Sandia National Laboratories/New Mexico

PROPOSAL FOR NO FURTHER ACTION ENVIRONMENTAL RESTORATION PROJECT SITE 101, BUILDING 9926 SEPTIC SYSTEM OPERABLE UNIT 1295

June 1996

Environmental Restoration Project

United States Department of Energy
Albuquerque Operations Office

PROPOSAL FOR
NO FURTHER ACTION
ENVIRONMENTAL RESTORATION PROJECT

SITE 101, EXPLOSIVE CONTAMINATED SUMPS, DRAINS (BUILDING 9926)
OPERABLE UNIT 1295
June 1996

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United States Department of Energy

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TABLE OF CONTENTS

Page

1. INTRODUCTION 1-1
   - 1.1 ER Site 101, Explosive Contaminated Sumps, Drains (Building 9926) 1-1
   - 1.2 SNL/NM Administrative NFA Process 1-1
   - 1.3 Local Setting 1-3
2. HISTORY OF THE SWMU 2-1
   - 2.1 Sources of Supporting Information 2-1
   - 2.2 Previous Audits, Inspections, and Findings 2-1
   - 2.3 Historical Operations 2-1
3. EVALUATION OF RELEVANT EVIDENCE 3-1
   - 3.1 Unit Characteristics 3-1
   - 3.2 Operating Practices 3-1
   - 3.3 Presence or Absence of Visual Evidence 3-1
   - 3.4 Results of Previous Sampling/Surveys 3-1
   - 3.5 Assessment of Gaps in Information 3-2
   - 3.6 Confirmatory Sampling 3-3
   - 3.7 Risk Analysis 3-7
   - 3.8 Rationale for Pursuing a Risk-Based NFA Decision 3-12
4. CONCLUSION 4-1
5. REFERENCES 5-1
   - 5.1 ER Site 101 References 5-1
   - 5.2 Other References 5-1

LIST OF TABLES

Page

Table 3-1 ER Site 101: Confirmatory Sampling Summary Table 3-6

Table 3-2 ER Site 101 Summary of Organic and Other Constituents, and pH Measurements in Confirmatory Soil Samples Collected Around the Seepage Pits, Septic Tank, and Drywell 3-8

Table 3-3: ER Site 101: Summary of RCRA Metals and Hexavalent Chromium in Confirmatory Soil Samples 3-9

Table 3-4: ER Site 101: Summary of Isotopic Uranium and Tritium in Confirmatory Soil Samples Collected Around the Seepage Pits and Drywell 3-10

LIST OF FIGURES

Figure 1-1: ER Site 101 Location Map 1-4

Figure 1-2: ER Site 101 Site Map 1-5

Figure 3-1: ER Site 101 Photographs 3-4

LIST OF APPENDICES

Appendix A OU 1295, Site 101 Results of Previous Sampling and Surveys A-1

Appendix A.1 ER Site 101 Summary of Constituents Detected in 1992 Septic Tank Samples A-3

Appendix A.2 ER Site 101 Summary of Constituents in 1994 Septic Tank Samples A-7

Appendix A.3 ER Site 101 Summary of 1994 PETREX™ Passive Soil-Gas Survey Results A-11

Appendix A.4 ER Site 101 Gamma Spectroscopy Screening Results for the West Seepage Pit Shallow Interval Composite Soil Sample A-17

Appendix A.5 ER Site 101 Gamma Spectroscopy Screening Results for the West Seepage Pit Deep Interval Composite Soil Sample A-21

Appendix A.6 ER Site 101 Gamma Spectroscopy Screening Results for the Middle and East Seepage Pit Shallow Interval Composite Soil Sample A-25

Appendix A.7 ER Site 101 Gamma Spectroscopy Screening Results for the Middle and East Seepage Pit Deep Interval Composite Soil Sample A-29

Appendix A.8 ER Site 101 Gamma Spectroscopy Screening Results for the Drywell Shallow Interval Soil Sample A-33

Appendix A.9 ER Site 101 Gamma Spectroscopy Screening Results for the Drywell Deep Interval Soil Sample A-37

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1. INTRODUCTION

1.1 ER Site 101, Explosive Contaminated Sumps, Drains (Building 9926)

Sandia National Laboratories/New Mexico (SNL/NM) is proposing a no further action (NFA) decision based on confirmatory sampling for Environmental Restoration (ER) Site 101, Explosive Contaminated Sumps, Drains (Building 9926), Operable Unit (OU) 1295. ER Site 101 is listed in the Hazardous and Solid Waste Amendments (HSWA) Module IV (EPA August 1993) of the SNL/NM Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Facility Permit (NM5890110518-1) (EPA August 1992).

1.2 SNL/NM Administrative NFA Process

This proposal for a determination of a 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 (SWMUs) at the facility that may pose a threat to human health or the environment" (as proposed in 40 CFR 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 101 is based primarily on analytical results of confirmatory soil samples collected at the site. Concentrations of site-specific constituents of concern (COCs) detected in the soil samples were first compared to background 95th percentile or upper tolerance limit (UTL) concentrations of COCs found in SNL/NM soils (IT March 1996). If no SNL/NM or other relevant background limit was available for a particular COC, or if the COC concentration exceeded the SNL/NM or other relevant background limit, then the constituent concentration was compared to the proposed 40 CFR Part 264 Subpart S (Subpart S) or other relevant soil action level for the compound (EPA July 1990). If the COC concentration exceeded both the background limit and relevant action level for that compound, or if no background limit or action level has been determined or proposed for the constituent, then a risk assessment was performed. The highest concentration of the particular COC identified at the site was then compared to the derived risk assessment action level to determine if the COC concentration at the site poses a significant health risk.

A site is eligible for an NFA proposal if it meets one or more of the following criteria taken from the Environmental Restoration Document of Understanding (NMED November 1995):

- NFA Criterion 1: The site cannot be located or has been found not to exist, is a duplicate potential release site (PRS) or is located within and therefore, investigated as part of another PRS.

- NFA Criterion 2: The site has never been used for the management (that is, generation, treatment, storage, or disposal) of RCRA solid or hazardous wastes and/ or constituents or other CERCLA hazardous substances.

- NFA Criterion 3: No release to the environment has occurred, nor is likely to occur in the future.

- NFA Criterion 4: There was a release, but the site was characterized and/or remediated under another authority which adequately addresses corrective action, and documentation, such as a closure letter, is available.

- NFA Criterion 5: The PRS 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.

Review and analysis of the ER Site 101 soil sample analytical data indicate that concentrations of COCs at this site are less than (1) SNL/NM or other applicable background limits, or (2) proposed Subpart S or other action levels, or (3) derived risk assessment action levels.

ER Site 101 is being proposed for an NFA decision based on confirmatory sampling data demonstrating that hazardous waste or COCs that may have been released from this SWMU into the environment pose an acceptable level of risk under current and projected future land use (Criterion 5).

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 (USFS), 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 101 is located in the Coyote Test Field on KAFB and is approximately 0.3 miles 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 1-1). ER Site 101 consists of the immediate area around the three seepage pits and septic tank north of Building 9926, and also includes the Building 9921 drywell (Figure 1-2). The site encompasses approximately 0.13 acres of flat-lying land at an average mean elevation of 5,460 feet above mean sea level (AMSL).

The surficial geology at ER Site 101 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 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 5,060 feet AMSL at this location, so depth to ground-water is approximately 400 feet. Local groundwater 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. The nearest ground-water monitoring wells to the site 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 miles southwest of ER Site 101 (SNL/NM June 1995).

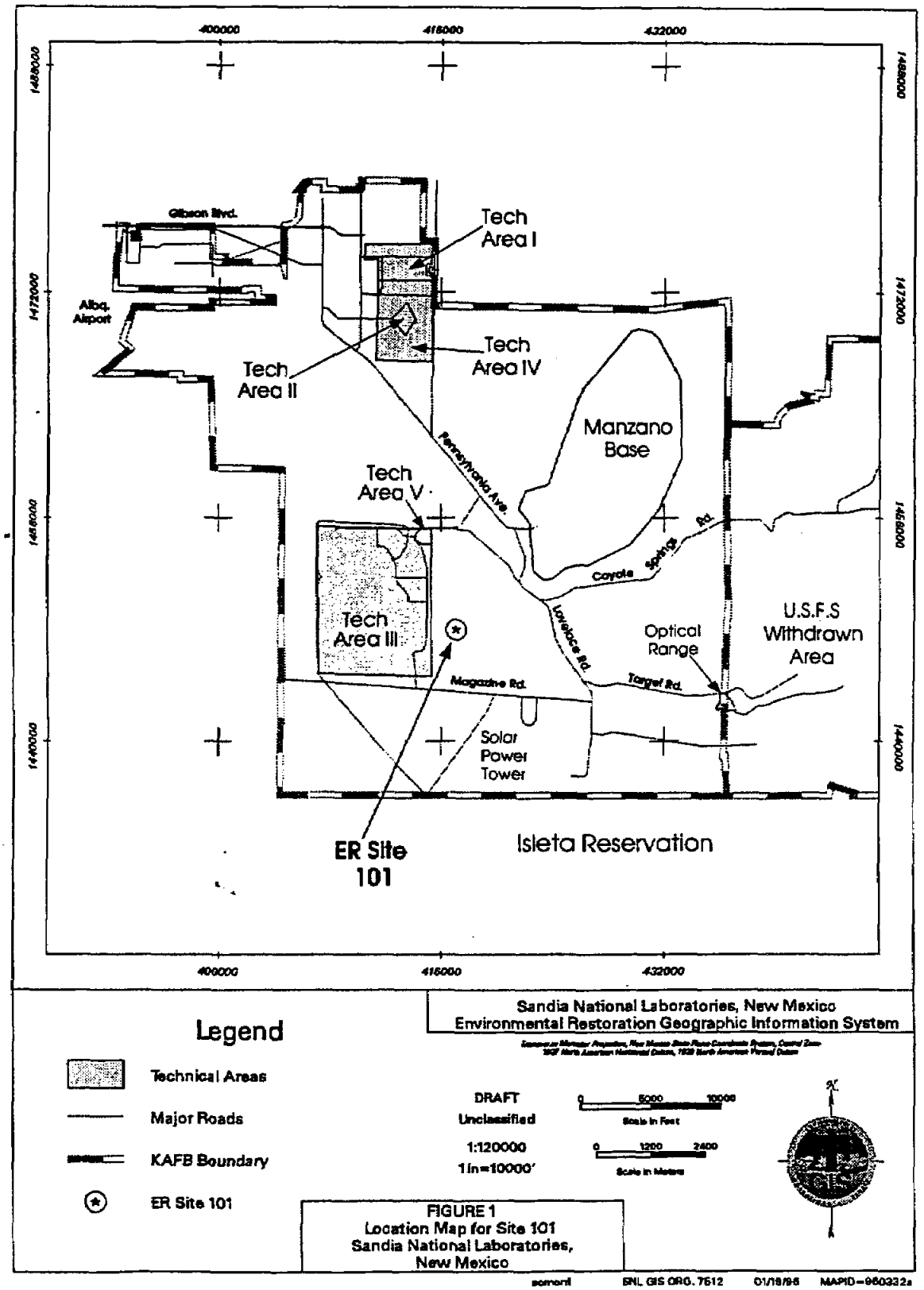

Figure 1-1: ER Site 101 Location Map

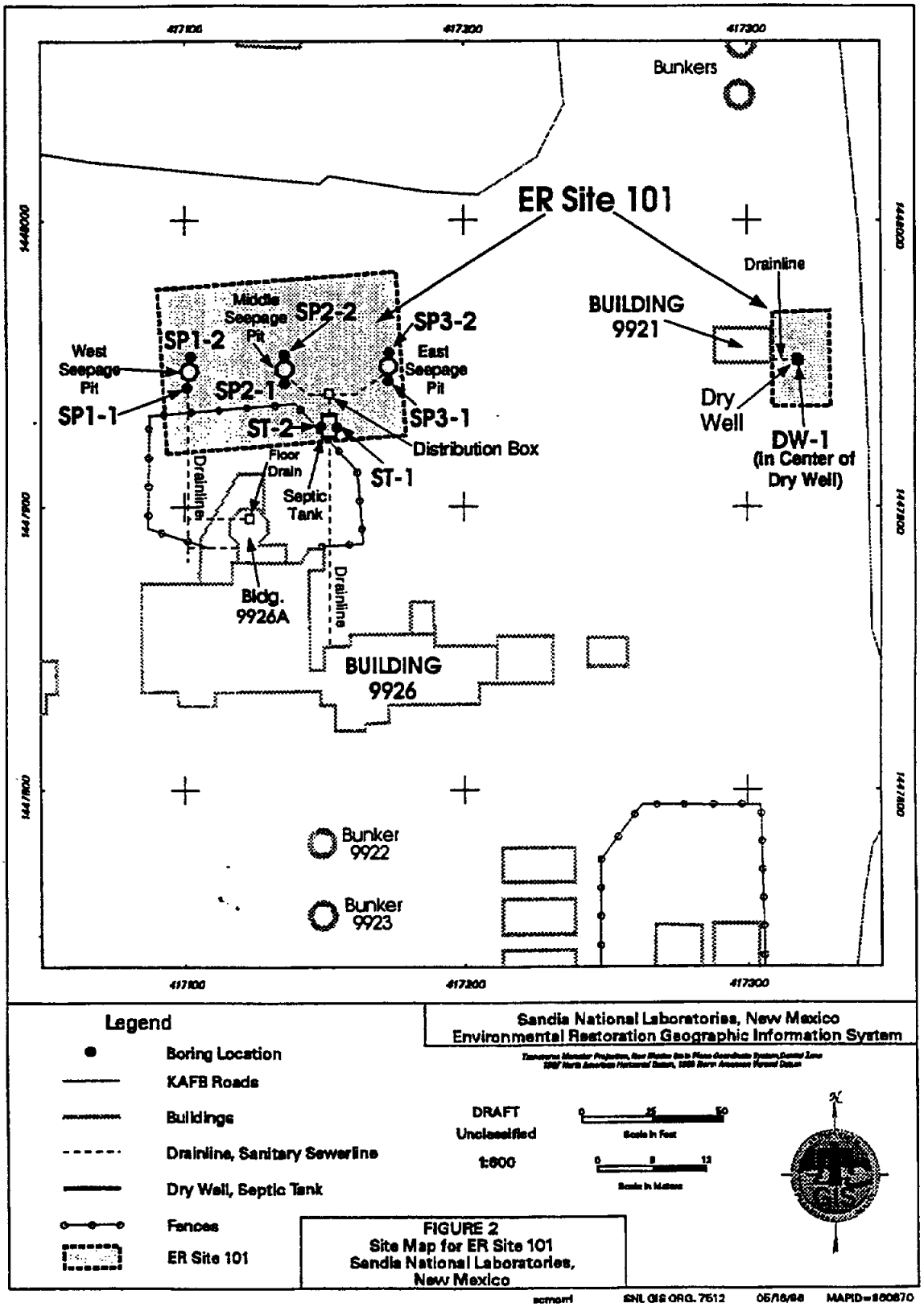

Figure 1-2: ER Site 101 Site Map

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2. HISTORY OF THE SWMU

2.1 Sources of Supporting Information

In preparing the confirmatory sampling NFA proposal for ER Site 101, 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 101:

- Confirmatory subsurface soil sampling conducted in September and October 1994, and January 1995 (SNL/NM September 1994 and January 1995b);
- Two survey reports, including a geophysical survey (Lamb 1994) and a passive soil gas survey (NERI June 1995);
- Results of samples collected from the septic tank in 1992 and 1994 (SNL/NM June 1993);
- RCRA Facilities Investigation Work Plan for OU 1295, Septic Tanks and Drainfields (SNL/NM March 1993);
- Photographs and field notes collected at the site by SNL/NM ER staff;
- SNL/NM Facilities Engineering building drawings;
- SNL/NM Geographic Information System (GIS) data; and
- The RCRA Facility Assessment (RFA) report (EPA April 1987).

2.2 Previous Audits, Inspections, and Findings

ER Site 101 was first listed as a potential release site in the Comprehensive Environmental Assessment and Response Program (CEARP) report (DOE September 1987), which noted (incorrectly) that Building 9920 had two septic tanks with drainfields that may have been contaminated with residual high explosives and small quantities of solvents. Building 9920 is at ER Site 146 (immediately west of ER Site 101), and there is only one septic tank, and no drainfield, at ER Site 101.

2.3 Historical Operations

The following historical information has been excerpted from several sources, including SNL/NM March 1993, IT March 1994, and SNL/NM November 1994.

The original wing of Building 9926 was constructed in 1960 and was expanded in 1967 with the addition of the Shock Wave Studies Laboratory and the semi-attached explosives room, designated Building 9926A (Figure 2-2). There are two restrooms in the two sections of Building 9926, which, along with indoor floor drains and sinks, discharge to an 875 gallon septic tank and 2 seepage pits 5 feet in diameter and 16 feet below grade. The original wing of Building 9926 contained a darkroom and a chemical laboratory. The darkroom had a floor drain and sink that may have received photoprocessing waste solutions. The laboratory had a fume hood sink, which may have discharged solvents such as methanol, TCE, and toluene to the septic system. Other cleaning fluids were used in small quantities, probably less than 0.5 gal per year per substance, and include hydrochloric, nitric, and sulfuric acids, acetone, and isopropyl alcohol. The Building 9926 septic system was removed from service by June 1991 when the TA-3 sewer system was constructed (SNL/NM June 1991).

Building 9926A is used for exploding 5 pound charges for shock wave studies, and explosive tests have involved the use of cadmium sulfide. Building 9926A has a floor drain that discharged to a separate seepage pit located west of the other two; this seepage pit is also 5 feet in diameter and is 12 feet below grade (Figure 2-2). The Building 9926A floor drain system reportedly never functioned properly, and the room is dry swept rather than hosed down.

In addition, a small explosives storage igloo, designated Building 9921, is located northeast of Building 9926. Explosives handled in the building include nitroguanidine and PETN. Building 9921 contains an explosive room with a sink which discharged to a drywell located 8 feet east of the southeast corner of the building (Figure 2-2).

3. EVALUATION OF RELEVANT EVIDENCE

3.1 Unit Characteristics

There are no safeguards inherent in the drain systems from Buildings 9926, 9926A, or 9921, or in facility operations that could have prevented past releases to the environment.

3.2 Operating Practices

As discussed in Section 2.3, effluent was released to the Building 9926 septic tank and seepage pits when the septic system was active. Hazardous wastes were not managed or contained at ER Site 101.

3.3 Presence or Absence of Visual Evidence

No visible evidence of soil discoloration, staining, or odors indicating residual contamination was observed when soil samples were collected around the seepage pits and septic tanks in September and October 1994 (SNL/NM September 1994), or beneath the drywell in January 1995 (SNL/NM January 1995b).

3.4 Results of Previous Sampling/Surveys

A sludge sample was collected from the ER Site 101 septic tank in August 1992 and was analyzed for selected radionuclide constituents. The brief narrative report for that sample indicated that "...no parameters were detected that exceeded U.S. Department of Energy derived concentration guidelines or the investigation levels established during this investigation." (SNL/NM June 1993). Apparently no liquid fraction remained in the tank when the sample was collected. The analytical results of this sample are presented in Appendix A.1.

A second round of septic tank sludge samples were collected for waste characterization purposes in April 1994 and were analyzed for volatile organic compounds (VOCs), explosives, cyanide, and RCRA total and Toxicity Characteristic Leaching Procedure (TCLP) metals. Trace concentrations of seven VOC compounds were identified in the material. Explosive compounds and cyanide were not detected. All eight RCRA metals were detected in two separate samples of the sludge, but only one out of eight metals was detected in the TCLP-derived leachate from two samples of the same material. The analytical results of the second round of septic tank samples are presented in Appendix A.2.

A third round of waste characterization sludge samples were collected in November 1994 and were analyzed for semivolatile organic compounds (SVOCs), isotopic uranium, and tritium. No SVOCs were detected. Low activity levels of the three isotopic uranium radionucludes and tritium were detected in the material. The analytical results of the third round of septic tank sludge characterization samples are also presented in Appendix A.2.

A geophysical survey using a magnetic locator was performed at the site in March 1994 to attempt to locate the Building 9921 drywell (Lamb 1994). An area approximately 20 feet south of Building 9921 was identified as the possible location of the unit, but the actual location was later determined with a backhoe to be east of the building (SNL/NM January 1995a). 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 passive soil-gas survey conducted in June and July 1994 used PETREX™ sampling tubes to identify any releases of VOCs and SVOCs from the seepage pit that may have occurred. A PETREX™ tube soil-gas survey is a semi-quantitative screening procedure that can be used to identify many volatile and semivolatile organic compounds. The advantages of this 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 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 inverted 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. In NERI's experience, levels below 100,000 ion counts for a single compound (such as perchloroethene [PCE] or trichloroethene[TCE]), and 200,000 ion counts for mixtures (such as BTEX or aliphatic compounds [C4-C11 cycloalkanes]), under normal site conditions, would not represent detectable levels by standard quantitative methods for soils and/or groundwater (NERI June 1995).

Thirty-four PETREX™ tube samplers were placed in a grid pattern that covered the area around the seepage pits and septic tank, and also covered the area between the seepage pits and the unpaved site access road which lies about 30 feet north of the seepage pits (SNL/NM June 1994). Aliphatic and/or BTEX compounds at potentially detectable concentrations were identified in soil gas at 6 of the 34 sampling locations. Five out of six of these locations were in or next to the access road, and the sixth location was between the road and the central seepage pit. PCE was also identified in soil-gas above 100,000 ion counts in one of the five roadway locations. Significant levels of VOCs in soil-gas were not detected in PETREX™ tubes placed closest to the seepage pits or septic tank. A map showing the PETREX™ tube sampling locations, and the analytical results of the ER Site 101 passive soil gas survey, are presented in Appendix A.3.

3.5 Assessment of Gaps in Information

The most recent material in the tank was not necessarily representative of all discharges to the unit that have occurred since it was put into service in 1960. The analytical results of the various rounds of septic tank sampling were used, along with process knowledge and other available information, to help identify the most likely COCs that might be found in soils surrounding the septic tank and seepage pits, and beneath the drywell, to help select the types of analyses to be performed on soil samples collected from the site.

While the history of past releases at the site is incomplete, analytical data from confirmatory soil samples collected in September and October 1994 and 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 101 was considered low, confirmatory soil sampling was conducted to determine whether COCs above background or detectable levels were released at this site. Samples were collected from the area immediately around the three seepage pits and the septic tank in September and October 1994 (SNL/NM September 1994) (Figure 1-2). This sampling operation is shown in the upper photograph of Figure 3-3. In January 1995 a backhoe was used to determine the precise location, dimensions, and depth of the Building 9921 drywell, which had no surface expression. The drywell excavation operation is shown in the lower photograph of Figure 3-3. Once this small drywell was located, soil samples were collected directly beneath it from a single borehole located in the center of the unit (SNL/NM January 1995a and 1995b). 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 Work Plan (SNL/NM March 1993), and addenda to the Work Plan developed during the OU 1295 project approval process (IT March 1994 and SNL/NM November 1994).

Soil samples were collected from two borings located on opposite sides of the three seepage pits, and on opposite sides of the septic tank, in September and October 1994 (Figure 2-2). In each seepage pit boring two depth intervals were sampled, the first starting at the bottom of the seepage pit, and the second at 10 feet below the top of the first sampling interval. The shallow and deep sampling intervals around the west seepage pit started at 12 and 22 feet below ground surface (BGS) respectively, and shallow and deep intervals around the middle and east seepage pits started at 16 and 26 feet BGS respectively. In each of the two septic tank borings, one depth interval starting at the bottom of the septic tank (9 feet BGS) was sampled (SNL/NM September 1994). Finally, in January 1995 soil samples were collected from one borehole directly beneath the drywell. The shallow sampling interval started at the bottom of the drywell at 4 feet BGS, and the deeper interval started at 10 feet below the top of the upper interval, or 14 feet BGS (SNL/NM January 1995b). 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 3-1.

Collecting soil samples around the ER Site 101 Seepage Pits north of Building 9926 with the Geoprobe sampling equipment. 10/3/94.

Excavation of the Building 9921 drywell to determine the location and depth of the drywell gravel. 1/11/95. View looking north-west.

Figure 3-1 : ER Site 101 Photographs

The Geoprobe™ sampling system was used to collect subsurface soil samples at this site. 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 two feet in order to fill the two-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 two-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.

Seepage pit and septic tank samples were analyzed for VOCs, SVOCs, cyanide, RCRA metals, and hexavalent chromium by an offsite commercial laboratory. Drywell samples were analyzed by an offsite commercial laboratory for VOCs, SVOCs, and RCRA metals. Samples were shipped to the offsite commercial laboratories by an overnight delivery service. Additional soil samples were collected from the seepage pits and septic tank sampling intervals and were submitted to the SNL/NM ER field laboratory (field laboratory) for TNT analyses using a field screening immunoassay technique, and soil pH determinations. TNT-screen samples were also collected from both of the drywell sampling intervals and were submitted to the field lab for analysis. Also, to determine if radionuclides were released from past activities at this site, two composite samples were collected from the west seepage pit shallow and deep sampling intervals, and two more composite samples were collected from the middle and east seepage pit shallow and deep intervals. These composite samples were analyzed by an offsite commercial laboratory for isotopic uranium, and were screened for other radionuclides using SNL/NM in-house gamma spectroscopy. Soil samples were also collected from the drywell intervals and were analyzed by an offsite commercial laboratory for isotopic uranium and tritium, and were screened for other radionuclides using SNL/NM in-house gamma spectroscopy. Routine SNL/NM chain-of-custody and sample documentation procedures were employed for all samples collected at this site.

Table 3-1
ER Site 101: Confirmatory Sampling Summary Table

Sampling Location	Analytical Parameters	Number of Borehole Locations	Top of Sampling Intervals at Each Boring Location	Total Number of Investigative Samples	Total Number of Duplicate Samples	Date(s) Samples Collected
West seepage pit	VOCs	2	12', 22'	4		9/28,29/94
	SVOCs	2	12', 22'	4		
	RCRA metals + Cr^{6+}	2	12', 22'	4		
	Cyanide	2	12', 22'	4		
	TNT screen	2	12', 22'	4		
	Soil pH	2	12', 22'	4		
	Iso. uranium composite	2	12', 22'	2		
	Gamma spec. composite	2	12', 22'	2		
Middle and east seepage pits	VOCs	4	16', 26'	8	1	9/29/94 - 10/3/94
	SVOCs	4	16', 26'	8	1	
	RCRA metals + Cr^{6+}	4	16', 26'	8	1	
	Cyanide	4	16', 26'	8	1	
	TNT screen	4	16', 26'	8	1	
	Soil pH	4	16', 26'	8	1	
	Iso. uranium composite	4	16', 26'	2		
	Gamma spec. composite	4	12', 22'	2		
Septic tank	VOCs	2	9'	2		10/3/94
	SVOCs	2	9'	2		
	RCRA metals + Cr^{6+}	2	9'	2		
	Cyanide	2	9'	2		
	TNT screen	2	9'	2		
	Soil pH	2	9'	2		
Building 9921 drywell	VOCs	2	4', 14'	2		1/11/95
	SVOCs	2	4', 14'	2		
	RCRA metals	2	4', 14'	2		
	TNT screen	2	4', 14'	2		
	Isotopic uranium	2	4', 14'	2		
	Tritium	2	4', 14'	2		
	Gamma spectroscopy	2	4', 14'	2		

Notes
Cr^{6+} = Hexavalent chromium
Iso. = Isotopic
RCRA = Resource Conservation and Recovery Act
Spec. = Spectroscopy
SVOCs = Semivolatile organic compounds
VOCs = Volatile organic compounds
TNT = Trinitrotoluene

Quality assurance/quality control (QA/QC) samples collected during this effort consisted of one set of duplicate soil samples from one of the shallow sampling intervals in the center seepage pit (Figure 1-2) and one set of aqueous equipment rinsate samples that were analyzed for most of the same non-radiologic constituents as the other seepage pit soil samples. No significant concentrations of COCs were detected in the equipment blank samples, and the concentrations of constituents detected in the duplicate soil sample were in good agreement with those detected in the equivalent field sample from the same interval. Also, soil trip blank samples were included with each of the three shipments of ER Site 101 seepage pit and septic tank soil samples to the offsite laboratory and were analyzed for VOCs only. Three or more of the following compounds were detected in each of the trip blanks: acetone, 2-hexanone, methyl ethyl ketone (MEK), methyl isobutyl ketone (MIBK), methylene chloride, and toluene. These common laboratory contaminants were either not detected, or were found in lower concentrations in the site samples than the trip blanks. Soil used for the trip blanks 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. It is thought that 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 either commercial laboratory analyses or by the SNL/NM field laboratory in these confirmatory samples is presented in Tables 3-2, 3-3, and 3-4. Results of the SNL/NM in-house gamma spectroscopy composite soil sample screening for other radionuclides are presented in Appendices A.4 through A.9. Complete soil sample analytical data packages are archived in the SNL/NM Environmental Operations Records Center and are readily available for review and verification (SNL/NM October 1994).

3.7 Risk Analysis

As shown in Table 3-4, tritium was detected in soil moisture from the shallow interval drywell sample at an activity level of 490 picocuries per liter (pCi/L), and was not detected in the deep interval sample from beneath this unit. Background tritium activity levels in SNL/NM soils were not evaluated as part of the SNL/NM background study completed in March 1996 (IT March 1996). The soil moisture contained in shallow soil samples such as these represents either infiltrated precipitation, or water discharged from the Building 9921 sink to the drywell. It is therefore appropriate to compare the tritium activity level detected in the sample soil moisture to naturally occurring tritium levels found in precipitation or drinking water samples. The tritium activity level of 490 pCi/L detected in this sample was compared to and was found to be slightly above the naturally occurring tritium activity range of 100 to 300 pCi/L found in precipitation samples collected from locations throughout the U.S., and 100 to 400 pCi/L in drinking water samples collected from locations around the country (EPA October 1993). A risk assessment was therefore performed to further evaluate this tritium activity level. The risk calculation was designed to produce a conservatively large estimate of radiation dose to counter uncertainties in the soil analytical data.

Table 3-2

ER Site 101
Summary of Organic and Other Constituents, and pH Measurements in Confirmatory Soil Samples Collected Around the Seepage Pits, Septic Tank, and Drywell

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	VOCs Method 8240						SVOCs Method 8270		Cyanide Method 9010/ 9012	TNT Screen Colorimetric method based on EPA 8515	Units	Soil pH ASTM Method 4972 (pH units)
						Acetone	2-Hexa-none	MEK	MIBK	Meth. Chloride	Toluene	Phenan-threne	Chrysene				
Seepage Pits Soil Samples:																	
017943-1,2	Soil	Field	9/28/94	SP1-1	12	ND	ND	ND	ND	2 J	ND	ND	ND	ND	ND	ug/kg	8.3
017945-1,2	Soil	Field	9/29/94	SP1-1	22	ND	ND	ND	ND	1.9 J	ND	ND	ND	1,200	ND	ug/kg	8.3
017946-1,2	Soil	Field	9/29/94	SP1-2	12	ND	ND	ND	ND	2.3 J	ND	ND	ND	710	ND	ug/kg	8.5
017947-1,2	Soil	Field	9/29/94	SP1-2	22	ND	ND	ND	ND	2.3 J	ND	ND	ND	ND	ND	ug/kg	8.4
017948-1,2	Soil	Field	9/29/94	SP2-1	16	ND	ND	ND	ND	2.6 J	ND	ND	ND	ND	ND	ug/kg	8.2
017950-1,2	Soil	Dupl.	9/29/94	SPD2-1	16	ND	ND	ND	ND	3.1 J	ND	ND	ND	ND	ND	ug/kg	8
017949-1,2	Soil	Field	9/29/94	SP2-1	26	ND	ND	ND	ND	2.7 J	ND	ND	ND	ND	ND	ug/kg	8.6
017952-1,2	Soil	Field	10/3/94	SP2-2	16	7.9 J	ND	ND	ND	1.6 J	2.4 J	ND	ND	ND	ND	ug/kg	7.8
017953-1,2	Soil	Field	10/3/94	SP2-2	26	ND	ND	ND	ND	1.9 J	8.2	ND	ND	ND	ND	ug/kg	7.9
017956-1,2	Soil	Field	10/3/94	SP3-1	16	ND	ND	ND	ND	1.8 J	11	ND	ND	ND	ND	ug/kg	7.6
017957-1,2	Soil	Field	10/3/94	SP3-1	26	ND	ND	ND	ND	1.2 J	ND	ND	ND	ND	ND	ug/kg	7.9
017958-1,2	Soil	Field	10/3/94	SP3-2	16	7.3 J	ND	ND	ND	1.1 J	5	ND	ND	ND	ND	ug/kg	7.6
017959-1,2	Soil	Field	10/3/94	SP3-2	26	5 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ug/kg	7.8
017944-1	Soil	TB	9/28/94	Site 101	NA	11	ND	ND	ND	4.7 J	1.3 J	NS	ND	NS	NS	ug/kg	NS
017951-1	Soil	TB	9/29/94	Site 101	NA	ND	2.1 J	ND	1.2 J	4 J	ND	NS	ND	NS	NS	ug/kg	NS
Septic Tank Soil Samples:																	
017954-1,2	Soil	Field	10/3/94	ST-1	9	7.7 J	ND	ND	ND	1.5 J	6.1	34 J	42 J	ND	ND	ug/kg	7.7
017955-1,2	Soil	Field	10/3/94	ST-2	9	6.6 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ug/kg	8
017960-1	Soil	TB	10/3/94	Site 101	NA	25	ND	3 J	ND	2.5 J	2.3 J	NS	NS	NS	NS	ug/kg	NS
017965-1,2,4	Water	EB	10/4/94	Site 101	NA	6.6 J	ND	ND	ND	1.2 J	ND	ND	ND	ND	NS	ug/L	NS

Table 3-2, concluded:

ER Site 101
Summary of Organic and Other Constituents, and pH Measurements in Confirmatory Soil Samples
Collected Around the Seepage Pits, Septic Tank, and Drywell

Sample Number	Sample Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	VOCs Method 8240						SVOCs Method 8270		Cyanide Method 9010/ 9012	TNT Screen Colorimetric method based on EPA 8515	Units	Soil pH ASTM Method 4972 (pH units)
						Acetone	2-Hexa-none	MEK	MIBK	Meth. Chloride	Toluene	Phenan-threne	Chrysene				
Drywell Soil Samples:																	
018907-1,2	Soil	Field	1/11/95	DW-1	4	6.8 J	ND	ND	ND	1.7 J	ND	ND	ND	NS	ND	ug/kg	NS
018908-1,2	Soil	Field	1/11/95	DW-1	14	14	ND	ND	ND	1.5 J	ND	ND	ND	NS	ND	ug/kg	NS
Laboratory Reporting Limit For Soil						10	10	10	10	5	5	330	330	500	1,000	ug/kg	
Laboratory Reporting Limit For Water						10	10	10	10	5	5	10	10	10	NA	ug/L	
Proposed Subpart S Action Level For Soil						8E+06	None	5E+07	4E+06	9E+04	2E+07	2.4E+07	9.6E+03	2E+06	4E+04	ug/kg	

Notes
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, or 2-Butanone
Meth. chloride = Methylene chloride
MIBK = Methyl isobutyl ketone, or 4-methyl-2-pentanone
NA = Not applicable
ND = Not detected
NS = No sample
SVOCs = Semivolatile organic compounds
TB = Trip blank
TNT = Trinotrotoluene
VOCs = Volatile organic compounds

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Table 3-3

ER Site 101

Summary of RCRA Metals and Hexavalent Chromium in Confirmatory Soil Samples
Collected Around the Seepage Pits, Septic Tank, and 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: Cr^{6+} Method 7196	Units
						As	Ba	Cd	Cr, total	Pb	Hg	Se	Ag		
Seepage Pits Soil Samples:															
017943-2	Soil	Field	9/28/94	SP1-1	12	2.7	112	ND	8.2	7.2	ND	0.58	ND	ND	mg/kg
017945-2	Soil	Field	9/29/94	SP1-1	22	2.4	52.6	ND	7.8	6.1	ND	ND	ND	ND	mg/kg
017946-2	Soil	Field	9/29/94	SP1-2	12	2.3	88.1	ND	23.6	6.4	ND	ND	ND	ND	mg/kg
017947-2	Soil	Field	9/29/94	SP1-2	22	2.1	51.7	ND	8.3	7.3	ND	ND	ND	ND	mg/kg
017948-2	Soil	Field	9/29/94	SP2-1	16	3	85.8	ND	8.7	5.7	ND	ND	ND	ND	mg/kg
017950-2	Soil	Dupl.	9/29/94	SPD2-1	16	3.2	79.6	ND	8.8	7.1	ND	ND	ND	ND	mg/kg
017949-2	Soil	Field	9/29/94	SP2-1	26	2.3	59.1	ND	9.2	6.6	ND	ND	ND	ND	mg/kg
017952-2	Soil	Field	10/3/94	SP2-2	16	2.6	115	ND	9.1	5.6	ND	ND	ND	ND	mg/kg
017953-2	Soil	Field	10/3/94	SP2-2	26	2.4	73.3	ND	8.9	6.6	ND	ND	ND	ND	mg/kg
017956-2	Soil	Field	10/3/94	SP3-1	16	3.1	80.4	ND	7.3	9.9	ND	1.3	ND	ND	mg/kg
017957-2	Soil	Field	10/3/94	SP3-1	26	2.2	97.8	ND	7.9	6.3	ND	ND	ND	ND	mg/kg
017958-2	Soil	Field	10/3/94	SP3-2	16	2	90.5	ND	9.5	5.4	ND	ND	ND	ND	mg/kg
017959-2	Soil	Field	10/3/94	SP3-2	26	2.1	58.3	ND	18.1	6.1	ND	ND	ND	ND	mg/kg
Septic Tank Soil and QA Samples:															
017954-2	Soil	Field	10/3/94	ST-1	9	2.8	96.4	ND	8.8	7.1	ND	ND	ND	ND	mg/kg
017955-2	Soil	Field	10/3/94	ST-2	9	2.8	150	ND	9.8	9.3	ND	ND	ND	ND	mg/kg
017965-3	Water	EB	10/4/94	Site 101	NA	ND	0.01	ND	0.0051 J	0.0037	ND	ND	ND	NS	mg/L
Drywell Soil Samples:															
018907-2	Soil	Field	1/11/95	DW-1	4	2.5	114	ND	5.3	4.4 J	ND	ND	ND	NS	mg/kg
018908-2	Soil	Field	1/11/95	DW-1	14	2.4	131	ND	6.7	5.1	ND	ND	ND	NS	mg/kg
Laboratory Reporting Limit For Soil						1	1	0.5	1	5	0.1	0.5	1	0.05 - 0.1	mg/kg
Laboratory Reporting Limit For Water						0.01	0.01	0.005	0.01	0.003	0.0002	0.005	0.01	NA	mg/L
Number of SNL/NM Background Soil Sample Analyses *						15	727	1,740	647	536	1,724	2,134	2,302	393	NA
SNL/NM Soil Background Range *						2.1-7.9	0.5-495	0.0027-6.2	0.5-31.4	0.75-103	0.0001-0.68	0.037-17.2	0.0016-8.7	0.02-<2.5	mg/kg
SNL/NM Soil Background UTL or 95th Percentile *						7	214	0.9	15.9	11.8	<0.1	<1.0	<1.0	<2.5	mg/kg
Proposed Subpart S Action Level For Soil						0.50	6,000	80	80,000 **	400 ***	20	400	400	400 **	mg/kg

Table 3-3, concluded:

ER Site 101
Summary of RCRA Metals and Hexavalent Chromium in Confirmatory Soil Samples Collected Around the Seepage Pits, Septic Tank, and Drywell

Notes:

As = Arsenic. Arsenic background concentrations presented above are based on analyses of subsurface soil samples collected in the Coyote Test Field (CTF) area.
Ba = Barium. Barium background concentrations presented above are based on analyses of subsurface soil samples collected in the Southwest and CTF areas.
Be = Beryllium. Beryllium background concentrations presented above are based on analyses of surface and subsurface samples collected in the Southwest, CTF, and Offsite areas
Cd = Cadmium. Cadmium background concentrations presented above are based on analyses of subsurface soil samples collected in the North, Tijeras, Southwest, CTF, and Offsite areas.
Cr = Chromium. Chromium background concentrations presented above are based on analyses of subsurface soil samples collected in the Southwest area.
Cr^{6+} = Hexavalent chromium. Hexavalent chromium background concentrations presented above are based on analyses of surface and subsurface soil samples collected in the Southwest area.
Pb = Lead. Lead background concentrations presented above are based on analyses of subsurface samples collected in the Southwest and Offsite areas.
Hg = Mercury. Mercury background concentrations presented above are based on analyses of subsurface soil samples collected in the North, Tijeras, Southwest, CTF and Offsite areas.
Se = Selenium. Selenium background concentrations presented above are based on analyses of surface and subsurface soil samples collected in the North, Tijeras, Southwest, CTF and Offsite areas.
Ag = Silver. Silver background concentrations presented above are based on analyses of subsurface soil samples collected in the North, Tijeras, Southwest, CTF, and Offsite areas.

CTF = Coyote Test Field
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.
NA = Not applicable
ND = Not detected
QA = Quality assurance
UTL = Upper Tolerance Limit
* IT March 1996
** 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)

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Table 3-4

ER Site 101
Summary of Isotopic Uranium and Tritium in Confirmatory Soil Samples
Collected Around the Seepage Pits and Drywell

Sample Number	Sampl Matrix	Sample Type	Sample Date	Sample Location (Figure 2)	Top of Sample Interval (fbgs)	Isotopic Uranium (Method EPI A-011B for seepage pit samples, and Method HASL-300 for drywell samples) (pCi/g)									Tritium (Method EPA-600 906.0) (pCi/L)		
						U-233/ U-234 Result	U-233/ U-234 Error *	U-233/ U-234 M.D.A.	U-235 Result	U-235 Error *	U-235 M.D.A.	U-238 Result	U-238 Error *	U-238 M.D.A.	Result	Error *	D.L.
Seepage Pits Composite Soil Samples:																	
023854-1	Soil	Compos.	9/28/94	SP1-1/2	12	0.864	0.125	0.09	0.036 J	0.020	0.09	0.83	0.121	0.09			
023855-1	Soil	Compos.	9/29/94	SP1-1/2	22	0.646	0.115	0.09	0.031 J	0.022	0.09	0.663	0.116	0.09			
023856-1	Soil	Compos.	9/29/94	SP2,3-1/2	16	0.623	0.1	0.09	0.034 J	0.02	0.09	0.547	0.092	0.09			
023857-1	Soil	Compos.	10/3/94	SP2,3-1/2	26	1.73	0.245	0.09	0.066 J	0.0391	0.09	1.65	0.237	0.09			
Drywell Soil Samples:																	
018907-4,5	Soil	Field	1/11/95	DW-1	4	1.1	0.19	0.039	0.052	0.032	0.013	1	0.17	0.034	490	190	300
018908-4,5	Soil	Field	1/11/95	DW-1	14	1	0.24	0.13	0.011	0.047	0.095	1	0.23	0.075	ND	150	250
Number of SNL/NM Background Soil Sample Analyses **						14			283			90			U		
SNL/NM Soil Background Range **						0.44-<5.02			0.004-3			0.153-2.3			U		
SNL/NM Soil Background 95th Percentile **						<5.02			0.16			1.4			U		
Nationwide Tritium Range in Precipation and Drinking Water ***						NA			NA			NA			100-400		

Notes:
U-233 = Uranium 233
U-234 = Uranium 234. Uranium 233/234 background concentrations presented above are based on analyses of surface and subsurface soil samples collected in the Southwest area.
U-235 = Uranium 235. Uranium 235 background concentrations presented above are based on analyses of surface and subsurface soil samples collected in the Southwest area.
U-238 = Uranium 238. Uranium 238 background concentrations presented above are based on analyses of surface and subsurface soil samples collected in the Southwest area.

Compos. = Composite
CTF = Coyote Test Field
fbgs = Feet below ground surface
J = Result is detected below the reporting limit or is an estimated concentration.
M.D.A. = Minimum detectable activity
ND = Not detected
pCi/g = Picocuries per gram
pCi/L = Picocuries per liter
U = Undefined for SNL/NM soils
UTL = Upper Tolerance Limit
* Error = +- 2 sigma uncertainty
** IT March 1996
*** EPA October 1993

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The PIP in Appendix J, Section 1.3.6 stipulates that, for the purpose of computing media action levels, the total radiation dose at a site should not be greater than 15 millirem/year (mrem/yr) (SNL/NM February 1995). 15 mrem/yr is also the maximum annual effective dose for all pathways that is being considered in the preliminary staff working draft of the EPA Radiation Site Cleanup regulation (EPA 1994). Therefore,

- if the dose estimate is unacceptable (greater than 15 mrem/yr), further investigation and remediation may be needed; or

- if the dose estimate is acceptable, the potential for health hazards at the site is extremely low, and further remedial actions are not needed.

The dose estimate for the tritium activity level cited above was computed using methods and equations promulgated in proposed Subpart S documentation (EPA July 1990). Accordingly, all calculations were based on the very conservative assumption that the receptor dose from radionuclides results from ingestion of 0.2 grams per day of contaminated soil for each of the 365 days in a year.

Calculation of radionuclide doses requires values of dose conversion factors for internal radiation from ingestion [(DCF(i)], which are used to convert radionuclide activities (in units of picocuries per gram [pCi/g]) into effective dose equivalents (in units of mrem/yr). A published DCF(i) value was found for tritium (0.000000063 [6.3E-08] mrem/pCi) (Gilbert et al., 1989); this DCF(i) value was used in the risk calculation.

To assure that the computed doses were conservatively large, the maximum observed activity of tritium detected at this site (490 pCi/L) was employed in the risk calculation. Analytical results for tritium in soil moisture are reported by the laboratory in units of pCi/L, and must be converted to units of pCi/g for the risk calculation presented below. The following conversion calculation was used:

Specified by the laboratory: 750 grams of sample, 7.4% by weight soil moisture in sample, tritium result of 490 pCi/L in soil moisture (SNL/NM January 1995c)

(1) 490 pCi/L x 1 L/1000 g = 0.49 pCi/g of soil moisture;

(2) 750 grams of sample x 0.074 = 55.5 g of soil moisture in sample;

(3) 55.5 g of soil moisture x 0.49 pCi/g in soil moisture = 27.19 pCi of tritium activity in the 750 g soil sample; and

(4) 27.19 pCi in 750 g of soil sample = 0.036 pCi/g for drywell soil

Following proposed Subpart S methodology, the equation and parameter values used to calculate the summed radiation dose were:

$$DOSE = \sum[DSR(i) \times S(i)]$$

where: DOSE = total effective dose equivalent (mrem/yr);
DSR(i) = dose-to-soil concentration ratio for the ith radionuclide = I x DCF(i), where:
I = soil ingestion rate = 0.2 grams/day = 73 grams/year; and
DCF(i) = internal radiation dose conversion factor for the ith radionuclide (mrem/pCi),
S(i) = soil concentration of the ith radionuclide (pCi/g)

The results of the radionuclide risk calculations show that the radiation dose (1.7E-07 mrem/yr) from the highest tritium activity detected (490 pCi/L, or 0.036 pCi/g) is much less than 15 mrem/yr. Therefore, the site is considered to be risk-free in terms of radionuclide contamination.

3.8 Rationale for Pursuing a Risk-Based NFA Decision

As discussed in Section 3.4, the passive soil gas survey identified potentially detectable concentrations of aliphatic and BTEX compounds at 6 of the 34 PETREX™ soil-gas sampling locations at this site. PCE was also identified in soil-gas above 100,000 ion counts at one of the six locations. Potentially detectable levels of VOCs in the soil were detected only at PETREX™ locations in or near the dirt access road to the site or in areas used for vehicle parking. Significant levels of VOCs in soil-gas were not detected in PETREX™ tubes placed closest to the seepage pits or septic tank, and SVOCs were not detected in soil gas at any of the sampling locations. Confirmatory soil samples were not collected in road or parking areas where VOCs (mainly BTEX) were identified in PETREX™ tubes because it was apparent that the compounds (if present in soils) originated from vehicles using at the site, rather than from the seepage pits or septic tank.

Confirmatory soil sampling around the seepage pits and septic tank, and beneath the drywell did not identify any residual COCs indicating past discharges that could pose a threat to human health or the environment. As shown in Table 3-2, only three VOC compounds (acetone, methylene chloride, and toluene), which are common laboratory contaminants, were detected in soil samples collected from this site. Two SVOC constituents (phenanthrene and chrysene) were detected at below reporting limit concentrations in one of the soil samples collected next to the septic tank, and no SVOC compounds were found in any of the other samples collected at this site. The detected concentrations of phenanthrene and chrysene were well below proposed Subpart S action levels for these compounds. Cyanide was detected in one of the shallow and one of the deep interval soil samples collected around the west seepage pit at concentrations of 1,200 and 710 micrograms per kilogram (ug/kg) respectively. These concentrations are much lower than the proposed Subpart S action level of 2,000,000 ug/kg for this constituent. Cyanide was not identified in any of the other seepage pit or septic tank soil samples. TNT was not detected in any of the seepage pit, septic tank, and drywell soil samples, and soil pH measurements of material collected from the seepage pits and septic tank sampling intervals ranged from neutral to slightly alkaline.

As shown on Table 3-3, soil sample analytical results indicate that the nine metals that were targeted in the Site 101 investigation were either (1) not detected, or (2) were detected in concentrations below the background UTL or 95th percentile concentrations presented in the draft SNL/NM study of naturally-occurring constituents (IT March 1996), or (3) were less than the proposed Subpart S action levels for these metals.

Isotopic uranium activity levels that were detected in the soil samples were found to be below the corresponding 95th percentile background activity levels presented in the IT March 1996 report for those radionuclides (Table 3-4). The tritium activity level detected in the drywell shallow interval sample was determined to result in a radiation dose much lower than the maximum acceptable radiation dose of 15 mrem/yr at a site presented in the PIP (SNL/NM February 1995). Also, the gamma spectroscopy semi-qualitative screening of shallow and deep interval composite soil samples did not indicate the presence of contamination from other radionuclides in soils at this site (Appendices A.4 through A.9).

Finally, the ER Site 101 septic tank contents were removed and the tank was cleaned in November 1995 (SNL/NM November 1995). The tank was then inspected by a representative of the New Mexico Environment Department (NMED) to verify that the tank contents had been removed and the tank had been closed in accordance with applicable State of New Mexico regulations (SNL/NM December 1995).

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4. CONCLUSION

Sample analytical results generated from this confirmatory sampling investigation have shown that detectable or significant concentrations of COCs are not present in soils at ER Site 101, and that additional investigations are unwarranted and unnecessary. Based on archival information and chemical and radiological analytical results of soil samples collected next to the seepage pits and septic tank, and beneath the drywell, SNL/NM has demonstrated that hazardous waste or COCs were not released from this SWMU into the environment (Criterion 5 of Section 1.2), and the site does not pose a threat to human health or the environment. Therefore, ER Site 101 is recommended for an NFA determination.

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