7-1-2004

Justification for Class III Permit Modification July 2004 DSS Site 1033 Operable Unit 1295 Building 6631 Septic System (TA -III)

Sandia National Laboratories/NM

Sandia National Laboratories

Justification for Class III Permit Modification

July 2004

DSS Site 1033
Operable Unit 1295
Building 6631 Septic System (TA-III)

NFA (SWMU Assessment Report) Submitted December 2003

Environmental
Restoration
Project

United States Department of Energy
Albuquerque Operations Office

Sandia National Laboratories

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Albuquerque Operations Office

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

DEC 1 7 2003

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:

Enclosed is one of two NMED copies of the SWMU Assessment Reports and Proposals for No Further Action (NFA) for Drain and Septic Systems (DSS) Sites 1009, 1025, 1026, 1027, 1033, 1093, 1101, 1105, and 1112 at Sandia National Laboratories, New Mexico, EPA ID No. NM5890110518. Per our verbal agreement, the second NMED copy is being sent directly to the Albuquerque Group Manager.

This submittal includes descriptions of the site characterization work, soil characterization data, and risk assessments for the nine DSS sites listed above. The risk assessments conclude that for these 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,

Karen L. Boardman
Manager

Enclosure

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Sandia National Laboratories/New Mexico
Environmental Restoration Project

SWMU ASSESSMENT REPORT AND PROPOSAL FOR NO FURTHER ACTION DRAIN AND SEPTIC SYSTEMS SITE 1033, BUILDING 6631 SEPTIC SYSTEM

December 2003

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
GEL	General Engineering Laboratories, Inc.
HE	high explosive(s)
HI	hazard index
HWB	Hazardous Waste Bureau
KAFB	Kirtland Air Force Base
kg	kilogram(s)
MDA	minimum detectable activity
MDL	method detection limit
µg	microgram(s)
mrem	millirem
NFA	no further action
NMED	New Mexico Environment Department
OU	Operable Unit
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
RPSD	Radiation Protection Sample Diagnostics
SAP	Sampling and Analysis Plan
SNL/NM	Sandia National Laboratories/New Mexico
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TA	Technical Area
TB	trip blank
TEDE	total effective dose equivalent
VOC	volatile organic compound
yr	year(s)

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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 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 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 1033: BUILDING 6631 SEPTIC SYSTEM

2.1 Summary

The SNL/NM ER Project conducted an assessment of DSS Site 1033, the Building 6631 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 1033. This NFA proposal provides documentation that the site was sufficiently characterized, that no significant releases of contaminants to the environment occurred via the Building 6631 septic system, and that it does not pose a threat to human health or the environment under either industrial or residential land-use scenarios. Current operations at the site are conducted in accordance with applicable laws and regulations that are protective of the environment, and septic system discharges are now directed to the City of Albuquerque sewer system.

Review and analysis of all relevant data for DSS Site 1033 indicate that concentrations of constituents of concern (COCs) at this site were found to be below applicable risk assessment action levels. Thus, DSS Site 1033 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 Site1033 is located in SNL/NM Technical Area (TA)-III on federally owned land controlled by Kirtland Air Force Base (KAFB) and permitted to the U.S. Department of Energy (Figure 2.2.1-1). DSS Site 1033 is situated approximately 1.2 miles southeast of the entrance to TA-III and is on the northwest side of Building 6631 (Figure 2.2.1-2). The abandoned septic system consisted of a septic tank connected to a distribution box that emptied to a drainfield consisting of four drain lines (Figure 2.2.1-2) approximately 70 feet in length. Construction details are based upon site inspections and backhoe excavations of the system.

The surface geology at DSS Site 1033 is characterized by a veneer of aeolian sediments underlain by Upper Santa Fe Group alluvial fan deposits that interfinger with sediments of the ancestral Rio Grande west of the site. These deposits extend to, and probably far below, the water table at this site. The alluvial fan materials originated in the Manzanita Mountains east of DSS Site 1033, 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

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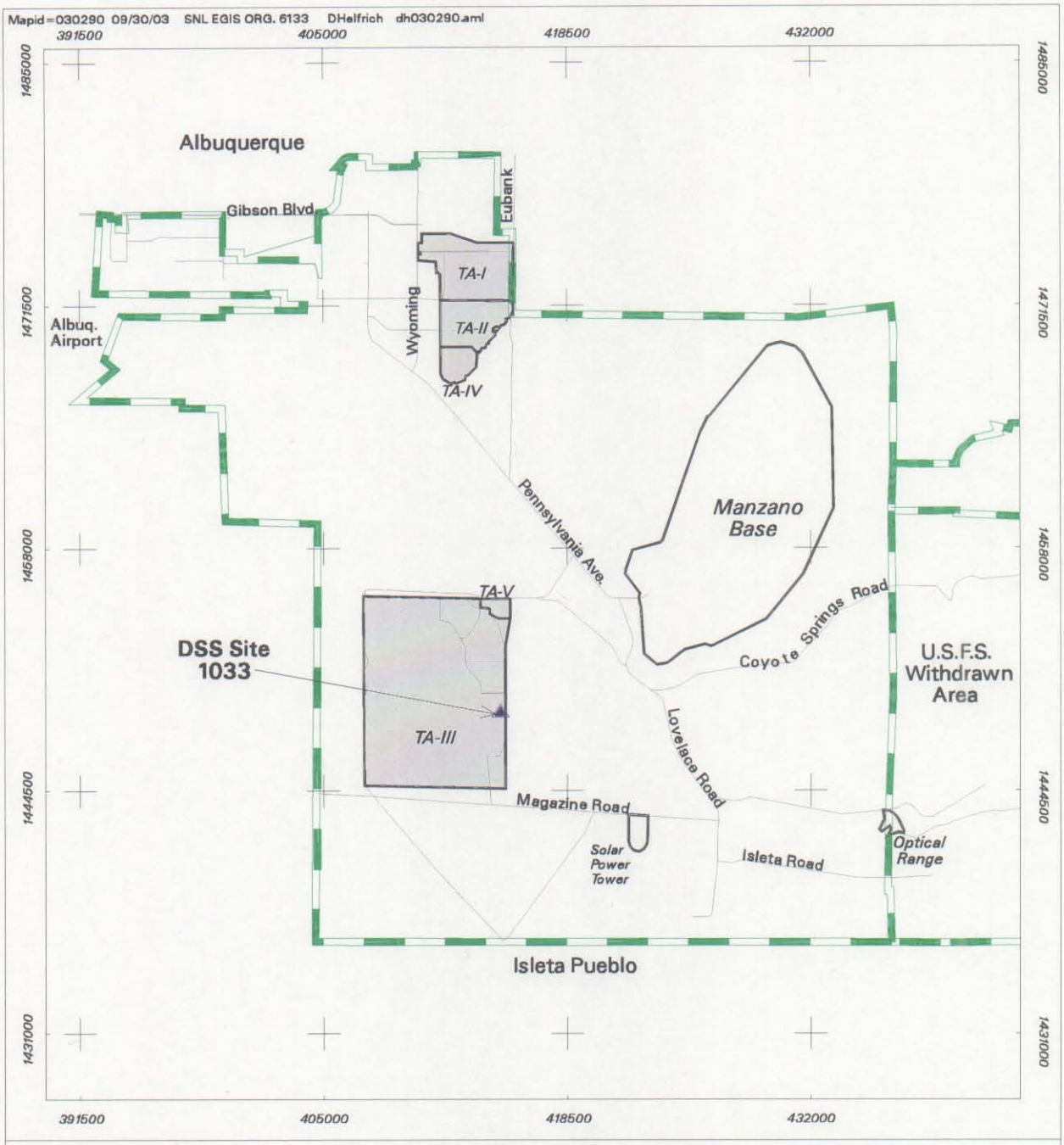

Legend

- DSS Site 1033
- Major Road
- KAFB Boundary
- SNL Technical Area

Figure 2.2.1-1
Location Map of Drain and Septic Systems (DSS) Site Number 1033, Bldg. 6631 Septic System, TA-III

0 4500 9000
Scale in Feet

0 1080 2160
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

840857.03010000A68

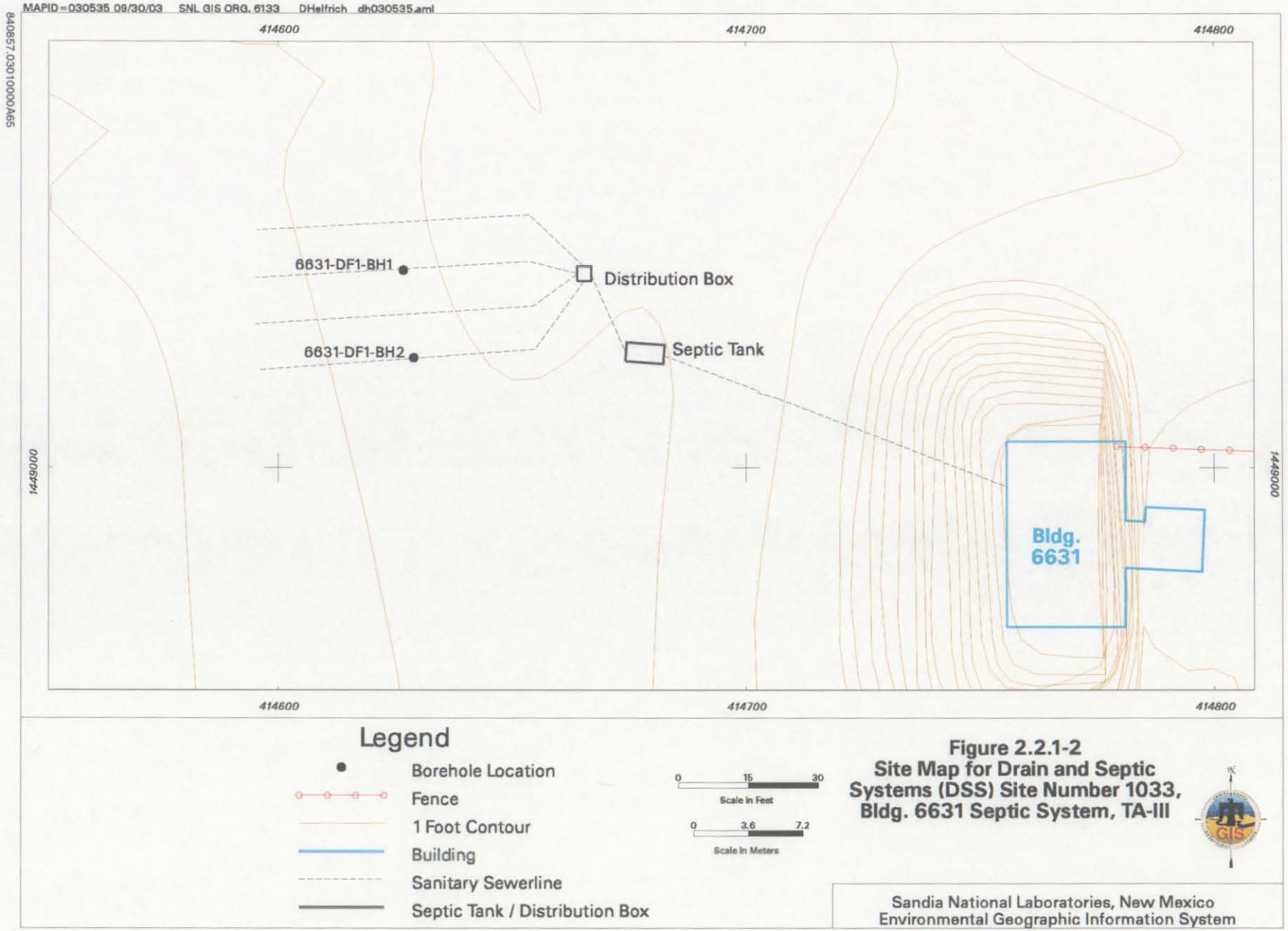

Figure 2.2.1-2
Site Map for Drain and Septic Systems (DSS) Site Number 1033, Bldg. 6631 Septic System, TA-III

thickness with a preferred east-west orientation, and have moderate to low hydraulic conductivities (SNL/NM March 1996). Site vegetation primarily consists of desert grasses, shrubs, and cacti.

The ground surface in the vicinity of the site is flat to very slightly inclined to the west. The closest major drainage lies south of the site and terminates in a playa just west of KAFB. No perennial surface-water bodies are present in the vicinity of the site. Average annual rainfall in the SNL/NM and KAFB area, as measured at Albuquerque International Sunport, is 8.1 inches (NOAA 1990). Infiltration of precipitation is almost nonexistent as virtually all of the moisture subsequently undergoes evapotranspiration. The estimates of evapotranspiration rates for the KAFB area range from 95 to 99 percent of the annual rainfall (Thompson and Smith 1985, SNL/NM March 1996). Most of the area immediately surrounding DSS Site 1033 is unpaved, and no storm sewers are used to direct surface water away from the site.

The site lies at an average elevation of approximately 5,425 feet above mean sea level (SNL/NM April 1995). Depth to groundwater is approximately 499 feet below ground surface (bgs) at the site. Groundwater flow is thought to be generally to the west in this area (SNL/NM March 2002). The nearest production wells to DSS Site 1033 are KAFB-4, approximately 3.9 miles to the northwest, and KAFB-11, approximately 4.1 miles to the northeast. The nearest groundwater monitoring well is MWL-BW1, approximately 0.76 mile northwest of the site.

2.2.2 Operational History

Available information indicates that Building 6631 was constructed in 1959 (SNL/NM March 2003) and is currently known as the controls facility for the Climatic Test Facility (Building 6630), the Acoustical Test Facility (Building 6640) and the Complex Wave Test Facility (Building 6610). It is assumed the Building 6631 septic system was constructed at the same time. Because operational records are not available, the investigation of the site was planned to be consistent with other DSS site investigations and to sample for the COCs most commonly found at similar facilities.

In June 1991, Building 6631 was connected to an extension of the City of Albuquerque sanitary sewer system (Jones June 1991). The old septic system line was disconnected and capped, and the system was abandoned in-place concurrent with this change (Romero September 2003).

2.3 Land Use

2.3.1 Current Land Use

The current land use for DSS Site 1033 is industrial.

2.3.2 Future/Proposed Land Use

The projected future land use for DSS Site 1033 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 August 1992 and August 1995, waste characterization samples were collected from the septic tank (Investigation 1). In May 1997, a backhoe was used to physically locate the buried drainfield drain lines at the site (Investigation 2). In June 1998 and August 1999, subsurface soil samples were collected from two borings in the drainfield area (Investigation 3). Investigations 2 and 3 were required by the NMED/HWB to adequately characterize the site and was 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 in numerous 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.

On August 17, 1992, and August 3, 1995, as part of the SNL/NM Septic System Monitoring Program, aqueous and sludge samples were collected from the Building 6631 septic tank (SNL/NM June 1993, SNL/NM December 1995). On August 17, 1992, a sludge sample was collected from the septic tank and analyzed for radiological constituents. On August 3, 1995, a sludge sample was analyzed at an off-site laboratory for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), 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 samples are presented in Annex A.

The septic tank was inspected in February 1996 and was found to be dry (Shain August 1996).

3.3 Investigation 2—Backhoe Excavation

On May 15, 1997, a backhoe was used to determine the location, dimensions, and average depth of the DSS Site 1033 drainfield system. The drainfield was found to have four laterals, arranged as shown on Figure 2.2.1-2, with an average drain line depth of 4 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 June 24, 1998, and again on August 16, 1999, soil samples were collected from two drainfield boreholes. Soil boring locations are shown on Figure 2.2.1-2. Figure 3.4-1 shows soil samples being collected at DSS Site 1033. A summary of the boreholes, sample depths, sample analyses, analytical methods, laboratories, and sample dates are 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 drainfields, 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-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 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 areas sampled, analytical methods, and laboratories used for the DSS Site 1033 soil samples are summarized in Table 3.4-1.

3.4.2 Soil Sampling Results and Conclusions

Analytical results for the soil samples collected at DSS Site 1033 are presented and discussed in this section. Samples were collected from the borehole locations shown on Figure 2.2.1-2.

VOCs

VOC analytical results for the four soil samples and one duplicate soil sample collected from the two drainfield boreholes are summarized in Table 3.4.2-1. The method detection limits (MDLs)

Figure 3.4-1
Collecting soil samples with the Geoprobe in the DSS Site 1033, Building 6631 septic system drainfield area. View to the west. August 16, 1999

Table 3.4-1
Summary of Areas Sampled, Analytical Methods, and Laboratories Used for
DSS Site 1033, Building 6631 Septic System Soil Samples

Sampling Area	Number of Borehole Locations	Top of Sampling Intervals in each Borehole (ft bgs)	Total Number of Soil Samples	Total Number of Duplicate Samples	Analytical Parameters and EPA Methods[a]	Analytical Laboratory	Date Samples Collected
Drainfield	2	6, 11	4	1	VOCs EPA Method 8260	ERCL, GEL	06-24-98
	2	6, 11	4	1	SVOCs EPA Method 8270	GEL	06-24-98
	2	6, 11	4	1	PCBs EPA Method 8082	GEL	08-16-99
	2	6, 11	4	1	HE EPA Method 8095	ERCL, GEL	06-24-98
	2	6, 11	4	1	RCRA Metals + Copper EPA Methods 6000/7000	ERCL, GEL	06-24-98
	2	6, 11	4	1	Hexavalent Chromium EPA Method 7196A	GEL	08-16-99
	2	6, 11	4	1	Total Cyanide EPA Method 9012A	GEL	08-16-99
	2	6, 11	4	1	Gamma Spectroscopy EPA Method 901.1	RPSD, GEL	06-24-98
	2	6, 11	4	0	Gross Alpha/Beta Activity EPA Method 900.0	GEL	06-24-98

[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).
PCB = Polychlorinated biphenyl.
RCRA = Resource Conservation and Recovery Act.
RPSD = Radiation Protection Sample Diagnostics Laboratory.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.

Table 3.4.2-1
Summary of DSS Site 1033, Building 6631 Septic System
Confirmatory Soil Sampling, VOC Analytical Results
June 1998
(On- and Off-Site Laboratories)

Sample Attributes			VOCs (EPA Method 8260[a]) (µg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	Methylene Chloride
600397	6631-DF1-BH1-6-S	6	ND (1)
600397	6631-DF1-BH1-11-S	11	ND (1)
600396	6631-DF1-BH1-11-DU	11	ND (0.25)
600397	6631-DF1-BH2-6-S	6	ND (5.2)
600397	6631-DF1-BH2-11-S	11	ND (1.1)
Quality Assurance/Quality Control Samples (µg/L)			
600396	6631-DF1-TB	NA	**2.9**
600397	6631-DF1-EB	NA	ND (0.5)
600397	6631-DF1-TB	NA	ND (0.5)

Note: Values in **bold** represent detected VOCs.
[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.
EB = Equipment blank.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
NA = Not applicable.
ND( ) = Not detected above the MDL, shown in parentheses.
S = Soil sample.
TB = Trip blank.
VOC = Volatile organic compound.

for the VOC analyses are presented in Table 3.4.2-2. No VOCs were detected in the soil samples collected from the drainfield boreholes. One VOC, methylene chloride, a common laboratory contaminant, was detected in the trip blank (TB) associated with these samples.

SVOCs

SVOC analytical results for the four soil samples and one duplicate soil sample collected from the two drainfield boreholes are summarized in Table 3.4.2-3. The MDLs for the SVOC analyses are presented in Table 3.4.2-4. Two SVOCs, phenanthrene and pyrene, were detected in the duplicate sample collected at 11 feet in borehole 6631-DF1-BH1 and no SVOCs were detected in any of the other samples from this site.

PCBs

PCB analytical results for the four soil samples and one duplicate soil sample collected from the two drainfield boreholes are summarized in Table 3.4.2-5. The MDLs for the PCB analyses are presented in Table 3.4.2-6. No PCBs were detected in the samples collected from the drainfield boreholes.

HE Compounds

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

RCRA Metals, Copper, and Hexavalent Chromium

Resource Conservation and Recovery Act (RCRA) metals plus copper, and hexavalent chromium analytical results for the four soil samples and one duplicate soil sample collected from the two drainfield boreholes are summarized in Table 3.4.2-9. Soil samples were analyzed for copper because an elevated concentration of copper was detected in the sludge sample collected in August 1995. The MDLs for the metals analyses are presented in Table 3.4.2-10. None of the metal concentrations detected in these samples exceed the corresponding NMED-approved background concentrations.

Total Cyanide

Total cyanide analytical results for the four soil samples and one duplicate soil sample collected from the two drainfield boreholes are summarized in Table 3.4.2-11. The MDLs for the cyanide analyses are presented in Table 3.4.2-12. Cyanide was detected at a concentration of 0.211 J milligrams/kilogram (kg) in the sample collected at 11 feet from borehole 6631-DF1-BH2.

Table 3.4.2-2
Summary of DSS Site 1033, Building 6631 Septic System
Confirmatory Soil Sampling, VOC Analytical MDLs
June 1998
(On- and Off-Site Laboratories)

Analyte	EPA Method 8260[a] Detection Limit (µg/kg)
Acetone	2.2–26
Benzene	0.25–5.2
Bromodichloromethane	0.24–5.2
Bromoform	0.27–5.2
Bromomethane	0.67–5.2
2-Butanone	2.1–26
Carbon disulfide	1–5.2
Carbon tetrachloride	0.22–5.2
Chlorobenzene	0.25–5.2
Chloroethane	0.72–5.2
Chloroform	0.24–5.2
Chloromethane	0.43–5.2
Dibromochloromethane	0.21–5.2
1,1-Dichloroethane	0.2–5.2
1,2-Dichloroethane	0.23–5.2
1,1-Dichloroethene	0.25–5.2
cis-1,2-Dichloroethene	0.25–5.2
trans-1,2-Dichloroethene	0.19–5.2
1,2-Dichloropropane	0.23–5.2
cis-1,3-Dichloropropene	0.25–2.6
trans-1,3-Dichloropropene	0.22–5.2
Ethylbenzene	0.23–10
2-Hexanone	4.4–52
Methylene chloride	0.25–5.2
4-Methyl-2-pentanone	2.9–26
Styrene	0.22–5.2
1,1,2,2-Tetrachloroethane	0.46–5.2
Tetrachloroethene	0.23–10
Toluene	0.22–5.2
1,1,1-Trichloroethane	0.18–5.2
1,1,2-Trichloroethane	0.24–5.2
Trichloroethene	0.27–5.2
Vinyl acetate	1.8
Vinyl chloride	0.4–5.2
Xylene	0.62
o-Xylene	2.1–10
p-, xylene, m-Xylene	3.1–16

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

Table 3.4.2-3
Summary of DSS Site 1033, Building 6631 Septic System
Confirmatory Soil Sampling, SVOC Analytical Results
June 1998
(Off-Site Laboratory)

Sample Attributes			SVOCs (EPA Method 8270[a]) (µg/kg)	
Record Number[b]	ER Sample ID	Sample Depth (ft)	Phenanthrene	Pyrene
600396	6631-DF1-BH1-6-S	6	ND (170)	ND (170)
600396	6631-DF1-BH1-11-S	11	ND (170)	ND (170)
600396	6631-DF1-BH1-11-DU	11	**230 J (338)**	**220 J (338)**
600396	6631-DF1-BH2-6-S	6	ND (170)	ND (170)
600396	6631-DF1-BH2-11-S	11	ND (170)	ND (170)
Quality Assurance/Quality Control Samples (µg/L)				
600396	6631-DF1-EB	NA	ND (5)	ND (5)

Note: Values in **bold** represent detected SVOCs.
[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.
EB = Equipment blank.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The reported value is greater than or equal to the MDL but is less than the practical quantitation limit, shown in parentheses.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the MDL, shown in parentheses.
S = Soil sample.
SVOC = Semivolatile organic compound.

Table 3.4.2-4
Summary of DSS Site 1033, Building 6631 Septic System
Confirmatory Soil Sampling, SVOC Analytical MDLs
June 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(g,h,i)perylene	170
Benzo(k)fluoranthene	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
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
Di-n-butyl phthalate	170
Dinitro-o-cresol	170
2,4-Dinitrophenol	330
2,4-Dinitrotoluene	170
2,6-Dinitrotoluene	170
Di-n-octyl phthalate	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 1033, Building 6631 Septic System Confirmatory Soil Sampling
SVOC Analytical MDLs
June 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-c,d)pyrene	170
Isophorone	170
2-Methylnaphthalene	170
Naphthalene	170
2-Nitroaniline	170
3-Nitroaniline	170
4-Nitroaniline	170
Nitrobenzene	170
2-Nitrophenol	170
4-Nitrophenol	330
n-Nitrosodiphenylamine	170
n-Nitrosodipropylamine	170
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.
SVOC = Semivolatile organic compound.

Table 3.4.2-5
Summary of DSS Site 1033, Building 6631 Septic System
Confirmatory Soil Sampling, PCB Analytical Results
August 1999
(Off-Site Laboratory)

Sample Attributes			PCB (EPA Method 8280[a]) (µg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	
602761	B6631-DF1-BH1-6-S	6	ND
602761	B6631-DF1-BH1-11-S	11	ND
602761	B6631-DF1-BH2-6-S	6	ND
602761	B6631-DF1-BH2-6-DU	6	ND
602761	B6631-DF1-BH2-11-S	11	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.
ND = Not detected.
PCB = Polychlorinated biphenyl.
S = Soil sample.

Table 3.4.2-6
Summary of DSS Site 1033, Building 6631 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
Aroclor-1221	2.82
Aroclor-1232	1.63
Aroclor-1242	1.67
Aroclor-1248	0.907
Aroclor-1254	1.16
Aroclor-1260	0.943

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

Table 3.4.2-7
Summary of DSS Site 1033, Building 6631 Septic System
Confirmatory Soil Sampling, HE Compound Analytical Results
June 1998
(On- and Off-Site Laboratories)

Sample Attributes			HE (EPA Method 8330[a]) (µg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	
600397	6631-DF1-BH1-6-S	6	ND
600397	6631-DF1-BH1-11-S	11	ND
600396	6631-DF1-BH1-11-DU	11	ND
600397	6631-DF1-BH2-6-S	6	ND
600397	6631-DF1-BH2-11-S	11	ND
Quality Assurance/Quality Control Samples (µg/L)			
600397	6631-DF1-EB	11	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.
EB = Equipment blank.
ER = Environmental Restoration.
ft = Foot (feet).
HE = High explosive(s).
ID = Identification.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
ND = Not detected.
S = Soil sample.

Table 3.4.2-8
Summary of DSS Site 1033, Building 6631 Septic System
Confirmatory Soil Sampling, HE Compound Analytical MDLs
June 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	0.0055–0.1
1,3-Dinitrobenzene	0.0041–0.074
2,4-Dinitrotoluene	0.0062–0.24
2,6-Dinitrotoluene	0.0065–0.28
Nitrobenzene	0.0052–0.17
2-Nitrotoluene	0.0078–0.15
3-Nitrotoluene	0.0011–0.15
4-Nitrotoluene	0.0011–0.13
HMX	0.0053–0.13
Pentaerythritol tetranitrate	0.0075–0.34
RDX	0.0097–0.18
1,3,5-Trinitrobenzene	0.0066–0.1
2,4,6-Trinitrotoluene	0.0057–0.28

[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.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

Table 3.4.2-9
Summary of DSS Site 1033, Building 6631 Septic System
Confirmatory Soil Sampling, Metals Analytical Results
June 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
600397, 602761	6631-DF1-BH1-6-S	6	3.2	190 J	0.12 J (0.16)	7.6	ND (0.034)	5.2	5.6	ND (0.041)	0.38 J (1.2)	ND (0.041)
600397, 602761	6631-DF1-BH1-11-S	11	3	120 J	0.26	7.8	ND (0.0337)	6.6	6.5	ND (0.042)	0.45 J (1.3)	ND (0.042)
600396	6631-DF1-BH1-11-DU	11	2.99	98.5	0.0841 J (0.486)	6.17	NS	5.87	4.63	ND (0.0173)	ND (0.07)	ND (0.031)
600397, 602761	6631-DF1-BH2-6-S	6	3.7	210 J	0.11 J (0.16)	5.8	ND (0.0339)	4.1	4.6	ND (0.04)	0.38 J (1.2)	ND (0.04)
602761	6631-DF1-BH2-6-DU	6	NS	NS	NS	NS	ND (0.0339)	NS	NS	NS	NS	NS
600397, 602761	6631-DF1-BH2-11-S	11	3.2	100 J	0.15 J (0.17)	8.1	ND (0.0338)	6.4	6.9	0.086 J (0.17)	ND (0.31)	ND (0.042)
Background Concentration—Southwest Area Supergroup[c]			4.4	214	0.9	15.9	1	18.2	11.8	<0.1	<1	<1
Quality Assurance/Quality Control Samples (µg/L)												
600397	6631-DF1-EB	NA	ND (3.4)	ND (4)	ND (0.23)	ND (8.5)	NS	ND (5.7)	ND (1.7)	ND (0.23)	ND (1.7)	ND (0.23)

[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.
EB = Equipment blank.
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.
µg/L = Microgram(s) per liter.
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
ND ( ) = Not detected above the MDL, shown in parentheses.
NS = Not sampled.
S = Soil sample.

Table 3.4.2-10
Summary of DSS Site 1033, Building 6631 Septic System
Confirmatory Soil Sampling, Metals Analytical MDLs
June 1998 and August 1999
(On- and Off-Site Laboratories)

Analyte	EPA Method 6000/7000/7196A[a] Detection Limit (mg/kg)
Arsenic	0.149–0.63
Barium	0.0166–0.53
Cadmium	0.0104–0.042
Chromium	0.0365–0.74
Chromium (VI)	0.0337–0.034
Copper	0.066–1
Lead	0.0339–0.32
Mercury	0.0173–0.042
Selenium	0.07–0.32
Silver	0.031–0.042

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

Table 3.4.2-11
Summary of DSS Site 1033, Building 6631 Septic System
Confirmatory Soil Sampling, Total Cyanide Analytical Results
August 1999
(Off-Site Laboratory)

Sample Attributes			Total Cyanide (EPA Method 9012A[a]) (mg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	
602761	6631-DF1-BH1-6-S	6	ND (0.138)
602761	6631-DF1-BH1-11-S	11	ND (0.139)
602761	6631-DF1-BH2-6-S	6	ND (0.136)
602761	6631-DF1-BH2-6-DU	6	ND (0.138)
602761	6631-DF1-BH2-11-S	11	**0.211 J (0.497)**

Note: Values in **bold** represent detected total cyanide.
[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.
J ( ) = The reported value is greater than or equal to the MDL but is less than the practical quantitation limit, shown in parentheses.
mg/kg = Milligram(s) per kilogram.
MDL = Method detection limit.
ND ( ) = Not detected above the MDL, shown in parentheses.
S = Soil sample.

Table 3.4.2-12
Summary of DSS Site 1033, Building 6631 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	0.136–0.139

[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.

Radionuclides

Gamma spectroscopy results for the four soil samples and one duplicate soil sample collected from the two drainfield boreholes are summarized in Table 3.4.2-13. No activities above NMED-approved background activities were detected in any sample analyzed. However, although not detected, the minimum detectable activities (MDAs) for uranium-235 and uranium-238, in the four samples analyzed by the SNL/NM RPSD Laboratory, exceeded the background activities because the standard gamma spectroscopy count time for soil samples (6,000 seconds) was not sufficient to reach the NMED-approved background activities established for SNL/NM soil. Even though the MDAs may be slightly elevated, the values are still very low, and the risk assessment outcome for the site is not significantly impacted by their use.

Gross Alpha/Beta Activity

Gross alpha/beta activity analytical results for the four soil samples collected from the two drainfield boreholes are presented in Table 3.4.2-14. No gross alpha or beta activities greater than the New Mexico-established background (Miller September 2003) were detected in any of the samples. These results indicate no significant levels of radioactive material are present in the soil at the site.

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

Quality assurance/quality control samples were collected at an approximate frequency of 1 per 20 field samples. These included duplicate samples, equipment blank (EB) and TB samples. Typically, samples were shipped to the laboratory in batches of 20, 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. The EB samples were analyzed for the same analytical suite as the soil samples in that shipment. Aqueous TB samples were used for VOC analysis only and were included in every sample cooler containing VOC soil samples. The analytical results for the EB and TB samples appear only on the data tables for the last site sampled in any one shipment, although the results were used in the data validation process for all the samples in that batch.

An aqueous TB was included in the sample cooler containing the VOC soil samples sent to SNL/NM ER Chemistry Laboratory and in the sample cooler containing the duplicate VOC soil sample sent to General Engineering Laboratories, Inc. (GEL) in June 1998. As shown in Table 3.4.2-1, methylene chloride was detected in the TB sample sent to GEL. Methylene chloride is a common laboratory contaminant and may not be indicative of contamination.

A set of aqueous EB samples was collected following completion of soil sampling in the Building 6631 drainfield in June 1998. These EB samples were analyzed for the same constituents as the soil collected at that time (including VOCs, SVOCs, HE compounds, and RCRA metals plus copper). No VOCs, SVOCs, HE compounds, or metals were detected in any of the EB samples.

Table 3.4.2-13
Summary of DSS Site 1033, Building 6631 Septic System
Confirmatory Soil Sampling, Gamma Spectroscopy Analytical Results
June 1998
(On- and Off-Site Laboratories)

Sample Attributes			Activity (EPA Method 901.1[a]) (pCi/g)							
Record Number[b]	ER Sample ID	Sample Depth (ft)	Cesium-137		Thorium-232		Uranium-235		Uranium-238	
			Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
600398	6631-DF1-BH1-6-S	6	ND (0.0325)	--	ND (0.136)	--	**ND (0.224)**	--	**ND (3.22)**	--
600398	6631-DF1-BH1-11-S	11	ND (0.0298)	--	0.681	0.383	**ND (0.225)**	--	**ND (3.18)**	--
600396	6631-DF1-BH1-11-DU	11	ND (0.0131)	--	0.902	0.119	ND (0.0687)	--	ND (0.394)	--
600398	6631-DF1-BH2-6-S	6	ND (0.0342)	--	0.636	0.325	**ND (0.240)**	--	**ND (3.46)**	--
600398	6631-DF1-BH2-11-S	11	ND (0.0339)	--	0.756	0.392	**ND (0.235)**	--	**ND (3.44)**	--
Background Activity—Southwest Area Supergroup[d]			0.079	NA	1.01	NA	0.16	NA	1.4	NA

Note: *Values in* **bold** exceeded background soil activities.
[a]EPA November 1986
[b]Analysis request/chain-of-custody record.
[c]Two standard deviations about the mean detected activity.
[d]Dinwiddie September 1997.
BH = Borehole.
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.*
NA = Not applicable.
ND ( ) = Not detected above the MDA, shown in parentheses.
ND ( ) = Not detected, but the MDA (shown in parentheses) exceeds background activity.
pCi/g = Picocurie(s) per gram.
S = *Soil sample.*
-- = Error not provided for nondetect results.

Table 3.4.2-14
Summary of DSS Site 1033, Building 6631 Septic System
Confirmatory Soil Sampling, Gross Alpha/Beta Activity Analytical Results
June 1998
(Off-Site Laboratory)

Sample Attributes			Activity (EPA Method 900.0[a]) (pCi/g)			
Record Number[b]	ER Sample ID	Sample Depth (ft)	Gross Alpha		Gross Beta	
			Result	Error[c]	Result	Error[c]
600396	6631-DF1-BH1-6-S	6	8.58	2.98	22.3	3.87
600396	6631-DF1-BH1-11-S	11	8.77	3.15	21.6	3.79
600396	6631-DF1-BH2-6-S	6	10.1	3.8	17.1	3.67
600396	6631-DF1-BH2-11-S	11	15.8	4.19	22.9	4.07
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.
NA = Not applicable.
pCi/g = Picocuries per gram.
S = Soil sample.

As shown in Tables 3.4.2-1, 3.4.2-3, 3.4.2-5, 3.4.2-7, 3.4.2-9, 3.4.2-11, and 3.4.2-13, 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 VOCs, SVOCs, PCBs, HE compounds, RCRA metals plus copper, hexavalent chromium, cyanide, and radionuclides by gamma spectroscopy.

As shown in Tables 3.4.2-1 and 3.4.2-7, VOC and HE compound concentrations in samples 6631-DF1-BH1-11-S and duplicate sample 6631-DF1-BH1-11-DU, collected from the same sampling interval, all VOCs and HE compounds were nondetect. As shown in Tables 3.4.2-5 and 3.4.2-11, PCB and cyanide concentrations in samples 6631-DF1-BH2-6-S and duplicate sample 6631-DF1-BH2-6-DU, collected from the same sampling interval, were nondetect.

As shown in Table 3.4.2-3, no SVOCs were detected in the sample 6631-DF1-BH1-11-S. However, phenanthrene and pyrene were detected at concentrations of 230 J micrograms (µg)/kg and 220 J µg/kg in the duplicate sample 6631-DF1-BH1-11-DU. The analytical results, as shown in Tables 3.4.2-9 and 3.4.2-13, for RCRA metals plus copper concentrations and radionuclides by gamma spectroscopy for soil sample 6631-DF1-BH1-11-S and duplicate sample 6631-DF1-BH1-11-DU are comparable.

All laboratory data were reviewed and verified/validated according to Data Verification/Validation Level 3, Rev. 0 (SNL/NM July 1994) or SNL/NM ER Project Data Validation Procedure for Chemical and Radiochemical Data, AOP [Administrative Operating Procedure] 00-03, Rev. 0

(SNL/NM December 1999). In addition, SNL/NM Department 7713 (RPSD Laboratory) reviewed all gamma spectroscopy results according to "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 02 (SNL/NM July 1996). Annex 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 assessments are sufficient for characterizing the nature and extent of possible COC releases. There are no further data gaps regarding characterization of DSS Site 1033.

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4.0 CONCEPTUAL SITE MODEL

The conceptual site model for DSS Site 1033, the Building 6631 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 1033 are VOCs, SVOCs, PCBs, HE compounds, cyanide, RCRA metals plus copper, hexavalent chromium, and radionuclides. SVOC compounds phenanthrene and pyrene were detected in the duplicate soil sample 6631-DF1-BH1-11-DU, and cyanide was detected in a soil sample collected from the 11-foot interval from borehole 6631-DF1-BH2-11-S. No VOCs, PCBs, HE compounds, or hexavalent chromium were detected in any of the soil samples collected at this site. None of the eight RCRA metals plus copper were detected at concentrations above the approved maximum background concentrations for SNL/NM Southwest Area Supergroup soils (Dinwiddie September 1997). When a metal concentration exceeded its maximum background screening value or the nonquantifiable background value, it was carried forward in the risk assessment process. None of the four representative gamma spectroscopy radionuclides were detected at activities exceeding the corresponding background levels. However, the MDA values for most of the U-235 and U-238 analyses exceed the background activities. Finally, no gross alpha/beta activities were detected above the New Mexico-established background levels (Miller September 2003) at the site.

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 to the soil beneath the drainfield (Figure 4.2-1). The depth to groundwater at the site (approximately 499 feet bgs) 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 1033.

Table 4.2-1 summarizes the potential COCs for DSS Site 1033. 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 1033 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

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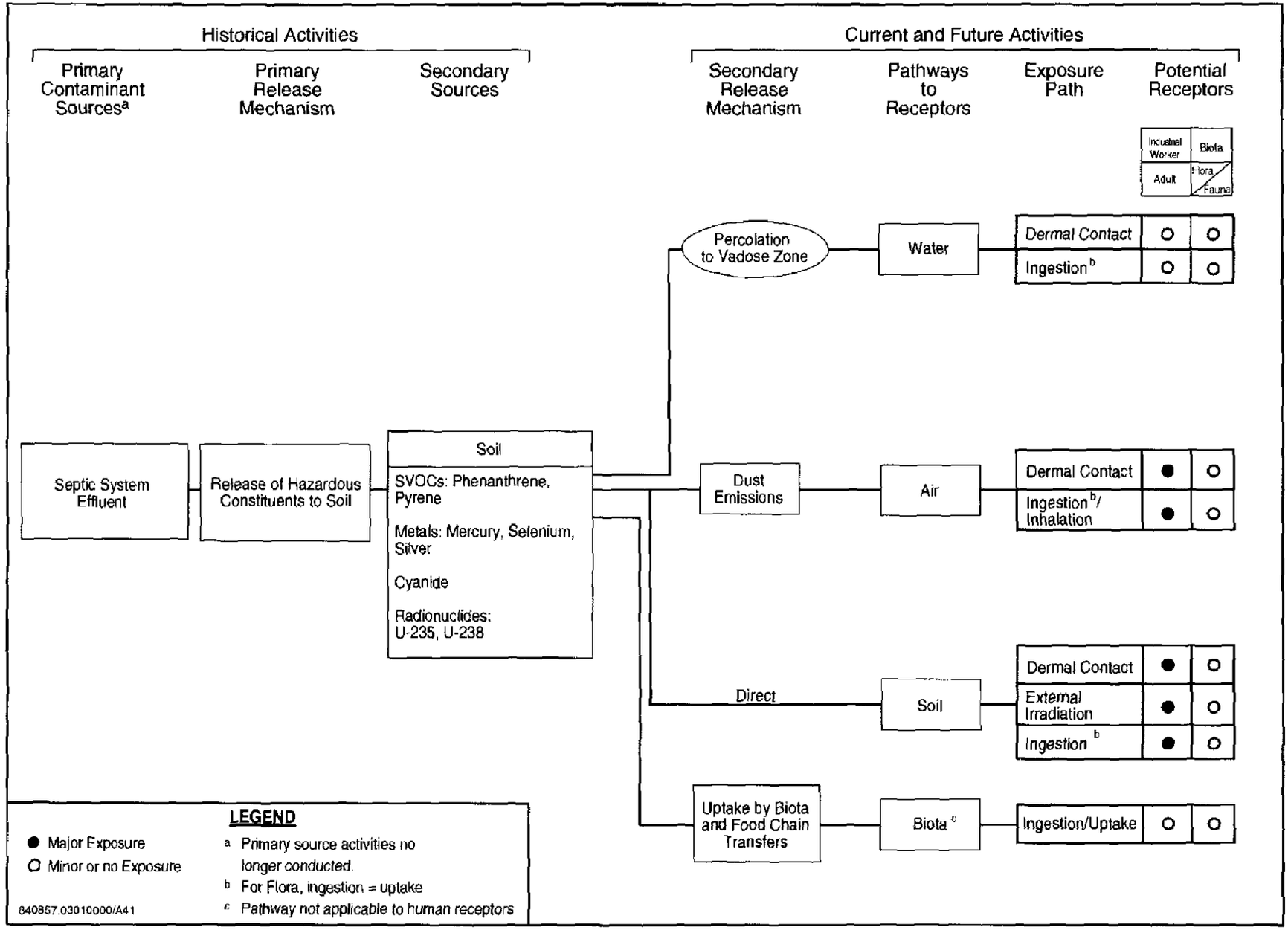

Figure 4.2-1

Conceptual Site Model Flow Diagram for DSS Site 1033, Building 6631 Septic System

Table 4.2-1
Summary of Potential COCs for DSS Site 1033, Building 6631 Septic System

COC Type		Number of Samples[a]	COCs Greater than Background	Maximum Background Limit/Southwest Area Supergroup[b] (mg/kg)	Maximum Concentration[c] (mg/kg)	Average Concentration[d] (mg/kg)	Number of Samples Where Background Concentration Exceeded[e]
VOCs		5	None	NA	NA	NA	None
SVOCs		5	Phenanthrene	NA	0.230	0.114	1
		5	Pyrene	NA	0.220	0.112	1
PCBs		5	None	NA	NA	NA	None
HE		5	None	NA	NA	NA	None
RCRA Metals + Copper		5	None	NA	NA	NA	None
Hexavalent Chromium		4	None	NA	NA	NA	None
Cyanide		5	Cyanide	NA	0.211	0.0973	1
Radionuclides (pCi/g)	Gamma Spectroscopy	5	U-235	0.16	ND (0.240)	NC[f]	4
		5	U-238	1.4	ND (3.46)	NC[f]	4
	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.
[g]Miller September 2003.

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

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

No pathways to groundwater and no intake routes through flora or fauna are considered appropriate for either the industrial or residential land-use scenarios. Annex C provides additional discussion of the exposure routes and receptors at DSS Site 1033.

4.3 Site Assessment

Site assessment at DSS Site 1033 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 1033 in more detail.

4.3.1 Summary

The site assessment concluded that DSS Site 1033 poses no significant threat to human health under either the industrial or residential land-use scenarios. Ecological risks were found to be insignificant because no pathways exist.

4.3.2 Risk Assessments

Risk assessments were performed for both human health and ecological risks at DSS Site 1033. This section summarizes the results.

4.3.2.1 Human Health

DSS Site 1033 has been recommended for an industrial land-use scenario (DOE et al. September 1995). Because SVOCs, metals, cyanide, and radionuclides are present, above background, or nonquantified background it was necessary to perform a human health risk assessment analysis for the site, which included all COCs detected. 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 at DSS Site 1033 is 0.08 under the industrial land-use scenario, which is lower 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 0.08. There is no quantifiable or incremental excess cancer risk for DSS Site 1033 COCs under an industrial land-use setting. 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. Both the incremental HI and excess cancer risk are below NMED guidelines.

The HI calculated for the COCs at DSS Site 1033 is 0.27 under the residential land-use scenario, which is lower 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 0.27. There is no quantifiable or incremental excess cancer risk for DSS Site 1033 COCs for a residential land-use setting. 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. Both the incremental HI and incremental excess cancer risk are below NMED guidelines.

For the radiological COCs, two of the constituents (uranium-235 and uranium-238) had an MDA or reported value greater than the corresponding background values. 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 1.2E-2 millirem (mrem)/year (yr) for the industrial land-use scenario. This value is much lower than the EPA's numerical guidance of 15 mrem/yr (EPA 1997a). The corresponding incremental estimated cancer risk value is 1.4E-7 for the industrial land-use scenario. Furthermore, the incremental TEDE for the residential land-use scenario that results from a complete loss of institutional control is 3.0E-2 mrem/yr with an associated risk of 4.0E-7. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, DSS Site 1033 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 1033, Building 6631 Septic System Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	0.0	1.4E-7	1.4E-7
Residential	0.0	4.0E-7	4.0E-7

DSS = Drain and Septic Systems.

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

4.3.2.2 Ecological

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

Environmental Restoration Program, Sandia National Laboratories, New Mexico" (IT July 1998). The risk assessment also includes the estimation of exposure and ecological risk.

All COCs at DSS Site 1033 are located at depths greater than 5 feet bgs. Therefore, no complete ecological pathways exist at this site, and a more detailed ecological risk assessment is not necessary.

4.4 Baseline Risk Assessments

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

4.4.1 Human Health

Because the results of the human health risk assessment summarized in Section 4.3.2.1 indicate that DSS Site 1033 poses insignificant risk to human health under both the industrial and residential land-use scenarios, a baseline human health risk assessment is not required for this site.

4.4.2 Ecological

Because the results of the ecological risk assessment summarized in Section 4.3.2.2 indicate that no complete pathways exist at DSS Site 1033, a baseline ecological risk assessment is not required for the site.

5.0 NFA 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 1033 for the following reasons:

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

5.2 Criterion

Based upon the evidence provided in Section 5.1, DSS Site 1033 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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6.0 REFERENCES

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ANNEX A
DSS Site 1033
Septic Tank Sampling Results

Attachment 1

Sandia National Laboratories
Septic System Monitoring Program
1992 Report

Building 6631

Building 6631
Area 3
Sample ID No. SNLA008585
Tank ID No. NRN

On August 17, 1992, a sludge sample was collected from the septic tank serving Building 6631. During review of the radiochemistry data, the following items were noted:

- ^{226}Ra was measured at 0.935 pCi/mL, which does not exceed the investigation level (IL) calculated during this monitoring effort. However, this measurement exceeds the U.S. Department of Energy (DOE) derived concentration guideline (DCG) of 0.5 pCi/mL. A more sensitive technique for assaying ^{226}Ra may be warranted.

- ^{214}Pb was measured at 0.401 pCi/mL, which is above the IL calculated during this monitoring effort. No other ^{238}U progeny was measured above the IL, which may indicate high radon levels at the site. The level of ^{214}Pb was less than 0.1 percent of its DGC limit.

- ^{212}Pb was measured at 0.473 pCi/mL, and ^{208}Tl was measured at 0.154 pCi/mL. These findings suggest above background levels of ^{232}Th exist at this location. The ^{212}Pb (3.1 percent) level was within DOE DCG constraints. ^{208}Tl is not regulated under DOE DCG.

Results of Septic Tank Analyses (Sludge Sample)			
Building No./Area:	6631 A-3		
Tank ID No.:	NRN		
Date Sampled:	8/17/92		
Sample ID No.:	SNLA008585		
Analytical Parameter	Measured Concentration	± 2 Sigma Uncertainty	Units
Gross Alpha	1E+1	2E+1	pCi/g
Gross Beta	2E+1	4E+1	pCi/g
Gross Alpha	1E+1	2E+1	pCi/g
Gross Beta	2E+1	3E+1	pCi/g
Gross Alpha	3E+1	2E+1	pCi/g
Gross Beta	0E+1	3E+1	pCi/g
Gross Alpha	1E+1	2E+1	pCi/g
Gross Beta	3E+1	3E+1	pCi/g
Tritium	-3E-01	3E-01	pCi/L
Actinium-228	0.551 (0.7)	0.0337 (0.2)	pCi/mL
Bismuth-212	0.246 (<0.751)	0.0384	pCi/mL
Bismuth-214	0.403 (0.5)	0.0212 (0.2)	pCi/mL
Cesium-137	<0.0185 (<0.467)	NA	pCi/mL
Potassium-40	0.124 (0.1)	0.313 (2)	pCi/mL
Lead-212	0.473 (0.5)	0.0252 (0.1)	pCi/mL
Lead-214	0.401 (0.4)	0.0208 (0.2)	pCi/mL
Radium-226	0.935 (<0.517)	0.128	pCi/mL
Thorium-234	<0.332 (<0.618)	NA	pCi/mL
Thallium-208	0.154 (0.3)	0.0104 (0.1)	pCi/mL

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

Attachment 2

Sandia National Laboratories
Septic Tank Characterization
Summary Tables of Analytical Reports

December 1995

Building 6631

SANDIA NATIONAL LABORATORIES
SEPTIC TANK CHARACTERIZATION
SUMMARY TABLES OF ANALYTICAL REPORTS

December 1995

Prepared for:

Sandia National Laboratories
Waste Management and Regulatory Projects
Department 7583
Albuquerque, New Mexico 87185-1303

Prepared by:

IT Corporation
5301 Central Avenue NE, Suite 700
Albuquerque, New Mexico 87108

December 14, 1995

RESULTS OF SEPTIC TANK SAMPLING
CHEMICAL ANALYSES OF SLUDGE SAMPLE

Building ID: 6631
Sample ID Number: 024398
Date Sampled: 8-03-95
Percent Moisture: Various[a]

Parameter (Method)	Result	Detection Limit (DL)	NM Discharge Limit[b]	COA Discharge Limit[c]	Comments
Volatile Organics (8260)	*(µg/kg)*	*(µg/kg)*	*(mg/L)*	*(mg/L)*	
Methylene Chloride	8J	10	0.1	TTO = 5.0	
Methylene Chloride (reanalyses)	5J	10	0.1	TTO = 5.0	
Acetone	90	10	NR	NR	
Acetone (reanalyses)	26	10	NR	NR	
Trichlorofluoromethane	4J	10	NR	TTO = 5.0	
Benzene	3BJ	10	0.01	TTO = 5.0	
Toluene	2J	10	0.75	TTO = 5.0	
Semivolatile Organics (8270)	*(µg/kg)*	*(µg/kg)*	*(mg/L)*	*(mg/L)*	
Phenanthrene	38J	330	NR	TTO = 5.0	
Fluoranthene	280J	330	NR	TTO = 5.0	
Pyrene	270J	330	NR	TTO = 5.0	
Benzo(a)Anthracene	340	330	NR	TTO = 5.0	
Chrysene	380	330	NR	TTO = 5.0	
bis(2-Ethylhexyl)Phthalate	790	330	NR	TTO = 5.0	
Benzo(k)Fluoranthene	100J	330	NR	TTO = 5.0	
Benzo(a)Pyrene	260J	330	0.0007	TTO = 5.0	
Indeno(1,2,3-CD)Pyrene	78J	330	NR	TTO = 5.0	
Benzo(g,h,i)Perylene	67J	330	NR	TTO = 5.0	
Pesticides/PCBs (8080)	*(µg/kg)*	*(µg/kg)*	*(mg/L)*	*(mg/L)*	
4,4' -DDE	14	3.3	NR	TTO = 5.0	
Endrin	ND X	31	NR	TTO = 5.0	
4,4'-DDT	ND X	20	NR	TTO = 5.0	
Endrin Aldehyde	ND X	18	NR	TTO = 5.0	

3.5 ppm

Refer to footnotes at end of table.

RESULTS OF SEPTIC TANK SAMPLING

CHEMICAL ANALYSES OF SLUDGE SAMPLE

Building ID: 6631
Sample ID Number: 024398
Date Sampled: 8-03-95
Percent Moisture: Various[a]

Parameter (Method)	Result	Detection Limit (DL)	NM Discharge Limit[b]	COA Discharge Limit[c]	Comments
Metals (6010/7470)	*(mg/kg)*	*(mg/kg)*	*(mg/L)*	*(mg/L)*	
Arsenic	7.9	1.0	0.1	2.0	
Barium	150	20.0	1.0	20.0	
Cadmium	3.0	2.5	0.01	2.8	
Chromium	66.7	10.0	0.05	20.0	
Copper	471	12.5	1.0	16.5	
Lead	68.6	10.0	0.05	3.2	
Manganese	179	1.5	0.2	20.0	
Nickel	39.2	4.0	0.2	12.0	
Selenium	0.46J	0.50	0.05	2.0	
Silver	6.3	5.0	0.05	5.0	
Thallium	4.0	1.0	NR	NR	
Zinc	527	2.0	10.0	28.0	
Mercury	1.8	0.10	0.002	0.1	

Notes:
[a] Percent moisture = 3.57 for VOCs; 2.73 for SVOCs, Pesticides and PCBs; and 5.18 for metals.
[b] New Mexico Water Quality Control Commission Regulations (1990), Section 3-103.
[c] 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.
X = Elevated detection limit due to PCB interference.
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.

RESULTS OF SEPTIC TANK SAMPLING
RADIOLOGICAL ANALYSES OF SLUDGE SAMPLE

Building ID: 6631
Sample ID Number: 024398
Date Sampled: 8-03-95
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/g)*	
Tritium	122 ± 58	94	46.1	NR	
Plutonium-239/240	0.006 ± 0.013	0.030	0.018	NR	
Plutonium-238	0.001 ± 0.009	0.025	0.016	NR	
Strontium-90	0.08 ± 0.01	0.61	0.29	NR	
Thorium-232	0.25 ± 0.07	0.017	0.013	NR	
Thorium-230	0.15 ± 0.05	0.018	0.014	NR	
Thorium-228	0.19 ± 0.06	0.034	0.022	NR	
Uranium-238	0.96 ± 0.20	0.020	0.016	NR	
Uranium-235/236	0.038 ± 0.029	0.031	0.022	NR	
Uranium-234	1.51 ± 0.29	0.029	0.020	NR	
Gamma Spectroscopy[c]	*(pCi/g ± 2-σ)*	*(pCi/g)*	*(pCi/g)*	*(pCi/g)*	
Cesium-137	ND	0.11	0.051	NR	
Cesium-134	ND	0.099	0.046	NR	
Potassium-40	16.7 ± 2.8	0.4	0.14	NR	
Chromium-51	ND	1.10	0.50	NR	
Iron-59	ND	0.30	0.13	NR	
Cobalt-60	ND	0.11	0.047	NR	
Zirconium-95	ND	0.20	0.090	NR	
Ruthenium-103	ND	0.11	0.051	NR	
Ruthenium-106	ND	0.95	0.43	NR	
Cerium-144	ND	0.49	0.23	NR	
Thallium-208	0.23 ± 0.12	0.10	NL	NR	
Lead-210	1.33 ± 0.96	1.10	NL	NR	
Lead-212	0.83 ± 0.13	0.13	0.059	NR	
Lead-214	0.67 ± 0.15	0.16	0.077	NR	

Refer to footnotes at end of table.

RESULTS OF SEPTIC TANK SAMPLING

RADIOLOGICAL ANALYSES OF SLUDGE SAMPLE

Building ID: 6631
Sample ID Number: 024398
Date Sampled: 8-03-95
Percent Moisture: Not Reported

Parameter (Method)	Result	MDA	Critical Level	NM Discharge Limit[a]	Comments
Gamma Spectroscopy[c]	*(pCi/g ± 2-σ)*	*(pCi/g)*	*(pCi/g)*	*(pCi/g)*	
Bismuth-214	0.57 ± 0.24	0.22	NL	NR	
Radium-224	2.07 ± 1.46	1.40	NL	NR	
Radium-226	0.64 ± 0.13	0.22	0.10	30.0[d]	
Radium-228	ND	0.60	0.28	30.0[d]	
Actinium-228	ND	0.60	0.28	NR	
Thorium-231	ND	3.10	1.50	NR	
Thorium-232	ND	0.60	0.28	NR	
Thorium-234	1.89 ± 0.75	0.98	0.48	NR	
Uranium-235	ND	0.51	0.25	NR	
Uranium-238	1.89 ± 0.75	0.98	0.48	NR	
Americium-241	ND	0.12	0.058	NR	

Notes:
[a] New Mexico Water Quality Control Commission Regulations (1990), Section 3-103.
[b] Tritium analyzed by EMSL-LV-0539-17; isotopic uranium 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.
[d] NMWQCCR standard for Ra-226 + Ra-228 combined in pCi/L.
MDA = Minimum detectable activity.
ND = Not detected above MDA indicated.
NR = Not regulated.
NL = Not listed.

ANNEX B
DSS Site 1033
Soil Sample Data Validation Results

SAMPLE FINDINGS SUMMARY

Site: ST & DF

AR/COC: 600396 Data Classification: Radiometrics

Sample Fraction No.	Analysis	DV Qualifiers	Comments
No Data is Qualified			
Data is Acceptable			
QC measures are adequate			

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: Kevin A Lambert Date: 8/4/98

verified

ANALYTICAL RADIOCHEMISTRY DATA VALIDATION CHECKLIST

Project Name	ST + DF			~~Site Name~~ Case #	7223.2300
Laboratory Name/Job No./Batch No.	GEL / 9806828			Chain of Custody No.	600396
Analysis Method	EPA900.0, HASL 300.0			Parameter List:	Gross Alpha/Beta, Gamma Spec
REVIEW ITEM	YES	NO	NA	COMMENTS	
A. HOLDING TIMES					
1. Preparation and analysis holding times met?				SEE CVP Form	
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 acceptance criteria	
1. Standard: Independent, certified reference material?	✓				
2. Frequency: Each batch?	✓				
% Recovery 80-120% or ____?	✓				
D. METHOD BLANK				No target analytes were above acceptance limits	
1. Frequency: Each batch?	✓				
2. Matrix: Matrix specific?	✓				
3. Preparation: Entire procedure?	✓				
4. Blanks show contamination?		✓			
E. MATRIX SPIKE					
1. Frequency: Each batch?		✓		No MS/MSD for Gamma Spec. Dup analysis from another ARCOC group in batch met criteria. No data qualified. MS/MSD for Gross A/B met acceptance criteria	
2. Matrix: Matrix specific?	✓				
3. Preparation: Entire procedure?	✓				
4. % Recovery: 75-125% or ____?	✓				
F. ANALYTICAL YIELDS/OTHER				Not Applicable	
1. Tracer: Correct type, recovery met?			✓		
2. Ingrowth and/or decay: Correct factors applied?			✓		
3. Solids density: Planchette loading <5 mg/cm^2?			✓		
G. DUPLICATE				RPDs for Gross A/B did not meet criteria however, the DER which is the appropriate measure of Lab precision met criteria. No data is qualified. The duplicate analysis for G. Spec is from another ARCOC group in the batch and met criteria. No data is qualified	
1. Type: Lab or field?	✓				
2. Frequency: Each batch?	✓				
3. Matrix: Matrix specific?	✓				

SAMPLE FINDINGS SUMMARY

Site: ST + DF

AR/COC: 600396 Data Classification: Organic

Sample Fraction No.	Analysis	DV Qualifiers	Comments
No data were qualified			
Data is acceptable			
QC measures are adequate			

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: Kevin A Lambert Date: 8/6/98

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

SITE OR PROJECT ST+DF
ANALYTICAL LABORATORY GEL
LABORATORY REPORT # 9806828
CASE NO. 7223.2300
ARCOC# 600396

SAMPLE IDS 26 : 24 soil, 2 aqueous
NO. OF SAMPLES
ER-1295-6620-XXX, ER-1295-6730-XXX,
ER-1295-6750-XXX, ER-1295-6631-XXX,

DATA ASSESSMENT SUMMARY

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

		VOC	SVOC	PEST/PCB	~~OTHER~~ HE KAL 8/4/98
1.	HOLDING TIMES/PRESERVATION	✓	✓	NA	✓
2.	GC/MS INST. PERFORM.	✓	✓		✓
3.	CALIBRATIONS/WINDOWS	✓	✓		✓
4.	BLANKS	✓	✓		✓
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

NA - Not Applicable

KAL 8/4/98
~~ACTION ITEMS:~~ All samples were prepared and analyzed with accepted procedures and specified methods. All compound were successfully analyzed. No problems were

KAL 8/6/98
~~AREAS OF CONCERN:~~ observed in the data package review that results in data qualification. The following sections discuss the data review and validation

Reviewed By: Kevin A Lambert
Date: 8/6/98

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

1.0 HOLDING TIMES AND PRESERVATION

Indicate the holding time criteria below that was used to evaluate the samples.

SW-846, 3rd. ed.
Other: _____

List below samples that were over holding time criteria.

Sample ID	VTSR	Date Analyzed	Action

SEE CVR FORM

NOTE: VTSR = Validated time of sample receipt.

Were the correct preservatives used? Yes ☐ No ☐

List below samples that were incorrectly preserved.

Sample No.	Type of Sample	Deficiency	Action

Reviewed By: Kevin A Lambert 8/4/98
Date:

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

3.3 DDT and Endrin Degradation

Not Applicable

List below the standards that have a DDT or Endrin breakdown of >20% (or a combined breakdown of >20%).

Date/Time	Standard ID	DDT/Endrin	% Breakdown	Action	Affected Samples

3.4 DBC Retention Time Check

Is the %D between EVAL A and each analysis (quantitation and confirmation) DBC retention time within QC limits (2% for packed column, 0.3% capillary ID <0.32 mm, and 1% for megabore)?

Yes ☐ No ☐

Date	Sample ID	DBC %D	Action

For the above criteria outlined in Sections 8.1–8.4, check for transcription/calculation errors.

If errors are found, list below with necessary corrections: _____

_____

_____

_____

Reviewed By: Kevin A Lambert
Date: 8/4/98

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

4.0 INITIAL CALIBRATION

Has initial calibration been performed as required in the EPA method? Yes ☑ No ☐

Were the correct number of standards used to calibrate the instrument? Yes ☑ No ☐

For GC analyses of PCBs and Pesticides, did the laboratory follow the correct 72-hour sequence of analysis?
Yes ☐ No ☐ Not Applicable

List below compounds which did not meet initial calibration criteria outlined by the EPA method.

Instrument ID	Date	Compound	RF/%RSD	Action	Samples Affected
VOC:	Several compounds are outside acceptance limits (see QC summary data). Majority are not on TCL. Those on TCL are non-detects in site sample. No data is qualified				
SVOC:	Met criteria				
HE:	Met criteria				

Check for transcription/calculation errors. If errors are present, summarize necessary corrections below:

Reviewed By: Kevin A Lambert
Date: 8/4/98

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 ☐ SVOCs Only

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

Date	Blank ID	Compound	Conc. ( )	PQL ( )	Action Level	Samples Affected (Action)
Batch 15500 7/7/98 1401	ER-1295-6631-TB-SD	methylene chloride	2.9 ug/l	1.0 ug/l	Not detected No data	in site sample is qualified
14879 6/30/98 1627	QC517681	2-Amino-4, 6-DNT	120 ug/kg	80 ug/kg	Not detected No data	in site sample is qualified
~~SVOC:~~	KHL 8/4/98					

PQL = Practical Quantitation Limit from EPA Method.

Note: VOCs - Methylene Chloride was observed at estimated values ("J" coded) in MBs. No detectable concentration was observed in site sample, no data is qualified.

Reviewed By: Kevin A Lambert
Date: 8/4/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

If surrogate recovery was outside of control limits, were the samples or method blank reanalyzed?

Yes ☐ No ☐ Not Applicable

Not Applicable

Are method blank surrogate recoveries outside of limits upon reanalysis? Yes ☐ No ☑ ~~Not Applic~~ KAL 8/4/98

KAL 8/4/98

Are transcription/calculation errors present? Yes ☐ No ☑

If yes, note necessary corrections. _____

_____

_____

_____

_____

Reviewed By: Kevin A Lambert 8/4/98

Date:

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

10.0 INTERNAL STANDARDS EVALUATION

List below the internal standard areas of samples or blanks which did not meet criteria.

Date	Sample ID	Internal Out	Acceptable Range	Action
		Met Criteria		

Are retention times of the internal standards within 30 seconds of the associated calibration standard?
Yes ☑ No ☐

11.0 TARGET COMPOUND LIST ANALYTES
11.1 GC/MS Analyses

Are the reconstructed ion chromatograms, the mass spectra for the identified compounds, and the data system printouts included? Yes ☑ No ☐

Is chromatographic performance acceptable with respect to:

Baseline stability? Yes ☑ No ☐

Resolution? Yes ☑ No ☐

Peak shape? Yes ☑ No ☐

Full-scale graph (attenuation)? Yes ☑ No ☐

Reviewed By: Kevin A Lambert
Date: 8/4/98

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 Not Applicable

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: Kevin A Lambert
Date: 8/4/98

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 Not Applicable

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: Kevin A Lambert
Date: 8/4/98

SAMPLE FINDINGS SUMMARY

Site: ST & DF

AR'COC: 600396 Data Classification: Inorganic

Sample Fraction No.	Analysis	DV Qualifiers	Comments
No data is qualified			
Data is acceptable			
QC measures are adequate			

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: Kevin A Lambert Date: 8/4/98

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

SITE OR PROJECT STDF
CASE NO. 7223.2300
ANALYTICAL LABORATORY GEL
SAMPLE IDS
LABORATORY REPORT # 9806828
ER-1295-6631-BH1-6-11-SD
~~TASK LEADER~~ ARCOC # 600396
NO. OF SAMPLES 1 soil

DATA ASSESSMENT SUMMARY

		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)
NA - Not Applicable

KH 8/4/98
~~ACTION ITEMS:~~ ① All samples were prepared and analyzed with accepted procedures and specified methods. All compounds were successfully analyzed. No Major/minor problems
KH 8/4/98
~~AREAS OF CONCERN:~~ were identified during data package review.
② Calibration met acceptance criteria. No target analytes were detected in the MB. LCS/LCSD met

REVIEWED BY: Kim A Lambert
DATE REVIEWED: 8/4/98

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

1.0 HOLDING TIMES

List holding time criteria used to evaluate samples, indicating which samples exceed the holding time. Holding time begins with validated time of sample collection.

Parameter	Holding Time Criteria	Sample ID	Days Holding Time was Exceeded	Action

SEE CVR FORM

Were the correct preservatives used? Yes ☐ No ☐

List below samples that were incorrectly preserved.

Sample No.	Type of Samples	Deficiency	Action

Reviewed By: Kim A Lambert Date: 8/4/98

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

3.2 Method Blank

Was one method blank analyzed for:

Each of 20 samples? Yes ☑ No ☐
Each digestion batch? Yes ☑ No ☐
Each matrix type? Yes ☑ No ☐
Both AA and ICP when both are used for the same analyte? Yes ☐ No ☐ Not Applicable
or
At the frequency indicated in the EPA method or QAPjP? Yes ☑ No ☐

NOTE: Method blank is the same as the calibration blank for mercury and for wet chemistry analysis.

List analytes detected in method blank samples below. NOTE: For soil samples, be sure to calculate blank values using digestion weights and volumes.

Preparation Date	Analyte	Conc.	Required Detection Limits	Action Level	Samples Affected

No Target Analytes were detected

Is concentration in the method blank below the detection limit? Yes ☑ No ☐

Affected samples: _____

_____

_____

Reviewed By: Kevin A Lambert Date: 8/4/98

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

3.3 Field/Rinse/Equipment Blanks

Was a field/equipment blank analyzed as required by the EPA method or QAPjP? Yes ☐ No ☑

List below analytes detected in the field blanks. NOTE: For soil samples, calculate blank values using digestion weights and volumes.

Collection Date	Blank ID	Analyte	Conc.	Required Detection Limits	Action Level	Samples Affected
		Not submitted on AR COC				

4.0 ICP INTERFERENCE CHECK SAMPLE ANALYSIS

Was an ICP interference check sample (ICS) analyzed at the beginning and end of a run or at least twice every 8 hours? (Not required for Ca, Mg, K, and Na) Yes ☑ No ☐

Samples affected: _____

Are the values of the ICS for solution AB within 80-120%R? Yes ☑ No ☐

If no, is the concentration of Al, Ca, Fe, or Mg lower than in ICS? Yes ☐ No ☐ Not Applicable

Reviewed By: Kevin A Lambert Date: Kevin A Lambert 8/4/98
KAL 8/4/98

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

List below any LCS recoveries not within limits.

Preparation Date	Analyte	%R	Action	Samples Affected
			Met Criteria	

6.0 LABORATORY DUPLICATE ANALYSIS

Were laboratory duplicates analyzed at required frequency? Yes ☑ No ☐

Samples affected: _____

_____

Was laboratory duplicate analysis performed on field or equipment blanks? Yes ☐ No ☑

Samples affected: _____

_____

_____

Is any value for sample duplicate pair <PQL and the other value >10xPQL? Yes ☐ No ☑

Samples affected: _____

_____

_____

Reviewed By: Kevin A Lambert Date: 8/4/98

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

Samples affected: _____

List below the analytes that do not meet RPD or PQL criteria. Use the same criteria as those used for laboratory duplicate analysis or criteria specified in EPA method or sampling plan.

Sample ID	Matrix	Collection Date	RPD	Control Limit	Action	Samples ~~Affected~~
					Not Submitted on ARCOC	

Check for transcription/calculation errors. Briefly summarize errors and associated actions when data quality might have been affects.

8.0 MATRIX SPIKE ANALYSIS

NOTE: *This matrix spike is a predigestion/predistallation spike.*

Was a matrix spike prepared and analyzed at the required frequency? Yes ☐ No ☑ Not run on ARCOC group, however MS/MSD from another ARCOC group met acceptance criteria

Reviewed By: Kevin A Lambert Date: 8/4/98

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

NOTE: If preparation blank spikes are analyzed, evaluate recoveries. These recoveries can indicate whether excursions in matrix spike recovery are caused by sample matrix effects or poor digestion efficiencies and/or problems with matrix spike solution. For example, if matrix spike recovery for selenium is 0% and preparation blank spike recovery for selenium is 92%, this may indicate sample matrix effects.

9.0 FURNACE ATOMIC ABSORPTION ANALYSIS

Not Applicable

Were duplicate injections present for each sample, including required QC analyses (not required if MSA is done)? Yes ☐ No ☐

Samples affected: _____

_____

_____

Were postdigestion spikes analyzed for samples, including QC samples? Yes ☐ No ☐

Were postdigestion spikes analyzed at the required concentration? Yes ☐ No ☐

Samples affected: _____

_____

_____

Was a dilution analyzed for samples with postdigestion spike recovery <40%? Yes ☐ No ☐

Samples affected: _____

_____

_____

MSA Analysis (Method of Standard Additions)—MSA is required when serial dilutions are not with ± 10%. Was MSA required for any sample but not performed? Yes ☐ No ☐

Are MSA calculations outside the linear range of the calibration curve? Yes ☐ No ☐

Reviewed By: Kevin A Lambert Date: 8/4/98

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 ☐ Not Applicable

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 ☐ Not Applica.

Are ICP Linear Ranges established and verified quarterly? Yes ☐ No ☐ Not Applicable

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: Kevin A Lambert Date: 8/4/98

SF 200 COC (10-97)
Supersedes (5-97) issue

Interlial Lab Batch No.

ANALYSIS REQUEST AND CHAIN OF CUSTODY

SAR/WR No.

AR/COC- 600397

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: 6/24/98 Bill of Lading/Air Bill 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

Location — Tech Area III — Building 6631 — 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 USE: Lab Sample ID
1.	041255-001	ER-1295-6631-DF1-BH1-6-S	6	N/A	6/24/98 0750	S	AC	300ml	4C	G	SA	VOCs (8260)	
2.	041256-001	ER-1295-6631-DF1-BH1-11-S	11	N/A	6/24/98 0910	S	AC	300ml	4C	G	SA	VOCs (8260)	
3.	041257-001	ER-1295-6631-DF1-BH2-6-S	6	N/A	6/24/98 0930	S	AC	300ml	4C	G	SA	VOCs (8260)	
4.	041258-001	ER-1295-6631-DF1-BH2-11-S	11	N/A	6/24/98 0945	S	AC	300ml	4C	G	SA	VOCs (8260)	
5.	041255-004	ER-1295-6631-DF1-BH1-6-S	6	N/A	6/24/98 0750	S	G	125ml	4C	G	SA	RCRA Met+Cu, HE(8330)	
6.	041256-004	ER-1295-6631-DF1-BH1-11-S	11	N/A	6/24/98 0910	S	G	125ml	4C	G	SA	RCRA Met+Cu, HE(8330)	
7.	041257-004	ER-1295-6631-DF1-BH2-6-S	6	N/A	6/24/98 0930	S	G	125ml	4C	G	SA	RCRA Met+Cu, HE(8330)	
8.	041258-004	ER-1295-6631-DF1-BH2-11-S	11	N/A	6/24/98 0945	S	G	125ml	4C	G	SA	RCRA Met+Cu, HE(8330)	
9.	041282-001	ER-1295-6631-TB	N/A	N/A	6/24/98 1010	DIW	G	2X40ml	HCl+4C	G	TB	VOCs	
10.	041283-001	ER-1295-6631-EB	N/A	N/A	6/24/98 105	DIW	G	3X40ml	HCl+4C	G	EB	VOCs	

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

Sample Tracking — Lab Use
Date Entered (mm/dd/yy):
Entered by:
QC Initials:

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

Abnormal Conditions on Receipt (Lab Use)

Turnaround Time XNormal ☐Rush Required Report Date

	Name	Signature	Init	Company/Organization/Phone
Sample Team Members	Chris Catchis		CC	MDA 6131 / 861-3196

Please list as separate report.

1. Relinquished by	Org. 6131	Date 6/24/98	Time 4:00 P.M.	4. Relinquished by	Org.	Date	Time
1. Received by	Org. 6133	Date 6/24/98	Time 16:00	4. Received by	Org.	Date	Time
2. Relinquished by	Org.	Date	Time	5. Relinquished by	Org.	Date	Time
2. Received by	Org.	Date	Time	5. Received by	Org.	Date	Time
3. Relinquished by	Org.	Date	Time	6. Relinquished by	Org.	Date	Time
3. Received by	Org.	Date	Time	6. Received by	Org.	Date	Time

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)

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.: 600397 | 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		

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 samples		
2.5	Matrix spike/matrix spike duplicate data provided(if requested)	—		Note: not requested/analyzed on samples		
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: A. Rule Date: 1/26/00 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-1295-6631-DF1 - (BH1-6,-11-S, BH2-6,-11S and ER 1295-6631-TB/EB

AR/COC No. 600397 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?	NA		Not applicable
4) Quantitation limit met for all samples?	✓		
5) Accuracy a) Laboratory control sample accuracy reported and met for all samples?	✓		
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique?	✓		

Reviewed by: Jeffrey A. Rabe

Date: 1/26/00

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?		✓	S198-18 ⇒ results not reported for Ba. ①
6) Precision a) Laboratory control sample precision reported and met for all samples?	NA		
b). Matrix spike duplicate RPD data reported and met for all samples for which it was requested?		✓	S198-18 ⇒ results not reported for Ba. ①
7) Blank data a) Method or reagent blank data reported and met for all samples?		✓	S198-18 ⇒ J values reported for Cd, Hg, and Pb ② W198-11 ⇒ J value reported for Cd.
b) Sampling blank (e.g., field, trip, and equipment) data reported and met?	✓		
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 Percent recoveries and RPD value were not reported for Ba in the MS and MSD samples (S198-18).

Reviewed by: Jeffrey A. Rabe

Date: 1/26/00

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

2.0 COMMENTS CONTINUATION SHEET

@ The following analytes were detected between the MDL and PQL in the LMB (5198-18): Cd, Hg, and Pb. See page 5 of 5 for data validation qualifiers regarding the above listed analytes. Cadmium was detected above the PQL in the H_2O LMB (W198-11). Analytical results for both the TB and EB metals analysis were all non-detect.

Note: H_2O LMB was not analyzed for HE. However analytical results for HE EB were all non-detect.

JR 1/26/00

Reviewed by: Jeffry A. Rahe

Date: 1/26/00

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

See page 5 of 5

1/26/00

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: Jeffrey A. Rabe

Date: 1/26/00

SAMPLE FINDINGS SUMMARY

Site: 101 Non-ER Septic Fields

AR COC: 600397 Data Classification: DV-2

Sample Fraction No.	Analysis	DV Qualifiers	Comments
ER-1295-6631-DF1 -BH1-6-S	7440-39-3	J, P2	Qualifiers apply to all listed samples
~~-BH-11-6-S~~ -BH2-6-S	7440-43-9	U1	
	7439-97-6	B	
ER-1295-6631 DF1-BH2-11-S	7440-39-3	J, P2	
	7440-43-9	U1	
	7439-97-6	U1	

-BH1-11-S JR 2/2/00

JR 2-2-00

1/26/00 JR

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-M3, EPA8270, HACH_ALK, HACH_NO2, HACH_NO3, MEKC_HE, PCBRISC

Reviewed by: Jeffrey P. Rabe Date: 1/26/00

SNL/NM ENVIRONMENTAL RESTORATION CHEMISTRY LABORATORY
NONCONFORMANCE AND CORRECTIVE ACTION REPORT (NCAR)

NCAR No. 98-097 (completed by ERCL QA Officer)

PART I - INITIATION (completed by originator)

Description of Nonconformance:
ICS A shows Cu and Ag at levels slightly above their respective PQL's. ICS AB has Hg present at twice the amount it should be. LMB shows Cd, Hg, and Pb present at levels between the MDL and PQL; samples will be reported with a "B" qualifier for these elements. MDUP rpd out of criteria for Ba.

Effect of Nonconformance:
The Cu and Ag data for the ICS A indicates possible matrix interference for these two elements, however, all recovery samples and blanks pass for Cu and Ag, thus any matrix effect appears to be minimal. It was determined by examination of a previously run batch that the ICAL-B solution used in the preparation of ICS AB was made incorrectly, and this is responsible for the high Hg level. Because the source of the problem has been found and the problem fixed, no action is necessary for this batch. As stated above, the samples will all carry "B" qualifiers for Cd, Hg, and Pb, due to their presence in the LMB. The high rpd on the MDUP is most likely attributable to sample nonhomogeneity, which is a common problem when analyzing soils.

Associated Samples: 9807-600303-01, -02, -03; 9806-600397-05, -06, -07, -08; 9806-600443-05, -06, -07, -08
Associated Batch #s: SI9818
Associated COCs: 600303, 600397, 600443

PART II - CORRECTIVE ACTION

Corrective Action Required? ☐YES ☑NO

Describe Corrective Action Required:
Date(s) for completion of Corrective Actions N/A

PART III - ACCEPTANCE AND APPROVAL

Linda Kear		7/16/98
Originator (print)	Signature	Date
MARGIE MARLEY	Margie Marley	8/5/98
ERCL QA Officer (print)	Signature	Date

PART IV - VERIFICATION OF COMPLETION OR CLOSE OUT

Comments:

MARGIE MARLEY	Margie Marley	8/5/98
ERCL QA Officer (print)	Signature	Date

VOC Peer Review Check List

Batch ID: SVOC-C4C

Did BFB Pass?	Yes ☒	No ☐	
Did the ICAL Pass %RSD $\leq$ 30%	Yes ☒	No ☐	
Did the ICAL and CCV pass:			
$\pm$ 20% recovery for the individual analytes?	Yes ☒	No ☐	
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: 7/17/98

VOC Peer Review Check List

Batch ID: SVOC-039

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: 7/8/98

VOC Peer Review Check List

Batch ID: SVOC-C4C

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 ☐	
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: 7/14/98

600397

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. 600397 Reviewed by Margie Marley Date 8/6/98

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

57 of 59

Internal Lab

ANALYSIS REQUEST AND CHAIN OF CUSTODY

Page 1 of 3

AR/COC 602761

Batch No. | SAR/WR No. | SMO Use

Dept. No./Mail Stop:	6135/1147 A. Rollow	[redacted]	Contract No.: AJ-2480A
Project/Task Manager:	NON-ER Septic Sys M. Sanders	[redacted]	Case No.: 7223.230
Project Name:	Non-ER Septic Systems	Lab Contact: E Kent 803 556 8171	SMO Authorization:
Record Center Code:	ER/1295/DAT	Lab Destination: GEL	Bill To: Sandia National Laboratories
Logbook Ref. No.:	N/A	SMO Contact/Phone: D Salmi 844-3110	Supplier Services Dept.:
Service Order No.	CF 0688	Send Report to SMO: S Jensen 844-3184	P.O. Box 5800 MS 0154
Location	Tech Area		
Building	Room	Reference LOV(available at SMO)	

Sample No.-Fraction	ER Sample ID or Sample Location Detail	Beginning Depth/ft.	ER Site No.	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Use Lab Sample ID
048278-002	B6922-DFI-BH1-5-S	5 ft	N/A	081699 1000	S	G	500 ml	4C	GR	SA	PCB, CN, Cr6+	[redacted]
048279-002	B6922-DFI-BH1-10-S	10 ft	N/A	081699 1085	S	G	500ml	4C	GR	SA	PCB, CN, Cr6+	
048280-002	B6922-DFI-BH2-5-S	5 ft	N/A	081699 11:16	S	G	500ml	4C	GR	SA	PCB, CN, Cr6+	
048281-002	B6922-DFI-BH2-10-S	10 ft	N/A	081699 11:30	S	G	500ml	4C	GR	SA	PCB, CN, Cr6+	
048282-002	B6631-DFI-BH1-6-S	6 ft	N/A	081699 1400	S	G	500ml	4C	GR	SA	PCB, CN, Cr6+	
048283-002	B6631-DFI-BH1-11-S	11 ft	N/A	081699 1440	S	G	500ml	4C	GR	SA	PCB, CN, Cr6+	
048284-002	B6631-DFI-BH2-6-S	6 ft	N/A	081699 1300	S	G	500ml	4C	GR	SA	PCB, CN, Cr6+	
048285-002	B6631-DFI-BH2-11-S	11 ft	N/A	081699 1335	S	G	500ml	4C	GR	DU SA	PCB, CN, Cr6+	
048286-002	B6631-DFI-BH2-6-DU	X 6 ft	N/A	081699 1300	S	G	500ml	4C	GR	DUP SA	PCB, CN, Cr6+	
048287-002	B6730-DFI-BH1-45-S	4.5 ft	N/A	081699 1530	S	G	500ml	4C	GR	SA	PCB, CN, Cr6+	

RMMA ☐ Yes ☒ No Ref. No. [redacted]

Sample Disposal ☐ Return to Client ☒ Disposal by lab

Turnaround Time ☒ Normal ☐ Rush

Required Report Date 8/19/99

Special Instructions/QC Requirements

EDD ☒ Yes ☐ No

Raw Data Package ☒ Yes ☐ No

Send info to Mike Sanderse

VOC (EPA 8260)
CN (EPA 9010A)
PCB (EPA 8082)
Cr6+ (EPA 8270)

Please list as separate report.

	Name	Signature	Init	Company/Organization/Phone
Sample Team Members	Margaret Sanchez	Margaret Sanchez	MS	Weston/6118/845-3267
	Gilbert Quintana			IT/6118/238-3417

1. Relinquished by		Org. 6118	Date 8-17-99	Time 1600	4. Relinquished by		Org.	Date	Time
1. Received by	SMO	Org. IT	Date 8/17/99	Time 1600	4. Received by		Org.	Date	Time
2. Relinquished by		Org. IT	Date 8/19/99	Time 11:30	5. Relinquished by		Org.	Date	Time
2. Received by		Org.	Date	Time	5. Received by		Org.	Date	Time
3. Relinquished by		Org.	Date	Time	6. Relinquished by		Org.	Date	Time
3. Received by		Org.	Date	Time	6. Received by		Org.	Date	Time

DATA VALIDATION SUMMARY:

SITE/PROJECT: Non-ER Septic CASE #: 7223.230
ARCOC #: 602761
LABORATORY: CEL
LABORATORY REPORT #: 9908674

OF SAMPLES: 1 MATRIX: Aqueous
LAB SAMPLE IDs: 9908674-121

ANALYSIS/ QC ELEMENT	VOC	SVOC	PEST/ PCB	HPLC (HE)	ICP/AES	GFAA/ AA	CVAA (Hg)	CN	RAD	OTHER C+G
1. HOLDING TIMES/ PRESERVATION			✓					✓		UJ2
2. CALIBRATIONS			✓					✓		✓
3. METHOD BLANKS			✓					✓		✓
4. MS/MSD			✓					✓		✓
5. LABORATORY CONTROL SAMPLES			✓					✓		✓
6. REPLICATES								✓		✓
7. SURROGATES			UJ							–
8. INTERNAL STDS										–
9. TCL COMPOUND IDENTIFICATION										–
10. ICP INTERFERENCE CHECK SAMPLE										–
11. ICP SERIAL DILUTION										–
12. CARRIER/CHEM TRACER RECOVERIES										–
13. OTHER QC			✓					✓		✓

CHECK MARK (√) – ACCEPTABLE
J – ESTIMATED
U – NOT DETECTED

SHADED CELLS – NOT APPLICABLE
UJ – NOT DETECTED, ESTIMATED
R – UNUSABLE

REVIEWED BY: _____ DATE: 10/28/99

Memorandum

Date: 10/29/99

To: File

From: Marcia Hilchey

Subject: Organic Data Review and Validation
Site: Non-ER Septic Systems
AR/COC: 602761
Case: 7223.230
Laboratory: GEL
SDG: 9908674

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 (PCB EPA8082). All compounds were successfully analyzed.

Qualification was applied to a PCB sample result due to low surrogate recovery.

Application of the UJ qualifier to equipment blank results (see Surrogate section above) does not affect field sample data quality.

Holding Times

The samples were analyzed within the prescribed holding times.

Calibration

Initial calibration met acceptance criteria.

CCV analyses on 8/26/99 at 1845 (Aroclor-1232) and 1904 (Aroclor-1221) exceeded percent difference criteria. These CCVs were only associated with the equipment blank sample. The laboratory case narrative indicates that these failures indicate a positive bias. Since the sample results were non-detect, no results were qualified.

Blanks

No target analytes were detected above the reporting limit in the method blanks.

Surrogates

Surrogate recovery in sample B6730-DF1-RN-PCB failed to meet acceptance recovery - low. Non-detect results for this equipment blank were qualified UJ.

Note: The laboratory case narrative incorrectly states that surrogate recovery for sample B6922-DF1-BH2-10S (instead of B6730-DF1-RN-PCB) failed to meet acceptance criteria.

PCBs:
SW846 - Method 8082

SITE/PROJECT: Non-ER-Sonic ARCOC #: 602761
LABORATORY: CEL LABORATORY REPORT #: 9908674

n/a

Name	CAS #	Intercept	Calib RSD / R^2	CCV RPD	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Eq. Blks	Field Blks			
			<20% / 0.99	<20%				20%			20%					©	
PCBs												✓					
Aroclor-1016	12674-11-2	✓	✓	✓	✓							✓	✓				
Aroclor-1221	11104-28-2	✓	✓														
Aroclor-1232	11141-16-5	✓	✓														
Aroclor-1242	53469-21-9		✓														
Aroclor-1248	12672-29-6		✓														
Aroclor-1254	11097-69-1		✓														
Aroclor-1260	11096-82-5		✓			✓	✓	✓	✓	✓	✓						

Sample	SMC % REC	SMC RT		Sample	SMC % REC	SMC RT
-21	38.1					

Confirmation

Sample	CAS #	RPD > 25%		Sample	CAS #	RPD > 25%
	OK					

Comments:

REVIEWED BY: _____ DATE: 10/29/99

Memorandum

Date: 10/29/99

To: File

From: Marcia Hilchey

Subject: General Chemistry Data Review and Validation
Site: Non-ER Septic Systems
AR/COC: 602761
Case: 7223.230
Laboratory: GEL
SDG: 9908674

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 Cr EPA7196). All components were successfully analyzed.

No qualifications were applied to CN sample results.

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 and analyzed 1 day after the prescribed 24hr. holding time. Sample results were UJ2 qualified.

Calibration

Initial and continuing calibrations met QC acceptance criteria.

Blanks

The method blanks and equipment blanks were free of target analytes above reporting limits.

Matrix Spike Analysis

The matrix spike sample analyses met QC acceptance criteria.

Laboratory Control/Laboratory Control Duplicate Samples

The LCS/LCSD samples met QC acceptance criteria.

Laboratory Replicate Analysis

The replicate sample analyses met QC acceptance criteria.

Other QC

Field duplicate 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.

GENERAL CHEMISTRY:

SITE/PROJECT: Non-ER septic ARCOC #: 602761
LABORATORY: CEC LABORATORY REPORT #: 9908674
METHODS: Cn, Cr61

QC/ Analyte	CAS #	ICV	CCV	ICB	CCB	Method Blanks	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	REP RPD	Serial Dilution	Field Dup RPD	Equip. Blks	Field Blks			
											n/a	n/a								
CN total		✓	✓	n/a	n/a	✓	✓	✓	✓	✓	n/a	n/a	✓	n/a	✓	✓	n/a			
Cr 6+		✓	✓	"	"	✓	✓	✓	✓	✓	"	"	~~Too~~	"	✓	✓				

Comments:

REVIEWED BY: _____ DATE: 10/29/99

Contract Verification Review (CVR)

Project Leader ROYBAL Project Name NON-ER SEPTIC SYSTEMS Case No. 7223.230

AR/COC No. 602761 Analytical Lab GEL SDG No. 9908674

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	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		CHROMIUM 6 + EQUIPMENT BLANK RECEIVED OUT OF HOLDING TIME	X	
2.13	Contractual qualifiers provided	X				
2.14	All requested result and TIC (if requested) data provided	X				

Contract Verification Review (Continued)

3.0 Data Quality Evaluation

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1 Are reporting units appropriate for the matrix and meet contract specified or project-specific requirements? Inorganics and metals reported as ppm (mg/liter or mg/Kg)? Tritium reported in picocuries per liter with percent moisture for soil samples? Units consistent between QC samples and sample data	X		
3.2 Quantitation limit met for all samples	X		
3.3 Accuracy a) Laboratory control samples accuracy reported and met for all samples	X		
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique		X	DECACHLOROBIPHENYL FAILED RECOVERY FOR PCB SAMPLE #9908674-21
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		
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	NA		
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	NA		
b) Initial calibration provided	NA		
c) Continuing calibration provided	NA		
d) Internal standard performance data provided	NA		
e) Instrument run logs provided	NA		
4.2 GC/HPLC (8330 and 8010 and 8082)			
a) Initial calibration provided	X		
b) Continuing calibration provided	X		
c) Instrument run logs provided	X		
4.3 Inorganics (metals)			
a) Initial calibration provided	NA		
b) Continuing calibration provided	NA		
c) ICP interference check sample data provided	NA		
d) ICP serial dilution provided	NA		
e) Instrument run logs provided	NA		
4.4 Radiochemistry			
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

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: W. Palencia Date: 10-4-99 Closed by:_____ Date:_____

DATA VALIDATION SUMMARY:

SITE/PROJECT: Non-ERS Solex CASE #: 7225.230
ARCOC #: 602761
LABORATORY: CEL
LABORATORY REPORT #: 9908674

OF SAMPLES: 18 MATRIX: soil
LAB SAMPLE IDs: 9908674-01 thru -18

ANALYSIS/ QC ELEMENT	VOC	SVOC	PEST/ PCB	HPLC (HE)	ICP/AES	GFAA/ AA	CVAA (Hg)	CN	RAD	OTHER Cr6
1. HOLDING TIMES/ PRESERVATION			✓					✓		✓
2. CALIBRATIONS			✓					✓		✓
3. METHOD BLANKS			✓					✓		✓
4. MS/MSD			✓					✓		✓
5. LABORATORY CONTROL SAMPLES			✓					✓		✓
6. REPLICATES								✓		✓
7. SURROGATES			✓							—
8. INTERNAL STDS										—
9. TCL COMPOUND IDENTIFICATION										—
10. ICP INTERFERENCE CHECK SAMPLE										—
11. ICP SERIAL DILUTION										—
12. CARRIER/CHEM TRACER RECOVERIES										—
13. OTHER QC			✓					✓		✓

CHECK MARK (√) – ACCEPTABLE
J – ESTIMATED
U – NOT DETECTED

SHADED CELLS – NOT APPLICABLE
UJ – NOT DETECTED, ESTIMATED
R – UNUSABLE

REVIEWED BY: _____ DATE: 10/29/99

FEDERAL SAMPLE RECEIPT REVIEW

Client SNL Received by DF Date 8/19/99

GEL COOLER___ GEL POLY COOLER___ CLIENT COOLER ✓ OTHER___

SAMPLE REVIEW CRITERIA	YES	NO	COMMENTS/QUALIFIERS
1. Were shipping containers received intact and sealed? If no, notify Project Manager	✓		
2. Was the Shipment screened following the radiochemistry survey procedure (EPI SOP S-007)?	✓		
Were the survey results negative? If no, notify Project Manager	✓		
Are any of the samples identified by the client as radioactive? If yes, did client provide RAD activity?		✓	
3. Were chain of custody documents included?	✓		
4. Were chain of custody documents completed correctly? (Ink, signed, match containers)	✓		
5. Were all sample containers properly labeled?	✓		
6. Were proper sample containers received?	✓		
7. Preserved samples checked for pH?	✓		
8. Were samples preserved correctly? If no, list samples & tests	✓		
9. Shipping container temperature checked?	✓		
10. Was shipping container temperature within specifications (4°±2° C) If no, notify Project Manager	✓		4°c
11. Is temperature documented on the Chain of Custody?	✓		
12. Were samples received within holding time? if No, notify Project Manger	✓		
13. Were VOA vials free of headspace?	—		
14. ARCOC# IF REQUIRED	✓		602761
15. SDG# IF REQUIRED	✓		98674

REVIEW [signature] DATE 8/19/99 (SA) SEALS ATTACHED NSA - NO SEALS ATTACHED

FEDEX TRACKER # 4223 3371 9941
9908
9982
9860
9919
9893
9930
9871
9920

808196511404

ANNEX C
DSS Site 1033
Risk Assessment

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DSS SITE 1033: RISK ASSESSMENT REPORT

I. Site Description and History

Drain and Septic Systems (DSS) Site 1033, the Building 6631 Septic System, at Sandia National Laboratories/New Mexico (SNL/NM), is located in Technical Area 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, located approximately 140 feet northwest of Building 6631, consisted of a septic tank connected to a distribution box and a drainfield consisting of four 70-foot-long drain lines. Available information indicates that Building 6631 was constructed in 1959 (SNL/NM March 2003), and it is assumed that the septic system was also constructed at that time. In June 1991, the septic system discharges were routed to the City of Albuquerque sanitary sewer system (Jones June 1991). The old septic system line was disconnected and capped, and the system was abandoned in place concurrent with this change (Romero September 2003).

Environmental concern about DSS Site 1033 is based upon the potential for the release of constituents of concern (COCs) in effluent discharged to the environment via the septic system at this site. Because operational records are not available, the investigation for this site 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 DSS Site 1033 is flat to very slightly inclined to the west. The closest major drainage lies south of the site and terminates in the playa just west of KAFB. No springs or perennial surface-water bodies are located within 2 miles of the site. Average annual rainfall in the SNL/NM and KAFB area, as measured at Albuquerque International Sunport, is 8.1 inches (NOAA 1990). Surface-water runoff in the vicinity of the site is minor because the surface slope is flat to gently inclined to the west. Infiltration of precipitation is almost nonexistent as virtually all of the moisture subsequently undergoes evapotranspiration. The estimates of evapotranspiration for the KAFB area range from 95 to 99 percent of the annual rainfall (Thomspon and Smith 1985, SNL/NM March 1996). Most of the area immediately surrounding DSS Site 1033 is unpaved, and no storm sewers are used to direct surface water away from the site.

DSS Site 1033 lies at an average elevation of approximately 5,425 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 499 feet below ground surface (bgs). The direction of groundwater flow is to the west in this area (SNL/NM March 2002). The nearest groundwater monitoring well is approximately 0.76 mile northwest of the site. The nearest production wells are northwest and northeast of the site and include KAFB-4 and KAFB-11, which are approximately 3.9 and 4.1 miles away, respectively.

II. Data Quality Objectives

The Data Quality Objectives (DQOs) presented in the "Sampling and Analysis Plan [SAP] for Characterizing and Assessing Potential Releases to the Environment From Septic and Other Miscellaneous Drain Systems at Sandia National Laboratories/New Mexico" (SNL/NM October

1999) and "Field Implementation Plan [FIP], Characterization of Non-Environmental Restoration Drain and Septic Systems" (SNL/NM November 2001) identified the site-specific sample locations, sample depths, sampling procedures, and analytical requirements for this and many other DSS sites. The DQOs outlined the quality assurance (QA)/quality control (QC) requirements necessary for producing defensible analytical data suitable for risk assessment purposes. The 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 1033 was effluent discharged to the environment from the drainfield at this site.

Table 1
Summary of Sampling Performed to Meet DQOs

DSS Site 1105 Sampling Areas	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 in two locations at DSS Site 1033 with a Geoprobe™ from two 3-foot-long sampling intervals at the boring locations. Drainfield sampling intervals started at 6 and 11 feet bgs in 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 1033 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 the

Table 2
Number of Confirmatory Soil and QA/QC Samples Collected from DSS Site 1033

Sample Type	VOCs	SVOCs	PCBs	HE	RCRA Metals	Hexavalent Chromium	Cyanide	Gamma Spectroscopy Radionuclides	Gross Alpha/Beta
Soil	4	4	4	4	4	4	4	4	4
Duplicates	1	1	1	1	1	1	1	1	0
EBs and TBs (VOCs only)	3	1	0	1	1	0	0	0	0
Total Samples	8	6	5	6	6	5	5	5	4
Analytical Laboratory	ERCL, 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

Analytical Method[a]	Data Quality Level	GEL	ERCL	RPSD
VOCs EPA Method 8260	Defensible	None	4 samples	None
SVOCs EPA Method 8270	Defensible	4 samples	None	None
PCBs EPA Method 8082	Defensible	4 samples	None	None
HE Compounds EPA Method 8330/8095	Defensible	None	4 samples	None
RCRA metals EPA Method 6020/7000	Defensible	None	4 samples	None
Hexavalent Chromium EPA Method 7196A	Defensible	4 samples	None	None
Total Cyanide EPA Method 9012A	Defensible	4 samples	None	None
Gamma Spectroscopy Radionuclides EPA Method 901.1	Defensible	None	None	4 samples
Gross Alpha/Beta Activity EPA Method 900.0	Defensible	4 samples	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.
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 Conversation and Recovery Act.
RPSD = Radiation Protection Sample Diagnostics Laboratory.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.

data quality requirements from the SAP (SNL/NM October 1999) and FIP (SNL/NM November 2001).

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 one trip blank (for VOCs only), one field duplicate, and one set of equipment blank 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 Data Verification/Validation Level 3 (SNL/NM July 1994) or SNL/NM ER Project Data Validation Procedure for Chemical and Radiochemical Data, AOP [Administrative Operating Procedure] 00-03, Rev. 0 (SNL/NM December 1999). The data validation reports are presented in the associated DSS Site 1033 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. 02 (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 1033 was based upon an initial conceptual model validated with confirmatory sampling at the site. The initial conceptual model was developed from archival site research, site inspections, and soil sampling. The DQOs contained in the 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 1033, which is presented in Section 4.0 of the associated NFA proposal. The quality of the data used to specifically 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 1033 were evaluated using laboratory analyses of the soil samples. The analytical requirements included analyses for VOCs, SVOCs, HE compounds, PCBs, RCRA metals, hexavalent chromium, cyanide, radionuclides by gamma spectroscopy, and gross alpha/beta activity. The analytes and methods listed in Tables 2 and 3 are appropriate to characterize the COCs and potential degradation products at DSS Site 1033.

III.3 Rate of Contaminant Migration

The septic system at DSS Site 1033 was deactivated in the early 1990s when Building 6631 was connected to an extension of the City of Albuquerque sanitary sewer system. The migration rate of COCs that may have been introduced into the subsurface via the septic system at this site was therefore dependent upon the volume of aqueous effluent discharged to the environment from this system when it was operational. Any migration of COCs from this site after use of the septic system was discontinued has been predominantly dependent upon precipitation. However, it is highly unlikely that sufficient precipitation has fallen on the site to reach the depth at which COCs may have been discharged to the subsurface from this system. Analytical data generated from the soil sampling conducted at the site are adequate to characterize the rate of COC migration at DSS Site 1033.

III.4 Extent of Contamination

Subsurface baseline soil samples were collected from boreholes drilled at two locations beneath the effluent release point in 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 6 and 11 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 New Mexico Environment Department (NMED) regulators and has been used at numerous DSS 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 1033 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 and 5.

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 this risk assessment consist of both inorganic and organic compounds.

Table 4 lists the nonradiological COCs and Table 5 lists radiological COCs for the human health risk assessment at DSS Site 1033. All samples were collected at depths greater than 5 feet bgs; therefore, evaluation of ecological risk was not performed. Both tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997). Section VI.4 discusses the results presented in Tables 4 and 5.

V. Fate and Transport

The primary releases of COCs at DSS Site 1033 occurred in the subsurface soil resulting from the discharge of effluents from Building 6631 to the septic tank and drainfield. Wind, water, and biota are natural mechanisms of COC transport from the primary release point. Because the discharges were to the subsurface soil, wind and surface water are considered to be of low significance as transport mechanisms at this site.

Table 4
Nonradiological COCs for Human Health Risk Assessment at DSS Site 1033 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

COC	Maximum Concentration (All Samples) (mg/kg)	SNL/NM Background Concentration (mg/kg)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Log K_{ow} (for organic COCs)	Bioaccumulator?[b] (BCF>40, Log K_{ow}>4)
Inorganic						
Arsenic	3.7	4.4	Yes	44[c]	–	**Yes**
Barium	210 J	214	Yes	170[d]	–	**Yes**
Cadmium	0.26	0.9	Yes	64[c]	–	**Yes**
Chromium, total	8.1	15.9	Yes	16[c]	–	No
Chromium VI	0.017[e]	1	Yes	16[c]	–	No
Copper	6.6	18.2	Yes	6[c]	–	No
Cyanide	0.211 J	NC	**Unknown**	NC	–	**Unknown**
Lead	6.9	11.8	Yes	49[c]	–	**Yes**
Mercury	0.086 J	<0.1	**Unknown**	5,500[c]	–	**Yes**
Selenium	0.45 J	<1	**Unknown**	800[f]	–	**Yes**
Silver	0.021[e]	<1	**Unknown**	0.5[c]	–	No
Organic						
Phenanthrene	0.23 J	NA	**NA**	23,800[c]	4.63[c]	**Yes**
Pyrene	0.22 J	NA	**NA**	36,300[c]	5.32[g]	**Yes**

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

Table 4 (Concluded)
Nonradiological COCs for Human Health Risk Assessment at DSS Site 1033 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
Radiological COCs for Human Health Risk Assessment at DSS Site 1033 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 (0.034)	0.079	Yes	900[c]	**Yes**
Th-232	0.90	1.01	Yes	900[c]	**Yes**
U-235	**ND (0.24)**	0.16	**No**	3,000[c]	**Yes**
U-238	**ND (3.46)**	1.4	**No**	3,000[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.

Water at DSS Site 1033 is received as precipitation (approximately 8.1 inches annually) that will either evaporate at or near the point of contact, infiltrate into the soil, or form runoff. Infiltration at the site is enhanced by the sandy texture of the soil. However, because it is estimated that 95 to 99 percent of the annual precipitation in this area is lost through evapotranspiration, the depth of percolation of this water into the soil is limited, and the potential for further downward movement of COCs through leaching is low. Because groundwater at this site is approximately 499 feet bgs, the potential for COCs to reach groundwater through the unsaturated zone above the water table is extremely low.

COCs can enter the food chain through uptake by plants. Once in the food web, COCs can be transported from the site by the movements of the organisms that contain them or other surficial transport mechanisms. However, because the COCs at DSS Site 1033 are located at depths greater than 5 feet bgs, which is below the expected rooting depth of plants, food chain transport is not expected to be a significant transport mechanism at this site.

COCs at DSS Site 1033 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. However, because of 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 radiological COCs (U-235 and U-238) will undergo decay to stable isotopes or radioactive daughter elements. However, because of the long half-lives of these radionuclides, this mechanism will not result in significant loss or transformation of the radiological COCs.

The two organic COCs at DSS Site 1033 (phenanthrene and pyrene) 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, the aridity of the environment, and the lack of potential contact with biota, none of these mechanisms is expected to result in significant losses or transformations of these COCs.

Table 6 summarizes the fate and transport processes that can occur at DSS Site 1033. COCs at this site include radiological and nonradiological inorganic and organic analytes. Wind, surface water, and biota are considered to be of low significance as potential transport mechanisms at this site. Significant leaching into the subsurface soil is unlikely, and leaching into the groundwater at this site is highly unlikely. The potential for transformation of organic and inorganic COCs is low, and loss through decay of the radiological COCs is insignificant because of their long half-lives.

Table 6
Summary of Fate and Transport at DSS Site 1033

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 1033. 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 1033 has been designated with a future land-use scenario of industrial (DOE et al. September 1995) (see Appendix 1 for default exposure pathways and parameters). However, the residential land-use scenario is also considered in the pathway analysis. Because of the location and characteristics of the potential contaminants, the primary pathway for human exposure is considered to be soil ingestion for the nonradiological COCs and direct gamma exposure for the radiological COCs. The inhalation pathway for both nonradiological and radiological COCs is included because the potential exists to inhale dust and volatiles. Soil ingestion is included for the radiological COCs as well; the dermal pathway is included for the nonradiological COCs because of the potential for the receptor to be exposed to contaminated soil. No water pathways to the groundwater are considered. Depth to groundwater at DSS Site 1033 is approximately 499 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 site model flow diagram for DSS Site 1033.

Pathway Identification

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

VI.4 Step 3. Background Screening Procedure

This section addresses 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 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 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 a background value and were detected above the analytical minimum detectable activity (MDA) 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.

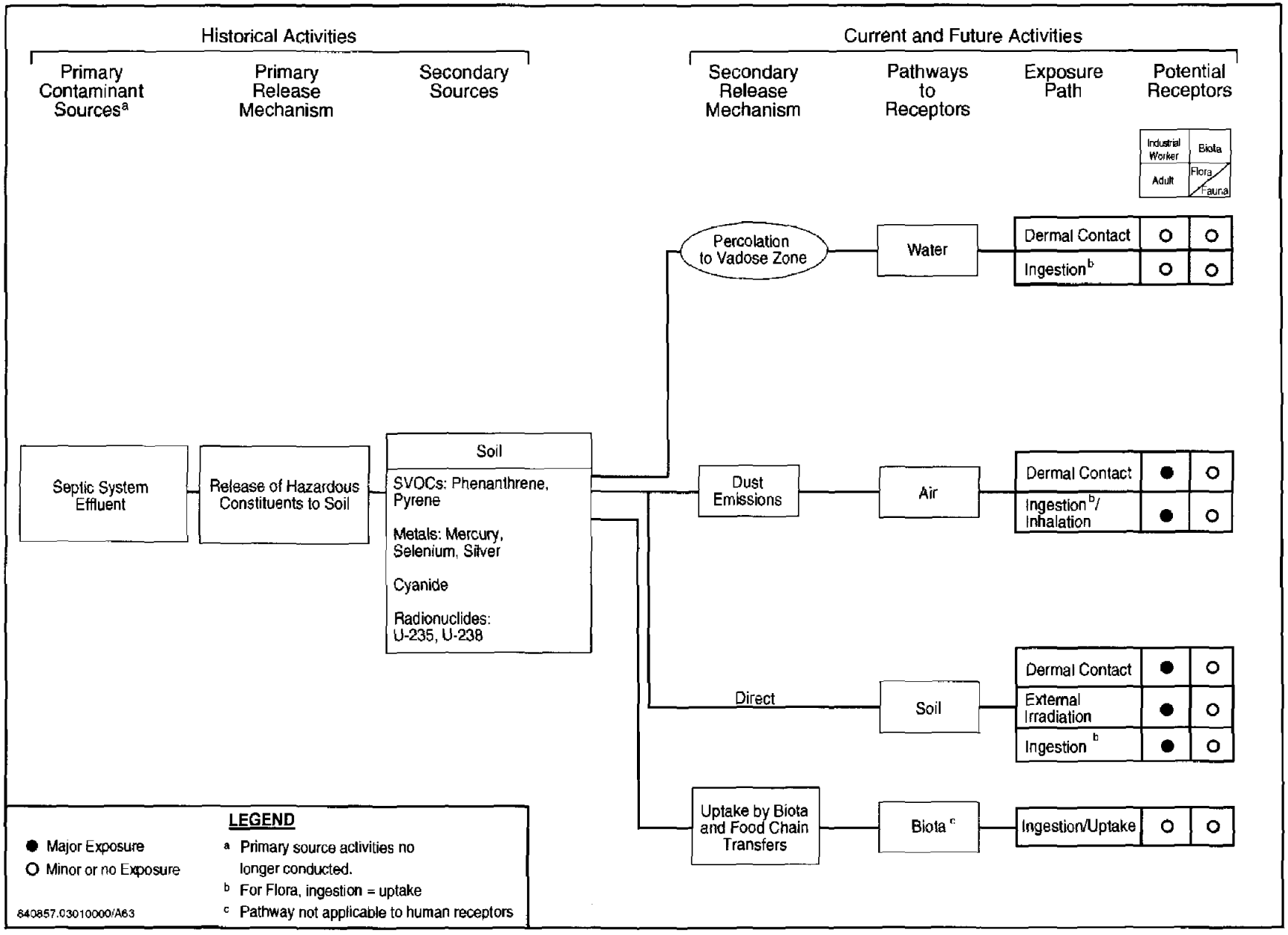

Figure 1

Conceptual Site Model Flow Diagram for DSS Site 1033, Building 6631 Septic System

VI.4.2 Results

Tables 4 and 5 show DSS Site 1033 maximum COC concentrations that were compared to the SNL/NM maximum background values (Dinwiddie September 1997) for the human health risk assessment. For the nonradiological COCs, four constituents do not have quantified background screening concentrations. Two constituents were organic compounds that do not have corresponding background screening values.

For the radiological COCs, two constituents (U-235 and U-238) exhibited MDAs greater than the corresponding background values.

VI.5 Step 4. Identification of Toxicological Parameters

Tables 7 (nonradiological) and 8 (radiological) list the COCs retained in the risk assessment and the values for the available toxicological information. The toxicological values for the nonradiological COCs presented in Table 7 were obtained from the Integrated Risk Information System (IRIS) (EPA 2003), the Health Effects Assessment Summary Tables (HEAST) (EPA 1997a), the Technical Background Document for Development of Soil Screening Levels (NMED December 2000), and the EPA Region 6 (EPA 2002a) electronic database. 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.

Table 7
Toxicological Parameter Values for DSS Site 1033 Nonradiological COCs

COC	RfD_o (mg/kg-d)	Confidence[a]	RfD_{inh} (mg/kg-d)	Confidence[a]	SF_o $(mg/kg-d)^{-1}$	SF_{inh} $(mg/kg-d)^{-1}$	Cancer Class[b]	ABS
Inorganic								
Cyanide	2E-2[c]	M	–	–	–	–	D	0.1[d]
Mercury	3E-4[e]	–	8.6E-5[c]	M	–	–	D	0.01[d]
Selenium	5E-3[c]	H	–	–	–	–	D	0.01[d]
Silver	5E-3[c]	L	–	–	–	–	D	0.01[d]
Organic								
Phenanthrene[f]	3E-1[c]	L	3E-1[g]	–	–	–	D	0.1[d]
Pyrene	3E-2[c]	L	3E-2[g]	–	–	–	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):
D = Not classifiable as to human carcinogenicity.
[c]Toxicological parameter values from IRIS electronic database (EPA 2003).
[d]Toxicological parameter values from NMED December 2000.
[e]Toxicological parameter values from HEAST (EPA 1997a).
[f]Toxicological parameter values for phenanthrene could not be found. Anthracene was used as a surrogate compound.
[g]Toxicological parameter values from EPA Region 6 (EPA 2002a).

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.
$(mg/kg-d)^{-1}$ = Per milligram per kilogram day.
RfD_{inh} = Inhalation chronic reference dose.
RfD_o = Oral chronic reference dose.
SF_{inh} = Inhalation slope factor.
SF_o = Oral slope factor.
– = Information not available.

Table 8
Radiological Toxicological Parameter Values for DSS Site 1033 COCs
Obtained from RESRAD Risk Coefficients[a]

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

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). 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 Office of Solid Waste and Emergency Response (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.

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

VI.6.2 Risk Characterization

Table 9 shows an HI of 0.08 for the DSS Site 1033 nonradiological COCs and no estimated excess cancer risk for the designated industrial land-use scenario. The numbers presented include exposure from soil ingestion, dermal contact, and dust and volatile inhalation for nonradiological COCs. Table 10 shows that for DSS Site 1033 associated background constituents, there is neither a quantifiable HI nor an estimated excess cancer risk for the designated industrial land-use scenario.

Table 9
Risk Assessment Values for DSS Site 1033 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					
Cyanide	0.211 J	0.00	–	0.00	–
Mercury	0.086 J	0.00	–	0.00	–
Selenium	0.45 J	0.00	–	0.00	–
Silver	0.021[b]	0.00	–	0.00	–
Organic					
Phenanthrene	0.23 J	0.08	–	0.27	–
Pyrene	0.22 J	0.00	–	0.00	–
Total		**0.08**	**–**	**0.27**	**–**

[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 10
Risk Assessment Values for DSS Site 1033 Nonradiological Background Constituents

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

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

For the radiological COCs, contribution from the direct gamma exposure pathway is included. For the industrial land-use scenario, a TEDE was calculated that resulted in an incremental TEDE of 1.2E-2 millirem (mrem)/year (yr). In accordance with EPA guidance found in 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 1033 for the industrial land use is well below this guideline. The estimated excess cancer risk is 1.4E-7.

For the nonradiological COCs under the residential land-use scenario, the HI is 0.27 with no estimated excess cancer risk (Table 9). The numbers in the table include exposure from soil ingestion, dermal contact, and dust and volatile inhalation. Although the EPA (1991) generally recommends that inhalation not be included in a residential land-use scenario, this pathway is included because of the potential for soil in Albuquerque, New Mexico, to be eroded and, 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 10 shows that for the DSS Site 1033 associated background constituents, there is no quantifiable HI or estimated excess cancer risk.

For the radiological COCs, the incremental TEDE for the residential land-use scenario is 3.0E-2 mrem/yr. The guideline being used is an excess TEDE of 75 mrem/yr (SNL/NM February 1998) for a complete loss of institutional controls (residential land use in this case); the calculated dose value for DSS Site 1033 for the residential land-use scenario is well below this guideline. Consequently, DSS Site 1033 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 4.0E-7. The excess cancer risk from the nonradiological and radiological COCs is not additive, as noted in the RAGS (EPA 1989).

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 0.08 (lower than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). There is no quantifiable excess cancer risk. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. This assessment also determined risks considering background concentrations of the potential nonradiological COCs for both the industrial and residential land-use scenarios. Assuming the industrial land-use scenario, for nonradiological COCs there is neither a quantifiable HI nor an estimated excess cancer risk. 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 quantifiable background screening values are assumed to have a hazard quotient of 0.00. The incremental HI is 0.08 and there is no incremental estimated excess cancer risk 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 1.2E-2 mrem/yr, which is significantly lower than EPA's numerical guideline of 15 mrem/yr. The incremental estimated excess cancer risk is 1.4E-7.

For the nonradiological COCs under the residential land-use scenario the calculated HI is 0.27, which is below the numerical guidance. There is no quantifiable excess cancer risk. 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. For background concentrations of the nonradiological COCs there is neither a quantifiable HI nor an estimated excess cancer risk. The incremental HI is 0.27, and there is no incremental cancer risk 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 for a residential land-use scenario from the radiological components is 3.0E-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 4.0E-7.

VI.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at DSS Site 1033 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), and 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 quality of the data used to perform the risk assessment at DSS Site 1033.

Because of the location, history of the site, and future land use (DOE et al. September 1995), there is low uncertainty in the land-use scenario and the potentially affected populations that were considered in performing the risk assessment analysis. 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 7 shows the uncertainties (confidence level) in nonradiological toxicological parameter values. There is a mixture of estimated values and values from the IRIS (EPA 2003), HEAST (EPA 1997a), the Technical Background Document for Development of Soil Screening Levels (NMED December 2000), and the EPA Region 6 (EPA 2002a) electronic database. 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 both the industrial and residential land-use scenarios compared to established numerical guidance.

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

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

VI.9 Summary

DSS Site 1033 contains identified COCs consisting of some organic, inorganic, and radiological compounds. Because of the location of the site, the designated industrial land-use scenario, and the nature of contamination, potential exposure pathways identified for this site included soil ingestion, dermal contact, and dust and volatile inhalation for chemical COCs and soil ingestion, dust inhalation, and direct gamma exposure for radionuclides. The same exposure pathways were applied to the residential land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for nonradiological COCs show that for the industrial land-use scenario the HI (0.08) is significantly lower than the accepted numerical guidance from the EPA. There is no quantifiable estimated excess cancer risk. 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 0.08, and there is no incremental excess cancer risk for the industrial land-use scenario. The incremental risk calculations indicate insignificant risk to human health for the industrial land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for nonradiological COCs show that for the residential land-use scenario the HI (0.27) is also below the accepted numerical guidance from the EPA. There is no quantifiable estimated excess cancer risk. Thus, excess cancer risk was also below the acceptable risk value provided by the NMED for a residential land-use scenario (Bearzi January 2001). The incremental HI is 0.27, and there is no incremental excess cancer risk for the residential land-use scenario. The incremental risk calculations indicate insignificant risk to human health for the residential land-use scenario.

The incremental TEDE and corresponding estimated cancer risk from radiological COCs are much lower than EPA guidance values; the estimated TEDE is 1.2E-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 1.4E-7 for the industrial land-use scenario. Furthermore, the incremental TEDE for the residential land-use scenario that results from a complete loss of institutional controls is 3.0E-2 mrem/yr with an associated

risk of 4.0E-7. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, DSS Site 1033 is eligible for unrestricted radiological release.

The summation of the nonradiological and radiological carcinogenic risks is tabulated in Table 11.

Table 11
Summation of Radiological and Nonradiological Risks from Site Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	0.0	1.4E-7	1.4E-7
Residential	0.0	4.0E-7	4.0E-7

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

VII. Ecological Risk Assessment

VII.1 Introduction

This section addresses the ecological risks associated with exposure to constituents of potential ecological concern (COPECs) in the soil at DSS Site 1033. A component of the NMED Risk-Based Decision Tree (NMED March 1998) is to conduct an ecological risk assessment that corresponds with that presented in EPA's Ecological RAGS (EPA 1997c). The current methodology is tiered and contains an initial scoping assessment followed by a more detailed risk assessment if warranted by the results of the scoping assessment. Initial components of NMED's decision tree (a discussion of DQOs, data assessment, and evaluations of bioaccumulation as well as fate and transport potential) are addressed in previous sections of this report. At the end of the scoping assessment, a determination is made as to whether a more detailed examination of potential ecological risk is necessary.

VII.2 Scoping Assessment

The scoping assessment focuses primarily on the likelihood of exposure of biota at, or adjacent to, the site to constituents associated with site activities. Included in this section are an evaluation of existing data with respect to the existence of complete ecological exposure pathways, an evaluation of bioaccumulation potential, and a summary of fate and transport potential. A scoping risk-management decision (Section VII.2.4) 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, all COCs at DSS Site 1033 are at depths greater than 5 feet bgs. Therefore, no complete ecological exposure pathways exist at this site, and no COCs are considered to be COPECs.

VII.2.2 Bioaccumulation

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

VII.2.3 Fate and Transport Potential

The potential for COCs to migrate from the source of contamination to other media or biota at this site is discussed in Section V. As noted in Table 6 (Section V), wind, surface water, and biota (food chain uptake) are expected to be of low significance as transport mechanisms for COCs at this site. Degradation, transformation, and radiological decay of the COCs 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 are not associated with COCs at this site. Therefore, no COPECs exist at the site, and a more detailed risk assessment was not deemed necessary to predict the potential level of ecological risk associated with the site.

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

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

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

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

References

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