9-1-2005

Justification for Class III Permit Modification September 2005 SWMU 146 OU 1295 Building 9920 Drain System Coyote Test Field

Sandia National Laboratories/NM

This work supported by the United States Department of Energy under contract DE-AC04-94l85000.

Sandia National Laboratories

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

EGIS

Environmental Restoration Project

Site History

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

SWMU Number	Site Name	Location	Year Bldg and System Built	Year Drain or Septic System Abandoned	Year(s) Septic Tank Effluent Sampled	Year Septic Tank Pumped For the last Time	Year Septic Tank Inspected and Closure Forms Signed
137	Bldg 6540/6542 Septic Systems	TA-III	1959 (north septic tank); 1975 (south septic tank)	1991	1992, 1994	Unknown (north tank removed in 1995); 1996 (south septic tank backfilled)	1995
146	Bldg 9920 Drain System	Coyote Test Field	1958	~1980	No septic tank at this site	NA	NA
148	Bldg 9927 Septic System	Coyote Test Field	1962	1991	1992, 1994, 1995	1995/1996 (backfilled)	1995
152	Bldg 9950 Septic System	Coyote Test Field	1964	1991	1992, 1994	1996 (backfilled)	1996
153	Bldg 9956 Septic System	Coyote Test Field	1969 (east septic system); 1988 (west septic system)	1993	1992 (east septic tank); 1994, 1995 (east and west septic tank)	1995/1996 (backfilled)	1995.

Depth to Groundwater

Depth to groundwater at the five sites is as follows:

SWMU Number	Site Name	Location	Groundwater Depth (ft bgs)
137	Bldg 6540/6542 Septic System	TA-III	480
146	Bldg 9920 Drain System	Coyote Test Field	420
148	Bldg 9927 Septic System	Coyote Test Field	355
152	Bldg 9950 Septic System	Coyote Test Field	460
153	Bldg 9956 Septic System	Coyote Test Field	470

Constituents of Concern

- VOCs
- SVOCs
- Metals
- Cyanide
- Radionuclides

Investigation

- All these SWMUs were selected by NMED for passive soil vapor sampling to screen for VOCs and SVOCs. No significant contamination was identified at any of the five sites.
- A backhoe was used to positively locate buried components (drainfield drain lines, drywells) for placement of soil vapor samplers, and soil borings.
- Soil samples were collected from directly beneath drainfield drain lines, seepage pits, and septic tanks to determine if COCs were released to the environment from drain systems.
- A 150-ft-deep, active soil-vapor monitoring well with vapor sampling ports at 5, 20, 70, 100, and 150-ft bgs, was installed at SWMU 137 for active soil vapor sampling to screen for VOCs. VOC concentrations were significantly lower than the 10 ppmv action level established by NMED.

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

SWMU Number	Site Name	Buried Components (Drain Lines, Drywells) Located With Backhoe	Soil Sampling Beneath Drainlines, Seepage Pits, Drywells	Type(s) of Drain System, and Soil Sampling Depths (ft bgs)	Passive Soil Vapor Sampling	Active Soil Vapor Monitor Well Installation and Sampling
137	Bldg 6540/6542 Septic Systems	1994	1990, 1994, 1995	North System: Drainfield-5,15 Septic Tank-9; South system Drainfield-7, 17 Septic Tank-11	1994	2003
146	Bldg 9920 Drain System	None	1995	Drywell: 4, 14	1994	None
148	Bldg 9927 Septic System	None	1994	Seepage Pit: 14, 24 Septic Tank: 12	1994	None
152	Bldg 9950 Septic System	1994	1994, 1995	Drainfield: 5, 15 Septic Tank: 9	1994	None
153	Bldg 9956 Septic System	1994	1994, 1995	West System: Drainfield--6, 16 Septic Tank-8; East System Seepage Pits-8, 18 Septic Tank: 8	1994	None

Summary of Data Used for NFA Justification

- Soil samples were analyzed at on- and off-site laboratories for VOCs, SVOCs, PCBs, HE compounds, metals, cyanide, isotopic uranium, tritium, and radionuclides by gamma spectroscopy.
- There were detections of VOCs at all five sites; SVOCs were detected at SWMUs 137, and 146.
- Arsenic was detected at concentrations above the background value at SWMUs 137, 148, and 152. Total chromium was at concentrations above the background value at SWMU 153. Barium and silver were detected at concentrations above the background values at SWMU 137, and lead was detected at concentrations above the background value at SWMU 153. No other metals were detected at concentrations above the background values.
- Cyanide was detected above the MDL at SWMUs 137 and 153.
- Thorium-232 was detected at an activity slightly above the background activity at all five sites. The MDAs for U-235 and U-238 exceeded background activities at SWMUs 137, 146, 152, and 153. The MDA for tritium exceeded the background activity at SWMU 148.
- All confirmatory soil sample analytical results for each site were used for characterization, for performing the risk screening assessment, and as justification for the NFA proposal.

Recommended Future Land Use

- Industrial land use was established for these five sites.

Results of Risk Analysis

- Risk assessment results for industrial and residential land-use scenarios are calculated per NMED risk assessment guidance as presented in "Supplemental Risk Document Supporting Class 3 Permit Modification Process".
- Because COCs were present in concentrations greater than background-screening levels or because constituents were present that did not have background-screening numbers, it was necessary to perform risk assessments for these five sites. The risk assessment analysis evaluated the potential for adverse health effects for the industrial and residential land-use scenarios.
- The maximum concentration value for lead was 27.3 J mg/kg at SWMU 153; this exceeds the background value. The EPA intentionally does not provide any human health toxicological data on lead; therefore, no risk parameter values could be calculated. The NMED guidance for lead screening concentrations for construction and industrial land-use scenarios are 750 and 1,500 mg/kg, respectively. The EPA screening guidance value for a residential land-use scenario is 400 mg/kg. The maximum concentration for lead at this site is less than all the screening values; therefore, lead was eliminated from further consideration in the human health risk assessment.
- The non-radiological total human health HIs and estimated excess cancer risks for the five sites are below NMED guidelines for the residential land-use scenarios.
- For SWMU 152, the HI is below the residential land-use guideline, but the total estimated excess cancer risk is slightly above the residential land-use guideline. However, the incremental excess cancer risk value for this site is below the NMED residential land-use guideline.
- The human health TEDEs for industrial land-use scenarios ranged from 5.7E-2 to 2.9E-8 mrem/yr, all of which are substantially below the EPA numerical guideline of 15 mrem/yr. The human health TEDEs for residential land-use scenarios ranged from 1.9E-5 to 0.15 mrem/yr, all of which are substantially below the EPA numerical guideline of 75 mrem/yr. Therefore, these sites are eligible for unrestricted radiological release.
- Using the SNL predictive ecological risk and scoping assessment methodologies, it was concluded that a complete ecological pathway for each of the five sites was not associated with the respective COPECs for that site. Thus, a more detailed ecological risk assessment to predict the level of risk was not deemed necessary for these sites.
- In conclusion, human health and ecological risks are acceptable per NMED guidance. Thus, these sites are proposed for CAC without institutional controls.

The total HIs and excess cancer risk values for a residential land-use scenario for the nonradiological COCs at the five SWMUs are as follows:

SWMU Number	SWMU Name	Residential Land-Use Scenario: Hazard Index	Residential Land-Use Scenario: Excess Cancer Risk
137	Bldg 6540/6542 Septic System	0.90	1E-7 Total
146	Bldg 9920 Drain System	0.00	3E-8 Total
148	Bldg 9927 Septic System	0.39	3E-8 Total
152	Bldg 9950 Septic System	0.37	2E-5 Total[a] /9.06E-6 Incremental
153	Bldg 9956 Septic System	0.00	6E-8 Total
NMED Guidance		≤ 1	<1E-5

[a]Value exceeds NMED guidance for specified land-use scenario; therefore, incremental values are shown.

For More Information Contact

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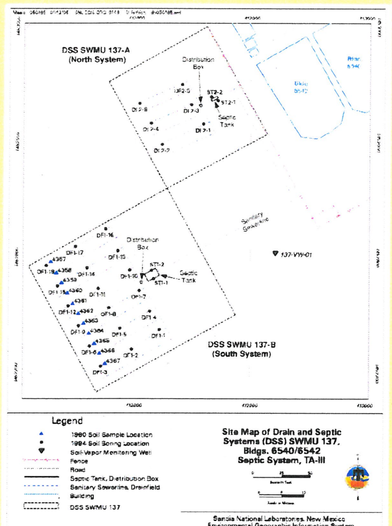
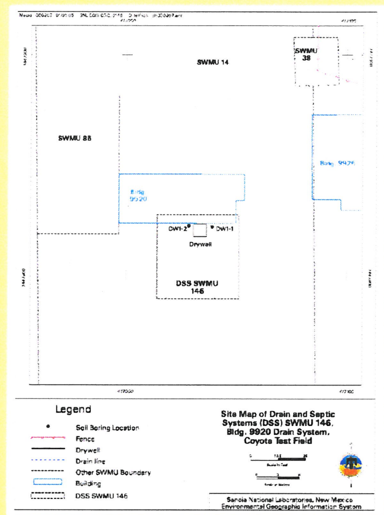
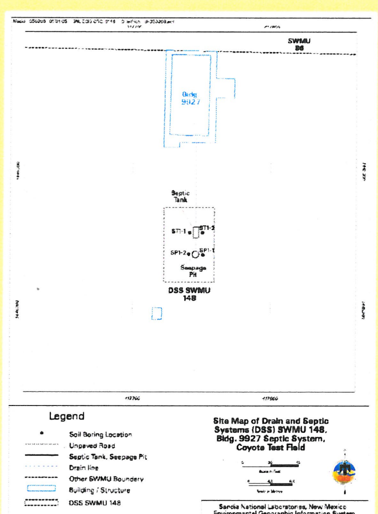
Drain and Septic Systems - Solid Waste Management Units (SWMUs) 137, 146, 148, 152, and 153

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

Environmental Restoration Project



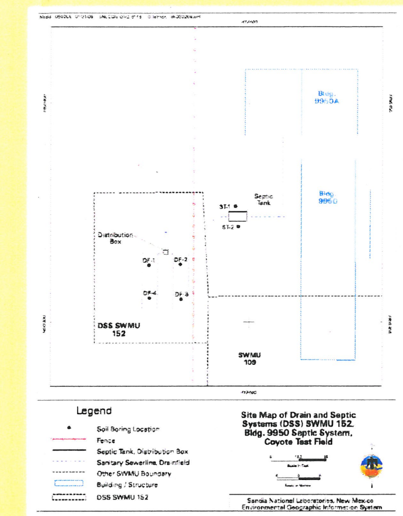


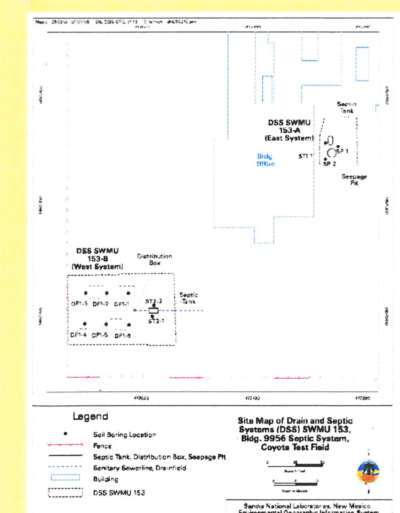


Collecting soil samples with the Geoprobe

System drainline terminating at the seepage pit.

Platform and Geoprobe sampling equipment used to collect soil samples from beneath the center of the seepage pit.





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Justification for Class III Permit Modification

September 2005

SWMU 146
OU 1295
Building 9920 Drain System Coyote Test Field

NFA Submitted August 1995

NOD Submitted June 1997

NOD Submitted March 2005

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

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NFA

Department of Energy
Albuquerque Operations Office
Kirtland Area Office
P. O. Box 5400
Albuquerque, New Mexico 87185-5400

AUG 28 1995

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. David Neleigh, Chief
New Mexico and Federal Facilities Section
RCRA Permits Branch
U. S. Environmental Protection Agency, Region VI
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Dear Mr. Neleigh:

Enclosed are copies of the second set of No Further Action (NFA) proposals for 23 solid waste management units (SWMUs) from the Resource Conservation and Recovery Act (RCRA) Hazardous and Solid Waste Amendments (HSWA) Final Permit for Sandia National Laboratories/New Mexico (SNL/NM), ID No. NM5890110518.

Copies of these proposals are also being submitted for comment to the New Mexico Environment Department (NMED), Hazardous and Radioactive Materials Bureau. The Class 3 permit modification process will be initiated after regulatory comments are addressed.

If you have any questions, please contact John Gould at (505) 845-6089 or Mark Jackson at (505) 845-6288.

Sincerely,

George K. Laskar

for Michael J. Zamorski
Acting Area Manager

Enclosures

cc w/enclosures:
T. Trujillo, AL, ERD
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Sandia National Laboratories / New Mexico

PROPOSAL FOR NO FURTHER ACTION
ENVIRONMENTAL RESTORATION PROJECT
SITE 146, BUILDING 9920 DRAIN SYSTEM
OPERABLE UNIT 1295

FY 1995

August 1995

Environmental Restoration Project

United States Department of Energy
Albuquerque Operations Office

PROPOSAL FOR NO FURTHER ACTION
Environmental Restoration Project

Site 146, Building 9920 Drain System
OU 1295

Prepared by
Sandia National Laboratories/New Mexico
Environmental Restoration Project
Albuquerque, New Mexico

Prepared for the
United States Department of Energy

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1. Introduction

1.1 ER Site 146, Building 9920 Drain System

Sandia National Laboratories/New Mexico (SNL/NM) is proposing a no further action (NFA) decision based on confirmatory sampling for Environmental Restoration (ER) Site 146, Building 9920 Drain System, Operable Unit (OU) 1295. ER Site 146 is listed in the Hazardous and Solid Waste Amendment (HSWA) Module IV (EPA August 1993) of the SNL/NM Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Facility Permit (NM5890110518) (EPA August 1992).

1.2 SNL/NM Confirmatory Sampling NFA Process

This proposal for a determination of an NFA decision based on confirmatory sampling was prepared using the criteria presented in Section 4.5.3 of the SNL/NM Program Implementation Plan (PIP) (SNL/NM February 1995). Specifically, this proposal "must contain information demonstrating that there are no releases of hazardous waste (including hazardous constituents) from solid waste management units (SWMU) at the facility that may pose a threat to human health or the environment" (as proposed in the code of Federal Regulations [CFR], Section 40 Part 264.514[a] [2]) (EPA July 1990). The HSWA Module IV contains the same requirements for an NFA demonstration:

> Based on the results of the RFI [RCRA Facility Investigation] and other relevant information, the Permittee may submit an application to the Administrative Authority for a Class III permit modification under 40 CFR 270.42(c) to terminate the RFI/CMS [corrective measures study] process for a specific unit. This permit modification application must contain information demonstrating that there are no releases of hazardous waste including hazardous constituents from a particular SWMU at the facility that pose threats to human health and/or the environment, as well as additional information required in 40 CFR 270.42(c) (EPA August 1993).

If the available archival evidence is not considered convincing, SNL/NM performs confirmatory sampling to increase the weight of the evidence and allow an informed decision on whether to proceed with the administrative-type NFA or to return to the site characterization program for additional data collection (SNL/NM February 1995).

The Environmental Protection Agency (EPA) acknowledged that the extent of sampling required may vary greatly, stating that:

> The agency does not intend this rule [the second codification of HSWA] to require extensive sampling and monitoring at every SWMU....Sampling is generally required only in situations where there is insufficient evidence on which to make an initial release determination....The actual extent of sampling will vary...depending on the amount and quality of existing information available (EPA December 1987).

This request for an NFA decision for ER Site 146, Building 9920 Drain System, is based primarily on results of a passive soil-gas survey (NERI 1994) and analytical results of confirmatory soil samples collected from immediately around the ER Site 146 drywell. Concentrations of site-specific constituents of concern (COCs) were first compared to background upper tolerance limit (UTL) concentrations of COCs found in SNL/NM soils. If, however, no background data were available for a particular COC, concentrations of that constituent were then compared to proposed 40 CFR Part 264 Subpart S (Subpart S) soil action levels for the COC of interest (EPA July 1990). Concentrations of constituents at this site were found to be less than either or both background UTLs or proposed Subpart S action levels. This unit is therefore eligible for an NFA proposal based on one or more of the following criteria taken from the RCRA Facility Assessment (RFA) Guidance (EPA October 1986):

- Criterion A: The unit has never contained constituents of concern.
- Criterion B: The unit has design and/or operating characteristics that effectively prevent releases to the environment.
- Criterion C: The unit clearly has not released hazardous waste or constituents into the environment.

Specifically, ER Site 146 is being proposed for an NFA decision based on confirmatory sampling data demonstrating that hazardous waste or COCs have not been released from this SWMU into the environment (Criterion C).

1.3 Local Setting

SNL/NM occupies 2,829 acres of land owned by the Department of Energy (DOE), with an additional 14,920 acres of land provided by land-use permits with Kirtland Air Force Base (KAFB), the United States Forest Service, the State of New Mexico, and the Isleta Indian Reservation. SNL/NM has been involved in nuclear weapons research, component development, assembly, testing, and other research and development activities since 1945 (DOE September 1987).

ER Site 146 is located in the Coyote Test Field on KAFB and is approximately 0.3 mile east of Technical Area III (TA-III). Access to the site is provided by paved and graded dirt roads that extend southwest from Lovelace Road, and north from Magazine Road (Figure 1). ER Site 146 consists of the immediate area around a single drywell that is located between four and ten feet south of the southeast corner of the building (Figure 2). This drywell formerly served a darkroom sink and lavatory in Building 9920. The site encompasses approximately 0.03 acres of flat-lying land at an average elevation of 5,459 feet above mean sea level (AMSL).

The surficial geology at ER Site 146 is characterized by a veneer of aeolian sediments that are underlain by alluvial fan or alluvial deposits. Based on drilling records of similar deposits at KAFB, the alluvial materials are highly heterogeneous, composed primarily of

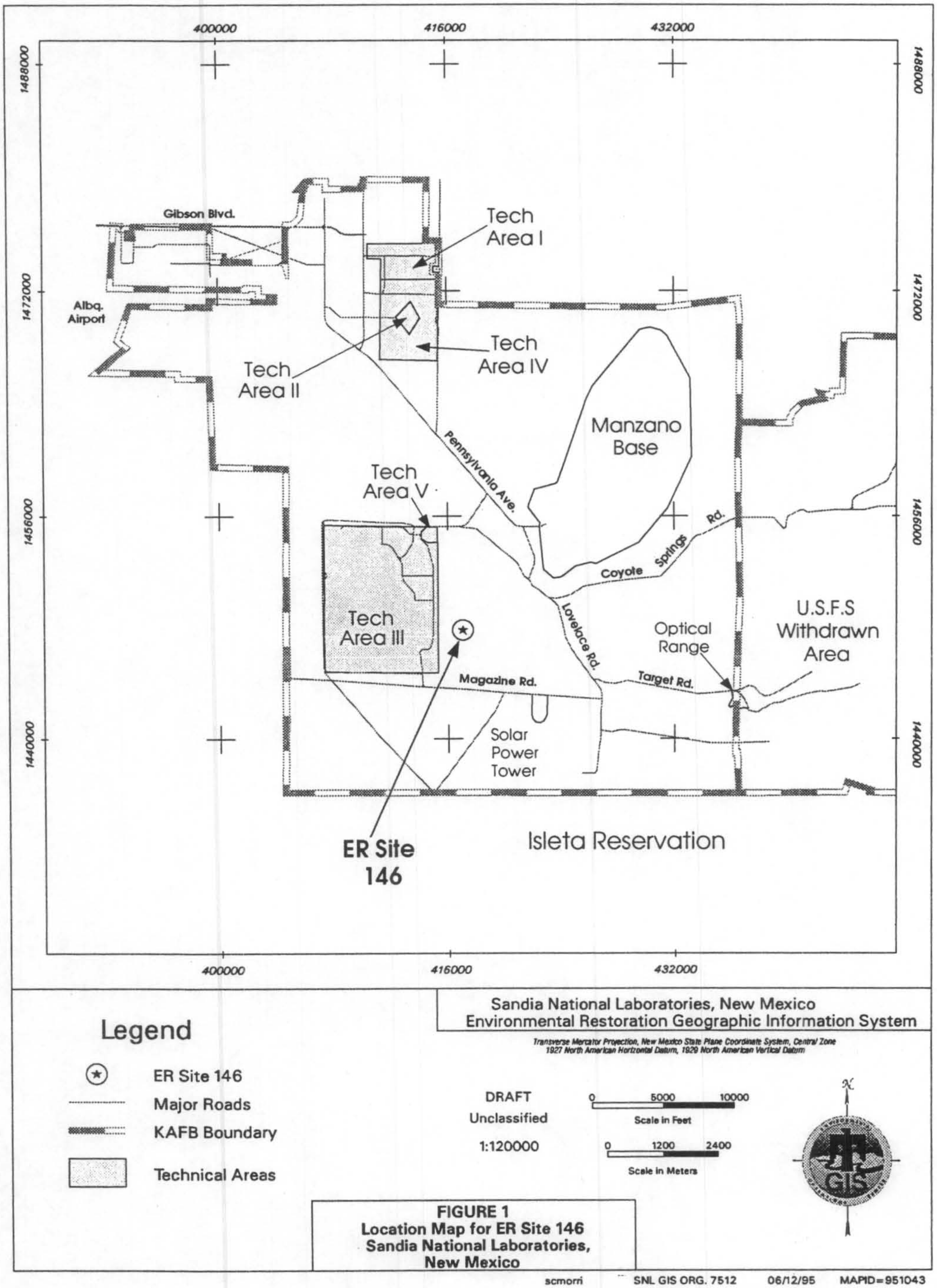

Figure 1. ER Site 146 Location Map

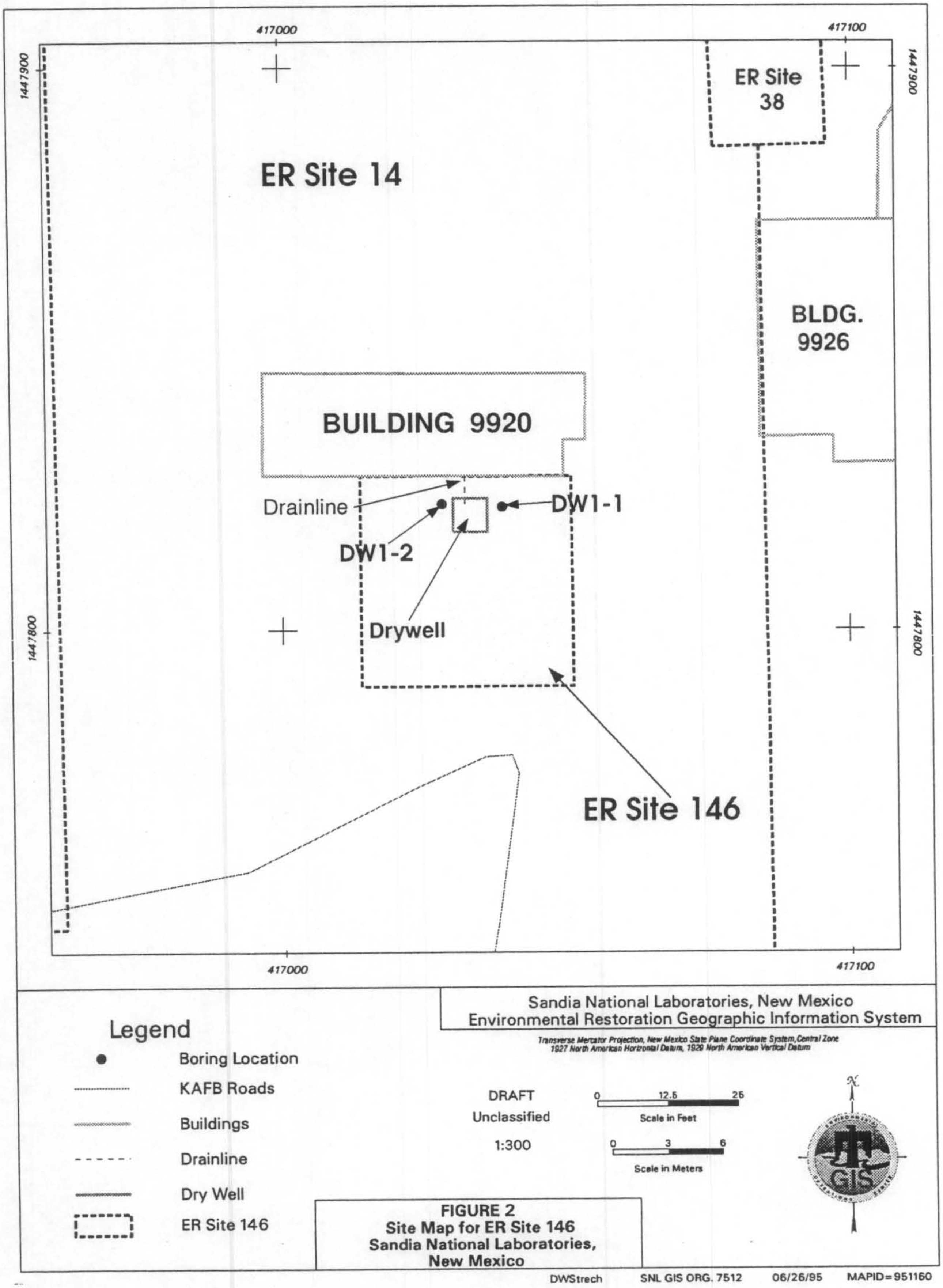

Figure 2. ER Site 146 Sampling Locations

medium to fine silty sands with frequent coarse sand, gravel, and cobble lenses. The alluvial deposits probably extend to the water table. Vegetation consists predominantly of grasses including grama, muhly, dropseed, and galleta. Shrubs commonly associated with the grasslands include sand sage, winter fat, saltbrush, and rabbitbush. Cacti are common, and include cholla, pincushion, strawberry, and prickly pear (SNL/NM March 1993).

The water-table elevation is approximately 5,200 feet AMSL at this location, so depth to ground water is approximately 259 feet. No production wells are located in the immediate vicinity of ER Site 146. The nearest ground-water monitoring wells to ER Site 146 are the group of wells installed around the Chemical Waste Landfill in the southeast corner of TA-III. These wells are located approximately 0.7 mile southwest of ER Site 146. Local ground water flow is believed to be in a generally west to northwest direction in the vicinity of this site (SNL/NM March 1995). The nearest production wells are northwest of the site and include KAFB-2, KAFB-4, KAFB-7, and KAFB-8 which are approximately 3.9 to 5.4 miles away (SNL/NM March 1995).

2. History of the SWMU

2.1 Sources of Supporting Information

In preparing the confirmatory sampling NFA proposal for ER Site 146, available background information was reviewed to quantify potential releases and to select analytes for the soil sampling. Background information was collected from SNL/NM facilities engineering drawings and interviews with employees familiar with site operational history.

The following sources of information, hierarchically listed with respect to assigned validity, were used to evaluate ER Site 146:

- Confirmatory shallow subsurface soil sampling conducted in January 1995
- Two survey reports, including data from a surface radiation survey (RUST December 1994), and a passive soil-gas survey (NERI 1994)
- RCRA Facilities Investigation Work Plan for OU 1295, Septic Tanks and Drainfields. This document contains information from interviews with past employees of the site (SNL/NM March 1993)
- Photographs and field notes generated by SNL/NM ER program staff at ER Site 146
- SNL/NM facilities engineering construction drawings
- SNL/NM Geographic Information System (GIS) data
- The RFA report (EPA April 1987)

2.2 Previous Audits, Inspections, and Findings

ER Site 146 was first listed as a potential release site in the RFA report (EPA April 1987), which noted that explosives residue and other COCs may have been discharged to the Building 9920 Drain System during past operations. This SWMU was included in the RFA report as Site 79, along with several other septic and drain systems at SNL/NM. All the sites included in Site 79 are now designated by individual SWMU numbers.

2.3 Historical Operations

Building 9920 was constructed in 1958. It contained instrumentation used to monitor explosives testing conducted in the immediate vicinity of the building. An SNL/NM Facilities Engineering construction drawing dated June 4, 1958, shows that the drywell served a darkroom sink and a lavatory in the southeast corner of Building 9920 (AEC June 1958). No toilet is shown on the drawing, and interviews with personnel familiar with this facility confirm that a toilet was never installed in the building. Prior to 1965, waste developing solutions were discharged into the darkroom sink. Black and white film processing was mainly performed, and some color film development may have also occurred. There are no floor drains in the building (SNL/NM March 1993). A SNL/NM employee familiar with the history of Building 9920 and who worked at the facility from 1965 to 1982 indicated that to the best of his recollection (1) a toilet and lavatory were never installed in the building; (2) the darkroom was dismantled sometime prior to 1965; and (3) the darkroom sink was removed about 1980 (SNL/NM June 1995).

Based on the activities performed at the facility, the primary COCs targeted in the investigation were spent photoprocessing chemicals (including silver, hexavalent chromium, cadmium, and cyanide). In addition, although ER Site 146 process knowledge indicates that radionuclides are unlikely COCs at this site, it lies within the eastern portion of ER Site 14 which is a designated Radioactive Materials Management Area (RMMA) (IT March 1994). For this reason, composite soil samples were collected from ER Site 146 and were analyzed for isotopic uranium. Potential beryllium surface contamination resulting from explosives experiments performed at the Building 9920 Firing Site, which is about 140 feet west of the building, is not included as part of OU 1295 assessment activities for ER Site 146 (SNL/NM March 1993). All potential surface contamination from this explosive testing is being investigated as part of the OU 1335 characterization program for ER Site 85.

3. Evaluation of Relevant Evidence

3.1 Unit Characteristics

There are no safeguards inherent in the drain system from Building 9920 or in facility operations that could have prevented past releases to the environment.

3.2 Operating Practices

As discussed in Section 2.3, the occasional release of photoprocessing wastes to the Building 9920 drywell was standard procedure. Hazardous wastes were not managed or contained at ER Site 146.

3.3 Presence or Absence of Visual Evidence

No visible evidence of soil discoloration, staining, or odors indicating residual contamination were observed when the drywell was located and partially uncovered with the backhoe, and soil samples were collected adjacent to the unit in January of 1995 (SNL/NM January 1995).

3.4 Results of Previous Sampling/Surveys

A surface radiological survey conducted by RUST Geotech Inc. at ER Sites 14 and 85 in March 1994 included the area around Building 9920, and did not detect any point or aerial anomalies above background levels within the confines of ER Site 146 (RUST December 1994).

A brief geophysical survey using a magnetometer was performed at the site in March 1994 to help locate metal parts of the drywell, if any. No attempt was made to use geophysical techniques to identify areas with high moisture content, since discharges of significant volumes of effluent did not occur at this site. The results of the magnetometer survey were inconclusive, most likely because of the abundance of buried utility cables in the immediate area of the drywell. Therefore, the geophysical survey results were not useful in identifying the location of the drywell.

The passive soil-gas survey conducted at the site in July 1994 utilized PETREX sampling tubes to identify any releases of volatile organic compounds (VOCs) and semivolatile organic compound (SVOCs) to the soil around the drywell (SNL/NM July 1994). The PETREX tube soil-gas survey is a semiquantitative screening procedure that can be used to identify many VOCs and SVOCs, and can be used to guide VOC and SVOC site investigations. The advantages of this soil-gas sampling methodology are that large areas can be surveyed at relatively low cost, the technique is highly sensitive to organic vapors, and the result produces a measure of soil-vapor chemistry integrated over a two- to three-week period rather than at one point in time. Each PETREX soil-gas sampler consists of two activated charcoal-coated wires housed in a reusable glass test tube container. At each sampling location, sample tubes are buried in an upside down position so that the mouth of the sampler is about 1 foot below grade. Samplers are left in place for a two- to three-week period, and are then removed from the ground and sent to the manufacturer, Northeast Research Institute (NERI), for analysis using Thermal Desorption-Gas Chromatography/ Mass Spectrometry. The analytical laboratory reports all sample results in terms of "ion counts" instead of concentrations, and identifies those samples that contain compounds above the PETREX technique detection limits. NERI considers a "hit" for individual compounds (such as perchloroethene [PCE] or trichloroethene [TCE]) to be greater than 100,000 ion counts, and

200,000 ion counts for mixtures of compounds (BTEX compounds or aliphatics, for example) (NERI 1994). No VOCs or SVOCs were found in detectable quantities in PETREX tubes placed at this site. The analytical results of the passive soil-gas survey at Site 146 are summarized in Table A.1 of Appendix A.

In January 1995 a backhoe was used to locate and partially excavate the drywell to determine the exact location of the end of the drain pipe from Building 9920. The drywell was found to consist of a rectangular pit 6 feet long by 6 feet wide excavated in native material, and was filled with 2-inch aggregate from about 1 foot below grade down to the estimated bottom of the drywell at 4 feet below grade. No concrete or metal liner enclosing the gravel was found. The actual bottom of the drywell was not determined by excavating because of the abundance of buried utilities at this location. The end of the Building 9920 drainline was found to be positioned 1.3 feet into the north side of the drywell gravel. The drainline itself consists of a 4-inch-diameter cast iron pipe buried about 18 inches below grade. No visual or olfactory evidence of contamination was noted in soils excavated from immediately around the gravel-filled pit (SNL/NM January 1995a). The photograph in Figure 3 shows the drywell excavating operation.

3.5 Assessment of Gaps in Information

While the history of past releases at the site is incomplete, analytical data from confirmatory soil samples collected in January 1995 (discussed below) are sufficient to determine whether releases of COCs occurred at the site.

3.6 Confirmatory Sampling

Although the likelihood of hazardous waste releases at ER Site 146 was considered low, confirmatory soil sampling was conducted in January 1995 immediately adjacent to the drywell to determine whether COCs above background or detectable levels were released by the drywell to the environment at this site. The confirmatory soil sampling program was performed in accordance with the rationale and procedures described in the Septic Tank and Drainfields (ADS-1295) RCRA Facility Investigation (RFI) Work Plan (SNL/NM March 1993), and addenda to the RFI Work Plan developed during the OU 1295 project approval process (IT March 1994 and SNL/NM November 1994).

A summary of the types of samples, number of sample locations, sample depths and analytical requirements for confirmatory soil samples collected at this site is presented in Table 1.

Soil samples were collected from one boring on either side of the drywell. The boreholes were located approximately 2 feet away from the edge of opposite sides of the gravel-filled drywell pit, and are shown on Figure 2. Two depth intervals were sampled in each borehole, the first starting at the estimated bottom of the drywell (4 feet below grade),

Locating the ER Site 146 Drywell with a backhoe.
(View looking north, Building 9920 in background.)

Figure 3. ER Site 146: Photograph Showing the Drywell Excavating Operation

Table 1
ER Site 146: Confirmatory Sampling Summary Table

ER Site Number and Unit	Analytical Parameters	Number of Sample Locns.	Top of Splg. Interval(s) at Each Boring Location	Total Number of Invest. Samples	Total Number of Duplicate Samples	Date(s) Samples Collected
146 Drywell (bottom of drywell estimated to be 4 feet below grade)	VOCs	2	4', 14'	4	1	1/11/95: 2 of 2 shallow, 2 of 2 deep intervals, 1 set duplicate samples
	SVOCs	2	4', 14'	4	1	
	RCRA metals+Cr6	2	4', 14'	4	1	
	HE (TNT screen)	2	4', 14'	4	1	
	Cyanide	2	4', 14'	4	1	
	Iso. uranium compos.	2	4', 14'	2	1	
	Gamma spec. compos.	2	4', 14'	2		
	Tritium composite	2	4', 14'	2		

Notes

VOC = Volatile organic compounds
SVOC = Semivolatile organic compounds
RCRA = Resource Conservation and Recovery Act
Cr = Chromium
HE = High explosives
TNT = Trinitrotoluene

and the second starting at 10 feet below the top of the first sampling interval (14 feet below grade) (SNL/NM January 1995b). One set of duplicate samples was collected from the shallow sampling interval in borehole S146-DW1-2 (Figure 2).

The Geoprobe sampling system was used to collect subsurface soil samples at this site. This equipment was used for most of the OU 1295 soil sampling work completed from October 1994 through January 1995. The Geoprobe sampling tool was fitted with a butyl acetate (BA) sampling sleeve and was then hydraulically driven to the top of the designated sampling depth. The sampling tool was opened, and driven an additional 2 feet in order to fill the 2-foot long by approximately 1.25-inch diameter BA sleeve. The sampling tool and soil-filled sleeve were then retrieved from the borehole. In order to minimize the potential for loss of volatile compounds (if present), the soil to be analyzed for VOCs was not emptied from the BA sleeve into another sample container. The filled BA sleeve was removed from the sampling tool, and the top seven inches were cut off. Both ends of the seven-inch section of filled sleeve were immediately capped with a teflon membrane and rubber end cap, sealed with tape, and placed in an ice-filled cooler at the site. The soil in this section of sleeve was submitted for a VOC analysis.

Soil from the remainder of the sleeve was then emptied into a decontaminated mixing bowl. Following this, one or two more 2-foot sampling runs were completed at each interval in order to recover enough soil to satisfy sample volume requirements for the interval. Soil recovered from these additional runs was also emptied into the mixing bowl, and blended with soil from the first sampling run. The soil was then transferred from the bowl into sample containers using a decontaminated plastic spatula, and was analyzed for SVOCs, RCRA metals, hexavalent chromium, and cyanide by laboratory analysis, and trinitrotoluene (TNT) compounds using a field screening immunoassay technique. Routine SNL/NM chain-of-custody and sample documentation procedures were employed, and samples were shipped to the laboratory by an overnight delivery service.

To determine if radionuclides were present in soils adjacent to the drywell at this site, shallow and deep interval composite soil samples were collected from the two borings, analyzed by a commercial laboratory for isotopic uranium and tritium, and screened for other radionuclides using SNL/NM in-house gamma spectroscopy.

Quality assurance/quality control (QA/QC) samples collected during this sampling effort consisted of one set of duplicate soil samples analyzed for the same consitituents as the field samples, except for tritium and the gamma spectroscopy radionuclides. One set of aqueous equipment rinsate samples were also collected and analyzed for the same nonradiologic chemical constituents as the field samples; 3.7 parts per billion of methylene chloride was the only contaminant detected in the rinsate samples. Also, a soil trip blank sample was included with the shipment of ER Site 146 soil samples to the laboratory and was analyzed for VOCs only. Acetone, 2-hexanone, methyl ethyl ketone (MEK), methylene chloride, toluene, and xylenes were detected in this soil trip blank by the laboratory. These common laboratory contaminants were either not detected, or were found in generally lower concentrations in the site soil samples compared to the trip blank. Soil used for this trip blank was prepared by heating the material, and then transferring it immediately to the sample container. This heating process drives off any residual organic compounds (if present), and soil moisture that may be contained in the material. Apparently when the soil trip blank container was opened at the laboratory, it immediately adsorbed both moisture and VOCs present in the laboratory atmosphere, and therefore became contaminated.

A summary of all constituents detected by commercial laboratory analyses in these confirmatory and associated QA/QC samples is presented in Tables 2, 3, and 4. Results of the SNL/NM in-house gamma spectroscopy composite soil sample screening for other radionuclides are presented in Tables A.2 and A.3 of Appendix A. Complete soil sample analytical data packages are archived in the Environmental Operations Records Center and are readily available for review and verification (SNL/NM January 1995c).

3.7 Rationale for Pursuing a Confirmatory Sampling NFA Decision

The passive soil-gas survey did not indicate any anomalies or areas of VOC or SVOC contamination in soils at ER Site 146.

Confirmatory soil sampling at the point of discharge around the drywell did not identify any residual COCs that indicate past releases from this unit that could pose a threat to human health or the environment. The four VOC compounds (acetone, MEK, methylene chloride, NOTE: CYANIDE UNITS SHOULD BE mg/kg, NOT ug/kg. [illegible] 2/28/05

Table 2

ER Site 146
Summary of Organic and Other Constituents Detected in Confirmatory Soil Samples Collected Around the Drywell

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	VOCs Method 8240: Acetone	2-Hexanone	MEK	Meth. Chloride	MIBK	Toluene	Total Xylenes	SVOCs, Method 8270	Cyanide, Method 9010/9012	TNT Screen, Colorimetric method based on EPA 8515	Units
018909-1,2	Soil	Field	1/11/95	S146-DW1-1	4	8.8 J	ND	4.7 J	1.7 J	ND	ND	ND	ND	ND	ND	ug/kg
018910-1,2	Soil	Field	1/11/95	S146-DW1-1	14	9.5 J	ND	ND	1.4 J	ND	ND	ND	ND	ND	ND	ug/kg
018911-1,2	Soil	Field	1/11/95	S146-DW1-2	4	13	ND	ND	2 J	1.3 J	ND	ND	ND	ND	ND	ug/kg
018912-1,2	Soil	Dupl.	1/11/95	S146-DWD1-2	4	12	ND	ND	2.2 J	1.3 J	ND	ND	ND	ND	ND	ug/kg
018913-1,2	Soil	Field	1/11/95	S146-DW1-2	14	13	ND	ND	1.1 J	ND	ND	ND	ND	ND	ND	ug/kg
018914-1	Water	EB	1/11/95	Site 146	NA	ND	ND	ND	3.7 B,J	ND	ND	ND	ND	ND	NS	ug/L
021453-1	Soil	TB	1/12/95	Site 146	NA	47	1.6 J	19	4.3 J	ND	2.3 J	1.4 J	NS	NS	NS	ug/kg
Laboratory Detection Limit For Soil						10	10	10	5	10	5	5	330, 1600	0.5	1000	ug/kg
Proposed Subpart S Action Level For Soil						8E+06	None	5E+07	9E+04	None	2E+07	2E+08	NA	2E+06	4E+04	ug/kg

Notes

B = Compound detected in associated blank sample
Dupl. = Duplicate soil sample
EB = Equipment rinsate blank
fbgs = Feet below ground surface
J = Result is detected below the reporting limit or is an estimated concentration.
MEK = Methyl ethyl ketone
Meth. Chloride = Methylene chloride
SVOC = Semivolatile organic compounds
VOC = Volatile organic compounds
MIBK = Methyl isobutyl ketone
NA = Not applicable
ND = Not detected
None = No Subpart S action level proposed for this constituent
NS = No sample
TB = Trip Blank
TNT = Trinotrotoluene
ug/kg = Micrograms per kilogram
ug/L = Micrograms per liter

Table 3

ER Site 146

Summary of RCRA Metals and Hexavalent Chromium Analytical Results for Confirmatory Soil Samples Collected Around the Drywell

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	RCRA Metals, Methods 6010 and 7471								Other Metals:	Units
						As	Ba	Cd	Cr, total	Pb	Hg	Se	Ag	Cr^{6+} Method 7196	
018909-2	Soil	Field	1/11/95	S146-DW1-1	4	2.8	116	ND	4.7	3.6 J	ND	ND	ND	ND	mg/kg
018910-2	Soil	Field	1/11/95	S146-DW1-1	14	2.4	110	ND	6.8	4.5 J	ND	ND	ND	ND	mg/kg
018911-2	Soil	Field	1/11/95	S146-DW1-2	4	2.7	185	ND	4.6	4.4 J	ND	ND	ND	ND	mg/kg
018912-2	Soil	Dupl.	1/11/95	S146-DWD1-2	4	2.2	116	ND	5.1	3.5 J	ND	ND	ND	ND	mg/kg
018913-2	Soil	Field	1/11/95	S146-DW1-2	14	2.2	75.2	ND	4.7	4.8 J	ND	ND	ND	ND	mg/kg
018914-3	Water	EB	1/11/95	Site 146	NA	ND	ND	ND	ND	ND	ND	ND	ND	NS	mg/L
Laboratory Detection Limit For Soil						1	1	0.5	1	5	0.1	0.5	1	0.05	mg/kg
SNL/NM Soil Background Range *						U	0.13-730	0.1-8.5	0.01-58.1	1-110	U	U	0.05-10	ND	mg/kg
SNL/NM Soil Background UTL, 95th %tile *						U	407.9	3.51	22.9	15	U	U	4	ND	mg/kg
Proposed Subpart S Action Level For Soil						20	6,000	80	80,000**	400***	20	400	400	400**	mg/kg

Notes

As = Arsenic
Ba = Barium
Cd = Cadmium
Cr = Chromium
Pb = Lead
Hg = Mercury
Se = Selenium
Ag = Silver
Dupl. = Duplicate soil sample
EB = Equipment rinsate blank
fbgs = Feet below ground surface
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
J = Result is detected below the reporting limit or is an estimated concentration.
NA = Not applicable
ND = Not detected
NS = No sample
U = Undefined for SNL/NM soils.
UTL = Upper Tolerance Limit
* IT Corp., October 1994
** 80,000 mg/kg is for Cr^{3+} only. For Cr^{6+}, proposed Subpart S action level is 400 mg/kg.
*** No proposed Subpart S action level for lead in soil, 400 ppm is EPA proposed action level (EPA, July 1994)

Table 4

ER Site 146
Summary of Isotopic Uranium and Tritium Analyses of Composite Confirmatory Soil Samples Collected From Around the Drywell

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	Analytical Method	Compound Name	Results	+- 2 Sigma Uncertainty	Detection Limit	Background UTL Activity *	Units
018909-5	Soil	Compos.	1/11/95	S146-DW1-1/2	4	HASL-300	Uranium-238	0.66	0.13	0.036	1.1	pCi/g
018909-5	Soil	Compos.	1/11/95	S146-DW1-1/2	4	HASL-300	Uranium-235	0.018 J	0.021	0.031	0.168	pCi/g
018909-5	Soil	Compos.	1/11/95	S146-DW1-1/2	4	HASL-300	Uranium-233/234	0.79	0.14	0.026	1	pCi/g
018912-5	Soil	Dupl. Comp.	1/11/95	S146-DWD1-1/2	4	HASL-300	Uranium-238	0.7	0.13	0.011	1.1	pCi/g
018912-5	Soil	Dupl. Comp.	1/11/95	S146-DWD1-1/2	4	HASL-300	Uranium-235	0.023 J	0.022	0.025	0.168	pCi/g
018912-5	Soil	Dupl. Comp.	1/11/95	S146-DWD1-1/2	4	HASL-300	Uranium-233/234	0.77	0.14	0.03	1	pCi/g
018910-5	Soil	Compos.	1/11/95	S146-DW1-1/2	14	HASL-300	Uranium-238	0.75	0.16	0.062	1.1	pCi/g
018910-5	Soil	Compos.	1/11/95	S146-DW1-1/2	14	HASL-300	Uranium-235	0.042 J	0.039	0.054	0.168	pCi/g
018910-5	Soil	Compos.	1/11/95	S146-DW1-1/2	14	HASL-300	Uranium-233/234	0.85	0.18	0.11	1	pCi/g
018914-6	Water	EB	1/11/95	Site 146	NA	HASL-300	Uranium-238	0.055 J	0.051	0.068	NA	pCi/L
018914-6	Water	EB	1/11/95	Site 146	NA	HASL-300	Uranium-235	0.034 J	0.041	0.059	NA	pCi/L
018914-6	Water	EB	1/11/95	Site 146	NA	HASL-300	Uranium-233/234	0.11	0.073	0.087	NA	pCi/L
018909-4	Soil	Compos.	1/11/95	S146-DW1-1/2	4	EPA 600 906.0	Tritium	150 J	170	280	U	pCi/L
018910-4	Soil	Compos.	1/11/95	S146-DW1-1/2	14	EPA 600 906.0	Tritium	250	150	250	U	pCi/L

Notes

Compos. = Composite sample
Dupl. Comp.= Duplicate composite sample
EB = Equipment rinsate blank
fbgs = Feet below ground surface
J = Result reported is an estimated activity level below the method practical quantitation limit.
NA = Not applicable
ND = Not detected
pCi/g = Picocuries per gram
pCi/L = Picocuries per liter
U = Undefined for SNL/NM soils
UTL = Upper Tolerance Limit
* IT Corp., October 1994

and methyl isobutyl ketone [MIBK]) that were detected in the drywell soil samples were for the most part identified at below-reporting-limit concentrations, and are common laboratory contaminants (Table 2). As shown in Table 2, no SVOC constituents, cyanide, or TNT compounds were identified in these soil samples. Soil sample analytical results also indicate that, except for arsenic, the nine heavy metals that were targeted in the Site 146 soil investigation were either not detected, or were detected in concentrations below the background UTL concentrations of metals presented in the draft SNL/NM study of naturally-occurring constituents (IT October 1994). Arsenic concentrations were therefore compared to, and were found to be much lower than, the Subpart S soil action level for that metal (Table 3). In addition, isotopic uranium activity levels detected in the three composite soil samples were less than corresponding background UTL activity levels for those nuclides (Table 4). As shown in Table 4, the highest tritium activity level detected in sample soil moisture was at the detection limit for this constituent, and indicates that tritium contamination is not present at this site. Finally, the gamma spectroscopy semiqualitative screening detected very low activity levels of a few radionuclides, and did not indicate the presence of contamination from other radionuclides in soils at this site (Tables A.2 and A.3 of Appendix A).

4. Conclusion

Sample analytical results generated from this confirmatory sampling investigation show that detectable or significant concentrations of COCs are not present in soils at ER Site 146, and that additional investigations are unwarranted and unnecessary.

Based on archival information and chemical and radiological analytical results of soil samples collected at the likely points of release of effluent from the Building 9920 drywell, SNL/NM has demonstrated that hazardous waste or COCs have not been released from this SWMU into the environment (Criterion C of Section 1.2), and the site does not pose a threat to human health or the environment. Therefore, ER Site 146 is recommended for an NFA determination.

5. References

5.1 ER Site 146 References

U.S. Atomic Energy Commission, Albuquerque Operations Office (AEC), June 4, 1958. Mechanical Engineering Drawing Number 87558 Showing the Building 9920 Sink, Lavatory, and Drywell.

Sandia National Laboratories/New Mexico (SNL/NM), July 1994. Field Log #0080, Pp. 54 and 56, 7/12/94 and 8/4/94, for ER Site 146 passive soil-gas survey notes, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), January 1995a. Field Log #0102, Pp. 9-10, 1/9/95, Field notes for ER Site 146 drywell excavating and mapping, OU 1295, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), January 1995b. Field Log #0096, Pp. 187-189, 1/11/95, Field notes for ER Site 146 soil sampling, OU 1295, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), January 1995c. Environmental Operations Records Center, Record Number ER/1295-146/DAT, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), June 1995. Field Log #0102, P. 51, 6/1/95, Notes pertaining to conversations with SNL/NM personnel regarding removal of sinks from Building 9920, Albuquerque, New Mexico.

5.2 Other References

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

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

IT Corporation (IT), October 1994, draft. "Background Concentrations of Constituents of Concern to the Sandia National Laboratories/New Mexico Environmental Restoration Project," IT Corporation, Albuquerque, New Mexico.

Northeast Research Institute (NERI), 1994. "PETREX Soil-Gas Survey Results Conducted at Various Sites of the Septic Tanks and Drainfields Operating Units, Sandia National Laboratories," Albuquerque, New Mexico, Northeast Research Institute, Lakewood, Colorado.

RUST Geotech, Inc. (RUST), December 1994. "Final Report, Surface Gamma Radiation Surveys for Sandia National Laboratories/New Mexico Environmental Restoration Project," RUST Geotech, Inc., Grand Junction, Colorado.

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

Sandia National Laboratories/New Mexico (SNL/NM), November 1994. "Comment Responses to USEPA Notice of Deficiency November 1994", Sandia National Laboratories, Albuquerque, New Mexico.

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

Sandia National Laboratories/New Mexico (SNL/NM), March 1995. "Groundwater Protection Program Calendar Year 1994 Annual Groundwater Monitoring Report Sandia National Laboratories/New Mexico", Sandia National Laboratories, Groundwater Protection Program, Environmental Operations Center, Organization 7500, Albuquerque, New Mexico.

U.S. Environmental Protection Agency (EPA), October 1986. "RCRA Facility Assessment Guidance," EPA/530-86-053, PB87-107769, Washington, D.C.

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

U.S. Environmental Protection Agency (EPA), July 1990. "Corrective Action for Solid Waste Management Units (SWMU) at Hazardous Waste Management Facilities, Proposed Rule," *Federal Register*, Vol. 55, No. 145, July 27, 1990, Washington, DC.

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

U.S. Environmental Protection Agency (EPA), August 1993. "Module IV of RCRA Permit No. NM 5890110518," EPA Region VI, issued to Sandia National Laboratories, Albuquerque, New Mexico.

APPENDIX A

OU 1295, Site 146

Results of Previous Sampling and Surveys

Table A.1

ER Site 146
Summary of 1994 PETREX Passive Soil-Gas Survey Results

Table 27
PETREX Relative Soil Gas Response Values
(in ion counts)
STD SITE 146

Sample	PCE	TCE	BTEX	Aliphatics
350	ND	ND	13181	1037
351	30792	ND	20481	10460
352	2710	ND	2419	1897
353	7791	ND	8493	1050
D-1352	1132	ND	6618	2914
* 354	ND	ND	ND	ND
* 355	ND	ND	ND	ND

PCE - Tetrachloroethene
Indicator Mass Peak(s) 164

TCE - Trichloroethene
Indicator Mass Peak(s) 130

BTEX - Benzene, toluene, Ethylbenzene/xylene(s)
Indicator Mass Peak(s) 78, 92, 106

Aliphatics - C4-C11 Cycloalkanes/Alkenes
Indicator Mass Peak(s) 56, 70, 84, 98, 112, 126, 140, 154

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

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

Table A.2

ER Site 146
Gamma Spectroscopy Screening Results for Drywell
Shallow Interval Composite Soil Sample

```
*************************************************************************
*                  Sandia National Laboratories                         *
*   Radiation Protection Sample Diagnostics Program [881 Laboratory]    *
*                      1-12-95  8:02:06 PM                              *
*************************************************************************
*
* Analyzed by:            1/13/95      Reviewed by:            1/13/95
*************************************************************************
```

Customer : B.GALLOWAY/McLAUGHLIN(7582/SMO)
Customer Sample ID : 018909-03
Lab Sample ID : 50003507

Sample Description : MARINELLI SOLID SAMPLE
Sample Type : Solid
Sample Geometry : 1SMAR
Sample Quantity : 636.000 Gram
Sample Date/Time : 1-11-95 3:30:00 PM
Acquire Start Date : 1-12-95 7:25:33 PM
Detector Name : LAB01
Elapsed Live Time : 1800 seconds
Elapsed Real Time : 1801 seconds

Comments:

****

Nuclide	Activity (pCi/Gram)	2S Error	MDA
U-238	Not Detected	--------	2.32
TH-234	1.10	5.46E-01	5.47E-01
U-234	Not Detected	--------	6.34E+01
RA-226	6.77E-01	3.30E-01	5.36E-01
PB-214	4.22E-01	1.23E-01	5.58E-02
BI-214	4.93E-01	1.03E-01	6.52E-02
PB-210	Not Detected	--------	6.01E+02
TH-232	5.25E-01	1.89E-01	1.65E-01
RA-228	4.73E-01	1.89E-01	2.31E-01
AC-228	Not Detected	--------	3.41E-01
TH-228	4.62E-01	2.98E-01	5.36E-01
RA-224	7.90E-01	4.23E-01	4.46E-01
PB-212	4.96E-01	1.58E-01	4.14E-02
BI-212	5.90E-01	2.92E-01	4.62E-01
TL-208	5.48E-01	1.26E-01	8.69E-02
U-235	Not Detected	--------	3.06E-01
TH-231	Not Detected	--------	8.33E-01
PA-231	Not Detected	--------	1.44
AC-227	Not Detected	--------	2.33
TH-227	Not Detected	--------	4.40E-01
RA-223	Not Detected	--------	2.69E-01
RN-219	Not Detected	--------	3.54E-01
PB-211	Not Detected	--------	8.80E-01
TL-207	Not Detected	--------	2.41E+01
AM-241	Not Detected	--------	3.44E-01
PU-239	Not Detected	--------	3.79E+02
NP-237	Not Detected	--------	2.65E-01
PA-233	Not Detected	--------	7.80E-02
TH-229	Not Detected	--------	3.81E-01

Table A.2, concluded

ER Site 146
Gamma Spectroscopy Screening Results for Drywell
Shallow Interval Composite Soil Sample

[Summary Report] - Sample ID: 50003507

Nuclide	Activity (pCi/Gram)	2S Error	MDA
AG-110m	Not Detected	--------	5.62E-02
AR-41	Not Detected	--------	3.53E+03
BA-133	Not Detected	--------	7.46E-02
BA-140	Not Detected	--------	1.69E-01
~~CD-109~~	~~5.46E-01~~	~~5.46E-01~~	~~1.10~~ Not detected [illegible]
CD-115	Not Detected	--------	1.22E-01
CE-139	Not Detected	--------	3.83E-02
CE-141	Not Detected	--------	6.94E-02
CE-144	Not Detected	--------	3.07E-01
CO-56	Not Detected	--------	6.83E-02
CO-57	Not Detected	--------	4.45E-02
CO-58	Not Detected	--------	5.55E-02
CO-60	Not Detected	--------	7.83E-02
CR-51	Not Detected	--------	3.15E-01
CS-134	Not Detected	--------	6.41E-02
CS-137	Not Detected	--------	6.50E-02
CU-64	Not Detected	--------	7.24E+01
EU-152	Not Detected	--------	4.45E-01
EU-154	Not Detected	--------	3.00E-01
EU-155	Not Detected	--------	2.06E-01
FE-59	Not Detected	--------	1.34E-01
GD-153	Not Detected	--------	1.41E-01
HG-203	Not Detected	--------	3.81E-02
I-131	Not Detected	--------	4.27E-02
IN-115m	Not Detected	--------	6.60
IR-192	Not Detected	--------	3.67E-02
K-40	1.45E+01	2.25	4.25E-01
LA-140	Not Detected	--------	1.27E-01
MN-54	Not Detected	--------	5.93E-02
MN-56	Not Detected	--------	1.33E+02
MO-99	Not Detected	--------	6.08E-01
NA-22	Not Detected	--------	8.63E-02
NA-24	Not Detected	--------	2.70E-01
NB-95	Not Detected	--------	2.48E-01
ND-147	Not Detected	--------	3.23E-01
NI-57	Not Detected	--------	1.60E-01
BE-7	Not Detected	--------	3.60E-01
RU-103	Not Detected	--------	4.57E-02
RU-106	Not Detected	--------	4.69E-01
SB-122	Not Detected	--------	8.53E-02
SB-124	Not Detected	--------	4.96E-02
SB-125	Not Detected	--------	1.29E-01
SC-46	Not Detected	--------	9.45E-02
SR-85	Not Detected	--------	5.60E-02
TA-182	Not Detected	--------	2.79E-01
TA-183	Not Detected	--------	3.47E-01
TE-132	Not Detected	--------	4.12E-02
TL-201	Not Detected	--------	1.95E-01
XE-133	Not Detected	--------	2.36E-01
Y-88	Not Detected	--------	7.75E-02
ZN-65	Not Detected	--------	1.80E-01
ZR-95	Not Detected	--------	1.08E-01

Table A.3

ER Site 146
Gamma Spectroscopy Screening Results for Drywell
Deep Interval Composite Soil Sample

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [881 Laboratory]
1-12-95 8:49:01 PM

Analyzed by: [signature] 1/13/95 Reviewed by: [signature] 1/13/95

Customer : B.GALLOWAY/McLAUGHLIN(7582/SMO)
Customer Sample ID : 018910-03
Lab Sample ID : 50003508

Sample Description : MARINELLI SOLID SAMPLE
Sample Type : Solid
Sample Geometry : 1SMAR
Sample Quantity : 702.000 Gram
Sample Date/Time : 1-11-95 4:00:00 PM
Acquire Start Date : 1-12-95 8:12:27 PM
Detector Name : LAB01
Elapsed Live Time : 1800 seconds
Elapsed Real Time : 1801 seconds

Comments:

Nuclide	Activity (pCi/Gram)	2S Error	MDA
U-238	Not Detected	--------	2.20
TH-234	8.79E-01	4.40E-01	5.59E-01
U-234	Not Detected	--------	5.92E+01
RA-226	1.10	4.07E-01	5.23E-01
PB-214	5.38E-01	1.52E-01	5.08E-02
BI-214	5.04E-01	1.02E-01	6.03E-02
PB-210	Not Detected	--------	5.46E+02
TH-232	4.95E-01	1.79E-01	1.53E-01
RA-228	6.86E-01	2.06E-01	1.97E-01
AC-228	Not Detected	--------	3.43E-01
TH-228	4.48E-01	2.89E-01	5.26E-01
RA-224	5.50E-01	2.86E-01	4.46E-01
PB-212	5.08E-01	1.61E-01	4.15E-02
BI-212	Not Detected	--------	8.81E-01
TL-208	5.10E-01	1.18E-01	8.27E-02
U-235	Not Detected	--------	3.05E-01
TH-231	Not Detected	--------	7.69E-01
PA-231	Not Detected	--------	1.38
AC-227	Not Detected	--------	2.23
TH-227	Not Detected	--------	4.36E-01
RA-223	Not Detected	--------	2.54E-01
RN-219	Not Detected	--------	3.23E-01
PB-211	Not Detected	--------	8.02E-01
TL-207	Not Detected	--------	2.40E+01
AM-241	Not Detected	--------	3.19E-01
PU-239	Not Detected	--------	3.64E+02
NP-237	Not Detected	--------	2.60E-01
PA-233	Not Detected	--------	7.24E-02
TH-229	Not Detected	--------	3.97E-01

Table A.3, concluded

ER Site 146
Gamma Spectroscopy Screening Results for Drywell
Deep Interval Composite Soil Sample

[Summary Report] - Sample ID: 50003508

Nuclide	Activity (pCi/Gram)	2S Error	MDA
AG-110m	Not Detected	--------	4.92E-02
AR-41	Not Detected	--------	3.90E+03
BA-133	Not Detected	--------	7.62E-02
BA-140	Not Detected	--------	1.62E-01
CD-109	Not Detected	--------	8.94E-01
CD-115	Not Detected	--------	1.22E-01
CE-139	Not Detected	--------	3.78E-02
CE-141	Not Detected	--------	6.96E-02
CE-144	Not Detected	--------	3.08E-01
~~CO-56~~	~~6.37E-03~~	~~1.95E-02~~	~~3.90E-02~~ not detected 1/17/95
CO-57	Not Detected	--------	4.28E-02
CO-58	Not Detected	--------	5.25E-02
CO-60	Not Detected	--------	6.92E-02
CR-51	Not Detected	--------	3.10E-01
CS-134	Not Detected	--------	5.70E-02
CS-137	Not Detected	--------	5.92E-02
CU-64	Not Detected	--------	7.38E+01
EU-152	Not Detected	--------	4.12E-01
EU-154	Not Detected	--------	2.74E-01
EU-155	Not Detected	--------	1.95E-01
FE-59	Not Detected	--------	1.28E-01
GD-153	Not Detected	--------	1.45E-01
HG-203	Not Detected	--------	3.51E-02
I-131	Not Detected	--------	4.16E-02
IN-115m	Not Detected	--------	6.86
IR-192	Not Detected	--------	3.48E-02
K-40	1.65E+01	2.49	3.95E-01
LA-140	Not Detected	--------	1.17E-01
MN-54	Not Detected	--------	5.82E-02
MN-56	Not Detected	--------	1.36E+02
MO-99	Not Detected	--------	5.73E-01
NA-22	Not Detected	--------	7.71E-02
NA-24	Not Detected	--------	2.53E-01
NB-95	Not Detected	--------	2.48E-01
ND-147	Not Detected	--------	3.12E-01
NI-57	Not Detected	--------	1.61E-01
BE-7	Not Detected	--------	3.37E-01
RU-103	Not Detected	--------	4.00E-02
RU-106	Not Detected	--------	4.50E-01
SB-122	Not Detected	--------	8.56E-02
SB-124	Not Detected	--------	4.57E-02
SB-125	Not Detected	--------	1.13E-01
SC-46	Not Detected	--------	8.84E-02
SR-85	Not Detected	--------	5.55E-02
TA-182	Not Detected	--------	2.62E-01
TA-183	Not Detected	--------	3.23E-01
TE-132	Not Detected	--------	4.20E-02
TL-201	Not Detected	--------	1.84E-01
XE-133	Not Detected	--------	2.21E-01
Y-88	Not Detected	--------	7.09E-02
ZN-65	Not Detected	--------	1.71E-01
ZR-95	Not Detected	--------	1.00E-01

NOD

ER/REQ/1295/1332/1333

Department of Energy
Field Office, Albuquerque
Kirtland Area Office
P.O. Box 5400
Albuquerque New Mexico 87185-5400

JUN

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Benito Garcia, Bureau Chief
New Mexico Environment Department
Hazardous and Radioactive Materials Bureau
2044 Galisteo Street
P.O. Box 26110
Santa Fe, NM 87505-2100

Dear Mr. Garcia:

Enclosed are two copies of the Department of Energy (DOE)/ Sandia National Laboratories/New Mexico (SNL/NM) response to the NMED Notice of Deficiency (NOD) for the third submission of No Further Action (NFA) proposals. NOD responses are provided for the following environmental restoration sites:

OU 1295 - Septic Tanks and Drain Fields
- Site 142 - Building 9970 Septic System
- Site 143 - Building 9972 Septic System
- Site 146 - Building 9920 Drain System
- Site 148 - Building 9927 Septic System

OU 1332 - Foothills Test Area
- Site 15 - Trash Pits
- Site 27 - Building 9820 Animal Disposal Pit
- Site 28-2 - Mine Shaft
- Site 28-10 - Mine Shaft
- Site 67 - Frustration Site

OU 1333 - Canyons Test Area
- Site 59 - Pendulum Site
- Site 63A - Balloon Test Area
- Site 63B - Balloon Test Area
- Site 64 - Gun Site
- Site 92 - Pressure Vessel Test Site

If you have any questions, please contact John Gould at (505) 845-6089, or Mark Jackson at (505) 845-6288.

Sincerely,

George K. Laskar

Michael J. Zamorski
for Acting Area Manager

Enclosures

Benito Garcia

cc w/enclosure:
T. Trujillo, AL, ERD
W. Cox, SNL, MS 1147
J. Parker, NMED-OB
R. Kennett, NMED-OB
D. Neleigh, EPA, Region 6 (2 copies via certified mail)

cc w/o enclosure:
B. Oms, KAO-OB
B. Galloway, SNL, MS 1147
C. Byrd, SNL, MS 1148
S. Young, SNL, MS 1147
S. Dinwiddie, NMED
T. Davis, NMED
S. Kruse, NMED

Sandia National Laboratories
Albuquerque, New Mexico
June 1997

Environmental Restoration Project
Responses to NMED Technical Comments
on No Further Action Proposals
Dated August 1995

INTRODUCTION

This document responds to comments received in a letter from the State of New Mexico Environment Department to the U.S. Department of Energy (Zamorski, April 28, 1997) documenting the review of 14 No Further Action (NFA) Proposals submitted in August 1995.

This response document is organized in sections by operable unit (OU) and subdivided in numerical order by site number. Each OU section provides NMED comments repeated in **bold** by comment number and by site number in the same order as provided in the call for response to comments. The DOE/SNL response is written in normal font style on a separate line under "<u>Response</u>". Responses to general technical comments begin on page 3 and responses to site-specific technical comments begin on page 5. Additional supporting information for the general and site-specific comments is included as figures and tables within each comment and as attachments within each section, as appropriate. When referenced in the site-specific NOD responses, risk assessment analyses will be submitted to NMED at a later date.

TABLE OF CONTENTS

RESPONSES TO NMED COMMENTS ON NO FURTHER ACTION PROPOSALS DATED AUGUST 1995

GENERAL COMMENTS

1. **Final, rather than draft, site maps should be provided for each unit proposed for No Further Action (NFA). (Needed for adequate review)**

   Response: Final site maps for OUs 1295, 1332, and 1333 are provided in Attachment A of this section. In addition, all future NFA submittals will be submitted with final rather than draft site maps.

2. **Interviews alone are not sufficient documentation to make an NFA determination. Site history and interviews can be used to guide an investigation or confirm other evidence, but are not sufficient by themselves. In the absence of any other supporting information, screening sampling should be conducted to further corroborate the interview and site history information. (Best Professional Judgment)**

   In most cases, an NFA proposal is not likely to be approved unless it is based on some sampling and analysis of the medium/media of concern. (Best Professional Judgment)

   Response: DOE/SNL believe that, where the actual persons involved with the operation, at the time of the suspected release, provide first-hand, eyewitness accounts, they are reliable sources of information. In most cases, a combination of information is used to determine whether a release has occurred, including sampling. In some cases the suspect media has been removed, and therefore can no longer be sampled. In summary, each case must be judged individually. Where additional sampling is appropriate for those sites reviewed in the third round of NFAs, it is so stated under the site-by-site responses given below.

3. **Analytical results obtained at Environmental Restoration (ER) sites should be compared with sitewide background concentrations, when approved by the New Mexico Environment Department, to determine whether contamination has occurred. (Best Professional Judgment)**

Response: DOE/SNL are currently in the process of negotiating site-wide background concentrations with the New Mexico Environment Department (NMED), and expect that all values except those for OUs 1332, 1333, and 1334 to be approved. Upon final approval of the site-wide background study report, all OUs except for OUs 1332, 1333, and 1334 will compare analytical results to the background concentrations contained in the report. Additional background samples will be collected at OUs 1332, 1333, and 1334 upon mutual agreement with NMED of locations for such sampling.

4. **A sampling and analysis plan or RFI Work Plan should be submitted prior to the start of any sampling activities conducted as a result of this Notice of Deficiency. (Permit Condition J.1)**

Response: Where sampling is anticipated, a sampling and analysis plan is developed which is provided to the NMED. Meetings with the NMED Oversight Bureau are scheduled in order to review these sampling plans and make any changes in the technical approach that would benefit the investigation. These practices will continue. However, DOE/SNL may not have always provided the NMED Hazardous and Radioactive Material Bureau with such sampling plans, or an invitation to participate in pre-sampling discussions. If that has happened, it was an oversight for which DOE/SNL apologizes. DOE/SNL will make every effort in the future to be inclusive in the pre-sampling discussions with all appropriate elements of NMED.

5. **Any sources cited in NFA proposals should be documented and referenced. The source documents should be readily available to the public and to any reviewers. (Additional information needed for adequate review)**

Response: Sources cited in all current submissions of NFA proposals are documented and referenced. General ER Project documents (e.g., RFI Work Plans, RFI Reports, NFAs, the Program Implementation Plan, etc.) are available to the public and other reviewers at the DOE Public Reading Room located at the Library Building at Albuquerque Technical-Vocational Institute, Joseph M. Montoya Campus, at 4700 Morris Avenue, NE. DOE/KAO will continue its practice of simultaneously transmitting to NMED copies of all documents sent to the Public Reading Room. OU-specific archival references are located at the ER Project Records Center. The public and regulators can access information from the ER Project Records Center by verbal or written request to John Gould, DOE/KAO, at (505) 845-6089.

ATTACHMENT A

FINAL SITE MAPS FOR
OUs 1295, 1332, AND 1333

FINAL SITE MAPS FOR OU 1295

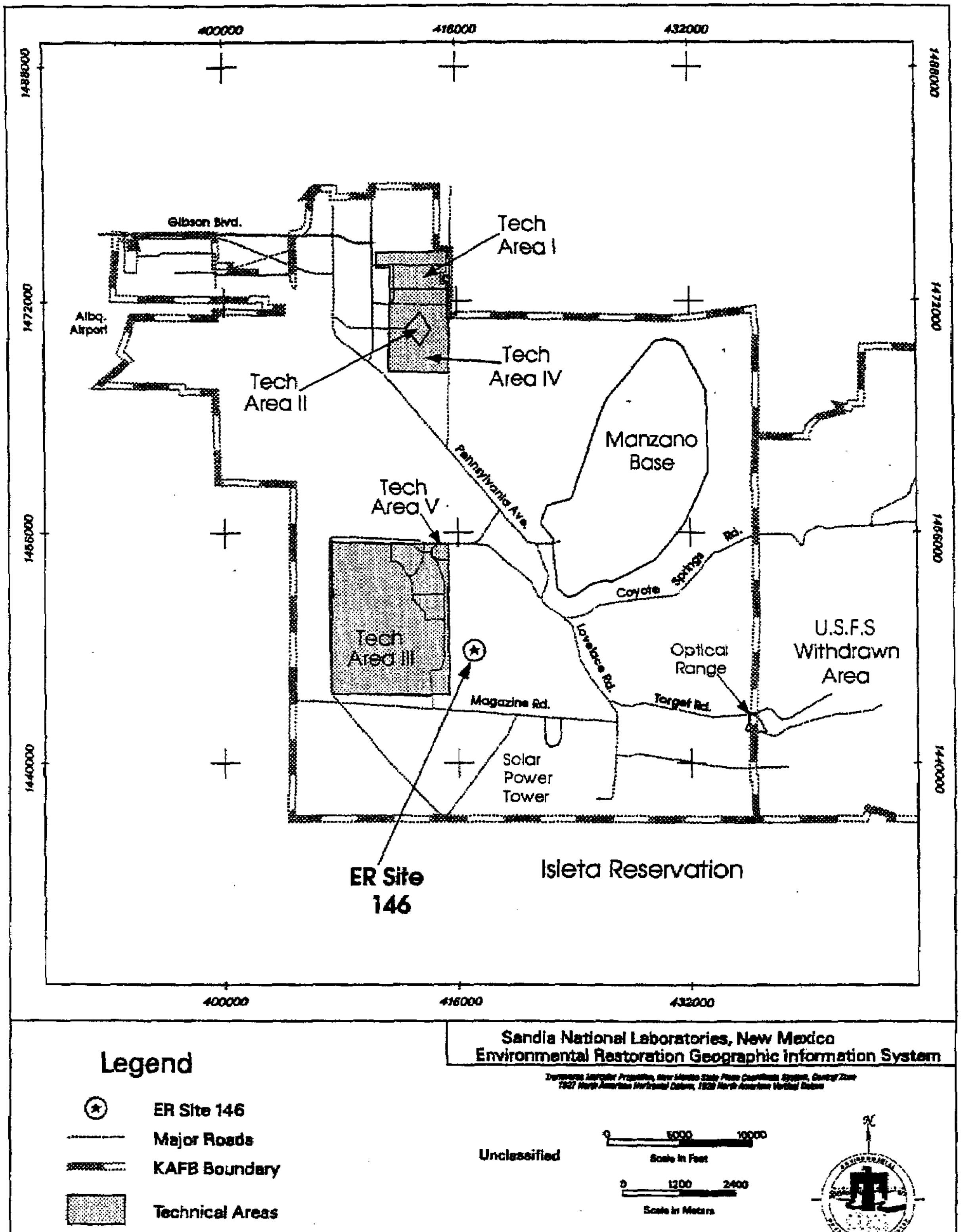

FIGURE 1
Location Map for ER Site 146
Sandia National Laboratories, New Mexico

SNL GIS ORG 6682 05/21/97 MAPID = 970479

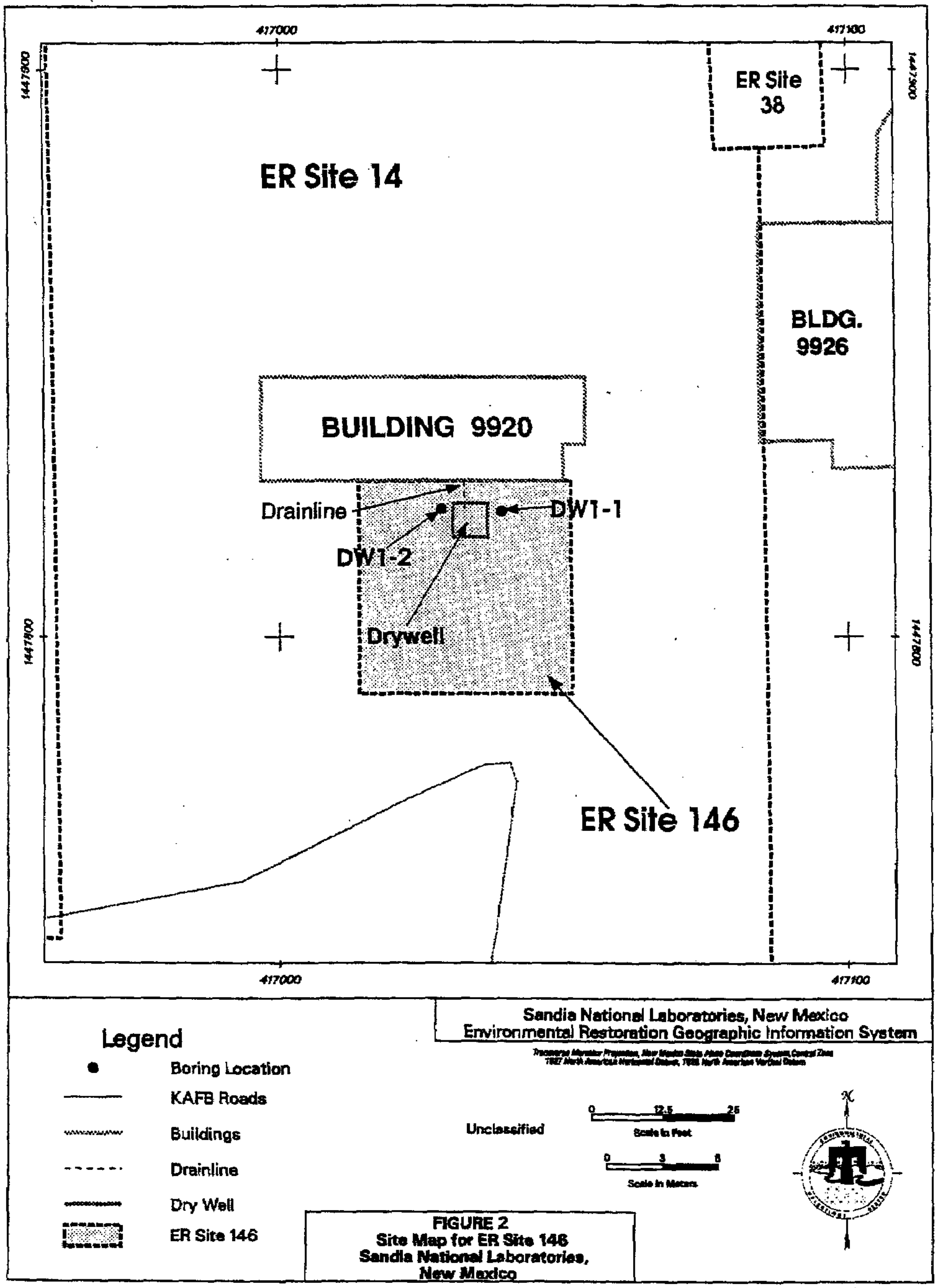

FIGURE 2
Site Map for ER Site 146
Sandia National Laboratories,
New Mexico

SNL GIS ORG. 7512 05/22/97 MAPID = 970476

SITE -SPECIFIC COMMENTS

OU 1295, Septic Tanks and Drain Fields

6. **Boreholes used to characterize ER sites consisting of septic tanks, drain fields, etc. must be located so as to intercept the mass of known or suspected contaminated matter in the Solid Waste Management Unit (SWMU). Boreholes must be drilled to allow sampling of waste matter and of environmental media beneath the SWMU to determine if a release has occurred. (Even then, contaminant concentrations may not reflect what lies at greater depth, due to percolation of waste.) (Best Professional Judgment)**

   Response: The characterization approach for SNL/NM septic tanks, drainfields, seepage pits, drywells, and other effluent release points is described in the RCRA Facility Investigation Work Plan, with addenda, for Operable Unit (OU) 1295, Septic Tanks and Drainfields, approved by EPA and NMED on March 31, 1995 (SNL/NM March 1993, SNL/NM 1994, SNL/NM May 1995, and EPA March 1995). This NOD comment will not be addressed here. DOE/SNL believe that the response should be subject to a separate negotiating process.

Site 142, OU 1295, Building 9970 Septic System

7. **A schedule for the removal of the tank and sludges at this site must be provided. (Additional information needed for adequate review)**

   Response: The top of the septic tank was excavated and opened, then the waste material was removed on December 14, 1995 (SNL/NM December 1995a). The tank was thoroughly steam-cleaned. Then on December 15, 1995, an inspector from NMED verified that the tank had been emptied in compliance with state guidelines (SNL/NM December 1995b). The tank was then backfilled with clean fill dirt and the site graded.

8. **Based on the detection of VOCs, SVOCs, metals and radionuclides in liquid and sludge from the septic tank, analysis of additional samples from below this structure is necessary. (Best Professional Judgment)**

   Response: Refer to the response to Comment #6 concerning the sampling approach for the OU 1295 septic and drain system sites. This NFA proposal is based on the confirmatory soil samples connected at the site, not the concentrations of constituents in the septic tank.

9. **Based on the shallow depth of the saturated zone at this site, groundwater monitoring must be conducted, unless the results of sampling and analysis required in Comment No. 6 above indicate otherwise. (Best Professional Judgment)**

Response: Refer to the response to Comment #6 concerning the sampling approach for the OU 1295 septic and drain system sites. The intermittent occupancy of Building 9970 and the nature of the testing performed at this facility (SNL/NM March 1993) indicate that only low effluent rates were disposed to the system and do not suggest the use or release of significant volumes of constituents of concern (COCs). For these reasons, along with the lack of significant COC concentrations detected in the confirmatory soil samples collected around the release point, DOE/SNL do not believe that groundwater monitoring is necessary or justified at this site.

Site 143, OU 1295, Building 9972 Septic System

10. **Based on the detection of VOCs, SVOCs, barium, and tritium in liquid and sludge from the septic tank and organics in soil samples from the leachfield, analysis of additional samples from beneath these features is necessary. (Best Professional Judgment)**

Response: Refer to the response to Comment #6 concerning the sampling approach for the OU 1295 septic and drain system sites. In addition, referring to Figure 2 of the NFA proposal for Site 143, the sampling locations are almost directly on top of the drainlines in the leachfield. With the first sampling interval starting level with the bottom of the trenches excavated for the leachfield and the second interval starting 10 feet below the first, DOE/SNL believe that the sampling would have intercepted and identified any significant release of COCs from the septic system. The septic tank still contained liquid wastes when it was emptied, indicating that there were no leaks from the structure. If the tank had been leaking, the two sampling locations on either side of the tank would have intercepted any COCs released.

This NFA proposal is based on the confirmatory soil samples, not the concentrations of constituents in the septic tank. The organic constituents reported in the soil samples are clearly attributable to analytical laboratory contamination. Concerning the organic constituents found in the soil samples, EPA guidance (EPA 1988) specifically states that "No positive sample results should be reported unless the concentration of the compound in the sample exceeds 10 times the amount in any blank for the common contaminants listed below, or 5 times the amount for other compounds." The guidance also states that if positive concentrations are reported and are below the Contract Required Quantitation Limit, the data should be qualified as non-detects. The list of five common laboratory contaminants listed by the EPA include MEK, acetone, and methylene chloride, which are the three compounds detected in Site 143 soil analyses. The soil trip blank shipped to the CLP laboratory with the site samples contains the highest concentrations of all the compounds reported, and all are common laboratory contaminants. All the concentrations of organics in site samples are below the laboratory quantitation limits for soil except for two samples with acetone, one at the reporting limit of 10 mg/kg, and the other at 11 mg/kg. In comparison, the trip blank contained acetone at 18 times the laboratory reporting limit (Table 2 of the NFA proposal for Site 143). DOE/SNL believe that the site was sufficiently characterized and that additional sampling is not justified. DOE/SNL will perform a risk assessment analysis to show that the COCs detected at the site do not pose any significant risk to human health or the environment.

11. **Based on the shallow depth of the saturated zone at this site, groundwater monitoring must be conducted unless the results of sampling and analysis recommended in Comment No. 8 above indicate otherwise. (Best Professional Judgment)**

Response: Refer to the response to Comment #6 concerning the sampling approach for the OU 1295 septic and drain system sites. The nature of the testing performed at this facility (SNL/NM March 1993) does not suggest the use or release of significant volumes of the COCs found in the septic tank. For this reason, along with the analytical results of confirmatory soil samples collected in the leachfield and next to the septic tank, DOE/SNL do not believe that groundwater monitoring is necessary or justified at this site.

Site 146, OU 1295, Building 9920 Drain System

12. **The only analyses available come from soil/sediment samples collected outside the 6-foot square area used for liquid waste disposal. Because VOCs, RCRA metals, and tritium were detected in these samples, analysis of additional samples from below the disposal area is necessary. (Best Professional Judgment)**

Response: Refer to the response to Comment #6 concerning the sampling approach for the OU 1295 septic and drain system sites. DOE/SNL believe that soil samples were collected from below the disposal area.

As stated in Section 3.7 of the NFA proposal for Site 146, DOE/SNL believe that the organic constituents detected in the soil samples collected are due to laboratory contamination rather than residual concentrations from a significant release at the site. Refer to the response to Comment #10 for EPA guidance on evaluating data to identify laboratory-introduced contamination. The volatile organic compounds (VOCs) detected in the soil trip blank (Table 2 of the NFA proposal) are an indicator of contamination introduced during transit or most likely in the analytical laboratory. The trip blank exhibits the highest concentrations and the largest number of VOCs found in the site soil samples.

The RCRA metals detected in the soil samples (Table 3 of the NFA proposal) were all less than the 95th percentile for background metals concentrations in soil at SNL/NM (IT March 1996). The highest concentration of each metal constituent detected at the site is compared to the latest available maximum background values in Table III-1 below. In addition, the lowest sampling interval started at 14 feet below ground surface (bgs); samples from this deep interval contained metals concentrations that did not vary significantly from those collected in the interval starting at 4 feet bgs, indicating that even if metal COCs were released from the facility, their downward migration in the soil column was insignificant during the approximately 22 years of facility operation.

Table III-1. Comparison of Soil Concentrations and Background Values for Site 146.

Constituent	Highest Concentration	SNL/NM Background
As	2.8 ppm	7 ppm
Ba	185 ppm	214 ppm
Cr	6.8 ppm	15.9 ppm
Pb	4.8 ppm	11.8 ppm

The highest tritium activity detected was 250 picocuries per liter (pCi/L) in soil moisture, which is at the method detection limit for the analytical laboratory. While no background activity has been estimated for tritium in soil at SNL/NM, the activity of tritium in soil moisture can be approximated by samples taken by the EPA of rainwater throughout the United States (EPA 1993). Assuming that the atmospheric tritium concentration in rainwater is in equilibrium with tritium in soil moisture, the background range for soil is 100 to 400 pCi/L, which brackets the highest tritium concentration detected at Site 146. DOE/SNL believe that the site was sufficiently characterized and that additional sampling is not justified. SNL/NM will perform a risk assessment analysis to show that the COCs detected at the site do not pose any significant risk to human health or the environment.

Site 148, OU 1295, Building 9927 Septic System

13. **The only analyses available come from soil/sediment samples outside the area used for liquid waste disposal here. Because VOCs and potentially elevated levels of RCRA metals were detected in these samples, analysis of additional samples from directly below the disposal area is necessary. (Best Professional Judgment)**

Response: Refer to the response to Comment #6 concerning the sampling approach for the OU 1295 septic and drain system sites.

From Table 2 in the NFA proposal for Site 148, organic compounds detected in the soil samples are again clearly the result of laboratory contamination. Refer to the response to Comment #10 for EPA guidance on evaluating data to identify laboratory-introduced contamination. The two VOC compounds detected above the laboratory reporting limit in the soil trip blank were not detected in the site samples. This strongly suggests that they were introduced in transit, or more likely in the laboratory once the trip blank container was opened. The concentrations reported in the site samples for toluene and methylene chloride were all below the laboratory reporting limit, and these compounds were also present in the trip blank.

From Table 3 in the NFA proposal for Site 148, the concentrations of RCRA metals reported in the site samples were all below the SNL/NM 95th percentile for soils except for arsenic from one sampling interval (IT March 1996). The highest concentration of each metal constituent is compared to the latest available maximum background values in Table IV-1 below. One arsenic value is slightly above the maximum background value for SNL/NM. However, the concentration is still within the range of background values for arsenic in subsurface SNL/NM soils of 0.033 to 17.0 milligrams per kilogram (mg/kg) (IT March 1996). The concentration is also well below the proposed Subpart S Action Level for soil of 20 mg/kg. DOE/SNL believe that the site was sufficiently characterized and that additional sampling is not justified. DOE/SNL will perform a risk assessment analysis to show that the COCs detected at the site do not pose any significant risk to human health or the environment.

Table IV-1. Comparison of Soil Concentrations and Background Values for Site 148.

Constituent	Highest Concentration	SNL/NM Background
As	8.5 ppm	7 ppm
Ba	111 ppm	214 ppm
Cr	5.6 ppm	12.8 ppm
Pb	9.7 ppm	11.8 ppm
Ag	0.78 ppm	<1 ppm

References (for OU 1295)

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

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

Sandia National Laboratories/New Mexico (SNL/NM), 1994, "Comment Responses to USEPA Notice of Deficiency November 1994", Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), May 1995, Letter with attachments dated May 11, 1995 from SNL/NM (Bob Galloway) to EPA (Nancy Morlock) describing number of and spacing between boreholes used to characterize each of the OU 1295 drainfields in late 1994 and early 1995. Maps showing borehole locations in each OU 1295 drainfield were also included with the transmittal.

Sandia National Laboratories/New Mexico (SNL/NM), December 1995a, Field Log #0147, Pages 87 through 91, 12/14/95, Field notes for the ER Site 142 septage waste removal and tank cleaning operation.

Sandia National Laboratories/New Mexico (SNL/NM), December 1995b, Field Log #0147, Book #2, Pages 93 through 97, 12/15/95, Field notes for the ER Site 142 empty septic tank inspection by NMED.

U.S. Environmental Protection Agency (EPA), February 1988, "Laboratory Data Validation Functional Guidelines for Evaluating Organics Analyses", prepared for the Hazardous Site Evaluation Division U.S. Environmental Protection Agency, February 1, 1988.

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

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

NOD

ESH SEC

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

MAR 2 3 2005

cc: Dick Fate
Carolyn D.
MS

CERTIFIED MAIL – RETURN RECEIPT REQUESTED

Mr. James Bearzi, Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Road East, Building 1
Santa Fe, NM 87505

Dear Mr. Bearzi:

On behalf of the Department of Energy (DOE) and Sandia Corporation, DOE is submitting the enclosed Solid Waste Management Unit (SWMU) Assessment Reports and Proposals for Corrective Action Complete (CAC) for Drain and Septic Systems (DSS) Sites 1081 and 1092. DOE is also submitting responses to the Request for Supplemental Information (RSI) for SWMUs 137, 146, 148, 152, and 153 at Sandia National Laboratories, New Mexico, EPA ID No. NM5890110518. These documents are compiled as DSS Round 8 and CAC (formerly No further Action [NFA]) Batch 26.

This submittal includes descriptions of the site characterization work and risk assessments for DSS Area of Concern (AOC) Sites 1081 and 1092, and SWMUs 137, 146, 148, 152, and 153. The risk assessments conclude that for these seven sites: (1) there is no significant risk to human health under both the industrial and residential land-use scenarios; and (2) that there are no ecological risks associated with these sites.

Based on the information provided, DOE and Sandia are requesting a determination of Corrective Action Complete without controls for these DSS sites.

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

INFORMATION COPY

SHEARS # 340833

Sincerely,

Patty Wagner
Manager

Enclosure

cc w/ enclosure:
L. King, EPA, Region 6 (Via Certified Mail)
W. Moats, NMED-HWB (Via Certified Mail)
M. Gardipe, NNSA/SC/ERD
D. Pepe, NMED-OB (Santa Fe)
J. Volkerding, NMED-OB

cc w/o enclosure.:
F. Nimick, SNL, MS 1089
D. Stockham, SNL, MS 1087
B. Langkopf, SNL, MS 1087
M. Sanders, SNL, MS 1087
R. Methvin, SNL MS 1087
J. Pavletich, SNL MS 1087
A. Villareal, SNL, MS 1035
A. Blumberg, SNL, MS 0141
M. J. Davis, SNL, MS 1089
ESHSEC Records Center, MS 1087

Sandia National Laboratories/New Mexico
Environmental Restoration Project

NOTICE OF DEFICIENCY RESPONSE AND PROPOSAL FOR CORRECTIVE ACTION COMPLETE FOR DRAIN AND SEPTIC SYSTEMS SWMU 146, BUILDING 9920 DRAIN SYSTEM COYOTE TEST FIELD

March 2005

United States Department of Energy
Sandia Site Office

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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
AOP	Administrative Operating Procedure
BCF	bioconcentration factor
bgs	below ground surface
CAC	Corrective Action Complete
COC	constituent of concern
COPEC	constituent of potential ecological concern
CTF	Coyote Test Field
DCF	dose conversion factor
DOE	U.S. Department of Energy
DQO	data quality objective
DSS	Drain and Septic Systems
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HQ	hazard quotient
HRMB	Hazardous and Radioactive Materials Bureau
IRIS	Integrated Risk Information System
KAFB	Kirtland Air Force Base
LOAEL	lowest-observed-adverse-effect level
MDA	minimum detectable activity
mrem	millirem
NFA	no further action
NMED	New Mexico Environment Department
NOAEL	no-observed-adverse-effect level
NOD	Notice of Deficiency
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
QA	quality assurance
QC	quality control
QES	Quanterra Environmental Services
RAGS	Risk Assessment Guidance for Superfund
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RME	reasonable maximum exposure
RPSD	Radiation Protection Sample Diagnostics
SAP	Sampling and Analysis Plan
SNL/NM	Sandia National Laboratories/New Mexico
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TEDE	total effective dose equivalent
TMA	Thermo Analytical Inc./Eberline Laboratories
TNT	trinitrotoluene
TOP	Technical Operating Procedure
VOC	volatile organic compound
yr	year

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1.0 INTRODUCTION

1.1 Investigation History

Solid Waste Management Unit (SWMU) 146 was originally one of 23 SWMUs designated as Operable Unit (OU) 1295 at Sandia National Laboratories/New Mexico (SNL/NM). This number was reduced to 22 when a petition for Administrative No Further Action (NFA) was approved by the New Mexico Environment Department (NMED) for SWMU 139 in 1995.

In August 1995, an NFA proposal was submitted to the NMED for SWMU 146 (SNL/NM August 1995). In April 1997, the NMED Hazardous and Radioactive Materials Bureau (HRMB) responded with a Notice of Deficiency (NOD) stating that volatile organic compounds (VOCs), Resource Conservation and Recovery Act (RCRA) metals, and tritium detections reported for the site soil samples would require additional samples from below the disposal area (NMED April 1997).

SNL/NM responded to the NOD in June 1997, and stated that SNL/NM believed the soil samples were collected from beneath the disposal area and that the VOC detections were the result of laboratory contamination, the RCRA metal concentrations were natural and showed no real variation with depth, and the tritium activity measured was at the minimum detectable activity (MDA) of the laboratory method and within the activity range assumed for atmospheric tritium in rainwater (SNL/NM June 1997). SNL/NM agreed to perform a risk assessment to show that the constituents of concern (COCs) do not pose any significant risk to human health or the environment.

At that time, negotiations were being conducted to define a technical and decision-making approach to complete environmental assessment and characterization work at the 22 SWMUs and at 61 other Drain and Septic Systems (DSS) Area of Concern (AOC) sites at SNL/NM. A Sampling and Analysis Plan (SAP) (SNL/NM October 1999) was written that documented investigations planned for completion at all OU 1295 SWMUs and AOC sites. The plan was approved by the NMED in January 2000 (Bearzi January 2000). Technical details for soil sampling procedures, soil sample locations, laboratory analytical methods, and passive soil-vapor sampling requirements at these sites were specified in a follow-up Field Implementation Plan (SNL/NM November 2001), which was also approved by the NMED in February 2002 (Moats February 2002).

Because of the physical similarity of the SWMUs and the AOC sites, and because the same characterization procedures were used for both, the 22 SWMUs were combined into the AOC site investigation procedures outlined in the 1999 SAP (SNL/NM October 1999). Shallow subsurface soil and soil-vapor sampling investigations were completed at the SWMUs and AOC sites by November 2002. The data were evaluated and the candidate SWMUs and AOC sites were ranked in order to select sites for deep soil-vapor well installation and sampling. DSS SWMU 146 was not selected for deep soil-vapor well sampling or any other additional work. No additional soil sampling was performed at SWMU 146 after 1995.

1.2 Remaining Requirements for DSS SWMU 146

The remaining requirement to fulfill the April 1997 NOD for SWMU 146 is addressed in this NOD response:

- Submit a revised risk assessment incorporating all available soil data

An updated general location map (Figure 1.2-1), and an updated site location map showing the soil sampling locations at this site (Figure 1.2-2) are also provided. Because the detailed site description and operational history were provided in the initial NFA proposal (SNL/NM August 1995), the information is only summarized in the risk assessment presented in Chapter 2.0.

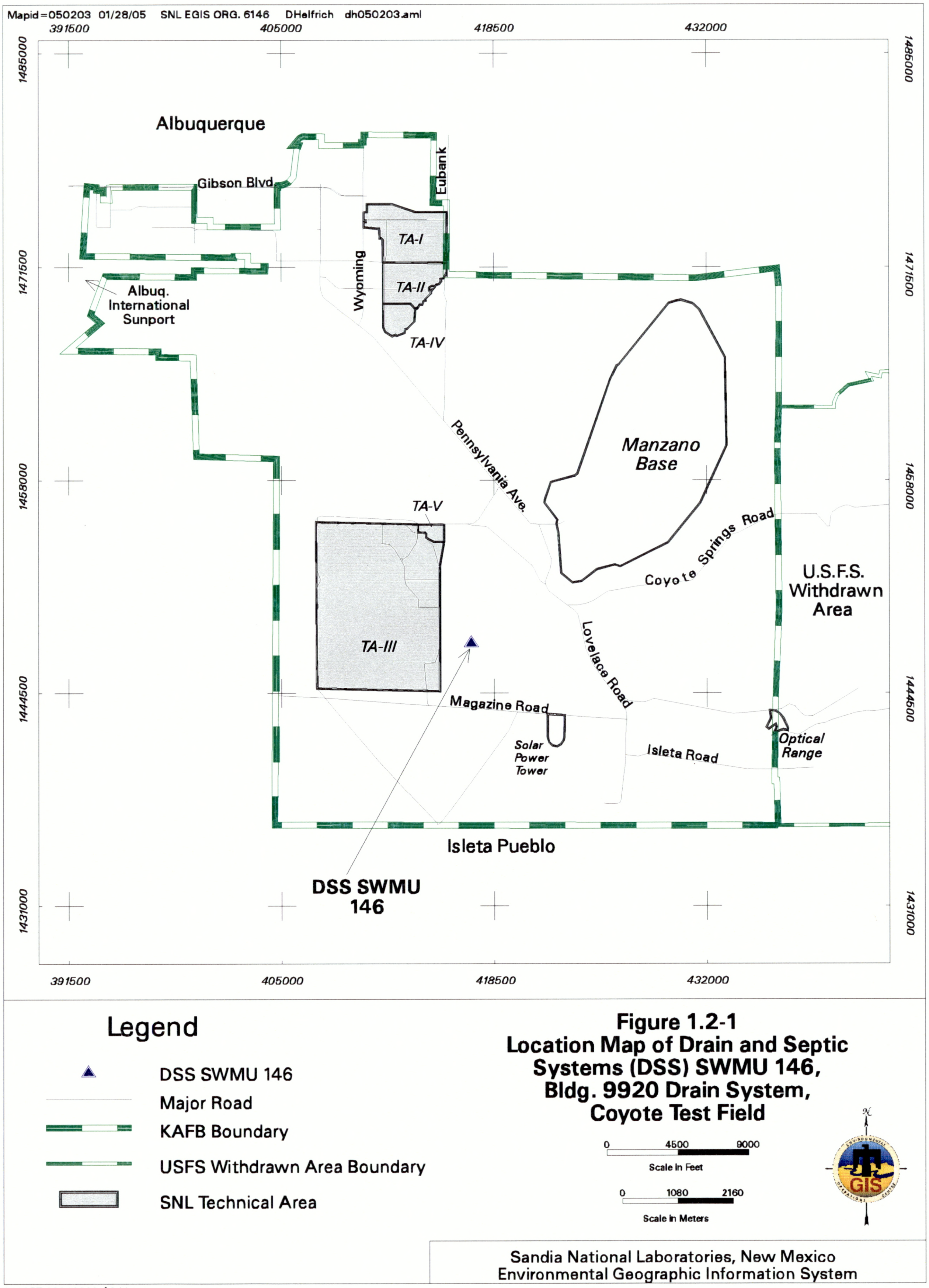

Figure 1.2-1
Location Map of Drain and Septic Systems (DSS) SWMU 146, Bldg. 9920 Drain System, Coyote Test Field

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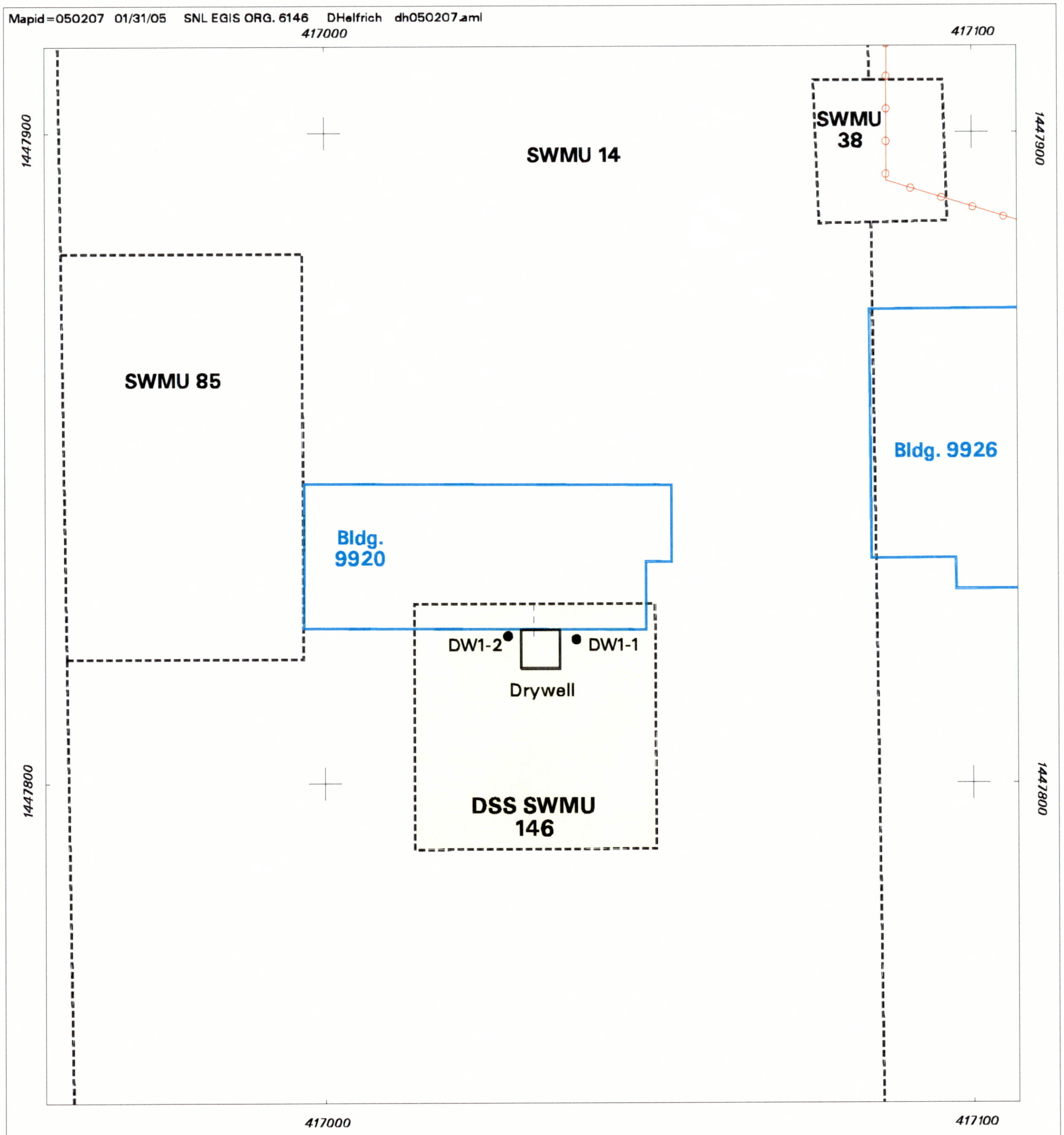
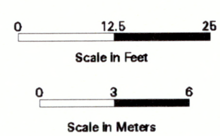


Legend

- Soil Boring Location
- Fence
- Drywell
- Drain line
- Other SWMU Boundary
- Building
- DSS SWMU 146

Figure 1.2-2
Site Map of Drain and Septic Systems (DSS) SWMU 146, Bldg. 9920 Drain System, Coyote Test Field



Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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2.0 RISK ASSESSMENT REPORT FOR DSS SWMU 146

2.1 Site Description and History

DSS SWMU 146, the Building 9920 Drain System at SNL/NM, is located in the Coyote Test Field (CTF) area east of SNL/NM Technical Area III on federally owned land controlled by Kirtland Air Force Base (KAFB) and permitted to the U.S. Department of Energy (DOE). The abandoned drain system consists of a 6-foot-square pit excavated into the native material, and filled with 2-inch-diameter gravel from approximately 1 foot below ground surface (bgs) to an estimated depth of 4 feet bgs. The drywell received discharges from a photography laboratory sink in the building. Available information indicates that Building 9920 was constructed in 1958 (SNL/NM August 1995), and it is assumed that the drywell was also constructed about that time. In 1965, photo-processing activities in Building 9920 ceased and, in 1980, a darkroom sink that discharged to the drywell was removed (Sanders June 1995). The drain system piping would have been disconnected and capped, and the system abandoned in place concurrent with this change.

Environmental concern about DSS SWMU 146 is based upon the potential for the release of COCs in effluent discharged to the environment via the drywell at this site. Because operational records were not available, the investigation was planned to be consistent with other AOC site investigations and to sample for possible COCs that may have been released during facility operations.

The ground surface in the vicinity of the site is flat or slopes slightly to the west. The closest drainage lies 200 feet southwest of the site and terminates in the playa just west of KAFB. No springs or perennial surface-water bodies are located within approximately 2 miles of the site. Average annual rainfall in the SNL/NM and KAFB area, as measured at Albuquerque International Sunport, is 8.1 inches (NOAA 1990). Surface-water runoff in the vicinity of the site is minor because the surface is nearly flat. Infiltration of precipitation is almost nonexistent as virtually all of the moisture subsequently undergoes evapotranspiration. The estimates of evapotranspiration for the KAFB area range from 95 to 99 percent of the annual rainfall (SNL/NM March 1996). Most of the area immediately surrounding SWMU 146 is unpaved with some native vegetation, and no storm sewers are used to direct surface water away from the site.

DSS SWMU 146 lies at an average elevation of approximately 5,459 feet above mean sea level. The groundwater beneath the site occurs in unconfined conditions in essentially unconsolidated silts, sands, and gravels. Groundwater is approximately 420 feet bgs. Groundwater flow is thought to be to the northwest in this area (SNL/NM April 2004). The nearest groundwater monitoring well (CTF-MW3) is approximately 0.5 miles southeast of the site in the central part of the CTF. The nearest production wells are KAFB-4 and KAFB-11, which are both located approximately 4.3 miles to the northwest and north, respectively.

2.2 Data Quality Objectives

Soil sampling was conducted in 1995 in accordance with the rationale and procedures described in the approved "Septic Tanks and Drainfields (ADS [Activity Data Sheet]-1295) RCRA Facility Investigation [RFI] Work Plan" (SNL/NM March 1993), the SAP for the RFI of the septic tanks and drainfields (IT March 1994), and subsequent site-specific addenda to the RFI Work Plan and SAP based upon discussions with the NMED/HRMB.

The sampling conducted at this site was designed to:

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

Table 2.2-1 summarizes the rationale for determining the sampling locations at this site. The source of potential COCs at DSS SWMU 146 was effluent discharged to the environment from the drywell at this site.

Table 2.2-1
Summary of Sampling Performed to Meet DQOs

DSS SWMU 146 Sampling Area(s)	Potential COC Source	Number of Sampling Locations	Sample Density (samples/acre)	Sampling Location Rationale
Soil adjacent to the drywell below depth of expected effluent discharge	Effluent discharged to the environment from the drywell	2	NA	Evaluate potential COC releases to the environment from effluent discharged from the drywell

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

In 1995, soil samples were collected at DSS SWMU 146 from boreholes drilled adjacent to the drywell using a Geoprobe™. The drywell borehole sampling intervals started 4 feet bgs, a depth equal to the base of the drywell, and at 14 feet bgs. Soil samples were collected using procedures described in the RFI Work Plan (SNL/NM March 1993) and the RFI SAP (IT March 1994). Table 2.2-2 summarizes the types of confirmatory and quality assurance (QA)/quality control (QC) samples collected at the site to meet the data quality objectives (DQOs) and the laboratories that performed the analyses.

The soil samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), RCRA metals, hexavalent chromium, total cyanide, isotopic uranium, tritium, and radionuclides by gamma spectroscopy. The samples were analyzed by off-site laboratories (Quanterra Environmental Services [QES] and Thermo Analytical Inc./Eberline [TMA]) and the on-site Radiation Protection Sample Diagnostics (RPSD) Laboratory. Samples were also screened for trinitrotoluene (TNT) at the on-site Environmental Restoration Chemistry Laboratory. No TNT was detected and these TNT screening samples were not used in the risk assessment analysis. Table 2.2-3 summarizes the analytical methods and the data quality requirements.

Table 2.2-2
Number of Confirmatory Soil and QA/QC Samples Collected from DSS SWMU 146

Sample Type	VOCs	SVOCs	RCRA Metals	Hexavalent Chromium	Total Cyanide	Isotopic Uranium	Tritium	Gamma Spectroscopy Radionuclides
Confirmatory	4	4	4	4	4	2	2	2
Duplicates	1	1	1	1	1	1	0	0
EBs and TBs[a]	2	1	1	0	1	1	0	0
Total Samples	7	6	6	5	6	4	2	2
Analytical Laboratory	QES	QES	QES	QES	QES	TMA	TMA	RPSD

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

Table 2.2-3
Summary of Data Quality Requirements for DSS SWMU 146

Analytical Method[a]	Data Quality Level	QES	TMA	RPSD
VOCs EPA Method 8260	Defensible	4	None	None
SVOCs EPA Method 8270	Defensible	4	None	None
RCRA Metals EPA Method 6000/7000	Defensible	4	None	None
Hexavalent Chromium EPA Method 7196A	Defensible	4	None	None
Total Cyanide EPA Method 9012A	Defensible	4	None	None
Isotopic Uranium HASL-300	Defensible	None	2	None
Tritium EPA Method 906.0 or equivalent	Defensible	None	2	None
Gamma Spectroscopy Radionuclides EPA Method 901.1	Defensible	None	None	2

Note: The number of samples does not include composite samples or 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.
HASL = Health and Safety Laboratory.
QA/QC = Quality assurance/quality control.
QES = Quanterra Environmental Services.
RCRA = Resource Conservation and Recovery Act.
RPSD = Radiation Protection Sample Diagnostics Laboratory.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
TMA = Thermo Analytical Inc./Eberline.
VOC = Volatile organic compound.

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

All of the DSS SWMU 146 soil sample results were verified/validated by SNL/NM. The off-site laboratory results from QES and TMA were reviewed according to "Verification and Validation of Chemical and Radiochemical Data," Technical Operating Procedure (TOP) 94-03, Rev. 0 (SNL/NM July 1994) or earlier ER Project Administrative Operating Procedures (AOPs). The gamma spectroscopy data from the RPSD Laboratory were reviewed according to "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 2 (SNL/NM July 1996) or an earlier procedure. The reviews confirmed that the analytical data are defensible and therefore acceptable for use in this NOD response. Therefore, the DQOs have been fulfilled.

2.3 Determination of Nature, Rate, and Extent of Contamination

2.3.1 Introduction

The determination of the nature, migration rate, and extent of contamination at DSS SWMU 146 is based upon an initial conceptual model validated with confirmatory sampling at the site. The initial conceptual model was developed from archival site research, site inspections, soil sampling, and passive soil-vapor sampling. The DQOs contained in the RFI Work Plan (SNL/NM March 1993), RFI SAP (IT March 1994), and subsequent negotiations with the NMED/HRMB identified the sample locations, sample density, sample depths, and analytical requirements. The sample data were subsequently used to develop the final conceptual site model for SWMU 146, which is presented in Section 2.6. The quality of the data specifically used to determine the nature, migration rate, and extent of contamination is described in the following sections.

2.3.2 Nature of Contamination

Both the nature of contamination and the potential for the degradation of COCs at DSS SWMU 146 were evaluated using laboratory analyses of the soil samples. The analytical requirements included analyses for VOCs, SVOCs, RCRA metals, hexavalent chromium, total cyanide, isotopic uranium, tritium, and radionuclides by gamma spectroscopy. The analytes and methods listed in Tables 2.2-2 and 2.2-3 are appropriate to characterize the COCs and any potential degradation products at SWMU 146.

2.3.3 Rate of Contaminant Migration

In 1965, photo-processing activities in Building 9920 ceased, and in 1980, the darkroom sink that discharged to the drywell was removed (Sanders June 1995). The migration rate of COCs that may have been introduced into the subsurface via the drywell 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 drywell was discontinued has been predominantly dependent upon precipitation. However, it is highly unlikely that sufficient precipitation has fallen on the site to reach the depth at which COCs may have been discharged to the subsurface from this system. Analytical data generated from the soil sampling conducted at the site are adequate to characterize the rate of COC migration at SWMU 146.

2.3.4 Extent of Contamination

Subsurface soil samples were collected at DSS SWMU 146 from boreholes drilled at two locations on either side of the effluent release point (drywell) at the site to assess whether releases of effluent from the drywell caused any environmental contamination.

The soil samples were collected at sampling depths starting at 4 and 14 feet bgs in the boreholes adjacent to the drywell. Sampling intervals started at the depth at which effluent discharged from the drywell would have entered the subsurface environment at the site. This sampling procedure was required by NMED regulators and has been used at numerous DSS-type sites at SNL/NM. The soil samples are considered to be representative of the soil potentially contaminated with the COCs at this site and are sufficient to determine the vertical extent, if any, of COCs.

2.4 Comparison of COCs to Background Screening Levels

Site history and characterization activities are used to identify potential COCs. This DSS SWMU 146 NOD response and request for a determination of Corrective Action Complete (CAC) without controls describes the identification of COCs and the sampling that was conducted in order to determine the concentration levels of those COCs across the site. Generally, COCs evaluated in this risk assessment include all detected organic, inorganic, and radiological COCs for which samples were analyzed. When the detection limit of an organic compound is too high (i.e., could possibly cause an adverse effect to human health or the environment), the compound is retained. Nondetected organic compounds not included in this assessment were determined to have detection limits low enough to ensure protection of human health and the environment. In order to provide conservatism in this risk assessment, the calculation uses only the maximum concentration value of each COC found for the entire site. The SNL/NM maximum background concentration (Dinwiddie September 1997) was selected to provide the background screen listed in Tables 2.4-1 through 2.4-4.

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

Tables 2.4-1 and 2.4-2 list the nonradiological COCs for the human health and ecological risk assessments at DSS SWMU 146, respectively. Tables 2.4-3 and 2.4-4 list the radiological COCs for the human health and ecological risk assessments, respectively. All tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997). Section 2.6.4.2 discusses the results presented in Tables 2.4-1 and 2.4-3; Sections 2.7.2.1 and 2.7.2.2 discuss the results presented in Tables 2.4-2 and 2.4-4.

2.5 Fate and Transport

The primary releases of COCs at DSS SWMU 146 were to the subsurface soil resulting from the discharge of effluents from the Building 9920 drywell. Wind, water, and biota are natural mechanisms of COC transport from the primary release point; however, because the discharge was to subsurface soil, none of these mechanisms are considered to be of potential significance as transport mechanisms at this site. Because the drywell is no longer active, additional infiltration of water is not expected. Infiltration of precipitation is essentially nonexistent at SWMU 146, as virtually all of the moisture either drains away from the site or evaporates. Because groundwater at this site is approximately 420 feet bgs, the potential for COCs to reach groundwater through the unsaturated zone above the water table is extremely low.

Table 2.4-1
Nonradiological COCs for Human Health Risk Assessment at DSS SWMU 146 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	2.8	4.4	Yes	44[c]	--	**Yes**
Barium	185	214	Yes	170[d]	--	**Yes**
Cadmium	0.25[e]	0.9	Yes	64[c]	--	**Yes**
Chromium, total	6.8	15.9	Yes	16[c]	--	No
Chromium VI	0.025[e]	1	Yes	16[c]	--	No
Cyanide	0.25[e]	NC	**Unknown**	NC	--	**Unknown**
Lead	4.8 J	11.8	Yes	49[c]	--	**Yes**
Mercury	0.05[e]	<0.1	Yes	5,500[c]	--	**Yes**
Selenium	0.25[e]	<1	Yes	800[f]	--	**Yes**
Silver	0.5[e]	<1	Yes	0.5[c]	--	No
Organic						
Acetone	0.013	NA	**NA**	0.69[g]	-0.24[g]	No
Methylene Chloride	0.0022 J	NA	**NA**	5.0[g]	1.25[g]	No
Methyl Ethyl Ketone	0.005[e]	NA	**NA**	1[h]	0.29[h]	No
Methyl Isobutyl Ketone	0.005[e]	NA	**NA**	5[i]	1.19[i]	No

Note: **Bold** indicates the COCs that exceed the background screening values and/or are bioaccumulators.
[a]Dinwiddie September 1997, Southwest Area Supergroup.
[b]NMED March 1998.
[c]Yanicak March 1997.
[d]Neumann 1976.
[e]Nondetected concentration (i.e., one-half the maximum detected limit is greater than the maximum detected concentration).
[f]Callahan et al. 1979.
[g]Howard 1990.
[h]Howard 1993.
[i]Micromedex, Inc. 1998.

Table 2.4-1 (Concluded)
Nonradiological COCs for Human Health Risk Assessment at DSS SWMU 146 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

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

Table 2.4-2
Nonradiological COCs for Ecological Risk Assessment at DSS SWMU 146 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

COC	Maximum Concentration (Samples ≤ 5 ft bgs) (mg/kg)	SNL/NM Background Concentration (mg/kg)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (Maximum Aquatic)	Log K_{ow} (for Organic COCs)	Bioaccumulator?[b] (BCF>40, Log K_{ow}>4)
Inorganic						
Arsenic	2.8	4.4	Yes	44[c]	--	**Yes**
Barium	185	214	Yes	170[d]	--	**Yes**
Cadmium	0.25[e]	0.9	Yes	64[c]	--	**Yes**
Chromium, total	5.1	15.9	Yes	16[c]	--	No
Chromium VI	0.025[e]	1	Yes	16[c]	--	No
Cyanide	0.25[e]	NC	**Unknown**	NC	--	**Unknown**
Lead	4.4 J	11.8	Yes	49[c]	--	**Yes**
Mercury	0.05[e]	<0.1	Yes	5,500[c]	--	**Yes**
Selenium	0.25[e]	<1	Yes	800[f]	--	**Yes**
Silver	0.5[e]	<1	Yes	0.5[c]	--	No
Organic						
Acetone	0.013	NA	**NA**	0.69[g]	-0.24[g]	No
Methylene Chloride	0.0022 J	NA	**NA**	5.0[g]	1.25[g]	No
Methyl Ethyl Ketone	0.005[e]	NA	**NA**	1[h]	0.29[h]	No
Methyl Isobutyl Ketone	0.005[e]	NA	**NA**	5[i]	1.19[i]	No

Note: **Bold** indicates the COCs that exceed the background screening values and/or are bioaccumulators.
[a]Dinwiddie September 1997, Southwest Area Supergroup.
[b]NMED March 1998.
[c]Yanicak March 1997.
[d]Neumann 1976.
[e]Nondetected concentration (i.e., one-half the maximum detection limit is greater than the maximum detected concentration).
[f]Callahan et al. 1979.
[g]Howard 1990.
[h]Howard 1993.
[i]Micromedex, Inc. 1998.

Table 2.4-2 (Concluded)
Nonradiological COCs for Ecological Risk Assessment at DSS SWMU 146 with
Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

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

Table 2.4-3
Radiological COCs for Human Health Risk Assessment at DSS SWMU 146 with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC	Maximum Activity (All Samples) (pCi/g)[a]	SNL/NM Background Activity (pCi/g)[b]	Is Maximum COC Activity Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Is COC a Bioaccumulator?[c] (BCF >40)
Cesium-137	ND (0.0650)	0.079	Yes	3,000[d]	**Yes**
Thorium-232	0.525	1.01	Yes	3,000[d]	**Yes**
Tritium	ND (0.014)	0.021[e]	Yes	NA	No
Uranium-235	**ND (0.306)**	0.16	**No**	900[d]	**Yes**
Uranium-238	**ND (2.32)**	1.4	**No**	900[d]	**Yes**

Note: **Bold** indicates COCs that exceed the background screening values and/or are bioaccumulators.
[a]Value listed is the greater of either the maximum detection or the highest MDA.
[b]Dinwiddie September 1997, Southwest Area Supergroup.
[c]NMED March 1998.
[d]Baker and Soldat 1992.
[e]Tharp February 1999. 420 pCi/L = 0.021 pCi/g assuming a soil density of 1 gram/cubic centimeter and 5 percent soil moisture.

BCF = Bioconcentration factor.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
MDA = Minimum detectable activity.
NA = Not applicable.
ND ( ) = Not detected above the MDA, shown in parentheses.
ND ( ) = Not detected, but the MDA (shown in parentheses) exceeds background activity.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

Table 2.4-4
Radiological COCs for Ecological Risk Assessment at DSS SWMU 146 with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC	Maximum Activity (Samples ≤ 5 ft bgs) (pCi/g)[a]	SNL/NM Background Activity (pCi/g)[b]	Is Maximum COC Activity Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (Maximum Aquatic)	Is COC a Bioaccumulator?[c] (BCF >40)
Cesium-137	ND (0.0650)	0.079	Yes	3,000[d]	**Yes**
Thorium-232	0.525	1.01	Yes	3,000[d]	**Yes**
Tritium	ND (0.014)	0.021[e]	Yes	NA	No
Uranium-235	**ND (0.306)**	0.16	**No**	900[d]	**Yes**
Uranium-238	**ND (2.32)**	1.4	**No**	900[d]	**Yes**

[a]Value listed is the greater of either the maximum detection or the highest MDA.
[b]Dinwiddie September 1997, Southwest Area Supergroup.
[c]NMED March 1998.
[d]Baker and Soldat 1992.
[e]Tharp February 1999. 420 pCi/L = 0.021 pCi/g assuming a soil density of 1 gram/cubic centimeter and 5 percent soil moisture.

BCF = Bioconcentration factor.
bgs = Below ground surface.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
ft = Foot (feet).
MDA = Minimum detectable activity.
NA = Not applicable.
ND ( ) = Not detected, above the MDA, shown in parentheses.
ND ( ) = Not detected, but the MDA (shown in parentheses) exceeds background activity.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

The COCs at DSS SWMU 146 include both inorganic and organic constituents. The inorganic COCs include both radiological and nonradiological analytes. With the exception of cyanide, the inorganic COCs are elemental in form and are not considered to be degradable. Transformations of these inorganic constituents could include changes in valence (oxidation/reduction reactions) or incorporation into organic forms (e.g., the conversion of selenite or selenate from soil to seleno-amino acids in plants). Cyanide can be metabolized by soil biota. Radiological COCs will undergo decay to stable isotopes or radioactive daughter elements. However, because of the long half-lives of the radiological COCs (uranium-235 and uranium-238), the aridity of the environment at this site, and the lack of potential contact with biota, none of these mechanisms are expected to result in significant losses or transformations of the inorganic COCs.

The organic COCs at DSS SWMU 146 are limited to VOCs. Organic constituents may be degraded through photolysis, hydrolysis, and biotransformation. Photolysis requires light and therefore takes place in the air, at the ground surface, or in surface water. Hydrolysis includes chemical transformations in water and may occur in the soil solution. Biotransformation (i.e., transformation caused by plants, animals, and microorganisms) may occur; however, biological activity may be limited by the arid environment at this site. Because of the depth of the COCs in the soil, the loss of VOCs through volatilization is expected to be minimal.

Table 2.5-1 summarizes the fate and transport processes that can occur at DSS SWMU 146. COCs at this site include organic analytes as well as radiological and nonradiological inorganic analytes. Wind, surface water, and biota are considered to be of low significance as potential transport mechanisms at this site. Significant leaching into the subsurface soil is unlikely, and leaching into the groundwater at this site is highly unlikely. The potential for transformation of COCs is low, and loss through decay of the radiological COCs is insignificant because of their long half-lives.

Table 2.5-1
Summary of Fate and Transport at DSS SWMU 146

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

DSS = Drain and Septic Systems.
SWMU = Solid Waste Management Unit.

2.6 Human Health Risk Assessment

2.6.1 Introduction

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

Step 1.	Site data are described that provide information on the potential COCs, as well as the relevant physical characteristics and properties of the site.
Step 2.	Potential pathways are identified by which a representative population might be exposed to the COCs.
Step 3.	The potential intake of these COCs by the representative population is calculated using a tiered approach. The first component of the tiered approach is a screening procedure that compares the maximum concentration of the COC to an SNL/NM maximum background screening value. COCs that are not eliminated during the first screening procedure are carried forward in the risk assessment process.
Step 4.	Toxicological parameters are identified and referenced for COCs that were not eliminated during the screening procedure.
Step 5.	Potential toxicity effects (specified as a hazard index [HI]) and estimated excess cancer risks are calculated for nonradiological COCs and background. For radiological COCs, the incremental total effective dose equivalent (TEDE) and 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.

2.6.2 Step 1. Site Data

Section 2.1 of this chapter provides the site description and history for DSS SWMU 146. Section 2.2 presents a comparison of results to DQOs. Section 2.3 discusses the nature, rate, and extent of contamination.

2.6.3 Step 2. Pathway Identification

DSS SWMU 146 has been designated with a future land-use scenario of industrial (DOE et al. September 1995) (see Annex A for default exposure pathways and parameters). However, the residential land-use scenario is also considered in the pathway analysis. Because of the location and characteristics of the potential contaminants, the primary pathway for human exposure is considered to be soil ingestion for the nonradiological COCs and direct gamma exposure for the radiological COCs. The inhalation pathway for both nonradiological and radiological COCs is included because the potential exists to inhale dust and volatiles. Soil ingestion is included for the radiological COCs as well. The dermal pathway is included for the nonradiological COCs because of the potential for the receptor to be exposed to contaminated soil. No water pathways to the groundwater are considered; depth to groundwater at SWMU 146 is approximately 420 feet bgs. No intake routes through plant, meat, or milk ingestion are considered appropriate for either the industrial or residential land-use scenarios. Figure 2.6.3-1 shows the conceptual site model flow diagram for SWMU 146.

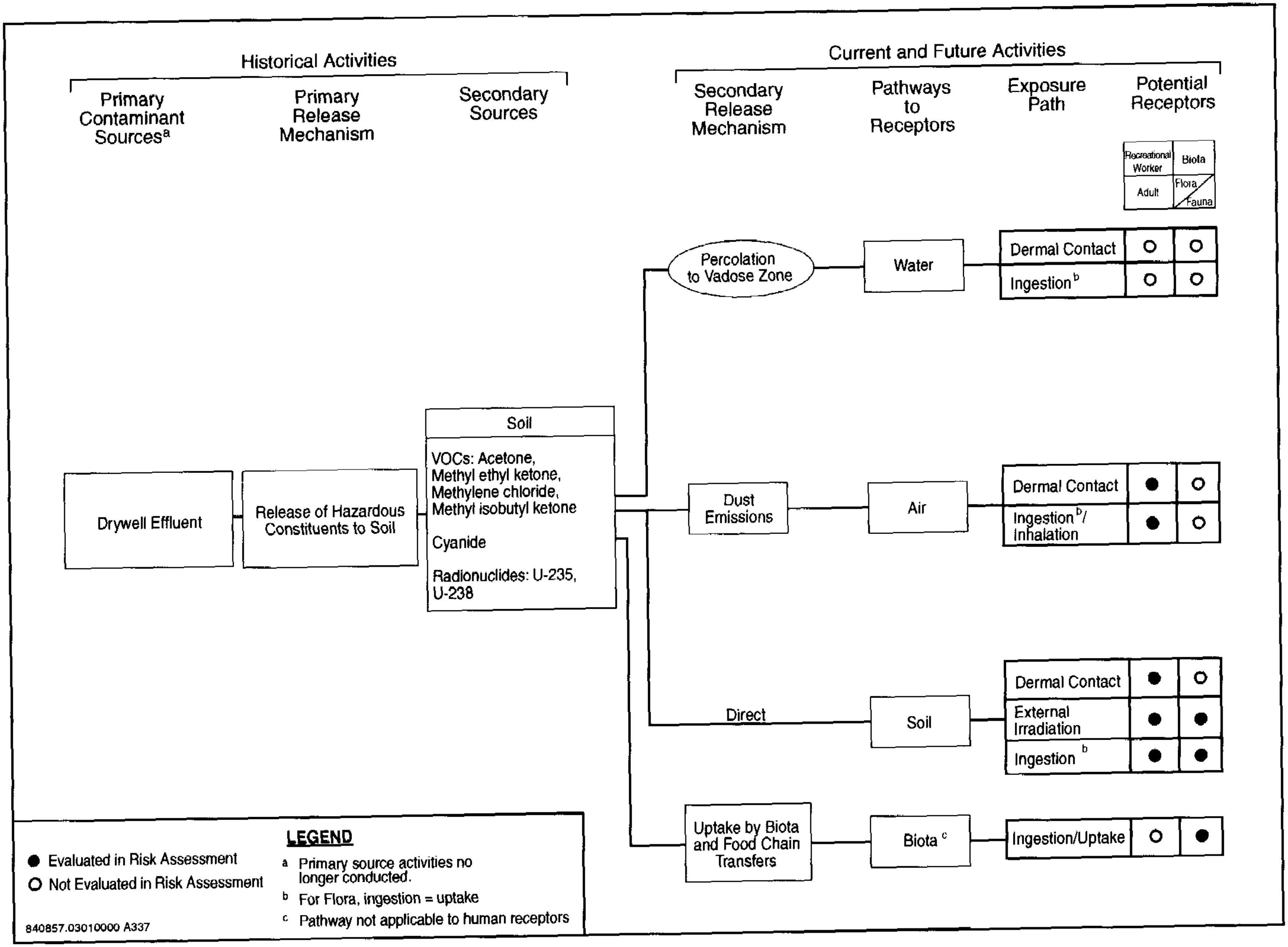

Figure 2.6.3-1
Conceptual Site Model Flow Diagram for DSS SWMU 146, Building 9920 Drain System

Pathway Identification

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

2.6.4 Step 3. Background Screening Procedure

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

2.6.4.1 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 2.4-1 and used to calculate risk attributable to background in Section 2.6.6.2. 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 the radiological COCs that exceed the SNL/NM background screening levels, background values were subtracted from the individual maximum radionuclide concentrations. Those that do not exceed these background levels are not carried any further in the risk assessment. This approach is consistent with DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE 1993). Radiological COCs that do not have background screening values and were detected above the analytical MDA are carried through the risk assessment at the maximum levels. The resultant radiological COCs remaining after this step are referred to as background-adjusted radiological COCs.

2.6.4.2 Results

Tables 2.4-1 and 2.4-3 show DSS SWMU 146 maximum COC concentrations that were compared to the SNL/NM maximum background values (Dinwiddie September 1997) for the human health risk assessment. The nonradiological COCs were below background values, except for cyanide, which does not have a quantified background screening concentration, and four organic compounds that do not have corresponding background screening values.

For the radiological COCs, two constituents (uranium-235 and uranium-238) had MDA values greater than the background screening levels. The greater of either the maximum detection or the highest MDA is conservatively used in the risk assessment.

2.6.5 Step 4. Identification of Toxicological Parameters

Tables 2.6.5-1 and 2.6.5-2 list the COCs retained in the risk assessment and provides the values for the available toxicological information. The toxicological values for the nonradiological COCs presented in Table 2.6.5-1 were obtained from the Integrated Risk Information System (IRIS) (EPA 2004a), the Health Effects Assessment Summary Tables (HEAST) (EPA 1997a), EPA Region 6 (EPA 2004b), Risk Assessment Information System (ORNL 2003), and the Technical Background Document for Development of Soil Screening Levels (NMED February 2004). Dose conversion factors (DCFs) used in determining the excess TEDE values for radiological COCs for the individual pathways are the default values provided in the RESRAD computer code (Yu et al. 1993a) as developed in the following documents:

- DCFs for ingestion and inhalation were taken from "Federal Guidance Report No. 11, Limiting Values of Radionuclide Intake and Air Concentration and Dose *Conversion Factors for Inhalation, Submersion, and Ingestion*" (EPA 1988).
- DCFs for surface contamination of the site were taken from DOE/EH-0070, "External Dose-Rate Conversion Factors for Calculation of Dose to the Public" (DOE 1988).
- DCFs for volume contamination (exposure to contamination deeper than the immediate surface of the site) were calculated using the methods discussed in "Dose-Rate Conversion Factors for External Exposure to Photon Emitters in Soil" (Kocher 1983) and in ANL/EAIS-8, "Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil" (Yu et al. 1993b).

2.6.6 Step 5. Exposure Assessment and Risk Characterization

Section 2.6.6.1 describes the exposure assessment for this risk assessment. Section 2.6.6.2 provides the risk characterization, including the HI and excess cancer risk for both the potential nonradiological COCs and associated background for the industrial and residential land-use scenarios. The incremental TEDE and incremental estimated cancer risk are provided for the *background-adjusted radiological COCs for both industrial and residential land-use scenarios.*

2.6.6.1 Exposure Assessment

Annex A provides the equations and parameter input values used to calculate intake values and subsequent HI and excess cancer risk values for the individual exposure pathways. The annex shows parameters for both industrial and residential land-use scenarios. The equations for nonradiological COCs are based upon the Risk Assessment Guidance for Superfund (RAGS) (EPA 1989). Parameters are based upon information from the RAGS (EPA 1989), the Technical Background Document for Development of Soil Screening Levels (NMED February 2004), as well as other EPA and NMED guidance documents. Parameters reflect the reasonable maximum exposure (RME) approach advocated by the RAGS (EPA 1989). For radiological COCs, the coded equations provided in RESRAD computer code are used to estimate the incremental TEDE and cancer risk for individual exposure pathways. Further

Table 2.6.5-1
Toxicological Parameter Values for DSS SWMU 146 Nonradiological COCs

COC	RfD_o (mg/kg-d)	Confidence[a]	RfD_{inh} (mg/kg-d)	Confidence[a]	SF_o $(mg/kg\text{-}d)^{-1}$	SF_{inh} $(mg/kg\text{-}d)^{-1}$	Cancer Class[b]	ABS
Inorganic								
Cyanide	2E-2[c]	M	--	--	--	--	D	0.1[d]
Organic								
Acetone	1E-1[c]	L	1E-1[e]	--	--	--	D	0.01[f]
Methylene Chloride	6E-2[c]	M	8.6E-1[g]	--	7.5E-3[c]	1.6E-3[c]	B2	0.1[d]
Methyl Ethyl Ketone	6E-1[c]	L	2.9E-1[c]	L	--	--	D	0.1[d]
Methyl Isobutyl Ketone	8E-2[g]	--	2.3E-2[g]	--	--	--	--	0.01[f]

[a]Confidence associated with IRIS (EPA 2004a) database values. Confidence: L = low, M = medium.
[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989) taken from IRIS (EPA 2004a):
B2 = Probable human carcinogen. Sufficient evidence in animals and inadequate or no evidence in humans.
D = Not classifiable as to human carcinogenicity.
[c]Toxicological parameter values from IRIS electronic database (EPA 2004a).
[d]Toxicological parameter values from NMED (February 2004).
[e]Toxicological parameter values from EPA Region 6 (EPA 2004b).
[f]Toxicological parameter values from Risk Assessment Information System (ORNL 2003).
[g]Toxicological parameter values from HEAST (EPA 1997a).

ABS = Gastrointestinal absorption coefficient.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
HEAST = Health Effects Assessment Summary Tables.
IRIS = Integrated Risk Information System.
mg/kg-d = Milligram(s) per kilogram day.
$mg/kg\text{-}d^{-1}$ = Per milligram per kilogram day.
NMED = New Mexico Environment Department.
RfD_{inh} = Inhalation chronic reference dose.
RfD_o = Oral chronic reference dose.
SF_{inh} = Inhalation slope factor.
SF_o = Oral slope factor.
SWMU = Solid Waste Management Unit.
-- = Information not available.

Table 2.6.5-2
Toxicological Parameter Values for DSS SWMU 146 Radiological COCs
Obtained from RESRAD Risk Coefficients[a]

COC	SF_o (1/pCi)	SF_{inh} (1/pCi)	SF_{ev} (g/pCi-yr)	Cancer Class[b]
Uranium-235	4.70E-11	1.30E-08	2.70E-07	A
Uranium-238	6.20E-11	1.20E-08	6.60E-08	A

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

discussion of this process is provided in the "Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD" (Yu et al. 1993a). Although the designated land-use scenario for this site is industrial, risk and TEDE values for a residential land-use scenario are also presented.

2.6.6.2 Risk Characterization

Table 2.6.6-1 shows an HI of 0.00 for the DSS SWMU 146 nonradiological COCs and an estimated excess cancer risk of 1E-8 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 2.6.6-2 shows no quantified HI or estimated excess cancer risk for the SWMU 146 associated background constituents under the designated industrial land-use scenario.

For the radiological COCs, contribution from the direct gamma exposure pathway is included. For the industrial land-use scenario, a TEDE is calculated for an individual on the site that results in an incremental TEDE of 4.5E-2 millirem (mrem)/year (yr). In accordance with EPA guidance found in Office of Solid Waste and Emergency Response (OSWER) Directive No. 9200.4-18 (EPA 1997b), an incremental TEDE of 15 mrem/yr is used for the probable land-use scenario (industrial in this case); the calculated dose value for SWMU 146 for the industrial land use is well below this guideline. The estimated incremental excess cancer risk is 4.0E-7.

The HI is 0.00 with an estimated excess cancer risk of 3E-8 for the nonradiological COCs under the residential land-use scenario (Table 2.6.6-1). The numbers in the table include exposure from soil ingestion, dermal contact, and dust inhalation. Although the EPA (1991) guidelines generally recommend that inhalation not be included in a residential land-use scenario, this

Table 2.6.6-1
Risk Assessment Values for DSS SWMU 146 Nonradiological COCs

COC	Maximum Concentration (All Samples) (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Cyanide	0.25[b]	0.00	--	0.00	--
Organic					
Acetone	0.013	0.00	--	0.00	--
Methylene Chloride	0.0022 J	0.00	1E-8	0.00	3E-8
Methyl Ethyl Ketone	0.005[b]	0.00	--	0.00	--
Methyl Isobutyl Ketone	0.005[b]	0.00	--	0.00	--
Total		0.00	1E-8	0.00	3E-8

[a]EPA 1989.
[b]Nondetected concentration (i.e., one-half the maximum detection limit is greater than the maximum detected concentration).
COC = Constituent of concern.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
-- = Information not available.

Table 2.6.6-2
Risk Assessment Values for DSS SWMU 146 Nonradiological Background Constituents

COC	Background Concentration[a] (mg/kg)	Industrial Land-Use Scenario[b]		Residential Land-Use Scenario[b]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Cyanide	NC	--	--	--	--
Total		--	--	--	--

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

pathway is included because of the potential for soil in Albuquerque, New Mexico, to be eroded and for dust to be present in predominantly residential areas. Based upon the nature of local soil, other exposure pathways are not evaluated (see Annex A). Table 2.6.6-2 shows no quantified HI or estimated excess cancer risk for the SWMU 146 associated background constituents under the designated residential land-use scenario.

For the radiological COCs, the incremental TEDE for the residential land-use scenario is 0.11 mrem/yr. The guideline being used is an excess TEDE of 75 mrem/yr (SNL/NM February 1998) for a complete loss of institutional controls (residential land use in this case); the calculated dose value for DSS SWMU 146 for the residential land-use scenario is well below this guideline. Consequently, SWMU 146 is eligible for unrestricted radiological release as the residential land-use scenario resulted in an incremental TEDE of less than 75 mrem/yr to the on-site receptor. The estimated incremental excess cancer risk is 1.2E-6. The excess cancer risk from the nonradiological and radiological COCs should be summed to provide risk estimates for persons exposed to both types of carcinogenic contaminants, as noted in OSWER Directive No. 9200.4-18, "*Establishment of Cleanup Levels for CERCLA [Comprehensive Environmental Response, Compensation, and Liability Act] Sites with Radioactive Contamination*" (EPA 1997b). This summation is tabulated in Section 2.6.9.

2.6.7 Step 6. Comparison of Risk Values to Numerical Guidelines

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

For the nonradiological COCs under the industrial land-use scenario, the HI is 0.00 (lower than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). The excess cancer risk is 1E-8. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. This assessment also determines risks by evaluating background concentrations of the potential nonradiological COCs for both the industrial and residential land-use scenarios. The incremental risk is determined by subtracting risk associated with background from potential COC risk. These numbers are not rounded before the difference is determined and therefore may appear to be inconsistent with numbers presented in tables and within the text. For conservatism, the background constituents that do not have quantified background concentrations are assumed to have a hazard quotient (HQ) of 0.00. The incremental HI is 0.00 and the estimated incremental cancer risk is 1.43E-8 for the industrial land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs considering an industrial land-use scenario.

For the radiological COCs under the industrial land-use scenario, the incremental TEDE is 4.5E-2 mrem/yr, which is significantly lower than EPA's numerical guideline of 15 mrem/yr (EPA 1997b). The estimated incremental excess cancer risk is 4.0E-7.

For the nonradiological COCs under the residential land-use scenario, the calculated HI is 0.00, which is below the numerical guidance. The excess cancer risk is 3E-8. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. The incremental HI is 0.00 and the estimated incremental excess cancer risk is 3.04E-8 for the residential land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs under a residential land-use scenario.

The incremental TEDE for a residential land-use scenario from the radiological components is 0.11 mrem/yr, which is significantly lower than the numerical guideline of 75 mrem/yr suggested in the SNL/NM "RESRAD Input Parameter Assumptions and Justification" (SNL/NM February 1998). The estimated incremental excess cancer risk is 1.2E-6.

2.6.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at DSS SWMU 146 is based upon an initial conceptual model that was validated with sampling conducted at the site. The sampling was implemented in accordance with procedures and DQOs in the RFI Work Plan (SNL/NM March 1993), the RFI SAP (IT March 1994), and subsequent negotiations with the NMED/HRMB. The data from soil samples collected at the effluent release point are representative of potential COC releases to the site. The analytical requirements and results satisfy the DQOs, and data quality was verified/validated in accordance with SNL/NM procedures. Therefore, there is no uncertainty associated with the data quality used to perform the risk assessment at SWMU 146.

Because of the location, history, and future land use, there is low uncertainty in the land-use scenario and the potentially affected populations that were considered in performing the risk assessment analysis. Based upon the COCs found in near-surface soil and the location and physical characteristics of the site, there is low uncertainty in the exposure pathways relevant to the analysis.

An RME approach is used to calculate the risk assessment values. Specifically, the parameter values in the calculations are conservative and calculated intakes may be overestimated. Maximum measured values of COC concentrations are used to provide conservative results.

Table 2.6.5-1 shows the uncertainties (confidence levels) in nonradiological toxicological parameter values. There is a combination of estimated values and values from the IRIS (EPA 2004a), HEAST (EPA 1997a), Risk Assessment Information System (ORNL 2003), EPA Region 6 (EPA 2004b), and Technical Background Document for Development of Soil Screening Levels (NMED February 2004). Where values are not provided, information is not available from the HEAST (EPA 1997a), IRIS (EPA 2004a), Technical Background Document for Development of Soil Screening Levels (NMED February 2004), Risk Assessment Information System (ORNL 2003), or EPA regions (EPA 2004b, EPA 2002a, EPA 2002b). Because of the conservative nature of the RME approach, uncertainties in toxicological values are not expected to change the conclusion from the risk assessment analysis.

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

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

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

2.6.9 Summary

DSS SWMU 146 contains identified COCs consisting of some organic, inorganic, and radiological compounds. Because of the location of the site, the designated industrial land-use scenario, and the nature of contamination, potential exposure pathways identified for this site include soil ingestion, dermal contact, and dust and volatile inhalation for chemical COCs and soil ingestion, dust inhalation, and direct gamma exposure for radionuclides. The same exposure pathways are applied to the residential land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for the nonradiological COCs show that for the industrial land-use scenario the HI (0.00) is significantly lower than the accepted numerical guidance from the EPA. The estimated excess cancer risk is 1E-8. 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 estimated incremental excess cancer risk is 1.43E-8 for the industrial land-use scenario. These incremental risk calculations indicate insignificant risk to human health for the industrial land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for the nonradiological COCs show that for the residential land-use scenario the HI (0.00) is also below the accepted numerical guidance from the EPA. The estimated excess cancer risk is 3E-8. Thus, excess cancer risk is below the acceptable risk value provided by the NMED for a residential land-use scenario (Bearzi January 2001). The incremental HI is 0.00 and the estimated incremental excess cancer risk is 3.04E-8 for the residential land-use scenario. These incremental risk calculations indicate insignificant risk to human health for the residential land-use scenario.

The incremental TEDE and corresponding estimated cancer risk from the radiological COCs are much lower than EPA guidance values. The estimated TEDE is 4.5E-2 mrem/yr for the industrial land-use scenario, which is much lower than the EPA's numerical guidance of 15 mrem/yr (EPA 1997b). The corresponding estimated incremental excess cancer risk value is 4.0E-7 for the industrial land-use scenario. Furthermore, the incremental TEDE for the residential land-use scenario that results from a complete loss of institutional control is 0.11 mrem/yr with an associated risk of 1.2E-6. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, DSS SWMU 146 is eligible for unrestricted radiological release.

The summation of the nonradiological and radiological carcinogenic risks is tabulated in Table 2.6.9-1.

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

Table 2.6.9-1
Summation of Incremental Nonradiological and Radiological Risks from
DSS SWMU 146, Building 9920 Drain System Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	1.43E-8	4.0E-7	4.1E-7
Residential	3.04E-8	1.2E-6	1.2E-6

DSS = Drain and Septic Systems.
SWMU = Solid Waste Management Unit.

2.7 Ecological Risk Assessment

2.7.1 Introduction

This section addresses the ecological risks associated with exposure to constituents of potential ecological concern (COPECs) in the soil at DSS SWMU 146. A component of the NMED Risk-Based Decision Tree in the "RPMP [RCRA Permits Management Program] Document Requirement Guide" (NMED March 1998) is to conduct an ecological assessment that corresponds with that presented in EPA's Ecological RAGS (EPA 1997c). The current methodology is tiered and contains an initial scoping assessment followed by a more detailed risk assessment. Initial components of NMED's decision tree (a discussion of DQOs, data assessment, and evaluations of bioaccumulation as well as fate and transport potential) are addressed in previous sections of this report. Following the completion of the scoping assessment, a determination is made as to whether a more detailed examination of potential ecological risk is necessary. If deemed necessary, the scoping assessment proceeds to a risk assessment whereby a more quantitative estimate of ecological risk is conducted. Although this assessment is conservative in the estimation of ecological risks, ecological relevance and professional judgment are also used as recommended by the EPA (1998) to ensure that predicted exposures of selected ecological receptors reflect those reasonably expected to occur at the site.

2.7.2 Scoping Assessment

The scoping assessment focuses primarily on the likelihood of exposure of biota at, or adjacent to, the site to constituents associated with site activities. Included in this section are an evaluation of existing data and a comparison of maximum detected concentrations to background concentrations, examination of bioaccumulation potential, and fate and transport potential. A scoping risk-management decision (Section 2.7.2.4) summarizes the scoping results and assesses the need for further examination of potential ecological impacts.

2.7.2.1 Data Assessment

As indicated in Section 2.4 (Tables 2.4-2 and 2.4-4), constituents in soil within the 0- to 5-foot depth interval that are identified as COPECs for this site include the following:

- Cyanide
- Acetone
- Methyl ethyl ketone
- Methylene chloride
- Methyl isobutyl ketone
- Uranium-235
- Uranium-238

2.7.2.2 Bioaccumulation

Among the COPECs listed in Section 2.7.2.1, the following are considered to have bioaccumulation potential in aquatic environments (Section 2.4, Tables 2.4-2 and 2.4-4):

- Uranium-235
- Uranium-238

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

2.7.2.3 Fate and Transport Potential

The potential for the COPECs to migrate from the source of contamination to other media or biota is discussed in Section 2.5. As noted in Table 2.5-1, wind, surface water, and biota (food chain uptake) are expected to be of low significance as transport mechanisms for COPECs at this site. Degradation, transformation, and radiological decay of the COPECs are also expected to be of low significance.

2.7.2.4 Scoping Risk-Management Decision

Based upon information gathered through the scoping assessment, it is concluded that complete ecological pathways may be associated with DSS SWMU 146 and that COPECs also exist at the site. As a consequence, a detailed ecological risk assessment is deemed necessary to predict the potential level of ecological risk associated with the site.

2.7.3 Risk Assessment

As concluded in Section 2.7.2.4, both complete ecological pathways and COPECs are associated with DSS SWMU 146. The ecological risk assessment performed for the site involves a quantitative estimate of current ecological risks using exposure models in association with exposure parameters and toxicity information obtained from the literature. The estimation of potential ecological risks is conservative to ensure that ecological risks are not underpredicted.

Components within the risk assessment include the following:

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

2.7.3.1 Problem Formulation

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

2.7.3.1.1 Ecological Pathways and Setting

DSS SWMU 146 is less than 1 acre in size. The site is located in an area dominated by grassland habitat. The site is unpaved and open to use by wildlife. No threatened or endangered species exist at this site (IT February 1995), and no surface-water bodies, seeps, or springs are associated with the site.

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

2.7.3.1.2 COPECs

Discharge of waste water from the drywell of Building 9920 is the primary source of COPECs at DSS SWMU 146. All COPECs identified for this site are listed in Section 2.7.2.1. The COPECs include both radiological and nonradiological analytes. The analytes were screened against background concentrations and those that exceeded the approved SNL/NM background screening levels (Dinwiddie September 1997) for the area were considered to be COPECs. All organic analytes detected in the soil and inorganic COCs with uncertain background levels were retained as COPECs. Nonradiological inorganic constituents that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, are not included in this risk assessment as set forth by the EPA (1989). In order to provide conservatism, this ecological risk assessment is based upon the maximum soil concentrations of the COPECs measured in the upper 5 feet of soil at this site. Tables 2.4-2 and 2.4-4 present the maximum concentrations for the COPECs.

2.7.3.1.3 Ecological Receptors

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

2.7.3.2 Exposure Estimation

For nonradiological COPECs, direct uptake from the soil is considered the only significant route of exposure for terrestrial plants. Exposure modeling for the wildlife receptors is limited to food and soil ingestion pathways. Inhalation and dermal contact are considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Drinking water is also considered an insignificant pathway because of the lack of surface water at this site. The deer mouse is modeled under three dietary regimes: as an herbivore (100 percent of its diet as plant material), as an omnivore (50 percent of its diet as plants and 50 percent as soil invertebrates), and as an insectivore (100 percent of its diet as soil invertebrates). The burrowing owl is modeled as a strict predator on small mammals (100 percent of its diet as deer mice). Because the exposure in the burrowing owl from a diet consisting of equal parts of herbivorous, omnivorous, and insectivorous mice would be equivalent to the exposure consisting of only omnivorous mice, the diet of the burrowing owl is modeled with intake of omnivorous mice only. Both species are modeled with soil ingestion comprising 2 percent of the total dietary intake. Table 2.7.3-1 presents the species-specific factors used in modeling exposures in the wildlife receptors. Justification for use of the factors presented in this table is described in the ecological risk assessment methodology document (IT July 1998).

Table 2.7.3-1
Exposure Factors for Ecological Receptors at DSS SWMU 146

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

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

Although home range is also included in this table, exposures for this risk assessment are modeled using an area use factor of 1.0, implying that all food items and soil ingested come from the site being investigated. The maximum COPEC concentrations measured in the upper 5 feet of soil were used to conservatively estimate potential exposures and risks to plants and wildlife at this site.

For the radiological dose-rate calculations, the deer mouse is modeled as an herbivore (100 percent of its diet as plants), and the burrowing owl is modeled as a strict predator on small mammals (100 percent of its diet as deer mice). Both are modeled with soil ingestion comprising 2 percent of the total dietary intake. Receptors are exposed to radiation both internally and externally from uranium-235 and uranium-238. Internal and external dose rates to the deer mouse and the burrowing owl are approximated using modified dose-rate models from the DOE (1995) as presented in the ecological risk assessment methodology document for the SNL/NM ER Project (IT July 1998). Radionuclide-dependent data for the dose-rate calculations were obtained from Baker and Soldat (1992). The external dose-rate model examines the total-body dose rate to a receptor residing in soil exposed to radionuclides. The soil surrounding the receptor is assumed to be an infinite medium uniformly contaminated with gamma-emitting radionuclides. The external dose-rate model is the same for both the deer mouse and the burrowing owl. The internal total-body dose-rate model assumes that a fraction of the radionuclide concentration ingested by a receptor is absorbed by the body and concentrated at the center of a spherical body shape. This provides for a conservative estimate for absorbed dose. This concentrated radiation source at the center of the body of the receptor is assumed to be a "point" source. Radiation emitted from this point source is absorbed by the body tissues to contribute to the absorbed dose. Alpha and beta emitters are assumed to transfer 100 percent of their energy to the receptor as they pass through tissues. Gamma-emitting radionuclides transfer only a fraction of their energy to the tissues because gamma rays interact less with matter than do beta or alpha emitters. The external and internal dose-rate results are summed to calculate a total dose rate from exposure to uranium-235 and uranium-238 in soil.

Table 2.7.3-2 provides the transfer factors used in modeling the concentrations of COPECs through the food chain. Table 2.7.3-3 presents maximum concentrations in soil and derived concentrations in tissues of the various food chain elements that are used to model dietary exposures for each of the wildlife receptors.

2.7.3.3 Ecological Effects Evaluation

Table 2.7.3-4 shows benchmark toxicity values for the plant and wildlife receptors. For plants, the benchmark soil concentrations are based upon the lowest-observed-adverse-effect level (LOAEL). For wildlife, the toxicity benchmarks are based upon the no-observed-adverse-effect level (NOAEL) for chronic oral exposure in a taxonomically similar test species. Sufficient toxicity information was not available to estimate the LOAELs or NOAELs for some COPECs.

The benchmark used for exposure of terrestrial receptors to radiation was 0.1 rad/day. This value has been recommended by the International Atomic Energy Agency (IAEA 1992) for the protection of terrestrial populations. Because plants and insects are less sensitive to radiation than vertebrates (Whicker and Schultz 1982), the dose of 0.1 rad/day should also protect other groups within the terrestrial habitat of DSS SWMU 146.

Table 2.7.3-2
Transfer Factors Used in Exposure Models for COPECs at DSS SWMU 146

COPEC	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Inorganic			
Cyanide	0.0E+0[a]	0.0E+0[a]	0.0E+0[a]
Organic[b]			
Acetone	5.3E+1	1.3E+1	1.0E-8
Methylene chloride	7.3E+0	1.5E+1	3.6E-7
Methyl ethyl ketone	2.6E+1	1.4E+1	3.7E-8
Methyl isobutyl ketone	7.9E+0	1.5E+1	3.1E-7

[a]No data found for food chain transfers of cyanide; however, because of its high metabolic activity, cyanide is assumed not to transfer in the food chain.
[b]Soil-to-plant and food-to-muscle transfer factors from equations developed in Travis and Arms (1988). Soil-to-invertebrate transfer factors from equations developed in Connell and Markwell (1990). All three equations based upon relationship of the transfer factor to the Log K_{ow} value of compound.
COPEC = Constituent of potential ecological concern.
DSS = Drain and Septic Systems.
K_{ow} = Octanol-water partition coefficient.
Log = Logarithm (base 10).
SWMU = Solid Waste Management Unit.

Table 2.7.3-3
Media Concentrations[a] for COPECs at DSS SWMU 146

COPEC	Soil (Maximum)[a]	Plant Foliage[b]	Soil Invertebrate[b]	Deer Mouse Tissues[c]
Inorganic				
Cyanide	2.5E-2[d]	0.0E+0	0.0E+0	0.0E+0
Organic				
Acetone	1.3E-2	6.9E-1	1.7E-1	1.4E-8
Methylene chloride	2.2E-3[e]	1.6E-2	3.3E-2	2.8E-8
Methyl ethyl ketone	5.0E-3[d]	1.3E-1	6.8E-2	1.2E-8
Methyl isobutyl ketone	5.0E-3[d]	4.0E-2	7.5E-2	5.6E-8

[a]In milligrams per kilogram. All biotic media are based upon dry weight of the media. Soil concentration measurements are assumed to have been based upon dry weight. Values have been rounded to two significant digits after calculation.
[b]Product of the soil concentration and the corresponding transfer factor.
[c]Based upon the deer mouse with an omnivorous diet. Product of the average concentration ingested in food and soil times the food-to-muscle transfer factor times a wet weight-dry weight conversion factor of 3.125 (EPA 1993).
[d]Nondetected concentration (i.e., one-half the maximum detection limit is greater than the maximum detected concentration).
[e]Estimated value.
COPEC = Constituent of potential ecological concern.
DSS = Drain and Septic Systems.
SWMU = Solid Waste Management Unit.

Table 2.7.3-4
Toxicity Benchmarks for Ecological Receptors at DSS SWMU 146

COPEC	Plant Benchmark[a,b]	Mammalian NOAELs			Avian NOAELs		
		Mammalian Test Species[c,d]	Test Species NOAEL[d,e]	Deer Mouse NOAEL[e,f]	Avian Test Species[d]	Test Species NOAEL[d,e]	Burrowing Owl NOAEL[e,g]
Inorganic							
Cyanide	--	rat[h]	68.7	126	--	--	--
Organic							
Acetone	--	rat	10	19.6	--	--	--
Methylene chloride	--	rat	5.85	11.4	--	--	--
Methyl ethyl ketone	--	rat	1,771	3,464	--	--	--
Methyl isobutyl ketone	--	rat	1,346	2,633	--	--	--

[a]In mg/kg soil dry weight.
[b]Efroymson et al. 1997.
[c]Body weights (in kg) for the NOAEL conversion are as follows: lab mouse, 0.030; lab rat, 0.350; oldfield mouse, 0.014 (except where noted).
[d]Sample et al. (1996), except where noted.
[e]In mg/kg body weight per day.
[f]Based upon NOAEL conversion methodology presented in Sample et al. (1996), using a deer mouse body weight of 0.0239 kg and a mammalian scaling factor of 0.25.
[g]Based upon NOAEL conversion methodology presented in Sample et al. (1996). The avian scaling factor of 0.0 was used, making the NOAEL independent of body weight.
[h]Body weight: 0.273 kg.
COPEC = Constituent of potential ecological concern.
DSS = Drain and Septic Systems.
kg = Kilogram(s).
mg = Milligram(s).
NOAEL = No-observed-adverse-effect level.
SWMU = Solid Waste Management Unit.
-- = Insufficient toxicity data.

2.7.3.4 *Risk Characterization*

Maximum concentrations in soil and estimated dietary exposures are compared to plant and wildlife benchmark values, respectively. Table 2.7.3-5 presents the results of these comparisons. HQs are used to quantify the comparison with benchmarks for plant and wildlife exposure.

None of the HQs exceed unity for any of the potential receptors. Because of a lack of sufficient toxicity information, the HQ for plants could not be determined for any of the COPECs. Similarly for the burrowing owl, HQs could not be determined for any of the COPECs. As directed by the NMED, HIs are calculated for each of the receptors (the HI is the sum of chemical-specific HQs for all pathways for a given receptor). None of the total HIs exceed unity.

Tables 2.7.3-6 and 2.7.3-7 summarize the internal and external dose-rate model results for uranium-235 and uranium-238 for the deer mouse and burrowing owl, respectively. The total radiation dose rate to the deer mouse is predicted to be 3.8E-4 rad/day and that for the burrowing owl is 3.7E-4 rad/day. The dose rates for the deer mouse and the burrowing owl are lower than the benchmark of 0.1 rad/day.

2.7.3.5 *Uncertainty Assessment*

Many uncertainties are associated with the characterization of ecological risks at DSS SWMU 146. These uncertainties result from assumptions used in calculating risk that may overestimate or underestimate true risk presented at the site. For this risk assessment, assumptions are made that are more likely to overestimate exposures and risk rather than to underestimate them. These conservative assumptions are used to be more protective of the ecological resources potentially affected by the site. Conservatisms incorporated into this risk assessment include the use of maximum analyte concentrations measured in soil to evaluate risk, the use of wildlife toxicity benchmarks based upon NOAEL values, and the incorporation of strict herbivorous and strict insectivorous diets for predicting the extreme HQ values for the deer mouse. Each of these uncertainties, which are consistent among each of the site-specific ecological risk assessments, is discussed in greater detail in the uncertainty section of the ecological risk assessment methodology document for the SNL/NM ER Project (IT July 1998).

Uncertainties associated with the estimation of risk to ecological receptors following exposure to uranium-235 and uranium-238 are primarily related to those inherent in the radionuclide-specific data. Radionuclide-dependent data are measured values that have their associated errors. The dose-rate models used for these calculations are based upon conservative estimates of receptor shape, radiation absorption by body tissues, and intake parameters. The goal is to provide a realistic but conservative estimate of a receptor's internal and external exposure to radionuclides in soil. These dose estimates are conservatively based upon detection limits of the two radionuclides, neither of which were detected at the site.

Table 2.7.3-5
HQs for Ecological Receptors at DSS SWMU 146

COPEC	Plant HQ	Deer Mouse HQ (Herbivorous)	Deer Mouse HQ (Omnivorous)	Deer Mouse HQ (Insectivorous)	Burrowing Owl HQ
Inorganic					
Cyanide	--	6.2E-9	6.2E-9	6.2E-9	--
Organic					
Acetone	--	5.5E-3	3.4E-3	1.3E-3	--
Methylene Chloride	--	2.2E-4	3.4E-4	4.6E-4	--
Methyl Ethyl Ketone	--	5.9E-6	4.5E-6	3.1E-6	--
Methyl Isobutyl Ketone	--	2.4E-6	3.4E-6	4.5E-6	--
HI[a]	--	5.7E-3	3.8E-3	1.8E-3	--

[a]The HI is the sum of individual HQs.
COPEC = Constituent of potential ecological concern.
DSS = Drain and Septic Systems.
HI = Hazard index.
HQ = Hazard quotient.
SWMU = Solid Waste Management Unit.
-- = Insufficient toxicity data available for risk estimation purposes.

Table 2.7.3-6
Total Dose Rates for Deer Mice
Exposed to Radionuclides at DSS SWMU 146

Radionuclide	Maximum Activity (pCi/g)	Total Dose (rad/day)
Uranium-235	ND (0.306)	8.3E-6
Uranium-238	ND (2.32)	3.8E-4
Total Dose		3.8E-4

DSS = Drain and Septic Systems.
MDA = Minimum detectable activity.
ND ( ) = Not detected above the MDA, shown in parentheses.
pCi/g = Picocurie(s) per gram.
SWMU = Solid Waste Management Unit.

Table 2.7.3-7
Total Dose Rates for Burrowing Owls
Exposed to Radionuclides at DSS SWMU 146

Radionuclide	Maximum Activity (pCi/g)	Total Dose (rad/day)
Uranium-235	ND (0.306)	6.3E-6
Uranium-238	ND (2.32)	3.6E-4
Total Dose		3.7E-4

DSS = Drain and Septic Systems.
MDA = Minimum detectable activity.
ND ( ) = Not detected above the MDA, shown in parentheses.
pCi/g = Picocurie(s) per gram.
SWMU = Solid Waste Management Unit.

2.7.3.6 Risk Interpretation

Ecological risks associated with DSS SWMU 146 were estimated through a risk assessment that incorporates site-specific information when available. All HQ values predicted for the COPECs at this site are less than unity.

Analysis of the uncertainties associated with these predicted values indicate that they are more likely to overestimate actual risk rather than underestimate it. Based upon this final analysis, the potential for ecological risks associated with DSS SWMU 146 is expected to be very low.

2.7.3.7 Risk Assessment Scientific/Management Decision Point

After potential ecological risks associated with the site have been assessed, a decision is made regarding whether the site should be recommended for CAC without controls (NMED April 2004) or whether additional data should be collected to more thoroughly assess actual ecological risk at the site. With respect to this site, ecological risks are predicted to be very low. The scientific/management decision is to recommend this site for CAC without controls.

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3.0 RECOMMENDATION FOR CORRECTIVE ACTION COMPLETE WITHOUT CONTROLS DETERMINATION

3.1 Rationale

Based upon field investigation data and the human health and ecological risk assessment analyses, a determination of CAC without controls (NMED April 2004) is recommended for DSS SWMU 146 for the following reasons:

- The soil has been sampled for all potential COCs.
- No COCs are present in the soil at levels considered hazardous to human health for either an industrial or residential land-use scenario.
- None of the COCs warrant ecological concern after conservative exposure assumptions are analyzed.

3.2 Criterion

Based upon the evidence provided in the risk assessment, a determination of CAC without controls (NMED April 2004) is recommended for DSS SWMU 146. This is consistent with the NMED's NFA Criterion 5, which states, "the SWMU/AOC [Area of Concern] has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use" (NMED March 1998).

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4.0 REFERENCES

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

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

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

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

Connell, D.W., and R.D. Markwell, 1990. "Bioaccumulation in the Soil to Earthworm System," *Chemosphere*, Vol. 20, Nos. 1-2, pp. 91-100.

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

DOE, see U.S. Department of Energy.

Dunning, J.B., 1993. *CRC Handbook of Avian Body Masses*, CRC Press, Boca Raton, Florida.

Efroymson, R.A., M.E. Will, G.W. Suter, II, and A.C. Wooten, 1997. "Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1997 Revision," ES/ER/TM-85/R3, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

EPA, see U.S. Environmental Protection Agency.

Haug, E.A., B.A. Millsap, and M.S. Martell, 1993. "*Speotyto cunicularia* Burrowing Owl," *in* A. Poole and F. Gill (eds.), *The Birds of North America*, No. 61, The Academy of Natural Sciences of Philadelphia.

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

Howard, P.H., 1993. Volume IV: "Solvents 2," *Handbook of Environmental Fate and Exposure Data for Organic Chemicals*, Lewis Publishers, Inc., Chelsea, Michigan.

IAEA, see International Atomic Energy Agency.

International Atomic Energy Agency (IAEA), 1992. "Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards," *Technical Report Series* No. 332, International Atomic Energy Agency, Vienna, Austria.

IT, see IT Corporation.

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

IT Corporation (IT), February 1995. "Sensitive Species Survey Results, Environmental Restoration Project, Sandia National Laboratories/New Mexico," IT Corporation, Albuquerque, New Mexico.

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

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

Micromedex, Inc., 1998. Hazardous Substances Databank.

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

Nagy, K.A., 1987. "Field Metabolic Rate and Food Requirement Scaling in Mammals and Birds," *Ecological Monographs*, Vol. 57, No. 2, pp. 111–128.

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

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

NCRP, see National Council on Radiation Protection and Measurements.

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

New Mexico Environment Department (NMED), April 1997. "Notice of Deficiency; Proposal to Approve: Proposals for No Further Action, Environmental Restoration Project (Third Round)." Hazardous and Radioactive Materials Bureau, New Mexico Environment Department, Santa Fe, New Mexico. April 28, 1997.

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

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

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

NMED, see New Mexico Environment Department.

NOAA, see National Oceanographic and Atmospheric Administration.

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

ORNL, see Oak Ridge National Laboratory.

Sample, B.E., and G.W. Suter, II, 1994. "Estimating Exposure of Terrestrial Wildlife to Contaminants," ES/ER/TM-125, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Sample, B.E., D.M. Opresko, and G.W. Suter, II, 1996. "Toxicological Benchmarks for Wildlife: 1996 Revision," ES/ER/TM-86/R3, Risk Assessment Program, Health Sciences Research Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Sanders, M.R. (Sandia National Laboratories/New Mexico), June 1995. Field Logbook #0102, page 51, "Notes pertaining to conversations with SNL/NM personnel regarding removal of sinks from Building 9920," Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico. June 1, 1995.

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

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

Sandia National Laboratories/New Mexico (SNL/NM), August 1995. "Proposal for No Further Action, Environmental Restoration Project Site 146, Building 9920 Drain System, Operable Unit 1295," Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico.

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

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

Sandia National Laboratories/New Mexico (SNL/NM), June 1997. "Environmental Restoration Project Responses to NMED Technical Comments on No Further Action Proposals Dated August 1995." Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico.

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

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

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

Sandia National Laboratories/New Mexico (SNL/NM), April 2004. "Fiscal Year 2003 Annual Groundwater Monitoring Report," Report #75-10077-6, Sandia National Laboratories, Albuquerque, New Mexico.

Silva, M., and J.A. Downing, 1995. *CRC Handbook of Mammalian Body Masses*, CRC Press, Boca Raton, Florida.

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

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

Travis, C.C., and A.D. Arms, 1988. "Bioconcentration of Organics in Beef, Milk, and Vegetation," *Environmental Science and Technology*, Vol. 22, No. 3, pp. 271-274.

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

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

U.S. Department of Energy (DOE), 1995. "Hanford Site Risk Assessment Methodology," DOE/RL-91-45 (Rev. 3), U.S. Department of Energy, Richland, Washington.

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

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

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

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

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

U.S. Environmental Protection Agency (EPA), 1993. "Wildlife Exposure Factors Handbook, Volume I of II," EPA/600/R-93/187a, Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C.

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

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

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

U.S. Environmental Protection Agency (EPA), 1998. "Guidelines for Ecological Risk Assessment," EPA/630/R-95/002F, Risk Assessment Forum, U.S. Environmental Protection Agency, Washington, D.C.

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

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

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

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

U.S. Fish and Wildlife Service (USFWS), September 1995. "Migratory Nongame Birds of Management Concern in the United States: The 1995 List," Office of Migratory Bird Management, U.S. Fish and Wildlife Service, Washington, D.C.

USFWS, see U.S. Fish and Wildlife Service.

Whicker, F.W., and V. Schultz, 1982. *Radioecology: Nuclear Energy and the Environment*, Vol. 2, CRC Press, Boca Raton, Florida.

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

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

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

ANNEX A
DSS SWMU 146
Exposure Pathway Discussion for
Chemical and Radionuclide Contamination

ANNEX A
EXPOSURE PATHWAY DISCUSSION FOR CHEMICAL AND RADIONUCLIDE CONTAMINATION

Introduction

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

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

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

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

- Ingestion of contaminated drinking water
- Ingestion of contaminated soil

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

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

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

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

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

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

Table 1
Exposure Pathways Considered for Various Land-Use scenarios

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

Equations and Default Parameter Values for Identified Exposure Routes

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

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

Generic Equation for Calculation of Risk Parameter Values

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

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

= 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):

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

where:

I_s = Intake of contaminant from soil inhalation (mg/kg-day)
C_s = Chemical concentration in soil (mg/kg)
IR = Inhalation rate (cubic meters [m^3]/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
VF = soil-to-air volatilization factor (m^3/kg)
PEF = particulate emission factor (m^3/kg)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

Soil Dermal Contact

$$D_a = \frac{C_s * CF * SA * AF * ABS * EF * ED}{BW * AT}$$

where:

D_a = Absorbed dose (mg/kg-day)
C_s = Chemical concentration in soil (mg/kg)
CF = Conversion factor (1E-6 kg/mg)
SA = Skin surface area available for contact (cm^2/event)
AF = Soil to skin adherence factor (mg/cm^2)
ABS = Absorption factor (unitless)
EF = Exposure frequency (events/year)

ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

Groundwater Ingestion

A receptor can ingest water by drinking it or through using household water for cooking. An estimate of intake from ingesting water will be calculated as follows (EPA August 1997):

$$I_w = \frac{C_w * IR * EF * ED}{BW * AT}$$

where:

I_w = Intake of contaminant from water ingestion (mg/kg/day)
C_w = Chemical concentration in water (mg/liter [L])
IR = Ingestion rate (L/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

Groundwater Inhalation

The amount of a constituent taken into the body via exposure to volatilization from showering or other household water uses will be evaluated using the concentration of the constituent in the water source (EPA 1991 and 1992). An estimate of intake from volatile inhalation from groundwater will be calculated as follows (EPA 1991):

$$I_w = \frac{C_w * K * IR_i * EF * ED}{BW * AT}$$

where:

I_w = Intake of volatile in water from inhalation (mg/kg/day)
C_w = Chemical concentration in water (mg/L)
K = volatilization factor (0.5 L/m^3)
IR_i = Inhalation rate (m^3/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged—days)

For volatile compounds, volatilization from groundwater can be an important exposure pathway from showering and other household uses of groundwater. This exposure pathway will only be evaluated for organic chemicals with a Henry's Law constant greater than $1x10^{-5}$ and with a molecular weight of 200 grams/mole or less (EPA 1991).

Tables 2 and 3 show the default parameter values suggested for use by SNL/NM at SWMUs, based upon the selected land-use scenarios for nonradiological and radiological COCs, respectively. References are given at the end of the table indicating the source for the chosen parameter values. SNL/NM uses default values that are consistent with both regulatory guidance and the RME approach. Therefore, the values chosen will, in general, provide a conservative estimate of the actual risk parameter. These parameter values are suggested for use for the various exposure pathways, based upon the assumption that a particular site has no unusual characteristics that contradict the default assumptions. For sites for which the assumptions are not valid, the parameter values will be modified and documented.

Summary

SNL/NM will use the described default exposure routes and parameter values in risk assessments at sites that have an industrial, recreational, or residential future land-use scenario. There are no current residential land-use designations at SNL/NM ER sites, but NMED has requested this scenario to be considered to provide perspective of the risk under the more restrictive land-use scenario. For sites designated as industrial or recreational land use, SNL/NM will provide risk parameter values based upon a residential land-use scenario to indicate the effects of data uncertainty on risk value calculations or in order to potentially mitigate the need for institutional controls or restrictions on SNL/NM ER sites. The parameter values are based upon EPA guidance and supplemented by information from other government sources. If these exposure routes and parameters are acceptable, SNL/NM will use them in risk assessments for all sites where the assumptions are consistent with site-specific conditions. All deviations will be documented.

Table 2
Default Nonradiological Exposure Parameter Values for Various Land-Use scenarios

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure Frequency (day/yr)	250[a,b]	8.7 (4 hr/wk for 52 wk/yr)[a,b]	350[a,b]
Exposure Duration (yr)	25[a,b,c]	30[a,b,c]	30[a,b,c]
Body Weight (kg)	70[a,b,c]	70 Adult[a,b,c] 15 Child[a,b,c]	70 Adult[a,b,c] 15 Child[a,b,c]
Averaging Time (days) for Carcinogenic Compounds (= 70 yr x 365 day/yr) for Noncarcinogenic Compounds (= ED x 365 day/yr)	25,550[a,b] 9,125 [a,b]	25,550[a,b] 10,950[a,b]	25,550 [a,b] 10,950 [a,b]
Soil Ingestion Pathway			
Ingestion Rate (mg/day)	100[a,b]	200 Child[a,b] 100 Adult[a,b]	200 Child [a,b] 100 Adult [a,b]
Inhalation Pathway			
Inhalation Rate (m^3/day)	20[a,b]	15 Child[a] 30 Adult[a]	10 Child[a] 20 Adult[a]
Volatilization Factor (m^3/kg)	Chemical Specific	Chemical Specific	Chemical Specific
Particulate Emission Factor (m^3/kg)	1.36E9[a]	1.36E9[a]	1.36E9[a]
Water Ingestion Pathway			
Ingestion Rate (liter/day)	2.4[a]	2.4[a]	2.4[a]
Dermal Pathway			
Skin Adherence Factor (mg/cm^2)	0.2[a]	0.2 Child[a] 0.07 Adult[a]	0.2 Child[a] 0.07 Adult[a]
Exposed Surface Area for Soil/Dust (cm^2/day)	3,300[a]	2,800 Child[a] 5,700 Adult[a]	2,800 Child[a] 5,700 Adult[a]
Skin Adsorption Factor	Chemical Specific	Chemical Specific	Chemical Specific

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

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

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

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

References

ANL, see Argonne National Laboratory.

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

DOE, see U.S. Department of Energy.

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

EPA, see U.S. Environmental Protection Agency.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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