug	TRIDEC, ug	PENTADEC, ug	TMBs, ug
	MDL=		0.03	0.02	0.01	0.01	0.01		0.02	0.01	0.02	
5/21/2002	179125	0.10	nd	0.08	nd	0.02	nd	0.05	0.04	0.01	bdl	0.00
5/21/2002	179126	0.00	nd	nd	nd	bdl	nd	0.04	0.03	0.02	bdl	0.00
5/21/2002	179127	0.09	nd	0.05	nd	0.02	0.01	0.04	0.04	bdl	bdl	0.00
5/21/2002	179128	0.07	nd	0.05	nd	0.02	nd	0.08	0.04	0.01	0.03	0.00
5/21/2002	179129	0.02	nd	nd	nd	0.02	nd	0.06	0.03	0.03	bdl	0.00
5/21/2002	179130	0.21	nd	0.15	nd	0.04	0.02	0.15	0.07	0.03	0.05	0.00
5/21/2002	179131	nd	nd	nd	nd	nd	nd	0.07	0.04	0.01	0.02	nd
5/21/2002	179132	nd	nd	nd	nd	nd	nd	0.05	bdl	0.02	0.02	0.00
5/21/2002	179133	0.08	nd	0.08	nd	nd	nd	0.19	0.04	0.09	0.05	nd
5/21/2002	179134	nd	nd	nd	nd	nd	nd	0.05	0.03	0.02	bdl	0.00
5/21/2002	179135	0.11	nd	0.10	nd	0.01	nd	0.16	0.04	0.04	0.08	0.00
5/21/2002	179136	0.09	nd	0.09	nd	nd	nd	0.04	0.02	0.01	bdl	0.00
5/21/2002	179139	nd	nd	nd	nd	nd	nd	0.68	0.07	0.10	0.51	0.00
5/21/2002	179142	0.11	nd	0.07	nd	0.03	0.01	0.25	0.12	0.07	0.06	0.00
5/21/2002	179143	nd	nd	nd	nd	nd	nd	0.07	0.03	0.02	0.03	nd
5/21/2002	179144	0.17	nd	0.09	0.02	0.05	0.01	0.08	0.04	0.01	0.02	0.00
5/21/2002	179150	0.40	nd	0.19	0.04	0.13	0.04	0.07	0.05	0.02	bdl	0.00
5/21/2002	179151	nd	nd	nd	nd	nd	nd	0.03	0.03	bdl	bdl	0.00
5/28/2002	179152	0.09	nd	0.05	nd	0.03	0.02	0.19	0.06	0.02	0.11	0.08
5/28/2002	179153	0.13	nd	0.08	nd	0.04	0.02	0.13	0.03	0.02	0.08	0.13
5/28/2002	179154	nd	nd	nd	nd	nd	nd	0.11	0.02	0.01	0.07	0.00
5/28/2002	179155	nd	nd	nd	nd	nd	nd	0.06	bdl	0.02	0.04	0.00
5/28/2002	179156	nd	nd	nd	nd	nd	nd	0.22	0.15	0.01	0.06	0.00
5/28/2002	179157	nd	nd	nd	nd	nd	nd	0.12	0.04	0.02	0.06	0.00
5/28/2002	179158	0.01	nd	nd	nd	0.01	nd	0.11	0.05	0.01	0.05	0.00
5/28/2002	179159	0.00	nd	nd	nd	bdl	nd	0.07	0.03	0.01	0.03	0.00
5/28/2002	179160	nd	nd	nd	nd	nd	nd	0.02	bdl	0.02	bdl	0.00
5/28/2002	179161	0.00	nd	nd	nd	bdl	nd	0.08	0.03	0.02	0.03	0.00
5/28/2002	179162	0.01	nd	nd	nd	0.01	nd	0.10	0.03	0.03	0.04	0.00
5/28/2002	179163	0.01	nd	nd	nd	0.01	nd	0.07	0.02	0.02	0.03	0.00
5/28/2002	179164	0.02	nd	nd	nd	0.02	bdl	0.14	0.06	0.02	0.06	0.00
5/28/2002	179165	nd	nd	nd	nd	nd	nd	0.08	0.03	bdl	0.05	0.00
5/28/2002	179166	0.00	nd	bdl	nd	nd	nd	0.05	0.03	0.01	bdl	0.00
5/28/2002	179167	nd	nd	nd	nd	nd	nd	0.02	0.02	bdl	bdl	0.00
5/28/2002	179168	0.04	nd	0.03	nd	0.01	nd	0.09	0.04	0.02	0.03	0.00
5/28/2002	179169	nd	nd	nd	nd	nd	nd	0.06	0.03	0.01	0.02	nd
5/28/2002	179170	0.03	nd	nd	nd	0.03	nd	0.06	0.04	0.02	bdl	0.00
5/28/2002	179171	nd	nd	nd	nd	nd	nd	0.04	0.03	0.02	bdl	0.00

SS 083

No mdl is available for summed combinations of analytes. In summed columns (eg., BTEX), the reported values should be considered ESTIMATED if any of the individual compounds were reported as bdl.

GORE SORBER SCREENING SURVEY ANALYTICAL RESULTS
SANDIA NATIONAL LABS, ALBUQUERQUE, NM
GORE STANDARD TARGET VOCs/SVOCs (A1)
NON-ER DRAIN AND SEPTIC, KIRTLAND AFB, NM
SITES CCT AND CCX - PRODUCTION ORDER #10960025

SAMPLE NAME	124TMB, ug	135TMB, ug	ct12DCE, ug	t12DCE, ug	c12DCE, ug	NAPH&2-MN, ug	NAPH, ug	2MeNAPH, ug	MTBE, ug	11DCA, ug	111TCA, ug	12DCA, ug
MDL=	0.03	0.02		0.14	0.03		0.01	0.02	0.04	0.04	0.02	0.02
179125	bdl	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
179126	bdl	nd	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179127	nd	bdl	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179128	bdl	nd	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179129	bdl	nd	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179130	bdl	bdl	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179131	nd	nd	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179132	bdl	nd	nd	nd	nd	0.00	nd	bdl	nd	nd	bdl	nd
179133	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
179134	bdl	nd	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179135	bdl	bdl	nd	nd	nd	0.02	0.02	bdl	nd	nd	nd	nd
179136	bdl	nd	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179139	bdl	nd	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179142	bdl	bdl	nd	nd	nd	0.01	0.01	bdl	nd	nd	nd	nd
179143	nd	nd	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179144	bdl	nd	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179150	bdl	bdl	nd	nd	nd	0.02	0.02	bdl	nd	nd	bdl	nd
179151	bdl	nd	nd	nd	nd	nd	nd	nd	nd	nd	bdl	nd
179152	0.06	0.03	nd	nd	nd	0.11	0.05	0.06	nd	nd	nd	nd
179153	0.09	0.03	nd	nd	nd	0.16	0.09	0.07	nd	nd	nd	nd
179154	bdl	bdl	nd	nd	nd	0.04	0.02	0.02	nd	nd	nd	nd
179155	bdl	bdl	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179156	bdl	bdl	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179157	bdl	bdl	nd	nd	nd	0.03	nd	0.03	nd	nd	nd	nd
179158	bdl	bdl	nd	nd	nd	0.04	0.02	0.03	nd	nd	nd	nd
179159	bdl	bdl	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179160	bdl	nd	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179161	nd	bdl	nd	nd	nd	0.11	0.05	0.06	nd	nd	nd	nd
179162	bdl	nd	nd	nd	nd	0.05	0.02	0.03	nd	nd	nd	nd
179163	bdl	bdl	nd	nd	nd	0.02	0.02	bdl	nd	nd	nd	nd
179164	bdl	bdl	nd	nd	nd	0.04	0.02	0.02	nd	nd	nd	nd
179165	bdl	nd	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179166	bdl	nd	nd	nd	nd	0.04	0.02	0.02	nd	nd	nd	nd
179167	bdl	nd	nd	nd	nd	0.04	nd	0.04	nd	nd	nd	nd
179168	bdl	bdl	nd	nd	nd	0.07	0.02	0.04	nd	nd	nd	nd
179169	nd	nd	nd	nd	nd	0.00	nd	bdl	nd	nd	nd	nd
179170	bdl	nd	nd	nd	nd	0.02	0.02	bdl	nd	nd	nd	nd
179171	bdl	bdl	nd	nd	nd	0.08	0.03	0.05	nd	nd	nd	nd

25
083

No mdl is available for summed combinations of analytes. In summed columns (eg., BTEX), the reported values should be considered ESTIMATED if any of the indi compounds were reported as bdl.

GORE SORBER SCREENING SURVEY ANALYTICAL RESULTS
SANDIA NATIONAL LABS, ALBUQUERQUE, NM
GORE STANDARD TARGET VOCs/SVOCs (A1)
NON-ER DRAIN AND SEPTIC, KIRTLAND AFB, NM
SITES CCT AND CCX - PRODUCTION ORDER #10960025

SAMPLE NAME	TCE, ug	OCT, ug	PCE, ug	14DCB, ug	CHCl3, ug	CCl4, ug	ClBENZ, ug
MDL=	0.02	0.02	0.01	0.01	0.03	0.03	0.01
179125	0.03	nd	1.24	nd	nd	nd	nd
179126	nd	nd	0.52	nd	nd	nd	nd
179127	nd	nd	0.55	nd	nd	nd	nd
179128	nd	nd	nd	nd	nd	nd	nd
179129	nd	nd	0.01	nd	nd	nd	nd
179130	nd	0.12	0.02	nd	nd	nd	nd
179131	nd	nd	nd	nd	nd	nd	nd
179132	nd	nd	0.75	nd	nd	nd	nd
179133	nd	nd	0.18	nd	nd	nd	nd
179134	nd	nd	0.33	nd	nd	nd	nd
179135	nd	nd	0.38	bdl	nd	nd	nd
179136	nd	nd	0.65	nd	0.05	nd	nd
179139	nd	nd	0.14	nd	nd	nd	nd
179142	nd	0.12	0.42	nd	nd	nd	nd
179143	0.41	nd	0.25	nd	nd	nd	nd
179144	0.84	0.13	0.21	nd	nd	nd	nd
179150	2.50	0.14	0.18	bdl	nd	nd	nd
179151	0.71	nd	0.32	nd	nd	nd	nd
179152	nd	nd	0.06	0.02	nd	nd	nd
179153	nd	nd	0.03	nd	0.08	nd	nd
179154	nd	nd	nd	nd	nd	nd	nd
179155	nd	nd	nd	nd	nd	bdl	nd
179156	nd	nd	nd	nd	nd	nd	nd
179157	nd	nd	0.38	nd	nd	nd	nd
179158	nd	nd	0.56	nd	nd	nd	nd
179159	nd	nd	0.60	nd	nd	nd	nd
179160	nd	nd	0.37	nd	nd	nd	nd
179161	nd	nd	nd	nd	nd	nd	nd
179162	nd	nd	bdl	nd	nd	nd	nd
179163	nd	nd	nd	nd	nd	nd	nd
179164	nd	nd	0.01	nd	nd	nd	nd
179165	nd	nd	nd	nd	nd	nd	nd
179166	nd	nd	nd	nd	nd	nd	nd
179167	nd	nd	nd	nd	nd	nd	nd
179168	nd	nd	nd	nd	nd	bdl	nd
179169	nd	nd	nd	nd	nd	nd	nd
179170	nd	nd	nd	nd	nd	nd	nd
179171	nd	nd	nd	nd	nd	nd	nd

SS 083

No mdl is available for summed combinations of analytes. In summed columns (eg., BTEX), the reported values should be considered ESTIMATED if any of the individual compounds were reported as bdl.

ANNEX C
DSS Site 1083
Soil Sample Data Validation Results

CONTRACT LABORATORY
ANALYSIS REQUEST AND CHAIN OF CUSTODY

Internal Lab N/A

Batch No. SMO Use

AR/COC 605667

Dept. No./Mail Stop:	6135/1089	Date Samples Shipped:	9-9-02	Project/Task No.:	7223.02.03.02
Project/Task Manager:	~~Mike Sanders~~ Sue Collins	Carrier/Waybill No.	13162	SMO Authorization:	
Project Name:	DSS soil sampling	Lab Contact:	Edie Kent 803-556-8171	Contract #:	PO 21671
Record Center Code:	ER/1295/DSS/DAT	Lab Destination:	GEL		$55 ATTACHED BOTTLE ORDER
Logbook Ref. No.:	ER 090	SMO Contact/Phone:	Pam Puissant/505-844-3185		
Service Order No.	CF032-02	Send Report to SMO:	Wendy Palencia/505-844-3132		
Location	Tech Area				
Building 6570-6589	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	Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
059784-001	6570/1083-DW1-BH1-9-S	9'	1083	9-3-02/0845	S	AS	4oz	4c	G	SA	VOC(8260B)	
059785-001	6570/1083-DW1-BH1-14-S	14'		0915	S	AS	4oz	4c	G	SA	VOC(8260B)	
059784-002	6570/1083-DW1-BH1-9-S	9'		0850	S	AG	500ml	4c	G	SA	see below for parameter	
059785-002	6570/1083-DW1-BH1-14-S	14'		0920	S	AG	500ml	4c	G	SA	see below for parameter	
059786-001	6570/1083-DW1-BH1-9-DU	9'		0900	S	AS	4oz	4c	G	SA	VOC(8260B)	
059787-001	6570/1083-DW1-BH1-9-DU	9'		0905	S	AG	500ml	4c	G	SA	see below for parameter	
059788-001	6589-6600/1031-SP1-BH1-15-S	15'	1031	9-5-02/1040	S	AS	4oz	4c	G	SA	VOC(8260B)	
059789-001	6589-6600/1031-SP1-BH1-20-S	20'		1100	S	AS	4oz	4c	G	SA	VOC(8260B)	
059788-002	6589-6600/1031-SP1-BH1-15-S	15'		1045	S	AG	500ml	4c	G	SA	see below for parameter	
059789-002	6589-6600/1031-SP1-BH1-20-S	20'		1105	S	AG	500ml	4c	G	SA	see below for parameter	

RMMA	☐ Yes ☑ No Ref. No.	Sample Tracking	Smo Use
Sample Disposal	☐ Return to Client ☑ Disposal by lab	Date Entered(mm/dd/yy)	09/11/02
Turnaround Time	☑ Normal ☐ Rush	Entered by:	RK
Return Samples By:	Level of Rush:	QC Inits.	JAC

Special Instructions/QC Requirements
EDD ☑ Yes ☐ No
Level C Package ☑ Yes ☐ No

*Send report to: Mike Sanders, Dept6135/MS/1089, Phone/505-284/2478

SVOC(8270C_ PCB(8082)HE(8330) Total Cyanide(9010) Cr6+(7197) RCRA metals(6020, 7000,7471)Gross alpha-beta(900)

*Please list as separate report.

Abnormal Conditions on Receipt — Lab Use

	Name	Signature	Init	Company/Organization/Phone/Cellular
Sample Team Members	J.Lee			Weston/6135/505-284-3309
	W.Gibson			MDM/6135/505-845-3267
	G.Quintana			Shaw/6135/505-284-3309

1.Relinquished by		Org.	Date	9-9-02	Time	0810	
1. Received by		Org.	Date	9/9/02	Time	0810	
2.Relinquished by		Org.	Date	9-9-02	Time	1030	
2. Received by		Org.	Date		Time		
3.Relinquished by		Org.	Date		Time		
3. Received by		Org.	Date		Time		
4.Relinquished by		Org.	Date		Time		
4. Received by		Org.	Date		Time		
5.Relinquished by		Org.	Date		Time		
5. Received by		Org.	Date		Time		
6.Relinquished by		Org.	Date		Time		
6. Received by		Org.	Date		Time		

OFF-SITE LABORATORY
Analysis Request And Chain Of Custody (Continuation)

AR/COC- 605667

Project Name:		Project/Task Manger:		Project/Task No.: 7220.02.03.02								
Location	Tech Area											
Building	Room	Reference LOV (available at SMO)										Lab use
Sample No- Fraction	ER Sample ID or Sample Location detail	Beginning 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
059790-001	6589-6600/1031-SP2-BH1-10-S	10'	1031	9-5-02/1130	S	AS	4oz	4c	G	SA	VOC(8260B)	
059791-001	6589-6600/1031-SP2-BH1-15-S	15'		1200	S	AS	4oz	4c	G	SA	VOC(8260B)	
059790-002	6589-6600/1031-SP2-BH1-10-S	10'		1135	S	AG	500ml	4c	G	SA	see below for parameter	
059791-002	6589-6600/1031-SP2-BH1-15-S	15'		1205	S	AG	500ml	4c	G	SA	see below for parameter	
059792-001	6589-6600/1031-SP2-TB	N/A		1218	DIW	G	3x40ml	HCL	G	TB	VOC(8260B)	

Abnormal Conditions on Receipt — LAB USE

Received Chilled

SAMPLE RECEIPT & REVIEW FORM

Date 9-10-02 Client SANDIA Received by MK

	SAMPLE REVIEW CRITERIA	YES	NO	N/A	COMMENTS/QUALIFIERS
1	Were shipping containers received intact and sealed? If no, notify the Project Manager	✓			
2	Were chain of custody documents included?	✓		■	
3	Shipping container temperature(s) checked?	✓			4°
4	Is temperature documented on Chain of Custody?	✓		■	
5	Was shipping container temperature within specifications (4 +/- 2 C)? If no, notify Project Manager	✓			
6	Are any of the samples identified by the client as radioactive? If yes, complete radioactive receipt form		✓	■	
	Any samples not indentified by the client as radioactive must be screened for radioactivity.		40		observed background CPM
	If screening results indicate > x2 background inform the RSO.		50		Max. observed sample CPM
7	Were chain of custody documents completed correctly? (Ink, signed, match containers)	✓		■	
8	Were sample containers received intact and sealed? If no, notify the Project Manager		✓	■	*
9	Were all sample containers properly labeled?	✓		■	
10	Were correct sample containers received?	✓		■	
11	Preserved samples checked for pH?			✓	soils +VOA
12	Were samples preserved correctly? If no, notify Project Manager	✓		■	
13	Were samples received within holding time? If No, notify Project Manager	✓		■	
14	Were VOA vials free of headspace?	✓			
15	ARCOC#	✓			605667
16	SDG#				

PM(A) Review: Laura Shuey Date Reviewed: 9/10/02

Cooler Air Bill #'s, Associated Temperatures, & Additional Comments:

* SAMPLE 059785-002 ARRIVED BROKEN - CONTAINER STILL IN BAG

FED EX # 6708 8609 4384

SAMPLE RECEIPT & REVIEW FORM

Date 9-10-02 Client SANDIA Received by MK

	SAMPLE REVIEW CRITERIA	YES	NO	N/A	COMMENTS/QUALIFIERS
1	Were shipping containers received intact and sealed? If no, notify the Project Manager	✓			
2	Were chain of custody documents included?	✓			
3	Shipping container temperature(s) checked?	✓			4°
4	Is temperature documented on Chain of Custody?	✓			
5	Was shipping container temperature within specifications (4 +/- 2 C)? If no, notify Project Manager	✓			
6	Are any of the samples identified by the client as radioactive? If yes, complete radioactive receipt form		✓		
	Any samples not indentified by the client as radioactive must be screened for radioactivitiy.		40		observed background CPM
	If screening results indicate > x2 background inform the RSO.		50		Max. observed sample CPM
7	Were chain of custody documents completed correctly? (Ink, signed, match containers)	✓			
8	Were sample containers received intact and sealed? If no, notify the Project Manager	✓			
9	Were all sample containers properly labeled?	✓			
10	Were correct sample containers received?	✓			
11	Preserved samples checked for pH?			✓	soils
12	Were samples preserved correctly? If no, notify Project Manager	✓			
13	Were samples received within holding time? If No, notify Project Manager	✓			
14	Were VOA vials free of headspace?			✓	
15	ARCOC#	✓			605668
16	SDG#				

PM(A) Review: Laura Shuey Date Reviewed: 9/10/02

Cooler Air Bill #'s, Associated Temperatures, & Additional Comments:

FED EX # 4708 8609 4384

Contract Verification Review (CVR)

Project Leader Collins | Project Name DSS Soil Sampling | Case No. 7223_02.03.02

AR/COC No. 605667, 605668 | Analytical Lab GEL | SDG No. 66780A, 66780B

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		059785-002 arrived broken		

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	X				
2.10	Narrative provided	X				
2.11	TAT met	X				
2.12	Hold times met		X	HE & PCBs re-extractions out of holding		
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	two HE LSC analytes not within acceptance limits with all re-extraction LSC analytes within acceptance limits (re-extracted out of holding)
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique		X	PCB sample 059795-002RE re-extracted sample failed surrogate recovery
c) Matrix spike recovery data reported and met		X	Barium not within inorganic acceptance limits
3.4 Precision a) Replicate sample precision reported and met for all inorganic and radiochemistry samples	X		
b) Matrix spike duplicate RPD data reported and met for all organic samples	X		
3.5 Blank data a) Method or reagent blank data reported and met for all samples		X	bis(2-Ethylhexyl)phthalate detected in SVOC method blank; cyanide detected in total cyanide method blank
b) Sampling blank (e.g., field, trip, and equipment) data reported and met	X		
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	X		
3.8 Narrative included, correct, and complete	X		
3.9 Second column confirmation data provided for methods 8330 (high explosives) and 8082 (pesticides/PCBs)	X		

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	X		
b) Continuing calibration provided	X		
c) Instrument run logs provided	X		
4.3 Inorganics (metals)			
a) Initial calibration provided	X		
b) Continuing calibration provided	X		
c) ICP interference check sample data provided	X		
d) ICP serial dilution provided	X		
e) Instrument run logs provided	X		
4.4 Radiochemistry			
a) Instrument run logs provided	X		

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
narrative	VOC	Incorrect word spacing rendering narrative illegible

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 5046 and date correction request was submitted: 10/16/02

Reviewed by: [signature] Date: 10/16/02 Closed by: _____ Date: _____

Sample F. s Summary

Site: DSS soil sampling | ARCOC:605667 and 605668 | Data: Organic, Inorganic and Radiochemistry

Sample ID	VOC(8260)	78-93-3 (2-butanone)	SVOC(8270)	117-81-7 (bis(2-ethylhexyl)phthalate)	All PCBs (aroclors) except:	11096-82-5 (aroclor 1260)	All HE(8330) compounds	479-45-8 (tetryl)	Metals	7440-39-3 (barium)	General Chemistry	5955-70-0 (total cyanide)	Radiochemistry				
059785-001 6570/1063-DW1-BH1-14-S		J															
059786-001 6570/1063-DW1-BH1-9-DU		J															
059788-001 6589-6600/1031-SP1-BH1-15-S		J															
059789-001 6589-6600/1031-SP1-BH1-20-S		J															
059790-001 6589-6600/1031-SP2-BH1-10-S		J															
059784-002 6570/1063-DW1-BH1-9-S				333U,B				UJ,A		J,A2		J,B,B3	All QC acceptance criteria were met. No data will be qualified.				
059785-002 6570/1063-DW1-BH1-14-S				333U,B				UJ,A		J,A2		J,B,B3					
059787-001 6570/1063-DW1-BH1-9-DU				333U,B				UJ,A		J,A2							
059788-002 6589-6600/1031-SP1-BH1-15-S				333U,B				UJ,A		J,A2							
059789-002 6589-6600/1031-SP1-BH1-20-S				333U,B				UJ,A		J,A2		J,B,B3					
059790-002 6589-6600/1031-SP2-BH1-10-S				333U,B				UJ,A		J,A2		J,B					
059791-002 6589-6600/1031-SP2-BH1-15-S				333U,B				UJ,A		J,A2		UJ,B3					
059793-002 6523/1066-SP1-BH1-10-S				333U,B				UJ,A		J,A2		J,B,B3					
059794-002 6523/1066-SP1-BH1-15-S				333U,B				UJ,A		J,A2		J,B,B3					
059795-002 669/1102-SP1-BH1-25-S				333U,B				UJ,A		J,A2		J,B,B3					
059796-002 669/1102-SP1-BH1-30-S				670U,B				UJ,A		J,A2		J,B,B3					
059784-002 6570/1063-DW1-BH1-9-S-RE					UJ,HT	UJ,HT	UJ,HT										
059785-002 6570/1063-DW1-BH1-14-S-RE							UJ,HT										
059787-001 6570/1063-DW1-BH1-9-DU-RE					UJ,HT	UJ,HT	UJ,HT										
059788-002 6589-6600/1031-SP1-BH1-15-S-RE					UJ,HT	UJ,HT	UJ,HT										
059789-002 6589-6600/1031-SP1-BH1-20-S-RE					UJ,HT	UJ,HT	UJ,HT										
059790-002 6589-6600/1031-SP2-BH1-10-S-RE					UJ,HT	UJ,HT	UJ,HT										
059791-002 6589-6600/1031-SP2-BH1-15-S-RE					UJ,HT	UJ,HT	UJ,HT										
059793-002 6523/1066-SP1-BH1-10-S-RE					UJ,HT	1.8J,HT	UJ,HT										
059794-002 6523/1066-SP1-BH1-15-S-RE					UJ,HT	UJ,HT	UJ,HT										
059795-002 669/1102-SP1-BH1-25-S-RE					UJ,HT,A1	J,HT,A1	UJ,HT										
059796-002 669/1102-SP1-BH1-30-S-RE					UJ,HT	J,HT	UJ,HT										

Validated By: A Neal

Date: 11/06/02

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

MEMORANDUM

DATE: 11/06/02

TO: File

FROM: Linda Thal

SUBJECT: Inorganic Data Review and Validation - SNL
Site: DSS soil sampling
ARCOC # 605667 and 605668 GEL SDG # 66780
Project/Task No. 7223.02.03.02

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

The samples were prepared and analyzed with approved procedures using methods SW-846 6010 (ICP-AES metals), SW-846 7471A (Hg), SW-846 9012A (total CN) and SW-846 7196A (hexavalent chromium). Problems were identified with the data package that resulted in the qualification of data.

ICP-AES – Metals
The MS had a %R > QC acceptance criteria (75-125%) for barium. All associated sample results were detect and will be qualified "J, A2".

Total Cyanide
The method blank (MB) had a value > DL but < RL and the continuing calibration blank (CCB) had a negative value with an absolute value > DL but < RL. Samples 66780-012, -013, -016, -019 through –022 had values < 5X the MB value and < 5X DL and will be qualified "J, B, B3". Sample 66780-017 had a value < 5X MB but > 5X DL and will be qualified "J, B". Sample 66780-018 was non-detect and unaffected by the MB, and will be qualified "UJ, B3".

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

Holding Times/Preservation

All Analyses: The samples were analyzed within the prescribed holding time and properly preserved.

It should be noted that sample 66780-013 was received in a broken container in a plastic bag. The laboratory was instructed to proceed with the analysis. It is not known what affect this will have on the sample results and therefore no data will be qualified.

Calibration

All Analyses: The initial and continuing calibration data met QC acceptance criteria.

Blanks

All Analyses: All blank criteria were met except as mentioned above in the summary section and as follows:

ICP-AES – Metals
Arsenic was detected in the initial calibration blank (ICB) and the continuing calibration blank (CCB) at a value > DL but < RL. All associated sample results were > 5X the blank values and will not be qualified.

Total Cyanide
The method blank (MB) had a value > DL but < RL and the continuing calibration blank (CCB) had a negative value with an absolute value > DL but < RL. Sample 66780-014 and –015 had values > 5X MB and > 5X DL and will not be qualified.

Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) Analyses

All Analyses: The LCS met QC acceptance criteria. No LCSD was performed. No data will be qualified as a result.

Matrix Spike (MS) Analysis

All Analyses: The MS met QC acceptance criteria except as mentioned above in the summary section and as follows:

ICP-AES
The sample used for the MS was of similar matrix from another SNL SDG. No data will be qualified as a result.

Hexavalent Chromium Batch # 200893
The sample used for the MS was of similar matrix from another SNL SDG. No data will be qualified as a result.

Replicate Analysis

All Analyses: The replicate analysis met QC acceptance criteria except as follows:

ICP-AES
The sample used for the replicate was of similar matrix from another SNL SDG. No data will be qualified as a result.

Hexavalent Chromium Batch # 200893
The sample used for the replicate was of similar matrix from another SNL SDG. No data will be qualified as a result.

ICP Interference Check Sample (ICS)

ICP-AES: The ICS-AB met QC acceptance criteria.

All Other Analyses: No ICS required.

ICP Serial Dilution

ICP-AES: The serial dilution met QC acceptance criteria.

It should be noted that the sample used for the serial dilution was of similar matrix from another SNL SDG. No data will be qualified as a result.

All Other Analyses: No serial dilutions required.

Detection Limits/Dilutions

All Analyses: All detection limits were properly reported.

ICP-AES: All samples were diluted 2X.

All Other Analyses: No dilutions were performed.

Other QC

All Analyses: A field duplicate was submitted on the ARCOC. There are no "required" validation procedures for assessing a field duplicate.

No equipment blank or field blank was submitted on the ARCOC.

It should be noted that the COC requested that metals be analyzed by method SW-846 6020.

No raw data was submitted with the package.

No other specific issues were identified which affect data quality.

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

MEMORANDUM

DATE: 11/01/02

TO: File

FROM: Linda Thal

SUBJECT: Organic Data Review and Validation - SNL
Site: DSS soil sampling
ARCOC # 605667 and 605668 GEL SDG # 66780 and 66782
Project/Task No. 7223.02.03.02

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

The samples were prepared and analyzed with approved procedures using methods SW-846 8260A/B (VOC), 8270C (SVOC), 8082 (PCBs) and 8330 (HEs). Problems were identified with the data package that resulted in the qualification of data.

VOC - soil
2-Butanone had a %D > 20 but < 40% with a negative bias in the CCV preceding samples 66780-001 through –008. Samples 66780-002 though –006 were detect and will be qualified "J".

SVOC – Batch 200259 and 200577
Bis(2-ethylhexyl)phthalate was detected in the method blanks (MB) at a value > DL but < RL. Samples 66780-012 through –021 had bis(2-ethylhexyl)phthalate values > DL, < RL and <10X the MB value and will be qualified "U, B" at the RL. Sample 66780-022 had a bis(2-ethylhexyl)phthalate value > RL, but < 10X the MB value and will be qualified "U, B" at the reported value.

PCB
Samples 66780-012 and -014 through –021 were re-extracted out of hold time. Only the re-extracted sample results appear on the Certificate of Analysis and only the re-extracted sample results will be validated. All associated sample results were non-detect for all aroclors and will be qualified "UJ, HT", with the exception of samples 66780 –019, 021 and –022. These sample results were > DL but < RL for aroclor 1260 and these results will be qualified "J, HT".

The surrogate (4cmx) %R for sample 66780-021 was < QC acceptance criteria (31-120%) but > 10%. The sample results are already qualified "J" for detects and "UJ" for non-detects due to hold time infringements. The descriptive flag "A1" will be added to these qualifiers.

Sample 66780-019 had an aroclor 1260 value > DL but < RL. The RPD (32%) between the primary and confirmation column was > QC acceptance criteria (25%). The value reported will be changed to the highest value and is already qualified "J" due to hold time infringements.

HE
The samples were re-extracted and re-analyzed after the holding time had expired. Both sets of results appear on the Certificate of Analysis and both sets of data will be validated.

Batch 200966: The LCS %R was < QC acceptance criteria but > 10% for tetryl. All associated sample results are non-detect and will be qualified "UJ, A".

Batch 203692: The samples were re-extracted after their holding time had expired. Both sets of results, QC summary's and calibration data are provided. All the re-extracted sample results were non-detect and will be qualified "UJ, HT".

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

Holding Times/Preservation

All Analysis: The samples were properly preserved and analyzed within the method prescribed holding time except as mentioned above in the summary section.

It should be noted that sample 66780-013 was received in a broken container in a plastic bag. The laboratory was instructed to proceed with the analysis. It is not known what affect this will have on the sample results and therefore no data will be qualified.

Calibration

All Analysis: All initial and continuing calibration acceptance criteria were met except as mentioned above in the summary section and as follows:

VOC
2-Butanone had a %D > 20 but < 40% with a negative bias in the CCV preceding samples 66780-001 through –008. Samples 66780-001, –007 and –008 were non-detect and will not be qualified. Several other compounds had %D > 20% but < 40% (refer to DV worksheet). All associated sample results were non-detect and no data will be qualified.

SVOC – Batch 200259
The CCV preceding the samples had a %D > 20% but < 40% with a negative bias for 2,4-dinitrophenol (24.5%) and 2,4-dinitrotoluene (24%), and with a positive bias for 2-nitroaniline (23%). All associated sample results were non-detect and no data will be qualified.

PCB – Batch 200519
The CCV preceding sample 66780-013 had a %D > 20% but < 40% with a positive bias for aroclor 1016. The sample result was non-detect and therefore unaffected by a positive bias; no data will be qualified.

Blanks

All Analysis: All method blank and trip blank acceptance criteria were met except as mentioned above in the summary section.

Surrogates

All Analysis: All surrogate acceptance criteria were met except as mentioned above in the summary section.

Internal Standards (ISs)

All Analysis: All internal standard acceptance criteria were met.

Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analysis

All Analysis: All MS/MSD acceptance criteria were met except as follows:

VOC- water
The PS/PSD was run on a sample of similar matrix from another SNL SDG. No data will be qualified as a result.

SVOC – Batch 200259 and 200577
Several compounds (see DV worksheet) had %R < QC acceptance criteria (75 – 125%) and RPDs slightly higher than QC acceptance criteria (20%). Using professional judgment, no data will be qualified.

Laboratory Control Samples (LCS/LCSD) Analysis

All Analysis: The LCS/LCSD acceptance criteria were met except as mentioned above in the summary section and as follows:

VOC - soils
The LCS acceptance criteria were met by the successful analysis of a second source CCV.

VOC – Soils and Waters
It should be noted that no compound was associated with internal standard 1,4-dichlorobenzene-d4. No data will be qualified as a result.

SVOC
It should be noted that no compound was associated with internal standard perylene-d12. No data will be qualified as a result.

HE – Batch 200966
The LCS had a %R slightly < QC acceptance criteria (79-123%) for 4-amino-2,6-dinitrotoluene (75%). The MS/MSD %R was in criteria, and using professional judgment, no data will be qualified.

Detection Limits/Dilutions

All Analysis: All detection limits were properly reported. Samples were not diluted with the exception of 66780-021 and –022 that were diluted 5X for PCB analysis.

Confirmation Analyses

VOC and SVOC: No confirmation analyses required.

PCB: All confirmation acceptance criteria were met except as mentioned above in the summary section.

HE: The sample results were non-detect and therefore no confirmation analysis was required.

Other QC

VOC: A trip blank and a field dup were submitted on the ARCOC. There are no "required" criteria for assessing a field dup. No equipment blank was submitted on the ARCOC.
It should be noted that vinyl acetate is on the TAL for soils but not for waters.

SVOC, PCB and HE: A field dup was submitted on the ARCOC. There are no "required" criteria for assessing a field dup. No equipment blank or field blank was submitted on the ARCOC.

No raw data was submitted with the package.

No other specific issues were identified which affect data quality.

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

MEMORANDUM

DATE: November 06, 2002

TO: File

FROM: Linda Thal

SUBJECT: Radiochemical Data Review and Validation - SNL
Site: DSS soil sampling
ARCOC 605667 and 605668
GEL SDG # 66780 Project/Task No. 7223.02.03.02

See the attached Data Validation Worksheets for supporting documentation on the data review and validation. This validation was performed according to SNL/NM ER Project AOP 00-03.

Summary

All samples were prepared and analyzed with approved procedures using method EPA 900.0 (Gross Alpha/Beta). No problems were identified with the data package that resulted 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/Preservation

All Analyses: All samples were analyzed within the prescribed holding times and properly preserved.

> It should be noted that sample 66780-013 was received in a broken container in a plastic bag. The laboratory was instructed to proceed with the analysis. It is not known what affect this will have on the sample results and therefore no data will be qualified.

Calibration

All Analyses: The case narrative stated the instruments used were properly calibrated.

Blanks

No target analytes were detected in the method blank at concentrations > the associated MDAs.

Matrix Spike (MS) Analysis

The MS/MSD analyses met all QC acceptance criteria.

Laboratory Control Sample (LCS) Analysis

The LCS analyses met all QC acceptance criteria.

Replicates

The replicate analyses met all QC acceptance criteria.

Tracer/Carrier Recoveries

No tracer/carrier required.

Negative Bias

All sample results met negative bias QC acceptance criteria.

Detection Limits/Dilutions

All detection limits were properly reported. No samples were diluted.

Other QC

A field duplicate was submitted on the ARCOC. There are however, no "required" data validation procedures for assessing a field duplicate.
No field blank or equipment blank was submitted on the ARCOC.

No raw data was submitted with the package.

No other specific issues were identified which affect data quality.

Data Validation Summary

Site/Project: DSS Soil Sampling Project/Task #: 7223.02.03.02 # of Samples: 22 & 1 Matrix: Soil & TB

AR/COC #: 605667 605668 Laboratory Sample IDs: 66780

Laboratory: GEL 66780-001 thru -022

Laboratory Report #: 66780 66782-001

QC Element	Analysis									
	Organics				Inorganics				RAD	Other (Hexavalent Chromium)
	VOC	SVOC	Pesticide/ PCB	HPLC (HE)	ICP/AES	GFAA/ AA	CVAA (Hg)	CN		
1. Holding Times/Preservation	✓	✓	✓ J, UJ, HT	✓ UJ HT	✓	NA	✓	✓	✓	✓
2. Calibrations	J	✓	✓	✓	✓		✓	✓	✓	✓
3. Method Blanks	✓	U, B	✓	✓	✓		✓	J, UJ, B, B2	✓	✓
4. MS/MSD	✓	✓	✓	✓	J, A2		✓	✓	✓	✓
5. Laboratory Control Samples	✓	✓	✓	UJ, A ✓	✓		✓	✓	✓	✓
6. Replicates					✓		✓	✓	✓	✓
7. Surrogates	✓	✓	J, UJ, A1	✓						NA
8. Internal Standards	✓	✓								
9. TCL Compound Identification	✓	✓								
10. ICP Interference Check Sample					✓					
11. ICP Serial Dilution					✓					
12. Carrier/Chemical Tracer Recoveries									NA	
13. Other QC	TB DUP	DUP	* DUP	DUP	DUP		DUP	DUP	DUP	DUP

- 013 received broken

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

Check (√) = Acceptable
Shaded Cells = Not Applicable (also "NA")
NP = Not Provided
Other: * Laboratory duplicate >25% value changed "J"

Reviewed By: [signature] Date: 11.06.02

Holding Time and Preservation

Site/Project: OSS Soil Sampling AR/COC #: 605667 - 68 Laboratory Sample IDs: 66780 - 001 thru - 022

Laboratory: GEL Laboratory Report #: 605667 LT 66780, -82 66782 - 001

# of Samples: 22 4 1 Matrix: Soil & TB

Sample ID	Analytical Method	Holding Time Criteria	Days Holding Time was Exceeded 8330 / 8082	Preservation Criteria	Preservation Deficiency	Comments 8082	8330
66780 - 012-RE	SW-846 8330 8082	14 days	14 / 7 days	NA	NA	All UJ, HT	All UJ, HT
-014-RE			14 / 7 days				
-015-RE			12 / 5 days				
-016-RE			12 / 5 days				
-017-RE			12 / 5 days				
-018-RE			12 / 5 days				
-019-RE			11 / 4 days			All UJ, HT except J, HT 1260	
-020-RE			11 / 4 days			All UJ, HT	
-021-RE			11 / 4 days			All UJ, HT except J, HT 1260	
-022-RE			11 / 4 days			All UJ HT except J, HT 1260	
66780 - 013-RE	SW-846 8330	14 days	14 days	NA	NA	All UJ, HT	

Reviewed By: [signature] Date: 11.06.02

Volatile Organics (SW 846 Method 8260)

Site/Project: DSS Soil Sampling COC #: 605667, -68 # of Samples: 11 & 1 Matrix: Soil & TB

Laboratory: GEL Laboratory Report #: Laboratory Sample IDs: 66780-001 thru -011 66782-001 (TB)

Methods: SW-846 8260A Batch #s: 200753 (1) (soil) 201029 (3) (TB)

IS	CAS #	Name	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Trip Blanks
					1 & 2	1 >.05 2	1 <20% / >.99 2	1 20% 2	1 2	1	2		1 2	1 2	1 2			
1	71-55-6	1,1,1-trichloroethane		0.10								NA					NA	
2	79-34-5	1,1,2,2-tetrachloroethane		0.30														
2	79-00-5	1,1,2-trichloroethane		0.10														
1	75-34-3	1,1-dichloroethane		0.10														
1	75-35-4	1,1-dichloroethene		0.20														
1	107-06-2	1,2-dichloroethane		0.10														
1	540-59-0	1,2-dichloroethene(total)		0.01														
1	78-87-5	1,2-dichloropropane		0.01														
1	78-93-3	2-butanone (MEK) (10xblk)		0.01														
1	110-75-8	2-chloroethyl vinyl ether																
2	591-78-6	2-hexanone (MBK)		0.01														
2	108-10-1	4-methyl-2-pentanone (MIBK)		0.10														
1	67-64-1	acetone(10xblk)		0.01														
1	71-43-2	benzene		0.50														
1	75-27-4	bromodichloromethane		0.20														
3	75-25-2	bromoform		0.10														
1	74-83-9	bromomethane		0.10														
1	75-15-0	carbon disulfide		0.10														
1	56-23-5	carbon tetrachloride		0.10														
2	108-90-7	chlorobenzene		0.50														
1	75-00-3	chloroethane		0.01														
1	67-66-3	chloroform		0.20														
1	74-87-3	chloromethane		0.10														
1	10061-01-5	cis-1,3-dichloropropene		0.20														
2	124-48-1	dibromochloromethane		0.10														
2	100-41-4	ethylbenzene		0.10														
1	75-09-2	methylene chloride (10xblk)		0.01														
2	100-42-5	styrene		0.30														
2	127-18-4	tetrachloroethene		0.20														
2	108-88-3	toluene(10xblk)		0.40														
2	10061-02-6	trans-1,3-dichloropropene		0.10														
1	79-01-6	trichloroethene		0.30														
1	75-01-4	vinyl chloride		0.10														
2	1330-20-7	xylenes(total)		0.30														
		cis-1,2-Dichloroethene																
		trans-1,2-Dichloroethene																

Comments: Vinyl Acetate (soils) only

Notes: Shaded rows are RCRA compounds. -32 -20

Reviewed By: [signature] Date: 11.05.02

Volatile Organics

Site/Project: _____ AR/COC #: 605667 - 68 Batch #s: _____

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

Surrogate Recovery and Internal Standard Outliers (SW 846 Method 8260)

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
IN CRITERIA									

SMC 1: 4-Bromofluorobenzene
SMC 2: Dibromofluoromethane
SMC 3: Toluene-d8

IS 1: Fluorobenzene
IS 2: Chorobenzene-d5
IS 3: 1,4-Dichlorobenzene-d4

Comments: H2O batch : PS/PSD 66606 66606 SM4 504

Soils LCS & CCV same file +ve. (SA 2 thru 6)
(SA 001 – 008) CCV 8.01 – 26hr - 24
009 - 011 CCV 28.09

* Applies to samples 001 thru - 008
1, 7, 8 NO No Q
2, 3, 5 7 RL All detects "J"
4, 6 >DL

WS # 1 of 1

Semivolatile Organics (SW 846 Method 8270)

Site/Project: OSJ Soil Sampling AR/COC #: 605667, -68 Laboratory Sample IDs: 66780-012 thru 022

Laboratory: GEL Laboratory Report #: 66780

Methods: SW-846 8270C

# of Samples: LT 10 11 Matrix: Soil

Batch #s: 200259 (Soil) ① 200572 (Soil) -013 only ②

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks	Field Dup
						1 & 2	≥.05	<20% / ≥.99	20%	1 2	1	2		1	1	1	MS 2	MSD 2	MS RPD 2	✓
2	BN	120-82-1	1,2,4-Trichlorobenzene	✓	0.20		✓	✓	✓ ✓	✓ ✓	✓	✓	NA	✓	✓	✓	✓	✓	✓	
1	BN	95-50-1	1,2-Dichlorobenzene		0.40															
1	BN	541-73-1	1,3-Dichlorobenzene		0.60															
1	BN	106-46-7	1,4-Dichlorobenzene		0.50						✓	✓								
3	A	95-95-4	2,4,5-Trichlorophenol		0.20						✓	✓		✓	72	✓	✓	✓	✓	
3	A	88-06-2	2,4,6-Trichlorophenol		0.20						✓	✓		✓	63	✓	70	✓	✓	
2	A	120-83-2	2,4-Dichlorophenol		0.20															
2	A	105-67-9	2,4-Dimethylphenol		0.20															
3	A	51-28-5	2,4-dinitrophenol		0.01	✓	✓	✓	24											
3	BN	121-14-2	2,4-Dinitrotoluene		0.20				28		✓	✓		✓	✓	✓	✓	✓	✓	
3	BN	606-20-2	2,6-Dinitrotoluene		0.20				✓											
3	BN	91-58-7	2-Chloronaphthalene		0.80															
1	A	95-57-8	2-Chlorophenol		0.80						✓	✓		✓	✓	✓	✓	✓	✓	
2	BN	91-57-6	2-Methylnaphthalene		0.40															
1	A	95-48-7	2-Methylphenol (o-cresol)		0.70						✓	✓		✓	65	22	69	✓	✓	
3	BN	88-74-4	2-Nitroaniline		0.01				23											
2	A	88-75-5	2-Nitrophenol		0.10				✓											
5	BN	91-94-1	3,3'-Dichlorobenzidine		0.01															
3	BN	99-09-2	3-Nitroaniline		0.01	✓	✓	✓												
4	A	534-52-1	4,6-Dinitro-2-methylphenol		0.01															
4	BN	101-55-3	4-Bromophenyl-phenylether		0.10															
3	BN	7005-72-3	4-Chlorophenyl-phenylether		0.40															
2	A	59-50-7	4-Chloro-3-methylphenol		0.20						✓	✓		✓	✓	✓	✓	✓	✓	
2	BN	106-47-8	4-Chloroaniline		0.01															
1	A	106-44-5	4-Methylphenol (p-cresol)		0.60															

Comments: m,p-Cresol ✓

Notes: Shaded rows are RCRA compounds.

✓ ✓ ✓ 63 21 69 ✓ ✓ 1

Reviewed By: [signature] Date: 11.01.02

Semivolatile Organics

Site/Project: _____ AR/COC #: 605667, -68 Batch #s: _____

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

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blanks		LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		Field DUP
						1&2	>.05 1&2	<20% / 0&2	1 20% 2	1	2	1	2		1	1	1	MS 2	MSD 2	MSD RPD 2		
3	BN	100-01-6	4-Nitroaniline	✓	0.01	✓	✓	✓		✓	✓			NA								✓
3	A	100-02-7	4-Nitrophenol		0.01							✓	✓		✓	✓	✓	✓	✓	✓		
3	BN	83-32-9	Acenaphthene		0.90							✓	✓		✓	✓	✓	✓	✓	✓		
3	BN	208-96-8	Acenaphthylene		0.90																	
4	BN	120-12-7	Anthracene		0.70																	
5	BN	56-55-3	Benzo(a)anthracene		0.80																	
6	BN	50-32-8	Benzo(a)pyrene		0.70																	
6	BN	205-99-2	Benzo(b)fluoranthene		0.70																	
6	BN	191-24-2	Benzo(g,h,i)perylene		0.50																	
6	BN	207-08-9	Benzo(k)fluoranthene		0.70																	
2	BN	111-91-1	bis(2-Chloroethoxy)methane		0.30																	
1	BN	111-44-4	bis(2-Chloroethyl)ether		0.70																	
1	BN	108-60-1	bis(2-chloroisopropyl)ether		0.01																	
5	BN	117-81-7	bis(2-Ethylhexyl)phthalate		0.01	✓	✓	✓		89 SJ 75J												
5	BN	85-68-7	Butylbenzylphthalate		0.01					✓	✓											
4	BN	86-74-8	Carbazole		0.01																	
5	BN	218-01-9	Chrysene		0.70																	
6	BN	53-70-3	Dibenz(a,h)anthracene		0.40																	
3	BN	132-64-9	Dibenzofuran		0.80																	
3	BN	84-66-2	Diethylphthalate		0.01																	
3	BN	131-11-3	Dimethylphthalate		0.01																	
4	BN	84-74-2	Di-n-butylphthalate		0.01																	
6	BN	117-84-0	Di-n-octylphthalate		0.01	✓	✓	✓														
4	BN	206-44-0	Fluoranthene		0.60																	
3	BN	86-73-7	Fluorene		0.90																	
4	BN	118-74-1	Hexachlorobenzene		0.10							✓	✓		✓	✓	✓	69	✓	✓		
2	BN	87-68-3	Hexachlorobutadiene		0.01							✓	✓		✓	64	21	74	✓	✓		
3	BN	77-47-4	Hexachlorocyclopentadiene		0.01																	
1	BN	67-72-1	Hexachloroethane		0.30							✓	✓		✓	58	21	66	71	✓		

Comments:

Semivolatile Organics

Site/Project: _____ AR/COC #: 605667, -68 Batch #s: _____

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

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blanks	LCS	LCS D	LCS RPD	MS	MSD	MS RPD	Field/ Dup. RPD	Equip. Blanks	Field Blanks		Field Dup
						1 2	1 2	<20% / ~~<30%~~	20% 1 2	1 2	1	2		1	1	1	MS D	MS D	MS D ~~EB~~ D		
6	BN	193-39-5	Indeno(1,2,3-cd)pyrene	✓	0.50		✓	✓	✓ ✓	✓ ✓			NA								✓
2	BN	78-59-1	Isophorone		0.40																
2	BN	91-20-3	Naphthalene		0.70																
2	BN	98-95-3	Nitrobenzene		0.20						✓	✓		✓	62	✓	69	74	✓		
4	BN	86-30-6	N-Nitrosodiphenylamine (1)		0.01																
1	BN	621-64-7	N-Nitroso-di-propylamine	✓	0.50						✓	✓		✓	✓	✓	✓	✓	✓		
4	A	87-86-5	Pentachlorophenol		0.05						✓	✓		✓	✓	✓	✓	✓	✓		
4	BN	85-01-8	Phenanthrene		0.70																
1	A	108-95-2	Phenol		0.80						✓	✓		✓	✓	✓	✓	✓	✓		
5	BN	129-00-0	Pyrene		0.60						✓	✓		✓	✓	✓	✓	✓	✓		
			Diphenylamine																		

Surrogate Recovery Outliers

Sample	SMC 1	SMC 2	SMC 3	SMC 4	SMC 5	SMC 6	SMC 7	SMC 8

SMC 1: Nitrobenzene-d5 (BN)
SMC 2: 2-Fluorobiphenyl (BN)
SMC 3: p-Terphenyl-d14 (BN)
SMC 4: Phenol-d6 (A)
SMC 5: 2-Fluorophenol (A)
SMC 6: 2,4,6-Tribromophenol (A)
SMC 7: 2-2-Chlorophenol-d4 (A)
SMC 8: 1,2-Dichlorobenzene-d4 (BN)

Comments: -013 received broken container
Pyridine on QC summary not on TIC.
22 > RL bis (2)
12 → 21 > DL " "

Internal Standard Outliers

Sample	IS 1-area	IS 1-RT	IS 2-area	IS 2-RT	IS 3-area	IS 3-RT	IS 4-area	IS 4-RT	IS 5-area	IS 5-RT	Is 6-area	IS 6-RT

IS 1: 1,4-Dichlorobenzene-d4 (BN)
IS 2: Naphthalene-d8 (BN)
IS 3: Acenaphthene-d10 (BN)
IS 4: Phenanthrene-d10 (BN)
IS 5: Chrysene-d12 (BN)
IS 6: Perylene-d12 (BN)

PCBs (SW 846 - Method 8082)

Site/Project: DSS Soil Sampling AR/COC #: 605667 Laboratory Sample IDs: 66780 - 012 thru -022

Laboratory: GEL Laboratory Report #: 66780

Methods: SW-846 8082

# of Samples: 11 Matrix: Soils

Batch #s: ① 200518 XT 9/12 200519 (-013 only) ② 203079 XT 9.26 203080 (-012, -014 → 022)

CAS #	Name	TCL	Intercept 1	Intercept 2	Calib RSD / R^2 <20% / 0.99 1	Calib RSD / R^2 <20% / 0.99 2	CCV %D / 20% 1	CCV %D / 20% 2	Method Blanks 1	Method Blanks 2	LCS 1	LCSB 2	LCS RPD 20%	MS 1	MS 2	MSD 1	MSD 2	MS RPD 120%	Field Dup. RPD	Equip. Blanks	Field Blanks		
12674-11-2	Aroclor-1016	✓	NA		✓	✓	22%	✓	✓	✓			NA						✓	NA			
11104-28-2	Aroclor-1221	✓							✓	✓									✓				
11141-16-5	Aroclor-1232	✓							✓	✓									✓				
53469-21-9	Aroclor-1242	✓			✓	✓			✓	✓									✓				
12672-29-6	Aroclor-1248	✓			✓	✓			✓	✓									✓				
11097-69-1	Aroclor-1254	✓			✓	✓			✓	✓									✓				
11096-82-5	Aroclor-1260	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓				

Sample	SMC % REC	SMC RT	Sample	SMC % REC	SMC RT
66780 - 021	Surr 26%	(31-120%)			
< lower acceptance criteria		> 10%			
All detects (1260)	J, AJ	All NDs "UJ, AJ"			

Comments: Sa-012, -014 thru -022 all "UJ, HT" except 19, 21, 22 1260 "JHT"

Confirmation

Sample	CAS #	RPD > 25%	Sample	CAS #	RPD > 25%
66780 - 019	1260	32%	Change to higher value		1.8

SA -012, -014 thru -022 Reextracted out of HT only 1 set of data on Col A

SA - 021 & -022 5X (case rest -021 - due to sample viscosity)

No raw data!

Batch # 200255 XT 9/10
200256

MB not delivered with samples not on Col A not validated

Reviewed By: [signature] Date: 11.06.02

High Explosives (SW 846 Method 8330)

Site/Project: DSS Soil Sampling AR/COC #: 605667, -68 Laboratory Sample IDs: 66780-012 thru -022

Laboratory: GEL Laboratory Report #: 66780

Methods: SW-846 8330 ① ②

# of Samples: 11 Matrix: Soil Batch #s: 200966 reextracted as 203692

CAS #	NAME	Intercept	Curve R^2	CCV %D	Method Blanks	LCS	LCSS	LCS RPD	MS	MSD	MS RPD	Field. Dup. RPD	Equip. Blanks	Field Blanks
			≥.99 ②	≤20% ②	✓ U ②	✓	②	20%	✓ ②	✓ ②	≤20% ②		U	U
2691-41-0	HMX	NA	✓ ✓	✓ ✓	✓ ✓	✓	✓	NA	✓ ✓	✓ ✓	✓ ✓	✓	NA	
121-82-4	RDX					✓								
99-35-4	1,3,5-Trinitrobenzene					✓								
99-65-0	1,3-dinitrobenzene					✓								
98-95-3	Nitrobenzene					(65-124%)								
479-45-8	Tetryl					11								
118-96-7	2,4,6-trinitrotoluene					✓								
35572-78-2	2-amino-4,6-dinitrotoluene					(79-123%)								
1946-51-0	4-amino-2,6-dinitrotoluene					75								
121-14-2	2,4-dinitrotoluene					✓								
606-20-2	2,6-dinitrotoluene					✓								
88-72-2	2-nitrotoluene					✓								
99-99-0	4-nitrotoluene					✓								
99-08-1	3-nitrotoluene					✓								
78-11-5	PETN													

Sample	SMC %REC	SMC RT	Sample	SMC %REC	SMC RT
IN CAL	96%				

Confirmation

Sample	CAS #	RPD > 25%	Sample	CAS #	RPD > 25%
NA					

Comments: 203692 All 90 "UJ MT" -RE

200966 All Tetryl 90 "UJ," A LCS > 10% but < lower acceptance criteria

Solids-to-aqueous conversion:
mg/kg = µg/g : [(µg/g) x (sample mass (g) / sample vol. (ml)) x (1000 ml / 1 liter)] / Dilution Factor = µg/l

Reviewed By: [signature] Date: 11.06.02

Inorganic Metals

Site/Project: DSS Soil Sampling AR/COC #: 605667 Laboratory Sample IDs: 66780 - 012 thru - 022

Laboratory: GEL Laboratory Report #: 66780

Methods: SW- 846 6010 (ICP-AES) 7471 (Hg - CVAA)

# of Samples: 11 Matrix: Aqueous Batch #s: 200317 (Hg) 201371 (Metals)

CAS # / Analyte	ug/L QC Element																			
	TAL	ICV	CCV	ICB	CCB	Method Blanks	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	Rep. RPD	ICS AB	Serial Dilution	Field Dup. RPD	Equip. Blanks	Field Blanks		
7429-90-5 Al								NA			NA						NA	NA		
7440-39-3 Ba	✓	✓	✓	✓	✓	✓	✓			127			✓	✓	✓	✓				
7440-41-7 Be																				
7440-43-9 Cd	✓	✓	✓	✓	✓	✓	✓			✓			✓	✓	✓	✓				
7440-70-2 Ca																				
7440-47-3 Cr	✓	✓	✓	✓	✓	✓	✓			NA			✓	✓	✓	✓				
7440-48-4 Co																				
7440-50-8 Cu																				
7439-89-6 Fe																				
7439-95-4 Mg																				
7439-96-5 Mn																				
7440-02-0 Ni																				
7440-09-7 K																				
7440-22-4 Ag	✓	✓	✓	✓	✓	✓	✓			✓			NA	✓	NA	✓				
7440-23-5 Na																				
7440-62-2 V																				
7440-66-6 Zn																				
7439-92-1 Pb	✓	✓	✓	✓	✓	✓	✓			✓			✓	✓	NA	✓			5Y	B
7782-49-2 Se	✓	✓	✓	✓	✓	✓	✓			✓			NA	✓	NA	✓				
7440-38-2 As	✓	✓	✓	2.50	2.41	✓	✓			✓			✓	✓	✓	✓			12.5	12.05
7440-36-0 Sb																				
7440-28-0 Tl																				
7439-97-6 Hg	✓	✓	✓	✓	✓	✓	✓			✓			NA							
Cyanide CN																				

Notes: Shaded rows are RCRA metals. Solids-to-aqueous conversion: mg / kg = µg / g : [(µg / g) x (sample mass (g) / sample vol. (ml)) x (1000 ml / 1 liter)] / Dilution Factor = µg / l

Comments: ICP-AES 2X dil

METALS 66765 dup / MS / SD
SNR SOG

All SA > 5 ICB / CCB NO Q AS.
All SA > Rl Ba "J, A2"

Reviewed By: [signature] Date: 11.06.02.

General Chemistry

Site/Project: DSS Soil Sampling AR/COC #: 605667, -68 Laboratory Sample IDs: 66780 - 012 thru - 022

Laboratory: GEL Laboratory Report #: 66780

Methods: SW-846 9012A (TCN) 7196A (Cr_6) -012 → -015 -016 → -022

# of Samples: 11 Matrix: Soil Batch #s: 201253 (TCN) 200893 (Cr^6) / 200895

CAS #	Analyte	TAL	QC Element: ICV	CCV	ICB	CCB	Method Blanks	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	Rep. RPD	ICS AB	Serial Dilution	Field Dup. RPD	Equip. Blanks	Field MBlanks
			ug/L				ug/kg												
5955-70-0	Total Cr		✓	✓	✓	[1.78]	0.129 J	✓✓	NA	NA	✓✓	NA	NA	NA	NA	NA	✓?	NA	All < 5X DL = J All >QL = UJ MBX5 = 0.645 ug/kg.
	200893																		
SA-012 thru -015	Hexavalent Chromium		✓	✓	✓	✓	✓	✓	NA	NA	✓✓	NA	NA	✓ NA	NA	NA	✓	NA	NA
	200895																		
SA-016 thru -022	Hexavalent Chromium		✓	✓	✓	✓	✓	✓	NA	NA	✓	NA	NA	NA	NA	NA	✓	NA	NA

Comments: Cr^6 Batch 200893: MS/Dup 66NSH 5X's 5DL. 66610

MB TCN 12. < 5X MB J, B 13. 16. 17. 19. 20. 21. 22.

CCB 12. < 5X DL J, B3 13. 16. 19. 20. 21. 22.

COC 18 = ND = UJ, B_3 Reviewed By: [signature] Date: 11.06.02

MB 14. > MB ND Q. 15. 18.

CCB > DL 15. 17

Radiochemistry

Site/Project: OSS Soil Sampling AR/COC #: 605667, -68 Laboratory Sample IDs: 66780 - 012 thru - 022

Laboratory: GEL Laboratory Report #: 66780

Methods: EPA 900.0

# of Samples: 11 Matrix: Soils Batch #s: 201305

Analyte	QC Element												
	Method Blanks	LCS	MS	Rep RER	Equip. Blanks	Field Dup. RER	Field Blanks	Sample ID	Isotope	IS/Trace	Sample ID	Isotope	IS/Trace
Criteria	U	20%	25%	<1.0	U	<1.0	U	NA		50-105			50-105
H3													
U-238													
U-234													
U-235/-236													
Th-232													
Th-228													
Th-230													
Pu-239/-240													
Gross Alpha ✓	✓	✓	✓	✓	✓	NA	✓	NA					
Nonvolatile Beta ✓	✓	✓	✓	✓	✓	NA	✓	NA					
Ra-226													
Ra-28													
Ni-63													
Gamma Spec. Am-241													
Gamma Spec. Cs-137													
Gamma Spec. Co-60													

Parameter	Method	Typical Tracer	Typical Carrier
Iso-U	Alpha spec.	U-232	NA
Iso-Pu	Alpha spec.	Pu-242	NA
Iso-Th	Alpha spec.	Th-229	NA
Am-241	Alpha spec.	Am-242	NA
Sr-90	Beta	Y ingrowth	NA
Ni-63	Beta	NA	Ni by ICP
Ra-226	Deamination	NA	NA
Ra-226	Alpha spec.	Ba-133 or Ra-225	NA
Ra-228	Gamma spec.	Ba-133	NA

Gamma spec. LCS contains: Am-241, Cs-137, and Co-60

Comments:

Reviewed By: [signature] Date: 11.06.02

ANNEX D
DSS Site 1083
Risk Assessment

TABLE OF CONTENTS

This page intentionally left blank.

LIST OF TABLES

LIST OF FIGURES

This page intentionally left blank.

DSS SITE 1083: RISK ASSESSMENT REPORT

I. Site Description and History

Drain and Septic Systems (DSS) Site 1083, the Building 6570 Septic System, at Sandia National Laboratories/New Mexico (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). The septic system consisted of a septic tank connected to an aggregate-filled drywell. Available information indicates that Building 6570 was constructed in 1956 (SNL/NM March 2003), and it is assumed that the septic system was also constructed at that time. By 1991, the septic system discharges were routed to the City of Albuquerque sanitary sewer system (Jones June 1991). The septic system was abandoned in place concurrent with this change (Romero September 2003).

Environmental concern about DSS Site 1083 is based upon the potential for the release of constituents of concern (COCs) in effluent discharged to the environment via the drywell at this site. Because operational records were not available, the investigation was planned to be consistent with other DSS site investigations and to sample for the COCs most commonly found at similar facilities.

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 1.3 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 slope 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 DSS Site 1083 is unpaved with some native vegetation, and no storm sewers are used to direct surface water away from the site.

DSS Site 1083 lies at an average elevation of approximately 5,416 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 493 feet below ground surface (bgs). Groundwater flow is thought to be to the west in this area (SNL/NM March 2002). The nearest groundwater monitoring wells are approximately 2,500 feet west of the site. The nearest production wells are northwest and northeast of the site and include KAFB-4 and KAFB-11, which are approximately 3.2 and 3.5 miles away, respectively.

II. Data Quality Objectives

The Data Quality Objectives (DQOs) presented in the "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" (SNL/NM October 1999) and "Field Implementation Plan [FIP], Characterization of Non-Environmental Restoration Drain and Septic Systems" (SNL/NM November 2001) identified the site-specific sample

locations, sample depths, sampling procedures, and analytical requirements for this and many other DSS sites. The DQOs outlined the quality assurance (QA)/quality control (QC) requirements necessary for producing defensible analytical data suitable for risk assessment purposes. 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 1 summarizes the rationale for determining the sampling locations at this site. The source of potential COCs at DSS Site 1083 was effluent discharged to the environment from the drywell this site.

Table 1
Summary of Sampling Performed to Meet DQOs

DSS Site 1083 Sampling Area	Potential COC Source	Number of Sampling Locations	Sample Density (samples/acre)	Sampling Location Rationale
Soil beneath the septic system drywell	Effluent discharged to the environment from the drywell	1	NA	Evaluate potential COC releases to the environment from effluent discharged from the drywell.

COC = Constituent of concern.
DQO = Data Quality Objective.
DSS = Drain and Septic Systems.
NA = Not applicable.

The soil samples were collected at one boring location at DSS Site 1083 with a Geoprobe™ from two 3- or 4-foot-long sampling intervals. Sampling intervals started at 9 and 14 feet bgs in the drywell boring. The soil samples were collected in accordance with the procedures described in the SAP (SNL/NM October 1999) and FIP (SNL/NM November 2001). Table 2 summarizes the types of confirmatory and QA/QC samples collected at the site and the laboratories that performed the analyses.

The DSS Site 1083 soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), high explosive (HE) compounds, polychlorinated biphenyls (PCBs), Resource Conservation and Recovery Act (RCRA) metals, hexavalent chromium, cyanide, radionuclides, and gross alpha/beta activity. The samples were analyzed by an off-site laboratory (General Engineering Laboratories, Inc.) and the on-site SNL/NM Radiation Protection Sample Diagnostics (RPSD) Laboratory. Table 3 summarizes the analytical methods and the data quality requirements from the SAP (SNL/NM October 1999) and FIP (SNL/NM November 2001).

Table 2
Number of Confirmatory Soil and QA/QC Samples Collected from DSS Site 1083

Sample Type	VOCs	SVOCs	PCBs	HE	RCRA Metals	Hexavalent Chromium	Cyanide	Gamma Spectroscopy Radionuclides	Gross Alpha/Beta
Confirmatory	2	2	2	2	2	2	2	2	2
Duplicates	1	1	1	1	1	1	1	1	1
EBs and TBs (VOCs only)	1	0	0	0	0	0	0	0	0
Total Samples	4	3	3	3	3	3	3	3	3
Analytical Laboratory	GEL	GEL	GEL	GEL	GEL	GEL	GEL	RPSD	GEL

DSS = Drain and Septic Systems.
EB = Equipment blank.
GEL = General Engineering Laboratories, Inc.
HE = High explosive(s).
PCB = Polychlorinated biphenyl.
QA = Quality assurance.
QC = Quality control.
RCRA = Resource Conservation and Recovery Act.
RPSD = Radiation Protection Sample Diagnostics Laboratory.
SVOC = Semivolatile organic compound.
TB = Trip blank.
VOC = Volatile organic compound.

Table 3
Summary of Data Quality Requirements for DSS Site 1083

Analytical Method[a]	Data Quality Level	GEL	RPSD
VOCs EPA Method 8260	Defensible	2	None
SVOCs EPA Method 8270	Defensible	2	None
PCBs EPA Method 8082	Defensible	2	None
HE Compounds EPA Method 8330	Defensible	2	None
RCRA Metals EPA Method 6000/7000	Defensible	2	None
Hexavalent Chromium EPA Method 7196A	Defensible	2	None
Total Cyanide EPA Method 9012A	Defensible	2	None
Gamma Spectroscopy Radionuclides EPA Method 901.1	Defensible	None	2
Gross Alpha/Beta Activity EPA Method 900.0	Defensible	2	None

Note: The number of samples does not include QA/QC samples such as duplicates, trip blanks, and equipment blanks.
[a]EPA November 1986.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
GEL = General Engineering Laboratories, Inc.
HE = High explosive(s).
PCB = Polychlorinated biphenyl.
QA = Quality assurance.
QC = Quality control.
RCRA = Resource Conservation and Recovery Act.
RPSD = Radiation Protection Sample Diagnostics Laboratory.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.

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

All of the soil sample results were verified/validated by SNL/NM according to "Verification and Validation of Chemical and Radiochemical Data," Technical Operating Procedure (TOP) 94-03, Rev. 0 (SNL/NM July 1994) or SNL/NM ER Project "Data Validation Procedure for Chemical and Radiochemical Data," Administrative Operating Procedure (AOP) 00-03 (SNL/NM December 1999). The data validation reports are presented in the associated DSS Site 1083 proposal for no further action (NFA). 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). The gamma spectroscopy

results are presented in the NFA proposal. The reviews confirmed that the analytical data are defensible and therefore acceptable for use in the NFA proposal. Therefore, the DQOs have been fulfilled.

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

III.1 Introduction

The determination of the nature, migration rate, and extent of contamination at DSS Site 1083 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, backhoe excavations, soil sampling, and passive soil-vapor sampling. The DQOs contained in the SAP (SNL/NM October 1999) and FIP (SNL/NM November 2001) identified the sample locations, sample density, sample depth, and analytical requirements. The sample data were subsequently used to develop the final conceptual model for DSS Site 1083, which is presented in Section 4.2.1 of the associated NFA proposal. The quality of the data specifically used to determine the nature, migration rate, and extent of contamination is described in the following sections.

III.2 Nature of Contamination

Both the nature of contamination and the potential for the degradation of COCs at DSS Site 1083 were evaluated using laboratory analyses of the soil samples. The analytical requirements included analyses for VOCs, SVOCs, HE compounds, PCBs, RCRA metals, hexavalent chromium, cyanide, radionuclides by gamma spectroscopy, and gross alpha/beta activity. The analytes and methods listed in Tables 2 and 3 are appropriate to characterize the COCs and any potential degradation products at DSS Site 1083.

III.3 Rate of Contaminant Migration

The septic system at DSS Site 1083 was deactivated in the early 1990s when Building 6570 was connected to an extension of the City of Albuquerque sanitary sewer system. The migration rate of COCs that may have been introduced into the subsurface via the septic system at this site was therefore dependent upon the volume of aqueous effluent discharged to the environment from this system when it was operational. Any migration of COCs from this site after use of the septic system was discontinued has been predominantly dependent upon precipitation. However, it is highly unlikely that sufficient precipitation has fallen on the site to reach the depth at which COCs may have been discharged to the subsurface from this system. Analytical data generated from the soil sampling conducted at the site are adequate to characterize the rate of COC migration at DSS Site 1083.

III.4 Extent of Contamination

Subsurface soil samples were collected from one borehole drilled beneath the drywell at DSS Site 1083 to assess whether releases of effluent from the septic system caused any environmental contamination.

The DSS Site 1083 soil samples were collected at sampling depths starting at 9 and 14 feet bgs beneath the drywell. Sampling intervals started at the depths at which effluent discharged from the drywell would have entered the subsurface environment at the site. This sampling procedure was required by the New Mexico Environment Department (NMED) regulators and has been used at numerous DSS-type sites at SNL/NM. The soil samples are considered to be representative of the soil potentially contaminated with the COCs at this site and are sufficient to determine the vertical extent, if any, of COCs.

IV. Comparison of COCs to Background Levels

Site history and characterization activities are used to identify potential COCs. The DSS Site 1083 NFA proposal describes the identification of COCs and the sampling that was conducted in order to determine the concentration levels of those COCs across the site. Generally, COCs evaluated in this risk assessment include all detected organic and all inorganic and radiological COCs for which samples were analyzed. When the detection limit of an organic compound is too high (i.e., could possibly cause an adverse effect to human health or the environment), the compound is retained. Nondetected organic compounds not included in this assessment were determined to have detection limits low enough to ensure protection of human health and the environment. In order to provide conservatism in this risk assessment, the calculation uses only the maximum concentration value of each COC found for the entire site. The SNL/NM maximum background concentration (Dinwiddie September 1997) was selected to provide the background screen listed in Tables 4 and 5.

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 4 lists the nonradiological COCs and Table 5 lists the radiological COCs for the human health risk assessment at DSS Site 1083. All samples were collected from depths greater than 5 feet bgs; therefore, evaluation of ecological risk was not performed. Both tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997). Section VI.4 discusses the results presented in Tables 4 and 5.

V. Fate and Transport

The primary releases of COCs at DSS Site 1083 were to the subsurface soil resulting from the discharge of effluents from the Building 6570 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 are considered to be of potential significance as transport mechanisms at this site. Because the septic system is no longer

Table 4
Nonradiological COCs for Human Health Risk Assessment at DSS Site 1083 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

COC	Maximum Concentration (All Samples) (mg/kg)	SNL/NM Background Concentration (mg/kg)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Log K_{ow} (for organic COCs)	Bioaccumulator?[b] (BCF>40, Log K_{ow}>4)
Inorganic						
Arsenic	3.45	4.4	Yes	44[c]	–	**Yes**
Barium	170 J	214	Yes	170[d]	–	**Yes**
Cadmium	0.224 J	0.9	Yes	64[c]	–	**Yes**
Chromium, total	13.1	15.9	Yes	16[c]	–	No
Chromium VI	0.0267[e]	1	Yes	16[c]	–	No
Cyanide	5.08	NC	**Unknown**	NC	–	**Unknown**
Lead	6.49	11.8	Yes	49[c]	–	**Yes**
Mercury	0.0227	<0.1	**Unknown**	5,500[c]	–	**Yes**
Selenium	0.08[e]	<1	**Unknown**	800[f]	–	**Yes**
Silver	0.0447[e]	<1	**Unknown**	0.5[c]	–	No
Organic						
2-Butanone	0.0136 J	NA	**NA**	1[g]	0.29[g]	No
bis(2-Ethylhexyl) phthalate	0.0892 J	NA	**NA**	851[h]	7.6[i]	**Yes**

Note: **Bold** indicates the COCs that exceed the background screening values and/or are bioaccumulators.

[a]Dinwiddie September 1997, Southwest Area Supergroup.

[b]NMED March 1998.

[c]Yanicak March 1997.

[d]Neumann 1976.

[e]Parameter was not detected. Concentration is one-half the maximum detection limit.

[f]Callahan et al. 1979.

[g]Howard 1990.

[h]Howard 1989.

[i]Micromedex, Inc. 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.
SNL/NM = Sandia National Laboratories/New Mexico.
– = Information not available.

Table 5
Radiological COCs for Human Health Risk Assessment at DSS Site 1083 with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC	Maximum Activity (All Samples) (pCi/g)	SNL/NM Background Activity (pCi/g)[a]	Is Maximum COC Activity Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Is COC a Bioaccumulator?[b] (BCF >40)
Cs-137	ND (0.03)	0.079	Yes	3,000[c]	**Yes**
Th-232	0.786	1.01	Yes	3,000[c]	**Yes**
U-235	**ND (0.213)**	0.16	**No**	900[c]	**Yes**
U-238	ND (0.783)	1.4	Yes	900[c]	**Yes**

Note: **Bold** indicates COCs that exceed the background screening values and/or are bioaccumulators.
[a]Dinwiddie September 1997, Southwest Area Supergroup.
[b]NMED March 1998.
[c]Baker and Soldat 1992.
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.
pCi/g = Picocurie(s) per gram.
SNL/NM = Sandia National Laboratories/New Mexico.

active, additional infiltration of water is not expected. Infiltration of precipitation is essentially nonexistent at DSS Site 1083, as virtually all of the moisture either drains away from the site or evaporates. Because groundwater at this site is approximately 493 feet bgs, the potential for COCs to reach groundwater through the unsaturated zone above the water table is extremely low.

The COCs at DSS Site 1083 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-life of the radiological COC (U-235), 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 Site 1083 are limited to 2-butanone, and bis(2-ethylhexyl) phthalate. 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 2-butanone through volatilization is expected to be minimal.

Table 6 summarizes the fate and transport processes that can occur at DSS Site 1083. 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 COC is insignificant because of its long half-life.

Table 6
Summary of Fate and Transport at DSS Site 1083

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

DSS = Drain and Septic Systems.

VI. Human Health Risk Assessment

VI.1 Introduction

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

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

VI.2 Step 1. Site Data

Section I of this risk assessment provides the site description and history for DSS Site 1083. Section II presents a comparison of results to DQOs. Section III discusses the nature, rate, and extent of contamination.

VI.3 Step 2. Pathway Identification

DSS Site 1083 has been designated with a future land-use scenario of industrial (DOE et al. September 1995) (see Appendix 1 for default exposure pathways and parameters). However, the residential land-use scenario is also considered in the pathway analysis. Because of the location and characteristics of the potential contaminants, the primary pathway for human exposure is considered to be soil ingestion for the nonradiological COCs and direct gamma exposure for the radiological COCs. The inhalation pathway for both nonradiological and radiological COCs is included because the potential exists to inhale dust 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 DSS

Site 1083 is approximately 493 feet bgs. No intake routes through plant, meat, or milk ingestion are considered appropriate for either the industrial or residential land-use scenarios. Figure 1 shows the conceptual model flow diagram for DSS Site 1083.

Pathway Identification

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

VI.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.

VI.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 4 and used to calculate risk attributable to background in Section VI.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.

VI.4.2 Results

Tables 4 and 5 show the DSS Site 1083 maximum COC concentrations that were compared to the SNL/NM maximum background values (Dinwiddie September 1997) for the human health risk assessment. Four constituents do not have quantified background screening concentrations; therefore, it is unknown whether these COCs exceed background. Two constituents are organic compounds that do not have corresponding background screening values.

This page intentionally left blank.

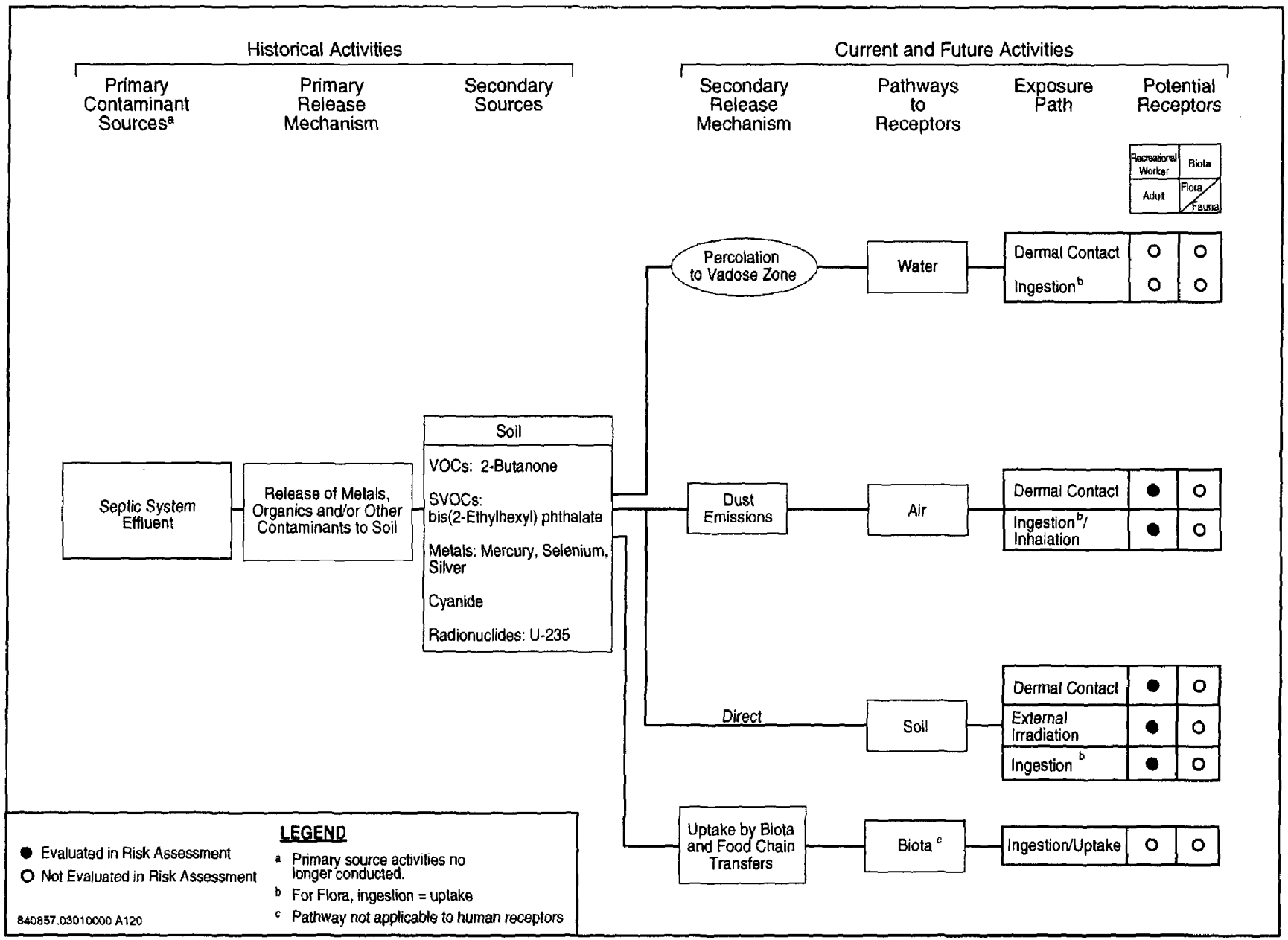


Figure 1

Conceptual Site Model Flow Diagram for DSS Site 1083, Building 6570 Septic System

For the radiological COCs, one constituent (U-235) exhibited an MDA greater than its background screening level.

VI.5 Step 4. Identification of Toxicological Parameters

Tables 7 (nonradiological) and 8 (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 7 were obtained from the Integrated Risk Information System (IRIS) (EPA 2003), the Health Effects Assessment Summary Tables (HEAST) (EPA 1997a), the Technical Background Document for Development of Soil Screening Levels (NMED December 2000), the EPA Region 6 electronic database (EPA 2002a), and the Risk Assessment Information System (ORNL 2003) electronic databases. 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).

VI.6 Step 5. Exposure Assessment and Risk Characterization

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

VI.6.1 Exposure Assessment

Appendix 1 provides the equations and parameter input values used in calculating intake values and subsequent HI and excess cancer risk values for the individual exposure pathways. The appendix 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 December 2000), as well as other EPA and NMED guidance documents. The

Table 7
Toxicological Parameter Values for DSS Site 1083 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								
Cyanide	2E-2[c]	M	–	–	–	–	D	0.1[d]
Mercury	3E-4[e]	–	8.6E-5[c]	M	–	–	D	0.01[d]
Selenium	5E-3[c]	H	–	–	–	–	D	0.01[d]
Silver	5E-3[c]	L	–	–	–	–	D	0.01[d]
Organic								
2-Butanone	6E-1[c]	L	2.9E-1[c]	L	–	–	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]

[a]Confidence associated with IRIS (EPA 2003) database values. Confidence: L = low, M = medium, H = high.
[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989) taken from IRIS (EPA 2003):
D = Not classifiable as to human carcinogenicity.
[c]Toxicological parameter values from IRIS electronic database (EPA 2003).
[d]Toxicological parameter values from NMED (December 2000).
[e]Toxicological parameter values from HEAST (EPA 1997a).
[f]Toxicological parameter values from EPA Region 6 (EPA 2002a).
[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.
IRIS = Integrated Risk Information System.
mg/kg-d = Milligram(s) per kilogram-day.
$(mg/kg\text{-}d)^{-1}$ = Per milligram per kilogram-day.
NMED = New Mexico Environment Department.
RfD_{inh} = Inhalation chronic reference dose.
RfD_o = Oral chronic reference dose.
SF_{inh} = Inhalation slope factor.
SF_o = Oral slope factor.
– = Information not available.

Table 8
Radiological Toxicological Parameter Values for
DSS Site 1083 COCs Obtained from RESRAD Risk Coefficients[a]

COC	SF_o (1/pCi)	SF_{inh} (1/pCi)	SF_{ev} (g/pCi-yr)	Cancer Class[b]
U-235	4.70E-11	1.30E-08	2.70E-07	A

[a]Yu et al. 1993a.
[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989): A = Human carcinogen for high dose and high dose rate (i.e., greater than 50 rem per year). For low-level environmental exposures, the carcinogenic effect has not been observed and documented.
1/pCi = One per picocurie.
COC = Constituent of concern.
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.

parameters reflect the reasonable maximum exposure (RME) approach advocated by the RAGS (EPA 1989). For the radiological COC, the coded equation provided in RESRAD computer code is used to estimate the incremental TEDE and cancer risk for individual exposure pathways. Further discussion of this process is provided in the "Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD" (Yu et al. 1993a).

Although the designated land-use scenario for this site is industrial, risk and TEDE values for a residential land-use scenario are also presented.

VI.6.2 Risk Characterization

Table 9 shows an HI of 0.00 for the DSS Site 1083 nonradiological COCs and an estimated excess cancer risk of 5E-10 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 10 shows an HI of 0.00 and no quantified estimated excess cancer risk for the DSS Site 1083 associated background constituents under the designated industrial land-use scenario.

For the radiological COC, contribution from the direct gamma exposure pathway is included. For the industrial land-use scenario, a TEDE was calculated that results in an incremental TEDE of 7.6E-3 millirem (mrem)/year (yr). In accordance with EPA guidance found in Office of Solid Waste and Emergency Response (OSWER) Directive No. 9200.4-18 (EPA 1997b), an incremental TEDE of 15 mrem/yr is used for the probable land-use scenario (industrial in this case); the calculated dose value for DSS Site 1083 for the industrial land-use scenario is well below this guideline. The estimated excess cancer risk is 9.0E-8.

Table 9
Risk Assessment Values for DSS Site 1083 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					
Cyanide	5.08	0.00	–	0.00	–
Mercury	0.0227	0.00	–	0.00	–
Selenium	0.08[b]	0.00	–	0.00	–
Silver	0.0447[b]	0.00	–	0.00	–
Organic					
2-Butanone	0.0136 J	0.00	–	0.00	–
bis(2-Ethylhexyl) phthalate	0.0892 J	0.00	5E-10	0.00	2E-9
Total		0.00	5E-10	0.00	2E-9

[a]EPA 1989.
[b]Concentration is one-half the maximum detection limit.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
– = Information not available.

Table 10
Risk Assessment Values for DSS Site 1083 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
Cyanide	NC	–	–	–	–
Mercury	<0.1	–	–	–	–
Selenium	<1	–	–	–	–
Silver	<1	–	–	–	–
Total		–	–	–	–

[a]Dinwiddie September 1997, Southwest Area Supergroup.
[b]EPA 1989.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
mg/kg = Milligram(s) per kilogram.
NC = Not calculated.
– = Information not quantified.

For the nonradiological COCs under the residential land-use scenario, the HI is 0.00 with an estimated excess cancer risk of 2E-9 (Table 9). The numbers in the table include exposure from soil ingestion, dermal contact, and dust and volatile inhalation. Although the EPA (1991) generally recommends that inhalation not be included in a residential land-use scenario, this pathway is included because of the potential for soil in Albuquerque, New Mexico, to be eroded and for dust to be present in predominantly residential areas. Because of the nature of the local soil, other exposure pathways are not considered (see Appendix 1). Table 10 shows an HI of 0.00 and no quanitified estimated excess cancer risk for the DSS Site 1083 associated background constituents under the residential land-use scenario.

For the radiological COC, the incremental TEDE for the residential land-use scenario is 2.0E-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 Site 1083 for the residential land-use scenario is well below this guideline. Consequently, DSS Site 1083 is eligible for unrestricted radiological release as the residential land-use scenario results in an incremental TEDE of less than 75 mrem/yr to the on-site receptor. The estimated excess cancer risk is 2.7E-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 Sites with Radioactive Contamination," (EPA 1997b). This summation is tabulated in Section VI.9, Summary.

VI.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 0.00 (less than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). The estimated excess cancer risk is 5E-10. 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 determined risks considering background concentrations of the potential nonradiological COCs for both the industrial and residential land-use scenarios. Assuming the industrial land-use scenario, there is neither a quantifiable HI nor an excess cancer risk for nonradiological COCs. The incremental risk is determined by subtracting risk associated with background from potential COC risk. These numbers are not rounded before the difference is determined and therefore may appear to be inconsistent with numbers presented in tables and within the text. For conservatism, the background constituents that do not have quantified background screening concentrations are assumed to have a hazard quotient of 0.00. The incremental HI is 0.00 and the incremental estimated excess cancer risk is 4.65E-10 for the industrial land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs under an industrial land-use scenario.

For the radiological COC under the industrial land-use scenario, the incremental TEDE is 7.6E-3 mrem/yr, which is significantly less than EPA's numerical guideline of 15 mrem/yr. The incremental estimated excess cancer risk is 9.0E-8.

The calculated HI for the nonradiological COCs under the residential land-use scenario is 0.00, which is below numerical guidance. The estimated excess cancer risk is 2E-9. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. The incremental HI is 0.00 and the estimated incremental cancer risk is 2.02E-9 for the residential land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs under the residential land-use scenario.

The incremental TEDE for a residential land-use scenario from the radiological component is 2.0E-2 mrem/yr, which is significantly less than the numerical guideline of 75 mrem/yr suggested in the SNL/NM "RESRAD Input Parameter Assumptions and Justification" (SNL/NM February 1998). The estimated excess cancer risk is 2.7E-7.

VI.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at DSS Site 1083 is based upon an initial conceptual model that was validated with sampling conducted at the site. The sampling was implemented in accordance with the SAP (SNL/NM October 1999) and FIP (SNL/NM November 2001). The DQOs contained in these two documents are appropriate for use in risk assessments. The data from soil samples collected at effluent release points are representative of potential COC releases to the site. The analytical requirements and results satisfy the DQOs, and data quality was verified/validated in accordance with SNL/NM procedures. Therefore, there is no uncertainty associated with the data quality used to perform the risk assessment at DSS Site 1083.

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 7 shows the uncertainties (confidence levels) in nonradiological toxicological parameter values. There is a combination of estimated values and values from the IRIS (EPA 2003), HEAST (EPA 1997a), EPA Regions 6, 9, and 3 (EPA 2002a, EPA 2002b, EPA 2002c), and Technical Background Document for Development of Soil Screening Levels (NMED December 2000). Where values are not provided, information is not available from the HEAST (EPA 1997a), IRIS (EPA 2003), Technical Background Document for Development of Soil Screening Levels (NMED December 2000), Risk Assessment Information System (ORNL 2003), or EPA regions (EPA 2002a, EPA 2002b, EPA 2002c). Because of the conservative nature of the RME approach, uncertainties in toxicological values are not expected to change the conclusion from the risk assessment analysis.

Risk assessment values for nonradiological COCs are within the acceptable range for human health under the industrial and residential land-use scenarios compared to established numerical guidance.

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

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

VI.9 Summary

DSS Site 1083 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 nonradiological COCs show that for the industrial land-use scenario the HI (0.00) is significantly lower than the accepted numerical guidance from the EPA. The estimated excess cancer risk is 5E-10; thus, excess cancer risk is also below the acceptable risk value provided by the NMED for an industrial land-use scenario (Bearzi January 2001). The incremental HI is 0.00 and the incremental estimated excess cancer risk is 4.65E-10 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 nonradiological COCs show that for the residential land-use scenario the HI (0.00) is below the accepted numerical guidance from the EPA. The estimated excess cancer risk is 2E-9. Thus, excess cancer risk is below the acceptable risk value provided by the NMED for a residential land-use scenario (Bearzi January 2001). The incremental HI is 0.00 and the incremental estimated excess cancer risk is 2.02E-9 for the residential land-use scenario. The incremental risk calculations indicate insignificant risk to human health for the residential land-use scenario.

The incremental TEDE and corresponding estimated cancer risk from radiological COCs are much less than EPA guidance values; the estimated TEDE is 7.6E-3 mrem/yr for the industrial land-use scenario, which is much less than the EPA's numerical guidance of 15 mrem/yr (EPA 1997b). The corresponding incremental estimated cancer risk value is 9.0E-8 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 2.0E-2 mrem/yr with an associated risk of 2.7E-7. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, DSS Site 1083 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 11.

Table 11
Summation of Incremental Radiological and Nonradiological Risks from DSS Site 1083, Building 6570 Septic System Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	4.65E-10	9.0E-8	9.0E-8
Residential	2.02E-9	2.7E-7	2.7E-7

DSS = Drain and Septic Systems.

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.

VII. Ecological Risk Assessment

VII.1 Introduction

This section addresses the ecological risks associated with exposure to constituents of potential ecological concern (COPECs) in the soil at DSS Site 1083. A component of the NMED Risk-Based Decision Tree (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.

VII.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 VII.2.4) summarizes the scoping results and assesses the need for further examination of potential ecological impacts.

VII.2.1 Data Assessment

As indicated in Section IV, all COCs at DSS Site 1083 are at depths greater than 5 feet bgs. Therefore, no complete ecological exposure pathways exist at this site, and no COCs are considered to be COPECs.

VII.2.2 Bioaccumulation

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

VII.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 V. As noted in Table 6 (Section V), wind, surface water, and biota (food chain uptake) are expected to be of low significance as transport mechanisms for COCs at this site. Degradation, transformation, and radiological decay of the COC also are expected to be of low significance.

VII.2.4 Scoping Risk-Management Decision

Based upon information gathered through the scoping assessment, it is concluded that complete ecological pathways are not associated with COCs at DSS Site 1083. 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.

VIII. 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.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.

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.

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.

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. "Risk-Based Decision Tree Description," *in* New Mexico Environment Department, "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), 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.

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, 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), July 1994. "Verification and Validation of Chemical and Radiochemical Data," Technical Operation Procedure (TOP) 94-03, Rev. 0, 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), February 1998. "RESRAD Input Parameter Assumptions and Justification," 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), December 1999. "Data Validation Procedure for Chemical and Radiochemical Data," Administrative Operating Procedure (AOP) 00-03, Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico.

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.

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

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 6 Preliminary Remediation Goals (PRGs) 2002," electronic database maintained by Region 6, U.S. Environmental Protection Agency, Dallas, Texas.

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

U.S. Environmental Protection Agency (EPA), 2003. Integrated Risk Information System (IRIS) electronic database, maintained by the U.S. Environmental Protection Agency, Washington, D.C.

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.

This page intentionally left blank.

APPENDIX 1
EXPOSURE PATHWAY DISCUSSION FOR CHEMICAL AND RADIONUCLIDE CONTAMINATION

Introduction

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

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

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

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

- Ingestion of contaminated drinking water
- Ingestion of contaminated soil

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

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

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

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

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

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

Table 1
Exposure Pathways Considered for Various Land-Use Scenarios

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

Equations and Default Parameter Values for Identified Exposure Routes

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

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

Generic Equation for Calculation of Risk Parameter Values

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

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

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

where;

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

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.

END OF DOCUMENT