3-1-2005

Justification for Class III Permit Modification March 2005, DSS Site 1015, Operable Unit 1295, Former MO 231-234 Septic System at Technical Area V

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

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Sandia Site Office
Environmental Restoration
Mr. John Gould
Telephone (505) 845-6089

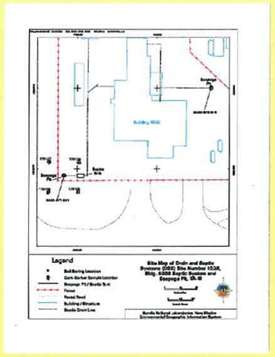
Sandia National Laboratories
Environmental Restoration Project
Task Leader: Brenda Langkopf
Telephone (505) 284-3272

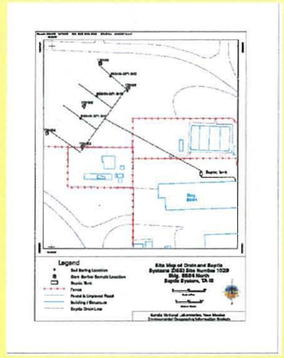
Drain and Septic Systems (DSS) Area of Concern (AOC) Sites 1028, 1029, 1083, 1086, 1108, and 1110

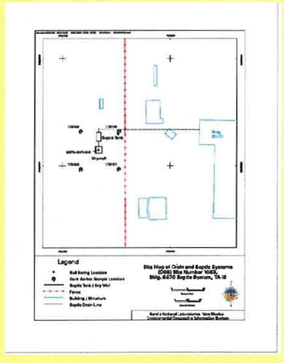
This work supported by the United States Department of Energy under contract DE-AC04-94AL85000.

Sandia National Laboratories

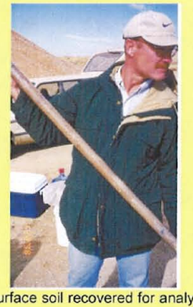
Environmental Restoration Project



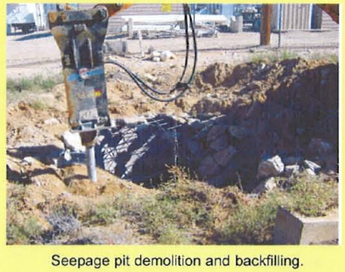




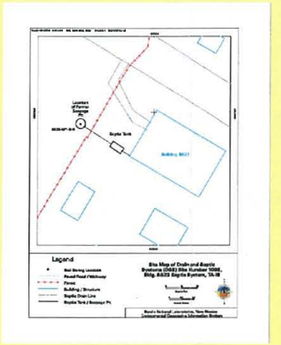
Collecting soil samples with the Geoprobe.

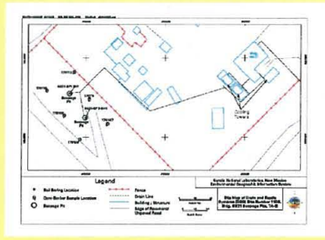


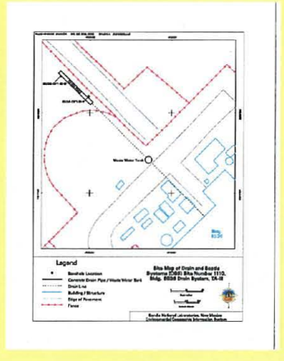
Subsurface soil recovered for analyses.



Seepage pit demolition and backfilling.







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Justification for Class III Permit Modification

March 2005

DSS Site 1015
Operable Unit 1295
Former MO 231-234 Septic System at Technical Area V

NFA (SWMU Assessment Report) Submitted March 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

ESH SEC

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

MAR 2 3 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 SWMU Assessment Reports and Proposals for No Further Action (NFA) for Drain and Septic Systems (DSS) Sites 1006, 1007, 1015, 1020, 1024, 1029, 1108, and 1110 at Sandia National Laboratories, New Mexico, EPA ID No. NM5890110518.

This submittal includes descriptions of the site characterization work, soil characterization data, and risk assessments for DSS Sites 1006, 1007, 1015, 1020, 1024, 1029, 1108, and 1110. The risk assessments conclude that for these eight 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.

DOE and Sandia are requesting a determination that these DSS sites are acceptable for No Further Action.

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:
K. Thomas, EPA, Region 6
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F. Nimick, SNL, MS 1089
D. Stockham, SNL, MS 1087
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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 1015, FORMER MO 231-234 SEPTIC SYSTEM

March 2004

United States Department of Energy
Sandia Site Office

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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
g	gram(s)
HE	high explosives
HI	hazard index
HWB	Hazardous Waste Bureau
KAFB	Kirtland Air Force Base
MDL	method detection limit
MO	mobile office
mrem	millirem
NFA	no further action
NMED	New Mexico Environment Department
OU	Operable Unit
PCB	polychlorinated biphenyl
pCi	picocuries(s)
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
TEDE	total effective dose equivalent
TB	trip blank
TOP	Technical Operating Procedure
VOC	volatile organic compound
yr	year

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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 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 1015: FORMER MO 231-234 SEPTIC SYSTEM

2.1 Summary

The SNL/NM ER Project conducted an assessment of DSS Site 1015, the Former Mobile Office (MO) 231-234 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 1015. This NFA proposal provides documentation that the site was sufficiently characterized, that no significant releases of contaminants to the environment occurred via the Former MO 231-234 Septic System, and that it does not pose a threat to human health or the environment under either industrial or residential land-use scenarios.

Review and analysis of all relevant data for DSS Site 1015 indicate that concentrations of constituents of concern (COCs) at this site were found to be below applicable risk assessment action levels. Thus, DSS Site 1015 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 1015 is located in SNL/NM Technical Area (TA)-V on federally owned land controlled by Kirtland Air Force Base (KAFB) and permitted to the U.S. Department of Energy. The site is located approximately 450 feet east of the entrance into TA-III and about the same distance west of the entrance into the fenced part of TA-V (Figure 2.2.1-1). The abandoned septic system consisted of a 1,000-gallon septic tank and distribution box connected to a drainfield with three 45-foot-long parallel drain lines (Figure 2.2.1-2). Construction details are based upon engineering drawings (SNL/NM November 1987), site inspections, and backhoe excavations of the system. The system received discharges from the former MO 231-234 complex, which was located approximately 30 feet to the south. This MO complex was dismantled and relocated to TA-I in 1995 or 1996 when the new TA-V Building 6585 was constructed.

The surface geology at DSS Site 1015 (now covered by parking lot pavement) 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

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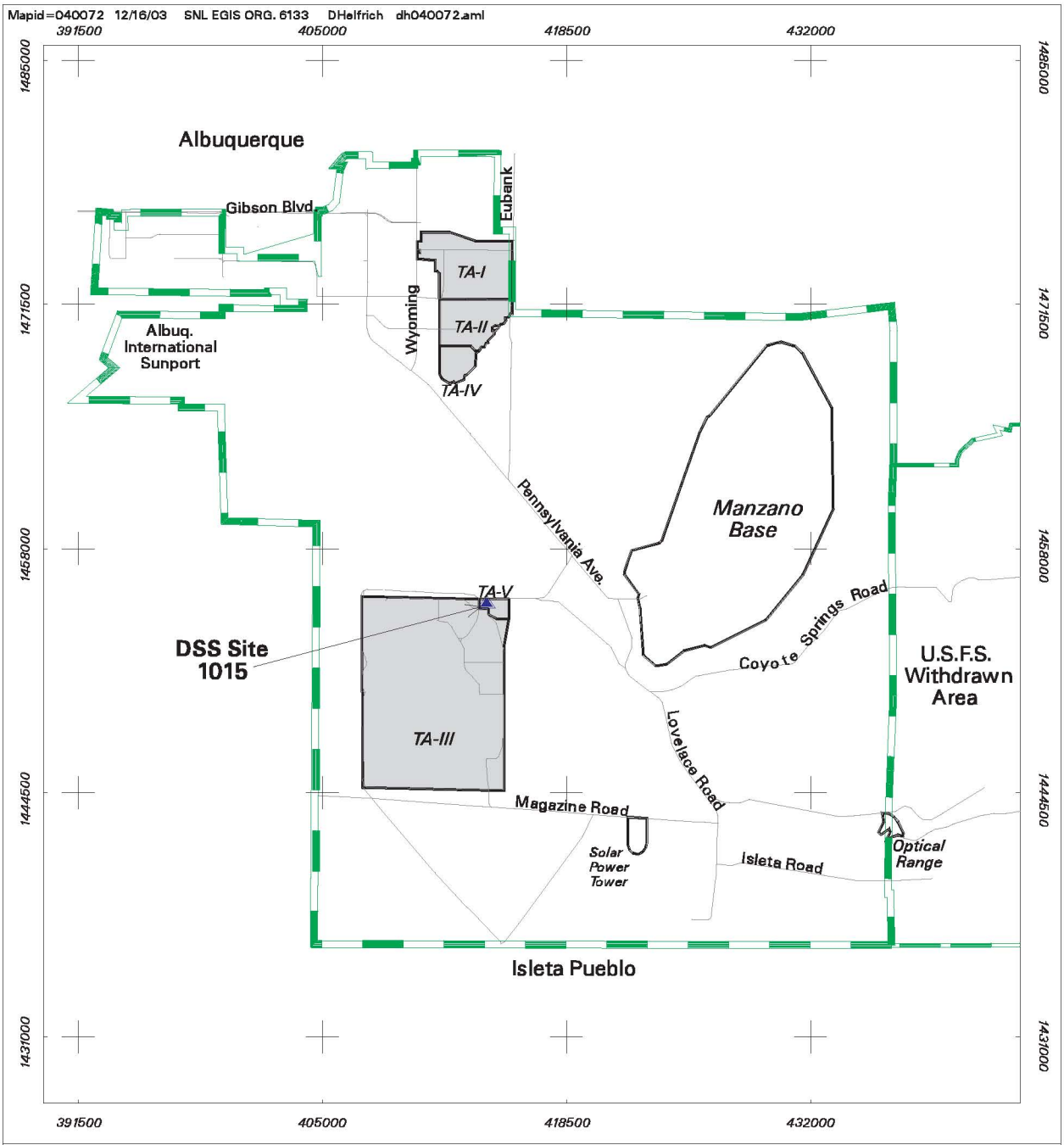

Legend

- DSS Site 1015
- 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 1015, Former MO 231-234 Septic System North of Bldg. 6585, TA-V

0 4500 9000
Scale in Feet

0 1080 2160
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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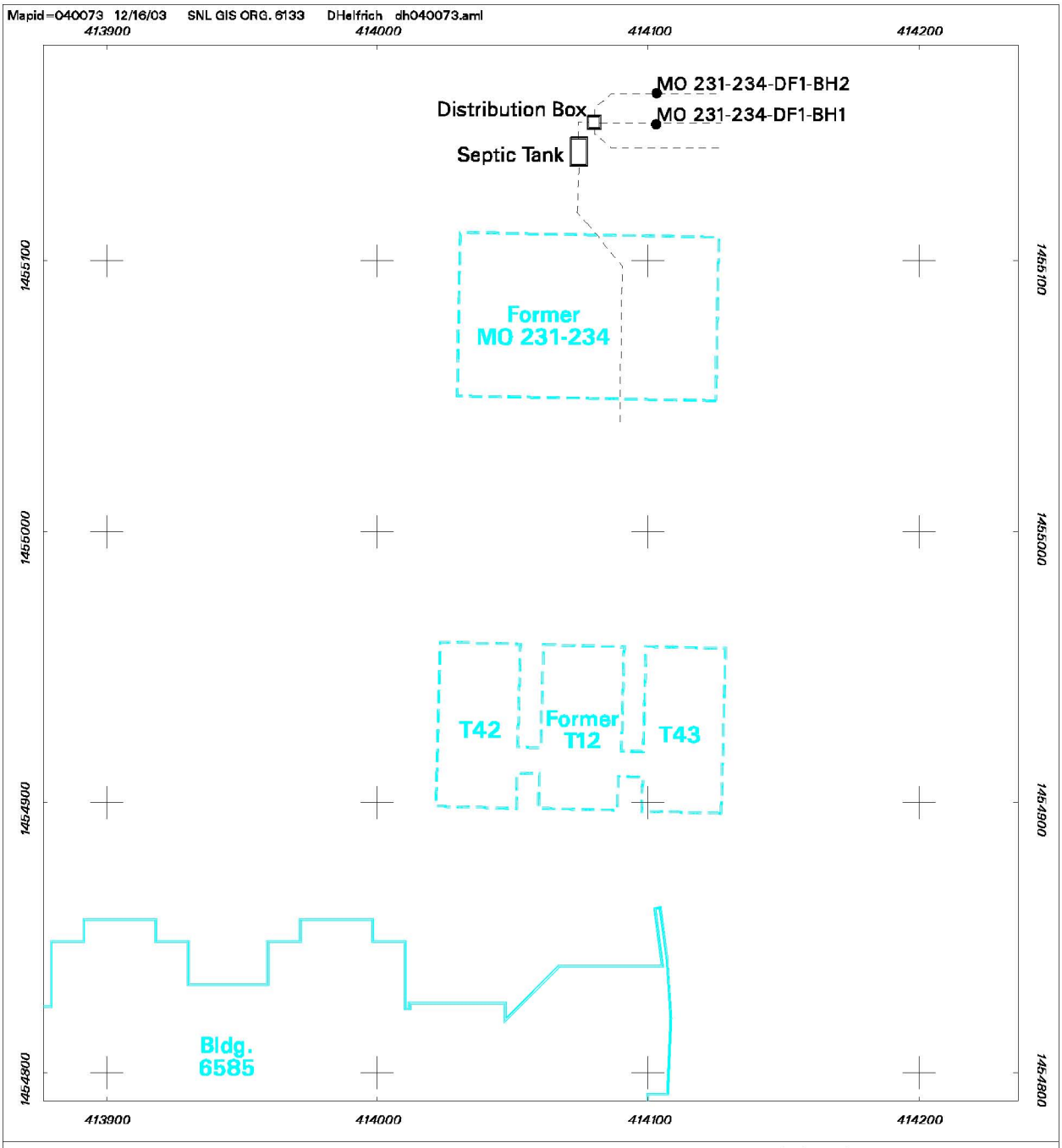

Legend

- Boring Location
- Building 6585
- Former Building Location
- Septic Tank, Distribution Box
- Sanitary Sewerline, Drainfield Drain line

Figure 2.2.1-2
Site Map of Drain and Septic Systems (DSS) Site Number 1015, Former MO 231-234 Septic System, North of Bldg.6585, TA-V

0 30 60
Scale in Feet

0 7.2 14.4
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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Manzanita Mountains east of DSS Site 1015, 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 in the general vicinity of DSS Site 1015 consists primarily of desert grasses, shrubs, and cacti.

The ground surface in the vicinity of this paved-over site is flat to very slightly sloping to the west. Precipitation drains to the northwest corner of the parking lot and then to a shallow storm-water ditch on the north side of the parking lot. Storm water then flows in a northwesterly direction to Arroyo del Coyote, located approximately 1 mile north 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 essentially nonexistent at DSS Site 1015, as virtually all of the moisture either drains away from the site or evaporates. 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 5,419 feet above mean sea level (SNL/NM April 2003). Depth to groundwater is approximately 496 feet below ground surface (bgs) at the site. Groundwater flow is generally to the west in this area (SNL/NM March 2002). The groundwater production wells nearest to DSS Site 1015 are KAFB-4 and KAFB-11, approximately 2.75 and 3.0 miles northwest and northeast of the site, respectively. The nearest groundwater monitoring wells are TAV-MW8 and TAV-MW9, approximately 200 feet west of the site.

2.2.2 Operational History

Although no precise construction information is available, records indicate that the former MO 231-234 facility was an office complex constructed in 1988, and it is assumed that the septic system was also constructed at that time (SNL/NM March 2003). Because operational records are not available, the investigation of this site was planned to be consistent with other DSS site investigations and to sample for the COCs most commonly found at similar facilities. By June 1991, the septic system discharges were routed to the City of Albuquerque sanitary sewer system (Jones June 1991). The old septic system line would have been disconnected, capped, and the system 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 Site 1015 is industrial.

2.3.2 Future/Proposed Land Use

The projected future land use for DSS Site 1015 is industrial (DOE et al. September 1995).

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3.0 INVESTIGATORY ACTIVITIES

3.1 Summary

Three assessment investigations have been conducted at this site. In late 1990 or early 1991, possibly 1992, and 1995, waste characterization samples were collected from the septic tank (Investigation 1). In June 1995, a backhoe was used to physically locate the buried drainfield drain lines at the site (Investigation 2). In 1998 and 1999, near-surface soil samples were collected from two borings in the drainfield (Investigation 3). Investigations 2 and 3 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.

As part of the SNL/NM Septic System Monitoring Program, aqueous and/or sludge waste characterization samples were collected from the former MO 231-234 septic tank in late 1990 or early 1991, possibly in 1992, and again in 1995 (SNL/NM April 1991, SNL/NM June 1993, SNL/NM December 1995). Aqueous samples collected in late 1990 or early 1991 were analyzed at an off-site laboratory for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), oil and grease, nitrate, phenolics, metals, gross alpha/beta activity, tritium, and three other radionuclides. Sludge samples collected on September 30, 1992, were analyzed at an off-site laboratory for metals, gross alpha/beta activity, tritium, and radionuclides by gamma spectroscopy. However, it is unclear from the data summary table whether these samples were collected from the former MO 231-234 septic tank or from another tank connected to a group of nearby trailer-type buildings called T-12, T-42, and T-43. Aqueous and sludge samples were also collected from the septic tank on June 23 and July 13, 1995. The aqueous samples were analyzed at an off-site laboratory for VOCs, SVOCs, pesticides, polychlorinated biphenyls (PCBs), total metals, formaldehyde, fluoride, nitrate plus nitrite, oil and grease, total phenol, gross alpha/beta activity, tritium, and radionuclides by gamma spectroscopy. Sludge samples were also analyzed at an off-site laboratory for VOCs, SVOCs, pesticides, PCBs, total metals, and radiological constituents. 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. The analytical results for these three septic tank sampling events are presented in Annex A.

On January 25, 1996, the residual contents, approximately 978 gallons of waste and added water, were pumped out and managed according to SNL/NM policy (Shain August 1996).

3.3 Investigation 2—Backhoe Excavation

On June 21, 1995, a backhoe was used to determine the location, dimensions, and average depth of the DSS Site 1015 drainfield drain lines. The drainfield was found to have three parallel drain lines arranged as shown on Figure 2.2.1-2, with an average depth of 3 to 3.5 feet bgs. 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.

3.4 Investigation 3—Soil Sampling

Once the system drain lines were located, soil sampling was conducted in accordance with the rationale and procedures in the SAP (SNL/NM October 1999) approved by the NMED. On July 7, 1998, soil samples were collected from two drainfield boreholes. Additional soil samples were collected from the same two boring locations on August 23, 1999. Soil boring locations are shown on Figure 2.2.1-2. A summary of the boreholes, sample depths, sample analyses, analytical methods, laboratories, and sample dates is presented in Table 3.4-1.

3.4.1 Soil Sampling Methodology

An auger drill rig was used to sample all boreholes at two depth intervals. In the drainfield, the top of the shallow interval started at the bottom of the drain line trenches, as determined by the backhoe excavation, and the lower (deep) interval started at 5 feet beneath the top sample 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. The area sampled, analytical methods, and laboratories used for the DSS Site 1015 soil samples are summarized in Table 3.4-1.

Table 3.4-1
Summary of Area Sampled, Analytical Methods, and Laboratories Used for
DSS Site 1015, Former MO 231-234 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
Drainfield	2	5, 10	4	VOCs EPA Method 8260	GEL	08-23-99
	2	5, 10	4 + 1 Duplicate	SVOCs EPA Method 8270	GEL	07-07-98
	2	5, 10	4	PCBs EPA Method 8082	GEL	08-23-99
	2	5, 10	4 + 1 Duplicate	HE Compounds EPA Methods 8330	ERCL, GEL	07-07-98
	2	5, 10	4 + 1 Duplicate	RCRA Metals + Cu, Zn EPA Methods 6000/7000	ERCL, GEL	07-07-98
	2	5, 10	4	Hexavalent Chromium EPA Method 7196A	GEL	08-23-99
	2	5, 10	4	Total Cyanide EPA Method 9012A	GEL	08-23-99
	2	5, 10	4 + 1 Duplicate	Gamma spectroscopy EPA Method 901.1	RPSD, GEL	07-07-98
	2	5, 10	4	Gross Alpha/Beta Activity EPA Method 900.0	GEL	07-07-98

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

3.4.2 Soil Sampling Results and Conclusions

Analytical results for the soil samples collected at DSS Site 1015 are presented and discussed in this section.

VOCs

VOC analytical results for the four soil samples collected from the drainfield boreholes are summarized in Table 3.4.2-1. Method detection limits (MDLs) for the VOC soil analyses are presented in Table 3.4.2-2. Two VOCs (2-butanone and toluene) were detected in three of the four VOC samples collected from this site. Even though these compounds were not detected in the associated trip blank (TB), they are common laboratory contaminants and may not indicate soil contamination at this site.

SVOCs

SVOC analytical results for the four soil samples and one duplicate collected from the drainfield boreholes are summarized in Table 3.4.2-3. MDLs for the SVOC soil analyses are presented in Table 3.4.2-4. No SVOCs were detected in any of the soil samples collected from this site.

PCBs

PCB analytical results for the four soil samples collected from the drainfield boreholes are summarized in Table 3.4.2-5. MDLs for the PCB soil analyses are presented in Table 3.4.2-6. No PCBs were detected in any of the soil samples collected from this site. However, the MDLs for the PCBs in the sample collected from the 5-foot interval in borehole BH1 were elevated as the laboratory applied a 20X dilution to the sample because it "was very dark." No other explanation was offered by the laboratory.

HE Compounds

High explosive (HE) compound analytical results for the four soil samples and one duplicate collected from the drainfield boreholes are summarized in Table 3.4.2-7. MDLs for the HE soil analyses are presented in Table 3.4.2-8. No HE compounds were detected in any of the soil samples collected from this site.

RCRA Metals Plus Copper and Zinc, and Hexavalent Chromium

Resource Conservation and Recovery Act (RCRA) metals plus copper and zinc, and hexavalent chromium analytical results for the four soil samples and one duplicate collected from the drainfield boreholes are summarized in Table 3.4.2-9. MDLs for the metals soil analyses are presented in Table 3.4.2-10. The metals soil samples collected at this site were analyzed for copper and zinc in addition to the eight RCRA metals because copper and zinc concentrations were somewhat elevated in the sludge samples collected from the septic tank in 1992 and 1995. With the exception of arsenic, none of the metal concentrations detected in these samples exceeded the corresponding NMED-approved

Table 3.4.2-1
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, VOC Analytical Results
August 1999
(Off-Site Laboratory)

Sample Attributes			VOCs (EPA Method 8260[a]) (µg/kg)	
Record Number[b]	ER Sample ID	Sample Depth (ft)	2-Butanone	Toluene
602763	MO231/234-DF1-BH1-5-S	5	ND (3.2)	ND (0.9)
602763	MO231/234-DF1-BH1-10-S	10	**12**	**4.2**
602763	MO231/234-DF1-BH2-5-S	5	**12**	**1.5**
602763	MO231/234-DF1-BH2-10-S	10	**16**	**9.6**
Quality Assurance/Quality Control Sample (µg/L)				
602763	T12/T42/T43-SP1-TB[c]	NA	ND (5.9)	ND (0.5)

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.
DF = Drainfield.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
MO = Mobile Office.
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 3.4.2-2
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, VOC Analytical MDLs
August 1999
(Off-Site Laboratory)

Analyte	EPA Method 8260[a] Detection Limit (µg/kg)
Acetone	10.3
Benzene	0.5
Bromodichloromethane	0.1
Bromoform	0.3
Bromomethane	0.3
2-Butanone	3.2
Carbon disulfide	0.3
Carbon tetrachloride	0.5
Chlorobenzene	0.3
Chloroethane	0.3
Chloroform	0.1
Chloromethane	0.2
Dibromochloromethane	0.2
1,1-Dichloroethane	0.1
1,2-Dichloroethane	0.2
1,1-Dichloroethene	0.3
cis-1,2-Dichloroethene	0.1
trans-1,2-Dichloroethene	0.1
1,2-Dichloropropane	0.2
cis-1,3-Dichloropropene	0.2
trans-1,3-Dichloropropene	0.3
Ethylbenzene	0.3
2-Hexanone	2.8
4-Methyl-2-pentanone	3.1
Methylene chloride	1.4
Styrene	0.3
1,1,2,2-Tetrachloroethane	0.6
Tetrachloroethene	0.4
Toluene	0.9
1,1,1-Trichloroethane	0.1
1,1,2-Trichloroethane	0.3
Trichloroethene	0.3
Vinyl acetate	2.1
Vinyl chloride	0.4
Xylene	0.7

[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.
MO = Mobile Office.
VOC = Volatile organic compound.

Table 3.4.2-3
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, SVOC Analytical Results
July 1998
(Off-Site Laboratory)

Sample Attributes			SVOCs
Record Number[b]	ER Sample ID	Sample Depth (ft)	(EPA Method 8270[a]) (µg/kg)
600429	MO231/234-DF1-BH1-5-S	5	ND
600429	MO231/234-DF1-BH1-10-S	10	ND
600429	MO231/234-DF1-BH2-5-S	5	ND
600429	MO231/234-DF1-BH2-10-S	10	ND
600429	MO231/234-DF1-BH2-10-DU	10	ND

[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
BH = Borehole.
DF = Drainfield.
DSS = Drain and Septic Systems.
DU = Duplicate sample.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification
µg/kg = Microgram(s) per kilogram.
MO = Mobile Office.
ND = Not detected.
S = Soil sample.
SVOC = Semivolatile organic compound.

Table 3.4.2-4
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, SVOC Analytical MDLs
July 1998
(Off-Site Laboratory)

Analyte	EPA Method 8270[a] Detection Limit (µg/kg)
Acenaphthene	170
Acenaphthylene	170
Anthracene	170
Benzo(a)anthracene	170
Benzo(a)pyrene	170
Benzo(b)fluoranthene	170
Benzo(k)fluoranthene	170
Benzo(g,h,i)perylene	170
Benzoic acid	330
Benzyl alcohol	170
4-Bromophenyl phenyl ether	170
Butylbenzyl phthalate	170
4-Chlorobenzenamine	330
bis(2-Chloroethoxy)methane	170
bis(2-Chloroethyl)ether	170
bis-Chloroisopropyl ether	170
4-Chloro-3-methylphenol	170
2-Chloronaphthalene	170
2-Chlorophenol	170
4-Chlorophenyl phenyl ether	170
Chrysene	170
m,p-Cresol	170
o-Cresol	170
Dibenz[a,h]anthracene	170
Dibenzofuran	170
Di-n-butyl phthalate	170
Di-n-octyl phthalate	170
1,2-Dichlorobenzene	170
1,3-Dichlorobenzene	170
1,4-Dichlorobenzene	170
3,3'-Dichlorobenzidine	830
2,4-Dichlorophenol	170
Diethylphthalate	170
2,4-Dimethylphenol	170
Dimethylphthalate	170
Dinitro-o-cresol	170
2,4-Dinitrophenol	330
2,4-Dinitrotoluene	170
2,6-Dinitrotoluene	170
1,2-Diphenylhydrazine	170
bis(2-Ethylhexyl) phthalate	170
Fluoranthene	170

Refer to footnotes at end of table.

Table 3.4.2-4 (Concluded)
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, SVOC Analytical MDLs
July 1998
(Off-Site Laboratory)

Analyte	EPA Method 8270[a] Detection Limit (µg/kg)
Fluorene	170
Hexachlorobenzene	170
Hexachlorobutadiene	170
Hexachlorocyclopentadiene	170
Hexachloroethane	170
Indeno(1,2,3-cd)pyrene	170
Isophorone	170
2-Methylnaphthalene	170
Naphthalene	170
2-Nitroaniline	170
3-Nitroaniline	170
4-Nitroaniline	170
Nitrobenzene	170
n-Nitrosodiphenylamine	170
n-Nitrosodipropylamine	170
2-Nitrophenol	170
4-Nitrophenol	330
Pentachlorophenol	170
Phenanthrene	170
Phenol	170
Pyrene	170
1,2,4-Trichlorobenzene	170
2,4,5-Trichlorophenol	170
2,4,6-Trichlorophenol	170

[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.
MO = Mobile Office.
SVOC = Semivolatile organic compound.

Table 3.4.2-5
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, PCB Analytical Results
August 1999
(Off-Site Laboratory)

Sample Attributes			PCBs (EPA Method 8082[a]) (µg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	
602763	MO231/234-DF1-BH1-5-S	5	ND
602763	MO231/234-DF1-BH1-10-S	10	ND
602763	MO231/234-DF1-BH2-5-S	5	ND
602763	MO231/234-DF1-BH2-10-S	10	ND

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

Table 3.4.2-6
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, PCB Analytical MDLs
August 1999
(Off-Site Laboratory)

Analyte	EPA Method 8082[a] Detection Limit (µg/kg)
Aroclor-1016	1.22–24.3
Aroclor-1221	2.82–56.4
Aroclor-1232	1.63–32.6
Aroclor-1242	1.67–33.4
Aroclor-1248	0.907–18.1
Aroclor-1254	1.16–23.3
Aroclor-1260	0.943–18.9

[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.
MO = Mobile Office.
PCB = Polychlorinated biphenyl.

Table 3.4.2-7
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, HE Compound Analytical Results
July 1998
(On- and Off-Site Laboratories)

Sample Attributes			HE (EPA Method 8330[a]) (mg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	
600428	MO231/234-DF1-BH1-5-S	5	ND
600428	MO231/234-DF1-BH1-10-S	10	ND
600428	MO231/234-DF1-BH2-5-S	5	ND
600428	MO231/234-DF1-BH2-10-S	10	ND
600429	MO231/234-DF1-BH2-10-DU	10	ND

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

Table 3.4.2-8
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, HE Compound Analytical MDLs
July 1998
(On- and Off-Site Laboratories)

Analyte	EPA Method 8330[a] Detection Limit (mg/kg)
2-Amino-4,6-dinitrotoluene	0.0066–0.13
4-Amino-2,6-dinitrotoluene	0.0055–0.11
1,3-Dinitrobenzene	0.0041–0.076
2,4-Dinitrotoluene	0.0062–0.25
2,6-Dinitrotoluene	0.0065–0.29
HMX	0.0053–0.13
Nitrobenzene	0.0052–0.17
2-Nitrotoluene	0.0078–0.15
3-Nitrotoluene	0.0011–0.15
4-Nitrotoluene	0.0011–0.13
Pentaerythritol tetranitrate	0.0075–0.35
RDX	0.0097–0.18
1,3,5-Trinitrobenzene	0.0066–0.11
2,4,6-Trinitrotoluene	0.0057–0.29

[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.
mg/kg = Milligram(s) per kilogram.
MO = Mobile Office.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

Table 3.4.2-9
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, Metals Analytical Results
July 1998 and August 1999
(On- and Off-Site Laboratories)

Sample Attributes			Metals (EPA Method 6000/7000/7196A[a]) (mg/kg)										
Record Number[b]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium	Chromium (VI)	Copper	Lead	Mercury	Selenium	Silver	Zinc
600428, 602763	MO231/234-DF1-BH1-5-S	5	3.3 J	21 J	0.063 J (0.16)	5 J	ND (0.0606)	4.1 J	2.7 J	0.047 J (0.16)	ND (0.3 J)	ND (0.04 J)	11 J (16)
600428, 602763	MO231/234-DF1-BH1-10-S	10	**4.9 J**	110 J	0.16 J (0.17)	10 J	0.0805 J (0.201)	8.7 J	7.5 J	ND (0.042 J)	0.36 J (1.3)	ND (0.042 J)	27 J
600428, 602763	MO231/234-DF1-BH2-5-S	5	4.2 J	44 J	0.06 J (0.16)	4.1 J	ND (0.0604)	3.3 J (4.1)	3.2 J	0.047 J (0.16)	ND (0.31 J)	ND (0.041 J)	7.6 J (16)
600428, 602763	MO231/234-DF1-BH2-10-S	10	3.3 J	48 J	0.058 J (0.16)	4.8 J	ND (0.0598)	4.6 J	3.9 J	ND (0.04 J)	ND (0.3 J)	ND (0.04 J)	12 J (16)
600429	MO231/234-DF1-BH2-10-DU	10	**4.45**	117 J	0.0526 J (0.595)	9.1	NS	8.23	6.14	ND (0.0173)	0.228 J (0.595)	0.247 J (0.595)	29.8
Background Concentration—Southwest Area Supergroup[c]			4.4	214	0.9	15.9	1	18.2	11.8	<0.1	<1	<1	62

Note: Values in **bold** exceed background soil concentrations.

[a]EPA November 1986.

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

[c]Dinwiddie September 1997.

BH = Borehole.
DF = Drainfield.
DSS = *Drain and Septic Systems.*
DU = Duplicate sample.
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.
MO = Mobile Office.
ND ( ) = Not detected above the MDL, shown in parentheses.
NS = No sample.
S = Soil sample.

Table 3.4.2-10
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, Metals Analytical MDLs
July 1998 and August 1999
(On- and Off-Site Laboratories)

Analyte	EPA Method 6000/7000/7196A[a] Detection Limit (mg/kg)
Arsenic	0.149–0.64
Barium	0.0166–0.53
Cadmium	0.0104–0.042
Chromium	0.0365–0.74
Chromium (VI)	0.0598–0.0606
Copper	0.066–1.1
Lead	0.0339–0.32
Mercury	0.0173–0.042
Selenium	0.07–0.32
Silver	0.031–0.042
Zinc	0.0483–4.2

[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.
MO = Mobile Office.

background concentrations. Arsenic was detected above the NMED-approved background in both the 10-foot sample from borehole BH1 and the 10-foot duplicate sample from borehole BH2.

Total Cyanide

Analytical results for the four soil samples collected from the drainfield boreholes are summarized in Table 3.4.2-11. MDLs for the cyanide soil analyses are presented in Table 3.4.2-12. Cyanide was not detected in any of the soil samples collected from this site.

Radionuclides

Analytical results for the gamma spectroscopy analysis of the four soil samples and one duplicate collected from the drainfield boreholes are summarized in Table 3.4.2-13. Uranium-238 was detected above the NMED-approved background activity level in the duplicate sample from the 10-foot interval in borehole BH2. No other radionuclide activities were detected above background in any of the other gamma spectroscopy samples from this site.

Table 3.4.2-11
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, Total Cyanide Analytical Results
August 1999
(Off-Site Laboratory)

Sample Attributes			Total Cyanide
Record Number[b]	ER Sample ID	Sample Depth (ft)	(EPA Method 9012A[a]) (mg/kg)
602763	MO231/234-DF1-BH1-5-S	5	ND
602763	MO231/234-DF1-BH1-10-S	10	ND
602763	MO231/234-DF1-BH2-5-S	5	ND
602763	MO231/234-DF1-BH2-10-S	10	ND

[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
BH = Borehole.
DF = Drainfield.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
mg/kg = Milligram(s) per kilogram.
MO = Mobile Office.
ND = Not detected.
S = Soil sample.

Table 3.4.2-12
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, Total Cyanide Analytical MDLs
August 1999
(Off-Site Laboratory)

Analyte	EPA Method 9012A[a] Detection Limit (mg/kg)
Total Cyanide	0.127–0.136

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

Table 3.4.2-13
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, Gamma Spectroscopy Analytical Results
July 1998
(On- and Off-Site Laboratories)

Sample Attributes			Activity (EPA Method 901.1[a] (pCi/g)							
			Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Record Number[b]	ER Sample ID	Sample Depth (ft)	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
600430	MO231/234-DF1-BH1-5-S	5	ND (0.0150)	--	0.475	0.236	ND (0.0854)	--	0.569	0.312
600430	MO231/234-DF1-BH1-10-S	10	ND (0.0186)	--	0.775	0.382	0.112	0.0940	0.463	0.350
600430	MO231/234-DF1-BH2-5-S	5	ND (0.0175)	--	0.525	0.267	ND (0.0981)	--	0.293	0.288
600430	MO231/234-DF1-BH2-10-S	10	ND (0.0179)	--	0.740	0.353	ND (0.100)	--	0.493	0.304
600429	MO231/234-DF1-BH2-10-DU	10	ND (0.0117)	--	0.807	0.108	ND (0.0595)	--	**1.9**	1.31
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 activity levels.
[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.
DF = Drainfield.
DSS = Drain and Septic Systems.
DU = Duplicate sample.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
MDA = Minimum detectable activity.
MO = Mobile Office.
NA = Not applicable.
ND ( ) = Not detected above the MDA, shown in parentheses.
pCi/g = Picocurie(s) per gram.
S = Soil sample.
-- = Error not calculated for nondetect results.

Gross Alpha/Beta Activity

Gross alpha/beta analytical results for the four soil samples collected from the drainfield boreholes are summarized in Table 3.4.2-14. No gross alpha/beta activity was detected above the New Mexico-established background (Miller September 2003) in any of the samples. These results indicate no significant levels of radioactive material in the site soil.

Table 3.4.2-14
Summary of DSS Site 1015, Former MO 231-234 Septic System
Confirmatory Soil Sampling, Gross Alpha/Beta Analytical Results
July 1998
(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]
600429	MO231/234-DF1-BH1-5-S	5	9.42	3.28	33.8	4.45
600429	MO231/234-DF1-BH1-10-S	10	7.68	3.01	21.8	3.8
600429	MO231/234-DF1-BH2-5-S	5	10.7	3.3	22.2	3.87
600429	MO231/234-DF1-BH2-10-S	10	17.4	4.18	22	3.74
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.
DF = Drainfield.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
MO = Mobile Office.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.
S = Soil sample.

3.4.3 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 sample duplicates, equipment blanks (EBs), and TBs. 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 samples and sent to the laboratory. 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. No EB samples were collected at DSS Site 1015.

Aqueous TBs, 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 samples in that batch. No VOCs were detected in this TB (Table 3.4.2-1).

To assess the precision and repeatability of sampling and analytical procedures, duplicate soil samples (designated 'DU') were collected and analyzed at the on- and off-site laboratories for SVOCs, HE compounds, RCRA metals plus zinc and copper, and radionuclides by gamma spectroscopy. As shown in Tables 3.4.2-3 and 3.4.2-7, SVOC and HE compounds were not detected in any of the primary or duplicate samples from this site. As shown in Table 3.4.2-9, metals concentrations in the primary and duplicate samples from the 10-foot interval in borehole BH2 that were sent to different laboratories compared as follows:

- Arsenic and cadmium concentrations were comparable.
- Barium, chromium, copper, lead, and zinc concentrations in the duplicate sample were approximately twice those in the primary sample.
- Mercury was not detected in either of the samples.
- Selenium and silver were not detected in the primary sample, but were detected at low concentrations in the duplicate sample.

As shown in Table 3.4.2-13, gamma spectroscopy activities for the four representative radionuclides in the primary and duplicate samples from the 10-foot interval in borehole BH2 (also submitted to different laboratories) compared as follows:

- Cesium-137 and uranium-235 were not detected in either sample.
- Thorium-232 activities were comparable in both samples.
- The uranium-238 activity in the duplicate sample (1.9 picocuries [pCi]/gram [g]) was approximately 4 times higher than that in the primary sample (0.493 pCi/g).

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. 2 (SNL/NM July 1996). Annex B contains the data validation reports for the samples collected at this site. The data are acceptable for use in this NFA proposal.

3.5 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 1015.

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4.0 CONCEPTUAL SITE MODEL

The conceptual site model for DSS Site 1015, the Former MO 231-234 Septic System, is based upon the COCs identified in the soil samples collected from beneath the drainfield 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 1015 consist of VOCs, SVOCs, PCBs, HE compounds, cyanide, RCRA metals plus copper and zinc, hexavalent chromium, and radionuclides. Two VOCs (2-butanone and toluene) were detected in samples from this site. There were no SVOCs, PCBs, HE compounds, or cyanide detected in any of the soil samples collected at this site. One of the 11 metals (arsenic) was detected above the nonquantified or NMED-approved maximum background concentration for SNL/NM Southwest Area Supergroup soils (Dinwiddie September 1997). However, when a metal concentration exceeded its maximum background screening value, or the nonquantified background value, it was carried forward in the risk assessment process. One of the four representative gamma spectroscopy radionuclides (uranium-238) was detected at an activity exceeding the corresponding background level. 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 drainfield. Possible secondary release mechanisms include the uptake of COCs that may have been released into the soil beneath the drainfield (Figure 4.2-1). The depth to groundwater at the site (approximately 496 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 C provides additional discussion on the fate and transport of COCs at DSS Site 1015.

Table 4.2-1 summarizes the potential COCs for DSS Site 1015. 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 1015 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 dermal pathway is included because of the potential for receptors to be exposed to the contaminated soil.

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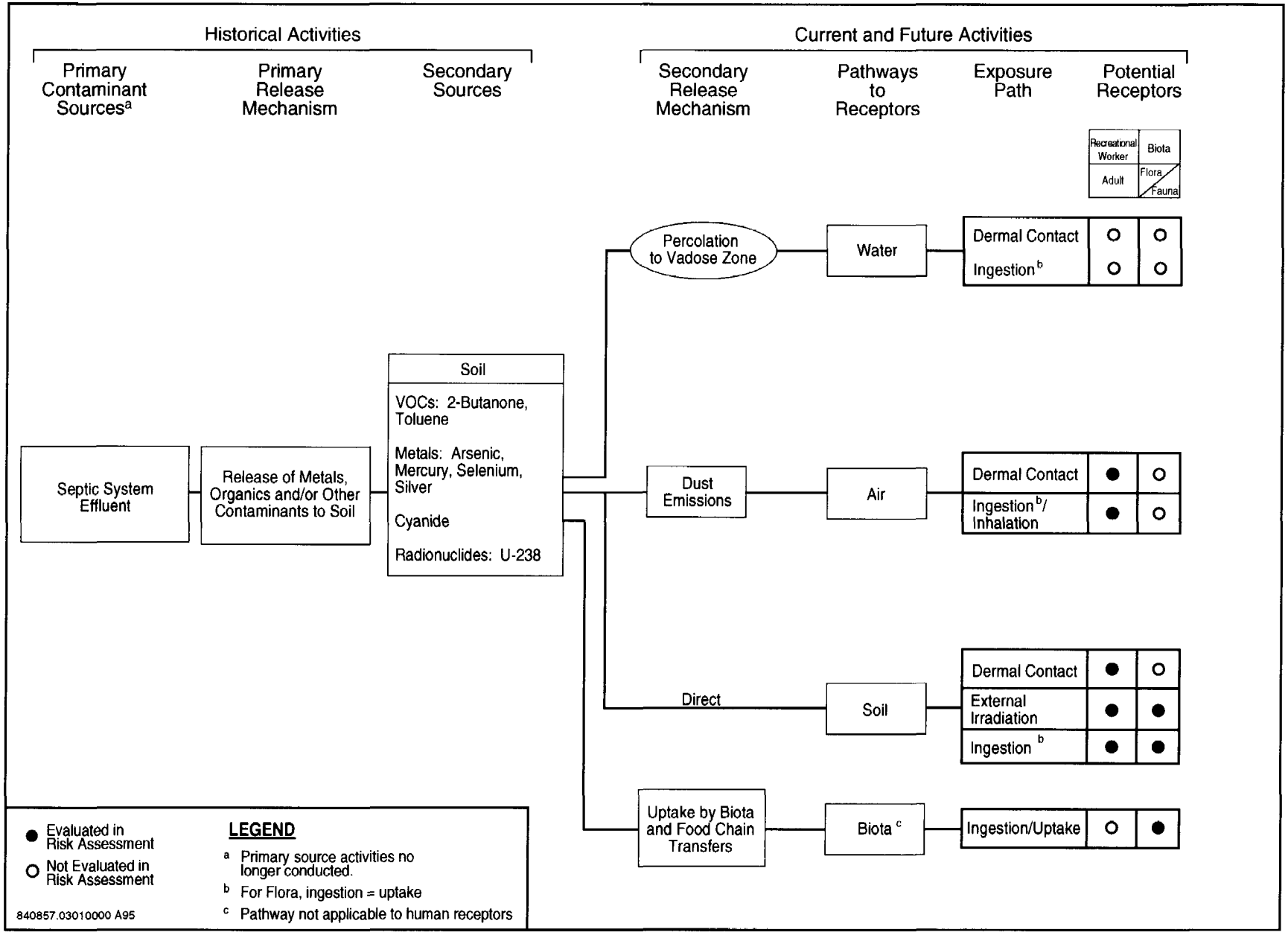

Figure 4.2-1

Conceptual Site Model Flow Diagram for DSS Site 1015, Former MO 231-234 Septic System

Table 4.2-1
Summary of Potential COCs for DSS Site 1015, Former MO 231-234 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		4	2-Butanone	NA	0.016	0.0104	3
		4	Toluene	NA	0.0096	0.0039	3
SVOCs		5	None	NA	NA	NA	None
PCBs		4	None	NA	NA	NA	None
HE Compounds		5	None	NA	NA	NA	None
RCRA Metals + Copper and Zinc		5	Arsenic	4.4	4.9 J	4.03	2
		5	Mercury	NQ	0.047 J	0.029 J	None
		5	Selenium	NQ	0.36 J	0.209 J	None
		5	Silver	NQ	0.247 J	0.066 J	None
Hexavalent Chromium		4	None	NA	NA	NA	None
Cyanide		4	Cyanide	NQ	ND (0.139)	0.0675	None
Radionuclides (pCi/g)	Gamma Spectroscopy	5	U-238	1.4	1.9	NC[f]	1
	Gross Alpha	4	None	NA	NA	NA	None
	Gross Beta	4	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 the maximum MDL or MDA if nothing was detected.
[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 = Analytical result was qualified as an estimated value.
MDA = Minimum detectable activity.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.
MO = Mobile Office.
NA = Not applicable.
NC = Not calculated.
PCB = Polychlorinated biphenyl.
pCi/g = Picocurie(s) per gram.
RCRA = Resource Conservation and Recovery Act.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.

Potential biota receptors include flora and fauna at the site. Major exposure routes for biota include direct soil ingestion, ingestion of COCs through food chain transfers, and direct contact with COCs in soil. Annex C provides additional discussion of the exposure routes and receptors at DSS Site 1015.

4.3 Site Assessment

Site assessment at DSS Site 1015 included risk assessments for both human health and ecological risk. This section briefly summarizes the site assessment results, and Annex C discusses the risk assessment performed for DSS Site 1015 in more detail.

4.3.1 Summary

The site assessment concluded that DSS Site 1015 poses no significant threat to human health under either the industrial or residential land-use scenarios. Ecological risks are expected to be very low.

4.3.2 Risk Assessments

4.3.2.1 Human Health

DSS Site 1015 has been recommended for an industrial land-use scenario (DOE et al. September 1995). Because 2-butanone, toluene, arsenic, mercury, selenium, silver, cyanide, and uranium-238 are present above background or nonquantified background levels, it was necessary to perform a human health risk assessment analysis for the site, which included these COCs. Annex C 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 is 0.02 at DSS Site 1015 under 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 excess cancer risk for DSS Site 1015 COCs is 3E-6 for the industrial 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 incremental excess cancer risk is 3.14E-7. Both the incremental HI and excess cancer risk are below NMED guidelines.

The HI calculated for the COCs is 0.23 at DSS Site 1015 under 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 0.03. The excess cancer risk for DSS Site 1015 COCs is 1E-5 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 above the suggested acceptable risk value. The incremental excess cancer risk is 1.29E-6. 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 lower than U.S. Environmental Protection Agency (EPA) guidance values. The estimated TEDE is 1.4E-2 millirem (mrem)/year (yr) for the industrial land-use scenario, which is much lower than the EPA's numerical guidance of 15 mrem/yr (EPA 1997a). The corresponding incremental estimated cancer risk value is 2.4E-9 for the industrial land-use scenario. Furthermore, the incremental TEDE for the residential land-use scenario that results from a complete loss of institutional control is 3.5E-2 mrem/yr with an associated risk of 3.7E-7. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, DSS Site 1015 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 Radiological and Nonradiological Risks from
DSS Site 1015, Former MO 231-234 Septic System Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	3.14E-7	2.4E-9	3.1E-7
Residential	1.29E-6	3.7E-7	1.7E-6

DSS = Drain and Septic Systems.
MO = Mobile Office.

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 C, Sections IV, VII.2, and VII.3). 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.

Table 18 of Annex C presents the results of the ecological risk assessment. Site-specific information was incorporated into the risk assessment when such data were available. No hazard quotients greater than 1 were originally predicted. Therefore, ecological risks associated with this site are expected to be very low.

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 1015 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 ecological risks at DSS Site 1015 are expected to be very low, 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 1015 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 after conservative exposure assumptions are analyzed.

5.2 Criterion

Based upon the evidence provided in Section 5.1, DSS Site 1015 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).

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ANNEX A
DSS Site 1015
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 25

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

BUILDING MO 231 - 234

SAMPLE NUMBERS SNLA004899, SNLA004900

Parameter	Results	Units
VOLATILE ORGANICS		
Acetone*	340	µg/l
SEMIVOLITILE ORGANICS		
Phenol*	25	µg/l
Benzyl Alcohol*	19	µg/l
4-Methylphenol*	130	µg/l
Benzoic Acid*	130	µg/l
Chrysene	15	µg/l
INORGANICS		
Oil and Grease	2.3	mg/l
Nitrate as N	1.9	mg/l
Phenolics	0.28	mg/l
METALS		
Barium	0.067	mg/l
Cadmium	0.0053	mg/l
Copper	0.19	mg/l
Manganese	0.035	mg/l
Zinc	0.15	mg/l
RADIOLOGICAL		
Gross Alpha	3.2	pCi/l
Gross Beta	34	pCi/l
Tritium	2.5	pCi/ml
Uranium 235	1.6	pCi/l
Uranium 238	1.8	pCi/l
Plutonium 239/240	1.5	pCi/l

*Not on total toxic organics list

Mobile Offices 231-234 and T12, T26, T42, and T43
Area 3/5
Sample ID No. SNLA008603
Tank ID No. AD89026R

On September 30, 1992, sludge samples were collected from the septic tank serving Area 3/5 Mobile Offices 231-234 and temporary buildings T12, T26, T42, and T43. Several metals that are regulated under the New Mexico Water Quality Control Commission Regulations, the City of Albuquerque sewer ordinance, and the Resource Conservation and Recovery Act were detected at low levels in the sludge: barium, cadmium, chromium, lead, mercury, and selenium. Additional sludge characterization may be needed to determine if the waste is a characteristic hazardous waste. Three additional metals that are only COA-regulated were detected in the sludge: copper, manganese, and zinc.

During review of the radiological data, no parameters were measured at concentrations exceeding U.S. Department of Energy derived concentration guidelines or the investigation levels established during this monitoring effort.

Results of Septic Tank Analyses[a] (Sludge Sample)			
Building No./Area:	**MO231-234, T12, T26, T42, and T43; A3/5**		
Tank ID No.:	**#AD89026R**		
Date Sampled:	**9/30/92**		
Sample ID No.:	**SNLA008603**		
Analytical Parameter	**Measured Concentration**	**± 2 Sigma Uncertainty**	**Units**
Water Content	88	NA	%
Arsenic	ND (4.0)	NA	mg/kg
Barium	280	NA	mg/kg
Cadmium	0.89	NA	mg/kg
Chromium	8.8	NA	mg/kg
Copper	225	NA	mg/kg
Lead	16.7	NA	mg/kg
Manganese	107	NA	mg/kg
Mercury	1.2	NA	mg/kg
Nickel	--	NA	mg/kg
Selenium	2.9	NA	mg/kg
Silver	ND (8.1)	NA	mg/kg
Thallium	ND (4.0)	NA	mg/kg
Zinc	702	NA	mg/kg
Gross Alpha	0E+01	2E+01	pCi/g
Gross Beta	-3+E01	4E+01	pCi/g
Gross Alpha	1E+01	2E+01	pCi/g
Gross Beta	0E+01	4E+01	pCi/g
Gross Alpha	1E+01	2E+01	pCi/g
Gross Beta	0E+01	4E+01	pCi/g
Gross Alpha	2E+01	2E+01	pCi/g
Gross Beta	-2E+01	3E+01	pCi/g
Tritium	-1E+02	3E+02	pCi/L
Bismuth-214	<0.0441	NA	pCi/g
Cesium-137	<0.0127	NA	pCi/g
Potassium-40	0.196	0.0485	pCi/g
Lead-212	0.0450	0.00693	pCi/g
Lead-214	0.0857	0.00963	pCi/g
Radium-226	0.161	0.105	pCi/g
Thorium-234	<0.250	NA	pCi/g
Thallium-208	<0.0127	NA	pCi/g

[a]Note that gamma spectrum results are given for weight of sludge.
ND = Not Detected
NA = Not Applicable

RESULTS OF SEPTIC TANK SAMPLING
CHEMICAL ANALYSES OF AQUEOUS SAMPLE

Building ID: Bldg MO231-234
Sample ID Number: 024417
Date Sampled: 6-23-95

Parameter (Method)	Result	Detection Limit (DL)	NM Discharge Limit[a]	COA Discharge Limit[b]	Comments
Volatile Organics (8260)	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	
Acetone	0.022	0.010	NR	TTO = 5.0	
Toluene	0.003J	0.010	0.75	TTO = 5.0	
Semivolatile Organics (8270)	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	
Napthalene	0.008J	0.010	NR	TTO = 5.0	
Napthalene(reanalysis)	0.008J	0.010	NR	TTO = 5.0	
bis(2-Ethylhexyl)Phthalate	0.003BJ	0.010	NR	TTO = 5.0	
bis(2-Ethylhexyl)Phthalate (reanalysis)	0.006BJ	0.010	NR	TTO = 5.0	
Pesticides/PCBs (8080)	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	
gamma-BHC (Lindane)	0.00016	0.00005	NR	TTO = 5.0	
Metals (6010/7470)	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	
Arsenic	ND	0.500	0.1	2.0	
Barium	0.0931J	0.200	1.0	20.0	
Cadmium	0.0108	0.005	0.01	2.8	(Exceeds NM discharge limit)
Chromium	0.0232	0.020	0.05	20.0	
Copper	0.0931	0.025	1.0	16.5	
Lead	0.0123J	0.100	0.05	3.2	
Manganese	0.0793	0.010	0.2	20.0	
Nickel	0.0715	0.040	0.2	12.0	
Selenium	0.0130	0.005	0.05	2.0	
Silver	0.0216	0.010	0.05	5.0	
Thallium	0.0132	0.010	NR	NR	
Zinc	0.130	0.020	10.0	28.0	
Mercury	ND	0.0002	0.002	0.1	
Miscellaneous Analyses	*(mg/L)*	*(mg/L)*	*(mg/L)*	*(mg/L)*	

Refer to footnotes at end of table.

RESULTS OF SEPTIC TANK SAMPLING

CHEMICAL ANALYSES OF AQUEOUS SAMPLE

Building ID: Bldg MO231-234

Sample ID Number: 024417

Date Sampled: 6-23-95

Parameter (Method)	Result	Detection Limit (DL)	NM Discharge Limit[a]	COA Discharge Limit[b]	Comments
Field pH	7.2 pH units	0 - 14 pH units	6 – 9 pH units	5 – 11 pH units	
Formaldehyde (NIOSH 3500)	1.3	0.25	NR	260.0	
Fluoride (300.0)	1.16	0.50	1.6	180.0	
Nitrate + Nitrite (300.0)	7.54	0.20	10.0	NR	
Oil + Grease (9070)	ND	0.97	NR	150.0	
Total Phenol (9066)	ND	0.05	0.005	4.0	

Notes:

[a] New Mexico Water Quality Control Commission Regulations (1990), Section 3-103.

[b] City of Albuquerque Sewer Use and Wastewater Control Ordinance (1993), Section 8-9-3 M – maximum allowable concentration for grab sample.

B = Analyte detected in method blank.

DL = Detection limit indicated on laboratory report.

IDL = Instrument detection limit.

J = Estimated concentration of analyte, between DL and IDL.

ND = Not detected above DL indicated.

NR = Not regulated.

TTO = Total toxic organics.

RESULTS OF SEPTIC TANK SAMPLING

RADIOLOGICAL ANALYSES OF AQUEOUS SAMPLE

Building ID: Bldg MO231-234

Sample ID Number: 024417

Date Sampled: 6-23-95

Parameter (Method)	Result	MDA	Critical Level	NM Discharge Limit[a]	Comments
Radiological Analyses	*(pCi/L ± 2-σ)*	*(pCi/L)*	*(pCi/L)*	*(pCi/L)*	
Gross Alpha (9310)	0.32 ± 0.30	5.25	2.28	NR	
Gross Beta (9310)	63.7 ± 6.9	3.5	1.68	NR	
Isotopic Analyses	*(pCi/L ± 2-σ)*	*(pCi/L)*	*(pCi/L)*	*(pCi/L)*	
Tritium (906.0)	-39.6 ± 56.1	96.1	47.5	NR	
Gamma Spectroscopy[b]	*(pCi/mL ± 2-σ)*	*(pCi/mL)*	*(pCi/L)*	*(pCi/L)*	
None detected above MDA	ND	various	NL	NR	

Notes:

[a] New Mexico Water Quality Control Commission Regulations (1990), Section 3-103.

[b] Analyzed in-house by SNL/NM Department 7715.

MDA = Minimum detectable activity.

ND = Not detected above MDA indicated.

NR = Not regulated.

NL = Not listed.

RESULTS OF SEPTIC TANK SAMPLING
CHEMICAL ANALYSES OF SLUDGE SAMPLE

Building ID: Bldg MO231-234
Sample ID Number: 024417
Date Sampled: 7-13-95
Percent Moisture: Not Reported

Parameter (Method)	Result	Detection Limit (DL)	NM Discharge Limit[a]	COA Discharge Limit[b]	Comments
Volatile Organics (8260)	*(µg/kg)*	*(µg/kg)*	*(mg/L)*	*(mg/L)*	
Acetone	380	250	NR	NR	
Benzene	330	250	0.01	TTO = 5.0	
Toluene	5800 E	250	0.75	TTO = 5.0	
Semivolatile Organics (8270)	*(µg/kg)*	*(µg/kg)*	*(mg/L)*	*(mg/L)*	
Butylbenzylphthalate	13000	8300	NR	TTO = 5.0	
bis(2-ethylhexyl)Phthalate	25000	8300	NR	TTO = 5.0	
Di-n-octylphthalate	45000	8300	NR	TTO = 5.0	
Pesticides/PCBs (8080)	*(µg/kg)*	*(µg/kg)*	*(mg/L)*	*(mg/L)*	
None detected above DL	ND	various	NR / PCBs = 0.001	TTO = 5.0	
Metals (6010/7470)	*(mg/kg)*	*(mg/kg)*	*(mg/L)*	*(mg/L)*	
Arsenic	ND	25.1	0.1	2.0	
Barium	ND	503	1.0	20.0	
Cadmium	ND	12.6	0.01	2.8	
Chromium	ND	50.3	0.05	20.0	
Copper	1360	62.8	1.0	16.5	
Lead	42.7	7.5	0.05	3.2	
Manganese	101	25.1	0.2	20.0	
Nickel	ND	101	0.2	12.0	
Selenium	ND	12.6	0.05	2.0	
Silver	ND	25.1	0.05	5.0	
Thallium	ND	25.1	NR	NR	
Zinc	2000	50.3	10.0	28.0	
Mercury	ND	2.5	0.002	0.1	

Refer to footnotes at end of table.

RESULTS OF SEPTIC TANK SAMPLING

CHEMICAL ANALYSES OF SLUDGE SAMPLE

Building ID: Bldg MO231-234

Sample ID Number: 024417

Date Sampled: 7-13-95

Percent Moisture: Not Reported

Parameter (Method)	Result	Detection Limit (DL)	NM Discharge Limit[a]	COA Discharge Limit[b]	Comments

Notes:

[a] New Mexico Water Quality Control Commission Regulations (1990), Section 3-103.

[b] City of Albuquerque Sewer Use and Wastewater Control Ordinance (1993), Section 8-9-3 M – maximum allowable concentration for grab sample.

B = Analyte detected in method blank.

DL = Detection limit indicated on laboratory report.

E = Spike exceeds IDL.

IDL = Instrument detection limit.

J = Estimated concentration of analyte, between DL and IDL.

ND = Not detected above DL indicated.

NR = Not regulated.

TTO = Total toxic organics.

Refer to footnotes at end of table.

RESULTS OF SEPTIC TANK SAMPLING
RADIOLOGICAL ANALYSES OF SLUDGE SAMPLE

Building ID: Bldg MO231-234
Sample ID Number: 024417
Date Sampled: 7-13-95
Percent Moisture: Not Reported

Parameter (Method)	Result	MDA	Critical Level	NM Discharge Limit[a]	Comments
Isotopic Analyses[b]	*(pCi/g ± 2-σ)*	*(pCi/g)*	*(pCi/g)*	*(pCi/L)*	
Plutonium-239/240	−0.002 ± 0.008	0.026	0.015	NR	
Plutonium-238	−0.006 ± 0.007	0.026	0.015	NR	
Strontium-90	−0.23 ± 0.02	0.38	0.19	NR	
Thorium-232	0.061 ± 0.043	0.025	0.022	NR	
Thorium-230	0.19 ± 0.08	0.027	0.023	NR	
Thorium-228	0.32 ± 0.12	0.050	0.034	NR	
Uranium-238	7.48 ± 1.56	0.038	0.027	NR	
Uranium-235/236	1.58 ± 0.38	0.042	0.032	NR	
Uranium-234	13.7 ± 2.8	0.036	0.026	NR	
Dry Gamma Spectroscopy[c]	*(pCi/g ± 2-σ)*	*(pCi/g)*	*(pCi/g)*	*(pCi/g)*	
Cesium-137	ND	0.024	0.011	NR	
Cesium-134	ND	0.018	0.009	NR	
Potassium-40	2.42 ± 0.45	0.22	0.11	NR	
Chromium-51	ND	0.18	0.086	NR	
Iron-59	ND	0.045	0.022	NR	
Cobalt-60	0.022 ± 0.013	0.016	0.007	NR	
Zirconium-95	ND	0.037	0.018	NR	
Ruthenium-103	ND	0.021	0.01	NR	
Ruthenium-106	ND	0.18	0.087	NR	
Cerium-144	ND	0.12	0.059	NR	
Thallium-208	0.099 ± 0.023	0.017	NL	NR	
Lead-212	0.29 ± 0.04	0.03	0.013	NR	
Lead-214	0.095 ± 0.034	0.040	0.019	NR	
Bismuth-212	0.33 ± 0.18	0.16	NL	NR	
Bismuth-214	0.045 ± 0.035	0.039	NL	NR	
Radium-224	0.59 ± 0.28	0.30	NL	NR	

Refer to footnotes at end of table.

RESULTS OF SEPTIC TANK SAMPLING

RADIOLOGICAL ANALYSES OF SLUDGE SAMPLE

Building ID: Bldg MO231-234

Sample ID Number: 024417

Date Sampled: 7-13-95

Percent Moisture: Not Reported

Parameter (Method)	Result	MDA	Critical Level	NM Discharge Limit[a]	Comments
Dry Gamma Spectroscopy[c]	*(pCi/g ± 2-σ)*	*(pCi/g)*	*(pCi/g)*	*(pCi/g)*	
Radium-226	0.063 ± 0.025	0.039	0.019	NR	
Radium-228	0.28 ± 0.07	0.07	0.033	NR	
Actinium-228	0.28 ± 0.07	0.07	0.033	NR	
Thorium-231	ND	0.54	0.26	NR	
Thorium-232	0.28 ± 0.07	0.07	0.033	NR	
Thorium-234	4.88 ± 0.69	0.30	0.15	NR	
Uranium-235	0.27 ± 0.04	0.12	0.061	NR	
Uranium-238	4.88 ± 0.69	0.30	0.15	NR	
Americium-241	ND	0.066	0.033	NR	

Notes:

[a] New Mexico Water Quality Control Commission Regulations (1990), Section 3-103.

[b] Isotopic uranium analyzed by NAS-NS-3050; plutonium by SL13028/SL13033; strontium by 7500-SR; thorium by NAS-NS-3004.

[c] Analyzed by method HASL 300 at Quanterra, St. Louis.

MDA = Minimum detectable activity.

ND = Not detected above MDA indicated.

NL = Not listed.

NR = Not regulated.

ANNEX B
DSS Site 1015
Soil Sample Data Validation Results

FOR AR/COC 600429
(DSS SITE 1015, GEL 7/98)

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

SITE OR PROJECT Non ER Septic Tanks CASE NO. 7225.2300

ANALYTICAL LABORATORY GEL SAMPLE IDS

LABORATORY REPORT # 9807247 A,B,C, AR COC's 600400

TASK LEADER A Roybal 600429

NO. OF SAMPLES 14 soils. 600510

DATA ASSESSMENT SUMMARY CVAA

		ICP	AA	MERCURY	CYANIDE
1.	HOLDING TIMES	✓	NA	✓	NA
2.	CALIBRATIONS	✓	✓	✓	✓
3.	BLANKS	✓	✓	✓	✓
4.	ICS	✓	✓	✓	✓
5.	LCS	✓	✓	✓	✓
6.	DUPLICATE ANALYSIS	✓	✓	✓	✓
7.	MATRIX SPIKE	✓	✓	✓	✓
8.	MSA		✓		
9.	SERIAL DILUTION	✓	✓	✓	✓
10.	SAMPLE VERIFICATION	✓	✓	✓	✓
11.	OTHER QC	✓	✓	✓	✓
12.	OVERALL ASSESSMENT	✓	✓	✓	✓

✓ (check mark) — Acceptable
Other — Qualified:
J - Estimate
UJ - Undetected, estimated
R - Unusable (analyte may or may not be present)

ACTION ITEMS: None

AREAS OF CONCERN: None — Except ICB1/CCB1 → B detected small amounts of analyte in Blank - Does Not significantly impact data; Case narrative not supported by required QC report for serial dilution and LCS/LCSD deficiencies written in narrative. Task leader may need to seek revised case narrative.

REVIEWED BY: D Brunell

DATE REVIEWED: 12/29/98

Site: NON ER SEPTIC TANKS

AR/COC: 600400 600429 600550 Data Classification: INDIGANICS

Sample Fraction No.	Analysis	DV Qualifiers	Comments
~~044471-003~~ KS 1/8/99	~~Pb~~	~~J~~	~~@ 0.0484 mg/kg.~~
ER-1295-M0231-OF1-B	Ag	U J-us	~~0.162 mg/kg~~ Detection Limit 0.595 mg/kg
ER-1295-M0231-OF1-B Hbr.	BA	R+J	MS out 60.9 with window (67.0-131) MSD 51 (67-131)
"	All	B_3	~~Numerous Analytes detected in CCB(1-13)~~ KS 1/8/99
"	~~As, Cd, Cr, Cu, Hg, Se, Ag~~ EN	A_2	~~CRDL STAND for ICP All out of limits except for Pb.~~ KS 1/8/99
	DATA IS	Acceptable	

Sample No./Fraction No. - This value is located on the Chain of Custody in the ER Sample Id field.

Analysis - Use valid test methods provided below or if the result applies to an individual analyte within a test method. use the CAS number from the analytical data sheet.

DV Qualifiers - The entry will be taken from the list of valid qualifiers and associated comments. If other qualifiers not on the list are needed, contact Tina Sanchez to coordinate adding them to the list.

Comments - This is only to be used if a comment associated with the qualifier is not appropriate. needs modification because of an unusual circumstance. or additional clarification is warranted.

Test Methods - Anions_CE, EPA6010. EPA6020. EPA7470/1, EPA8015B. EPA8081. EPA8260. EPA8260-MS. EPA8270. HACH_ALK. HACH_NO2. HACH_NO3. MEKC_HE. PCBRISC

Reviewed by: [signature] Date: 12/29/98

[signature] 1/8/99

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

If no for any of the above, sample results may be inaccurate. Note necessary changes and if errors are present, request resubmittal of laboratory package.

Were any sample results higher than the linear range of calibration curve and not subsequently reanalyzed at the appropriate dilution? Yes ☐ No ☑

Samples affected: _____

11.3 Sample Quantitation

Check a minimum of 10% of positive sample results for transcription/calculation errors. Summarize necessary corrections. If errors are large, request resubmittal of laboratory package.

Comments:

O.K- data is Good/ACCEPTABLE

Approved By:* _____

Date: _____

*Task/Project Leader is responsible for approval of data set.

Reviewed By: _____ Date: 12/29/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

11.0 SAMPLE RESULT VERIFICATION

11.1 Verification of Instrumental Parameters

Are instrument detection limits present and verified on a quarterly basis? Yes ☐ No ☐ NA

Are IDLs present for each analyte and each instrument used? Yes ☑ No ☐

Is the IDL greater than the required detection limits for any analyte? Yes ☐ No ☑
(If IDL > required detection limits, flag values less than 5xIDL.)

Samples affected: _____

_____

_____

Are ICP Interelement Correction Factors established and verified annually? Yes ☐ No ☐ NA

Are ICP Linear Ranges established and verified quarterly? Yes ☐ No ☐ NA

If no for any of the above, review problems and resolutions in narrative report. _____

_____

_____

11.2 Reporting Requirements

Were sample results reported down to the PQL? Yes ☑ No ☐

If no, indicate necessary corrections. _____

_____

Were sample results that were analyzed by ICP for Se, Tl, As, or Pb at least 5xIDL? Yes ☑ No ☐

Were sample weights, volumes, and dilutions taken into account when reporting sample results and detection limits? Yes ☑ No ☐

Reviewed By: _____ Date: 12/29/98

ANALYTICAL RADIOCHEMISTRY DATA VALIDATION CHECKLIST

Project Name	NON ER SEPTIC TANKS			Site Name	
Laboratory Name/Job No./Batch No.	GEL / 9807247			Chain of Custody No.	600400 600429 600510
Analysis Method	EPA 900 HASL 300			Parameter List:	
REVIEW ITEM	YES	NO	NA	COMMENTS	
A. HOLDING TIMES				MET CRITERIA	
1. Preparation and analysis holding times met?	✓				
2. Short-half life parameters analyzed for and checked?	✓				
B. CALIBRATION VERIFICATION				MET CRITERIA	
1. Detectors numbered and documented?	✓				
2. Frequency: Daily ✓, weekly ____, or monthly ____?	✓				
3. Acceptance criteria: Met?	✓				
C. LABORATORY CONTROL SAMPLES				MET CRITERIA	
1. Standard: Independent, certified reference material?	✓				
2. Frequency: Each batch?	✓				
% Recovery 80-120% or ____?	✓				
METHOD BLANK					
1. Frequency: Each batch?	✓				
2. Matrix: Matrix specific?	✓				
3. Preparation: Entire procedure?	✓				
4. Blanks show contamination?	✓				
E. MATRIX SPIKE				MET CRITERIA	
1. Frequency: Each batch?	✓			*	
2. Matrix: Matrix specific?	✓				
3. Preparation: Entire procedure?	✓				
4. % Recovery: 75-125% or ____?	✓				
F. ANALYTICAL YIELDS/OTHER				MET CRITERIA	
1. Tracer: Correct type, recovery met?	✓				
2. Ingrowth and/or decay: Correct factors applied?	✓		NA		
3. Solids density: Planchette loading <5 mg/cm^2?	✓				
G. DUPLICATE				MET CRITERIA	
1. Type: Lab or field?	✓				
2. Frequency: Each batch?	✓				
3. Matrix: Matrix specific?	✓				

ANALYTICAL RADIOCHEMISTRY DATA VALIDATION CHECKLIST (CONTINUED)

Project Name	NON ER SEPTIC TANKS			Site Name	
Laboratory Name/Job No./Batch No.	GEL / 9807247			Chain of Custody No.	600400, 600429, 600510
Analysis Method	EPA 900.0 HASL 300			Parameter List:	
REVIEW ITEM	YES	NO	NA	COMMENTS	
4. Preparation: Entire procedure?	✓				
H. ANALYTE DETECTION				met criteria	
1. Detection limit sample/batch specific?	✓				
2. Errors evaluated?	✓				
3. False positives/negatives suspected?		✓			

Reviewed by: [signature] 12/29/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

6.0 BLANK ANALYSES

6.1 Method/Reagent and Instrument Blanks

Has a method/reagent blank been analyzed for each set of samples or for every 20 samples of similar matrix, whichever is more frequent? Yes ☑ No ☐

Has an instrument blank been analyzed at least once every twelve hours for each GC/MS system used? Yes ☐ No ☑

6.2 Field Rinse/Equipment Blanks

Are there field rinse/equipment blanks associated with each sampling day or at frequency specified in the sampling plan. Yes ☐ No ☒ Not submitted w/ ARCOC

List below compounds for which analyses were requested that were detected in any of the blanks analyzed:

Date	Blank ID	Compound	Conc. ug/(kg)	PQL ( )	Action Level	Samples Affected (Action)
7/17/98	12645B	methylene chloride	1.2	5 ug/kg	ND in sample	———

PQL = Practical Quantitation Limit from EPA Method.

Reviewed By: D Bruce
Date: 12 29 98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

SITE OR PROJECT NON ER SEPTIC TANK
ANALYTICAL LABORATORY GEL
LABORATORY REPORT # 5807247
CASE NO. 7223.230

SAMPLE IDS
NO. OF SAMPLES 16 Soils
COC - 600400 600429
600510

DATA ASSESSMENT SUMMARY

Describe problems/qualifications below (Action Items and Areas of Concern)

		VOC	SVOC	PEST/PCB	OTHER
1.	HOLDING TIMES/PRESERVATION	✓	✓	N/A	NA
2.	GC/MS INST. PERFORM.	✓	✓		
3.	CALIBRATIONS/WINDOWS	W	W ✓		
4.	BLANKS	X	X		
5.	SURROGATES	✓	✓		
6.	MATRIX SPIKE/DUP	✓	✓		
7.	LABORATORY CONTROL SAMPLES	✓	✓		
8.	INTERNAL STANDARDS	✓	✓		
9.	COMPOUND IDENTIFICATION	✓	✓		
10.	SYSTEM PERFORMANCE	✓	✓		
11.	OVERALL ASSESSMENT	✓	✓		

✓ (check mark) — Acceptable: Data had no problems or qualified due to minor problems
N - Data qualified due to major problems
X - Problems, but do not affect data
Qualifiers: J - Estimate
UJ - Undetected, estimated

N/A = NOT APPLICABLE

ACTION ITEMS: None to be taken

FOR VOC/SVOC
AREAS OF CONCERN: Small contamination in ICB/CCB's but does not significantly affect data.

HE - used ms from 126117 - missed @ D/O R on MS
All MSD w/in Acceptance

Reviewed By: [signature]
Date: 12-29-98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

13.1 Chromatogram Quality

Were baselines stable? Yes ☑ No ☐

Were any negative peaks or unusual peaks present? Yes ☐ No ☑

Were early eluting peaks resolved to baseline? Yes ☑ No ☐

If incorrect quantitations are evident, note corrections necessary below: _____

_____

_____

Are the required quantitation limits (detection limits) adjusted to reflect sample dilutions and for soils, sample moisture? Yes ☑ No ☐

If no, make necessary corrections and note below.

_____

_____

_____

14.0 TENTATIVELY IDENTIFIED COMPOUNDS

Are Tentatively Identified Compounds (TIC) properly identified with scan number or retention time, estimated concentration, and J qualifier? Yes ☑ No ☐

Are the mass spectra for TICs and associated "best match" spectra included? Yes ☑ No ☐

Are any TCL compounds listed as TIC compounds? Yes ☐ No ☑

Are each of the ions present in the reference mass spectra with a relative intensity greater than 10% also present in the sample mass spectrum? Yes ☑ No ☐

Reviewed By: _____
Date: 12 29 98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

Other: _____

Is the RRT of each reported compound within the limits given in the method of the standard RRT in the continuing calibration? Yes ☑ No ☐

Are all the ions present in the standard mass spectrum at a relative intensity greater than 10% also present in the mass spectrum? Yes ☑ No ☐

Do sample and standard relative intensities agree within 20%? Yes ☑ No ☐

If no for any of the above, indicate below problems and qualifications made to data:

_____

_____

_____

11.2 GC Analyses

Are there any transcription/calculation errors between the raw data and the reporting forms?
Yes ☐ No ☐

If yes, review errors and necessary corrections below; if errors are large, resubmittal of laboratory package may be necessary.

_____

_____

_____

Are retention times of sample compounds within the calculated retention time windows for both quantitation and confirmation analysis? Yes ☑ No ☐

Was GC/MS confirmation performed when required by the EPA method? Yes ☐ No ☐

If no for any of the above, reject positive results except for retention time windows if associated standard compounds are similarly shifted.

Reviewed By: _____
Date: 12 29 98

3.0 Data Quality Evaluation

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1)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). Units consistent between QC samples and sample data.	X		
3.2)Quantitation limit met for all samples?	X		
3.3)Accuracy a) Laboratory control sample accuracy reported and met for all samples?	X		
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique?	X		
c) If requested, matrix spike recovery data reported and met .	NA		
3.4)Precision a) Laboratory control sample precision reported and met for all samples? For rad analysis, sample duplicate precision reported and met.	X		
b) If requested, matrix spike duplicate RPD data reported and met.	NA		
3.5)Blank data a) Method or reagent blank data reported and met for all samples?	X		
b) Sampling blank (e.g., field, trip, and equipment) data reported and met?	NA		
3.6)Contractual qualifiers provided: "J"- estimated quantity; "B"-analyte found in method blank; "U"- analyte undetected (results are below the MDL or L_c (rad)); "H"-analysis done beyond the holding time.	X		
3.7)Narrative included, correct, and complete?	X		

Contract Verification Review (CVR)

Project Leader SANDERS | Project Name NON-ER SEPTIC FIELDS | Case No. 7223.230

AR/COC No. 600400/600429/600510 | Analytical Lab GEL | SDG No. 9807247

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	X				
1.7	Date samples received	X				
1.8	Condition upon receipt information provided	X				

2.0 Analytical Laboratory Report

Line No.	Item	Complete? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? No
2.1	Data reviewed, signature	X				
2.2	Method reference number(s) complete and correct	X				
2.3	QC analysis and acceptance limits provided (MB, LCS, LCD)	X				
2.4	Matrix spike/matrix spike duplicate data provided(if requested)	NA				
2.5	Detection Limits provided; PQL and MDL(or IDL)	X				
2.6	QC batch numbers provided	X				
2.7	Dilution Factors provided	X				
2.8	Data reported using correct sig. fig. (2 for org.; 3 for inorg.)	X				
2.9	Rad analysis uncertainty provided (2 sigma error)	X				
2.10	Narrative provided	X				
2.11	TAT met	X				
2.12	Hold times met	X				
2.13	Were contractual qualifiers provided	X				
2.14	All requested result data provided	X				

4.0 Data Quality Evaluation Continuation

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

Sample/ Fraction No.	Analysis	Qualifiers	Comments

Were deficiencies noted. ☹ Yes ☺ No

Based on the review, this data package is complete. ☺ Yes ☹ No

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

Reviewed by: W. Palencia Date: 9-17-98 Closed by: _____ Date: _____

SF 2001-COC (10-97)
Supersedes (5-97) Issue

Internal Lab Batch No. N/A

ANALYSIS REQUEST AND CHAIN OF CUSTODY

SAR/WR No.

AR/COC- 600429

Dept. No./Mail Stop: 6133 MS-1147
Project/Task Manager: Mike Sanders
Project Name: 101 Non-ER Septic Fields
Record Center Code: ER/1295/DAT
Logbook Ref. No.:
Service Order No.: 0526

Date Samples Shipped: 7/8/98 SMO USE
Carrier/Waybill No.: 710268

Lab Contact: Edie Kent/803-556-8171
Lab Destination: GEL
SMO Contact/Phone: Doug Salmi/844-3110
Send Report to SMO: Suzi Montano

Contract No.: AJ-2480A
Case No.: 7223.230
SMO Authorization
Bill to: Sandia National Laboratories
Supplier Services, Dept.
P.O. Box 5800 MS 0154

Location — Tech Area III — Building MO231 — Room

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO): Sample Matrix	Container: Type	Container: Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
											9807247	LAB USE
041308-002	ER-1295-MO231-DF1-BH1-5-S (10ft)	~~5~~ 10 ft	N/A	7/7/98 1120	S	AG	500ml	4C	G	SA	SVOCs (8270) Gross A/B	01
041309-002	ER-1295-MO231-DF1-BH1-~~10~~ 5-S (5ft)	~~10~~ 5ft	N/A	7/7/98 1105	S	AG	500ml	4C	G	SA	SVOCs (8270) Gross A/B	02
041310-002	ER-1295-MO231-DF1-BH2-5-S	5	N/A	7/7/98 1225	S	AG	500ml	4C	G	SA	SVOCs (8270) Gross A/B	03
041311-002	ER-1295-MO231-DF1-BH2-10-S	10	N/A	7/7/98 1230	S	AG	500ml	4C	G	SA	SVOCs (8270) Gross A/B	04
041470-001	ER-1295-MO231-DF1-BH2-10-SD	10	N/A	7/7/98 1230	S	AC	300ml	4C	G	DU	VOCs (8260)	05
041471-003	ER-1295-MO231-DF1-BH2-10-SD	10	N/A	7/7/98 1230	S	AG	1L	4C	G	DU	SVOC8270, HE 8330, G Spec, RCRA Met+Zn,Cu	06

RMMA ☐Yes XNo Ref. No.
Sample Disposal ☐Return to Client XDisposal by lab

Sample Tracking SMO USE
Date Entered (mm/dd/yy)
Entered by

Special Instructions/QC Requirements
EDD XYes ☐No
Raw data package XYes ☐No

Abnormal Conditions on Receipt LAB USE
2°C

Turnaround Time XNormal ☐Rush Required Report Date

QC Inits.

	Name	Signature	Init	Company/Organization/Phone
Sample Team Members	Chris Catechis	C. Catechis	C.C.	MDM/6131/881-3196
	CHRIS SEARS	Chris Sears	CS	SNL/6131/844-4434

Please list as separate report.

1. Relinquished by	Chris Sears	Org.	6131	Date	7/7/98	Time	1445	4. Relinquished by	Org.	Date	Time
1. Received by	[illegible]	Org.	7577	Date	7/7/98	Time	1445	4. Received by	Org.	Date	Time
2. Relinquished by	[illegible]	Org.	7577	Date	7/8/98	Time	1130	5. Relinquished by	Org.	Date	Time
2. Received by	Patricia Moore	Org.	GEL	Date	7/9/98	Time	09:00	5. Received by	Org.	Date	Time
3. Relinquished by		Org.		Date		Time		6. Relinquished by	Org.	Date	Time
3. Received by		Org.		Date		Time		6. Received by	Org.	Date	Time

Original To Accompany Samples, Laboratory Copy (White) — 1st Copy To Accompany Samples, Return to SMO (Blue) — 2nd Copy SMO Suspense Copy (Yellow) — 3rd Copy Field Copy (Pink)

FOR AR/COC 600428
(DSS SITE 1015, ERCL 7/98)

HE-028

High Explosives by Capillary Electrophoresis QC Check List

Analyst: Jim Barnett Date: 7/16 - 7/18/98

Peer Reviewer: Linda Kear Date: 8/10/98

trument Run Date: 7/16 - 7/18/98 Instrument Run ID#:

Instrument-related QC:		
[1] Did ICAL pass?	Yes[✓] No[ ]	and all Pearson Coefficients > 0.995
[2] Calibration Slopes Correct?	Yes[✓] No[ ]	Are the slopes from the ICAL cut and pasted correctly into the CCV calculations?
[3] Did bracketing CCV pass?	Yes[ ] No[✓]	Target analytes recovered ~~90-110%~~ 85-115%, bracketing CCV every 10 samples
Batch-related QC:	(A batch is less than or equal to 20 samples)	
[4] Did Surrogates Recover?	Yes[✓] No[ ]	Recovery should be inside charted range.
[5] Did LMB Pass?	Yes[✓] No[ ]	All analytes < PQL. Must prepare and analyze at least one LMB with each batch.
[6] Did LCS Pass?	Yes[✓] No[ ]	All analytes recovered 80-120%. Must prepare and analyze at least one LCS with each batch of up to 20 samples.
[7] Did MS/MSD %REC Pass?	Yes[✓] No[ ]	All analytes recovered 75-125% Must prepare and analyze an MS and MSD with each batch.
[8] Did MS/MSD RPD's Pass?	Yes[✓] No[ ]	All analytes recovered less than +/- 20%
Sample-related QC:		
[9] Analytes inside Calibration?	Yes[✓] No[ ]	Target analytes must be bracketed by calibration values or valid LRS.
[10] Migration Times?	Yes[✓] No[ ]	Are migration times reasonable compared to bracketing CCV's and batch related QC such as LCS and MS/MSD?

(3) CCV %rec low for Tetryl on "Stds 1649" but has no effect to data because tetryl is not a compd which is reported.

RCRA, Ba, Co

Metals by ICP-MS QC Check List

Analyst:	Linda Kear Date: 7/15/98	NCAR#:	98-107
er Reviewer:	Kathleen Swenson Date: 7/31/98	Preparation Batch ID#:	5I9822
andards:		Instrument Run Date:	7/15 AB
Cal Level 0 (ICB, CCB)	51-14	Instrument Run ID#:	5I9822
Cal Level 1	61-17	ICS-A	136-05
Cal Level 2	71-09	ICS-AB	146-09
Cal Level 3	81-09	LRS	118-01
Cal Level 4	N/A	ISS	156-02
ICV, CCV	106-08	ICP-TUNE	171-08

Instrument-related QC:

[1] Did Tune Pass?	Yes[✓] No[ ]	4 reps < 5% RPD for internal standards Li, Y, In, Bi
[2a] Did ICV pass?	Yes[✓] No[ ]	Target analytes recovered 90-110%
[2b] Did ICB Pass?	Yes[✓] No[ ]	All analytes < PQL
[2c] Did CCV pass?	Yes[✓] No[ ]	Target analytes recovered 90-110%
[2d] Did CCB Pass?	Yes[✓] No[ ]	All analytes < PQL
[2e] Did ISS recovery pass?	Yes[✓] No[ ]	Internal standards 60-125% of initial calibration values
[3] Did ICS_A's Pass?	Yes[✓] No[ ]	All analytes not present < PQL
[4] Did ICS_AB's Pass?	Yes[✓] No[ ]	All analytes present recovered 80-120%
[5] Did LRS pass?	Yes[✓] No[ ]	Linear dynamic range check (if run) must agree to 95-105% of stated value to validate beyond calibration values

Batch-related QC: (A batch is less than or equal to 20 samples) → MDL

[6] Did LMB Pass?	Yes[ ] No[✓]	All analytes <~~PQL~~ MDL. Must prepare and analyze at least one LRB with each batch.
[7] Did LCS/LCSD Pass?	Yes[ ] No[✓]	All analytes recovered 80-120%. Must prepare and analyze at least one LCS with each batch.
[8] Did MS/MSD Pass?	Yes[ ] No[✓]	All analytes recovered 75-125%. Recovery not required if spike < 30% of sample analyte level Must prepare and analyze an MS and MSD with each batch.
[9] Did M/MDup Pass?	Yes[ ] No[✓]	All analytes RPD 20% at 5 times the PQL. Must prepare and analyze at least one with each batch.
[10] Did M/Mdil Pass?	Yes[✓] No[ ]	All analytes > 10X the MDL in the 5X dilution agree 90-110% with the undiluted reference. Must prepare and analyze at least one with each batch.
[11] Digestion Problems?	No[✓] Yes[ ]	Digestion 3015, 3051 problems?

Sample-related QC:

[11] Did sample ISS pass?	Yes[✓] No[ ]	Internal standards >= 60% or <= 125% or sample must be rerun at a 5X dilution.
[12] Analytes inside Calibration?	Yes[✓] No[ ]	Target analytes must be bracketed by calibration values or valid LDR.
[13] Analyte carryover OK?	No[✓] Yes[ ]	Using the sequence order, was carry over contamination probable?

Note: When the HP Enviroquant software refers to an IDL, we are using the ERCL MDL; when it refers to a CRDL, we are using the ERCL PQL which is 4 times the MDL

(6) LMB had As present at a level slightly above the MDL, but less than the PQL; samples will have a "B" qualifier for As

(7) LCS the recovery is 2x higher than it is supposed to be. This is due to this batch being spiked with improperly prepared ICAL-IS soln. The problem has been fixed so it will not recur.

(8) MS recoveries high for Ba & Hg. The Hg is due to the spike problem mentioned in (7) above. All MSD recoveries are low, which leads to poor rpd's. Because the low values are constant for all elements, this points to error during sample prep (too little spike added). Note that all MS recoveries (except Hg which is 2x too high) are good; the MSD is showing data is not compromised.

(9) MDUP rpd high out of criteria for Ba, most likely due to sample nonhomogeneity.

Received by QA 8/4/98

VOC Peer Review Check List

Batch ID: SVOC-043

Did BFB Pass?	Yes ☒	No ☐	
Did the ICAL Pass %RSD ≤ 30%	Yes ☒	No ☐	
Did the ICAL and CCV pass:			
± 20% recovery for the individual analytes?	Yes ☐	No ☒	See NCR/Case Narrative
Calibration Check Compounds in criteria?	Yes ☒	No ☐	
System Performance Check Compounds in criteria?	Yes ☒	No ☐	
Did the blank pass?	Yes ☒	No ☐	
Did the MS/MSD pair pass accuracy and precision and criteria?	Yes ☒	No ☐	
Did LCS pass accuracy criteria?	Yes ☒	No ☐	N/A ☐
Were all IS areas within a factor of 2 of the average area in the ICAL	Yes ☒	No ☐	
Did Retention Times remain inside windows for all standards and samples?	Yes ☒	No ☐	
Did all surrogates pass criteria for each standard and sample?	Yes ☒	No ☐	

Check for:	
Carry-over contamination	OK ☒
Correct interpretation of mass spectra	OK ☒
Errors in data entry, rounding and/or calculations	OK ☒

Reviewed by: Kathleen Swenson Date: 7/23/98

600428

QA Officer Review Checklist

SNL/NM Environmental Restoration Chemistry Laboratory

	YES	NO	Comments
1. Samples were preserved and handled in accordance with QAPjP and LOPs	✓		
2. The appropriate number and type of laboratory QC check samples were analyzed	✓		
3. Laboratory QC checks met the established acceptance criteria		✓	See Case Narrative
4. Deviations from analytical methods are documented	N/A		
5. Data package is complete, per section 10.4 of the ERCL QAPjP	✓		

Data Package Checklist

	YES	NO	Comments
Date of Issue	✓		
Case Narrative	✓		
Description of data package	✓		
Index of samples, including sampling ID and laboratory ID	✓		
Description of any problems encountered in analysis	✓		
Circumstances leading to the use of data qualifiers	✓		
Type of digestion used for general inorganic analysis of soil samples	✓		
Analytical results for each sample - must include the parameter name, the parameter value, uncertainty value (where applicable), MDL and PQL, units of measure, data qualifier(s), method of analysis, and analysis date	✓		
Calibration ranges	✓		
QC Summaries	✓		
Surrogate data	✓		
Matrix spike or LCS recovery data for accuracy	✓		
MS/MSD or LCS/LCSD for precision	✓		
Method or reagent blank data	✓		
QA review documentation:	✓		
QA Officer Review Checklist	✓		
Electronic copy of the analytical data	✓		
COC	✓		

Data Package COC No. 600428 Reviewed by Margie Marley Date 8/24/98

c:\document\ercl\reports\qacheck.doc

600428

SF 2001-COC (10-97)
Supersedes (5-97) issue

Internal Lab Batch No.

ANALYSIS REQUEST AND CHAIN OF CUSTODY

SAR/WR No.

AR/COC- 600428

Dept. No./Mail Stop: 6133 MS-1147
Project/Task Manager: Mike Sanders
Project Name: 101 Non-ER Septic Fields
Record Center Code: ER/1295/DAT
Logbook Ref. No.:
Service Order No.: 0526

Date Samples Shipped: _____ SMO USE
Carrier/Waybill No.: _____
Lab Contact: Warren Strong/284-3313
Lab Destination: ERCL
SMO Contact/Phone: Doug Salmi/844-3110
Send Report to SMO: Suzi Montano

Contract No.:
Case No.: 7223.230
SMO Authorization _____
Bill to: Sandia National Laboratories
Supplier Services, Dept. _____
P.O. Box 5800 MS 0154

Fridge 3 shelf 5
Fridge 4 shelf 3

Location — Tech Area III — Building MO231 — Room

Reference LOV (available at SMO)

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	LAB USE Lab Sample ID
041308-001	ER-1295-MO231-DF1-BH1-5-S	5	N/A	7/7/98 1105	S	AC	300ml	4C	G	SA	VOCs (8260)	
041309-001	ER-1295-MO231-DF1-BH1-10-S	10	N/A	7/7/98 1120	S	AC	300ml	4C	G	SA	VOCs (8260)	
041310-001	ER-1295-MO231-DF1-BH2-5-S	5	N/A	7/7/98 1225	S	AC	300ml	4C	G	SA	VOCs (8260)	
041311-001	ER-1295-MO231-DF1-BH2-10-S	10	N/A	7/7/98 1230	S	AC	300ml	4C	G	SA	VOCs (8260)	
041308-004	ER-1295-MO231-DF1-BH1-5-S	~~5~~ 10	N/A	7/7/98 1120	S	G	125ml	4C	G	SA	RCRA Met+Zn,Cu, HE	
041309-004	ER-1295-MO231-DF1-BH1-10-S	~~10~~ 30	N/A	7/7/98 1105	S	G	125ml	4C	G	SA	RCRA Met+Zn,Cu, HE	
041310-004	ER-1295-MO231-DF1-BH2-5-S	5	N/A	7/7/98 1225	S	G	125ml	4C	G	SA	RCRA Met+Zn,Cu, HE	
041311-004	ER-1295-MO231-DF1-BH2-10-S	10	N/A	7/7/98 1230	S	G	125ml	4C	G	SA	RCRA Met+Zn,Cu, HE	

RMMA ☐Yes XNo Ref. No.

Sample Disposal ☐Return to Client XDisposal by lab

Sample Tracking SMO USE
Date Entered (mm/dd/yy) _____
Entered by _____

Special Instructions/QC Requirements
EDD XYes ☐No
Raw data package XYes ☐No

Please list as separate report.

Abnormal Conditions on Receipt LAB USE

Turnaround Time XNormal ☐Rush Required Report Date _____ QC Inits. _____

	Name	Signature	Init	Company/Organization/Phone
Sample Team Members	Chris Catechis	C. Catechis	CC	MDM / 6131 / 881-3986
	CHRIS SEARS	Chris Sears	CS	SNL/6911/844-1136

1. Relinquished by	Chris Sears	Org.	6631	Date	7/7/98	Time	1518	
1. Received by		Org.	6133	Date	7/7/98	Time	3:14 pm	
2. Relinquished by		Org.		Date		Time		
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		

Original To Accompany Samples, Laboratory Copy (White) — **1st Copy** To Accompany Samples, Return to SMO (Blue) — **2nd Copy** SMO Suspense Copy (Yellow) — **3rd Copy** Field Copy (Pink)

40 of 40

TOI 13
Rev. 1
Attachment A
November 1995

Wmd 11-9-95

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1 - DV1)

Project Leader: Tony Roybal | Project Name: 101 Non-ER Septic Fields | Case No.: 7223.230

AR/COC No.: 600428 | Analytical Lab: ERCL | SDG No.: NA

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

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	NA		Not applicable		
1.2	Container type(s) correct for analyses requested	✓				
1.3	Sample volume adequate for # and types of analyses requested	✓				
1.4	Preservative correct for analyses requested	✓				
1.5	Custody records continuous and complete	✓				
1.6	Lab sample number(s) provided	✓				
1.7	Condition upon receipt information provided	✓				
1.8	Tritium Screen data provided (Rad labs)	NA		Not applicable, non-RMMA location		

2.0 Analytical Laboratory Report

Line No.	Item	Complete? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? No
2.1	Data reviewed, signature	✓				
2.2	Date samples received	✓				
2.3	Method reference number(s) complete and correct	✓				
2.4	Quality control data provided (MB, LCS, LCD, Detection Limit)		✓	LCD not analyzed with submitted sample		
2.5	Matrix spike/matrix spike duplicate data provided(if requested)	✓		Note: not requested		
2.6	Narrative provided	✓				
2.7	TAT met	NA		Not applicable		
2.8	Hold times met	✓				
2.9	All requested result data provided	✓				

Based on the review, this data package is complete ☑ Yes ☐ No

If no, provide: correction request tracking # _____ and date correction request was submitted: _____

Reviewed by: Jeffrey A. Rabe Date: 10/15/98 Closed by: _____ Date: _____

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

Project Name 101 Non-ER Septic Fields

Case Number 7223.230

Sample Numbers ER-1295-M0231-0F1-BH1 (BHz) - 5 (10)-5

AR/COC No. 600428 Analytical laboratory ERCL SDG No. NA

AR/COC No. _____ Analytical laboratory _____ SDG No. _____

AR/COC No. _____ Analytical laboratory _____ SDG No. _____

AR/COC No. _____ Analytical laboratory _____ SDG No. _____

1.0 EVALUATION

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
1) Sample volume, container, and preservation correct?	✓		
2) Holding times met for all samples?	✓		
3) Reporting units appropriate for the matrix and meet project-specific requirements?	✓		
4) Quantitation limit met for all samples?	✓		
5) Accuracy a) Laboratory control sample accuracy reported and met for all samples?		✓	S198 ⇒ Hg (biased high). ①
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique?	✓		

Reviewed by: Jeffrey A. Rabe

Date: 10/15/98

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

Item	Yes	No	If no: Sample ID No./Fraction(s) and Analysis
c) Matrix spike recovery data reported and met for all samples for which it was requested?		—	S198-22 ⇒ Cr, Cu, Zn, Ba, Pb and Hg. ②
6) Precision a) Laboratory control sample precision reported and met for all samples?	NA		Not applicable; LCS duplicate was not analyzed with submitted samples
b) Matrix spike duplicate RPD data reported and met for all samples for which it was requested?		—	S198-22 ⇒ Cr, Cd, Cu, As, Se, Ag, Ba, Hg and Pb. ②
7) Blank data a) Method or reagent blank data reported and met for all samples?		—	S198-22 ⇒ "J" value reported for As ①
b) Sampling blank (e.g., field, trip, and equipment) data reported and met?	NA		Not applicable
8) Narrative included, correct, and complete?	—		

2.0 COMMENTS: All items marked "No" above must be explained in this section. For each item, give SNL/NM ID No. and the analysis, if appropriate, of all samples affected by the finding.

① The percent recovery for mercury was biased high in the LCS (S198-22)

Reviewed by: Jeffrey A. Rabe

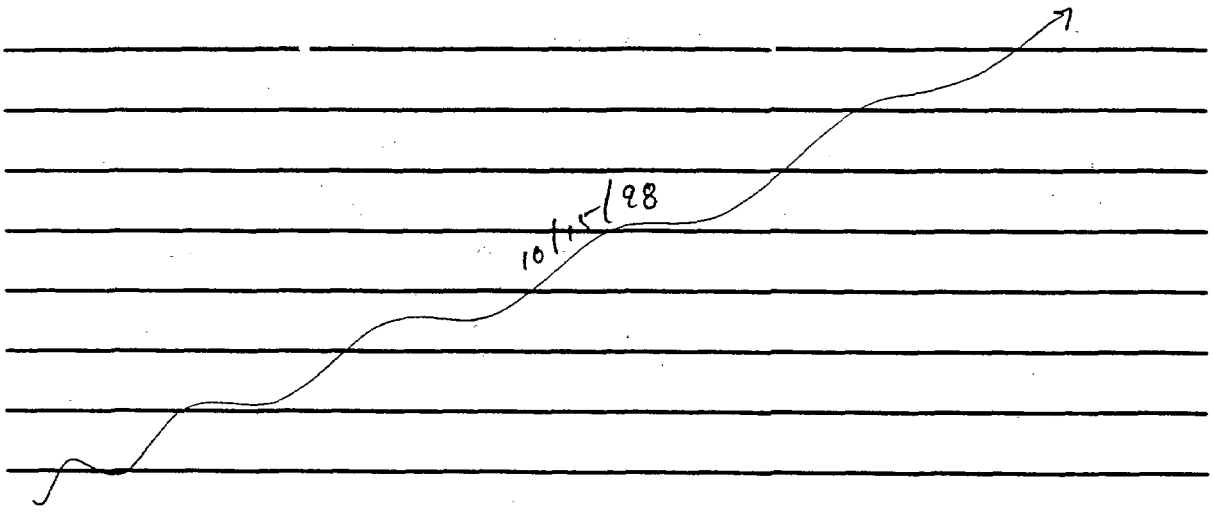
Date: 10/15/98

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

2.0 COMMENTS CONTINUATION SHEET

② The following analytes were outside of QC windows for percent recovery in the MS and MSD samples: MS ⇒ Ba and Hg (biased high), MSD ⇒ Cr, Cu, Zn, Ba and Pb (biased low) and Hg (biased high). Relative percent difference values were out side of QC windows for all the requested analyes except Zn.

③ "J" value was reported for arsenic in the metals LMB (5198-22). All detected results were greater than 5x the blank concentration.



Reviewed by: Jeffry J. Rabe

Date: 10/15/98

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

3.0 SUMMARY: Summarize the findings in the table below. List only samples/fractions for which deficiencies have been noted. Use the qualifiers given at the end of the table if possible. Explain any other qualifiers in the comments column.

Sample/ Fraction No.	Analysis	Qualifiers	Comments

10/15/98 JR

5 of 5

see page

Attach continuation sheet for additional samples

QUALIFIERS:

J = Estimated quantity (provide reason)
B = Contamination in blank (indicate which blank)
P = Laboratory precision does not meet criteria
R = Reporting units inappropriate
N = There is presumptive evidence of the presence of the material
UJ = The material was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
Q = Quantitation limit does not meet criteria
A = Laboratory accuracy does not meet criteria
U = Analyte is undetected (indicate which analyte and reason for qualification)
NJ = There is presumptive evidence of the presence of the material at an estimated quantity.

Reviewed by: _____

Date: _____

144828

CHAIN OF CUSTODY

SAMPLE FINDINGS SUMMARY

Site: 101 Non-ER Septic Fields

AR COC: 600428 Data Classification: DV-2

Sample Fraction No.	Analysis	DV Qualifiers	Comments
All Samples Submitted For metals analysis	7440-22-4	J, P1	Sample #'s - BH1-10-S and -BH2-10-S are UJ, P1
	7440-38-2	J, P1	
ER-1295-M0231-DF1-	7440-39-3	J A2, P1	
BH1-10-S BH1-5-S	7440-43-9	J, P1	
BH2-5-S BH2-10-S	7440-47-3	J A2, P1	
	7440-50-8	J A2, P1	
	7439-97-6	J, A A2-P1	
	7439-92-1	J A2, P1	
	7782-49-2	UJ, P1	Sample number -BH1-10-S qualified as J, P1
	7440-66-6	J, A2	

Sample No./Fraction No. - This value is located on the Chain of Custody in the ER Sample Id field.

Analysis - Use valid test methods provided below or if the result applies to an individual analyte within a test method, use the CAS number from the analytical data sheet.

DV Qualifiers - The entry will be taken from the list of valid qualifiers and associated comments. If other qualifiers not on the list are needed, contact Tina Sanchez to coordinate adding them to the list.

Comments - This is only to be used if a comment associated with the qualifier is not appropriate, needs modification because of an unusual circumstance, or additional clarification is warranted.

Test Methods - Anions_CE, EPA6010, EPA6020, EPA7470A, EPA8015B, EPA8081, EPA8260, EPA8260-MS, EPA8270, HACH_ALK, HACH_NO2, HACH_NO3, MEKC_HE, PCBRISC

Reviewed by: Jeffry A. Rabe Date: 10/15/98

INFORMATION COPY

SHEARS # 144828

FOR AR/COC 602763
(DSS SITE 1015, GEL, 8/99)

Records Center Code: ER / 1295 / DAT

SMO ANALYTICAL DATA ROUTING FORM

Project Name: Non-ER Septic Systems

Case No./Service Order: 7223.230 / CF0686

SNL Task Leader: ROYBAL

Org/Mail Stop: 6135 / 1089

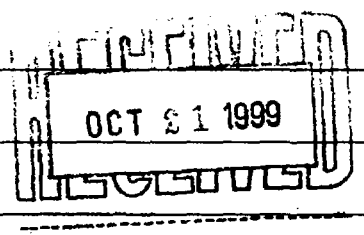
SMO Project Coordinator: SALMI

Sample Ship Date: 8/24/99

ARCOC	Lab	Lab ID	Preliminary Received	Final Received	EDD Req'd YES	EDD Req'd NO	EDD Rec'd YES	EDD Rec'd NO
602763	GEL	9908918		9/24/99	x		x	

	Date		
Correction Requested from Lab:	None	Correction Request #:	
Corrections Received:		Requester:	
Review Complete:		Signature:	
Priority Data Faxed:		Faxed To:	
Preliminary Notification:		Person Notified:	
Final Transmittal:	10-7-99	Transmitted To:	A. Roybal
		Transmitted By:	Doug Salmi
Filed in ~~Records Center~~/ER:	10-12-99	Filed By:	A. Jensen

Comments:



Received (Records Center) By:

General Chem.

SAMPLE FINDINGS SUMMARY

COC: 602763 Sample Number	total cyanide (57-12-5)	hexavalent chromium (18540-29-9)											
M0146/M0235/T40-DF1-BH1-5.5-S	JB												
M0146/M0235/T40-DF1-BH1-10.5-S	JB												
M0146/M0235/T40-DF1-BH2-10.5-S	JB												
B6583-DF1-BH1-6.5-S	JB												
B6583-DF1-BH2-11.5-S	JB												
B6584W-DF1-BH2-5-S	JB												
B6584W-DF1-BH2-10-S	UJA2												
B6584W-DF1-BH2-10-DU	UJA2												
B6584W-DF1-BH2-10-MSDS	UJA2												
B6584W-DF1-BH3-5-S	UJA2												
B6584W-DF1-BH3-10-S	UJA2												
M0231/234-DF1-BH2-5-S	UJA2												
M0231/234-DF1-BH2-10-S	UJA2												
M0231/234-DF1-BH1-5-S	UJA2												
M0231/234-DF1-BH1-10-S	UJA2												
T12/T42/T43-SP1-BH1-14-S	UJA2												
T12/T42/T43-SP1-BH1-19-S	UJA2												
T12/T42/T43-SP1-BH1-19-CR		UJ2											

SAMPLE FINDINGS SUMMARY

Site: Non-ER Septic

AR/COC: 602763 Data Classification: Organic

Sample/ Fraction No.	Analysis	DV Qualifiers	Comments
T12/T42/T43-SA-BH1-17-PCB	EPA 8082 PCB	UJ	low surrogate recovery
M0146/M0235/T40-DF1-BH2-5.5-S	Aroclor 1016 12674-11-2	J	lack of confirmation info.

Sample No./Fraction No. - This value is located on the Chain of Custody in the ER Sample Id field

Analysis - Use valid test methods provided below or if the result applies to an individual analyte within a test method, use the CAS number from the analytical data sheet.

DV Qualifiers - The entry will be taken from the list of valid qualifiers and associated comments. If other qualifiers not on the list are needed, contact Tina Sanchez to coordinate adding them to the list.

Comments - This is only to be used if a comment associated with the qualifier is not appropriate, needs modification because of an unusual circumstance, or additional clarification is warranted.

Test Methods - Anions_CE, EPA6010, EPA6020, EPA7470/1, EPA8015B, EPA8081, EPA8260, EPA8260-M3, EPA8270, HACH_ALK, HACH_ NO2, HACH_NO3, MEKC_HE, PCBRISC

Reviewed by: [redacted] Date: 11/5/99

Memorandum

Date: 11/05/99

To: File

From: Marcia Hilchey

Subject: General Chemistry Data Review and Validation
Site: Non-ER Septic Systems
AR/COC: 602763
Case: 7223.230
Laboratory: GEL
SDG: 9908918

See attached Data Assessment Summary Forms for supporting documentation on the data review and validation.

Summary

All samples were prepared and analyzed with accepted procedures and with specified methods (total cyanide EPA9012, hexavalent chromium EPA7196). All components were successfully analyzed.

Qualifications were applied to CN sample results due to blank contamination and failure to meet matrix spike sample acceptance criteria.

Qualification was applied to a Cr6+ sample result due to exceeded holding time.

Holding Times

The CN samples were analyzed within the prescribed holding time.

The Cr6+ equipment blank sample was received 2 days and analyzed 3 days after the prescribed 24hr. holding time. Sample results were UJ2 qualified.

Calibration

Initial and continuing calibrations met QC acceptance criteria.

Blanks

The Cr6+ method blanks and equipment blanks were free of target analyte above reporting limits. The Cr6+ equipment blank result was previously qualified UJ2 (see Holding Times section above). This qualification has no affect on soil sample data quality.

Several samples exhibited CN at less than 5 times the associated method blank value. These sample results were qualified JB. See attached Sample Findings Summary. The CN equipment blank was free of target analyte above the reporting limit.

Matrix Spike Analysis

The CN matrix spike associated with several soil samples failed to meet recovery acceptance criteria (low). These sample results were qualified UJA2. See attached Sample Findings Summary.

The Cr6+ matrix spike sample analyses met QC acceptance criteria.

Laboratory Control/Laboratory Control Duplicate Samples

The Cr6+ LCS/LCSD samples met QC acceptance criteria.

One CN LCS result was not reported, but the associated LCSD was acceptable. No sample results were qualified.

Laboratory Replicate Analysis

The replicate sample analyses met QC acceptance criteria.

Other QC

Field duplicate soil sample analyses met RPD acceptance criteria.

No other specific issues were identified which affect data quality.

Please contact me if you have any questions or comments regarding the review of this package.

Memorandum

Date: 11/05/99

To: File

From: Marcia Hilchey

Subject: Organic Data Review and Validation
Site: Non-ER Septic Systems
AR/COC: 602763
Case: 7223.230
Laboratory: GEL
SDG: 9908918

See attached Data Assessment Summary Forms for supporting documentation on the data review and validation.

Summary

All samples were prepared and analyzed with accepted procedures and with specified methods (VOC EPA8270, PCB EPA8082). All compounds were successfully analyzed.

No qualifications were applied to VOC sample data.

Qualifications were applied to PCB sample results due to failure to meet acceptance criteria for surrogate recovery, and lack of positive target analyte result confirmation.

Holding Times

The samples were analyzed within the prescribed holding times.

Calibration

Several VOC CCVs had greater than 20% and less than 40%D. Since all other QC acceptance criteria were met for these analytes, no sample results were qualified.

The PCB laboratory case narrative states that several Aroclors failed to meet CCV acceptance criteria. For the purposes of data validation, only the CCV results of Aroclors 1016 and 1260 are assessed. The CCV for Aroclor 1016 analyzed on 9/4/99 at 1213 (associated with several field samples) had greater than 20 and less than 40%D. No sample results were qualified.

Blanks

No target analytes were detected above the reporting limit in the method, equipment, or trip blanks.

The results for the PCB equipment blank were qualified UJ (see Surrogate section below). This qualification has no affect on the data quality of the associated PCB samples.

Surrogates

All VOC surrogate recoveries met acceptance criteria.

The recovery for DCB in samples B6584W-DF1-BH110-S and M0231/234-DF1-BH1-10-S was slightly low. The samples were not reextracted, but were reinjected with similar results. Sample results were not qualified.

The laboratory case narrative states that DCB recovery was low for samples T12/T42/T43-SP1-BH1-14-S and T12/T42/T43-SP1-BH1-19-S. The results report pages for these samples indicate that surrogate recovery acceptance criteria were met. Sample results were not qualified.

Surrogate recovery was low for sample T12/T42/T43-SP1-GB1-19-PCB (EB). Results for this sample were qualified UJ.

Matrix Spike/Matrix Spike Duplicates (MS/MSD)

Matrix spike sample analysis for soil VOC and PCB met acceptance criteria.

No matrix spike samples were analyzed for aqueous VOC or PCB. No sample data were qualified as a result.

Internal Standards

All VOC internal standard QC acceptance criteria were met.

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

VOC LCS/LCSD samples met all acceptance criteria.

One soil PCB LCSD failed to meet acceptance criteria (high) for recovery and RPD. All associated sample results were non-detect, with the exception of sample M0146/M0235/T40-DF1-BH2-5.5-S. Non-detect sample results were not qualified; no further qualifications were applied to the positive sample result (see Confirmation section below).

Confirmation

Sample M0146/M0235/T40-DF1-BH2-5.5-S exhibited a positive result for Aroclor 1260. The reviewer could find no explicit evidence of secondary column confirmation of this result. This sample result was qualified J.

Other QC

No field duplicate samples were submitted for VOC analysis in this SDG.

PCB field duplicate analysis met RPD acceptance criteria.

No other specific issues were identified which affect data quality.

Please contact me if you have any questions or comments regarding the review of this package.

Contract Verification Review (CVR)

Project Leader A. Roybal | Project Name Non ER Septic Systems | Case No. 7223.230

AR/COC No. 602763 | Analytical Lab GEL | SDG No. 9908918

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

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

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

2.0 Analytical Laboratory Report

Line No.	Item	Complete? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? No
2.1	Data reviewed, signature	X				
2.2	Method reference number(s) complete and correct	X				
2.3	QC analysis and acceptance limits provided (MB, LCS, Replicate)	X				
2.4	Matrix spike/matrix spike duplicate data provided(if requested)	X				
2.5	Detection limits provided; PQL and MDL(or IDL), MDA and L_c	X				
2.6	QC batch numbers provided	X				
2.7	Dilution factors provided and all dilution levels reported	X				
2.8	Data reported in appropriate units and using correct significant figures	X				
2.9	Radiochemistry analysis uncertainty (2 sigma error) and tracer recovery (if applicable) reported	NA				
2.10	Narrative provided	X				
2.11	TAT met	X				
2.12	Hold times met		X	The equipment blank (aqueous) Chromium 6 hold time (24 hours) was not met.		
2.13	Contractual qualifiers provided	X				
2.14	All requested result and TIC (if requested) data provided	X				

Contract Verification Review (Continued)

3.0 Data Quality Evaluation

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1 Are reporting units appropriate for the matrix and meet contract specified or project-specific requirements? Inorganics and metals reported as ppm (mg/liter or mg/Kg)? Tritium reported in picocuries per liter with percent moisture for soil samples? Units consistent between QC samples and sample data	X		
3.2 Quantitation limit met for all samples	X		
3.3 Accuracy a) Laboratory control samples accuracy reported and met for all samples	X		
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique		X	Some PCB surrogate recoveries were slightly out. See page 125
c) Matrix spike recovery data reported and met	X		
3.4 Precision a) Replicate sample precision reported and met for all inorganic and radiochemistry samples		X	RPD for PCB archlor 1260 was slightly high. See page 128
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		
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 pesticides/PCBs	X		

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)	NA		
a) Initial calibration provided	NA		
b) Continuing calibration provided	NA		
c) Instrument run logs provided	NA		
4.3 Inorganics (metals)	X		
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	NA		
a) Instrument run logs provided	NA		

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
048404-002 Soil	PCB	PCB surrogate recoveries were slightly out of acceptance window. See page 125
048414-002 Soil	PCB	PCB surrogate recoveries were slightly out of acceptance window. See page 125
048447-005 Water	PCB	PCB surrogate recoveries were slightly out of acceptance window. See page 239
048408-002 Water	Cyanide	Due to matrix interference, the MS was not with-in window
048446-005 Water	Cyanide	EB done outside the 24 hour hold time

Were deficiencies unresolved? ☐ Yes ☒ No

Based on the review, this data package is complete. ☒ Yes ☐ No

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

Reviewed by: Nancy Talbert Date: 10-7-99 Closed by: _____ Date: _____

Analysis Request And Chain Of Custody (Continuation)

AR/COC-6 602763

Project Name: Non-ER Sypelic System	Project/Task Manger: M Sanders	Case No.: 7223 230

Location	Tech Area	Reference LOV (available at SMO)									Lab use
Building	Room										
Sample No-Fraction	ER Sample ID or Sample Location detail	Depth in Ft	ER Site No.	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Methods	Sample Type	Parameter & Method Requested	Lab Sample ID
048411-001	MO231/234-DFI-BH1-5-S	5ft	N/A	082399 0913	S	AC	125 ml	4C	GR	SA	VOC 35	
048411-002	MO231/234-DFI-BH1-5-S	5 ft	N/A	082399 0913	S	AG	250m	4C	GR	SA	PCB CN Cr6 36	
048412-001	MO231/234-DFI-BH2-10-S	10 ft	N/A	082399 0927	S	AC	125ml	4C	GR	SA	VOC 37	
048412-002	MO231/234-DFI-BH2-10-S	10 ft	N/A	082399 0927	S	AG	250ml	4C	GR	SA	PCB CN Cr6 38	
048413-001	MO231/234-DFI-BH1-5-S	5 ft	N/A	082399 1007	S	AC	125ml	4C	GR	SA	VOC 39	
048413-002	MO231/234-DFI-BH1-5-S	5 ft	N/A	082399 1007	S	AG	250ml	4C	GR	SA	PCB CN Cr6 40	
048414-001	MO231/234-DFI-BH1-10-S	10 ft	N/A	082399 1020	S	AC	125ml	4C	GR	SA	VOC 41	
048414-002	MO231/234-DFI-BH1-10-S	10 ft	N/A	082399 1020	S	AG	250ml	4C	GR	SA	PCB CN Cr6 42	
048443-001	T12/T42/T43-SPI-BH1-14-S	14ft	N/A	082399 1150	S	AC	125ml	4C	GR	SA	VOC 43	
048443-002	T12/T42/T43-SPI-BH1-14-S	14 ft	N/A	082399 1150	S	AG	250 125ml	4C	GR	SA	PCB CN Cr6 44	
048444-001	T12/T42/T43-SPI-BH1-19-S	19 ft	N/A	082399 1201	S	AC	125ml	4C	GR	SA	VOC 45	
048444-002	T12/T42/T43-SPI-BH1-19-S	19 ft	N/A	082399 1201	S	AG	250ml	4C	GR	SA	PCB CN Cr6 46	
048445-005	T12/T42/T43-SPI-BH1-19-CN	N/A	N/A	082399 1100	QW	P	1L	NaOH	GR	EB	Total Cyanide 47	
048446-005	T12/T42/T43-SPI-BH1-19-Cr	N/A	N/A	082399 1100	QW	P	500ml	4C	GR	EB	Chrome 6 48	
048447-005	T12/T42/T43-SPI-BH1-19-PCB	N/A	N/A	082399 1100	QW	AG	2x1L	4C	GR	EB	PCB 49	
048448-005	T12/T42/T43-SPI-BH1-19-EB	N/A	N/A	082399 1100	QW	G	3x40ml	HCL	GR	EB	VOC 50	
048449-005	T12/T42/T43-SPI-BH1-19-TB	N/A	N/A	082399 1100	QW	G	3x40ml	HCL	GR	TB	VOC 51	

Abnormal Condition(s) Explain

048443 >10

048449

048452

Contract Verification Review (CVR)

Project Leader A. Roybal | Project Name Non ER Septic Systems | Case No. 7223.230

AR/COC No. 602763 | Analytical Lab GEL | SDG No. 9908918

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

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

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

2.0 Analytical Laboratory Report

Line No.	Item	Complete? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? No
2.1	Data reviewed, signature	X				
2.2	Method reference number(s) complete and correct	X				
2.3	QC analysis and acceptance limits provided (MB, LCS, Replicate)	X				
2.4	Matrix spike/matrix spike duplicate data provided(if requested)	X				
2.5	Detection limits provided; PQL and MDL(or IDL), MDA and L_c	X				
2.6	QC batch numbers provided	X				
2.7	Dilution factors provided and all dilution levels reported	X				
2.8	Data reported in appropriate units and using correct significant figures	X				
2.9	Radiochemistry analysis uncertainty (2 sigma error) and tracer recovery (if applicable) reported	NA				
2.10	Narrative provided	X				
2.11	TAT met	X				
2.12	Hold times met		X	The equipment blank (aqueous) Chromium 6 hold time (24 hours) was not met.		
2.13	Contractual qualifiers provided	X				
2.14	All requested result and TIC (if requested) data provided	X				

Contract Verification Review (Continued)

3.0 Data Quality Evaluation

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1 Are reporting units appropriate for the matrix and meet contract specified or project-specific requirements? Inorganics and metals reported as ppm (mg/liter or mg/Kg)? Tritium reported in picocuries per liter with percent moisture for soil samples? Units consistent between QC samples and sample data	X		
3.2 Quantitation limit met for all samples	X		
3.3 Accuracy a) Laboratory control samples accuracy reported and met for all samples	X		
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique		X	Some PCB surrogate recoveries were slightly out. See page 125
c) Matrix spike recovery data reported and met	X		
3.4 Precision a) Replicate sample precision reported and met for all inorganic and radiochemistry samples		X	RPD for PCB archlor 1260 was slightly high. See page 126
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		
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 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)	NA		
a) Initial calibration provided	NA		
b) Continuing calibration provided	NA		
c) Instrument run logs provided	NA		
4.3 Inorganics (metals)	X		
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	NA		
a) Instrument run logs provided	NA		

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
048404-002 Soil	PCB	PCB surrogate recoveries were slightly out of acceptance window. See page 125
048414-002 Soil	PCB	PCB surrogate recoveries were slightly out of acceptance window. See page 125
048447-005 Water	PCB	PCB surrogate recoveries were slightly out of acceptance window. See page 239
048408-002 Water	Cyanide	Due to matrix interference, the MS was not with-in window
048446-005 Water	Cyanide	EB done outside the 24 hour hold time

Were deficiencies unresolved? ☐ Yes ☒ No

Based on the review, this data package is complete. ☒ Yes ☐ No

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

Reviewed by: Doug Sabol Date: 10-7-99 Closed by: _____ Date: _____

ANNEX C
DSS Site 1015
Risk Assessment

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TABLE OF CONTENTS

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LIST OF FIGURES

DSS SITE 1015: RISK ASSESSMENT REPORT

I. Site Description and History

Drain and Septic Systems (DSS) Site 1015, the Former Mobile Office (MO) 231-234 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 1,000-gallon septic tank connected to a drainfield consisting of three 45-foot-long drain lines. Available information indicates that the former MO 231-234 complex was constructed in 1988 (SNL/NM March 2003), and it is assumed that the septic system was also constructed at that time. By June 1991, the septic system discharges were routed to the City of Albuquerque sanitary sewer system (Jones June 1991). The old septic system line would have been disconnected and capped, and the system was abandoned in place concurrent with this change (Romero September 2003). This MO complex was dismantled and relocated to TA-I in 1995 or 1996 when the new TA-V Building 6585 was constructed.

Environmental concern about DSS Site 1015 is based upon the potential for the release of constituents of concern (COCs) in effluent discharged to the environment via the septic system drainfield at this site. Because operational records are 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 this paved site is flat to very slightly sloping to the west. Precipitation drains to the northwest corner of the parking lot, then to a shallow storm-water ditch on the north side of the parking lot. Storm water then flows in a northwesterly direction to Arroyo del Coyote, located approximately 1 mile north 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 essentially nonexistent at DSS Site 1015, as virtually all of the moisture either drains away from the site or evaporates. The estimates of evapotranspiration for the KAFB area range from 95 to 99 percent of the annual rainfall (SNL/NM March 1996).

DSS Site 1015 lies at an average elevation of approximately 5,419 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 496 feet below ground surface (bgs). Groundwater flow is to the west in this area (SNL/NM March 2002). The production wells nearest to DSS Site 1015 are KAFB-4 and KAFB-11, approximately 2.75 and 3.0 miles northwest and northeast of the site, respectively. The nearest groundwater monitoring wells are TAV-MW8 and TAV-MW9, approximately 200 feet west of the site.

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 baseline 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 1015 was effluent discharged to the environment from the drainfield.

Table 1
Summary of Sampling Performed to Meet DQOs

DSS Site 1015 Sampling Area	Potential COC Source	Number of Sampling Locations	Sample Density (samples/acre)	Sampling Location Rationale
Soil beneath the septic system drainfield	Effluent discharged to the environment from the drainfield	2	NA	Evaluate potential COC releases to the environment from effluent discharged from the drainfield

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

The baseline soil samples were collected with a Geoprobe™ in two locations at DSS Site 1015 from two 3- to 4-foot-long sampling intervals at each boring location. Drainfield sampling intervals started at 5 and 10 feet bgs in each of the drainfield borings. 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 1015 baseline 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 Environmental Restoration (ER) Chemistry Laboratory and Radiation Protection Sample Diagnostics (RPSD) Laboratory. Table 3 summarizes the analytical methods and 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 1015

Sample Type	VOCs	SVOCs	PCBs	HE	RCRA Metals + Copper and Zinc	Hexavalent Chromium	Cyanide	Gamma Spectroscopy Radionuclides	Gross Alpha/Beta
Confirmatory	4	4	4	4	4	4	4	4	4
Duplicates	0	1	0	1	1	0	0	1	0
EBs and TBs (VOCs only)	1	0	0	0	0	0	0	0	0
Total Samples	5	5	4	5	5	4	4	5	4
Analytical Laboratory	GEL	GEL	GEL	ERCL, GEL	ERCL, GEL	GEL	GEL	RPSD, GEL	GEL

DSS = Drain and Septic Systems.
EB = Equipment blank.
ERCL = Environmental Restoration Chemistry Laboratory.
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 1015

Analytical Method[a]	Data Quality Level	GEL	ERCL	RPSD
VOCs EPA Method 8260	Defensible	4	None	None
SVOCs EPA Method 8270	Defensible	4	None	None
PCBs EPA Method 8082	Defensible	4	None	None
HE Compounds EPA Method 8330	Defensible	None	4	None
RCRA metals + Copper and Zinc EPA Method 6000/7000/7196A	Defensible	None	4	None
Hexavalent Chromium EPA Method 7196A	Defensible	4	None	None
Total Cyanide EPA Method 9012A	Defensible	4	None	None
Gamma Spectroscopy Radionuclides EPA Method 901.1	Defensible	None	None	4
Gross Alpha/Beta Activity EPA Method 900.0	Defensible	4	None	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.
ERCL = Environmental Restoration Chemistry Laboratory.
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 baseline sampling effort according to the ER Project Quality Assurance Project Plan. The QA/QC samples consisted of one trip blank (for VOCs only) and four duplicate soil samples. No significant QA/QC problems were identified in the QA/QC samples.

All of the baseline 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 1015 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 1015 was based upon an initial conceptual model validated with confirmatory sampling at the site. The initial conceptual model was developed from archival site research, septic tank sampling, site inspections, and soil 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 1015, which is presented in Chapter 4.0 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 1015 were evaluated using laboratory analyses of the soil samples. The analytical requirements included analyses for VOCs, SVOCs, HE compounds, PCBs, RCRA metals plus copper and zinc, 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 potential degradation products at DSS Site 1015.

III.3 Rate of Contaminant Migration

The septic system at DSS Site 1015 was deactivated in the early 1990s when the former MO 231-234 complex 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 would have been predominantly dependent upon infiltrating precipitation. However, it is highly unlikely that sufficient precipitation would have reached the depth at which COCs may have been discharged to the subsurface because the site is covered by pavement. Analytical data generated from the soil sampling conducted at the site are adequate to characterize the rate of COC migration at DSS Site 1015.

III.4 Extent of Contamination

Subsurface baseline soil samples were collected from boreholes drilled at two locations beneath the effluent release points and areas (the drainfield) at the site to assess whether releases of effluent from the septic system caused any environmental contamination.

The baseline soil samples were collected at sampling depths starting at 5 and 10 feet bgs in the drainfield area. Sampling intervals started at the depths at which effluent discharged from the drainfield drain lines 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 baseline 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 Screening Levels

Site history and characterization activities are used to identify potential COCs. The DSS Site 1015 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 that were evaluated in this risk assessment included all detected organic and all inorganic and radiological COCs for which samples were analyzed. When the detection limit of an organic compound was too high (i.e., could possibly cause an adverse effect to human health or the environment), the compound was 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 used 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 through 7.

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

Tables 4 and 5 list the nonradiological COCs for the human health and ecological risk assessments at DSS Site 1015, respectively. Tables 6 and 7 list the radiological COCs for the human health and ecological risk assessments, respectively. All tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997). Section VI.4 discusses the results presented in Tables 4 and 5; Sections VII.2 and VII.3 discuss the results presented in Tables 6 and 7.

V. Fate and Transport

The primary releases of COCs at DSS Site 1015 were to the subsurface soil resulting from the discharge of effluents from the MO 231-234 Septic System. Wind, water, and biota are natural mechanisms of COC transport from the primary release point; however, because the

Table 4
Nonradiological COCs for Human Health Risk Assessment at DSS Site 1015 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	4.9 J	4.4	**No**	44[c]	–	**Yes**
Barium	117 J	214	Yes	170[d]	–	**Yes**
Cadmium	0.16 J	0.9	Yes	64[c]	–	**Yes**
Chromium, total	10 J	15.9	Yes	16[c]	–	No
Chromium VI	0.0805 J	1	Yes	16[c]	–	No
Copper	8.7 J	18.2	Yes	6[c]	–	No
Cyanide	0.068[e]	NC	**Unknown**	NC	–	**Unknown**
Lead	7.5 J	11.8	Yes	49[c]	–	**Yes**
Mercury	0.047 J	<0.1	**Unknown**	5,500[c]	–	**Yes**
Selenium	0.36 J	<1	**Unknown**	800[f]	–	**Yes**
Silver	0.247 J	<1	**Unknown**	0.5[c]	–	No
Zinc	29.8	62	Yes	47[c]	–	**Yes**
Organic						
2-Butanone	0.016	NA	**NA**	1[g]	0.29[g]	No
Toluene	0.0096	NA	**NA**	10.7[c]	2.69[c]	No

Note: **Bold** indicates the COCs that exceed the background screening values and/or are bioaccumulators.
[a]Dinwiddie September 1997, Southwest Area Supergroup.
[b]NMED March 1998.
[c]Yanicak March 1997.
[d]Neumann 1976.
[e]Parameter was not detected. Concentration used is one-half of the highest detection limit.
[f]Callahan et al. 1979.
[g]Howard 1990.

Table 4 (Concluded)
Nonradiological COCs for Human Health Risk Assessment at DSS Site 1015 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

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

Table 5
Nonradiological COCs for Ecological Risk Assessment at DSS Site 1015 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

COC	Maximum Concentration (Samples ≤ 5 ft bgs) (mg/kg)	SNL/NM Background Concentration (mg/kg)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (Maximum Aquatic)	Log K_{ow} (for Organic COCs)	Bioaccumulator?[b] (BCF>40, Log K_{ow}>4)
Inorganic						
Arsenic	4.2 J	4.4	Yes	44[c]	–	**Yes**
Barium	44 J	214	Yes	170[d]	–	**Yes**
Cadmium	0.063 J	0.9	Yes	64[c]	–	**Yes**
Chromium, total	5.0 J	15.9	Yes	16[c]	–	No
Chromium VI	0.0303[e]	1	Yes	16[c]	–	No
Copper	4.1 J	18.2	Yes	6[c]	–	No
Cyanide	0.0655[e]	NC	**Unknown**	NC	–	**Unknown**
Lead	3.2 J	11.8	Yes	49[c]	–	**Yes**
Mercury	0.047 J	<0.1	**Unknown**	5,500[c]	–	**Yes**
Selenium	0.15[e]	<1	**Unknown**	800[f]	–	**Yes**
Silver	0.0205[e]	<1	**Unknown**	0.5[c]	–	No
Zinc	11 J	62	Yes	47[c]	–	**Yes**
Organic						
2-Butanone	0.012	NA	**NA**	1[g]	0.29[g]	No
Toluene	0.0015	NA	**NA**	10.7[c]	2.69[c]	No

Note: **Bold** indicates the COCs that exceed the background screening values and/or are bioaccumulators.
[a]Dinwiddie September 1997, Southwest Area Supergroup.
[b]NMED March 1998.
[c]Yanicak March 1997.
[d]Neumann 1976.
[e]Parameter was not detected. Concentration is one-half the detection limit.
[f]Callahan et al. 1979.
[g]Howard 1990.

Table 5 (Concluded)
Nonradiological COCs for Ecological Risk Assessment at DSS Site 1015 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

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

Table 6
Radiological COCs for Human Health Risk Assessment at DSS Site 1015 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 (0.0186)	0.079	Yes	3,000[c]	**Yes**
Th-232	0.807	1.01	Yes	3,000[c]	**Yes**
U-235	0.112	0.16	Yes	900[c]	**Yes**
U-238	**1.9**	1.4	**No**	900[c]	**Yes**

Note: **Bold** indicates COCs that exceed 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.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
SNL/NM = Sandia National Laboratories/New Mexico.

Table 7
Radiological COCs for Ecological Risk Assessment at DSS Site 1015 with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC	Maximum Activity (Samples ≤ 5 ft bgs) (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 (0.0175)	0.079	Yes	3,000[c]	**Yes**
Th-232	0.525	1.01	Yes	3,000[c]	**Yes**
U-235	ND (0.0981)	0.16	Yes	900[c]	**Yes**
U-238	0.569	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.
bgs = Below ground surface.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
ft = Foot (feet).
MDA = Minimum detectable activity.
ND ( ) = Not detected, above the MDA, shown in parentheses.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
SNL/NM = Sandia National Laboratories/New Mexico.

discharge was to subsurface soil that is covered by pavement, none of these are considered to be of potential significance as transport mechanisms at this site. Because the septic system is no longer active, additional infiltration of water is not expected. Virtually all of the moisture received at DSS Site 1015 either drains away from the site or evaporates. Because depth to groundwater at this site is approximately 496 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 1015 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-238), the aridity of the environment at this site, and the lack of potential contact with biota, none of these mechanisms is expected to result in significant losses or transformations of the inorganic COCs.

The organic COCs at DSS Site 1015 are 2-butanone and toluene. 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 and the pavement covering the site, the loss of 2-butanone and toluene through volatilization is expected to be minimal.

Table 8 summarizes the fate and transport processes that can occur at DSS Site 1015. The COCs at this site include organic analytes as well as radiological and nonradiological inorganic analytes. Wind, surface water, and biota are considered to be of low significance as potential transport mechanisms at this site. Significant leaching into the subsurface soil is unlikely, and leaching into the groundwater at this site is highly unlikely. The potential for transformation of COCs is low and loss through decay of the radiological COC is insignificant because of its long half-life.

Table 8
Summary of Fate and Transport at DSS Site 1015

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 1015. 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 1015 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. 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 1015 is approximately 496 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 1015.

Pathway Identification

Nonradiological Constituents	Radiological Constituents
Soil ingestion	Soil ingestion
Inhalation (dust)	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 were compared to the approved SNL/NM maximum screening levels for this area. The SNL/NM maximum background concentration was selected to provide the background screen in Table 4 and used to calculate risk attributable to background in Section VI.6.2. Only the COCs that were either detected above the corresponding SNL/NM maximum background screening levels or did not have either a quantifiable or calculated background screening level were considered in further risk assessment analyses.

For the radiological COCs that exceeded the SNL/NM background screening levels, background values were subtracted from the individual maximum radionuclide concentrations. Those that did not exceed these background levels were 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 background screening values and were detected above the analytical minimum detectable activity were 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 6 show DSS Site 1015 maximum COC concentrations that were compared to the SNL/NM maximum background values (Dinwiddie September 1997) for the human health risk assessment. For the nonradiological COCs, one constituent was measured at a concentration greater than the background screening value. Four constituents do not have quantified background screening concentrations, therefore it is unknown if these COCs exceeded background. Two nonradiological COCs were organic compounds that do not have corresponding background screening values.

For the radiological COCs, one constituent (U-238) exhibited a reported value greater than the background screening level. This value was conservatively used in the risk assessment.

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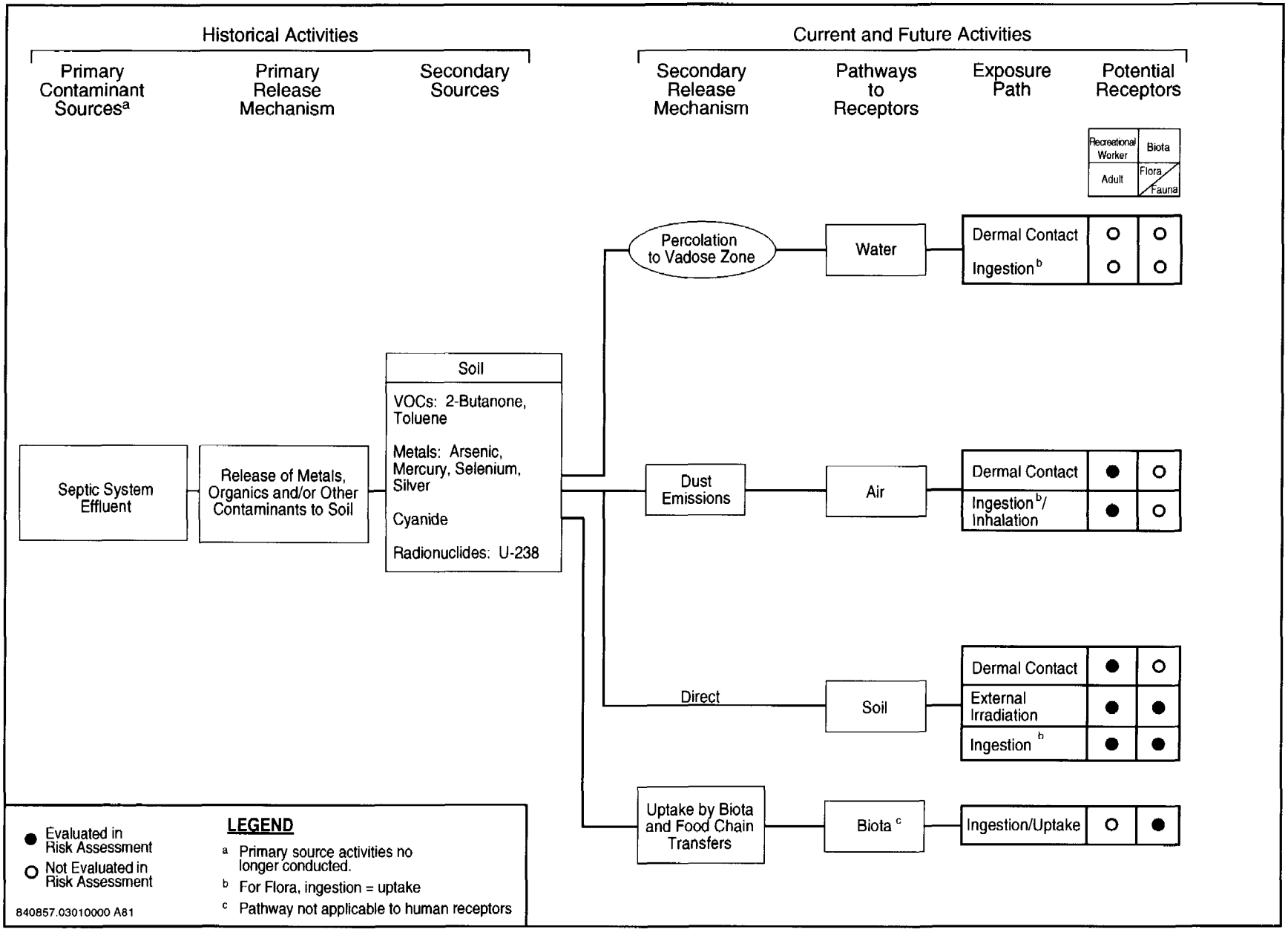

Figure 1

Conceptual Site Model Flow Diagram for DSS Site 1015, Former MO 231-234 Septic System

VI.5 Step 4. Identification of Toxicological Parameters

Tables 9 and 10 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 9 were obtained from the Integrated Risk Information System (IRIS) (EPA 2003), the Health Effects Assessment Summary Tables (HEAST) (EPA 1997a), and the Technical Background Document for Development of Soil Screening Levels (NMED December 2000). 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 COCs for both 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, and reflect the reasonable maximum exposure (RME) approach advocated by the RAGS (EPA 1989). For radiological COCs, the coded equations provided in RESRAD computer code are used to estimate the incremental TEDE and cancer risk for individual exposure pathways. Further discussion of this process is provided in the "Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD" (Yu et al. 1993a).

Table 9
Toxicological Parameter Values for DSS Site 1015 Nonradiological COCs

COC	RfD_o (mg/kg-d)	Confidence[a]	RfD_{inh} (mg/kg-d)	Confidence[a]	SF_o $(mg/kg\text{-}d)^{-1}$	SF_{inh} $(mg/kg\text{-}d)^{-1}$	Cancer Class[b]	ABS
Inorganic								
Arsenic	3E-4[c]	M	–	–	1.5E+0[c]	1.5E+1[c]	A	0.03[d]
Cyanide	2E-2[c]	M	–	–	–	–	D	0.1[d]
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]
Toluene	2E-1[c]	M	1.1E-1[c]	M	–	–	D	0.1[d]

[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):

A = Human carcinogen.
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).

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 10
Toxicological Parameter Values for DSS Site 1015 Radiological COCs Obtained from RESRAD Risk Coefficients[a]

COC	SF_o (1/pCi)	SF_{inh} (1/pCi)	SF_{ev} (g/pCi-yr)	Cancer Class[b]
U-238	6.20E-11	1.20E-08	6.60E-08	A

[a]Yu et al. 1993a.
[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989): A = Human carcinogen for high dose and high dose rate (i.e., greater than 50 rem per year). For low-level environmental exposures, the carcinogenic effect has not been observed and documented.
1/pCi = One per picocurie.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
g/pCi-yr = Gram(s) per picocurie-year.
SF_{ev} = External volume exposure slope factor.
SF_{inh} = Inhalation slope factor.
SF_o = Oral (ingestion) slope factor.

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 11 shows an HI of 0.02 for the DSS Site 1015 nonradiological COCs and an estimated excess cancer risk of 3E-6 for the designated industrial land-use scenario. The numbers presented include exposure from soil ingestion, dermal contact, and dust and volatile inhalation for nonradiological COCs. Table 12 shows an HI of 0.02 and an estimated excess cancer risk of 3E-6 for the DSS Site 1015 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 for an individual on the site, which resulted in an incremental TEDE of 1.4E-2 millirem (mrem)/year (yr). In accordance with EPA guidance found in Office of Solid Waste and Emergency Response (OSWER) Directive No. 9200.4-18 (EPA 1997b), an incremental TEDE of 15 mrem/yr is used for the probable land-use scenario (industrial in this case); the calculated dose value for DSS Site 1015 for the industrial land use is well below this guideline. The estimated excess cancer risk is 2.4E-9.

For the nonradiological COCs under the residential land-use scenario the HI is 0.23 with an estimated excess cancer risk of 1E-5 for the designated residential land-use scenario (Table 11). The numbers in the table include exposure from soil ingestion, dermal contact, and dust 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, subsequently, 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 12 shows an HI of 0.20 and an

Table 11
Risk Assessment Values for DSS Site 1015 Nonradiological COCs

COC	Maximum Concentration (All Samples) (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Arsenic	4.9	0.02	3E-6	0.23	1E-5
Cyanide	0.068[b]	0.00	–	0.00	–
Mercury	0.047 J	0.00	–	0.00	–
Selenium	0.36 J	0.00	–	0.00	–
Silver	0.247 J	0.00	–	0.00	–
Organic					
2-Butanone	0.016	0.00	–	0.00	–
Toluene	0.0096	0.00	–	0.00	–
Total		**0.02**	**3E-6**	**0.23**	**1E-5**

[a]EPA 1989.
[b]Maximum concentration was one-half the detection limit.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
J = Estimated concentration
mg/kg = Milligram(s) per kilogram.
– = Information not available.

Table 12
Risk Assessment Values for DSS Site 1015 Nonradiological Background Constituents

COC	Background Concentration[a] (mg/kg)	Industrial Land-Use Scenario[b]		Residential Land-Use Scenario[b]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	4.4	0.02	3E-6	0.20	1E-5
Cyanide	NC	–	–	–	–
Mercury	<0.1	–	–	–	–
Selenium	<1	–	–	–	–
Silver	<1	–	–	–	–
Total		**0.02**	**3E-6**	**0.20**	**1E-5**

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

estimated excess cancer risk of 1E-5 for the DSS Site 1015 associated background constituents under the residential land-use scenario.

For the radiological COCs, the incremental TEDE for the residential land-use scenario is 3.5E-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 1015 for the residential land-use scenario is well below this guideline. Consequently, DSS Site 1015 is eligible for unrestricted radiological release as the residential land-use scenario resulted in an incremental TEDE of less than 75 mrem/yr to the on-site receptor. The estimated excess cancer risk is 3.7E-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 evaluated the potential for adverse health effects for both the industrial (the designated land-use scenario for this site) and residential land-use scenarios.

For the nonradiological COCs under the industrial land-use scenario, the HI is 0.02 (lower than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). The excess cancer risk is 3E-6. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. This assessment also determined risks considering background concentrations of the potential nonradiological COCs for both the industrial and residential land-use scenarios. The incremental risk is determined by subtracting risk associated with background from potential COC risk. These numbers are not rounded before the difference is determined and therefore may appear to be inconsistent with numbers presented in tables and within the text. For conservatism, the background constituents that do not have quantified background screening concentrations are assumed to have a hazard quotient (HQ) of 0.00. The incremental HI is 0.00 and the estimated incremental cancer risk is 3.47E-7 for the industrial land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs considering an industrial land-use scenario.

For the radiological COCs under the industrial land-use scenario, the incremental TEDE is 1.4E-2 mrem/yr, which is significantly lower than EPA's numerical guideline of 15 mrem/yr. The incremental estimated excess cancer risk is 2.4E-9.

For the nonradiological COCs under the residential land-use scenario, the calculated HI is 0.23, which is below the numerical guidance. The excess cancer risk is 1E-5. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is slightly above the suggested acceptable risk value. The incremental HI is 0.03 and the estimated incremental cancer risk is 1.29E-6 for the residential land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs, considering a residential land-use scenario.

The incremental TEDE from the radiological components for the residential land-use scenario is 3.5E-2 mrem/yr, which is significantly lower than the numerical guideline of 75 mrem/yr suggested in the SNL/NM "RESRAD Input Parameter Assumptions and Justification" (SNL/NM February 1998). The estimated excess cancer risk is 3.7E-7.

VI.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at DSS Site 1015 was based upon an initial conceptual model that was validated with baseline sampling conducted at the site. The baseline 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 for the risk assessment at DSS Site 1015.

Because of the location, history, 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. Because the COCs are found in near-surface soil and because of the location and physical characteristics of the site, there is little uncertainty in the exposure pathways relevant to the analysis.

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

Table 9 shows the uncertainties (confidence levels) in nonradiological toxicological parameter values. There is a mixture of estimated values and values from the IRIS (EPA 2003), HEAST (EPA 1997a), and the 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), the Risk Assessment Information System (ORNL 2003) or the 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 land-use scenario compared to established numerical guidance.

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

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

VI.9 Summary

DSS Site 1015 contains identified COCs consisting of some inorganic and radiological compounds. Because of the location of the site, the designated industrial land-use scenario, and the nature of contamination, potential exposure pathways identified for this site included soil ingestion, dermal contact, and dust inhalation for chemical COCs and soil ingestion, dust inhalation, and direct gamma exposure for radionuclides. The same exposure pathways were applied to the residential land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for the nonradiological COCs show that for the industrial land-use scenario the HI (0.02) is significantly lower than the accepted numerical guidance from the EPA. The estimated excess cancer risk is 3E-6. Thus, excess cancer risk is also below the acceptable risk value provided by the NMED for an industrial land-use scenario (Bearzi January 2001). The incremental HI is 0.00 and the incremental excess cancer risk is 3.14E-7 for the industrial land-use scenario. Incremental risk calculations indicate insignificant risk to human health for the industrial land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for the nonradiological COCs show that for the residential land-use scenario the HI (0.23) is also below the accepted numerical guidance from the EPA. The estimated excess cancer risk is 1E-5. Thus, excess cancer risk is slightly above the acceptable risk value provided by the NMED for a residential land-use scenario (Bearzi January 2001). The incremental HI is 0.03 and the incremental excess cancer risk is 1.29E-6 for the residential land-use scenario. The incremental risk calculations indicate insignificant risk to human health for the residential land-use scenario.

The incremental TEDE and corresponding estimated cancer risk from radiological COCs are less than EPA guidance values. The estimated TEDE is 1.4E-2 mrem/yr for the industrial land-use scenario, which is much lower than the EPA's numerical guidance of 15 mrem/yr (EPA 1997b). The corresponding incremental estimated cancer risk value is 2.4E-9 for the industrial land-use scenario. Furthermore, the incremental TEDE for the residential land-use scenario that results from a complete loss of institutional control is 3.5E-2 mrem/yr with an associated risk of 3.7E-7. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, DSS Site 1015 is eligible for unrestricted radiological release.

The summation of the nonradiological and radiological carcinogenic risks is tabulated in Table 13.

Uncertainties associated with the calculations are considered small relative to the conservatism of this 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.

Table 13
Summation of Radiological and Nonradiological Risks from DSS Site 1015, Former MO 231–234 Septic System Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	3.14E-7	2.4E-9	3.1E-7
Residential	1.29E-6	3.7E-7	1.7E-6

DSS = Drain and Septic Systems.

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 1015. A component of the NMED Risk-Based Decision Tree (NMED March 1998) is to conduct an ecological 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. Initial components of NMED's decision tree (a discussion of DQOs, data assessment, and evaluations of bioaccumulation as well as fate and transport potential) are addressed in previous sections of this report. Following the completion of the scoping assessment, a determination is made as to whether a more detailed examination of potential ecological risk is necessary. If deemed necessary, the scoping assessment proceeds to a risk assessment whereby a more quantitative estimate of ecological risk is conducted. Although this assessment is conservative in the estimation of ecological risks, ecological relevance and professional judgment are also used as recommended by the EPA (1998) to ensure that predicted exposures of selected ecological receptors reflect those reasonably expected to occur at the site.

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 and a comparison of maximum detected concentrations to background concentrations, examination of bioaccumulation potential, and fate and transport potential. A scoping risk-management decision (Section VII.2.4) involves summarizing the scoping results and determining whether further examination of potential ecological impacts is necessary.

VII.2.1 Data Assessment

As indicated in Section IV (Tables 5 and 7), constituents in soil within the 0- to 5-foot depth interval that were identified as COPECs for this site were as follows:

- Cyanide
- Mercury

- Selenium
- Silver
- 2-Butanone
- Toluene

VII.2.2 Bioaccumulation

Among the COPECs listed in Section VII.2.1, the following were considered to have bioaccumulation potential in aquatic environments (Section IV, Tables 5 and 7):

- Mercury
- Selenium

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

VII.2.3 Fate and Transport Potential

The potential for the COPECs to migrate from the source of contamination to other media or biota is discussed in Section V. As noted in Table 8 (Section V), wind, surface water, and biota (food chain uptake) are expected to be of low significance as transport mechanisms for COPECs at this site. Degradation, transformation, and radiological decay of the COPECs are also expected to be of low significance.

VII.2.4 Scoping Risk-Management Decision

Based upon information gathered through the scoping assessment, it was concluded that complete ecological pathways may be associated with this site and that COPECs also exist at the site. As a consequence, a detailed ecological risk assessment was deemed necessary to predict the potential level of ecological risk associated with the site.

VII.3 Risk Assessment

As concluded in Section VII.2.4, both complete ecological pathways and COPECs are associated with this site. The ecological risk assessment performed for the site involves a quantitative estimate of current ecological risks using exposure models in association with exposure parameters and toxicity information obtained from the literature. The estimation of potential ecological risks is conservative to ensure that ecological risks are not underpredicted.

Components within the risk assessment include the following:

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

VII.3.1 Problem Formulation

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

VII.3.1.1 Ecological Pathways and Setting

DSS Site 1015 is less than 1 acre in size and located underneath a paved area. No threatened or endangered species are known to occur at this site (IT February 1995), and no surface-water bodies, seeps, or springs are associated with the site.

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

VII.3.1.2 COPECs

Discharge of waste water from the septic system of the former MO 231–234 complex is the primary source of COPECs at DSS Site 1015. COPECs identified for this site are listed in Section VII.2 and include both inorganic and organic constituents. The analytes were screened against background concentrations and those that exceeded the approved SNL/NM background screening levels (Dinwiddie September 1997) for the area were considered to be COPECs. All organic analytes detected and all inorganic analytes with uncertain background concentrations were retained as COPECs. Inorganic constituents that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, were not included in this risk assessment as set forth by the EPA (1989). In order to provide conservatism, this ecological risk assessment was based upon the maximum soil concentrations of the COPECs measured in the upper 5 feet of soil at this site. Tables 5 and 7 present maximum concentrations for the COPECs.

VII.3.1.3 Ecological Receptors

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

VII.3.2 Exposure Estimation

For nonradiological COPECs, direct uptake from the soil was considered the only significant route of exposure for terrestrial plants. Exposure modeling for the wildlife receptors was limited to food and soil ingestion pathways. Inhalation and dermal contact were considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Drinking water was also considered an insignificant pathway because of the lack of surface water at this site. The deer mouse was modeled under three dietary regimes: as an herbivore (100 percent of its diet as plant material), as an omnivore (50 percent of its diet as plants and 50 percent as soil invertebrates), and as an insectivore (100 percent of its diet as soil invertebrates). The burrowing owl was modeled as a strict predator on small mammals (100 percent of its diet as deer mice). Because the exposure in the burrowing owl from a diet consisting of equal parts of herbivorous, omnivorous, and insectivorous mice would be equivalent to the exposure consisting of only omnivorous mice, the diet of the burrowing owl was modeled with intake of omnivorous mice only. Both species were modeled with soil ingestion comprising 2 percent of the total dietary intake. Table 14 presents the species-specific factors used in modeling exposures in the wildlife receptors. Justification for use of the factors presented in this table is described in the ecological risk assessment methodology document (IT July 1998).

Although home range is also included in this table, exposures for this risk assessment were modeled using an area use factor of 1.0, implying that all food items and soil ingested come

Table 14
Exposure Factors for Ecological Receptors at DSS Site 1015

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

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

from the site being investigated. The maximum COPEC concentrations measured in the upper 5 feet of soil were used to conservatively estimate potential exposures and risks to plants and wildlife at this site.

Table 15 provides the transfer factors used in modeling the concentrations of COPECs through the food chain. Table 16 presents maximum concentrations in soil and derived concentrations in tissues of the various food chain elements that are used to model dietary exposures for each of the wildlife receptors.

VII.3.3 Ecological Effects Evaluation

Table 17 shows benchmark toxicity values for the plant and wildlife receptors. For plants, the benchmark soil concentrations are based upon the lowest-observed-adverse-effect level (LOAEL). For wildlife, the toxicity benchmarks are based upon the no-observed-adverse-effect level (NOAEL) for chronic oral exposure in a taxonomically similar test species. Sufficient toxicity information was not available to estimate the LOAELs or NOAELs for some COPECs.

VII.3.4 Risk Characterization

Maximum concentrations in soil and estimated dietary exposures were compared to plant and wildlife benchmark values, respectively. Table 18 presents the results of these comparisons. HQs are used to quantify the comparison with benchmarks for plant and wildlife exposure.

None of the HQs for this site exceed unity. Because of a lack of sufficient toxicity information, an HQ for plants could not be determined for cyanide and 2-butanone, and HQs for the burrowing owl could not be determined for cyanide, silver, 2-butanone, and toluene. As directed by the NMED, HIs were calculated for each of the receptors (the HI is the sum of chemical-specific HQs for all pathways for a given receptor). None of the HIs exceed unity, with a maximum HI of 0.68 for the burrowing owl.

VII.3.5 Uncertainty Assessment

Many uncertainties are associated with the characterization of ecological risks at DSS Site 1015. These uncertainties result from assumptions used in calculating risk that could overestimate or underestimate true risk presented at the site. For this risk assessment, assumptions are made that are more likely to overestimate exposures and risk rather than to underestimate them. These conservative assumptions are used to be more protective of the ecological resources potentially affected by the site. Conservatisms incorporated into this risk assessment include the use of maximum analyte concentrations measured in soil to evaluate risk, the use of wildlife toxicity benchmarks based upon NOAEL values, and the incorporation of strict herbivorous and strict insectivorous diets for predicting the extreme HQ values for the deer mouse. Each of these uncertainties, which are consistent among each of the site-specific ecological risk assessments, is discussed in greater detail in the uncertainty section of the ecological risk assessment methodology document for the SNL/NM ER Program (IT July 1998).

Because no HQs greater than unity were predicted and because these HQs are based upon conservative estimates of exposure and toxicity, the potential for ecological risks at DSS Site 1015 is expected to be very low.

Table 15
Transfer Factors Used in Exposure Models for COPECs at DSS Site 1015

COPEC	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Inorganic			
Cyanide	0.0E+0[a]	0.0E+0[a]	0.0E+0[a]
Mercury	1.0E+0[b]	1.0E+0[c]	2.5E-1[d]
Selenium	5.0E-1[b]	1.0E+0[c]	1.0E-1[b]
Silver	1.0E+0[b]	2.5E-1[e]	5.0E-3[b]
Organic[f]			
2-Butanone	2.6E+1	1.4E+1	3.7E-8
Toluene	1.0E+0	1.8E+1	1.3E-5

[a]No data found for food chain transfers of cyanide; however, because of its high metabolic activity, cyanide is assumed not to transfer in the food chain.
[b]NCRP January 1989.
[c]Default value.
[d]Baes et al. 1984.
[e]Stafford et al. 1991.
[f]Soil-to-plant and food-to-muscle transfer factors from equations developed in Travis and Arms (1988). Soil-to-invertebrate transfer factors from equations developed in Connell and Markwell (1990). All three equations based upon relationship of the transfer factor to the Log K_{ow} value of compound.

COPEC = Constituent of potential ecological concern.
DSS = Drain and Septic Systems.
K_{ow} = Octanol-water partition coefficient.
Log = Logarithm (base 10).
NCRP = National Council on Radiation Protection and Measurements.

Table 16
Media Concentrations[a] for COPECs at DSS Site 1015

COPEC	Soil (Maximum)[a]	Plant Foliage[b]	Soil Invertebrate[b]	Deer Mouse Tissues[c]
Inorganic				
Cyanide	6.6E-2[d]	0.0E+0	0.0E+0	0.0E+0
Mercury	4.7E-2[e]	4.7E-2	4.7E-2	3.8E-2
Selenium	1.5E-1[d]	7.5E-2	1.5E-1	3.6E-2
Silver	2.1E-2	2.1E-2	5.1E-3	2.1E-4
Organic				
2-Butanone	1.2E-2	3.2E-1	1.6E-1	2.8E-8
Toluene	1.5E-3	1.5E-3	2.7E-2	5.7E-8

[a]In milligrams per kilogram. All biotic media are based upon dry weight of the media. Soil concentration measurements are assumed to have been based upon dry weight. Values have been rounded to two significant digits after calculation.
[b]Product of the soil concentration and the corresponding transfer factor.
[c]Based upon the deer mouse with an omnivorous diet. Product of the average concentration ingested in food and soil times the food-to-muscle transfer factor times a wet weight-dry weight conversion factor of 3.125 (EPA 1993).
[d]Analyte not detected. Maximum concentration is one-half the detection limit.
[e]Estimated value.
COPEC = Constituent of potential ecological concern.
DSS = Drain and Septic Systems.

Table 17
Toxicity Benchmarks for Ecological Receptors at DSS Site 1015

COPEC	Plant Benchmark[a,b]	Mammalian NOAELs			Avian NOAELs		
		Mammalian Test Species[c,d]	Test Species NOAEL[d,e]	Deer Mouse NOAEL[e,f]	Avian Test Species[d]	Test Species NOAEL[d,e]	Burrowing Owl NOAEL[e,g]
Inorganics							
Cyanide	–	rat[h]	68.7	126	–	–	–
Mercury (organic)	0.3	rat	0.032	0.063	mallard	0.0064	0.0064
Mercury (inorganic)	0.3	mouse	13.2	14.0	Japanese quail	0.45	0.45
Selenium	1	rat	0.2	0.391	screech owl	0.44	0.44
Silver	2	rat	17.8[i]	34.8	–	–	–
Organic							
2-Butanone	–	rat	1,771	3,464	–	–	–
Toluene	200	mouse	26	27.5	–	–	–

[a]In mg/kg soil dry weight.
[b]Efroymson et al. 1997.
[c]Body weights (in kg) for the NOAEL conversion are as follows: lab mouse, 0.030; lab rat, 0.350 (except where noted).
[d]Sample et al. 1996, except where noted.
[e]In mg/kg body weight per day.
[f]Based upon NOAEL conversion methodology presented in Sample et al. (1996), using a deer mouse body weight of 0.0239 kg and a mammalian scaling factor of 0.25.
[g]Based upon NOAEL conversion methodology presented in Sample et al. (1996). The avian scaling factor of 0.0 was used, making the NOAEL independent of body weight.
[h]Body weight: 0.273 kg.
[i]Based upon a rat lowest-observed-adverse-effect level of 89 mg/kg/day (EPA 2003) and an uncertainty factor of 0.2.

COPEC = Constituent of potential ecological concern.
DSS = Drain and Septic Systems.
kg = Kilogram(s).
mg/kg = Milligram(s) per kilogram.
mg/kg/day = Milligram(s) per kilogram per day.
NOAEL = No-observed-adverse-effect level.
– = Insufficient toxicity data.

Table 18
HQs for Ecological Receptors at DSS Site 1015

COPEC	Plant HQ	Deer Mouse HQ (Herbivorous)	Deer Mouse HQ (Omnivorous)	Deer Mouse HQ (Insectivorous)	Burrowing Owl HQ
Inorganic					
Cyanide	–	1.6E-6	1.6E-6	1.6E-6	–
Mercury (organic)	1.6E-1	1.2E-1	1.2E-1	1.2E-1	6.7E-1
Mercury (inorganic)	1.6E-1	5.3E-4	5.3E-4	5.3E-4	9.5E-3
Selenium	1.5E-1	3.1E-2	4.6E-2	6.1E-2	9.9E-3
Silver	1.0E-2	9.6E-5	5.9E-5	2.5E-5	–
Organic					
2-Butanone	–	1.4E-5	1.1E-5	7.3E-5	–
Toluene	7.5E-6	8.6E-6	8.1E-5	1.5E-4	–
HI[a]	3.2E-1	1.5E-1	1.7E-1	1.8E-1	6.8E-1

Note: **Bold** text indicates the HQ or HI exceeds unity.
[a]The HI is the sum of individual HQs.
COPEC = Constituent of potential ecological concern.
DSS = Drain and Septic Systems.
HI = Hazard index.
HQ = Hazard quotient.
– = Insufficient toxicity data available for risk estimation purposes.

VII.3.6 Risk Interpretation

Ecological risks associated with DSS Site 1015 were estimated through a risk assessment that incorporated site-specific information when available. All HQ and HI values predicted for the COPECs at this site were found to be less than unity. Analysis of the uncertainties associated with these predicted values indicate that they are more likely to overestimate actual risk rather than underestimate it. Further, it should be noted that this assessment is based on the assumption of complete ecological pathways; however the site is currently paved, making the existence of such pathway unlikely. Based upon this final analysis, the potential for ecological risks associated with DSS Site 1015 is expected to be very low.

VII.3.7 Risk Assessment Scientific/Management Decision Point

After potential ecological risks associated with the site have been assessed, a decision is made regarding whether the site should be recommended for NFA or whether additional data should be collected to assess actual ecological risk at the site more thoroughly. With respect to this site, ecological risks are predicted to be very low. The scientific/management decision is to recommend this site for NFA.

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

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

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

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

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