7-1-2004

Justification for Class III Permit Modification July 2004 DSS Site 1101 Operational Unit 1295 Building 885 Septic System (TA-l)

Sandia National Laboratories/NM

Sandia National Laboratories

Justification for Class III Permit Modification

July 2004

DSS Site 1101
Operational Unit 1295
Building 885 Septic System (TA-1)

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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United States Department of Energy
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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L. King, EPA, Region 6 (2 copies, via Certified Mail)
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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 1101, BUILDING 885 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
ER	Environmental Restoration
FIP	Field Implementation Plan
GPR	ground penetrating radar
HE	high explosive(s)
HI	hazard index
HWB	Hazardous Waste Bureau
KAFB	Kirtland Air Force Base
MDL	method detection limit
NFA	no further action
NMED	New Mexico Environment Department
OU	Operable Unit
PCB	polychlorinated biphenyl
QC	quality control
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
VOC	volatile organic compound

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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 1101: BUILDING 885 SEPTIC SYSTEM

2.1 Summary

The SNL/NM ER Project conducted an assessment of DSS Site 1101, the Building 885 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 1101. This NFA proposal provides documentation that the site was sufficiently characterized, that no significant releases of contaminants to the environment occurred via the Building 885 septic system, and that it does not pose a threat to human health or the environment under either an industrial or residential land-use scenario. 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 1101 indicate that concentrations of constituents of concern (COCs) at this site were found to be below applicable risk assessment action levels. Thus DSS Site 1101 is proposed for an NFA decision based upon sampling data demonstrating that COCs released from the site into the environment pose an acceptable level of risk under current and projected future land uses as set forth by Criterion 5, which states: "The SWMU/AOC [Area of Concern] has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use" (NMED March 1998).

2.2 Site Description and Operational History

2.2.1 Site Description

DSS Site 1101 is located on the north side of SNL/NM Technical Area (TA)-I 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). An SNL/NM Facilities Engineering drawing indicates that the Building 885 septic system was situated approximately 100 feet north of the northwest corner of Building 885. This location is now beneath a large asphalt parking lot that is north of Building 885, on the north side of "H" Street. The abandoned septic system consisted of a septic tank and distribution box that emptied to a 5-foot-diameter by an estimated 25-foot-deep seepage pit located approximately 45 feet northeast of the septic tank (Figure 2.2.1-2).

Construction details for this system are based solely on an SNL/NM engineering drawing (SNL/NM June 1980) because no surface expression of this system remains. No backhoe excavation was conducted to locate the system at this site, which has been paved. An attempt to locate the seepage pit using ground penetrating radar (GPR) equipment was completed on June 21, 2002. However, the survey results were inconclusive as to the actual location of the system. The GPR investigation is described in Section 3.3.

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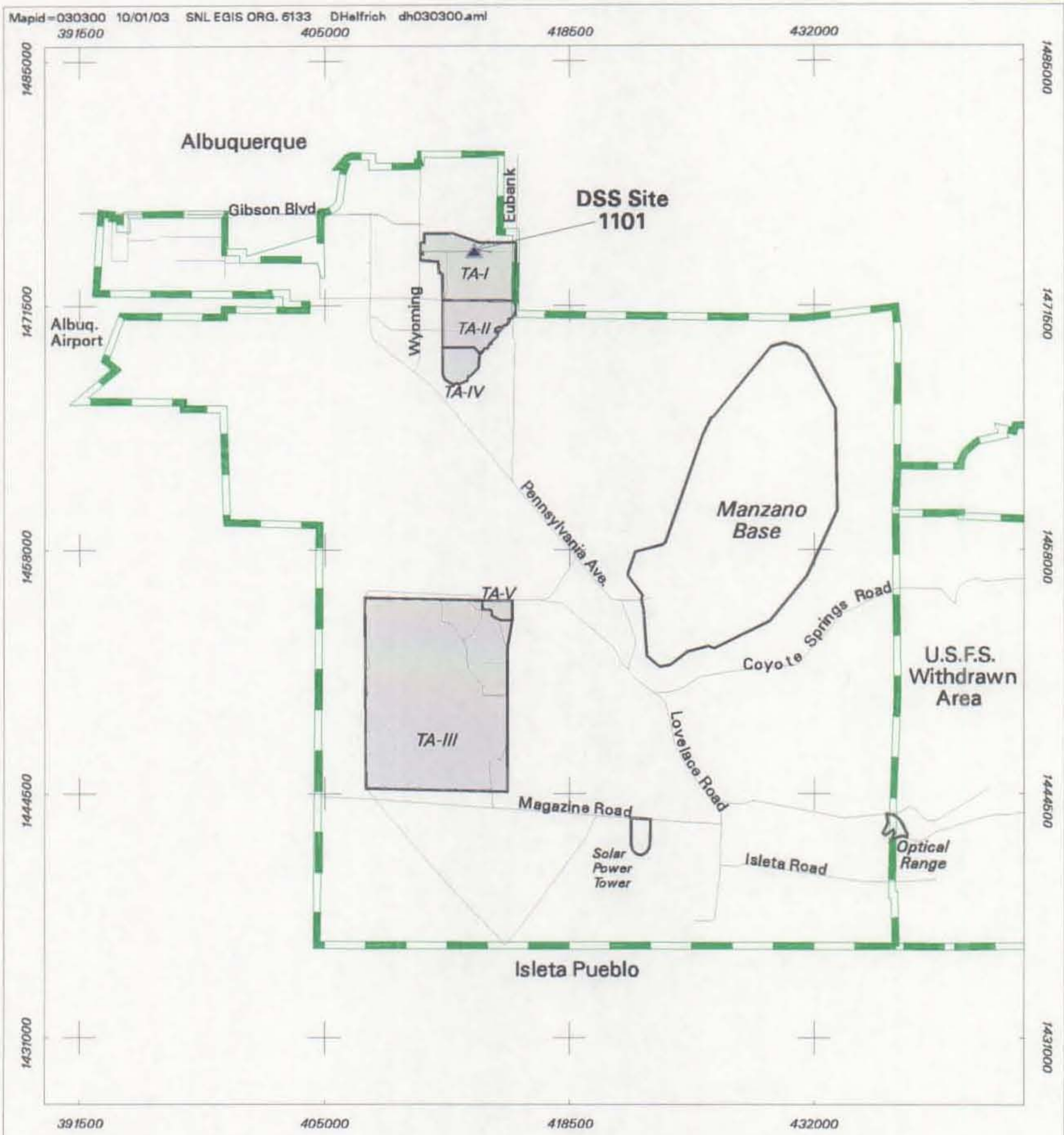

Legend

- ▲ DSS Site 1101
- Major Road
- KAFB Boundary
- SNL Technical Area

Figure 2.2.1-1
Location Map of Drain and Septic Systems (DSS) Site Number 1101, Bldg. 885 Septic System, TA-I

0 4500 9000
Scale in Feet

0 1080 2160
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

840857.03010000A51

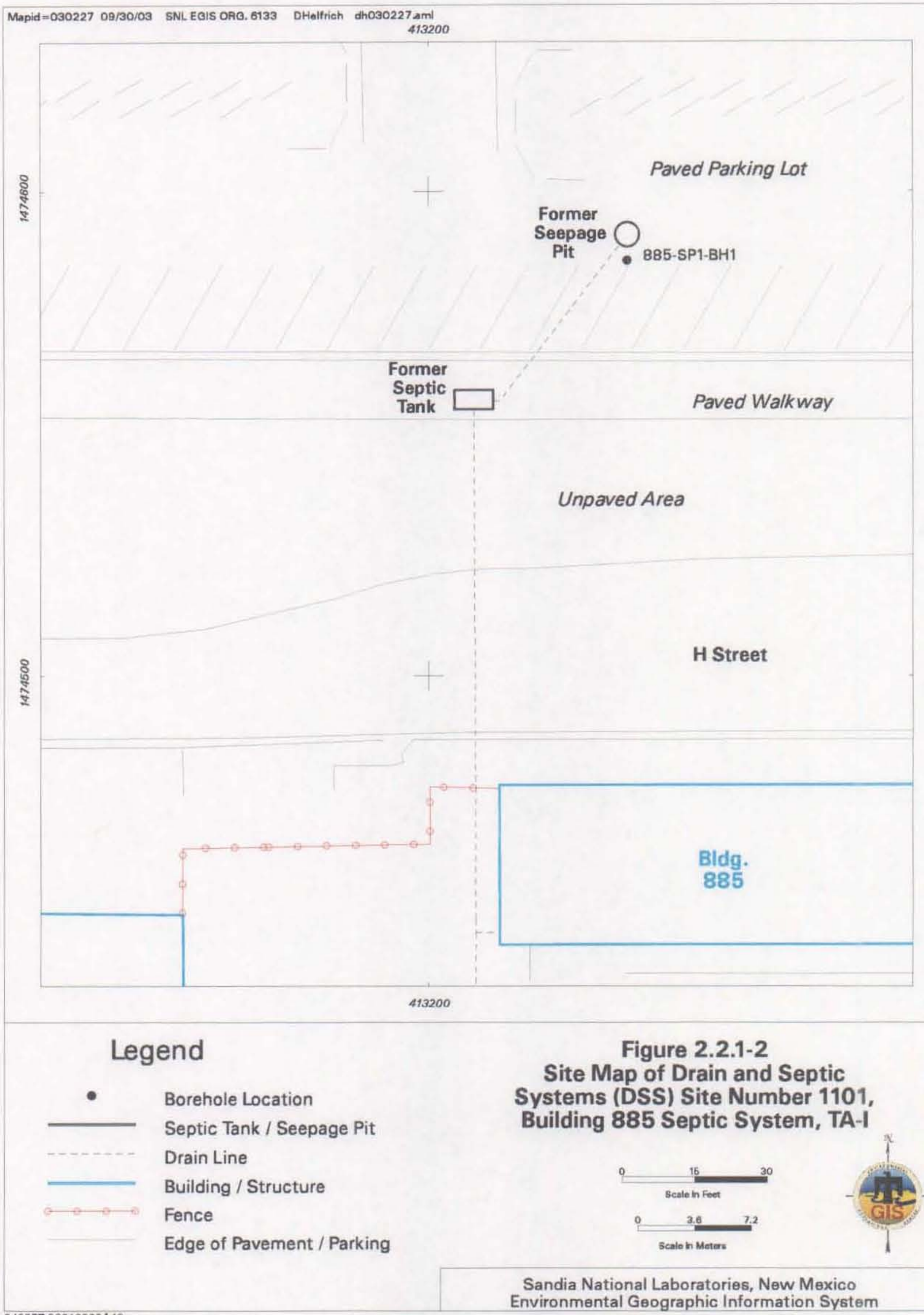

Figure 2.2.1-2
Site Map of Drain and Septic Systems (DSS) Site Number 1101, Building 885 Septic System, TA-I

840857.03010000A49

DSS Site 1101 is located on a partially dissected piedmont surface formed by coalescing Holocene and Pleistocene alluvial fans originating in the Sandia and Manzanita Mountains. These deposits are underlain by the Upper Santa Fe Group, which is composed primarily of two interfingering facies: alluvial fan and fluvial facies. Both facies are less than 5 million years old and are composed of unconsolidated to poorly cemented gravel, sand, silt, and clay. These deposits extend to, and probably far below, the water table at this site. The alluvial fan deposits are derived from Tijeras Canyon, which bisects the Sandia and Manzanita Mountains to the east. The fluvial facies are derived from the ancestral Rio Grande and are typically well-sorted with relatively high hydraulic conductivities (SNL/NM June 2003).

The ground surface in the vicinity of DSS Site 1101, which is mostly paved, is very slightly inclined to the west. Precipitation drains from the parking lot to subsurface storm drains on the south and west sides of the parking lot. Storm water is then conveyed in a southerly direction via a subsurface storm drain into an open storm-water channel that discharges to Tijeras Arroyo approximately 1.5 miles south of the site. No perennial surface-water bodies are present in the vicinity of the site. Average annual rainfall in the SNL/NM and KAFB area, as measured at Albuquerque International Sunport, is 8.1 inches (NOAA 1990). Infiltration of precipitation is essentially nonexistent as virtually all of the moisture either drains away from the site or evaporates. The estimates of evapotranspiration rates for the KAFB area range from 95 to 99 percent of the annual rainfall (Thompson and Smith 1985, SNL/NM March 1996).

The site lies at an average elevation of approximately 5,432 feet above mean sea level (SNL/NM April 1995). Two water-bearing zones, a shallow groundwater system and the regional aquifer, underlie the site. Depth to the shallow groundwater system, which has a limited lateral extent and is present beneath the north-central part of KAFB, is approximately 310 feet below ground surface (bgs) at the site. The shallow groundwater system is not used as a water supply source. Depth to the regional groundwater aquifer is approximately 560 feet bgs. Both the City of Albuquerque and KAFB use the regional groundwater aquifer as a water supply source. Groundwater flow in the shallow groundwater system is to the southeast, while that in the regional aquifer is to the northwest beneath DSS Site 1101 (SNL/NM June 2003). The nearest production wells to DSS Site 1101 are KAFB-1 and KAFB-11 which are approximately 1.1 miles southwest and 1.3 miles southeast of the site, respectively. The nearest groundwater monitoring wells are the perched and regional aquifer well pair TA1-W-08 and TA1-W-05, which are located approximately 800 feet north of the site.

2.2.2 Operational History

Available information indicates that Building 885 was constructed in 1953 (SNL/NM March 2003) as a building materials warehouse, and it is assumed the septic system was constructed at that 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 1988, Building 885 was connected to the City of Albuquerque sanitary sewer system, and it is assumed that the septic system was abandoned and paved over at that time (SNL/NM August 1988).

2.3 Land Use

2.3.1 Current Land Use

The current land use for DSS Site 1101 is industrial.

2.3.2 Future/Proposed Land Use

The projected future land use for DSS Site 1101 is industrial (DOE et al. September 1995).

3.0 INVESTIGATORY ACTIVITIES

3.1 Summary

Three assessment investigations have been conducted at this site. In 2002, a backhoe was used to physically locate a portion of the buried drain line running north from Building 885 to the septic system (Investigation 1). In June 2002, a GPR survey was conducted to attempt to locate the position of the septic system seepage pit (Investigation 2). In October 2002, subsurface soil samples were collected from a boring drilled through the parking lot asphalt at a location approximately 5 feet south of the presumed center of the seepage pit (Investigation 3). These three investigations were required by the NMED/HWB to adequately characterize the site and were conducted in accordance with procedures presented in the SAP (SNL/NM October 1999) and FIP (SNL/NM November 2001) described in Chapter 1.0. These investigations are discussed in the following sections.

3.2 Investigation 1—Backhoe Excavation

On March 26, 2002, a backhoe was used to locate and expose the septic system drain line shown on the engineering drawing (SNL/NM June 1980) running north from the northwest corner of Building 885 to the former septic system. The line was located at an average depth of approximately 5 feet in the unpaved strip between "H" Street and the south side of the parking lot. The line was followed north to the point where it continued under the paved pedestrian walkway on the south side of the parking lot (Figure 2.2.1-2). The backhoe work was stopped at this point in order to prevent damage to the concrete curb and gutter and asphalt pavement and evaluate noninvasive methods that might be used to locate the seepage pit beneath the pavement. The location of the trench excavated to expose the drain line in this area is marked by orange pinflags shown in Figure 3.2-1. No visible evidence of stained or discolored soil indicating possible leakage from the drain line was observed during the excavating procedure. No samples were collected during the backhoe excavation at the site.

3.3 Investigation 2—GPR Survey

On June 21, 2002, a GPR survey was conducted at the site to attempt to precisely determine the location and depth of the septic system seepage pit. A 70- by 40-foot area centered on the presumed location of the seepage pit, indicated on the SNL/NM engineering drawing (SNL/NM June 1980), was surveyed with the GPR equipment. The technique identified a 70- by 10-foot rectangular area of "subsurface structure," but it was not possible to locate specific structures within the rectangular area. However, two possible seepage pit locations, including the location indicated on the engineering drawing, were identified as a result of the survey (IE-T June 2002). Given the inconclusive and ambiguous results of this survey, it was concluded that the engineering drawing provided the best available information showing the location of the unit.

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Figure 3.2-1
Two orange pinflags mark the location of the DSS Site 1101, Building 885 septic system, drain line running north from Building 885 (upper left of photo) and beneath "H" Street. View to the south. March 26, 2002

3.4 Investigation 3—Soil Sampling

Soil sampling was conducted at this site in accordance with the rationale and procedures in the SAP (SNL/NM October 1999) approved by the NMED. On October 21, 2002, an initial borehole was drilled at the center of the seepage pit location (Figure 3.4-1) shown on the June 1980 engineering drawing. At a depth of 23 feet, concrete or metal assumed to be remains of the seepage pit was encountered causing auger refusal. Because further attempts to drill deeper at this location could have resulted in a stuck drill string and lost tools, it was decided to abandon this initial borehole and relocate to an offset location 5 feet south of the first boring. On October 22, a second borehole was drilled at the offset location (shown on Figure 2.2.1-2), and soil samples were successfully collected from an upper depth interval starting at the estimated base of the seepage pit at 25 feet bgs and a second deeper interval starting at 30 feet bgs. 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 the borehole at two depth intervals. In the borehole drilled on the south side of the seepage pit, the shallow sample interval started at the estimated base of the gravel aggregate in the bottom of the seepage pit, and the lower (deep) interval started 5 feet beneath the top of the upper 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 volatile organic compound (VOC) analysis was immediately collected by slicing off a 3- to 4-inch section from the lower end of the BA sleeve and capping the section ends with Teflon film, then a rubber end cap, and finally sealing the tube with tape.

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

All samples were documented and handled in accordance with applicable SNL/NM operating procedures and transported to on- and off-site laboratories for analysis. The area sampled, analytical methods, and laboratories used for the DSS Site 1101 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 1101 are presented and discussed in this section. Samples were collected from the borehole location shown on Figure 2.2.1-2.

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Figure 3.4-1
Auger drilling at the DSS Site 1101, Building 885 septic system seepage pit location in the parking lot north of Building 885, shown in the center-left side of the photo.
View to the southwest. October 21, 2002

Table 3.4-1
Summary of Area Sampled, Analytical Methods, and Laboratories Used for DSS Site 1101, Building 885 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
Seepage Pit	1	25, 30	2	0	VOCs EPA Method 8260	GEL	10-22-02
	1	25, 30	2	0	SVOCs EPA Method 8270	GEL	10-22-02
	1	25, 30	2	0	PCBs EPA Method 8082	GEL	10-22-02
	1	25, 30	2	0	HE EPA Method 8330	GEL	10-22-02
	1	25, 30	2	0	RCRA Metals EPA Methods 6020/7000	GEL	10-22-02
	1	25, 30	2	0	Hexavalent Chromium EPA Method 7196A	GEL	10-22-02
	1	25, 30	2	0	Total Cyanide EPA Method 9012A	GEL	10-22-02
	1	25, 30	2	0	Gamma Spectroscopy EPA Method 901.1	RPSD	10-22-02
	1	25, 30	2	0	Gross Alpha/Beta Activity EPA Method 900.0	GEL	10-22-02

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

VOCs

VOC analytical results for the two soil samples collected from the seepage pit borehole are summarized in Table 3.4.2-1. The method detection limits (MDLs) for the VOC analyses are presented in Table 3.4.2-2. No VOCs were detected in either of the soil samples collected from this site, or in the trip blank (TB) associated with these samples.

SVOCs

Semivolatile organic compound (SVOC) analytical results for the two soil samples collected from the seepage pit borehole are summarized in Table 3.4.2-3. The MDLs for the SVOC analyses are presented in Table 3.4.2-4. As shown in Table 3.4.2-3, a total of six SVOCs were detected in the shallow sample and only two SVOCs were detected in the deep sample. Also, because two of the six SVOCs detected in the shallow sample were detected in the deep sample, this suggests that the contamination is limited to the area immediately beneath the seepage pit and has not migrated beyond the unit.

PCBs

Polychlorinated biphenyl (PCB) analytical results for the two soil samples collected from the seepage pit borehole 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 either of the samples collected from this site.

HE Compounds

High explosive (HE) compound analytical results for the two soil samples collected from the seepage pit borehole are summarized in Table 3.4.2-7. The MDLs for the HE compound analyses are presented in Table 3.4.2-8. No HE compounds were detected in either of the samples collected from this site. The HE samples from this site were reanalyzed, as explained in Section 3.4.3.

RCRA Metals and Hexavalent Chromium

Resource Conservation and Recovery Act (RCRA) metals and hexavalent chromium analytical results for the two soil samples collected from the seepage pit borehole are summarized in Table 3.4.2-9. The MDLs for the metals analyses are presented in Table 3.4.2-10. None of the metal concentrations detected in these samples exceeded the corresponding NMED-approved background concentrations.

Total Cyanide

Total cyanide analytical results for the two soil samples collected from the seepage pit borehole are summarized in Table 3.4.2-11. The MDLs for the cyanide analyses are presented in Table 3.4.2-12. As shown in Table 3.4.2-11, cyanide was detected in the 25-foot-bgs sample; cyanide was not detected in the 30-foot-bgs sample from the borehole.

Table 3.4.2-1
Summary of DSS Site 1101, Building 885 Septic System
Confirmatory Soil Sampling, VOC Analytical Results
October 2002
(Off-Site Laboratory)

Sample Attributes			VOCs (EPA Method 8260[a]) (µg/kg)
Record Number [b]	ER Sample ID	Sample Depth (ft)	
605786	885-SP1-BH1-25-S	25	ND
605786	885-SP1-BH1-30-S	30	ND
Quality Assurance/Quality Control Samples (all in µg/L)			
605786	885-SP1-TB	NA	ND

[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
BH = Borehole.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
NA = Not applicable.
ND = Not detected.
S = Soil sample.
SP = Seepage pit.
TB = Trip blank.
VOC = Volatile organic compound.

Table 3.4.2-2
Summary of DSS Site 1101, Building 885 Septic System
Confirmatory Soil Sampling, VOC Analytical MDLs
October 2002
(Off-Site Laboratory)

Analyte	EPA Method 8260[a] Detection Limit (µg/kg)
Acetone	3.52
Benzene	0.45
Bromodichloromethane	0.49
Bromoform	0.49
Bromomethane	0.5
2-Butanone	3.74
Carbon disulfide	2.36
Carbon tetrachloride	0.49
Chlorobenzene	0.41
Chloroethane	0.81
Chloroform	0.52
Chloromethane	0.37
Dibromochloromethane	0.5
1,1-Dichloroethane	0.47
1,2-Dichloroethane	0.43
1,1-Dichloroethene	0.5
cis-1,2-Dichloroethene	0.47
trans-1,2-Dichloroethene	0.53
1,2-Dichloropropane	0.48
cis-1,3-Dichloropropene	0.43
trans-1,3-Dichloropropene	0.25
Ethylbenzene	0.38
2-Hexanone	3.77
4-Methyl-2-pentanone	4.03
Methylene chloride	1.35
Styrene	0.39
1,1,2,2-Tetrachloroethane	0.91
Tetrachloroethene	0.38
Toluene	0.34
1,1,1-Trichloroethane	0.53
1,1,2-Trichloroethane	0.54
Trichloroethene	0.45
Vinyl acetate	1.78
Vinyl chloride	0.56
Xylene	0.39

[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 1101, Building 885 Septic System, Confirmatory Soil Sampling
SVOC Analytical Results, October 2002
(Off-Site Laboratory)

Sample Attributes			SVOCs (EPA Method 8270[a]) (µg/kg)						
Record Number[b]	ER Sample ID	Sample Depth (ft)	Acenaphthene	2-Chlorophenol	Chrysene	Di-n-octyl phthalate	bis(2-Ethylhexyl) phthalate	Fluoranthene	Fluorene
605786	885-SP1-BH1-25-S	25	**10.7 J (33.3)**	**16.9 J (333)**	**18.5 J (33.3)**	ND (30.3)	**31.7 J (333)**	**17.4 J (33.3)**	**10.4 J (33.3)**
605786	885-SP1-BH1-30-S	30	ND (8)	ND (15.3)	ND (16.7)	**150 J (333)**	**182 J (333)**	ND (16.7)	ND (4)

Note: Values in **bold** represent detected analytes.
[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
BH = Borehole.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The reported value is greater than or equal to the MDL but is less than the practical quantitation limit, shown in parentheses.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
ND ( ) = Not detected above the MDL, shown in parentheses.
S = Soil sample.
SP = Seepage pit.
SVOC = Semivolatile organic compound.

Table 3.4.2-4
Summary of DSS Site 1101, Building 885 Septic System
Confirmatory Soil Sampling, SVOC Analytical MDLs
October 2002
(Off-Site Laboratory)

Analyte	EPA Method 8270[a] Detection Limit (µg/kg)
Acenaphthene	8
Acenaphthylene	16.7
Anthracene	16.7
Benzo(a)anthracene	16.7
Benzo(a)pyrene	16.7
Benzo(b)fluoranthene	16.7
Benzo(ghi)perylene	16.7
Benzo(k)fluoranthene	16.7
4-Bromophenyl phenyl ether	34
Butylbenzyl phthalate	28.7
Carbazole	16.7
4-Chlorobenzenamine	167
bis(2-Chloroethoxy)methane	12.3
bis(2-Chloroethyl)ether	37.3
bis-Chloroisopropyl ether	11
4-Chloro-3-methylphenol	167
2-Chloronaphthalene	13.7
2-Chlorophenol	15.3
4-Chlorophenyl phenyl ether	19.7
Chrysene	16.7
o-Cresol	26
Dibenz(a,h)anthracene	16.7
Dibenzofuran	17
1,2-Dichlorobenzene	10
1,3-Dichlorobenzene	11.3
1,4-Dichlorobenzene	15.7
3,3'-Dichlorobenzidine	167
2,4-Dichlorophenol	20.7
Diethylphthalate	17.7
2,4-Dimethylphenol	167
Dimethylphthalate	18.3
Di-n-butyl phthalate	24
Dinitro-o-cresol	167
2,4-Dinitrophenol	167
2,4-Dinitrotoluene	25.3
2,6-Dinitrotoluene	33.3
Di-n-octyl phthalate	30.3
Diphenyl amine	22.3
bis(2-Ethylhexyl) phthalate	30
Fluoranthene	16.7
Fluorene	4
Hexachlorobenzene	20
Hexachlorobutadiene	12.7

Refer to footnotes at end of table.

Table 3.4.2-4 (Concluded)
Summary of DSS Site 1101, Building 885 Septic System
Confirmatory Soil Sampling, SVOC Analytical MDLs
October 2002
(Off-Site Laboratory)

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

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

Table 3.4.2-5
Summary of DSS Site 1101, Building 885 Septic System
Confirmatory Soil Sampling, PCB Analytical Results
October 2002
(Off-Site Laboratory)

Sample Attributes			PCBs (EPA Method 8082[a]) (µg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	
605786	885-SP1-BH1-25-S	25	ND
605786	885-SP1-BH1-30-S	30	ND

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

Table 3.4.2-6
Summary of DSS Site 1101, Building 885 Septic System
Confirmatory Soil Sampling, PCB Analytical MDLs
October 2002
(Off-Site Laboratory)

Analyte	EPA Method 8270[a] Detection Limit (µg/kg)
Aroclor-1016	1
Aroclor-1221	2.82
Aroclor-1232	1.67
Aroclor-1242	1.67
Aroclor-1248	1
Aroclor-1254	0.5
Aroclor-1260	1

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

Table 3.4.2-7
Summary of DSS Site 1101, Building 885 Septic System
Confirmatory Soil Sampling, HE Compounds Analytical Results
October 2002
(Off-Site Laboratory)

Sample Attributes			HE (EPA Method 8330[a]) (µg/kg)
Record Number [b]	ER Sample ID	Sample Depth (ft)	
605786	885-SP1-BH1-25-S	25	ND H
605786	885-SP1-BH1-30-S	30	ND

[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
BH = Borehole.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
H = The holding time was exceeded for the associated sample analysis.
HE = High explosive(s).
ID = Identification.
µg/kg = Microgram(s) per kilogram.
ND = Not detected.
S = Soil sample.
SP = Seepage pit.

Table 3.4.2-8
Summary of DSS Site 1101, Building 885 Septic System
Confirmatory Soil Sampling, HE Compounds Analytical MDLs
October 2002
(Off-Site Laboratory)

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

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

Table 3.4.2-9
Summary of DSS Site 1101, Building 885 Septic System Confirmatory Soil Sampling, Metals Analytical Results October 2002 (Off-Site Laboratory)

Sample Attributes			Metals (EPA Methods 6020/7000/7196A[a]) (mg/kg)								
Record Number[b]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium	Chromium (VI)	Lead	Mercury	Selenium	Silver
605786	885-SP1-BH1-25-S	25	1.97	56.2 J	0.187 J (0.481)	11.8	ND (0.0533)	4.29	0.00124 J (0.00897)	0.613 J	ND (0.0867)
605786	885-SP1-BH1-30-S	30	2.15	85.7 J	0.158 J (0.495)	7.44	ND (0.0533)	4.68	0.00459 J (0.00913)	0.288 J (0.495)	ND (0.0893)
Background Concentration—North Area Supergroup[c]			4.4	200	0.9	12.8	NC	11.2	<0.1	<1	<1

[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
[c]Dinwiddie September 1997.
BH = Borehole.
DSS = Drain and Septic Systems.
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.
J = Analytical result was qualified as an estimated value during data validation.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.
NC = Not calculated.
ND ( ) = Not detected above the MDL, shown in parentheses.
S = Soil sample.
SP = Seepage pit.

Table 3.4.2-10
Summary of DSS Site 1101, Building 885 Septic System
Confirmatory Soil Sampling, Metals Analytical MDLs
October 2002
(Off-Site Laboratory)

Analyte	EPA Method 6020/7000/7196A[a] Detection Limit (mg/kg)
Arsenic	0.198–0.204
Barium	0.0641–0.066
Cadmium	0.046–0.0473
Chromium	0.155–0.16
Chromium (VI)	0.0533
Lead	0.273–0.281
Mercury	0.000882–0.000898
Selenium	0.156–0.16
Silver	0.0867–0.0893

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

Table 3.4.2-11
Summary of DSS Site 1101, Building 885 Septic System
Confirmatory Soil Sampling, Total Cyanide Analytical Results
October 2002
(Off-Site Laboratory)

Sample Attributes			Total Cyanide (EPA Method 9012[a]) (mg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	Total Cyanide
605786	885-SP1-BH1-25-S	25	**0.184 J (0.244)**
605786	885-SP1-BH1-30-S	30	ND (0.0378)

Note: Values in **bold** represent detected analytes.
[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
BH = Borehole.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The reported value is greater than or equal to the MDL but is less than the practical quantitation limit, shown in parentheses.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.
ND ( ) = Not detected above the MDL, shown in parentheses.
S = Soil sample.
SP = Seepage pit.

Table 3.4.2-12
Summary of DSS Site 1101, Building 885 Septic System
Confirmatory Soil Sampling, Total Cyanide Analytical MDLs
October 2002
(Off-Site Laboratory)

Analyte	EPA Method 9012A[a] Detection Limit (mg/kg)
Total Cyanide	0.0378–0.0409

[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

Radionuclide analytical results for the gamma spectroscopy analysis of the two soil samples collected from the seepage pit borehole are summarized in Table 3.4.2-13. No activities above NMED-approved background levels were detected in the samples from this site.

Gross Alpha/Beta Activity

Gross alpha/beta analytical results for the two soil samples collected from the seepage pit borehole are summarized in Table 3.4.2-14. No gross alpha or beta activity above the New Mexico-established background levels (Miller September 2003) was detected in either 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 (QC) samples were collected at an approximate frequency of 1 per 20 field samples. These typically included duplicate, 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 sample was included in the sample cooler containing the VOC soil samples collected from the Building 885 septic system and other DSS sites in October 2002. As shown in Table 3.4.2-1, no VOCs were detected in this TB sample. No duplicate or EB samples were collected at this site.

Table 3.4.2-13
Summary of DSS Site 1101, Building 885 Septic System Confirmatory Soil Sampling
Gamma Spectroscopy Analytical Results, October 2002
(On-Site Laboratory)

Sample Attributes			Activity (EPA Method 901.1[a]) (pCi/g)							
Record Number[b]	ER Sample ID	Sample Depth (ft)	Cesium-137		Thorium-232		Uranium-235		Uranium-238	
			Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
605791	885-SP1-BH1-25-S	25	ND (0.0264)	--	0.564	0.265	ND (0.159)	--	ND (0.386)	--
605791	885-SP1-BH1-30-S	30	ND (0.0286)	--	0.617	0.29	ND (0.172)	--	ND (0.419)	--
Background Activity—North Area Supergroup[d]			0.084	NA	1.54	NA	0.18	NA	1.3	NA

[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
[c]Two standard deviations about the mean detected activity.
[d]Dinwiddie September 1997.

BH = Borehole.
DSS = Drain and Septic Systems.
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.
pCi/g = Picocuries per gram.
S = Soil sample.
SP = Seepage pit.
-- = Error not calculated for nondetected results.

Table 3.4.2-14
Summary of DSS Site 1101, Building 885 Septic System
Confirmatory Soil Sampling, Gross Alpha and Beta Analytical Results
October 2002
(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]
605786	885-SP1-BH1-25-S	25	5.91	1.34	16.8	2.23
605786	885-SP1-BH1-30-S	30	10.3	1.69	17.7	1.29
Background Activity[d]			17.4	NA	35.4	NA

[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
[c]Two standard deviations about the mean detected activity.
[d]Miller September 2003.
BH = Borehole.
DSS = Drain and Septic Systems.
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.
SP = Seepage pit.

All laboratory data were reviewed and verified/validated according to Data Verification/Validation Level 3 (SNL/NM July 1994) or Data Validation Procedure for Chemical and Radiochemical Data in 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. 2 (SNL/NM July 1996). Annex A contains the data validation reports for the samples collected at this site.

As shown in Annex A, the HE compound HMX was initially detected in the HE sample from the 25-foot depth interval. However, internal laboratory QC procedures suggested that the compound was not actually present; as a result, a reanalysis was requested by SNL/NM sample management personnel. The reanalysis was performed, and HMX was not detected the second time. However, by then the holding time for the HE analysis (14 days for extraction) of the original sample had expired. Therefore, the revised HE results for the 25-foot sample were qualified "H" to indicate a missed holding time (Table 3.4.2-7). Aside from this problem, the data are acceptable for use in this NFA proposal.

3.5 Site Sampling Data Gaps

Analytical data from the site assessment were sufficient for characterizing the nature and extent of possible COC releases. There are no further data gaps regarding characterization of DSS Site 1101.

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4.0 CONCEPTUAL SITE MODEL

The conceptual site model for DSS Site 1101, the Building 885 septic system, is based upon the COCs identified in the soil samples collected from beneath the seepage pit at this site. This chapter 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 1101 are VOCs, SVOCs, PCBs, HE compounds, cyanide, RCRA metals, hexavalent chromium, and radionuclides. There were no VOCs, PCBs, HE compounds, or hexavalent chromium detected in any of the soil samples collected at this site. Up to seven SVOCs were detected in the SVOC samples, and cyanide was detected in one of the two cyanide samples collected from the site. None of the eight RCRA metals were detected at concentrations above the approved maximum background concentrations for SNL/NM North Area Supergroup soil (Dinwiddie September 1997). However, 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. Finally, gross alpha/beta activity indicated no significant radioactive contamination 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 seepage pit. Possible secondary release mechanisms include the uptake of COCs that may have been released into the soil beneath the seepage pit (Figure 4.2-1). The depth to groundwater at the site (approximately 310 and 560 feet bgs to the shallow and regional aquifers, respectively) 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 B provides additional discussion on the fate and transport of COCs at DSS Site 1101.

Table 4.2-1 summarizes the potential COCs for DSS Site 1101. 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 1101 is industrial (DOE et al. September 1995).

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

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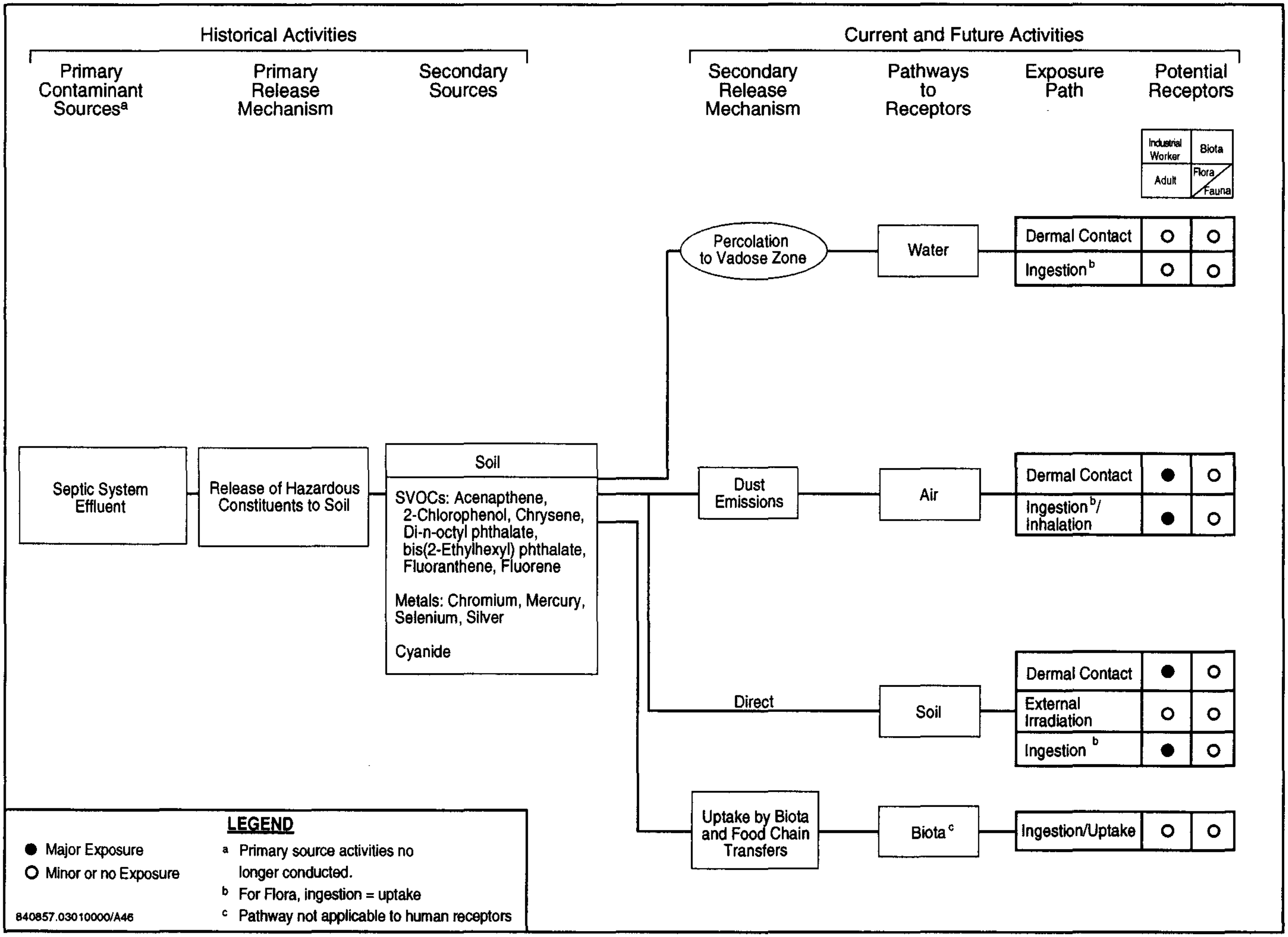

Figure 4.2-1

Conceptual Site Model Flow Diagram for DSS Site 1101, Building 885 Septic System

Table 4.2-1
Summary of Potential COCs for DSS Site 1101, Building 885 Septic System

COC Type		Number of Samples[a]	COCs Greater than Background	Maximum Background Limit/North Area Supergroup[b] (mg/kg)	Maximum Concentration[c] (mg/kg)	Average Concentration[d] (mg/kg)	Number of Samples Where Background Concentration Exceeded[e]
VOCs		2	None	NA	NA	NA	None
SVOCs		2	Acenapthene	NA	0.0107 J	0.0074	1
		2	2-Chlorophenol	NA	0.0169 J	0.0123	1
		2	Chrysene	NA	0.0185 J	0.0134	1
		2	Di-n-octyl phthalate	NA	0.150 J	0.0826	2
		2	bis(2-Ethylhexyl) phthalate	NA	0.182 J	0.1069	2
		2	Fluoranthene	NA	0.0174 J	0.0129	1
		2	Fluorene	NA	0.0104 J	0.0062	1
PCBs		2	None	NA	NA	NA	None
HE		2	None	NA	NA	NA	None
RCRA Metals		2	None	NA	NA	NA	None
Hexavalent Chromium		2	None	NA	NA	NA	None
Cyanide		2	Cyanide	NA	0.184 J	0.101	1
Radionuclides (pCi/g)	Gamma Spectroscopy	2	None	NA	NA	NC[f]	None
	Gross Alpha	2	None	NA	10.3	NC[f]	None
	Gross Beta	2	None	NA	17.7	NC[f]	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 nondetected 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 nondetected activities for gamma spectroscopy.

COC = Constituent of concern.
DSS = Drain and Septic Systems.
HE = High explosive(s).
J = Estimated concentration.
MDA = Minimum detectable activity.
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
NC = Not calculated.
PCB = Polychlorinated biphenyl.
pCi/g = Picocurie(s) per gram.
RCRA = Resource Conservation and Recovery Act.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.

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 B provides additional discussion of the exposure routes and receptors at DSS Site 1101.

4.3 Site Assessment

Site assessment at DSS Site 1101 included risk assessments for both human health and ecological risk. This section briefly summarizes the site assessment results, and Annex B discusses the risk assessment performed for DSS Site 1101 in more detail.

4.3.1 Summary

The site assessment concluded that DSS Site 1101 poses no significant threat to human health under either the industrial or residential land-use scenarios. Ecological risks were found to be insignificant because no pathways exist.

4.3.2 Risk Assessments

Risk assessments were performed for both human health and ecological risk at DSS Site 1101. This section summarizes the results.

4.3.2.1 Human Health

DSS Site 1101 has been recommended for an industrial land-use scenario (DOE et al. September 1995). Because SVOCs, total cyanide, and metals are present, it was necessary to perform a human health risk assessment analysis for the site, which included all COCs detected. Annex B 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 1101 is 0.00 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 0.00. The excess cancer risk for DSS Site 1101 COCs under an industrial land-use scenario is 1E-9. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus, the excess cancer risk for this site is below the suggested acceptable risk value. The incremental excess cancer risk is 1.05E-9. Both the incremental HI and excess cancer risk are below NMED guidelines.

The HI calculated for the COCs at DSS Site 1101 is 0.00 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 0.00. The excess cancer risk for DSS Site 1101 COCs is 5E-9 for a residential industrial land-use scenario. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. The incremental excess cancer risk is 4.54E-9. Both the incremental HI and incremental excess cancer risk are below NMED guidelines.

For the radiological COCs, none of the constituents had a minimum detectable activity or reported value greater than the corresponding background values; therefore no risk was calculated.

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 1101, Building 885 Septic System Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	1.05E-9	0.0	1.05E-9
Residential	4.54E-9	0.0	4.54E-9

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 U.S. Environmental Protection Agency's Ecological Risk Assessment Guidance for Superfund (EPA 1997) 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 B, Sections IV, VII.2, and VII.3). This methodology also required developing a site conceptual model and a food web model, as well as selecting ecological receptors, as presented in the "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 COC s at DSS Site 1101 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 1101 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 1101, 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 1101 for the following reasons:

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

5.2 Criterion

Based upon the evidence provided in Section 5.1, DSS Site 1101 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 1101
Soil Sample Data Validation Results

Site: DSS soil sampling **ARCOC:** 605786 **Data:** Organic, Inorganic and Radiochemistry

Sample ID	VOC	SVOC	PCB	HE	2691-41-0 (HMX)	Metals	7440-39-3 (barium)	7440-47-3 (chromium)	7782-49-2 (selenium)	General Chemistry	Radiochemistry			
060063-002 885/1101-SP1-BH1-25-S	All QC acceptance criteria were met.No data will be qualified.	All QC acceptance criteria were met.No data will be qualified.	All QC acceptance criteria were met.No data will be qualified.		R		J	J	J, B3	All QC acceptance criteria were met.No data will be qualified.	All QC acceptance criteria were met.No data will be qualified.			
060064-002 885/1101-SP1-BH1-30-S							J	J	J, B3					

Validated By: [signature]

Date: 01/03/03

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MEMORANDUM

DATE: 01/03/03

TO: File

FROM: Linda Thal

SUBJECT: Inorganic Data Review and Validation - SNL
Site: DSS soil sampling
ARCOC # 605786
GEL SDG # 69322
Project/Task No. 7223.02.03.02

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

Summary

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

ICP-AES

Selenium was detected in the ICB at a negative value with an absolute value > DL but < RL. Both associated sample results were detects, < 5X MDL and will be qualified "J, B3".

The replicate had a RPD > QC acceptance criteria (35%) for barium (46%) and chromium (38%). Both associated sample results were > 5X RL and will be qualified "J".

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

Holding Times/Preservation

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

Calibration

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

Blanks

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

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

All Analyses: The LCS/LCSD met QC acceptance criteria.

Matrix Spike (MS) Analysis

All Analyses: The MS met QC acceptance criteria except as follows:

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

Replicate Analysis

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

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

ICP Interference Check Sample (ICS)

ICP-AES (All batches): The ICS-AB met QC acceptance criteria.

All Other Analyses: No ICS required.

Detection Limits/Dilutions

All Analyses: All detection limits were properly reported.

ICP-AES: All soil samples were diluted 2X.

All Other Analyses: No dilutions were performed.

Other QC

All Analyses: No field blank, field duplicate or equipment blank was submitted on the ARCOC.

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

No raw data was submitted with the package.

No other specific issues were identified which affect data quality.

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MEMORANDUM

DATE: 01/02/03

TO: File

FROM: Linda Thal

SUBJECT: Organic Data Review and Validation - SNL
Site: DSS soil sampling
ARCOC # 605786
GEL SDG # 69322 and 69323
Project/Task No. 7223.02.03.02

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

Summary

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

HE
It was noted that the HMX recovered in the MS/MSD was similar to the spiked amount, thereby raising the question of the validity of the reported HMX result in sample 69322-003. Re-extraction and reanalysis was requested and the HMX in this reanalyzed sample (73243-001) was not confirmed. Therefore, the HMX results for sample 69322-003 will be qualified R.

Data are acceptable except as mentioned above, and QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times/Preservation

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

Calibration

All Analyses: All initial and continuing calibration acceptance criteria were met except as follows:

VOC Batch # 211014 and 210994
The RF for trichloroethene in the initial calibration was < specified minimum (0.30) but > 0.01. The associated sample results were non-detect, and using professional judgment no data will be qualified.

SVOC
Phenanthrene (0.98) had a correlation coefficient > 0.90 but < 0.99 in the initial calibration preceding sample 69322-003 and 2,4-dinitrophenol (0.98) preceding sample 69322-004.The associated sample results were non-detect and will not be qualified.

Benzo(g,h,i)perylene (43%) and indeno(1,2,3-cd)pyrene (43%) had %R > 40% but < 60%, and dibenz(a,h)anthracene (32%) had a %R > 20% but < 40%, all with a positive bias in the CCV preceding sample 69322-003.All associated sample results were non-detect and unaffected by a positive bias; no data will be qualified.

Several compounds had %D > 20% but < 40% in the CCV preceding sample 69322-004. All associated sample results were non-detect and will not be qualified.

PCB
The CCVs bracketing the samples had a %R > 20% but < 40% with a positive bias for aroclor 1016.The associated sample results were non-detect and unaffected by a positive bias; no data will be qualified.

Blanks

All Analyses: All method blank (MB) and trip blank (TB) acceptance criteria were met.

Surrogates

All Analyses: All surrogate acceptance criteria were met.

Internal Standards (ISs)

All Analyses: All internal standard acceptance criteria were met.

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

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

VOC Batch # 210994
It should be noted that the sample used for the MS/MSD was of similar matrix from another SNL SDG. No data will be qualified.

SVOC
Several compounds (see DV worksheet) had %Rs < QC acceptance criteria (75 – 125%). Using professional judgment, no data will be qualified.

Laboratory Control Samples (LCS/LCSD) Analysis

All Analyses: The LCS acceptance criteria were met. No LCSD was analyzed. The MS/MSD is used to assess the precision for the batch. No data will be qualified as a result.

VOC Batch # 211014
The LCS acceptance criteria were met by the successful analysis of a second source CCV.

VOC Batch # 211014 and 210994
It should be noted that no compound was associated with internal standard 1,4-dichlorobenzene-d4. No data will be qualified as a result.

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

Detection Limits/Dilutions

All Analyses: All detection limits were properly reported. Samples were not diluted.

Confirmation Analyses

VOC and SVOC: No confirmation analyses required.

PCB: All sample results were non-detect; therefore, no confirmation analyses were required.

HE: All confirmation acceptance criteria were met.

Other QC

VOC: A trip blank was submitted on the ARCOC. No field duplicate or equipment blank was submitted. It should be noted that Vinyl Acetate was on the TAL for the soils but not for the TB.

SVOC, PCB and HE: No equipment blank, field duplicate or field blank was submitted on the ARCOC.

No raw data were submitted with the package.

No other specific issues were identified which affect data quality.

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MEMORANDUM

DATE: 01/02/03

TO: File

FROM: Linda Thal

SUBJECT: Radiochemical Data Review and Validation - SNL
Site: DSS soil sampling
ARCOC 605786
GEL SDG # 69322
Project/Task No. 7223.02.03.02

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

Summary

All samples were prepared and analyzed with approved procedures using method EPA 900.0 (Gross Alpha/Beta). No problems were identified with the data package that resulted in the qualification of data. Data are acceptable and QC measures appear to be adequate. The following sections discuss the data review and validation.

Holding Times/Preservation

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

Calibration

The case narrative stated the instruments used were properly calibrated.

Blanks

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

Matrix Spike (MS) Analysis

The MS analyses met all QC acceptance criteria.

Laboratory Control Sample (LCS) Analysis

The LCS analyses met all QC acceptance criteria.

Replicates

The replicate analyses met all QC acceptance criteria.

Tracer/Carrier Recoveries

No tracer/carrier required.

Negative Bias

All sample results met negative bias QC acceptance criteria.

Detection Limits/Dilutions

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

Other QC

No equipment blank, field blank or field duplicates were submitted on the ARCOC.

No raw data was submitted with the package.

No other specific issues were identified which affect data quality.

Data Valuation Summary

Site/Project: DSS soil sampling Project/Task #: 7223.02.03.02 # of Samples: 4 & 1 Matrix: Soil & TB

AR/COC #: 605786 Laboratory Sample IDs: 69322-001 thru -004

Laboratory: GEL 69323-001 (TB)

Laboratory Report #: 69322

QC Element	Analysis									
	Organics				Inorganics				RAD	Other
	VOC	SVOC	Pesticide/ PCB	HPLC (HE)	ICP/AES	GFAA/ AA	CVAA (Hg)	CN		Cr+6
1. Holding Times/Preservation	✓	✓	✓	✓	✓	NA	✓	✓		✓
2. Calibrations	✓	✓	✓	✓	✓		✓	✓		✓
3. Method Blanks	✓	✓	✓	✓	J,B3		✓	✓		✓
4. MS/MSD	✓	✓	✓	✓	✓		✓	✓		✓
5. Laboratory Control Samples	✓	✓	✓	✓	✓		✓	✓		✓
6. Replicates					J		✓	✓		✓
7. Surrogates	✓	✓	✓	✓						NA
8. Internal Standards	✓	✓								
9. TCL Compound Identification	✓	✓								
10. ICP Interference Check Sample					✓					
11. ICP Serial Dilution					✓					
12. Carrier/Chemical Tracer Recoveries										
13. Other QC	TB	NA	NA	NA R*	NA		NA	NA		

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

Check (√) = Acceptable
Shaded Cells = Not Applicable (also "NA")
NP = Not Provided
Other: * Did not confirm on reanalysis

Reviewed By: [signature] Date: 01.03.03

Volatile Organics (SW 846 Method 8260)

Site/Project: DSS Soil Sampling AR/COC #: 605786 # of Samples: 2 & 1 Matrix: Soils & H2O

Laboratory: GEL Laboratory Report #: 69322 Laboratory Sample IDs: 69322-001 & -002 69323-0C

Methods: SW-846 8260A/B Batch #s: 211014 ① 210994 ② (TB) (TE

IS	CAS #	Name	TCL	Min. RF	Intercept	Calib. RF >.05 (1, 2)	Calib. RSD/ R^2 <20% / 0.99 (1, 2)	CCV %D 20% (1, 2)	Method Blks (1, 2)	LCS (1)	LCSD (2)	LCS RPD	MS (1)	MSD (1)	MS RPD (1)	Field Dup. RPD	Equip. Blanks	Trip Blanks	MS (2)	MSD (2)
1	71-55-6	1,1,1-trichloroethane	✓	0.10		✓ ✓	✓ ✓	✓ ✓	✓ ✓		[illegible]	NA				NA		✓		
2	79-34-5	1,1,2,2-tetrachloroethane		0.30																
2	79-00-5	1,1,2-trichloroethane		0.10																
1	75-34-3	**1,1-dichloroethane**		0.10																
1	75-35-4	**1,1-dichloroethene**		0.20	✓	✓	✓			✓	✓		✓	✓	✓				✓	✓
1	107-06-2	**1,2-dichloroethane**		0.10																
1	540-59-0	**1,2-dichloroethene(total)**		0.01																
1	78-87-5	**1,2-dichloropropane**	✓	0.01																
1	78-93-3	**2-butanone (MEK) (10xblk)**	✓	0.01																
1	110-75-8	2-chloroethyl vinyl ether																		
2	591-78-6	2-hexanone (MBK)	✓	0.01																
2	108-10-1	4-methyl-2-pentanone (MIBK)		0.10																
1	67-64-1	**acetone(10xblk)**		0.01																
1	71-43-2	**benzene**		0.50						✓	✓			✓	✓	✓			✓	✓
1	75-27-4	bromodichloromethane		0.20																
3	75-25-2	bromoform		0.10	✓	✓	✓													
1	74-83-9	bromomethane		0.10	✓	✓	✓													
1	75-15-0	carbon disulfide		0.10																
1	56-23-5	**carbon tetrachloride**		0.10	✓	✓	✓													
2	108-90-7	**chlorobenzene**		0.50						✓	✓			✓	✓	✓			✓	✓
1	75-00-3	chloroethane		0.01	✓	✓	✓													
1	67-66-3	**chloroform**		0.20																
1	74-87-3	chloromethane		0.10																
1	10061-01-5	cis-1,3-dichloropropene		0.20																
2	124-48-1	dibromochloromethane		0.10	✓	✓	✓													
2	100-41-4	ethylbenzene		0.10																
1	75-09-2	methylene chloride (10xblk)		0.01	✓ ✓	✓ ✓	✓ ✓													
2	100-42-5	styrene		0.30																
2	127-18-4	**tetrachloroethene**		0.20																
2	108-88-3	toluene(10xblk)		0.40						✓	✓			✓	✓	✓			✓	✓
2	10061-02-6	trans-1,3-dichloropropene		0.10																
1	79-01-6	**trichloroethene**		0.30		0.23/.24				✓	✓			✓	✓	✓			✓	✓
1	75-01-4	**vinyl chloride**		0.10	✓	✓	✓													
2	1330-20-7	xylenes(total)		0.30																
		cis-1,2-Dichloroethene																		
		trans-1,2-Dichloroethene																		

Comments: Vinyl Acetate

Notes: Shaded rows are RCRA compounds.

NO VINYL ACETATC IN

Reviewed By: [signature] Date: 01.02.03

211014 LCS/CCV same ρUC

Volatile Organics

Site/Project: ______ AR/COC #: 605786 Batch #s: ______

Laboratory: ______ Laboratory Report #: ______ # of Samples: ______ Matrix: ______

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

Sample	SMC 1	SMC 2	SMC 3	IS 1 Area	IS 1 RT	IS 2 area	IS 2 RT	IS 3 area	IS 3 RT
IN CRITERIA									

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

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

Comments: 21099N – 69015 ND/PSO SNA SOG

Semivolatile Organics (SW 846 Method 8270)

Site/Project: OSS Soil Sampling AR/COC #: 605786 Laboratory Sample IDs: 69322 - 003 & -004

Laboratory: GEL Laboratory Report #:

Methods: SW-846 8270C

# of Samples: 2 Matrix: Soils Batch #s: 211309

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF (SA >.05) 3	Calib. RF 4	Calib. RSD/ R^2 (<20% / .99) 3	Calib. RSD/ R^2 4	CCV %D (SA 20%) 3	CCV %D 4	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		
2	BN	120-82-1	1,2,4-Trichlorobenzene	✓	0.20		✓	✓	✓	✓	✓	✓	✓	✓	NA		✓	✓	✓	NA				
1	BN	95-50-1	1,2-Dichlorobenzene		0.40																			
1	BN	541-73-1	1,3-Dichlorobenzene		0.60																			
1	BN	106-46-7	1,4-Dichlorobenzene		0.50									✓										
3	A	95-95-4	2,4,5-Trichlorophenol		0.20									✓			73	77	✓					
3	A	88-06-2	2,4,6-Trichlorophenol		0.20									✓			65	69	✓					
2	A	120-83-2	2,4-Dichlorophenol		0.20																			
2	A	105-67-9	2,4-Dimethylphenol		0.20																			
3	A	51-28-5	2,4-dinitrophenol		0.01	✓ ✓	✓	✓	✓	.98														
3	BN	121-14-2	2,4-Dinitrotoluene		0.20					✓				✓										
3	BN	606-20-2	2,6-Dinitrotoluene		0.20																			
3	BN	91-58-7	2-Chloronaphthalene		0.80																			
1	A	95-57-8	2-Chlorophenol		0.80									✓										
2	BN	91-57-6	2-Methylnaphthalene		0.40																			
1	A	95-48-7	2-Methylphenol (o-cresol)		0.70									✓			67	70	✓					
3	BN	88-74-4	2-Nitroaniline		0.01							-22												
2	A	88-75-5	2-Nitrophenol		0.10							✓												
5	BN	91-94-1	3,3'-Dichlorobenzidine		0.01							+40 (31.5)												
3	BN	99-09-2	3-Nitroaniline		0.01							✓												
4	A	534-52-1	4,6-Dinitro-2-methylphenol		0.01	✓ ✓	✓	✓	✓	✓														
4	BN	101-55-3	4-Bromophenyl-phenylether		0.10																			
3	BN	7005-72-3	4-Chlorophenyl-phenylether		0.40																			
2	A	59-50-7	4-Chloro-3-methylphenol		0.20									✓										
2	BN	106-47-8	4-Chloroaniline		0.01																			
1	A	106-44-5	4-Methylphenol (p-cresol)		0.60																			

Comments: m,p - cresol

Notes: Shaded rows are RCRA compounds.

✓ 68 71 ✓

Reviewed By: [illegible signature] Date: 1.02.03

Semivolatile Organics

Site/Project: ______ AR/COC #: 605786 Batch #s: ______

Laboratory: ______ Laboratory Report #: ______ # of Samples: ______ Matrix: ______

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks
							3 >.05 4	<20% / 3 0.99 4	3 20% 4										
3	BN	100-01-6	4-Nitroaniline	✓	0.01		✓ ✓	✓ ✓	✓ +21	✓		NA					NA		
3	A	100-02-7	4-Nitrophenol		0.01	✓	✓	✓	✓		✓			✓	✓	✓			
3	BN	83-32-9	Acenaphthene		0.90						✓			✓	✓	✓			
3	BN	208-96-8	Acenaphthylene		0.90														
4	BN	120-12-7	Anthracene		0.70														
5	BN	56-55-3	Benzo(a)anthracene		0.80														
6	BN	50-32-8	Benzo(a)pyrene		0.70														
6	BN	205-99-2	Benzo(b)fluoranthene		0.70														
6	BN	191-24-2	Benzo(g,h,i)perylene		0.50	✓	✓	✓	+43 ✓										
6	BN	207-08-9	Benzo(k)fluoranthene		0.70				✓										
2	BN	111-91-1	bis(2-Chloroethoxy)methane		0.30														
1	BN	111-44-4	bis(2-Chloroethyl)ether		0.70				-22										
1	BN	108-60-1	bis(2-chloroisopropyl)ether		0.01				✓										
5	BN	117-81-7	bis(2-Ethylhexyl)phthalate		0.01														
5	BN	85-68-7	Butylbenzylphthalate		0.01				[illegible]										
4	BN	86-74-8	Carbazole		0.01				✓										
5	BN	218-01-9	Chrysene		0.70														
6	BN	53-70-3	Dibenz(a,h)anthracene		0.40	✓ ✓	✓ ✓	✓ ✓	+32										
3	BN	132-64-9	Dibenzofuran		0.80				✓										
3	BN	84-66-2	Diethylphthalate		0.01														
3	BN	131-11-3	Dimethylphthalate		0.01														
4	BN	84-74-2	Di-n-butylphthalate		0.01														
6	BN	117-84-0	Di-n-octylphthalate		0.01														
4	BN	206-44-0	Fluoranthene		0.60														
3	BN	86-73-7	Fluorene		0.90														
4	BN	118-74-1	Hexachlorobenzene		0.10						✓			71	74	✓			
2	BN	87-68-3	Hexachlorobutadiene		0.01						✓			60	66	✓			
3	BN	77-47-4	Hexachlorocyclopentadiene		0.01														
1	BN	67-72-1	Hexachloroethane		0.30						✓			63	69	✓			

Comments:

Semivolatile Organics

Site/Project: ______ AR/COC #: 605786 Batch #s: ______

Laboratory: ______ Laboratory Report #: ______ # of Samples: ______ Matrix: ______

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept 3	Intercept 4	Calib. RF >.05 3	Calib. RF >.05 4	Calib. RSD/ R^2 <20%/ 0.99 3	Calib. RSD/ R^2 <20%/ 0.99 4	CCV %D 20% 3	CCV %D 20% 4	Method Blanks	LCS	LCS D	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		
6	BN	193-39-5	Indeno(1,2,3-cd)pyrene	✓	0.50	✓	✓	✓	✓	✓	✓	+43	✓	✓		NA					NA				
2	BN	78-59-1	Isophorone		0.40							✓													
2	BN	91-20-3	Naphthalene		0.70	✓		✓		✓															
2	BN	98-95-3	Nitrobenzene		0.20								-22		✓			73	81	✓					
4	BN	86-30-6	N-Nitrosodiphenylamine (1)		0.01								✓												
1	BN	621-64-7	N-Nitroso-di-propylamine	✓	0.50										✓			✓	✓	✓					
4	A	87-86-5	Pentachlorophenol		0.05										✓			✓	✓	✓					
4	BN	85-01-8	Phenanthrene		0.70	✓		✓		,98															
1	A	108-95-2	Phenol		0.80					✓					✓			✓	✓	✓					
5	BN	129-00-0	Pyrene		0.60										✓			✓	✓	✓					
			Diphenylamine																						

Surrogate Recovery Outliers

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

Comments: 69322 - 003 MSD 8
- 004 MSD 4

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

Internal Standard Outliers

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

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

PCBs (SW 846 - Method 8082)

Site/Project: OSJ soil sampling AR/COC #: 605786 Laboratory Sample IDs: 69322 - 003, 004

Laboratory: GEL Laboratory Report #: 69322

Methods: SW-846 8082

# of Samples: 2 Matrix: Soils Batch #s: 210749

CAS #	Name	TCL	Intercept	Calib RSD / R^2 <20% / 0.99	CCV %D 20%	Method Blanks	LCS	LCSD	LCS RPD 20%	MS	MSD	MS RPD 20%	Field Dup. RPD	Equip. Blanks	Field Blanks		
12674-11-2	Aroclor-1016	✓	NA	✓	20.6/26.4	✓		NA					NA				
11104-28-2	Aroclor-1221	✓		X U		✓											
11141-16-5	Aroclor-1232	✓		X U		✓											
53469-21-9	Aroclor-1242	✓		✓		✓											
12672-29-6	Aroclor-1248	✓		✓		✓											
11097-69-1	Aroclor-1254	✓		✓		✓											
11096-82-5	Aroclor-1260	✓		✓	✓	✓	✓			✓	✓	✓					

Sample	SMC % REC	SMC RT	Sample	SMC % REC	SMC RT
IN CRITERIA					

Comments:

Confirmation

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

Reviewed By: [signature] Date: 1.03.03

High Explosives (SW 846 Method 8330)

Site/Project: OSU soil sampling AR/COC #: 605786 Laboratory Sample IDs: 69322-003, -004

Laboratory: GEL Laboratory Report #: 69322

Methods: SW-846 8330

# of Samples: 2 Matrix: Soil Batch #s: 209593

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

Sample	SMC %REC	SMC RT	Sample	SMC %REC	SMC RT
IN CRITERIA					

Confirmation

Sample	CAS #	RPD > 25%	Sample	CAS #	RPD > 25%
IN CRITERIA					

Comments: Due to "suspect" HMX results it was requested that the sample be reanalysed. It was reextracted & reanalysed as 73243-001 and the HMX was not confirmed.

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

Reviewed By: [signature] Date: 01.03.03

∴ the HMX results for sample 69322-003 will be qual. "R"

Inorganic Metals

Site/Project: DSS soil sampling AR/COC #: 605786 Laboratory Sample IDs: 69322 - 003 & -004

Laboratory: GEL Laboratory Report #: 69322

Methods: SW 846 7471A (Ag) 6010B (Metals)

# of Samples: 2 Matrix: Soils Batch #s: 211021 (Ag) 210929 (Metals)

CAS #/ Analyte	QC Element																			
				ug/l	ug/l								<35%							
	TAL	ICV	CCV	ICB	CCB	Method Blanks	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	Rep. RPD	ICS AB	Serial Dilution	Field Dup. RPD	Equip. Blanks	Field Blanks		
7429-90-5 Al								NA			NA					NA				
7440-39-3 Ba	✓	✓	✓	✓	✓	✓	✓			✓			46	✓	✓					
7440-41-7 Be																				
7440-43-9 Cd	✓	✓	✓	✓	✓	✓	✓			✓			NA	✓	NA					
7440-70-2 Ca																				
7440-47-3 Cr	✓	✓	✓	✓	✓	✓	✓			✓			38	✓	✓					
7440-48-4 Co																				
7440-50-8 Cu																				
7439-89-6 Fe																				
7439-95-4 Mg																				
7439-96-5 Mn																				
7440-02-0 Ni																				
7440-09-7 K																				
7440-22-4 Ag	✓	✓	✓	✓	✓	✓	✓			✓			NA	✓	NA					
7440-23-5 Na																				
7440-62-2 V																				
7440-66-6 Zn																				
7439-92-1 Pb	✓	✓	✓	✓	✓	✓	✓			✓			✓	✓	✓					
7782-49-2 Se	✓	✓	✓	-1.71	✓	✓	✓			✓			NA	✓	NA					
7440-38-2 As	✓	✓	✓	✓	✓	✓	✓			✓			✓	✓	✓					
7440-36-0 Sb																				
7440-28-0 Tl																				
7439-97-6 Hg	✓	✓	✓	✓	✓	✓	✓			✓			NA							
Cyanide CN																				

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

Comments: ICP AES 2X

Reviewed By: [signature] Date: 01.03.03

① Se ICB neg. 3/4 < 5X MDL J, B3

② Ba ↑RPD 384 > 5X RL "J"

③ -d-14↑ RPD > 5X RL "J"

General Chemistry

Site/Project: DSS Soil Sampling AR/COC #: 605786 Laboratory Sample IDs: 69322-003, -004

Laboratory: GEL Laboratory Report #: 69322

Methods: SW-846 9012A (TCN) 7196A (Cr⁺⁶)

\# of Samples: 2 Matrix: Soils Batch #s: 212382 (TCN) 213487 (Cr⁺⁶)

CAS #	Analyte	TAL	ICV	CCV	ICB	CCB	Method Blanks	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	Rep. RPD	ICS AB	Serial Dilution	Field Dup. RPD	Equip. Blanks	Field Blanks	
	Total Cyanide		✓	✓	✓	✓	✓	✓	NA	NA	✓	NA	→	NA	→	→	→	→	→	
	Hexavalent Chromium		✓	✓	✓	✓	✓	✓	NA	NA	✓	NA	→	NA	→	→	→	→	→	

Comments: 213487 Cr⁺⁶ 68835 MS/DUP. SNA.

Reviewed By: [signature] Date: 01.03.03

Radiochemistry

Site/Project: OU3 soil sampling AR/COC #: 605786 Laboratory Sample IDs: 69322-003 & -004

Laboratory: GEL Laboratory Report #: 69322

Methods: EPA 900.0

# of Samples: 2 Matrix: Soils Batch #s: 211317

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

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

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

Comments:

Reviewed By: [signature] Date: 01.03.03

Subj: [Fwd: FW: Results for Re-extraction and Reanalysis for HMX]
Date: 1/17/2003 2:12:24 PM Mountain Standard Time
From: mhilchey@earthlink.net
To: LThal4618@aol.com
File: 72343.pdf (170969 bytes) DL Time (45333 bps): < 1 minute
Sent from the Internet (Details)

HMX not confirmed. "R" qualify original data based on LC/MS/MS confirmation analysis.

AMENDED

-------- Original Message --------
Subject: FW: Results for Re-extraction and Reanalysis for HMX
Date: Fri, 17 Jan 2003 13:25:52 -0700
From: "Puissant, Pamela M" <pmpuiss@sandia.gov>
To: "MarciaAQA (E-mail)" <mhilchey@earthlink.net>

Here's the reanalysis for HMX, DSS Project. As we suspected there was no HMX in this sample.
Pam

-----Original Message-----
From: Edie Kent [mailto:emk@gel.com]
Sent: Friday, January 17, 2003 8:22 AM
To: Pam Puissant; Palencia, Wendy J; David Setzer; Herrera, Lorraine R
Cc: Nicole McCleary
Subject: Results for Re-extraction and Reanalysis for HMX

Attached are the results from the re-extraction and reanalysis of sample 060063-002 from ARCOC-605786 due to the HMX detected in the original analysis. The data package and EDD will follow within the week.

Edie

amend to pkg 605786

--
Edith M. Kent
Project Manager
General Engineering Laboratories, LLC
2040 Savage Road
Charleston, SC 29407
(843) 769-7385
emk@gel.com

CONTRACT LABORATORY
ANALYSIS REQUEST AND CHAIN OF CUSTODY

Internal Lab

Page 1 of 1

Batch No. N/A

SMO Use

AR/COC **605786**

Dept. No./Mail Stop:	6135/1089	Date Samples Shipped:	10-23-02	Project/Task No.: 7223.02.03.02	☐ Waste Characterization
Project/Task Manager:	~~Mike Sanders~~ Sue Collins	Carrier/Waybill No.	15092	SMO Authorization:	-Send preliminary/copy report to:
Project Name:	DSS soil sampling	Lab Contact:	Edie Kent 803-556-8171	Contract #: PO 21671	
Record Center Code:	ER/1295/DSS/DAT	Lab Destination:	GEL	SEE ATTACHED BOTTLE ORDER	☐ Released by COC No.:
Logbook Ref. No.:	ER 090	SMO Contact/Phone:	Pam Puissant/505-844-3185		☑ Validation Required
Service Order No.	CF032-03	Send Report to SMO:	Wendy Palencia/505-844-3132		Bill To: Sandia National Labs (Accounts Payable)
Location	Tech Area				P.O. Box 5800 MS 0154
Building 885	Room		Reference LOV(available at SMO)		Albuquerque, NM 87185-0154

Sample No.-Fraction	ER Sample ID or Sample Location Detail	Pump Depth (ft)	ER Site No.	Date/Time(hr) Collected	Sample Matrix	Container Type	Container Volume	Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
060063-001	885/1101-SP1-BH1-25-S	25'	1101	10-22-02/1210	S	AS	4oz	4c	G	SA	VOC(8260B)	
060064-001	885/1101-SP1-BH1-30-S	30'	↑	↑ 1345	S	AS	4oz	4c	G	SA	VOC(8260B)	
060063-002	885/1101-SP1-BH1-25-S	25'		1215	S	AG	500ml	4c	G	SA	see below for parameter	
060064-002	885/1101-SP1-BH1-30-S	30'		1350	S	AG	500ml	4c	G	SA	see below for parameter	
060065-001	885/1101-SP1-BH1-TB	N/A	↓	↓ 1400	DIW	G	3x40ml	HCL	G	TB	VOC(8260B)	

RMMA ☐ Yes ☑ No Ref. No.	Sample Tracking Smo Use	Special Instructions/QC Requirements	Abnormal Conditions on Receipt
Sample Disposal ☐ Return to Client ☑ Disposal by lab	Date Entered(mm/dd/yy) 10/28/02	EDD ☑ Yes ☐ No	
Turnaround Time ☑ Normal ☐ Rush	Entered by: RK	Level C Package ☑ Yes ☐ No	
Return Samples By: Level of Rush:	QC inits. JAC	*Send report to: Mike Sanders Dept6135/MS/1089 Phone/505-284/2478 *Please list as separate report.	SVOC(8270C_ PCB(8082)HE(8330) Total Cyanide(9010) Cr6+(7197) RCRA metals(6020, 7000,7471)Gross alpha-beta(900)

Sample Team Members	Name	Signature	Init	Company/Organization/Phone/Cellular
	J.Lee	[signature]	JL	Weston/6135/505-284-3309
	W.Gibson	[signature]	WG	~~MDM~~/6135/505-845-3267 Weston Solutions
	G.Quintana	[signature]	GQ	Shaw/6135/505-284-3309

Lab Use

	Org.	Date	Time		Org.	Date	Time
1.Relinquished by [signature]	6135	10/23/02	0915	4.Relinquished by			
1. Received by [signature]	6137	10/23/02	0915	4. Received by			
2.Relinquished by [signature]	6137	10/23/02	0955	5.Relinquished by			
2. Received by				5. Received by			
3.Relinquished by				6.Relinquished by			
3. Received by				6. Received by			

ANNEX B
DSS Site 1101
Risk Assessment

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DSS SITE 1101: RISK ASSESSMENT REPORT

I. Site Description and History

Drain and Septic Systems (DSS) Site 1101, the Building 885 Septic System, at Sandia National Laboratories/New Mexico (SNL/NM), is located in Technical Area (TA)-I on federally owned land controlled by Kirtland Air Force Base (KAFB) and permitted to the U.S. Department of Energy (DOE). The septic system consisted of a septic tank connected to a seepage pit. Available information indicates that Building 885 was constructed in 1953 (SNL/NM March 2003), and it is assumed that the septic system was also constructed at that time. By 1988, the septic system discharges were being routed to the City of Albuquerque sanitary sewer system (SNL/NM August 1988).

Environmental concern about DSS Site 1101 is based upon the potential for the release of constituents of concern (COCs) in effluent discharged to the environment via the seepage pit at this site. Because operational records are not available, the investigation of DSS Site 1101 was planned to be consistent with other DSS site investigations and to sample for the COCs most commonly found at similar facilities.

The ground surface in the vicinity of the site is flat to very slightly inclined to the west. The closest major drainage is Tijeras Arroyo, located approximately 1 mile southeast of the site. No springs or perennial surface-water bodies were located within 3 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). Because most of the area in the vicinity of this site is paved, precipitation that falls in and around the site drains to a storm-water channel that discharges to Tijeras Arroyo. Infiltration of precipitation at the site is essentially nonexistent, and virtually all of the moisture either drains away from the site or evaporates.

DSS Site 1101 lies at an average elevation of approximately 5,432 feet above mean sea level. The groundwater beneath the site occurs in both a shallow and regional aquifer in unconfined conditions in essentially unconsolidated silts, sands, and gravels. Depth to the shallow groundwater system, which has a limited lateral extent and is present beneath the north-central part of KAFB, is approximately 310 feet below ground surface (bgs) at the site. The shallow groundwater system is not used as a water supply source. Depth to the regional groundwater aquifer is approximately 560 feet bgs. Both the City of Albuquerque and KAFB use the regional groundwater aquifer as a water supply source. Groundwater flow in the shallow groundwater system is to the southeast, while that in the regional aquifer is to the northwest beneath the site (SNL/NM June 2003). The nearest production wells to DSS Site 1101 are KAFB-1 and KAFB-11 which are approximately 1.1 miles southwest and 1.3 miles southeast of the site, respectively. The nearest groundwater monitoring wells are the perched and regional aquifer well pair TA1-W-08 and TA1-W-05, which are located approximately 800 feet north of the site.

II. Data Quality Objectives

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

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

- Determine whether hazardous waste or hazardous constituents were released at the site.
- Characterize the nature and extent of any releases.
- Provide analytical data of sufficient quality to support risk assessments.

Table 1 summarizes the rationale for determining the sampling locations at this site. The source of potential COCs at DSS Site 1101 is effluent discharged to the environment from the seepage pit at this site.

Table 1
Summary of Sampling Performed to Meet DQOs

DSS Site 1101 Sampling Areas	Potential COC Source	Number of Sampling Locations	Sample Density (samples/acre)	Sampling Location Rationale
Soil beneath the septic system seepage pit	Effluent discharged to the environment from the seepage pit	1	NA	Evaluate potential COC releases to the environment from effluent discharged from the seepage pit

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

The baseline soil samples were collected at one location at DSS Site 1101 with a Geoprobe™ from two 3-foot-long sampling intervals at each boring location. The seepage pit sampling intervals started at 25 and 30 feet bgs in the boring. The soil samples were collected in accordance with the procedures described in the SAP (SNL/NM October 1999) and FIP (SNL/NM November 2001). Table 2 summarizes the types of confirmatory and QA/QC samples collected at the site and the laboratories that performed the analyses.

The DSS Site 1101 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 Radiation Protection Sample Diagnostics (RPSD) Laboratory.

Table 2
Number of Confirmatory Soil and QA/QC Samples Collected from DSS Site 1101

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

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

Table 3 summarizes the analytical methods and the data quality requirements from the SAP (SNL/NM October 1999) and FIP (SNL/NM November 2001).

Table 3
Summary of Data Quality Requirements for DSS Site 1101

Analytical Method[a]	Data Quality Level	GEL	RPSD
VOCs EPA Method 8260	Defensible	2	None
SVOCs EPA Method 8270	Defensible	2	None
PCBs EPA Method 8082	Defensible	2	None
HE Compounds EPA Method 8330	Defensible	2	None
RCRA metals EPA Method 6020/7000	Defensible	2	None
Hexavalent Chromium EPA Method 7196A	Defensible	2	None
Total Cyanide EPA Method 9012A	Defensible	2	None
Gamma Spectroscopy Radionuclides EPA Method 901.1	Defensible	None	2
Gross Alpha/Beta Activity EPA Method 900.0	Defensible	2	None

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

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

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 1101 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 1101 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 1101, 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 1101 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 1101.

III.3 Rate of Contaminant Migration

The septic system at DSS Site 1101 was deactivated by 1988, at which time Building 885 was connected the City of Albuquerque sanitary sewer system. The migration rate of COCs that may have been introduced into the subsurface via the septic system at this site was therefore dependent upon the volume of aqueous effluent discharged to the environment from this system when it was operational. Any migration of COCs from this site after use of the septic system was discontinued would have been predominantly dependent upon infiltrating precipitation. However, it is highly unlikely that sufficient precipitation would have reached the depth at which COCs may have been discharged to the subsurface because the immediate area surrounding the site is covered by pavement. Analytical data generated from the soil sampling conducted at the site are adequate to characterize the rate of COC migration at DSS Site 1101.

III.4 Extent of Contamination

Subsurface baseline soil samples were collected from a borehole drilled at one location beneath the effluent release point (seepage pit) 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 25 and 30 feet bgs in the seepage pit borehole. Sampling intervals started at the depths at which effluent discharged from the seepage pit 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 1101 NFA proposal describes the identification of COCs and the sampling conducted in order to determine the concentration levels of those COCs across the site. Generally, COCs 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 the radiological COCs for the human health risk assessment at DSS Site 1101. 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 1101 occurred in the subsurface soil resulting from the discharge of effluents from Building 885 to the septic tank and seepage pit. Wind, water, and biota are natural mechanisms of COC transport from the primary release point. Because the discharge was to the subsurface and because the ground surface at this site is currently covered by asphalt pavement, wind, surface water, and biota are not considered to be viable transport mechanisms at this site.

Table 4
Nonradiological COCs for Human Health Risk Assessment at DSS Site 1101 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	2.15	4.4	Yes	44[c]	–	**Yes**
Barium	85.7 J	200	Yes	170[d]	–	**Yes**
Cadmium	0.187 J	0.9	Yes	64[c]	–	**Yes**
Chromium, total	11.8	12.8	Yes	16[c]	–	No
Chromium VI	0.02665[e]	NC	**Unknown**	16[c]	–	No
Cyanide	0.184 J	NC	**Unknown**	NC	–	**Unknown**
Lead	4.68	11.2	Yes	49[c]	–	**Yes**
Mercury	0.00459 J	<0.1	**Unknown**	5,500[c]	–	**Yes**
Selenium	0.613 J	<1	**Unknown**	800[f]	–	**Yes**
Silver	0.04465[e]	<1	**Unknown**	0.5[c]	–	No
Organic						
Acenaphthene	0.0107 J	NA	**NA**	389[g]	3.92[g]	**Yes**
2-Chlorophenol	0.0169 J	NA	**NA**	214[h]	2.15[h]	**Yes**
Chrysene	0.0185 J	NA	**NA**	18,000[g]	5.91[g]	**Yes**
Di-n-octyl phthalate	0.15 J	NA	**NA**	9,334[g]	5.22[g]	**Yes**
bis(2-Ethylhexyl) phthalate	0.182 J	NA	**NA**	851[h]	7.6[g]	**Yes**
Fluoranthene	0.0174 J	NA	**NA**	12,302[g]	4.90[g]	**Yes**
Fluorene	0.0104 J	NA	**NA**	2,239[g]	4.18[g]	**Yes**

Note: **Bold** indicates the COCs that exceed the background screening values and/or are bioaccumulators.
[a]Dinwiddie September 1997, North 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.

Table 4 (Concluded)
Nonradiological COCs for Human Health Risk Assessment at DSS Site 1101 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

[f]Callahan et al. 1979.
[g]Micromedex 1998.
[h]Howard 1989.

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 1101 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 (0.029)	0.084	Yes	900[c]	**Yes**
Th-232	0.62	1.54	Yes	900[c]	**Yes**
U-235	ND (0.17)	0.18	Yes	3,000[c]	**Yes**
U-238	ND (0.42)	1.3	Yes	3,000[c]	**Yes**

Note: **Bold** indicates COCs that exceed the background screening values and/or are bioaccumulators.
[a]Dinwiddie September 1997, North 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 1101 is received as precipitation (approximately 8.1 inches annually [NOAA 1990]). Because the site is paved, infiltration at the site is essentially nonexistent. The depth to groundwater at this site is approximately 310 feet bgs; therefore, the potential for COCs to reach groundwater through the unsaturated zone above the water table is extremely low.

COCs at DSS Site 1101 include nonradiological inorganic and organic constituents. No radiological analytes exceeded background screening values. With the exception of cyanide, the inorganic COCs are elemental in form and not considered to be degradable. Transformations of these inorganic COCs 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, the asphalt pavement, and the consequent lack of potential contact with biota, none of these mechanisms is expected to result in significant losses or transformations of the inorganic COCs.

The organic COCs at DSS Site 1101 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. Again, because of the arid environment, the asphalt pavement, and the lack of contact with biota at this site, none of these mechanisms is expected to result in significant losses or transformations of the organic COCs.

Table 6 summarizes the fate and transport processes that can occur at DSS Site 1101. The COCs at this site include nonradiological inorganic and organic analytes. Wind, surface water, and biota are not considered to be 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 the COCs is insignificant.

Table 6
Summary of Fate and Transport at DSS Site 1101

Transport and Fate Mechanism	Existence at Site	Significance
Wind	Yes	None
Surface runoff	Yes	None
Migration to groundwater	No	None
Food chain uptake	No	None
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 1101. 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 1101 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 1101 is approximately 310 feet bgs. No intake routes through plant, meat, or milk ingestion are considered appropriate for either the industrial or residential land-use scenarios. Figure 1 shows the conceptual model flow diagram for DSS Site 1101.

Pathway Identification

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

VI.4 Step 3. Background Screening Procedure

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

VI.4.1 Methodology

Maximum concentrations of nonradiological COCs 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.

VI.4.2 Results

Tables 4 and 5 show DSS Site 1101 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, five constituents did not have quantified background screening concentrations. Seven constituents were organic compounds that do not have corresponding background screening values. For the radiological COCs, no constituent exhibited an MDA greater than its background value.

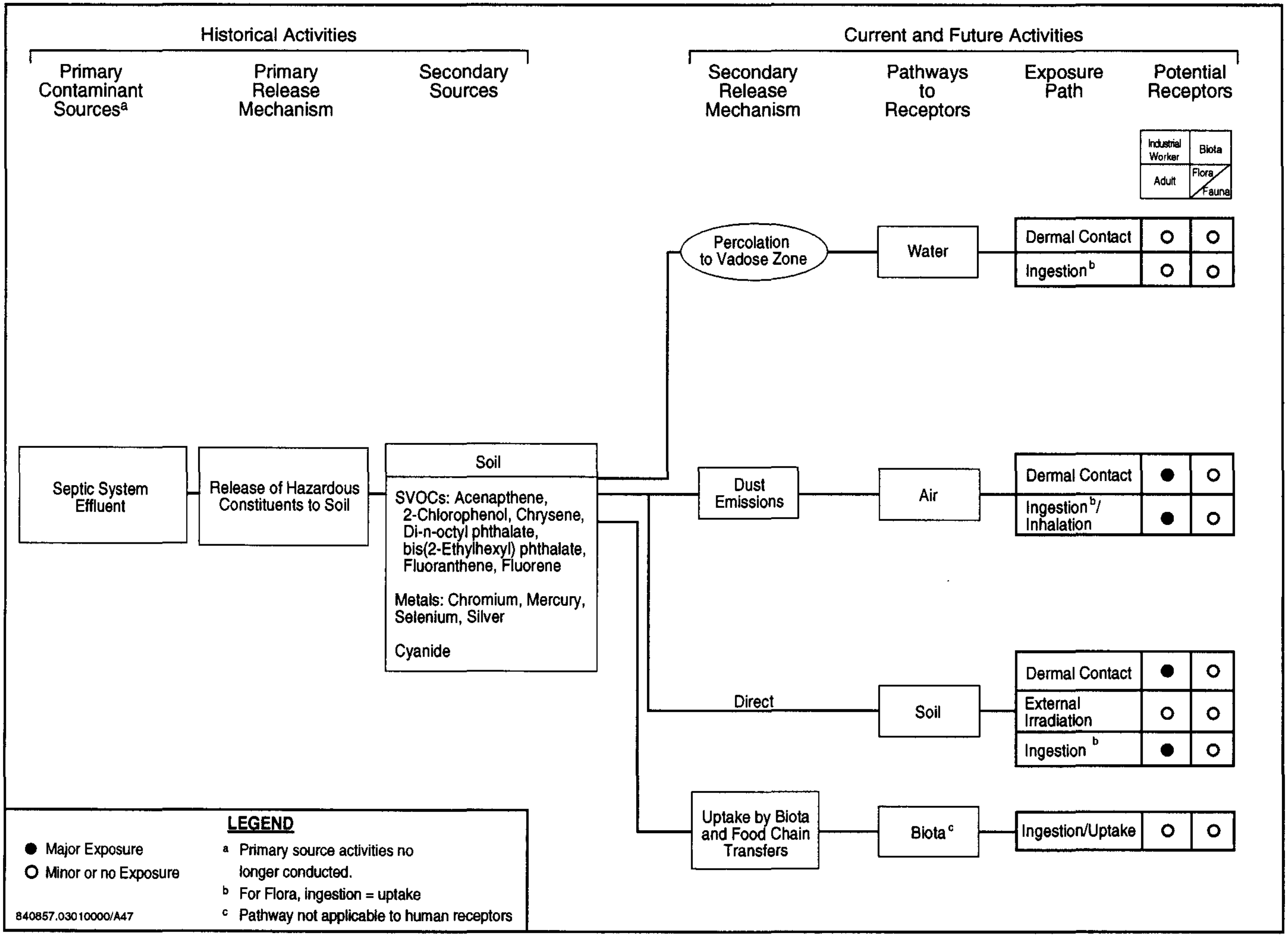

Figure 1

Conceptual Site Model Flow Diagram for DSS Site 1101, Building 885 Septic System

VI.5 Step 4. Identification of Toxicological Parameters

Table 7 lists 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 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), EPA Region 9 (EPA 2002b) and the Risk Assessment Information System (ORNL 2003) electronic databases.

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 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 uses.

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). 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 8 shows an HI of 0.00 for the DSS Site 1101 nonradiological COCs and an estimated excess cancer risk of 1E-9 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 9 shows that for DSS Site 1101 associated background constituents, there is neither a quantifiable HI nor an estimated excess cancer risk for the designated industrial land-use scenario.

For the radiological COCs, no constituents exceeded the corresponding background values. Therefore, no risk was calculated for the industrial land-use scenario.

For the nonradiological COCs under the residential land-use scenario, the HI is 0.00 with an estimated excess cancer risk of 5E-9 (Table 8). The numbers in the table include exposure

Table 7
Toxicological Parameter Values for DSS Site 1101 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								
Chromium VI	3E-3[c]	L	2.3E-6[c]	L	–	4.2E+1[c]	A	0.01[d]
Cyanide	2E-2[c]	M	–	–	–	–	D	0.1[d]
Mercury	3E-4[e]	–	8.6E-5[c]	M	–	–	D	0.01[d]
Selenium	5E-3[c]	H	–	–	–	–	D	0.01[d]
Silver	5E-3[c]	L	–	–	–	–	D	0.01[d]
Organic								
Acenaphthene	6E-2[c]	L	6E-2[f]	–	–	–	–	0.13[d]
2-Chlorophenol	5E-3[c]	L	5E-3[f]	–	–	–	–	0.01[g]
Chrysene	–	–	–	–	7.3E-3[f]	3.1E-3[f]	B2	0.13[d]
Di-n-octylphthalate	2E-2[e]	–	2E-2[f]	–	–	–	–	0.1[h]
bis(2-Ethylhexyl) phthalate	2E-2[f]	–	2E-2[f]	–	1.4E-2[f]	1.4E-2[f]	–	0.01[g]
Fluoranthene	4E-2[c]	L	4E-2[f]	–	–	–	D	0.13[d]
Fluorene	4E-2[c]	L	4E-2[f]	–	–	–	D	0.1[d]

[a]Confidence associated with IRIS (EPA 2003) database values. Confidence: L = low, M = medium, H = high.
[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989) taken from IRIS (EPA 2003):
A = Human carcinogen.
B2 = Probable human carcinogen. Sufficient evidence in animals and inadequate or not evidence in humans.
D = Not classifiable as to human carcinogenicity.
[c]Toxicological parameter values from IRIS electronic database (EPA 2003).
[d]Toxicological parameter values from NMED December 2000.
[e]Toxicological parameter values from HEAST (EPA 1997a).
[f]Toxicological parameter values from EPA Region 6 (EPA 2002a).
[g]Toxicological parameter values from Risk Assessment Information System (ORNL 2003).
[h]Toxicological parameter values from EPA Region 9 (EPA 2002b).

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.
NMED = New Mexico Environment Department.
RfD_{inh} = Inhalation chronic reference dose.
RfD_o = Oral chronic reference dose.
SF_{inh} = Inhalation slope factor.
SF_o = Oral slope factor.
– = Information not available.

Table 8
Risk Assessment Values for DSS Site 1101 Nonradiological COCs

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Chromium VI	0.02665[b]	0.00	6E-11	0.00	1E-10
Cyanide	0.184 J	0.00	–	0.00	–
Mercury	0.00459 J	0.00	–	0.00	–
Selenium	0.613 J	0.00	–	0.00	–
Silver	0.04465[b]	0.00	–	0.00	–
Organic					
Acenaphthene	0.0107 J	0.00	–	0.00	–
2-Chlorophenol	0.0169 J	0.00	–	0.00	–
Chrysene	0.0185 J	0.00	9E-11	0.00	3E-10
Di-n-octylphthalate	0.15 J	0.00	–	0.00	–
bis(2-Ethylhexyl) phthalate	0.182 J	0.00	9E-10	0.00	4E-9
Fluoranthene	0.0174 J	0.00	–	0.00	–
Fluorene	0.0104 J	0.00	–	0.00	–
Total		**0.00**	**1E-9**	**0.00**	**5E-9**

[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 9
Risk Assessment Values for DSS Site 1101 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
Chromium VI	NC	–	–	–	–
Cyanide	NC	–	–	–	–
Mercury	<0.1	–	–	–	–
Selenium	<1	–	–	–	–
Silver	<1	–	–	–	–
Total		**–**	**–**	**–**	**–**

[a]Dinwiddie September 1997, North 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.

from soil ingestion, dermal contact, and dust and volatile inhalation. Although the EPA (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 9 shows that for the DSS Site 1101 associated background constituents, there is no quantifiable HI or estimated excess cancer risk.

For the radiological COCs, no constituents exceeded the corresponding background values for either the residential or industrial land-use scenario. Therefore, no calculation of risk was performed.

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 scenario.

For the nonradiological COCs under the industrial land-use scenario, the HI is 0.00, which is lower than the numerical guideline of 1 suggested in the RAGS (EPA 1989). The estimated excess cancer risk is 1E-9. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. 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. 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. For background concentrations of the nonradiological COCs, there is neither a quantifiable HI nor an estimated excess cancer risk. The incremental HI is 0.00, and the incremental estimated excess cancer risk is 1.05E-9 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, no constituents exceeded the corresponding background values. Therefore, no calculation of risk was performed for the industrial land-use scenario.

For the nonradiological COCs under the residential land-use scenario, the calculated HI is 0.00, which is below the numerical guidance. The estimated excess cancer risk is 5E-9. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. For background concentrations of the nonradiological COCs, there is neither a quantifiable HI nor an estimated excess cancer risk. The incremental HI is 0.00 and the incremental estimated cancer risk is 4.54E-9 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.

For the radiological COCs, no constituents exceeded the corresponding background values. Therefore, no calculation of risk was performed for the residential land-use scenario.

VI.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at DSS Site 1101 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 1101.

Because of the location, history of the site, and future industrial 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), EPA Region 9 (EPA 2002b) and the Risk Assessment Information System (ORNL 2003) electronic databases. 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, 2002b, 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 radiological COCs, the conclusion of the risk assessment is that potential effects on human health for both industrial and residential land-use scenarios are within guidelines and represent only a small fraction of the estimated 360 millirem/year received by the average U.S. population (NCRP 1987).

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

VI.9 Summary

DSS Site 1101 contains identified COCs consisting of some inorganic and radiological compounds. Because of the location of the site, the designated industrial land-use scenario, and the nature of contamination, potential exposure pathways identified for this site included soil ingestion, dermal contact, and dust 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 (0.00) is significantly lower than the accepted numerical guidance from the EPA. The estimated excess cancer risk is 1E-9. Thus excess cancer risk is also below the acceptable risk value provided by the NMED for an industrial land-use scenario (Bearzi January 2001). The incremental HI is 0.00, and the incremental excess cancer risk is 1.05E-9 for the industrial land-use scenario. The incremental risk calculations indicate insignificant risk to human health for the industrial land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for nonradiological COCs show that for the residential land-use scenario the HI (0.00) is also below the accepted numerical guidance from the EPA. The estimated excess cancer risk is 5E-9. Thus excess cancer risk is also below the acceptable risk value provided by the NMED for a residential land-use scenario (Bearzi January 2001). The incremental HI is 0.00, and the incremental excess cancer risk is 4.54E-9 for the residential land-use scenario. The incremental risk calculations indicate insignificant risk to human health for the residential land-use scenario.

For the radiological COCs, no constituents exceeded the corresponding background values. Therefore, no calculation of risk was performed for industrial or residential land-use scenarios.

The summation of the nonradiological and radiological carcinogenic risks is tabulated in Table 10.

Table 10
Summation of Radiological and Nonradiological Risks from DSS Site 1101, Building 885 Septic System Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	1.05E-9	0.0	1.05E-9
Residential	4.54E-9	0.0	4.54E-9

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 1101. 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 1997b). The current methodology is tiered and contains an initial scoping assessment which is 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 1101 are at depths greater than 5 feet bgs. Therefore, no complete ecological exposure pathways exist at this site, and no COCs are considered to be COPECs.

VII.2.2 Bioaccumulation

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

VII.2.3 Fate and Transport Potential

The potential for the COCs to migrate from the source of contamination to other media or biota is discussed in Section V. As noted in Table 6 (Section V), wind, surface water, and biota (food chain uptake) are not considered to be viable transport mechanisms for COCs at this site. Degradation and transformation of the COCs are 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 x (CR x EFD/BW/AT) x Toxicity Effect (1)

where;

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

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

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

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

Soil Ingestion

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

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

where:

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

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

Soil Inhalation

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

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

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).

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