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Justification for Class III Permit Modification March 2005 SWMU 159 Operable Unit 1303 Building 935 Drain Systems at Technical Area II

Sandia National Laboratories/NM

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SWMU 159
Building 935 Septic System and Drywell (TA-II)

Environmental Restoration Project

Site History

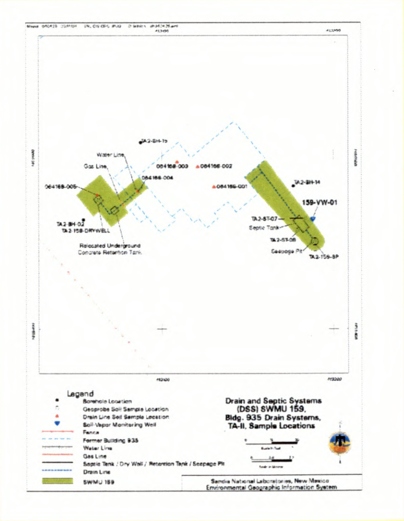
- SWMU 159, Building 935 Septic System and Drywell, is located in the southwestern portion of TA-II, and covers approximately 0.01 acres.
- Building 935 was constructed in 1963 and used for a variety of purposes, including testing and packaging of electronic and explosive-type neutron generators, and special weapon-component testing.
- The building had one septic system that discharged to a seepage pit and one waste water drain system that discharged to a drywell. In 1989, the floor drains leading to the waste water drain system were sealed shut. The septic system was shut down in 1991 when contaminants were discovered in the septic tank waste.
- Building 935 was decontaminated and demolished in December 2002. The building slab was demolished in February 2004.

Depth to Groundwater

- The regional aquifer is approximately 545 ft bgs, and a perched aquifer (not a source of drinking water) is approximately 300 ft bgs.

Constituents of Concern

- VOCs
- SVOCs
- PCBs
- HE compounds
- Metals
- Radionuclides



Investigations

- In 1987, all septic tanks and drainfields throughout TA-II, III, and V were grouped together as part of the RFA. SWMU 159 was listed because industrial wastes could have been discharged to the sanitary sewer system.
- In 1991, a study was conducted for SWMU 159 that included background information reviews and personnel interviews.
- In November-December 1993 and January-February 1994, passive soil-vapor surveys were conducted in TA-II. The majority of compounds detected were chlorinated solvents and petroleum hydrocarbons. The highest detections were in the southern part of TA-II.
- In March and December 1994, soil samples were collected from a borehole drilled near the septic drain line, a borehole drilled near the drywell, and a borehole drilled near a suspected drywell location.
- In August 1995, soil samples were collected from two boreholes drilled adjacent to the septic tank.
- In November and December 1996, three boreholes were drilled at TA-II and sampled for soil vapor to approximately 100 ft bgs. Two of the borings were completed as active soil-vapor monitoring wells. The long-term monitoring results indicate an apparent widespread presence of VOCs in soil vapor; the concentrations were low and remained steady with no apparent periodicity.
- In early 2000, portions of the septic system were excavated with a backhoe to confirm the positions and dimensions of the septic tank and seepage pit.
- In August 2000, soil samples were collected from a borehole drilled beneath the seepage pit and a borehole drilled below the drywell.
- In May 2003, an active soil-vapor monitoring well was installed near the seepage pit at SWMU 159. The well was sampled in September 2003, and based on the low total VOC concentrations, NMED did not require any additional soil-vapor sampling or soil-vapor or groundwater monitoring wells at this site.
- In February 2004, during the building slab demolition, soil samples were collected under the floor drain and waste water piping system to the drywell. Additional samples were collected from boreholes drilled below the seepage pit and drywell. Also in February 2004, waste water drain line samples were collected with a backhoe at the approximate depth the line entered the drywell.

Summary of Data Used for NFA Justification

- All confirmatory soil sample analytical results were used for characterizing the site, for performing the risk assessment, and for justification for the NFA proposal.
- VOCs and SVOCs were detected in these samples. Numerous metals were detected above background values. Tritium and U-238 were detected above background activities. No PCBs, HE compounds, or cyanide were detected in these soil samples.

Recommended Future Land Use

- Industrial land use was established for this site.

This is a partially excavated seepage pit at DSS SWMU 159. This seepage pit is constructed of unmortared concrete blocks and was surrounded by a layer of gravel. Seepage pits like these typically had several feet of gravel in the bottom. The seepage pit is approximately 7 ft deep and 5 ft in diameter. The inlet pipe is approximately 5.5 ft below grade.

Results of Risk Analysis

- Risk assessment results for the residential scenario are calculated per NMED risk assessment guidance as presented in "Supplemental Risk Document Supporting Class 3 Permit Modification Process" (SNL October 2003).
- Because COCs were present in concentrations greater than background-screening levels or because constituents were present that did not have background-screening numbers, it was necessary to perform a risk assessment for the site. The risk assessment analysis evaluated the potential for adverse health effects for the residential land-use scenario.
- The maximum concentration for lead was 239 mg/kg. NMED guidance for lead screening concentrations for construction and industrial land-use scenarios are 750 and 1500 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 residential HI (0.87) is below the NMED guidance. The total estimated excess cancer risk for the residential land-use scenario, 1E-5, is at the NMED guideline. However, the UCL of the average concentration for the main contributor to risk, arsenic, is below the background value and was eliminated from the risk calculation. With the removal of arsenic, the total HI was reduced to 0.65 and the total estimated excess cancer risk was reduced to 8E-7. Thus, by using realistic concentrations in the risk calculations that more accurately depict actual site conditions, the total risk calculations are below NMED guidelines.
- The residential land-use scenario incremental TEDE was 1.1E-1 mrem/yr, which is below the EPA numerical guideline of 75 mrem/yr. Therefore, SWMU 159 is eligible for unrestricted radiological release.
- Using the SNL predictive ecological risk assessment methodology, the ecological risk for SWMU 159 is expected to be very low.
- In conclusion, human health and ecological risks are acceptable per NMED guidance. Thus, SWMU 159 is proposed for CAC without institutional controls.

Risk Assessment Values for SWMU 159 Nonradiological COCs

COC Name	Maximum Concentration / UCL (mg/kg)	Residential Land Use Scenario	
		Hazard Index	Cancer Risk
Inorganic			
Antimony	6	0.20	--
Arsenic	4.7 / **2.83**	0.21 / **Below Background**	1E-5 / **Below Background**
Barium	524	0.10	--
Beryllium	0.86	0.01	8E-10
Cadmium	1.3	0.03	9E-10
Chromium, total	58.4	0.00	--
Chromium VI	0.027	0.00	1E-10
Cobalt	9.8	0.01	1E-8
Copper	17.3	0.01	---
Cyanide	0.0455	0.00	--
Mercury	0.19	0.01	--
Selenium	0.25	0.00	--
Silver	1	0.00	--
Thallium	1	0.20	--
Uranium	2.6	0.01	--
Vanadium	41.5	0.08	--
Organic			
Acetone	0.048	0.00	--
Benzo(k)fluoranthene	0.039 J	0.00	6E-9
2-Butanone	0.017 J	0.00	--
Bis (2-ethylhexyl) phthalate	1.3	0.00	3E-8
Fluoranthene	0.14 J	0.00	--
Methylene chloride	0.057	0.00	8E-7
Pyrene	0.11 J	0.00	--
Toluene	0.003 J	0.00	--
Total		**0.87 / 0.65**	**1E-5 / 8E-7**

– = Information not available.

For More Information Contact

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Sandia National Laboratories

Justification for Class III Permit Modification

March 2005

SWMU 159
Operable Unit 1303
Building 935 Drain Systems at Technical Area II

NFA Originally Submitted August 1995
Comment Response October 1996
NOD Response January 2000
RSI Response June 2004
Soil Vapor Sampling June 2004

Environmental
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Project

United States Department of Energy
Sandia Site Office

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

NFA

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
L. Aker, AIP (2 copies)
W. Cox, SNL, MS 1147

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M. Jackson, KAO
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Sandia National Laboratories / New Mexico

PROPOSAL FOR NO FURTHER ACTION ENVIRONMENTAL RESTORATION PROJECT SITE 159, BUILDING 935 SEPTIC SYSTEM (TA II) OPERABLE UNIT 1303

June 1995

Environmental
Restoration
Project

United States Department of Energy
Albuquerque Operations Office

PROPOSAL FOR NO FURTHER ACTION

Site 159, Building 935 Septic System (Technical Area II)
Operable Unit 1303

SANDIA NATIONAL LABORATORIES/NEW MEXICO

1. Introduction

1.1 ER Site Identification Number and Name

Sandia National Laboratories/New Mexico (SNL/NM) is proposing an administrative no further action (NFA) decision based on confirmatory sampling for Environmental Restoration (ER) Site 159, Building 935 Septic System, Operable Unit (OU) 1303. The Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) grouped all septic tanks and leachfields found throughout Technical Area (TA) II, III and V together. The Building 935 Septic System and all other associated systems, were given RFA number 79 [Environmental Protection Agency (EPA 1987)]. ER Site 159 was identified as the Building 935 Septic System in the Hazardous and Solid Waste Amendment (HSWA) Module IV (EPA 1993) of the SNL/NM RCRA Hazardous Waste Management Facility Permit (NM5890110518) (EPA 1992).

1.2 SNL/NM Administrative NFA Based on Confirmatory Sampling Process

This proposal for a determination of an administrative NFA decision based on confirmatory sampling has been prepared using the criteria presented in Section 4.5.3. of the SNL/NM Program Implementation Plan (PIP) (SNL/NM 1995). Specifically, this proposal "contains 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 264.51(a)(2)] (EPA 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 1993).

In requesting an administrative NFA decision based on confirmatory sampling for ER Site 159, Building 935 Septic System, this proposal is using existing administrative/archival information to satisfy permit requirements. This unit is eligible for an administrative with confirmatory sampling NFA proposal based on one or more of the following criteria taken from the RCRA Facility Assessment Guidance (EPA 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 159 is being proposed for an administrative NFA decision based on confirmatory sampling because the SWMU clearly has not released hazardous waste or constituents 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 (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 nuclear activities since 1945.

ER Site 159 (Figure 1) is owned by the DOE. The site is located in the southwest portion of Technical Area (TA)-II. TA-II, one of five technical areas within SNL/NM, is diamond-shaped, approximately 1450 feet on a side, and encompasses 45 acres. The center of TA-II is approximately 3,000 feet south of TA-I, the location for most administrative and research activities, and TA-II abuts TA-IV to the south. TA-II is surrounded by a 10-foot high chain link fence, with a security guarded gate at the west corner. In earlier years, guard towers were located at each corner; now only the west entrance tower remains. TA-II currently contains 22 buildings, 27 high explosives (HE) bunkers of various sizes, and four mobile offices (MOs).

TA-II lies west of the basin-bounding fault complex and northwest of the Tijeras Arroyo fault, which are the two main structural features of the Albuquerque Basin. The geologic materials consist of thick alluvial sediments which overlie deep bedrock. An alluvial fan and piedmont colluvium overlie Santa Fe Group strata. The Santa Fe deposits are estimated to be approximately 3,000 feet thick beneath TA-II (Hawley and Haase 1992). Detailed descriptions of the regional geology are in the PIP and in the annual Site-Wide Hydrogeologic Characterization Project (SWHCP) 1993 Annual Report (SNL/NM 1993).

Previous SWHCP soil surveys and 1993 surficial mapping activities provide general soil characteristics for TA-II. Soil associated with the escarpments of the Tijeras Arroyo is poorly developed, such as the Bluepoint-Kokan Association (Hacker 1977). Areas underlain by this soil series, however, locally contain well-developed calcic horizons, which are the remnants of the Tijeras, Wink, and Madurez soil originally developed on older surficial deposits. The Bluepoint-Kokan soil reflects erosion of older soil and therefore is characterized by discontinuous soil horizons. The heterogeneity would be expected to strongly influence the location and rates of infiltration and geochemical interactions between soil and percolating water (SNL/NM 1993). TA-II is characterized as having an average surface soil permeability of approximately 0.1 inch per hour (SNL/NM 1993).

No perennial surface-water bodies are present within TA-II or in the immediate vicinity of the area. However, a large ephemeral surface drainage, the Tijeras Arroyo, is located directly southeast of TA-II. TA-II is located outside the 100- and 500-year floodplains of the Tijeras Arroyo.

Depth of regional ground water in the vicinity of TA-II is approximately 540 feet, with shallower water-bearing units present at approximately 305 to 315 feet In the shallower saturated zones, the ground water gradient is to the south-southeast at 0.016 ft/feet No water supply wells are present within TA-II.

2. History of the SWMU

2.1 Sources of Supporting Information

In preparation to request an administrative NFA decision based on confirmatory sampling for ER site 159, a background study was conducted to collect available and relevant site information. Background information sources included existing records and reports of site activity. In addition, interviews were conducted with SNL/NM staff and contractors familiar with site operational history. The study was completely documented and has provided traceable references which sustain the integrity of this proposal.

The following information sources were available for use in the evaluation of ER site 159:

- Interviews were combined and summarized in three reports (Anonymous no date; Haines, Kelly, and Cochran 1991; and Byrd 1991).
- Surface soil samples were collected from two locations in the vicinity of Building 935.
- The Site-Wide Hydrogeologic Characterization Project 1993 Annual Report (SNL/NM 1993).
- Sequential historical aerial photographs from 1951 to 1992 for the specifically-prescribed area of ER Site 159 (Ebert 1994).
- A passive soil vapor survey (SVS) investigation was conducted in the immediate vicinity of the Building 935 Septic System [Northeast Research Institute (NERI 1994)].
- A borehole was drilled and soil samples were collected behind Building 935 near the relocated retention tank. Two additional boreholes were drilled and soil samples were collected near the Building 935 septic tank and adjacent to the former retention tank and dry well.

Utilizing this information, a brief history of ER Site 159 and a discussion of all relevant evidence regarding past waste practices and releases at the site have been prepared and are presented in this proposal for an administrative NFA decision based on confirmatory sampling.

2.2 Previous Audits, Inspections, and Findings

The RCRA RFA grouped all septic tanks and leachfields found throughout TA-II, III, and V together. The Building 935 Septic System and all associated systems were given RFA number 79 (EPA 1987). The Building 935 Septic System was listed as an SWMU because sanitary wastes were not separated from industrial wastes; therefore hazardous wastes may have been discharged to septic tanks and leachfields.

The 1987 RCRA RFA is summarized below.

The wastes managed at this location included sanitary and industrial wastes, including trichloroethene (TCE), toluene, and methanol. Septic tank contents were discharged to leachfields. Release controls did not appear to have been present. There is no history of releases at this location. The potential for air contamination resulting from ER site 159 is low because the wastes were discharged to underground septic tanks, then to leachfields. The potential for surface water and ground water contamination was not determined in the RFA. Because sanitary wastes were disposed in tanks and leached through surface soils, there is a potential for subsurface gas generation.

2.3 Historical Operations

Building 935, the neutron generator test facility (NGTF), was constructed in 1963 and is located in the southwestern portion of TA-II (Figure 1). Also referred to as Building A-II, it is an active test facility and is used for conducting experiments with electronic- and explosive-type neutron generators. It contains 1,875 square feet and has an office, data acquisition and instrumentation room, machine shop, restroom, furnace room, explosives assembly area, and three test cells. The building was originally designed with two test cells; a third test cell was added in 1967. According to as-built drawings, the other rooms were used for storage, as hallways, or contained control valves. The drawings also show a darkroom sink; however, the darkroom was never completed. In addition to testing explosive-type neutron generators, the NGTF has supported other projects, including preliminary packaging of neutron generators for environmental and systems tests, special weapons-component testing using a centrifuge, and neutron measurements for stockpile integrated laboratory tests. Approximately 100 explosives test shots are conducted inside Building 935 each year, and electronic development work is occasionally conducted in the building.

As a result of the neutron generator experiments, some fragments (including HE compounds and tritium) may have been discharged into the floor drains. In November 1989, the floor drains in the three test cells were sealed with metal plates and silicon sealant. Prior to sealing the test cell floor drains, standing water was observed in one of the drain traps. The origin of the water is not known and what was done with the water, if anything, is unknown. Experiments at Building 935 consisted of explosively activated neutron generators, which subsequently destroy the test devices. The fragments were swept up and disposed off site. Residual material from the experiments may include metal that typically contains less than 100 microcuries (µCi) of tritium. The amount of tritium released from an explosives neutron generator test could be up to 4.8 µCi. Building 935 is the largest single source of tritium waste (i.e., volume and total activity produced) at SNL/NM.

The primary metals used in the neutron generator experiments include lead, zirconium, and zinc, with lesser amounts of titanium, tin, niobium, and silver. Trace amounts of cobalt, bismuth, antimony, and manganese also have been observed. Typical types of HE include hexanitrostilbene (HNS), hexanitroazobenzene (HNAB), trinitrotoluene (TNT), and pentaerythritol tetranitrate (PETN). The total mass of HE compounds used during these experiments is less than 2.5 grams. During an explosives test, carbon, water, nitrogen, and carbon monoxide are produced. Potting materials occasionally used with explosives-type neutron generators include epoxy resins, curing agents (diethanolamine hardener), and alumina (Al_2O_3).

In summary, potential constituents of concern that could have been discharged into the Building 935 Septic System and retention tank include:

- HE compounds
- Metals, including zinc, manganese, silver, lead, zirconium, titanium, tin, niobium, cobalt, bismuth, and antimony
- Radionuclides, particularly tritium

3. Evaluation of Relevant Evidence

3.1 Unit Characteristics

Building 935 neutron generator experiments were conducted in test cells; each test cell had a floor drain. Before the third cell was added in 1967, the drains discharged into a concrete-lined retention tank, formerly located beneath the present location of the third test cell. The volume of the original retention tank was 27 cubic feet; overflow discharged into an unlined, gravel-filled dry well located immediately west of the retention tank. During construction of the third test cell on the southwest side of the building in 1967, the original retention tank and dry well were moved about 15 to 20 feet southwest of the building. The third test cell was constructed over the former location of the retention tank and dry well. Although the relocated concrete-lined retention tank is visible on the surface and contains a metal discharge pipe, it is not known if the tank discharges into a gravel-filled dry well.

The restroom and furnace room each contained a floor drain that discharged into the septic tank south of Building 935. The septic tank is a two-stage, below-grade, concrete tank with an estimated volume of 27 cubic feet; the tank discharges into a gravel-lined seepage pit. According to an as-built drawing, the seepage pit is 4 feet in diameter and 6 feet deep (about 75 cubic feet in volume).

3.2 Operating Practices

In November 1989, the floor drains in the three test cells were sealed with metal plates and silicon sealant, preventing any additional materials or liquids from entering the sewer system. In late 1991, the Septic System for the building was shut down because potential constituents of concern were identified in the septic tank waste.

3.3 Presence or Absence of Visual Evidence

Because ER Site 159 is located underground, no visual evidence was obtained to determine that contamination has not occurred originating from this site to the environment.

3.4 Results of Previous Sampling/Surveys

During May and August 1992, surface soil samples were collected from two locations in the vicinity of Building 935. The samples were analyzed for tritium, total uranium, and other radioisotopes. One sample was collected near the large bay door located on the southeastern corner of the building; the other was collected near the double personnel doors located on the northeastern corner of the building. The samples collected near the bay door contained tritium at 4.1 picocuries per milliliter (pCi/ml) and 660 pCi/ml in May and August 1992, respectively. The August sample also contained total uranium at 1.9 micrograms per gram (µg/g). The samples collected near the personnel doors contained tritium at 39 pCi/ml and 170 pCi/ml in May and August, respectively. The May sample also contained total uranium at 1.7 µg/g.

Changes in vegetation that appeared to be related to septic line discharge were identified through the interpretation and digital mapping of vegetation from sequential historical aerial photographs for the specifically-prescribed area of ER Site 159 (Ebert 1994).

3.5 Assessment of Gaps of Information

Identified data gaps required that a more comprehensive analysis of volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) in the immediate vicinity of the Building 935 Septic System be accomplished by a soil gas survey. The more comprehensive investigation was needed to locate and qualify the nature and extent of potential organic contamination. Location-specific soil sampling and analysis for tritium, metals, HE compounds, radioisotopes, and total uranium were deemed necessary near the relocated retention tank, original retention tank, and dry well to provide supplementary confirmation of the soil gas survey results and to quantify contamination at potential source areas.

3.6 Confirmatory Sampling

Two investigations were determined to be necessary to fill the data gaps (Section 3.5). The results of the investigations are presented below. The Sampling and Analysis Plans (SAPs) for the two borehole investigations are included in Appendix A. The raw data, along with Quality Assurance/Quality Control (QA/QC) documentation, are readily available and can be viewed in the Environmental Operations (EO) Records Center. A summary of the data is presented in Table 1 and includes the maximum concentrations of the constituents of concern, the site-wide upper tolerance limit (UTL) background concentrations, and the proposed RCRA Subpart S action levels as appropriate and available.

During November and December 1993, a passive SVS investigation was conducted in the immediate vicinity of Building 935. No VOCs or SVOCs were detected in the immediate vicinity of the Building 935 Septic System. A copy of the 1994 NERI report has been included as a separate report with the submittal of this NFA proposal.

On March 2 and 3, 1994, Borehole TA2-BH-02 was drilled behind Building 935 near the relocated retention tank (Figure 2). The borehole was drilled to a total depth of 102 feet. Soil samples were collected at depths of 5, 10, 15, 20, 30, 40, 50, 75, and 100 feet. All soil samples were analyzed for tritium. Soil samples collected to a depth of 50 feet deep were analyzed for metals, HE compounds, radioisotopes, and total uranium. Soil samples were collected and analyzed for VOCs and SVOCs to a depth of 20 feet.

On December 3, 1994, Boreholes TA2-BH-14 and TA2-BH-15 were drilled near Building 935. Borehole TA2-BH-14 was drilled near the septic tank. Borehole TA2-BH-15 was drilled adjacent to the former retention tank and dry well. Soil samples were collected from each borehole at approximate depths of 5, 10, 15, 20, 30, 40, and 50 feet. The soil samples were analyzed at off-site laboratories for total metals, tritium, and gamma spectroscopy.

No VOCs, with the exception of acetone and methylene chloride, or HE compounds were identified above instrument detection limits. Acetone and methylene chloride are common laboratory contaminates and were reported significantly below their respective proposed RCRA Subpart S action levels. The only SVOC detected was the common laboratory contaminant bis (2-ethylhexyl) phthalate in Borehole TA2-BH-02 with a maximum concentration of 1,300 micrograms per kilogram (μg/kg) at a depth of 20 feet. To support the conclusion that this constituent was a result of laboratory contamination, the passive SVS identified no SVOCs in the vicinity of Building 935, and no SVOCs were identified as potential constituents of concern for this site (Section 2.3).

Metals that exceed the SNL/NM site-wide calculated UTL background concentrations (IT 1994) are: barium [UTL = 407.9 milligrams per kilogram (mg/kg)], detected at a maximum of 524 mg/kg (50.5-foot depth) in Borehole TA2-BH-14, less than the proposed RCRA Subpart S action level of 6,000 mg/kg.; chromium (UTL = 22.9 mg/kg), detected at a maximum of 58.4 mg/kg (20.0-foot depth) in Borehole TA2-BH-15, less than the proposed Subpart S action level of 80,000 mg/kg (chromium-III) or 400 mg/kg (chromium-VI); beryllium (UTL = 0.8 mg/kg), detected at a maximum of 0.86 mg/kg (40.5-foot depth) in Borehole TA2-BH-15, compared to the proposed Subpart S action level of 0.2 mg/kg; copper, detected at a maximum of 17.3 mg/kg (10-foot depth) in Borehole TA2-BH-02 (no action level derived as copper is an essential nutritional element); nickel (UTL = 15.4 mg/kg) detected at a maximum of 17.4 mg/kg (40.5-foot depth) in Borehole TA2-BH-15, less than the proposed Subpart S action level value of 2,000 mg/kg; and zinc (UTL = 46.7 mg/kg) detected at a maximum of 66.2 mg/kg (40.5-foot depth) in Borehole TA2-BH-15, less than the proposed Subpart S action level of 20,000 mg/kg. Radiological data show no elevated activities other than tritium, which was detected at a maximum of 1100 picocuries per gram (pCi/g) at a depth of 5.0 feet in Borehole TA2-BH-15.

Site-wide UTL background concentrations were not calculated for arsenic, mercury, or vanadium. However, proposed RCRA Subpart S action levels were available. Arsenic was identified at a maximum concentration of 4.2 mg/kg (10.5-foot depth) in Borehole TA2-BH-14, less than the proposed RCRA Subpart S action level of 20 mg/kg. Mercury was reported at a maximum concentration of .19 mg/kg (51-foot depth) in Borehole TA2-BH-02, less than the proposed RCRA Subpart S action level of 20 mg/kg. Vanadium was identified at a maximum concentration of 41.5 mg/kg (30.5-foot depth) in Borehole TA2-BH-15, less than the proposed RCRA Subpart S action level of 600 mg/kg.

Although beryllium was detected slightly above the SNL/NM site-wide calculated UTL, the value of 0.86 mg/kg is within the range of all observed values used for the statistical calculation of background beryllium concentration.

3.7 Rationale for Pursuing a Confirmatory Sampling NFA Decision

A comparison of soil analytical results to SNL/NM background levels and proposed RCRA Subpart S action levels shows that all constituents of concern are either below background or significantly below the prescribed action levels, with the exception of beryllium detected at 0.86 mg/kg in Borehole TA2-BH-15 at a depth of 40.5 feet. Soil samples collected at 30.5-foot and 50.5-foot depths in Borehole TA2-BH-15 showed beryllium levels of 0.27 mg/kg and 0.25 mg/kg, respectively. Additionally, beryllium has not been historically used in Building 935. Though beryllium was detected slightly above the SNL/NM site-wide calculated UTL, the value of 0.86 mg/kg is within the range of all observed values used for the statistical calculation of background beryllium concentration. Therefore, it should be concluded that the elevated level of beryllium is a result of natural variation in background soil. The results of the surface surveys and soil analyses indicate that no hazardous constituents have been released from this site that may pose a threat to human health and/or the environment.

4. Conclusion

ER Site 159 is being proposed for an administrative NFA decision based on confirmatory sampling because the evidence cited above demonstrates that the SWMU clearly has not released hazardous wastes or constituents into the environment (Criterion C) (see Section 1.2). Therefore, no threat to human health or the environment exists.

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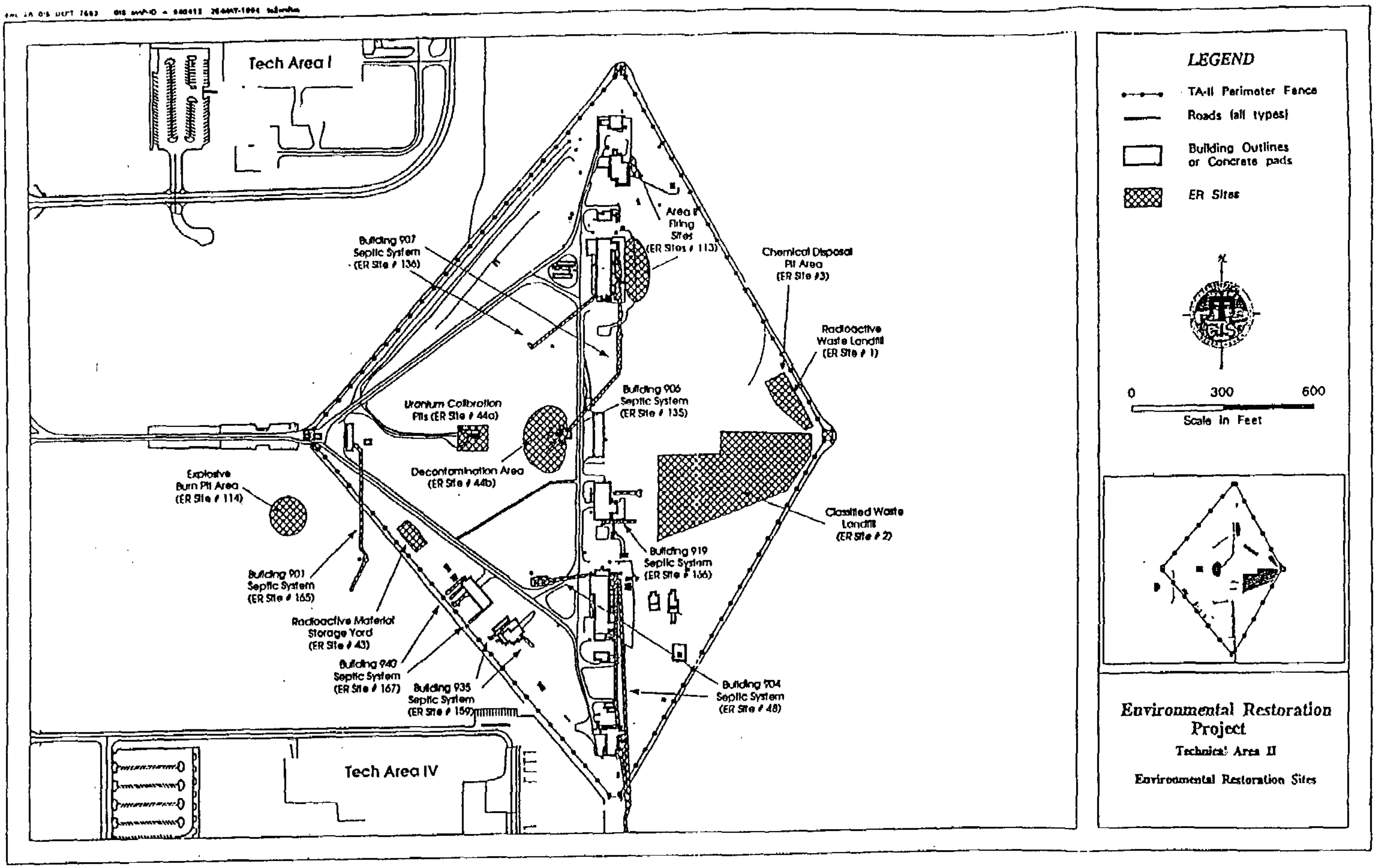

Figure 1. Map Showing Technical Area II and the Location of Environmental Restoration Sites

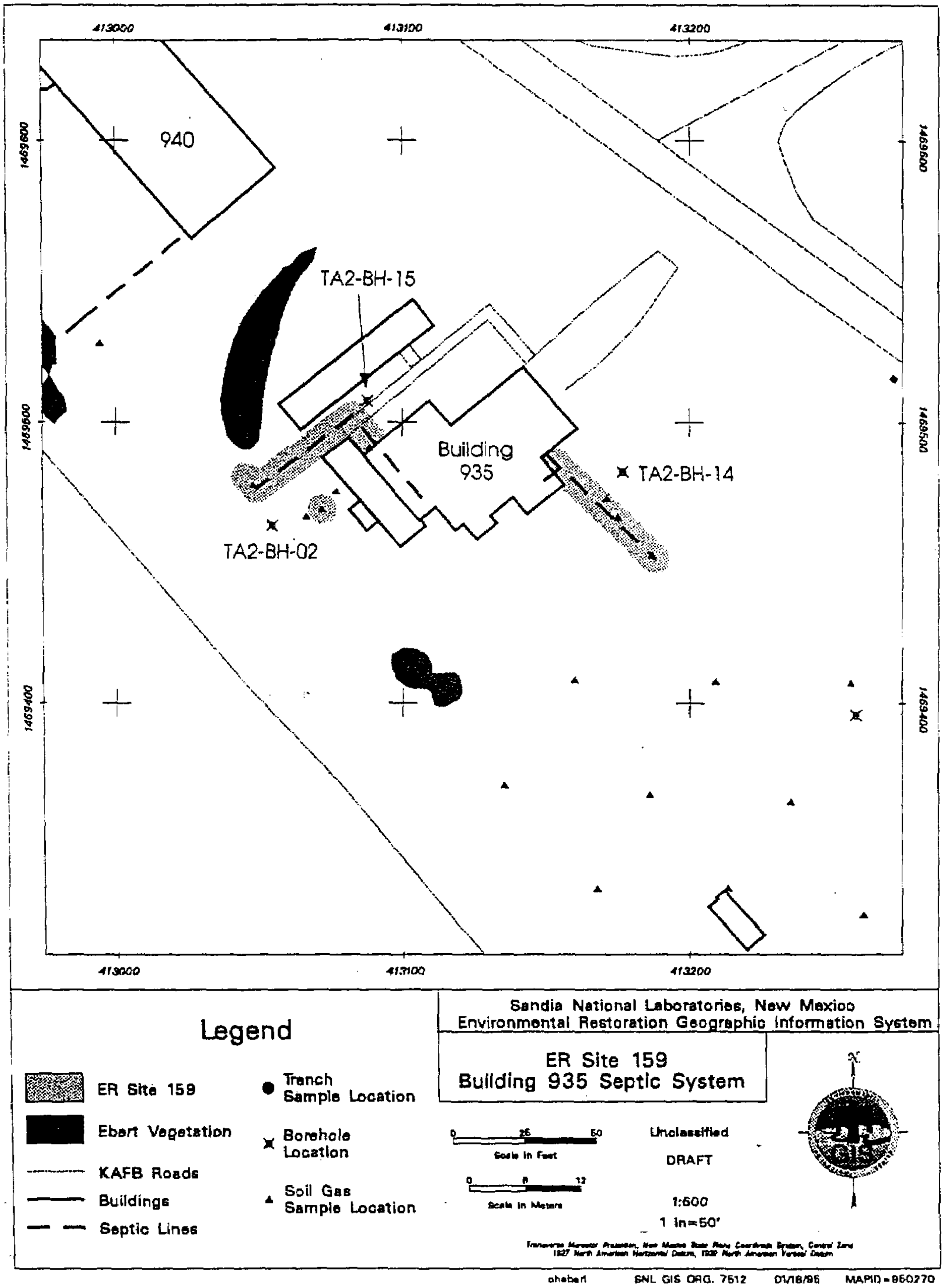

Figure 2. Map Showing ER Site 159 Building 935 Septic System

Table 1. Site 159, Building 935 Septic System, Data Summary of Soil Samples Collected from Borehole 02 , Borehole 15 and Borehole 15

Parameter	BH-02 max. concen. mg/kg-metals ug/kg-organic	Depth (ft)	BH-14 max. concen. mg/kg-metals ug/kg-organic	Depth (ft)	BH-15 max. concen. mg/kg-metals ug/kg-organic	Depth (ft)	Site-Wide UTL backgnd concen. mg/kg-metals ug/kg-organic	RCRA Subpart S Action Level mg/kg-metals ug/kg-organic
Antimony	ND	N/A	ND	N/A	ND	N/A	NC	30
Arsenic	3.6	20	4.2	10.5	3.7	40.5	NC	20
Barium	291	20	524	50.5	122	6, 15.5	407.9	6,000
Beryllium	.69	15	.55	31.5	.86	40.5	.8	.2
Cadmium	ND	N/A	ND	N/A	ND	N/A	3.5	80
Chromium	12.8	15	12.8	31.5	58.4	20	22.9	80,000
Cobalt	7.2	22	ND	N/A	ND	N/A	21[a]	NC
Copper	17.3	10	9.2	31.5, 50.5	17.2	40.5	16.7	NC
Lead	7.3	51	8.6	31.5	11.4	40.5	15	NC
Mercury	.19	51	ND	N/A	ND	N/A	NC	20
Nickel	10.4	51	12.1	31.5	17.4	40.5	15.4	2,000

Table 1. Site 159, Building 935 Septic System, Data Summary of Soil Samples Collected from Borehole 02, Borehole 15 and Borehole 15 (Continued)

Parameter	BH-02 max. concen. mg/kg-metals ug/kg-organic	Depth (ft)	BH-14 max. concen. mg/kg-metals ug/kg-organic	Depth (ft)	BH-15 max. concen. mg/kg-metals ug/kg-organic	Depth (ft)	Site-Wide UTL backgnd concen. mg/kg-metals ug/kg-organic	RCRA Subpart S Action Level mg/kg-metals ug/kg-organic
Selenium	ND	N/A	ND	N/A	ND	N/A	NC	400
Silver	ND	N/A	ND	N/A	ND	N/A	4.0	400
Thallium	ND	N/A	ND	N/A	ND	N/A	NC	6.92
Vanadium	36.2	22	26.2	6	41.5	30.5	NC	600
Zinc	36.8	51	36.2	50.5	66.2	40.5	46.7	20,000
Acetone	48B	18	NS	N/A	NS	N/A	NC	8,000
Methylene Chloride	5.7B	12.5	NS	N/A	NS	N/A	NC	90
bis (2-ethylhexyl)phthalate	1300	20	NS	N/A	NS	N/A	NC	50
HMX	ND	N/A	NS	N/A	NS	N/A	NC	NC
RDX	ND	N/A	NS	N/A	NS	N/A	NC	NC

Table 1. Site 159, Building 935 Septic System, Data Summary of Soil Samples Collected from Borehole 02, Borehole 15 and Borehole 15 (Concluded)

Notes

ND = Not detected.
N/A = Not applicable.
NS = Not sampled.
NC = Not calculated.
B = Parameter detected in blank.
a = A site-wide UTL was not calculated for cobalt. However, a UTL was calculated for the Tijeras Arroyo sites which are adjacent to TA-II. The UTL for Tijeras Arroyo was used in this NFA proposal.

Aluminum, calcium, iron, magnesium, manganese, potassium and sodium were excluded from the table due to natural abundance.

APPENDIX A

Confirmatory Sampling and Analysis Plan

Workplan for Drilling at Technical Area 2

Introduction

Beginning on March 1, 1994, drilling will be conducted at four locations at Technical Area II (TA-2) (Figure 1) to collect preliminary data for the RFI Workplan. The scope of work will be divided into two phases. Phase I involves drilling three deep boreholes and eleven shallow boreholes in the vicinity of TA-2. Phase II involves advancing one and possibly two of the deep boreholes to first water and completing each as monitor wells. All Phase I boreholes will be drilled with a Barber drill rig using sonic resonance. All Phase II boreholes will be drilled with a Dresser XT-70E drill rig using mud-rotary punch coring. During both Phase I and Phase II, continuous core will be collected from each borehole with a core barrel. The scope of work for Phase I involves:

- Drilling and sampling nine boreholes to 6 ft BGL and two boreholes to 12 ft BGL in the vicinity of the former High Explosives Burn Pit (HEBP) area;
- Drilling and sampling one borehole to 150 ft below ground level (BGL) near the Building 906 dry well;
- Drilling and sampling one borehole to 100 ft BGL near the Building 935 retention tank and dry well; and
- Drilling and sampling one borehole to 150 ft BGL in the Classified Waste Landfill (CWL).

The scope of work for Phase II involves:

- Advancing the 150-ft deep borehole drilled near the Building 906 dry well to first water and completing the borehole as a monitor well; and
- If time and budget permit, the 150-ft deep borehole drilled in the CWL will be advanced to first water and completed as a monitor well.

The Phase II boreholes and monitor wells will be advanced and installed, respectively, with the XT-70E Dresser drill rig after it has completed work at the Chemical Waste Landfill (expected to be April 1994).

The purposes of Phase I are to:

- Drill and sample shallow boreholes with the Barber drill rig at the former HEBP area;
- Drill and sample pilot boreholes with the Barber drill rig prior to using the larger Dresser drill rig; and
- Determine the nature and vertical extent of contamination, if any, beneath the designated ER sites prior to well installation.

The purposes of Phase II are to:

- Advance the boreholes at Building 906 and the CWL (if time and budget permit) to first water using the Dresser XT-70E drill rig;
- Collect soil samples from the two deep boreholes; and
- Complete the two boreholes as monitor wells in the first water-bearing zone encountered (assumed to be at 300 ft BGL.

The Dresser XT-70E drill rig will not be available until about mid- to late April. Therefore, the smaller Barber drill rig will be used to drill pilot boreholes at Building 906 and in the vicinity of the CWL, and drill and sample boreholes in the former HEBP area and one at Building 935. The Dresser drill rig is better suited for drilling deep boreholes than the Barber drill rig. In addition, mud-rotary wireline punch coring can be used with the Dresser drill rig, which is more effective and reliable than sonic coring at depths greater than about 150 ft.

The soil analytical data collected during Phase I will be used to determine the nature and extent of potential contamination at the four drilling locations. These data also will be used to evaluate waste management issues regarding the use of mud-rotary drilling and well installation methods if the subsurface soil is contaminated. Geophysical logging will be conducted after well completion and will consist of EM Induction (EMI) resistivity or resistivity (which ever is available), natural gamma, and neutron. Neutron logging will not be conducted in the open boreholes to avoid the potential for losing the radiation source in the borehole.

Details of the drilling and sampling at the four locations at TA-2 are described separately below. Management of investigation-derived waste (IDW) is presented in the Waste Management Plan for Investigation-Derived Waste at Technical Area II.

Project Personnel

A site-specific Health and Safety Plan (HASP) has been developed for the planned drilling activities at TA-2. The Technical Task Leader for the drilling activities is Rarilee Conway of Department 7582. The Site Safety Officer (SSO) for the drilling activities is Michael Wade and/or a designated Health Physics (HP) Technician or person from IT Corporation (IT). The boreholes will be drilled by Water Development Corporation (WDC) of Woodland, California, and logged by Michael Wade, Rarilee Conway, John Copland, and/or Tom Tharp. WDC will provide equipment for drilling (Drill rod, PVC pipe, etc.). Jerry Mercer (Department 9333) will serve as a consultant who will be "on call" during drilling operations to assist with any technical and/or other drilling situations that may occur during drilling. He will also assist with ordering necessary drilling supplies and assisting with coordinating drilling activities.

Two technicians/geologists from IT will assist with soil and ground-water sampling, filling out chain-of-custody (COC) forms, health and safety monitoring, obtaining field sampling equipment and sample jars, delivering samples to the Sample Management Office (SMO), and any other related field work. IT will also provide field-screening for VOCs with a PID or FID (i.e., sample equipment, core, etc.). Sandia will provide a full-time, Certified Industrial Hygienist (CIH) and HP Technician to monitor drilling and sampling equipment and soil and samples for health and safety reasons. At Buildings 906 and 935 and at the CWL, the HP will be available for the first 50 ft of drilling (i.e., the primary zone of potential contamination). The HP will let the field team know when it is no longer necessary for continued radiation field-screening. Potential project personnel and their phone numbers are listed in the site-specific HASP.

If any laboratory questions arise regarding sample containers, sample quantity, holding times, etc., please contact the following people:

Bob Friberg, Sample Coordinator at TMA/Eberline (or Jim Lozito): 505-345-3461.
Ellen LaRiviere, ENSECO: 303-421-6611; ext. 308.

Samples collected for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), high explosives (HE) compounds, and Target Analyte Listed

(TAL) metals will be submitted to ENSECO unless otherwise notified. Radiological samples (total uranium, tritium, and photon emitters (gamma scan), will be submitted to TMA/Eberline. In addition, soil will be collected in a plastic marinelli beaker and screened by Amir Monagheghi at the Health Physics Laboratory, Department 7715 (Radioactive Protection & Measurement Department) for radiological screening. These samples will be collected at every interval where soil samples are collected for pre-laboratory screening purposes. Equipment rinse blanks will also be collected and submitted to the analytical laboratories at various times in the field, such as after completing a borehole. The frequency of collecting equipment blanks will be determined in the field by the sampling team.

The backgrounds for the Environmental Restoration (ER) sites associated with this project are described separately in the Draft RFI Workplan and are available on request. The HASP provides additional information concerning potential contaminants of concern (COCs) at each site. Details of the Phase I and Phase II sampling and analysis plans (SAPs) for each of the four locations are presented below.

Phase I Drilling and Soil Sampling

Phase I activities involve drilling 14 boreholes from 6 ft to 150 ft deep at four locations at TA-2. These activities are described separately below. Because of ongoing activities at TA-2, drilling during the weekend is necessary in the CWL. To avoid the potential for shrapnel and debris striking the drill rig, drilling must take place at the CWL during Friday, March 4 through Monday, March 7. Therefore, Phase 1 drilling will begin at the former HEBP area on Tuesday March 1 to avoid the potential to stop drilling in a deep borehole before it is finished (such as at Building 906 or 935).

The estimated schedule for Phase 1 drilling at TA-2 is as follows, and assumes that no major drill rig or health and safety issues occur during fieldwork:

Proposed schedule for drilling at TA-2 in March 1994.

Estimated Drilling Dates	Location/Activity
Week Prior to March 1	Drillers and any field personnel take RAD 101 on Tuesday, February 22. Mobilize drill rig to TA-2; set-up at former HEBP area.
Tuesday, March 1	Start drilling shallow 11 boreholes (6 ft to 12 ft deep) at the former HEBP area. Backfill boreholes with grout.
Thursday, March 3 - afternoon	Decontaminate drill rod; mob and set-up at CWL.
Friday, March 4	Start to drill 150-ft pilot borehole at CWL.
Monday, March 7	Backfill borehole with grout, if necessary. Decontaminate drill rod; mob and set-up at Building 906.
Tuesday, March 8	Start to drill 150-ft pilot borehole at Building 906.
Thursday, March 11	Possibly complete pilot borehole at Building 906. Backfill with grout, if necessary. End of first field cycle.
Tuesday, March 15	Decontaminate drill rig and equipment; mob and set-up at Building 935. Start to drill 100-ft borehole at Building 935.
Friday, March 18	Complete borehole at Building 935. Backfill with grout. Decontaminate drill rig and equipment. TA-2 Phase 1 drilling complete. Drill rig mobilizes to LWDS site.

The total estimated drilling days (including decontamination and mobilization) are 14. If Phase 1 drilling takes longer, Phase 2 drilling time will be reduced, and potentially only one monitor well will be installed (Building 906) instead of two. In addition, drilling schedules could change depending on activities or security issues at TA-2 or the availability of drill rigs. For additional information, Attachment A presents draft site background information about Buildings 906 and 935 and the Classified Waste Landfill.

Former High Explosives Burn Pit Area

Extensive field sampling has been conducted in the vicinity of the former HEBP area to locate two former burn pits and to determine the vertical and lateral extent of any potential contamination (Figure 2). Between September 3rd and 22nd, 1992, a total of 185 boreholes were drilled with a CME-75 drill rig to 6 ft BGL. The boreholes were drilled on a 4-ft grid pattern to achieve a 95 percent confidence level for locating the two former burn pits. As part of the investigation, the two former burn pits were informally named Burn Pit Y (BPY) and Burn Pit Z (BPZ) (IT, 1993) (Figures 2 and 3). A total of 370 soil samples were collected (one each at depths of 3 ft and 6 ft at each borehole location). The soil samples were analyzed for total RCRA metals and HE compounds. The soil samples were not analyzed for VOCs or SVOCs. However, all soil samples were field screened for VOCs with a PID and for alpha, beta, and gamma radiation using alpha scintillation and G-M probes. No VOCs or radioisotopes were detected above background levels during field sampling (IT, 1993). Details of this investigation are discussed in IT (1993) and are summarized below.

Figures 2 and 3 show the locations of soil samples collected from boreholes BPY-11,4 through BPY-11,6 which contained elevated metals concentrations (IT, 1993). The highest elevated concentrations of the metals in soil from these boreholes are:

- Barium at 23,800 mg/kg (6-ft sample from borehole BPY-11,5);
- Cadmium at 16.8 mg/kg (6-ft sample from borehole BPY-11,5);
- Chromium at 9.7 mg/kg (6-ft sample from borehole BPY-11,5); and
- Lead at 110 mg/kg (6-ft sample from borehole BPY-11,4).

Only the soil sample collected from 6 ft in borehole BPY-11,5 contained detectable concentrations of HE. At this location, RDX was detected at a concentration of 5.9 mg/kg, and HMX was detected at 3.1 mg/kg (IT, 1993). No other HE compounds were detected in this or any other sample collected in the vicinity of the former HEBP area; the detection limit was 1 mg/kg (IT, 1993).

The purpose the additional sampling described in this document is to collect data to:

1) Identify the lateral extent of barium and any associated COCs in the immediate vicinity east of boreholes BPY-11,4 through BPY-11,6 (i.e., between Burn Pit Y and Burn Pit Z);

2) Determine the vertical extent of barium and any associated COCs at depths greater than 6 ft in boreholes BPY-11,4 and BPY-11,5; and

3) Support a proposal for No Further Action (NFA) or for evaluating remedial alternatives at the HEBP area, if necessary.

The sampling for the HEBP area involves:

- Collecting soil samples at 3-ft and 6-ft depths in the area between boreholes BPY-11,4 through BPY-11,6 (Burn Pit Y) and Burn Pit Z. If any COCs are detected above background concentrations at the 6 ft depth, additional soil samples will be collected vertically and laterally as part of the RFI Workplan activities for TA-2 until no COCs are identified significantly above background concentrations;
- Collecting soil samples at the 9 ft and 12 ft depths at borehole locations BPY-11,4 and BPY-11,5; and
- Analyzing the soil samples for HE compounds and metals.

To fully determine the lateral extent of barium and any associated COCs between Burn Pit Y and Burn Pit Z, soil samples will be collected at 3-ft and 6-ft depths from boreholes using a 4-ft sampling grid. The boreholes will be drilled with the Barber drill rig using continuous sonic coring. The 4-ft sampling grid established during the September 1992 investigation will be extended east toward Burn Pit Z.

As shown on Figures 2 and 3, three boreholes each will be drilled east of boreholes BPY-11,4, BPY-11,5, and BPY-11,6 (i.e., 9 boreholes total). Because of the extensive soil sampling conducted in this area in September 1992, the boreholes and soil samples in this investigation will be identified using the same name convention as in September 1992, except that all samples will be preceded by TA-2 (e.g., TA2-BPY-12,5-3.0). As shown in Tables 1 and 2, the soil samples will be analyzed for TAL metals by EPA Methods 6010 and 7000 and HE compounds by USATHAMA Method. Only one sample needs to be collected from each depth, but can be used for all analyses to reduce sample collection time and management. If any potential COCs are detected in soil samples collected from the easternmost locations, additional boreholes will be drilled to the western edge of Burn Pit Z as part of the TA-2 RFI Workplan activities (since analytical results will not be available for up to 2 months).

At boreholes BPY-11,4 and BPY-11,5, soil samples will be collected at 9-ft and 12-ft depths to evaluate the vertical extent of elevated metals concentrations (i.e., primarily barium). The samples collected for metals will be analyzed by EPA Methods 6010 and 7000 (Table 1). In addition, soil samples collected from boreholes

BPY-11,4 and BPY-11,5 also will be analyzed for HE compounds by the USATHAMA Method for HE compounds. This HE analysis has a 7-day holding time, so samples must be delivered to the SMO as soon as possible (Table 1). If any potential COCs are detected in soil samples collected from 12 ft deep in either BPY-11,4 or BPY-11,5, the borehole will be advanced and sampled below 12 ft deep as part of the TA-2 RFI Workplan activities (since analytical results will not be available for up to 2 months).

All drilling equipment and drill core material will be field-screened for VOCs with a PID or FID and for radioisotopes using alpha scintillation and G-M probes. If any potential COCs are identified above background levels, the samples will be submitted for analysis. All soil samples collected will submitted for off-site analysis; samples also will be submitted for QA/QC (duplicates and Matrix Spike/Matrix Spike Duplicate, etc.) (Tables 1 and 2). In addition, all samples should be preserved on ice. The drilling geologist may collect additional soil samples in more permeable zones or submit more samples for QA/QC analysis if determined necessary in the field. In addition, ground water samples should be collected from any perched water-bearing zone(s) encountered during drilling, although no perched ground water is expected at these shallow locations. The samples should be collected, submitted, and analyzed for the potential COCs as listed in Tables 1 and 2. To minimize any potential cross-contamination, all sampling equipment should be decontaminated according to PRO 91-27 - General Equipment Decontamination (i.e., a mixture of water and Alconox soap followed by deionized water).

After each borehole has been drilled to the total depth (i.e., 6 ft or 12 ft BGL), each will be backfilled with grout. No additional drilling is planned in the vicinity of the former HEBP area for Phase II. This site is planned for an NFA proposal.

Table 1. Summary of analyses for soil samples to be collected from boreholes drilled in the immediate vicinity of Burn Pit Y (BPY), former HEBP area, Technical Area 2 (see Figure 5 for the locations of boreholes).

Borehole Locations	Sample Type or QA/QC Type	Sample Depth (in ft)	TAL Metals[a]	HE [b]	Sample Container Type[c]	Number of containers[d]
Lateral Sample Grid - BPY Row 12						
TA2-BPY-12,4-3.0	Subsurface soil	3	1	1	500 ml	1
TA2-BPY-12,4-6.0	Subsurface soil	6	1	1	500 ml	1
TA2-BPY-12,4-6.0	*MS/MSD - Include on COC for BPY-12,4-6.0*	6	--	--	--	--
TA2-BPY-12,5-3.0	Subsurface soil	3	1	1	500 ml	1
TA2-BPY-12,5-6.0	Subsurface soil	6	1	1	500 ml	1
TA2-BPY-12,6-3.0	Subsurface soil	3	1	1	500 ml	1
TA2-BPY-12,6-6.0	Subsurface soil	6	1	1	500 ml	1
TA2-BPY-12,6-6.0	*Duplicate of TA2-BPY-12,9-6.0*	6	1	1	500 ml	1
Total	---	---	7 analyses	7 analyses	7 containers	7 total containers
Lateral Sampling Grid - BPY Row 13						
TA2-BPY-13,4-3.0	Subsurface soil	3	1	1	500 ml	1
TA2-BPY-13,4-6.0	Subsurface soil	6	1	1	500 ml	1
TA2-BPY-13,5-3.0	Subsurface soil	3	1	1	500 ml	1
TA2-BPY-13,5-6.0	Subsurface soil	6	1	1	500 ml	1
TA2-BPY-13,6-3.0	Subsurface soil	3	1	1	500 ml	1
TA2-BPY-13,6-6.0	Subsurface soil	6	1	1	500 ml	1
TA2-BPY-13,6-6.0	*Duplicate of TA2-BPY-13,6-6.0*	6	1	1	500 ml	1
Total	---	---	7 analyses	7 analyses	7 containers	7 total containers
Lateral Sampling Grid - BPY Row 14						
TA2-BPY-14,4-3.0	Subsurface soil	3	1	1	500 ml	1
TA2-BPY-14,4-6.0	Subsurface soil	6	1	1	500 ml	1
TA2-BPY-14,5-3.0	Subsurface soil	3	1	1	500 ml	1
TA2-BPY-14,5-6.0	Subsurface soil	6	1	1	500 ml	1
TA2-BPY-14,6-3.0	Subsurface soil	3	1	1	500 ml	1
TA2-BPY-14,6-6.0	Subsurface soil	6	1	1	500 ml	1
Total	---	---	6 analyses	6 analyses	6 containers	76total containers

a - EPA Methods 6010 and 7000 for TAL metals.

b - USATHAMA Method for 9 HE compounds; 7-day holding time so deliver to SMO ASAP.

c - All samples will be collected in 500 ml glass jars.

d - TAL Metals and HE compound analyses can be collected in one 500 ml glass jar. Total number of containers does not include miranelli beaker samples for radiological screening.

NOTE: All soil samples should be preserved on ice unless otherwise noted.

NOTE: NO soil will be collected for radiological screening (i.e., for Amir) at the HEBP area.

NOTE: Equipment blanks will be collected at the end of each day or each borehole at the HEBP area. Sampling frequency can be determined in the field by the sampling team and/or geologist. These samples will be labeled as TA2-BPY-EB; a designation can be added to the BPY if it's sampled at a particular borehole (e.g., BPY-11). These samples should be collected in a 2.5 liter amber glass jar or in a 1 liter bottle for TAL metals and HE compounds combined.

NOTE: Collect a soil split sample (about 100 grams) at each sample location in a ziplock bag and label accordingly for future transport to Department 7584 to Nelson Capitan. Keep samples refrigerated and at the site or shed.

Table 2. Summary of analyses for soil samples to be collected from boreholes drilled in Burn Pit Y (BPY), Row 11, former HEBP area, Technical Area II (see Figure 5 for the locations of boreholes).

Borehole Locations	Sample Type or QA/QC Type	Sample Depth (in ft)	TAL Metals[a]	HE[b]	Sample Container Type[c]	Number of containers[d]
TA2-BPY-11,4-9.0	Subsurface soil	9	1	1	500 ml	1
TA2-BPY-11,4-12.0	Subsurface soil	12	1	1	500 ml	1
TA2-BPY-11,5-9.0	Subsurface soil	9	1	1	500 ml	1
TA2-BPY-11,5-12.0	Subsurface soil	12	1	1	500 ml	1
Total	---	---	4 analyses	4	4 containers	4 containers

a - EPA Methods 6010 and 7000 for TAL metals.
b - USATHAMA Method for 9 HE compounds.
c - All samples will be collected in 500 ml glass jars.
d - One 500 ml glass jar will be submitted for both TAL Metals and HE compounds. Total number of containers does not include soil samples collected in miranelli beaker samples for radiological screening.

NOTE: All soil samples should be preserved on ice unless otherwise noted.
NOTE: NO soil will be collected for radiological screening (i.e., Amir) at the HEBP area.
NOTE: Equipment blanks will be collected at the end of each day or each borehole at the HEBP area. Sampling frequency can be determined in the field by the sampling team and/or geologist. These samples will be labeled as TA2-BPY-EB; a designation can be added to the BPY if it's sampled at a particular borehole (e.g., BPY-11). These samples should be collected in either a 2.5 liter amber glass jar or in a 1 liter bottle for TAL metals and HE compounds combined.

Classified Waste Landfill

This location has been selected based on historical information and the results of a passive soil vapor survey (SVS) and surface geophysics. The SVS data identified two separate PCE soil vapor plumes in the Classified Waste Landfill (CWL) (Figure 3). TCE also was identified as a co-contaminant in one of the PCE soil vapor plumes.

The surface geophysics data shows an abundance of metallic debris buried at the location of the soil vapor plume. Therefore, one borehole (TA2-BH-03) will be drilled immediately north (about 10 to 20 ft) of the PCE and TCE soil vapor plume so that no buried metallic debris are encountered during drilling (Figure 4). Using the sonic coring system retrieved with drill rod, the borehole will be cored continuously and the lithology of the core will be described. Soil samples will be collected for analysis at the following depth intervals: 5, 10, 15, 20, 30, 40, 50, 75, 100, and 150 ft. As listed in detail in Tables 3a and 3b, the soil samples will be analyzed for TAL metals, HE compounds, VOCs, SVOCs, gamma spectroscopy, total uranium, and tritium. Because the passive SVS results indicate that VOCs are present in soil vapor, it is assumed that VOCs have been released to the environment in the CWL. The SVS data also indicate that 1,1,1-TCA and Freon compounds may be present in the landfill. No SVOCs were identified from the SVS investigation. However, soil samples will be collected and analyzed for SVOCs to a depth of 50 ft.

All drilling equipment and drill core material will be field-screened for VOCs with a PID or FID and for radioisotopes using alpha scintillation and G-M probes. If any potential COCs are identified above background levels, the samples will be submitted for analysis. In addition, all soil samples will be field-screened for radioisotopes and VOCs. All soil samples collected will be submitted for off-site analysis; additional samples will be collected and submitted for QA/QC (duplicates and Matrix Spike/Matrix Spike Duplicate, etc.) (Tables 3a and 3b). In addition, all samples should be preserved on ice. The drilling geologist may collect additional soil samples in more permeable zones or submit more samples for QA/QC analysis if determined necessary in the field. In addition, ground-water samples will be collected from any perched water-bearing zone(s) encountered during drilling. The samples should be collected, submitted, and analyzed for the potential COCs as listed in Tables 3a and 3b. To minimize any potential cross-contamination, all sampling equipment should be decontaminated according to PRO 91-27 - General Equipment Decontamination (i.e., a mixture of water and Alconox soap followed by deionized water).

After the borehole has been drilled to a total depth of 150 ft, it will be backfilled to ground surface with grout. After monitor well TA2-MW-01 (Building 906) has been installed and developed with the Dresser drill rig (Phase 2), borehole TA2-BH-03 will be advanced, if time and budget permit, to first water using mud-rotary wireline punch-coring as part of Phase II drilling activities, as described later.

Table 3a. Summary of non-radiological analyses for soil samples to be collected from borehole TA2-BH-03 drilled in the vicinity of the Classified Waste Landfill, Technical Area 2.

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	Sample container type[e]	SVOCs[b]	HE[c]	TAL Metals[d]	Sample container type[e]	Total number of containers[f]
Subsurface soil	5	1	125 ml	1	1	1	500 ml	2
Subsurface soil	10	1	125 ml	1	1	1	500 ml	2
MS/MSD - Include on COC	10	---	---	---	---	---	---	---
Subsurface soil	15	1	125 ml	1	1	1	500 ml	2
Subsurface soil	20	1	125 ml	1	1	1	500 ml	2
Subsurface soil	30	1	125 ml	1	1	1	500 ml	2
Subsurface soil	40	1	125 ml	1	1	1	500 ml	2
Subsurface soil	50	1	125 ml	1	1	1	500 ml	2
Duplicate of sample at 50 ft	50	---	---	---	1	1	500 ml	1
Subsurface soil	75	1	125 ml	---	---	---	---	1
Subsurface soil	100	1	125 ml	---	---	---	---	1
Subsurface soil	150	1	125 ml	---	---	---	---	1
Total	---	10	10	7	8	8	8	18 total containers

a - EPA Method 8240.
b - EPA Method 8270.
c - USATHAMA Method for 9 HE compounds.
d - EPA Methods 6010 and 7000.
e - All samples will be collected in glass jars as per laboratory request (Enseco); SVOCs, HE, and TAL Metals will all be collected and submitted in a 16 oz. (500 ml) glass jar.
f - All VOC samples will be collected in a 4 oz. (125 ml) glass jar.

NOTE: A VOC and SVOC field blank should be prepared and submitted-one each for the CWL borehole.

NOTE: All soil samples should be preserved on ice unless otherwise noted.

NOTE: All soil samples should be labeled as TA2-BH-03-depth-medium (50.5-S).

NOTE: Soil will be collected in a miranelli beaker from every sample interval and submitted to Amir for radiological screening.

NOTE: Equipment blanks will be collected at the end of each day or after a particular sampling interval (e.g., 0 to 50 ft). Sampling frequency can be determined in the field by the sampling team and/or geologist. These samples will be labeled as TA2-BH-03-EB. These samples should be collected in either a 2.5 liter amber glass jar or in a 1 liter bottle for SVOCs, TAL metals, and HE compounds combined. A 40 ml VOA can be used for VOC samples.

Workplan for Drilling
at Technical Area 2

Introduction

Beginning on about Tuesday, November 1, 1994 (time is approximate; assumes all drilling contracts are in place), drilling will be conducted at several locations within Technical Area II (TA-II) to collect data in support of the DOE-approved TA-II RFI Workplan and no further action (NFA) proposals. The scope of work will be divided into two phases. Phase I involves drilling 25 boreholes in TA-II ranging in depths from 30 to about 125 ft below ground level (BGL). The majority of the boreholes will be drilled to 50 ft. Phase II will involve drilling up to 2 boreholes to first water and completing them as monitor wells. This mini-Workplan only presents work and sampling and analysis (SAP) tables for Phase I. Phase II work details will be presented at a later date. All Phase I boreholes probably will be drilled with hollow stem augers and samples will be collected in split-spoon samplers lined with stainless steel liners (as done in the March 1994 drilling at Technical Area II). Phase I drilling will probably be conducted with an F-10, Mobile B-61, or a CME-75 or -95 drill rig (depending upon availability). Installation of the Phase II monitor wells will be determined after the results of the Phase I drilling, but may involve wireline coring using air or air-mist. During Phase I, continuous core will not be collected; the lithology at each borehole will be described from split-spoon samples and drill cuttings. All angled boreholes probably will be drilled with hollow stem augers, but other methods also will be evaluated.

The scope of work for Phase I drilling will involve:

Non-Landfill Portions of TA-II

- Drilling and sampling two boreholes to 50 ft BGL at Building 904 (one at the septic leachfield and one along the high explosives [HE] catch box);
- Drilling and sampling two boreholes to 50 ft BGL at Building 907 (one at the septic leachfield and one along the HE catch box);
- Drilling and sampling three boreholes in the vicinity of Building 935 (two 50-ft boreholes, one downgradient from the former retention tank and dry well locations and one adjacent to the septic tank; and one 30-ft borehole

east of the septic tank in a high trichloroethene [TCE] soil vapor survey [SVS] location);

- Drilling and sampling two boreholes to 50 ft BGL at Building 940 (one near the septic tank and one near the dry well);
- Drilling and sampling one borehole to 50 ft BGL west of Buildings 915 and 922 (at a high benzene-toluene-ethylbenzene-xylene [BTEX] SVS location in the vicinity of the septic tank);
- Drilling and sampling one borehole to 100 ft BGL southwest of Building 913 (at the highest TCE SVS location in TA-II); and
- Drilling and sampling two boreholes to 50 ft BGL east of Building 919 (one in the septic leachfield and one near the seepage pit).

Thus, thirteen boreholes will be drilled and sampled in non-landfill portions of TA-II. Phase I also will involve:

Eastern Portion of TA-II (Landfill Areas)

- Drilling and sampling four angled boreholes to a maximum of about 95 ft BGL beneath the Radioactive Waste Landfill (RWL) and one 30-ft deep borehole at the former Chemical Disposal Pit (CDP) outside of, and adjacent to, the RWL fence; and
- Drilling and sampling two angled boreholes to about 95 ft BGL beneath the Classified Waste Landfill (CWL) and five 50-ft boreholes, one at each American Car and Foundry (ACF) pit and/or cut-and-fill trench within the CWL.

Thus, six angled boreholes and 6 non-angled boreholes will be drilled and sampled in the landfill portions of TA-II (i.e., eastern portion of TA-II). A total of twenty-five boreholes will be drilled throughout TA-II as part of the Phase I drilling activities.

In addition to drilling and sampling boreholes during Phase I, surface and near-surface soil samples also will be collected from the vicinity of Building 935. The scope of work for this sampling event will involve:

- Collecting 13 surface (0 to 0.5 ft deep) and 13 near-surface (3 to 5 ft deep) soil samples in the immediate vicinity of Building 935 (Table to be added later).

The purposes of the Phase I work are to:

- Drill and sample boreholes in the vicinity of Environmental Restoration (ER) sites in support of the DOE-approved RFI Workplan and NFA proposals;
- Determine if any potential contaminants are present in soil near the ACF pits and/or trenches and beneath part of the CWL;
- Determine concentrations of TCE in soil in the vicinity of Buildings 913 and 935; and
- Justify no further action (NFA) proposals for the 5 septic system ER sites, if appropriate.

The scope of work for Phase II will involve:

- Installing up to 3 deep boreholes within TA-II and completing them as monitor wells. One of the three boreholes drilled in the CWL last March may be advanced to the first water-bearing zone at approximately 330 ft BGL. The other two boreholes will be installed at the apexes of TA-II: one at the northern apex, possibly near Building 915, and one at the southern apex, possibly near Building 913. Both of these also will be installed in the first water-bearing zone at about 330 ft BGL; and
- Conducting geophysical logging at each potential well location.

The drilling method(s) for the Phase II monitor wells will be determined from the results of the Phase I investigation and from the availability of drill rigs.

The purposes of Phase II are to:

- Determine if ground water has been impacted by potential contaminants in soil in the vicinity of the CWL and Building 913; and
- Determine if the ground water flow direction and gradient are consistent throughout TA-II.

Geophysical logs (e.g., neutron, caliper, density, EMI) will be performed prior to installing each monitor well to confirm the location of the first water-bearing zone and evaluate the integrity of the borehole for well completion.

Project Personnel

A site-specific Health and Safety Plan (HASP) has been developed and approved by DOE and Sandia Health and Safety as part of the TA-II Workplan for the planned RFI fieldwork activities at TA-II. The Technical Task Leader for the drilling activities is Rarilee Conway of Department 7582. A designated Site Safety Officer (SSO) will be on-site for all drilling activities at TA-II. A contractor technician will conduct all field screening for volatile organic compound (VOC) vapors and radiosiotopes, and monitor overall site conditions and drilling equipment. One or more designated health physics (HP) technicians will conduct field-screening for radioisotopes. The boreholes will be logged and sampled by Tom Tharp, Michael Wade, Rarilee Conway, or some other designated geologist.

The technician will conduct soil and/or ground water sampling, fill out chain-of-custody (COC) forms, perform health and safety monitoring, obtain field sampling equipment and sample jars, deliver samples to the Sample Management Office (SMO), log lithologies, and conduct any other related field work. The technician also will provide field-screening for VOCs with a Photoionization detector (PID) or, if short-chained hydrocarbons are thought to be present, a Flame ionization detector (FID) (i.e., sample equipment, core, etc.). Tom Tharp and/or Michael Wade also will assist with sampling activities. Sandia will provide an Industrial Hygienist (IH) technician and an health physicist (HP) technician to monitor drilling and sampling equipment, soil and samples, and overall field conditions (i.e., temperature, cold stress, weather, etc.) for health and safety concerns. At the CWL and RWL, the HP will be available for the first 30 to 50 ft of drilling vertical (i.e., the primary zone of potential contamination). The HP will let the field team know when it is no longer necessary for continued radiation field-screening and/or upscaled personnel protective equipment. Potential project personnel and their phone numbers are listed in workplan HASP.

If any laboratory questions arise regarding sample containers, sample quantity, holding times, etc., the following people will be contacted from the field to reduce time and receive immediate technical advice:

Bob Friberg or a Sample Coordinator at TMA/Eberline (or Jim Lozito): 505-345-3461.
Ellen LaRiviere, Quanterra (previously ENSECO): 303-421-6611.

Mike Gonzalez, Sandia SMO (848-0404).

Samples collected for VOCs, semi-volatile organic compounds (SVOCs), HE compounds, total cyanide, and/or Target Analyte List (TAL) metals will be submitted to Quanterra in Colorado unless otherwise notified. Radiological samples (total uranium, tritium, and photon emitters (gamma spectroscopy) will be submitted to TMA/Eberline in Albuquerque. In addition, soil will be collected in a plastic marinelli beaker and screened by Amir Monagheghi at the Health Physics Laboratory, Department 7715 (Radiation Protection Measurements Department) for radiological screening, but ONLY in areas where potential radioisotopes may be encountered (i.e., Building 935, CWL, and the RWL only). These samples will be collected at every interval where soil samples are collected for pre-laboratory screening purposes. Equipment rinse blanks also will be collected at various times in the field, such as after completing a borehole, and will be submitted to the analytical laboratories. The frequency of collecting equipment blanks will be determined in the field by the sampling team but will be at least once pre borehole.

The historical backgrounds for the ER sites associated with this project are available on request. The HASP provides additional information concerning potential contaminants of concern at each site. Details of the Phase I SAPs for each ER site are presented below.

Phase I Drilling and Soil Sampling

Phase I activities involve drilling 25 boreholes from 30 to 135 ft deep at several locations within TA-II. These activities are described separately below. Because of ongoing activities at TA-II, drilling during the weekend may be necessary at the CWL and RWL. This is to avoid the potential for shrapnel and debris striking the drill rig (or Tom Tharp and Michael Wade) during TA-II testing activities. However, the drilling activities will be conducted primarily during weekdays and no other weekend field activities are planned.

Schedule for Phase I drilling activities at TA-II beginning Tuesday, November 1, 1994. Please note that the schedule may change due to potential activities at TA-II and/or any access problems.

Field Activity Dates (Estimated)	Borehole	Location
Tuesday, November 1, 1994	TA2-BH-11	Drill 50-ft borehole west of Buildings 915 and 922 - septic leachfield area; non-ER site; BTEX in soil vapor.
Wednesday, November 2	TA2-BH-08	Drill 50-ft borehole west of Building 907; septic leachfield area.
Thursday, November 3	TA2-BH-06	Drill 50-ft borehole west of Building 904; septic leachfield area.
Friday, November 4	TA2-BH-10	Drill 100-ft borehole southwest of Building 913; power line for night lighting shut-off for day; drilling at high TCE soil vapor location. Must complete this in one day.
Saturday, November 5	TA2-BH-09 (935) and TA2-BH-16 (907)	Drill 2 boreholes today - power shut off at 8 am (back on by 6 pm). Drill 30-ft borehole east of Building 935 at TCE soil vapor spot; drill 50-ft borehole north of Building 920 at Building 907 HE catch basin. Must finish both today due to power shut off in the area - weekend only.
Sunday, November 6	TA2-BH-17 and TA2-BH-18 (both at Building 940)	Drill 2 boreholes today - Both will be 50-ft deep near the Building 940 septic tank and drywell areas. Must complete these today due to power shutoff in the area - weekend only.
Monday, November 7	NO Drilling	NO Drilling - Day off.
Tuesday, November 8	TA2-BH-07	Drill 50-ft borehole along Building 904 HE Drain Trench immediately east of Buildings 914/917.
Wednesday, November 9	TA2-BH-12	Drill 50-ft borehole east of Building 919 - eastern portion of TA-II but will not interfere with testing activities.
Thursday, November 10	TA2-BH-13	Drill 50-ft borehole east of Building 919 - eastern portion of TA-II but will not interfere with testing activities.
Friday, November 11, 1994	End Phase I Drilling	Any site cleanup; drill rig decon at TA-III decontamination pad, if necessary.

Please Note: All drill rod and sampling equipment decontamination will take place at each drilling site. The drilling operation will have a mobile decontamination vehicle and augers and split-spoon samplers will be steam-cleaned at each site. The decontamination water tank will be drained into 55-gallon drums and labeled as IDW until analytical results are received for each site. All work will be performed in Level D protection, but Level C equipment will be on-hand, if required. Please refer to the TA-II site-specific workplan, sampling and analysis plan, and/or waste management plan for more details about these activities.

The estimated schedule for Phase I drilling at TA-II is as follows, and assumes that no major drill rig or health and safety issues occur during fieldwork. In addition, the schedule assumes that a minimum of one 50-ft deep borehole will be drilled and sampled each day. If the drilling contractor has at least 150 ft of hollow stem augers available, drill rig decontamination can be performed every few days (unless decontamination is conducted at each site each day).

If time and budget permit, a third moniter well will be installed in the vicinity of the northern apex of TA-II, near Buildings 915 and 922. Assuming 10 days to well completion, the estimated dates of drilling will be from Wednesday, February 1 through about February 15 (includes decontamination and demob time).

Field activity schedules may change depending on testing activities and/or security issues at TA-II, the availability of drill rigs, and schedule conflicts during the holiday season. Field work may be completed well ahead of schedule if TA-II testing activities don't affect drilling activities. Detailed SAP tables and brief descriptions of activities planned for each site are described separately below. In addition, the following sections describe field-screening methods and other activities that apply to most of the sites in general.

All drilling equipment and drill cuttings will be field-screened for VOCs with a PID or FID and/or for radioisotopes using alpha scintillation and G-M probes. If any potential COCs are identified above background levels, samples will be collected and submitted for analysis. Samples will be submitted for off-site analysis for QA/QC (i.e., duplicates and Matrix Spike/Matrix Spike Duplicate [MS/MSD], etc.). All samples will be preserved on ice, inlcuding tritium (but not other radioisotope analyses unless if it easier to do so for transporting purposes). The drilling geologist may collect additional soil samples in more permeable zones or submit more samples for QA/QC analysis if determined necessary in the field. In addition, ground water samples may be collected from any perched water-bearing zone(s) encountered during drilling, although perched ground water is not expected at the shallow depths planned for Phase I drilling. Samples will be collected, submitted, and analyzed for the potential COCs as listed in the tables in the following sections. To minimize the potential for cross-contamination, all sampling equipment will be decontaminated according to ER Operating Procedures (FOP) 94-57 (i.e., a mixture of water and Alconox soap followed by deionized water). Each borehole will be backfilled with grout after it has been drilled to the total depth.

All tritium samples will be collected in 16 oz. glass jars or plastic bottles as preferred by TMA/Eberline. Any samples collected for isotopic uranium and/or plutonium will be collected with the tritium and submitted for all three analyses as per TMA. This will reduce sample containers, filling out COCs, and sample collection time. In addition, other samples sent to Quanterra can be combined into one liner. For example, SVOCs, HE compounds, and TAL metals analyses can all be collected into one 2-inch diameter by 6-inch long stainless steel liner and submitted as such to the lab.

In general, all soil samples will be collected in a driven split-spoon sampler (typically a 2-in. diameter) lined with stainless steel liners. The liners will then be sealed with Teflon sheets, plastic end caps, and inert duct tape. The samples will then be labeled with the appropriate I.D. (i.e., borehole number and depth) and placed on ice. Collecting samples in liners via split-spoons also was performed during TA-II drilling during March and June 1994 and at the Kauai Test Facility site in April. This is the best technical method to collect undisturbed samples, especially for VOCs and SVOCs. Although noted in the tables in the following sections, the preferred liner size and appropriate analyses for soil are as follows (as per Quanterra and TMA/Eberline):

Analysis	Minimum Stainless Steel Liner Length (inches)[a]	Minimum Glass Sample Jar Size
VOCs	3	---
Total Cyanide	3	---
TAL metals, HE compounds, and SVOCs	6	---
TAL metals, HE compounds, and Total Cyanide	6	---
Tritium[b]	---	250 ml
Gamma spectroscopy and total uranium	---	500 ml
PCBs, SVOCs, and HE compounds	6	---
Tritium, isotopic uranium, and isotopic plutonium	---	500 ml plastic or glass jar (16 oz.)

a - The stainless steel liners are typically 3 inches or 6 inches long and 2 inches in diameter.
b - Liquid scintillation counter method.

NOTE: Miranelli beakers will be collected for radiological screening at each interval where samples are collected for gamma spectroscopy and/or total uranium at RMMA sites only.

The tritium samples and any other radiological samples can be collected in the split-spoon sampler and pushed into a jar/bottle since volatilization is not an issue or collected directly from a non-lined split-spoon sampler. In addition, most of the septic system ER sites will only require collecting VOCs and SVOCs in the first 15 to 20 ft to confirm the results of the passive SVSs. Therefore, there will be more sample material for the other analyses.

Unless contaminated soil and/or water is encountered during drilling activities, no additional soil samples will be collected during drilling. The field team has the discretion to collect additional samples at any time during these activities. The analytical results from samples collected during drilling activities will be used for waste characterization.

The following sections present the SAPs for each Phase I site and include sampling and analysis tables for all field activities.

All aqueous samples (including equipment blanks) will be sent to an off-site laboratory. For equipment blank (EB) and other aqueous samples, the following minimum quantities of water and bottle types/sizes have been requested by the analytical laboratories (Quanterra; TMA) (RCRA analytical holding times in parentheses):

TAL Metals	One 500 ml poly. bottle with nitric preservative (180 days)
HE Compounds	Two 1-liter amber glass bottles (7 days)
SVOCs	Two 1-liter amber glass bottles (7 days)
VOCs	Three 40 ml VOAs (14 days)
Total Cyanide	One 8 ounce poly. bottle (14 days)
Mercury	One 250 ml glass bottle (preferred) with sodium hydroxide preservative (13 days in plastic bottle; 28 days in glass bottle)
Tritium	One 1-liter amber glass bottle (none)

Building 904

Two boreholes (TA2-BH-06 and TA2-BH-07) will be drilled in the vicinity of Building 904 (see figure). Borehole TA2-BH-06 will be drilled adjacent to the septic system leachfield; borehole TA2-BH-07 will be drilled along the former HE drain trench. Both boreholes will be drilled with a hollow stem auger drill rig and samples will be collected with a split-spoon sampler. The lithology will be described from drill cuttings and split-spoon samples.

At borehole TA2-BH-06 (leachfield), soil samples will be collected for analysis at the following depth intervals: 5, 10, 15, 20, 30, 40, and 50 ft. As listed in detail in Table 1a, the soil samples will be analyzed for SVOCs, total cyanide, high explosives, gamma spectroscopy, TAL metals, tritium, and VOCs. No VOCs or SVOCs were identified from the passive SVS investigation in the leachfield area. However, limited confirmatory sampling will be done for VOCs between 5 and 20 ft and SVOCs between 10 and 20 ft.

At borehole TA2-BH-07 (drain trench), soil samples will be collected for analysis at the following depth intervals: 5, 10, 15, 20, 30, 40, and 50 ft. As listed in detail in Table 1b, the soil samples will be analyzed for SVOCs, total cyanide, high explosives, gamma spectroscopy, TAL metals, tritium, and VOCs. Limited confirmatory sampling will be done for VOCs between 5 and 20 ft and SVOCs between 10 and 20 ft.

Building 907

Two boreholes (TA2-BH-08 and TA2-BH-09) will be drilled in the vicinity of Building 907 (see attached figures). Borehole TA2-BH-08 will be drilled adjacent to the septic system leachfield; borehole TA2-BH-09 will be drilled near the HE catch box. Both boreholes will be drilled with a hollow stem auger drill rig and samples will be collected with a split-spoon sampler. The lithology will be described from drill cuttings and split-spoon samples.

At borehole TA2-BH-08, soil samples will be collected for analysis at the following depth intervals: 5, 10, 15, 20, 30, 40, and 50 ft. As listed in detail in Table 2a, the soil samples will be analyzed for SVOCs, total cyanide, high explosives, gamma spectroscopy, TAL metals, tritium, and VOCs. No VOCs or SVOCs were identified from the passive SVS investigation in the leachfield area. Limited confirmatory sampling will be done for VOCs and SVOCs between 5 and 15 ft and 10 and 20 ft, respectively.

At borehole TA2-BH-09, soil samples will be collected for analysis at the following depth intervals: 5, 10, 15, 20, 30, 40, and 50 ft. As listed in detail in Table 2b, the soil samples will be analyzed for SVOCs, total cyanide, high explosives, gamma spectroscopy, TAL metals, tritium, and VOCs.

Building 913

This location has been selected based on the results of a passive SVS. The SVS investigation identified TCE in soil vapor south-southwest of Building 913. This area is not designated as an ER site. One borehole (TA2-BH-10) will be drilled at the location of the highest TCE soil vapor point (see figure). The borehole will be drilled with a hollow stem auger drill rig and samples will be collected with a split-spoon sampler. The lithology will be described from drill cuttings and split-spoon samples.

Soil samples will be collected for analysis at the following depth intervals: 5, 10, 15, 20, 30, 40, 50, 75, and 100 ft. As listed in detail in Table 3, the soil samples will be analyzed for SVOCs, TAL metals, tritium, and VOCs. No SVOCs were identified from the passive SVS investigation. However, soil samples will be collected and analyzed for SVOCs at 10, 15, and 20 ft. In addition, soil samples will be collected from selected depths and analyzed for VOCs by EPA Methods 8010 and 8020.

Building 915/922

One borehole (TA2-BH-11) will be drilled in the vicinity west of Buildings 915 and 922. The borehole will be drilled adjacent to the septic system leachfield area (see attached figure). The borehole will be drilled with a hollow stem auger drill rig and samples will be collected with a split-spoon sampler. The lithology will be described from drill cuttings and split-spoon samples.

At borehole TA2-BH-11, soil samples will be collected for analysis at the following depth intervals: 5, 10, 15, 20, 30, 40, and 50 ft. As listed in detail in Table 4, the soil samples will be analyzed for SVOCs, high explosives, gamma spectroscopy, TAL metals, tritium, and VOCs. No SVOCs were identified from the passive SVS investigation in the leachfield area. However, limited confirmatory sampling will be done for SVOCs between 10 and 20 ft.

Building 919

Two boreholes (TA2-BH-12 and TA2-BH-13) will be drilled in the vicinity east of Building 919. Each borehole will be drilled in the septic system leachfield area (see figure. Both boreholes will be drilled with a hollow stem auger drill rig and samples will be collected with a split-spoon sampler. The lithology will be described from drill cuttings and split-spoon samples.

At each borehole, soil samples will be collected for analysis at the following depth intervals: 5, 10, 15, 20, 30, 40, and 50 ft. As listed in detail in Table 5, the soil samples will be analyzed for high explosives, gamma spectroscopy, TAL metals, tritium, and VOCs. No VOCs or SVOCs were identified from the passive SVS investigation in the leachfield area. However, limited confirmatory sampling will be done for VOCs between 5 and 15 ft.

Building 935

Three boreholes (TA2-BH-14, TA2-BH-15, and TA2-BH-16) will be drilled in the vicinity of Building 935. Borehole TA2-BH-14 will be drilled adjacent to the septic tank; borehole TA2-BH-15 will be drilled southwest of the former retention tank and dry well (see attached figure); and borehole TA2-BH-16 will be drilled southeast of Building 935 in the vicinity of high TCE concentrations in soil vapor. All three boreholes will be drilled with a hollow stem auger drill rig, two 50 ft deep and one to 30 ft deep (TA2-BH-16). Soil samples will be collected with a split-spoon sampler, and the lithology will be described from drill cuttings and split-spoon samples.

At boreholes TA2-BH-14 and TA2-BH-15 (Table 6a for both boreholes), soil samples will be collected for analysis at the following depth intervals: 5, 10, 15, 20, 30, 40, and 50 ft. As listed in detail in Table 6a, the soil samples will be analyzed for gamma spectroscopy, TAL metals, and tritium. No VOCs or SVOCs were identified from the passive SVS investigation in the leachfield area and confirmatory samples were collected during drilling activities in March 1994. These two boreholes are located within the Building 935 ER site and RMMA boundaries. Therefore, drilling will begin in Level C protection to at least 30 ft. The decision for downgrading from Level C to Level D protection will be decided by an HP.

At borehole TA2-BH-16, soil samples will be collected at the following depth intervals: 5, 10, 15, 20, and 30 (Table 6b). The samples will only be analyzed for VOCs by EPA Methods 8010 and 8020. Borehole TA2-BH-16 is located east of Building 935 and is not within the Building 935 ER site or the RMMA boundary.

Building 940

Two boreholes (TA2-BH-17 and TA2-BH-18) will be drilled in the vicinity of Building 940. Borehole TA2-BH-17 will be drilled adjacent to the septic tank near the northwest side of the building. Borehole TA2-BH-18 will be drilled near the dry well southwest of the building. Both boreholes will be drilled with a hollow stem auger drill rig to 50 ft deep. Soil samples will be collected with a split-spoon sampler, and the lithology will be described from drill cuttings and split-spoon samples.

At both borehole locations, soil samples will be collected for analysis at the following depth intervals: 5, 10, 15, 20, 30, 40, and 50 ft. As listed in Table 7, the soil samples will be analyzed for HE compounds, gamma spectroscopy, TAL metals, tritium, and VOCs. No VOCs were identified from the passive SVS investigation in the leachfield area. However, limited confirmatory sampling will be done for VOCs between 5 and 15 ft.

Radioactive Waste Landfill

Five boreholes (TA2-BH-19 through TA2-BH-23) will be drilled in the vicinity of the Radioactive Waste Landfill (RWL). Except for borehole TA2-BH-19, boreholes TA2-BH-20 through TA2-BH-23 will be angled.

Borehole TA2-BH-19 will be drilled to a depth of 30 ft in the location of a Chemical Disposal Pit (CDP) identified from historical air-photos. The CDP is located outside the northwest corner of the RWL. Although the borehole location is outside the RWL (an RMMA site), all drilling activities will be conducted as if it is an RMMA site. The borehole will be drilled with a hollow stem auger drill rig. Soil samples will be collected with a split-spoon sampler, and the lithology will be described from drill cuttings and split-spoon samples. At this borehole, soil samples will be collected for analysis at the following depth intervals: 5, 10, 15, 20, and 30 ft. As listed in Table 8a, the soil samples will be analyzed for VOCs (confirmatory), gamma spectroscopy, TAL metals, isotopic uranium, and tritium.

The four angled boreholes will be drilled beneath trench and/or pit locations within the RWL. Each borehole however will be drilled from a minimum of 10 ft outside the RWL. Table RWL-1 shows the angles, lateral and vertical distances, and the total depth of each proposed borehole. The actual lengths of the angled boreholes range from 55 to 140 ft.

Table RWL-1. Approximate depths and angles for boreholes planned to be drilled beneath the RWL. Depths and/or angles may change depending on field conditions and sampling requirements.

Borehole Number	Angle (approximate degrees from vertical)	Lateral Distance (Approximate range in ft)	Total Length of Borehole (ft) (Approximate)	Total Depth (ft BGL) (Approximate)
TA2-BH-20	40	35	55	41
TA2-BH-21	45	40	55	40
TA2-BH-22	45	80	100	80
TA2-BH-23	45	80-100	100-140	80-95

At each of the four angled borehole locations soil samples will be collected for analysis at several depth intervals (see Tables 8b through 8e). In general, the soil samples will be analyzed for VOCs (confirmatory at some locations only), gamma spectroscopy, TAL metals, tritium, isotopic uranium, and isotopic plutonium.

Classified Waste Landfill

Seven boreholes (TA2-BH-24 through TA2-BH-30) will be drilled in the vicinity of the Classified Waste Landfill (CWL); two of these boreholes (TA2-BH-29 and TA2-BH-30) will be angled.

Boreholes TA2-BH-24 through 28 each will be drilled 50 ft deep adjacent to four ACF pits and one ACF cut-and-fill trench. The ACF pits are reportedly 6 ft in diameter by 30 ft in depth; the cut-and-fill trench is 6-ft wide by 10-ft long by 12-ft deep. Each of these five boreholes will be drilled with a hollow stem auger drill rig to 50-ft deep. Soil samples will be collected with a split-spoon sampler, and the lithology will be described from drill cuttings and split-spoon samples. At each of these five boreholes, soil samples will be collected for analysis at the following depth intervals: 5, 10, 15, 20, 30, 40, and 50 ft. As listed in Table 9a, the soil samples will be analyzed for HE compounds, SVOCs, isotopic uranium, gamma spectroscopy, TAL metals, tritium, PCBs, and VOCs. TCE, PCE, and BTEX were identified from the passive SVS investigations previously conducted in the CWL. However, two boreholes have already been drilled at the location of the two SVS "hot spots" and no VOCs were identified above detection limits. Limited confirmatory sampling will be done for VOCs at each of these boreholes.

The two angled boreholes will be drilled beneath trench locations within the CWL. One angled borehole (TA2-BH-30) will be drilled beneath a series of east-west oriented trenches (see Table CWL-1 below). This borehole will be drilled at an angle of 40 degrees from vertical to about 95 ft BGL (see Table CWL-1 below). The total length of the drilled borehole will be 125 ft. The other angled borehole (TA2-BH-29) will be drilled beneath a former pit and trench area (see attached Figure). This borehole will be drilled at about 40 degrees from vertical to about 60 ft BGL. The total length of the borehole will be about 75 ft.

Table CWL-1. Approximate depths and angles for boreholes planned to be drilled in the CWL. Depths and/or angles may change depending on field conditions and sampling requirements.

Borehole Number	Angle (degrees from vertical)	Lateral Distance (ft)	Total Length of Borehole (ft)	Total Depth (ft BGL)
TA2-BH-29	40	50	75	60
TA2-BH-30	40	95-100 ft	125	95

At each of the two angled borehole locations, soil samples will be collected for analysis at several depth intervals (see Tables 9b and 9c). In general, the soil samples will be analyzed for VOCs, gamma spectroscopy, TAL metals, tritium, isotopic uranium, PCBs, SVOCs, and HE compounds.

Workplan SAP Tables
for Technical Area 2

The following SAP tables are for drilling and sampling activities to be conducted from October 1994 through about January 1995 at TA-2. Please note that five boreholes planned to be drilled at the CWL ACF pits have only one sampling and analysis table since the table will apply the same to all 5 boreholes (TA2-BH-24 through -28).

Table 1a. Summary of analyses for soil samples to be collected from borehole TA2-BH-06 drilled near the septic system leachfield west of Building 904, Technical Area 2.

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	Tritium[b]	SVOCs[c]	TAL Metals[d]	HE[e]	Total Cyanide	Gamma Spec	Total # o Containe
Subsurface soil	5	1	1	---	---	---	1	1	4
Subsurface soil	10	1	1	1	1	1	1	1	5
Subsurface soil	15	1	1	1	1	1	1	1	5
Subsurface soil	20	---	1	1	1	1	1	1	4
MS/MSD - Include on COC	30	---	---	---	---	---	---	---	---
Subsurface soil	30	---	1	---	1	---	1	1	4
Subsurface soil	40	---	1	---	1	---	1	1	4
Subsurface soil	50	---	1	---	1	---	1	1	4
Total Analyses 36	---	3	7	3	6	3	7	7	30 Total Containe

a - EPA Method 8240. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.

b - Liquid scintillation counter method. Tritium will be collected in a split-spoon sampler and transferred into a 250 ml glass jar.

c - EPA Method 8270.

d - EPA Methods 6010 and 7000.

e - EPA Method 8330.

NOTE: <u>This is NOT an RMMA site.</u>

Note: SVOCs, High Explosives (HE), and TAL Metals samples will be collected into one 6-in. liner.

Note: A VOC and SVOC trip blank will be prepared and submitted for this borehole.

Note: All soil samples should be preserved on ice unless otherwise noted.

Note: All soil samples should be labeled as TA2-BH-06-depth.

Note: No soil will be collected from this borehole for a miranelli beaker.

Note: Equipment blanks will be collected after reaching the total depth of the borehole. The samples will be labeled as TA2-BH-06-EB. These samples should be collected in either a 2.5 liter amber glass jar or in a 1 liter bottle for SVOCs, HE, and TAL metals, and a 40 ml VOA for VOC samples.

Table 1b. Summary of analyses for soil samples to be collected from borehole TA2-BH-07 drilled in the vicinity of the former HE drain trench along the east side of Building 904, Technical Area 2.

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	Tritium[b]	SVOCs[c]	TAL Metals[d]	HE[e]	Total Cyanide	Gamma Spec	Total # o Containe
Subsurface soil	5	1	1	---	---	---	1	1	4
Subsurface soil	10	1	1	1	1	1	1	1	5
Subsurface soil	15	1	1	1	1	1	1	1	5
Subsurface soil	20	---	1	1	1	1	1	1	4
MS/MSD - Include on COC	30	---	---	---	---	---	---	---	---
Subsurface soil	30	---	1	---	1	1	1	1	4
Subsurface soil	40	---	1	---	1	1	1	1	4
Subsurface soil	50	---	1	---	1	1	1	1	4
Total Analyses 39	---	3	7	3	6	6	7	7	30 Total Containe

a - EPA Method 8240. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.

b - Liquid scintillation counter method. Tritium will be collected in a split-spoon sampler and transferred into a 250 ml glass jar.

c - EPA Method 8270.

d - EPA Methods 6010 and 7000.

e - EPA Method 8330.

NOTE: This is NOT an RMMA site.

Note: SVOCs, High Explosives, and TAL Metals samples will be collected into one 6-in. liner.

Note: A VOC and SVOC trip blank will be prepared and submitted for this borehole.

Note: All soil samples should be preserved on ice unless otherwise noted.

Note: All soil samples should be labeled as TA2-BH-07-depth.

Note: No soil will be collected from this borehole for a miranelli beaker.

Note: Equipment blanks will be collected after the total depth of the borehole has been drilled. The samples will be labeled as TA2-BH-07-EB. The samples should be collected in either a 2.5 liter amber glass jar or in a 1 liter bottle for SVOCs, HE, and TAL metals, and a 40 ml VOA for VOC samples.

Table 2a. Summary of analyses for soil samples to be collected from borehole TA2-BH-08 drilled near the septic system leachfield southwest of Building 907, Technical Area 2.

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	Tritium[b]	SVOCs[c]	TAL Metals[d]	HE[e]	Total Cyanide	Gamma Spec	Total # o Containe
Subsurface soil	5	1	1	---	---	---	1	1	4
Subsurface soil	10	1	1	1	1	1	1	1	5
Subsurface soil	15	1	1	1	1	1	1	1	5
Subsurface soil	20	---	1	1	1	1	1	1	4
MS/MSD - Include on COC	30	---	---	---	---	---	---	---	---
Subsurface soil	30	---	1	---	1	---	1	1	4
Subsurface soil	40	---	1	---	1	---	1	1	4
Subsurface soil	50	---	1	---	1	---	1	1	4
Total Analyses 36	---	3	7	3	6	3	7	7	30 Total Containe

a - EPA Method 8240. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.

b - Liquid scintillation counter method. Tritium will be collected in a split-spoon sampler and transferred into a 250 ml glass jar.

c - EPA Method 8270.

d - EPA Methods 6010 and 7000.

e - EPA Method 8330.

NOTE: <u>This is NOT an RMMA site.</u>

Note: SVOCs, High Explosives, and TAL Metals samples will be collected into one 6-in. liner.

Note: A VOC and SVOC trip blank will be prepared and submitted for this borehole.

Note: All soil samples should be preserved on ice unless otherwise noted.

Note: All soil samples should be labeled as TA2-BH-08-depth.

Note: No soil will be collected from this borehole for a miranelli beaker.

Note: Equipment blanks will be collected after the total depth of the borehole has been reached. The samples will be labeled as TA2-BH-08-EB, and should be collected in either a 2.5 liter amber glass jar or in a 1 liter bottle for SVOCs, HE, and TAL metals. A 40 ml VOA will be used for VOC samples.

Table 2b. Summary of analyses for soil samples to be collected from borehole TA2-BH-09 drilled near the HE catch box along the HE drain trench south of Building 907, Technical Area 2.

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	Tritium[b]	SVOCs[c]	TAL Metals[d]	HE[e]	Total Cyanide	Gamma Spec	Total # o Containe
Subsurface soil	5	1	1	---	---	---	1	1	4
Subsurface soil	10	1	1	1	1	1	1	1	5
Subsurface soil	15	1	1	1	1	1	1	1	5
Subsurface soil	20	---	1	1	1	1	1	1	4
MS/MSD - Include on COC	30	---	---	---	---	---	---	---	---
Subsurface soil	30	---	1	---	1	1	1	1	4
Subsurface soil	40	---	1	---	1	1	1	1	4
Subsurface soil	50	---	1	---	1	1	1	1	4
Total Analyses 39	---	3	7	3	6	6	7	7	30 Total Containe

a - EPA Method 8240. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.

b - Liquid scintillation counter method. Tritium will be collected in a split-spoon sampler and transferred into a 250 ml glass jar.

c - EPA Method 8270.

d - EPA Methods 6010 and 7000.

e - EPA Method 8330.

NOTE: This is NOT an RMMA site.

Note: SVOCs, High Explosives, and TAL Metals samples will be collected into one 6-in. liner.

Note: A VOC and SVOC trip blank will be prepared and submitted for this borehole.

Note: All soil samples should be preserved on ice unless otherwise noted.

Note: All soil samples should be labeled as TA2-BH-09-depth.

Note: No soil will be collected from this borehole for a miranelli beaker.

Note: Equipment blanks will be collected after the total depth of the borehole has been reached. The samples will be labeled as TA2-BH-09-EB, and should be collected in either a 2.5 liter amber glass jar or in a 1 liter bottle for SVOCs, HE, and TAL metals. A 40 ml VOA will be used for VOC samples.

Table 3. Summary of analyses for soil samples to be collected from borehole TA2-BH-10 drilled south-southwest of Building 913, Technical Area 2.

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	Tritium[b]	SVOCs[c]	TAL Metals[d]	Total number of containers
Subsurface soil	5	1	1	---	---	2
Subsurface soil	10	1	1	1	1	3
Subsurface soil	10[e]	1[e]	---	---	---	1
Subsurface soil	15	1	1	1	1	3
Subsurface soil	20[e]	1[e]	---	---	---	1
Subsurface soil	20	1	1	1	1	3
MS/MSD - Include on COC	30	---	---	---	---	---
Subsurface soil	30	1	1	---	---	2
Subsurface soil	40[e]	1[e]	---	---	---	1
Subsurface soil	40	1	1	---	---	2
Subsurface soil	50	1	1	---	---	2
Subsurface soil	75	1	1	---	---	2
Subsurface soil	100[e]	1[e]	---	---	---	1
Subsurface soil	100	1	1	---	---	2
Total Analyses 28	---	13	9	3	3	25 total containers

a - EPA Methods 8010/8020. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.

b - Liquid scintillation counter method. Tritium will be collected in a split-spoon sampler and transferred into a 250 ml glass jar.

c - EPA Method 8270.

d - EPA Methods 6010 and 7000.

e - EPA Method 8240.

NOTE: This is NOT an RMMA or an ER site.
NOTE: SVOCs and TAL Metals samples will both be collected in one 6-in. liner.
NOTE: A VOC and SVOC field blank will be prepared and submitted for this borehole.
NOTE: All soil samples should be preserved on ice unless otherwise noted.
NOTE: All soil samples should be labeled as TA2-BH-10-depth.
NOTE: No soil will be collected from this borehole for a miranelli beaker.
Note: Equipment blanks will be collected after the total depth of the borehole has been reached. The samples will be labeled as TA2-BH-10-EB, and should be collected in either a 2.5 liter amber glass jar or in a 1 liter bottle for SVOCs and TAL metals. A 40 ml VOA will be used for VOC samples.

Table 4. Summary of analyses for soil samples to be collected from borehole TA2-BH-11 drilled near the septic system leachfield southwest of Building 915/northwest of Building 922, Technical Area 2.

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	Tritium[b]	SVOCs[c]	TAL Metals[d]	HE[e]	Gamma Spec	Total # of Containers
Subsurface soil	5	1	1	---	---	---	1	3
Subsurface soil	10	1	1	1	1	1	1	4
Subsurface soil	15	1	1	1	1	1	1	4
Subsurface soil	20	1	1	1	1	1	1	4
MS/MSD - Include on COC	30	---	---	---	---	---	---	---
Subsurface soil	30	1	1	---	1	1	1	4
Subsurface soil	40	1	1	---	1	1	1	4
Subsurface soil	50	1	1	---	1	1	1	4
Total Analyses 36	---	7	7	3	6	6	7	27 Total Containers

a - EPA Method 8240. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.

b - Liquid scintillation counter method. Tritium will be collected in a split-spoon sampler and transferred into a 250 ml glass jar.

c - EPA Method 8270.

d - EPA Methods 6010 and 7000.

e - EPA Method 8330.

NOTE: This is NOT an RMMA site.

Note: SVOCs, High Explosives, and TAL Metals samples will be collected into one 6-in. liner.

Note: A VOC and SVOC trip blank will be prepared and submitted for this borehole.

Note: All soil samples should be preserved on ice unless otherwise noted.

Note: All soil samples should be labeled as TA2-BH-11-depth.

Note: No soil will be collected from this borehole for a miranelli beaker.

Note: Equipment blanks will be collected after the total depth of the borehole has been reached. The samples will be labeled as TA2-BH-11-EB, and should be collected in either a 2.5 liter amber glass jar or in a 1 liter bottle for SVOCs, HE, and TAL metals. A 40 ml VOA will be used for VOC samples.

Table 5. Summary of analyses for soil samples to be collected from boreholes TA2-BH-12 and TA2-BH-13 drilled in the septic system leachfield area east of Building 919, Technical Area 2. This table will be used for analyses at both boreholes.

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	Tritium[b]	TAL Metals[c]	HE[d]	Gamma Spec	Total # of Containers
Subsurface soil	5	1	1	---	---	1	4
Subsurface soil	10	1	1	1	1	1	5
Subsurface soil	15	1	1	1	1	1	5
Subsurface soil	20	---	1	1	1	1	4
MS/MSD - Include on COC	30	---	---	---	---	---	---
Subsurface soil	30	---	1	1	---	1	4
Subsurface soil	40	---	1	1	---	1	4
Subsurface soil	50	---	1	1	---	1	4
Total Analyses 36	---	3	7	6	6	7	30 Total Containers

a - EPA Method 8240. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.

b - Liquid scintillation counter method. Tritium will be collected in a split-spoon sampler and transferred into a 250 ml glass jar.

c - EPA Methods 6010 and 7000.

d - EPA Method 8330.

NOTE: This is NOT an RMMA site.

Note: High Explosives (HE) and TAL Metals samples will be collected into one 6-in. liner.

Note: A VOC trip blank will be prepared and submitted for this borehole.

Note: All soil samples should be preserved on ice unless otherwise noted.

Note: All soil samples should be labeled as TA2-BH-12-depth (or TA2-BH-13-depth).

Note: No soil will be collected from this borehole for a miranelli beaker.

Note: Equipment blanks will be collected after the total depth of the borehole has been reached. The samples will be labeled as TA2-BH-12-EB (or -13-EB), and should be collected in either a 2.5 liter amber glass jar or in a 1 liter bottle for SVOCs, HE, and TAL metals. A 40 ml VOA will be used for VOC samples.

Table 6a. Summary of analyses for soil samples to be collected from boreholes TA2-BH-14 and TA2-BH-15 drilled adjacent to the septic tank southeast of Building 935, Technical Area 2. This table will be used for analyses at both boreholes.

Sample Type or QA/QC Type	Sample Depth (in ft)	Tritium[a]	TAL Metals[b]	Gamma Spec	Total # of Containers
Subsurface soil	5	1	---	1	3
Subsurface soil	10	1	1	1	3
Subsurface soil	15	1	1	1	3
Subsurface soil	20	1	1	1	3
MS/MSD - Include on COC	30	---	---	---	---
Subsurface soil	30	1	1	1	3
Subsurface soil	40	1	1	1	3
Subsurface soil	50	1	1	1	3
Total Analyses 20	---	7	6	7	20 Total Containers

a - Liquid scintillation counter method. Tritium will be collected in a split-spoon sampler and transferred into a 250 ml glass jar.

b- EPA Methods 6010 and 7000.

NOTE: <u>This IS an RMMA site.</u>

Note: TAL Metals samples will be collected into one 6-in. liner.

Note: All soil samples should be preserved on ice unless otherwise noted.

Note: All soil samples should be labeled as TA2-BH-14-depth.

Note: Soil samples will be collected from this borehole at each sample location for a miranelli beaker and analyzed by Department 7715.

Note: Equipment blanks will be collected after the total depth of the borehole has been reached. The samples will be labeled as TA2-BH-14-EB, and should be collected in either a 2.5 liter amber glass jar or in a 1 liter bottle for TAL metals. A 40 ml VOA will be used for VOC samples.

Table 6b. Summary of analyses for soil samples to be collected from borehole TA2-BH-16 drilled in a soil vapor TCE "hot spot" east of Building 935, Technical Area 2.

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs by EPA Methods 8010 and 8020	Total # of Containers
Subsurface soil	5	1	1
Subsurface soil	10	1	1
Subsurface soil	15	1	1
Subsurface soil	20	1	1
MS/MSD - Include on COC	30	---	---
Subsurface soil	30	1	1
Total Analyses 5	---	5	5 Total Containers

NOTE: This is NOT an RMMA or an ER site.

Note: Each sample will be collected into one 3-in. liner for each depth interval and the analyses labeled as 8010/8020.
Note: All soil samples should be preserved on ice unless otherwise noted.
Note: A VOC field blank will be should be prepared for this borehole.
Note: All soil samples should be labeled as TA2-BH-16-depth.
Note: Soil samples will be collected from this borehole at each sample location for a miranelli beaker and analyzed by Department 7715.
Note: Equipment blanks will be collected after the total depth of the borehole has been reached. The samples will be labeled as TA2-BH-16-EB. A 40 ml VOA will be used for VOC samples.

Table 7. Summary of analyses for soil samples to be collected from boreholes TA2-BH-17 and TA2-BH-18 drilled near the septic tank on the west side of Building 940, Technical Area 2. This table will be used for both boreholes TA2-BH-17 and TA2-BH-18.

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	Tritium[b]	TAL Metals[c]	HE[d]	Gamma Spec	Total # of Containers
Subsurface soil	5	1	1	---	---	1	3
Subsurface soil	10	1	1	1	1	1	4
Subsurface soil	15	1	1	1	1	1	4
Subsurface soil	20	---	1	1	1	1	3
MS/MSD - Include on COC	30	---	---	---	---	---	---
Subsurface soil	30	---	1	1	1	1	3
Subsurface soil	40	---	1	1	1	1	3
Subsurface soil	50	---	1	1	1	1	3
Total Analyses 29	---	3	7	6	6	7	23 Total Containers

a - EPA Method 8240. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.

b - Liquid scintillation counter method. Tritium will be collected in a split-spoon sampler and transferred into a 250 ml glass jar.

c - EPA Methods 6010 and 7000.

d - EPA Method 8330.

NOTE: <u>This is NOT an RMMA site.</u>

Note: High Explosives (HE) and TAL Metals samples will be collected into one 6-in. liner.

Note: A VOC trip blank will be prepared and submitted for this borehole.

Note: All soil samples should be preserved on ice unless otherwise noted.

Note: All soil samples should be labeled as TA2-BH-17-depth and/or TA2-BH-18-depth

Note: No soil will be collected from this borehole for a miranelli beaker.

Note: Equipment blanks will be collected after the borehole has been drilled to the total depth of about 50 ft. These samples will be labeled as TA2-BH-17-EB (or -18-EB) and should be collected in either a 2.5 liter amber glass jar or in a 1 liter bottle for TAL metals and a 40 ml VOA for VOC samples.

Table 8a. Summary of analyses for soil samples to be collected from angled borehole TA2-BH-19 drilled in the former Chemical Disposal Pit located near the Radioactive Waste Landfill, Technical Area 2.

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	Tritium[b]	Isotopic Uranium	gamma spec	TAL Metals[c]	Total # of Containers
Subsurface soil	5	1	1	1	1	1	4
Subsurface soil	10	1	1	1	1	1	4
Subsurface soil	15	1	1	1	1	1	4
MS/MSD - Include on COC	15	---	---	---	---	---	---
Subsurface soil	20	---	1	1	1	1	3
Subsurface soil	30	---	1	1	1	1	3
Total Analyses 23	---	3	5	5	5	5	18 Total Containers

a - EPA Method 8240. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.

b - Liquid scintillation counter method. Tritium will be collected in a split-spoon sampler and transferred into a 500 ml glass jar or plastic bottle and analyzed with isotopic uranium.

c - EPA Methods 6010 and 7000.

NOTE: This is located outside the RWL and is not an RMMA site. However, the site will be considered as an RMMA site during this drilling event.

Note: TAL Metals samples will be collected into one 6-in. liner.

Note: All soil samples should be preserved on ice unless otherwise noted.

Note: All soil samples should be labeled as TA2-BH-19-depth.

Note: Gamma spectroscopy samples will be collected from this borehole in a miranelli beaker.

Note: Equipment blanks will be collected after the borehole has been drilled to the total depth of 30 ft. These samples will be labeled as TA2-BH-19-EB and should be collected in either a 2.5 liter amber glass jar or in a 1 liter bottle for TAL metals and a 40 ml VOA for VOC samples.

Table 8b. Summary of analyses for soil samples to be collected from angled borehole TA2-BH-20 drilled beneath Pit 1 at the Radioactive Waste Landfill, Technical Area 2. Approximate angle is 40 degrees from vertical and 55 ft deep (41 ft BGL). Borehole will be drilled 10 ft from the RWL fence.

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	TAL Metals[b]	Tritium[c]	Isotopic Plutonium	Isotopic Uranium	Gamma Spec	Total # of Containers
Subsurface soil	20	1	1	1	1	1	1	4
Subsurface soil	30	1	1	1	1	1	1	4
MS/MSD - Include on COC	30	---	---	---	---	---	---	---
Subsurface soil	40	---	1	1	1	1	1	3
Subsurface soil	50	---	1	1	1	1	1	3
Total Analyses 22	---	2	4	4	4	4	4	14 Total Containers

a - EPA Method 8240. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.

b - EPA Methods 6010 and 7000.

c - Liquid scintillation counter method for tritium. Tritium will be collected in a split-spoon sampler and transferred into a 500 ml glass jar or plastic bottle and analyzed with isotopic uranium and plutonium.

NOTE: This IS an RMMA site (although the drill rig and sampling will be conducted outside of the RWL).

Note: TAL Metals samples will be collected into one 6-in. liner.

Note: All soil samples should be preserved on ice unless otherwise noted.

Note: All soil samples should be labeled as TA2-BH-20-depth.

Note: Tritium, isotopic uranium and isotopic plutonium all will be collected into one 500 ml plastic or glass jar.

Note: Equipment blanks will be collected after the borehole has been drilled to the total depth. These samples will be labeled as TA2-BH-20-EB and should be collected in a 2.5 liter amber glass jar or in a 1 liter bottle for TAL metals and a 40 ml VOA for VOC samples.

Table 8c. Summary of analyses for soil samples to be collected from angled borehole TA2-BH-21 drilled beneath Pit 2 at the Radioactive Waste Landfill, Technical Area 2. Approximate angle is 45 degrees from vertical and 55 ft deep (40 ft BGL). Borehole will be drilled 10 ft from the RWL fence.

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	TAL Metals[b]	Tritium[c]	Isotopic Plutonium	Isotopic Uranium	Gamma Spec	Total # of Containers
Subsurface soil	20	1	1	1	1	1	1	4
Subsurface soil	30	1	1	1	1	1	1	4
MS/MSD - Include on COC	30	---	---	---	---	---	---	3
Subsurface soil	40	---	1	1	1	1	1	---
Subsurface soil	50	---	1	1	1	1	1	3
Total Analyses 22	---	2	4	4	4	4	4	14 Total Containers

a - EPA Method 8240. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.

b - EPA Methods 6010 and 7000.

c - Liquid scintillation counter method for tritium. Tritium will be collected in a split-spoon sampler and transferred into a 500 ml glass jar or plastic bottle and analyzed with isotopic uranium and plutonium.

NOTE: This IS an RMMA site.

Note: TAL Metals samples will be collected into one 6-in. liner.

Note: All soil samples should be preserved on ice unless otherwise noted.

Note: All soil samples should be labeled as TA2-BH-21-depth.

Note: Tritium, isotopic uranium, and isotopic plutonium all will be collected into one 500 ml plastic bottle or glass jar.

Note: Equipment blanks will be collected after the borehole has been drilled to the total depth. These samples will be labeled as TA2-BH-21-EB and should be collected in a 2.5 liter amber glass jar or in a 1 liter bottle for TAL metals and a 40 ml VOA for VOC samples.

Table 8d. Summary of analyses for soil samples to be collected from angled borehole TA2-BH-22 drilled beneath Trench 5 at the Radioactive Waste Landfill, Technical Area 2. Approximate angle is 45 degrees from vertical and 100 ft deep (80 ft BGL). Borehole will be drilled 10 ft from the RWL fence.

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	TAL Metals[b]	Tritium[c]	Isotopic Plutonium	Isotopic Uranium	Gamma Spec	Total # of Containers
Subsurface soil	30	1	1	1	1	1	1	4
Subsurface soil	40	1	1	1	1	1	1	4
MS/MSD - Include on COC	40	---	---	---	---	---	---	---
Subsurface soil	50	---	1	1	1	1	1	3
Subsurface soil	60	---	1	1	1	1	1	3
Subsurface soil	70	---	1	1	1	1	1	3
Subsurface soil	85	---	1	1	1	1	1	3
Subsurface soil	100	---	1	1	1	1	1	3
Total Analyses 37	---	2	7	7	7	7	7	23 Total Containers

a - EPA Method 8240. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.
b - EPA Methods 6010 and 7000.
c - Liquid scintillation counter method for tritium. Tritium will be collected in a split-spoon sampler and transferred into a 500 ml glass or plastic jar and analyzed with isotopic uranium and plutonium.

NOTE: <u>This IS an RMMA site.</u>
Note: TAL Metals samples will be collected into one 6-in. liner.
Note: All soil samples should be preserved on ice unless otherwise noted.
Note: All soil samples should be labeled as TA2-BH-22-depth.
Note: Tritium, isotopic uranium, and isotopic plutonium all will be collected into one 500 ml plastic bottle or glass jar.
Note: Equipment blanks will be collected after the borehole has been drilled to the total depth. These samples will be labeled as TA2-BH-22-EB and should be collected in a 2.5 liter amber glass jar or in a 1 liter bottle for TAL metals and a 40 ml VOA for VOC samples.

Table 8e. Summary of analyses for soil samples to be collected from angled borehole TA2-BH-23 drilled beneath Trench 6 at the Radioactive Waste Landfill, Technical Area 2. Approximate angle is 45 degrees from vertical at a maximum of 135 ft deep and a minimum of 100 ft deep (i.e., 80 ft and 95 BGL, respectively).

Sample Type or QA/QC Type	Sample Depth (in ft)	TAL Metals[a]	Tritium[b]	Isotopic Plutonium	Isotopic Uranium	Gamma Spec	Total # of Containers
Subsurface soil	30	1	1	1	1	1	3
Subsurface soil	40	1	1	1	1	1	3
MS/MSD - Include on COC	40	---	---	---	---	---	---
Subsurface soil	55	1	1	1	1	1	3
Subsurface soil	70	1	1	1	1	1	3
Subsurface soil	85	1	1	1	1	1	3
Subsurface soil	100	1	1	1	1	1	3
Subsurface soil	120	1	1	1	1	1	3
Subsurface soil	135	1	1	1	1	1	3
Total Analyses 40	---	8	8	8	8	8	24 Total Containers

a - EPA Methods 6010 and 7000.

b- Liquid scintillation counter method for tritium. Tritium will be collected in a split-spoon sampler and transferred into a 500 ml glass jar or plastic bottle along with isotopic uranium and plutonium.

NOTE: <u>This IS an RMMA site.</u>

Note: Minimum length of borehole will be about 100 ft; maximum depth (if no auger refusal) will be 135 ft.

Note: TAL Metals samples will be collected into one 6-in. liner.

Note: All soil samples should be preserved on ice unless otherwise noted.

Note: All soil samples should be labeled as TA2-BH-23-depth.

Note: Tritium, isotopic uranium, and isotopic plutonium all will be collected into a 500 ml plastic bottle or glass jar.

Note: Equipment blanks will be collected after the borehole has been drilled to the total depth. These samples will be labeled as TA2-BH-23-EB and should be collected in a 2.5 liter amber glass jar or in a 1 liter bottle for TAL metals.

Table 9a. Summary of analyses for soil samples to be collected from five 50-ft deep boreholes planned to be drilled adjacent to the ACF pits in the Classified Waste Landfill, Technical Area 2. The five boreholes are TA2-BH-24, -25, -26, -27, and -28. *(NOTE to SMO: this table will be applied to all five ACF boreholes; therefore, for the number of analyses and containers, multiply by 5. Also, multiply by 5 for containers/analyses for equipment and trip blanks).*

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	TAL Metals[b]	SVOCs[c]	HE	PCBs	Iso. U	Tritium	Gamma Spec	Total # of Containers
Subsurface soil	5	1	1	1	1	1	1	1	1	5
Subsurface soil	10	1	1	1	1	1	1	1	1	5
Subsurface soil	15	1	1	1	1	1	1	1	1	5
MS/MSD - Include on COC	15	---	---	---	---	---	---	---	---	---
Subsurface soil	20	---	1	1	1	1	1	1	1	4
Subsurface soil	30	---	1	1	1	1	1	1	1	4
Subsurface soil	40	---	1	1	1	1	1	1	1	4
Subsurface soil	50	---	1	1	1	1	1	1	1	4
Total Analyses 52	---	3	7	7	7	7	7	7	7	31 Total Containers

a - EPA Method 8240. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.

b - EPA Methods 6010 and 7000.

c - Liquid scintillation counter method for tritium. Tritium will be collected in a split-spoon sampler and transferred into a 500 ml glass jar or plastic bottle along with isotopic uranium and plutonium.

NOTE: <u>This is NOT an RMMA site.</u>

Note: TAL Metals, SVOCs, and HE compound samples all will be collected into one 6-in. liner.

Note: PCBs will be collected into one 3-inch liner.

Note: All soil samples should be preserved on ice unless otherwise noted.

Note: Tritium and isotopic uranium will be collected into one 500 ml glass jar or plastic bottle.

Note: All soil samples should be labeled as TA2-BH-23-depth.

Note: Tritium, isotopic uranium, and isotopic plutonium all will be collected into a 500 ml plastic bottle or glass jar.

Note: Equipment blanks will be collected after the borehole has been drilled to the total depth. These samples will be labeled as TA2-BH-24-EB and should be collected in a 2.5 liter amber glass jar or in a 1 liter bottle for TAL metals and a 40 ml VOA for VOC samples (Subsequent ACF boreholes should be labeled as -25-EB; -26-EB; -27-EB; and -28-EB).

Table 9b. Summary of analyses for soil samples to be collected from angled borehole TA2-BH-29 drilled beneath pits and trenches at the Classified Waste Landfill, Technical Area 2. Approximate angle is 40 degrees from vertical and about 75 ft long (60 ft BGL).

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	TAL Metals[b]	SVOCs[c]	HE	PCBs	Iso. U	Tritium	Gamma Spec	Total # of Containers
Subsurface soil	20	1	1	1	1	1	1	1	1	5
Subsurface soil	30	1	1	1	1	1	1	1	1	5
Subsurface soil	40	1	1	1	1	1	1	1	1	5
MS/MSD - Include on COC	40	---	---	---	---	---	---	---	---	---
Subsurface soil	50	1	1	1	1	1	1	1	1	5
Subsurface soil	60	1	1	1	1	1	1	1	1	5
Subsurface soil	70	1	1	1	1	1	1	1	1	5
Total Analyses 48	---	6	6	6	6	6	6	6	6	30 Total Containers

a - EPA Method 8240. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.
b - EPA Methods 6010 and 7000.
c - Liquid scintillation counter method for tritium. Tritium will be collected in a split-spoon sampler and transferred into a 500 ml glass jar or plastic bottle along with isotopic uranium.

NOTE: Drilling and sampling will probably be conducted in Level C protection until decided otherwise by the HP and SSO.
Note: TAL Metals, SVOCs, and HE compound samples all will be collected into one 6-in. liner.
Note: PCBs will be collected into one 3-inch liner.
Note: All soil samples should be preserved on ice unless otherwise noted.
Note: Tritium and isotopic uranium will be collected into one 500 ml glass jar or plastic bottle.
Note: All soil samples should be labeled as TA2-BH-29-depth.
Note: Tritium and isotopic uranium all will be collected into a 500 ml plastic bottle or glass jar.
Note: Equipment blanks will be collected after the borehole has been drilled to the total depth. These samples will be labeled as TA2-BH-29-EB and should be collected in a 2.5 liter amber glass jar or in a 1 liter bottle for TAL metals and a 40 ml VOA for VOC samples.

Table 9c. Summary of analyses for soil samples to be collected from angled borehole TA2-BH-30 drilled beneath pits and trenches at the Classified Waste Landfill, Technical Area 2. Approximate angle is 40 degrees from vertical and 125 ft long (95 ft BGL).

Sample Type or QA/QC Type	Sample Depth (in ft)	VOCs[a]	TAL Metals[b]	SVOCs[c]	HE	PCBs	Iso. U	Tritium	Gamma Spec	Total # of Containers
Subsurface soil	30	1	1	1	1	1	1	1	1	5
Subsurface soil	45	1	1	1	1	1	1	1	1	5
Subsurface soil	60	1	1	1	1	1	1	1	1	5
MS/MSD - Include on COC	60	---	---	---	---	---	---	---	---	---
Subsurface soil	75	1	1	1	1	1	1	1	1	5
Subsurface soil	90	1	1	1	1	1	1	1	1	5
Subsurface soil	115	1	1	1	1	1	1	1	1	5
Subsurface soil	125	1	1	1	1	1	1	1	1	5
Total Analyses 52	---	7	7	7	7	7	7	7	7	35 Total Containers

a - EPA Method 8240. VOCs will be collected in 2-in. diameter by 3-in. long stainless steel liners.

b - EPA Methods 6010 and 7000.

c - Liquid scintillation counter method for tritium. Tritium will be collected in a split-spoon sampler and transferred into a 500 ml glass jar or plastic bottle along with isotopic uranium.

NOTE: Drilling and sampling will probably be conducted in Level C protection until decided otherwise by the HP and SSO.

Note: TAL Metals, SVOCs, and HE compound samples all will be collected into one 6-in. liner.

Note: PCBs will be collected into one 3-inch liner.

Note: All soil samples should be preserved on ice unless otherwise noted.

Note: Tritium and isotopic uranium will be collected into one 500 ml glass jar or plastic bottle.

Note: All soil samples should be labeled as TA2-BH-30-depth.

Note: Tritium and isotopic uranium all will be collected into a 500 ml plastic bottle or glass jar.

Note: Equipment blanks will be collected after the borehole has been drilled to the total depth. These samples will be labeled as TA2-BH-30-EB and should be collected in a 2.5 liter amber glass jar or in a 1 liter bottle for TAL metals and a 40 ml VOA for VOC samples.

Comment Response

Department of Energy
Field Office, Albuquerque
Kirtland Area Office
P.O. Box 5400
Albuquerque, New Mexico 87115

OCT 17 1996

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 Sandia National Laboratories, New Mexico/Department of Energy (SNL/NM/DOE) response to the New Mexico Environment Department (NMED) technical comments on the 23 No Further Action (NFA) proposals submitted to NMED in June of 1995.

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

Sincerely,

Michael J. Zamorski
Acting Area Manager

Enclosure

cc w/enclosure:
T. Trujillo, AL, ERD
W. Cox, SNL, MS 1147
N. Weber, NMED-AIP
R. Kern, NMED-AIP
D. Neleigh, EPA, Region 6 (2 copies)

cc w/o enclosure:
B. Oms, KAO-AIP
E. Krauss, SNL, MS 0141
B. Hoditschek, NMED
S. Dinwiddie, NMED

OCT 21 [illegible]

Sandia National Laboratories
Albuquerque, New Mexico
October 1996

Environmental Restoration Project
Responses to NMED Technical Comments on No Further Action Proposals
Dated June 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, July 29, 1996) documenting the review of 23 No Further Action (NFA) Proposals submitted in June 1995.

This response document is organized in numerical order 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 "Response". Responses to general technical comments begin on page 3 and responses to site-specific technical comments begin on page 4. Responses to general risk assessment comments begin on page 143 and responses to specific risk assessment comments begin on page 144. Additional supporting information for the site-specific comments is included as figures and tables within each comment response and as attachments to each section of this document.

SANDIA NATIONAL LABORATORIES
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ENVIRONMENTAL OPERATIONS
RECORDS CENTER

TABLE OF CONTENTS

RESPONSES TO NMED TECHNICAL COMMENTS ON NO FURTHER ACTION PROPOSALS DATED JUNE 1995

GENERAL TECHNICAL COMMENTS

1. **Please provide a Table of Contents so that the individual sites and their order of discussion can be more readily tracked.**

   Response: A Table of Contents is provided with each No Further Action Proposal submission sent to the regulators.

2. **Information sources are listed for individual proposals within the section Sources of Supporting Information. Although the information sources might be useful for evaluation of the proposals, it is generally difficult to match the information source the referenced document. Information sources should be referenced.**

   Response: Citations in text to the references cited will be provided in future NFA proposals submissions and resubmissions.

3. **The background soil sampling results should be submitted for NMED review.**

   Response: A Site-Wide statistical study for determining the background concentrations of metals and radionuclides in soil and water at Sandia National Laboratories/New Mexico and Kirtland Air Force Base has been recently completed and submitted to NMED in March 1996 (IT, 1996). These new background values were used to replace values provided for specific NFA proposals in this response.

4. **Concerns exist over the sampling of the "septic system" solid waste management units (SWMUs). NMED believes the soil borings for drywells, seepage pits, or drain fields are inadequate. The proposal states that soil borings/samples were taken near the units (within 10 feet), but not underneath them. A sampling plan must be established to investigate underneath the seepage pits, drywells, or drain fields. Also, samples taken underneath the septic pipes/drain pipes need to be taken deeper than 3 feet.**

   Response: See Response to Site-Specific Technical Comment #1 below.

3. <u>Site 159, OU 1303, Building 935 Septic System (TA-II)</u>

a. The passive soil gas surveys were not included. NMED is also concerned about the validity of a passive soil gas survey conducted during winter months.

b. As the sampling at this site indicates, both passive soil gas sampling and analysis of soils by SW-846 Method 8240/8260 fail to show evidence of VOCs in soil. Active soil vapor sampling should be conducted.

c. Section 3.6, Confirmatory Sampling, Page 7, paragraph 5: "...the passive SVS identified no SVOCs..." Was the SVS designed to identify SVOCs and, if so, which ones?

d. According to sampling results presented, barium, beryllium, chromium, copper, nickel, and zinc exceeded calculated UTLs from the draft report <u>"Background Concentrations of Constituents of Concern..."</u> (IT, 1994). Because these data indicate that there has been a release, an evaluation of risk due to the contributions of all constituents in excess of background should be conducted.

e. What are the potential constituents of concern?

f. Please provide a more detailed map of Figure 2. In addition, please provide a more detailed schematic or map of the sanitary system which clearly identifies all components of the system. Lastly, please provide further information of the retention tank, including a description of what the tank is constructed of.

g. What was borehole TA2-BH-15 not drilled into the dry well? Were the angled boreholes drilled? Please discuss.

h. Page 13; Table 1: Please include the sampling results for all sampling intervals in the table and also please include the soil boring logs and the PID/FID readings for each sampling interval.

i. The most shallow borehole sample depth was 5 feet below ground level. Was there a rationale for this being the most shallow soil depth sampled?

j. RECOMMENDATION: Based upon site concerns, including the hazardous constituent detections in soils at the site and in the perched groundwater (approximately 320 feet of depth) beneath TA-II, NMED considers that NFA is not appropriate for Site 159. NMED considers that additional investigation is necessary at Site 159 and may require a RFI Workplan for this site.

Response: See Response to Site-Specific Technical Comment #1 above.

4. Site 166, OU 1303, Building 919 Septic System (TA-II)

a. The passive soil gas surveys were not included.

b. Metals, including barium, lead, and zinc, all exceeding their respective site-wide UTL background concentrations, have been detected in soils from boreholes. The extent of contamination above background should be determined and the risk for constituents exceeding background and Screening Action Levels (SAL) should be evaluated.

c. Please provide a more detailed map of Figure 2. In addition, please provide a more detailed schematic or map of the sanitary system which clearly identifies all components of the system.

3. Site 159, Building 935, Septic System (TA II), OU 1303

The only chemical maximum concentrations that exceed expected human health-based screening values are arsenic, beryllium, and bis (2-ethylhexyl) phthalate. Arsenic and beryllium are within expected regional values. Bis (2-ethylhexyl) phthalate is above both the industrial and residential human health-based screening values with a value of 1300 ppm. Only one of the three borehole soil samples was analyzed for bis (2-ethylhexyl) phthalate.

Response: See Response to Site-Specific Technical Comment #1 above.

NOD

U.S. Department of Energy
Albuquerque Operations Office
Kirtland Area Office
P.O. Box 5400
Albuquerque, NM 87185-5400

M.J.
Fran
David
Dick
Lane
NTTK.
Brenda

Copied 1/31/00

JAN 26 2000

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. James Bearzi, Chief
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044 Galisteo Street
P.O. Box 26110
Santa Fe, NM 87502-2100

Dear Mr. Bearzi:

Enclosed is one of two NMED copies of the Department of Energy and Sandia National Laboratories/New Mexico response to the NMED Notice of Deficiency (NOD), dated October 13, 1999, for Environmental Restoration sites 7, 46, 48, 50, 136, 159, 166, 227, 229, 230, 231, 233, 234, and 235. These sites were all included in the 2nd batch of No Further Action (NFA) proposals.

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

Sincerely,

George K. Laskar

Michael J. Zamorski
Area Manager

Enclosure

Sandia National Laboratories
Albuquerque, New Mexico
December 1999

Environmental Restoration Project
Responses to NMED Notice of Deficiency
No Further Action Proposals (2nd Round)
Dated June 1995

INTRODUCTION

Sandia National Laboratories/New Mexico (SNL/NM) is submitting this Notice of Deficiency (NOD) response for sites managed by the Tijeras Arroyo Operable Unit (OU) 1309 and the Technical Area (TA) II OU 1303. This response addresses Enclosures A and B comments in the October 13, 1999 NOD (NMED, 1999).

This is the second NOD response for Environmental Restoration (ER) Sites 50 and 235. Most of the following information addresses omissions in the ER Sites 50 and 235 No Further Action (NFA) Proposals (SNL/NM, 1995) and the first ER Sites 50 and 235 NOD responses (SNL/NM, 1996). This response addresses the need for reorganizing the confirmatory sampling analytical data and conducting human health and ecological risk assessments. For ER Site 50, this response also contains additional analytical data obtained during the Voluntary Corrective Measure activities recently conducted at nearby ER Site 228A (the Centrifuge Dump Site) in 1999 (SNL/NM, 1999). For ER Site 235, this response addresses the need for reorganizing the confirmatory sampling analytical data and conducting human and ecological risk assessments.

TABLE OF CONTENTS

Site-Specific Comments

RESPONSES TO NMED NOTICE OF DEFICIENCY COMMENTS ON NO FURTHER ACTION PROPOSALS
ER SITES 7, 46, 48, 135, 136, 159, 165, 166, 167, 227, 229, 230, 231, 232, 233, AND 234
JUNE 1995 (2ND ROUND)

ENCLOSURE B

The following discussion documents the negotiations between SNL/NM ER staff and NMED HRMB staff as requested in NMED (1999). These negotiations were finalized in a November 17, 1999 meeting.

OU 1303

ER Sites 48, 135, 136, 159, 165, 166, and 167 (TA-2 Septic Systems)

Additional site characterization work proposed includes:

1. **Finish compiling and provide the information requested in Stu Dindwiddie's letter to Michael Zamorski (DOE) and Joan Woodard (SNLNM) (dated December 11, 1998).**

   Response: The information requested in the referenced letter is listed below and is followed by the SNL/NM response.

   a. **Please submit maps showing the locations of boreholes with respect to seepage pits and other septic-system components for the above ER sites (48, 135, 136, 159, 165, 166, and 167).**

   Response: The existing site maps have been revised to reflect the best-known information on all the TA-II septic and drain system sites. The changes are based on SNL/NM Facilities Engineering drawings and Global Positioning System (GPS) mapping of visible system components. To improve the accuracy of the site maps, an excavator and GPS surveying will be used to locate system components below grade, confirm drainfield dimensions, and pinpoint effluent release locations. Planning for this work is in progress. Accurate site maps will be available in May 2000. Any further sampling at TA-II ER septic and drain system sites will be discussed with NMED HRMB staff when the maps are finalized. Note that this comment also addresses ER Sites 135 and 165, which were not incorporated in the 2nd Round of the NFA proposals. After discussions with NMED HRMB, the HE rinse-water drain from Site 48 will be investigated at the same time as co-located ER Sites 227 and 229, which are managed by Tijeras Arroyo OU 1309.

   b. **Please submit all analytical results of soil samples obtained from these boreholes. Data tables must include a listing of all constituents analyzed for, analytical methods, detection limits, and concentrations.**

Site-Specific Comments

Response: The requested soil analytical results for the boreholes at TA-II ER septic and drain system sites will be submitted with the revised site maps.

2. **Summarize in written form, as applicable, all geologic, hydrologic, and ground-water quality data for all boreholes and ground-water monitor wells in the vicinity of TA-2.**

   Response: SNL/NM will summarize in written form, as applicable, all geologic, hydrologic, and groundwater quality data for all boreholes and groundwater monitor wells in the vicinity of the TA-II ER sites. This information will be presented in the Sandia North Groundwater Investigation Annual Report for FY01 or FY02.

RSI

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

JUN 1 8 2004

CERTIFIED MAIL-RETURN RECEIPT REQUESTED

Mr. John E. Kieling, Manager
Permits Management Program
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Rd., Building E
Santa Fe, NM 87505

Dear Mr. Kieling,

On behalf of the Department of Energy (DOE) and Sandia Corporation, DOE is submitting the enclosed Solid Waste Management Unit (SWMU) Assessment Reports and Proposals for No Further Action (NFA) for Drain and Septic Systems (DSS) Sites 1010, 1028, 1083, and 1086. DOE is also submitting the Request for Supplemental Information (RSI) responses for SWMUs 48, 135, 136, 159, 165, 166, and 167; and a soil vapor summary report for Technical Area II at Sandia National Laboratories, New Mexico, EPA ID No. NM5890110518. These documents are compiled as DSS Round 5 and NFA Batch 23.

On April 29, 2004, the final Compliance Order on Consent (Consent Order) for Sandia National Laboratories was issued, replacing the HSWA Module as the sole enforceable mechanism for corrective action. The enclosed SWMU Assessment Reports/NFA Proposals and RSI responses were in the final stage of preparation when the Order was issued; thus, the enclosed documents contain language related to a NFA determination. We are requesting, consistent with the terminology in the Consent Order, an NMED determination of corrective action complete for each of these DSS sites.

This submittal includes descriptions of the site characterization work and risk assessments for DSS Sites 1010, 1028, 1083, and 1086, and SWMUs 48, 135, 136, 159, 165, 166, and 167. The risk assessments conclude that for these eleven 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.

Sincerely,

Patty Wagner

Patty Wagner
Manager

Enclosure

cc w/ enclosure:
L. King, EPA, Region 6 (2 copies, via Certified Mail)
W. Moats, NMED-HWB (via Certified Mail)
M. Gardipe, NNSA/SC/ERD
C. Voorhees, NMED-OB (Santa Fe)
D. Bierley, NMED-OB

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J. Bearzi, NMED-HWB
K. Thomas, EPA, Region 6
F. Nimick, SNL, MS 1089
D. Stockham, SNL, MS 1087
P. Freshour, SNL, MS 1087
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Sandia National Laboratories/New Mexico
Environmental Restoration Project

REQUEST FOR SUPPLEMENTAL INFORMATION RESPONSE FOR DRAIN AND SEPTIC SYSTEMS SWMU 159, BUILDING 935 DRAIN SYSTEMS AT TECHNICAL AREA II

June 2004

United States Department of Energy
Sandia Site Office

TABLE OF CONTENTS

TABLE OF CONTENTS (Concluded)

LIST OF FIGURES

Figure

LIST OF TABLES

Table

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LIST OF ANNEXES

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ACRONYMS AND ABBREVIATIONS

AOP	Administrative Operating Procedure
ARCH	air-rotary casing hammer
bgs	below ground surface
COC	constituent of concern
DSS	Drain and Septic Systems
EB	equipment blank
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
HE	high explosive(s)
HI	hazard index
HWB	Hazardous Waste Bureau
KAFB	Kirtland Air Force Base
kg	kilogram(s)
MDA	minimum detectable activity
MDL	method detection limit
mg	milligram(s)
mrem	millirem
NFA	no further action
NMED	New Mexico Environment Department
NOD	Notice of Deficiency
PCB	polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
RPSD	Radiation Protection Sample Diagnostics
RSI	Request for Supplemental Information
SNL/NM	Sandia National Laboratories/New Mexico
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TA	Technical Area
TAG	Tijeras Arroyo Groundwater
TB	trip blank
TEDE	total effective dose equivalent
TOP	Technical Operating Procedure
VOC	volatile organic compound
yr	year(s)

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1.0 INTRODUCTION

1.1 Investigation History

In August 1994, no further action (NFA) proposals were submitted for Solid Waste Management Units (SWMUs) 135 and 165 in Technical Area (TA)-II at Sandia National Laboratories/New Mexico (SNL/NM). In July 1995, NFA proposals were also submitted for TA-II SWMUs 48, 136, 159, 166, and 167. These seven SWMUs are shown on Figure 1.1-1.

In November 1995, the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) responded with comments on the NFA proposals submitted for SWMUs 48, 136, 159, 166, and 167, and recommended that a Resource Conservation and Recovery Act (RCRA) Facility Investigation Work Plan, which included these SWMUs, be developed for TA-II. At that time, the SNL/NM Environmental Restoration (ER) Project decided to undertake the investigation and cleanup of these sites and others in TA-II as Voluntary Corrective Actions, and formal work plans were not submitted.

On October 13, 1999, NMED-HWB issued a Notice of Deficiency (NOD) for these seven SWMUs. Negotiations held on November 17, 1999, further defined specific procedures for sampling these seven SWMUs and transferred a requirement for groundwater reporting for these SWMUs to the ongoing Tijeras Arroyo Groundwater (TAG) Investigation. The NOD subsequently was changed by the NMED to a Request for Supplemental Information (RSI).

The requirements negotiated to fulfill the RSI for these seven TA-II SWMUs were:

- Submit revised site maps showing septic and drain system component locations (as determined by backhoe excavation).
- Submit the results for passive soil-vapor surveys and active soil-vapor monitoring wells at TA-II.
- Collect soil samples at a depth equal to the base, and 5 feet below the base, of septic tanks, seepage pits, and drain lines. Sample locations in drainfields and system outfalls were approved by HWB personnel.
- Analyze soil samples for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), high explosive (HE) compounds, polychlorinated biphenyls (PCBs), RCRA metals, including hexavalent chromium, and total cyanide, radionuclides by gamma spectroscopy, and gross alpha/beta activity.
- Submit revised risk assessments for all seven SWMUs using all available soil data.

On January 26, 2000, the SNL/NM ER Project submitted a response to the NMED RSI, agreeing to excavations to locate system components below ground surface (bgs), confirm drainfield dimensions, pinpoint effluent release points, and investigate the SWMU 48 HE rinse-water drain line. SNL/NM also agreed to discuss additional sampling with the NMED-HWB when the maps were finalized and to submit the groundwater data requested in a subsequent TAG Investigation report.

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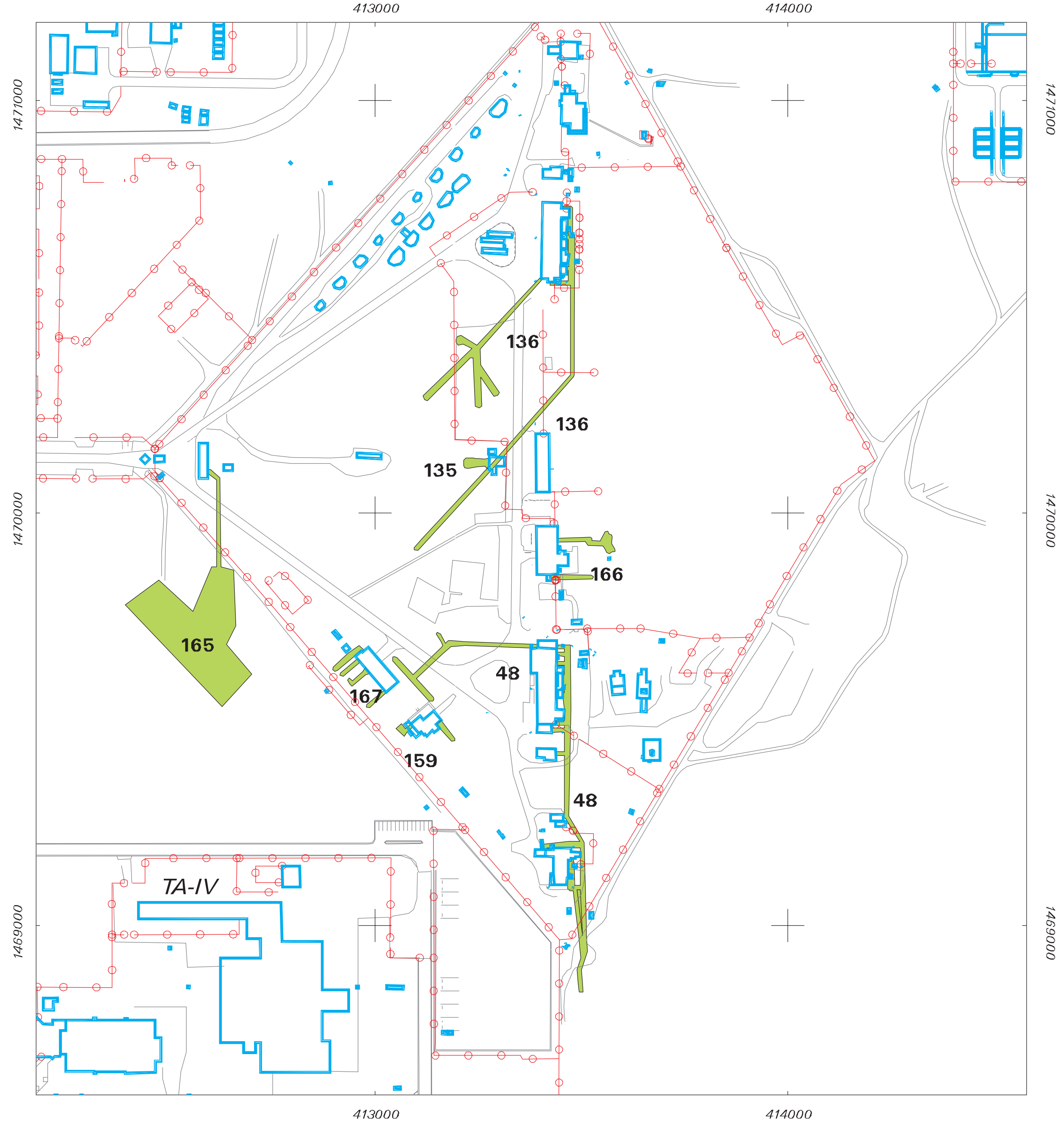

Legend

— Road

-o-o- Fence

▭ Building / Structure

🟩 DSS SWMU

Figure 1.1-1
Location Map of Drain and Septic Systems (DSS) SWMUs at Technical Area-II (TA-II)

0 200 400
Scale in Feet

0 48 96
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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For tracking purposes, these seven SWMUs are included with sites listed in the SNL/NM Drain and Septic Systems (DSS) program reporting schedule. In this RSI response, they will be referred to as the "Drain and Septic Systems SWMUs at TA-II."

1.2 Additional Investigation Information

Although not specifically required as part of the RSI, this report presents additional information for several TA-II SWMUs as follows:

- In May 2003, soil-vapor monitoring wells were installed at SWMUs 159 and 165 as part of a separate site-wide DSS investigation. Additional details and sampling results for these wells are presented in the soil-vapor sampling chapter of this RSI response.
- Residual material in catch (settling) boxes for HE compound particulates located on HE rinse-water drain lines at SWMU 48 and 136 was sampled as part of the site characterization process. The results are presented in the SWMU 48 and SWMU 136 chapters of this RSI response.

1.3 Report Organization

This RSI response presents the required information as follows:

- The soil-vapor survey information is presented as a whole and is not discussed on a site-by-site basis.
- Because NFA proposals were previously submitted for these SWMUs, only a brief description and history for each site is presented. Each SWMU is discussed in a separate report. The soil sampling analytical results and risk assessments for each site are presented in separate annexes for each SWMU.

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2.0 SOIL SAMPLING AT TA-II

2.1 Soil Sampling Methodology

Soil samples were collected at the TA-II DSS SWMUs using a variety of methods. Some shallow soil samples were collected from trenches excavated with a backhoe. For deep borehole sampling, either auger or air-rotary casing hammer (ARCH) drill rigs were used to drill down to the top of the desired sample interval. A drive sampler (split-spoon or thin-wall tube sampler) lined with stainless steel or brass sleeves was then mechanically advanced into the undisturbed soil below the drilled depth. For shallow soil sampling, a Geoprobe™ sample tube system with an inner butyl acetate liner was used through hollow-stem augers. The length of the recovered interval varied with the length of the sampling system, ranging from 2 feet using a split-spoon-type sampler, to up to 4 feet using a Geoprobe™ system. Following retrieval from the borehole, the sample for VOC analysis was collected by immediately capping and sealing either one of the metal liners from the split-spoon sampler or a cut portion of the butyl acetate liner from the Geoprobe™ sampler.

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

All samples were documented and handled in accordance with applicable SNL/NM operating procedures and transported to on- and off-site laboratories for analysis.

2.2 Soil Sampling Events for DSS SWMUs at TA-II

In August and September 1992, 10 boreholes were drilled and sampled in the SWMU 165 drainfield. Samples were collected and analyzed for VOCs, SVOCs, HE compounds, metals, radionuclides by gamma spectroscopy, gross alpha/beta activity, and tritium. In November 1992, the groundwater monitoring well TA2-SW1-320 was installed in the shallow aquifer beneath the SWMU 165 drainfield, and soil samples collected from the borehole during drilling were analyzed for VOCs, SVOCs, PCBs, HE compounds, metals, cyanide, radionuclides by gamma spectroscopy, gross alpha/beta activity, and tritium.

In October and November 1993, trenches were excavated across septic and other drain system drain lines at SWMUs 48, 136, 165, and 166. At each trench-drain line intersection, samples were collected at three depths; the surface (0 to 0.5 feet bgs), at the top of the piping, and immediately below the piping. Samples were analyzed for VOCs, SVOCs, HE compounds, metals, radionuclides by gamma spectroscopy, and tritium.

From March to December 1994, 18 boreholes to depths of at least 50 feet were drilled throughout TA-II. The locations were chosen to be in and around the anomalies identified by the passive soil-vapor surveys, and also near the septic tanks, drain lines, and catch boxes that may have had releases. Fourteen borehole locations were near or within the seven SWMUs addressed in this RSI response. The borehole locations are shown on the appropriate sample location maps for each SWMU. The SWMU 135 borehole, TA2-BH-01, was completed as groundwater monitoring well TA2-W-01. All borehole soil samples were analyzed for VOCs, SVOCs, HE compounds, metals, radionuclides by gamma spectroscopy, and tritium. Some samples were also analyzed for cyanide and gross alpha/beta activity.

In August 1995, soil samples were collected from borings drilled next to the septic tanks at SWMUs, 48, 136, 159, 165, 166, and 167 using a Geoprobe™ sampling system. Samples were collected starting at the approximate depth of the septic tank bottom and analyzed for VOCs, SVOCs, HE compounds, metals, including hexavalent chromium, and total cyanide, and radionuclides by gamma spectroscopy.

In August and October 2000, additional soil sampling was conducted at the seven TA-II SWMUs to fulfill the RSI requirements. Borehole soil samples were collected at depths starting at the base, and 5 feet below the base, of septic tanks, seepage pits, drywells, and septic drainfield drain lines. Sample locations in drainfields and system outfalls were approved by NMED-HWB personnel. The samples were analyzed for VOCs, SVOC, PCBs, HE compounds, RCRA metals, total cyanide, and radionuclides by gamma spectroscopy.

In February 2004, additional soil sampling was conducted during the Building 935 foundation, waste-water drain line, and retention tank removal. Soil samples for metals analysis were collected at locations where floor drains joined the piping, at the former retention box location, and at the drywell. Soil samples for tritium were also collected from boreholes drilled through, and beneath, the seepage pit and drywell.

2.2.1 Soil Sampling Events at DSS SWMU 159

Soil samples were collected from seven boreholes, five locations along the waste-water piping, and one backhoe sampling location in the drywell at DSS SWMU 159. Boreholes adjacent to the septic tank and in the vicinity of the septic and waste-water drain lines were drilled in 1994 and 1995 using a hollow-stem auger. Samples were collected using a hollow-stem auger and a 2-foot-long split-spoon-type drive sampler. Samples were collected next to the septic tank at depths equal to, and below, the unit using a 3- or 4-foot-long Geoprobe™ sample tube system inside hollow-stem augers.

Samples beneath the seepage pit and drywell were also collected using a Geoprobe™ in 2000 and 2004. For the August 2000 sampling, sample intervals started at 9.5 and 15.5 feet bgs in the single boring through, and beneath, the seepage pit and at 8 and 13 feet bgs in the single boring through, and beneath, the drywell. For the February 2004 H-3 sampling, sample intervals started at 9.5, 14.5, and 24.5 feet bgs in the single boring through, and beneath, the seepage pit, and at 8, 13, and 23 feet bgs in the single boring through, and beneath, the drywell. The February 2004 waste-water drain line samples were collected by filling sample containers with soil collected directly under the piping system. The February 2004 5-foot-bgs drywell sample container was filled with soil collected with a backhoe at the approximate depth the piping entered the drywell.

The soil samples in 2000 and 2004 were collected in accordance with the procedures developed for, and described in, the Operable Unit 1295 Sampling and Analysis Plan (SNL/NM October 1999) and subsequent "Field Implementation Plan, Characterization of Non-Environmental Restoration Drain and Septic Systems" (SNL/NM November 2001) approved by the NMED. The 1994 and 1995 sampling activities were conducted using similar procedures.

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3.0 DSS SWMU 159: BUILDING 935 DRAIN SYSTEMS

3.1 Site Description

Building 935 is located in the southwest portion of TA-II (Figure 3.1-1). There were two drain systems comprising SWMU 159 at Building 935. A septic system received discharges from a restroom and a furnace room floor drain and discharged to an estimated 700-gallon septic tank that was connected to a 5-foot-diameter, 13-foot-deep, gravel-filled seepage pit. A waste-water drain system received discharges from test cell (room) floor drains and first emptied to a concrete retention tank and then to an unlined, gravel-filled drywell. The septic and waste-water drain line systems are shown on Figure 3.1-2.

The building was constructed in 1963 and used as a test facility until all but the foundation slab and drain systems were demolished in December 2002. In February 2004, the foundation slab and test cell drain line piping were characterized and removed. A drywell was reportedly located near the original site of the concrete retention tank, which was relocated further southwest when a loading dock was added to Building 935 (Figure 3.1-2). However, no evidence for this drywell was found during the waste-water drain line removal. Additional information on the operational history for Building 935 can be found on the SNL/NM ER Project web page (SNL/NM April 2004) and in the original NFA proposal (SNL/NM June 1995). A summary of the drain systems investigated at Building 935 is presented in Table 3.1-1.

3.2 DSS SWMU 159 Soil Sampling Results and Conclusions

Soil sampling was conducted at DSS SWMU 159 as described in Section 2.2. Figure 3.1-2 shows the soil sampling locations at DSS SWMU 159. The analytical data summary tables are presented in Annex A. Because there were several sampling events at this site, the results are grouped by general area or location in the analytical tables. Additional samples were collected in February 2004 as part of the Building 935 waste-water drain line and concrete retention tank removal. The results are included in the appropriate tables and discussed as follows.

VOCs

VOC analytical results for soil samples collected from the DSS SWMU 159 boreholes are summarized in Table A-1, and method detection limits (MDLs) for the VOC soil analyses are presented in Table A-2. Four VOCs were detected in the samples from borehole BH-02 near the waste-water drain line. No VOCs were detected in the seepage pit borehole samples or in the duplicate sample, although the results for acetone were rejected during data validation. Two VOCs were detected in the 13-foot-bgs drywell borehole sample, and the results for acetone were also rejected during data validation.

Acetone was detected in one of the two equipment blanks (EBs) for the March and November 1994 sampling events. Methylene chloride was detected in the EB and trip blank (TB) for the March 1994 sampling activity. Bromoform was detected only in the August 2000 EB. Several VOCs were rejected or qualified as not detected in the EB and TB for the August 2000 sampling.

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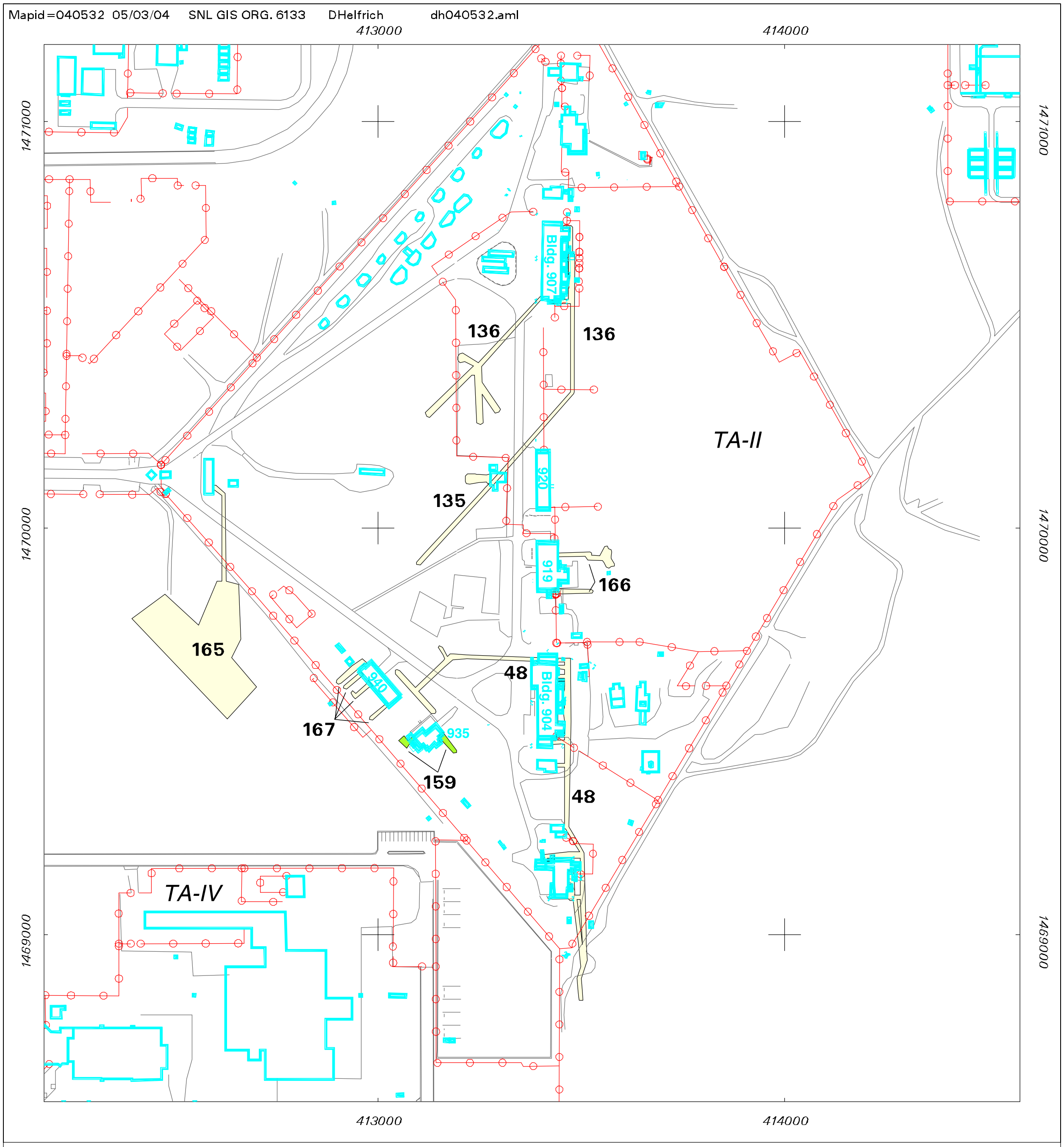

Legend

— Road
-o-o- Fence
▭ Building / Structure
🟩 DSS SWMU 159
▭ Other DSS SWMU

Figure 3.1-1
Drain and Septic Systems (DSS) SWMU 159, Bldg. 935 Drain Systems, TA-II

0 200 400
Scale in Feet

0 48 96
Scale in Meters

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Environmental Geographic Information System

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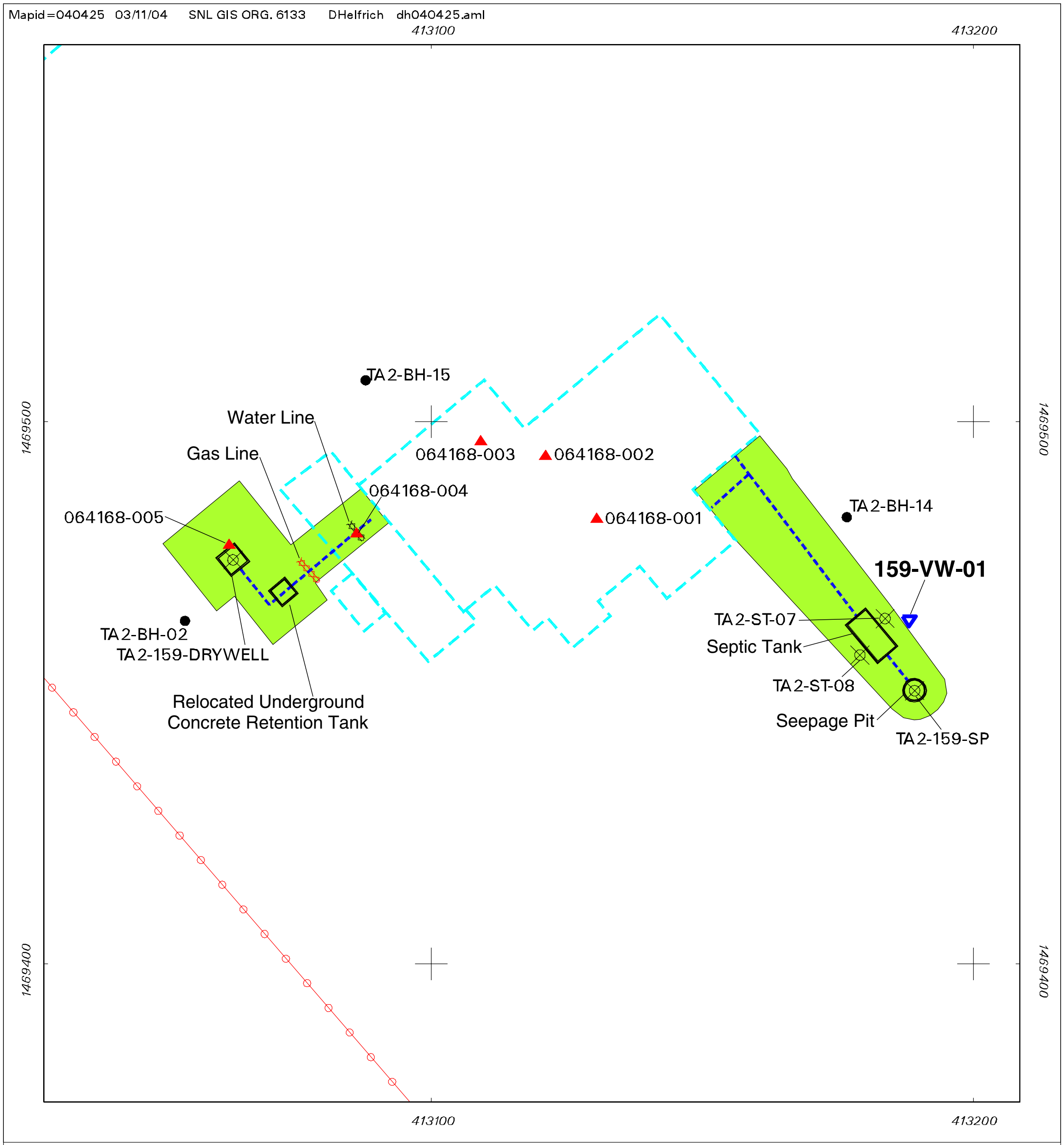

Legend

● Borehole Location
⊗ Geoprobe Soil Sample Location
▲ Drain Line Soil Sample Location
▽ Soil-Vapor Monitoring Well
-o-o-o- Fence
— — — Former Building 935
xxxxxxxx Water Line
xxxxxxxx Gas Line
——— Septic Tank / Dry Well / **R**etention Tank / Seepage Pit
- - - - - Drain Line
🟩 SWMU 159

Figure 3.1-2
Drain and Septic Systems (DSS) SWMU 159, Bldg. 935 Drain Systems, TA-II, Sample Locations

0 15 30
Scale in Feet

0 3.6 7.2
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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Table 3.1-1
Summary of DSS SWMU 159, Building 935 Drain Systems

Building 935 Drain Systems	Systems Operational Years	Building 935 Drain System Descriptions	System Status
1-septic system 1-waste water	1963–1991	The building restroom and a furnace room floor drain discharged into a septic tank southeast of Building 935 (Figure 3.1-2). The septic system consisted of an estimated 700-gallon septic tank that discharged into a gravel-filled, 5-foot-diameter by 13-foot-deep seepage pit. In late 1991, the septic system for the building was shut down because contaminants were identified in the septic tank waste. Prior to 1967, floor drains for two interior test cells (rooms) discharged into a concrete-lined, 200-gallon concrete retention tank located at the southwest edge of the building. The tank discharged west to an unlined, gravel-filled drywell (Figure 3.1-2). In 1967, a third test cell and loading dock were added to the building and the concrete retention tank was relocated further southwest. In 1989, the floor drains for the three test cells were sealed shut. A former drywell was reportedly located near the original location of the concrete retention tank. However, no evidence for this drywell was found during the building slab and drain line demolition in February 2004.	The septic tank was pumped out in late 1995 and the empty tank was inspected by NMED. Sixteen 55-gallon drums of waste were generated when the septic tank was pumped. The waste was characterized and managed according to SNL/NM policy. The system was subsequently abandoned in place. The retention tank contents were sampled and removed during the Building 935 foundation and drain line removal in February 2004.

DSS = Drain and Septic Systems.
NMED = New Mexico Environment Department.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

Most of the VOCs detected are common laboratory contaminants and may not indicate soil contamination at this site.

SVOCs

SVOC analytical results for the soil samples collected from the DSS SWMU 159 boreholes are summarized in Table A-3, and MDLs for the SVOC soil analyses are presented in Table A-4. Three SVOCs were detected in the samples from borehole BH-02 near the waste-water drain line. One SVOC was detected in the seepage pit borehole 9.5-foot-bgs duplicate sample. No SVOCs were detected in the drywell borehole samples.

Two SVOCs were detected in the EBs associated with these samples.

PCBs

PCB analytical results for the soil samples collected from the DSS SWMU 159 boreholes are summarized in Table A-5, and MDLs for the PCB soil analyses are presented in Table A-6. No PCBs were detected in any of the soil samples collected at this site. Aroclor-1260 was detected in the EB associated with these samples.

HE Compounds

HE compound analytical results for the soil samples collected from the DSS SWMU 159 boreholes are summarized in Table A-7, and MDLs for the HE compound soil analyses are presented in Table A-8. No HE compounds were detected in any sample analyzed.

Metals, Including Hexavalent Chromium, and Cyanide

Metals, including hexavalent chromium, and cyanide analytical results for the soil samples collected from the DSS SWMU 159 boreholes and locations under the drain line piping to the drywell are summarized in Table A-9, and MDLs for the soil analyses are presented in Table A-10.

Nine metals were detected in the borehole samples near the drain lines above their respective NMED-approved background concentrations. One of the nine metals, mercury, was only detected in the 51-foot-bgs primary sample and not in the duplicate. Arsenic and lead were detected at concentrations above the NMED-approved background in the samples collected under the drain line piping to the drywell. Arsenic and barium were detected at concentrations above their NMED-approved background in the seepage pit borehole samples. Only barium was detected in the drywell samples at concentrations above the NMED-approved background.

Hexavalent chromium was not detected in any sample where an analysis for it was performed.

Cyanide was not detected in any sample where an analysis for it was performed.

Radionuclides

Analytical results for the gamma spectroscopy analysis of the soil samples and isotopic analysis for uranium in one sample collected from the DSS SWMU 159 boreholes are summarized in Table A-11. Uranium-238 was detected above the NMED-approved background in several samples from boreholes BH-14 and BH-15 drilled near the septic and waste-water drain lines. Uranium-235 was detected in one sample from the seepage pit borehole. All other radionuclides were not detected. However, although not detected, the minimum detectable activities (MDAs) for several uranium-235 analyses and one uranium-238 analysis exceeded their respective background activities in the site soil samples because the standard gamma spectroscopy count time for soil samples (6,000 seconds) was not sufficient to reach the NMED-approved background activities established for SNL/NM soils (Dinwiddie September 1997). Even though the MDAs may be slightly elevated, they are still very low, and the risk assessment outcome for the site is not significantly impacted by their use.

Tritium

Tritium analytical results for the soil samples collected from the DSS SWMU 159 boreholes are summarized in Table A-12. Tritium activities exceed the SNL-NM-established background of 420 picocuries/liter (Tharp February 1999) in samples from boreholes BH-02, BH-14, BH-15, and ST-07. The highest detection was in the 5-foot-bgs sample from borehole BH-15. No tritium was detected in the seepage pit or drywell borehole samples collected during the Building 935 foundation demolition.

3.2.1 Soil Sampling Quality Assurance/Quality Control Samples and Data Validation

Quality assurance/quality control samples were collected according to the ER Project guidelines and operating procedures in effect at the time of sampling. These included duplicate, EB, and TB samples. EB samples were analyzed for the same analytical suite as the associated soil samples. TB samples were included with soil sample shipments sent to laboratories for VOC analysis. The analytical results for the EB and TB samples appear only on the data tables for the site where they were reported. However, the results would have been used in the data validation process for all the samples analyzed at that time. EB and TB results are discussed with the associated analytical results in Section 3.2.

As shown in the data summary tables in Annex A, to assess the precision and repeatability of sampling and analytical procedures, duplicate soil samples (designated "D" or "DU") were collected and analyzed for VOCs, SVOCs, PCBs, HE compounds, metals, including hexavalent chromium, and cyanide, radionuclides by gamma spectroscopy, and tritium. The results are comparable for the primary and duplicate sample analyses.

All laboratory data were reviewed and verified/validated according to "Verification and Validation of Chemical and Radiochemical Data," Technical Operating Procedure (TOP) 94-03, Rev. 0 (SNL/NM July 1994) or SNL/NM ER Project "Data Validation Procedure for Chemical and Radiochemical Data" in Administrative Operating Procedure (AOP) 00-03 (SNL/NM December 1999). In addition, SNL/NM Department 7713 (Radiation Protection Sample Diagnostics [RPSD] Laboratory) reviewed all gamma spectroscopy results according to "Laboratory Data

Review Guidelines," Procedure No. RPSD-02-11, Issue No. 2 (SNL/NM July 1996). The data are acceptable for use in this RSI response.

3.3 Soil-Vapor Monitoring at DSS SWMU 159

Although not specifically identified as part of the RSI, additional soil-vapor sampling results for DSS SWMUs 159 and 165 are presented.

In May 2003, as part of the SNL/NM ER Project site-wide DSS investigation, soil-vapor monitoring wells were installed at SWMUs 159 and 165. Each vapor well was 150 feet deep and had vapor sampling ports at depths of 5, 20, 70, 100, 150 feet bgs. After installation, subsurface conditions were allowed to equilibrate for over three months before the wells were sampled. The wells were sampled in September 2003.

In accordance with previous agreements with the NMED (SNL/NM October 1999), because the total VOC concentration in the 150-foot-bgs sample from each well was less than 10 parts per million by volume, no additional soil-vapor sampling from these two wells, or soil-vapor or groundwater monitoring wells were required by the NMED at DSS SWMUs 159 and 165.

Vapor well 159-VW-01 was installed at SWMU 159. The full analytical results are presented in the soil-vapor sampling chapter of this RSI response.

3.4 Site Sampling Data Gaps

Analytical data from the site assessment were sufficient for characterizing the nature and extent of possible constituent of concern (COC) releases. There are no further data gaps regarding characterization of DSS SWMU 159.

4.0 CONCEPTUAL SITE MODEL

The conceptual site model for DSS SWMU 159, the Building 935 Drain Systems, is based upon the COCs identified in the soil samples collected from boreholes near the drain lines, septic tank, and beneath the seepage pit and drywell. Samples were also collected under the waste-water drain line piping at this site. This section summarizes the nature and extent of contamination and the environmental fate of the COCs.

4.1 Nature and Extent of Contamination

Potential COCs at DSS SWMU 159 are VOCs, SVOCs, PCBs, HE compounds, metals, including hexavalent chromium, and cyanide, and radionuclides. There were no PCBs or HE compounds detected in any of the soil samples. Four VOCs and four SVOCs were detected in the soil samples. Fifteen metals were detected at concentrations above the approved maximum background concentrations for SNL/NM North Area Supergroup soils or above the nonquantified background concentrations (Dinwiddie September 1997). Neither hexavalent chromium nor cyanide were detected above their nonquantified background concentrations. When a metal concentration exceeded its maximum background screening value, had MDLs above background, or had no quantified background value, it was considered further in the risk assessment process. Uranium-235 and uranium-238 were detected at activities above their corresponding background levels. For some of the uranium-235 and uranium-238 analyses, the MDAs exceed the corresponding background activities. Tritium was detected at, or above, the SNL/NM-approved background activity (Tharp February 1999) in nine samples.

4.2 Environmental Fate

Potential COCs may have been released into the vadose zone via aqueous effluent discharged from the waste-water drain line and drywell and the septic system seepage pit. Possible secondary release mechanisms include the uptake of COCs that may have been released into the soil beneath the drywell and seepage pit (Figure 4.2-1).

Two water-bearing zones, a shallow groundwater system and the regional aquifer, underlie DSS SWMU 159. The depth to the shallow groundwater system is approximately 300 feet bgs. The shallow groundwater system is not used as a water supply. The depth to the regional aquifer is approximately 545 feet bgs. Both the City of Albuquerque and Kirtland Air Force Base (KAFB) utilize the regional aquifer as a water supply. Groundwater flow in the shallow groundwater system is to the southeast, while regional groundwater flow is predominantly to the north-northwest in this portion of KAFB. The nearest downgradient water-supply wells are KAFB-1 and KAFB-4, which are approximately 1.3 and 1.1 miles northwest and southwest of the site, respectively. The depth to the shallow and regional aquifers at the site most likely precludes migration of potential COCs into the groundwater system. The potential pathways to receptors include soil ingestion, dermal contact, and inhalation, which could occur as a result of receptor exposure to contaminated subsurface soil at the site. No intake routes through plant, meat, or milk ingestion are considered appropriate for either the industrial or residential land-use scenarios. Annex B provides additional discussion on the fate and transport of COCs at DSS SWMU 159.

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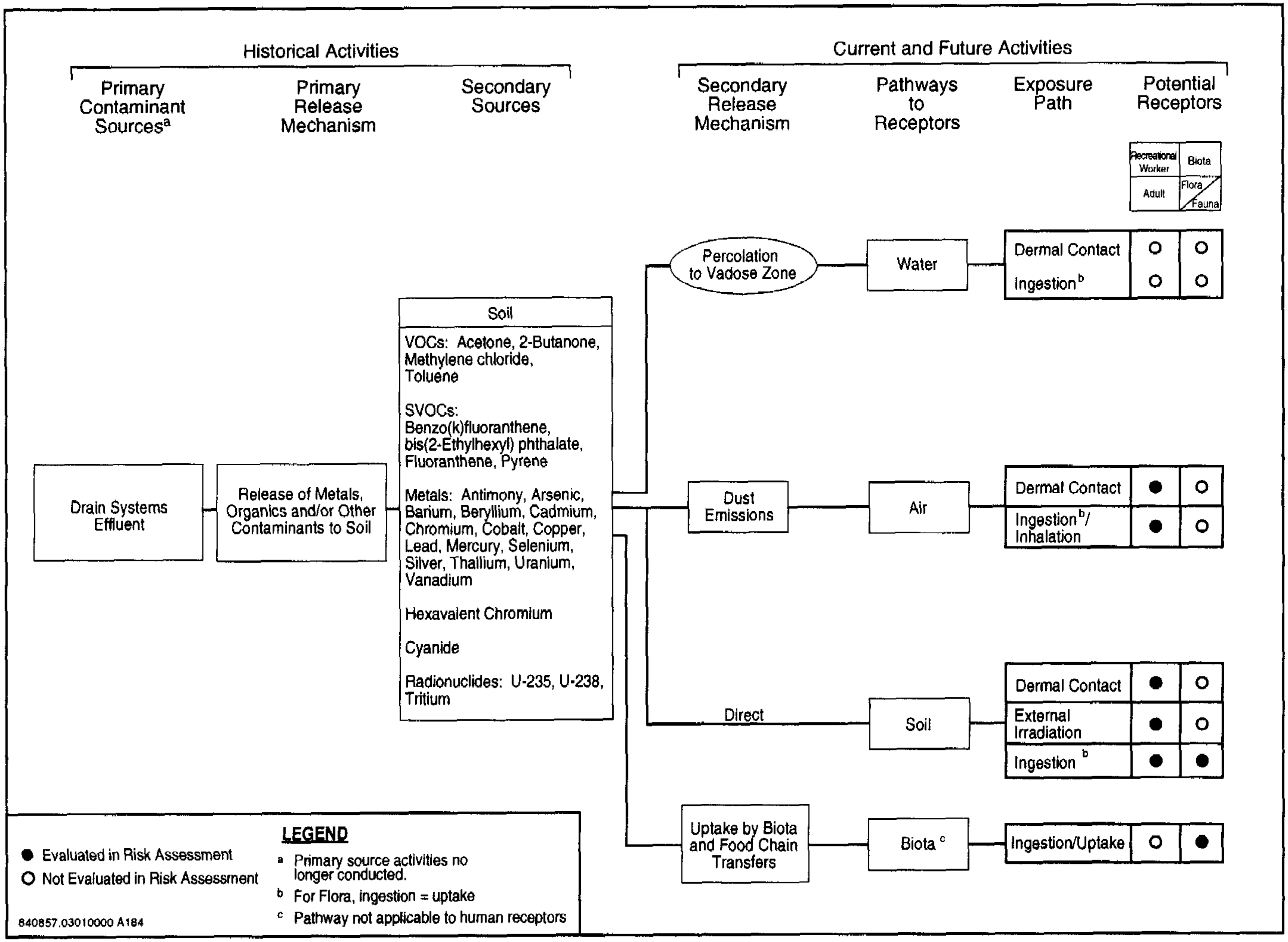

Figure 4.2-1
Conceptual Site Model Flow Diagram for DSS SWMU 159, Building 935 Drain Systems

Table 4.2-1 summarizes the potential COCs for DSS SWMU 159. All potential COCs were retained in the conceptual model and evaluated in both the human health and ecological risk assessments. The current and future land use for DSS SWMU 159 is industrial (DOE et al. September 1995).

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

Potential biota receptors include flora and fauna at the site. Major exposure routes for biota include direct soil ingestion, ingesting COCs through food chain transfers, and direct contact with COCs in the soil. Annex B provides additional discussion of the exposure routes and receptors at DSS SWMU 159.

4.3 Site Assessment

Site assessment at DSS SWMU 159 included risk assessments for both human health and ecological risk. This section briefly summarizes the site assessment results, and Annex B discusses the risk assessment performed for DSS SWMU 159 in more detail.

4.3.1 Summary

The site assessment concluded that DSS SWMU 159 poses no significant threat to human health under either the industrial or residential land-use scenarios. Ecological risks are expected to be very low.

4.3.2 Risk Assessments

Risk assessments were performed for both human health and ecological risk at DSS SWMU 159. This section summarizes the results.

4.3.2.1 Human Health

DSS SWMU 159 has been recommended for an industrial land-use scenario (DOE et al. September 1995). Because acetone, 2-butanone, methylene chloride, toluene, benzo(k)fluoranthene, bis(2-ethylhexyl) phthalate, fluoranthene, pyrene, antimony, arsenic, barium, beryllium, cadmium, chromium, hexavalent chromium, cobalt, copper, lead, mercury, selenium, silver, thallium, uranium, vanadium, cyanide, uranium-235, uranium-238, and tritium are present above background, have MDLs above background, or have nonquantified background levels, it was necessary to perform a human health risk assessment analysis for the site, which included these COCs. Annex B provides a complete discussion of the risk

Table 4.2-1
Summary of Potential COCs in Soil for DSS SWMU 159, Building 935 Drain Systems

COC Type	Number of Soil Samples[a]	COCs Detected or with Concentrations Greater than Background or Nonquantified Background	Maximum Background Limit/North Area Supergroup[b] (mg/kg)	Maximum Concentration[c] (All Samples) (mg/kg)	Average Concentration[d] (mg/kg)	Number of Samples Where COCs Detected with Concentrations Greater than Background or Nonquantified Background[e]
VOCs	5	Acetone	NA	0.048	0.0208	3
	10	2-Butanone	NA	0.017 J	0.0044	3
	10	Methylene Chloride	NA	0.0057	0.0080	3
	10	Toluene	NA	0.003 J	0.0012	2
SVOCs	8	Benzo(k)fluoranthene	NA	0.039 J	0.0750	1
	8	bis(2-Ethylhexyl) phthalate	NA	1.300	0.3519	3
	8	Fluoranthene	NA	0.140 J	0.0584	2
	8	Pyrene	NA	0.110 J	0.0939	2
PCBs	5	None	NA	NA	NA	None
HE Compounds	15	None	NA	NA	NA	None
Metals	30	Antimony	3.9	ND (12)	2.80	None
	35	Arsenic	4.4	ND (50)	3.75	2
	35	Barium	200	524	140	6
	30	Beryllium	0.8	0.86	0.49	1
	35	Cadmium	0.9	ND (10)	0.53	None
	35	Chromium	12.8	58.4	9.02	5
	25	Cobalt	7.1	ND (10)	4.87	1
	25	Copper	17	ND (20)	7.84	2
	35	Lead	11.2	239	17.26	4
	35	Mercury	NQ	0.19	0.042	1
	35	Selenium	NQ	ND (50)	1.6	None
	35	Silver	NQ	ND (10)	0.41	None
	30	Thallium	NQ	ND (200)	7.06	None
	8	Uranium	2.3	2.60	1.58	1
	30	Vanadium	33.0	41.5	24.2	4

Refer to footnotes at end of table.

Table 4.2-1 (Concluded)
Summary of Potential COCs in Soil for DSS SWMU 159, Building 935 Drain Systems

COC Type		Number of Soil Samples[a]	COCs Detected or with Concentrations Greater than Background or Nonquantified Background	Maximum Background Limit/North Area Supergroup[b] (mg/kg)	Maximum Concentration[c] (All Samples) (mg/kg)	Average Concentration[d] (mg/kg)	Number of Samples Where COCs Detected with Concentrations Greater than Background or Nonquantified Background[e]
Hexavalent Chromium		7	Hexavalent Chromium	NQ	ND (0.38)	0.07	None
Cyanide		5	Cyanide	NQ	ND (0.091)	0.046	None
Radionuclides (pCi/g)	Gamma Spectroscopy	21	U-235	0.18	ND (0.359)	NC[f]	1
		21	U-238	1.3	1.96	NC[f]	5
	Tritium (pCi/L)	32	Tritium	420[g]	1100	NC[f]	9

[a] Number of soil samples includes duplicates and splits.

[b] Dinwiddie September 1997.

[c] Maximum concentration for metals and cyanide, or maximum activity for radionuclides, is the greater of either the maximum amount detected or the maximum MDL or MDA above background or nonquantified background. For other COCs, the value listed is the maximum amount detected.

[d] Average concentration includes all samples except blanks. The average is calculated as the sum of detected amounts and one-half of the MDLs for nondetect results, divided by the number of samples.

[e] See appropriate data table for sample locations.

[f] An average MDA is not calculated because of the variability in instrument counting error and the number of reported nondetect activities for gamma spectroscopy or tritium analyses.

[g] Tharp February 1999.

COC = Constituent of concern.
DSS = Drain and Septic Systems.
HE = High explosive(s).
J = Value qualified as an estimated value.
MDA = Minimum detectable activity.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
NC = Not calculated.
ND ( ) = Not detected above the MDL or MDA shown in parentheses.
NQ = Nonquantified background value.
PCB = Polychlorinated biphenyl.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
VOC = Volatile organic compound.

assessment process, results, and uncertainties. The risk assessment process provides a quantitative evaluation of the potential adverse human health effects from constituents in the site's soil by calculating the hazard index (HI) and excess cancer risk for both industrial and residential land-use scenarios.

The HI calculated for the COCs at DSS SWMU 159 is 0.07 for the industrial land-use scenario, which is less than the numerical standard of 1.0 suggested by risk assessment guidance (EPA 1989). The incremental HI risk, determined by subtracting risk associated with background from potential nonradiological COC risk (without rounding), is 0.03. The excess cancer risk for DSS SWMU 159 COCs is 3E-6 for an industrial land-use scenario. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. The incremental excess cancer risk is 5.05E-7. Both the incremental HI and excess cancer risk are below NMED guidelines.

The HI calculated for the COCs at DSS SWMU 159 is 0.87 for the residential land-use scenario, which is less than the numerical standard of 1.0 suggested by risk assessment guidance (EPA 1989). The incremental HI risk, determined by subtracting risk associated with background from potential nonradiological COC risk (without rounding), is 0.38. The excess cancer risk for DSS SWMU 159 COCs is 1E-5 for a residential land-use scenario. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is approximately equal to the suggested acceptable risk value. The incremental excess cancer risk is 1.34E-6. Both the incremental HI and incremental excess cancer risk are below NMED guidelines.

Although the estimated excess cancer risk is at the NMED guideline for the residential land-use scenario, maximum concentrations were used in the risk calculation. Because the site has been adequately characterized, average concentrations are more representative of actual site conditions. The 95% upper confidence limit of the average concentrations for arsenic, the main contributor to excess cancer risk (3.0 milligrams [mg]/kilogram [kg]) (Appendix 2), is below background (4.4 mg/kg); therefore, arsenic is eliminated from the risk calculation. With the removal of arsenic, the total estimated excess cancer risk is reduced to 8E-7, and the incremental excess cancer risk is reduced to 8.37E-7. Thus, by using realistic concentrations in the risk calculations that more accurately depict actual site conditions, the total and incremental estimated excess cancer risk are below NMED guidelines.

For the radiological COCs, three of the constituents (uranium-235, uranium-238, and tritium) also had MDA values greater than the corresponding background values. The incremental total effective dose equivalent (TEDE) and corresponding estimated cancer risk from radiological COCs are much lower than the U.S. Environmental Protection Agency (EPA) guidance values; the estimated TEDE is 4.2E-2 millirem (mrem)/year (yr) for the industrial land-use scenario. This value is much lower than the EPA's numerical guidance of 15 mrem/yr (EPA 1997a). The corresponding incremental estimated cancer risk value is 4.6E-7 for the industrial land-use scenario. Furthermore, the incremental TEDE for the residential land-use scenario that results from a complete loss of institutional controls is 1.1E-1 mrem/yr with an associated risk of 1.4E-6. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, DSS SWMU 159 is eligible for unrestricted radiological release.

The incremental nonradiological and radiological carcinogenic risks are tabulated and summed in Table 4.3.2-1.

Table 4.3.2-1
Summation of Incremental Radiological and Nonradiological Risks from DSS SWMU 159, Building 935 Drain Systems Carcinogens

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	5.05E-7	4.6E-7	9.7E-7
Residential	8.37E-7	1.4E-6	2.2E-6

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

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

4.3.2.2 Ecological

An ecological assessment that corresponds with the procedures in the EPA's Ecological Risk Assessment Guidance for Superfund (EPA 1997b) also was performed as set forth by the NMED Risk-Based Decision Tree in the "RPMP [RCRA Permits Management Program] Document Requirement Guide" (NMED March 1998). An early step in the evaluation compared COC concentrations and identified potentially bioaccumulative constituents (see Annex B, Sections IV, VII.2, and VII.3). This methodology also required developing a site conceptual model and a food web model, as well as selecting ecological receptors, as presented in "Predictive Ecological Risk Assessment Methodology, Environmental Restoration Program, Sandia National Laboratories, New Mexico" (IT July 1998). The risk assessment also includes the estimation of exposure and ecological risk.

Table 17 of Annex B presents the results of the ecological risk assessment. Ecological risks associated with DSS SWMU 159 were estimated through a risk assessment that incorporated site-specific information when available. Predictions of potential risk to omnivorous and insectivorous deer mice from exposures to arsenic and thallium are attributed to the assumption of 100-percent area use, as well as the use of maximum detected values (in the case of arsenic) or one-half the detection limit (in the case of thallium) as conservative estimates of exposure point concentrations. For plants, the initial prediction of risk for exposure to lead is largely based upon the use of the maximum lead concentration as the exposure concentration. The extremely small size of this site (0.03 acres) coupled with the low hazard quotient values associated with it make the potential for significant risk to ecological populations or communities negligible. Based upon this final analysis, the potential for ecological risks associated with DSS SWMU 159 is expected to be very low.

4.4 Baseline Risk Assessments

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

4.4.1 Human Health

Because the results of the human health risk assessment summarized in Section 4.3.2.1 indicate that DSS SWMU 159 poses insignificant risk to human health under both the industrial and residential land-use scenarios, a baseline human health risk assessment is not required for this site.

4.4.2 Ecological

Because the results of the ecological risk assessment summarized in Section 4.3.2.2 indicate that ecological risks at DSS SWMU 159 are expected to be very low, a baseline ecological risk assessment is not required for the site.

5.0 NO FURTHER ACTION PROPOSAL

5.1 Rationale

Based upon field investigation data and the human health and ecological risk assessment analyses, an NFA decision is recommended for DSS SWMU 159 for the following reasons:

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

5.2 Criterion

Based upon the evidence provided in Section 5.1, DSS SWMU 159 is proposed for an NFA decision according to 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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ANNEX A
DSS SWMU 159
Analytical Data Summary Tables

LIST OF TABLES

Table **Page**

LIST OF TABLES (Concluded)

Table A-1
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory Soil Sampling, VOC Analytical Results
March 1994–August 2000
(On- and Off-Site Laboratories)

Sample Attributes				VOCs (EPA Method 8000[a]) (µg/kg)				
Record Number[b]	ER Sample ID	Sample Depth (ft)	Sample Date	Acetone	Bromoform	2-Butanone	Methylene Chloride	Toluene
Borehole samples near drain lines or septic tanks								
508470	TA2-BH-02	6.5	03-02-94	**12**	ND (5)	ND (10)	**4.3 J (5)**	ND (5)
508470	TA2-BH-02	12.5	03-02-94	**39**	ND (5)	**2.6 J (10)**	**5.7**	**3 J (5)**
508470	TA2-BH-02	18	03-02-94	**48**	ND (5)	**9.9 J (10)**	**5.2**	ND (5)
04280	TA2-ST-07-7.5-S	7.5	08-28-95	ND (5)	ND (5)	ND (5)	ND (1)	ND (1)
04280	TA2-ST-08-7.5-S	7.5	08-28-95	ND (5)	ND (5)	ND (5)	ND (1)	ND (1)
Seepage pit borehole samples								
603690	TA2-159-SPG-S-9.5	9.5	08-24-00	R	ND (2.6)	ND (2.5)	ND (5)	ND (1.1)
603690	TA2-159-SPG-DU-9.5	9.5	08-24-00	R	ND (2.6)	ND (2.5)	ND (5)	ND (1.1)
603690	TA2-159-SPG-S-15.5	15.5	08-24-00	R	ND (2.6)	ND (2.5)	ND (5)	ND (1.1)
Drywell borehole samples								
603690	TA2-159-DRYWELL-S-8	8	08-24-00	R	ND (2.6)	ND (2.5)	ND (5)	ND (1.1)
603690	TA2-159-DRYWELL-S-13	13	08-24-00	R	ND (2.6)	**17 J (20)**	ND (5)	**1.1 J (5)**
Quality Assurance/Quality Control Samples (µg/L)								
508471	TA2-BH-02 (EB)	NA	03-03-94	**5 J (10)**	ND (5)	ND (10)	**1.7 J (5)**	ND (5)
508471	TA2-BH-02 (TB)	NA	03-03-94	ND (10)	ND (5)	ND (10)	**1.6 J (5)**	ND (5)
603690	TA2-159-SPT-TB	NA	08-21-00	R	ND (0.24)	ND (3.9 U)	R	ND (0.46 U)
603690	TA2-159-SPT-EB	NA	08-28-00	R	**0.31 J (1)**	ND (3.7 U)	R	ND (0.37 U)

Note: Values in **bold** represent detected analytes.

[a] EPA November 1986.

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

BH = Borehole.
DRYWELL = Drywell.
DSS = Drain and Septic Systems.
DU = Duplicate Sample.
EPA = U.S. Environmental Protection Agency.
EB = Equipment blank.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The reported value is greater than or equal to the MDL but is less than the practical quantitation limit, shown in parentheses.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the MDL, shown in parentheses.
NR = Not reported.
R = Value rejected during data validation.
S = Soil sample.
SPG = Seepage pit.
SPT = Septic tanks project.
ST = Septic tank.
SWMU = Solid Waste Management Unit.
TA = Technical Area.
TB = Trip blank.
U = Analytical result was qualified as not detected.
VOC = Volatile Organic Compound.

Table A-2
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory Soil Sampling, VOC Analytical MDLs
March 1994–August 2000
(On- and Off-Site Laboratories)

Analyte	EPA Method 8000[a] Detection Limits (µg/kg)
Acetone	2.42–10
Benzene	0.276–50
Bromodichloromethane	0.194–100
Bromoform	0.145–500
Bromomethane	0.31–500
2-Butanone	1.76–10
Carbon disulfide	0.62–5
Carbon tetrachloride	0.144–50
Chlorobenzene	0.206–200
Chloroethane	0.286–500
2-Chloroethyl vinyl ether	1.8
Chloroform	0.204–50
Chloromethane	0.192–500
Dibromochloromethane	0.111–100
1,2-Dibromoethane	200
1,2-Dichlorobenzene	4.33–1300
1,3-Dichlorobenzene	3.33–1300
1,4-Dichlorobenzene	5.99–1300
1,1-Dichloroethane	0.231–50
1,2-Dichloroethane	0.17–100
1,1-Dichloroethene	0.262–50
cis-1,2-Dichloroethene	0.327–0.7
trans-1,2-Dichloroethene	0.232–50
1,2-Dichloroethene	5
1,2-Dichloropropane	0.19–100
cis-1,3-Dichloropropene	0.216–200
trans-1,3-Dichloropropene	0.163–100
Ethylbenzene	0.212–50
2-Hexanone	1.33–10
Methylene chloride	0.96–500
4-Methyl-2-pentanone	1.17–10
Styrene	0.198–5
1,1,2,2-Tetrachloroethane	0.195–100
Tetrachloroethene	0.582–50
Toluene	0.259–50
1,1,1-Trichloroethane	0.157–50
1,1,2-Trichloroethane	0.177–100
Trichloroethene	0.72–50
1,1,2-trichloro-1,2,2-trifluoroethane	100

Refer to footnotes at end of table.

Table A-2 (Concluded)
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory Soil Sampling, VOC Analytical MDLs
March 1994–August 2000
(On- and Off-Site Laboratories)

Analyte	EPA Method 8000[a] Detection Limits (µg/kg)
Vinyl acetate	0.83–10
Vinyl chloride	0.255–100
Xylene	0.68–50

Note: Because of the long time period covering sample collection at this site, MDL ranges are presented. MDLs were not routinely reported, or were reported as ranges, by the laboratories for analyses performed in the early- to mid-1990s.

[a] EPA November 1986.

DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
MDL = Method Detection Limit.
µg/kg = Microgram(s) per kilogram.
SWMU = Solid Waste Management Unit.
VOC = Volatile organic compound.

Table A-3
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory Soil Sampling, SVOC Analytical Results
March 1994–August 2000
(Off-Site Laboratories)

Sample Attributes				SVOCs (EPA Method 8270[a]) (µg/kg)				
Record Number[b]	ER Sample ID	Sample Depth (ft)	Sample Date	Benzo(k)fluoranthene	Diethylphthalate	bis(2-Ethylhexyl) phthalate	Fluoranthene	Pyrene
Borehole samples near drain lines or septic tanks								
508470	TA2-BH-02	10	03-02-94	ND (330)	ND (330)	**410**	ND (330)	ND (330)
508470	TA2-BH-02	15	03-02-94	ND (330)	ND (330)	**640**	**140 J (330)**	**110 J (330)**
508470	TA2-BH-02	20	03-02-94	ND (330)	ND (330)	**1300**	**100 J (330)**	**76 J (30)**
Seepage pit borehole samples								
603690	TA2-159-SPG-S-9.5	9.5	08-24-00	ND (33)	ND (55)	ND (160 U)	ND (25)	ND (160)
603690	TA2-159-SPG-DU-9.5	9.5	08-24-00	**39 J (330)**	ND (55)	ND (240 U)	ND (25)	ND (160)
603690	TA2-159-SPG-S-15.5	15.5	08-24-00	ND (33)	ND (55)	ND (170 U)	ND (25)	ND (160)
Drywell borehole samples								
603690	TA2-159-DRYWELL-S-8	8	08-24-00	ND (33)	ND (55)	ND (160 U)	ND (25)	ND (160)
603690	TA2-159-DRYWELL-S-13	13	08-24-00	ND (33)	ND (55)	ND (200 U)	ND (25)	ND (160)
Quality Assurance/Quality Control Samples (µg/L)								
508471	TA2-BH-02 (EB)	NA	03-03-94	ND (10)	ND (10)	**7.1 J (10)**	ND (10)	ND (10)
603690	TA2-159-SPT-EB	NA	08-28-00	ND (0.74)	**2.7 J (10)**	ND (6.4 U)	ND (0.6)	ND (0.71)

Note: Values in **bold** represent detected analytes.

[a] EPA November 1986.

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

BH = Borehole.
DRYWELL = Drywell.
DSS = Drain and Septic Systems.
DU = Duplicate sample.
EPA = U.S. Environmental Protection Agency.
EB = Equipment blank.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The reported value is greater than or equal to the MDL but is less than the practical quantitation limit, shown in parentheses.
MDL = Method detection limit.
NA = Not applicable.
ND ( ) = Not detected above the MDL, shown in parentheses.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
S = Soil sample.
SPG = Seepage pit.
SPT = Septic tanks project.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
TA = Technical Area.
U = Analytical result was qualified as not detected.

Table A-4
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory Soil Sampling, SVOC Analytical MDLs
March 1994–August 2000
(Off-Site Laboratories)

Analyte	EPA Method 8270[a] Detection Limits (µg/kg)
Acenaphthene	4–1300
Acenaphthylene	3.66–1300
Anthracene	4.66–1300
Benzo(a)anthracene	5.99–1300
Benzo(a)pyrene	5.66–1300
Benzo(b)fluoranthene	8.99–1300
Benzo(g,h,i)perylene	8.99–1300
Benzo(k)fluoranthene	8.99–1300
Benzoic acid	1600–6400
Benzyl alcohol	330–1300
4-Bromophenyl phenyl ether	4.66–1300
Butylbenzyl phthalate	12–1300
4-Chlorobenzenamine	54–1300
bis(2-Chloroethoxy)methane	5.99–1300
bis(2-Chloroethyl)ether	6.66–1300
bis-Chloroisopropyl ether	5.99–1300
4-Chloro-3-methylphenol	19.6–1300
2-Chloronaphthalene	3.66–1300
2-Chlorophenol	5–1300
4-Chlorophenyl phenyl ether	3.33–1300
Chrysene	6.33–1300
o-Cresol	7.66–1300
Dibenz[a,h]anthracene	4.66–1300
Dibenzofuran	2.66–1300
1,2-Dichlorobenzene	4.33–1300
1,3-Dichlorobenzene	3.33–1300
1,4-Dichlorobenzene	5.99–1300
3,3'-Dichlorobenzidine	28–2600
2,4-Dichlorophenol	7.99–1300
Diethylphthalate	6.33–1300
2,4-Dimethylphenol	6.99–1300
Dimethylphthalate	27.3–1300
Di-n-butyl phthalate	14–1300
Dinitro-o-cresol	33.3–6400
2,4-Dinitrophenol	15.7–6400
2,4-Dinitrotoluene	5–1300
2,6-Dinitrotoluene	3–1300
Di-n-octyl phthalate	8.99–1300
Diphenyl amine	15.7–84.9
bis(2-Ethylhexyl) phthalate	19.6–1300
Fluoranthene	5–1300
Fluorene	3–1300
Hexachlorobenzene	4.66–1300

Refer to footnotes at end of table.

Table A-4 (Concluded)
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory Soil Sampling, SVOC Analytical MDLs
March 1994–August 2000
(Off-Site Laboratories)

Analyte	EPA Method 8270[a] Detection Limits (µg/kg)
Hexachlorobutadiene	6.66–1300
Hexachlorocyclopentadiene	2.33–1300
Hexachloroethane	4.33–1300
Indeno(1,2,3-cd)pyrene	8.99–1300
Isophorone	2.33–1300
2-Methylnaphthalene	4–1300
4-Methylphenol	5.66–1300
Naphthalene	3.33–1300
2-Nitroaniline	56–6400
3-Nitroaniline	37–6400
4-Nitroaniline	52–6400
Nitrobenzene	36.6–1300
2-Nitrophenol	3.66–1300
4-Nitrophenol	79–6400
n-Nitrosodiphenylamine	30–1300
n-Nitrosodipropylamine	6.66–1300
Pentachlorophenol	65–6400
Phenanthrene	4–1300
Phenol	3.66–1300
Pyrene	8.66–1300
1,2,4-Trichlorobenzene	4.66–1300
2,4,5-Trichlorophenol	24.3–6400
2,4,6-Trichlorophenol	5.33–1300

Note: Because of the long time period covering sample collection at this site, MDL ranges are presented. MDLs were not routinely reported, or were reported as ranges, by the laboratories for analyses performed in the early- to mid-1990s.

[a] EPA November 1986.

DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
MDL = Method Detection Limit.
µg/kg = Microgram(s) per kilogram.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.

Table A-5
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory Soil Sampling, PCB Analytical Results
August 2000
(Off-Site Laboratory)

Sample Attributes				(EPA Method 8082[a]) (µg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	Sample Date	Aroclor-1260
Seepage pit borehole samples				
603690	TA2-159-SPG-S-9.5	9.5	08-24-00	ND (31)
603690	TA2-159-SPG-DU-9.5	9.5	08-24-00	ND (31)
603690	TA2-159-SPG-S-15.5	15.5	08-24-00	ND (31)
Drywell borehole samples				
603690	TA2-159-DRYWELL-S-8	8	08-24-00	ND (31)
603690	TA2-159-DRYWELL-S-13	13	08-24-00	ND (31)
Quality Assurance/Quality Control Samples (µg/L)				
603690	TA2-159-SPT-EB	NA	08-28-00	**1.8 J (0.25)**

Note: Values in **bold** represent detected analytes.

[a] EPA November 1986.

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

DRYWELL = Drywell.
DSS = Drain and Septic Systems.
DU = Duplicate Sample.
EPA = U.S. Environmental Protection Agency.
EB = Equipment blank.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The reported value is greater than or equal to the MDL but is less than the practical quantitation limit, shown in parentheses.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the MDL, shown in parentheses.
PCB = Polychlorinated biphenyl.
S = Soil sample.
SPG = Seepage pit.
SPT = Septic tanks project.
SWMU = Solid Waste Management Unit.
TA = Technical Area.

Table A-6
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory Soil Sampling, PCB Analytical MDLs
August 2000
(Off-Site Laboratory)

Analyte	EPA Method 8082[a] Detection Limit (µg/kg)
Aroclor-1016	0.782–30
Aroclor-1221	2.79–30
Aroclor-1232	0.719–30
Aroclor-1242	1.65–30
Aroclor-1248	0.898–30
Aroclor-1254	1.36–31
Aroclor-1260	1.42–31

[a] EPA November 1986.

DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
PCB = Polychlorinated biphenyl.
SWMU = Solid Waste Management Unit.

Table A-7
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory Soil Sampling, HE Compound Analytical Results
March 1994–August 2000
(On- and Off-Site Laboratories)

Sample Attributes				HE (EPA Method 8330[a]) (mg/kg)
Record Number[b]	ER Sample ID	Sample Depth (ft)	Sample Date	
Borehole samples near drain lines or septic tanks				
508470	TA2-BH-02	10	03-02-94	ND
508470	TA2-BH-02	15	03-02-94	ND
508470	TA2-BH-02	20	03-02-94	ND
508470	TA2-BH-02	22	03-02-94	ND
508470	TA2-BH-02	32	03-02-94	ND
508468	TA2-BH-02	41	03-02-94	ND
508470	TA2-BH-02	51	03-02-94	ND
508470	TA2-BH-02 (DU)	51	03-02-94	ND
04279	TA2-ST-07-7.5-S	7.5	08-28-95	ND
04279	TA2-ST-08-7.5-S	7.5	08-28-95	ND
Seepage pit borehole samples				
603690	TA2-159-SPG-S-9.5	9.5	08-24-00	ND
603690	TA2-159-SPG-DU-9.5	9.5	08-24-00	ND
603690	TA2-159-SPG-S-15.5	15.5	08-24-00	ND
Drywell borehole samples				
603690	TA2-159-DRYWELL-S-8	8	08-24-00	ND
603690	TA2-159-DRYWELL-S-13	13	08-24-00	ND
Quality Assurance/Quality Control Samples (µg/L)				
508471	TA2-BH-02 (EB)	NA	03-03-94	ND
603690	TA2-159-SPT-EB	NA	08-28-00	ND

[a] EPA November 1986.

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

BH = Borehole.
DRYWELL = Drywell.
DSS = Drain and Septic Systems.
DU = Duplicate Sample.
EPA = U.S. Environmental Protection Agency.
EB = Equipment blank.
ER = Environmental Restoration.
ft = Foot (feet).
HE = High explosive(s).
ID = Identification.
mg/kg = Milligram(s) per kilogram.
µg/L = Microgram(s) per liter.
NA = Not applicable.
ND = Not detected.
S = Soil sample.
SPG = Seepage pit.
SPT = Septic tanks project.
ST = Septic tank.
SWMU = Solid Waste Management Unit.
TA = Technical Area.

Table A-8
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory Soil Sampling, HE Compound Analytical MDLs
March 1994–August 2000
(On- and Off-Site Laboratories)

Analyte	EPA Method 8330[a] Detection Limit (mg/kg)
2-Amino-4,6-dinitrotoluene	0.0134–0.25
4-Amino-2,6-dinitrotoluene	0.0101–0.25
1,3-Dinitrobenzene	0.0134–1
2,4-Dinitrotoluene	0.012–1
2,6-Dinitrotoluene	0.0157–1
HMX	0.0168–1
Nitrobenzene	0.014–1
Nitroglycerine	0.030
2-Nitrotoluene	0.0152–0.25
3-Nitrotoluene	0.0116–0.25
4-Nitrotoluene	0.0116–0.25
PETN	124
RDX	0.0125–1
Tetryl	0.0155–1
1,3,5-Trinitrobenzene	0.0119–1
2,4,6-Trinitrotoluene	0.0141–1

Note: Because of the long time period covering sample collection at this site, MDL ranges are presented. MDLs were not routinely reported, or were reported as ranges, by the laboratories for analyses performed in the early- to mid-1990s.

[a] EPA November 1986.

DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
HE = High Explosive(s).
HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.
PETN = Pentaerythritol tetranitrate.
RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.
SWMU = Solid Waste Management Unit.
Tetryl = Methyl-2,4,6-trinitrophenylnitramine.

Table A-9
Summary of DSS SWMU 159, Building 935 Drain Systems
Confirmatory Soil Sampling, Metals, Including Hexavalent Chromium, and Cyanide Analytical Results
March 1994–February 2004
(On- and Off-Site Laboratories)

Sample Attributes				Metals (EPA Methods 6000/7000/9012A/908[a]) (mg/kg)																			
Record Number[b]	ER Sample ID	Sample Depth (ft)	Sample Date	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Chromium (VI)	Cobalt	Copper	Cyanide	Lead	Manganese	Mercury	Nickel	Selenium	Silver	Thallium	Uranium	Vanadium	Zinc
Borehole samples near drain lines or septic tanks																							
508470	TA2-BH-02	10	03-02-94	**ND (6)**	2.9	**202**	0.52	ND (0.5)	7.5	NR	7	**17.3**	NR	3	271	**ND (0.1)**	6.6	**ND (1)**	**ND (1)**	**ND (2)**	**2.6**	**33.9**	25.4
508470	TA2-BH-02	15	03-02-94	**ND (6)**	2.2	125	0.53	ND (0.5)	**12.8**	NR	4.4	11	NR	3.6	195	**ND (0.1)**	6.8	**ND (1)**	**ND (1)**	**ND (2)**	1.5	30.7	25
508470	TA2-BH-02	20	03-02-94	**ND (6)**	3.6	**291**	0.53	ND (0.5)	10.5	NR	4.6	7.7	NR	4.5	244	**ND (0.1)**	5.7	**ND (1)**	**ND (1)**	**ND (2)**	2.0	24.3	24.1
508470	TA2-BH-02	22	03-02-94	**ND (6)**	1.5	84.3	0.43	ND (0.5)	7.1	NR	7.2	10.9	NR	4	213	**ND (0.1)**	6.8	**ND (1)**	**ND (1)**	ND (1)	1.4	**36.2**	31.3
508470	TA2-BH-02	32	03-02-94	**ND (6)**	0.91	**260**	0.46	ND (0.5)	4	NR	4.5	7	NR	4.1	257	**ND (0.1)**	4.7	**ND (1)**	**ND (1)**	ND (1)	1.2	19.3	26.5
508468	TA2-BH-02	41	03-02-94	**ND (6)**	0.8	72.2	0.36	ND (0.5)	4.2	NR	4.5	7.3	NR	3.5	260	**ND (0.1)**	5.6	**ND (1)**	**ND (1)**	ND (0.5)	1.2	19.9	28.1
508470	TA2-BH-02	51	03-02-94	**ND (6)**	1.5	120	0.61	ND (0.5)	9.7	NR	5.6	12.5	NR	3.7	255	**0.19**	10.4	**ND (1)**	**ND (1)**	ND (1)	1.3	27.7	36.8
508470	TA2-BH-02 (DU)	51	03-02-94	**ND (6)**	2.3	127	0.69	ND (0.5)	10.4	NR	6.3	9.9	NR	7.3	341	**ND (0.1)**	6	**ND (1)**	**ND (1)**	ND (1)	1.4	24.7	29.5
2026	TA2-BH-14-6.0	6	12-03-94	**ND (6)**	1.8	24.9	0.17 J (0.2)	ND (0.5)	6.2	NR	4.9	4.5	NR	3.4 J (5)	168	**ND (0.1)**	4.5	ND (0.5)	**ND (1)**	ND (1)	NR	26.2	19.9
2026	TA2-BH-14-10.5	10.5	12-03-94	**ND (6)**	4.2	198	0.17 J (0.2)	ND (0.5)	5.4	NR	2.9	2.7	NR	4.1 J (5)	107	**ND (0.1)**	4.9	ND (0.5)	**ND (1)**	ND (1)	NR	23.6	15.7
2026	TA2-BH-14-15.5	15.5	12-03-94	**ND (6)**	1.4	32	0.23	ND (0.5)	3.5	NR	2.9	3.9	NR	4 J (5)	175	**ND (0.1)**	2.6 J (4)	ND (0.5)	**ND (1)**	ND (1)	NR	17	17.2
2026	TA2-BH-14-20.5	20.5	12-03-94	**ND (6)**	ND (1)	27.4	0.24	ND (0.5)	6.7	NR	3.3	6.5	NR	ND (5)	165	**ND (0.1)**	4.2	ND (0.5)	**ND (1)**	ND (1)	NR	15.9	20.5
2026	TA2-BH-14-31.5	31.5	12-03-94	**ND (6)**	3.1	76.5	0.55	ND (0.5)	**12.8**	NR	6.1	9.2	NR	8.6	310	**ND (0.1)**	12.1	ND (0.5)	**ND (1)**	0.84 J (1)	NR	22.9	34.8
2026	TA2-BH-14-40.5	40.5	12-03-94	**ND (6)**	2.3	78.2	0.26	ND (0.5)	6.9	NR	3.5	4.2	NR	5.4	171	**ND (0.1)**	5.7	ND (0.5)	**ND (1)**	ND (1)	NR	19	21.6
2026	TA2-BH-14-50.5	50.5	12-03-94	**ND (6)**	2.4	**524**	0.51	ND (0.5)	10.9	NR	6	9.2	NR	8.2	330	**ND (0.1)**	10.3	ND (0.5)	**ND (1)**	0.77 J (1)	NR	24.1	36.2
2026	TA2-BH-15-6.0	6	12-03-94	**ND (6)**	2.2	122	0.2	ND (0.5)	11.8	NR	5.1	7.5	NR	6.3	228	**ND (0.1)**	6.4	ND (0.5)	**ND (1)**	ND (1)	NR	30.4	32.8
2026	TA2-BH-15-10.5	10.5	12-03-94	**ND (12)**	1.4 J (2)	107	ND (0.4)	**ND (1)**	1.5 J (2)	NR	1.5 J (2)	1 J (4)	NR	ND (10)	31.6	**ND (0.1)**	1.9 J (8)	**ND (1)**	**ND (2)**	**ND (2)**	NR	9.5	8.6
2026	TA2-BH-15-15.5	15.5	12-03-94	**ND (6)**	3.1	122	0.38	ND (0.5)	7.9	NR	3.5	3.1	NR	4.7 J (5)	128	**ND (0.1)**	5.1	ND (0.5)	**ND (1)**	ND (1)	NR	24.5	20.5
2026	TA2-BH-15-20.0	20	12-03-94	**ND (6)**	1.5	81.5	0.2	ND (0.5)	**58.4**	NR	4.6	6.2	NR	3.4 J (5)	245	**ND (0.1)**	8.1	ND (0.5)	**ND (1)**	0.66 J (1)	NR	29.7	23.3
2026	TA2-BH-15-20.5	20.5	12-03-94	**ND (6)**	1.7	68.7	0.26	ND (0.5)	6	NR	4.4	5	NR	3.9 J (5)	225	**ND (0.1)**	5.1	ND (0.5)	**ND (1)**	ND (1)	NR	24	25.7
2026	TA2-BH-15-30.5	30.5	12-03-94	**ND (6)**	2.8	74.4	0.27	ND (0.5)	**12.8**	NR	5.5	7.4	NR	5.8	236	**ND (0.1)**	8.2	ND (0.5)	**ND (1)**	0.63 J (1)	NR	**41.5**	31.5
2026	TA2-BH-15-40.5	40.5	12-03-94	**ND (6)**	3.7	70.3	**0.86**	ND (0.5)	**17.5**	NR	**9.8**	**17.2**	NR	**11.4**	592	**ND (0.1)**	17.4	ND (0.5)	**ND (1)**	0.86 J (1)	NR	**38.9**	66.2
2026	TA2-BH-15-50.5	50.5	12-03-94	**ND (6)**	1.9	84.5	0.25	ND (0.5)	7.3	NR	3.6	4.9	NR	4.1 J (5)	182	**ND (0.1)**	4.9	ND (0.5)	**ND (1)**	ND (1)	NR	27	24.2
04280	TA2-ST-07-7.5-S *(On-site laboratory)*	7.5	08-28-95	**ND (10)**	**ND (50)**	160	**ND (3.4)**	**ND (10)**	ND (10)	ND (0.38)	**ND (10)**	**ND (20)**	NR	ND (10)	74	ND (0.06)	ND (4.0)	**ND (50)**	**ND (10)**	**ND (200)**	NR	ND (10)	ND (10)
04280	TA2-ST-08-7.5-S *(On-site laboratory)*	7.5	08-28-95	**ND (10)**	**ND (50)**	190	**ND (3.4)**	**ND (10)**	ND (10)	ND (0.38)	**ND (10)**	**ND (20)**	NR	ND (10)	90	ND (0.06)	ND (4.0)	**ND (50)**	**ND (10)**	**ND (200)**	NR	10 J (38)	54
Samples under drain line piping to drywell																							
607188	064168-001 (Floor drain location)	3	02-09-04	0.22 J (1.1)	**4.7**	128	0.61	ND (0.57)	9.2	NR	NR	NR	NR	**26.5**	NR	ND (0.038)	10.2	ND (0.57)	**ND (1.1)**	**ND (1.1)**	NR	27.9	NR
607188	064168-002 (Floor drain location)	3	02-09-04	ND (1.1)	3.2	108	0.40 J (0.55)	ND (0.55)	5.5	NR	NR	NR	NR	4.4	NR	ND (0.037)	7.5	ND (0.55)	**ND (1.1)**	**ND (1.1)**	NR	20.1	NR
607188	064168-003 (Floor drain location)	4	02-09-04	ND (1.1)	3.4	113	0.48 J (0.53)	**ND (2.6)**	9.1	NR	NR	NR	NR	**188**	NR	ND (0.035)	9.2	ND (0.53)	0.064 J (1.1)	0.82 J (1.1)	NR	26.7	NR
607188	064168-004 (Former retention box location)	2.5	02-09-04	0.22 J (1)	4.0	114	0.53	ND (0.51)	10.2	NR	NR	NR	NR	**239**	NR	ND (0.034)	9.0	ND (0.51)	**ND (1)**	0.65 J (1)	NR	30.7	NR
Seepage pit borehole samples																							
603690	TA2-159-SPG-S-9.5	9.5	08-24-00	NR	2.3	115 J	NR	ND (0.03)	5.1	ND (0.054)	NR	NR	ND (0.091)	3.4	NR	ND (0.017)	NR	ND (0.24)	ND (0.14)	NR	NR	NR	NR
603690	TA2-159-SPG-DU-9.5	9.5	08-24-00	NR	2.2	166 J	NR	ND (0.03)	4.7	ND (0.054)	NR	NR	ND (0.091)	3.2	NR	ND (0.017)	NR	ND (0.24)	ND (0.14)	NR	NR	NR	NR
603690	TA2-159-SPG-S-15.5	15.5	08-24-00	NR	**4.6**	**260 J**	NR	ND (0.03)	5.8	ND (0.054)	NR	NR	ND (0.091)	3.5	NR	ND (0.017)	NR	ND (0.24)	ND (0.14)	NR	NR	NR	NR
Drywell borehole samples																							
603690	TA2-159-DRYWELL-S-8	8	08-24-00	NR	1.7	81.7 J	NR	ND (0.03)	4.3	ND (0.054)	NR	NR	ND (0.091)	2.5	NR	ND (0.017)	NR	ND (0.24)	ND (0.14)	NR	NR	NR	NR
603690	TA2-159-DRYWELL-S-13	13	08-24-00	NR	3.7	**426 J**	NR	ND (0.03)	6.2	ND (0.054)	NR	NR	ND (0.091)	4	NR	ND (0.017)	NR	ND (0.24)	ND (0.14)	NR	NR	NR	NR
607188	064168-005	5	02-09-04	ND (1.1)	1.6	61.5	0.28 J (0.53)	ND (0.53)	3.8	NR	NR	NR	NR	5.2	NR	ND (0.035)	3.6 J (4.2)	ND (0.53)	0.25 J (1.1)	**ND (1.1)**	NR	16.0	NR
Background Concentration—North Area Supergroup[c]				3.9	4.4	200	0.8	0.9	12.8	NQ	7.1	17	NQ	11.2	831[d]	<0.1	25.4	<1	<1	<1.1	2.3	33	76
Quality Assurance/Quality Control Samples (mg/L)																							
2026	TA2-BH-14 E (EB)	NA	12-03-94	ND (0.06)	ND (0.01)	ND (0.01)	0.001 J (0.002)	ND (0.005)	ND (0.01)	NR	ND (0.01)	0.0046 J (0.02)	NR	0.0033	0.0058 J (0.01)	ND (0.0002)	ND (0.04)	ND (0.005)	ND (0.01)	ND (0.01)	NR	ND (0.01)	0.01 J (0.02)
2026	TA2-BH-15 E (EB)	NA	12-03-94	ND (0.06)	ND (0.01)	0.0097 J (0.01)	ND (0.002)	ND (0.005)	0.0074 J (0.01)	NR	ND (0.01)	0.0032 J (0.02)	NR	0.013	0.023	ND (0.0002)	ND (0.04)	ND (0.005)	ND (0.01)	ND (0.01)	NR	ND (0.01)	0.021
508471	TA2-BH-02 (EB)	NA	03-03-94	ND (0.06)	ND (0.005)	0.0068 J (0.01)	ND (0.004)	ND (0.005)	ND (0.01)	NR	ND (0.01)	ND (0.02)	NR	0.0012 J (0.005)	0.0068 J (0.01)	ND (0.0002)	ND (0.04)	ND (0.005)	ND (0.01)	ND (0.005)	0.0000 J (0.00005)	ND (0.01)	0.018 J (0.02)
603690	TA2-159-SPT-EB	NA	08-28-00	NR	ND (0.0014	ND (0.0032)	NR	ND (0.0003)	0.0022 J (0.005)	ND (3.4)	NR	NR	ND (1.6)	ND (0.0019)	NR	ND (0.0001)	NR	0.0028 J (0.005)	ND (0.0014 J)	NR	NR	NR	NR

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

[a] EPA November 1986.

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

[c] Dinwiddie September 1997.

[d] USGS 1994.

BH = Borehole.
DRYWELL = Drywell.
DSS = Drain and Septic Systems.
DU = Duplicate Sample.

Table A-9 (Concluded)
Summary of DSS SWMU 159, Building 935 Drain Systems
Confirmatory Soil Sampling, Metals, Including Hexavalent Chromium, and Cyanide Analytical Results
March 1994–February 2004
(On- and Off-Site Laboratories)

EPA = U.S. Environmental Protection Agency.
EB = Equipment blank.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J = Analytical result was qualified as an estimated value.
J ( ) = The reported value is greater than or equal to the MDL but is less than the practical quantitation limit, shown in parentheses.
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.
mg/L = Milligram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the MDL, shown in parentheses.
ND ( ) = Not detected but the MDL, shown in parentheses, exceeds the background concentration level.
NQ = Nonquantified background value.
NR = Not reported.
S = Soil sample.
SPG = Seepage pit.
SPT = Septic tanks project.
ST = Septic tank.
SWMU = Solid Waste Management Unit.
TA = Technical Area.
USGS = U.S. Geological Survey.

Table A-10
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory Soil Sampling, Metals, Including Hexavalent Chromium, and Cyanide Analytical MDLs
March 1994–February 2004
(On- and Off-Site Laboratories)

Analyte	EPA Method 6000/7000/7196A/9012A[a] Detection Limits (mg/kg)
Antimony	6–12
Arsenic	0.131–50
Barium	0.0465–2
Beryllium	0.02–3.4
Cadmium	0.03–10
Chromium	0.0645–2
Chromium (VI)	0.38
Cobalt	1–10
Copper	2–20
Cyanide	0.091–1.5
Lead	0.099–10
Manganese	1–50
Mercury	0.00455–0.1
Nickel	4–8
Selenium	0.146–50
Silver	0.101–10
Thallium	1–200
Uranium	0.0017
Vanadium	1–10
Zinc	2–10

Note: Because of the long time period covering sample collection at this site, MDL ranges are presented. MDLs were not routinely reported, or were reported as ranges, by the laboratories for analyses performed in the early- to mid-1990s.

[a] EPA November 1986.

DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
MDL = Method Detection Limit.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.

Table A-11
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory Soil Sampling, Gamma Spectroscopy Analytical Results
March 1994–August 2000
(On- and Off-Site Laboratories)

Sample Attributes				Activity (EPA Method 901.1[a]) (pCi/g)							
				Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Record Number[b]	ER Sample ID	Sample Depth (ft)	Sample Date	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
Borehole samples near drain lines or septic tanks											
508467	TA2-BH-02 (*Off-site laboratory*)	12	03-02-94	ND (0.058)	--	0.97	0.3	NR	--	NR	--
508467	TA2-BH-02 (*Off-site laboratory*)	15	03-02-94	ND (0.052)	--	0.61	0.21	NR	--	NR	--
508467	TA2-BH-02 (*Off-site laboratory*)	20	03-02-94	ND (0.05)	--	0.76	0.29	NR	--	NR	--
508467	TA2-BH-02 (*Off-site laboratory*)	22	03-02-94	ND (0.049)	--	0.94	0.3	NR	--	NR	--
508467	TA2-BH-02 (*Off-site laboratory*)	32	03-02-94	ND (0.05)	--	0.75	0.29	NR	--	NR	--
508467	TA2-BH-02 (*Off-site laboratory*)	41	03-02-94	ND (0.054)	--	1.1	0.3	NR	--	NR	--
508467	TA2-BH-02 (*Off-site laboratory*)	51	03-02-94	0.06	0.066	0.76	0.36	NR	--	NR	--
508467	TA2-BH-02 (DU) (*Off-site laboratory*)	51	03-02-94	ND (0.061)	--	0.77	0.36	NR	--	NR	--
2028	TA2-BH-14-5.0	5.0	12-03-94	ND (0.0344)	--	0.908	0.270	ND (0.0799)	--	ND (0.874)	--
2028	TA2-BH-14-11.0	11.0	12-03-94	ND (0.0278)	--	0.706	0.285	ND (0.0669)	--	ND (0.771)	--
2028	TA2-BH-14-16.0	16.0	12-03-94	ND (0.0249)	--	1.29	0.206	ND (0.0512)	--	**1.49**	0.685
2028	TA2-BH-14-21.0	21.0	12-03-94	ND (0.0267)	--	1.13	0.269	ND (0.0653)	--	ND (0.730)	--
2028	TA2-BH-14-30.5	30.5	12-03-94	ND (0.0158)	--	1.05	0.139	ND (0.0400)	--	1.22	0.424
2028	TA2-BH-14-41.0	41.0	12-03-94	ND (0.0316)	--	1.29	0.235	ND (0.0661)	--	ND (0.770)	--
2028	TA2-BH-14-51.0	51.0	12-03-94	ND (0.0290)	--	1.36	0.226	ND (0.0658)	--	**1.76**	0.810
2028	TA2-BH-15-5.5	5.5	12-03-94	ND (0.0174)	--	0.821	0.147	ND (0.0374)	--	ND (0.427)	--
2028	TA2-BH-15-10.0	10.0	12-03-94	ND (0.0203)	--	1.11	0.166	ND (0.0440)	--	**1.39**	0.527
2028	TA2-BH-15-16.0	16.0	12-03-94	ND (0.0212)	--	1.02	0.190	ND (0.0440)	--	**1.54**	0.600
2028	TA2-BH-15-21.0	21.0	12-03-94	ND (0.0218)	--	0.947	0.168	ND (0.0383)	--	0.994	0.408
2028	TA2-BH-15-30.0	30.0	12-03-94	ND (0.0227)	--	0.932	0.164	ND (0.0468)	--	ND (0.516)	--
2028	TA2-BH-15-41.0	41.0	12-03-94	ND (0.0176)	--	1.22	0.174	ND (0.0443)	--	ND (0.510)	--
2028	TA2-BH-15-51.0	51.0	12-03-94	ND (0.0234)	--	1.37	0.180	ND (0.0488)	--	**1.96**	0.667
04278	TA2-ST-07-7.5	7.5	08-28-95	ND (0.0513)	--	0.335	0.178	**ND (0.359)**	--	**ND (1.94)**	--
04275	TA2-ST-07-7.5 (DU) (*Off-site laboratory*)	7.5	08-28-95	NR	--	NR	--	0.054[d]	0.017	0.661[d]	0.067
Seepage pit borehole samples											
603689	TA2-159-SPG-S-9.5	9.5	08-24-00	ND (0.0398)	--	0.579	0.414	**ND (0.204)**	--	ND (0.870)	--
603689	TA2-159-SPG-DU-9.5	9.5	08-24-00	ND (0.0410)	--	ND (0.315)	--	**ND (0.210)**	--	ND (0.581)	--
603689	TA2-159-SPG-S-15.5	15.5	08-24-00	ND (0.0418)	--	0.580	0.416	**0.220**	0.188	ND (0.604)	--
Background Activity—North Area Supergroup[e]				0.084		1.54		0.18		1.3	

Refer to footnotes at end of table.

Table A-11 (Concluded)
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory Soil Sampling, Gamma Spectroscopy Analytical Results
March 1994–August 2000
(On- and Off-Site Laboratories)

Sample Attributes				Activity (EPA Method 901.1[a]) (pCi/g)							
				Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Record Number[b]	ER Sample ID	Sample Depth (ft)	Sample Date	Result	Error[c]	Result	Error[c]	Result	Error[c]	Result	Error[c]
Drywell borehole samples											
603689	TA2-159-DRYWELL-S-8	8	08-24-00	ND (0.0295)	--	0.576	0.342	ND (0.172)	--	ND (0.463)	--
603689	TA2-159-DRYWELL-S-13	13	08-24-00	ND (0.0333)	--	ND (0.251)	--	**ND (0.182)**	--	ND (0.525)	--
Background Activity—North Area Supergroup[e]				0.084		1.54		0.18		1.3	
Quality Assurance/Quality Control Samples (pCi/mL)											
2028	TA2-BH-14-EB	NA	12-03-94	ND (0.0108)	--	ND (0.0498)	--	ND (0.0150)	--	ND (0.178)	--
2028	TA2-BH-15-EB	NA	12-03-94	ND (0.00683)	--	ND (0.0506)	--	ND (0.0142)	--	ND (0.182)	--
2214	TA2-159-ST-EB	NA	03-13-95	ND (0.019)	--	NR	--	ND (0.003)	--	ND (0.036)	--
603689	TA2-159-SPT-EB	NA	08-28-00	ND (0.0211)	--	ND (0.145)	--	ND (0.120)	--	ND (0.275)	--

Note: Values in **bold** exceeded background soil activity.

[a] EPA November 1986.

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

[c] Two standard deviations around the mean detected activity.

[d] Isotopic uranium analysis.

[e] Dinwiddie September 1997.

BH = Borehole.
DRYWELL = Drywell.
DSS = Drain and Septic Systems.
DU = Duplicate Sample.
EB = Equipment blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
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.
NR = Not reported.
pCi/g = Picocurie(s) per gram.
pCi/mL = Picocurie(s) per milliliter.
S = Soil sample.
SPG = Seepage pit.
SPT = Septic tanks project.
ST = Septic tank.
SWMU = Solid Waste Management Unit.
TA = Technical Area.
-- = Error not calculated for nondetect results.

Table A-12
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory *Soil Sampling*, Tritium Analytical Results
March 1994–February 2004
(On- and Off-Site Laboratories)

Sample Attributes				Activity (EPA 906.0[a]) (pCi/L)	
Record Number[b]	ER Sample ID	Sample Depth (ft)	Sample Date	Result	Error[c]
Borehole samples near drain lines or septic tanks					
508467	TA2-BH-02	12	03-07-94	200	150
508467	TA2-BH-02	15	03-07-94	300	150
508467	TA2-BH-02	20	03-07-94	**550**	160
508467	TA2-BH-02	22	03-07-94	**780**	180
508467	TA2-BH-02	32	03-07-94	**520**	160
508467	TA2-BH-02	41	03-07-94	**440**	160
508467	TA2-BH-02	51	03-07-94	400	160
508472	TA2-BH-02	75	03-07-94	150	150
508472	TA2-BH-02	100	03-07-94	290	160
2025	TA2-BH-14-5.5	5.5	12-03-94	ND (300)	--
2025	TA2-BH-14-10.0	10	12-03-94	ND (240)	--
2025	TA2-BH-14-20.0	20	12-03-94	**550**	230
2025	TA2-BH-14-30.0	30	12-03-94	**430**	220
2025	TA2-BH-14-40.0	40	12-03-94	**460**	220
2025	TA2-BH-14-50.0	50	12-03-94	ND (280)	--
2025	TA2-BH-15-5.0	5	12-03-94	**1100**	270
2025	TA2-BH-15-11.0	11	12-03-94	ND (170)	--
2025	TA2-BH-15-15.0	15	12-03-94	ND (170)	--
2025	TA2-BH-15-21.5	21.5	12-03-94	ND (130)	--
2025	TA2-BH-15-22.0	22	12-03-94	ND (44)	--
2025	TA2-BH-15-31.0	31	12-03-94	ND (240)	--
2025	TA2-BH-15-40.0	40	12-03-94	ND (280)	--
2025	TA2-BH-15-50.0	50	12-03-94	340	210
04276	TA2-ST-07-7.5	7.5	08-28-95	**420**	270
Seepage pit borehole samples					
607191	TA2-159-SPG-9.5-S (*On-site laboratory*)	9.5	02-16-04	ND (260)	--
607191	TA2-159-SPG-9.5-DU (*On-site laboratory*)	9.5	02-16-04	ND (260)	--
607191	TA2-159-SPG-14.5-S (*On-site laboratory*)	14.5	02-16-04	ND (260)	--
607191	TA2-159-SPG-24.5-S (*On-site laboratory*)	24.5	02-16-04	ND (260)	--
Drywell borehole samples					
607191	TA2-159-DRYWELL-8-S (*On-site laboratory*)	8	02-16-04	ND (260)	--
607191	TA2-159-DRYWELL-8-DU (*On-site laboratory*)	8	02-16-04	ND (260)	--
607191	TA2-159-DRYWELL-13-S (*On-site laboratory*)	13	02-16-04	ND (260)	--
607191	TA2-159-DRYWELL-23-S (*On-site laboratory*)	23	02-16-04	ND (260)	--
Background Activity[d]				420	NA

Refer to footnotes at end of table.

Table A-12 (Concluded)
Summary of DSS SWMU 159, Building 935 Drain Systems Confirmatory Soil Sampling, Tritium Analytical Results March 1994–February 2004 (On- and Off-Site Laboratories)

Sample Attributes				Activity (EPA 906.0[a]) (pCi/L)	
Record Number[b]	ER Sample ID	Sample Depth (ft)	Sample Date	Result	Error[c]
Quality Assurance/Quality Control Samples (pCi/L)					
2025	TA2-BH-14 E-BLANK	NA	12-03-94	ND (250)	--
2025	TA2-BH-15 E-BLANK	NA	12-03-94	ND (250)	--
607191	TA2-159-EB	NA	02-16-04	ND (260)	--

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

[a] EPA November 1986.

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

[c] Two standard deviations around the mean detected activity.

[d] Tharp February 1999.

BH = Borehole.
DRYWELL = Drywell.
DSS = Drain and Septic Systems.
DU = Duplicate sample.
EB = Equipment blank.
E-BLANK = Equipment blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
MDA = Minimum detectable activity.
NA = Not applicable.
ND ( ) = Not detected above the MDA, shown in parentheses.
pCi/L = Picocurie(s) per liter.
S = Soil sample.
SPG = Seepage pit.
ST = Septic tank.
SWMU = Solid Waste Management Unit.
TA = Technical Area.
-- = Error not calculated for nondetect results.

ANNEX B
DSS SWMU 159
Risk Assessment

TABLE OF CONTENTS

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LIST OF TABLES

LIST OF FIGURES

DSS SWMU 159: RISK ASSESSMENT REPORT

I. Site Description and History

Drain and Septic Systems (DSS) Solid Waste Management Unit (SWMU) 159, the Building 935 Drain Systems, at Sandia National Laboratories/New Mexico (SNL/NM), is located in Technical Area (TA)-II on federally owned land controlled by Kirtland Air Force Base (KAFB) and permitted to the U.S. Department of Energy (DOE). There were two drain systems at Building 935. A septic system received discharges from a restroom and a furnace room floor drain and discharged to an estimated 700-gallon septic tank that was connected to a 5-foot-diameter, 13-foot-deep, gravel-filled seepage pit. A waste-water drain system received discharges from test cell (room) floor drains and emptied first to a 200-gallon concrete retention tank and then into an unlined, gravel-filled drywell.

Available information indicates that Building 935 was constructed in 1963 (SNL/NM March 2003), and it is assumed that the septic and drain systems were also constructed at that time. In 1989, the floor drains for the test cells were sealed shut. In late 1991, the septic system for the building was shut down because contaminants were identified in the septic tank waste. The building was demolished in December 2002. The foundation slab, waste line piping, and retention tank were characterized and removed in February 2004. The septic system and drywell were abandoned in place.

Environmental concern about DSS SWMU 159 is based upon the potential for the release of constituents of concern (COCs) in effluent discharged to the environment via the seepage pit and drywell at this site. Because operational records were not available, the investigation was planned to be consistent with other DSS site investigations and to sample for the COCs most commonly found at similar facilities.

The ground surface in the vicinity of the site is flat or slopes slightly to the west. The closest major drainage is Tijeras Arroyo, located approximately 2,100 feet east of the site. No springs or perennial surface-water bodies are located within 2 miles of the site. Average annual rainfall in the SNL/NM and KAFB area, as measured at Albuquerque International Sunport, is 8.1 inches (NOAA 1990). Surface-water runoff in the vicinity of the site is minor because the surface slope is flat or inclines to the west. Infiltration of precipitation is almost nonexistent as virtually all of the moisture subsequently undergoes evapotranspiration. The estimates of evapotranspiration for the KAFB area range from 95 to 99 percent of the annual rainfall (SNL/NM March 1996). Most of the area immediately surrounding DSS SWMU 159 is unpaved with some native vegetation, and no storm sewers are used to direct surface water away from the site.

DSS SWMU 159 lies at an average elevation of approximately 5,409 feet above mean sea level. The groundwater beneath the site occurs in unconfined conditions in essentially unconsolidated silts, sands, and gravels. Two water-bearing zones, a shallow groundwater system and the regional aquifer, underlie DSS SWMU 159. The depth to the shallow groundwater system is approximately 300 feet below ground surface (bgs). The shallow groundwater system is not used for water supply purposes. The depth to the regional aquifer is approximately 545 feet bgs (SNL/NM May 2003). Both the City of Albuquerque and KAFB utilize the regional aquifer as a water supply. Groundwater flow in the shallow groundwater system is to the southeast, while regional groundwater flow is predominantly to the north-northwest in this portion of KAFB. The nearest downgradient water-supply wells are southwest and northwest of the site and include KAFB-1 and KAFB-4, which are approximately 1.3 and 1.1 miles away, respectively.

II. Data Quality Objectives

Between 1992 and 1994, borehole drilling, monitoring well installation, and sampling in trenches were performed in accordance with the DOE-approved "Interim RCRA [Resource Conservation and Recovery Act] Facility Investigation [RFI] Workplan" (SNL/NM 1991). Beginning in late 1994, borehole drilling and sampling were performed in accordance with the Quality Assurance Project Plan (QAPjP) for the RFI for TA-II (SNL/NM August 1994).

The sampling event completed in 2000 was conducted in accordance with the Data Quality Objectives (DQOs) presented in the "Sampling and Analysis Plan [SAP] for Characterizing and Assessing Potential Releases to the Environment From Septic and Other Miscellaneous Drain Systems at Sandia National Laboratories/New Mexico" (SNL/NM October 1999). Negotiations held on November 17, 1999, with the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) defined specific procedures for soil sampling at the seven DSS SWMUs located in TA-II and transferred a requirement for groundwater reporting for these SWMUs to the ongoing Tijeras Arroyo groundwater investigation. The DQOs outlined the quality assurance (QA)/quality control (QC) requirements necessary for producing defensible analytical data suitable for risk assessment purposes. 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 1 summarizes the rationale for determining the sampling locations at this site. The source of potential COCs at DSS SWMU 159 was effluent discharged to the environment from the seepage pit and drywell at this site.

The soil samples were collected at three areas at DSS SWMU 159. Boreholes adjacent to the septic tank and in the vicinity of the septic and waste-water drain lines were drilled in 1994 and 1995 using a hollow-stem auger. Samples were collected using a hollow-stem auger and a 2-foot-long split-spoon-type drive sampler. Samples were collected next to the septic tank at depths equal to, and below, the unit using a 3- or 4-foot-long Geoprobe™ sample tube system inside hollow-stem augers.

Samples beneath the seepage pit and drywell were also collected using a Geoprobe™ in 2000 and 2004. For the August 2000 sampling, sample intervals started at 9.5 and 15.5 feet bgs in the single boring through, and beneath, the seepage pit and at 8 and 13 feet bgs in the single boring through, and beneath, the drywell. For the February 2004 H-3 sampling, sample intervals started at 9.5, 14.5, and 24.5 feet bgs in the single boring through, and beneath, the

Table 1
Summary of Sampling Performed to Meet DQOs

DSS SWMU 159 Sampling Areas	Potential COC Source	Number of Sampling Locations	Sample Density (samples/acre)	Sampling Location Rationale
Soil adjacent to the septic tank, drain line, and beneath the septic system seepage pit	Effluent discharged to the environment from the seepage pit	4	NA	Evaluate potential COC releases to the environment from effluent discharged from the seepage pit.
Soil in, beneath, and adjacent to the drywell	Effluent discharged to the environment from the drywell	4	NA	Evaluate potential COC releases to the environment from effluent discharged from the drywell.
Soil beneath the waste-water drain line and retention box	Effluent discharged to the environment from the drain line and retention box	4	NA	Evaluate potential COC releases to the environment from effluent discharged from the drain line and retention box.

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

seepage pit, and at 8, 13, and 23 feet bgs in the single boring through, and beneath, the drywell. The February 2004 waste-water drain line samples were collected by filling sample containers with soil collected directly under the piping system. The February 2004 5-foot-bgs drywell sample container was filled with soil collected with a backhoe at the approximate depth the piping entered the drywell.

The soil samples in 2000 and 2004 were collected in accordance with the procedures developed for, and described in, the Operable Unit (OU) 1295 SAP (SNL/NM October 1999) and subsequent "Field Implementation Plan [FIP], Characterization of Non-Environmental Restoration Drain and Septic Systems" (SNL/NM November 2001) approved by the NMED. The 1994 and 1995 sampling activities were conducted using similar procedures. Table 2 summarizes the types of confirmatory and QA/QC samples collected at the site and the laboratories that performed the analyses.

The DSS SWMU 159 soil samples were analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), high explosive (HE) compounds, polychlorinated biphenyls (PCBs), metals, hexavalent chromium, cyanide, radionuclides by gamma spectroscopy, and H-3 activity. The samples were analyzed by off-site laboratories (Enseco, Inc. [ENS], Severn Trent Laboratories [STL], and Thermo Analytical Inc./Eberline Laboratories [TMA]) and at the on-site SNL/NM Environmental Restoration Chemistry Laboratory (ERCL) and Radiation Protection Sample Diagnostic (RPSD) Laboratory. Table 3 summarizes the analytical methods and data quality requirements based upon the subsequently developed OU 1295 SAP and FIP.

Table 2
Number of Confirmatory Soil and QA/QC Samples Collected at DSS SWMU 159

Sample Type	VOCs	SVOCs	PCBs	HE	Metals	Hexavalent Chromium	Cyanide	Gamma Spectroscopy Radionuclides	H-3
Confirmatory	9	7	4	13	33	6	4	26	30
Duplicates	1	1	1	2	2	1	1	3	2
EBs and TBs[a]	4	2	1	2	4	1	1	4	3
Total Samples	14	10	6	17	39	8	6	33	35
Analytical Laboratory	ENS, ERCL, STL	ENS, STL	STL	ENS, ERCL, STL	ENS, ERCL, STL	ERCL, STL	STL	RPSD, TMA	RPSD, TMA

[a] TBs for VOCs only.

DSS = Drain and Septic Systems.
EB = Equipment blank.
ENS = Enseco, Inc., Arvada, Colorado.
ERCL = Environmental Restoration Chemistry Laboratory.
HE = High explosive(s).
PCB = Polychlorinated biphenyl.
QA = Quality assurance.
QC = Quality control.
RPSD = Radiation Protection Sample Diagnostics Laboratory.
STL = Severn Trent Laboratories.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
TB = Trip blank.
TMA = Thermo Analytical Inc./Eberline Laboratories.
VOC = Volatile organic compound.

Table 3
Summary of Data Quality Requirements for DSS SWMU 159

Analytical Method^{a}	Data Quality Level	ENS	ERCL	RPSD	STL	TMA
VOCs EPA Method 8000	Defensible	3	2	None	4	None
SVOCs EPA Method 8270	Defensible	3	None	None	4	None
PCBs EPA Method 8082	Defensible	None	None	None	4	None
HE Compounds EPA Method 8330	Defensible	7	2	None	4	None
Metals EPA Methods 6000/7000/908	Defensible	22	2	None	9	None
Hexavalent Chromium EPA Method 7196A	Defensible	None	2	None	4	None
Total Cyanide EPA Method 9012A	Defensible	None	None	None	4	None
Gamma Spectroscopy Radionuclides EPA Method 901.1	Defensible	None	None	19	None	7
H-3 EPA Method 906.0	Defensible	None	None	6	None	24

Note: The number of samples does not include QA/QC samples such as duplicates, trip blanks, and equipment blanks.
[a]EPA November 1986.
DSS = Drain and Septic Systems.
ENS = Enseco, Inc., Arvada, Colorado.
EPA = U.S. Environmental Protection Agency.
ERCL = Environmental Restoration Chemistry Laboratory.
HE = High explosive(s).
PCB = Polychlorinated biphenyl.
QA = Quality assurance.
QC = Quality control.
RPSD = Radiation Protection Sample Diagnostics Laboratory.
STL = Severn Trent Laboratories.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
TMA = Thermo Analytical Inc./Eberline Laboratories.
VOC = Volatile organic compound.

The QA/QC samples were collected during the sampling effort according to the Environmental Restoration (ER) Project QAPjP. The QA/QC samples consisted of two trip blanks (for VOCs only) and, depending upon the analysis, from one to four equipment blanks and one to three field duplicates. No significant QA/QC problems were identified in the QA/QC samples.

All of the DSS SWMU 159 soil sample results were verified/validated by SNL/NM. The laboratory results from ENS, ERCL, STL, and TMA were reviewed according to "Verification and Validation of Chemical and Radiochemical Data" SNL/NM ER Project Technical Operating

Procedure (TOP) 94-03, Rev. 0 (SNL/NM July 1994) or earlier ER Project Administrative Operating Procedures. 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 the response to the Request for Supplemental Information (RSI). Therefore, the DQOs have been fulfilled.

III. Determination of Nature, Rate, and Extent of Contamination

III.1 Introduction

The determination of the nature, migration rate, and extent of contamination at DSS SWMU 159 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 Workplan (SNL/NM 1991) and the SAP (SNL/NM October 1999) as well as negotiations with the NMED-HWB held on November 17, 1999, identified the sample locations, sample density, sample depth, and analytical requirements. The sample data were subsequently used to develop the final conceptual model for DSS SWMU 159, which is presented in Section 4.0 of the associated RSI response. The quality of the data specifically used to determine the nature, migration rate, and extent of contamination is described in the following sections.

III.2 Nature of Contamination

Both the nature of contamination and the potential for the degradation of COCs at DSS SWMU 159 were evaluated using laboratory analyses of the soil samples. The analytical requirements include analyses for VOCs, SVOCs, HE compounds, PCBs, metals, hexavalent chromium, cyanide, radionuclides by gamma spectroscopy, and H-3 activity. The analytes and methods listed in Tables 2 and 3 are appropriate to characterize the COCs and potential degradation products at DSS SWMU 159.

III.3 Rate of Contaminant Migration

The Building 935 waste-water drain system was deactivated in 1989. The septic system was deactivated in 1991. The migration rate of COCs that may have been introduced into the subsurface via the waste-water drain systems at this site was therefore dependent upon the volume of aqueous effluent discharged to the environment from these systems when they were operational. Any migration of COCs from this site after use of the systems were discontinued has been predominantly dependent upon precipitation. However, it is highly unlikely that sufficient precipitation has fallen on the site to reach the depth at which COCs may have been discharged to the subsurface from this system. Analytical data generated from the soil sampling conducted at the site are adequate to characterize the rate of COC migration at DSS SWMU 159.

III.4 Extent of Contamination

Subsurface soil samples were collected along the waste-water drain line piping system, from boreholes drilled at seven locations beneath the effluent release points, and in areas (drain lines, septic tank, seepage pit, drywell) at the site to assess whether releases of effluent from the drain systems caused any environmental contamination.

The DSS SWMU 159 soil samples were collected at sampling depths at which effluent discharged from the drain lines, seepage pit, drywell, and waste-water piping system would have entered the subsurface environment at the site. This sampling procedure was required by NMED regulators, and similar sampling 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.

IV. Comparison of COCs to Background Screening Levels

Site history and characterization activities are used to identify potential COCs. The DSS SWMU 159 RSI response 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 compounds and all 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 4 and 5.

By agreement with the NMED, two metals samples analyzed by the on-site laboratory are not included in the risk assessment due to high method detection limits (MDLs) (Pavletich May 2003). The justification being that sufficient data was collected to adequately characterize the site, and the risk assessment would not be negatively impacted by exclusion of these samples.

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 evaluated include inorganic and organic compounds.

Tables 4 and 5 list the nonradiological COCs for the human health and ecological risk assessments at DSS SWMU 159, respectively. Table 6 lists the radiological COCs for the human health risk assessment. Because all samples that contained radiological COCs were at a depth of greater than 5 feet bgs, no ecological risk is evaluated for these COCs. All tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997). Section VI.4 discusses the results presented in Tables 4 and 6; Sections VII.2 and VII.3 discuss Table 5.

Table 4
Nonradiological COCs for Human Health Risk Assessment at DSS SWMU 159 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^{c}						
Antimony	6^{d}	3.9	**No**	16,000^{e}	–	**Yes**
Arsenic	4.7	4.4	**No**	44^{f}	–	**Yes**
Barium	524	200	**No**	170^{g}	–	**Yes**
Beryllium	0.86	0.80	**No**	19^{f}	–	No
Cadmium	1.3^{d}	0.9	**No**	64^{f}	–	**Yes**
Chromium, total	58.4	12.8	**No**	16^{f}	–	No
Chromium VI	0.027^{d}	NC	**Unknown**	16^{f}	–	No
Cobalt	9.8	7.1	**No**	10,000^{h}	–	**Yes**
Copper	17.3	17	**No**	6^{f}	–	No
Cyanide	0.0455^{d}	NC	**Unknown**	NC	–	**Unknown**
Lead	239	11.2	**No**	49^{f}	–	**Yes**
Manganese	592	831^{i}	Yes	100,000^{h}	–	**Yes**
Mercury	0.19	<0.1	**Unknown**	5,500^{f}	–	**Yes**
Nickel	17.4	25.4	Yes	47^{f}	–	**Yes**
Selenium	0.5^{d}	<1	**Unknown**	800^{e}	–	**Yes**
Silver	1^{d}	<1	**Unknown**	0.5^{f}	–	No
Thallium	1^{d}	<1.1	**Unknown**	119^{f}	–	**Yes**
Uranium	2.6	2.3	**No**	20^{g}	–	No
Vanadium	41.5	33	**No**	3,000^{g}	–	**Yes**
Zinc	66.2	76	Yes	47^{f}	–	**Yes**
Organic						
Acetone	0.048	NA	**NA**	0.69^{j}	-0.24^{j}	No
Benzo(k)fluoranthene	0.039 J	NA	**NA**	93,325^{k}	6.84^{k}	**Yes**

Refer to footnotes at end of table.

Table 4 (Concluded)
Nonradiological COCs for Human Health Risk Assessment at DSS SWMU 159 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)
2-Butanone	0.017 J	NA	**NA**	1[j]	0.29[j]	No
bis(2-Ethylhexyl) phthalate	1.3	NA	**NA**	851[l]	7.6[k]	**Yes**
Fluoranthene	0.14 J	NA	**NA**	12,302[k]	4.90[k]	**Yes**
Methylene chloride	0.0057	NA	**NA**	5[j]	1.25[j]	No
Pyrene	0.11 J	NA	**NA**	36,300[f]	5.32[k]	**Yes**
Toluene	0.003 J	NA	**NA**	10.7[f]	2.69[f]	No

Note: **Bold** indicates the COCs that exceed the background screening values and/or are bioaccumulators.

[a] Dinwiddie September 1997, North Area Supergroup.

[b] NMED March 1998.

[c] In agreement with the NMED, two metals samples evaluated by the on-site laboratory were not included in the risk assessment due to high MDLs.

[d] Concentration is one-half the maximum MDL.

[e] Callahan et al. 1979.

[f] Yanicak March 1997.

[g] Neumann 1976.

[h] Vanderploeg, et al. 1975.

[i] USGS 1994.

[j] Howard 1990.

[k] Micromedex 1998.

[l] Howard 1989.

BCF = Bioconcentration factor.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
J = Estimated concentration.
K_{ow} = Octanol-water partition coefficient.
Log = Logarithm (base 10).
MDL = Method detection limit.
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.
USGS = U.S. Geological Survey.
– = Information not available.

Table 5
Nonradiological COCs for Ecological Risk Assessment at DSS SWMU 159 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						
Antimony	0.55[c]	3.9	Yes	16,000[d]	–	**Yes**
Arsenic	4.7	4.4	**No**	44[e]	–	**Yes**
Barium	128	200	Yes	170[f]	–	**Yes**
Beryllium	0.61	0.80	Yes	19[e]	–	No
Cadmium	1.3[c]	0.9	**No**	64[e]	–	**Yes**
Chromium, total	10.2	12.8	Yes	16[e]	–	No
Lead	239	11.2	**No**	49[e]	–	**Yes**
Mercury	0.019	<0.1	**Unknown**	5,500[e]	–	**Yes**
Nickel	10.2	25.4	Yes	47[e]	–	**Yes**
Selenium	0.29[c]	<1	**Unknown**	800[d]	–	**Yes**
Silver	0.55[c]	<1	**Unknown**	0.5[e]	–	No
Thallium	0.82 J	<1.1	**Unknown**	119[e]	–	**Yes**
Vanadium	30.7	33	Yes	3,000[f]	–	**Yes**

Note: **Bold** *indicates the* COCs that exceed the background screening values and/or are bioaccumulators.

[a] Dinwiddie September 1997, North Area Supergroup.

[b] NMED March 1998.

[c] Parameter was not detected. Concentration is one-half of the maximum MDL.

[d] Callahan et al. 1979.

[e] Yanicak March 1997.

[f] Neumann 1976.

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).
MDL = Method detection limit.
mg/kg = Milligram(s) per kilogram.
NMED = New Mexico Environment Department.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.
– = Information not available.

Table 6
Radiological COCs for Human Health Risk Assessment at DSS SWMU 159 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)
Cs-137	ND (0.061)	0.084	Yes	3,000[d]	**Yes**
H-3	**0.055**	0.021[e]	**No**	NA	No
Th-232	1.37	1.54	Yes	3,000[f]	**Yes**
U-235	**ND (0.359)**	0.18	**No**	900[f]	**Yes**
U-238	**1.96**	1.3	**No**	900[f]	**Yes**

Note: **Bold** indicates COCs that exceed 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, North Supergroup.

[c] NMED March 1998.

[d] Whicker and Schultz 1982.

[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.

[f] Baker and Soldat 1992.

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.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

V. Fate and Transport

The primary releases of COCs at DSS SWMU 159 were to the subsurface soil resulting from the discharge of waste water from the Building 935 drain systems. 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 are considered to be of potential significance as transport mechanisms at this site. Because the septic system is no longer active, additional infiltration of water is not expected. Infiltration of precipitation is essentially nonexistent at DSS SWMU 159, as virtually all of the moisture either drains away from the site or evaporates. Because the regional aquifer at this site is approximately 545 feet bgs, the potential for COCs to reach groundwater through the unsaturated zone above the water table is extremely low.

The COCs at DSS SWMU 159 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, 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 159 include both VOCs and SVOCs. Organic COCs may be degraded through photolysis, hydrolysis, and biotransformation. Photolysis requires light and therefore takes place in the air, at the ground surface, or in surface water. Hydrolysis includes chemical transformations in water and may occur in the soil solution. Biotransformation (i.e., transformation caused by plants, animals, and microorganisms) may occur; however, biological activity may be limited by the arid environment at this site. Because of the depth of the COCs in the soil, the loss of VOCs through volatilization is expected to be minimal.

Table 7 summarizes the fate and transport processes that can occur at DSS SWMU 159. The COCs at this site include both radiological and nonradiological inorganic analytes as well as organic analytes. Wind, surface water, and biota are considered to be of low significance as potential transport mechanisms at this site. Significant leaching into the subsurface soil is unlikely, and leaching into the regional 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 the long half-lives.

Table 7
Summary of Fate and Transport at DSS SWMU 159

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

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

VI. Human Health Risk Assessment

VI.1 Introduction

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

Step 1.	Site data are described that provide information on the potential COCs, as well as the relevant physical characteristics and properties of the site.
Step 2.	Potential pathways are identified by which a representative population might be exposed to the COCs.
Step 3.	The potential intake of these COCs by the representative population is calculated using a tiered approach. The first component of the tiered approach is a screening procedure that compares the maximum concentration of the COC to an SNL/NM maximum background screening value. COCs that are not eliminated during the first screening procedure are carried forward in the risk assessment process.
Step 4.	Toxicological parameters are identified and referenced for COCs that were not eliminated during the screening procedure.
Step 5.	Potential toxicity effects (specified as a hazard index [HI]) and estimated excess cancer risks are calculated for nonradiological COCs and background. For radiological COCs, the incremental total effective dose equivalent (TEDE) and incremental estimated cancer risk are calculated by subtracting applicable background concentrations directly from maximum on-site contaminant values. This background subtraction applies only when a radiological COC occurs as contamination and exists as a natural background radionuclide.
Step 6.	These values are compared with guidelines established by the U.S. Environmental Protection Agency (EPA), NMED, and the DOE to determine whether further evaluation and potential site cleanup are required. Nonradiological COC risk values also are compared to background risk so that an incremental risk can be calculated.
Step 7.	Uncertainties of the above steps are addressed.

VI.2 Step 1. Site Data

Section I of this risk assessment provides the site description and history for DSS SWMU 159. Section II presents a comparison of results to DQOs. Section III discusses the nature, rate, and extent of contamination.

By agreement with the NMED, two metals samples analyzed by the on-site laboratory are not included in the risk assessment due to high MDLs (Pavletich May 2003). The justification being that sufficient data was collected to adequately characterize the site, and the risk assessment would not be negatively impacted by exclusion of these samples.

VI.3 Step 2. Pathway Identification

DSS SWMU 159 has been designated with a future land-use scenario of industrial (DOE et al. September 1995) (see Appendix 1 for default exposure pathways and parameters). However, the residential land-use scenario is also considered in the pathway analysis. Because of the location and characteristics of the potential contaminants, the primary pathway for human exposure is considered to be soil ingestion for the nonradiological COCs and direct gamma exposure for the radiological COCs. The inhalation pathway for both nonradiological and radiological COCs is included because the potential exists to inhale dust. Soil ingestion is included for the radiological COCs as well. The dermal pathway is included for the nonradiological COCs because of the potential for the receptor to be exposed to contaminated soil. No water pathways to the groundwater are considered; depth to the regional aquifer at DSS SWMU 159 is approximately 545 feet bgs. No intake routes through plant, meat, or milk ingestion are considered appropriate for either the industrial or residential land-use scenarios. Figure 1 shows the conceptual model flow diagram for DSS SWMU 159.

Pathway Identification

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

VI.4 Step 3. Background Screening Procedure

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

VI.4.1 Methodology

Maximum concentrations of nonradiological COCs are compared to the approved SNL/NM maximum screening levels for this area. The SNL/NM maximum background concentration was selected to provide the background screen in Table 4 and used to calculate risk attributable to background in Section VI.6.2. Only the COCs that were detected above the corresponding SNL/NM maximum background screening levels or did not have either a quantifiable or calculated background screening level are considered in further risk assessment analyses.

For the radiological COCs that exceed the SNL/NM background screening levels, background values are 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 minimum detectable activity (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.

VI.4.2 Results

Tables 4 and 6 show the DSS SWMU 159 maximum COC concentrations that were compared to the SNL/NM maximum background values (Dinwiddie September 1997) for the human health risk assessment. For the nonradiological COCs, 11 constituents were measured at concentrations greater than the background screening values. Six constituents do not have quantified background screening concentrations; therefore, it is unknown whether these COCs exceed background values. Eight nonradiological COCs are organic compounds that do not have corresponding background screening values.

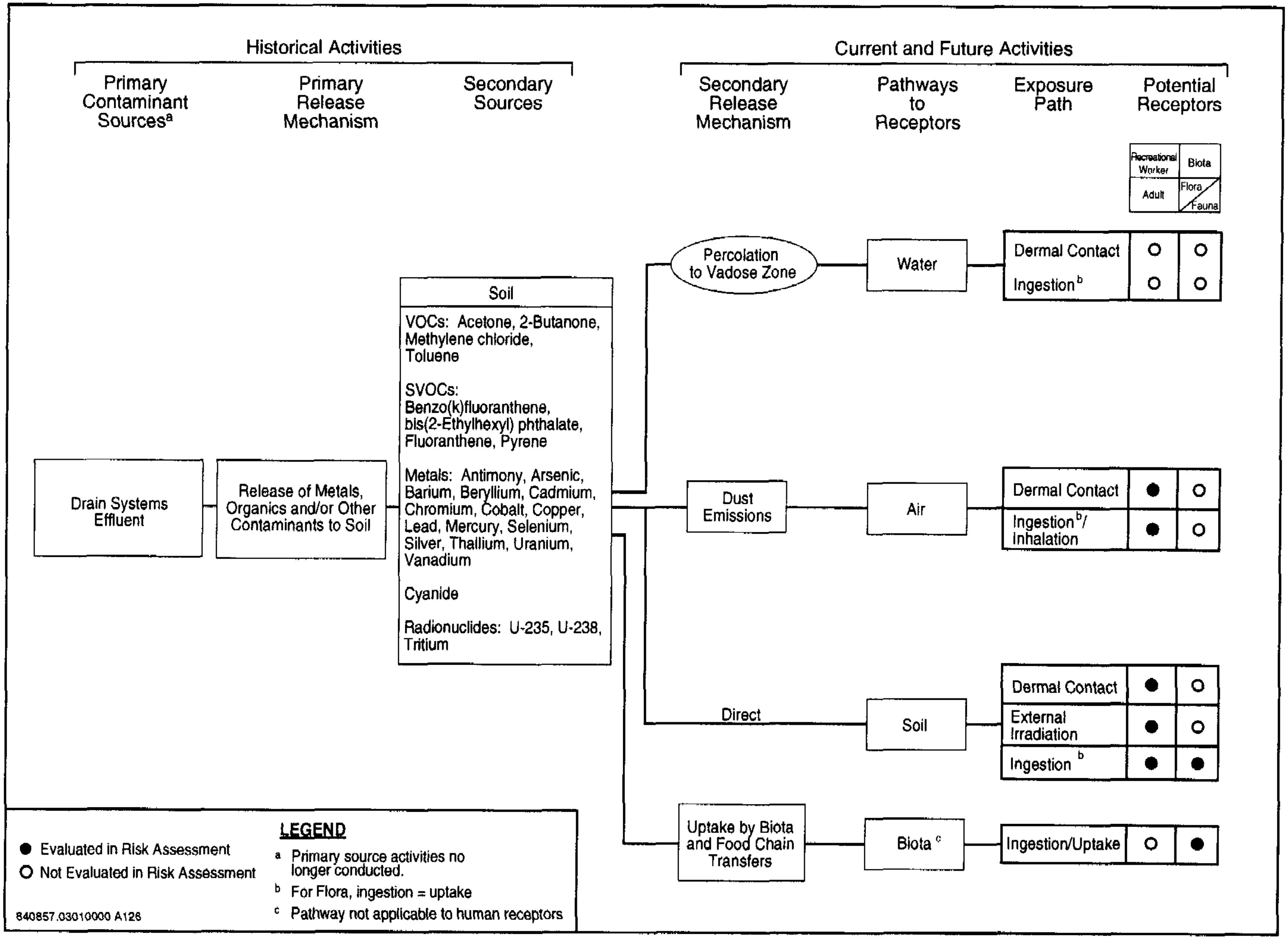

Figure 1

Conceptual Site Model Flow Diagram for DSS SWMU 159, Building 935 Drain Systems

The maximum concentration value for lead is 239 mg/kg. The EPA intentionally does not provide any human health toxicological data on lead; therefore, no risk parameter values could be calculated. However, the NMED guidance for lead screening concentrations for construction and industrial land-use scenarios are 750 and 1,500 mg/kg, respectively (Olson and Moats March 2000). The EPA screening guidance value for a residential land-use scenario is 400 mg/kg (Laws July 1994). The maximum concentration value for lead at this site is less than all the screening values; therefore, lead is eliminated from further consideration in the human health risk assessment.

For the radiological COCs, three constituents (H-3, U-235, and U-238) had detections or 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.

VI.5 Step 4. Identification of Toxicological Parameters

Tables 8 (nonradiological) and 9 (radiological) list the COCs retained in the risk assessment and provide the values for the available toxicological information. The toxicological values for the nonradiological COCs presented in Table 8 were obtained from the Integrated Risk Information System (IRIS) (EPA 2003), the Health Effects Assessment Summary Tables (HEAST) (EPA 1997a), the Technical Background Document for Development of Soil Screening Levels (NMED December 2000), Risk Assessment Information System (ORNL 2003), and the EPA Regions 6 and 9 electronic databases (EPA 2002a, EPA 2002b). 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).

VI.6 Step 5. Exposure Assessment and Risk Characterization

Section VI.6.1 describes the exposure assessment for this risk assessment. Section VI.6.2 provides the risk characterization, including the HI and excess cancer risk for both the potential nonradiological COCs and associated background for industrial and residential land uses. The incremental TEDE and incremental estimated cancer risk are provided for the background-adjusted radiological COCs for both industrial and residential land-use scenarios.

Table 8
Toxicological Parameter Values for DSS SWMU 159 Nonradiological COCs

COC	RfD$_o$ (mg/kg-d)	Confidence[a]	RfD$_{inh}$ (mg/kg-d)	Confidence[a]	SF$_o$ $(mg/kg-d)^{-1}$	SF$_{inh}$ $(mg/kg-d)^{-1}$	Cancer Class[b]	ABS
Inorganic								
Antimony	4E-4[c]	L	–	–	–	–	–	0.01[d]
Arsenic	3E-4[c]	M	–	–	1.5E+0[c]	1.5E+1[c]	A	0.03[d]
Barium	7E-2[c]	M	1.4E-4[e]	–	–	–	D	0.01[d]
Beryllium	2E-3[c]	L to M	5.7E-6[c]	M	–	8.4E+0[c]	B1	0.01[d]
Cadmium	5E-4[c]	H	5.7E-5[f]	–	–	6.3E+0[c]	B1	0.001[d]
Chromium, total	1.5E+0[c]	L	–	–	–	–	D	0.01[d]
Chromium VI	3E-3[c]	L	2.3E-6[c]	L	–	4.2E+1[c]	A	0.01[d]
Cobalt	2E-2[g]	–	5.7E-6[g]	–	–	9.8E+0[f]	–	0.01[d]
Copper	3.7E-2[f]	–	–	–	–	–	D	0.01[d]
Cyanide	2E-2[c]	M	–	–	–	–	D	0.1[d]
Mercury	3E-4[e]	–	8.6E-5[c]	M	–	–	D	0.01[d]
Selenium	5E-3[c]	H	–	–	–	–	D	0.01[d]
Silver	5E-3[c]	L	–	–	–	–	D	0.01[d]
Thallium	6.6E-5[g]	–	–	–	–	–	–	0.01[d]
Uranium	3E-3[c]	M	–	–	–	–	–	0.01[h]
Vanadium	7E-3[e]	–	–	–	–	–	–	0.01[d]
Organic								
Acetone	1E-1[c]	L	1E-1[f]	–	–	–	D	0.01[h]
Benzo(k)fluoranthene	–	–	–	–	7.3E-2[f]	3.1E-2[f]	B2	0.13[d]
2-Butanone	6E-1[c]	L	2.9E-1[c]	L	–	–	D	0.1[d]
bis(2-Ethylhexyl) phthalate	2E-2[f]	–	2E-2[f]	–	1.4E-2[f]	1.4E-2[f]	–	0.01[h]
Fluoranthene	4E-2[c]	L	4E-2[f]	–	–	–	D	0.13[d]
Methylene chloride	6E-2[c]	M	8.6E-1[e]	–	7.5E-3[c]	1.6E-3[c]	B2	0.1[d]
Pyrene	3E-2[c]	L	3E-2[f]	–	–	–	D	0.1[d]
Toluene	2E-1[c]	M	1.1E-1[c]	M	–	–	D	0.1[d]

Refer to footnotes at end of table.

Table 8 (Concluded)
Toxicological Parameter Values for DSS SWMU 159 Nonradiological COCs

[a] Confidence associated with IRIS (EPA 2003) database values. Confidence: L = low, M = medium, H = high.

[b] EPA weight-of-evidence classification system for carcinogenicity (EPA 1989) taken from IRIS (EPA 2003):
A = Human carcinogen.
B1 = Probable human carcinogen. Limited human data are available.
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 2003).

[d] Toxicological parameter values from NMED (December 2000).

[e] Toxicological parameter values from HEAST (EPA 1997a).

[f] Toxicological parameter values from EPA Region 6 electronic database (EPA 2002a).

[g] Toxicological parameter values from EPA Region 9 electronic database (EPA 2002b).

[h] Toxicological parameter values from ORNL (2003).

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.
ORNL = Oak Ridge National Laboratory.
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 9
Radiological Toxicological Parameter Values for DSS SWMU 159 COCs Obtained from RESRAD Risk Coefficients[a]

COC	SF_o (1/pCi)	SF_{inh} (1/pCi)	SF_{ev} (g/pCi-yr)	Cancer Class[b]
H-3	7.20E-14	9.60E-14	0.0	A
U-235	4.70E-11	1.30E-08	2.70E-07	A
U-238	6.20E-11	1.20E-08	6.60E-08	A

[a] Yu et al. 1993a.

[b] EPA weight-of-evidence classification system for carcinogenicity (EPA 1989): A = Human carcinogen for high dose and high dose rate (i.e., greater than 50 rem per year). For low-level environmental exposures, the carcinogenic effect has not been observed and documented.

1/pCi = One per picocurie.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
g/pCi-yr = Gram(s) per picocurie-year.
SF_{ev} = External volume exposure slope factor.
SF_{inh} = Inhalation slope factor.
SF_o = Oral (ingestion) slope factor.
SWMU = Solid Waste Management Unit.

VI.6.1 Exposure Assessment

Appendix 1 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 appendix shows parameters for both industrial and residential land-use scenarios. The equations for nonradiological COCs are based upon the Risk Assessment Guidance for Superfund (RAGS) (EPA 1989). Parameters are based upon information from the RAGS (EPA 1989), the Technical Background Document for Development of Soil Screening Levels (NMED December 2000), as well as other EPA and NMED guidance documents. The 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 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.

VI.6.2 Risk Characterization

Table 10 shows an HI of 0.07 for the DSS SWMU 159 nonradiological COCs and an estimated excess cancer risk of 3E-6 for the designated industrial land-use scenario. The numbers presented include exposure from soil ingestion, dermal contact, and dust and volatile inhalation for nonradiological COCs. Table 11 shows an HI of 0.04 and an estimated excess cancer risk

Table 10
Risk Assessment Values for DSS SWMU 159 Nonradiological COCs

COC	Maximum Concentration (mg/kg)	Industrial Land-Use Scenario[a]		Residential Land-Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Inorganic					
Antimony	6[b]	0.02	–	0.20	–
Arsenic	4.7	0.02	3E-6	0.21	1E-5
Barium	524	0.01	–	0.10	–
Beryllium	0.86	0.00	4E-10	0.01	8E-10
Cadmium	1.3[b]	0.00	4E-10	0.03	9E-10
Chromium, total	58.4	0.00	–	0.00	–
Chromium VI	0.027[b]	0.00	6E-11	0.00	1E-10
Cobalt	9.8	0.00	5E-9	0.01	1E-8
Copper	17.3	0.00	–	0.01	–
Cyanide	0.0455[b]	0.00	–	0.00	–
Mercury	0.19	0.00	–	0.01	–
Selenium	0.5[b]	0.00	–	0.00	–
Silver	1[b]	0.00	–	0.00	–
Thallium	1[b]	0.02	–	0.20	–
Uranium	2.6	0.00	–	0.01	–
Vanadium	41.5	0.01	–	0.08	–
Organic					
Acetone	0.048	0.00	–	0.00	–
Benzo(k)fluoranthene	0.039 J	0.00	2E-9	0.00	6E-9
2-Butanone	0.017 J	0.00	–	0.00	–
bis(2-Ethylhexyl) phthalate	1.3	0.00	7E-9	0.00	3E-8
Fluoranthene	0.14 J	0.00	–	0.00	–
Methylene chloride	0.0057	0.00	4E-7	0.00	8E-7
Pyrene	0.11 J	0.00	–	0.00	–
Toluene	0.003 J	0.00	–	0.00	–
Total		**0.07**	**3E-6**	**0.87**	**1E-5**

[a] EPA 1989.

[b] Maximum concentration is one-half of the maximum method detection limit.

COC = Constituent of concern.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
– = Information not available.

Table 11
Risk Assessment Values for DSS SWMU 159 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
Antimony	3.9	0.01	–	0.13	–
Arsenic	4.4	0.02	3E-6	0.20	1E-5
Barium	200	0.00	–	0.04	–
Beryllium	0.80	0.00	3E-10	0.01	7E-10
Cadmium	0.9	0.00	2E-10	0.02	6E-10
Chromium, total	12.8	0.00	–	0.00	–
Chromium VI	NQ	–	–	–	–
Cobalt	8.8	0.00	4E-9	0.01	9E-9
Copper	17	0.00	–	0.01	–
Cyanide	NQ	–	–	–	–
Mercury	<0.1	–	–	–	–
Selenium	<1	–	–	–	–
Silver	<1	–	–	–	–
Thallium	<1.1	–	–	–	–
Uranium	2.3	0.00	–	0.01	–
Vanadium	33	0.00	–	0.06	–
Total		**0.04**	**3E-6**	**0.49**	**1E-5**

[a] Dinwiddie September 1997, North Area Supergroup.
[b] EPA 1989.
COC = Constituent of concern.
DSS = Drain and Septic Systems.
EPA = U.S. Environmental Protection Agency.
mg/kg = Milligram(s) per kilogram.
NQ = Nonquantified background.
SWMU = Solid Waste Management Unit.
– = Information not available.

of 3E-6 for the DSS SWMU 159 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 was calculated that results in an incremental TEDE of 4.2E-2 millirem (mrem)/year (yr). In accordance with EPA guidance found in Office of Solid Waste and Emergency Response (OSWER) Directive No. 9200.4-18 (EPA 1997b), an incremental TEDE of 15 mrem/yr is used for the probable land-use scenario (industrial in this case); the calculated dose value for DSS SWMU 159 for the industrial land use is well below this guideline. The estimated excess cancer risk is 4.6E-7.

For the nonradiological COCs under the residential land-use scenario, the HI is 0.87 and the estimated excess cancer risk is 1E-5 (Table 10). The numbers in the table include exposure from soil ingestion, dermal contact, and dust and volatile inhalation. Although the EPA (1991) generally recommends that inhalation not be included in a residential land-use scenario, this pathway is included because of the potential for soil in Albuquerque, New Mexico, to be eroded and for dust to be present in predominantly residential areas. Because of the nature of the local soil, other exposure pathways are not considered (see Appendix 1). Table 11 shows that for the DSS SWMU 159 associated background constituents, the HI is 0.49 with an estimated excess cancer risk of 1E-5.

For the radiological COCs, the incremental TEDE for the residential land-use scenario is 1.1E-1 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 159 for the residential land-use scenario is well below this guideline. Consequently, DSS SWMU 159 is eligible for unrestricted radiological release as the residential land-use scenario results in an incremental TEDE of less than 75 mrem/yr to the on-site receptor. The estimated excess cancer risk is 1.4E-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 VI.9, "Summary."

VI.7 Step 6. Comparison of Risk Values to Numerical Guidelines

The human health risk assessment analysis evaluates 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 0.07 (less than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). The excess cancer risk is estimated at 3E-6. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001); thus the excess cancer risk for this site is below the suggested acceptable risk value. This assessment also determines risks considering background concentrations of the potential nonradiological COCs for both the industrial and residential land-use scenarios. Assuming the industrial land-use scenario, for the nonradiological background COCs the HI is 0.04 and the estimated excess cancer risk is 3E-6. The incremental risk is determined by subtracting risk associated with background from potential COC risk. These numbers are not rounded before the difference is determined and, therefore, may appear to be inconsistent with numbers presented in tables and within the text. For conservatism, the background constituents that do not have quantified background screening concentrations are assumed to have a hazard quotient (HQ) of 0.00. The incremental HI is 0.03 and the estimated incremental cancer risk is 5.05E-7 for the industrial land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs considering an industrial land-use scenario.

For the radiological COCs under the industrial land-use scenario, the incremental TEDE is 4.2E-2 mrem/yr, which is significantly lower than EPA's numerical guideline of 15 mrem/yr. The incremental estimated excess cancer risk is 4.6E-7.

The calculated HI for the nonradiological COC under the residential land-use scenario is 0.87, which is below the numerical guidance. The excess cancer risk is estimated to be 1E-5. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi

January 2001); thus the excess cancer risk for this site is at the suggested acceptable risk value. The HI for associated background for the residential land-use scenario is 0.49; the estimated excess cancer risk is 1E-5. The incremental HI is 0.38 and the estimated incremental cancer risk is 1.34E-6 for the residential land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs considering a residential land-use scenario.

The incremental TEDE for a residential land-use scenario from the radiological components is 1.1E-1 mrem/yr, which is significantly lower than the numerical guideline of 75 mrem/yr suggested in the SNL/NM "RESRAD Input Parameter Assumptions and Justification" (SNL/NM February 1998). The estimated excess cancer risk is 1.4E-6.

VI.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at DSS SWMU 159 is based upon an initial conceptual model that was validated with sampling conducted at the site. The sampling was implemented in accordance with the RFI Workplan (SNL/NM 1997), the SAP (SNL/NM October 1999), and negotiations with the NMED-HWB. The DQOs contained in these two documents are appropriate for use in risk assessments. The data from soil samples collected at effluent release points are representative of potential COC releases at 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 DSS SWMU 159.

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 8 shows the uncertainties (confidence levels) in nonradiological toxicological parameter values. There is a mixture of estimated values and values from the IRIS (EPA 2003), HEAST (EPA 1997a), and the Technical Background Document for Development of Soil Screening Levels (NMED December 2000). Where values are not provided, information is not available from the HEAST (EPA 1997a), IRIS (EPA 2003), Technical Background Document for Development of Soil Screening Levels (NMED December 2000), the Risk Assessment Information System (ORNL 2003), or the EPA regions (EPA 2002a, EPA 2002b, EPA 2002c). Because of the conservative nature of the RME approach, uncertainties in toxicological values are not expected to change the conclusion from the risk assessment analysis.

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

The HI for the nonradiological COCs is within the acceptable range for human health under the residential land-use scenario compared to established numerical guidance. Although the estimated excess cancer risk is at the NMED guideline for the residential land-use scenario, maximum concentrations were used in the risk calculation. Because the site has been adequately characterized, average concentrations are more representative of actual site conditions. The 95% upper confidence limit (UCL) of the average concentrations for arsenic, the main contributor to excess cancer risk (2.83 mg/kg) (Appendix 2), is below background (3.0 mg/kg); therefore, arsenic is eliminated from the risk calculation. With the removal of arsenic, the total estimated excess cancer risk is reduced to 8E-7 and the incremental excess cancer risk is reduced to 8.37E-7. Thus, by using realistic concentrations in the risk calculations that more accurately depict actual site conditions, the total and incremental estimated excess cancer risk are below NMED guidelines.

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

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

VI.9 Summary

DSS SWMU 159 contains identified COCs consisting of some inorganic, organic, 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 nonradiological COCs show that for the industrial land-use scenario the HI (0.07) is significantly lower than the accepted numerical guidance from the EPA. The estimated excess cancer risk is 3E-6. Thus, excess cancer risk is also below the acceptable risk value provided by the NMED for an industrial land-use scenario (Bearzi January 2001). The incremental HI is 0.03 and the incremental excess cancer risk is 5.05E-7 for the industrial land-use scenario. The incremental risk calculations indicate insignificant risk to human health for the industrial land-use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for nonradiological COCs show that for the residential land-use scenario the HI (0.87) is below the accepted numerical guidance from the EPA. The estimated excess cancer risk is 1E-5. Thus, excess cancer risk is at the acceptable risk value provided by the NMED for a residential land-use scenario (Bearzi January 2001). The incremental HI is 0.38 and the incremental excess cancer risk is 1.34E-6 for the residential land-use scenario. The incremental risk calculations indicate insignificant risk to human health considering the residential land-use scenario.

The HI for the nonradiological COCs is within the acceptable range for human health under the residential land-use scenario compared to established numerical guidance. Although the estimated excess cancer risk is at the NMED guideline for the residential land-use scenario, maximum concentrations were used in the risk calculation. Because the site has been adequately characterized, average concentrations are more representative of actual site conditions. The 95% UCL of the average concentrations for arsenic, the main contributor to excess cancer risk (2.83 mg/kg) (Appendix 2), is below background (3.0 mg/kg); therefore, arsenic is eliminated from the risk calculation. With the removal of arsenic, the total estimated excess cancer risk is reduced to 8E-7 and the incremental excess cancer risk is reduced to 8.37E-7. Thus, by using realistic concentrations in the risk calculations that more accurately depict actual site conditions, the total and incremental estimated excess cancer risk are below NMED guidelines.

The incremental TEDE and corresponding estimated cancer risk from the radiological COCs are much lower than EPA guidance values. The estimated TEDE is 4.2E-2 mrem/yr for the industrial land-use scenario, which is much lower than the EPA's numerical guidance of 15 mrem/yr (EPA 1997b). The corresponding incremental estimated cancer risk value is 4.6E-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 1.1E-1 mrem/yr with an associated risk of 1.4E-6. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, DSS SWMU 159 is eligible for unrestricted radiological release.

The summation of the incremental nonradiological and radiological carcinogenic risks is tabulated in Table 12.

Table 12
Summation of Incremental Radiological and Nonradiological Risks from DSS SWMU 159

Scenario	Nonradiological Risk	Radiological Risk	Total Risk
Industrial	5.05E-7	4.6E-7	9.7E-7
Residential	8.37E-7	1.4E-6	2.2E-6

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

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

VII. Ecological Risk Assessment

VII.1 Introduction

This section addresses the ecological risks associated with exposure to constituents of potential ecological concern (COPECs) in the soil at DSS SWMU 159. A component of the NMED Risk-Based Decision Tree (NMED March 1998) is to conduct an ecological assessment that corresponds with that presented in EPA's Ecological RAGS (EPA 1997c). The current methodology is tiered and contains an initial scoping assessment followed by a more detailed risk assessment. Initial components of NMED's decision tree (a discussion of DQOs, data assessment, and evaluations of bioaccumulation as well as fate and transport potential) are addressed in previous sections of this report. Following the completion of the scoping assessment, a determination is made as to whether a more detailed examination of potential ecological risk is necessary. If deemed necessary, the scoping assessment proceeds to a risk assessment whereby a more quantitative estimate of ecological risk is conducted. Although this assessment incorporates conservatisms in the estimation of ecological risks, ecological relevance and professional judgment are also used as recommended by the EPA (1998) to ensure that predicted exposures of selected ecological receptors reflect those reasonably expected to occur at the site.

VII.2 Scoping Assessment

The scoping assessment focuses primarily on the likelihood of exposure of biota at, or adjacent to, the site to constituents associated with site activities. Included in this section are an evaluation of existing data and a comparison of maximum detected concentrations to background concentrations, examination of bioaccumulation potential, and fate and transport potential. A scoping risk-management decision (Section VII.2.4) summarizes the scoping results and assesses the need for further examination of potential ecological impacts.

VII.2.1 Data Assessment

As indicated in Section IV (Table 5), inorganic constituents in soil within the 0- to 5-foot depth interval that exceed background concentrations or that do not have a quantified background screening level include the following:

- Arsenic
- Cadmium
- Lead
- Mercury
- Selenium
- Silver
- Thallium

No samples for organic analysis were collected in the 0- to 5-foot depth interval of the soil at this site.

VII.2.2 Bioaccumulation

Among the COPECs listed in Section VII.2.1, the following are considered to have bioaccumulation potential in aquatic environments (Section IV, Table 5):

- Arsenic
- Cadmium
- Lead
- Mercury
- Selenium
- Thallium

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.

VII.2.3 Fate and Transport Potential

The potential for the COPECs to migrate from the source of contamination to other media or biota is discussed in Section V. As noted in Table 7 (Section V), wind is expected to be of low significance as a transport mechanism for COPECs at this site, and surface-water runoff is potentially of low significance. Migration to groundwater is not anticipated. Food chain uptake is expected to be of low significance. Degradation (decay) and transformation for the inorganic COPECs and radionuclides are expected to be of low significance.

VII.2.4 Scoping Risk-Management Decision

Based upon information gathered through the scoping assessment, it was concluded that complete ecological pathways may be associated with DSS SWMU 159 and that COPECs also exist at the site. As a consequence, a risk assessment is deemed necessary to predict the potential level of ecological risk associated with the site.

VII.3 Risk Assessment

As concluded in Section VII.2.4, both complete ecological pathways and COPECs are associated with DSS SWMU 159. The 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 ecological risk assessment.

VII.3.1 Problem Formulation

Problem formulation is the initial stage of the ecological 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 a risk assessment) are presented in "Predictive Ecological Risk Assessment Methodology, Environmental Restoration Program, Sandia National Laboratories, New Mexico" (IT July 1998) and are not duplicated here.

VII.3.1.1 Ecological Pathways and Setting

DSS SWMU 159 is approximately 0.03 of an acre in size. The site is located in an area dominated by grassland habitat, unpaved, and open to use by wildlife. No threatened or endangered species are known to occur at this site (IT February 1995), and no surface-water bodies, seeps, or springs are associated with the site.

Complete ecological pathways may exist at this site through the exposure of plants and wildlife to COPECs in surface 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. Because of the lack of surface water at this site, exposure to COPECs through the ingestion of surface water is considered insignificant. Inhalation and dermal contact also are considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Groundwater is not expected to be affected by COCs at this site.

VII.3.1.2 COPECs

The Building 935 drain systems were the primary source of COPECs at DSS SWMU 159. COPECs identified for DSS SWMU 159 are limited to the nonradiological inorganic analytes listed in Section VII.2.1. These were screened against background concentrations and those that exceed the approved SNL/NM background screening levels (Dinwiddie September 1997) for the area or that do not have a quantified background screening value are considered to be 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. Table 5 presents the maximum concentrations for the COPECs.

VII.3.1.3 Ecological Receptors

A nonspecific perennial plant has been 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).

VII.3.2 Exposure Estimation

Direct uptake of COPECs 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 also is 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 13 presents the species-specific factors used in modeling exposures in the wildlife receptors. Justification for use of the factors presented in this table is described in the ecological risk assessment methodology document (IT July 1998).

Although home range is also included in this table, exposures for this risk assessment 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 surface soil samples are used to conservatively estimate potential exposures and risks to plants and wildlife at this site.

Table 14 presents the transfer factors used in modeling the concentrations of COPECs through the food chain. Table 15 presents the maximum concentrations in soil and derived concentrations in tissues of the various food chain elements that are used to model dietary exposures for each of the wildlife receptors.

VII.3.3 Ecological Effects Evaluation

Table 16 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.

Table 13
Exposure Factors for Ecological Receptors at DSS SWMU 159

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% 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.

Table 14
Transfer Factors Used in Exposure Models for COPECs at DSS SWMU 159

COPEC	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Arsenic	4.0E-2[a]	1.0E+0[b]	2.0E-3[a]
Cadmium	5.5E-1[a]	6.0E-1[c]	5.5E-4[a]
Lead	9.0E-2[d]	4.0E-2[c]	8.0E-4[d]
Mercury	1.0E+0[d]	1.0E+0[b]	2.5E-1[a]
Selenium	5.0E-1[d]	1.0E+0[b]	1.0E-1[d]
Silver	1.0E+0[d]	2.5E-1[c]	5.0E-3[d]
Thallium	4.0E-3[a]	1.0E+0[b]	4.0E-2[a]

[a] Baes et al. 1984.

[b] Default value.

[c] Stafford et al. 1991.

[d] NCRP January 1989.

COPEC = Constituent of potential ecological concern.
DSS = Drain and Septic Systems.
NCRP = National Council on Radiation Protection and Measurements.
SWMU = Solid Waste Management Unit.

Table 15
Media Concentrations[a] for COPECs at DSS SWMU 159

COPEC	Soil (maximum)[a]	Plant Foliage[b]	Soil Invertebrate[b]	Deer Mouse Tissues[c]
Arsenic	4.7E+0	1.9E-1	4.7E+0	1.6E-2
Cadmium	1.3E+0[d]	7.2E-1	7.8E-1	1.3E-3
Lead	2.4E+2	2.2E+1	9.6E+0	5.1E-2
Mercury	1.9E-2[d]	1.9E-2	1.9E-2	1.5E-2
Selenium	2.9E-1[d]	1.5E-1	2.9E-1	7.0E-2
Silver	5.5E-1[d]	1.0E+0	2.5E-1	1.0E-2
Thallium	8.2E-1[d]	3.3E-3	8.2E-1	5.4E-2

[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] Maximum concentration of parameter is one-half the detection limit.

COPEC = Constituent of potential ecological concern.
DSS = Drain and Septic Systems.
SWMU = Solid Waste Management Unit.

Table 16
Toxicity Benchmarks for Ecological Receptors at DSS SWMU 159

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]
Arsenic	10	mouse	0.126	0.133	mallard	5.14	5.14
Cadmium	3	rat[h]	1.0	1.9	mallard	1.45	1.45
Lead	50	rat	8.0	15.7	American kestrel	3.85	3.85
Mercury (organic)	0.3	rat	0.03	0.06	mallard	0.0064	0.0064
Mercury (inorganic)	0.3	mouse	13.2	14.0	Japanese quail	0.45	0.45
Selenium	1	rat	0.2	0.391	screech owl	0.44	0.44
Silver	2	rat	17.8[i]	34.8	–	–	–
Thallium	1	rat[j]	0.0074	0.015	–	–	–

[a] In mg/kg soil dry weight.
[b] Efroymson et al. 1997.
[c] Body weights (in kg) for the NOAEL conversion are as follows: lab mouse, 0.030; lab rat, 0.350, (except where noted).
[d] Sample et al. 1996, except where noted.
[e] In mg/kg body weight per day.
[f] Based upon NOAEL conversion methodology presented in Sample et al. (1996), using a deer mouse body weight of 0.0239 kg and a mammalian scaling factor of 0.25.
[g] Based upon NOAEL conversion methodology presented in Sample et al. (1996). The avian scaling factor of 0.0 was used, making the NOAEL independent of body weight.
[h] Body weight: 0.303 kg.
[i] Based upon a rat lowest-observed-adverse-effect level of 89 mg/kg/d (EPA 2003) and an uncertainty factor of 0.2.
[j] Body weight: 0.365 kg.

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

VII.3.4 Risk Characterization

Maximum concentrations in soil and estimated dietary exposures are compared to plant and wildlife benchmark values, respectively. Table 17 presents the results of these comparisons. HQs are used to quantify the comparison with benchmarks for plant and wildlife exposure.

HQs exceed unity for plants for lead and for the omnivorous and insectivorous deer mice for arsenic and thallium. No HQs exceed unity for the herbivorous deer mouse or the burrowing owl. Because of a lack of sufficient toxicity information, HQs for the burrowing owl could not be determined for silver and thallium. 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). HIs are greater than unity for plants and the omnivorous and insectivorous deer mice, with a maximum HI of 15 for the insectivorous deer mouse.

VII.3.5 Uncertainty Assessment

Many uncertainties are associated with the characterization of ecological risks at DSS SWMU 159. These uncertainties result from assumptions used in calculating risk that could overestimate or underestimate true risk presented at the site. For this risk assessment, assumptions are made that are more likely to overestimate exposures and risk rather than to underestimate them. These conservative assumptions are used to be more protective of the ecological resources potentially affected by the site. Conservatisms incorporated into this risk assessment include the use of maximum analyte concentrations measured in soil samples 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 SWMU-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).

Although the HQs for thallium exceed unity for both the omnivorous and insectivorous deer mice (4.6 and 8.9, respectively), the exposure point concentration (0.82 mg/kg) for thallium is based upon the maximum detection in 0- to 5-foot interval samples (Table 5) for this analyte. Although the potential for risk to these two receptors from exposure to thallium cannot be ruled out, the conservative estimates of that risk, based upon this exposure point concentration, are low. Therefore, it is considered unlikely that actual concentrations of thallium at this site are sufficient to pose a risk to ecological receptors.

The assumption of an area use factor of 1.0 is a source of uncertainty for the deer mice and the burrowing owl at this site. Because DSS SWMU 159 is approximately 0.03 acres in size and the home ranges of the deer mice and burrowing owl are 0.27 and 35 acres (respectively), area use factors of approximately 0.11 and 0.0009 (respectively) would be justified for these receptors. For the herbivorous deer mouse and the burrowing owl, these area use factors further support the conclusion of no risk, as is indicated by the HQs shown in Table 17. In the cases of the omnivorous and insectivorous deer mice, the area use factor (0.11) is sufficient to reduce the HQs for arsenic to 0.33 and 0.62, respectively, and those for thallium to 0.51 and 0.98. Therefore, the predictions of risk to these two dietary regimes of the deer mouse can be explained by the assumed area use factor of 1.0.

Table 17
HQs for Ecological Receptors at DSS SWMU 159

COPEC	Plant HQ[a]	Deer Mouse HQ (Herbivorous)[a]	Deer Mouse HQ (Omnivorous)[a]	Deer Mouse HQ (Insectivorous)[a]	Burrowing Owl HQ[a]
Inorganic					
Arsenic	4.7E-1	3.3E-1	**3.0E+0**	**5.6E+0**	2.4E-3
Cadmium	4.3E-1	6.1E-2	6.4E-2	6.6E-2	2.1E-3
Lead	**4.8E+0**	2.6E-1	2.0E-1	1.4E-1	1.4E-1
Mercury (organic)	6.3E-2	4.8E-2	4.8E-2	4.8E-2	2.7E-1
Mercury (inorganic)	6.3E-2	2.2E-4	2.2E-4	2.2E-4	3.8E-3
Selenium	2.9E-1	6.0E-2	8.9E-2	1.2E-1	1.9E-2
Silver	2.8E-1	2.5E-3	1.6E-3	6.6E-4	–
Thallium	8.2E-1	2.1E-1	**4.6E+0**	**8.9E+0**	–
HI[b]	**7.4E+0**	9.7E-1	**7.9+0**	**1.5E+1**	4.3E-1

[a] **Bold** values indicate the HQ or HI exceeds unity.
[b] 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.

In the estimation of ecological risk, background concentrations are included as a component of maximum on-site concentrations. Conservatisms in the modeling of exposure and risk can result in the prediction of risk to ecological receptors when exposed at background concentrations. For example, the background screening value for arsenic (4.4 mg/kg), when used as the exposure point concentration, results in HQs for the omnivorous and insectivorous deer mice of 2.8 and 5.2. It should be noted that background exposure to arsenic, as indicated by the background screening value, accounts for as much as 94 percent of the exposure based upon the maximum concentration at this site.

Further, the use of the maximum measured concentration as the exposure point concentration will tend to overestimate the overall exposure and risk. The average concentration of arsenic in the 0- to 5-foot depth interval at this site is 3.38 mg/kg, which is less than the background screening value. For lead, the average concentration is 92.6 mg/kg, which, if used as the exposure point concentration for plants, would result in an HQ of only 1.9.

Based upon this uncertainty analysis, the potential for ecological risks at DSS SWMU 159 is expected to be low. HQs greater than unity were initially predicted; however, closer examination of the exposure assumptions reveal that these predictions probably overestimate actual risk due primarily to the use of maximum concentrations and maximum area use to estimate exposure, and the contribution of background risk.

VII.3.6 Risk Interpretation

Ecological risks associated with DSS SWMU 159 were estimated through a risk assessment that incorporates site-specific information when available. Predictions of potential risk to omnivorous and insectivorous deer mice from exposures to arsenic and thallium can be attributed to the assumption of 100-percent area use and the use of maximum detected values for arsenic and thallium as conservative estimates of exposure point concentrations. For plants, the initial prediction of risk from exposure to lead is largely based upon the use of the maximum lead concentration as the exposure concentration. It should also be noted that the extremely small size of this site (0.03 acres), coupled with the low HQ values associated with it, make the potential for significant risk to ecological populations or communities negligible. Based upon this final analysis, the potential for ecological risks associated with DSS SWMU 159 is expected to be very low.

VII.3.7 Risk Assessment Scientific/Management Decision Point

After potential ecological risks associated with the site have been assessed, a decision is made regarding whether the site should be recommended for no further action (NFA) or whether additional data should be collected to assess actual ecological risk at the site more thoroughly. With respect to this site, ecological risks are predicted to be very low. The scientific/management decision is to recommend this site for NFA.

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APPENDIX 1
EXPOSURE PATHWAY DISCUSSION FOR CHEMICAL AND RADIONUCLIDE CONTAMINATION

Introduction

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

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

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

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

- Ingestion of contaminated drinking water
- Ingestion of contaminated soil

- Ingestion of contaminated fish and shellfish

- Ingestion of contaminated fruits and vegetables

- Ingestion of contaminated meat, eggs, and dairy products

- Ingestion of contaminated surface water while swimming

- Dermal contact with chemicals in water

- Dermal contact with chemicals in soil

- Inhalation of airborne compounds (vapor phase or particulate)

- External exposure to penetrating radiation (immersion in contaminated air; immersion in contaminated water; and exposure from ground surfaces with photon-emitting radionuclides)

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

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

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

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

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

Table 1
Exposure Pathways Considered for Various Land-Use scenarios

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

Equations and Default Parameter Values for Identified Exposure Routes

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

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

Generic Equation for Calculation of Risk Parameter Values

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

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

$$= C \times (CR \times EFD/BW/AT) \times \text{Toxicity Effect} \qquad (1)$$

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):

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

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).

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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.

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APPENDIX 2
CALCULATION OF THE UPPER CONFIDENCE LIMITS OF MEAN CONCENTRATIONS

For conservatism, Sandia National Laboratories/New Mexico uses the maximum concentration of the constituents of concern (COCs) for initial risk calculation. If the maximum concentrations produce risk above New Mexico Environment Department (NMED) guidelines, conservatism with this approach is evaluated and, if appropriate, a more realistic approach is applied. When the site has been adequately characterized, an estimate of the mean concentration of the COCs is more representative of actual site conditions. The NMED has proposed the use of the 95% upper confidence limit (UCL) of the mean to represent average concentrations at a site (NMED December 2000). The 95% UCL is calculated according to NMED guidance (Tharp June 2002) using the U.S. Environmental Protection Agency ProUCL program (EPA April 2002). Attached are the outputs from that program and the calculated UCLs used in the risk analysis.

References

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ATTACHMENT

SWMU 159 Human Health			
Summary Statistics for	Arsenic	Summary Statistics for	ln(Arsenic)
Number of Samples	33	Minimum	-0.69315
Minimum	0.5	Maximum	1.547563
Maximum	4.7	Mean	0.785329
Mean	2.457879	Standard Deviation	0.516424
Median	2.3	Variance	0.266694
Standard Deviation	1.102122		
Variance	1.214673	Shapiro-Wilk Test Statisitic	0.9456
Coefficient of Variation	0.448404	Shapiro-Wilk 5% Critical Value	0.931
Skewness	0.359829	Data are Lognormal at 5% Significance Level	
95 % UCL (Assuming Normal Data)		Estimates Assuming Lognormal Distribution	
Student's-t	2.78286	MLE Mean	2.50597
		MLE Standard Deviation	1.38542
95 % UCL (Adjusted for Skewness)		MLE Coefficient of Variation	0.552848
Adjusted-CLT	2.786293	MLE Skewness	1.827515
Modified-t	2.784862	MLE Median	2.193129
		MLE 80% Quantile	3.392976
95 % Non-parametric UCL		MLE 90% Quantile	4.258572
CLT	2.773452	MLE 95% Quantile	5.128671
Jackknife	2.78286	MLE 99% Quantile	7.290202
Standard Bootstrap	2.759938		
Bootstrap-t	2.780808	MVU Estimate of Median	2.184284
Chebyshev (Mean, Std)	3.294155	MVU Estimate of Mean	2.494649
		MVU Estimate of Std. Dev.	1.356049
		MVU Estimate of SE of Mean	0.235085
		UCL Assuming Lognormal Distribution	
		95% H-UCL	2.990266
		95% Chebyshev (MVUE) UCL	3.51936
		99% Chebyshev (MVUE) UCL	4.833713
		Recommended UCL to use:	
		H-UCL	

SV Sampling

Sandia National Laboratories/New Mexico
Environmental Restoration Project

REQUEST FOR SUPPLEMENTAL INFORMATION RESPONSE FOR DRAIN AND SEPTIC SYSTEMS SWMUs 48, 135, 136, 159, 165, 166, AND 167 AT TECHNICAL AREA II SOIL-VAPOR SAMPLING

June 2004

United States Department of Energy
Sandia Site Office

TABLE OF CONTENTS

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LIST OF FIGURES

Figure

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LIST OF ANNEXES

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ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
DCB	dichlorobenzene
DSS	Drain and Septic Systems
ER	Environmental Restoration
HE	high explosive(s)
HWB	Hazardous Waste Bureau
MDL	method detection limit
NFA	no further action
NMED	New Mexico Environment Department
NOD	Notice of Deficiency
PCE	tetrachloroethene
RCRA	Resource Conservation and Recovery Act
RSI	Response for Supplemental Information
SNL/NM	Sandia National Laboratories/New Mexico
SVOC	semivolatile organic compound
SWMU	Solid Waste Management Unit
TA	Technical Area
TAG	Tijeras Arroyo Groundwater
TCA	trichloroethane
TCE	trichloroethene
VOC	volatile organic compound

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1.0 INTRODUCTION

1.1 Investigation History

In August 1994, no further action (NFA) proposals were submitted for Solid Waste Management Units (SWMUs) 135 and 165 in Technical Area (TA)-II at Sandia National Laboratories/New Mexico (SNL/NM). In July 1995, NFA proposals were also submitted for TA-II SWMUs 48, 136, 159, 166, and 167. These seven SWMUs are shown on Figure 1.1-1.

In November 1995, the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB) responded with comments on the NFA proposals submitted for SWMUs 48, 136, 159, 166, and 167 and recommended that a Resource Conservation and Recovery Act (RCRA) Facility Investigation Work Plan, which included these SWMUs, be developed for TA-II. At that time, the SNL/NM Environmental Restoration (ER) Project decided to undertake the investigation and cleanup of these sites and others in TA-II as Voluntary Corrective Actions, and formal work plans were not submitted.

On October 13, 1999, the NMED-HWB issued a Notice of Deficiency (NOD) for these seven SWMUs. Negotiations on November 17, 1999, further defined specific procedures for sampling these seven SWMUs and transferred a requirement for groundwater reporting for these SWMUs to the ongoing Tijeras Arroyo Groundwater (TAG) Investigation. The NOD subsequently was changed by NMED to a Request for Supplemental Information (RSI). The requirements negotiated to fulfill the RSI for these seven TA-II SWMUs were:

- Submit revised site maps showing septic and drain system component locations (as determined by backhoe excavation).

- Submit the results for passive soil-vapor surveys and active soil-vapor monitoring wells at TA-II.

- Collect soil samples at a depth equal to the base, and 5 feet below the base, of septic tanks, seepage pits, and drain lines. Sample locations in drainfields and system outfalls were approved by HWB personnel.

- Analyze soil samples for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), high explosive (HE) compounds, polychlorinated biphenyls, RCRA metals, including hexavalent chromium, and total cyanide, radionuclides by gamma spectroscopy, and gross alpha/beta activity.

- Submit revised risk assessments for all seven SWMUs using all available soil data.

On January 26, 2000, the SNL/NM ER Project submitted a response to the NMED RSI, agreeing to excavations to locate system components below ground surface (bgs), confirm drainfield dimensions, pinpoint effluent release points, and investigate the SWMU 48 HE rinse-water drain line. SNL/NM also agreed to discuss additional sampling with the NMED-HWB when the maps were finalized and to submit the groundwater data requested in a subsequent TAG Investigation report.

For tracking purposes, these seven SWMUs are included with sites listed in the SNL/NM Drain and Septic Systems (DSS) program reporting schedule. In this RSI response, they will be referred to as the "Drain and Septic Systems SWMUs at TA-II."

1.2 Additional Investigation Information

Although not specifically required as part of the RSI, this report presents additional information for several TA-II SWMUs as follows:

- In May 2003, soil-vapor monitoring wells were installed at SWMUs 159 and 165 as part of a separate site-wide DSS investigation. Additional details and sampling results for these wells are presented in the soil-vapor sampling chapter of this RSI response.
- Residual material in catch (settling) boxes for HE compound particulates located on HE rinse-water drain lines at SWMUs 48 and 136 was sampled as part of the site characterization process. The results are presented in the SWMU 48 and SWMU 136 chapters of this RSI response.

1.3 Report Organization

This RSI response presents the required information as follows:

- The soil-vapor survey information is presented as a whole and is not discussed on a site-by-site basis.
- Because NFA proposals were previously submitted for these SWMUs, only a brief description and history for each site is presented. Each SWMU is discussed as a separate report. The soil sampling analytical results and risk assessments are presented in separate annexes for each SWMU.

2.0 SOIL-VAPOR SAMPLING AT TA-II

2.1 Introduction

Soil-vapor data was collected using passive and active sampling methods at TA-II. The passive technique uses buried samplers to collect soil-vapor components onto suitable adsorbent material. After an appropriate period, the samplers are retrieved and analyzed for the components of interest. Active soil-vapor sampling analyzes soil-vapor volumes collected at discrete borehole depths while drilling or by specially designed vapor monitoring wells.

Passive soil-vapor surveys were conducted at TA-II in 1993 and 1994 to identify possible source areas. In November and December 1996, three boreholes were drilled in TA-II and sampled at 10-foot intervals for soil vapor. Two of these boreholes were later converted to permanent soil-vapor monitoring wells. In May 2003, soil-vapor monitoring wells were installed at SWMUs 159 and 165 as part of the SNL/NM site-wide DSS investigation. Additional details and the analytical results are presented in the following sections.

2.2 Passive Soil-Vapor Sampling at TA-II

2.2.1 Passive Soil-Vapor Sampling Methodology

PETREX™ passive soil-vapor sampling involves burying collectors containing activated carbon adsorption elements in shallow holes throughout the area to be investigated. After an appropriate period, usually approximately two weeks, the collectors are removed and submitted for analysis by thermal desorption-mass spectrometry. The methodology reports compound detections as relative intensities or response levels rather than the actual concentration of the compound in soil vapor. The data are best utilized as a semiquantitative measure, with an order of magnitude change in ion count values considered significant for interpreting potential source areas and migration/dispersion pathways versus background areas. Full details on the procedures, analytical methodology, and associated quality assurance/quality control measures are presented in the report prepared by Northeast Research Institute, Inc. (NERI 1994).

2.2.2 Passive Soil-Vapor Sampling Results

Two phases of passive soil-vapor sampling using PETREX™ collectors were conducted at TA-II (NERI 1994). The first phase, conducted between November and December 1993, installed 365 collectors throughout portions of TA-II. The second phase, conducted between January and February 1994, installed 99 additional collectors. Phase I was a broad reconnaissance survey to determine the types and locations of VOCs and SVOCs at the site. The Phase II survey further investigated potential areas of concern identified in Phase I.

As part of Phase I, eighteen collectors were installed west of TA-II in unimpacted areas assumed to represent background. It was later determined that these "background" areas may have been part of the old Oxnard Field runway where much activity occurred during the 1940s.

With the exception of some petroleum hydrocarbons, the areas provided suitable background data for VOCs and SVOCs.

The sample locations and identifications are shown on Figure 2.2.2-1. The analytical results for Phases I and II are presented in Tables A-1 and A-2 in Annex A. As shown in Table A-1, the majority of compounds detected in the soil-vapor samples were the chlorinated solvents trichloroethene (TCE) and tetrachloroethene (PCE) and the petroleum hydrocarbons benzene, toluene, ethylbenzene, and xylene(s) (BTEX). Table A-2 lists additional compounds detected during the surveys and shows that trichloroethane (TCA), dichlorobenzene (DCB), Freon-11 (trichlorofluoromethane), and Freon-113 (trichlorotrifluoroethane) were also detected in some samples.

Figures 2.2.2-2, 2.2.2-3, and 2.2.2-4 show the ion count contour plots for TCE, PCE, and BTEX respectively. Because TCA, DCB, Freon-11, and Freon-113 were detected only in a few samples, their distributions are not plotted. The highest TCE and BTEX ion counts were also identified near Buildings 913 and 914 at the southern end of TA-II. The survey concluded that the potential source area for these detections might exist southeast of TA-II (NERI 1994). No SVOCs were detected in any of the samples.

Figures 2.2.2-5 through 2.2.2-13 show the PETREX™ soil-vapor sample locations and, where appropriate, the soil-vapor monitoring wells for each of the TA-II SWMUs addressed in this RSI response. The analytical results for the passive soil-vapor samples at individual SWMUs are presented in Tables A-1 and A-2. The soil-vapor monitoring well analytical results are discussed Section 2.3.2.

2.3 Active Soil-Vapor Sampling at TA-II

2.3.1 Active Soil-Vapor Sampling Methodology

Active soil-vapor sampling typically involves directly pumping soil-vapor from the subsurface for analysis. Vapor collection can be through simple open pipe systems analogous to groundwater monitoring wells screened in the interval of interest, or through sophisticated "down hole" systems with individual inlet port and collection tube sets placed at multiple depths. The extracted soil-vapor can be collected onto adsorbent media and analyzed immediately, or collected into special canisters for later laboratory analysis.

2.3.2 Active Soil-Vapor Sampling Results

In November and December 1996, boreholes BH-020, BH-021, and BH-023 were drilled at TA-II (Figure 2.3.2-1) and sampled at 10-foot intervals during drilling for VOCs in soil-vapor. Permanent soil-vapor wells were constructed in boreholes BH-020 and BH-021 (TA2-VW-20 and TA2-VW-21). BH-023 was abandoned by backfilling with cuttings after drilling and sampling. Vapor well TA2-VW-020 was constructed so that vapor samples could be collected at 72 feet bgs. Vapor well TA2-VW-021 was constructed so that vapor samples could be collected at 52 and 92 feet bgs. The vapor wells were sampled for VOCs on an approximately quarterly basis between July 1997 and March 2002.

The July 1997 samples were collected onto adsorbent media both during and after purging of the collection system and were analyzed at the on-site Environmental Restoration Chemistry Laboratory. All subsequent samples were collected into special vacuum canisters and analyzed at various off-site laboratories. Sample results for wells TA2-VW-020 and TA2-VW-021 are presented in Tables A-3 and A-4, respectively. The results collected during the drilling of borehole BH-023 are presented in Table A-5. Method detection limits (MDLs) for the VOC analyses are presented in Table A-6.

The results for samples collected during the drilling for all three boreholes show the apparent widespread presence of VOCs in soil vapor at TA-II. Although the long-term monitoring data show a large amount of scatter, the results for vapor wells TA2-VW-20 and TA2-VW-21 indicate that VOC concentrations are somewhat steady with no apparent periodicity.

In May 2003, as part of the SNL/NM ER Project site-wide DSS investigation, soil-vapor monitoring wells were installed at SWMUs 159 and 165 (Figures 2.3.2-1, 2.2.2-10 and 2.2.2-11). Each vapor well was 150 feet deep and had vapor sampling ports at depths of 5, 20, 70, 100, 150 feet bgs. After installation, subsurface conditions were allowed to equilibrate over three months before the wells were sampled. The wells were sampled in September 2003 and the results are presented in Table A-7 for vapor well 159-VW-01 and Table A-8 for vapor well 165-VW-01. MDLs for the VOC analyses are presented in Table A-6.

In accordance with previous agreements with the NMED (SNL/NM October 1999), because the total VOC concentrations in the 150-foot-bgs sample from each well were less than 10 parts per million by volume, no additional soil-vapor sampling from these two wells, or soil-vapor or groundwater monitoring wells were required by the NMED at SWMUs 159 and 165.

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3.0 REFERENCES

EPA, see U.S. Environmental Protection Agency.

NERI, see Northeast Research Institute, Inc.

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U.S. Environmental Protection Agency (EPA), January 1997. *EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*, 2nd ed., EPA/625/R-96/010b, Center for Environmental Research Information, Office of Research and Development, U.S. Environmental Protection Agency, Cincinnati, Ohio.

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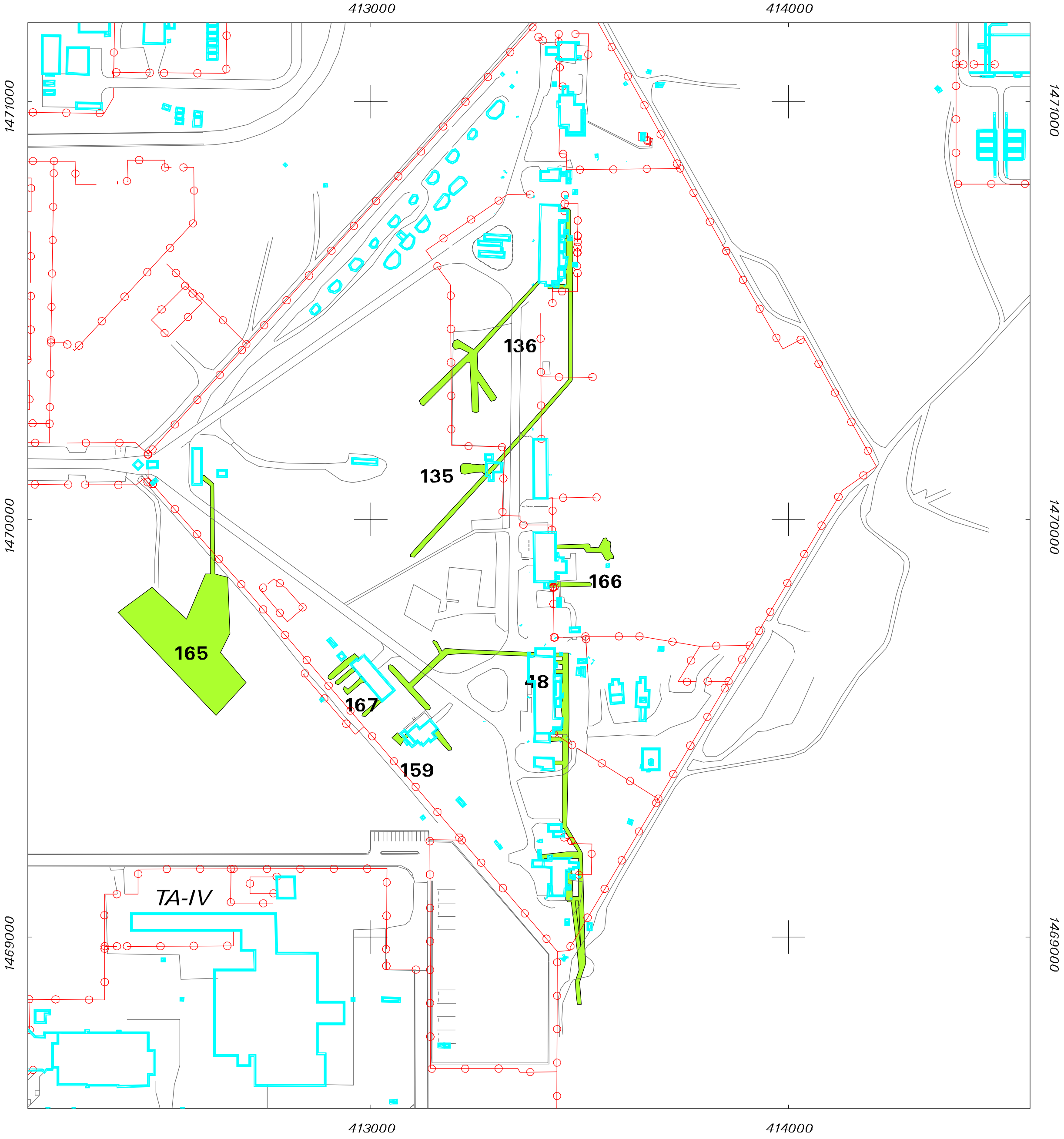
FIGURES

Mapid=040483 04/08/04 SNL GIS ORG. 6133 DHelfrich dh040483.aml



Legend

Road

Fence

▭ Building / Structure

🟩 DSS SWMU

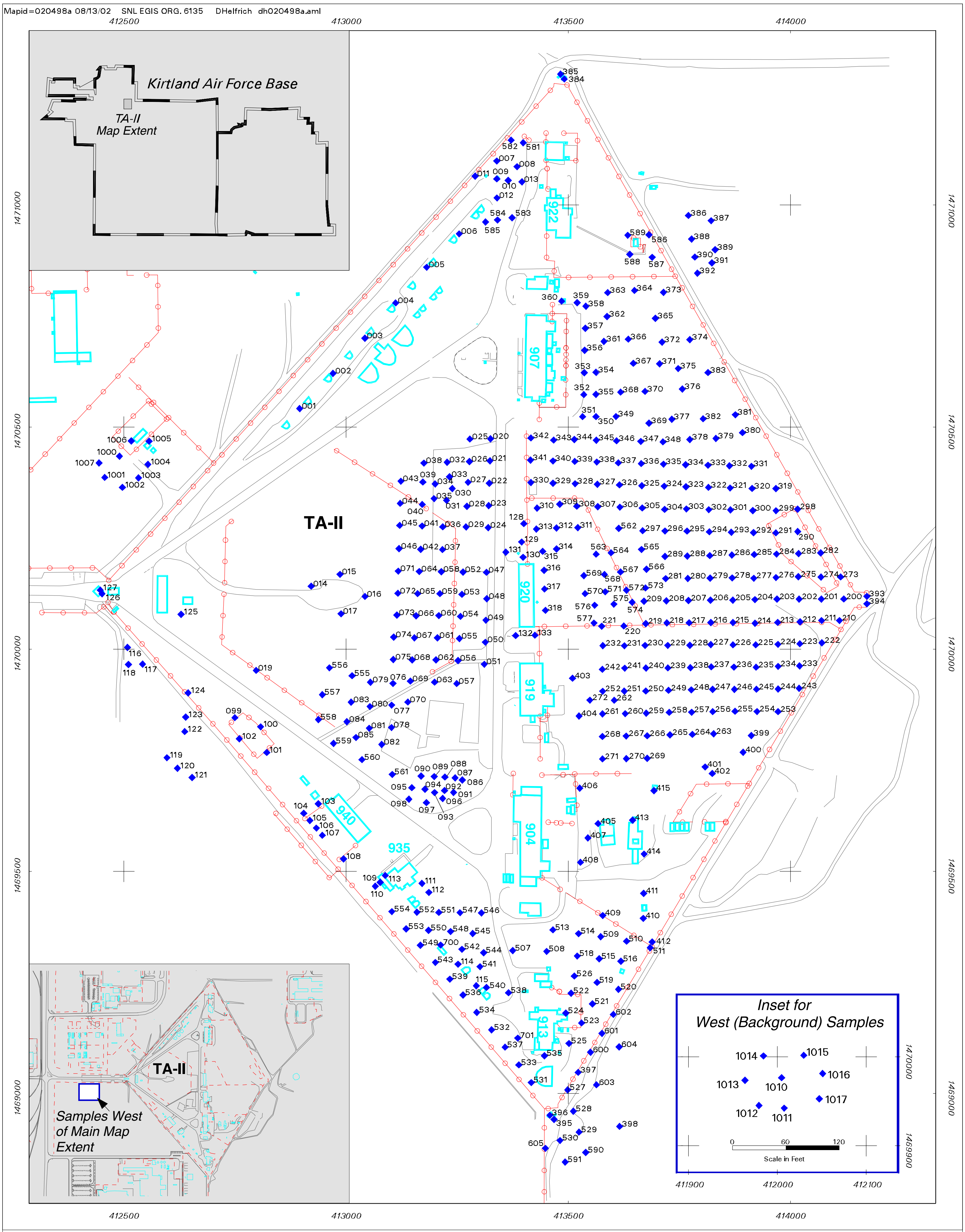
Figure 1.1-1
Location Map of Drain and Septic Systems (DSS) SWMUs at Technical Area-II (TA-II)

0 200 400
Scale in Feet

0 48 96
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Mapid=020498a 08/13/02 SNL EGIS ORG. 6135 DHelfrich dh020498a.aml



Legend

◆ 398 Sample Location and Identification Number

—o—o—o— Fence

—— Paved and Unpaved Road

▭ Building / Structure

Figure 2.2.2-1
Technical Area-II
PETREX™ Passive Soil-Vapor Sample Locations and Identification Numbers

0 240 480

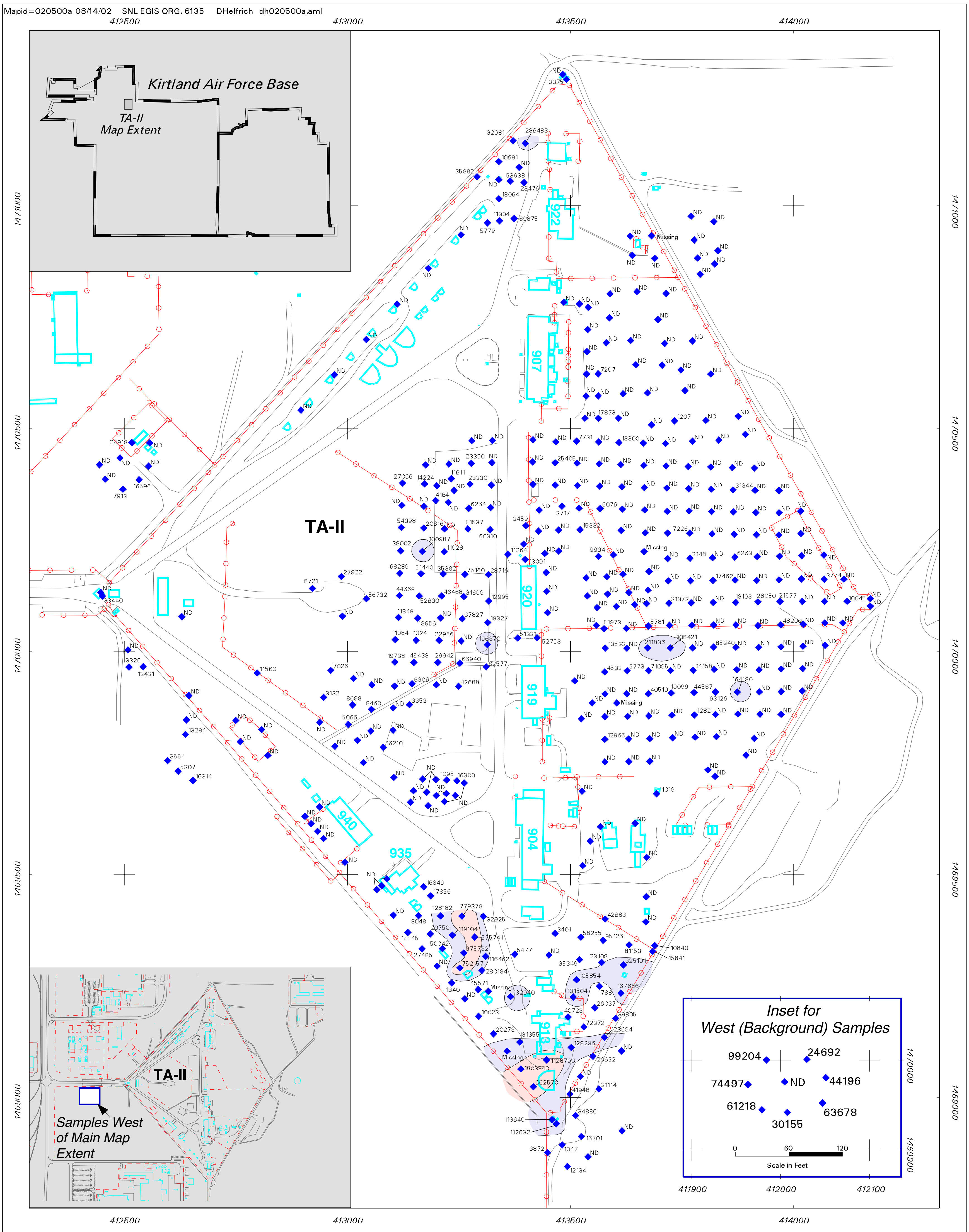
Scale in Feet

0 58 116

Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Mapid=020500a 08/14/02 SNL EGIS ORG. 6135 DHelfrich dh020500a.aml



Legend

● 205372 Sample Location and Relative Response Value

Fence

Paved and Unpaved Road

▭ Building / Structure

▨ Relative Response (Ion Count) 100,000 - 499,999

▨ Relative Response (Ion Count) ≥ 500,000

Figure 2.2.2-2
Technical Area-II
PETREX Passive Soil-Vapor Sample Locations and Trichloroethene (TCE) Relative Response (Ion Count) Values

0 240 480

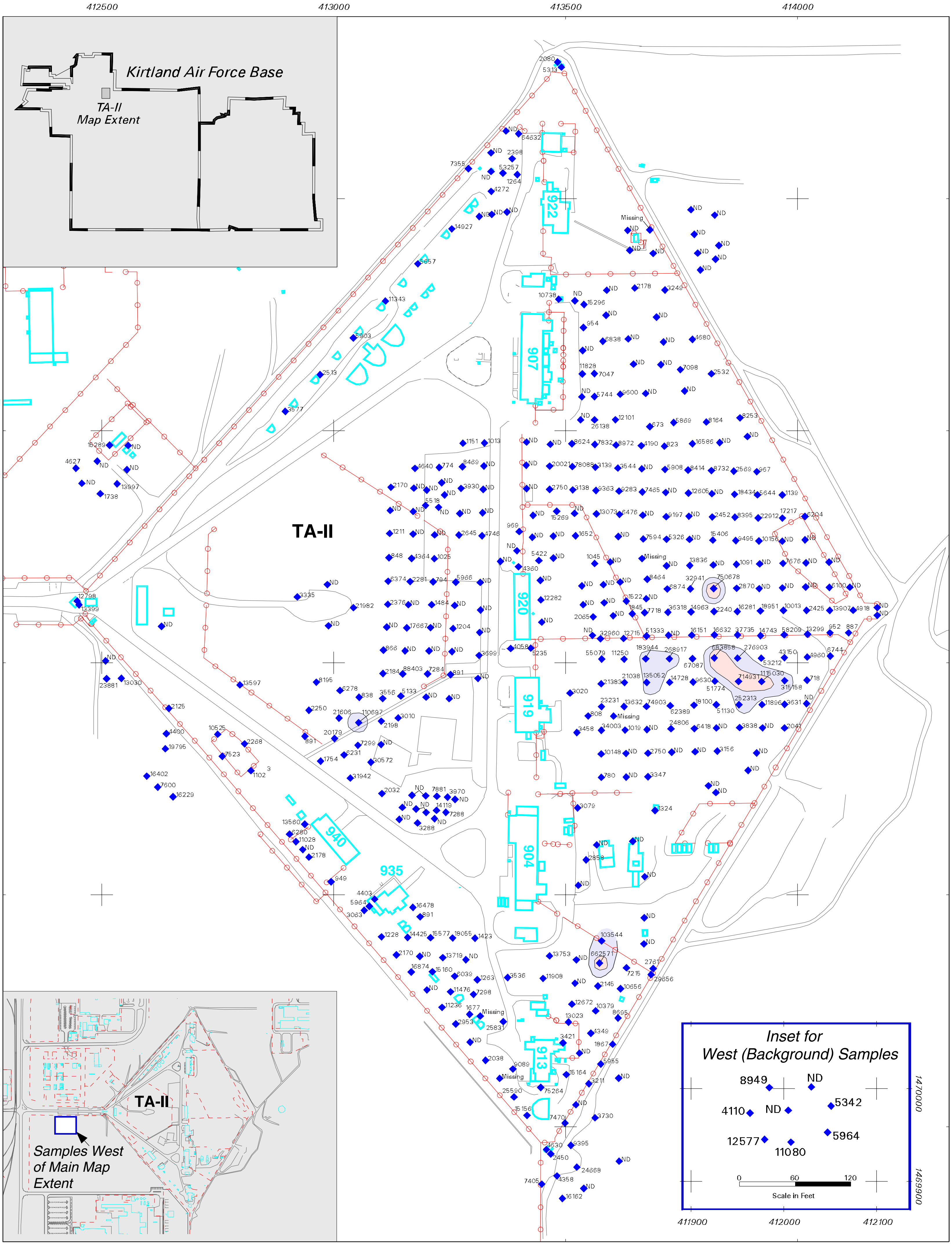
Scale in Feet

0 58 116

Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Mapid=020499a 08/14/02 SNL EGIS ORG. 6135 DHelfrich dh020499a.aml



Legend

◆ 9395 Sample Location and Relative Response Value

—o—o—o— Fence

—— Paved and Unpaved Road

▭ Building / Structure

▨ Relative Response (Ion Count) 100,000 - 499,999

▨ Relative Response (Ion Count) ≥ 500,000

Figure 2.2.2-3
Technical Area-II
PETREX^{TM} Passive Soil-Vapor Sample Locations and Tetrachloroethene (PCE) Relative Response (Ion Counts) Values

0 240 480

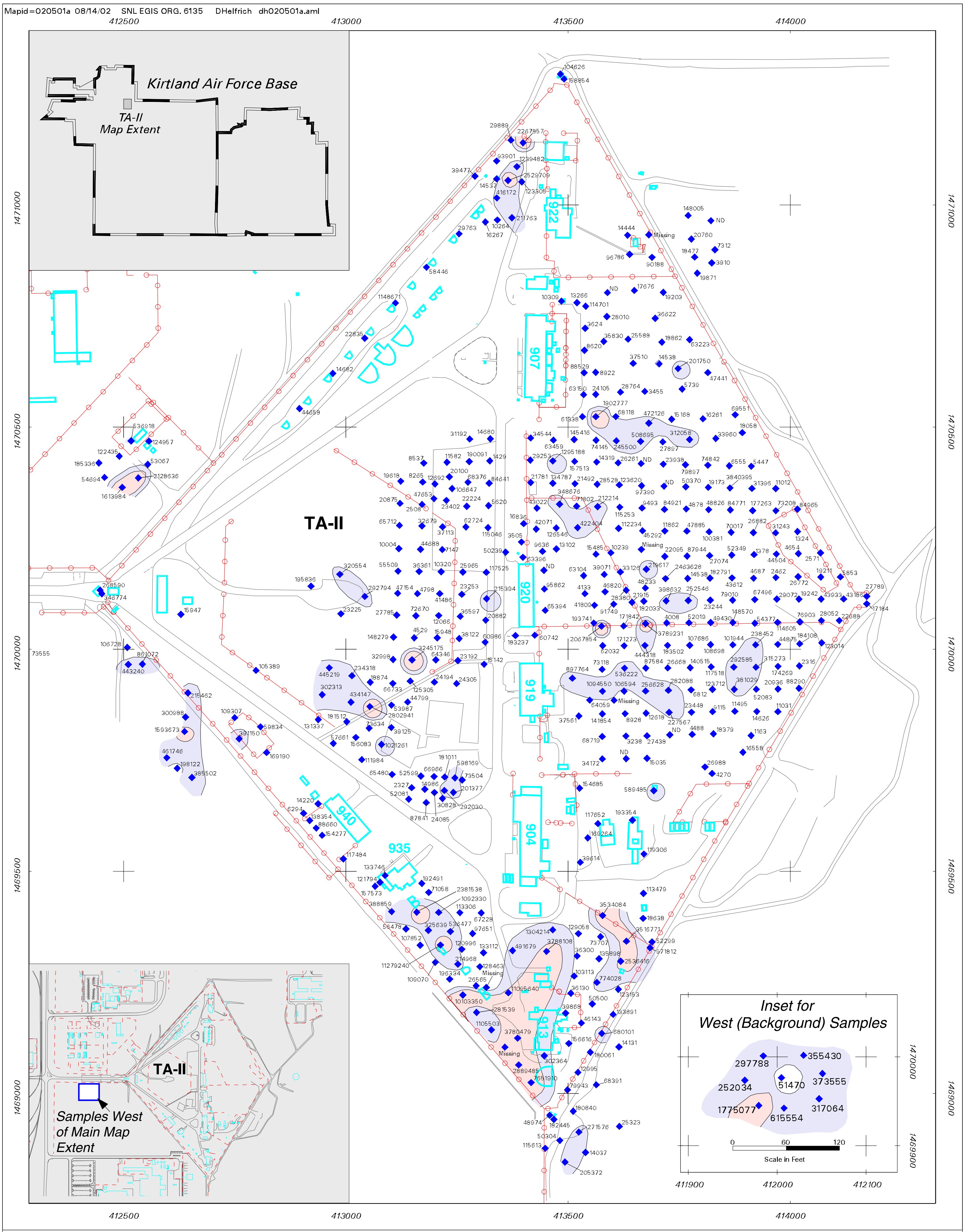
Scale in Feet

0 58 116

Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Mapid=020501a 08/14/02 SNL EGIS ORG. 6135 DHelfrich dh020501a.aml



Legend

◆ 205372 Sample Location and Relative Response Value

Fence

Paved and Unpaved Road

Building / Structure

▨ Relative Response (Ion Count) 200,000 - 1,499,999

▨ Relative Response (Ion Count) $\geq$ 1,500,000

Figure 2.2.2-4 Technical Area-II PETREX^{TM} Passive Soil-Vapor Sample Locations and Benzene, Toluene, Ethylbenzene, and Xylene (BTEX) Relative Response (Ion Count) Values

0 240 480
Scale in Feet

0 58 116
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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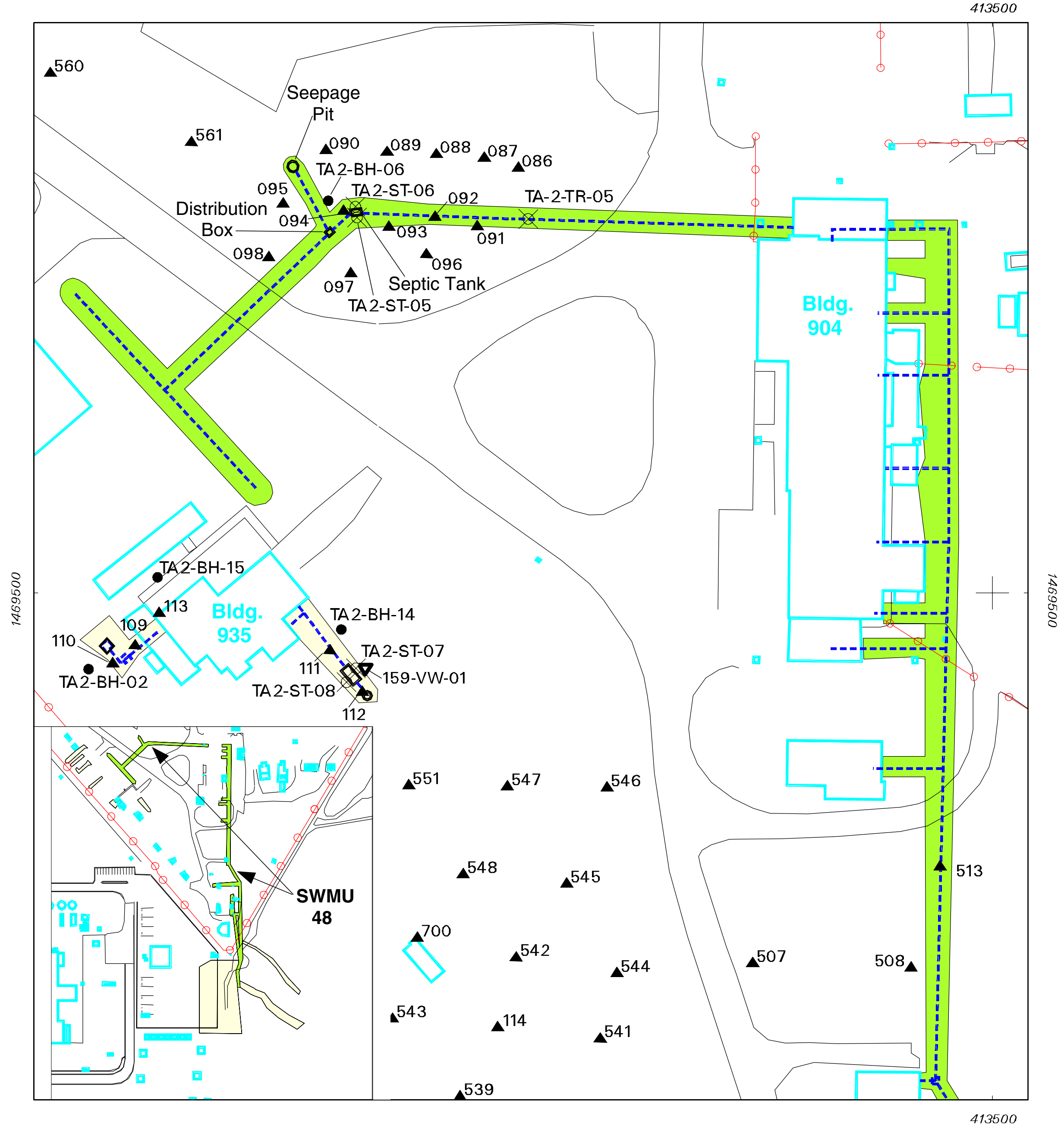


▲542 PETREX™ Soil-Vapor Sample & Identification

▼ Soil-Vapor Monitor Well

● Borehole Location

⊗ Geoprobe or Trench Sample

— Road

-○-○- Fence

— Former Building / Structure

- - - Drain Line

═ Septic Tank / Seepage Pit

🟩 SWMU 48

▭ Other SWMU

Figure 2.2.2-5
Drain and Septic Systems (DSS) SWMU 48, Building 904 (Northern Extent) PETREX™ Soil-Vapor Sample Locations

0 40 80

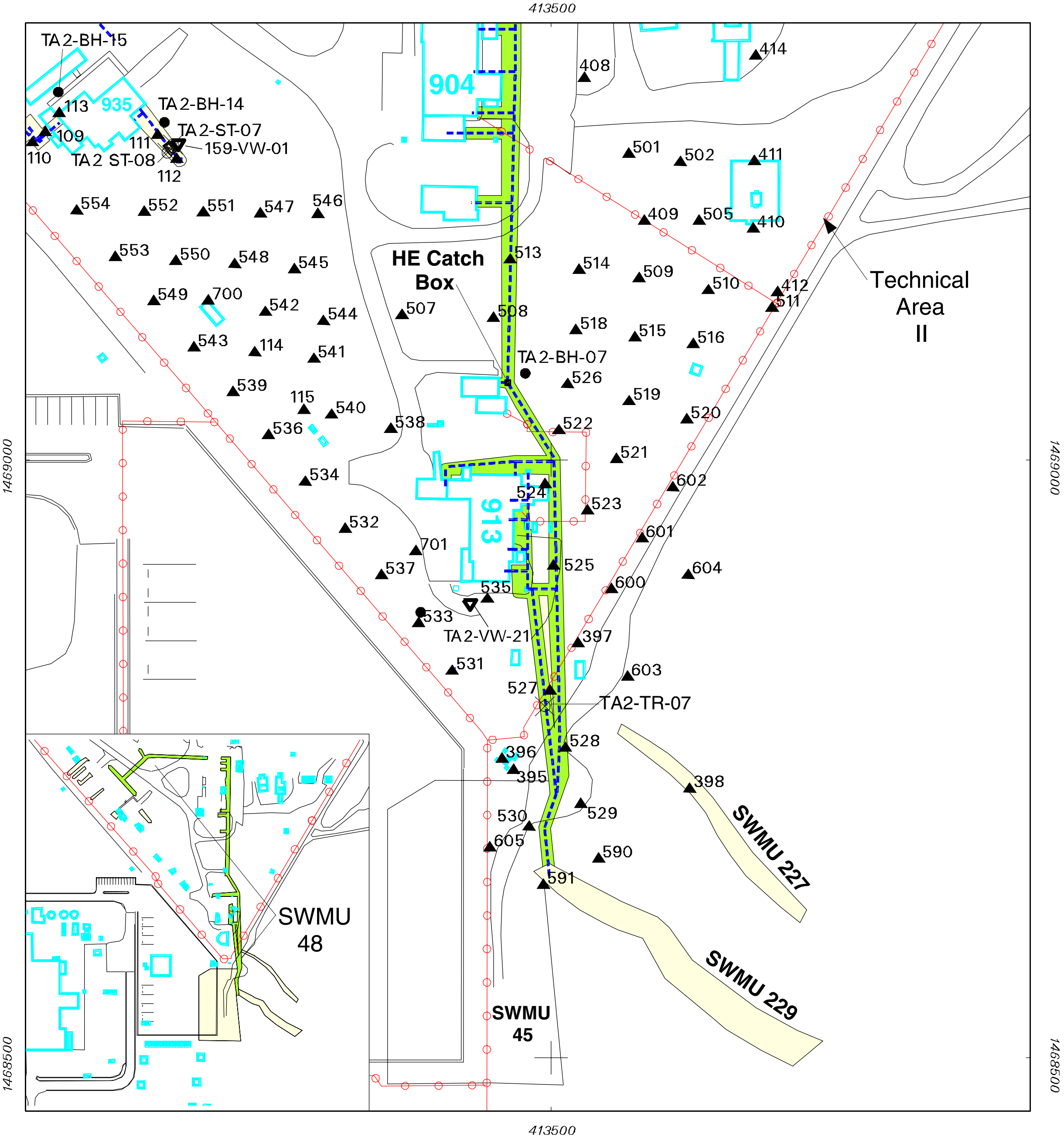
Scale in Feet

0 9.6 19.2

Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Mapid=040485 04/08/04 SNL GIS ORG. 6133 DHelfrich dh040485.aml



▲590 PETREX™ Soil-Vapor Sample & Identification

▽ Soil-Vapor Monitor Well

● Borehole Location

⊠ Geoprobe or Trench Sample

— Road

Fence

Former Building / Structure

Drain Line

▭ Septic Tank / Seepage Pit

🟩 SWMU 48

▨ Other SWMU

Figure 2.2.2-6
Drain and Septic Systems (DSS) SWMU 48, Building 904 (Southern Extent) PETREX™ Soil-Vapor Sample Locations

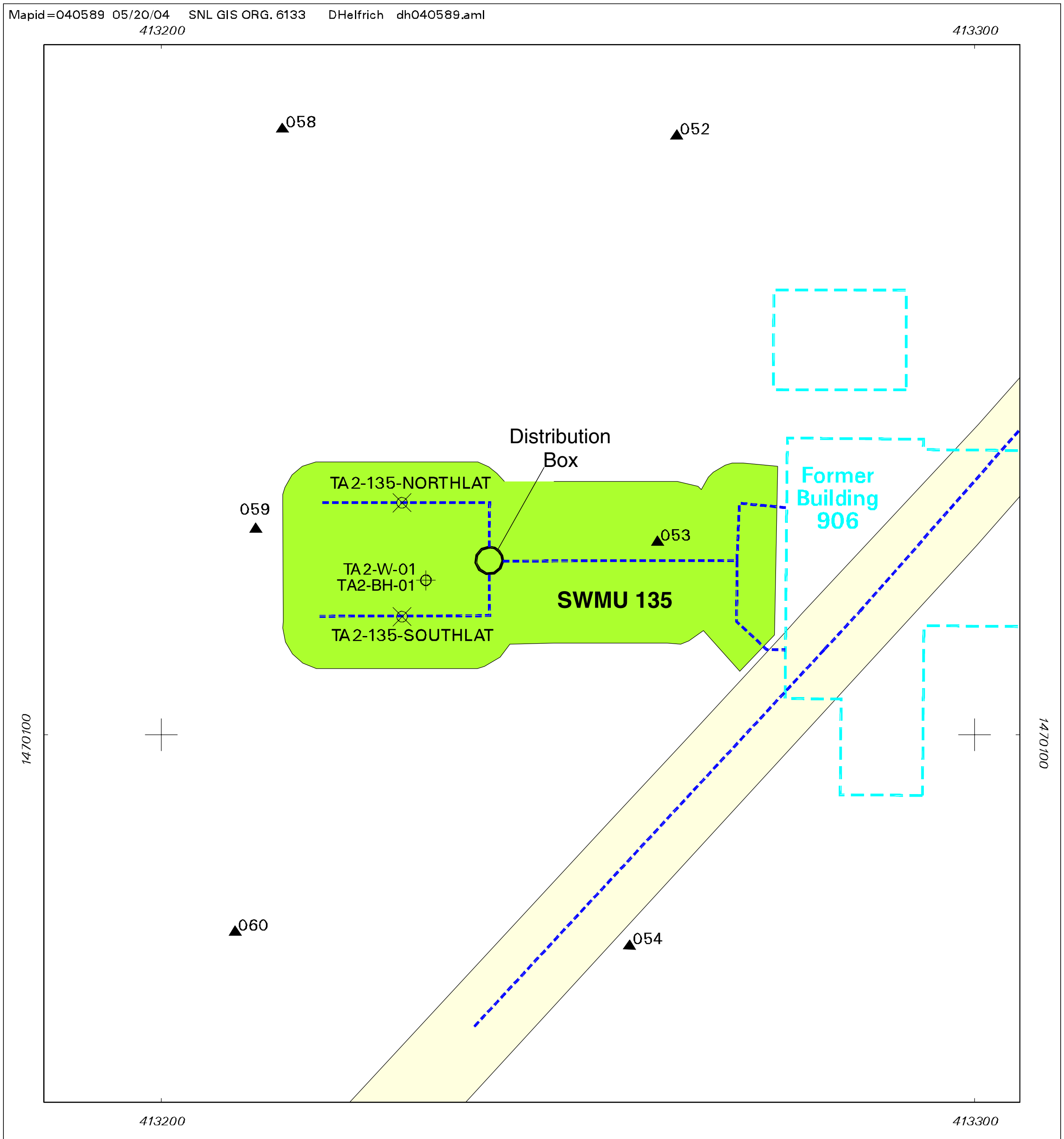
0 70 140
Scale in Feet

0 16.8 33.6
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

840857.03010000 A173

Mapid=040589 05/20/04 SNL GIS ORG. 6133 DHelfrich dh040589.aml



▲059 PETREX™ Soil-Vapor Sample & Identification

⌖ Groundwater Monitoring Well

⊠ Geoprobe Sample

▬ Distribution Box

- - - - Drain Line

— — — Former Building / Structure

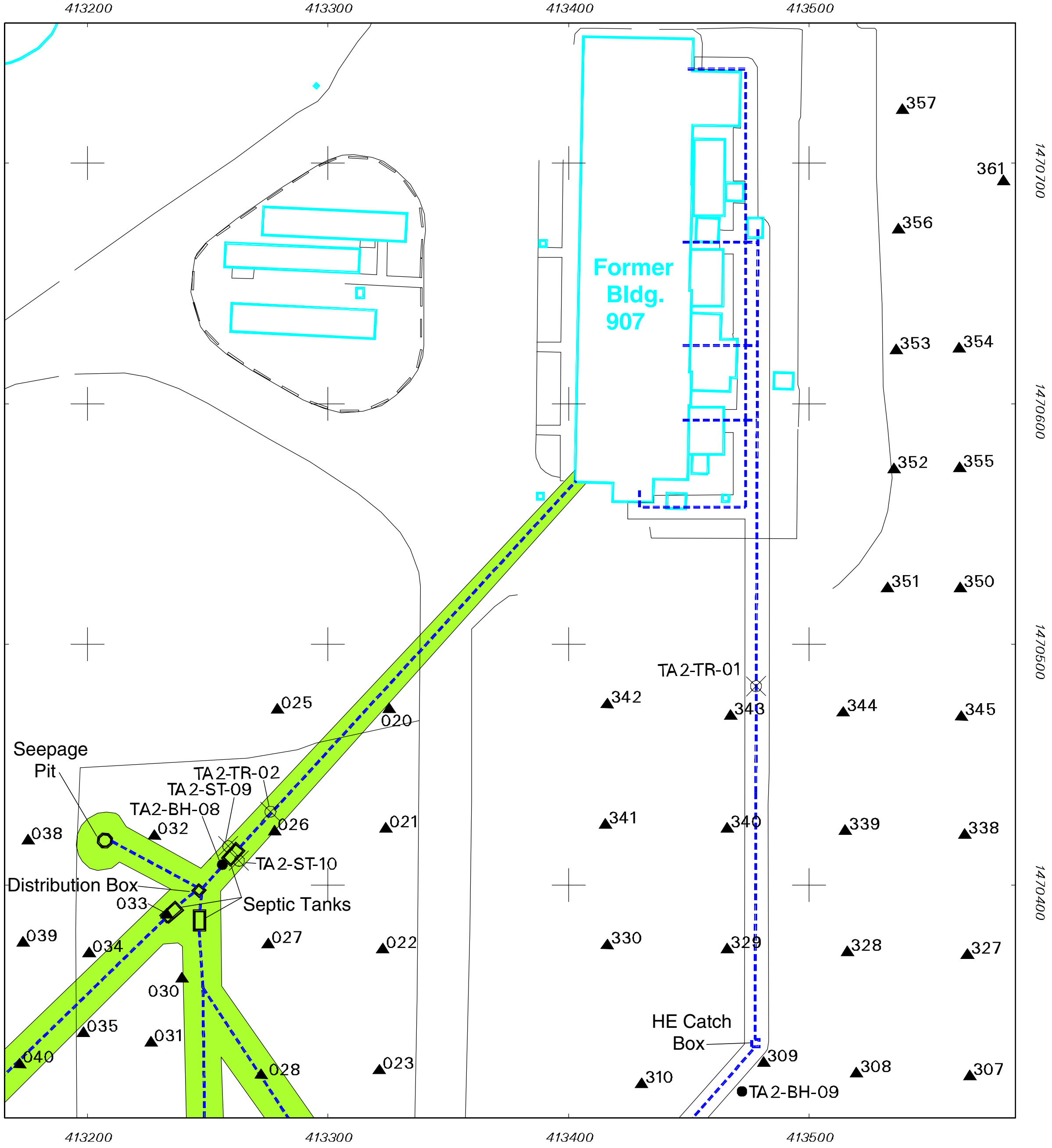
☐ Other SWMU

🟩 SWMU 135

Figure 2.2.2-7
Drain and Septic Systems (DSS) SWMU 135, Building 906 PETREX™ Soil-Vapor Sample Locations

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Mapid=040487 04/08/04 SNL GIS ORG. 6133 DHelfrich dh040487.aml



▲361 PETREX™ Soil-Vapor Sample & Identification

● Borehole Location

⊗ Geoprobe or Trench Sample

— Road

— Former Building / Structure

— Septic Tank / Seepage Pit / Distribution Box

- - - Drain Line

🟩 SWMU 136

Figure 2.2.2-8
Drain and Septic Systems (DSS) SWMU 136, Building 907 (Northern Extent) PETREX™ Soil-Vapor Sample Locations

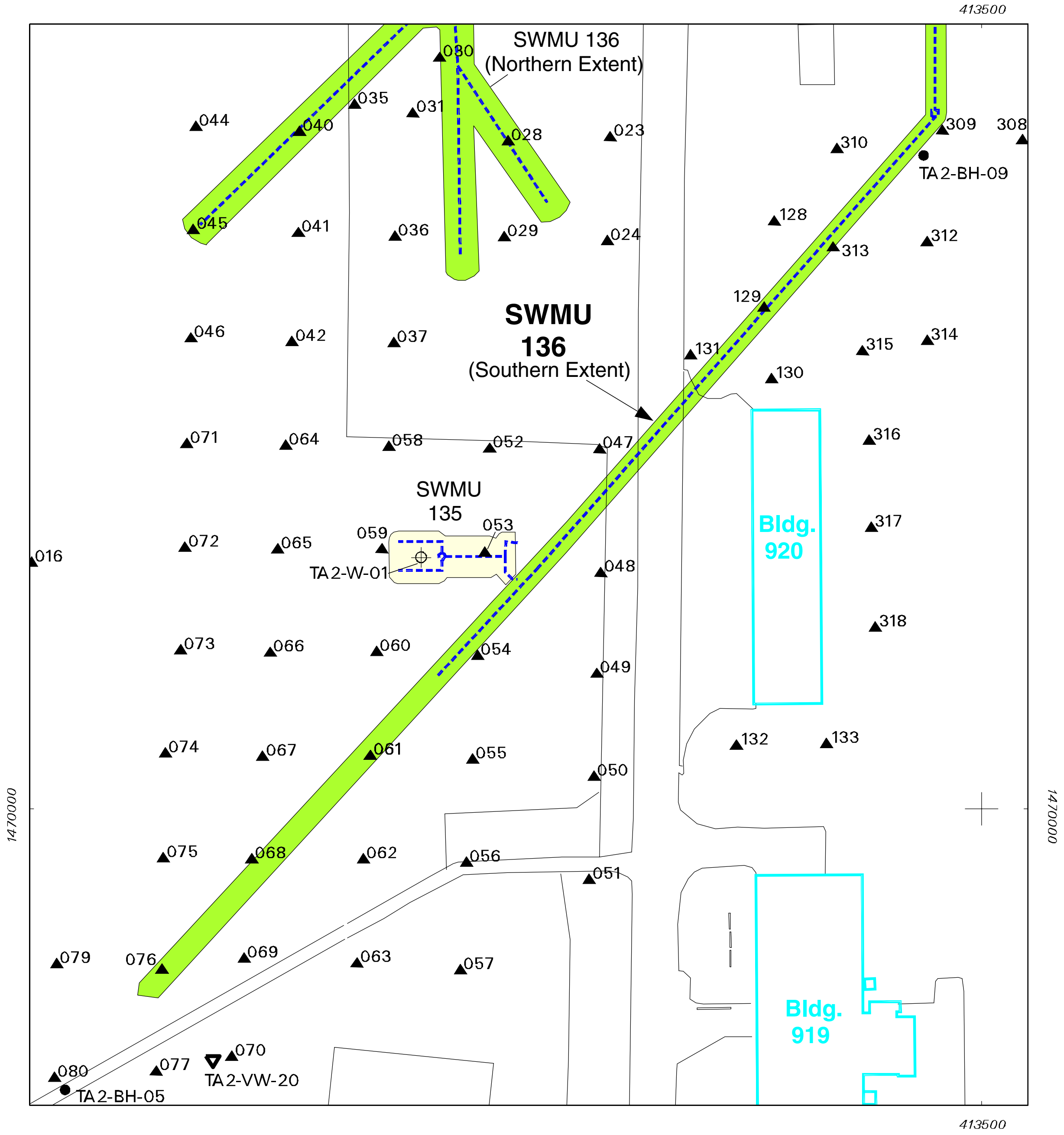
0 35 70
Scale in Feet

0 8.4 16.8
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

840857.03010000 A175

Mapid=040488 04/08/04 SNL GIS ORG. 6133 DHelfrich dh040488.aml



▲076 PETREX™ Soil-Vapor Sample & Identification

▽ Soil-Vapor Monitor Well

● Borehole Location

⌖ Groundwater Monitoring Well

Road

Drain Line

Building / Structure

Other SWMU

🟩 SWMU 136

Figure 2.2.2-9 Drain and Septic Systems (DSS) SWMU 136, Building 907 (Southern Extent) PETREX™ Soil-Vapor Sample Locations

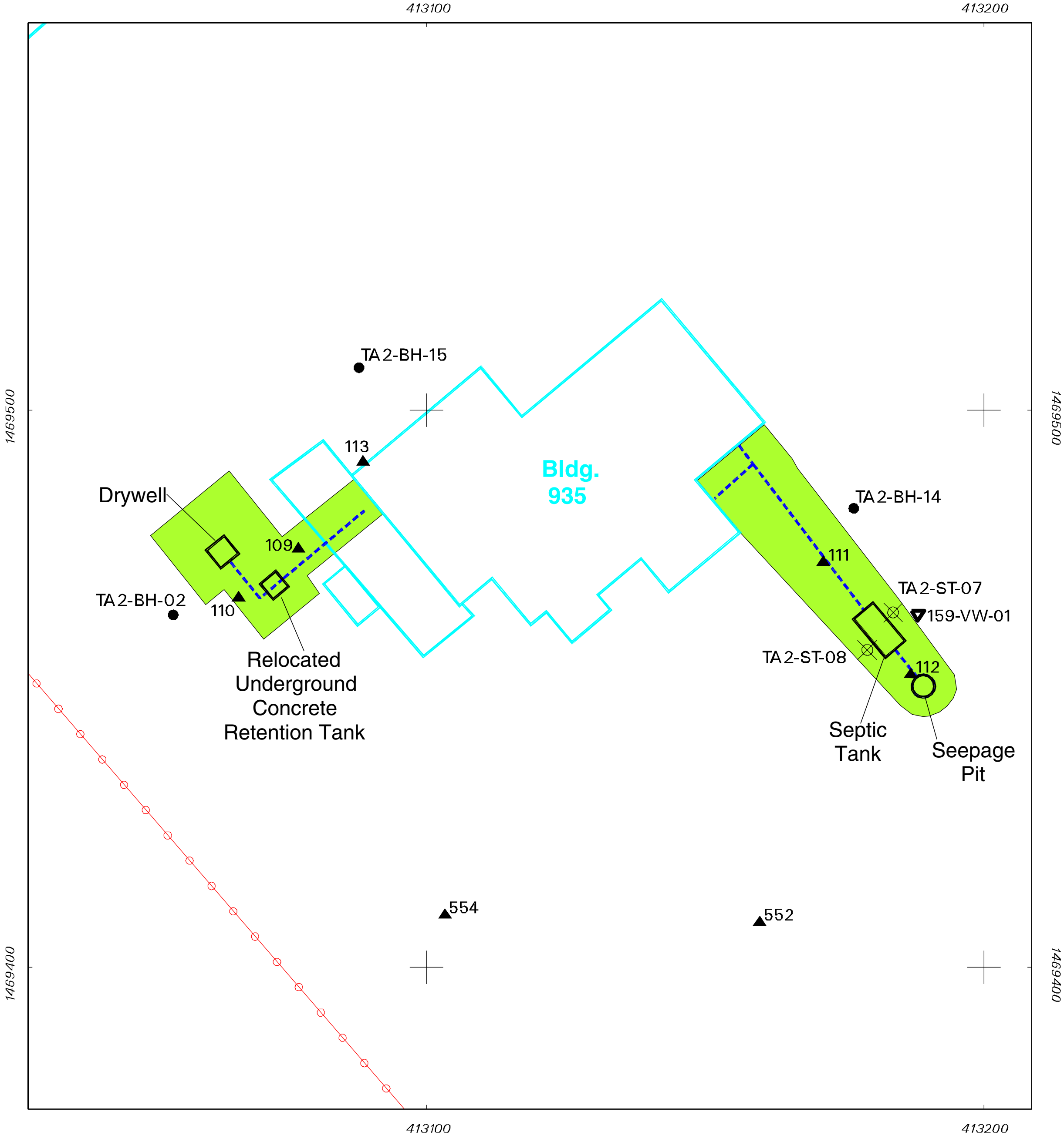
0 40 80
Scale in Feet

0 9.6 19.2
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

840857.03010000 A176

Mapid=040489 04/08/04 SNL GIS ORG. 6133 DHelfrich dh040489.aml



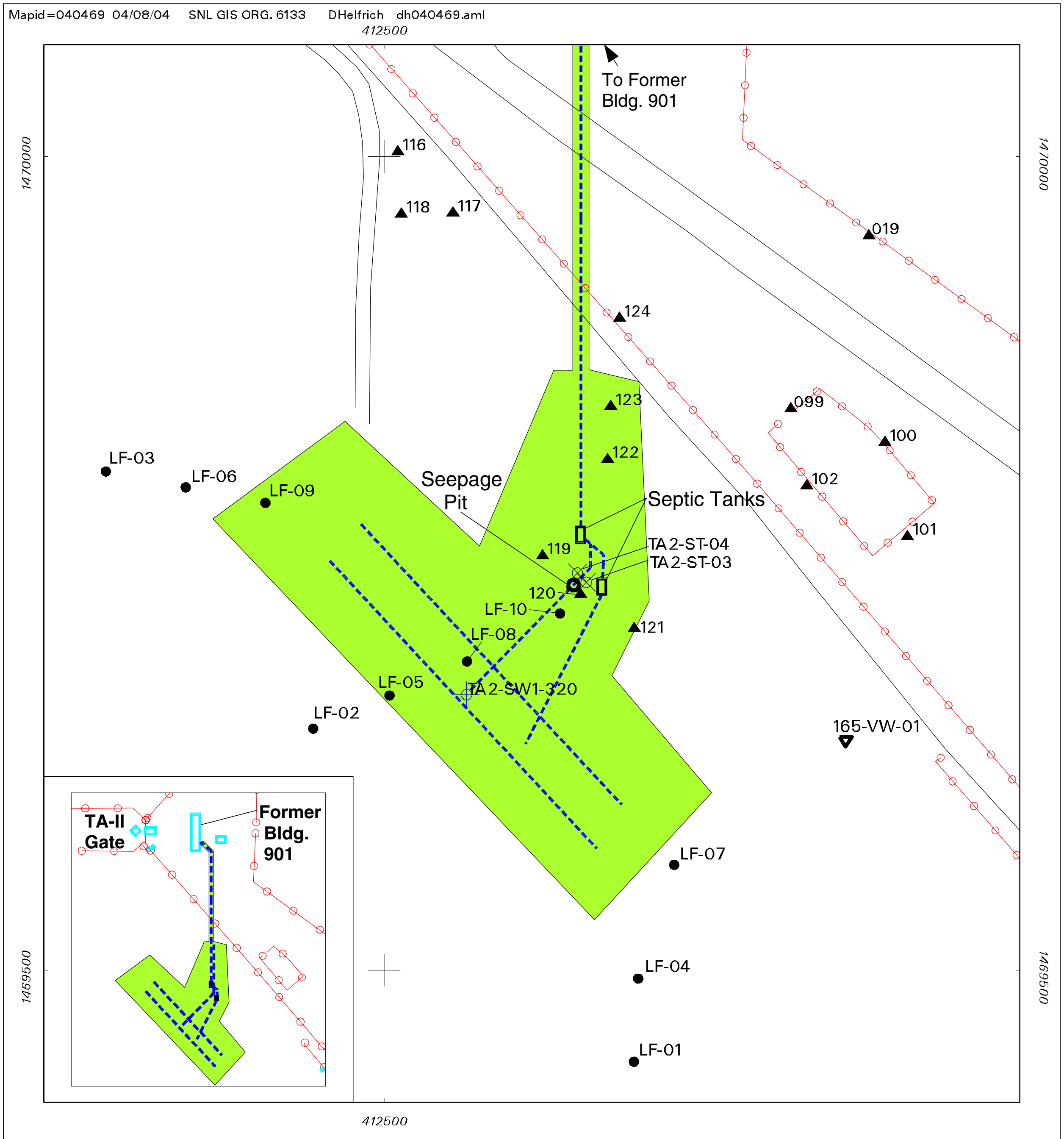
▲554	PETREX™ Soil-Vapor Sample & Identification
▽	Soil-Vapor Monitoring Well
●	Borehole Location
⊗	Geoprobe Location
○—○—○—○	Fence
—	Building / Structure
- - - -	Drain Line
—	Septic Tank / Dry Well / Seepage Pit
🟩	SWMU 159

Figure 2.2.2-10
Drain and Septic Systems (DSS) SWMU 159, Building 935 PETREX™ Soil-Vapor Sample Locations

0 15 30
Scale in Feet

0 3.6 7.2
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System



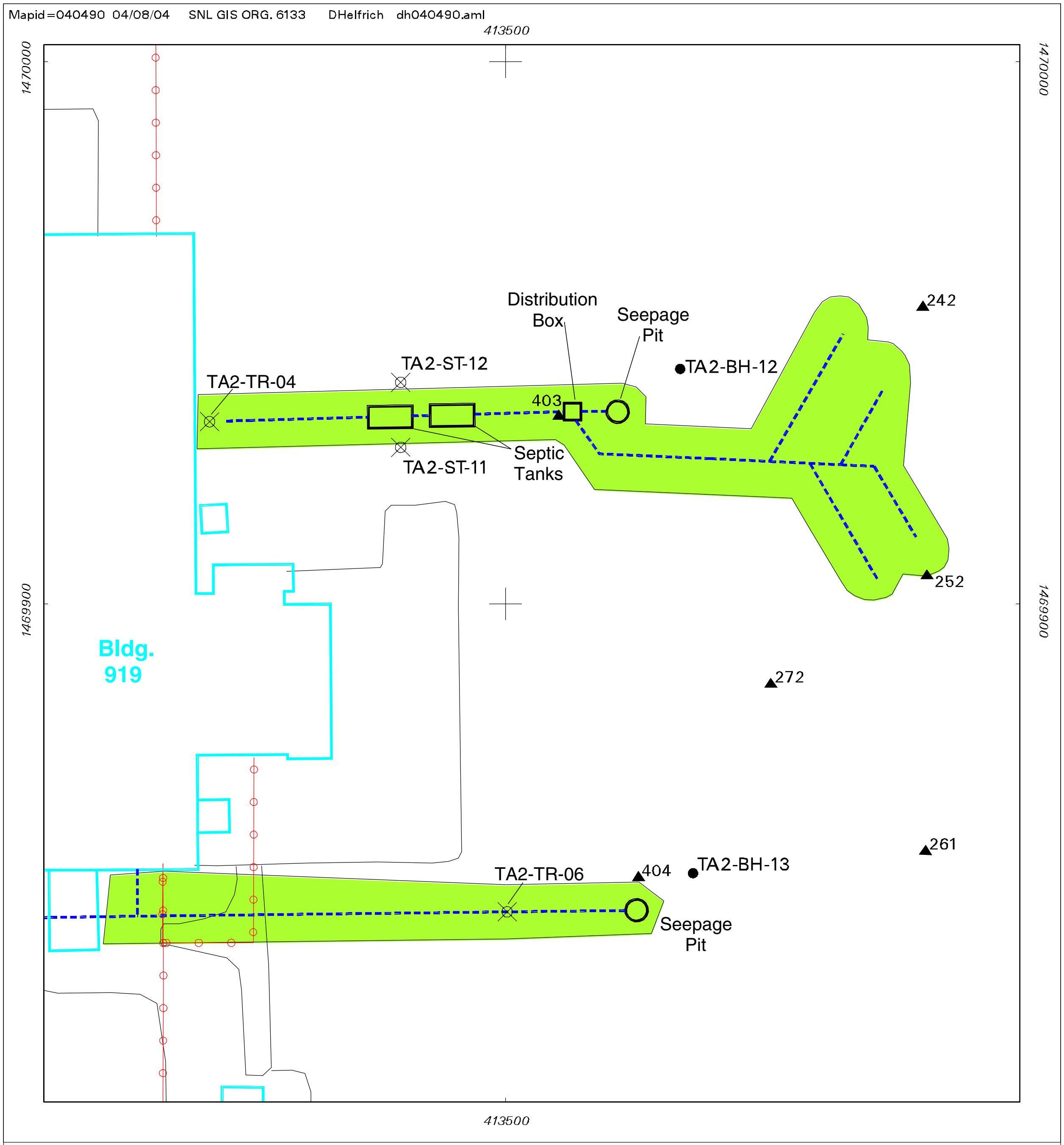
- ▲019 PETREX^{TM}Soil-Vapor Sample & Identification
- ▼ Soil-Vapor Monitoring Well
- ⌖ Groundwater Monitoring Well
- ● Borehole Location
- ⊠ Geoprobe Location
- — Road
- o—o Fence
- ═ Septic Tank / Seepage Pit
- - - - Drain Line
- 🟩 SWMU 165

Figure 2.2.2-11
Drain and Septic Systems (DSS) SWMU 165, Building 901 PETREX^{TM}Soil-Vapor Sample Locations

0 50 100
Scale in Feet

0 12 24
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System



▲404	PETREX$^{\text{TM}}$ Soil-Vapor Sample & Identification
●	Borehole Location
⊗	Geoprobe or Trench Sample
─	Road / Walkway
-o-o-o-	Fence
━	Building / Structure
-------	Drain Line
═	Seepage Pit / Septic Tank / Distribution Box
🟩	SWMU 166

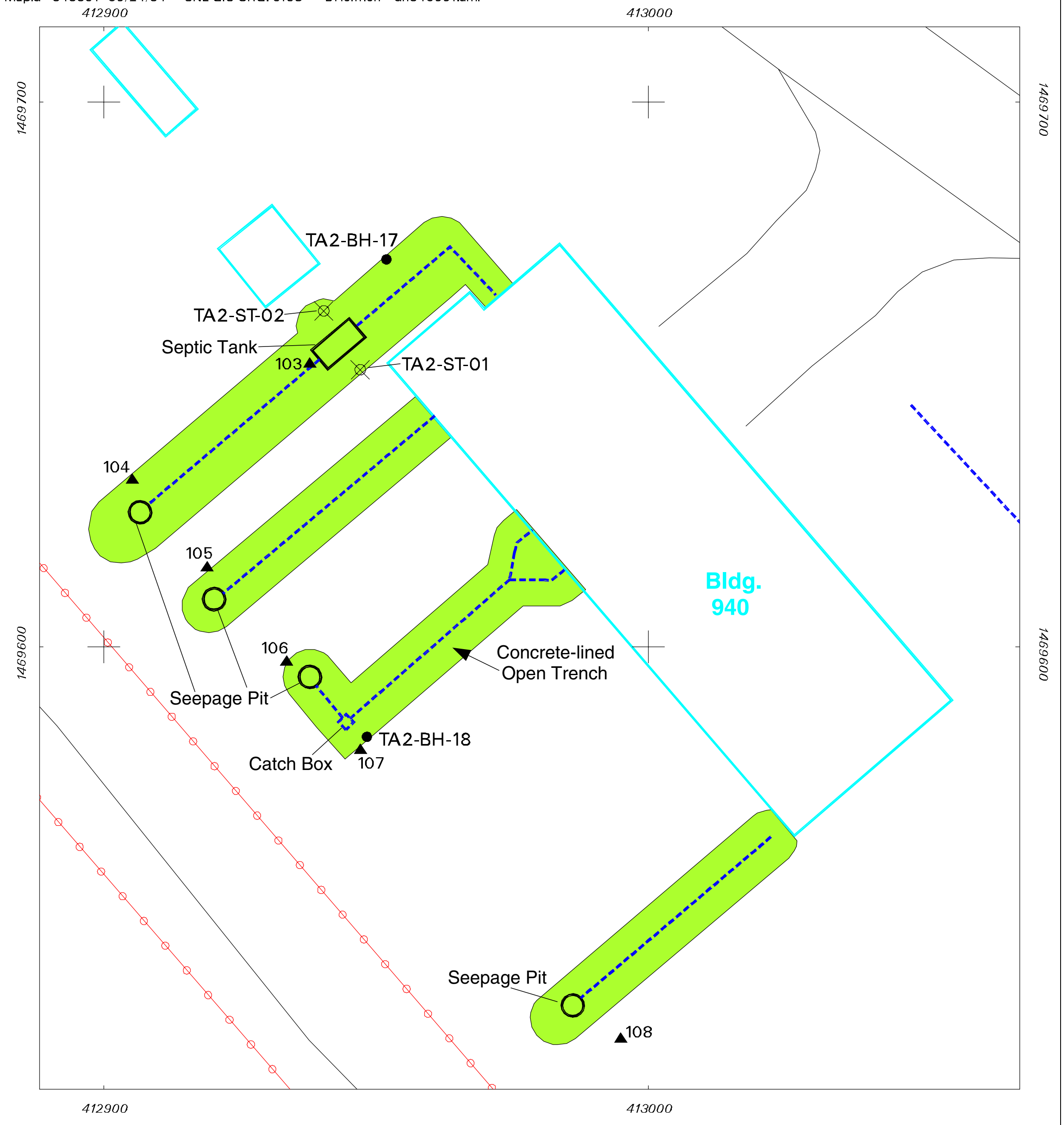
Figure 2.2.2-12
Drain and Septic Systems
(DSS) SWMU 166, Building 919
PETREX$^{\text{TM}}$ Soil-Vapor
Sample Locations

0 15 30
Scale in Feet

0 3.6 7.2
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Mapid=040591 05/24/04 SNL GIS ORG. 6133 DHelfrich dh040591.aml



▲108 PETREX™ Soil-Vapor Sample & Identification
● Borehole Location
⊗ Geoprobe Location
— Road
—○—○— Fence
▬ Septic Tank / Seepage Pit
- - - - Drain Line
— Former Building / Structure
🟩 SWMU 167

Figure 2.2.2-13
Drain and Septic Systems (DSS) SWMU 167, Building 940 PETREX™ Soil-Vapor Sample Locations

0 15 30
Scale in Feet

0 3.6 7.2
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

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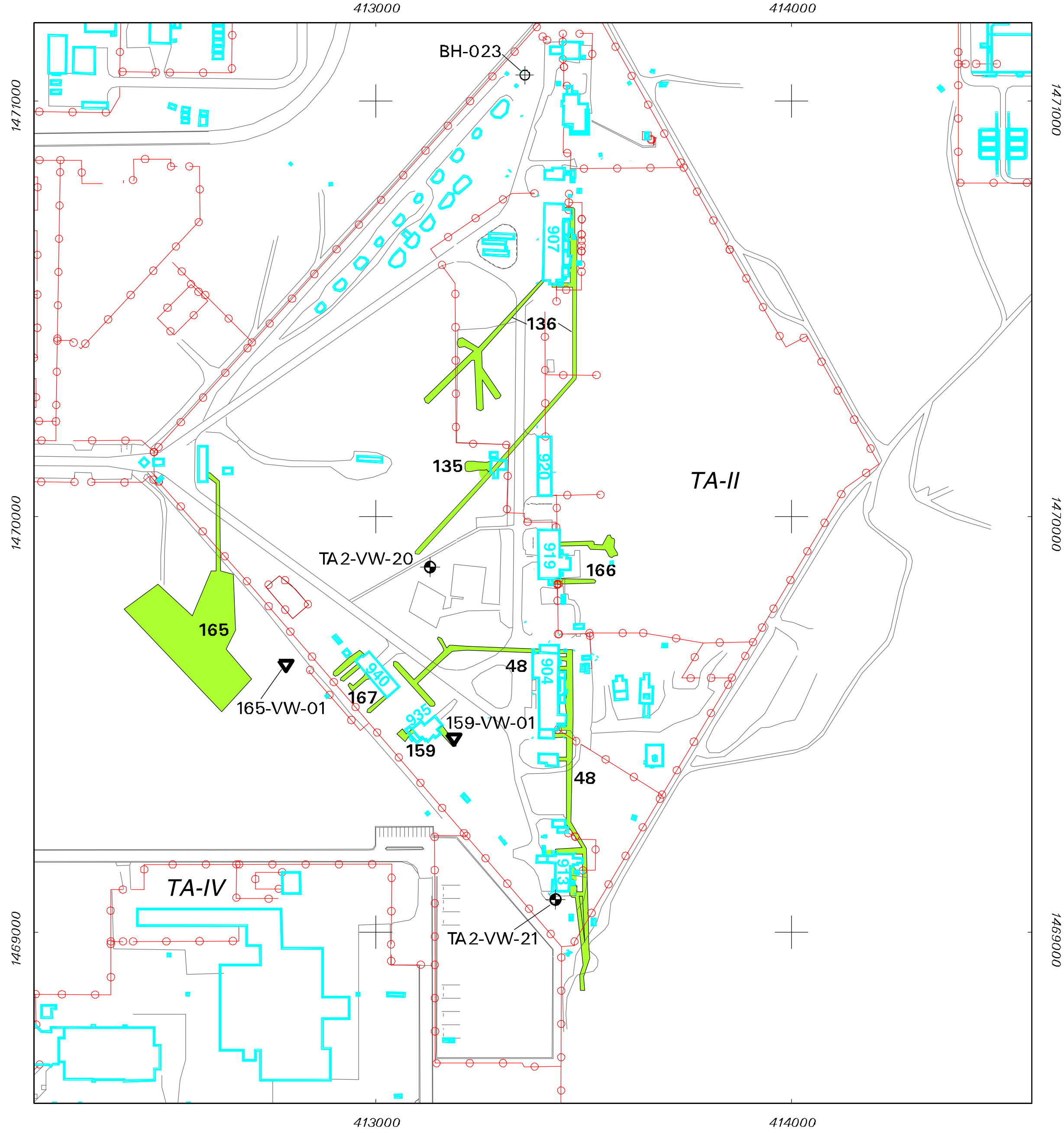

Legend

⊕ Borehole

⊕ Borehole Completed as a Soil-Vapor Monitoring Well

▼ Drain and Septic Systems Investigation Soil-Vapor Monitoring Well

— Road

-o-o-o- Fence

▭ Building / Structure

🟩 DSS SWMU

Figure 2.3.2-1 Location Map of Active Soil-Vapor Monitoring Wells at Technical Area-II

0 200 400
Scale in Feet

0 48 96
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

ANNEX A
Soil-Vapor Analytical Data Summary Tables

LIST OF TABLES

Table

Table A-1
Summary of Technical Area II PETREX™ Passive Soil-Vapor Sampling VOC Analytical Results
Phase I (November–December 1993) and Phase II (January–February 1994)

Sample Number	PETREX™ Response Values (ion counts)		
	TCE	PCE	BTEX
Phase I Samples (November-December 1993)			
001	ND	3577	44658
002	ND	2513	14682
003	ND	5903	22835
004	ND	11343	1148671
005	ND	5657	58446
006	ND	14927	29763
007	10691	ND	93901
008	ND	2398	1239482
009	ND	ND	14537
010	53938	53257	2529709
011	35882	7355	39477
012	18064	4272	416172
013	23476	1264	123305
014	8721	3335	195836
015	27922	ND	320554
016	56732	21982	292794
017	ND	ND	23225
018	ND	ND	41953
019	11560	13597	105389
020	ND	1013	14680
021	ND	ND	1429
022	ND	ND	84641
023	ND	ND	5620
024	60310	4746	115046
025	ND	1151	31192
026	23360	8469	190091
027	23330	3930	68376
028	6264	ND	22224
029	51537	2645	62724
030	ND	ND	106647
031	ND	ND	23402
032	ND	774	11582
033	11611	ND	20100
034	ND	ND	12692
035	4164	5518	47653
036	ND	ND	37113
037	11928	1025	7147
037-DU	17256	3829	11332
038	ND	4640	8537
038-DU	ND	3878	15434
039	14224	ND	8265
040	ND	ND	2508
041	20616	ND	32679

Refer to footnotes at end of table.

Table A-1 (Continued)
Summary of Technical Area II PETREX™ Passive Soil-Vapor Sampling VOC Analytical Results
Phase I (November–December 1993) and Phase II (January–February 1994)

Sample Number	PETREX™ Response Values (ion counts)		
	TCE	PCE	BTEX
042	100987	4364	44688
043	27066	2170	19618
044	ND	ND	20875
045	54398	1211	65712
046	38002	848	10004
047	28716	ND	117525
048	12995	ND	215394
049	19327	ND	20882
050	196370	3699	60986
051	62577	ND	15142
052	75160	5966	25965
053	31699	ND	23253
054	37827	1204	36597
055	ND	ND	38122
056	66940	891	23192
057	42688	ND	24305
058	35382	794	10320
059	46468	1484	41486
060	ND	ND	12066
061[a]	22986	ND	15948
062	29942	7284	64346
063	ND	ND	24194
063-DU	ND	ND	31862
064	51440	2281	36361
065	52630	ND	4798
066	49956	17667	72670
067	1024	ND	4529
068	45438	88403	3245175
069	6306	5133	125305
070	3353	3010	44799
071	68289	6374	55509
072	44669	2376	47154
073	11849	ND	27785
074	11804	866	148279
074-DU	24355	ND	377027
075	19738	2184	32998
076	ND	3556	66733
077	ND	2198	35987
078	ND	ND	39125
078-DU	ND	ND	90355
079	ND	838	18874
080	8460	110697	2802941
082	16210	30572	1021261
083	8698	21606	434147

Refer to footnotes at end of table.

Table A-1 (Continued)
Summary of Technical Area II PETREX™ Passive Soil-Vapor Sampling VOC Analytical Results
Phase I (November–December 1993) and Phase II (January–February 1994)

Sample Number	PETREX™ Response Values (ion counts)		
	TCE	PCE	BTEX
084	5066	20179	181512
085	ND	6231	156083
086	ND	ND	73504
087	16300	3970	598169
088	1095	7881	181011
089	ND	ND	66966
090	ND	ND	52599
091	ND	7288	201377
092	ND	14119	292030
093	ND	ND	24085
093-DU	ND	ND	59981
094	ND	ND	14986
094-DU	ND	ND	3888
095	ND	ND	2327
095-DU	ND	ND	6303
096	ND	ND	30828
097	ND	3288	87841
098	ND	ND	52081
099	ND	10525	109307
100	ND	2268	59834
101	ND	11023	169190
102	ND	7523	391150
103	ND	13560	14220
103-DU	ND	30270	35014
104	ND	6280	6294
104-DU	ND	6622	9747
105	ND	11028	138354
105-DU	ND	2599	27159
106	ND	ND	88660
107	ND	2178	154277
108	ND	949	117484
109	ND	5964	121794
110	ND	3063	157573
111	16849	16478	192491
112	17865	891	71058
113	ND	4403	133746
114	752157	11476	214968
115	45571	1677	26565
116	ND	ND	106728
116-DU	ND	ND	168846
117	13431	13030	861072
118	3326	23881	443240
119	3554	16402	461746
120	5307	7600	198122

Refer to footnotes at end of table.

Table A-1 (Continued)
Summary of Technical Area II PETREX™ Passive Soil-Vapor Sampling VOC Analytical Results
Phase I (November–December 1993) and Phase II (January–February 1994)

Sample Number	PETREX™ Response Values (ion counts)		
	TCE	PCE	BTEX
121	16314	16229	385502
122	13294	19795	1593673
123	ND	4400	300988
124	ND	2125	215462
125	ND	ND	15947
126	33440	13399	346774
127	ND	12798	268590
127-DU	ND	7324	179772
128	3459	969	16836
129	ND	ND	3505
130	13091	4360	63396
131	11264	ND	50239
132	51331	4058	183237
133	52753	5235	60742
180	ND	699	16063
200	10045	4918	43186
201	ND	13907	43933
201-DU	ND	3400	15394
202	ND	2425	19242
202-DU	ND	2600	15505
203	21577	10013	29072
204	28050	18951	67496
205	18193	16281	79010
206	ND	2240	23244
207	ND	14936	252546
208	31372	36318	398632
209-DU	ND	1020	48050
209	ND	7718	182033
210	ND	887	2688
211	ND	952	28052
212	ND	13299	76903
213	48200	58209	114605
214	ND	14743	54377
215	ND	37735	148570
215-DU	ND	15626	57474
216	ND	16632	49430
217	ND	16151	52019
218	ND	ND	4008
219	5781	51333	3789231
220	ND	12715	171842
221	51973	32960	2067854
222	ND	6744	123014
223	ND	4960	184108
224	ND	43150	44875

Refer to footnotes at end of table.

Table A-1 (Continued)
Summary of Technical Area II PETREX™ Passive Soil-Vapor Sampling VOC Analytical Results
Phase I (November–December 1993) and Phase II (January–February 1994)

Sample Number	PETREX™ Response Values (ion counts)		
	TCE	PCE	BTEX
225	ND	53212	238452
226	ND	276903	101944
227	85340	683858	108698
228	ND	67087	107686
229	408421	268917	183502
230	211836	183944	444318
231	ND	11250	171278
232	13533	55079	62032
233	ND	718	2316
234	ND	315158	174269
235	ND	1115030	315273
236	ND	714931	292585
237	ND	51774	117518
238	14158	9630	140515
239	ND	14728	26668
240	71095	135052	87584
241	5773	21038	536222
242	4533	21383	73118
243	ND	ND	88290
244	ND	3631	20936
245	ND	11896	52083
246	164190	252313	381029
247	93126	51130	123712
248	44567	18100	6812
249	19099	62389	282088
250	40519	74903	256628
251	ND	13632	106594
252	ND	23231	1094550
253	ND	2041	11031
254	ND	ND	14626
255	ND	3838	11495
256	ND	ND	9115
257	1282	6418	23448
258	ND	24806	227567
259	ND	ND	12618
260	ND	1019	8928
261	ND	34003	141854
261-DU	ND	10041	95682
263	ND	3156	18379
264	ND	ND	4488
265	ND	ND	ND
266	ND	2750	27438
267	ND	ND	3238
268	12966	10148	68719

Refer to footnotes at end of table.

Table A-1 (Continued)
Summary of Technical Area II PETREX™ Passive Soil-Vapor Sampling VOC Analytical Results
Phase I (November–December 1993) and Phase II (January–February 1994)

Sample Number	PETREX™ Response Values (ion counts)		
	TCE	PCE	BTEX
269	ND	3347	15035
270	ND	ND	ND
271	ND	780	34172
272	ND	808	64059
273	ND	ND	5853
274	3774	6100	19211
275	ND	ND	26772
276	ND	ND	2462
277	ND	ND	4687
278	ND	2870	43612
279	17462	750678	182791
280	ND	32941	14538
281[a]	ND	6874	2463628
282	ND	ND	2571
283	ND	ND	4654
284	ND	7676	44504
285	ND	ND	1378
286	6263	1091	52349
287	ND	ND	27074
288	2148	13836	87944
289	ND	ND	22095
290	ND	ND	1324
290-DU	ND	ND	6664
291	ND	ND	31243
292	ND	10156	26882
292-DU	ND	7440	18285
293	ND	9495	70017
294	ND	15406	100381
295	ND	ND	47885
296	17226	5326	11862
296-DU	17964	10405	13166
297	ND	7594	45292
298	ND	6204	84965
299	ND	17217	73208
300	ND	22912	177263
301	ND	8395	84771
302	ND	2452	48826
303	ND	ND	4878
304	ND	9197	84921
305	ND	ND	9493
305-DU	ND	ND	921
306	4973	6476	115253
307	6076	13073	212214
308	ND	ND	71802

Refer to footnotes at end of table.

Table A-1 (Continued)
Summary of Technical Area II PETREX™ Passive Soil-Vapor Sampling VOC Analytical Results
Phase I (November–December 1993) and Phase II (January–February 1994)

Sample Number	PETREX™ Response Values (ion counts)		
	TCE	PCE	BTEX
309	3717	15269	348676
310	ND	ND	43022
311	15332	1652	422404
312	ND	ND	126546
313	ND	ND	42071
314	ND	ND	13102
315	ND	5422	9636
316	ND	ND	ND
317	ND	12282	95862
318	ND	ND	65394
319	ND	1139	11012
320	ND	5644	31396
320-DU	ND	926	16657
321[b]	31144	18434	3840395
322	ND	ND	19173
323	ND	12605	50370
324	ND	ND	ND
324-DU	ND	ND	ND
325	ND	7465	97390
325-DU	ND	3465	63036
326	ND	9283	123620
327	ND	9363	28528
328	ND	3138	21492
329	ND	2750	134787
330	ND	ND	21781
331	ND	967	5447
332	ND	2569	6555
333	ND	8732	74842
333-DU	ND	22418	163380
334	ND	8414	79897
335	ND	5908	23938
336	ND	ND	ND
336-DU	ND	ND	ND
337	ND	3544	26261
338	ND	3139	14319
339	ND	78088	157513
340	25405	20021	1295188
341	ND	ND	29253
342	ND	ND	34544
343	ND	ND	63459
344	7731	8624	145416
345	ND	7832	74145
346	13300	8972	245500
347	ND	4190	508695

Refer to footnotes at end of table.

Table A-1 (Continued)
Summary of Technical Area II PETREX™ Passive Soil-Vapor Sampling VOC Analytical Results
Phase I (November–December 1993) and Phase II (January–February 1994)

Sample Number	PETREX™ Response Values (ion counts)		
	TCE	PCE	BTEX
347-DU	ND	6553	703828
348	ND	823	27897
349	ND	12101	68118
350	17873	26138	1902777
351	ND	ND	61338
352	ND	ND	63150
353	ND	11828	88529
354	7297	7047	8922
355	ND	5744	24105
356	ND	ND	8620
357	ND	954	3624
358	ND	15296	114701
359	ND	ND	13266
360	ND	40738	10309
361	ND	6838	35830
362	ND	ND	28010
363	ND	ND	ND
363-DU	ND	ND	ND
364	ND	2178	17676
365	ND	ND	36622
366	ND	ND	25588
367	ND	ND	37510
368	ND	9600	28764
369	ND	673	472126
369-DU	ND	650	404020
370	ND	ND	3455
371	ND	ND	14538
372	ND	ND	18862
373	ND	3249	19203
374	ND	4680	63223
375	ND	7098	201750
376	ND	ND	5739
376-DU	ND	ND	2554
377	1207	5869	15168
378	ND	16586	312058
379	ND	ND	33960
380	ND	ND	18058
381	2146	8253	69551
382	ND	8164	16261
383	ND	2532	47441
384	13375	5313	158854
385	ND	2080	104626
385-DU	ND	5144	116846
386	ND	6425	148005

Refer to footnotes at end of table.

Table A-1 (Continued)
Summary of Technical Area II PETREX™ Passive Soil-Vapor Sampling VOC Analytical Results
Phase I (November–December 1993) and Phase II (January–February 1994)

Sample Number	PETREX™ Response Values (ion counts)		
	TCE	PCE	BTEX
387	ND	ND	ND
387-DU	ND	ND	ND
388	ND	ND	20760
389	ND	ND	7312
390	ND	ND	18477
391	ND	ND	3910
392	ND	ND	19871
393	3296	ND	27789
394	ND	ND	17184
395	112632	2450	182445
396	113649	4630	48974
397	ND	ND	12995
398	ND	ND	25323
399	ND	ND	1163
400	ND	ND	16558
401	ND	ND	26988
402	ND	ND	4270
403	ND	3020	897764
404	ND	3458	37561
405	ND	ND	117652
405-DU	ND	ND	59474
406	ND	3079	154685
407	ND	2858	168264
408	ND	ND	39614
408-DU	ND	ND	1618
409	42683	103544	3534084
410	ND	ND	18638
410-DU	ND	1943	26259
411	ND	ND	113479
412	10840	2761	52299
413	ND	ND	193354
414	ND	ND	119306
415	11019	1324	589485
1000	ND	ND	122435
1001	ND	ND	54694
1002	7913	1738	1613984
1003	16596	13997	2128636
1004	ND	ND	53067
1005	ND	ND	124957
1006	24918	15289	536918
1007	ND	4627	185336
1010	ND	ND	51470
1011	30155	11080	615554
1012	61218	12577	1775077

Refer to footnotes at end of table.

Table A-1 (Continued)
Summary of Technical Area II PETREX™ Passive Soil-Vapor Sampling VOC Analytical Results
Phase I (November–December 1993) and Phase II (January–February 1994)

Sample Number	PETREX™ Response Values (ion counts)		
	TCE	PCE	BTEX
1013	74497	4110	252034
1014	99204	8949	297788
1015	24692	ND	355430
1016	44196	5342	373555
1017	63678	5964	317064
2000	ND	15002	143273
Phase II Samples (January-February 1994)			
42	7150	ND	73181
60	ND	ND	12066
66	140502	11934	18071
68	ND	ND	8666
80	ND	932	83164
81	ND	7299	73634
216	ND	ND	62478
227	84801	198874	24686
229[c]	178643	29509	40857
234	2585	11950	76896
262	4178	21257	192011
321	ND	ND	24278
339	22976	5489	200428
279	ND	ND	26977
507	ND	3536	491679
508	ND	ND	3788108
509	95126	662571	73707
510	81153	7215	3516771
511	15841	29656	971812
513	3401	13753	1304214
514	58255	ND	129058
515	23108	2145	135898
516	325191	10656	2536416
518	35349	ND	36300
519	1788	10379	774028
520	167686	8695	123153
521	26037	4349	50500
522	131504	13023	36130
523	72372	ND	46143
524	40723	3421	39868
525	128296	15164	156616
526	105854	12672	103113
527	41948	7470	79943
528	34886	9395	180840
529	16701	24668	271567
530	1047	4358	50304
531	662570	15156	7651910

Refer to footnotes at end of table.

Table A-1 (Continued)
Summary of Technical Area II PETREX™ Passive Soil-Vapor Sampling VOC Analytical Results
Phase I (November–December 1993) and Phase II (January–February 1994)

Sample Number	PETREX™ Response Values (ion counts)		
	TCE	PCE	BTEX
532	20273	2038	1105503
533	1803940	25590	2889485
534	10023	ND	281539
535	1128790	75264	302364
536	ND	2953	10103350
538	132940	25831	11095640
539	1340	11236	196334
541	280184	7298	128463
542	375732	6039	120996
543	ND	ND	109070
544	116462	1263	133112
545	575741	ND	97651
546	32925	1423	67228
547	779378	18055	113306
548	119104	13719	536477
549	27485	16874	107852
550	20750	ND	325639
551	128182	15577	1092330
552	8048	14425	2381538
553	15545	2170	56478
554	ND	1228	388859
555	ND	6278	234318
556	7026	8195	445219
557	3132	2250	302313
558	ND	891	131337
559	ND	1754	57661
560	ND	31942	111984
561	ND	2032	65480
562	ND	ND	112234
563	9934	10451	15485
564	ND	ND	10239
566	ND	8464	219617
567	ND	ND	33126
568	ND	ND	39071
569	ND	ND	63104
570	ND	ND	4133
571	ND	ND	46820
572	ND	ND	21915
573	ND	ND	48233
574	ND	1845	28380
575	ND	ND	91749
576	ND	2065	41809
577	ND	ND	193741
581	286483	64632	2267857

Refer to footnotes at end of table.

Table A-1 (Concluded)
Summary of Technical Area II PETREX™ Passive Soil-Vapor Sampling
VOC Analytical Results
Phase I (November–December 1993) and Phase II (January–February 1994)

Sample Number	PETREX™ Response Values (ion counts)		
	TCE	PCE	BTEX
582	32981	ND	29889
583	69875	ND	211763
584	11304	ND	10264
585	5779	ND	16267
586	MISSING	MISSING	MISSING
587	ND	ND	90188
590	ND	ND	10437
591	12134	16162	205372
581	286483	64632	2267857
600	26652	3211	180061
601	123694	5955	680101
602	39805	1867	133891
603	31114	3730	68391
604	ND	ND	14131
605	3782	7405	115613
700	50042	15160	11279240
701	131355	9089	3780479
908	ND	ND	2494249
910	143838	9293	1755741
914	61556	ND	152262
916	378129	11156	2248256
922	88777	13378	25666
926	55521	1945	48394
929	18789	17065	291392
962	ND	ND	125956
968	ND	ND	24803
972	ND	ND	9635
Quality Assurance/Quality Control Samples			
TB 2001	ND	ND	78838
TB 2002	ND	ND	3153
TB 2003	ND	ND	ND
TB 2004	ND	ND	ND

[a] Value elevated due to interference with terpene compounds.

[b] Sampler integrity compromised; value may be elevated due to incidental cross-contamination.

[c] Sampler exposed approximately 10 days longer than the remaining data set.

BTEX = Benzene, toluene, ethylbenzene, and xylene(s).
DU = Duplicate analysis. In laboratory reports, these samples are prefixed with a "3" before the sample number.
ND = Not detected above the PETREX™ background value.
PCE = Tetracholoroethene.
TB = Trip blank.
TCE = Trichloroethene.
VOC = Volatile organic compound.

Table A-2
Summary of Technical Area II PETREX™ Passive Soil-Vapor Sampling Additional VOCs Detected
Phase I (November–December 1993) and Phase II (January–February 1994)

Sample Number	PETREX™ Response Values (ion counts)			
	TCA	DCB	Freon-11	Freon-113
Phase I Samples (November-December 1993)				
5	ND	221746	ND	ND
10	ND	415426	ND	ND
68	ND	704865	ND	ND
80	ND	886514	ND	ND
83	ND	1742220	ND	ND
85	ND	271140	ND	ND
216	ND	ND	100532	ND
219	ND	2122370	ND	ND
225	ND	ND	227552	137744
226	ND	ND	558425	478299
227	ND	ND	204234	88984
228	ND	ND	408375	284606
231	ND	ND	554822	ND
235	ND	ND	379641	274423
236	ND	ND	500416	447926
238	ND	ND	600607	510369
239	ND	ND	222725	111590
240	ND	ND	146644	ND
246	ND	ND	174304	135227
247	109033	ND	ND	ND
251	ND	212469	ND	ND
346	ND	470719	ND	ND
406	ND	161433	ND	ND
409	ND	391198	ND	ND
Phase II Samples (January-February 1994)				
531	ND	ND	247990	ND
801[a]	ND	ND	183453	ND

[a] No known sample point with this designation, possibly referring to Sample 81.

DCB = Dichlorobenzene.
Freon-11 = Trichlorofluoromethane.
Freon-113 = Trichlorotrifluoroethane.
ND = Not detected above the PETREX™ background value.
TCA = Trichloroethane.
VOC = Volatile organic compound.

Table A-3
Summary of Technical Area II Active Soil-Vapor Monitoring Well VW-20 Sampling
Soil-Vapor VOC Analytical Results
November 1996 to March 2002
(On- and Off-Site Laboratories)

Sample Attributes				VOCs (EPA Method 8260-M3^a, TO-14/TO-14A^b) Units as indicated																																								
Laboratory and Record Number^c	ER Sample ID	Sample Depth (ft)	Sample Date	Acetone	Benzene	Bromodichloromethane	1,3-Butadiene	2-Butanone	Carbon disulfide	Carbon tetrachloride	Chloroform	Chloroethane	Chloromethane	Cyclohexane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethene	cis-1,2-Dichloroethene	Ethanol	Ethyl benzene	4-Ethyltoluene	Heptane	Hexane	2-Hexanone	Methylene chloride	4-Methyl-2-pentanone	2-Propanol	Propylene	Styrene	Tetrachloroethene	Toluene	1,2,4-Trichlorobenzene	1,1,1-Trichloroethane	Trichloroethene	Trichlorofluoromethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	o-Xylene	m-, p-Xylene	Total Xylene
Soil-vapor samples collected during borehole drilling ppb(v/v)																																												
ATL 9267	TA2-BH-020-10-SV	10	11-14-96	**180**	**21**	ND (7.0)	**13**	**28**	ND (7.0)	ND (1.8)	ND (1.8)	ND (1.8)	ND (1.8)	ND (7.0)	ND (1.8)	ND (1.8)	ND (1.8)	ND (1.8)	ND (1.8)	ND (1.8)	ND (1.8)	**36**	**8.6**	ND (7.0)	**35**	**11**	ND (7.0)	ND (1.8)	ND (7.0)	ND (7.0)	ND (7.0)	**2.7**	ND (1.8)	**300**	ND (1.8)	ND (1.8)	**3.4**	ND (1.8)	**18**	**14**	**6.6**	**11**	**32**	NR
ATL 9267	TA2-BH-020-20-SV	20	11-14-96	**130**	**6.8**	ND (4.4)	**7.9**	**12**	ND (4.4)	ND (1.1)	ND (1.1)	ND (1.1)	ND (1.1)	ND (4.4)	ND (1.1)	ND (1.1)	ND (1.1)	ND (1.1)	**1.3**	ND (1.1)	ND (1.1)	**21**	**6.8**	**9.1**	**38**	**6.4**	ND (4.4)	ND (1.1)	ND (4.4)	ND (4.4)	ND (4.4)	**1.2**	ND (1.1)	**300**	ND (1.1)	ND (1.1)	**5.3**	ND (1.1)	**24**	**20**	**8.5**	**9.2**	**29**	NR
ATL 9267	TA2-BH-020-30-SV	30	11-14-96	**320**	**38**	ND (6.2)	**36**	**38**	ND (6.2)	ND (1.6)	ND (1.6)	ND (1.6)	ND (1.6)	ND (6.2)	ND (1.6)	ND (1.6)	ND (1.6)	ND (1.6)	ND (1.6)	ND (1.6)	ND (1.6)	ND (6.2)	**8.0**	**12**	**38**	**19**	ND (6.2)	ND (1.6)	ND (6.2)	ND (6.2)	ND (6.2)	**2.9**	ND (1.6)	**260**	ND (1.6)	ND (1.6)	**4.6**	ND (1.6)	**17**	**22**	**9.6**	**11**	**30**	NR
ATL 9267	TA2-BH-020-40-SV	40	11-14-96	**130**	**7.7**	ND (4.9)	**6.8**	**14**	ND (4.9)	ND (1.2)	ND (1.2)	ND (1.2)	ND (1.2)	ND (4.9)	ND (1.2)	ND (1.2)	ND (1.2)	ND (1.2)	**1.9**	ND (1.2)	ND (1.2)	**15**	**4.6**	ND (4.9)	**26**	**5.7**	ND (4.9)	ND (1.2)	ND (4.9)	ND (4.9)	ND (4.9)	ND (1.2)	ND (1.2)	**200**	ND (1.2)	ND (1.2)	**12**	**2.3**	**60**	**8.5**	**3.4**	**7.0**	**18**	NR
ATL 9268	TA2-BH-020-40-SV-DU	40	11-14-96	**150**	**11**	ND (4.1)	**9.4**	**24**	ND (4.1)	**2.1**	**3.5**	ND (1.0)	ND (1.0)	ND (4.1)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	**1.8**	ND (1.0)	ND (1.0)	**16**	**3.7**	ND (4.1)	**15**	**6.6**	ND (4.1)	ND (1.0)	ND (4.1)	ND (4.1)	ND (4.1)	**1.0 J (1.0)**	ND (1.0)	**130**	ND (1.0)	ND (1.0)	**14**	**2.5**	**80**	**6.8**	**3.0**	**5.5**	**15**	NR
ATL 9268	TA2-BH-020-50-SV	50	11-14-96	**75**	**31**	ND (3.7)	**29**	**15**	**5.4**	ND (0.92)	**2.3**	ND (0.92)	ND (0.92)	ND (3.7)	ND (0.92)	ND (0.92)	ND (0.92)	ND (0.92)	**1.1**	ND (0.92)	**1.2**	**430**	**5.8**	**5.5**	**22**	**10**	ND (3.7)	ND (0.92)	ND (3.7)	ND (3.7)	ND (3.7)	**2.5**	ND (0.92)	**150**	ND (0.92)	ND (0.92)	**7.5**	**1.4**	**35**	**11**	**4.7**	**7.2**	**19**	NR
ATL 9268	TA2-BH-020-60-SV	60	11/14/96	**240**	**46**	ND (3.7)	**22**	**50**	**6.2**	**3.8**	**5.8**	ND (0.92)	ND (0.92)	**75**	ND (0.92)	ND (0.92)	ND (0.92)	ND (0.92)	**1.7**	ND (0.92)	ND (0.92)	**18**	**11**	**9.3**	**59**	**54**	**4.5**	ND (0.92)	ND (3.7)	ND (3.7)	ND (3.7)	**2.2**	ND (0.92)	**280**	ND (0.92)	ND (0.92)	**24**	**4.0**	**120**	**28**	**12**	**20**	**58**	NR
ATL 9268	TA2-BH-020-70-SV	70	11-15-96	**170**	**17**	ND (3.5)	**20**	**21**	**6.2**	**1.5**	**3.2**	ND (0.88)	ND (0.88)	**22**	ND (0.88)	ND (0.88)	ND (0.88)	ND (0.88)	**1.0**	ND (0.88)	ND (0.88)	**17**	**5.1**	**4.4**	**19**	**20**	ND (3.5)	ND (0.88)	ND (3.5)	ND (3.5)	ND (3.5)	ND (0.88)	ND (0.88)	**100**	ND (0.88)	ND (0.88)	**11**	**1.7**	**45**	**10**	**3.9**	**6.7**	**20**	NR
ATL 9268	TA2-BH-020-80-SV	80	11-15-96	**460**	**41**	ND (12)	**42**	**95**	**25**	**4.2**	**7.4**	ND (3.0)	ND (3.0)	ND (12)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	ND (3.0)	**55**	**26**	**12**	**100**	**44**	ND (12)	ND (3.0)	ND (12)	ND (12)	ND (12)	**3.2**	ND (3.0)	**960**	ND (3.0)	ND (3.0)	**30**	**4.6**	**140**	**29**	**12**	**38**	**110**	NR
ATL 9268	TA2-BH-020-90-SV	90	11-15-96	**330**	**32**	ND (23)	ND (23)	**58**	ND (23)	ND (5.7)	**9.5**	ND (5.7)	ND (5.7)	ND (23)	ND (5.7)	ND (5.7)	ND (5.7)	ND (5.7)	ND (5.7)	ND (5.7)	ND (5.7)	**78**	**19**	ND (23)	**83**	**31**	ND (23)	ND (5.7)	ND (23)	ND (23)	ND (23)	ND (5.7)	ND (5.7)	**690**	ND (5.7)	ND (5.7)	**41**	**6.2**	**190**	**15**	**6.9**	**26**	**72**	NR
ATL 9268	TA2-BH-020-100-SV	100	11-15-96	**400**	**86**	ND (18)	**96**	**57**	**18**	**4.3 J (4.6)**	**13**	ND (4.6)	ND (4.6)	ND (18)	ND (4.6)	ND (4.6)	ND (4.6)	ND (4.6)	**3.0 J (4.6)**	ND (4.6)	ND (4.6)	**80**	**36**	**8.8 J (18)**	**200**	**86**	ND (18)	ND (4.6)	ND (18)	ND (18)	ND (18)	ND (4.6)	ND (4.6)	**1600**	ND (4.6)	ND (4.6)	**47**	**6.2**	**200**	**22**	**11**	**44**	**140**	NR
ATL 9268	TA2-BH-020-100-SV-DU	100	11-15-96	**380**	**94**	ND (3.7)	**100**	**62**	**19**	**5.8**	**15**	ND (0.92)	ND (0.92)	ND (3.7)	ND (0.92)	ND (0.92)	ND (0.92)	ND (0.92)	**2.7**	ND (0.92)	ND (0.92)	**71**	**36**	**8.3**	**190**	**100**	ND (2.7)	ND (0.92)	ND (3.7)	ND (3.7)	ND (3.7)	**3.2**	ND (0.92)	**1400 J**	ND (0.92)	ND (0.92)	**52**	**7.2**	**220**	**22**	**9.4**	**47**	**150**	NR
Soil-vapor concentration mg/m^3																																												
ERCL 6173	TA2-VW-20-72-P	72	07-17-97	NR	ND (1.2)	ND (1.2)	NA	NR	ND (1.2)	ND (1.2)	ND (1.2)	NA	NR	NA	NR	NR	NR	NR	NR	ND (1.2)	ND (1.2)	NA	ND (1.2)	NR	NA	NA	NR	**29 J (4.8)**	NA	NA	NA	ND (1.2)	ND (1.2)	**5.5 J (4.8)**	NR	ND (1.2)	ND (1.2)	NR	ND (1.2)	NR	NR	ND (1.2)	**5.2 J (9.5)**	NR
ERCL 6173	TA2-VW-20-72-S	72	07-17-97	NR	ND (1.2)	ND (1.2)	NA	NR	ND (1.2)	ND (1.2)	ND (1.2)	NA	NR	NA	NR	NR	NR	NR	NR	ND (1.2)	ND (1.2)	NA	ND (1.2)	NR	NA	NA	NR	**18**	NA	NA	NA	ND (1.2)	ND (1.2)	ND (1.2)	NR	ND (1.2)	ND (1.2)	NR	**1.8 J (4.8)**	NR	NR	ND (1.2)	ND (2.5)	NR
ERCL 6942	TA2-VW-20-72-P	72	09-04-97	NR	ND (1.25)	ND (1.25)	NA	NR	ND (1.25)	ND (1.25)	ND (1.25)	NA	NR	NA	NR	NR	NR	NR	NR	ND (1.25)	ND (1.25)	NA	ND (1.25)	NR	NA	NA	NR	**23**	NA	NA	NA	ND (1.25)	ND (1.25)	ND (1.25)	NR	ND (1.25)	ND (1.25)	NR	ND (1.25)	NR	NR	ND (1.25)	ND (2.5)	NR
ERCL 6942	TA2-VW-20-72-S	72	09-04-97	NR	ND (1.25)	ND (1.25)	NA	NR	ND (1.25)	ND (1.25)	ND (1.25)	NA	NR	NA	NR	NR	NR	NR	NR	ND (1.25)	ND (1.25)	NA	ND (1.25)	NR	NA	NA	NR	**5.3**	NA	NA	NA	ND (1.25)	ND (1.25)	ND (1.25)	NR	ND (1.25)	ND (1.25)	NR	ND (1.25)	NR	NR	ND (1.25)	ND (2.5)	NR
Soil-vapor concentration ppb(v/v)																																												
Core 600308	TA2-VW-20-72	72	05-14-98	ND (1.0)	ND (1.0)	ND (1.0)	ND (1)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1)	ND (1.0)	NR	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	NR	ND (1.0)	ND (1.0)	NR	NR	NR	ND (1.0)	NR	NR	NR	ND (1.0)	ND (1.0)	**9.0**	ND (1.0)	ND (1.0)	**8.0**	ND (1.0)	**42**	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Core 600308	TA2-VW-20-72-DU	72	05-14-98	ND (1.0)	ND (1.0)	ND (1.0)	ND (1)	ND (1.0)	ND (1.0)	ND (1.0)	**7.0**	ND (1)	ND (1.0)	NR	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	NR	ND (1.0)	ND (1.0)	NR	NR	NR	**4.0**	NR	NR	NR	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	**9.0**	ND (1.0)	**38**	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Quanterra 600796	TA2-VW-20-72	72	09-02-98	**16**	**0.97 J (2)**	ND (0.27)	ND (0.57)	ND (3.5)	ND (0.73)	**2.6**	**5.6**	ND (1.5)	ND (1.4)	NR	**2.7**	**43**	**4.1**	**10**	**1.5 J (2)**	ND (0.87)	ND (0.54)	NR	**1.9 J (2)**	**0.48 J (2)**	NR	NR	ND (3.9)	ND (0.44)	ND (0.38)	NR	NR	ND (0.64)	**21**	**5.6**	**6.3 J (20)**	ND (0.49)	**31**	**4.1**	**120**	**0.88 J (2)**	**0.42 J (2)**	NR	NR	**9.3**
Quanterra 600796	TA2-VW-20-72-DU	72	09-02-98	**20**	ND (0.42J)	ND (0.27)	ND (0.57)	ND (3.5)	ND (0.73)	**2.2**	**5.1**	ND (1.5)	ND (1.4)	NR	**1.7 J (2)**	**29**	**2.7**	**6.9**	**1.4 J (2)**	ND (0.87)	ND (0.54)	NR	**1.2 J (2)**	**0.31 J (2)**	NR	NR	ND (3.9)	ND (0.44)	ND (0.38)	NR	NR	ND (0.64)	**14**	**3.5**	**4.4 J (20)**	ND (0.49)	**28**	**3.7**	**110**	**0.68 J (2)**	ND (0.29)	NR	NR	**6**
Quanterra 601237	TA2-VW-20-72	72	12-02-98	ND (2)	ND (0.8J)	ND (0.8)	ND (1)	ND (2)	ND (2)	**3 J**	**5.8**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	**1.6 J (2)**	ND (0.5)	ND (0.8)	NR	ND (0.5)	ND (0.5)	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	**0.51 J (2)**	ND (0.5)	ND (3J)	ND (0.5)	**21**	**4**	**120**	ND (0.5)	ND (0.5)	NR	NR	ND (0.8)
Quanterra 601237	TA2-VW-20-72-DU	72	12-02-98	ND (2)	ND (0.8J)	ND (0.8)	ND (1)	ND (2)	ND (2)	**3 J**	**5.4**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	**1.5 J (2)**	ND (0.5)	ND (0.8)	NR	ND (0.5)	ND (0.5)	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	ND (0.5)	ND (0.5)	ND (3J)	ND (0.5)	**21**	**3.9**	**110**	ND (0.5)	ND (0.5)	NR	NR	ND (0.8)
Quanterra 601638	TA2-VW-20-72	72	03-22-99	**31**	ND (0.8)	ND (0.8)	ND (1)	ND (2)	ND (2)	**3.6**	**6.8**	ND (0.8)	ND (1)	NR	ND (0.5)	**1 J (2)**	ND (0.5)	**1.5 J (2)**	**1.9 J (2)**	ND (0.5)	ND (0.8)	NR	ND (0.5)	ND (0.5)	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	**0.57 J (2)**	ND (0.5)	ND (3)	ND (0.5)	**25**	**4.9**	**110**	ND (0.5)	ND (0.8)	**0.52 J (2)**	**1.5 J (2)**	NR
Quanterra 601638	TA2-VW-20-72-DU	72	03-22-99	**23**	ND (0.8)	ND (0.8)	ND (1)	ND (2)	ND (2)	**3.7**	**7.7**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.5)	**2**	**2.1**	ND (0.5)	ND (0.8)	NR	ND (0.5)	ND (0.5)	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	**0.67 J (2)**	**0.74 J (2)**	ND (3)	ND (0.5)	**28**	**5.3**	**120**	ND (0.5)	ND (0.8)	ND (0.5)	**1.1 J (2)**	NR
Quanterra 601823	TA2-VW-20-72	72	06-24-99	**50**	ND (0.8)	ND (0.8)	ND (1)	**3 J (10)**	ND (2)	**2.9**	**5.8**	ND (0.8)	ND (1)	NR	ND (0.5)	**3.6**	ND (0.5)	ND (0.8)	**1.6 J (2)**	ND (0.5)	ND (0.8)	NR	**0.51 J (2)**	**0.62 J (2)**	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	**3.6**	**2.5**	ND (3)	ND (0.5)	**24**	**4**	**97**	**1 J (2)**	ND (0.8)	**2.6**	**2**	NR
Quanterra 601823	TA2-VW-20-72-DU	72	06-24-99	**43**	ND (0.8)	ND (0.8)	ND (1)	**3 J (10)**	ND (2)	**3.2**	**6**	ND (0.8)	ND (1)	NR	ND (0.5)	**4.5**	ND (0.5)	ND (0.8)	**1.8 J (2)**	ND (0.5)	ND (0.8)	NR	ND (0.5)	**0.52 J (2)**	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	**4.5**	**1.8 J (2)**	ND (3)	**0.6 J (2)**	**25**	**4.3**	**100**	**1 J (2)**	ND (0.8)	**2.4**	**1.8 J (2)**	NR
Quanterra 602830	TA2-VW-20-72	72	09-07-99	**4.1 J (10)**	ND (0.8)	ND (0.8)	ND (1)	ND (2)	ND (2)	**2.7**	**5.9**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	**1.7 J (2)**	ND (0.5	ND (0.8)	NR	ND (0.5)	ND (0.5)	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	ND (0.5)	**0.51 J (2)**	ND (3)	ND (0.5)	**20**	**4.7**	**130**	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	NR
Quanterra 602830	TA2-VW-20-72-DU	72	09-07-99	**6.9 J (10)**	ND (0.8)	ND (0.8)	ND (1)	ND (2)	ND (2)	**1.9 J (2)**	**4.3**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	**1.2 J (2)**	ND (0.5)	ND (0.8)	NR	**0.55 J (2)**	**0.7 J (2)**	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	**3.5**	**3.8**	ND (3)	**0.84 J (2)**	**17**	**3.1**	**95**	**0.99 J (2)**	ND (0.8)	**0.75 J (2)**	**2.3**	NR

Refer to footnotes at end of table.

Table A-3 (Concluded)
Summary of Technical Area II Active Soil-Vapor Monitoring Well VW-20 Sampling
Soil-Vapor VOC Analytical Results
November 1996 to March 2002
(On- and Off-Site Laboratories)

Sample Attributes				VOCs (EPA Method 8260-M3[a], TO-14/TO-14A[b]) Units as indicated																																								
Laboratory and Record Number[c]	ER Sample ID	Sample Depth (ft)	Sample Date	Acetone	Benzene	Bromodichloromethane	1,3-Butadiene	2-Butanone	Carbon disulfide	Carbon tetrachloride	Chloroform	Chloroethane	Chloromethane	Cyclohexane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethene	cis-1,2-Dichloroethene	Ethanol	Ethyl benzene	4-Ethyltoluene	Heptane	Hexane	2-Hexanone	Methylene chloride	4-Methyl-2-pentanone	2-Propanol	Propylene	Styrene	Tetrachloroethene	Toluene	1,2,4-Trichlorobenzene	1,1,1-Trichloroethane	Trichloroethene	Trichlorofluoromethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	o-Xylene	m-, p-Xylene	Total Xylene
Quanterra 602989	TA2-VW-20-72	72	12-07-99	ND (2)	ND (0.8)	ND (0.8)	ND (1)	ND (2)	ND (2)	**4.7**	**8.1**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	**2.2**	ND (0.5)	ND (0.8)	NR	**0.69 J (2)**	ND (0.5)	NR	NR	ND (3)	**0.82 J (2)**	ND (2)	NR	NR	ND (0.5)	**0.59 J (2)**	**1.8 J (2)**	ND (3)	ND (0.5)	**25**	**5.7**	**130**	**0.67 J (2)**	ND (0.8)	**0.99 J (2)**	**3.9**	NR
Quanterra 602989	TA2-VW-20-72-DU	72	12-07-99	ND (2)	ND (0.8)	ND (0.8)	ND (1)	ND (2)	ND (2)	**4.5**	**7.7**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	**2.1**	ND (0.5)	ND (0.8)	NR	ND (0.5)	ND (0.5)	NR	NR	ND (3)	**0.93 J (2)**	ND (2)	NR	NR	ND (0.5)	**0.73 J (2)**	**0.69 J (2)**	ND (3)	ND (0.5)	**25**	**5.7**	**120**	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	NR
Q/STL 603136	TA2-VW-20-72	72	03-01-00	**100**	ND (0.8)	ND (0.8)	ND (1)	ND (2)	ND (2)	**2.8**	**5**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	**1.4 J (2)**	ND (0.5)	ND (0.8)	NR	**8**	ND (0.5)	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	**0.7 J (2)**	**20**	ND (3)	ND (0.5)	**16**	**3.6**	**98**	**0.75 J (2)**	ND (0.8)	**7.3**	**27**	NR
Q/STL 603136	TA2-VW-20-72-DU	72	03-01-00	**42**	ND (0.8)	ND (0.8)	ND (1)	ND (2)	ND (2)	**3.2**	**6**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	**1.7 J (2)**	ND (0.5)	ND (0.8)	NR	**15**	**0.9 J (2)**	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	ND (0.5)	**42**	ND (3)	ND (0.5)	**19**	**4.1**	**120**	**0.96 J (2)**	ND (0.8)	**24**	**54**	NR
Q/STL 603340	TA2-VW-020-72	72	06-20-00	**14**	**1.9 J (2)**	ND (0.8)	ND (1)	ND (2)	ND (2)	**3.1**	**5.2**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	**1.3 J (2)**	ND (0.5)	ND (0.8)	NR	ND (0.5)	ND (0.5)	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	ND (0.5)	ND (0.5)	ND (3)	ND (0.5)	**19**	**3.8**	**110**	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	NR
Q/STL 603340	TA2-VW-020-72-DU	72	06-20-00	**9.8 J (10)**	**1.9 J (2)**	ND (0.8)	ND (1)	ND (2)	ND (2)	**3**	**5.3**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	**1.4 J (2)**	ND (0.5)	ND (0.8)	NR	ND (0.5)	ND (0.5)	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	**0.51 J (2)**	ND (0.5)	ND (3)	ND (0.5)	**19**	**3.6**	**100**	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	NR
Q/STL 603661	TA2-VW-20-72	72	09-13-00	**7.4 J (10)**	ND (0.8)	ND (0.8)	ND (1)	ND (2)	ND (2)	**2.1**	**3.6**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	**1.1 J (2)**	ND (0.5)	ND (0.8)	NR	ND (0.5)	ND (0.6)	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	ND (0.6)	ND (0.5)	ND (3)	ND (0.5)	**13**	**2.7**	**73**	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	NR
Q/STL 603661	TA2-VW-20-72-DU	72	09-13-00	**6.3 J (10)**	ND (0.8)	ND (0.8)	ND (1)	ND (2)	ND (2)	**2.7**	**4.6**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	**1.4 J (2)**	ND (0.5)	ND (0.8)	NR	ND (0.5)	ND (0.6)	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	ND (0.6)	ND (0.5)	ND (3)	ND (0.5)	**17**	**3.6**	**96**	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	NR
Q/STL 603898	TA2-VW-20-72	72	12-11-00	**5.2 J (10)**	ND (0.8)	ND (0.8)	ND (1)	ND (2)	ND (2)	**4.3**	**7**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	**1.9 J (2)**	**0.94 J (2)**	ND (0.8)	NR	ND (0.5)	ND (0.6)	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	**0.62 J (2)**	ND (0.5)	ND (3)	ND (0.5)	**20**	**4.8**	**120**	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	NR
Q/STL 603898	TA2-VW-20-72-DU	72	12-11-00	**4.3 J (10)**	ND (0.8)	ND (0.8)	ND (1)	ND (2)	**5.3 J (10)**	**4.5**	**7.1**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	**1.9 J (2)**	ND (0.5)	ND (0.8)	NR	ND (0.5)	ND (0.6)	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	ND (0.6)	ND (0.5)	ND (3)	ND (0.5)	**20**	**4.9**	**120**	**0.65 J (2)**	ND (0.8)	ND (0.6)	ND (0.8)	NR
Q/STL 604434	TA2-VW-20-72	72	04-19-01	**9 J (10)**	ND (0.8)	ND (0.8)	ND (1)	**2.3 J (10)**	ND (2)	**3.7**	**6.9**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	**2.6**	**1.1 J (2)**	ND (0.8)	NR	**0.75 J (2)**	ND (0.6)	NR	NR	ND (3)	**0.86 J (2)**	ND (2)	NR	NR	ND (0.5)	**0.64 J (2)**	**3.1**	ND (3)	ND (0.5)	**21**	**5.2**	**130**	ND (0.5)	ND (0.8)	ND (0.6)	**2**	NR
Q/STL 604643	TA2-VW-20-72	72	06-22-01	ND (2)	ND (0.8)	ND (0.8)	ND (1)	ND (2)	ND (2)	**3.7**	**6.6**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	**2.3**	ND (0.5)	ND (0.8)	NR	ND (0.5)	ND (0.6)	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	ND (0.6)	ND (0.5)	ND (3)	ND (0.5)	**20**	**5.2**	**120**	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	NR
Q/STL 604921	TA2-VW-20-72	72	09-25-01	**4.2 J (10)**	ND (0.8)	ND (0.8)	ND (1)	ND (2)	ND (2)	**4.1**	**6.2**	ND (0.8)	ND (1)	NR	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	**2.3**	ND (0.5)	ND (0.8)	NR	ND (0.5)	ND (0.6)	NR	NR	ND (3)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	ND (0.6)	ND (0.5)	ND (3)	ND (0.5)	**34**	**5**	**110**	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	NR
Q/STL 605162	TA2-VW-20-72	72	12-11-01	**6.3 J (13)**	**2.1 J (2.6)**	ND (1)	ND (1.3)	ND (2.6)	ND (2.6)	**2.5 J (2.6)**	**5.8**	ND (1)	ND (1.3)	NR	ND (0.64)	ND (1)	ND (0.77)	ND (1)	ND (0.64)	ND (0.64)	ND (1)	NR	**0.87 J (2.6)**	**1.6 J (2.6)**	NR	NR	ND (1.3)	ND (1)	ND (2.6)	NR	NR	ND (0.64)	ND (0.77)	**3.5**	ND (0.77)	ND (0.64)	**36**	**4.1**	**92**	**3.3**	**1.5 J (2.6)**	ND (0.77)	**2.3 J (2.6)**	NR
Q/STL 605407	TA2-VW-20-72	72	3-19-02	**10**	ND (0.8)	ND (0.8)	ND (1)	**2.4 J (10)**	ND (2)	**2.6**	**4.6**	ND (0.8)	**3.5 J (4)**	NR	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	**1.6 J (2)**	ND (0.5)	ND (0.8)	NR	ND (0.5)	ND (0.7)	NR	NR	ND (1)	ND (0.8)	ND (2)	NR	NR	ND (0.5)	ND (0.6)	ND (0.5)	ND (0.6)	ND (0.5)	**47**	**3.1**	**67**	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	NR
Quality Assurance/Quality Control Sample ppb(v/v)																																												
ATL 9268	TA2-BH-020-000-FB	--	11-15-96	**16**	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	**9.9**	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	**6.4**	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)

Note: Values in **bold** represent detected analytes.

[a]EPA November 1986.

[b]EPA January 1997.

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

BH = Borehole.
ATL = Air Toxics Ltd. Laboratory.
Core = Core Laboratories.
DU = Duplicate sample.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ERCL = Environmental Restoration Chemistry Laboratory.
FB = Field Blank.
ft = Foot (feet).
ID = Identification.
J ( ) = The reported value is greater than or equal to the MDL but less than the practical quantitation limit, shown in parentheses.
MDL = Method detection limit.
mg/m^3 = Milligram(s) per cubic meter (air).
NA = Not Applicable
ND ( ) = Not detected above the MDL, shown in parentheses.
NR = Not reported.
ppb(v/v) = Part(s) per billion on a volume per volume basis.
OVA = Organic vapor analyzer.
P = Sample collected while system tubing was being purged and before OVA readings stabilized.
Quanterra = Quanterra Laboratory.
Q/STL = Quanterra/Severn Trent Laboratories.
S = Sample collected after system tubing fully purged and OVA readings stabilized.
SV = Soil vapor.
TA = Technical Area.
VOC = Volatile organic compound.
VW = Vapor well.
-- = Not applicable.

Table A-4
Summary of Technical Area II Active Soil-Vapor Monitoring Well VW-21 Sampling
Soil-Vapor VOC Analytical Results
November 1996 to March 2002
(On- and Off-Site Laboratories)

Sample Attributes				VOCs (EPA Method 8260-M3[a], TO-14/TO-14A[b]) Units as indicated																																								
Laboratory and Record Number[c]	ER Sample ID	Sample Depth (ft)	Sample Date	Acetone	Benzene	Bromodichloromethane	1,3-Butadiene	2-Butanone	Carbon disulfide	Carbon tetrachloride	Chloroform	Chloroethane	Chloromethane	Cyclohexane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethene	cis-1,2-Dichloroethene	Ethanol	Ethyl benzene	4-Ethyltoluene	Heptane	Hexane	2-Hexanone	Methylene chloride	4-Methyl-2-pentanone	2-Propanol	Propylene	Styrene	Tetrachloroethene	Toluene	1,2,4-Trichlorobenzene	1,1,1-Trichloroethane	Trichloroethene	Trichlorofluoromethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	o-Xylene	m-, p-Xylene	Total Xylene
Soil-vapor samples collected during drilling ppb(v/v)																																												
ATL 9264	TA2-BH-021-10-SV	10	11-12-96	72	11	ND (3.2)	ND (3.2)	10	ND (3.2)	ND (0.79)	0.92	ND (0.79)	2.2	7.4	NR	ND (0.79)	ND (0.79)	ND (0.79)	1.6	ND (0.79)	ND (0.79)	ND (3.2)	5.4	14	7.0	7.3	ND (3.2)	ND (0.79)	ND (3.2)	4.7	ND (3.2)	60	ND (0.79)	20	ND (0.79)	ND (0.79)	56	2.3	ND (0.79)	18	7.0	8.1	13	NR
ATL 9264	TA2-BH-021-20-SV	20	11-12-96	380	13	ND (4.1)	ND (4.1)	52	4.8	ND (1.0)	ND (1.0)	6.3	ND (1.0)	13	NR	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (4.1)	5.8	16	15	18	ND (4.1)	ND (1.0)	ND (4.1)	8.8	430	5.2	1.9	28	ND (1.0)	ND (1.0)	17	ND (1.0)	ND (1.0)	23	8.8	7.1	10	NR
ATL 9264	TA2-BH-021-20-SV-DU	20	11-12-96	320	9.8	ND (4.0)	ND (4.0)	44	7.2	ND (1.0)	ND (1.0)	6.6	9.9	ND (4.0)	NR	ND (1.0)	ND (1.0)	ND (1.0)	1.3	ND (1.0)	ND (1.0)	19	2.4	11	9.8	12	ND (4.0)	ND (1.0)	ND (4.0)	ND (4.0)	ND (4.0)	3.3	2.2	17	ND (1.0)	ND (1.0)	15	ND (1.0)	ND (1.0)	22	9.1	7.5	9.7	NR
ATL 9264	TA2-BH-021-30-SV	30	11-12-96	66	22	ND (9.8)	ND (9.8)	ND (4.8)	ND (9.8)	ND (2.4)	13	ND (2.4)	ND (2.4)	41	NR	ND (2.4)	ND (2.4)	ND (2.4)	6.2	ND (2.4)	ND (2.4)	ND (9.8)	ND (2.4)	ND (9.8)	30	39	ND (9.8)	ND (2.4)	ND (9.8)	ND (9.8)	ND (9.8)	ND (2.4)	3.0	34	ND (2.4)	ND (2.4)	690	13	ND (2.4)	12	4.6	6.5	18	NR
ATL 9264	TA2-BH-021-40-SV	40	11-12-96	48	63	ND (13)	ND (13)	ND (13)	ND (13)	ND (3.3)	26	ND (3.3)	ND (3.3)	80	NR	ND (3.3)	ND (3.3)	ND (3.3)	5.9	ND (3.3)	ND (3.3)	ND (13)	10	ND (13)	54	75	ND (13)	ND (3.3)	ND (13)	ND (13)	ND (13)	7.0	5.0	94	ND (3.3)	ND (3.3)	1100	9.5	ND (3.3)	35	14	19	47	NR
ATL 9264	TA2-BH-021-50-SV	50	11-12-96	2500	73	ND (31)	84	420	ND (31)	ND (7.9)	17	ND (7.9)	36	ND (31)	NR	ND (7.9)	ND (7.9)	ND (7.9)	ND (7.9)	ND (7.9)	ND (7.9)	ND (31)	63	210	160	86	40	ND (7.9)	48	ND (31)	ND (31)	13	ND (7.9)	1500	ND (7.9)	ND (7.9)	570	ND (7.9)	ND (7.9)	280	130	130	230	NR
ATL 9264	TA2-BH-021-60-SV	60	11-12-96	230	140	ND (40	ND (40)	48	ND (40)	ND (10)	44	ND (10)	ND (10)	320	NR	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (10)	ND (40)	24	ND (40)	270	330	ND (40)	ND (10)	ND (40)	ND (40)	ND (40)	ND (10)	ND (10)	250	ND (10)	ND (10)	920	ND (10)	ND (10)	77	34	46	110	NR
ATL 9264	TA2-BH-021-70-SV	70	11-12-96	160	3.3	7.2	ND (6.4)	24	12	ND (1.6)	45	ND (1.6)	ND (1.6)	ND (6.4)	NR	ND (1.6)	ND (1.6)	ND (1.6)	2.1	ND (1.6)	1.8	28	5.2	ND (6.4)	14	ND (6.4)	ND (6.4)	2.7	ND (6.4)	ND (6.4)	ND (6.4)	1.9	2.9	170	ND (1.6)	ND (1.6)	640	3.5	ND (1.6)	7.9	3.0	7.8	21	NR
ATL 9265	TA2-BH-021-80-SV	80	11-12-96	160	5.8	6.6	ND (3.8)	26	5.4	ND (0.96)	41	ND (0.96)	ND (0.96)	ND (3.8)	NR	ND (0.96)	ND (0.96)	ND (0.96)	2.2	ND (0.96)	2.3	14	4.7	9.1	17	4.7	ND (3.8)	3.6	ND (3.8)	ND (3.8)	ND (3.8)	3.0	3.7	150	ND (0.96)	ND (0.96)	720	4.0	2.0	13	5.5	7.4	17	NR
ATL 9265	TA2-BH-021-90-SV	90	11-12-96	550	40	ND (11)	ND (11)	92	ND (11)	ND (2.9)	45	ND (2.9)	ND (2.9)	ND (11)	NR	ND (2.9)	ND (2.9)	ND (2.9)	ND (2.9)	ND (2.9)	ND (2.9)	23	16	43	91	46	ND (11)	4.6	ND (11)	ND (11)	ND (11)	5.6	4.3	550	ND (2.9)	ND (2.9)	820	3.9	ND (2.9)	63	29	27	63	NR
ATL 9265	TA2-BH-021-100-SV	100	11-12-96	170	16	ND (6.4)	16	30	7.0	ND (1.6)	38	ND (1.6)	ND (1.6)	ND (6.4)	NR	ND (1.6)	ND (1.6)	ND (1.6)	2.0	ND (1.6)	3.5	86	17	13	71	18	ND (6.4)	7.1	9.6	ND (6.4)	ND (6.4)	5.8	4.1	560	ND (1.6)	ND (1.6)	950	3.9	ND (1.6)	22	9.9	20	66	NR
ATL 9265	TA2-BH-021-110-SV	110	11-13-96	110	3.2	ND (5.1)	ND (5.1)	17	ND (5.1)	ND (1.3)	ND (1.3)	ND (1.3)	ND (1.3)	ND (5.1)	NR	ND (1.3)	ND (1.3)	ND (1.3)	ND (1.3)	ND (1.3)	ND (1.3)	11	6.5	40	47	5.2	ND (5.1)	ND (1.3)	ND (5.1)	ND (5.1)	160	5.2	ND (1.3)	340	ND (1.3)	ND (1.3)	22	ND (1.3)	ND (1.3)	45	29	13	20	NR
Soil-vapor concentration mg/m^3																																												
ERCL 6173	TA2-VW-21-50-P	50	07-17-97	NR	ND (1.2)	ND (1.2)	NA	NR	ND (1.2)	ND (1.2)	ND (1.2)	NA	NR	NA	NR	NR	NR	NR	NR	ND (1.2)	ND (1.2)	NA	ND (1.2)	NR	NA	NA	NR	ND (1.2)	NA	NA	NA	ND (1.2)	ND (1.2)	ND (1.2)	NR	ND (1.2)	2.9 J (4.8)	NR	ND (1.2)	NR	NR	ND (1.2)	ND (2.5)	NR
ERCL 6173	TA2-VW-21-50-S	50	07-17-97	NR	ND (1.2)	ND (1.2)	NA	NR	ND (1.2)	ND (1.2)	ND (1.2)	NA	NR	NA	NR	NR	NR	NR	NR	ND (1.2)	ND (1.2)	NA	ND (1.2)	NR	NA	NA	NR	3.5 J (4.8)	NA	NA	NA	ND (1.2)	ND (1.2)	ND (1.2)	NR	ND (1.2)	ND (1.2)	NR	2 J (4.8)	NR	NR	ND (1.2)	ND (2.5)	NR
ERCL 6173	TA2-VW-21-92-P	92	07-17-97	NR	ND (1.2)	ND (1.2)	NA	NR	ND (1.2)	ND (1.2)	ND (1.2)	NA	NR	NA	NR	NR	NR	NR	NR	ND (1.2)	ND (1.2)	NA	ND (1.2)	NR	NA	NA	NR	1.9 J (4.8)	NA	NA	NA	ND (1.2)	ND (1.2)	ND (1.2)	NR	ND (1.2)	ND (1.2)	NR	ND (1.2)	NR	NR	ND (1.2)	ND (2.5)	NR
ERCL 6173	TA2-VW-21-92-S	92	07-17-97	NR	ND (1.2)	ND (1.2)	NA	NR	ND (1.2)	ND (1.2)	ND (1.2)	NA	NR	NA	NR	NR	NR	NR	NR	ND (1.2)	ND (1.2)	NA	4 J (4.8)	NR	NA	NA	NR	37 J (4.8)	NA	NA	NA	2.6 J (4.8)	ND (1.2)	ND (1.2)	NR	ND (1.2)	ND (1.2)	NR	6.7 J (4.8)	NR	NR	5.2 J (4.8)	24 J (9.5)	NR
ERCL 6942	TA2-VW-21-50-P	50	09-04-97	NR	ND (1.25)	ND (1.25)	NA	NR	ND (1.25)	ND (1.25)	ND (1.25)	NA	NR	NA	NR	NR	NR	NR	NR	ND (1.25)	ND (1.25)	NA	ND (1.25)	NR	NA	NA	NR	5.2	NA	NA	NA	ND (1.25)	ND (1.25)	ND (1.25)	NR	ND (1.25)	4.2 J (5)	NR	ND (1.25)	NR	NR	ND (1.25)	ND (2.5)	NR
ERCL 6942	TA2-VW-21-50-S	50	09-04-97	NR	ND (1.25)	ND (1.25)	NA	NR	ND (1.25)	ND (1.25)	ND (1.25)	NA	NR	NA	NR	NR	NR	NR	NR	ND (1.25)	ND (1.25)	NA	ND (1.25)	NR	NA	NA	NR	11	NA	NA	NA	ND (1.25)	ND (1.25)	ND (1.25)	NR	ND (1.25)	ND (1.25)	NR	ND (1.25)	NR	NR	ND (1.25)	ND (2.5)	NR
ERCL 6942	TA2-VW-21-92-P	92	09-04-97	NR	ND (1.25)	ND (1.25)	NA	NR	ND (1.25)	ND (1.25)	ND (1.25)	NA	NR	NA	NR	NR	NR	NR	NR	ND (1.25)	ND (1.25)	NA	ND (1.25)	NR	NA	NA	NR	10	NA	NA	NA	ND (1.25)	ND (1.25)	ND (1.25)	NR	ND (1.25)	45	NR	1.7 J (5)	NR	NR	ND (1.25)	ND (2.5)	NR
ERCL 6942	TA2-VW-21-92-S	92	09-04-97	NR	ND (1.25)	ND (1.25)	NA	NR	ND (1.25)	ND (1.25)	ND (1.25)	NA	NR	NA	NR	NR	NR	NR	NR	ND (1.25)	ND (1.25)	NA	ND (1.25)	NR	NA	NA	NR	74	NA	NA	NA	ND (1.25)	ND (1.25)	ND (1.25)	NR	ND (1.25)	8.9	NR	7.7	NR	NR	ND (1.25)	ND (2.5)	NR
Soil-vapor concentration ppb(v/v)																																												
Core 600308	TA2-VW-21-50	50	05-14-98	ND (1.0)	ND (1.0)	ND (1.0)	NA	ND (1.0)	ND (1.0)	ND (1.0)	7.0	ND (1)	ND (1.0)	NA	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	NA	ND (1.0)	ND (1.0)	NA	NA	NR	13	NR	NA	NA	ND (1.0)	2.0	1.0	ND (1.0)	ND (1.0)	230	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Core 600308	TA2-VW-21-92	92	05-14-98	ND (1.0)	ND (1.0)	ND (1.0)	NA	ND (1.0)	ND (1.0)	ND (1.0)	27	ND (1)	ND (1.0)	NA	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	NA	ND (1.0)	ND (1.0)	NA	NA	NR	10	NR	NA	NA	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	190	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Core 600308	TA2-VW-21-92-DU	92	05-14-98	ND (1.0)	ND (1.0)	ND (1.0)	NA	ND (1.0)	ND (1.0)	ND (1.0)	22	ND (1)	ND (1.0)	NA	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	NA	ND (1.0)	ND (1.0)	NA	NA	NR	ND (1.0)	NR	NA	NA	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	98	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Quanterra 600796	TA2-VW-21-50	50	09-02-98	11 J (34)	ND (0.42J)	0.95 J (6.8)	ND (0.57)	ND (3.5)	ND (0.73)	ND (0.42)	13	ND (1.5)	ND (1.4)	NA	ND (0.37)	3.7 J (6.8)	ND (0.48)	ND (0.68)	2.3 J (6.8)	ND (0.87)	ND (0.54)	NA	ND (0.32)	ND (0.25)	NA	NA	ND (3.9)	ND (0.44)	ND (0.38)	NA	NA	ND (0.64)	4.9 J (6.8)	1.8 J (6.8)	ND (3.3)	ND (0.49)	460	3.7 J (6.8)	ND (0.52)	ND (0.32)	ND (0.29)	NR	NR	ND (0.57)
Quanterra 600796	TA2-VW-21-92	92	09-02-98	ND (2.4)	ND (0.42J)	ND (0.27)	ND (0.57)	ND (3.5)	ND (0.73)	ND (0.42)	19	ND (1.5)	ND (1.4)	NA	ND (0.37)	30	ND (0.48)	7.4 J (15)	ND (0.45)	ND (0.87)	ND (0.54)	NA	ND (0.32)	ND (0.25)	NA	NA	ND (3.9)	13 J (15)	ND (0.38)	NA	NA	ND (0.64)	20	6.2 J (15)	ND (3.3)	ND (0.49)	970	ND (0.27)	ND (0.52)	ND (0.32)	ND (0.29)	NR	NR	10 J (15)
Quanterra 600796	TA2-VW-21-92-DU	92	09-02-98	ND (2.4)	ND (0.42J)	ND (0.27)	ND (0.57)	ND (3.5)	ND (0.73)	ND (0.42)	21	ND (1.5)	ND (1.4)	NA	ND (0.37)	19	ND (0.48)	ND (0.68)	ND (0.45)	ND (0.87)	ND (0.54)	NA	ND (0.32)	ND (0.25)	NA	NA	ND (3.9)	14 J (15)	ND (0.38)	NA	NA	ND (0.64)	14 J (15)	ND (0.33)	ND (3.3)	ND (0.49)	1100	2 J (15)	ND (0.52)	ND (0.32)	ND (0.29)	NR	NR	ND (0.57)
Quanterra 601237	TA2-VW-21-50	50	12-02-98	ND (2)	ND (0.8J)	ND (0.8)	ND (1)	ND (2)	ND (2)	ND (0.5)	14	ND (0.8)	ND (1)	NA	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	2.5 J (8.4)	ND (0.5)	ND (0.8)	NA	ND (0.5)	ND (0.5)	NA	NA	ND (3)	ND (0.8)	ND (2)	NA	NA	ND (0.5)	2.4 J (8.4)	ND (0.5)	ND (3J)	ND (0.5)	510	3.9 J (8.4)	ND (0.5)	ND (0.5)	ND (0.5)	NR	NR	ND (0.8)
Quanterra 601237	TA2-VW-21-92	92	12-02-98	ND (2)	ND (0.8J)	ND (0.8)	ND (1)	ND (2)	ND (2)	ND (0.5)	20 J (22)	ND (0.8)	ND (1)	NA	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	ND (0.5)	7.1 J (22	ND (0.8)	NA	ND (0.5)	ND (0.5)	NA	NA	ND (3)	21 J (22)	ND (2)	NA	NA	ND (0.5)	6.3 J (22)	ND (0.5)	ND (3J)	ND (0.5)	1300	ND (0.5)	ND (0.5)	ND (0.5)	ND (0.5)	NR	NR	ND (0.8)
Quanterra 601237	TA2-VW-21-SV-DU	92	12-02-98	ND (2)	ND (0.8J)	ND (0.8)	ND (1)	ND (2)	ND (2)	ND (0.5)	20	ND (0.8)	ND (1)	NA	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	ND (0.5)	8.2 J (17	ND (0.8)	NA	ND (0.5)	ND (0.5)	NA	NA	ND (3)	21	ND (2)	NA	NA	ND (0.5)	6.4 J (17)	ND (0.5)	ND (3J)	ND (0.5)	1400	ND (0.5)	4.2 J (17)	ND (0.5)	ND (0.5)	NR	NR	ND (0.8)
Quanterra 601638	TA2-VW-21-50	50	03-22-99	33	ND (0.8)	2.8	ND (1)	ND (2)	ND (2)	ND (0.5)	20	ND (0.8)	ND (1)	NA	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	3	ND (0.5)	1.8 J (2)	NA	ND (0.5)	ND (0.5)	NA	NA	ND (3)	ND (0.8)	ND (2)	NA	NA	ND (0.5)	4.4	0.53 J (2)	ND (3)	0.74 J (2)	520	5.4	1.6 J (2)	ND (0.5)	ND (0.8)	ND (0.5)	ND (0.8)	NR

Refer to footnotes at end of table.

Table A-4 (Continued)
Summary of Technical Area II Active Soil-Vapor Monitoring Well VW-21 Sampling
Soil-Vapor VOC Analytical Results
November 1996 to March 2002
(On- and Off-Site Laboratories)

Sample Attributes				VOCs (EPA Method 8260-M3[a], TO-14/TO-14A[b]) Units as indicated																																								
Laboratory and Record Number[c]	ER Sample ID	Sample Depth (ft)	Sample Date	Acetone	Benzene	Bromodichloromethane	1,3-Butadiene	2-Butanone	Carbon disulfide	Carbon tetrachloride	Chloroform	Chloroethane	Chloromethane	Cyclohexane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethene	cis-1,2-Dichloroethene	Ethanol	Ethyl benzene	4-Ethyltoluene	Heptane	Hexane	2-Hexanone	Methylene chloride	4-Methyl-2-pentanone	2-Propanol	Propylene	Styrene	Tetrachloroethene	Toluene	1,2,4-Trichlorobenzene	1,1,1-Trichloroethane	Trichloroethene	Trichlorofluoromethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	o-Xylene	m-, p-Xylene	Total Xylene
Quanterra 601638	TA2-VW-21-92	92	03-22-99	16	ND (0.8)	3.8	ND (1)	ND (2)	ND (2)	ND (0.5)	23	ND (0.8)	ND (1)	NA	ND (0.5)	ND (0.8)	ND (0.5)	0.82 J (2)	1 J (2)	8.8	2.4	NA	ND (0.5)	ND (0.5)	NA	NA	ND (3)	23	ND (2)	NA	NA	ND (0.5)	10	1 J (2)	ND (3)	1 J (2)	1200	3.1	4.4	ND (0.5)	ND (0.8)	ND (0.5)	1.3 J (2)	NR
Quanterra 601638	TA2-VW-21-DU	92	03-22-99	16 J (26)	ND (2.1)	3.4 J (5.2)	ND (2.6)	ND (5.2)	ND (5.2)	ND (1.3)	22	ND (2.1)	ND (2.6)	NA	ND (1.3)	ND (2.1)	ND (1.3)	ND (2.1)	ND (1.3)	8.7	2.4 J (5.2)	NA	ND (1.3)	ND (1.3)	NA	NA	ND (7.8)	22	ND (5.2)	NA	NA	ND (1.3)	6.3	ND (1.3)	ND (7.8)	ND (1.3)	1200	2.9 J (5.2)	4.2 J (5.2)	ND (1.3)	ND (2.1)	ND (1.3)	ND (2.1)	NR
Quanterra 601823	TA2-VW-21-50	50	06-24-99	6.9 J (22)	ND (1.8)	ND (1.8)	ND (2.2)	ND (4.4)	ND (4.4)	ND (1.1)	17	ND (1.8)	ND (2.2)	NA	ND (1.1)	ND (1.8)	ND (1.1)	ND (1.8)	3 J (4.4)	ND (1.1)	ND (1.8)	NA	ND (1.1)	ND (1.1)	NA	NA	ND (6.6)	ND (1.8)	ND (4.4)	NA	NA	ND (1.1)	2.8 J (4.4)	ND (1.1)	ND (6.6)	ND (1.1)	410	4.6	1.7 J (4.4)	ND (1.1)	ND (1.8)	ND (1.1)	ND (1.8)	NR
Quanterra 601823	TA2-VW-21-92	92	06-24-99	25 J (44)	ND (3.5)	ND (3.5)	ND (4.4)	ND (8.8)	ND (8.8)	ND (2.2)	15	ND (3.5)	ND (4.4)	NA	ND (2.2)	ND (3.5)	ND (2.2)	ND (3.5)	ND (2.2)	3.4 J (8.8)	ND (3.5)	NA	ND (2.2)	ND (2.2)	NA	NA	ND (13)	13	ND (8.8)	NA	NA	ND (2.2)	5.2 J (8.8)	2.5 J (8.8)	ND (13)	ND (2.2)	530	ND (3.5)	2.3 J (8.8)	ND (2.2)	ND (3.5)	ND (2.2)	ND (3.5)	NR
Quanterra 601823	TA2-VW-21-92-DU	92	06-24-99	26 J (77)	ND (6.2)	ND (6.2)	ND (7.7)	ND (15)	ND (15)	ND (3.8)	24	ND (6.2)	ND (7.7)	NA	ND (3.8)	ND (6.2)	ND (3.8)	ND (6.2)	ND (3.8)	5.9 J (15)	ND (6.2)	NA	ND (3.8)	ND (3.8)	NA	NA	ND (23)	20	ND (15)	NA	NA	ND (3.8)	7.7 J (15)	ND (3.8)	ND (23)	ND (3.8)	920	ND (6.2)	ND (3.8)	ND (3.8)	ND (6.2)	ND (3.8)	ND (6.2)	NR
Quanterra 602830	TA2-VW-21-50	50	09-07-99	ND (7.3)	ND (2.9)	ND (2.9)	ND (3.7)	ND (7.3)	ND (7.3)	ND (1.8)	17	ND (2.9)	ND (3.7)	NA	ND (1.8)	ND (2.9)	ND (1.8)	ND (2.9)	2.2 J (7.3)	ND (1.8)	ND (2.9)	NA	ND (1.8)	ND (1.8)	NA	NA	ND (11)	ND (2.9)	ND (7.3)	NA	NA	ND (1.8)	2.9 J (7.3)	ND (1.8)	ND (11)	ND (1.8)	460	3.7 J (7.3)	ND (1.8)	ND (1.8)	ND (2.9)	ND (1.8)	ND (2.9)	NR
Quanterra 602830	TA2-VW-21-92	92	09-07-99	ND (11)	ND (4.4)	ND (4.4)	ND (5.5)	ND (11)	ND (11)	ND (2.7)	22	ND (4.4)	ND (5.5)	NA	ND (2.7)	ND (4.4)	ND (2.7)	ND (4.4)	ND (2.7)	4.7 J (11)	ND (4.4)	NA	ND (2.7)	ND (2.7)	NA	NA	ND (16)	14	ND (11)	NA	NA	ND (2.7)	6.2 J (11)	8.6 J (11)	ND (16)	ND (2.7)	960	ND (2.7)	3.2 J (11)	ND (2.7)	ND (4.4)	ND (2.7)	ND (4.4)	NR
Quanterra 602830	TA2-VW-21-92-DU	92	09-07-99	ND (11)	ND (4.4)	ND (4.4)	ND (5.5)	ND (11)	ND (11)	ND (2.7)	27	ND (4.4)	ND (5.5)	NA	ND (2.7)	ND (4.4)	ND (2.7)	ND (4.4)	ND (2.7)	6.4 J (11)	ND (4.4)	NA	ND (2.7)	ND (2.7)	NA	NA	ND (16)	16	ND (11)	NA	NA	ND (2.7)	6.9 J (11)	ND (2.7)	ND (16)	ND (2.7)	960	3.2 J (11)	4.4 J (11)	ND (2.7)	ND (4.4)	ND (2.7)	ND (4.4)	NR
Quanterra 602989	TA2-VW-21-50	50	12-07-99	ND (4.5)	ND (1.8)	3.6 J (4.5)	ND (2.2)	ND (4.5)	ND (4.5)	ND (1.1)	20	ND (1.8)	ND (2.2)	NA	ND (1.1)	ND (1.8)	ND (1.1)	ND (1.8)	2.5 J (4.5)	ND (1.1)	ND (1.8)	NA	ND (1.1)	ND (1.1)	NA	NA	ND (6.7)	ND (1.8)	ND (4.5)	NA	NA	ND (1.1)	3.1 J (4.5)	ND (1.1)	ND (6.7)	ND (1.1)	470	4.5	1.7 J (4.5)	ND (1.1)	ND (1.8)	ND (1.1)	ND (1.8)	NR
Quanterra 602989	TA2-VW-21-92	92	12-07-99	ND (13)	ND (5.4)	ND (5.4)	ND (6.7)	ND (13)	ND (13)	ND (3.4)	23	ND (5.4)	ND (6.7)	NA	ND (3.4)	ND (5.4)	ND (3.4)	ND (5.4)	ND (3.4)	10 J (13)	ND (5.4)	NA	ND (3.4)	ND (3.4)	NA	NA	ND (20)	29	ND (13)	NA	NA	ND (3.4)	8.4 J (13)	ND (3.4)	ND (20)	ND (3.4)	1500	3.7 J (13)	6.6 J (13)	ND (3.4)	ND (5.4)	ND (3.4)	ND (5.4)	NR
Quanterra 602989	TA2-VW-21-92-DU	92	12-07-99	13 J (40)	ND (3.2)	4 J (8.1)	ND (4)	ND (8.1)	ND (8.1)	ND (2)	24	ND (3.2)	ND (4)	NA	ND (2)	ND (3.2)	ND (2)	ND (3.2)	ND (2)	13	ND (3.2)	NA	ND (2)	ND (2)	NA	NA	ND (12)	31	ND (8.1)	NA	NA	ND (2)	9.4	ND (2)	ND (12)	ND (2)	1500	4.4 J (8.1)	7.7 J (8.1)	ND (2)	ND (3.2)	ND (2)	ND (3.2)	NR
Q/STL 603136	TA2-VW-21-50	50	03-01-00	ND (6)	ND (2.4)	2.5 J (6)	ND (3)	ND (6)	ND (6)	ND (1.5)	18	ND (2.4)	ND (3)	NA	ND (1.5)	ND (2.4)	ND (1.5)	ND (2.4)	2.2 J (6)	ND (1.5)	ND (2.4)	NA	ND (1.5)	ND (1.5)	NA	NA	ND (9)	ND (2.4)	ND (6)	NA	NA	ND (1.5)	ND (1.5)	ND (1.5)	ND (9)	ND (1.5)	440	3.6 J (6)	ND (1.5)	ND (1.5)	ND (2.4)	ND (1.5)	ND (2.4)	NR
Q/STL 603136	TA2-VW-21-92	92	03-01-00	ND (14)	ND (5.6)	ND (5.6)	ND (7)	ND (14)	ND (14)	ND (3.5)	21	ND (5.6)	ND (7)	NA	ND (3.5)	ND (5.6)	ND (3.5)	ND (5.6)	ND (3.5)	5.8 J (14)	ND (5.6)	NA	ND (3.5)	ND (3.5)	NA	NA	ND (21)	15	ND (14)	NA	NA	ND (3.5)	6.9 J (14)	ND (3.5)	ND (21)	ND (3.5)	1200	ND (3.5)	3.8 J (14)	ND (3.5)	ND (5.6)	ND (3.5)	ND (5.6)	NR
Q/STL 603136	TA2-VW-21-92-DU	92	03-01-00	ND (12)	ND (4.8)	ND (4.8)	ND (6)	ND (12)	ND (12)	ND (3)	16	ND (4.8)	ND (6)	NA	ND (3)	ND (4.8)	ND (3)	ND (4.8)	ND (3)	4.4 J (12)	ND (4.8)	NA	ND (3)	ND (3)	NA	NA	ND (18)	14	ND (12)	NA	NA	ND (3)	5.5 J (12)	ND (3)	ND (18)	ND (3)	850	ND (3)	3.1 J (12)	ND (3)	ND (4.8)	ND (3)	ND (4.8)	NR
Q/STL 603340	TA2-VW-021-50	50	06-20-00	ND (3.2)	2.6 J (3.2)	2.7 J (3.2)	ND (1.6)	ND (3.2)	ND (3.2)	ND (0.8)	16	ND (1.3)	ND (1.6)	NA	ND (0.8)	ND (1.3)	ND (0.8)	ND (1.3)	1.9 J (3.2)	ND (0.8)	ND (1.3)	NA	ND (0.8)	ND (0.8)	NA	NA	ND (4.8)	ND (1.3)	ND (3.2)	NA	NA	ND (0.8)	2.7 J (3.2)	ND (0.3)	ND (4.8)	ND (0.8)	470	3 J (3.2)	1 J (3.2)	ND (0.8)	ND (1.3)	ND (0.8)	ND (1.3)	NR
Q/STL 603340	TA2-VW-021-92	92	06-20-00	ND (7.2)	ND (2.9)	3.6 J (7.3)	ND (3.6)	ND (7.2)	ND (7.2)	ND (1.8)	18	ND (2.9)	ND (3.6)	NA	ND (1.8)	ND (2.9)	ND (1.8)	ND (2.9)	ND (1.8)	4 J (7.3)	ND (2.9)	NA	ND (1.8)	ND (1.8)	NA	NA	ND (11)	14	ND (7.2)	NA	NA	ND (1.8)	5.2 J (7.3)	ND (1.8)	ND (11)	ND (1.8)	1100	1.9 J (7.3)	2.9 J (7.3)	ND (1.8)	ND (2.9)	ND (1.8)	ND (2.9)	NR
Q/STL 603340	TA2-VW-021-92-DU	92	06-20-00	ND (5.4)	2.9 J (5.4)	3.3 J (5.4)	ND (2.7)	ND (5.4)	ND (5.4)	ND (1.3)	19	ND (2.2)	ND (2.7)	NA	ND (1.3)	ND (2.2)	ND (1.3)	ND (2.2)	ND (1.3)	4.1 J (5.4)	ND (2.2)	NA	ND (1.3)	ND (1.3)	NA	NA	ND (8.1)	15	ND (5.4)	NA	NA	ND (1.3)	4.4 J (5.4)	ND (1.3)	ND (8.1)	ND (1.3)	1200	1.7 J (5.4)	2.9 J (5.4)	ND (1.3)	ND (2.2)	ND (1.3)	ND (2.2)	NR
Q/STL 603661	TA2-VW-21-50	50	09-13-00	ND (2.9)	ND (1.2)	2.3 J (2.9)	ND (1.5)	ND (2.9)	ND (2.9)	ND (0.74)	15	ND (1.2)	ND (1.5)	NA	ND (0.74)	ND (1.2)	ND (0.88)	ND (1.2)	1.8 J (2.9)	ND (0.74)	ND (1.2)	NA	ND (0.74)	ND (0.88)	NA	NA	ND (4.4)	ND (1.2)	ND (2.9)	NA	NA	ND (0.74)	2.4 J (2.9)	ND (0.74)	ND (4.4)	ND (0.74)	400	3	1 J (2.9)	ND (0.74)	ND (1.2)	ND (0.88)	ND (1.2)	NR
Q/STL 603661	TA2-VW-21-92	92	09-13-00	ND (7.2)	ND (2.9)	3.5 J (7.3)	ND (3.6)	ND (7.2)	ND (7.2)	ND (1.8)	19	ND (2.9)	ND (3.6)	NA	ND (1.8)	ND (2.9)	ND (2.2)	ND (2.9)	ND (1.8)	4 J (7.3)	ND (2.9)	NA	ND (1.8)	ND (2.2)	NA	NA	ND (11)	12	ND (7.2)	NA	NA	ND (1.8)	4.3 J (7.3)	ND (1.8)	ND (11)	ND (1.8)	870	1.9 J (7.3)	3 J (7.3)	ND (1.8)	ND (2.9)	ND (2.2)	ND (2.9)	NR
Q/STL 603661	TA2-VW-21-92-DU	92	09-13-00	ND (7.4)	ND (2.9)	3.2 J (7.4)	ND (3.7)	ND (7.4)	ND (7.4)	ND (1.8)	20	ND (2.9)	ND (3.7)	NA	ND (1.8)	ND (2.9)	ND (2.2)	ND (2.9)	ND (1.8)	4.3 J (7.4)	ND (2.9)	NA	ND (1.8)	ND (2.2)	NA	NA	ND (11)	12	ND (7.4)	NA	NA	ND (1.8)	4.2 J (7.4)	ND (1.8)	ND (11)	ND (1.8)	850	2.1 J (7.4)	3 J (7.4)	ND (1.8)	ND (2.9)	ND (2.2)	ND (2.9)	NR
Q/STL 603898	TA2-VW-21-50	50	12-11-00	14	ND (0.8)	2.6	ND (1)	ND (2)	16	ND (0.5)	23	ND (0.8)	ND (1)	NA	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	2.5	ND (0.5)	1.2 J (2)	NA	ND (0.5)	ND (0.6)	NA	NA	ND (3)	ND (0.8)	ND (2)	NA	NA	ND (0.5)	2.1	ND (0.5)	ND (3)	ND (0.5)	350	3.9	1.6 J (2)	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	NR
Q/STL 603898	TA2-VW-21-92	92	12-11-00	5.9 J (27)	ND (2.2)	2.8 J (5.4)	ND (2.7)	ND (5.4)	ND (5.4)	ND (1.3)	23	ND (2.2)	ND (2.7)	NA	ND (1.3)	ND (2.2)	ND (1.6)	ND (2.2)	ND (1.3)	8.1	ND (2.2)	NA	ND (1.3)	ND (1.6)	NA	NA	ND (8.1)	14	ND (5.4)	NA	NA	ND (1.3)	6.5	ND (1.3)	ND (8.1)	ND (1.3)	1000	2.5 J (5.4)	4.8 J (5.4)	ND (1.3)	ND (2.2)	ND (1.6)	ND (2.2)	NR
Q/STL 603898	TA2-VW-21-92-DU	92	12-11-00	2 J (10)	ND (0.81)	3	ND (1)	ND (2)	ND (2)	ND (0.5)	27	ND (0.81)	ND (1)	NA	ND (0.5)	ND (0.81)	ND (0.61)	ND (0.81)	ND (0.5)	8.8	2.4	NA	ND (0.5)	ND (0.61)	NA	NA	ND (3)	17	ND (2)	NA	NA	ND (0.5)	6.5	ND (0.6)	ND (3)	ND (0.5)	1100	3	5.7	ND (0.5)	ND (0.81)	ND (0.61)	ND (0.81)	NR
Q/STL 604434	TA2-VW-21-50	50	04-19-01	3.4 J (10)	ND (0.8)	2.3	ND (1)	ND (2)	ND (2)	ND (0.5)	24	ND (0.8)	ND (1)	NA	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	2.5	ND (0.5)	1.2 J (2)	NA	ND (0.5)	ND (0.6)	NA	NA	ND (3)	ND (0.8)	ND (2)	NA	NA	ND (0.5)	2.5	ND (0.5)	ND (3)	ND (0.5)	360	3.8	1.5 J (2)	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	NR
Q/STL 604434	TA2-VW-21-92	92	04-19-01	ND (10)	ND (4.1)	ND (4.1)	ND (5.1)	ND (10)	ND (10)	ND (2.6)	25	ND (4.1)	ND (5.1)	NA	ND (2.6)	ND (4.1)	ND (3.1)	ND (4.1)	ND (2.6)	6.9 J (10)	ND (4.1)	NA	ND (2.6)	ND (3.1)	NA	NA	ND (15)	21	ND (10)	NA	NA	ND (2.6)	6.2 J (10)	ND (2.6)	ND (15)	ND (2.6)	1000	ND (2.6)	5 J (10)	ND (2.6)	ND (4.1)	ND (3.1)	ND (4.1)	NR
Q/STL 604643	TA2-VW-21-50	50	06-22-01	7.6 J (21)	ND (1.7)	2.8 J (4.2)	ND (2.1)	ND (4.1)	ND (4.1)	ND (1)	21	ND (1.7)	ND (2.1)	NA	ND (1)	ND (1.7)	ND (1.2)	ND (1.7)	2.7 J (4.2)	ND (1)	ND (1.7)	NA	ND (1)	ND (1.2)	NA	NA	ND (6.2)	ND (1.7)	ND (4.1)	NA	NA	ND (1)	2.5 J (4.2)	ND (1)	ND (6.2)	ND (1)	370	3.9 J (4.2)	1.5 J (4.2)	ND (1)	ND (1.7)	ND (1.2)	ND (1.7)	NR
Q/STL 604643	TA2-VW-21-92	92	06-22-01	ND (11)	ND (4.3)	ND (4.3)	ND (5.4)	ND (11)	ND (11)	ND (2.7)	25	ND (4.3)	ND (5.4)	NA	ND (2.7)	ND (4.3)	ND (3.2)	ND (4.3)	ND (2.7)	5.7 J (11)	ND (4.3)	NA	ND (2.7)	ND (3.2)	NA	NA	ND (16)	14	ND (11)	NA	NA	ND (2.7)	5.3 J (11)	ND (2.7)	ND (16)	ND (2.7)	870	ND (2.7)	3.9 J (11)	ND (2.7)	ND (4.3)	ND (3.2)	ND (4.3)	NR
Q/STL 604921	TA2-VW-21-50	50	09-25-01	4.6 J (10)	ND (0.8)	2.9	ND (1)	ND (2)	ND (2)	ND (0.5)	21	ND (0.8)	ND (1)	NA	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	2.5	ND (0.5)	0.88 J (2)	NA	ND (0.5)	ND (0.6)	NA	NA	ND (3)	ND (0.8)	ND (2)	NA	NA	ND (0.5)	2.5	ND (0.5)	ND (3)	ND (0.5)	370	4.3	1.5 J (2)	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	NR
Q/STL 604921	TA2-VW-21-92	92	09-25-01	13 J (54)	ND (4.4)	ND (4.4)	ND (5.4)	ND (11)	ND (11)	ND (2.7)	27	ND (4.4)	ND (5.4)	NA	ND (2.7)	ND (4.4)	ND (3.3)	ND (4.4)	ND (2.7)	5.3 J (11)	ND (4.4)	NA	ND (2.7)	ND (3.3)	NA	NA	ND (16)	15	ND (11)	NA	NA	ND (2.7)	5.9 J (11)	ND (2.7)	ND (16)	ND (2.7)	890	ND (2.7)	5.4 J (11)	ND (2.7)	ND (4.4)	ND (3.3)	ND (4.4)	NR
Q/STL 605162	TA2-VW-21-50	50	12-11-01	ND (2)	ND (0.8)	2.3	ND (1)	ND (2)	ND (2)	ND (0.5)	19	ND (0.8)	ND (1)	NA	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	0.88 J (2)	ND (0.5)	ND (0.8)	NA	ND (0.5)	ND (0.7)	NA	NA	ND (1)	ND (0.8)	ND (2)	NA	NA	ND (0.5)	2.2	ND (0.6)	ND (0.6)	ND (0.5)	330	2.8	1.2 J (2)	ND (0.5)	ND (0.8)	ND (0.6)	ND (0.8)	NR
Q/STL 605162	TA2-VW-21-92	92	12-11-01	ND (9.5)	ND (3.8)	ND (3.8)	ND (4.7)	ND (9.5)	ND (9.5)	ND (2.4)	18	ND (3.8)	ND (4.7)	NA	ND (2.4)	ND (3.8)	ND (2.8)	ND (3.8)	ND (2.4)	10	ND (3.8)	NA	ND (2.4)	ND (3.3)	NA	NA	ND (4.7)	25	ND (9.5)	NA	NA	ND (2.4)	9.5	ND (2.4)	ND (2.8)	ND (2.4)	1500	3 J (9.5)	7.2 J (9.5)	ND (2.4)	ND (3.8)	ND (2.8)	ND (3.8)	NR

Refer to footnotes at end of table.

Table A-4 (Concluded)
Summary of Technical Area II Active Soil-Vapor Monitoring Well VW-21 Sampling
Soil-Vapor VOC Analytical Results
November 1996 to March 2002
(On- and Off-Site Laboratories)

Sample Attributes				VOCs (EPA Method 8260-M3[a], TO-14/TO-14A[b]) Units as indicated																			
Laboratory and Record Number[c]	ER Sample ID	Sample Depth (ft)	Sample Date	Acetone	Benzene	Bromodichloromethane	1,3-Butadiene	2-Butanone	Carbon disulfide	Carbon tetrachloride	Chloroform	Chloroethane	Chloromethane	Cyclohexane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethene	cis-1,2-Dichloroethene	Ethanol	Ethyl benzene
Q/STL 605407	TA2-VW-21-50	50	3-19-02	**3.8 J (13)**	ND (1.1)	**3.1**	ND (1.3)	**4.6 J (13)**	ND (2.7)	ND (0.67)	**15**	ND (1.1)	ND (1.3)	NA	ND (0.67)	ND (1.1)	ND (0.8)	ND (1.1)	**1.6 J (2.7)**	ND (0.67)	ND (1.1)	NA	ND (0.67)
Q/STL 605407	TA2-VW-21-92	92	3-19-02	ND (6.9)	ND (2.8)	**4.4 J (6.9)**	ND (3.4)	ND (6.9)	ND (6.9)	ND (1.7)	**19**	ND (2.8)	ND (3.4)	NA	ND (1.7)	ND (2.8)	ND (2.1)	ND (2.8)	ND (1.7)	**4 J (6.9)**	ND (2.8)	NA	ND (1.7)

Sample Attributes				VOCs (EPA Method 8260-M3[a], TO-14/TO-14A[b]) Units as indicated																				
Laboratory and Record Number[c]	ER Sample ID	Sample Depth (ft)	Sample Date	4-Ethyltoluene	Heptane	Hexane	2-Hexanone	Methylene chloride	4-Methyl-2-pentanone	2-Propanol	Propylene	Styrene	Tetrachloroethene	Toluene	1,2,4-Trichlorobenzene	1,1,1-Trichloroethane	Trichloroethene	Trichlorofluoromethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	o-Xylene	m-, p-Xylene	Total Xylene
Q/STL 605407	TA2-VW-21-50	50	3-19-02	ND (0.94)	NA	NA	ND (1.3)	ND (1.1)	ND (2.7)	NA	NA	ND (0.67)	**1.5 J (2.7)**	ND (0.67)	ND (0.8)	ND (0.67)	**270**	**2.4 J (2.7)**	**0.95 J (2.7)**	ND (0.67)	ND (1.1)	ND (0.8)	ND (1.1)	NR
Q/STL 605407	TA2-VW-21-92	92	3-19-02	ND (2.4)	NA	NA	ND (3.4)	**14**	ND (6.9)	NA	NA	ND (1.7)	**4.8 J (6.9)**	ND (1.7)	ND (2.1)	ND (1.7)	**980**	ND (1.7)	**3.2 J (6.9)**	ND (1.7)	ND (2.8)	ND (2.1)	ND (2.8)	NR

Note: Values in **bold** represent detected analytes.
[a]EPA November 1986.
[b]EPA January 1997.
[c]Analysis request/chain-of-custody record.
ATL = Air Toxics Ltd. Laboratory.
BH = Borehole.
Core = Core Laboratories.
DU = Duplicate sample.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ERCL = Environmental Restoration Chemistry Laboratory.
ft = Foot (feet).
ID = Identification.
J () = The reported value is greater than or equal to the MDL but less than the practical quantitation limit, shown in parentheses.
MDL = Method detection limit.
mg/m^3 = Milligram(s) per cubic meter (air).
NA = Not analyzed.
ND () = Not detected above the MDL, shown in parentheses.
NR = Not Reported.
ppb(v/v) = Part(s) per billion on a volume per volume basis.
OVA = Organic vapor analyzer.
P = Sample collected while system tubing was being purged and before OVA readings stabilized.
Quanterra = Quanterra Laboratory.
Q/STL = Quanterra/Severn Trent Laboratories.
S = Sample collected after system tubing fully purged and OVA readings stabilized.
STL = Severn Trent Laboratories.
SV = Soil vapor.
TA = Technical Area.
VOC = Volatile organic compound.
VW = Vapor well.

Table A-5
Summary of Technical Area II Active Soil Vapor Sampling During Borehole BH-023 Drilling
Soil-Vapor VOC Analytical Results
November 1996
(Off-Site Laboratory)

Sample Attributes				VOCs (EPA Method TO-14^a) ppb(v/v)																																							
Laboratory and Record Number^b	ER Sample ID	Sample Depth (ft)	Sample Date	Acetone	Benzene	Bromodichloromethane	1,3-Butadiene	2-Butanone	Carbon disulfide	Carbon tetrachloride	Chloroform	Chloroethane	Chloromethane	Cyclohexane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethene	cis-1,2-Dichloroethene	Ethanol	Ethyl benzene	4-Ethyltoluene	Heptane	Hexane	2-Hexanone	Methylene chloride	4-Methyl-2-pentanone	2-Propanol	Propylene	Styrene	Tetrachloroethene	Toluene	1,2,4-Trichlorobenzene	1,1,1-Trichloroethane	Trichloroethene	Trichlorofluoromethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	o-Xylene	m-, p-Xylene
Soil-vapor samples collected during borehole drilling																																											
ATL 9265	TA2-BH-023-10-SV	10	11-13-96	**100**	**4.9**	ND (3.3)	**10**	**16**	**11**	ND (0.82)	ND (0.82)	ND (0.82)	**1.2**	ND (3.3)	ND (0.82)	ND (0.82)	ND (0.82)	ND (0.82)	**0.85**	ND (0.82)	ND (0.82)	**7.8**	**8.0**	ND (3.3)	**21**	**7.4**	ND (3.3)	**1.7**	ND (3.3)	ND (3.3)	ND (3.3)	**1.0**	**1.4**	**250**	ND (0.82)	ND (0.82)	**7.5**	ND (0.82)	**1.2**	**7.5**	**2.7**	**8.2**	**28**
ATL 9265	TA2-BH-023-20-SV	20	11-13-96	**40**	**1.7**	ND (3.4)	ND (3.4)	**5.4**	**10**	ND (0.86)	ND (0.86)	ND (0.86)	ND (0.86)	ND (3.4)	ND (0.86)	ND (0.86)	ND (0.86)	ND (0.86)	ND (0.86)	ND (0.86)	ND (0.86)	**7.9**	**2.8**	ND (3.4)	**6.2**	ND (3.4)	ND (3.4)	ND (0.86)	ND (3.4)	ND (3.4)	ND (3.4)	ND (0.86)	ND (0.86)	**88**	ND (0.86)	ND (0.86)	**1.1**	ND (0.86)	ND (0.86)	**1.9**	**0.90**	**3.6**	**10**
ATL 9265	TA2-BH-023-30-SV	30	11-13-96	**12**	**7.0**	ND (3.4)	ND (3.4)	ND (3.4)	**5.8**	ND (0.86)	**3.0**	ND (0.86)	ND (0.86)	**7.6**	ND (0.86)	ND (0.86)	ND (0.86)	ND (0.86)	**1.1**	ND (0.86)	ND (0.86)	ND (3.4)	**1.7**	ND (3.4)	**11**	**10**	ND (3.4)	ND (0.86)	ND (3.4)	ND (3.4)	ND (3.4)	ND (0.86)	**2.7**	**22**	ND (0.86)	ND (0.86)	**46**	ND (0.86)	**7.5**	**9.7**	**3.5**	**6.3**	**12**
ATL 9265	TA2-BH-023-30-SV-DU	30	11-13-96	**11**	**7.9**	ND (3.4)	ND (3.4)	ND (3.4)	**4.7**	ND (0.86)	**2.2**	ND (0.86)	ND (0.86)	**7.4**	ND (0.86)	ND (0.86)	ND (0.86)	ND (0.86)	**1.4**	ND (0.86)	ND (0.86)	ND (3.4)	**1.9**	ND (3.4)	**14**	**7.1**	ND (3.4)	ND (0.86)	ND (3.4)	ND (3.4)	ND (3.4)	ND (0.86)	**2.2**	**30**	ND (0.86)	ND (0.86)	**43**	ND (0.86)	**5.7**	**9.1**	**3.5**	**6.6**	**13**
ATL 9265	TA2-BH-023-40-SV	40	11-13-96	**150**	**18**	ND (9.8)	**17**	**18**	**26**	ND (2.4)	ND (2.4)	ND (2.4)	ND (2.4)	ND (9.8)	ND (2.4)	ND (2.4)	ND (2.4)	ND (2.4)	ND (2.4)	ND (2.4)	ND (2.4)	**30**	**19**	ND (9.8)	**71**	**20**	ND (9.8)	ND (2.4)	ND (9.8)	ND (9.8)	ND (9.8)	ND (2.4)	**2.8**	**780**	ND (2.4)	ND (2.4)	**46**	ND (2.4)	**7.0**	**14**	**5.1**	**19**	**72**
ATL 9265	TA2-BH-023-50-SV	50	11-13-96	**19**	**4.1**	ND (3.5)	ND (3.5)	ND (3.5)	**11**	ND (0.88)	**8.6**	ND (0.88)	ND (0.88)	**3.8**	ND (0.88)	ND (0.88)	ND (0.88)	ND (0.88)	**1.1**	ND (0.88)	**4.5**	**7.9**	ND (0.88)	ND (3.5)	ND (3.5)	ND (3.5)	ND (3.5)	ND (0.88)	ND (3.5)	ND (3.5)	ND (3.5)	ND (0.88)	**4.9**	**7.2**	ND (0.88)	ND (0.88)	**130**	ND (0.88)	**21**	**1.0**	ND (0.88)	**1.0**	**2.3**
ATL 9266	TA2-BH-023-50-SV-DU	50	11-13-96	**18**	**1.8**	ND (3.3)	ND (3.3)	ND (3.3)	**8.4**	ND (0.82)	**5.2**	ND (0.82)	ND (0.82)	ND (3.3)	ND (0.82)	ND (0.82)	ND (0.82)	ND (0.82)	**1.9**	ND (0.82)	**3.1**	**7.6**	ND (0.82)	ND (3.3)	ND (3.3)	ND (3.3)	ND (3.3)	ND (0.82)	ND (3.3)	ND (3.3)	ND (3.3)	ND (0.82)	**3.4**	**7.5**	ND (0.82)	ND (0.82)	**100**	ND (0.82)	**11**	**0.82**	ND (0.82)	ND (0.82)	**1.8**
ATL 9266	TA2-BH-023-60-SV	60	11-13-96	**18**	ND (0.84)	ND (3.4)	ND (3.4)	**6.2**	ND (3.4)	**1.9**	**9.5**	ND (0.84)	ND (0.84)	ND (3.4)	ND (0.84)	ND (0.84)	ND (0.84)	ND (0.84)	**1.3**	ND (0.84)	**5.6**	**26**	ND (0.84)	ND (3.4)	ND (3.4)	ND (3.4)	ND (3.4)	ND (0.84)	ND (3.4)	ND (3.4)	ND (3.4)	ND (0.84)	**5.2**	**2.0**	ND (0.84)	ND (0.84)	**160**	ND (0.84)	**24**	ND (0.84)	ND (0.84)	ND (0.84)	ND (0.84)
ATL 9266	TA2-BH-023-60-SV-DU	60	11-13-96	**17**	ND (1.0)	ND (4.1)	ND (4.1)	**6.1**	ND (4.1)	**1.5**	**9.1**	ND (1.0)	ND (1.0)	ND (4.1)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	**1.1**	ND (1.0)	**5.7**	**28**	ND (1.0)	ND (4.1)	ND (4.1)	ND (4.1)	ND (4.1)	ND (1.0)	ND (4.1)	ND (4.1)	ND (4.1)	ND (1.0)	**5.2**	**1.8**	ND (1.0)	ND (1.0)	**150**	ND (1.0)	**25**	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
ATL 9266	TA2-BH-023-70-SV	70	11-13-96	**26**	ND (0.86)	ND (3.4)	ND (3.4)	ND (3.4)	**4.8**	ND (0.86)	**4.9**	ND (0.86)	ND (0.86)	ND (3.4)	ND (0.86)	ND (0.86)	ND (0.86)	ND (0.86)	**2.4**	ND (0.86)	**2.8**	ND (3.4)	ND (0.86)	ND (3.4)	ND (3.4)	ND (3.4)	ND (3.4)	ND (0.86)	ND (3.4)	ND (3.4)	**18**	ND (0.86)	**3.0**	**2.1**	ND (0.86)	ND (0.86)	**120**	ND (0.86)	**9.8**	ND (0.86)	ND (0.86)	ND (0.86)	ND (0.86)
ATL 9267	TA2-BH-023-80-SV	80	11-13-96	**43**	**3.2**	ND (3.5)	ND (3.5)	**6.9**	ND (3.5)	**1.2**	**5.5**	ND (0.88)	ND (0.88)	ND (3.5)	ND (0.88)	ND (0.88)	ND (0.88)	ND (0.88)	ND (0.88)	ND (0.88)	**7.3**	**12**	**3.9**	ND (3.5)	**12**	ND (3.5)	ND (3.5)	ND (0.88)	ND (3.5)	ND (3.5)	**34**	ND (0.88)	**2.5**	**150**	ND (0.88)	ND (0.88)	**96**	ND (0.88)	**17**	**1.8**	ND (0.88)	**4.6**	**14**
ATL 9267	TA2-BH-023-90-SV	90	11-13-96	**12**	**7.2**	ND (3.6)	ND (3.6)	ND (3.6)	ND (3.6)	**4.2**	**17**	ND (0.90)	ND (0.90)	**9.4**	ND (0.90)	ND (0.90)	ND (0.90)	ND (0.90)	**1.5**	**1.1**	**25**	ND (3.6)	**1.2**	ND (3.6)	**4.2**	**3.6**	ND (3.6)	ND (0.90)	ND (3.6)	ND (3.6)	ND (3.6)	ND (0.90)	**6.9**	**26**	ND (0.90)	ND (0.90)	**310**	ND (0.90)	**59**	**2.4**	ND (0.90)	**1.8**	**5.0**
ATL 9267	TA2-BH-023-100-SV	100	11-14-96	**59**	ND (0.88)	ND (3.5)	ND (3.5)	**21**	ND (3.5)	ND (0.88)	ND (0.88)	ND (0.88)	ND (0.88)	ND (3.5)	ND (0.88)	ND (0.88)	ND (0.88)	ND (0.88)	ND (0.88)	ND (0.88)	ND (0.88)	**23**	**7.4**	ND (3.5)	**24**	**3.6**	ND (3.5)	ND (0.88)	ND (3.5)	ND (3.5)	**120**	**1.9**	ND (0.88)	**290**	ND (0.88)	ND (0.88)	**3.3**	ND (0.88)	ND (0.88)	**1.5**	ND (0.88)	**7.8**	**31**

Note: Values in **bold** represent detected analytes.
[a] EPA January 1997.
[b] Analysis request/chain-of-custody record.

ATL = Air Toxics Ltd. Laboratory.
BH = Borehole.
DU = Duplicate sample.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
MDL = Method detection Limit.
ND ( ) = Not detected above the MDL, shown in parentheses.
ppb(v/v) = Part(s) per billion on a volume per volume basis.
SV = Soil vapor.
VOC = Volatile organic compound.

Table A-6
Summary of Active Soil-Vapor VOC Analytical Method Detection Limits November 1996 to September 2003 (On- and Off-Site Laboratories)

Analyte	EPA Method 8260-M3[a] Detection Limit On-Site Laboratory July and September 1997 (mg/m^3)	EPA Method TO-14[b] Detection Limit Off-Site Laboratories November 1996–March 2002 [ppb(v/v)]	EPA Method TO-14[b] Detection Limit Off-Site Laboratory September 2003 [ppb(v/v)]
Acetone	NA	2–560	2–4.1
Benzene	1.2–1.25	0.42–230	0.8–1.6
Benzyl chloride	NA	0.8–230	0.8–1.6
Bromodichloromethane	1.2–1.25	0.27–230	0.8–1.6
Bromoform	1.2–1.25	0.22–140	0.5–1
Bromomethane	NA	0.68–280	1–2
2-Butanone	NA	2–560	2–4.1
Carbon disulfide	1.2–1.25	0.73–560	2–4.1
Carbon tetrachloride	1.2–1.25	0.42–140	0.5–1
Chlorobenzene	1.2–1.25	0.5–140	0.5–1
Chloroethane	NA	0.8–230	0.8–1.6
Chloroform	1.2–1.25	0.39–230	0.8–1.6
Chloromethane	NA	1–280	1–2
Dibromochloromethane	1.2–1.25	0.23–140	0.5–1
1,2-Dibromoethane	NA	0.37–140	0.5–1
1,2-Dichlorobenzene	NA	0.69–230	0.8–1.6
1,3-Dichlorobenzene	NA	0.48–170	0.7–1.4
1,4-Dichlorobenzene	NA	0.68–230	0.8–1.6
Dichlorodifluoromethane	NA	0.45–140	0.5–1
1,1-Dichloroethane	1.2–1.25	0.5–140	0.5–1
1,2-Dichloroethane	1.2–1.25	0.76–230	0.8–1.6
1,1-Dichloroethene	1.2–1.25	0.5–140	0.5–1
cis-1,2-Dichloroethene	1.2–1.25	0.54–230	0.8–1.6
trans-1,2-Dichloroethene	1.2–1.25	0.5–140	0.5–1
1,2-Dichloropropane	1.2–1.25	0.8–230	0.8–1.6
cis-1,3-Dichloropropene	1.2–1.25	0.5–140	0.5–1
trans-1,3-Dichloropropene	1.2–1.25	0.8–230	0.8–1.6
Ethylbenzene	1.2–1.25	0.32–140	0.5–1
4-Ethyltoluene	NA	0.25–200	0.7–1.4
Hexachlorobutadiene	NA	0.57–280	1–2
2-Hexanone	NA	1–630	1–2
Methylene chloride	1.2–1.25	0.44–230	0.8–1.6
4-methyl-2-Pentanone	NA	0.38–560	2–4.1
Styrene	1.2–1.25	0.5–140	0.6–1.2
1,1,2,2-Tetrachloroethane	1.2–1.25	0.41–140	0.5–1
Tetrachloroethene	1.2–1.25	0.5–170	0.6–1.2
1,2-Dichloro-1,1,2,2-tetrafluoroethane	NA	0.36–230	0.8–1.6
Toluene	1.2–1.25	0.33–140	0.5–1
1,2,4-Trichlorobenzene	NA	0.6–630	1–2
1,1,1-Trichloroethane	1.2–1.25	0.49–140	0.5–1
1,1,2-Trichloroethane	1.2–1.25	0.5–170	0.6–1.2
Trichloroethene	1.2–1.25	0.28–140	0.5–1
1,1,2-Trichloro-1,2,2-trifluoroethane	0.25–1.25	0.5–140	0.5–1

Refer to footnotes at end of table.

Table A-6 (Concluded)
Summary of Active Soil-Vapor VOC Analytical Method Detection Limits
November 1996 to September 2003
(On- and Off-Site Laboratories)

Analyte	EPA Method 8260-M3[a] Detection Limit On-Site Laboratory July and September 1997 (mg/m^3)	EPA Method TO-14[b] Detection Limit Off-Site Laboratories November 1996–March 2002 [ppb(v/v)]	EPA Method TO-14[b] Detection Limit Off-Site Laboratory September 2003 [ppb(v/v)]
Trichlorofluoromethane	NA	0.27–140	0.5–1
1,2,4-Trimethylbenzene	NA	0.32–140	0.8–1.6
1,3,5-Trimethylbenzene	NA	0.29–230	0.8–1.6
Vinyl acetate	NA	1.2–560	2–4.1
Vinyl chloride	1.2–1.25	0.8–230	0.8–1.6
m-, p-Xylene	2.5	0.8–230	1–2
o-Xylene	1.2–1.25	0.5–170	0.6–1.2
Xylene (total)	NA	0.57–0.8	NA

[a] EPA November 1986.
[b] EPA January 1997.

EPA = U.S. Environmental Protection Agency.
mg/m^3 = Milligram(s) per cubic meter (air).
NA = Not analyzed.
ppb(v/v) = Part(s) per billion on a volume/volume basis.
VOC = Volatile organic compound.

Table A-7
Summary of Technical Area II Active Soil-Vapor Monitoring Well 159-VW-01 Sampling
Soil-Vapor VOC Analytical Results
September 2003
(Off-Site Laboratory)

Sample Attributes				VOCs (EPA Method TO-14/TO-14A[a]) ppb(v/v)										
Laboratory and Record Number[b]	ER Sample ID	Sample Depth (ft)	Sample Date	Acetone	Benzene	Bromodichloromethane	1,3-Butadiene	2-Butanone	Carbon disulfide	Carbon tetrachloride	Chloroform	Chloroethane	Chloromethane	Cyclohexane
STL 606760	159-VW-01-5-SV	5	9-9-03	ND (10)	ND (2.0)	ND (2.0)	ND (1.0)	ND (10)	ND (10)	**1.4 J (2.0)**	ND (2.0)	ND (0.80)	ND (4.0)	NA
STL 606760	159-VW-01-20-SV	20	9-9-03	ND (10)	ND (2.0)	ND (2.0)	ND (1.0)	ND (10)	ND (10)	**2.4**	ND (2.0)	ND (0.80)	ND (4.0)	NA
STL 606760	159-VW-01-70-SV	70	9-9-03	**2.8 J (10)**	ND (2.0)	ND (2.0)	ND (1.0)	ND (10)	ND (10)	**11**	**1.9 J (2.0)**	ND (0.80)	ND (4.0)	NA
STL 606760	159-VW-01-100-SV	100	9-9-03	**3.1 J (10)**	ND (2.0)	ND (2.0)	ND (1.0)	ND (10)	ND (10)	**14**	**2.6**	ND (0.80)	ND (3.0)	NA
STL 606760	159-VW-01-150-SV	150	9-9-03	**6.7 J (20)**	ND (4.1)	ND (4.1)	ND (2.0)	**31**	**11 J (20)**	**7.2**	**2.0 J (4.1)**	ND (1.6)	ND (8.1)	NA
STL 606760	159-VW-01-150-DU	150	9-9-03	**7.7 J (20)**	ND (4.0)	ND (4.0)	ND (2.0)	**54**	**4.4 J (20)**	**6.9**	**2.0 J (4.0)**	ND (1.6)	**2.1 J (8.0)**	NA

Sample Attributes				VOCs (EPA Method TO-14/TO-14A[a]) ppb(v/v)															
Laboratory and Record Number[b]	ER Sample ID	Sample Depth (ft)	Sample Date	1,2-Dibromoethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethene	cis-1,2-Dichloroethene	Ethanol	Ethyl benzene	4-Ethyltoluene	Heptane	Hexane	2-Hexanone	Methylene chloride	4-Methyl-2-pentanone	2-Propanol
STL 606760	159-VW-01-5-SV	5	9-9-03	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	**0.70 J (2.0)**	ND (2.0)	ND (2.0)	NA	ND (2.0)	ND (2.0)	NA	NA	ND (1.0)	ND (2.0)	ND (2.0)	NA
STL 606760	159-VW-01-20-SV	20	9-9-03	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	**0.94 J (2.0)**	ND (2.0)	ND (2.0)	NA	ND (2.0)	ND (2.0)	NA	NA	ND (1.0)	ND (2.0)	ND (2.0)	NA
STL 606760	159-VW-01-70-SV	70	9-9-03	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	**2.5**	**1.3 J (2.0)**	ND (2.0)	NA	ND (2.0)	ND (2.0)	NA	NA	ND (1.0)	ND (2.0)	ND (2.0)	NA
STL 606760	159-VW-01-100-SV	100	9-9-03	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	**4.8**	**2.5**	ND (2.0)	NA	ND (2.0)	ND (2.0)	NA	NA	ND (1.0)	ND (2.0)	ND (2.0)	NA
STL 606760	159-VW-01-150-SV	150	9-9-03	ND (4.1)	ND (4.1)	ND (4.1)	ND (4.1)	**4.4**	**2.3 J (4.1)**	ND (4.1)	NA	ND (4.1)	ND (4.1)	NA	NA	ND (2.0)	ND (4.1)	ND (4.1)	NA
STL 606760	159-VW-01-150-DU	150	9-9-03	ND (4.0)	ND (4.0)	ND (4.0)	ND (4.0)	**4.3**	**2.1 J (4.0)**	ND (4.0)	NA	ND (4.0)	ND (4.0)	NA	NA	ND (2.0)	ND (4.0)	ND (4.0)	NA

Sample Attributes				VOCs (EPA Method TO-14/TO-14A[a]) ppb(v/v)														
Laboratory and Record Number[b]	ER Sample ID	Sample Depth (ft)	Sample Date	Propylene	Styrene	Tetrachloroethene	Toluene	1,2,4-Trichlorobenzene	1,1,1-Trichloroethane	Trichloroethene	Trichlorofluoromethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	o-Xylene	m-, p-Xylene	Total Xylene
STL 606760	159-VW-01-5-SV	5	9-9-03	NA	ND (2.0)	ND (2.0)	**0.67 J (2.0)**	ND (5.0)	ND (2.0)	**24**	**1.7 J (2.0)**	**29**	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	NR
STL 606760	159-VW-01-20-SV	20	9-9-03	NA	ND (2.0)	ND (2.0)	**1.7 J (2.0)**	ND (5.0)	ND (2.0)	**37**	**2.1**	**57**	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	NR
STL 606760	159-VW-01-70-SV	70	9-9-03	NA	ND (2.0)	**1.2 J (2.0)**	**2.6**	ND (5.0)	ND (2.0)	**140**	**7.7**	**250**	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	NR
STL 606760	159-VW-01-100-SV	100	9-9-03	NA	ND (2.0)	**1.6 J (2.0)**	**3.0**	ND (5.0)	ND (2.0)	**320**	**19**	**480**	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	NR
STL 606760	159-VW-01-150-SV	150	9-9-03	NA	ND (4.1)	**1.4 J (4.1)**	**1.4 J (4.1)**	ND (10)	ND (4.1)	**440**	**18**	**440**	ND (4.1)	ND (4.1)	ND (4.1)	ND (4.1)	NR
STL 606760	159-VW-01-150-DU	150	9-9-03	NA	ND (4.0)	**1.6 J (4.0)**	**2.0 J (4.0)**	ND (10)	ND (4.0)	**450**	**18**	**440**	ND (4.0)	ND (4.0)	ND (4.0)	ND (4.0)	NR

Note: Values in **bold** represent detected analytes.

[a] EPA January 1997.

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

DU = Duplicate sample.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The reported value is greater than or equal to the MDL but less than the practical quantitation limit, shown in parentheses.
MDL = Method detection Limit.
NA = Not analyzed.
ND ( ) = *Not detected above the MDL, shown in parentheses.*
NR = Not Reported.
ppb(v/v) = Part(s) per billion on a volume per volume basis.
STL = *Severn Trent Laboratories.*
SV = Soil vapor.
VOC = Volatile organic compound.
VW = Vapor well.

Table A-8
Summary of Technical Area II Active Soil-Vapor Monitoring Well 165-VW-01 Sampling
Soil-Vapor VOC Analytical Results
September 2003
(Off-Site Laboratory)

Sample Attributes				VOCs (EPA Methods TO-14/TO-14A[a]) ppb(v/v)																																								
Laboratory and Record Number[b]	ER Sample ID	Sample Port Depth (ft)	Sample Date	Acetone	Benzene	Bromodichloromethane	1,3-Butadiene	2-Butanone	Carbon disulfide	Carbon tetrachloride	Chloroform	Chloroethane	Chloromethane	Cyclohexane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethene	cis-1,2-Dichloroethene	Ethanol	Ethyl benzene	4-Ethyltoluene	Heptane	Hexane	2-Hexanone	Methylene chloride	4-Methyl-2-pentanone	2-Propanol	Propylene	Styrene	Tetrachloroethene	Toluene	1,2,4-Trichlorobenzene	1,1,1-Trichloroethane	Trichloroethene	Trichlorofluoromethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	o-Xylene	m-, p-Xylene	Total Xylene
STL 606761	165-VW-01-5-SV	5	9-9-03	**4.0 J (10)**	ND (2.0)	ND (2.0)	ND (1.0)	ND (10)	**3.8 J (10)**	**0.60 J (2.0)**	**6.9**	ND (1.0)	ND (4.0)	NA	ND (2.0)	ND (2.0)	ND (2.0)	ND (1.2)	**0.51 J (2.0)**	ND (2.0)	ND (2.0)	NA	ND (2.0)	ND (2.0)	NA	NA	ND (1.0)	ND (2.0)	ND (2.0)	NA	NA	ND (2.0)	ND (2.0)	ND (2.0)	ND (5.0)	ND (2.0)	**1.7 J (2.0)**	**1.5 J (2.0)**	**10**	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	NR
STL 606761	165-VW-01-20-SV	20	9-9-03	ND (10)	ND (2.0)	ND (2.0)	ND (1.0)	ND (10)	ND (10)	**1.0 J (2.0)**	**17**	ND (0.80)	ND (4.0)	NA	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	NA	ND (2.0)	ND (2.0)	NA	NA	ND (1.0)	ND (2.0)	ND (2.0)	NA	NA	ND (2.0)	ND (2.0)	**0.63 J (2.0)**	ND (5.0)	ND (2.0)	**3.4**	**0.85 J (2.0)**	**8.2**	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	NR
STL 606761	165-VW-01-70-SV	70	9-9-03	**15**	ND (2.0)	ND (2.0)	ND (1.0)	ND (10)	ND (10)	ND (2.0)	**21**	ND (0.80)	ND (4.0)	NA	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	**0.57 J (2.0)**	ND (2.0)	ND (2.0)	NA	ND (2.0)	ND (2.0)	NA	NA	ND (1.0)	**1.7 J (2.0)**	ND (2.0)	NA	NA	ND (2.0)	ND (2.0)	**2.9**	ND (5.0)	ND (2.0)	**3.4**	**0.58 J (2.0)**	**8.3**	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	NR
STL 606761	165-VW-01-100-SV	100	9-9-03	**3.4 J (10)**	ND (2.0)	**2.1**	ND (1.0)	ND (10)	ND (10)	**8.1**	**140**	ND (0.80)	ND (4.0)	NA	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	**1.1 J (2.0)**	**0.93 J (2.0)**	ND (2.0)	NA	ND (2.0)	ND (2.0)	NA	NA	ND (1.0)	**8.0**	ND (2.0)	NA	NA	ND (2.0)	**1.4 J (2.0)**	**1.6 J (2.0)**	ND (5.0)	ND (2.0)	**26**	**4.4**	**170**	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	NR
STL 606761	165-VW-01-150-SV	150	9-9-03	**3.4 J (10)**	ND (2.0)	ND (2.0)	ND (1.0)	ND (10)	ND (10)	**6.9**	**120**	ND (0.80)	ND (4.0)	NA	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	**1.1 J (2.0)**	**0.88 J (2.0)**	ND (2.0)	NA	ND (2.0)	ND (2.0)	NA	NA	ND (1.0)	**14**	ND (2.0)	NA	NA	ND (2.0)	**1.5 J (2.0)**	**2.8**	ND (5.0)	ND (2.0)	**8.2**	**3.4**	**170**	ND (2.0)	ND (2.0)	ND (2.0)	ND (2.0)	NR

Note: Values in **bold** represent detected analytes.

[a] EPA January 1997.

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

EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = The reported value is greater than or equal to the MDL but less than the practical quantitation limit, shown in parentheses.
MDL = Method detection Limit.
NA = Not analyzed.
ND ( ) = Not detected above the MDL, shown in parentheses.
NR = Not Reported.
ppb(v/v) = Part(s) per billion on a volume per volume basis.
STL = Severn Trent Laboratories.
SV = Soil vapor.
VOC = Volatile organic compound.
VW = Vapor well.