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Justification for Class III Permit Modification April 2001 SWMU 94C Operable Unit 1333 Bomb Burner Area and Discharge Line, Lurance Canyon Burn Site

Sandia National Laboratories/NM

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Sandia National Laboratories

Justification for Class III Permit Modification

April 2001

SWMU 94C
Operable Unit 1333
Bomb Burner Area and Discharge Line, Lurance Canyon Burn Site

NFA Originally Submitted March 2001

Environmental
Restoration
Project

United States Department of Energy
Albuquerque Operations Office

Justification for
Class III Permit Modification

April 2001

Solid Waste Management Unit 94C
Operable Unit 1333
Round 15

(RCRA Permit No. NM5890110518)

NFA Originally Submitted March 2001

NFA

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Class III Permit Modification

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Solid Waste Management Unit 94C
Operable Unit 1333
Round 15

NFA Originally Submitted March 2001

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2.0 SOLID WASTE MANAGEMENT UNIT 94C, BOMB BURNER AREA AND DISCHARGE LINE, LURANCE CANYON BURN SITE

2.1 Summary

Sandia National Laboratories/New Mexico (SNL/NM) is proposing a risk-based no further action (NFA) decision for Environmental Restoration (ER) Solid Waste Management Unit (SWMU) 94C, Bomb Burner Area and Discharge Line, Lurance Canyon Burn Site (LCBS), Operable Unit (OU) 1333, on Kirtland Air Force Base (KAFB). SWMU 94C is an inactive subunit in the central portion of the LCBS (Figure 2.1-1). Environmental concern for SWMU 94C is based upon past testing activities at the Bomb Burner Unit. The Bomb Burner Unit was removed in the spring of 1997 as part of SNL/NM's Decommissioning and Demolition (D&D) Program and was not listed as a separate SWMU 94 subunit. The discharge line from this unit was not characterized during the Bomb Burner Unit D&D project. This NFA decision is based upon environmental sampling documenting that the Voluntary Corrective Action (VCA) conducted on the discharge line during 2000 removed all contamination and that 94C does not pose a threat to human health or the environment.

This NFA addresses possible releases from the Bomb Burner Discharge Line. Review and analysis of all relevant data for SWMU 94C indicate that concentrations of constituents of concern (COCs) at this site are below applicable risk assessment action levels. Thus, SWMU 94C is proposed for an NFA decision based upon confirmatory sampling data demonstrating that COCs that may have been released from the SWMU into the environment pose an acceptable level of risk under current and projected future land uses as set forth by Criterion 5, which states, "The SWMU/AOC [area of concern] has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use" (NMED March 1998).

2.2 Description and Operational History

Section 2.2 describes SWMU 94C and discusses its operational history.

2.2.1 Site Description

SWMU 94C is a subunit of SWMU 94, identified as the LCBS on the Resource Conservation and Recovery Act (RCRA) Hazardous and Solid Waste Amendments (HSWA) permit. SWMU 94C is an inactive subunit located on U.S. Air Force (USAF) land withdrawn from the U.S. Forest Service (USFS) and permitted to the U.S. Department of Energy (DOE) (SNL/NM July 1994). The site comprises approximately 0.2 acre at an elevation of approximately 6,343 feet above sea level (SNL/NM April 1995) (Figure 2.2.1-1). The site is located on the canyon floor alluvium in the closed upper reaches of the Lurance Canyon drainage. This drainage is surrounded by moderately steep canyon walls; the immediate topographic relief around the site is over 500 feet. The canyon floor at the site is isolated by the canyon

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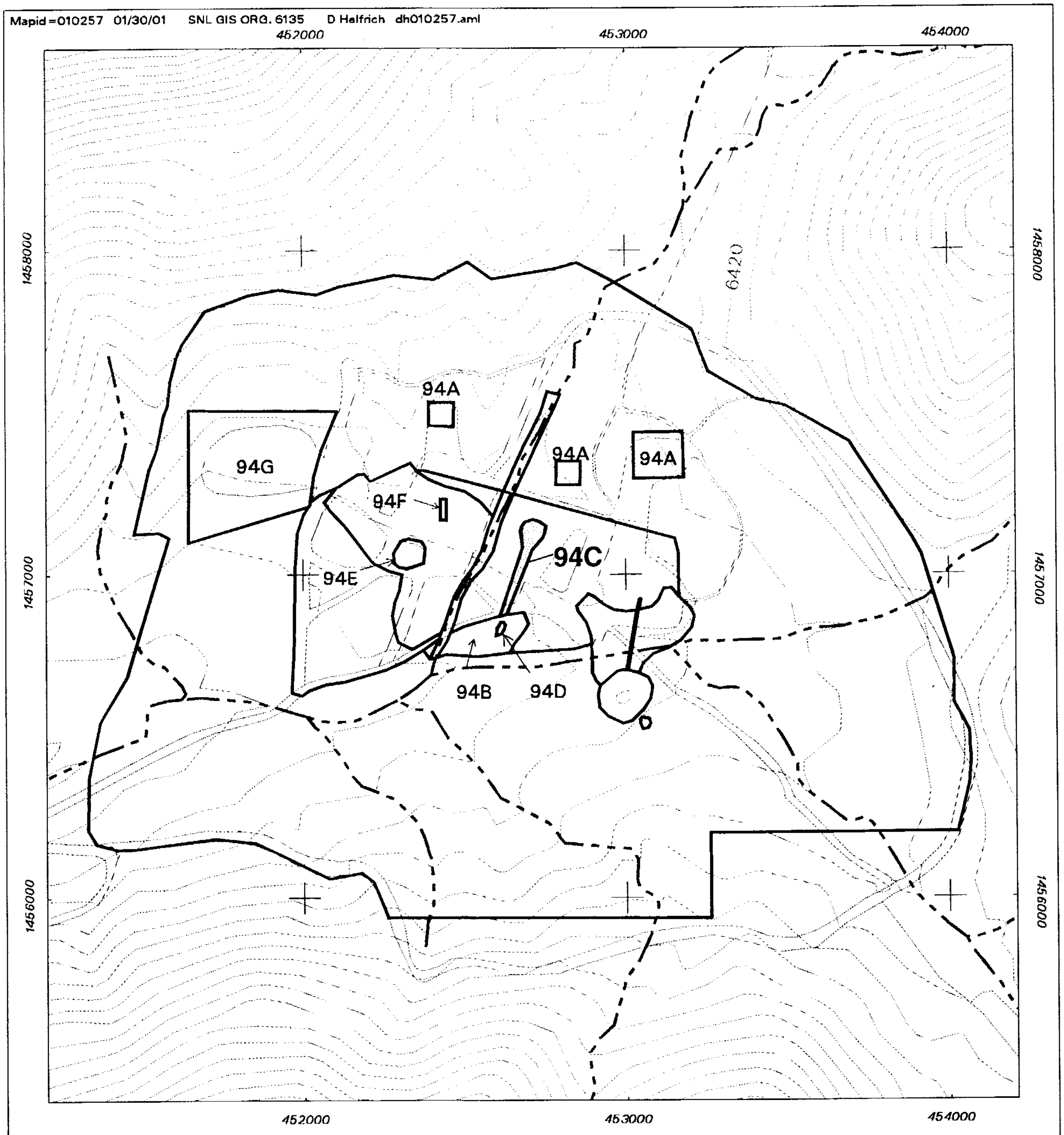

Figure 2.1-1
Location of SWMU 94C and other SWMU 94 Subunits

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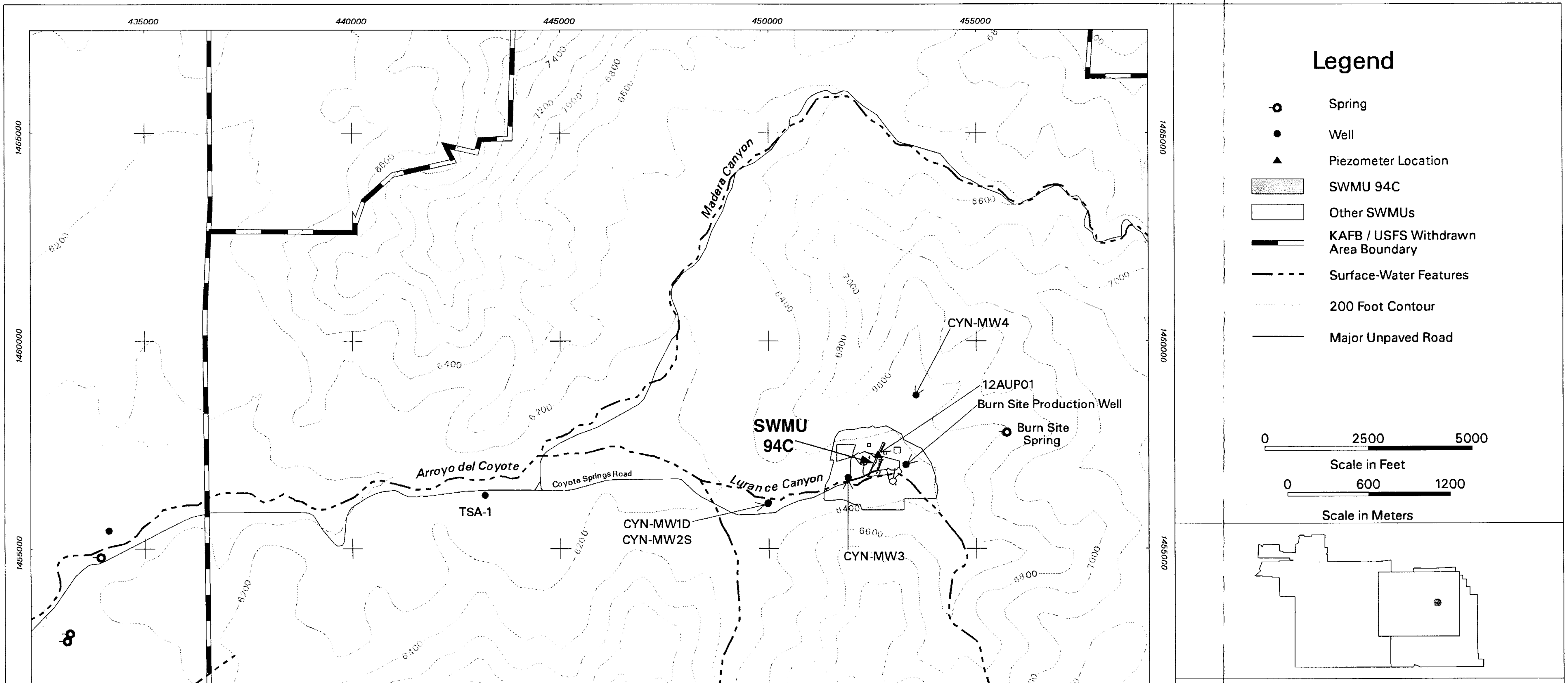

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Figure 2.2.1-1
Location of SWMU 94C
Bomb Burner Area & Discharge
Line within Operable Unit 1333

Transverse Mercator Projection, New Mexico State Plane Coordinate System,
Central Zone, 1927 North American Horizontal Datum,
1929 North American Vertical Datum

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walls except for the western drainage into the Arroyo del Coyote. Coyote Springs Road follows this drainage and is the main access road into Lurance Canyon.

SWMU 94C was an inactive corrugated metal discharge line. The line is approximately 300 feet long, and conveyed water used to extinguish fires at the Bomb Burner Unit to an unlined discharge pit (SWMU 94D) (Figure 2.2.1-2). The Bomb Burner was constructed in 1982 and used until 1988 for a series of 23 burn tests involving the exposure of weapons (some containing depleted uranium [DU]) and components to abnormal environments (Hooper May 1983, Stevenson December 1985, Mata December 1983). Several burn tests were also conducted in the Bomb Burner Unit trench. The Bomb Burner was designed as an expendable duplicate of more expensive test units. Swipe samples collected inside the Bomb Burner indicated that the building material was contaminated with uranium, thorium, mercury, and beryllium (SNL/NM September 1997c).

The Bomb Burner Unit was demolished in 1997 and the results of this activity are summarized in a separate report (SNL/NM September 1997c). None of the building debris was determined to be hazardous material; however, some of it was disposed of as low level radioactive waste. There was a burn pan in the bottom of the unit that contained sludge. Approximately 14 cubic feet of sludge was containerized and disposed of as low-level radioactive waste. After the burn pan was removed, the soil on the bottom of the Bomb Burner Unit was evaluated. The soil also had elevated radiological activity, and approximately 9.6 cubic yards of soil was removed from the area and containerized in 37 55-gallon drums. After the soil was removed, three confirmatory soil samples were collected. The data from this sampling event was transmitted to New Mexico Environment Department (NMED) in September 1999 as part of the Notice of Deficiency response on the OU 1333 RCRA Facility Investigation (RFI) Work Plan (DOE September 1999). The confirmatory samples indicated that areas of gross soil contamination had been removed. Uranium-238 and uranium-235 activities were greater than background, but not above risk-based action levels. The project Radiation Control Technician (RCT) informally surveyed the upgradient end of the discharge line (SWMU 94C) and determined that it had elevated radiological activity. The discharge line was left in place awaiting further characterization. The initial conceptual model for SWMU 94C is an inactive drain line that may have radiologic and/or organic contamination within and under the line.

The LCBS is currently used for testing fire survivability of transportation containers, weapons components, simulated weapons, and satellite components (Martz November 1985, SNL/NM May 1986). Only a few of the permanent engineered structures currently at the site are active today. The location of SWMU 94 coincides with SWMU 65 (Lurance Canyon Explosives Test Site), an inactive site that was used for high explosives (HE) tests and for liquid and solid propellant burn tests.

Historical published information regarding the hydrogeology of Sol se Mete and Lurance Canyons is summarized in the "RCRA Facility Investigation (RFI) Work Plan for OU 1333, Canyons Test Area" (SNL/NM September 1995). The stratigraphy of OU 1333 consists of Precambrian metamorphic and intrusive rocks that are overlain by Paleozoic clastic and sedimentary carbonate rocks. Along the canyon bottoms, these rocks are overlain by alluvial sediments. In general, the conceptual model provided by the RFI Work Plan is that groundwater flows through a series of fractures of unknown extent and complexity. The groundwater flow direction is assumed to be topographically controlled and flow is to the west

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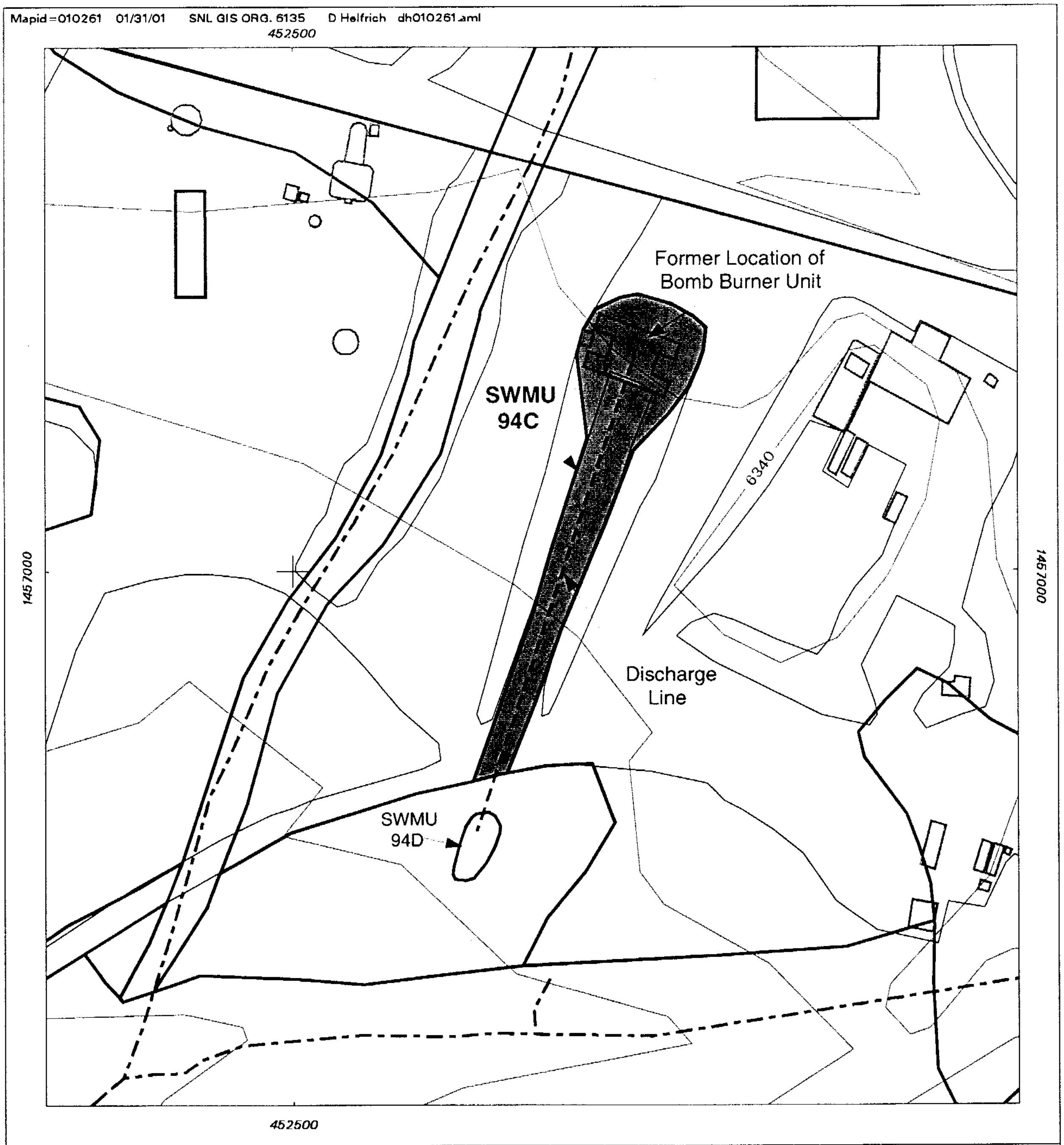

Legend

———	Road
═══	Building Structure
·······	10 Foot Contour
— · · —	Surface Drainage
━━━	Other SWMU Boundary
- - - -	Discharge Line
▨	SWMU 94C

Figure 2.2.1-2
Site Map of SWMU 94C
Bomb Burner Area
and Discharge Line

0 50 100
Scale in Feet

0 12 24
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

along the Lurance Canyon drainage. Figure 2.2.1-1 shows the locations of the wells and spring discussed below.

The Burn Site Production Well (located approximately 600 feet east of SWMU 94C) was drilled in February 1986 to a total depth of 350 feet below ground surface (bgs). This well provided a nonpotable water source for fire suppression during burn tests. The driller's log describes encountering 74 feet of clay, silt, and shale units overlying fractured schist and granite. The water-bearing zone was encountered at a depth of 222 feet bgs. Following well completion, the water level reportedly rose to 68 feet bgs, indicating confined conditions at this location.

The Burn Site Spring is an ephemeral spring or seep located approximately 2,500 feet east-northeast of SWMU 94C. The seep discharges small quantities of water from fractures and/or bedding planes within the carbonate rocks.

As part of the SWMU 12A and SWMU 12B investigations, a shallow piezometer (12AUP01) was installed in November 1996 in the SWMU 12A arroyo approximately 100 feet west-northwest of SWMU 94C. This piezometer was installed in conformance with a document of understanding between SNL/NM and the NMED/DOE Oversight Bureau (Dawson August 1996). The piezometer monitored the alluvium/bedrock interface to determine if water was present during any time during the year, and, if so, could be used to monitor the water quality. At 12AUP01, about 55 feet of alluvium (poorly sorted sand and gravel in matrix of silt and clay) overlies Coyote Metasediments. The piezometer was completed to a depth of approximately 58 feet bgs. Moist soil was encountered in the first 5 feet of alluvium. The remaining 53 feet to bedrock were dry. No groundwater was encountered during drilling and no groundwater has ever been present in the piezometer.

In 1996, groundwater samples collected from the Burn Site Production Well by the NMED showed nitrate at concentrations above the U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCL) of 10 milligrams (mg)/liter (L). NMED and the ER Project entered into discussions regarding the source of the elevated nitrate and a study was initiated (SNL/NM July 1997, SNL/NM September 1997a). The Burn Site Production Well was resampled in October 1997 by SNL/NM ER and a report of the results was provided to NMED (SNL/NM December 1997). In 1997, a groundwater monitoring well (CYN-MW1D) and a shallow underflow piezometer (CYN-MW2S) were installed west of the Burn Site in the arroyo where the canyon narrows before opening up again. Thus, the wells were referred to as the "Narrows" wells by the NMED and SNL/NM ER. The geology at CYN-MW1D/MW2S was found to be significantly different than at the Burn Site Well, with about 25 feet of alluvial sediments overlying unfractured to moderately fractured Manzanita Gneiss.

Groundwater was first encountered in CYN-MW1D at a depth of 372 feet bgs and rose to 320 feet bgs. No water was encountered while drilling through the alluvium, and no water has been recorded in CYN-MW2S since its installation. Groundwater samples from CYN-MW1D showed the presence of nitrate concentrations slightly above the MCL and also trace levels of fuel-related volatile compounds. The highest concentrations were toluene at 77 micrograms (µg)/L and total petroleum hydrocarbons (TPH) (as diesel) at 0.5 mg/L. Subsequent sampling shows the volatile organic compound (VOC) and TPH values to be gradually decreasing with time. Nitrate levels have remained about the same over time.

As a continuation of the groundwater study, two additional monitoring wells, CYN-MW3 and CYN-MW4, were installed in June 1999. CYN-MW3 was installed in the assumed downgradient direction from SWMU 94F, the suspected primary source of hydrocarbon groundwater contamination. The monitoring well is located approximately 650 feet southwest of SWMU 94C near the arroyo draining Lurance Canyon. At CYN-MW3, about 35 feet of alluvial fill overlie fractured phyllite interbedded with quartzite units (Coyote Metasediments). Groundwater at CYN-MW3 was encountered at a depth of 124 feet bgs and rose to a static level of 104 feet bgs. Extensive fracturing was evident in the bedrock units at this location. The alluvium appeared to be dry, so a shallow piezometer was not installed. Groundwater samples from this well indicate nitrate concentrations above the MCL but show very low to nondetectable concentrations of petroleum hydrocarbons.

CYN-MW4 was installed as a background/upgradient monitoring well. The objective of this well was to establish background concentrations of nitrate in groundwater (SNL/NM September 1997a). It is located approximately 1,600 feet north-northeast of SWMU 94C. CYN-MW4 is located within the same drainage in which SWMU 12A and SWMU 12B are located and is surrounded by steep hillsides that are comprised of Paleozoic carbonates interbedded with shale, siltstone, sandstone, and pebble conglomerate units. At the well, the alluvium is 21 feet thick. Paleozoic limestone is present beneath the alluvium to a depth of about 85 feet bgs. Precambrian schist and quartzite units occur from 85 feet to the total depth of the borehole. These units are fractured but do not exhibit the same degree of fracturing that is found at CYN-MW3. CYN-MW4 was drilled to a depth of 318 feet bgs without evidence of saturated conditions. However, following an overnight standdown, the water level was measured at 218 feet bgs. The well was completed to a total depth of 290 feet bgs. Samples from this well show nitrate concentrations of less than 1 mg/L; trace levels of hydrocarbons have been detected during three quarters in FY00. It is currently unknown whether these constituents are a result of sampling contamination or are representative of the groundwater quality at this location. No SNL/NM operations are present upgradient of this well and the area is undeveloped.

The presence of nitrate and fuel-related compounds in groundwater (COCs at the Burn Site SWMUs) suggests that there is a mechanism for transporting these contaminants to the uppermost aquifer. Although the groundwater appears to be confined beneath the site, there must be recharge occurring at the Burn Site through an extensive fracture network. How contaminants are transported offsite, possibly even across fault zones, is not well understood.

For a detailed discussion regarding the local setting at SWMU 94G, refer to the RFI Work Plan for OU 1333 (SNL/NM September 1995). This discussion includes details on the history of the other subunits of SWMU 94.

2.2.2 Operational History

SWMU 94, identified as the LCBS in the HSWA Module, is located on USAF land withdrawn from the USFS and permitted to the DOE (SNL/NM July 1994). In order to facilitate site characterization, SWMU 94 has been subdivided into seven subunits where hazardous constituents could have been released (Figure 2.2.2-1): SWMU 94A (Aboveground Tanks), SWMU 94B (Debris/Soil Mound Area), SWMU 94C (Bomb Burner Area and Discharge Line), SWMU 94D (Bomb Burner Discharge Pit), SWMU 94E (Small Surface Impoundment), SWMU 94F (Light Airtransport Accident Resistant Container [LAARC] Discharge Pit), and SWMU 94G (Scrap Yard). All of these subunits are inactive except for SWMU 94G (Scrap Yard) and SWMU 94A, which contains both active and inactive tanks. This NFA addresses

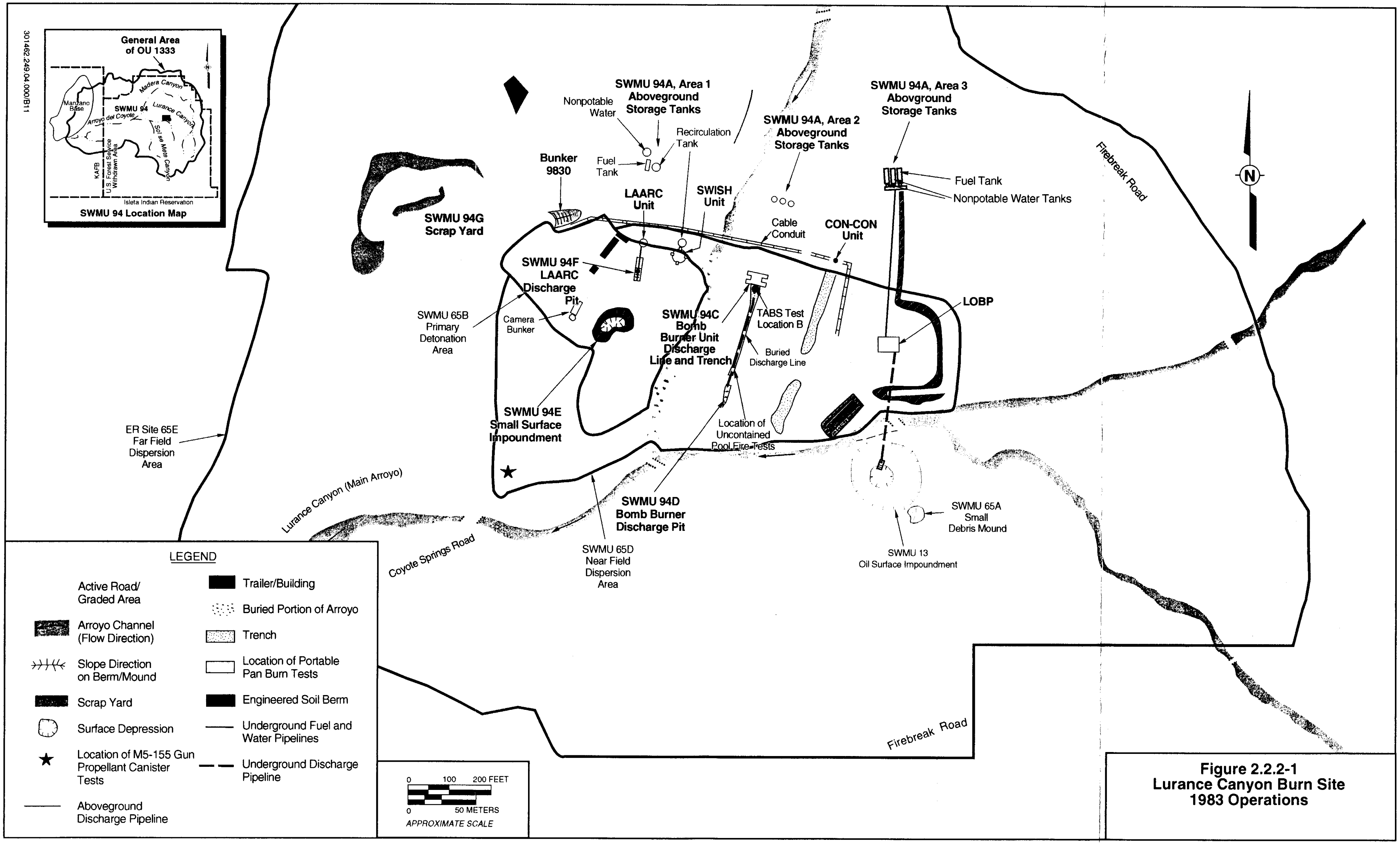

Figure 2.2.2-1
Lurance Canyon Burn Site
1983 Operations

historical releases from the Bomb Burner Discharge Line. Table 2.2.2-1 contains the rationale for subunit designation or omission. Each SWMU 94 subunit is addressed in a separate NFA proposal. The NFA proposal for SWMU 94A was submitted in September 1998 (SNL/NM September 1998), that for SWMU 94D was submitted in June 1999 (SNL/NM June 1999), and that for SWMU 94E was submitted in September 1999 (SNL/NM September 1999). SWMUs 94C and 94G are addressed in this NFA submittal.

Historical aerial photographs indicate that the transition of testing activities from predominantly open-detonation explosives testing and jet fuel composition 4 (JP-4) fuel fires in excavated pits (SWMU 65) to open burning of test units with JP-4 fuel fires in portable pans (SWMU 94) occurred between 1971 and 1982 (SNL/NM August 1994). Based upon test reports and interviews, open burning with JP-4 fuel fires in portable burn pans began around 1975. By 1980, the first permanent engineered burn unit (the LAARC) was constructed on the former location of the Primary Detonation Area (SWMU 65B) and was in operation (Annex 2-A). The scrap yard (SWMU 94G) was established in the northwestern portion of the site within the former location of the Far-Field Dispersion Area (SWMU 65E) (Larson and Palmieri October 1994). The scrap yard has historically been used to store spare materials used in explosives and burn tests and is still in use today for storing nonliquid materials and used equipment.

By 1983, most of SWMU 94 had been constructed, with a total of six permanent engineered burn units (the Large Open Burn Pool, the Small Open Burn Pool, the LAARC Unit, the Bomb Burner Unit, the Small Wind-Shielded [SWISH] Unit, and the Conical Container [CON-CON] Unit) placed on the graded area that was formerly the location of the Primary Detonation Area (SWMU 65B) and the Near-Field Dispersion Area (SWMU 65D) (SNL/NM August 1994) (Figure 2.2.2-1). One burn unit, the SWISH Unit, was constructed to provide testing facilities that would eliminate wind effects and provide accurate temperature control and instrumentation for test monitoring (Palmieri April 1995a). A small surface impoundment (SWMU 94E) is also visible southeast of Bunker 9830. Engineered soil berms had been constructed by 1983 in the southeastern portion of the site for flood protection from the main arroyo in Lurance Canyon.

By 1992, the site contained all the current permanent engineered burn units (Figure 2.2.2-2). The CON-CON Unit, identified in the 1983 historical aerial photograph, was dismantled prior to 1989, and by 1992 a new burn unit, the Smoke Emissions Reduction Facility (SMERF) Unit, had been constructed in the same location (SNL/NM August 1994). Prior to 1992, a debris/soil mound area (SWMU 94B) had been created in the southern portion of SWMU 94, directly north of the main arroyo in the Lurance Canyon (Figure 2.2.2-2). This debris/soil mound could have been associated with ongoing grading activities at the site. Northeast of the debris/soil mound area (SWMU 94B) is a second soil mound created during remediation of a wastewater spill from the SMERF on March 20, 1992.

Burn testing at the LCBS has always been conducted with JP-4 fuel pool fires in open portable pans or contained within the permanent engineered structures (Jercinovic et al. November 1994). Pool fires provide the closest simulation of accidents involving flammable liquids. For the tests, the pans are filled with approximately 1 to 2 feet of water, and an average 8-inch layer of JP-4 fuel is placed on the water. A test unit, such as a transportation container, is placed on a stand above the fuel. The fuel is ignited, and the fire typically burns until the JP-4 fuel is consumed. The length of the test is controlled by the volume (thickness) of the JP-4 fuel layer. After a burn test is completed, test units are retrieved and salvageable materials are collected and stored in the scrap yard located in the northwestern portion of the site (Figure 2.2.2-2). Any

Table 2.2.2-1
Correlation of Burn Testing Structures and Associated Features to SWMU 94 Subunits

Burn Unit/Structure	Designated Subunit for Site Characterization	Type/Nature of Operational Release	Rationale for Characterization
Portable Pans	None	Detonations (HE, gun propellant, radionuclides)	Nature of operational release covered in sampling plans for SWMUs 65B and 65D
	SWMU 94E	Wastewater	No operational historical releases in most tests; some documented releases to Small Surface Impoundment
Small Surface Impoundment	SWMU 94E	Wastewater (JP-4 fuel and water mixture)	Documented releases and burn test in the Small Surface Impoundment
LOBP (30 x 60 feet)	None	Wastewater (JP-4 fuel and water mixture)	Only operational historical releases to SWMU 13, no documented historical releases from accidental spills
SOBP (20 x 20 feet)	None	Wastewater (JP-4 fuel and water mixture)	No operational historical releases and no documented historical releases from accidental spills
LAARC Unit	None	Wastewater (JP-4 fuel and water mixture)	No documented historical releases within LAARC Unit from accidental spills
LAARC Discharge Pit	SWMU 94F	Wastewater (JP-4 fuel and water mixture)	Operational historical releases to discharge pit
Bomb Burner Unit and Trench	SWMU 94C	Detonations (HE, radionuclides, metals) and wastewater (JP-4 fuel and water mixture)	Documented operational historical releases inside and near the Bomb Burner Unit, removed in D&D activities in 1997
		Detonations (HE, radionuclides, metals)	Documented detonations in Bomb Burner Unit trench
Bomb Burner Discharger Pit	SWMU 94E	Wastewater (JP-4 fuel and water mixture)	Documented operational historical releases to discharge pit
SWISH Unit	None	None (wastewater recirculated, i.e., never disposed of)	No operational historical releases and no documented historical releases from accidental spills
SMERF	None	None (wastewater recirculated)	No operational historical releases

Refer to footnotes at end of table.

Table 2.2.2-1 (Concluded)
Correlation of Burn Testing Structures and Associated Features to SWMU 94 Subunits

Burn Unit/Structure	Designated Subunit for Site Characterization	Type/Nature of Operational Release	Rationale for Characterization
Bunker 9830	None	None	No operational historical releases outside structure; historical releases within structure covered in future D&D activities
Aboveground Tanks	SWMU 94A	Accidental spills of JP-4 fuel on soil	Documented historical releases from accidental spills
Debris/Soil Mounds	SWMU 94B	Metals or radionuclides	Mounds have no documented history and contain radiological anomalies
Scrap Yard	SWMU 94G	Accidental spills of hydraulic oils on soil	Documented release of hydraulic oil

D&D = Decommissioning and demolition.
HE = High explosive(s).
JP-4 = Jet fuel composition 4.
LAARC = Light Airtransport Accident Resistant Container.
LOBP = Large Open Burn Pool.
SMERF = Smoke Emission Reduction Facility.
SOBP = Small Open Burn Pool.
SWISH = Small Wind-Shielded.
SWMU = Solid Waste Management Unit.

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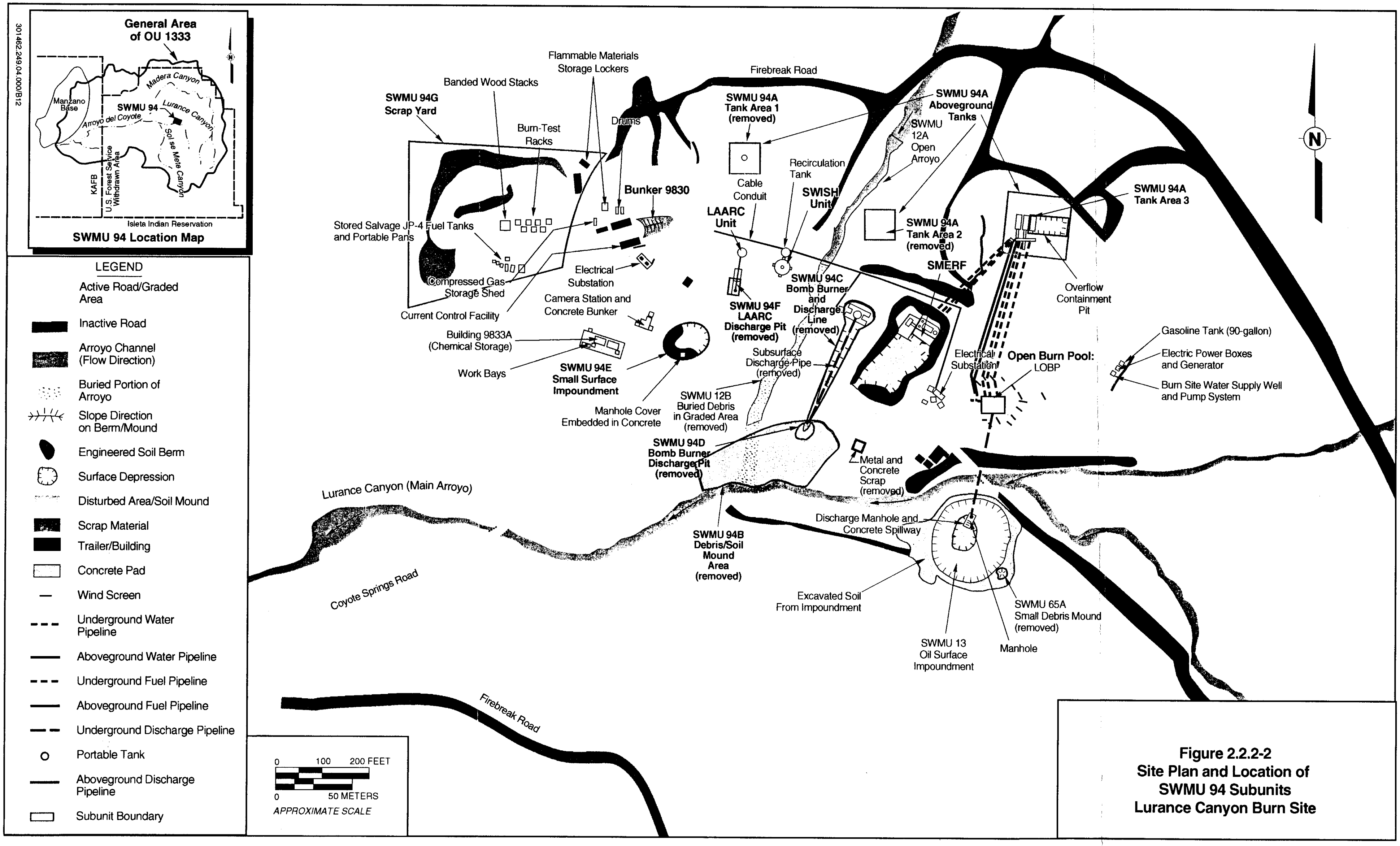

Figure 2.2.2-2
Site Plan and Location of
SWMU 94 Subunits
Lurance Canyon Burn Site

test object residue (e.g., metal slag) is recovered with the test unit and is removed from the site by the testing group. It is possible that small residue particulates were left in the water following the burn test (Larson and Palmieri October 1994). While no testing is currently conducted on components containing radioactive materials, SWMU 94 is classified as a Radioactive Material Management Area (RMMA) because of the presence of residual DU in the soil from earlier burn tests (Gaither December 1993) and from former explosives testing activities associated with SWMU 65 (Gaither January 1994). Annex 2-A presents tabulated data from SWMU 94 testing activities documented in test logs since 1979.

2.3 Land Use

This section discusses the current and future land uses of SWMU 94C.

2.3.1 Current Land Use

SWMU 94C is located on withdrawn lands within the boundaries of KAFB (refer to Figure 2.3.1-1) within the active LCBS.

2.3.2 Future/Proposed Land Use

The projected land use for SWMU 94C is recreational (DOE et al. October 1995).

2.4 Investigatory Activities

SWMU 94C has been investigated in a series of four investigations, summarized in the following subsections.

2.4.1 Summary

SWMU 94C was originally investigated (as part of SWMU 94) under the DOE Comprehensive Environmental Assessment and Response Program (CEARP) in the mid-1980s (Investigation #1) in conformance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). In 1993, preliminary investigations included background information reviews, interviews, field surveys, and scoping sampling (Investigation #2). In 1999, an RFI was conducted to determine if COCs exist at the site (Investigation #3). In 2000, a VCA was conducted to remediate confirmed contamination, followed by confirmatory sampling to verify the completion of the VCA (Investigation #4).

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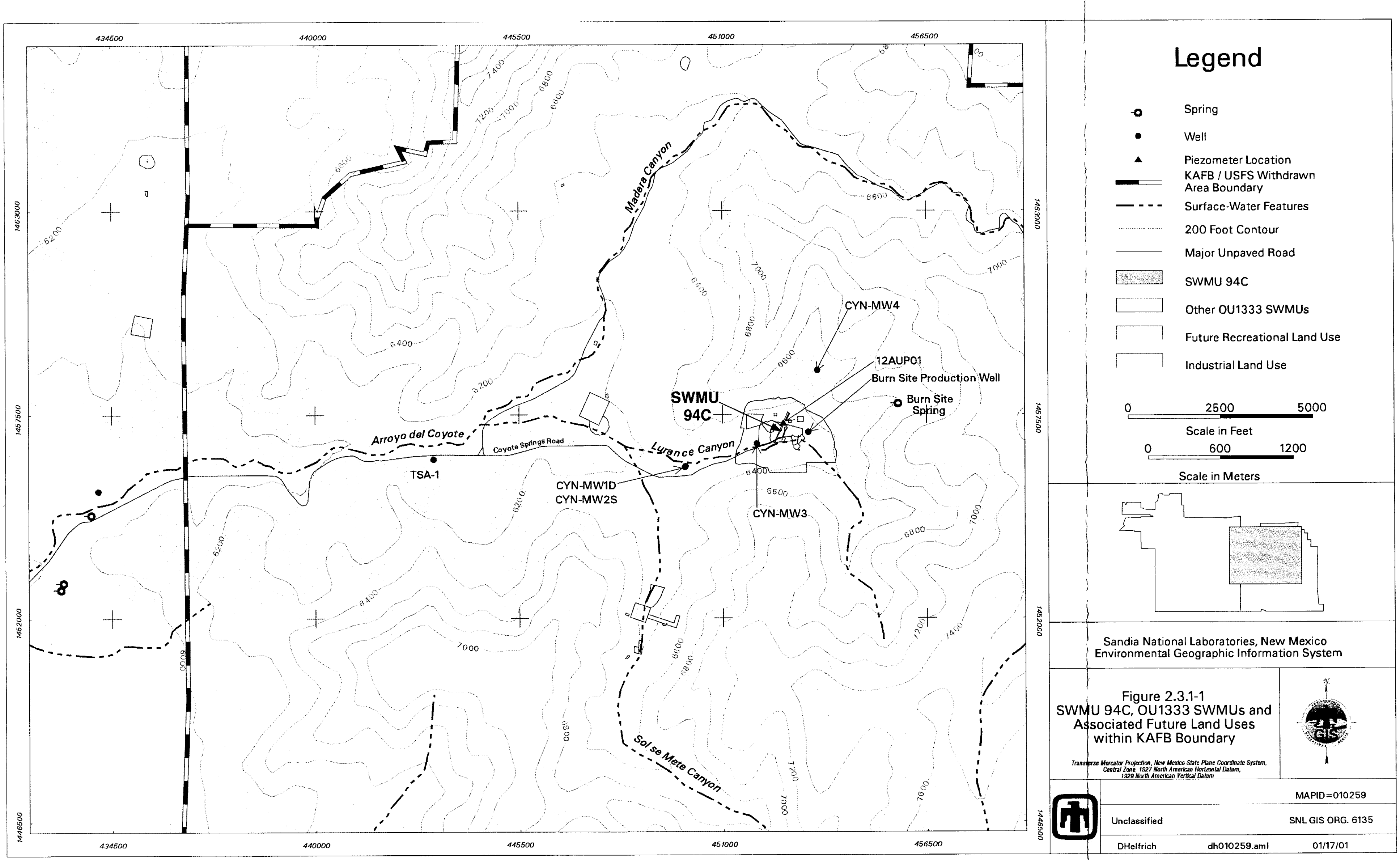

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Figure 2.3.1-1
SWMU 94C, OU1333 SWMUs and Associated Future Land Uses within KAFB Boundary

Transverse Mercator Projection, New Mexico State Plane Coordinate System, Central Zone, 1927 North American Horizontal Datum, 1929 North American Vertical Datum

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2.4.2 Investigation #1—CEARP

2.4.2.1 *Nonsampling Data Collection*

SWMU 94 was evaluated during investigations conducted under the CEARP (DOE September 1987, SNL/NM May 1986) and the RCRA Facility Assessment (RFA) (EPA April 1987). The CEARP Phase I report noted that SWMU 94 was constructed in the late 1970s and is currently used for studying the effects of fire on a variety of test units (e.g., weapons components and transportation containers). JP-4 is the standard fuel burned, but some other materials used include propellants and nitromethane. Current testing activities may release metallic particulates and other materials to the environment.

The RFA report (EPA April 1987) only noted that scrap metal, old equipment, empty drums, and empty tanks used in impact experiments are contained in a 3- to 5-acre area (SWMU 94G; Scrap Yard). The storage of liquids was not noted during the visual site inspection. Conclusions from the report noted that the potential for releases to air, soil, surface water, and groundwater is low due to the types of materials stored.

2.4.2.2 *Sampling Data Collection*

No sampling activities were conducted at SWMU 94C as part of the CEARP or RFA.

2.4.2.3 *Data Gaps*

Insufficient information was available to calculate Hazard Ranking System (HRS) and Modified HRS migration mode scores.

2.4.2.4 *Results and Conclusions*

The CERCLA finding was uncertain for RCRA-regulated hazardous waste.

2.4.3 Investigation #2—SNL/NM ER Preliminary Investigations

2.4.3.1 *SNL/NM ER Nonsampling Data Collection*

This section describes the nonsampling data collected at SWMU 94C.

2.4.3.1.1 *Background Review*

A background review was conducted to collect available and relevant information regarding SWMU 94C. Background information sources included interviews with SNL/NM staff and contractors familiar with the site's operational history and reviews of existing historical site records and reports. The study was documented completely and has provided traceable references that sustain the integrity of the NFA proposal. Table 2.4.3-1 lists the information sources used to assist in evaluating SWMU 94C.

Table 2.4.3-1
Summary of Background Information Review for SWMU 94C

Information Source	Reference	
Technical test reports and project log books	Hill [Date unk.] Kervin April 1981 Moore September 1981 Moore June 1982 Gill November 1982 Moore and Luna February 1983 Luna March 1983	Hooper May 1983 Luna and Moore June 1983 Mata December 1983 Cocke May 1984 Stevenson December 1985 SNL/NM November 1994a
Engineering drawings "Burn Site" (Drawing Number T95597)	SNL/NM 1983	
Site inspections (field notes, aerial photograph review, site photographs, radiological, UXO/HE, biological, and cultural resource surveys)	Gaither [Date unk.] Luna October 1985 Gaither October 1992 Oldewage May 1993 Karas June 1983	Oldewage December 1993a Oldewage December 1993b Oldewage February 1994 SNL/NM August 1994 Young September 1994
Employee interviews, 24 interviews with 11 facility personnel (current and retired)	Martz September 1985 Martz November 1985 Brouillard June 1994 Larson and Palmieri August 1994 Palmieri September 1994a Palmieri September 1994b Palmieri and Larson October 1994 Jercinovic et al. November 1994 Palmieri November 1994a Palmieri November 1994b	Hickox and Abitz December 1994 Palmieri December 1994a Palmieri December 1994b Palmieri December 1994c Palmieri January 1995 Palmieri March 1995 Jercinovic April 1995 Palmieri April 1995a Palmieri April 1995b Palmieri August 1995

HE = High explosive(s).
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.
UXO = Unexploded ordnance.

2.4.3.1.2 Unexploded Ordnance/High Explosives Survey

In October 1993, KAFB Explosive Ordnance Disposal personnel conducted a visual survey for the presence of unexploded ordnance/HE on the ground surface at SWMU 94 in conjunction with SWMUs 65, 12, and 13. The survey identified one trip flare as live ordnance and one slap flare and one rifle-propelled illuminator round as ordnance debris. The survey report also documented that metal fragments were found in the hills surrounding these sites (Young September 1994).

2.4.3.1.3 Radiological Survey(s)

SWMU 94 is classified as an RMMA because it is colocated with the SWMU 65 RMMA (SNL/NM November 1994b), the presence of residual DU in the soil from earlier burn tests (Gaither December 1993), and from former explosives testing activities associated with SWMU 65 (Gaither January 1994). On April 30 and May 4, 1993, SNL/NM Radiation Protection Office personnel conducted contamination surveys of several sections of road in the Coyote Canyon area. Adhesive swipes on the underside of the vehicle collected samples of dust from the air behind the vehicle as it was moving. Analysis yielded no contamination, nor was airborne radioactivity detected in the dust kicked up by the vehicle (Oldewage May 1993).

During November and December 1993 and January 1994, RUST Geotech Inc. conducted a surface gamma radiation survey of SWMU 94 in conjunction with SWMUs 65, 12, and 13 (RUST Geotech Inc. December 1994). The gamma scan survey was performed at 6-foot centers (100-percent coverage) over the surface of the graded portion of the site (SWMU 65D), which included the area of SWMU 94C. Three point source gamma radiation anomalies were detected within the boundaries of SWMU 94C (SNL/NM September 1997b). Based upon this survey, voluntary corrective action activities were conducted during May, June, and October 1996. A total of 69 point sources and 12 area sources were removed from the surrounding area during the VCA. After completion of the VCA, 21 verification samples were collected throughout the graded portion of the Burn Site. However, none were collected in the area of SWMU 94C. Subsequent risk assessments using the maximum values from the verification samples indicated the area did not pose a significant risk to human health or the environment.

2.4.3.1.4 Cultural Resources Survey

A cultural resources survey of SWMU 94 was conducted as part of the assessment of the LCBS. Seven cultural resources sites were identified within the boundary of SWMU 65 at the LCBS (Hoagland and Dello-Russo February 1995). However, none of the cultural resource sites are within 100 feet of the SWMU 94C boundaries, and SWMU 94C sampling activities have not affected the cultural resources.

2.4.3.1.5 Sensitive-Species Survey

A sensitive-species survey was conducted as part of a biological assessment of the LCBS (Biggs May 1991). No sensitive species were found during this survey (IT February 1995). The site is active and no undisturbed habitat remains in the graded portion of the LCBS.

2.4.3.2 Sampling Data Collection

In July 1995, SWMU 94C was investigated as part of a sitewide scoping sampling program. This effort obtained preliminary analytical data to support the ER Project site ranking and prioritization. Two sampling locations were selected within the boundaries of SWMU 94C. Surface (0 to 6 inches) and shallow subsurface (6 to 12 inches) samples were collected at the two locations. The SNL/NM ER Chemistry Laboratory analyzed the four environmental samples for RCRA metals (plus beryllium) using modified EPA Method 6010 (EPA November 1986), and for HE using high-performance liquid chromatography. In addition, the Radiation Protection Sample Diagnostics (RPSD) Laboratory analyzed the samples for gamma-emitting radionuclides using gamma spectroscopy.

2.4.3.3 Results

Of the RCRA-regulated metals (plus beryllium), only barium and lead were detected in the soil samples. None of the four barium concentrations were above the background concentration limit of 246 mg/kilogram (kg). Lead was detected in all four of the samples at estimated concentrations, and two of the four detections (19 mg/kg and 20 mg/kg) slightly exceeded the background concentration limit of 18.9 mg/kg. Arsenic, cadmium, mercury, selenium, and silver were not detected (the method detection limits [MDLs] ranged from 0.2 to 50 mg/kg for mercury and for arsenic and selenium, respectively). One HE compound, HMX, was detected in the two shallow subsurface samples at concentrations of 2 mg/kg and 5 mg/kg. The HE MDLs ranged from 0.150 to 0.750 mg/kg.

Uranium-235 was not detected in any sample above the minimum detectable activity (MDA). However, the MDA for all uranium-235 analyses exceeded the background activity limit of 0.16 picocuries (pCi)/gram (g). Uranium-238 was also not detected above its MDA; however the MDA slightly exceeded the background activity limit of 2.31 pCi/g. Thorium-232 was detected in all four samples but all activities were below the background activity limit of 1.03 pCi/g. Cesium-137 was not detected in any of the samples.

2.4.3.4 Data Gaps

Information gathered from process knowledge, reviewing historical site files, and personal interviews aided in identifying the most likely COCs at SWMU 94C and in selecting the types of analyses to be performed on soil samples. However, the preliminary scoping sampling data are not adequate to support a risk screening assessment.

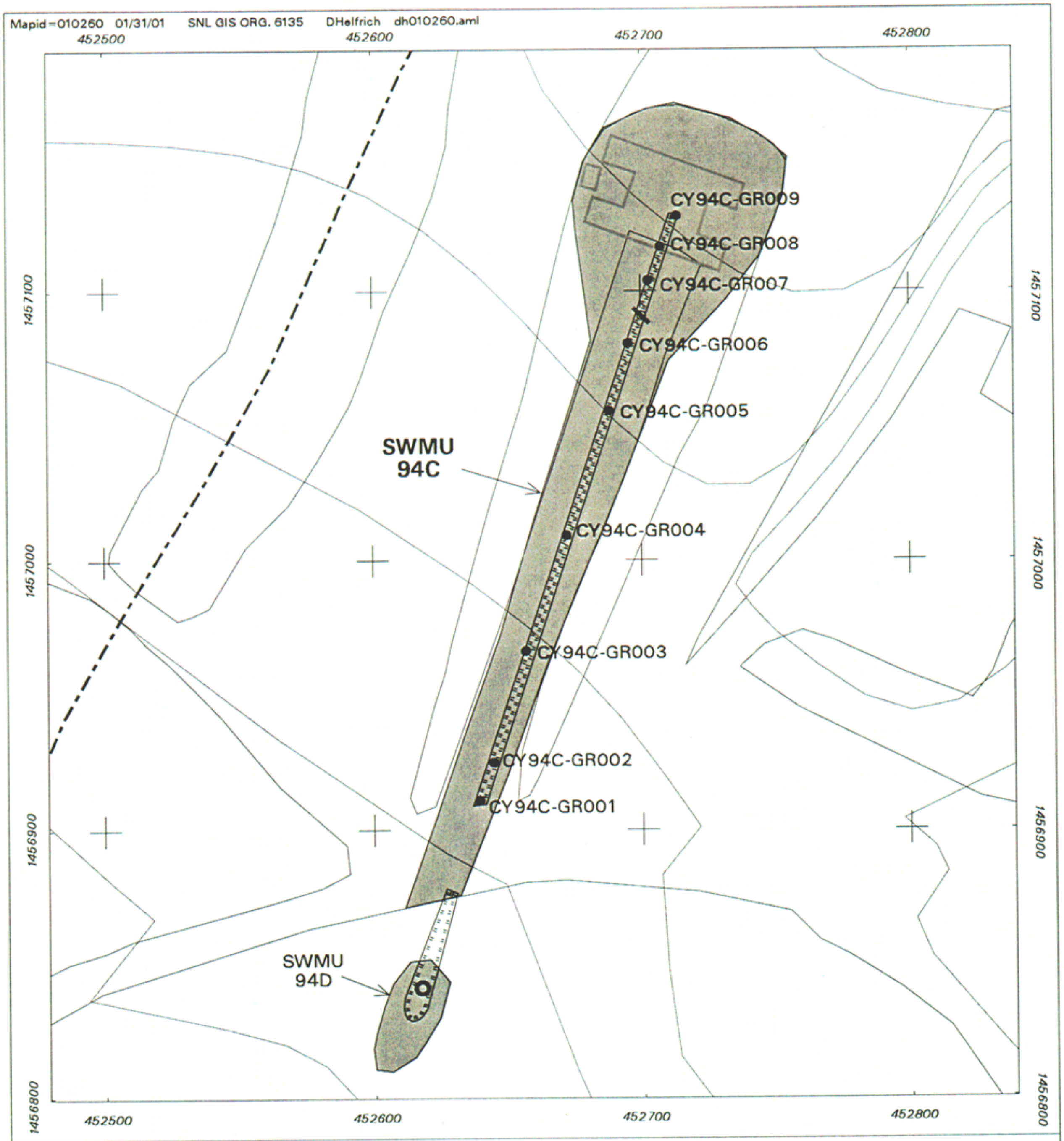
2.4.4 Investigation #3—RFI Sampling

2.4.4.1 Nonsampling Data Collection

There were no nonsampling data collection activities associated with Investigation #3 of SWMU 94C.

2.4.4.2 Sample Data Collection

During the D&D of the Bomb Burner Unit in 1997, it was determined that the north end of the discharge line had radiological contamination (SNL/NM September 1997c). Confirmatory sampling was conducted after the D&D of the Bomb Burner Unit; the resulting data were transmitted under separate cover to NMED (DOE September 1999) and are not discussed in this NFA. SNL/NM conducted an RFI at SWMU 94C beginning in August 1999. The RFI at SWMU 94C was developed as a phased approach to determine the extent of contamination in the discharge line, the extent of any potential soil contamination adjacent to the discharge line, and the appropriate scope of the VCA to remediate the site. All sampling activities were performed in accordance with the rationale and procedures described in the RFI Work Plan for OU 1333 (SNL/NM September 1995), the response to the Request for Supplemental Information (RSI) on the OU 1333 Work Plan (SNL/NM October 1997), and the Field Implementation Plan (FIP) (SNL/NM August 1999). Based upon the RSI, VOCs, semivolatile organic compounds (SVOCs), gross alpha, gross beta, and gamma spectroscopy were added to the analyte list. In addition, the RSI requested the removal of the discharge line and the collection of samples beneath it. SNL/NM chain-of-custody and sample documentation procedures were followed for all samples that were collected (SNL/NM June 1995). Figure 2.4.4-1 shows the RFI sample locations associated with SWMU 94C.



Legend

- ● Grab Sample Location
- ○ Discharge Drum
- Cut-off Valve
- Road
- 5 Foot Contour
- Surface Drainage
- Former Bomb Burner Unit
- Trench
- ▨ SWMUs 94C & 94D

Figure 2.4.4-1
RFI Sampling Locations at SWMU 94C Bomb Burner Area and Discharge Line

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Beginning in late August 1999, the entire discharge line was exposed by using an excavator to remove approximately 3 feet of overburden. Exposing the line allowed evaluation of the integrity of the line and provided access to the line so that the interior could be surveyed to determine if it was radiologically contaminated. At the time of excavation, the northern 40 feet of the line contained water. At 40 feet there was a cut-off valve which sealed the line from this point south. The water was pumped out, containerized, and sampled for VOCs, TPH, metals, HE, and radiological constituents. The results of the analyses indicated that the water had no hazardous or radiological characteristics and approval was received to discharge the water to the sanitary sewer system. Details of this activity are presented in SNL/NM ER Waste Management Memorandum 99-083 (SNL/NM November 1999).

Once exposed, the interior of the line was evaluated for radiological contamination by using a hammer and punch to create holes in the top of the line and surveying the interior with a pancake probe. Based upon this evaluation, it was determined that the interior of the line had fixed radiological contamination on the bottom along its entire length and required removal and disposal as low level radioactive waste. The line was in good condition and there was no evidence of leakage at the joints.

During the removal of the line, a seam of DU was discovered on the west bank of the excavation. The seam was approximately 2 feet below the surface, 2 inches in thickness, and approximately 34 feet in length. It was hypothesized that the area represented a historic above-ground burn test site that had been subsequently buried during earth moving activities.

In September 1999, subsurface (0 to 1.0 foot below the base of the trench, approximately 3 feet below the surrounding land surface) soil samples were collected at SWMU 94C from nine locations along the base of the trench created from the removal of the discharge line. The trench was approximately 3 feet below the surrounding ground surface and was approximately 4 feet wide. The samples were collected at former joint locations and both ends of the line (Figure 2.4.4-1). Quality assurance (QA)/quality control (QC) samples collected included one duplicate sample and one equipment blank (EB).

All soil samples collected in September 1999 were analyzed off site for VOCs, SVOCs, metals, HE, gross alpha and gross beta activity, and gamma spectroscopy. General Engineering Laboratories of Charleston, South Carolina, analyzed the samples for VOCs using EPA Method 8260, SVOCs using EPA Method 8270, RCRA metals plus beryllium using EPA Method 6010/7000, HE using EPA Method 8330, gross alpha and gross beta using EPA Method 900.0, and gamma spectroscopy using EPA Method 901.1 (EPA November 1986). In addition, SNL/NM Department 7132 RPSD Laboratory also used gamma spectroscopy to analyze the samples for radionuclides prior to shipment to General Engineering Laboratory.

2.4.4.2.1 Data Gaps

Analytical data from RFI sampling were sufficient to determine the nature and extent of possible contamination beneath the discharge line. However, the unexpected discovery of the DU seam on the west bank of the trench was beyond the scope of the RFI. Therefore, the extent of contamination due to the DU seam was not determined during the RFI at SWMU 94C and a VCA was planned.

2.4.4.2.2 *Results and Conclusions*

In September 1999, soil samples were collected from nine locations along the base of the trench created by removing the discharge line at SWMU 94C. The samples were collected in conformance with the RFI Work Plan (SNL/NM September 1995) as reviewed by NMED, the SNL/NM response to the RSI on the OU 1333 Work Plan (SNL/NM October 1997), and the FIP (SNL/NM August 1999).

Tables 2.4.4-1 through 2.4.4-6 summarize the RFI soil sampling analyses. Tables 2.4.4-1, 2.4.4-5, and 2.4.4-6 summarize the metals and radionuclide (i.e., gamma spectroscopy, gross alpha, and gross beta) analytical results for all of the RFI soil samples collected at SWMU 94C. Annex 2-B contains the MDAs for the gamma spectroscopy analyses used during the RFI. Tables 2.4.4-2, 2.4.4-3, and 2.4.4-4 summarize the analytical MDLs for the target analyte list for VOCs, SVOCs, and HE compounds, respectively.

Sample numbers are coded to identify specific information regarding the samples. For example, for CY94C-GR-001-S, CY94C designates a sample collected from SWMU 94C in the Canyons Test Area of SNL/NM. *GR* indicates that a grab sample was collected from Location 001, and *S* designates a subsurface soil sample, in this case from the base of the trench, which is approximately 3 feet bgs. The remainder of this section describes the results of RFI sampling at SWMU 94C.

<u>Metals</u>

Table 2.4.4-1 summarizes the metals analysis results for the nine RFI soil samples and one duplicate sample collected from SWMU 94C.

No metals were detected above the background concentration limits in the soil samples collected at SWMU 94C during the RFI.

<u>VOCs</u>

Because there are no background concentrations for VOCs in soil, any detectable VOCs in the samples collected at SWMU 94C may be considered an indication of contamination. However, no VOCs were detected in any of the soil samples collected at SWMU 94C during the RFI.

Table 2.4.4-2 summarizes the MDLs used for analyzing VOCs by the off-site laboratory.

<u>SVOCs</u>

Because there are no background concentrations for SVOCs in soil, any detectable SVOCs in the samples collected at SWMU 94C may be considered an indication of contamination. However, no SVOCs were detected in any of the soil samples collected at SWMU 94C during the RFI.

Table 2.4.4-3 summarizes the MDLs used for analyzing SVOCs by the off-site laboratory.

Table 2.4.4-1
Summary of SWMU 94C RFI Soil Sampling Metals Analytical Results
September 1999
(Off-Site Laboratory)

Sample Attributes			Metals (EPA Method 6010/7000)[a] (mg/kg)								
Record Number[b]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
602819	CY94C-GR-001-S	0.0–1.0	3.4	205	0.673	ND (0.0369)	11.3	7.23	ND (0.00219)	ND (0.262)	0.281 J (0.485)
602819	CY94C-GR-002-S	0.0–1.0	3.54	156	0.564	ND (0.0349)	10.4	7.48	ND (0.00201)	ND (0.248)	0.302 J (0.459)
602819	CY94C-GR-003-S	0.0–1.0	1.96 J	112	0.208 J (0.467)	ND (0.0355)	3.52	3	ND (0.00217)	ND (0.252)	0.238 J (0.467)
602819	CY94C-GR-004-S	0.0–1.0	2.56	112	0.281 J (0.459)	ND (0.0349)	3.1	3.3	ND (0.00205)	ND (0.248)	0.196 J (0.459)
602819	CY94C-GR-005-S	0.0–1.0	1.62 J	107	0.182 J (0.463)	ND (0.0352)	3.02	2.85	ND (0.00212)	ND (0.25)	0.164 J (0.463)
602819	CY94C-GR-006-S	0.0–1.0	4.15	114	0.53	ND (0.0352)	5.26	7.21	0.0151 J (0.0327)	ND (0.25)	0.2 J (0.463)
602819	CY94C-GR-007-S	0.0–1.0	1.48 J	122	0.24 J (0.481)	ND (0.0365)	3.68	3.72	ND (0.00224)	ND (0.26)	0.252 J (0.481)
602819	CY94C-GR-008-S	0.0–1.0	2.55	95.2	0.295 J (0.495)	ND (0.0376)	5.53	5.07	0.0217 J (0.0291)	ND (0.267)	0.223 J (0.495)
602819	CY94C-GR-009-DU	0.0-1.0	3.69	104	0.392 J (0.481)	ND (0.0365)	10.6	6.38	0.00986 J (0.0331)	ND (0.26)	0.213 J (0.481)
602819	CY94C-GR-009-S	0.0–1.0	3.03	104	0.382 J (0.476)	ND (0.0362)	8.71	7.64	0.0303	ND (0.257)	0.213 J (0.476)
Background Soil Concentrations—Canyons Area[c]			9.8	246	0.75	0.64	18.8	18.9	0.055	3.0	<0.5
Quality Assurance/Quality Control Sample (mg/L)											
602819	CY94C-GR-001-EB	NA	ND (0.00451)	0.00372 J (0.005)	ND (0.00026)	0.00049 J (0.005)	ND (0.00056)	ND (0.00159)	ND (0.00004)	ND (0.00271)	ND (0.00073)

[a] EPA November 1986.

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

[c] From Garcia November 1998.

CY = Canyon.
DU = Duplicate.
EB = Equipment blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
J = The reported value is estimated based upon Data Validation.
J ( ) = The reported value is greater than or equal to the method detection limit but is less than the practical quantitation limit, shown in parentheses.
mg/kg = Milligram(s) per kilogram.
mg/L = Milligram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the method detection limit, shown in parentheses.
RCRA = Resource Conservation and Recovery Act.
RFI = RCRA Facility Investigation.
S = Subsurface soil sample.
SWMU = Solid Waste Management Unit.

Table 2.4.4-2
VOC Analytical Method Detection Limits Used for SWMU 94C RFI Soil Sampling
September 1999
(Off-Site Laboratory)

Analyte	Method Detection Limit (µg/kg)
1,1,1-Trichloroethane	0.1
1,1,2,2-Tetrachloroethane	0.6
1,1,2-Trichloroethane	0.3
1,1-Dichloroethane	0.1
1,1-Dichloroethene	0.3
1,2-Dichloroethane	0.2
1,2-Dichloropropane	0.2
2-Butanone	3.2
2-Hexanone	2.8
4-methyl-, 2-Pentanone	3.1
Acetone	10.3
Benzene	0.5
Bromodichloromethane	0.1
Bromoform	0.3
Bromomethane	0.3
Carbon disulfide	0.3
Carbon tetrachloride	0.5
Chlorobenzene	0.3
Chloroethane	0.3
Chloroform	0.1
Chloromethane	0.2
Dibromochloromethane	0.2
Ethyl benzene	0.3
Methylene chloride	1.4
Styrene	0.3
Tetrachloroethene	0.4
Toluene	0.9
Trichloroethene	0.3
Vinyl acetate	2.1
Vinyl chloride	0.4
Xylene	0.7
cis-1,2-Dichloroethene	0.1
cis-1,3-Dichloropropene	0.2
trans-1,2-Dichloroethene	0.1
trans-1,3-Dichloropropene	0.3

µg/kg = Microgram(s) per kilogram.
RCRA = Resource Conservation and Recovery Act.
RFI = RCRA Facility Investigation.
SWMU = Solid Waste Management Unit.
VOC = Volatile organic compound.

Table 2.4.4-3
SVOC Analytical Method Detection Limits Used for SWMU 94C RFI Soil Sampling September 1999 (Off-Site Laboratory)

Analyte	Method Detection Limit (µg/kg)
1,2,4-Trichlorobenzene	187
1,2-Dichlorobenzene	170
1,3-Dichlorobenzene	130
1,4-Dichlorobenzene	61
1,2-Diphenylhydrazine	56.7
2,4,5-Trichlorophenol	153
2,4,6-Trichlorophenol	76.7
2,4-Dichlorophenol	177
2,4-Dimethylphenol	110
2,4-Dinitrophenol	367
2,4-Dinitrotoluene	117
2,6-Dinitrotoluene	140
2-Chloronaphthalene	173
2-Chlorophenol	157
2-Methylnaphthalene	203
2-Nitroaniline	66.7
2-Nitrophenol	180
3,3'-Dichlorobenzidine	277
3-Nitroaniline	83.3
4-Bromophenyl phenyl ether	117
4-Chloro-3-methylphenol	127
4-Chlorobenzenamine	153
4-Chlorophenyl phenyl ether	147
4-Nitroaniline	103
4-Nitrophenol	110
Acenaphthene	160
Acenaphthylene	147
Anthracene	86.7
Benzo(a)anthracene	66.7
Benzo(a)pyrene	73.3
Benzo(b)fluoranthene	143
Benzo(ghi)perylene	80
Benzo(k)fluoranthene	133
Butylbenzylphthalate	90
Carbazole	153
Chrysene	53.3
Di-n-butylphthalate	73.3
Di-n-octylphthalate	173
Dibenz(a,h)anthracene	83.3
Dibenzofuran	133

Refer to footnotes at end of table.

Table 2.4.4-3 (Concluded)
SVOC Analytical Method Detection Limits
Used for SWMU 94C RFI Soil Sampling
September 1999
(Off-Site Laboratory)

Analyte	Method Detection Limit (µg/kg)
Diethylphthalate	76.7
Dimethylphthalate	110
Dinitro-o-cresol	100
Fluoranthene	66.7
Fluorene	113
Hexachlorobenzene	70
Hexachlorobutadiene	153
Hexachlorocyclopentadiene	193
Hexachloroethane	133
Indeno(1,2,3-c,d)pyrene	80
Isophorone	147
Naphthalene	157
Nitrobenzene	133
Pentachlorophenol	56.7
Phenanthrene	60
Phenol	56.7
Pyrene	73.3
Bis(2-chloroethoxy)methane	170
Bis(2-chloroethyl)ether	53.3
Bis(2-ethylhexyl)phthalate	300
Bis-chloroisopropyl ether	103
m,p-Cresol	153
n-Nitrosodiphenylamine	20.7
n-Nitrosodipropylamine	130
o-Cresol	63.3

µg/kg = Microgram(s) per kilogram.
RCRA = Resource Conservation and Recovery Act.
RFI = RCRA Facility Investigation.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.

Table 2.4.4-4
HE Analytical Method Detection Limits Used for SWMU 94C RFI Soil Sampling September 1999 (Off-Site Laboratory)

Analyte	Method Detection Limit (µg/kg)
1,3,5-Trinitrobenzene	6.6
1,3-Dinitrobenzene	4.1
2,4,6-Trinitrotoluene	5.7
2,4-Dinitrotoluene	6.2
2,6-Dinitrotoluene	6.5
2-Amino-4,6-Dinitrotoluene	6.6
2-Nitrotoluene	7.8
3-Nitrotoluene	11
4-Amino-2,6-Dinitrotoluene	5.5
4-Nitrotoluene	11
HMX	5.3
Nitrobenzene	5.2
RDX	9.7
TETRYL	7.5

HE = High explosive(s).
HMX = 1,3,5,7-tetranitro-1,3,5,7-tetrazacyclooctane.
µg/kg = Microgram(s) per kilogram.
RCRA = Resource Conservation and Recovery Act.
RDX = 1,3,5-Trinitro-1,3,5-triazacyclohexane.
RFI = RCRA Facility Investigation.
SWMU = Solid Waste Management Unit.
TETRYL = 2,4,6-Trinitrophenylmethylnitramine.

Table 2.4.4-5
Summary of SWMU 94C RFI Soil Sampling Gamma Spectroscopy Analytical Results
September 1999
(Off-Site Laboratory)

Sample Attributes			Activity (pCi/g)							
Record Number[a]	ER Sample ID	Sample Depth (ft)	Cesium-137		Thorium-232		Uranium-235		Uranium-238	
			Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
602819	CY94C-GR-001-S	0.0–1.0	ND (0.0147)	--	1	0.133	0.158	0.147	0.74	1.23
602819	CY94C-GR-002-S	0.0–1.0	ND (0.0163)	--	**1.09**	0.145	ND (0.0891)	--	1.88	1.44
602819	CY94C-GR-003-S	0.0–1.0	ND (0.0104)	--	0.797	0.108	ND (0.0584)	--	1.42	2.02
602819	CY94C-GR-004-S	0.0–1.0	0.0111	0.0172	0.703	0.0932	ND (0.0536)	--	0.96	1.23
602819	CY94C-GR-005-S	0.0–1.0	ND (0.00951)	--	0.585	0.0801	0.0713	0.0901	0.945	0.978
602819	CY94C-GR-006-S	0.0–1.0	ND (0.011)	--	0.806	0.105	ND (0.0601)	--	1.48	1.41
602819	CY94C-GR-007-S	0.0–1.0	ND (0.0103)	--	0.663	0.0904	0.104	0.133	0.712	1.31
602819	CY94C-GR-008-S	0.0–1.0	ND (0.0133)	--	0.817	0.116	ND (0.0727)	--	**3.36**	1.97
602819	CY94C-GR-009-DU	0.0–1.0	ND (0.0168)	--	0.825	0.127	0.128	0.249	**4.58**	1.06
602819	CY94C-GR-009-S	0.0–1.0	ND (0.0143)	--	0.861	0.131	**0.175**	0.207	**5.97**	1.43
Background Soil Activities—Upper Canyons Area[c]			0.515	NA	1.03	NA	0.16	NA	2.31	NA

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

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

[b] Two standard deviations about the mean detected activity.

[c] From Dinwiddie September 1997.

CY = Canyon.
DU = Duplicate sample.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected above the minimum detectable activity, shown in parentheses.
pCi/g = Picocurie(s) per gram.
RCRA = Resource Conservation and Recovery Act.
RFI = RCRA Facility Investigation.
S = Subsurface soil sample.
SWMU = Solid Waste Management Unit.
-- = Error not calculated for nondetectable results.

Table 2.4.4-6
Summary of SWMU 94C RFI Soil Sampling Gross Alpha and Beta Analytical Results
September 1999
(Off-Site Laboratory)

Sample Attributes			Activity (pCi/g)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Gross Alpha		Gross Beta	
			Result	Error[b]	Result	Error[b]
602819	CY94C-GR-001-S	0.0–1.0	11.9	3.88	18.3	3.7
602819	CY94C-GR-002-S	0.0–1.0	14.9	4.34	23.8	3.95
602819	CY94C-GR-003-S	0.0–1.0	13.4	3.84	20.7	3.56
602819	CY94C-GR-004-S	0.0–1.0	14.3	4.1	28.3	4.02
602819	CY94C-GR-005-S	0.0–1.0	10.2	3.56	19.7	3.58
602819	CY94C-GR-006-S	0.0–1.0	11	3.65	27.8	4.06
602819	CY94C-GR-007-S	0.0–1.0	5.54	2.57	18.7	3.39
602819	CY94C-GR-008-S	0.0–1.0	16.2	4.27	29.5	4.37
602819	CY94C-GR-009-DU	0.0–1.0	**20.4**	5.08	24.6	4.07
602819	CY94C-GR-009-S	0.0–1.0	13.8	4.33	24.3	4.43
Background Soil Activities—Canyons Area[c]			18.3	NA	52.7	NA

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

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

[b] Two standard deviations about the mean detected activity.

[c] From Tharp July 1998.

CY = Canyon.
DU = Duplicate sample.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.
RCRA = Resource Conservation and Recovery Act.
RFI = RCRA Facility Investigation.
S = Subsurface soil sample.
SWMU = Solid Waste Management Unit.

HE

Because there are no background concentrations for HE in soil, any detectable HE in the samples collected at SWMU 94C may be considered an indication of contamination. However, no HE compounds were detected in any of the soil samples collected at SWMU 94C during the RFI.

Table 2.4.4-4 summarizes the MDLs used for analyzing HE compounds by the off-site laboratory.

Radionuclides

Table 2.4.4-5 summarizes the off-site gamma spectroscopy analysis results for the nine soil samples and one duplicate sample collected at SWMU 94C during the RFI. Gamma activity attributable to uranium-235 was slightly above the 0.16 pCi/g background activity in one sample, CY94C-GR-009-S, at an activity of 0.175 pCi/g. Uranium-235 was not above background in the duplicate sample. Gamma activity attributable to cesium-137 was not detected above the MDA and/or background activity in any of the samples. Gamma activity attributable to thorium-232 was slightly above the 1.03 pCi/g background activity in one sample, CY94C-GR-002-S, at an activity of 1.09 pCi/g. Gamma activity attributable to uranium-238 was above the 2.31 pCi/g background activity in three samples, CY94C-GR-008-S, CY94C-GR-009-S, and CY94G-GR-009-DU, at activities of 3.36, 5.97, and 4.58 pCi/g, respectively. Refer to Annex 2-B for a listing of the MDAs used for the gamma spectroscopy analyses during the RFI.

Gross Alpha and Gross Beta

Table 2.4.4-6 summarizes the off-site gross alpha and gross beta analyses results for the nine soil samples and one duplicate sample collected at SWMU 94C during the RFI. Gross alpha was slightly above the 18.3 pCi/g background activity in one sample, CY94C-GR-009-DU, at an activity of 20.4 pCi/g. Gross alpha was not above background in the primary sample, CY94C-GR-009-S. Gross beta was not detected above the background activity in any of the soil samples collected at SWMU 94C during the RFI.

2.4.5 Investigation #4—SNL/NM ER VCA and Confirmatory Sampling

2.4.5.1 Nonsampling Data Collection

There were no nonsampling data collection activities associated with Investigation #4 of SWMU 94C.

2.4.5.2 VCA Activities

The purpose of the SWMU 94C VCA was to remove all contaminated material from the site, rendering it suitable for future industrial or recreational use. The results of the RFI were used to scope the VCA at SWMU 94C. The VCA plan was prepared in consultation with NMED and a courtesy copy was transmitted to NMED (SNL/NM March 2000). The RFI determined that the entire discharge line had fixed radiological contamination and would require disposal as low-level radioactive waste. The RFI indicated the integrity of the discharge line had not been compromised, as evidenced by visual observation during excavation. In addition, RFI sampling along the base of the trench created by removing the discharge line verified that contamination above risk-based levels was not present in the surrounding area. However, during the RFI, the presence of a DU seam in the west bank of the trench was discovered, which necessitated including a soil removal action into the VCA.

Strategy

The overall strategy of the SWMU 94C VCA was to determine the aerial extent of DU contamination, remove the DU-contaminated soil, and properly dispose of the contaminated discharge line and soil. Specific elements of the VCA included:

- Waste volume reduction
- Characterization sampling
- Excavation of DU-contaminated soil

- Confirmatory work
  - Confirmatory radiological walkover survey
  - Confirmatory soil sampling
- Waste management
  - Waste characterization sampling
  - Disposal of radiologically-contaminated metal
  - Disposal of radiologically-contaminated soil
- Site restoration.

Chronology of Events

The RFI was completed in September 1999. The SWMU 94C VCA was initiated in March 2000 after the RFI data were reviewed and the VCA plan completed. The SWMU 94C VCA fieldwork was scheduled concurrently with other VCAs (SWMUs 94B and 94F) planned at the Burn Site for maximum efficiency. SNL/NM mobilized to the site on March 15, 2000 to perform the VCA. The initial task involved flattening the excavated discharge line, greatly decreasing the volume, and staging it in the southwest corner of the site. In mid-April, the grid for the characterization sampling was established and the sampling conducted. In late April, based upon the characterization sampling, excavation of the DU-contaminated soil was conducted, confirmatory radiological surveys completed, and confirmatory samples collected. In late June 2000, after the results from the confirmatory sampling were reviewed, site restoration activities were completed. In November, the DU-contaminated soil was loaded into burrito bags and transported to the Nevada Test Site (NTS) for disposal. The transportainer containing the discharge line was transported to NTS in February 2001.

Waste Volume Reduction

The initial task was to ready the excavated galvanized steel discharge line for packaging and disposal. The line was separated at the joints into 20-foot sections and flattened using an excavator bucket. Once flattened, the sections of line were folded until they were approximately 6 feet in length. The volume-reduced sections were later stacked and strapped on wood pallets for future loading into the transportainer (Figure 2.4.5-1).

Characterization Sampling

During the RFI, a DU seam was discovered in the west bank of the excavation approximately 2 feet bgs. The DU seam was visible as a unique stratigraphic horizon containing grayish burned material. Surveying the seam with a pancake probe showed high radioactivity compared to the surrounding soil. Visual observation and radiological surveys confirmed that the DU seam was not present in the east bank of the excavation, but the extent of DU contamination in the west bank was not determined.

During the VCA, a northeast-southwest sampling traverse was established on the west side of the trench to determine the boundary of the DU contamination. Eighteen Geoprobe borings to 4 feet bgs were completed during the characterization sampling (Figure 2.4.5-2). The borings were located 4 feet to the west of the trench and spaced on 5-foot centers. In the area of visible

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Figure 2.4.5-1
Volume-Reduced Discharge Line at SWMU 94C

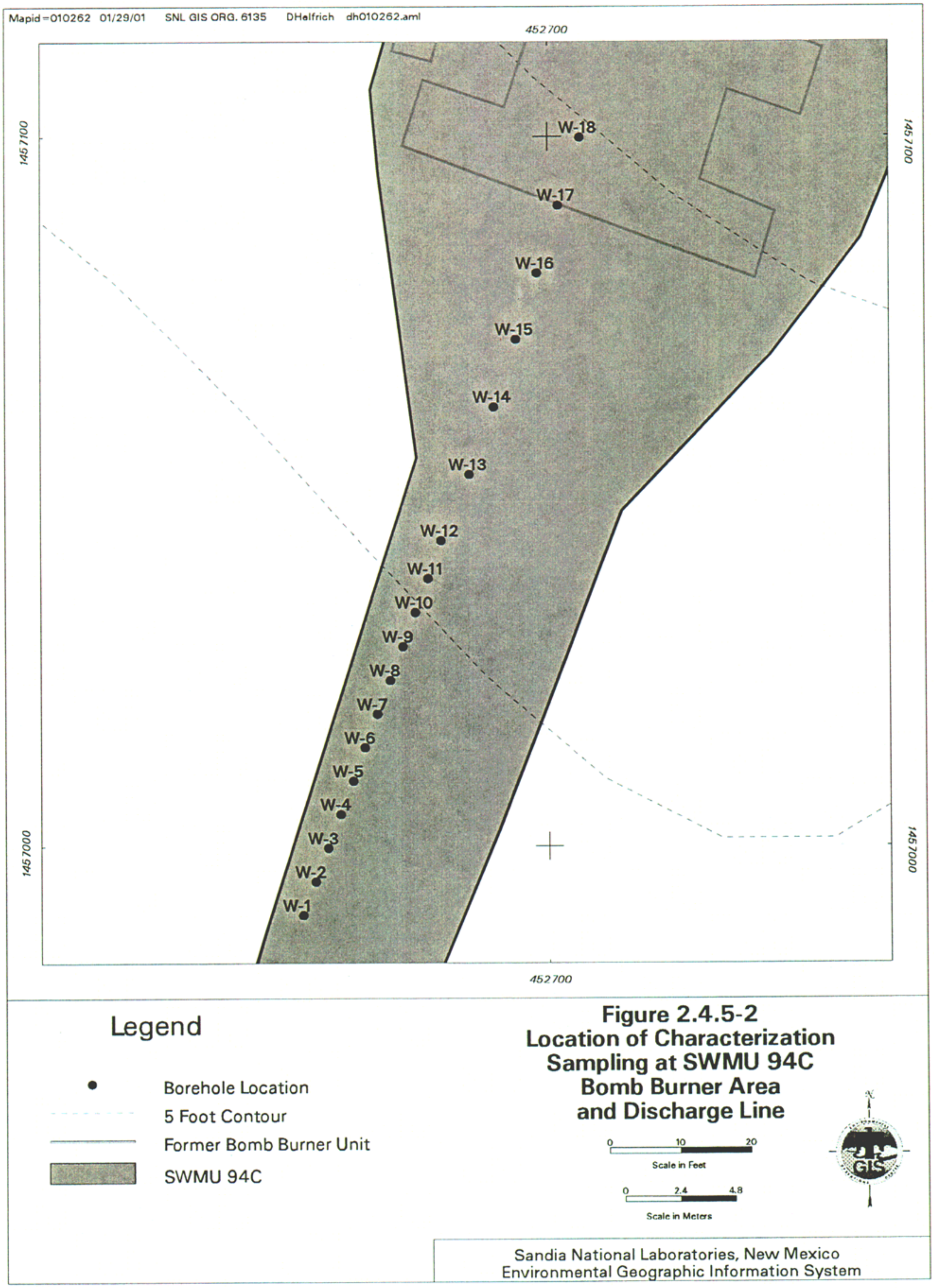

Figure 2.4.5-2
Location of Characterization Sampling at SWMU 94C Bomb Burner Area and Discharge Line

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

DU contamination, 12 Geoprobe borings were completed on approximate 5-foot centers. To the north of visible DU contamination, Geoprobe borings were completed on 10-foot centers along the same northeast-southwest traverse. East-west traverses were not completed because the east and west boundaries were to be determined during the removal of the DU seam.

Each of the Geoprobe locations was continuously cored. The soil cores from the Geoprobe borings were screened in the field for radioactivity using a pancake probe (Figure 2.4.5-3). None of the core samples had activities above background values, indicating that the DU seam was limited in width and extended less than 4 feet to the west. Based upon these results and the visual nature of the DU seam, it was determined that excavation of the DU could be conducted without additional sampling.

Excavation of DU-Contaminated Soil

Prior to removal of the DU seam, the entire length of the excavation was surveyed with a sodium iodide probe. The survey found no areas with readings above background (Annex 2-C). Based upon the results of the survey, the southernmost portion of the trench was backfilled to allow better site access.

The results of the characterization sampling were used to approximate the area of DU-contaminated soil to be excavated. Initially, the upper 12–14 inches of the overburden were removed with a backhoe and stockpiled separately west of the trench. Removing the upper 12–14 inches left a buffer of 4–6 inches of undisturbed overburden above the DU seam. The DU seam was clearly visible in the western side wall of the excavation. The seam was continuous on the northern end of the trench but became somewhat discontinuous towards the south, though it was still clearly visible for the entire 34-foot length. Once the overburden was removed, an excavator was used to remove the DU-contaminated soil and a buffer zone both above and below the DU seam. The soil was then transferred to a front end loader bucket and transported to the staging area at SWMU 94B. Excavation of DU-contaminated soil continued until field screening using a pancake probe indicated that the soil was within background activity limits. The volume of DU-contaminated soil removed was approximately 1 foot thick, 8 feet wide, and 35 feet in length.

During removal of the discharge line, a small portion of the DU seam was disturbed. In addition to removing the DU seam on the west side of the trench, manual removal of DU hot spots from the excavated soil from the trench was undertaken. A pancake probe was used to survey the excavated soil and manual removal of DU hot spots was accomplished. Radiological surveys confirmed that the DU hot spots were removed (Annex 2-C).

2.4.5.3 VCA Confirmatory Work

To verify that SWMU 94C was adequately remediated during the VCA, confirmatory work was conducted. The confirmatory work consisted of a radiological walkover survey performed by SNL/NM RCTs prior to site restoration and evaluation of RFI and confirmatory sampling data to assess the residual levels of COCs remaining in soil at the site.

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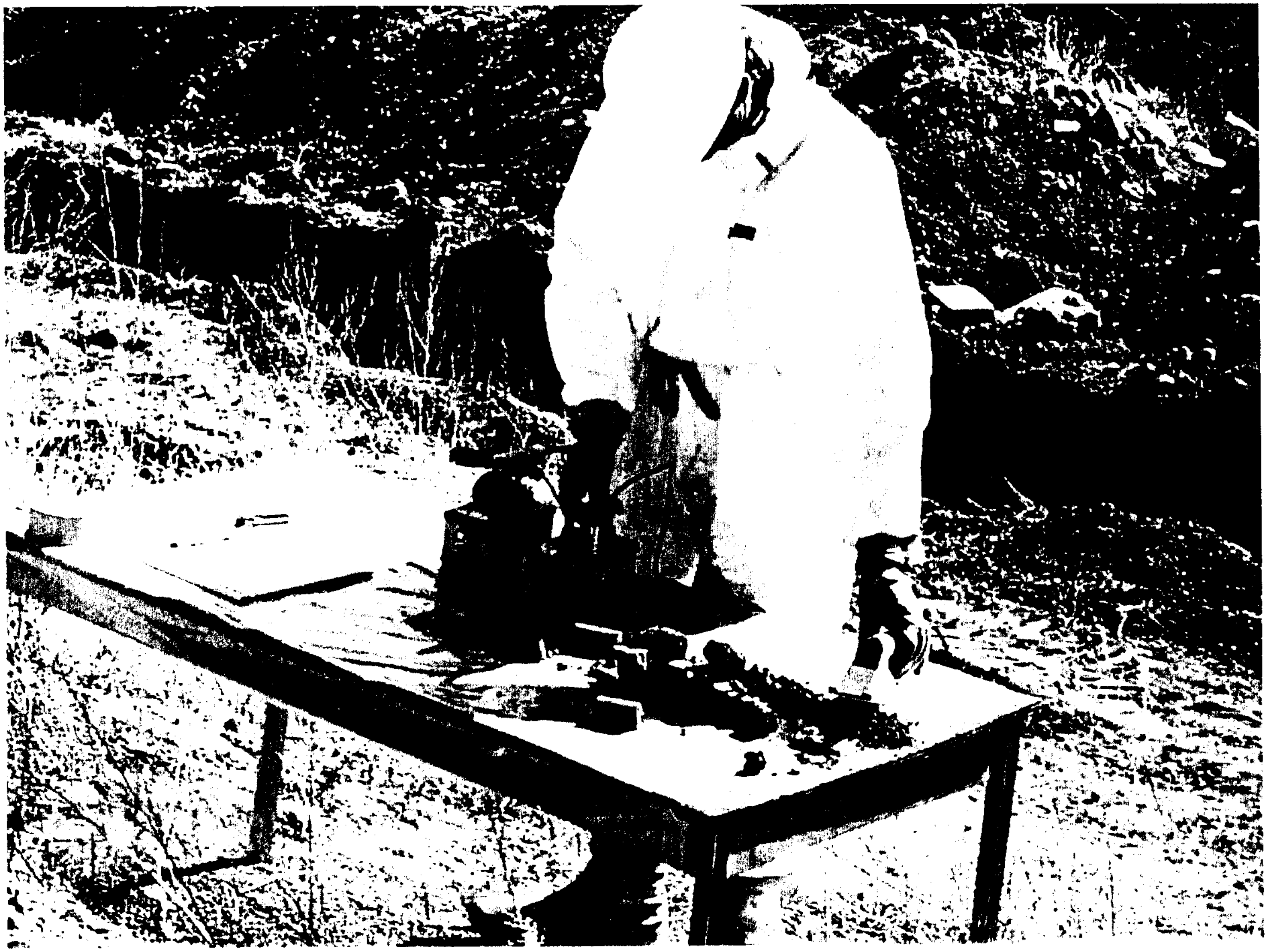

Figure 2.4.5-3
Field Screening Soil Cores for Radioactivity at SWMU 94C

Confirmatory Radiological Walkover Survey

After removal of the DU seam was complete, based upon surveys using a pancake probe, a radiological walkover survey using a sodium iodide probe was conducted. The radiological survey was conducted over 100 percent of the excavated area. The survey results showed no activity readings above the action limit of 1.70 x 10^{-4} counts per minute. The final radiological free-release survey is included in Annex 2-C.

Confirmatory Soil Sampling

After the radiological survey had confirmed that all of the DU-contaminated soil had been removed, confirmatory samples were collected. In April 1999, surface (0 to 1.0 foot bgs) soil samples were collected at SWMU 94C from a total of five locations throughout the area of the excavation (Figure 2.4.5-4). QA/QC samples collected included one duplicate sample and one EB.

Three of the five samples and the duplicate sample collected in April 1999 were analyzed off site for VOCs, SVOCs, metals, HE, and gamma spectroscopy. Two of the five samples were analyzed for gamma spectroscopy only. General Engineering Laboratories of Charleston, South Carolina, analyzed the samples for VOCs using EPA Method 8260, SVOCs using EPA Method 8270, RCRA metals plus beryllium and uranium using EPA Method 6010/7471, and HE using EPA Method 8330 (EPA November 1986). In addition, SNL/NM Department 7132 RPSD Laboratory used gamma spectroscopy to analyze the all of the samples.

2.4.5.3.1 Data Gaps

Analytical data from RFI and VCA confirmatory sampling were sufficient to determine the nature and extent of residual COCs that remain following the VCA. There are no further data gaps regarding characterization of SWMU 94C.

2.4.5.3.2 Results and Conclusions

In April 1999, soil samples were collected from five locations around the perimeter of the DU seam excavation area to verify the adequacy of the VCA.

Tables 2.4.5-1 through 2.4.5-6 summarize the confirmatory soil sampling analyses.
Tables 2.4.5-1, 2.4.5-2, and 2.4.5-6 summarize the metals, VOCs, and gamma spectroscopy analytical results for the confirmatory soil samples collected at SWMU 94C. Annex 2-B contains complete results for the gamma spectroscopy analyses. Tables 2.4.5-3, 2.4.5-4, and 2.4.5-5 summarize the analytical MDLs for the target analyte list for VOCs, SVOCs, and HE compounds, respectively.

Sample numbers are coded to identify specific information regarding the samples. For example, for CY94C-GR-001-SS, CY94C designates a sample collected from SWMU 94C in the Canyons Test Area of SNL/NM. *GR* indicates that a grab sample was collected from Location 001, and *SS* designates a surface soil sample. The remainder of this section describes the results of the VCA confirmatory sampling at SWMU 94C.

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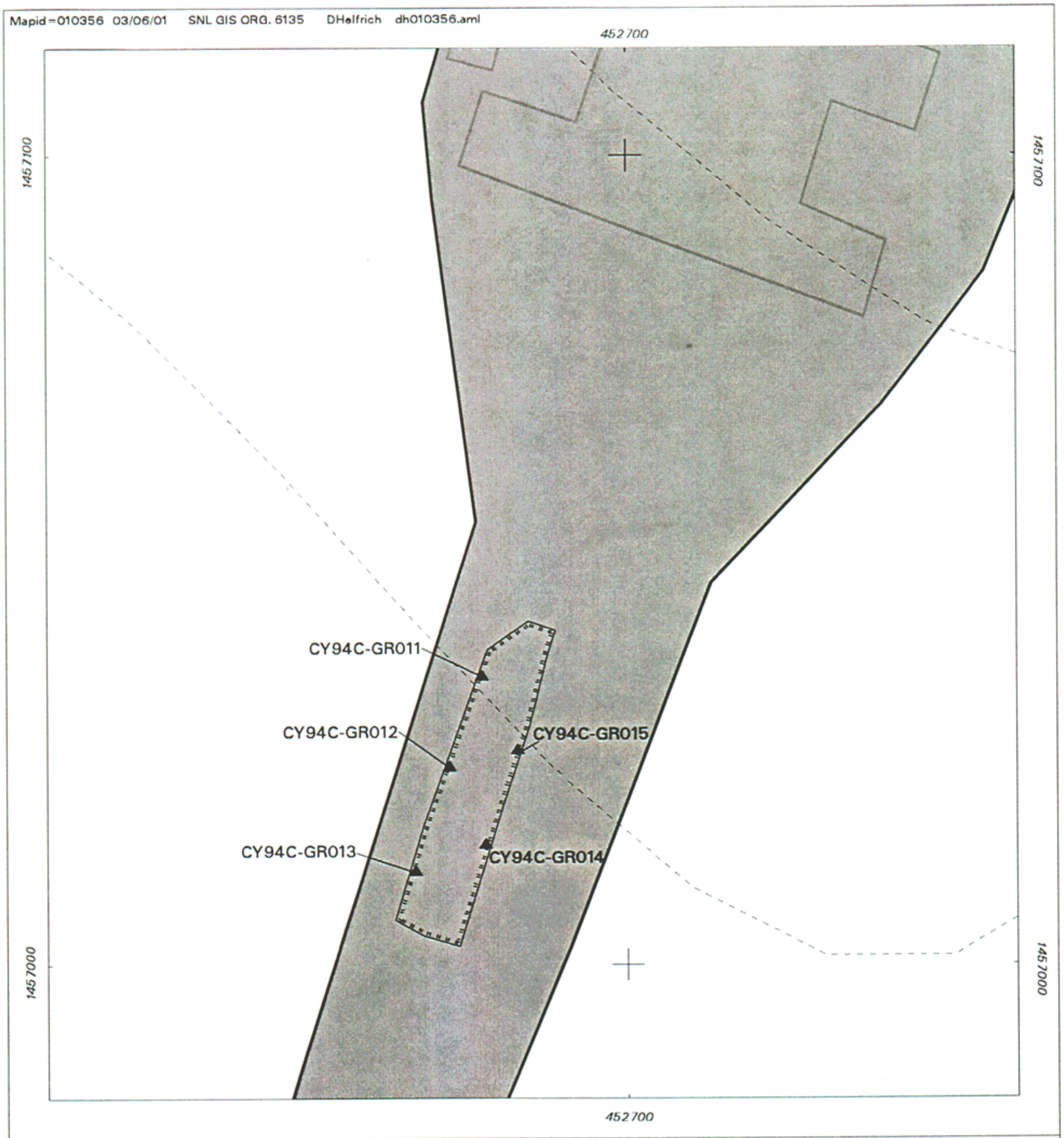

Figure 2.4.5-4
Confirmatory Sampling Locations at SWMU 94C Bomb Burner Area and Discharge Line

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Table 2.4.5-1
Summary of SWMU 94C Confirmatory Soil Sampling Metals Analytical Results
April 2000
(Off-Site Laboratory)

Sample Attributes			Metals (EPA Method 6010/7471)[a] (mg/kg)									
Record Number[b]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver	Uranium
603231	CY94C-GR-011-SS	0.0–1.0	3.11	177	0.644	0.204 J (0.481)	14.2	8	0.0176 J (0.0266)	0.685	ND (0.101)	2.32
603231	CY94C-GR-012-SS	0.0–1.0	3.64	191	0.68	0.272 J (0.455)	16	10.1	0.0147 J (0.026)	0.746	ND (0.101)	**9.28**
603231	CY94C-GR-013-DU	0.0–1.0	2.92	191	0.574	0.219 J (0.49)	12.4	7.01	ND (0.0152)	0.508	ND (0.101)	2.8
603231	CY94C-GR-013-SS	0.0–1.0	3.08	194	0.608	0.207 J (0.49)	12.9	7.07	0.0183 J (0.0294)	0.644	ND (0.101)	**4.82**
Background Soil Concentrations—Canyons Area[c]			9.8	246	0.75	0.64	18.8	18.9	0.055	2.7	<0.5	3.42
Quality Assurance/Quality Control Sample (mg/L)												
603231	CY94C-GR-002-EB	NA	ND (0.00257)	0.00155 J (0.005)	ND (0.00047)	ND (0.00063)	ND (0.00106)	ND (0.00183)	ND (0.00006)	ND (0.00236)	0.00098 J (0.005)	ND (0.00002)

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

[a] EPA November 1986.

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

[c] From Garcia November 1998.

CY = Canyon.
DU = Duplicate.
EB = Equipment blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
J ( ) = The reported value is greater than or equal to the method detection limit but is less than the practical quantitation limit, shown in parentheses.
mg/kg = Milligram(s) per kilogram.
mg/L = Milligram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the method detection limit, shown in parentheses.
SS = Surface soil sample.
SWMU = Solid Waste Management Unit.

Table 2.4.5-2
Summary of SWMU 94C Confirmatory Soil Sampling VOC Analytical Results
April 2000
(Off-Site Laboratory)

Sample Attributes			Analyte (EPA Method SW846 8260[a]) (µg/kg)	
Record Number[b]	ER Sample ID	Sample Depth (ft)	Acetone	Toluene
603231	CY94C-GR-011-SS	0.0–1.0	ND (2.42)	ND (0.259)
603231	CY94C-GR-012-SS	0.0–1.0	**8.47 J**	**0.331 J (1)**
603231	CY94C-GR-013-DU	0.0–1.0	ND (2.42)	ND (0.259)
603231	CY94C-GR-013-SS	0.0–1.0	ND (2.42)	ND (0.259)
Quality Assurance/Quality Control Samples (all in µg/L)				
603231	CY94C-GR-001-EB	NA	ND (0.224)	ND (0.262)
603231	CY94C-001-TB	NA	ND (0.224)	ND (0.262)

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

[a] EPA November 1986.

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

CY = Canyon.
DU = Duplicate.
EB = Equipment blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
J = The reported value is estimated based upon data validation.
J ( ) = The reported value is greater than or equal to the method detection limit but is less than the practical quantitation limit, shown in parentheses.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the method detection limit, shown in parentheses.
SS = Surface soil sample.
SWMU = Solid Waste Management Unit.
TB = Trip Blank.
VOC = Volatile organic compound.

Table 2.4.5-3
VOC Analytical Method Detection Limits Used for SWMU 94C Confirmatory Soil Sampling
April 2000
(Off-Site Laboratory)

Analyte	Method Detection Limit (µg/kg)
1,1,1-Trichloroethane	0.157
1,1,2,2-Tetrachloroethane	0.195
1,1,2-Trichloroethane	0.177
1,1-Dichloroethane	0.231
1,1-Dichloroethene	0.262
1,2-Dichloroethane	0.17
1,2-Dichloropropane	0.19
2-Butanone	1.76
2-Hexanone	1.33
4-methyl-, 2-Pentanone	1.17
Acetone	2.42
Benzene	0.276
Bromodichloromethane	0.194
Bromoform	0.145
Bromomethane	0.478
Carbon disulfide	0.988
Carbon tetrachloride	0.144
Chlorobenzene	0.206
Chloroethane	0.286
Chloroform	0.204
Chloromethane	0.192
Dibromochloromethane	0.111
Ethyl benzene	0.212
Methylene chloride	0.971
Styrene	0.198
Tetrachloroethene	0.582
Toluene	0.259
Trichloroethene	0.998
Vinyl acetate	3.2
Vinyl chloride	0.255
Xylene	0.68
cis-1,2-Dichloroethene	0.327
cis-1,3-Dichloropropene	0.216
trans-1,2-Dichloroethene	0.232
trans-1,3-Dichloropropene	0.163

µg/kg = Microgram(s) per kilogram.
SWMU = Solid Waste Management Unit.
VOC = Volatile organic compound.

Table 2.4.5-4
SVOC Analytical Method Detection Limits
Used for SWMU 94C Confirmatory Soil Sampling
April 2000
(Off-Site Laboratory)

Analyte	Method Detection Limit (µg/kg)
1,2,4-Trichlorobenzene	4.66
1,2-Dichlorobenzene	4.33
1,3-Dichlorobenzene	3.33
1,4-Dichlorobenzene	5.99
2,4,5-Trichlorophenol	24.3
2,4,6-Trichlorophenol	5.33
2,4-Dichlorophenol	7.99
2,4-Dimethylphenol	6.99
2,4-Dinitrophenol	15.7
2,4-Dinitrotoluene	5
2,6-Dinitrotoluene	3
2-Chloronaphthalene	3.66
2-Chlorophenol	5
2-Methylnaphthalene	4
2-Nitroaniline	80.9
2-Nitrophenol	3.66
3,3'-Dichlorobenzidine	143
3-Nitroaniline	62.9
4-Bromophenyl phenyl ether	4.66
4-Chloro-3-methylphenol	19.6
4-Chlorobenzenamine	58.9
4-Chlorophenyl phenyl ether	3.33
4-Methylphenol	5.66
4-Nitroaniline	83.9
4-Nitrophenol	156
Acenaphthene	4
Acenaphthylene	3.66
Anthracene	4.66
Benzo(a)anthracene	5.99
Benzo(a)pyrene	5.66
Benzo(b)fluoranthene	8.99
Benzo(ghi)perylene	8.99
Benzo(k)fluoranthene	8.99
Butylbenzylphthalate	12

Refer to footnotes at end of table.

Table 2.4.5-4 (Concluded)
SVOC Analytical Method Detection Limits
Used for SWMU 94C Confirmatory Soil Sampling
April 2000
(Off-Site Laboratory)

Analyte	Method Detection Limit (µg/kg)
Carbazole	5
Chrysene	6.33
Dibenzo(a,h)anthracene	4.66
Dibenzofuran	2.66
Di-n-butylphthalate	14
Di-n-octylphthalate	8.99
Diethylphthalate	6.33
Dimethylphthalate	27.3
Dinitro-o-cresol	33.3
Diphenylamine	84.9
Fluoranthene	5
Fluorene	3
Hexachlorobenzene	4.66
Hexachlorobutadiene	6.66
Hexachlorocyclopentadiene	2.33
Hexachloroethane	4.33
Indeno(1,2,3-c,d)pyrene	8.99
Isophorone	2.33
Naphthalene	3.33
Nitrobenzene	11
Pentachlorophenol	115
Phenanthrene	4
Phenol	3.66
Pyrene	8.66
Bis(2-chloroethoxy)methane	5.99
Bis(2-chloroethyl)ether	6.66
Bis(2-ethylhexyl)phthalate	19.6
Bis-chloroisopropyl ether	5.99
n-Nitrosodipropylamine	6.66
o-Cresol	7.66

µg/kg = Microgram(s) per kilogram.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.

Table 2.4.5-5
HE Analytical Method Detection Limits
Used for SWMU 94C Confirmatory Soil Sampling
April 2000
(Off-Site Laboratory)

Analyte	Method Detection Limit (µg/kg)
1,3,5-Trinitrobenzene	11.9
1,3-Dinitrobenzene	13.4
2,4,6-Trinitrotoluene	14.1
2,4-Dinitrotoluene	12
2,6-Dinitrotoluene	15.7
2-Amino-4,6-dinitrotoluene	13.4
2-Nitrotoluene	15.2
3-Nitrotoluene	11.6
4-Amino-2,6-dinitrotoluene	10.1
4-Nitrotoluene	11.6
HMX	16.8
Nitrobenzene	14
RDX	12.5
TETRYL	15.5

HE = High explosive(s).
HMX = 1,3,5,7-tetranitro-1,3,5,7-tetrazacyclooctane.
µg/kg = Microgram(s) per kilogram.
RDX = 1,3,5-Trinitro-1,3,5-triazacyclohexane.
SWMU = Solid Waste Management Unit.
TETRYL = 2,4,6-Trinitrophenylmethylnitramine.

Table 2.4.5-6
Summary of SWMU 94C Confirmatory Soil Sampling Gamma Spectroscopy Analytical Results
April 2000
(On-Site Laboratory)

Sample Attributes			Activity (pCi/g)							
Record Number[a]	ER Sample ID	Sample Depth (ft)	Cesium-137		Thorium-232		Uranium-235		Uranium-238	
			Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603232	CY94C-GR-011-SS	0.0–1.0	ND (0.0296)	--	0.866	0.468	ND (0.224)	--	ND (0.825)	--
603232	CY94C-GR-012-SS	0.0–1.0	ND (0.0224)	--	**1.04**	0.558	ND (0.256)	--	ND (0.798)	--
603232	CY94C-GR-013-SS	0.0–1.0	ND (0.0173)	--	0.811	0.374	ND (0.207)	--	ND (0.796)	--
603232	CY94C-GR-014-SS	0.0–1.0	ND (0.0438)	--	0.886	0.879	ND (0.19)	--	**11.9**	5.49
603232	CY94C-GR-015-SS	0.0–1.0	ND (0.0399)	--	0.786	0.42	ND (0.175)	--	**3.07**	0.887
Background Soil Activities—Upper Canyons Area[c]			0.515	NA	1.03	NA	0.16	NA	2.31	NA

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

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

[b] Two standard deviations about the mean detected activity.

[c] From Dinwiddie September 1997.

CY = Canyon.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected above the minimum detectable activity, shown in parentheses.
pCi/g = Picocurie(s) per gram.
SS = Surface soil sample.
SWMU = Solid Waste Management Unit.
-- = Error not calculated for nondetectable results.

Metals

Table 2.4.5-1 summarizes the metals analysis results for the three confirmatory soil samples and one duplicate sample collected from the DU seam excavation area at SWMU 94C.

With the exception of uranium, all metals were below the background concentration limits. Uranium was detected above the background concentration limit of 3.42 mg/kg in two samples, CY94C-GR-012-SS and CY94C-GR-013-SS, at concentrations of 9.28 mg/kg and 4.82 mg/kg, respectively. Uranium was not detected above the background concentration limit in the duplicate sample CY94C-GR-013-DU.

VOCs

Because there are no background concentrations for VOCs in soil, any detectable VOCs in the samples collected at SWMU 94C may be considered an indication of contamination. Two VOCs, acetone and toluene, were detected at low estimated concentrations in one confirmatory soil sample, CY94C-GR-012-SS, from the DU seam excavation area at SWMU 94C. Acetone was detected at a concentration of 8.47 J µg/kg and toluene was detected a concentration of 0.331 J µg/kg (Table 2.4.5-2). Both acetone and toluene are believed to be laboratory contaminants.

Table 2.4.5-3 summarizes the MDLs used for analyzing VOCs by the off-site laboratory.

SVOCs

Because there are no background concentrations for SVOCs in soil, any detectable SVOCs in the samples collected at SWMU 94C may be considered an indication of contamination. However, no SVOCs were detected in any of the confirmatory soil samples collected from the DU seam excavation area at SWMU 94C.

Table 2.4.5-4 summarizes the MDLs used for analyzing SVOCs by the off-site laboratory.

HE

Because there are no background concentrations for HE in soil, any detectable HE in the samples collected at SWMU 94C may be considered an indication of contamination. However, no HE compounds were detected in any of the confirmatory soil samples collected from the DU seam excavation area at SWMU 94C.

Table 2.4.5-5 summarizes the MDLs used for analyzing HE compounds by the off-site laboratory.

Radionuclides

Table 2.4.5-6 summarizes the on-site gamma spectroscopy analysis results for the five confirmatory soil samples collected from the DU seam excavation area at SWMU 94C. The MDA associated with nondetectable results for uranium-235 slightly exceeded background in all instances. Therefore, gamma activity attributable to uranium-235 could be slightly above the 0.16 pCi/g background activity. Gamma activity attributable to uranium-238 was above the 2.31 pCi/g background activity in two samples, CY94C-GR-014-SS and CY94G-GR-015-SS, at activities of 11.9 pCi/g and 3.07 pCi/g, respectively. No corresponding elevated uranium-235 activity was seen in these samples. Gamma activity attributable to cesium-137 was not detected above the MDA in any of the samples. Gamma activity attributable to thorium-232 was slightly above the 1.03 pCi/g background activity in one sample, CY94C-GR-012-SS, at an activity of 1.04 pCi/g. Refer to Annex 2-B for the full gamma spectroscopy results.

2.4.5.4 Waste Management

The SWMU 94C VCA generated approximately 15 cubic yards of radiologically-contaminated soil and approximately 2 cubic yards of radiologically-contaminated galvanized steel. In addition, approximately 40 cubic yards of radiologically-contaminated soil from the VCAs performed at SWMUs 94B and 94F was stockpiled with the soil from SWMU 94C. The stockpiled soil was sampled to determine the level of radioactivity present and whether it exhibited any RCRA hazardous characteristics. All waste characterization sampling was performed in conformance with the requirements set forth by the SNL/NM Waste Management group.

Waste Characterization Sampling

The stockpiled soil removed from SWMUs 94C, 94B, and 94F was analyzed for Toxicity Characteristic Leaching Procedure (TCLP) VOCs, SVOCs, and metals, and additionally for antimony, beryllium, copper, nickel, thallium, zinc, polychlorinated biphenyls, isotopic uranium, and gamma spectroscopy. No SVOCs or PCBs were detected in the soil. The results of the TCLP metals, VOCs, gamma spectroscopy, and isotopic uranium analyses are presented in Tables 2.4.5-7 through 2.4.5-10, respectively. The results indicated that the soil did not exhibit any RCRA hazardous waste characteristics and could be disposed of as low-level radioactive waste at the NTS.

Disposal of Radiologically-Contaminated Metal

The crushed and palletized galvanized steel pipe was loaded into the transportainer in April 2000. An inventory of material loaded into the transportainer, including sampling data, is presented in SNL/NM ER Waste Management Memorandum 00-030 (SNL/NM July 2000). The transportainer was trucked to the NTS for disposal in February 2001.

Disposal of Radiologically-Contaminated Soil

In November 1999, the approximately 60 cubic yards of radiologically-contaminated soil stockpiled at SWMU 94B was loaded into four 20-cubic-yard burrito bags (Figure 2.4.5-5). The burrito bags lined the interior of 20-cubic-yard semi-truck beds. Once loaded, the beds were covered and the material was transported to the NTS for disposal.

Table 2.4.5-7
Summary of SWMU 94C Soil Pile TCLP Metals Analytical Results
May 2000
(Off-Site Laboratory)

Sample Attributes			Metals (EPA Method SW846 6010/SW846 7470[a]) (mg/L)													
Record Number[b]	ER Sample ID	Sample Depth (ft)	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
603229	CY94C-SP01-01	NA	ND (0.00343)	ND (0.00257)	0.781 J (0.05)	ND (0.00047)	ND (0.00063)	ND (0.00106)	ND (0.00184)	ND (0.00183)	ND (0.00006)	ND (0.00309)	ND (0.00236)	ND (0.00053)	ND (0.00393)	ND (0.00389)
603229	CY94C-SP01-03	NA	ND (0.00343)	ND (0.00257)	0.992 J (0.05)	ND (0.00047)	ND (0.00063)	ND (0.00106)	0.0315 J (0.05)	ND (0.00183)	ND (0.00006)	0.0329 J (0.05)	ND (0.00236)	ND (0.00053)	ND (0.00393)	0.0598 J (0.15)
603233	CY94C-SP01-04	NA	ND (0.00343)	ND (0.00257)	0.844	ND (0.00047)	ND (0.00063)	ND (0.00106)	ND (0.00184)	ND (0.00183)	ND (0.00006)	ND (0.00309)	ND (0.00236)	ND (0.00053)	ND (0.00393)	ND (0.00389)
603233	CY94C-SP01-05	NA	ND (0.00343)	ND (0.00257)	0.889	ND (0.00047)	ND (0.00063)	ND (0.00106)	ND (0.00184)	ND (0.00183)	ND (0.00006)	ND (0.00309)	ND (0.00236)	0.00982 J (0.05)	ND (0.00393)	ND (0.00389)
603233	CY94C-SP01-06	NA	ND (0.00343)	0.0433 J (0.05)	0.867	ND (0.00047)	ND (0.00063)	ND (0.00106)	ND (0.00184)	ND (0.00183)	ND (0.00006)	ND (0.00309)	ND (0.00236)	ND (0.00053)	ND (0.00393)	ND (0.00389)
603233	CY94C-SP01-07	NA	ND (0.00343)	ND (0.00257)	0.889	ND (0.00047)	ND (0.00063)	ND (0.00106)	ND (0.00184)	ND (0.00183)	ND (0.00006)	ND (0.00309)	ND (0.00236)	ND (0.00053)	ND (0.00393)	ND (0.00389)

[a] EPA November 1986.

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

CY = Canyon.
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 method detection limit but is less than the practical quantitation limit, shown in parentheses.
mg/L = Milligram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the method detection limit, shown in parentheses.
SP = Soil pile sample.
SWMU = Solid Waste Management Unit.
TCLP = Toxicity Characteristic Leaching Procedure.

Table 2.4.5-8
Summary of SWMU 94C Soil Pile TCLP VOC Analytical Results
May–June 2000
(Off-Site Laboratory)

Sample Attributes			VOCs (EPA Method SW846 8260[a]) (µg/L)			
Record Number[b]	ER Sample ID	Sample Depth (ft)	1,2-Dichloroethane	Acetone	Benzene	Methylene chloride
603341	CY94C-SP01-R01	NA	ND (0.158)	NR	11.5	NR
603341	CY94C-SP01-R03	NA	ND (0.158)	NR	ND (0.149)	NR
603341	CY94C-SP01-R04	NA	ND (0.158)	NR	ND (0.149)	NR
603341	CY94C-SP01-R05	NA	ND (0.158)	NR	ND (0.149)	NR
603341	CY94C-SP01-R06	NA	ND (0.158)	NR	ND (0.149)	NR
603341	CY94C-SP01-R07	NA	ND (0.158)	NR	ND (0.149)	NR
Quality Assurance/Quality Control Samples (all in µg/L)						
603229	CY94B-GR-018-TB	NA	ND (0.158)	ND (0.224)	ND (0.149)	6.54
603341	CY94C-SP01-TB	NA	0.248 J (1)	2.21 J (5)	ND (0.149)	ND (0.971)

[a] EPA November 1986.

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

CY = Canyon.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
µg/L = Microgram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the method detection limit, shown in parentheses.
NR = Not reported.
SP = Soil pile sample.
SWMU = Solid Waste Management Unit.
TB = Trip blank.
TCLP = Toxicity Characteristic Leaching Procedure.
VOC = Volatile organic compound.

Table 2.4.5-9
Summary of SWMU 94C Soil Pile Gamma Spectroscopy Analytical Results
April–May 2000
(On-Site Laboratory)

Sample Attributes			Activity (pCi/g)							
			Cesium-137		Thorium-232		Uranium-235		Uranium-238	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
603230	CY94C-SP01-01	NA	ND (0.045)	--	0.904	0.471	**1.6**	0.374	**118**	24.5
603230	CY94C-SP01-02	NA	ND (0.084)	--	0.995	0.526	**7.46**	1.16	**542**	75.9
603230	CY94C-SP01-03	NA	ND (0.0581)	--	0.934	0.529	**4.19**	7.61	**317**	43.4
603230	CY94C-SP01-04	NA	ND (0.0368)	--	0.814	0.442	**0.815**	0.369	**76.8**	16.1
603230	CY94C-SP01-05	NA	ND (0.0544)	--	0.76	1.34	**1.72**	0.589	**132**	19.5
603230	CY94C-SP01-06	NA	ND (0.0438)	--	1	0.543	**0.245**	0.217	**6.28**	1.18
603230	CY94C-SP01-07	NA	ND (0.0742)	--	ND (0.37)	--	**2.35**	2.06	**178**	25.7
Background Soil Activities—Upper Canyons Area[c]			0.515	NA	1.03	NA	0.16	NA	2.31	NA

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

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

[b] Two standard deviations about the mean detected activity.

[c] From Dinwiddie September 1997.

CY = Canyon.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND ( ) = Not detected above the minimum detectable activity, shown in parentheses.
pCi/g = Picocurie(s) per gram.
SP = Soil pile sample.
SWMU = Solid Waste Management Unit.
-- = Error not calculated for nondetectable results.

Table 2.4.5-10
Summary of SWMU 94C Soil Pile Isotopic Uranium Analytical Results
April–May 2000
(Off-Site Laboratory)

Sample Attributes			(EPA Method Gamma/HASL 300[a]) (pCi/g)			
Record Number[b]	ER Sample ID	Sample Depth (ft)	Uranium-234	Uranium-235	Uranium-236	Uranium-238
603229	CY94C-SP01-01	NA	6.16	NR	0.558	40.6
603229	CY94C-SP01-03	NA	17.2	NR	2.23	136
603233	CY94C-SP01-04	NA	7.58	NR	1.1	61
603233	CY94C-SP01-05	NA	5.31	NR	0.651	35.3
603233	CY94C-SP01-06	NA	1.75	NR	0.232	9.05
603233	CY94C-SP01-07	NA	6.37	NR	0.995	33.1

[a] EPA November 1986.

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

CY = Canyon.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
HASL = Health and Safety Laboratory.
ID = Identification.
NA = Not applicable.
NR = Not reported.
pCi/g = Picocurie(s) per gram.
SP = Soil pile sample.
SWMU = Solid Waste Management Unit.

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Figure 2.4.5-5
Loading of Radiologically-Contaminated Soil at SWMU 94C

Site Restoration

After all VCA activities were completed and results from the confirmatory sampling were reviewed, site restoration began. Clean soil stockpiled at SWMU 12B was used to fill in the trench from the removal of the discharge line and the area of the DU seam excavation. Additional soil, from SWMU 12B, was brought in to recontour the area to reduce the slope of the hill and minimize surface erosion (Figure 2.4.5-6).

2.4.5.5 *Data Quality*

QA/QC Results

Tables 2.4.4-1 and 2.4.5-1 present the results of analyses of the metal QA/QC samples that were collected during the RFI and confirmatory sampling programs at SWMU 94C. The QA/QC sample consisted of two EBs collected to ensure contamination was not transferred from one sample to another via unclean sampling equipment. The EBs were analyzed off site for metals, VOCs, SVOCs, and HE. Metals concentrations in the EBs were at less than detection limits for all analytes except barium, cadmium, and silver. The concentrations of barium, cadmium, and silver were below the practical quantitation limit, and were qualified as J (estimated value). No VOC, SVOCs, or HE compounds were detected in either of the EBs. No QA/QC samples were collected for radionuclide analyses.

To assess the precision of soil sampling procedures, two soil samples was collected and analyzed in replicate off site. Relative percent differences (RPDs) were calculated from the data and are shown in Table 2.4.5-11. Because some results for the sample pairs are nondetect or are estimated concentrations, RPDs could not be calculated for both the sample pairs for beryllium, cadmium, mercury, selenium, and silver. The RPDs ranged from a low of 0.0 percent for barium to a high of 52.02 percent for uranium. With the exception of uranium, all of the RPDs are less than 25 percent and are in good agreement for an inhomogeneous soil matrix. The samples were not homogenized thoroughly in the field, which could explain the large RPD seen for uranium.

Data Validation

All off-site laboratory results were reviewed and verified/validated according to "Data Validation Procedure for Chemical and Radiochemical Data" SNL/NM ER Project Analytical Operating Procedure 00-03, Rev. 0 (SNL/NM December 1999). In addition, SNL/NM Department 7713 (RPSD Laboratory) reviewed all gamma spectroscopy results according to "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 02 (SNL/NM July 1996). Annex 2-D contains off-site data validation reports. The verification/validation process confirmed that the data are acceptable for use in this NFA proposal for SWMU 94C.

During data validation, qualifications were applied to some of the data. For chain-of-custody 603229, validation qualifications were applied to a few SVOC compounds due to laboratory control sample (LCS) percent recovery and LCS/laboratory control sample duplicate (LCSD) RPD not meeting QC acceptance criteria. The sample results were nondetect but were qualified "nondetect estimated." Nondetect results for chromium, lead, and mercury were qualified "nondetect estimated" due to problems in the continuing calibration blank.

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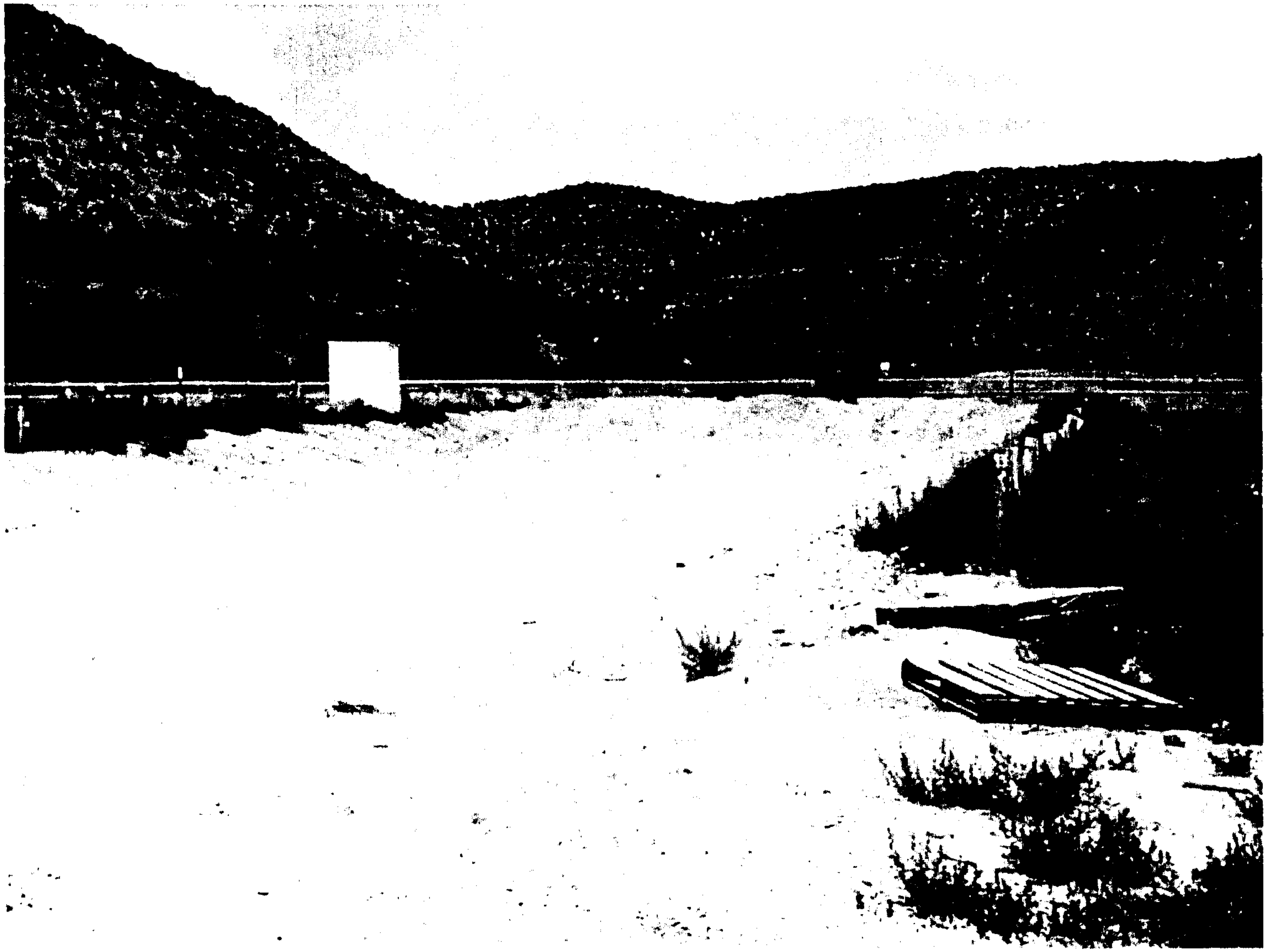

Figure 2.4.5-6
Final Site Restoration at SWMU 94C

Table 2.4.5-11
Summary of SWMU 94C Field Duplicate Relative Percent Differences

Sample Attributes			Relative Percent Difference						
Record Number[a]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Chromium	Lead	Selenium	Uranium
602819	CY94C-GR-009-S CY94C-GR-009-DU (off-site laboratory)	0.0–1.0	19.64	0.0	NC	19.58	17.97	NC	NA
603231	CY94C-GR-013-SS CY94C-GR-013-DU (off-site laboratory)	0.0–1.0	5.33	1.56	5.75	3.95	0.85	23.61	53.02

[a]Analysis request/chain-of-custody record.
CY = Canyon.
DU = Duplicate sample.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
NA = Not analyzed.
NC = Not calculated for nondetected results or laboratory estimated values.
S = Subsurface soil sample.
SS = Surface soil sample.
SWMU = Solid Waste Management Unit.

For chain-of-custody 602819, validation qualifications were applied to two VOC compounds due to the initial calibration response factors (RFs) being less than the required minimums and nondetect results were qualified "nondetect estimated." All nondetect SVOC results for the EB were qualified "nondetect estimated" due to matrix spike (MS)/matrix spike duplicate (MSD) percent recoveries being less than QC limits. The nondetect results for one HE compound were qualified "nondetect estimated" due to the MS/MSD RPD for the EB being greater than QC limits.

For chain-of-custody 603231, validation qualifications were applied to a few VOC compounds due to initial calibration RF and the internal standard count area being outside of QC limits. Nondetect results were qualified "nondetect estimated." The continuing calibration verification percent difference of acetone was outside of QC limits and the one detection was qualified as estimated. For HE compounds, the LCS/LCSD percent recoveries were less than QC limits and all nondetect results were qualified "nondetect estimated." In the continuing calibration blank for the EB where silver and mercury were detected, the associated sample results were qualified "estimated." Arsenic was detected in the initial calibration blank for the EB and was qualified "nondetect estimated" in the associated sample.

2.5 Site Conceptual Model

The site conceptual model for SWMU 94C is based upon the site history, hydrogeologic setting, and residual COCs identified in the soil samples collected from the site. This section summarizes the nature and extent of contamination and the environmental fate of COCs.

2.5.1 Nature and Extent of Contamination

The RFI verified the initial conceptual model of the discharge line being contaminated and also verified that no contamination above risk-based concentrations had been released to the surrounding soil. The conceptual model was modified to incorporate the discovery of the DU seam immediately west of the discharge line. The DU seam is believed to have been a remnant of a previous surface burn test that was subsequently buried by grading activities in the area. The primary COCs at SWMU 94C are radionuclides from previous testing at the Bomb Burner Unit. A minor estimated detection of two VOCs was seen in one sample, believed to represent laboratory contamination. Uranium was the only metal detected above background. Gamma activities were detected above background in a few samples. Gross alpha was above background in one sample. Metal and radionuclide COCs were determined by comparing sample results to background concentrations and to activities established for the Canyons Area (Dinwiddie September 1997, Garcia November 1998, Tharp July 1998). Any metal or radionuclide found to exceed background in any sample is considered a potential COC for the site. Because the MDAs for uranium-235 analyses in the confirmation samples exceeded background activity limits, nondetect sample results are also considered in identifying potential COCs.

Organic COCs include acetone and toluene. The metal COC is uranium. The radionuclide COCs are uranium-235, thorium-232, and uranium-238. No SVOC or HE compounds were detected in any of the soil samples collected at SWMU 94C. The COCs that exceed background limits occurred primarily in the northern most part of the site very near the location of the former Bomb Burner Unit. The concentrations are only slightly above background and do not represent a significant source of contamination; they may represent a remnant of the former operations in this area. Table 2.5.1-1 lists the COCs and the sample locations where they were detected.

For radionuclides, the MDA is used for comparison to background. Gamma activity attributable to uranium-235 and thorium-232 was detected above background in a few samples. Because the MDA associated with nondetectable results for uranium-235 analyses was above background in some instances (see Table 2.4.4-4), nondetect sample results are also considered in identifying potential COCs. Three of the sample locations were above the background activity. Thorium-232 was above the background activity in one sample and uranium-235 was above the background activity in two samples. All elevated activities are believed to be naturally occurring at SWMU 94C due to the natural characteristics of the rock and soil in the area (RUST Geotech Inc. December 1994).

2.5.2 Environmental Fate

The primary source of COCs at SWMU 94C was the operation of the former Bomb Burner Unit and open burn testing conducted in the area. The primary release mechanism of COCs to the surface soil was direct contact of the Bomb Burner Unit and open burn tests with the native soil (Figure 2.5.2-1). SWMU 94C lies just above the floor of Lurance Canyon. During intense rainfall events, it is possible for surface runoff to erode the site and erosion could be considered a release mechanism.

Table 2.5.1-1
Summary of COCs for SWMU 94C

COC Type	Number of Samples	COCs Greater Than Background	Maximum Background Limit/Canyons Area[a] (mg/kg, except where noted)	Maximum Concentration (mg/kg, except where noted)	Average Concentration[b] (mg/kg, except where noted)	Sampling Locations Where Background Concentration Exceeded[c]
VOC	12 environmental 2 duplicate	Acetone	NA	8.47 J μg/kg	Not calculated	CY94C-GR-012-SS
		Toluene	NA	0.331 J μg/kg	Not calculated	CY94C-GR-012-SS
Metals	12 environmental, 2 duplicate	Uranium	3.42	9.28	4.8	CY94C-GR-012-SS CY94C-GR-013-SS
Radionuclides	15 environmental, 1 duplicate	Thorium-232	1.03 pCi/g	1.09 pCi/g	Not calculated[d]	CY94C-GR-002-S CY94C-GR-012-SS
		Uranium-235	0.16 pCi/g	0.175 pCi/g	Not calculated[d]	CY94C-GR-009-S (plus 5 samples where MDA exceeds background)
		Uranium-238	2.31 pCi/g	11.9 pCi/g	Not calculated[d]	CY94C-GR-008-S CY94C-GR-009-S CY94C-GR-009-DU CY94C-GR-014-SS CY94C-GR-015-SS

[a] From Garcia November 1998 (for metals); from Dinwiddie September 1997 (for radionuclides).

[b] Average concentration includes all samples.

[c] Includes all samples with nondetectable results where the minimum detectable activity exceeds background (for radionuclides).

[d] An average minimum detectable activity is not calculated because of the variability in instrument counting error and the number of reported nondetectable activities.

COC = Constituent of concern.
CY = Canyon.
DU = Duplicate.
GR = Grab sample.
μg/kg = Microgram(s) per kilogram.
MDA = Minimum detectable activity.
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.
S = Subsurface soil sample.
SS = Surface soil sample.
SWMU = Solid Waste Management Unit.
VOC = Volatile organic compound.

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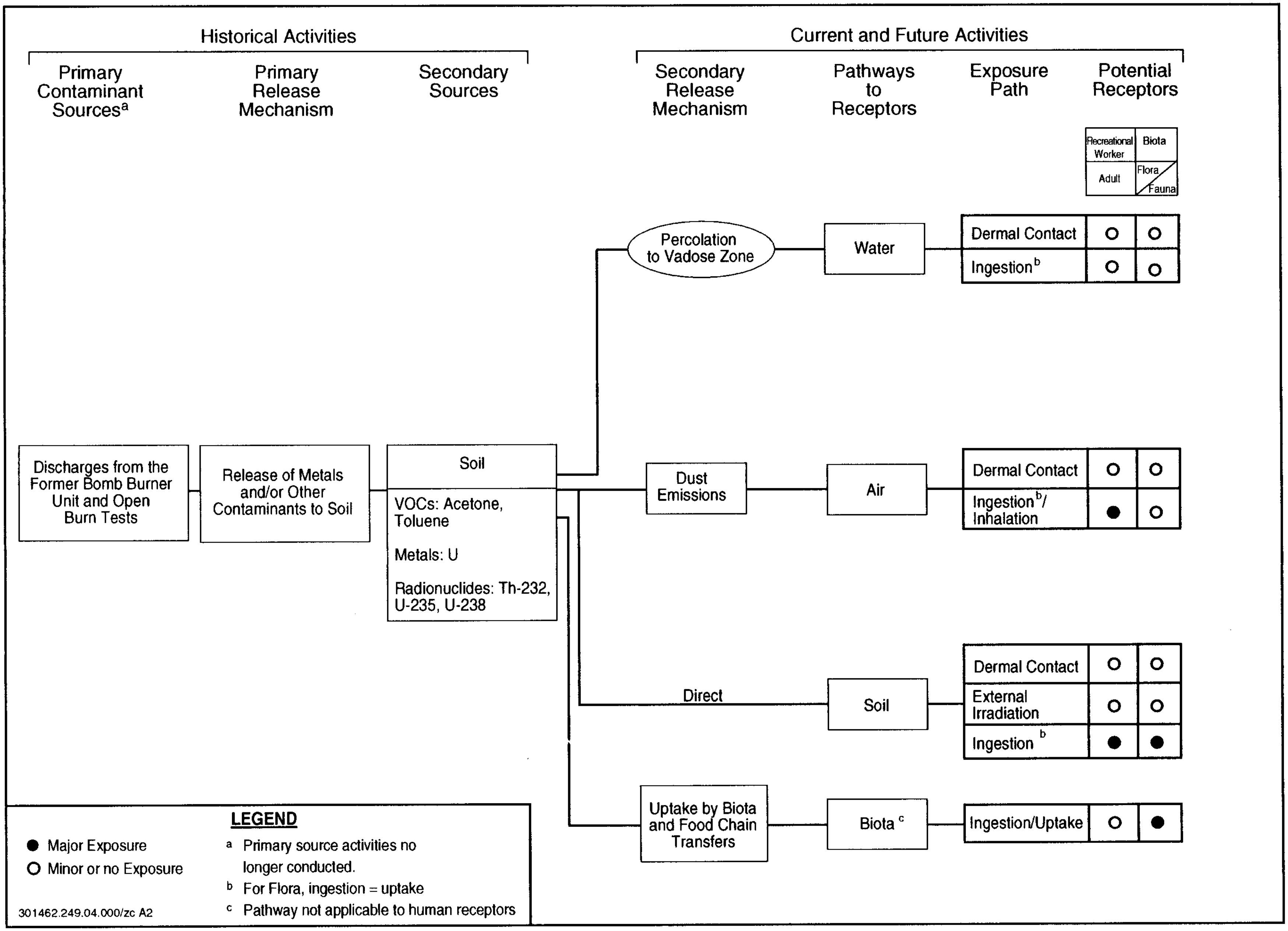

Figure 2.5.2-1

Conceptual Model Flow Diagram for SWMU 94C, Bomb Burner Area and Discharge Line

Table 2.5.1-1 summarizes potential COCs for SWMU 94C. Based upon the nature and extent of contamination at the site, metals and radionuclide COCs occur sporadically in surface soil at isolated location within the site boundary. No distinct horizontal distribution of contamination is present. The depth to groundwater is approximately 150 feet bgs. High partitioning coefficients and low mobility of the COCs in soil media indicate the COCs will not migrate, but will instead tend to stay fixed in the surface soil. Therefore, groundwater is not considered a viable contaminant pathway. All potential COCs were retained in the conceptual model and were evaluated in the human health and ecological risk assessments.

The current land use for SWMU 94C is industrial. However, because the future land use for SWMU 94C is recreational (DOE et al. October 1995), the potential human receptor is considered a recreational user of the site. For all applicable pathways, the exposure routes for the recreational user are dermal contact and ingestion/inhalation. Only ingestion of soil is considered a major exposure route for the recreational user. Potential biota receptors include flora and fauna at the site. Similar to the recreational user, direct ingestion of soil is considered the major exposure route for biota, in addition to ingestion through food chain transfers or direct uptake. Annex 2-E, Section V, provides additional discussion of the exposure routes and receptors at SWMU 94C.

2.6 Site Assessments

Site assessments at SWMU 94C include risk screening assessments followed by risk baseline assessments (as required) for both human health and ecological risk. The following sections summarize the site assessment results. Annex 2-E provides details of the site assessment.

2.6.1 Summary

The site assessment concludes that SWMU 94C has no significant potential to affect human health under a recreational land use scenario. After considering the uncertainties associated with the available data and modeling assumptions, ecological risks associated with SWMU 94C were found to be very low. Section 2.6.2 briefly describes and Annex 2-E provides details of the site screening assessments.

2.6.2 Screening Assessments

Risk screening assessments were performed for both human health risk and ecological risk for SWMU 94C. This section briefly summarizes the risk screening assessments.

2.6.2.1 Human Health

SWMU 94C has been recommended for recreational land use (DOE et al. October 1995). Annex 2-E provides a complete discussion of the risk assessment process, results, and uncertainties. Because COCs are present in concentrations or activities greater than background levels, it was necessary to perform a health risk assessment analysis for the site. Generally, COCs that were evaluated in this risk assessment included all detected organics and all inorganic and radiological COCs for which samples were analyzed. The risk assessment process provides a quantitative evaluation of the potential adverse human health effects caused by constituents in the site's soil by calculating the hazard index (HI) and excess cancer risk for a recreational land use setting. The excess cancer risk from nonradiological COCs and radiological COCs is not additive (EPA 1989).

In summary, the HI for a recreational land use setting calculated for SWMU 94C nonradiological COCs is 0.00, which is less than the numerical standard of 1.0 suggested by risk assessment guidance (EPA 1989). Incremental HI risk, determined by subtracting risk associated with background from potential nonradiological COC risk, is 0.00. There was no calculated excess cancer risk for SWMU 94C nonradiological COCs. NMED Guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (NMED March 2000), thus the excess cancer risk for this site is below the suggested acceptable risk value. There was no calculated incremental excess cancer risk.

The incremental total effective dose equivalent for radionuclides for a recreational land use setting for SWMU 94C is 5.02E-2 millirems (mrem)/year (yr), which is well below the recommended dose limit of 15 mrem/yr found in EPA's Office of Solid Waste and Emergency Response Directive No. 9200.4-18 (EPA 1997) and reflected in a document entitled, "Sandia National Laboratories/New Mexico Environmental Restoration Project—RESRAD Input Parameter Assumptions and Justification" (SNL/NM February 1998). The incremental excess cancer risk for the recreational land use scenario for the radionuclide COCs is 7.6E-7, which is much lower than risk values calculated from naturally occurring radiation and from intakes considered as background concentration values.

The residential land use scenarios for this site are provided only for comparison in the Risk Assessment Report (Annex 2-E). The report concludes that SWMU 94C does not have potential to affect human health under a recreational land use scenario.

2.6.2.2 Ecological

An ecological screening assessment that corresponds with the screening procedures (NMED March 1998) in the EPA's Ecological Risk Assessment Guidance for Superfund (EPA 1997) was performed as set forth by the NMED Risk-Based Decision Tree. An early step in the evaluation compared COC concentrations and identified potentially bioaccumulative constituents (see Annex 2-E, Sections III, VI, 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. Each of these items was presented in the "Predictive Ecological Risk Assessment Methodology for SNL/NM ER Program, Sandia National Laboratories/New Mexico" (IT July 1998) and will not be duplicated here. The screening also includes the estimation of exposure and ecological risk.

Tables 15, 16, 17, and 18 of Annex 2-E present the results of the ecological risk assessment screen. Site-specific information was incorporated into the screening assessment when such data were available. One hazard quotient greater than 1 was originally predicted; however, closer examination of the exposure assumptions revealed an overestimation of risk primarily attributed to exposure concentration (maximum COC concentration was used in estimating risk), the plant toxicity benchmark, and background risk. Based upon an evaluation of these uncertainties, ecological risks associated with this site are expected to be very low.

2.6.3 Baseline Risk Assessments

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

2.6.3.1 Human Health

Because human health results of the screening assessment summarized in Section 2.6.2.1 indicate that SWMU 94C does not have potential to affect human health under a recreational land use setting, a baseline human health risk assessment is not required for SWMU 94C.

2.6.3.2 Ecological

Because ecological results of the screening assessment summarized in Section 2.6.2.2 indicate that SWMU 94C has very low ecological risk, a baseline ecological risk assessment is not required for SWMU 94C.

2.6.4 Other Applicable Assessments

A surface-water site assessment was conducted at SWMU 94C in November 2000. The surface-water assessment guidance was developed jointly by Los Alamos National Laboratory and the NMED Surface-Water Quality Bureau. The assessment evaluated the potential for erosion from SWMU 94C. SWMU 94C received a score of 77.2, indicating that it has a relatively high erosion potential primarily due to the lack of vegetative or rock cover. The few COCs detected at the site were at scattered locations (Table 2.5.1-1), indicating that surface runoff is not causing contaminant migration at SWMU 94C. Additionally, as discussed under the Results and Conclusions (Section 2.4.4.2.2) and Screening Assessments (Section 2.6.2) sections, COCs detected are not at levels that pose a threat to human health or the environment or that could adversely affect surface-water quality.

2.7 No Further Action Proposal

2.7.1 Rationale

Based upon field investigation data and the human health risk assessment analysis, an NFA decision is recommended for SWMU 94C because no COCs (metals, VOCs, or radionuclides) were present in concentrations considered hazardous to human health for a recreational land use scenario.

2.7.2 Criterion

Based upon the evidence provided above, SWMU 94C is proposed for an NFA decision in conformance with Criterion 5 (NMED March 1998), which states, "The SWMU/AOC has been characterized or remediated in accordance with current applicable state or federal regulations, and that available data indicate that contaminants pose an acceptable level of risk under current and projected future land use."

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Annex 2-A

ANNEX 2-A
Summary of Testing Activities at SWMU 94
Lurance Canyon Burn Site

2A.0 INTRODUCTION

The Lurance Canyon Burn Site (LCBS) was used for testing fire survivability of transportation containers, weapons components, simulated weapons, and satellite components. Testing programs at the LCBS can be grouped into the following six categories related to burn structures:

- Portable pan burn tests
- Small surface impoundment (Solid Waste Management Unit [SWMU] 94E)
- Large Open Burn Pool (LOBP)
- Small Open Burn Pool (SOBP)
- Light Airtransport Accident Resistant Container (LAARC) Unit (Discharge Pit, SWMU 94F)
- Bomb Burner Unit (Lines at Discharge Pit, SWMUs 94C and 94D)
- Small Wind-Shielded (SWISH) Unit
- Smoke Emissions Reduction Facility (SMERF)
- Bunker 9830 and Support Buildings
- Aboveground tanks (SWMU 94A)
- Debris/soil mounds (SWMU 94B)
- Scrap Yard (SWMU 94G).

Table 2A-1 summarizes the burn testing structures and associated features at SWMU 94. This annex describes the historical operations at each of these structures and locations are shown on Figures 2A-1 and 2A-2.

2A.1 PORTABLE PAN BURN TESTS

The test log for SWMU 94 records 65 burn tests involving seven testing programs that took place in portable pans (Table 2A-1) (SNL/NM November 1994), but additional tests may have taken place prior to the first 1979 entry. Portable pan burn tests were conducted from approximately 1975 to 1991 (Palmieri April 1995a). Burn tests requiring a similar testing environment are now conducted in the SOBP. Round portable pans, 6 to 10 feet in diameter and 2 to 3 feet deep (Figure 2A-3), were set up with or without temporary chimneys in at least five locations within SWMU 94 (Gill November 1982, Hickox and Abitz December 1994, Palmieri April 1995a). These sites are just north and just south of the Small Surface Impoundment (SWMU 93E), south of the SWISH Unit in the Bomb Burner Unit trench and at the current-day

Table 2A-1
Summary of Burn Testing and Associated Operations at SWMU 94, Lurance Canyon Burn Site

Test Unit/Structure	Test Type/ Operation	Test Date	Number of Recorded Tests (SNL/NM November 1994)	Test/Operational Release Location	Test Materials/ Operational Release	Reference
Portable Pans	Open Burning	1975 to March 1991 1985 to 1987 (none conducted)	65 (minimum)	Primary Detonation Area (SWMU 65B) and Near Field Dispersion Area (SWMU 65D)	Detonations (HE, gun propellant, radionuclides)	SNL/NM November 1994 Moore September 1981 Larson and Palmieri October 1994 Caregeorges January 1994 Hickox and Abitz December 1994 Palmieri March 1995 Palmieri April 1995a
				None (most evaporated) Small Surface Impoundment	Wastewater (JP-4 fuel and water mixture)	
Small Surface Impoundment	Open Burning	pre-1979 to 1980	4	Subsurface infiltration	Wastewater (JP-4 fuel and water mixture)	SNL/NM November 1994
LOBP (30 x 60 feet)	Open Burning	1977 to present	53 (Includes Railcar Burn Test)	1977 test (evaporated) 1977 to 1983 (Inactive) 1983 to 1987 (SWMU 13) 1988 to present (COA POTW via trucking)	Wastewater (JP-4 fuel and water mixture, radionuclides)	Palmieri October 1994
SOBP (20 x 20 feet)	Open Burning	1992 to present	23	1992 to present (COA POTW via trucking; connected to the LOBP)	Wastewater (JP-4 fuel and water mixture)	SNL/NM November 1994 Palmieri October 1994
LAARC Unit	Enclosed Burning	June 1980 to August 1987	63	Unlined discharge pit	Wastewater (JP-4 fuel and water mixture)	SNL/NM November 1994
Bomb Burner Unit	Enclosed Burning	September 1982 to January 1988	23	Within Bomb Burner Unit	Detonations (HE radionuclides, metals)	SNL/NM November 1994
				Unlined discharge pit	Wastewater (JP-4 fuel and water mixture)	
			1 TABS Test	Bomb Burner Unit trench	Detonation (HE, radionuclides, metals)	

Refer to footnotes at end of table.

Table 2A-1 (Concluded)
Summary of Burn Testing and Associated Operations at SWMU 94, Lurance Canyon Burn Site

Test Unit/Structure	Test Type/ Operation	Test Date	Number of Recorded Tests (SNL/NM November 1994)	Test/Operational Release Location	Test Materials/Operational Release	Reference
SWISH Unit	Enclosed Burning	January 1983 to April 1990	61	None (never disposed of wastewater)	None (wastewater recirculated, never disposed)	SNL/NM November 1994 Author [unk] Date [unk]c Palmieri October 1994 Palmieri December 1994a
SMERF	Enclosed Burning	August 1992 to present	27	1992 to present (COA POTW via trucking)	None (wastewater recirculated)	
Bunker 9830	Enclosed Burning	1967 to present (Control Bunker/Storage) 1975 to 1988 (Burn Testing)	Cable testing 10 (fire suppressant)	None (contained within the bunker)	None	Larson and Palmieri August 1994 Palmieri November 1994a
Aboveground Tanks	Supply Water, JP-4 Fuel, and Coolant for Burn Testing	1980 to present	NA	Subsurface infiltration	Accidental spills of JP-4 fuel on soil	Hickox November 1994 Larson and Palmieri October 1994
Debris/Soil Mounds	Grading	pre-1992 to present	NA	Subsurface infiltration or surface runoff	Metals or radionuclides leachate	Palmieri April 1995a
Scrap Yard	Storage of surplus test materials	1980 to present	NA	Subsurface infiltration	Accidental spills of hydraulic oils on soil	Hickox November 1994 Larson and Palmieri October 1994 Palmieri November 1994b

COA = City of Albuquerque.
HE = High explosive(s).
JP-4 = Jet fuel composition 4.
LAARC = Light Airtransport Accident Resistant Container.
LOBP = Large Open Burn Pool.
NA = Not applicable.
POTW = Publicly Owned Treatment Works.
SMERF = Smoke Emission Reduction Facility.
SNL/NM = Sandia National Laboratories/New Mexico.
SOBP = Small Open Burn Pool.
SWISH = Small Wind-Shielded (Unit).
SWMU = Solid Waste Management Unit.
TABS = Torch Activated Burn System.

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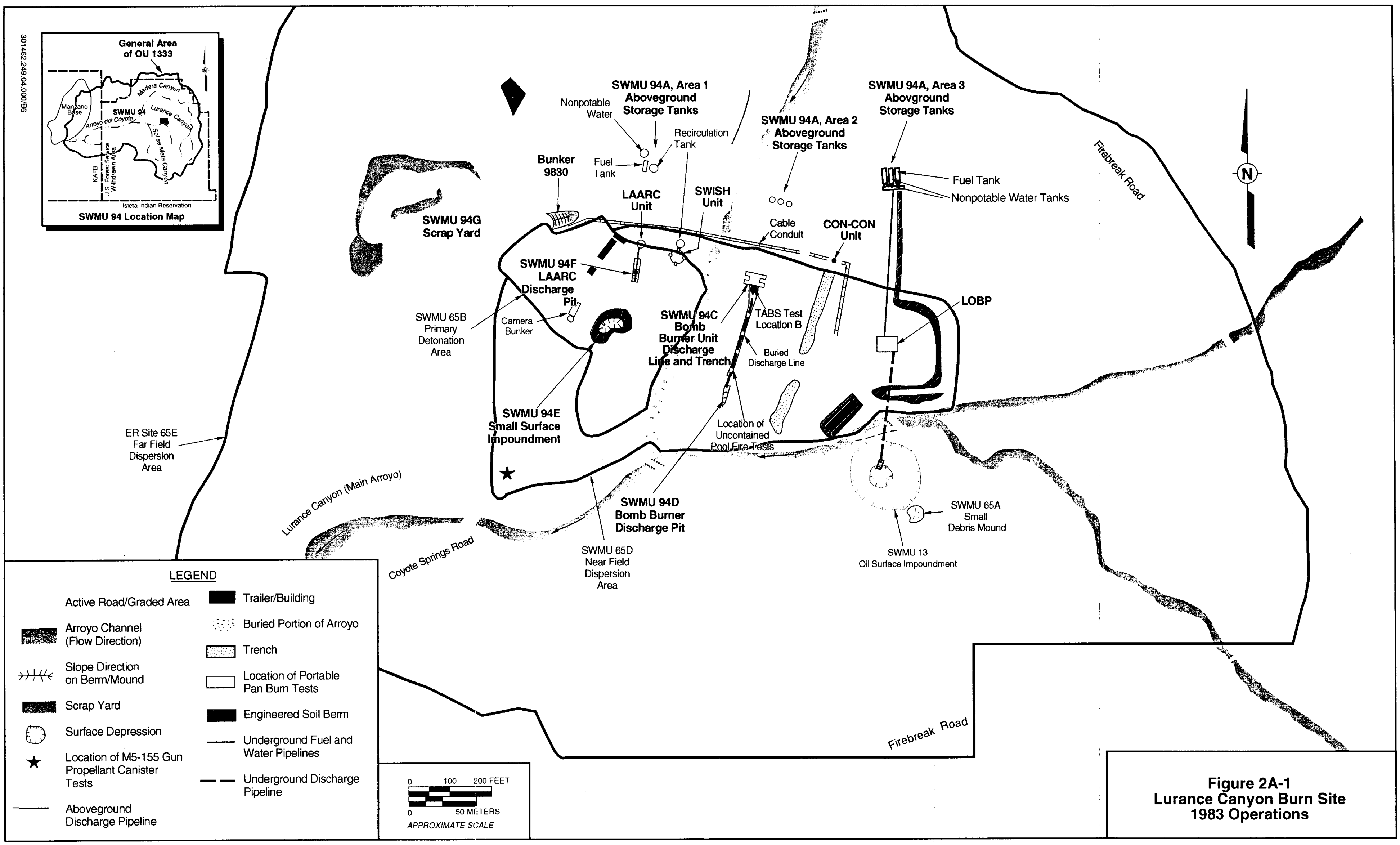


Figure 2A-1
Lurance Canyon Burn Site
1983 Operations

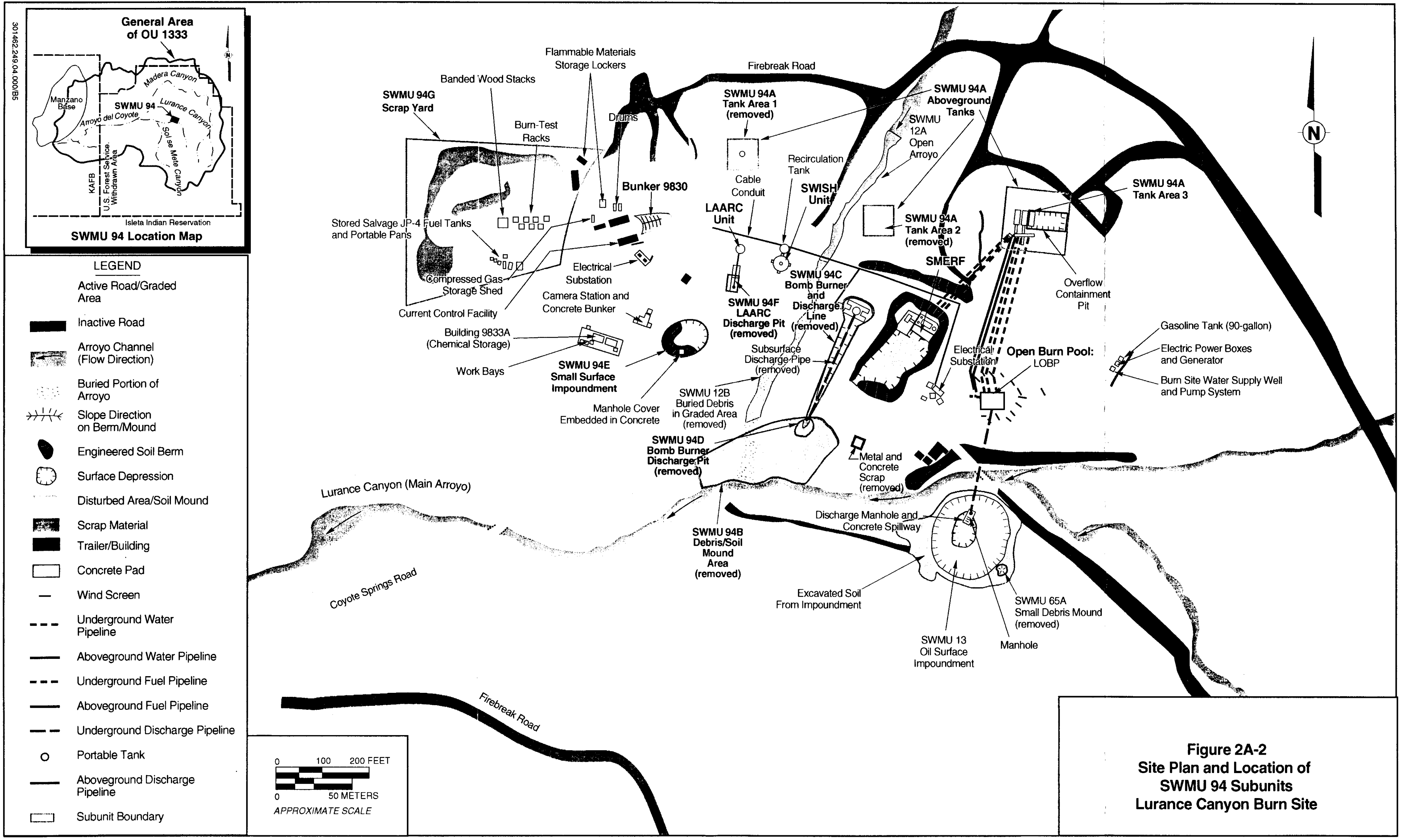
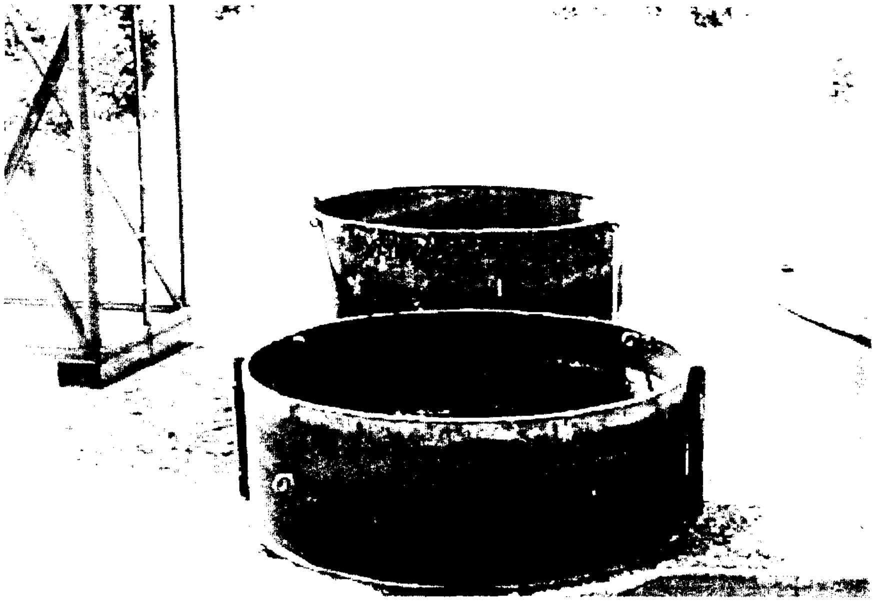


Figure 2A-2
Site Plan and Location of
SWMU 94 Subunits
Lurance Canyon Burn Site



Photograph of portable pans in the southern portion of the scrap yard in April 1995. The pans held JP-4 fuel and water used in small-scale burn tests at SWMU 94.

Figure 2A-3
Photograph of Portable Pan

location of the SOBP (Palmieri April 1995a). Following a test, water remaining in the portable pans was typically left to evaporate (Jercinovic et al. November 1994). However, some wastewater from the portable pans may have been discharged into the Small Surface Impoundment fuel fire at a minimum temperature of 1,850 degrees Fahrenheit (°F) (Caregeorges January 1994). After completing the test, the test unit was swipe tested to determine whether uranium dioxide was released (Larson and Palmieri October 1994). No radioactivity was found on the swipe samples.

Uncontained Pool-Fire Tests

In September 1981, five tests of uncontained pool fires were conducted in the area of the Bomb Burner Unit trench (SWMU 94C) to investigate the size of a fire produced from fuel leaking from an aircraft wing. Jet fuel composition 4 (JP-4) fuel was pumped from a 55-gallon tank onto a steel plate that rested on a pan, which was then covered with a concrete pad. A portable chimney was placed over the pan. The JP-4 fuel was pumped onto the steel plate at varying rates to control the size of the burn pool. No other materials were burned (Moore September 1981, Hickox and Abitz December 1994). These tests occurred prior to the first portable pan entry in the log book.

Gun-Propellant Canister Tests

In October 1982, five burn tests involving exposure of M5-155 gun-propellant canisters to JP-4 fuel fires were performed at SWMU 94 (Gill November 1982, Palmieri March 1995, SNL/NM November 1994) in a portable pan located near the entrance to the site (Figure 2A-1). Gun and rocket propellants are composed primarily of nitrocellulose, but they differ in that gun propellant does not contain aluminum or potassium perchlorate (Hickox and Abitz December 1994). The purpose of the 11-minute burn tests was to observe and record the behavior of gun-propellant canisters in a fully engulfing fire representative of an accidental fire situation. A portable pan (6 feet in diameter and 2 feet deep) with an air curtain system was used for the tests. The air curtain, produced by a fan rated at 14,000 cubic feet per minute to blow air through an annular area around the lip of the burn pan, protected the fire from wind effects. In three of the tests, the M5-155 gun-propellant canister was breached in approximately 100 seconds, as evidenced by a brilliant flash associated with the ignition of the gun propellant. An accelerated burning of the fire ensued for about 15 to 20 seconds, presumably corresponding to the consumption of the gun propellant. In two of the tests, the accelerated burning stage was followed by an igniter explosion, which is not considered a large explosion (Hickox and Abitz December 1994). The igniter consisted of a mild detonating fuse surrounded by barium nitrate. No detailed information is available for two of the five tests.

Slow-Heat Tests

The vented slow-heat tests conducted in 1983 (Mata December 1983) were designed to investigate whether the combustion products of burning PBX-9502 (TATB-95 percent, Kel-F 800-5 percent) (Dobratz and Crawford January 1995) explosive would vent from the test unit without reaching critical internal pressure that would cause an explosion. A corrugated culvert chimney was placed over a portable burn pan in the Bomb Burner Unit trench, and a hole was cut in the side for a large water-cooled lever arm. The lever arm portion inside the corrugated culvert chimney extended over the portable pan. A mock weapon containing high explosives (HE) was placed on the end of the lever arm that extended over the burn pool, and the other end of the lever arm was attached to a piston-like instrument that determined the change in mass of the HE inside the weapon as a function of burn time (Hickox and Abitz December 1994). Two burn tests were conducted to demonstrate the successful operation of the water-cooling system. On October 4, 1983, a third test with a vented stainless steel casing containing insensitive (i.e., nonshockwave initiated) HE was conducted in a JP-4 fuel fire at a nominal temperature of 2,000°F for approximately 60 minutes (Mata December 1983, Hickox and Abitz December 1994). The HE inside the weapon was completely burned without an explosion.

Nitromethane Calibration Tests

Thirty-eight nitromethane calibration tests were conducted at SWMU 94 between September and October 1984 (SNL/NM November 1994). The tests involved filling test units with nitromethane and exposing them to a JP-4 fuel fire. The purpose of these tests was to calibrate detonation velocity using liquid nitromethane and Composition-1 (C-1) and Composition-7 explosives (Palmieri March 1995). The tests were conducted in the Bomb Burner Unit trench. A trial test was conducted in August 1984 using gasoline rather than nitromethane. Neither the trial test using gasoline nor the first two nitromethane tests completely detonated the C-1 explosives. The remaining 36 tests were high-order detonations (see SNL/NM November 1994 for additional information on these tests).

2A.2 SMALL SURFACE IMPOUNDMENT

SWMU 94E, Small Surface Impoundment is approximately 60 feet long, 25 feet wide, and less than 2 feet deep (Figure 2A-1) (Palmieri December 1994b, SNL/NM August 1994). The inactive impoundment is surrounded by low soil berms on the south and west sides (Larson and Palmieri October 1994) (Figures 2A-4a and 2A-4b). A crude concrete trough approximately 3 feet long is located at the northeastern edge of the impoundment, and a manhole is on the southern edge of the impoundment (Hickox November 1994, Palmieri December 1994b) (Figure 2A-4a). The exact use of the manhole is not known (Hickox November 1994, Palmieri December 1994b). It is believed that the small surface impoundment was used once to burn JP-4 fuel as a test demonstration (Jercinovic et al. November 1994). The first three log book entries (from October 1979 through February 1980) reference the "old facility" and the "culvert facility," which refer to portable chimney setups in the small surface impoundment (Palmieri April 1995a, SNL/NM November 1994). These tests consisted only of JP-4 fuel fires and investigated the effectiveness of controlling the flames with portable chimneys. The impoundment currently receives storm runoff from the northwestern portion of the site and may have received liquids from the portable pans (Jercinovic et al. November 1994).

2A.3 THE LARGE OPEN BURN POOL

The LOBP is an active burn unit located approximately 200 feet southeast of the SMERF (SNL/NM August 1994) (Figure 2A-2). The pool is formed by a rectangular concrete basin 30 by 60 feet and 3 feet deep (Figure 2A-5a) and is concrete/fiber-ceramic-lined (Palmieri October 1994, Larson and Palmieri October 1994). Fire tests at the LOBP were primarily performed on a variety of shipping containers, most of which burned in the LOBP and contained

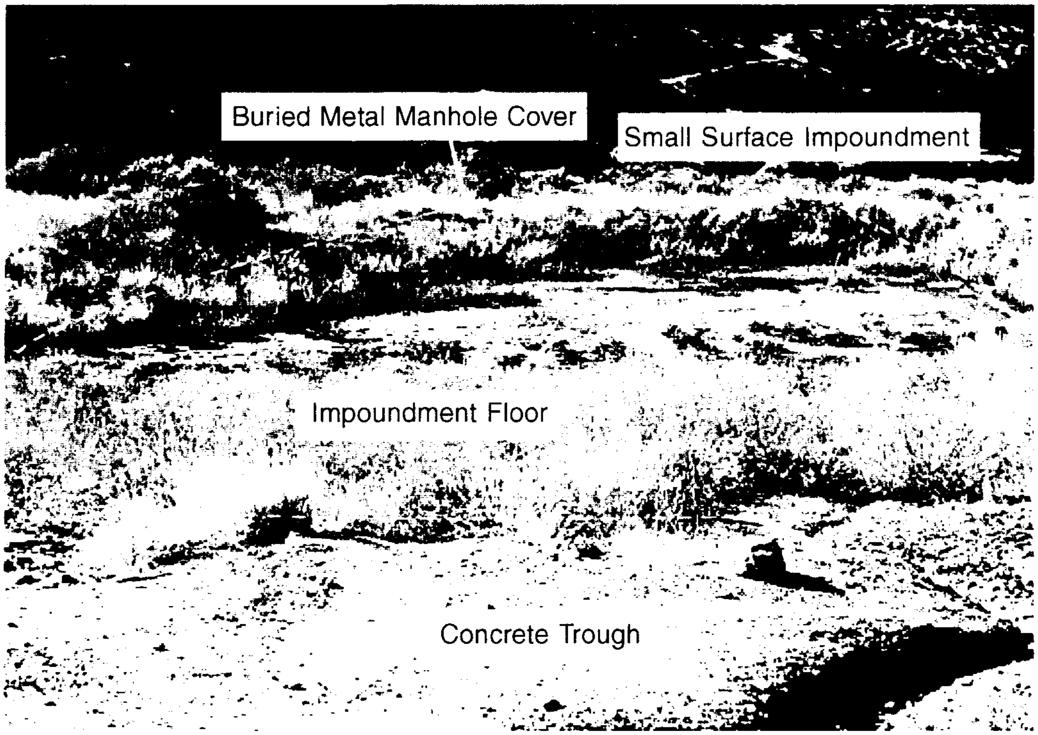


Figure 2A-4a Photograph of the small surface impoundment (SWMU 94E) in December 1994. The impoundment is located east of the camera bunker. View is to the southwest.

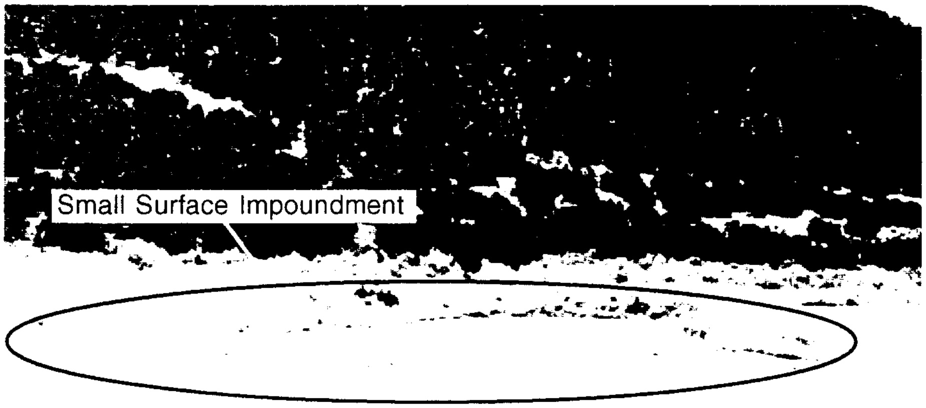


Figure 2A-4b Photograph of the small surface impoundment (SWMU 94E) in April 1995. Photograph was taken from the direction of surface runoff. View is to the southwest.

Figure 2A-4
Photographs of SWMU 94E, Small Surface Impoundment

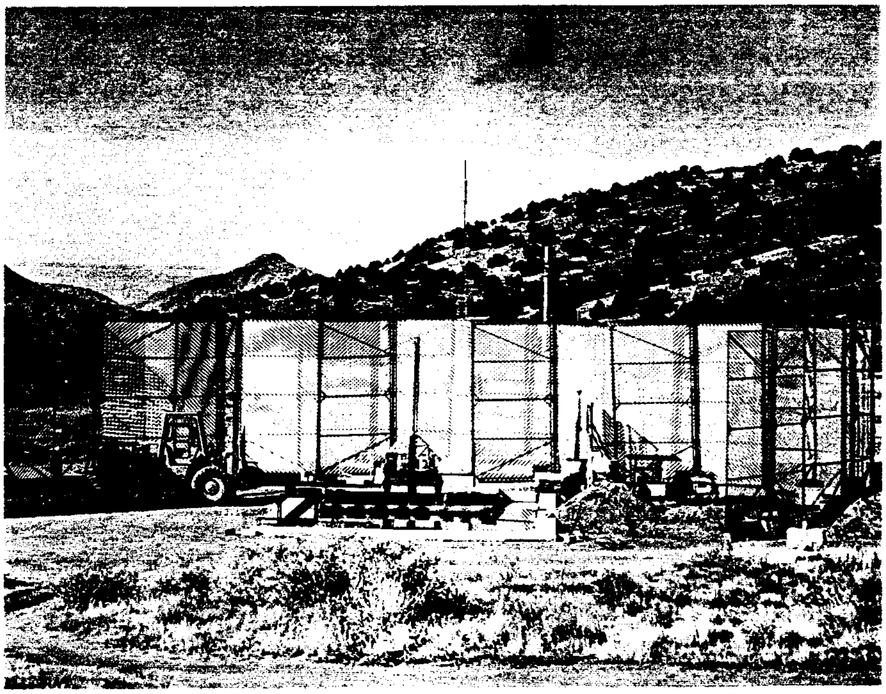


Figure 2A-5a Photograph of the LOBP under construction at SWMU 94 in 1977. View is to the northwest.

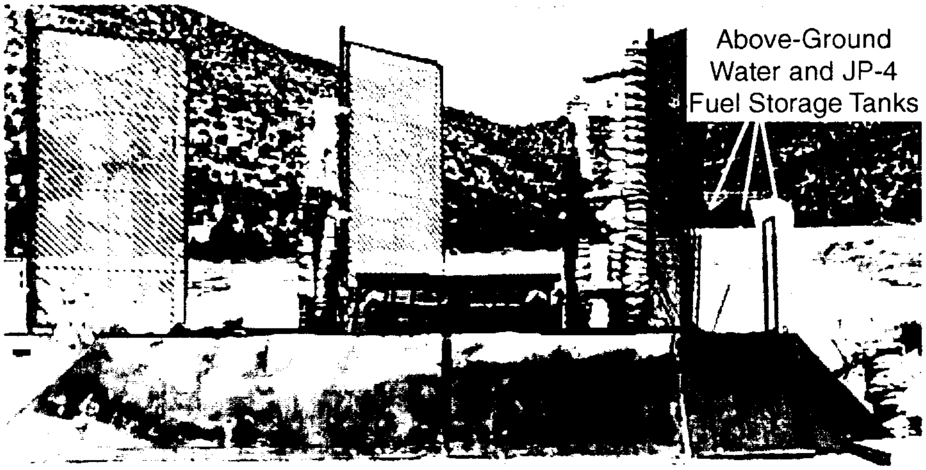


Figure 2A-5b Photograph of the SOBP at SWMU 94 in April 1995. View is to the north.

Figure 2A-5
Photographs of Large Open Burn Pool and Small Open Burn Pool

no radioactive materials (Palmieri October 1994). However, one test in 1991 involved an H1501 accident-resistant container unit that did contain uranium-238 and beryllium (SNL/NM November 1994).

The LOBP was built in 1977 in order to conduct the Railcar Burn Test (synonymous with the Yankee Cask Test) (Palmieri October 1994, Jercinovic et al. November 1994, Palmieri December 1994c). Wastewater from this burn test was left in the LOBP to evaporate. Following the Railcar Burn Test in 1977, the LOBP was inactive until testing resumed in June 1983 (Jercinovic et al. November 1994, Palmieri March 1995, SNL/NM November 1994).

In 1983 a drain was installed in the LOBP (Jercinovic et al. November 1994) in order to facilitate test unit access following a burn test. The drain was connected to the Oil Surface Impoundment (SWMU 13) with 24-inch-diameter corrugated culvert pipe. The Oil Surface Impoundment is located approximately 200 feet south of the LOBP (Figure 2A-2) (Palmieri October 1994, Jercinovic et al. November 1994).

Fifty-two burn tests have been conducted in the LOBP from June 1983, when burn testing resumed, to the present. From 1984 to 1987, the operational practice was to discharge the water and residual JP-4 fuel from the LOBP to the Oil Surface Impoundment after the JP-4 fuel burned out. Nine tests in the LOBP discharged wastewater to the impoundment through the underground corrugated piping system during this time period (Larson and Palmieri October 1994, Jercinovic et al. November 1994). In 1987 waste-water discharges to the impoundment ceased (Palmieri October 1994, Larson and Palmieri October 1994), and a closed-loop, recirculation system was constructed between the LOBP and the aboveground tanks (SWMU 94A) north of the LOBP. All wastewater associated with the burn testing is currently recycled to these tanks for reuse in subsequent burn tests. Recycled wastewater is periodically tested and pumped into tanker trucks, removed from the site, and released to the City of Albuquerque (COA) publicly owned treatment works under the Sandia National Laboratories/New Mexico (SNL/NM) allotment of 1 million gallons per year (Palmieri December 1994d). Nonhazardous solid waste such as damaged ceramic insulation was disposed of at the Kirtland Air Force Base landfill (Author [unk] Date [unk]a, Martz September 1985, Author [unk] Date [unk]d). The personnel conducting the tests are responsible for the disposal of solid residues remaining in the bottom of the LOBP (Larson and Palmieri October 1994).

2A.4 THE SMALL OPEN BURN POOL

The SOBP (an active burn unit) is located approximately 8 feet west of the LOBP (Figure 2A-2). The SOBP was built in 1992 in order to reduce the amount of fuel required to perform the same length test in the LOBP and, thereby, reduce the total smoke emissions (Palmieri October 1994). Since its construction, 23 burn tests have been conducted in the SOBP on transportation containers and weapons components (SNL/NM November 1994). The pool is formed by a square concrete basin 20 by 20 feet and 3 feet deep and is lined with sheet steel (Figure 2A-5b). Metal sheets have been welded together and to the metal pan, so that a skirt is formed around the pan at a 45-degree angle. A metal mesh drain is located in the northeastern corner of the SOBP and is connected to the LOBP with a 2-inch-diameter underground pipeline. Wastewater is drained from the SOBP to the LOBP in order to recirculate it back to the aboveground storage tanks to the north (Figure 2A-2) (Palmieri April 1995a). Two aboveground 3.5-inch-diameter galvanized metal pipes supply water and fuel to the SOBP from the aboveground tanks. These pipes connect into a single 3-inch-diameter pipe that enters the

SOBP. All testing in the SOBP was completely contained, and there have been no documented historical releases of hazardous constituents to the environment.

2A.5 THE LAARC UNIT

The LAARC Unit is an inactive burn unit located approximately 200 feet east of Bunker 9830 (SNL/NM August 1994) (Figures 2A-2 and 2A-6a). This unit was the first permanent structure constructed at the site. The unit was constructed in approximately 1980 and was used for 63 fire tests of small transportation containers and mock weapons (Moore June 1982, Cocke May 1984, Luna and Moore June 1983, Moore and Luna February 1983, Palmieri October 1994, Jercinovic et al. November 1994, Larson and Palmieri August 1994). The LAARC Unit was last used in August 1987 (SNL/NM November 1994; Author [unk], January 1993; Palmieri December 1994a) under an assurance of discontinuance with the City of Albuquerque Air Pollution Bureau (Palmieri October 1994).

The burn pan located inside the unit is approximately 10 feet in diameter (Moore and Luna February 1983) (Figure 2A-7). The LAARC received water and JP-4 fuel through an underground pipeline from aboveground tanks located approximately 200 feet north of the unit (Figure 2A-1) (Palmieri April 1995a). Wastewater was discharged from the burn pan through a 12-inch-diameter aboveground pipe to the LAARC Discharge Pit (SWMU 94F) located approximately 50 feet south of the unit (Figure 2A-6b).

The wastewater was released into a 55-gallon drum in the bottom of the unlined discharge pit (Figures 2A-6b and 2A-7) (Martz November 1985). The drum functioned as a flame arrestor, sealing off and extinguishing any burning JP-4 fuel discharged with the wastewater (Jercinovic et al. November 1994). As much as 1,500 gallons of wastewater per test may have been discharged into the pit.

2A.6 THE BOMB BURNER UNIT

The Bomb Burner Unit (also referred to as the Corrugated Facility) was removed in 1997 under the SNL/NM decommissioning and demolition program. The Bomb Burner Unit was constructed of corrugated galvanized steel and mantled by a concrete platform (Figure 2A-8a). It is located approximately 200 feet southeast of the SWISH Unit (SNL/NM August 1994) (Figure 2A-2). The Bomb Burner Unit was constructed in 1982 (Palmieri October 1994, Jercinovic et al. November 1994). Between 1982 and its shutdown in 1988, it was used for 23 burn tests involving the exposure of weapons (some containing depleted uranium) and components to abnormal environments (Hooper May 1983, Stevenson December 1985, Mata December 1983, Palmieri October 1994). The Bomb Burner Unit was built inexpensively as an expendable duplicate of the LAARC Unit for conducting burn tests on weapons to avoid risking damage to the LAARC Unit through a possible weapons detonation (Jercinovic et al. November 1994). The Bomb Burner Unit was closed in 1988 under an assurance of discontinuance agreement with the COA Air Pollution Bureau (Palmieri October 1994). The “RCRA [Resource Conservation and Recovery Act] Facility Investigation [RFI] Work Plan for Operable Unit [OU] 1333, Canyons Test Area” (SNL/NM September 1995) summarizes the tests conducted at the Bomb Burner Unit.

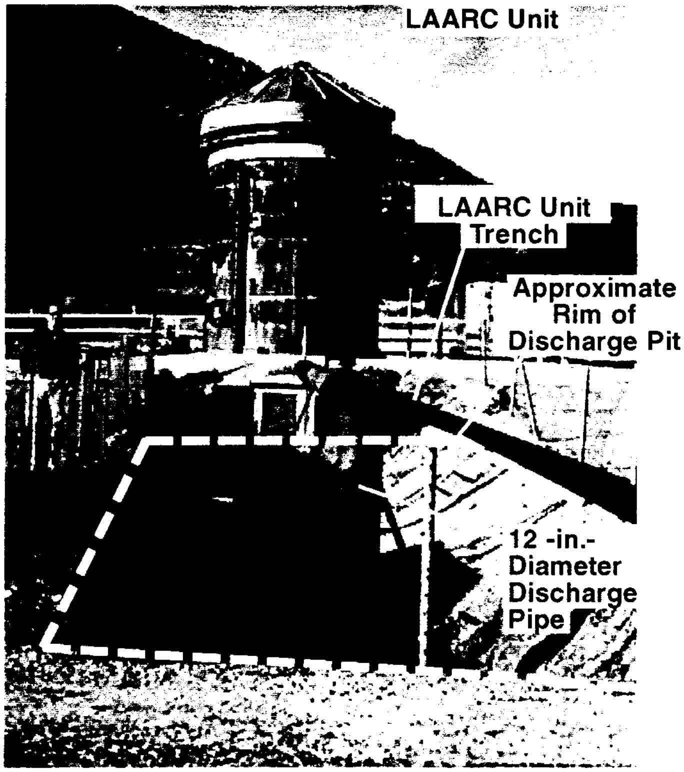


Figure 2A-6a February 1993 photograph of the LAARC Unit trench and discharge pit (SWMU 94F) showing the wastewater management system. Dashed lines show approximate location of the discharge pit rim. View is to the north.

Figure 2A-6b Photograph of LAARC Unit discharge pit (SWMU 94F). The wastewater is discharged through the 12 in.-diameter pipe into a 55-gal drum. The wastewater subsequently overflows into the pit.

Figure 2A-6
Photographs of LAARC Unit and
SWMU 94F, LAARC Unit Discharge Pit

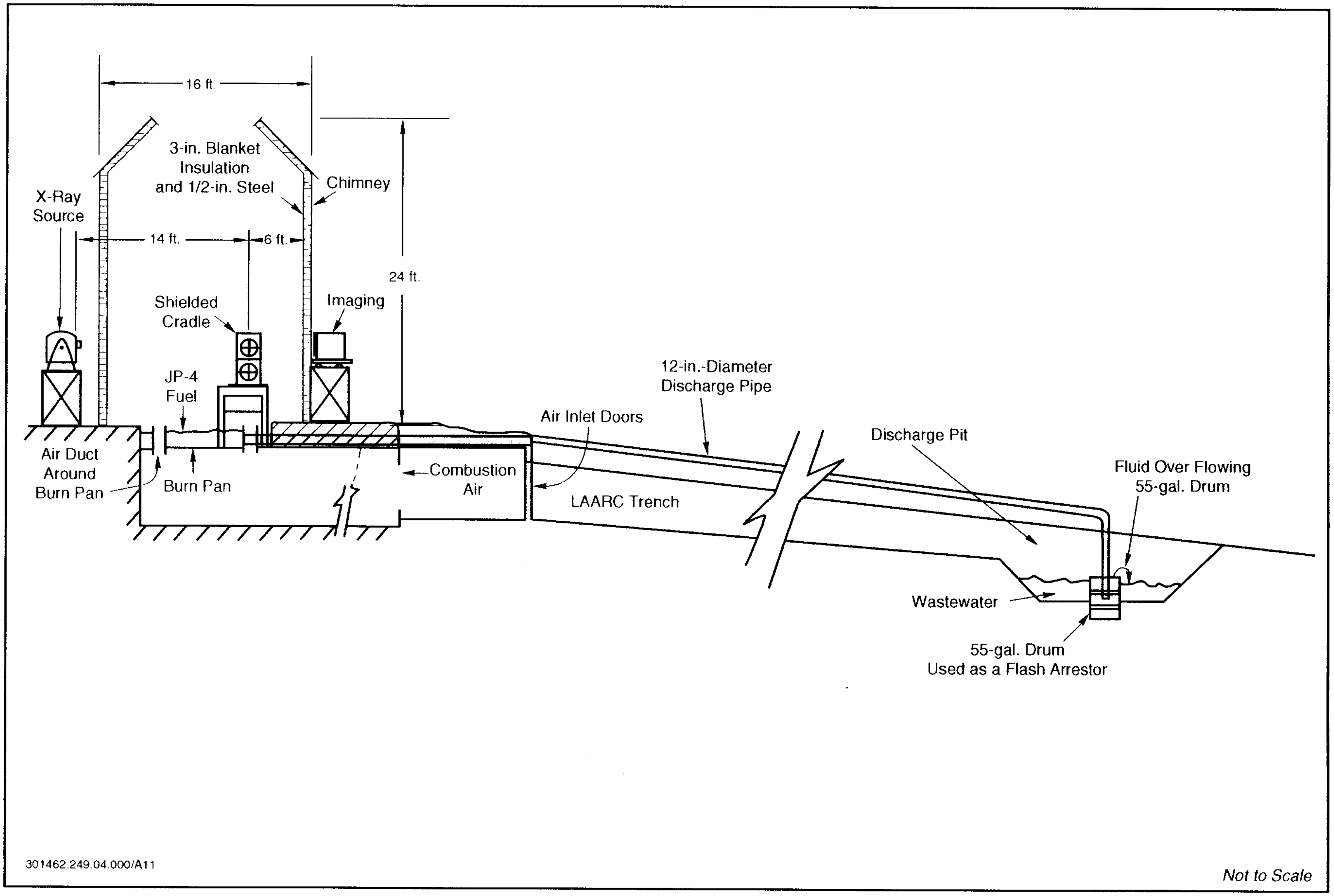


Figure 2A-7
Cross Section of LAARC Unit Showing Aboveground Burn Pan Test and Wastewater System

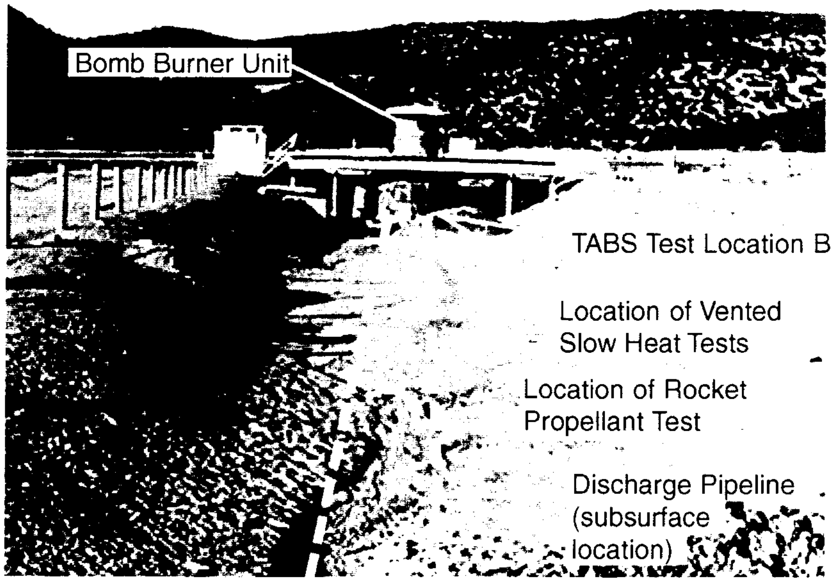


Figure 2A-8a Photograph of the Bomb Burner area and discharge line (SWMU 94C) in February 1993. Approximate locations of the discharge pipeline, TABS Test, Location B rocket propellant test, and vented slow-heat tests are indicated. The approximate location of the uncontained pool-fire tests, which were conducted at the southernmost end of the trench, is not pictured. View is to the north.

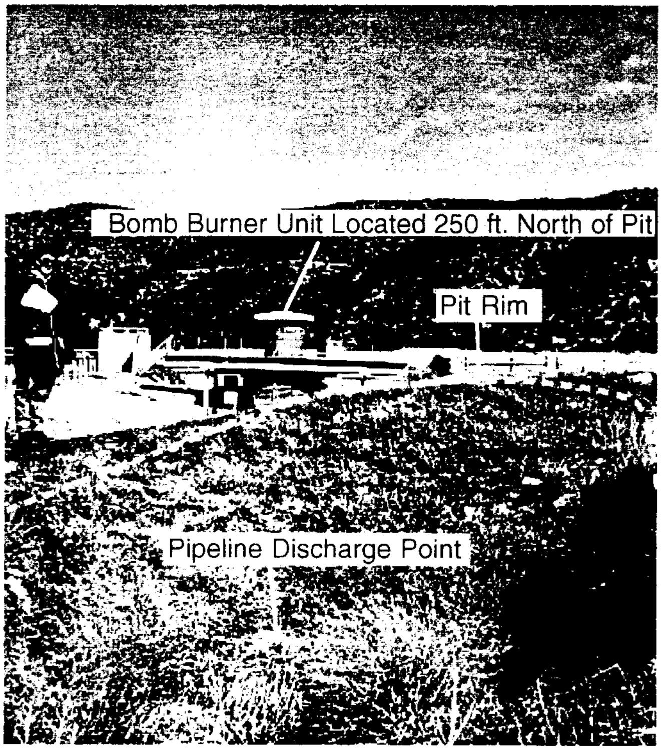


Figure 2A-8b Photograph of Bomb Burner discharge pit (SWMU 94D) in December 1994. The pit is approximately 10 ft wide x 25 ft long x 8 ft deep. View is to the north.

Figure 2A-8

Photographs of SWMU 94C, Bomb Burner Area and Discharge Line, and SWMU 94D, Bomb Burner Discharge Pit

The Bomb Burner Unit was constructed below ground level to contain potential explosions that might have occurred during burn tests. A shallow, open trench extending southward from the Bomb Burner Unit was constructed to provide vehicle and equipment access to the unit (Figure 2A-8a). Engineering drawings and maps suggest that fuel and water were supplied to the burn unit from three aboveground tanks formerly located approximately 200 feet north of the unit (Figure 2A-1) (SNL/NM 1983). These aboveground tanks have since been removed from the site. The burn pan used in the Bomb Burner Unit is 10 feet in diameter (Hooper May 1983, Mata December 1983). A 12-inch-diameter corrugated pipe connects the burn pan to the Bomb Burner Discharge Pit (SWMU 94D) located approximately 250 feet south of the Bomb Burner Unit (Figure 2A-1) (Palmieri October 1994, Jercinovic et al. November 1994). The discharge pit is approximately 25 feet long, 10 feet wide and 8 feet deep (Figure 2A-8b) (Palmieri December 1994d). Following tests that involved radionuclides, wastewater from the Bomb Burner Unit was screened for radiological activity before being released into the discharge pit (Palmieri October 1994). As many as 1,500 gallons of wastewater per test may have been discharged into the pit.

Test reports document a number of the tests at the Bomb Burner Unit (Hooper May 1983, Stevenson December 1985, Hill Date [unk], Mata December 1983) and describe the test set up and materials involved. The Bomb Burner Area and Discharge Line are designated as SWMU 94C. The remainder of this section describes two reported tests that are representative of the testing conducted in the Bomb Burner Unit.

In September 1982, a burn test was conducted on a W-69 warhead used in the SRAM missile (Hooper May 1983). Aluminum, steel, HE, and insulation materials were exposed to a JP-4 fuel fire in order to determine the response of the W-69 to an accidental fuel fire. The fuel fire was performed at a temperature of approximately 1,800°F for a total burn time of 95 minutes. The warhead remained in place on the test stand and, as expected, all aluminum and organic components melted (Hooper May 1983). The PBX-9404 HE did not detonate and was consumed in a nonviolent manner, and no warhead materials were expelled from the unit.

On March 9, 1983, a W-80 warhead was subjected to a high-intensity JP-4 fuel fire at a nominal temperature of 2,000°F for approximately 30 minutes (Hill Date [unk], Luna March 1983, SNL/NM November 1994). The purpose of the test was to determine the behavior of internal HE components and the inherent safety of the weapon when exposed to an accidental fuel fire. The test unit configuration consisted of the warhead external aluminum case, binary parts, live insensitive HE material, and a mass simulated canned subassembly placed 3.5 feet above the surface of the fuel. Test unit thermocouples were wrapped with cera-blanket insulation, shielded in a steel pipe, and then wrapped with additional insulation. The HE burned successfully without any explosive incident. Real-time radiography and video coverage of the warhead burn test was observed at Bunker 9830 (Hill Date [unk]).

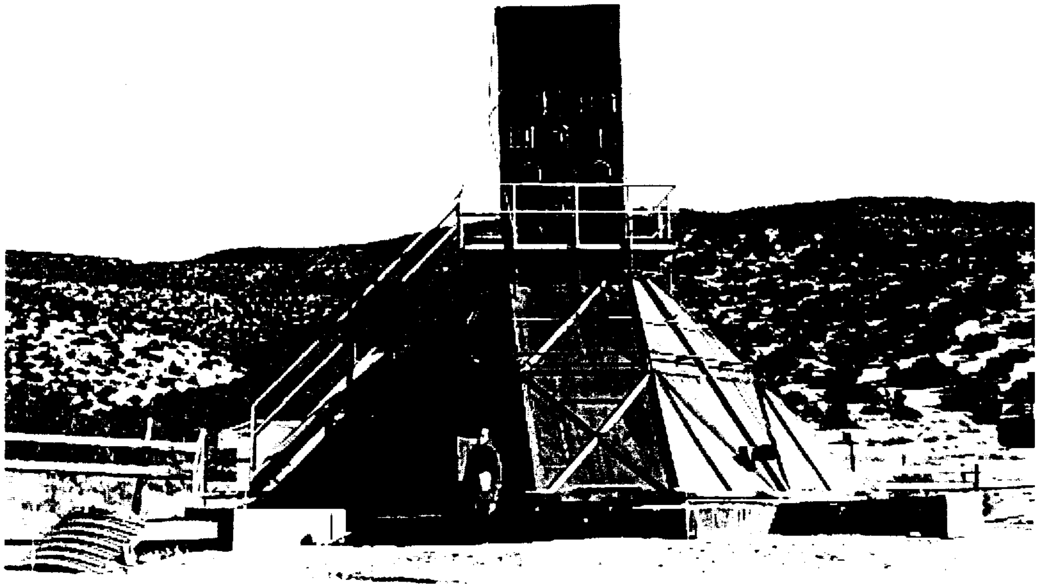
Several burn tests have been conducted in the Bomb Burner Unit trench since 1982, including portable pan burn tests such as the vented slow-heat tests and uncontained pool fires. Fuel-fire burn testing conducted in the trench includes the Torch Activated Burn System (TABS) test Location B (Figure 2A-1) and one series of rocket propellant tests. The TABS test Location B resulted in detonation within the trench.

2A.7 THE SWISH UNIT

The SWISH Unit (Figure 2A-9) is located approximately 300 feet east of Bunker 9830 (Figure 2A-2) (SNL/NM August 1994). This active unit was constructed in 1983 and is currently used to study the potential for protecting large pool burns from the wind (Author [unk] Date [unk]c, Palmieri October 1994, Palmieri December 1994a). The SWISH Unit is the prototype for meeting air-quality requirements while conducting burn tests. To request an exemption from opacity requirements, testimony was given before the COA and Bernalillo County Joint Air Quality Board on September 13, 1995. Approval for the requested exemption is expected in October 1995. This unit has been used in 61 tests where large explosives fragments or blast overpressures were not expected. Typical tests require small volumes (of up to 150 gallons) of JP-4 fuel and involve test units such as hazardous materials shipping containers, small weapon components and weapons mockups containing insensitive HE. Burn pools, typically ranging from 6 feet up to 9 feet in diameter and 3 feet in depth were placed in the center of the SWISH Unit floor, which is about 25 by 25 feet (Author [unk] Date [unk]c, Jercinovic et al. November 1994). The base of the structure tapers to a stack assembly 3 by 6 feet by 13 feet tall (Figure 2A-9). The stack is insulated and contains baffles to mix the flow and to reduce the visible air emissions. JP-4 fuel was delivered to the SWISH Unit using portable tanks (Hickox November 1994). Other records indicate that the small brown tank stationed between the SWISH and LAARC Units (Figure 2A-2) was used to store fuel for burn tests at either the SWISH or the LAARC Units (Palmieri December 1994b). The tank is portable, may have been supported by wheels, and holds approximately 100 gallons of fuel (Palmieri December 1994b). Wastewater from burn tests conducted in the SWISH Unit is not discharged but is allowed to evaporate (Palmieri December 1994e). There have been no documented historical releases of hazardous constituents to the environment. An external sprinkler system cools the walls of the SWISH Unit. Water circulation pipes and spray nozzles are situated at numerous points on the outside structure. Cooling water that does not evaporate is captured in a shallow trough at the base and is routed to an underground tank for storage and reuse. Burn tests at the SWISH Unit are primarily performed on shipping containers, although lithium batteries have also been burned in the facility (SNL/NM November 1994).

2A.8 THE SMERF

The SMERF (Figures 2A-10a and 2A-10b) is an active burn unit located approximately 150 feet east of the Bomb Burner Unit (Figure 2A-2). This facility was constructed after the removal of the Conical Container (CON-CON) Unit in 1988 as a scale-up of the SWISH Unit (Author [unk] Date [unk]c, Palmieri October 1994, Larson and Palmieri October 1994). The first recorded test at the SMERF was conducted in August 1992. This burn unit was built to test hazardous materials shipping containers, transportation systems, weapons mockups, and associated materials under actual fire accident conditions (Kent July 1994). Soil removed to enlarge the CON-CON Unit site for the SMERF was bermed to direct surface-water flow away from the burn site facilities into the main arroyo of the Lurance Canyon (Engineered Soil Berms, Figure 2A-2) (Larson and Palmieri October 1994). To date, the only burns conducted in the SMERF have been performance tests with JP-4 fuel (SNL/NM November 1994) to demonstrate compliance with the City of Albuquerque Air Pollution Bureau regulations (Kent July 1994). To request an exemption from opacity requirements, testimony was given before the COA and Bernalillo County Joint Air Quality Board on September 13, 1995. Pending approval for the requested exemption is expected in October 1995.



Photograph of the SWISH Unit at SWMU 94 in December 1994.
View is to the north.

Figure 2A-9
Photograph of SWISH Unit

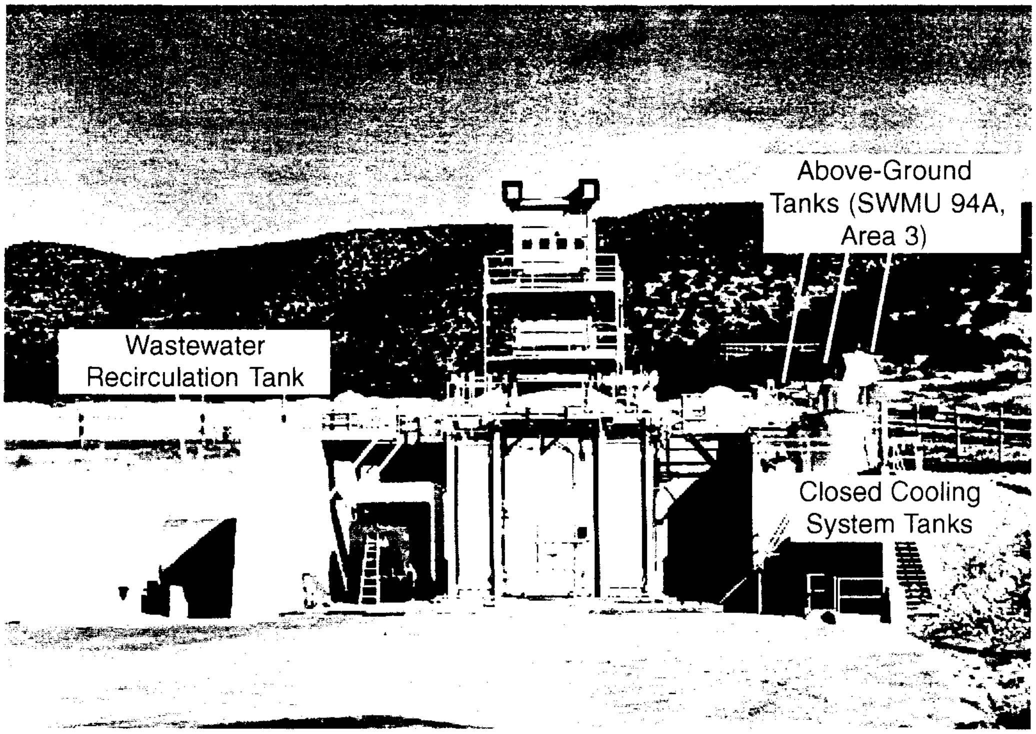


Figure 2A-10a Photograph of the SMERF at SWMU 94 in December 1994. View is to the north.

Figure 2A-10b Photograph of the SMERF conducting performance tests at SWMU 94 in December 1994. View is to the northeast.

Figure 2A-10
Photographs of SMERF

The SMERF is accessed by a shallow, open trench that rises southward to the entry road (SNL/NM August 1994). The unit consists of a cubical test chamber approximately 20 by 20 feet. The chamber contains a 10- by 10-foot-square burn pan (Author [unk] Date [unk]c) that can be reduced to an 8- or 7-foot-square configuration (SNL/NM November 1994).

A 20-foot-tall stack houses a passive afterburner to reduce smoke emissions (Author [unk] Date [unk]c, Kent July 1994). Underground pipelines connect the unit to two of the three aboveground tanks located north of the LOBP (SWMU 94A, Area 3). Two of the lines recirculate a glycol/water cooling mixture between the vertical walls, roof panels, and the storage tank. A third line supplies fuel from the JP-4 fuel tank. The underground pipes join the SMERF at a valve box on the northern side of the unit. The valves are marked "fuel," "water," and "water return." Three additional aboveground tanks are located inside a concrete berm enclosure on the eastern side of the SMERF. These tanks are connected to the incoming pipelines by 8- and 3-inch lines. The tanks are part of the water recirculation system. Two of these aboveground tanks are labeled "nonpotable water," and the third is labeled "water/glycol." These tanks are part of a closed recirculation system. Propylene glycol is used for active cooling of the walls and roof panels in the SMERF (Larson and Palmieri October 1994).

2A.9 BUNKER 9830 AND SUPPORT BUILDINGS

Bunker 9830, located approximately 200 feet northwest of the LAARC Unit (Figure 2A-1), was constructed in 1967 to house instrumentation for SWMU 65 activities. The eastern half of Bunker 9830 was used from 1975 though 1980 for fire tests on nuclear reactor control cables (Larson and Palmieri August 1994, Palmieri November 1994a). These tests were conducted as part of the reactor safety program in response to the Browns Ferry Reactor fire. In the initial test, a mockup of a nuclear reactor cable assembly was constructed in Bunker 9830 and was ignited to simulate the incident (Brouillard June 1994). The tests used heptane as a fuel source. The number of tests conducted is unknown. Fire suppression tests were conducted in Bunker 9830 from 1975 to 1980. A series of ten fire tests on cable insulation were conducted using propane gas (Palmieri April 1995e). The bunker is not involved in current SWMU 94 burn operations (Palmieri December 1994e) and is used to store equipment. All testing in Bunker 9830 was completely contained, and there have been no documented historical releases of hazardous constituents to the environment.

Several small trailers northwest of Bunker 9830 store equipment, tools, parts, insulation, cable, television monitors, instrumentation, and data systems (Larson and Palmieri October 1994). Several trailers are marked by placards indicating the storage of hazardous chemicals. According to interviewees, these designations are inaccurate for all but one identified trailer, because there actually is no chemical storage in these trailers (Larson and Palmieri October 1994, Palmieri December 1994b). Currently, all chemicals are stored in Building 9833A, which is located about 200 feet southwest of Bunker 9830 (Figure 2A-2) (Larson and Palmieri October 1994).

The control and instrumentation point for the Lurance Canyon Explosives Test Site during explosives testing was Building 9831 at SWMU 81 (New Aerial Cable Site). By 1979, the control facility was moved to what is now the lunch trailer (Palmieri April 1995a) located 30 feet from Bunker 9830. Currently, the control facility is set up in a trailer located off the southwest corner of Bunker 9830 (Figure 2A-1) (Larson and Palmieri August 1994). Cables radiate from each of the previous control facilities to the various burn site units (Larson and Palmieri October 1994).

2A.10 ABOVEGROUND TANKS

Aboveground tanks (SWMU 94A) have been used to supply water, JP-4 fuel, and coolant for burn testing at all of the engineered structures. There are three storage tank locations at SWMU 94 that served the LAARC Unit, the Bomb Burner Unit, the SMERF, the SOBP, and the LOBP. The aboveground tank locations include an area north of the LAARC Unit, north of the Bomb Burner Unit, and the current tank location north of the LOBP (Figure 2A-1). These three aboveground tank locations are discussed below.

North of the LAARC Unit (Area 1)

An aboveground tank labeled "nonpotable water" is currently located north of the LAARC Unit and was used to supply water to the unit (Figures 2A-1 and 2A-11a) (Hickox November 1994). Two aboveground tanks were also formerly used for fuel storage at this location (Kervin April 1981). These two tanks have since been removed.

North of the Bomb Burner Unit (Area 2)

The 1983 historical aerial photograph shows that three aboveground tanks were formerly located north of the Bomb Burner Unit (Figures 2A-1 and 2A-11b) (SNL/NM 1983). These aboveground tanks were used to supply JP-4 fuel and water for testing at the Bomb Burner Unit. The tanks are no longer present at the site, and no documentation exists that describes the installation and removal of the tanks. No physical evidence exists at the site to identify their former locations.

North of the LOBP (Area 3)

Three aboveground tanks are now located approximately 400 feet north of the LOBP: One contains JP-4 fuel, another contains nonpotable water, and the third contains glycol/water (Figures 2A-2 and 2A-11c). Prior to 1992, when the nonpotable water and glycol/water tanks were installed, there were two nonpotable water tanks in addition to a JP-4 fuel tank at the same location (Figure 2A-2) (Hickox November 1994). The current nonpotable water and JP-4 fuel tanks provide water and fuel for burn tests conducted at the LOBP, the SOBP, and the SMERF. The glycol/water is used as a coolant for the SMERF. A plastic-lined, earthen, secondary overflow containment pit is installed around the aboveground tank containing JP-4 fuel (Figure 2A-11d) (Larson and Palmieri October 1994).

Two underground pipelines connect the LOBP to the JP-4 fuel tank and to the nonpotable water tank. Two aboveground 3.5-inch-diameter galvanized metal pipelines connect the SOBP to the JP-4 fuel tank and to the nonpotable water tank. Three underground pipelines run from the tanks to the SMERF: One connects to the JP-4 fuel tank, and the other two provide glycol/water

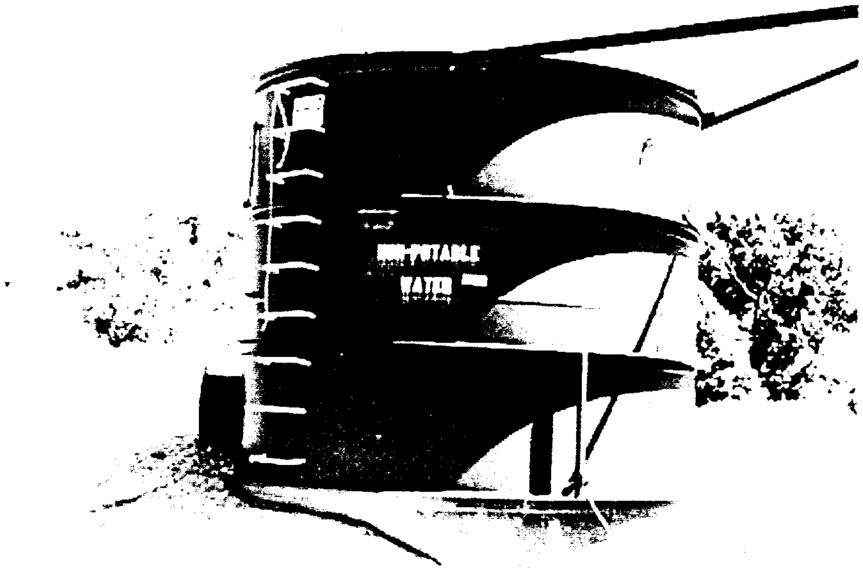


Figure 2A-11a Photograph of the above ground tank (SWMU 94A, Area 1) north of the LAARC Unit in April 1995. Additional above ground tanks storing fuel were located here when the LAARC was active. View is to the northeast.

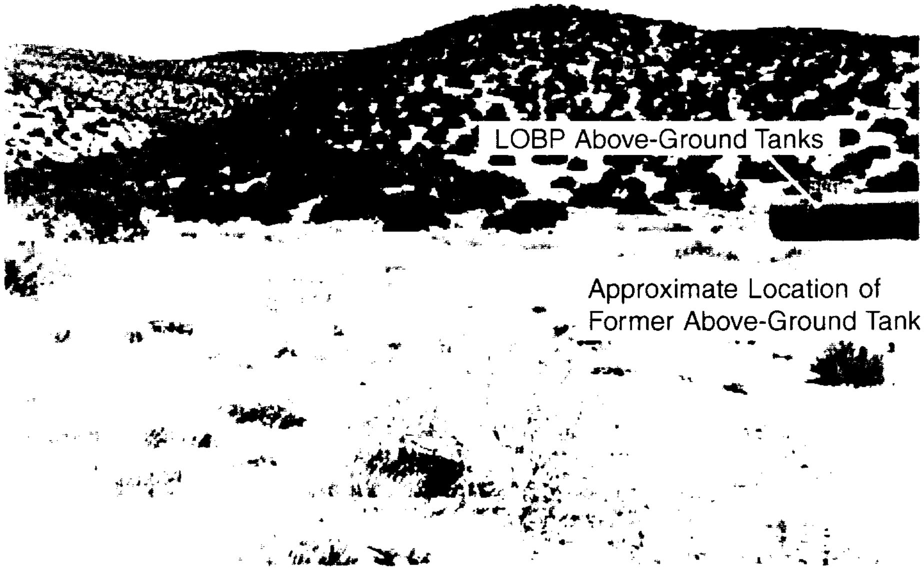


Figure 2A-11b Photograph of the former above ground tank location (SWMU 94A, Area 2) north of the Bomb Burner Unit in April 1995. The above ground tanks north of the LOBP are visable in the background. View is to the northeast.

Figure 2A-11

Photographs of SWMU 94A, Aboveground Tank North of LAARC Unit and Location of Former Aboveground Tank North of Bomb Burner Unit

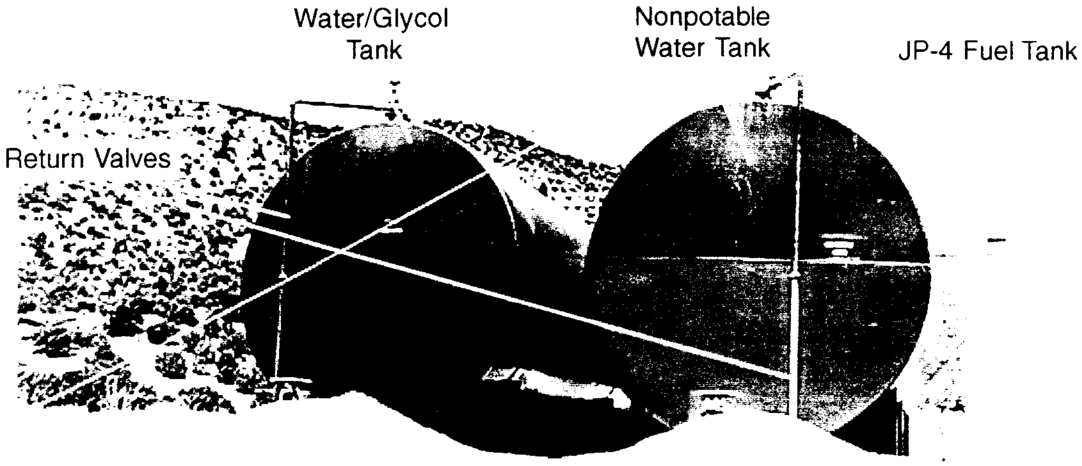


Figure 2A-11c Photograph of the aboveground tanks north of the LOBP (SWMU 94A, Area 3) in April 1995. The aboveground tanks provide the recirculation system for the LOBP, SOBP, and for the SMERF. Nonpotable water is recirculated back to the labeled tank following testing. View is to the north.

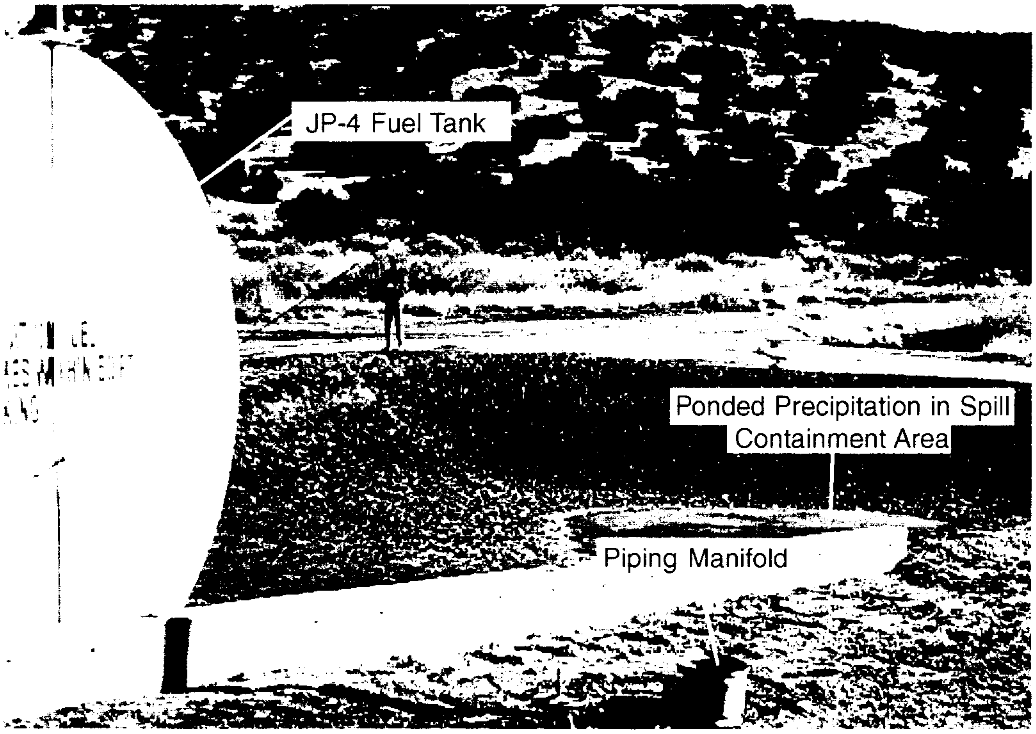


Figure 2A-11d Photograph of the spill containment area surrounding the JP-4 fuel aboveground tank (SWMU 94A, Area 3) north of the LOBP in December 1994. The spill containment area is constructed of soil overlying a plastic liner. View is to the northeast.

Figure 2A-11
Photographs of SWMU 94A, Aboveground Tanks North of LOBP

coolant for circulation between the vertical walls and roof panels of the SMERF. A recirculation system currently routes wastewater back to the water and water/glycol tanks for storage and reuse (Hickox November 1994, Larson and Palmieri October 1994).

2A.11 DEBRIS/SOIL MOUNDS

A Debris/Soil Mound Area (SWMU 94B) is located on the southern portion of SWMU 94, north of the main arroyo in the Lurance Canyon (Figures 2A-2 and 2A-12). There is little documentation for the origination of the debris/soil mound area, but this site appears to be the product of grading and soil redistribution during the evolution of SWMU 94 since 1983. The mounds, which range in height from about 3 to 6 feet, are not clearly defined but merge together. The only apparent debris in the soil mound area is concrete fragments, electrical cables, and wood (Figure 2A-12). Several radiological anomalies have been identified in the debris/soil mound area. The radiological anomalies may be associated with past activities at SWMU 65.

2A.12 SCRAP YARD

The Lurance Canyon Burn Site Scrap Yard (SWMU 94G) was started in 1980 in the northwestern portion of the site (Figures 2A-2 and 2A-13a) (Palmieri November 1994b). The scrap yard contains unused test equipment, portable generators, fiber/ceramic insulation, pipes, pump motors, cinder blocks, test stands, cables, wood, portable pans, empty tanks labeled JP-4, empty drums, and scrap metal (Figure 2A-13a and 2A-13b) (Hickox November 1994, Larson and Palmieri October 1994). In approximately 1990, hydraulic oil leaked onto the soil in the equipment/scrap yard (Larson and Palmieri October 1994). This is the only documented release of liquid at the scrap yard. The affected soil was placed in 55-gallon drums and removed (Larson and Palmieri October 1994). No other containerized fluids have ever been (nor are expected to be) stored in the scrap yard.

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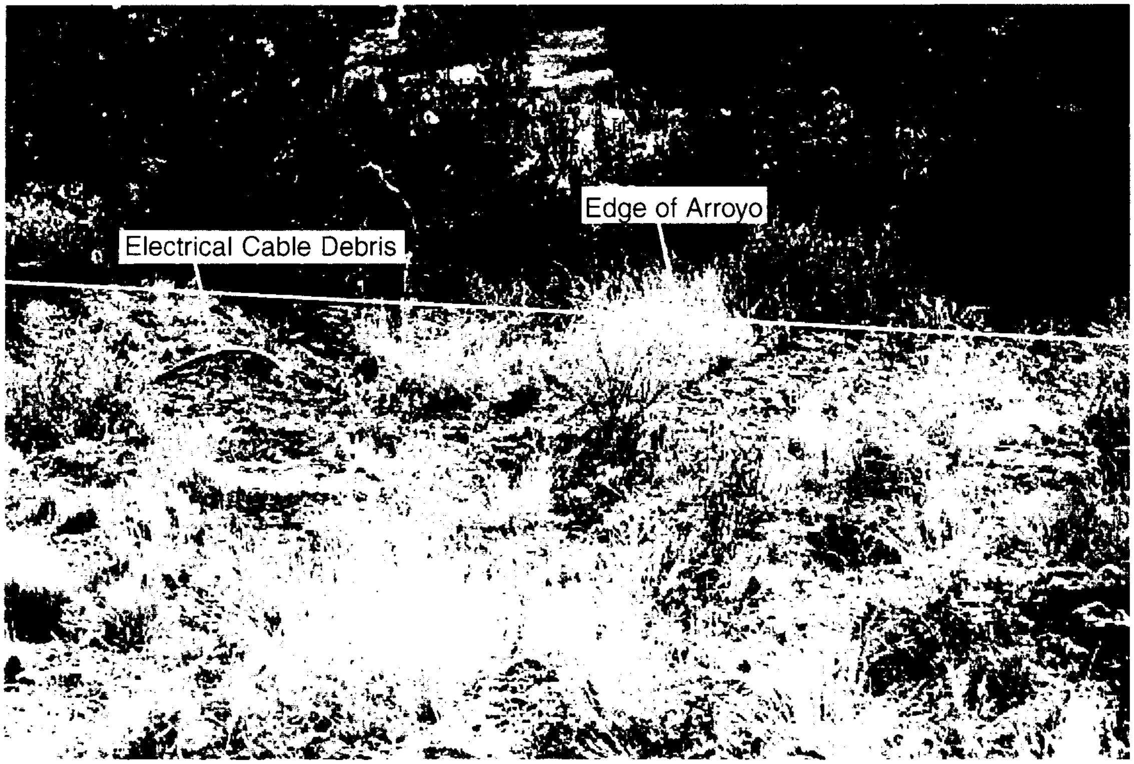

Photograph of part of the debris/soil mound area (SWMU 94B) in December 1994.
Visible debris is identified. View is to the south.

Figure 2A-12
Photograph of SWMU 94B, Debris/Soil Mound Area

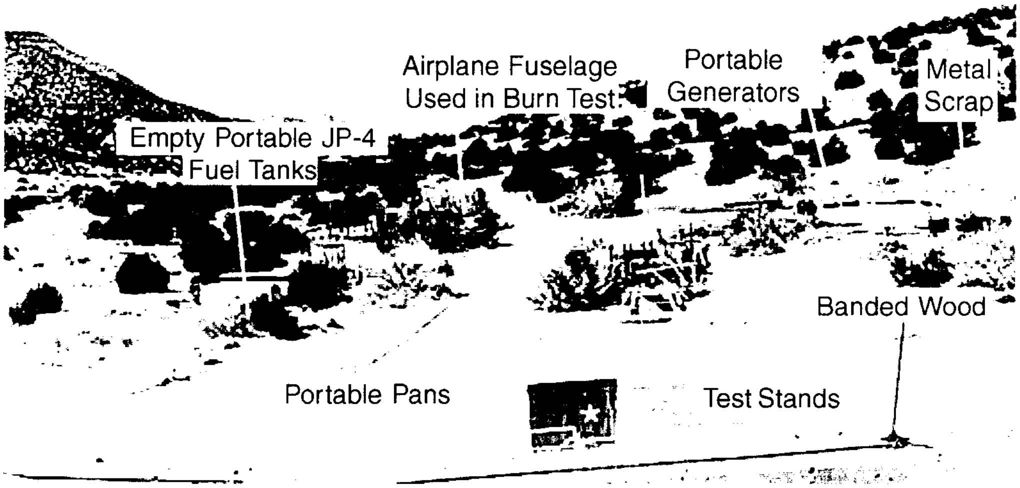

Figure 2A-13a Photograph of the scrap yard (SWMU 94G) in April 1995. Stored inventory is indicated. View is to the west.

Figure 2A-13b Photograph of empty drums in the northern portion of the scrap yard (SWMU 94G) in April 1995. View is to the north.

Figure 2A-13
Photographs of SWMU 94G, Scrap Yard

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Annex 2-B

ANNEX 2-B
Gamma Spectroscopy Results

94C RFI MDAs

COC NUMBER	ER_SAMPLE_ID	ANALYTE	ACTIVITY DETECTED	UNITs	MDA
602819	CY94C-GR-001-S	Actinium-228	0.956	pCi/g	0.0615
602819	CY94C-GR-002-S	Actinium-228	1.11	pCi/g	0.0684
602819	CY94C-GR-003-S	Actinium-228	0.62	pCi/g	0.0438
602819	CY94C-GR-004-S	Actinium-228	0.514	pCi/g	0.0412
602819	CY94C-GR-005-S	Actinium-228	0.532	pCi/g	0.0398
602819	CY94C-GR-006-S	Actinium-228	0.842	pCi/g	0.046
602819	CY94C-GR-007-S	Actinium-228	0.703	pCi/g	0.0432
602819	CY94C-GR-008-S	Actinium-228	0.992	pCi/g	0.0558
602819	CY94C-GR-009-DU	Actinium-228	0.953	pCi/g	0.0705
602819	CY94C-GR-009-S	Actinium-228	0.75	pCi/g	0.0593
602819	CY94C-GR-001-S	Americium-241	<.0376	pCi/g	0.0376
602819	CY94C-GR-002-S	Americium-241	<.0409	pCi/g	0.0409
602819	CY94C-GR-003-S	Americium-241	<.038	pCi/g	0.038
602819	CY94C-GR-004-S	Americium-241	<.0254	pCi/g	0.0254
602819	CY94C-GR-005-S	Americium-241	0.0687	pCi/g	0.025
602819	CY94C-GR-006-S	Americium-241	<.032	pCi/g	0.032
602819	CY94C-GR-007-S	Americium-241	<.0321	pCi/g	0.0321
602819	CY94C-GR-008-S	Americium-241	<.0428	pCi/g	0.0428
602819	CY94C-GR-009-DU	Americium-241	<.0287	pCi/g	0.0287
602819	CY94C-GR-009-S	Americium-241	<.0218	pCi/g	0.0218
602819	CY94C-GR-001-S	Cerium-144	0.0821	pCi/g	0.0726
602819	CY94C-GR-002-S	Cerium-144	<.0798	pCi/g	0.0798
602819	CY94C-GR-003-S	Cerium-144	<.0526	pCi/g	0.0526
602819	CY94C-GR-004-S	Cerium-144	<.0481	pCi/g	0.0481
602819	CY94C-GR-005-S	Cerium-144	<.0467	pCi/g	0.0467
602819	CY94C-GR-006-S	Cerium-144	0.0653	pCi/g	0.0541
602819	CY94C-GR-007-S	Cerium-144	0.145	pCi/g	0.0511
602819	CY94C-GR-008-S	Cerium-144	<.0654	pCi/g	0.0654
602819	CY94C-GR-009-DU	Cerium-144	<.0761	pCi/g	0.0761
602819	CY94C-GR-009-S	Cerium-144	<.068	pCi/g	0.068
602819	CY94C-GR-001-S	Cesium-134	<.0153	pCi/g	0.0153
602819	CY94C-GR-002-S	Cesium-134	<.0169	pCi/g	0.0169
602819	CY94C-GR-003-S	Cesium-134	<.0109	pCi/g	0.0109
602819	CY94C-GR-004-S	Cesium-134	<.0102	pCi/g	0.0102
602819	CY94C-GR-005-S	Cesium-134	<.00991	pCi/g	0.00991
602819	CY94C-GR-006-S	Cesium-134	<.0115	pCi/g	0.0115
602819	CY94C-GR-007-S	Cesium-134	<.0107	pCi/g	0.0107
602819	CY94C-GR-008-S	Cesium-134	<.0139	pCi/g	0.0139
602819	CY94C-GR-009-DU	Cesium-134	<.0174	pCi/g	0.0174
602819	CY94C-GR-009-S	Cesium-134	<.0149	pCi/g	0.0149
602819	CY94C-GR-001-S	Cesium-137	<.0147	pCi/g	0.0147
602819	CY94C-GR-002-S	Cesium-137	<.0163	pCi/g	0.0163
602819	CY94C-GR-003-S	Cesium-137	<.0104	pCi/g	0.0104
602819	CY94C-GR-004-S	Cesium-137	0.0111	pCi/g	0.00981
602819	CY94C-GR-005-S	Cesium-137	<.00951	pCi/g	0.00951
602819	CY94C-GR-006-S	Cesium-137	<.011	pCi/g	0.011
602819	CY94C-GR-007-S	Cesium-137	<.0103	pCi/g	0.0103

602819	CY94C-GR-008-S	Cesium-137	<.0133	pCi/g	0.0133
602819	CY94C-GR-009-DU	Cesium-137	<.0168	pCi/g	0.0168
602819	CY94C-GR-009-S	Cesium-137	<.0143	pCi/g	0.0143
602819	CY94C-GR-001-S	Chromium-51	<.166	pCi/g	0.166
602819	CY94C-GR-002-S	Chromium-51	<.182	pCi/g	0.182
602819	CY94C-GR-003-S	Chromium-51	0.125	pCi/g	0.118
602819	CY94C-GR-004-S	Chromium-51	<.109	pCi/g	0.109
602819	CY94C-GR-005-S	Chromium-51	<.106	pCi/g	0.106
602819	CY94C-GR-006-S	Chromium-51	<.122	pCi/g	0.122
602819	CY94C-GR-007-S	Chromium-51	<.115	pCi/g	0.115
602819	CY94C-GR-008-S	Chromium-51	<.148	pCi/g	0.148
602819	CY94C-GR-009-DU	Chromium-51	<.178	pCi/g	0.178
602819	CY94C-GR-009-S	Chromium-51	<.156	pCi/g	0.156
602819	CY94C-GR-001-S	Cobalt-60	<.0168	pCi/g	0.0168
602819	CY94C-GR-002-S	Cobalt-60	<.0188	pCi/g	0.0188
602819	CY94C-GR-003-S	Cobalt-60	<.0121	pCi/g	0.0121
602819	CY94C-GR-004-S	Cobalt-60	<.0112	pCi/g	0.0112
602819	CY94C-GR-005-S	Cobalt-60	<.0109	pCi/g	0.0109
602819	CY94C-GR-006-S	Cobalt-60	<.0126	pCi/g	0.0126
602819	CY94C-GR-007-S	Cobalt-60	<.0118	pCi/g	0.0118
602819	CY94C-GR-008-S	Cobalt-60	<.0153	pCi/g	0.0153
602819	CY94C-GR-009-DU	Cobalt-60	<.0192	pCi/g	0.0192
602819	CY94C-GR-009-S	Cobalt-60	<.0159	pCi/g	0.0159
602819	CY94C-GR-001-S	Iron-59	<.0388	pCi/g	0.0388
602819	CY94C-GR-002-S	Iron-59	<.0433	pCi/g	0.0433
602819	CY94C-GR-003-S	Iron-59	<.0278	pCi/g	0.0278
602819	CY94C-GR-004-S	Iron-59	<.026	pCi/g	0.026
602819	CY94C-GR-005-S	Iron-59	<.0251	pCi/g	0.0251
602819	CY94C-GR-006-S	Iron-59	<.029	pCi/g	0.029
602819	CY94C-GR-007-S	Iron-59	<.0273	pCi/g	0.0273
602819	CY94C-GR-008-S	Iron-59	<.0352	pCi/g	0.0352
602819	CY94C-GR-009-DU	Iron-59	<.0443	pCi/g	0.0443
602819	CY94C-GR-009-S	Iron-59	<.0369	pCi/g	0.0369
602819	CY94C-GR-001-S	Lead-212	1.02	pCi/g	0.0256
602819	CY94C-GR-002-S	Lead-212	1.11	pCi/g	0.0282
602819	CY94C-GR-003-S	Lead-212	0.813	pCi/g	0.0182
602819	CY94C-GR-004-S	Lead-212	0.717	pCi/g	0.0169
602819	CY94C-GR-005-S	Lead-212	0.597	pCi/g	0.0164
602819	CY94C-GR-006-S	Lead-212	0.823	pCi/g	0.0189
602819	CY94C-GR-007-S	Lead-212	0.677	pCi/g	0.0178
602819	CY94C-GR-008-S	Lead-212	0.834	pCi/g	0.0228
602819	CY94C-GR-009-DU	Lead-212	0.842	pCi/g	0.0273
602819	CY94C-GR-009-S	Lead-212	0.878	pCi/g	0.0241
602819	CY94C-GR-001-S	Lead-214	1.16	pCi/g	0.0287
602819	CY94C-GR-002-S	Lead-214	1.18	pCi/g	0.0316
602819	CY94C-GR-003-S	Lead-214	0.777	pCi/g	0.0204
602819	CY94C-GR-004-S	Lead-214	0.785	pCi/g	0.019
602819	CY94C-GR-005-S	Lead-214	0.649	pCi/g	0.0184
602819	CY94C-GR-006-S	Lead-214	0.751	pCi/g	0.0213

602819	CY94C-GR-007-S	Lead-214	0.734	pCi/g	0.02
602819	CY94C-GR-008-S	Lead-214	0.861	pCi/g	0.0258
602819	CY94C-GR-009-DU	Lead-214	0.943	pCi/g	0.0312
602819	CY94C-GR-009-S	Lead-214	0.989	pCi/g	0.0273
602819	CY94C-GR-001-S	Potassium-40	17.1	pCi/g	0.214
602819	CY94C-GR-002-S	Potassium-40	17.9	pCi/g	0.238
602819	CY94C-GR-003-S	Potassium-40	18.6	pCi/g	0.153
602819	CY94C-GR-004-S	Potassium-40	20.5	pCi/g	0.142
602819	CY94C-GR-005-S	Potassium-40	19.9	pCi/g	0.138
602819	CY94C-GR-006-S	Potassium-40	25.1	pCi/g	0.16
602819	CY94C-GR-007-S	Potassium-40	18.7	pCi/g	0.15
602819	CY94C-GR-008-S	Potassium-40	17.7	pCi/g	0.195
602819	CY94C-GR-009-DU	Potassium-40	14.7	pCi/g	0.244
602819	CY94C-GR-009-S	Potassium-40	15.3	pCi/g	0.201
602819	CY94C-GR-001-S	Radium-226	0.984	pCi/g	0.0342
602819	CY94C-GR-002-S	Radium-226	0.957	pCi/g	0.0378
602819	CY94C-GR-003-S	Radium-226	0.745	pCi/g	0.0242
602819	CY94C-GR-004-S	Radium-226	0.628	pCi/g	0.0228
602819	CY94C-GR-005-S	Radium-226	0.641	pCi/g	0.0221
602819	CY94C-GR-006-S	Radium-226	0.646	pCi/g	0.0255
602819	CY94C-GR-007-S	Radium-226	0.58	pCi/g	0.0239
602819	CY94C-GR-008-S	Radium-226	0.763	pCi/g	0.0309
602819	CY94C-GR-009-DU	Radium-226	0.77	pCi/g	0.0388
602819	CY94C-GR-009-S	Radium-226	0.857	pCi/g	0.0332
602819	CY94C-GR-001-S	Radium-228	0.956	pCi/g	0.0615
602819	CY94C-GR-002-S	Radium-228	1.11	pCi/g	0.0684
602819	CY94C-GR-003-S	Radium-228	0.62	pCi/g	0.0438
602819	CY94C-GR-004-S	Radium-228	0.514	pCi/g	0.0412
602819	CY94C-GR-005-S	Radium-228	0.532	pCi/g	0.0398
602819	CY94C-GR-006-S	Radium-228	0.842	pCi/g	0.046
602819	CY94C-GR-007-S	Radium-228	0.703	pCi/g	0.0432
602819	CY94C-GR-008-S	Radium-228	0.992	pCi/g	0.0558
602819	CY94C-GR-009-DU	Radium-228	0.953	pCi/g	0.0705
602819	CY94C-GR-009-S	Radium-228	0.75	pCi/g	0.0593
602819	CY94C-GR-001-S	Ruthenium-103	<.0161	pCi/g	0.0161
602819	CY94C-GR-002-S	Ruthenium-103	<.0177	pCi/g	0.0177
602819	CY94C-GR-003-S	Ruthenium-103	<.0114	pCi/g	0.0114
602819	CY94C-GR-004-S	Ruthenium-103	<.0107	pCi/g	0.0107
602819	CY94C-GR-005-S	Ruthenium-103	<.0104	pCi/g	0.0104
602819	CY94C-GR-006-S	Ruthenium-103	0.0193	pCi/g	0.012
602819	CY94C-GR-007-S	Ruthenium-103	<.0112	pCi/g	0.0112
602819	CY94C-GR-008-S	Ruthenium-103	<.0145	pCi/g	0.0145
602819	CY94C-GR-009-DU	Ruthenium-103	<.0179	pCi/g	0.0179
602819	CY94C-GR-009-S	Ruthenium-103	<.0155	pCi/g	0.0155
602819	CY94C-GR-001-S	Ruthenium-106	<.143	pCi/g	0.143
602819	CY94C-GR-002-S	Ruthenium-106	<.158	pCi/g	0.158
602819	CY94C-GR-003-S	Ruthenium-106	<.101	pCi/g	0.101
602819	CY94C-GR-004-S	Ruthenium-106	<.0949	pCi/g	0.0949
602819	CY94C-GR-005-S	Ruthenium-106	<.0921	pCi/g	0.0921

602819	CY94C-GR-006-S	Ruthenium-106	<.107	pCi/g	0.107
602819	CY94C-GR-007-S	Ruthenium-106	<.0996	pCi/g	0.0996
602819	CY94C-GR-008-S	Ruthenium-106	<.129	pCi/g	0.129
602819	CY94C-GR-009-DU	Ruthenium-106	<.162	pCi/g	0.162
602819	CY94C-GR-009-S	Ruthenium-106	<.138	pCi/g	0.138
602819	CY94C-GR-001-S	Thorium-231	<.0726	pCi/g	0.0726
602819	CY94C-GR-002-S	Thorium-231	<.0799	pCi/g	0.0799
602819	CY94C-GR-003-S	Thorium-231	<.0516	pCi/g	0.0516
602819	CY94C-GR-004-S	Thorium-231	<.0478	pCi/g	0.0478
602819	CY94C-GR-005-S	Thorium-231	<.0464	pCi/g	0.0464
602819	CY94C-GR-006-S	Thorium-231	<.0536	pCi/g	0.0536
602819	CY94C-GR-007-S	Thorium-231	<.0503	pCi/g	0.0503
602819	CY94C-GR-008-S	Thorium-231	<.0647	pCi/g	0.0647
602819	CY94C-GR-009-DU	Thorium-231	0.146	pCi/g	0.0776
602819	CY94C-GR-009-S	Thorium-231	<.0684	pCi/g	0.0684
602819	CY94C-GR-001-S	Thorium-232	1	pCi/g	0.0251
602819	CY94C-GR-002-S	Thorium-232	1.09	pCi/g	0.0277
602819	CY94C-GR-003-S	Thorium-232	0.797	pCi/g	0.0179
602819	CY94C-GR-004-S	Thorium-232	0.703	pCi/g	0.0165
602819	CY94C-GR-005-S	Thorium-232	0.585	pCi/g	0.0161
602819	CY94C-GR-006-S	Thorium-232	0.806	pCi/g	0.0185
602819	CY94C-GR-007-S	Thorium-232	0.663	pCi/g	0.0174
602819	CY94C-GR-008-S	Thorium-232	0.817	pCi/g	0.0224
602819	CY94C-GR-009-DU	Thorium-232	0.825	pCi/g	0.0267
602819	CY94C-GR-009-S	Thorium-232	0.861	pCi/g	0.0236
602819	CY94C-GR-001-S	Thorium-234	0.74	pCi/g	0.38
602819	CY94C-GR-002-S	Thorium-234	1.88	pCi/g	0.414
602819	CY94C-GR-003-S	Thorium-234	1.42	pCi/g	0.363
602819	CY94C-GR-004-S	Thorium-234	0.96	pCi/g	0.256
602819	CY94C-GR-005-S	Thorium-234	0.945	pCi/g	0.251
602819	CY94C-GR-006-S	Thorium-234	1.48	pCi/g	0.317
602819	CY94C-GR-007-S	Thorium-234	0.712	pCi/g	0.31
602819	CY94C-GR-008-S	Thorium-234	3.36	pCi/g	0.416
602819	CY94C-GR-009-DU	Thorium-234	4.58	pCi/g	0.271
602819	CY94C-GR-009-S	Thorium-234	5.97	pCi/g	0.24
602819	CY94C-GR-001-S	Uranium-235	0.158	pCi/g	0.081
602819	CY94C-GR-002-S	Uranium-235	<.0891	pCi/g	0.0891
602819	CY94C-GR-003-S	Uranium-235	<.0584	pCi/g	0.0584
602819	CY94C-GR-004-S	Uranium-235	<.0536	pCi/g	0.0536
602819	CY94C-GR-005-S	Uranium-235	0.0713	pCi/g	0.052
602819	CY94C-GR-006-S	Uranium-235	<.0601	pCi/g	0.0601
602819	CY94C-GR-007-S	Uranium-235	0.104	pCi/g	0.055
602819	CY94C-GR-008-S	Uranium-235	<.0727	pCi/g	0.0727
602819	CY94C-GR-009-DU	Uranium-235	0.128	pCi/g	0.0827
602819	CY94C-GR-009-S	Uranium-235	0.175	pCi/g	0.0739
602819	CY94C-GR-001-S	Uranium-238	0.74	pCi/g	0.38
602819	CY94C-GR-002-S	Uranium-238	1.88	pCi/g	0.414
602819	CY94C-GR-003-S	Uranium-238	1.42	pCi/g	0.363
602819	CY94C-GR-004-S	Uranium-238	0.96	pCi/g	0.256

602819	CY94C-GR-005-S	Uranium-238	0.945	pCi/g	0.251
602819	CY94C-GR-006-S	Uranium-238	1.48	pCi/g	0.317
602819	CY94C-GR-007-S	Uranium-238	0.712	pCi/g	0.31
602819	CY94C-GR-008-S	Uranium-238	3.36	pCi/g	0.416
602819	CY94C-GR-009-DU	Uranium-238	4.58	pCi/g	0.271
602819	CY94C-GR-009-S	Uranium-238	5.97	pCi/g	0.24
602819	CY94C-GR-001-S	Yttrium-88	<.0182	pCi/g	0.0182
602819	CY94C-GR-002-S	Yttrium-88	<.0201	pCi/g	0.0201
602819	CY94C-GR-003-S	Yttrium-88	<.0129	pCi/g	0.0129
602819	CY94C-GR-004-S	Yttrium-88	<.012	pCi/g	0.012
602819	CY94C-GR-005-S	Yttrium-88	0.0156	pCi/g	0.0118
602819	CY94C-GR-006-S	Yttrium-88	<.0136	pCi/g	0.0136
602819	CY94C-GR-007-S	Yttrium-88	<.0126	pCi/g	0.0126
602819	CY94C-GR-008-S	Yttrium-88	<.0166	pCi/g	0.0166
602819	CY94C-GR-009-DU	Yttrium-88	<.0211	pCi/g	0.0211
602819	CY94C-GR-009-S	Yttrium-88	<.0173	pCi/g	0.0173
602819	CY94C-GR-001-S	Zirconium-95	<.0311	pCi/g	0.0311
602819	CY94C-GR-002-S	Zirconium-95	<.0345	pCi/g	0.0345
602819	CY94C-GR-003-S	Zirconium-95	<.0221	pCi/g	0.0221
602819	CY94C-GR-004-S	Zirconium-95	<.0208	pCi/g	0.0208
602819	CY94C-GR-005-S	Zirconium-95	<.0201	pCi/g	0.0201
602819	CY94C-GR-006-S	Zirconium-95	<.0233	pCi/g	0.0233
602819	CY94C-GR-007-S	Zirconium-95	<.0218	pCi/g	0.0218
602819	CY94C-GR-008-S	Zirconium-95	<.0282	pCi/g	0.0282
602819	CY94C-GR-009-DU	Zirconium-95	0.0429	pCi/g	0.0356
602819	CY94C-GR-009-S	Zirconium-95	<.0302	pCi/g	0.0302

ON-SITE LABORATORY (RPSD)
ANALYSIS REQUEST AND CHAIN OF CUSTODY

Page 1 of 2

Internal Lab Batch No. 000743

SAR/WR No.

AR/COC **603232**

Dept. No./Mail Stop: 6134/MS1088
Project/Task Manager: Freshour/Henderson
Project Name: Site 94C Bomb Burner
Record Center Code:
Logbook Ref. No.:
Service Order No.: CFO 021

Date Samples Shipped: 4-25-00 SMO USE
Carrier/Waybill No. HC
Lab Contact: F Dominguez
Lab Destination: RPSD
SMO Contact/Phone: D Salmi 844-3110

Logged By:
Project/Task No.: 7214.02.02.14
SMO Authorization: [illegible]
Location: Tech Area:
Building: Room:

☐ **Characterization Only**
☐ **Waste Characterization**
-RCRA Date =
-Send preliminary/copy report to:

☐ **Release to ERCL On-Site Lab**
☑ **Release to Off-Site Lab**
-This COC Number Releases COC No(s).: 603231

Sample No.-Fraction / RPSD No.-Fraction	ER Sample ID or Sample Location Detail / RPSD Remarks/Aliquot Amounts	Beginning Depth (ft) / Screen CPM	ER Site No. / Sample Mass	Date/Time(hr) Collected / Sample Quantity	Sample Matrix	Container Type	Container Volume	Preservative	Collection Method	Sample Type	Analysis Request
051783-005	CY94C-GR-011-SS	0	94C	042400 1220	S	M	16oz	none	G	SA	Gamma Spec 627g
01					▨	▨	▨	▨	▨	▨	
051784-005	CY94C-GR-012-SS	0	94C	042400 1225	S	M	16oz	none	G	SA	Gamma Spec 515g *
02					▨	▨	▨	▨	▨	▨	
051785-005	CY94C-GR-013-SS	0	94C	042400 1235	S	M	16oz	none	G	SA	Gamma Spec 619g
03					▨	▨	▨	▨	▨	▨	
051792-005	CY94C-GR-014-SS	0	94C	042400 1240	S	M	16oz	none	G	SA	Gamma Spec 583g *
04					▨	▨	▨	▨	▨	▨	

RMMA ☑ Yes ☐ No Ref. No.
Sample Disposal ☑ Return to Client ☐ Disposal by Lab
Turnaround Time ☐ Normal ☑ Rush
Required Report Date

Sample Tracking Smo Use
Date Entered(mm/dd/yy)
Entered by:
QC inits.

Special Instructions/QC Requirements
EDD ☑ Yes ☐ No
Raw Data Package ☑ Yes ☐ No
***Send report to:**

P Henderson 284-2617

THIS COC RELEASES 603231

***Please list as separate report.**

Sample Team Members	Name	Signature	Init	Company/Organization/Phone/Cellular
	M Sanchez	M Sanchez		Weston/6135/845-3267

		Org.	Date	Time
1.Relinquished by	Margaret Sanchez	6135	042500	1300
1. Received by		7135	4/25/00	1300
2.Relinquished by		7135	4/25/00	1330
2. Received by		7132	4/25/00	1330
3.Relinquished by		7132	4/26/00	0830
3. Received by		6133	4/26/00	0830
4.Relinquished by		7135	4/27/00	755
4. Received by		6133	4/27/00	755
5.Relinquished by				
5. Received by				
6.Relinquished by				
6. Received by				

* not taped completely around marinelli lid.

ON-SITE LABORATORY
Analysis Request And Chain Of Custody (Continuation)

000743

Page 2 of 2

AR/COC- 603232

Project Name:

Project/Task Manger:

Case No:

Sample No.-Fraction RPSD No.-Fraction	ER Sample ID or Sample Location Detail RPSD Remarks/Aliquot Amounts	Beginning Depth (ft) Screen CPM	ER Site No. Sample Mass	Date/Time (hr) Collected Sample Quantity	Reference LOV(available at SMO)						Analysis Request
					Sample Matrix	Container Type	Container Volume	Preserv-ative	Collection Method	Sample Type	
051793-005	CY94C-GR-015-SS	0	94C	042400 1242	S	M	16oz	none	G	SA	Gamma Spec
05											650g
									G		
LCS 06											
LCS 07											

Abnormal Conditions on Receipt

LAB USE

Recipient Initials________

```
*********************
***   TX REPORT   ***
*********************

TRANSMISSION OK

TX/RX NO                  0239
CONNECTION TEL                          78455262
SUBADDRESS
CONNECTION ID
ST. TIME                  04/26 09:05
USAGE T                   05'59
PGS. SENT                  16
RESULT                    OK
```

```
*****************************************************************
*               Sandia National Laboratories                    *
*  Radiation Protection Sample Diagnostics Program [806 Laboratory]  *
*                  4/25/00  3:43:07 PM                          *
*****************************************************************
*                                                               *
* Analyzed by: Uken 4/26/00       Reviewed by: 4/26/00          *
*****************************************************************
Customer                      : FRESHOUR/PERRY (6134-SMO)
Customer Sample ID            : 051783-005  94C-6R011
Lab Sample ID                 : 00074301

Sample Description            : MARINELLI SOIL SAMPLE
Sample Quantity               :   627.000  gram
Sample Date/Time              :  4/24/00  12:20:00 PM
Acquire Start Date/Time       :  4/25/00   2:02:54 PM
Detector Name                 : LAB02
Elapsed Live/Real Time        :   6000 /   6003 seconds

Comments:
*****************************************************************

 Nuclide       Activity        2-sigma          MDA
  Name       (pCi/gram )        Error       (pCi/gram )
 -------     -----------     -----------    -----------
 U-238      Not Detected     ---------      8.25E-001
 RA-226         1.95E+000    3.21E+000      5.99E-001
 PB-214         7.45E-001    3.45E-001      4.25E-002
 BI-214         6.61E-001    1.31E-001      4.46E-002
 PB-210     Not Detected     ---------      3.59E+001

 TH-232         8.66E-001    4.68E-001      1.51E-001
 RA-228         9.73E-001    2.90E-001      1.23E-001
 AC-228         9.08E-001    2.43E-001      8.14E-002
 TH-228     Not Detected     ---------      4.41E-001
 RA-224         8.59E-001    1.94E-001      6.66E-002
 PB-212         8.59E-001    6.55E-001      3.98E-002
 BI-212         8.19E-001    5.70E-001      2.97E-001
 TL-208         7.39E-001    1.68E-001      6.85E-002

 U-235      Not Detected     ---------      2.24E-001
 TH-231     Not Detected     ---------      1.25E+001
 PA-231     Not Detected     ---------      1.34E+000
 TH-227     Not Detected     ---------      3.74E-001
 RA-223     Not Detected     ---------      2.06E-001
 RN-219     Not Detected     ---------      3.43E-001
 PB-211     Not Detected     ---------      7.69E-001
```

Note: Ra-226 and U-235 gamma peaks interfere. Either isotope may be over-estimated.

WT. OF SOIL
627g

IN

```
*****************************************************************
                Sandia National Laboratories                     *
ation Protection Sample Diagnostics Program [806 Laboratory]     *
                   4/25/00  3:43:07 PM                           *
*****************************************************************
                                                                 *
! by: Ulem 4/26/00         Reviewed by: 4/26/00                  *
*****************************************************************
                   : FRESHOUR/PERRY (6134-SMO)
ample ID           : 051783-005 94A -6SOIL
 ID                : 00074301

cription           : MARINELLI SOIL SAMPLE
ntity              :   627.000  gram
e/Time             :   4/24/00   12:20:00 PM
art Date/Time      :   4/25/00    2:02:54 PM
ame                : LAB02
ve/Real Time       :   6000 /    6003 seconds

 ****************************************************************

     Activity           2-sigma            MDA
    (pCi/gram )          Error           (pCi/gram )
    -----------        ----------        -----------
   Not Detected        ---------         8.25E-001
      1.95E+000        3.21E+000         5.99E-001
      7.45E-001        3.45E-001         4.25E-002
      6.61E-001        1.31E-001         4.46E-002
   Not Detected        ---------         3.59E+001

      8.66E-001        4.68E-001         1.51E-001
      9.73E-001        2.90E-001         1.23E-001
      9.08E-001        2.43E-001         8.14E-002
   Not Detected        ---------         4.41E-001
      8.59E-001        1.94E-001         6.66E-002
      8.59E-001        6.55E-001         3.98E-002
      8.19E-001        5.70E-001         2.97E-001
      7.39E-001        1.68E-001         6.85E-002

    Iot Detected       ---------         2.24E-001
    Iot Detected       ---------         1.25E+001
     ot Detected       ---------         1.34E+000
     ot Detected       ---------         3.74E-001
     ot Detected       ---------         2.06E-001
     ot Detected       ---------         3.43E-001
     ot Detected       ---------         7.69E-001
     ot Detected       ---------         1.14E+001

     ot Detected       ---------         5.15E-001
     ot Detected       ---------         4.16E+002
     ot Detected       ---------         2.32E+000
     t Detected        ---------         5.13E-002
      t Detected       ---------         2.52E-001
```

Note: Ra-226 and U-235 gamma peaks interfere. Either isotope may be over-estimated.

WT. OF SOIL
627g

*MIKE IS IN RCRA TRAINING

Post-It™ brand fax transmittal memo 7671

To MIKE ENGHAUSER	# of pages ▸ 10 From D. PERRY
Co. WESTON	Co. WESTON
Dept.	Phone # 845-0867
Fax # 845-5262	Fax # 844-3128

051783-005

[Summary Report] - Sample ID: : 00074301

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	----------	3.54E-002
AG-110m	Not Detected	----------	2.80E-002
BA-133	Not Detected	----------	4.93E-002
BE-7	Not Detected	----------	2.20E-001
CD-115	Not Detected	----------	9.19E-002
CE-139	Not Detected	----------	2.66E-002
CE-141	Not Detected	----------	4.95E-002
CE-144	Not Detected	----------	2.26E-001
CO-56	Not Detected	----------	2.76E-002
CO-57	Not Detected	----------	2.91E-002
CO-58	Not Detected	----------	2.86E-002
CO-60	Not Detected	----------	3.20E-002
CR-51	Not Detected	----------	2.13E-001
CS-134	Not Detected	----------	3.91E-002
CS-137	Not Detected	----------	2.96E-002
EU-152	Not Detected	----------	8.73E-002
EU-154	Not Detected	----------	1.71E-001
EU-155	Not Detected	----------	1.36E-001
FE-59	Not Detected	----------	7.05E-002
GD-153	Not Detected	----------	1.04E-001
HG-203	Not Detected	----------	2.97E-002
I-131	Not Detected	----------	2.71E-002
IR-192	Not Detected	----------	2.45E-002
K-40	1.41E+001	1.93E+000	2.37E-001
MN-52	Not Detected	----------	3.15E-002
MN-54	Not Detected	----------	3.25E-002
MO-99	Not Detected	----------	2.81E-001
NA-22	Not Detected	----------	3.56E-002
NA-24	Not Detected	----------	1.06E-001
NB-95	Not Detected	----------	1.99E-001
ND-147	Not Detected	----------	1.96E-001
NI-57	Not Detected	----------	7.82E-002
RU-103	Not Detected	----------	2.68E-002
RU-106	Not Detected	----------	2.54E-001
SB-122	Not Detected	----------	4.76E-002
SB-124	Not Detected	----------	2.70E-002
SB-125	Not Detected	----------	7.36E-002
SN-113	Not Detected	----------	3.37E-002
SR-85	Not Detected	----------	3.60E-002
TA-182	Not Detected	----------	1.39E-001
TA-183	Not Detected	----------	5.10E-001
TL-201	Not Detected	----------	2.30E-001
XE-133	Not Detected	----------	2.01E-001
Y-88	Not Detected	----------	2.70E-002
ZN-65	Not Detected	----------	9.06E-002
ZR-95	Not Detected	----------	5.34E-002

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
4/25/00 5:25:01 PM

Analyzed by: 4/26/00 Reviewed by: 4/26/00

Customer : FRESHOUR/PERRY (6134-SMO)
Customer Sample ID : 051784-005 94C-GR012-
Lab Sample ID : 00074302

Sample Description : MARINELLI SOIL SAMPLE
Sample Quantity : 515.000 gram
Sample Date/Time : 4/24/00 12:25:00 PM
Acquire Start Date/Time : 4/25/00 3:44:49 PM
Detector Name : LAB02
Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	---------	7.98E-001
RA-226	Not Detected	---------	6.31E-001
PB-214	8.84E-001	1.73E-001	5.33E-002
BI-214	7.70E-001	1.59E-001	5.21E-002
PB-210	Not Detected	---------	4.00E+001
TH-232	1.04E+000	5.58E-001	1.81E-001
RA-228	1.09E+000	3.78E-001	1.55E-001
AC-228	1.02E+000	2.70E-001	8.08E-002
TH-228	5.07E-001	5.02E-001	5.57E-001
RA-224	9.80E-001	2.25E-001	8.18E-002
PB-212	9.14E-001	4.16E-001	4.61E-002
BI-212	1.08E+000	6.43E-001	3.62E-001
TL-208	8.38E-001	2.06E-001	7.89E-002
U-235	Not Detected	---------	2.56E-001
TH-231	Not Detected	---------	1.49E+001
PA-231	Not Detected	---------	1.54E+000
TH-227	Not Detected	---------	4.34E-001
RA-223	Not Detected	---------	2.61E-001
RN-219	Not Detected	---------	4.15E-001
PB-211	Not Detected	---------	9.08E-001
TL-207	Not Detected	---------	1.40E+001
AM-241	Not Detected	---------	5.71E-001
PU-239	Not Detected	---------	4.76E+002
NP-237	Not Detected	---------	2.64E+000
PA-233	Not Detected	---------	6.12E-002
TH-229	Not Detected	---------	2.93E-001

WT. OF SOIL
515g

051784-005

[Summary Report] - Sample ID: : 00074302

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	----------	4.23E-002
AG-110m	Not Detected	----------	3.83E-002
BA-133	Not Detected	----------	5.94E-002
BE-7	Not Detected	----------	2.63E-001
CD-115	Not Detected	----------	1.10E-001
CE-139	Not Detected	----------	3.05E-002
CE-141	Not Detected	----------	5.70E-002
CE-144	Not Detected	----------	2.57E-001
CO-56	Not Detected	----------	3.38E-002
CO-57	Not Detected	----------	3.39E-002
CO-58	Not Detected	----------	3.42E-002
CO-60	Not Detected	----------	3.96E-002
CR-51	Not Detected	----------	2.57E-001
CS-134	Not Detected	----------	4.66E-002
CS-137	Not Detected	----------	2.24E-002
EU-152	Not Detected	----------	1.01E-001
EU-154	Not Detected	----------	2.01E-001
EU-155	Not Detected	----------	1.60E-001
FE-59	Not Detected	----------	7.56E-002
GD-153	Not Detected	----------	1.24E-001
HG-203	Not Detected	----------	3.47E-002
I-131	Not Detected	----------	3.24E-002
IR-192	Not Detected	----------	2.92E-002
K-40	1.55E+001	2.13E+000	2.68E-001
MN-52	Not Detected	----------	3.82E-002
MN-54	Not Detected	----------	1.52E-002
MO-99	Not Detected	----------	3.32E-001
NA-22	Not Detected	----------	4.37E-002
NA-24	Not Detected	----------	1.21E-001
NB-95	Not Detected	----------	2.36E-001
ND-147	Not Detected	----------	2.48E-001
NI-57	Not Detected	----------	9.05E-002
RU-103	Not Detected	----------	2.94E-002
RU-106	Not Detected	----------	2.85E-001
SB-122	Not Detected	----------	5.65E-002
SB-124	Not Detected	----------	3.15E-002
SB-125	Not Detected	----------	9.04E-002
SN-113	Not Detected	----------	3.94E-002
SR-85	Not Detected	----------	4.18E-002
TA-182	Not Detected	----------	1.72E-001
TA-183	Not Detected	----------	5.78E-001
TL-201	Not Detected	----------	2.80E-001
XE-133	Not Detected	----------	2.39E-001
Y-88	Not Detected	----------	3.29E-002
ZN-65	Not Detected	----------	1.14E-001
ZR-95	Not Detected	----------	5.87E-002

Sandia National Laboratories

Radiation Protection Sample Diagnostics Program [806 Laboratory]

4/25/00 7:06:56 PM

Analyzed by: Ukun 4/26/00 Reviewed by: 4/26/00

Customer : FRESHOUR/PERRY (6134-SMO)
Customer Sample ID : 051785-005 94C-6B013
Lab Sample ID : 00074303

Sample Description : MARINELLI SOIL SAMPLE
Sample Quantity : 619.000 gram
Sample Date/Time : 4/24/00 12:35:00 PM
Acquire Start Date/Time : 4/25/00 5:26:43 PM
Detector Name : LAB02
Elapsed Live/Real Time : 6000 / 6002 seconds

Note: Ra-226 and U-235 gamma peaks interfere. Either isotope may be over-estimated.

Comments:

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	---------	7.96E-001
RA-226	1.93E+000	7.43E-001	5.98E-001
PB-214	7.33E-001	1.40E-001	4.16E-002
BI-214	6.33E-001	1.37E-001	3.95E-002
PB-210	Not Detected	---------	3.45E+001
TH-232	8.11E-001	3.74E-001	1.34E-001
RA-228	8.12E-001	2.93E-001	1.21E-001
AC-228	7.81E-001	2.15E-001	6.94E-002
TH-228	8.10E-001	6.87E-001	4.17E-001
RA-224	7.87E-001	1.81E-001	5.69E-002
PB-212	7.30E-001	2.82E-001	3.92E-002
BI-212	8.05E-001	5.60E-001	2.84E-001
TL-208	Not Detected	---------	6.34E-002
U-235	Not Detected	---------	2.07E-001
TH-231	Not Detected	---------	1.19E+001
PA-231	Not Detected	---------	1.25E+000
TH-227	Not Detected	---------	3.57E-001
RA-223	Not Detected	---------	2.00E-001
RN-219	Not Detected	---------	3.30E-001
PB-211	Not Detected	---------	7.41E-001
TL-207	Not Detected	---------	1.16E+001
AM-241	Not Detected	---------	4.81E-001
PU-239	Not Detected	---------	4.04E+002
NP-237	Not Detected	---------	2.20E+000
PA-233	Not Detected	---------	5.19E-002
TH-229	Not Detected	---------	2.35E-001

WT. OF SOIL
619g

051785-005

```
[Summary Report] - Sample ID:     : 00074303

Nuclide      Activity          2-sigma          MDA
 Name       (pCi/gram )        Error           (pCi/gram )
-------     ----------        ----------       ----------
AG-108m    Not Detected      ---------        3.28E-002
AG-110m    Not Detected      ---------        2.72E-002
BA-133     Not Detected      ---------        4.88E-002
BE-7       Not Detected      ---------        2.17E-001
CD-115     Not Detected      ---------        9.15E-002
CE-139     Not Detected      ---------        2.59E-002
CE-141     Not Detected      ---------        4.59E-002
CE-144     Not Detected      ---------        2.17E-001
CO-56      Not Detected      ---------        2.92E-002
CO-57      Not Detected      ---------        2.74E-002
CO-58      Not Detected      ---------        3.09E-002
CO-60      Not Detected      ---------        3.16E-002
CR-51      Not Detected      ---------        2.16E-001
CS-134     Not Detected      ---------        3.76E-002
CS-137     Not Detected      ---------        1.73E-002
EU-152     Not Detected      ---------        8.19E-002
EU-154     Not Detected      ---------        1.59E-001
EU-155     Not Detected      ---------        9.74E-002
FE-59      Not Detected      ---------        6.10E-002
GD-153     Not Detected      ---------        9.68E-002
HG-203     Not Detected      ---------        2.87E-002
I-131      Not Detected      ---------        2.62E-002
IR-192     Not Detected      ---------        2.51E-002
K-40           1.22E+001     1.68E+000        2.31E-001
MN-52      Not Detected      ---------        3.34E-002
MN-54      Not Detected      ---------        3.20E-002
MO-99      Not Detected      ---------        2.78E-001
NA-22      Not Detected      ---------        3.35E-002
NA-24      Not Detected      ---------        1.11E-001
NB-95      Not Detected      ---------        1.94E-001
ND-147     Not Detected      ---------        1.80E-001
NI-57      Not Detected      ---------        8.28E-002
RU-103     Not Detected      ---------        2.62E-002
RU-106     Not Detected      ---------        2.36E-001
SB-122     Not Detected      ---------        4.75E-002
SB-124     Not Detected      ---------        2.53E-002
SB-125     Not Detected      ---------        7.44E-002
SN-113     Not Detected      ---------        3.44E-002
SR-85      Not Detected      ---------        3.54E-002
TA-182     Not Detected      ---------        1.36E-001
TA-183     Not Detected      ---------        4.92E-001
TL-201     Not Detected      ---------        2.33E-001
XE-133     Not Detected      ---------        1.98E-001
Y-88       Not Detected      ---------        2.63E-002
ZN-65      Not Detected      ---------        9.12E-002
ZR-95      Not Detected      ---------        4.78E-002
```

```
*****************************************************************************
*                      Sandia National Laboratories                         *
*    Radiation Protection Sample Diagnostics Program [806 Laboratory]       *
*                          4/25/00  3:42:46 PM                              *
*****************************************************************************
*                                                                           *
* Analyzed by: Utem 4/26/00          Reviewed by: 4/26/00                   *
*****************************************************************************
Customer                    :  FRESHOUR/PERRY (6134-SMO)
Customer Sample ID          :  051792-005  C494C-GR014
Lab Sample ID               :  00074304

Sample Description          :  MARINELLI SOIL SAMPLE
Sample Quantity             :    583.000  gram
Sample Date/Time            :   4/24/00  12:40:00 PM
Acquire Start Date/Time     :   4/25/00   2:02:33 PM
Detector Name               :  LAB01
Elapsed Live/Real Time      :    6000 /    6003 seconds

Comments:
*****************************************************************************

 Nuclide       Activity       2-sigma          MDA
  Name        (pCi/gram )      Error          (pCi/gram )
 -------     -----------    ----------       -----------
 U-238          1.19E+001    5.49E+000        6.87E-001
 RA-226         4.17E+000    3.62E+000        6.87E-001
 PB-214         9.00E-001    4.46E-001        6.55E-002
 BI-214         8.69E-001    2.01E-001        6.49E-002
 PB-210      Not Detected    ---------        1.08E+001

 TH-232         8.86E-001    8.79E-001        2.01E-001
 RA-228         1.13E+000    1.72E-001        2.41E-001
 AC-228         1.06E+000    9.64E-001        1.16E-001
 TH-228         7.24E-001    3.26E-001        6.30E-001
 RA-224         1.04E+000    3.95E-001        8.94E-002
 PB-212         1.02E+000    1.87E-001        5.14E-002
 BI-212         1.14E+000    8.74E-001        4.33E-001
 TL-208         9.07E-001    6.98E-001        9.89E-002

 U-235       Not Detected    ---------        1.90E-001
 TH-231      Not Detected    ---------        1.07E+001
 PA-231      Not Detected    ---------        1.72E+000
 TH-227      Not Detected    ---------        3.62E-001
 RA-223      Not Detected    ---------        1.91E-001
 RN-219      Not Detected    ---------        4.72E-001
 PB-211      Not Detected    ---------        1.04E+000
 TL-207      Not Detected    ---------        1.81E+001

 AM-241      Not Detected    ---------        2.82E-001
 PU-239      Not Detected    ---------        4.64E+002
 NP-237      Not Detected    ---------        2.59E+000
 PA-233      Not Detected    ---------        7.24E-002
 TH-229      Not Detected    ---------        2.44E-001
```

Note: Ra-226 and U-235 gamma peaks interfere. Either isotope may be over-estimated.

WT. OF SOIL

583g

[Summary Report] - Sample ID: : 00074304   051792-005

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	5.07E-002
AG-110m	Not Detected	---------	4.08E-002
BA-133	Not Detected	---------	6.52E-002
BE-7	Not Detected	---------	3.36E-001
CD-115	Not Detected	---------	1.20E-001
CE-139	Not Detected	---------	3.17E-002
CE-141	Not Detected	---------	5.75E-002
CE-144	Not Detected	---------	2.44E-001
CO-56	Not Detected	---------	4.23E-002
CO-57	Not Detected	---------	3.16E-002
CO-58	Not Detected	---------	4.43E-002
CO-60	Not Detected	---------	4.47E-002
CR-51	Not Detected	---------	2.83E-001
CS-134	Not Detected	---------	5.06E-002
CS-137	Not Detected	---------	4.38E-002
EU-152	Not Detected	---------	9.48E-002
EU-154	Not Detected	---------	2.44E-001
EU-155	Not Detected	---------	1.53E-001
FE-59	Not Detected	---------	9.57E-002
GD-153	Not Detected	---------	9.65E-002
HG-203	Not Detected	---------	3.73E-002
I-131	Not Detected	---------	3.88E-002
IR-192	Not Detected	---------	3.36E-002
K-40	1.59E+001	2.58E+000	3.97E-001
MN-52	Not Detected	---------	4.66E-002
MN-54	Not Detected	---------	4.63E-002
MO-99	Not Detected	---------	4.27E-001
NA-22	Not Detected	---------	5.73E-002
NA-24	Not Detected	---------	1.39E-001
NB-95	Not Detected	---------	1.54E-001
ND-147	Not Detected	---------	2.80E-001
NI-57	Not Detected	---------	1.10E-001
RU-103	Not Detected	---------	3.80E-002
RU-106	Not Detected	---------	3.69E-001
SB-122	Not Detected	---------	6.70E-002
SB-124	Not Detected	---------	3.79E-002
SB-125	Not Detected	---------	1.11E-001
SN-113	Not Detected	---------	4.67E-002
SR-85	Not Detected	---------	4.88E-002
TA-182	Not Detected	---------	2.16E-001
TA-183	Not Detected	---------	2.74E-001
TL-201	Not Detected	---------	1.61E-001
XE-133	Not Detected	---------	1.68E-001
Y-88	Not Detected	---------	4.03E-002
ZN-65	Not Detected	---------	1.41E-001
ZR-95	Not Detected	---------	8.28E-002

```
************************************************************************
*                    Sandia National Laboratories                      *
*    Radiation Protection Sample Diagnostics Program [806 Laboratory]  *
*                       4/25/00  5:24:59 PM                            *
************************************************************************
*                                                                      *
* Analyzed by:       4/26/00          Reviewed by:     4/26/00         *
************************************************************************
Customer                  : FRESHOUR/PERRY (6134-SMO)
Customer Sample ID        : 051793-005 94C-6R015
Lab Sample ID             : 00074305

Sample Description        : MARINELLI SOIL SAMPLE
Sample Quantity           :   650.000  gram
Sample Date/Time          :  4/24/00  12:42:00 PM
Acquire Start Date/Time   :  4/25/00   3:44:47 PM
Detector Name             : LAB01
Elapsed Live/Real Time    :   6000 /   6002 seconds

Comments:
************************************************************************

 Nuclide      Activity        2-sigma           MDA
  Name       (pCi/gram )       Error         (pCi/gram )
 -------     -----------     ----------      -----------
 U-238          3.07E+000    8.87E-001        5.85E-001
 RA-226         2.70E+000    4.34E+000        5.91E-001
 PB-214         7.30E-001    1.55E-001        5.20E-002
 BI-214         6.62E-001    1.57E-001        5.49E-002
 PB-210      Not Detected    ---------        8.91E+000

 TH-232         7.86E-001    4.20E-001        1.73E-001
 RA-228      Not Detected    ---------        1.98E-001
 AC-228         8.19E-001    2.73E-001        1.18E-001
 TH-228         1.06E+000    3.22E-001        4.75E-001
 RA-224         9.39E-001    3.78E-001        8.74E-002
 PB-212         8.65E-001    2.33E-001        4.64E-002
 BI-212         9.21E-001    6.40E-001        3.73E-001
 TL-208         7.45E-001    7.41E-001        7.99E-002

 U-235       Not Detected    ---------        1.75E-001
 TH-231      Not Detected    ---------        8.56E+000
 PA-231      Not Detected    ---------        1.49E+000
 TH-227      Not Detected    ---------        3.16E-001
 RA-223      Not Detected    ---------        1.51E-001
 RN-219      Not Detected    ---------        4.10E-001
 PB-211      Not Detected    ---------        9.02E-001
 TL-207      Not Detected    ---------        1.58E+001

 AM-241      Not Detected    ---------        2.25E-001
 PU-239      Not Detected    ---------        3.91E+002
 NP-237      Not Detected    ---------        2.20E+000
 PA-233      Not Detected    ---------        6.45E-002
 TH-229      Not Detected    ---------        1.99E-001
```

WT OF SOIL

650g

051793-005

[Summary Report] - Sample ID: : 00074305

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	----------	4.38E-002
AG-110m	Not Detected	----------	3.83E-002
BA-133	Not Detected	----------	5.42E-002
BE-7	Not Detected	----------	2.88E-001
CD-115	Not Detected	----------	1.04E-001
CE-139	Not Detected	----------	2.66E-002
CE-141	Not Detected	----------	4.97E-002
CE-144	Not Detected	----------	2.11E-001
CO-56	Not Detected	----------	4.22E-002
CO-57	Not Detected	----------	2.61E-002
CO-58	Not Detected	----------	3.78E-002
CO-60	Not Detected	----------	4.32E-002
CR-51	Not Detected	----------	2.57E-001
CS-134	Not Detected	----------	4.45E-002
CS-137	Not Detected	----------	3.99E-002
EU-152	Not Detected	----------	7.91E-002
EU-154	Not Detected	----------	2.12E-001
EU-155	Not Detected	----------	1.27E-001
FE-59	Not Detected	----------	9.04E-002
GD-153	Not Detected	----------	7.91E-002
HG-203	Not Detected	----------	3.32E-002
I-131	Not Detected	----------	3.18E-002
IR-192	Not Detected	----------	3.06E-002
K-40	1.48E+001	2.44E+000	2.86E-001
MN-52	Not Detected	----------	4.24E-002
MN-54	Not Detected	----------	4.09E-002
MO-99	Not Detected	----------	3.76E-001
NA-22	Not Detected	----------	5.09E-002
NA-24	Not Detected	----------	1.27E-001
NB-95	Not Detected	----------	1.39E-001
ND-147	Not Detected	----------	2.58E-001
NI-57	Not Detected	----------	1.01E-001
RU-103	Not Detected	----------	3.26E-002
RU-106	Not Detected	----------	3.30E-001
SB-122	Not Detected	----------	5.94E-002
SB-124	Not Detected	----------	3.41E-002
SB-125	Not Detected	----------	9.42E-002
SN-113	Not Detected	----------	4.14E-002
SR-85	Not Detected	----------	4.12E-002
TA-182	Not Detected	----------	1.91E-001
TA-183	Not Detected	----------	2.24E-001
TL-201	Not Detected	----------	1.37E-001
XE-133	Not Detected	----------	1.37E-001
Y-88	Not Detected	----------	3.12E-002
ZN-65	Not Detected	----------	1.27E-001
ZR-95	Not Detected	----------	7.24E-002

```
*************************************************************************
*                     Sandia National Laboratories                      *
*    Radiation Protection Sample Diagnostics Program [806 Laboratory]   *
*                        4/26/00  7:12:58 AM                            *
*************************************************************************
*                                                                       *
* Analyzed by: Wem  4/26/00             Reviewed by:  4/26/00           *
*************************************************************************
Customer                    : FRESHOUR/PERRY (6134-SMO)
Customer Sample ID          : LAB CONTROL SAMPLE USING CG134
Lab Sample ID               : 00074306

Sample Description          : MIXED_GAMMA_STANDARD_CG134
Sample Quantity             :    1.000  Each
Sample Date/Time            : 11/01/90  12:00:00 PM
Acquire Start Date/Time     :  4/26/00   7:02:44 AM
Detector Name               : LAB01
Elapsed Live/Real Time      :    600 /    604 seconds

Comments:
*************************************************************************

 Nuclide       Activity        2-sigma            MDA
  Name        (pCi/Each )      Error            (pCi/Each )
 -------      -----------     ----------        -----------
 U-238       Not Detected     ----------         2.63E+003
 RA-226      Not Detected     ----------         5.34E+003
 PB-214      Not Detected     ----------         6.81E+002
 BI-214      Not Detected     ----------         6.50E+002
 PB-210      Not Detected     ----------         7.41E+004

 TH-232      Not Detected     ----------         2.13E+003
 RA-228      Not Detected     ----------         2.86E+003
 AC-228      Not Detected     ----------         1.58E+003
 TH-228      Not Detected     ----------         2.05E+005
 RA-224      Not Detected     ----------         6.98E+003
 PB-212      Not Detected     ----------         1.32E+004
 BI-212      Not Detected     ----------         1.34E+005
 TL-208      Not Detected     ----------         3.01E+004

 U-235       Not Detected     ----------         1.39E+003
 TH-231      Not Detected     ----------         4.48E+004
 PA-231      Not Detected     ----------         1.33E+004
 TH-227      Not Detected     ----------         2.22E+003
 RA-223      Not Detected     ----------         1.00E+026
 RN-219      Not Detected     ----------         6.06E+003
 PB-211      Not Detected     ----------         1.37E+004
 TL-207      Not Detected     ----------         2.43E+005

 AM-241         8.45E+004     1.29E+004          1.43E+003
 PU-239      Not Detected     ----------         2.36E+006
 NP-237      Not Detected     ----------         1.26E+004
 PA-233      Not Detected     ----------         5.94E+002
 TH-229      Not Detected     ----------         1.07E+003
```

[Summary Report] - Sample ID: : 00074306

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
AG-108m	Not Detected	----------	3.42E+002
AG-110m	Not Detected	----------	2.56E+007
BA-133	Not Detected	----------	8.05E+002
BE-7	Not Detected	----------	1.35E+023
CD-115	Not Detected	----------	1.00E+026
CE-139	Not Detected	----------	6.71E+009
CE-141	Not Detected	----------	1.00E+026
CE-144	Not Detected	----------	6.11E+006
CO-56	Not Detected	----------	1.31E+016
CO-57	Not Detected	----------	1.17E+006
CO-58	Not Detected	----------	1.83E+017
CO-60	7.93E+004	1.09E+004	7.14E+002
CR-51	Not Detected	----------	1.00E+026
CS-134	Not Detected	----------	7.25E+003
CS-137	6.80E+004	8.90E+003	2.91E+002
EU-152	Not Detected	----------	8.29E+002
EU-154	Not Detected	----------	3.22E+003
EU-155	Not Detected	----------	3.07E+003
FE-59	Not Detected	----------	1.00E+026
GD-153	Not Detected	----------	9.25E+006
HG-203	Not Detected	----------	1.00E+026
I-131	Not Detected	----------	1.00E+026
IR-192	Not Detected	----------	3.72E+016
K-40	Not Detected	----------	1.53E+003
MN-52	Not Detected	----------	1.00E+026
MN-54	Not Detected	----------	8.53E+005
MO-99	Not Detected	----------	1.00E+026
NA-22	Not Detected	----------	2.29E+003
NA-24	Not Detected	----------	1.00E+026
NB-95	Not Detected	----------	1.00E+026
ND-147	Not Detected	----------	1.00E+026
NI-57	Not Detected	----------	1.00E+026
RU-103	Not Detected	----------	1.00E+026
RU-106	Not Detected	----------	2.07E+006
SB-122	Not Detected	----------	1.00E+026
SB-124	Not Detected	----------	6.22E+019
SB-125	Not Detected	----------	1.29E+004
SN-113	Not Detected	----------	4.97E+011
SR-85	Not Detected	----------	4.69E+018
TA-182	Not Detected	----------	1.39E+012
TA-183	Not Detected	----------	1.00E+026
TL-201	Not Detected	----------	1.00E+026
XE-133	Not Detected	----------	1.00E+026
Y-88	Not Detected	----------	9.35E+011
ZN-65	Not Detected	----------	1.71E+007
ZR-95	Not Detected	----------	1.13E+019

```
************************************************************************
*                  Sandia National Laboratories                        *
*          Radiation Protection Sample Diagnostics Program             *
*                   Quality Assurance Report                           *
************************************************************************

Report Date           :  4/26/00  7:13:00 AM
QA File               : C:\GENIE2K\CAMFILES\LCS1.QAF
Analyst               : LRH
Sample ID             : 00074306
Sample Quantity       :     1.00 Each
Sample Date           : 11/01/90 12:00:00 PM
Measurement Date      :  4/26/00  7:02:44 AM
Elapsed Live Time     :      600 seconds
Elapsed Real Time     :      604 seconds

Parameter         Mean         1S Error       New Value    < LU : SD : UD : BS >
--------------- -----------  ------------   -----------   ---------------------

AM-241 ACTIVITY  8.495E-002   2.764E-003     8.449E-002   <    :    :    :    >

CS-137 Activity  6.836E-002   1.165E-003     6.798E-002   <    :    :    :    >

CO-60 Activity   7.631E-002   2.596E-003     7.777E-002   <    :    :    :    >


Flags Key:   LU = Boundary Test             (Ab = Above       , Be = Below )
             SD = Sample Driven N-Sigma Test (In = Investigate, Ac = Action)
             UD = User   Driven N-Sigma Test (In = Investigate, Ac = Action)
             BS = Measurement Bias Test      (In = Investigate, Ac = Action)
```

Reviewed by: Ukun 4/26/00

```
***********************************************************************
*                     Sandia National Laboratories                    *
*    Radiation Protection Sample Diagnostics Program [806 Laboratory] *
*                       4/26/00  7:33:53 AM                           *
***********************************************************************
*                                                                     *
* Analyzed by:      4/26/00           Reviewed by:     4/26/00        *
***********************************************************************
Customer                     : FRESHOUR/PERRY (6134-SMO)
Customer Sample ID           : LAB CONTROL SAMPLE USING CG134
Lab Sample ID                : 00074307

Sample Description           : MIXED_GAMMA_STANDARD_CG134
Sample Quantity              :     1.000  Each
Sample Date/Time             : 11/01/90  12:00:00 PM
Acquire Start Date/Time      :  4/26/00   7:23:40 AM
Detector Name                : LAB02
Elapsed Live/Real Time       :    600 /    605 seconds

Comments:
***********************************************************************

 Nuclide      Activity        2-sigma           MDA
  Name       (pCi/Each )       Error         (pCi/Each )
 -------     -----------     ----------      -----------
 U-238      Not Detected     ---------        4.19E+003
 RA-226     Not Detected     ---------        5.54E+003
 PB-214     Not Detected     ---------        6.09E+002
 BI-214     Not Detected     ---------        5.74E+002
 PB-210     Not Detected     ---------        2.51E+005

 TH-232     Not Detected     ---------        2.01E+003
 RA-228     Not Detected     ---------        2.20E+003
 AC-228     Not Detected     ---------        1.33E+003
 TH-228     Not Detected     ---------        1.95E+005
 RA-224     Not Detected     ---------        7.64E+003
 PB-212     Not Detected     ---------        1.51E+004
 BI-212     Not Detected     ---------        1.10E+005
 TL-208     Not Detected     ---------        2.72E+004

 U-235      Not Detected     ---------        1.64E+003
 TH-231     Not Detected     ---------        7.49E+004
 PA-231     Not Detected     ---------        1.32E+004
 TH-227     Not Detected     ---------        2.53E+003
 RA-223     Not Detected     ---------        1.00E+026
 RN-219     Not Detected     ---------        5.80E+003
 PB-211     Not Detected     ---------        1.30E+004
 TL-207     Not Detected     ---------        1.92E+005

 AM-241         8.54E+004    1.41E+004        3.12E+003
 PU-239     Not Detected     ---------        2.85E+006
 NP-237     Not Detected     ---------        1.55E+004
 PA-233     Not Detected     ---------        5.69E+002
 TH-229     Not Detected     ---------        1.67E+003
```

[Summary Report] - Sample ID: : 00074307

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
AG-108m	Not Detected	---------	2.68E+002
AG-110m	Not Detected	---------	2.37E+007
BA-133	Not Detected	---------	7.20E+002
BE-7	Not Detected	---------	1.17E+023
CD-115	Not Detected	---------	1.00E+026
CE-139	Not Detected	---------	7.82E+009
CE-141	Not Detected	---------	1.00E+026
CE-144	Not Detected	---------	7.47E+006
CO-56	Not Detected	---------	1.02E+016
CO-57	Not Detected	---------	1.47E+006
CO-58	Not Detected	---------	1.44E+017
CO-60	8.38E+004	1.10E+004	4.54E+002
CR-51	Not Detected	---------	1.00E+026
CS-134	Not Detected	---------	6.63E+003
CS-137	7.56E+004	9.84E+003	2.41E+002
EU-152	Not Detected	---------	1.05E+003
EU-154	Not Detected	---------	2.51E+003
EU-155	Not Detected	---------	3.80E+003
FE-59	Not Detected	---------	1.00E+026
GD-153	Not Detected	---------	1.39E+007
HG-203	Not Detected	---------	1.00E+026
I-131	Not Detected	---------	1.00E+026
IR-192	Not Detected	---------	3.43E+016
K-40	Not Detected	---------	1.33E+003
MN-52	Not Detected	---------	1.00E+026
MN-54	Not Detected	---------	6.42E+005
MO-99	Not Detected	---------	1.00E+026
NA-22	Not Detected	---------	2.41E+003
NA-24	Not Detected	---------	1.00E+026
NB-95	Not Detected	---------	1.00E+026
ND-147	Not Detected	---------	1.00E+026
NI-57	Not Detected	---------	1.00E+026
RU-103	Not Detected	---------	1.00E+026
RU-106	Not Detected	---------	1.81E+006
SB-122	Not Detected	---------	1.00E+026
SB-124	Not Detected	---------	5.61E+019
SB-125	Not Detected	---------	1.11E+004
SN-113	Not Detected	---------	4.66E+011
SR-85	Not Detected	---------	4.17E+018
TA-182	Not Detected	---------	1.10E+012
TA-183	Not Detected	---------	1.00E+026
TL-201	Not Detected	---------	1.00E+026
XE-133	Not Detected	---------	1.00E+026
Y-88	Not Detected	---------	8.00E+011
ZN-65	Not Detected	---------	1.36E+007
ZR-95	Not Detected	---------	8.60E+018

```
***************************************************************************
*                     Sandia National Laboratories                         *
*           Radiation Protection Sample Diagnostics Program               *
*                      Quality Assurance Report                            *
***************************************************************************

Report Date           :  4/26/00  7:33:55 AM
QA File               : C:\GENIE2K\CAMFILES\LCS2.QAF
Analyst               : LRH
Sample ID             : 00074307
Sample Quantity       :     1.00 Each
Sample Date           : 11/01/90 12:00:00 PM
Measurement Date      :  4/26/00  7:23:40 AM
Elapsed Live Time     :      600 seconds
Elapsed Real Time     :      605 seconds

Parameter              Mean       1S Error      New Value   < LU : SD : UD : BS >
--------------- ----------- ------------  -----------  ---------------------

AM-241 Activity  8.191E-002   3.637E-003    8.536E-002  <    :    :    :    >

CS-137 Activity  7.128E-002   2.459E-003    7.558E-002  <    :    :    :    >

CO-60 Activity   7.942E-002   2.753E-003    8.283E-002  <    :    :    :    >


Flags Key:   LU = Boundary Test               (Ab = Above       , Be = Below )
             SD = Sample Driven N-Sigma Test  (In = Investigate, Ac = Action)
             UD = User   Driven N-Sigma Test  (In = Investigate, Ac = Action)
             BS = Measurement Bias Test       (In = Investigate, Ac = Action)
```

Reviewed by: 4/26/00

Annex 2-C

ANNEX 2-C
Radiological Surveys

Survey Number: S32267

RADIOLOGICAL SURVEY FORM

Page 1 of 3

Location ER Site 94/All	Requester/Org. HENDERSON,PHILLIP C/06134	Date 04/10/2000	Time 1100	Duration 1.5 Hrs

Purpose Other - see remarks	Request # N/A	RWP # RWP0946	RPIR # N/A

Instrument and Probe Type and Serial Number		Surveyor(s) Printed Name	Surveyor(s) Signature/Date
ESP-2 w/ SPA-3 / 2169	N/A	Hanson, Donald J.	4/21/00
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A

#	Item Description/Location	BETA-GAMMA ACTIVITY Counting Data Attached ☐Yes ☒No % Eff. N/A /Radionuclide N/A .				ALPHA ACTIVITY Counting Data Attached ☐Yes ☒No % Eff. N/A /Radionuclide N/A .				RADIATION SURVEY Bkg. 10050 .	
		cpm	Bkg. cpm	dpm / 100 cm^2 (1)	T/R/F(2)	cpm	Bkg. cpm	dpm / 100 cm^2 (1)	T/R/F(2)	CPM	Distance
	In And Around Trench									<15075	2 in

(1) If area other than 100 cm^2, record as dpm/probe, or dpm/LAW. (2) Total/Removable/Fixed. (3) Indicate type, if other than gamma (i.e., n, α, or β).

Remarks: Walk over survey prior to filling in part of a trench at site 94C.

Reviewed by: Date: 4-24-00

Reference RPO-04-401

11/26/97

COPY

Survey #: S32267
Page #: 2 of 3

BACKGROUND DETERMINATION LOG

Project Location: ER Site 94/ All
RCT Signature:

Project Description: Walk over survey

Inst. Type: ESP-2 w/ SPA-3 Inst. S/N: 2169 Time: 11:00 Date: 4/10/00	Inst. Type: Inst. S/N: Time: Date:	Inst. Type: Inst. S/N: Time: Date:
Background Readings 1) 10400 2) 10100 3) 9850 4) 9850	Background Readings 1) 2) 3) 4)	Background Readings 1) 2) 3) 4)
	N/A	
Mean Background $\bar{x}$ = 10050	Mean Background $\bar{x}$ =	Mean Background $\bar{x}$ =
Standard Deviation σ = 261	Standard Deviation σ =	Standard Deviation σ =
Action Level AL = 15075	Action Level AL =	Action Level AL =
Comments N/A	Comments	Comments

Standard Deviation: $\sigma = \sqrt{\dfrac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$

$AL = \bar{x} + 2\sigma$ Sample Screening

$AL = 1.5\bar{x}$ Area Surveys

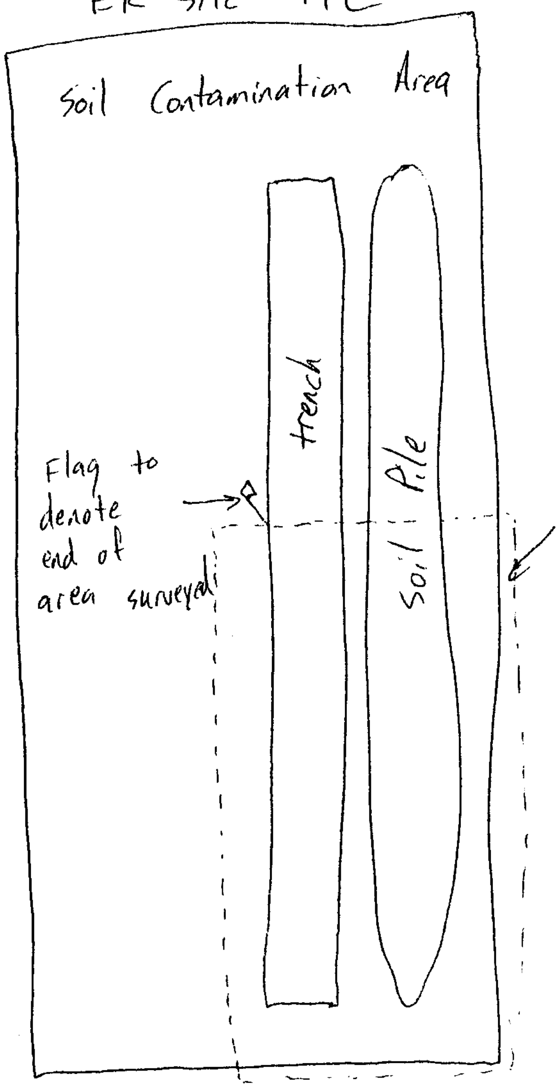
where:

$\bar{x}$ = Mean Background
x_i = Individual Background Measurement
n = Number of Measurements

RADIOLOGICAL SURVEY MAP

Survey Number: S32267
Page 3 of 3

ER site 94C



Area surveyed with in dashed box.
All areas surveyed were < AL (Action Limit) of 15075 CPM.

○ indicates smear location * indicates contact radiation reading Δ indicates Large Area Wipe All radiation readings are gamma in mrem/h unless noted otherwise.

Survey Number: S32064

RADIOLOGICAL SURVEY FORM

Page 1 of 3

Location ER Site 94/All	Requester/Org. Henderson, Phillip C/06134	Date 04/17/00	Time 09:00	Duration 3.0
Purpose Characterization	Request # N/A	RWP # RWP0946	RPIR # N/A	

Instrument and Probe Type and Serial Number		Surveyor(s) Printed Name	Surveyor(s) Signature/Date
ESP-2/SPA-3 #2217	N/A	Johnny Ethridge	5-2-00
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A

#	Item Description/Location	BETA-GAMMA ACTIVITY Counting Data Attached ☒ Yes ☐ No % Eff. N/A /Radionuclide N/A .				ALPHA ACTIVITY Counting Data Attached ☒ Yes ☐ No % Eff. N/A /Radionuclide N/A .				RADIATION SURVEY Bkg. 1.045E4 cpm.	
		cpm	Bkg. cpm	dpm/100 cm^2 (1)	T/R/F(2)	cpm	Bkg. cpm	dpm/100 cm^2 (1)	T/R/F(2)	mrem/hr(3)	Distance
N/A	Site 94 Trench	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	See Map	Contact

N/A

COPY

(1) If area other than 100 cm^2, record as dpm/probe, or dpm/LAW. (2) Total/Removable/Fixed. (3) Indicate type, if other than gamma (i.e., n, α, or β).

Remarks: Walk-over of trench bottom & side walls. Also, walk-over of area approximately 6' on either side of the trench. The areas of elevated readings will be excavated and then sampled.

Reviewed by:

Date: 5/2/00

Reference RPO-04-401
rsf.dot

Effective: 4/1/00

Survey #: S32064
Page #: 2 of 3

BACKGROUND DETERMINATION LOG

Project Location: ER Site 94
RCT Signature:

Project Description: Walk-over of trench and area within 6' of trench

Inst. Type: ESP-2 w SPA-3 Inst. S/N: 2217 Time: 09:00 Date: 04/17/00	Inst. Type: Inst. S/N: Time: Date:	Inst. Type: Inst. S/N: Time: Date:
Background Readings 1) 1.08E4 2) 1.05E4 3) 1.03E4 4) 1.02E4	Background Readings 1) 2) 3) 4)	Background Readings 1) 2) 3) 4)
Mean Background $\bar{x}$ = 1.045E4	Mean Background $\bar{x}$ = 0	Mean Background $\bar{x}$ = 0
Standard Deviation σ = 264.58	Standard Deviation σ = 0	Standard Deviation σ = 0
Action Level AL = 1.57E4	Action Level AL = 0	Action Level AL = 0
Comments	Comments	Comments

N/A

Standard Deviation: $$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$

$AL = \bar{x} + 2\sigma$ Sample Screening

$AL = 1.5\bar{x}$ Area Surveys

where:

$\bar{x}$ = Mean Background
x_i = Individual Background Measurement
n = Number of Measurements

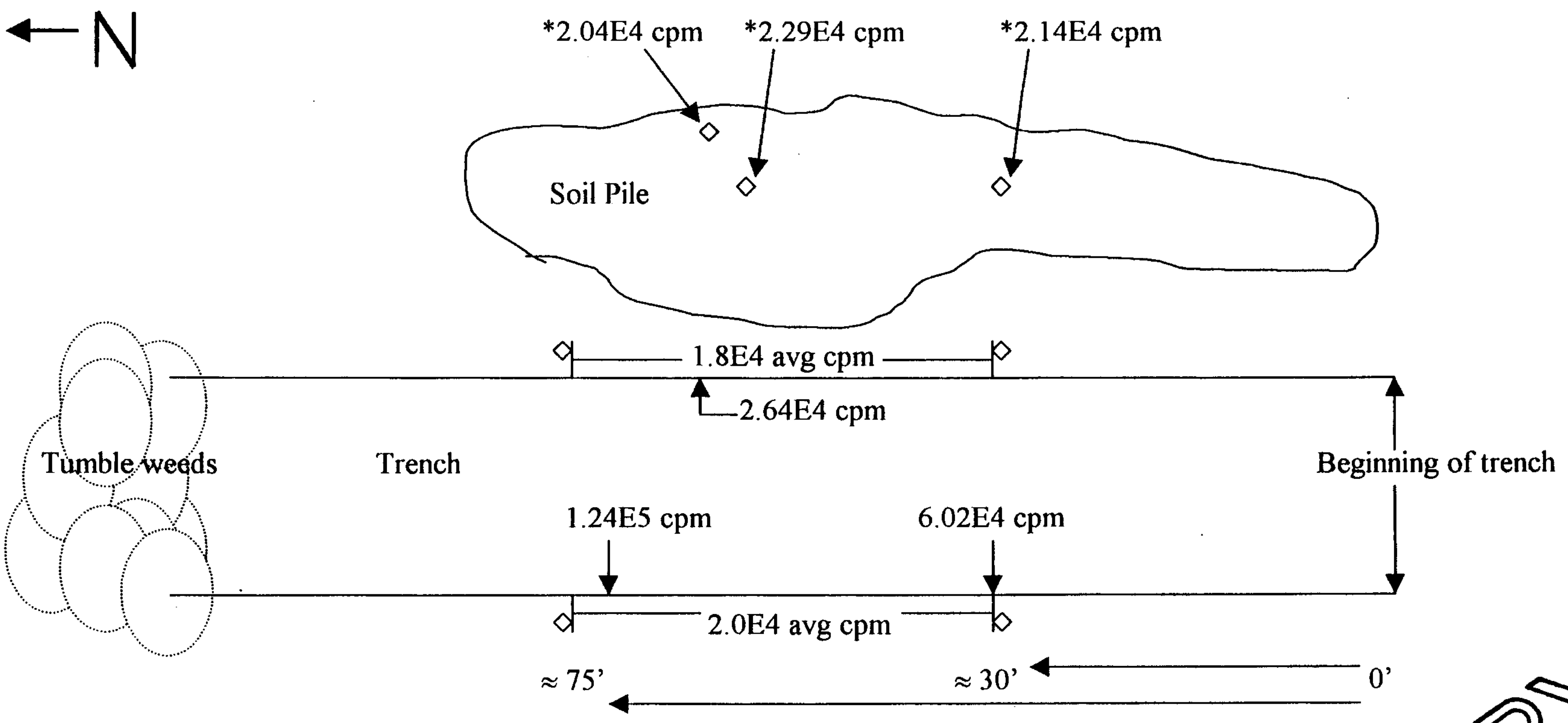
COPY

RADIOLOGICAL SURVEY MAP

Survey Number: S32064

Page 3 of 3

ER SITE 94



All readings were ≤ 1.04E4 cpm except where noted.

◇ = Pin Flag Location

COPY

○ indicates smear location * indicates contact radiation reading Δ indicates Large Area Wipe All radiation readings are gamma in mrem/h unless noted otherwise.

Survey Number: S32744

RADIOLOGICAL SURVEY FORM

Page 1 of 3

Location ER Site 94/All	Requester/Org. Henderson, Phillip C/06134	Date 05/04/00	Time 10:00	Duration 2.0
Purpose Characterization	Request # N/A	RWP # RWP0946		RPIR # N/A

Instrument and Probe Type and Serial Number		Surveyor(s) Printed Name	Surveyor(s) Signature/Date
ESP-2/SPA-3 #2217	N/A	Johnny Ethridge	5-4-00
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A

BETA-GAMMA ACTIVITY Counting Data Attached ☒ Yes ☐ No — % Eff. N/A /Radionuclide N/A .

ALPHA ACTIVITY Counting Data Attached ☒ Yes ☐ No — % Eff. N/A /Radionuclide N/A .

RADIATION SURVEY Bkg. 1.12E4 cpm.

#	Item Description/Location	BETA-GAMMA ACTIVITY cpm	Bkg. cpm	dpm/100 cm² (1)	T/R/F (2)	ALPHA ACTIVITY cpm	Bkg. cpm	dpm/100 cm² (1)	T/R/F (2)	RADIATION SURVEY mrem/hr (3)	Distance
N/A	Site 94 Trench	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	See Map	Contact

N/A

COPY

(1) If area other than 100 cm², record as dpm/probe, or dpm/LAW. (2) Total/Removable/Fixed. (3) Indicate type, if other than gamma (i.e., n, α, or β).

Remarks: Walk-over remainder of trench and proximity of trench. Two anomalies were located and will be remediated.

Reviewed by:

Date: 5/9/00

Reference RPO-04-401
rsf.dot

Effective: 4/1/00

Survey #: S32744
Page #: 2 of 3

BACKGROUND DETERMINATION LOG

Project Location: ER Site 94 RCT Signature:

Project Description: Walk-over remainder and proximity of trench

Inst. Type: ESP-2 w SPA-3	Inst. Type:	Inst. Type:
Inst. S/N: 2217	Inst. S/N:	Inst. S/N:
Time: 10:00	Time:	Time:
Date: 05/04/00	Date:	Date:
Background Readings	Background Readings	Background Readings
1) 1.10E4	1)	1)
2) 1.03E4	2)	2)
3) 1.13E4	3)	3)
4) 1.15E4	4)	4)
Mean Background	Mean Background	Mean Background
$\bar{x}$ = 1.12E4	$\bar{x}$ = 0	$\bar{x}$ = 0
Standard Deviation	Standard Deviation	Standard Deviation
σ = 525.20	σ = 0	σ = 0
Action Level	Action Level	Action Level
AL = 1.70E4	AL = 0	AL = 0
Comments	Comments	Comments

N/A

Standard Deviation: $$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$

$AL = \bar{x} + 2\sigma$ Sample Screening

$AL = 1.5\bar{x}$ Area Surveys

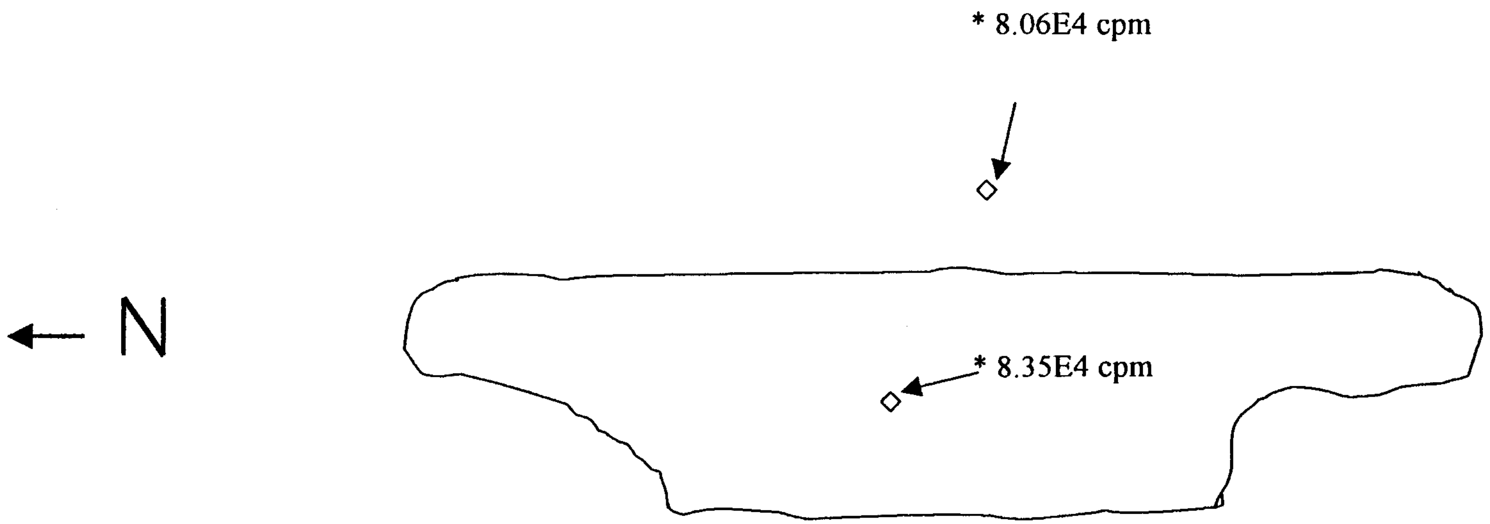
where:

$\bar{x}$ = Mean Background
x_i = Individual Background Measurement
n = Number of Measurements

RADIOLOGICAL SURVEY MAP

Survey Number: S32744
Page 3 of 3

ER SITE 94



All readings were ≤ 1.7E4 cpm except where noted.

◇ = Pin Flag Location

○ indicates smear location * indicates contact radiation reading Δ indicates Large Area Wipe All radiation readings are gamma in mrem/h unless noted otherwise.

Survey Number: S32888

RADIOLOGICAL SURVEY FORM

Page 1 of 3

Location ER Site 94/All	Requester/Org. Henderson, Phillip C/06134	Date 05/08/00	Time 11:15	Duration 1.5
Purpose Characterization	Request # N/A	RWP # RWP0946		RPIR # N/A

Instrument and Probe Type and Serial Number		Surveyor(s) Printed Name	Surveyor(s) Signature/Date
ESP-2/SPA-3 #2217	N/A	Johnny Ethridge	5-9-00
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A

#	Item Description/Location	BETA-GAMMA ACTIVITY Counting Data Attached ☒ Yes ☐ No % Eff. N/A /Radionuclide N/A .				ALPHA ACTIVITY Counting Data Attached ☒ Yes ☐ No % Eff. N/A /Radionuclide N/A .				RADIATION SURVEY Bkg. 1.17E4 cpm.	
		cpm	Bkg. cpm	dpm / 100 cm² (1)	T/R/F(2)	cpm	Bkg. cpm	dpm / 100 cm² (1)	T/R/F(2)	CPM ~~mrem/hr~~(3) SDE 050900	Distance
N/A	Anomaly #1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	≤ 1.17E4	Contact
N/A	Anomaly #2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	≤ 1.17E4	Contact

N/A

COPY

(1) If area other than 100 cm², record as dpm/probe, or dpm/LAW. (2) Total/Removable/Fixed. (3) Indicate type, if other than gamma (i.e., n, α, or β).

Remarks: Clean-up of two anamolies from Survey #S32744.

Reviewed by: Date: 5/10/00

Reference RPO-04-401
rsf.dot

Effective: 4/1/00

Survey #: S32888
Page #: 2 of 3

BACKGROUND DETERMINATION LOG

Project Location: ER Site 94
RCT Signature:

Project Description: Clean-up of two anomalies

Inst. Type: ESP-2 w SPA-3 Inst. S/N: 2217 Time: 11:15 Date: 05/08/00	Inst. Type: Inst. S/N: Time: Date:	Inst. Type: Inst. S/N: Time: Date:
Background Readings 1) 1.03E4 2) 1.13E4 3) 1.19E4 4) 1.33E4	Background Readings 1) 2) 3) 4) N/A	Background Readings 1) 2) 3) 4)
Mean Background $\bar{x}$ = 1.17E4	Mean Background $\bar{x}$ = 0	Mean Background $\bar{x}$ = 0
Standard Deviation σ = 1254.33	Standard Deviation σ = 0	Standard Deviation σ = 0
Action Level AL = 1.755E4	Action Level AL = 0	Action Level AL = 0
Comments	Comments	Comments

Standard Deviation: $$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$

$AL = \bar{x} + 2\sigma$ Sample Screening

$AL = 1.5\bar{x}$ Area Surveys

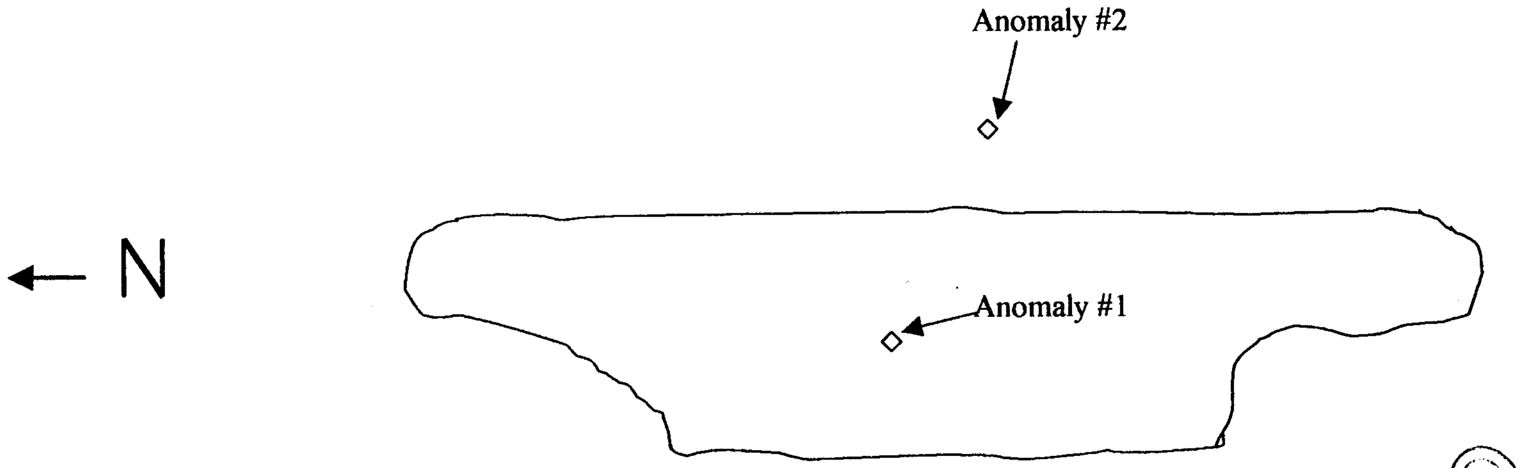
where:

$\bar{x}$ = Mean Background
x_i = Individual Background Measurement
n = Number of Measurements

RADIOLOGICAL SURVEY MAP

Survey Number: S32888
Page 3 of 3

ER SITE 94



◇ = Pin Flag Location

○ indicates smear location   * indicates contact radiation reading   Δ indicates Large Area Wipe   All radiation readings are gamma in mrem/h unless noted otherwise.

Survey Number: S34458

RADIOLOGICAL SURVEY FORM

Page 1 of 3

Location ER Site 94/All	Requester/Org. Henderson, Phillip C/06134	Date 06/20/00	Time 10:45	Duration 2.5
Purpose Characterization	Request # N/A	RWP # RWP0946		RPIR # N/A

Instrument and Probe Type and Serial Number		Surveyor(s) Printed Name	Surveyor(s) Signature/Date
ESP-2/SPA-3 #2217	N/A	Johnny Ethridge	J Ethridge 6-30-00
N/A	N/A	N/A	N/A
N/A	N/A	N/A	N/A

		BETA-GAMMA ACTIVITY Counting Data Attached ☒Yes ☐No % Eff. N/A /Radionuclide N/A .				ALPHA ACTIVITY Counting Data Attached ☒Yes ☐No % Eff. N/A /Radionuclide N/A .				RADIATION SURVEY Bkg. 1.16E4 cpm.	
#	Item Description/Location	cpm	Bkg. cpm	dpm/100 cm^2 (1)	T/R/F (2)	cpm	Bkg. cpm	dpm/100 cm^2 (1)	T/R/F (2)	CPM ~~mrem/hr~~ (3)	Distance
N/A	Site 94 Trench	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	See Map	Contact

N/A

(1) If area other than 100 cm^2, record as dpm/probe, or dpm/LAW. (2) Total/Removable/Fixed. (3) Indicate type, if other than gamma (i.e., n, α, or β).

Remarks: Walk-over of 94C. The trench was previously surveyed (S32744 & S32888).

Reviewed by: Date: 7/3/00

Reference RPO-04-401
rsf.dot

Effective: 4/1/00

COPY

Survey #: S34458
Page #: 2 of 3

BACKGROUND DETERMINATION LOG

Project Location: ER Site 94
RCT Signature:

Project Description: Walk-over of 94C

Inst. Type: ESP-2 w SPA-3	Inst. Type:	Inst. Type:
Inst. S/N: 2217	Inst. S/N:	Inst. S/N:
Time: 10:45	Time:	Time:
Date: 06/20/00	Date:	Date:
Background Readings	Background Readings	Background Readings
1) 1.09E4	1)	1)
2) 1.15E4	2)	2)
3) 1.32E4	3)	3)
4) 1.11E4	4)	4)
	N/A	
Mean Background	Mean Background	Mean Background
$\bar{x}$ = 1.16E4	$\bar{x}$ = 0	$\bar{x}$ = 0
Standard Deviation	Standard Deviation	Standard Deviation
σ = 798	σ = 0	σ = 0
Action Level	Action Level	Action Level
AL = 1.70E4	AL = 0	AL = 0
Comments	Comments	Comments

Standard Deviation: $$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}}$$

$AL = \bar{x} + 2\sigma$ Sample Screening

$AL = 1.5\bar{x}$ Area Surveys

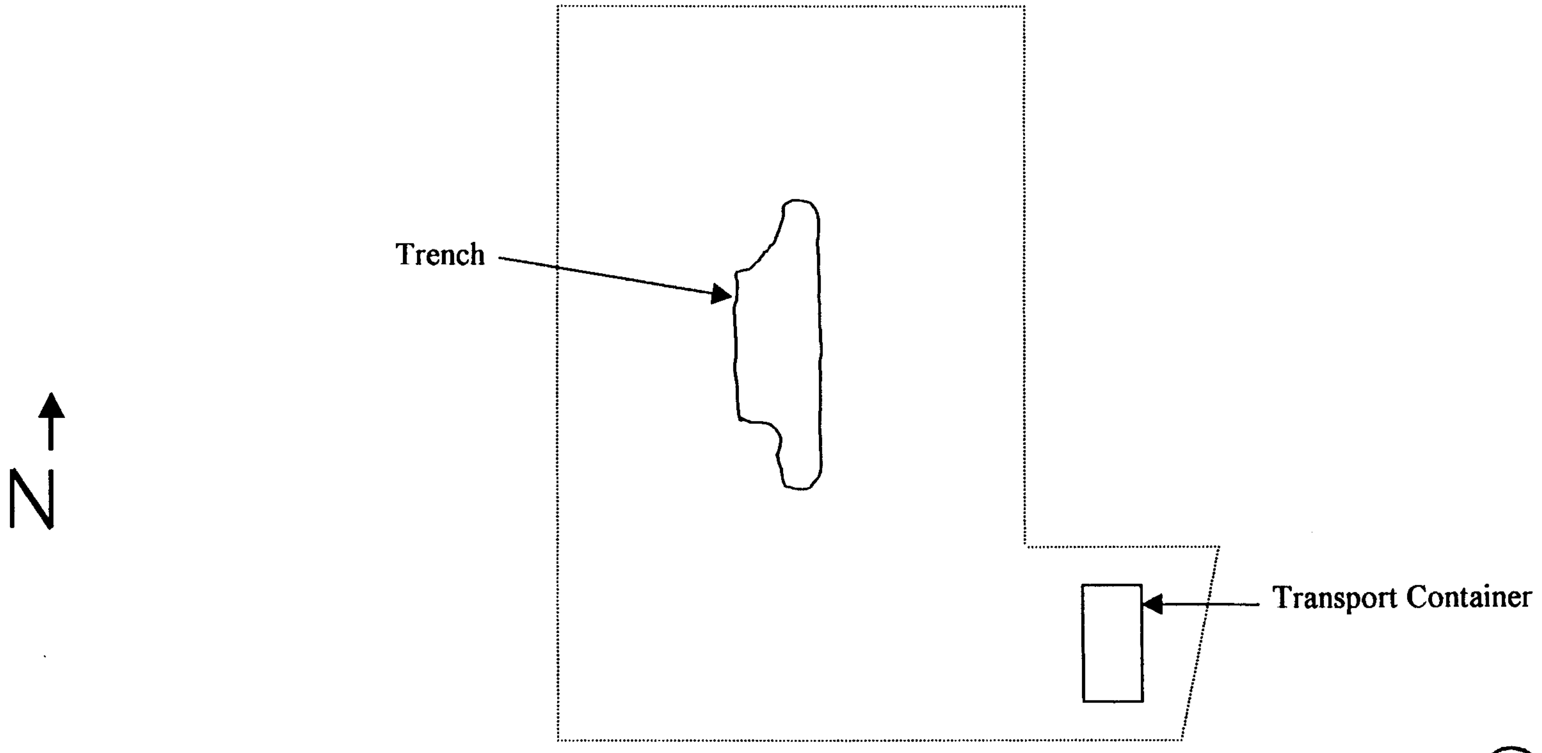
where:

$\bar{x}$ = Mean Background
x_i = Individual Background Measurement
n = Number of Measurements

RADIOLOGICAL SURVEY MAP

Survey Number: S34458
Page 3 of 3

ER SITE 94



All readings were less than the action limit of 1.70E4 cpm

○ indicates smear location * indicates contact radiation reading Δ indicates Large Area Wipe All radiation readings are gamma in mrem/h unless noted otherwise.

Annex 2-D

ANNEX 2-D
Data Validation Results

Sample Findings Summary

Site: Site 94C Bomb Burner

AR/COC: 603231

Data Classification: Organics (EPA 8260A/B ↓ 8270C ↓ 8330)

ER Sample ID	Analysis	DV Qualifiers	Comments
051783-002 CY94C-GR-011-SS	479-45-8 (Tetryl)	UJ, A	
↓ 4- ↓ ↓ ↓ -012- ↓	↓	↓	
5- -013-			
6- -013-DU			
⇒ Note: See attached spreadsheet for VOC data qualifications. No SVOC data were qualified.			
Data are acceptable.			
QC Measures appear to be adequate.			

ER Sample ID - This value is located on the AR/Chain of Custody.

Analysis - Use valid test methods provided below or if the result applies to an individual analyte within a test method, use the CAS number from the analytical data sheet.

DV Qualifiers - The entry will be taken from the list of valid qualifiers and associated comments. If other qualifiers not on the list are needed, contact Tina Sanchez to coordinate adding them to the list.

Comments - This is only to be used if a comment associated with the qualifier is not appropriate, needs modification because of an unusual circumstance, or additional clarification is warranted.

Test Methods - Anions_CE, EPA6010, EPA6020, EPA7470/1, EPA8015B, EPA8081, EPA8260, EPA8260-M3, EPA8270, HACH_ALK, HACH_ NO2, HACH_NO3, MEKC_HE, PCBRISC

Reviewed by:

Date: 6/21/00

ARCOC #603231 **Organic Analyses (VOCs)** **ER Sample ID**	67-64-1 (acetone)	79-01-6 (trichloroethene)	108-10-1 (4-methyl-2-pentanone)	591-78-6 (2-hexanone)	127-18-4 (tetrachloroethene)	79-34-5 (1,1,2,2-tetrachloroethane)	108-88-3 (toluene)	108-90-7 (chlorobenzene)	100-41-4 (ethylbenzene)	100-42-5 (styrene)	1330-20-7 (xylenes)				
051783-001 CY94C-GR-011-SS		UJ													
051784-001 CY94C-GR-012-SS	J	UJ													
051785-001 CY94C-GR-013-SS		UJ													
051786-001 CY94C-GR-013-DU		UJ	UJ	UJ	UJ	UJ	UJ	UJ	UJ	UJ	UJ				
051787-001 CY94C-GR-001-EB		UJ													
051791-001 CY94C-001-TB		UJ													

6/21/00

MEMORANDUM

DATE: June 21, 2000

TO: File

FROM: Kenneth Salaz

SUBJECT: Organic Data Review and Validation
Site 94C Bomb Burner, ARCOC #603231,
Project/Task No. 7214.02.02.14

See the attached Data Validation Worksheets for supporting documentation on the data review and validation.

Summary

All samples were prepared and analyzed with accepted procedures and specified methods: EPA8260A/B (VOCs), EPA8270C (SVOCs), and EPA8330 (HEs). Problems were identified with the data package that result in the qualification of data.

1. VOC Analysis: The initial calibration response factor (RF) of trichloroethene was less than (<) the required minimum but greater than (>) 0.01. All associated sample results were non-detect (ND) and will be qualified "UJ." The continuing calibration verification (CCV) percent difference (%D) of acetone was >20% for the field samples. The associated result of sample 24964-002 was a detect and will be qualified "J."
2. VOC Analysis: The internal standard area count of 1,4-dichlorobenzene-d4 was <50% but >25% of the 12 hour standard for sample 24964-004. All results associated with the internal standard were ND and will be qualified "UJ."
3. HE Analysis: The LCS/LCSD percent recoveries (%Rs) of tetryl were < QC acceptance limits for the field samples. All associated sample results were ND and will be qualified "UJ,A."

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

Holding Times/Preservation

All Analyses: All samples were extracted and/or analyzed within the prescribed holding times. All samples were properly preserved.

Calibration

VOC Analysis: The initial and continuing calibrations met QC acceptance criteria except as noted above in the summary section and the following. The CCV %Ds of several compounds (see Data Validation Worksheets) were >20% but <40%. However, all associated sample results were ND. Thus, no data were qualified.

SVOC Analysis: The initial and continuing calibrations met QC acceptance criteria except for the following. The CCV %D of 4-nitroaniline was >20% but <40% for the field samples. However, all associated sample results were ND. Thus, no data were qualified.

HE Analysis: The initial and continuing calibrations met QC acceptance criteria.

Blanks

All Analyses: No target analytes were detected in the method blanks.

Surrogates

All Analyses: The surrogate %Rs met QC acceptance criteria.

Internal Standards (ISs)

VOC Analysis: The IS areas and retention times met QC acceptance criteria except as noted above in the summary section.

SVOC Analysis: The IS areas and retention times met QC acceptance criteria.

HE Analysis: No IS was required for this method.

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

VOC/SVOC Analyses: The MS/MSDs were performed on samples from other SDGs. The case narratives stated that all QC acceptance criteria were met.

HE Analysis: The MS/MSD for the field samples met QC acceptance criteria. The MS/MSD for the field QC samples was performed on a sample from another SDG. The case narrative stated that all QC acceptance criteria were not met. However, the MS/MSD results are not applicable to this SDG.

Laboratory Control Samples (LCS/LCSD)

VOC/SVOC Analyses: The LCS/LCSDs met QC acceptance criteria.

HE Analysis: The LCS/LCSD met QC acceptance criteria except as noted above in the summary section.

Other QC

All Analyses: Field duplicates were submitted on the ARCOC. However, there are no "required" review criteria for field duplicate analyses comparability. No target analytes were detected in the trip blank (TB) or equipment blanks (EBs). No field blanks (FBs) were submitted on the ARCOC.

No other specific issues were identified which affect data quality.

Please contact me if you have any questions or comments regarding the review of this package.

Sample Findings Summary

Site: Site 94C Bomb Burner

AR/COC: 603231

Data Classification: Inorganics (EPA6010B ↓ 6020 ↓ 7470A)

ER Sample ID	Analysis	DV Qualifiers	Comments
051788-002 CY94C-GR-002-EB	7440-22-4 (silver)	J,B3	
↓ ↓ ↓ ↓ ↓	7439-97-6 (mercury)	U J,B3	
	Data are acceptable.		
QC	Measures appear	to be adequate.	

ER Sample ID - This value is located on the AR/Chain of Custody.

Analysis - Use valid test methods provided below or if the result applies to an individual analyte within a test method, use the CAS number from the analytical data sheet.

DV Qualifiers - The entry will be taken from the list of valid qualifiers and associated comments. If other qualifiers not on the list are needed, contact Tina Sanchez to coordinate adding them to the list.

Comments - This is only to be used if a comment associated with the qualifier is not appropriate, needs modification because of an unusual circumstance, or additional clarification is warranted.

Test Methods - Anions_CE, EPA6010, EPA6020, EPA7470/1, EPA8015B, EPA8081, EPA8260, EPA8260-M3, EPA8270, HACH_ALK, HACH_ NO2, HACH_NO3, MEKC_HE, PCBRISC

Reviewed by:

Date: 6/21/00

MEMORANDUM

DATE: June 21, 2000

TO: File

FROM: Kenneth Salaz KAS

SUBJECT: Inorganic Data Review and Validation
Site 94C Bomb Burner, ARCOC #603231,
Project/Task No. 7214.02.02.14

See the attached Data Validation Worksheets for supporting documentation on the data review and validation.

Summary

All samples were prepared and analyzed with accepted procedures and specified methods: EPA6010B (ICP-AES), EPA6020 (ICP-MS), and EPA7470A (CVAA). Problems were identified with the data package that result in the qualification of data.

1. ICP Analyses: In the continuing calibration blank (CCB) for the equipment blank (EB), silver (Ag) was detected. The associated sample result was a detect, less than (<) 5X the blank concentration, and will be qualified "J,B3." In the initial calibration blank (ICB) for the EB, arsenic (As) was detected at a negative concentration. The absolute value was greater than (>) the detection limit (DL) but < the reporting limit (RL). The associated sample result was non-detect (ND) and will be qualified "UJ,B3."

   CVAA Analysis: In the CCB for the EB, mercury (Hg) was detected at a negative concentration. The absolute value was > the DL but < the RL. The associated sample result was ND and will be qualified "UJ,B3."

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

Holding Times

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

Calibration

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

Blanks

ICP Analyses: No target analytes were detected in the blanks except as noted above in the summary section and the following. Chromium (Cr) was detected in the ICB for the EB and in the CCB for the field samples. However, the EB result was ND, and the field sample results were all >5X the blank concentration. Also, beryllium (Be) and lead (Pb) were detected in the ICB and/or CCB for the field samples at negative concentrations. The absolute values were > the DL but < the RL. However, all associated results were >5X the DL. Thus, no data were qualified.

CVAA Analysis: No target analytes were detected in the blanks except as noted above in the summary section and the following. Hg was detected in the ICB and CCB for the field samples at negative concentrations. However, the absolute values of the blank concentrations were < the DL. Thus, no data were qualified.

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

All Analyses: The MSs performed on samples from this SDG met QC acceptance criteria. No MSDs were performed. The replicate analyses were used as measures of laboratory precision.

Laboratory Control Samples (LCS/LCSD)

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

Replicates

All Analyses: The replicate analyses performed on samples from this SDG met QC acceptance criteria.

ICP Interference Check Sample (ICS)

ICP Analyses: The ICSs met QC acceptance criteria.

CVAA Analysis: No ICS was required for this method.

ICP Serial Dilution

ICP Analysis: The serial dilutions performed on samples from this SDG met QC acceptance criteria.

CVAA Analyses: No serial dilution was required for this method.

Other QC

ICP Analyses: In the EB, barium (Ba) and Ag were detected. However, all Ba results were >5X the blank concentration, and all Ag results were ND. Thus, no data were qualified. A field duplicate was submitted. However, there are no "required" review criteria for field duplicate analyses comparability. No field blank (FB) was submitted on the ARCOC.

CVAA Analysis: No target analytes were detected in the EB. A field duplicate was submitted. However, there are no "required" review criteria for field duplicate analyses comparability. No field blank (FB) was submitted on the ARCOC.

No other specific issues were identified which affect data quality.

Please contact me if you have any questions or comments regarding the review of this package.

Data Validation Summary

Site/Project: Site 94C Bomb Burner Project/Task #: 7214.02.02.14

# of Samples: 13 Matrix: 8 soil / 5 aqueous

AR/COC #: 603231

Laboratory Sample IDs: 24964-001 to -008

24966-001 to -005

Laboratory: GEL

Laboratory Report #: 24964/24966

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

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

Check (√) = Acceptable
Shaded Cells = Not Applicable (also "NA")
NP = Not Provided
Other: ______

Reviewed By: ______ Date: 6/21/00

KAS 6/21/00 Volatile Organics (SW 846 Method 8260)

Site/Project: Site 94C Bomb Burner AR/COC #: ~~602634~~ 603231 # of Samples: 4 Matrix: ~~Aqueous~~ KAS 6/19/00 Soil

Laboratory: GEL Laboratory Report #: 24964 Laboratory Sample IDs: 24964-001 to -004

Methods: EPA 8260A Batch #s: 23422

IS	CAS #	Name	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blks	LCS	LCSD	LCS RPD	① MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Trip Blanks		
						>.05	<20% / 0.99	20%												
1	74-87-3	Chloromethane	✓	0.10	NA	✓	✓	✓	✓							NA	✓	✓		
1	74-83-9	Bromomethane		0.10	✓															
1	75-01-4	vinyl chloride		0.10	NA															
1	75-00-3	Chloroethane		0.01	✓															
1	75-09-2	methylene chloride (10xblk)		0.01	✓															
1	67-64-1	acetone(10xblk)		0.01	✓			-34.8												
1	75-15-0	carbon disulfide		0.10	NA			-33.2												
1	75-35-4	1,1-dichloroethene		0.20				✓		✓	✓	✓	NA	NA	NA					
1	75-34-3	1,1-dichloroethane		0.10				✓												
1	67-66-3	Chloroform		0.20				✓												
1	107-06-2	1,2-dichloroethane		0.10				-25.7												
1	78-93-3	2-butanone(10xblk)		0.01				✓												
2	71-55-6	1,1,1-trichloroethane		0.10																
2	56-23-5	carbon tetrachloride		0.10																
2	75-27-4	Bromodichloromethane		0.20																
2	78-87-5	1,2-dichloropropane		0.01																
2	10061-01-5	cis-1,3-dichloropropene		0.20																
2	79-01-6	Trichloroethene		0.30		0.26				✓	✓	✓	NA	NA	NA					
2	124-48-1	Dibromochloromethane		0.10		✓														
2	79-00-5	1,1,2-trichloroethane		0.10																
2	71-43-2	Benzene		0.50						✓	✓	✓	NA	NA	NA					
2	10061-02-6	trans-1,3-dichloropropene		0.10																
2	75-25-2	Bromoform		0.10				-23.1												
3	108-10-1	4-methyl-2-pentanone		0.10				-27.7												
3	591-78-6	2-hexanone		0.01				-37.8												
3	127-18-4	Tetrachloroethene		0.20				✓												
3	79-34-5	1,1,2,2-tetrachloroethane		0.30				-31.7												
3	108-88-3	toluene(10xblk)		0.40				✓		✓	✓	✓	NA	NA	NA					
3	108-90-7	Chlorobenzene		0.50						✓	✓	✓	NA	NA	NA					
3	100-41-4	Ethylbenzene		0.10																
3	100-42-5	Styrene		0.30																
3	1330-20-7	xylenes(total)		0.30																
-, trans-) →	540-59-0	1,2-dichloroethylene(total)		0.01																
	110-75-8	2-chloroethyl vinyl ether																		
1	108-05-4	Vinyl Acetate	✓		✓	✓	✓	-35.7	✓								✓	✓		

Comments:

Notes: Shaded rows are RCRA compounds.

NA = Not Applicable

① MS/MSD performed on a sample from another SDG. Case narrative says all QC were met.

Reviewed By: Date: 6/21/00

Volatile Organics

KJS 6/21/00

Site/Project: Site 94C Bomb Burner
AR/COC #: ~~602637~~ 603231
Batch #s: 23422
Laboratory: GEL
Laboratory Report #: 24964
# of Samples: 4
Matrix: Aqueous

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

Sample	SMC 1	SMC 2	SMC 3	IS 1 area	IS 1 RT	IS 2 area	IS 2 RT	IS 3 area	IS 3 RT
24964-004	✓	✓	✓	✓	✓	✓	✓	<50% (>25%)	✓

SMC 1: ~~4-~~Bromofluorobenzene
SMC 2: ~~1,2-Dichloroethane-d4~~ Dibromofluoromethane
SMC 3: Toluene-d8

IS 1: ~~Bromochloromethane~~ Fluorobenzene
IS 2: 1,4-Di~~fluoro~~chlorobenzene-d4
IS 3: Chlorobenzene-d5

KJS 6/14/00

Comments: *Summary

Calibration:

⇒ The RF of trichloroethene was < the min but >0.01. All assoc. results were ND and qualified "UJ."

⇒ The CCV %D of acetone was >20% but <40%. The assoc. result of sample -002 was a detect and qualified "J." All other results were ND and, thus, were not qualified.

⇒ The CCV %Ds of several other compounds (see worksheets) were also >20% but < 40%. All assoc. results were ND. Thus, no data were qualified.

I.S.:

⇒ The area of I.S. #3 for sample -004 was <50% but >25% of the 12 hr std. All assoc. results were ND and will be qualified "UJ."

Volatile Organics (SW 846 Method 8260)

Site/Project: Site 94C Bomb Burner AR/COC #: 603231 # of Samples: 2 Matrix: Aqueous

Laboratory: GEL Laboratory Report #: 24966 Laboratory Sample IDs: 24966-001 + -002

Methods: EPA 8260B Batch #s: 24296

IS	CAS #	Name	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blks	LCS	LCSD	LCS RPD	① MS	MSD	MS RPD	Field Dup. RPD	② Equip. Blanks	Trip Blanks		
						>.05	<20% / 0.99	20%												
1	74-87-3	Chloromethane	✓	0.10	NA	✓	✓	✓	✓				NA	NA	NA	NA	NA	NA		
1	74-83-9	Bromomethane	✓	0.10	✓	✓	✓													
1	75-01-4	**vinyl chloride**	✓	0.10	NA	✓	✓													
1	75-00-3	Chloroethane	✓	0.01	✓	✓	✓													
1	75-09-2	methylene chloride (10xblk)	✓	0.01	✓	✓	✓													
1	67-64-1	**acetone(10xblk)**	✓	0.01	✓	✓	✓	↓												
1	75-15-0	carbon disulfide	✓	0.10	NA	✓	✓	-30.6												
1	75-35-4	**1,1-dichloroethene**	✓	0.20		✓	✓	✓		✓	✓	✓								
1	75-34-3	**1,1-dichloroethane**	✓	0.10		✓	✓													
1	67-66-3	**Chloroform**	✓	0.20		✓	✓													
1	107-06-2	**1,2-dichloroethane**	✓	0.10		✓	✓													
1	78-93-3	**2-butanone(10xblk)**	✓	0.01		✓	✓													
2	71-55-6	1,1,1-trichloroethane	✓	0.10		✓	✓													
2	56-23-5	**carbon tetrachloride**	✓	0.10		✓	✓													
2	75-27-4	Bromodichloromethane	✓	0.20		✓	✓													
2	78-87-5	**1,2-dichloropropane**	✓	0.01		✓	✓													
2	10061-01-5	cis-1,3-dichloropropene	✓	0.20		✓	✓													
2	79-01-6	**Trichloroethene**	✓	0.30		0.26	✓			✓	✓	✓								
2	124-48-1	Dibromochloromethane	✓	0.10		✓	✓													
2	79-00-5	1,1,2-trichloroethane	✓	0.10		✓	✓													
2	71-43-2	**Benzene**	✓	0.50		✓	✓			✓	✓	✓								
2	10061-02-6	trans-1,3-dichloropropene	✓	0.10		✓	✓													
2	75-25-2	Bromoform	✓	0.10		✓	✓													
3	108-10-1	4-methyl-2-pentanone	✓	0.10		✓	✓													
3	591-78-6	2-hexanone	✓	0.01		✓	✓													
3	127-18-4	**Tetrachloroethene**	✓	0.20		✓	✓	↓												
3	79-34-5	1,1,2,2-tetrachloroethane	✓	0.30		✓	✓	-23.3												
3	108-88-3	toluene(10xblk)	✓	0.40		✓	✓	✓		✓	✓	✓								
3	108-90-7	**Chlorobenzene**	✓	0.50		✓	✓			✓	✓	✓								
3	100-41-4	Ethylbenzene	✓	0.10		✓	✓													
3	100-42-5	Styrene	✓	0.30		✓	✓													
3	1330-20-7	xylenes(total)	✓	0.30		✓	✓													
-, trans-) →	540-59-0	**1,2-dichloroethylene(total)**	✓	0.01	↓	✓	✓	↓	↓											
	110-75-8	2-chloroethyl vinyl ether											↓	↓	↓	↓	↓	↓		
	108-05-4	Vinyl Acetate	✓		✓	✓	✓	-24.2	✓											

Comments:

Notes: Shaded rows are RCRA compounds.

NA = Not Applicable

①MS/MSD performed on a sample from another SDG. Case narrative says all QC met.

②Samples are EB + TB.

Reviewed By: Date: 6/21/00

Volatile Organics

Page 2 of 2

Site/Project: Site 94C Bomb Burner AR/COC #: 603231 Batch #s: 24296

Laboratory: GEL Laboratory Report #: 24966 # of Samples: 2 Matrix: Aqueous

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

Sample	SMC 1	SMC 2	SMC 3	IS 1 area	IS 1 RT	IS 2 area	IS 2 RT	IS 3 area	IS 3 RT
All									
Passed									

SMC 1: ~~4-~~Bromofluorobenzene
SMC 2: ~~1,2-Dichloroethane-d4~~
SMC 3: Toluene-d8
Dibromofluoromethane

IS 1: ~~Bromochloromethane~~ Fluorobenzene
IS 2: 1,4-Di~~fluoro~~chlorobenzene-d4
IS 3: Chlorobenzene-d5

KJS
6/19/00

Comments: *Summary

Calibration:

⇒ The RF of trichloroethene was < the min but >0.01. All assoc. results were ND and were qualified "UJ."

⇒ The CCV %Ds of carbon disulfide, 1,1,2,2-tetrachloroethane, and vinyl acetate were >20% but <40%. All assoc. results were ND. Thus, no data were qualified.

Semivolatile Organics (SW 846 Method 8270)

Site/Project: Site 94C Bomb Burner AR/COC #: 603231 Laboratory Sample IDs: 24964-005, -006, -007, -008

Laboratory: GEL Laboratory Report #: 2496~~6~~4 6/19/00

Methods: EPA 8270C

# of Samples: 4 Matrix: Soil Batch #s: 23473(Analysis), 23228(Prep.)

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks 6/19/00	Field Blanks		
							>.05	<20% / 0.99	20%												
1	A	108-95-2	Phenol	✓	0.80	NA	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	NA	~~NA~~ ✓	NA		
1	BN	111-44-4	bis(2-Chloroethyl)ether		0.70		✓	✓													
1	A	95-57-8	2-Chlorophenol		0.80		✓	✓			✓	✓	✓	NA	NA	NA					
1	BN	541-73-1	1,3-Dichlorobenzene		0.60		✓	✓													
1	BN	106-46-7	1,4-Dichlorobenzene		0.50		✓	✓			✓	✓	✓	NA	NA	NA					
1	BN	95-50-1	1,2-Dichlorobenzene		0.40		✓	✓													
1	A	95-48-7	2-Methylphenol (o-cresol)		0.70		✓	✓													
1	BN	108-60-1	bis(2-chloroisopropyl)ether		0.01		✓	✓													
1	A	106-44-5	4-Methylphenol (m,p-cresol)		0.60		✓	✓													
1	BN	621-64-7	N-Nitroso-di-n-propylamine		0.50		✓	✓			✓	✓	✓	NA	NA	NA					
1	BN	67-72-1	Hexachloroethane		0.30		✓	✓													
2	BN	98-95-3	Nitrobenzene		0.20		✓	✓													
2	BN	78-59-1	Isophorone		0.40		✓	✓													
2	A	88-75-5	2-Nitrophenol		0.10		✓	✓													
2	A	105-67-9	2,4-Dimethylphenol		0.20		✓	✓													
2	BN	111-91-1	bis(2-Chloroethoxy)methane		0.30		✓	✓													
2	A	120-83-2	2,4-Dichlorophenol		0.20		✓	✓													
2	BN	120-82-1	1,2,4-Trichlorobenzene		0.20		✓	✓			✓	✓	✓	NA	NA	NA					
2	BN	91-20-3	Naphthalene		0.70		✓	✓													
2	BN	106-47-8	4-Chloroaniline		0.01		✓	✓													
2	BN	87-68-3	Hexachlorobutadiene		0.01		✓	✓													
2	A	59-50-7	4-Chloro-3-methylphenol		0.20		✓	✓			✓	✓	✓	NA	NA	NA					
2	BN	91-57-6	2-Methylnaphthalene		0.40	↓	✓	✓													
3	BN	77-47-4	Hexachlorocyclopentadiene		0.01	✓	✓	✓													
3	A	88-06-2	2,4,6-Trichlorophenol		0.20	NA	✓	✓													
3	A	95-95-4	2,4,5-Trichlorophenol	↓	0.20	↓	✓	✓	↓	↓							↓	↓	↓		

Notes: Shaded rows are RCRA compounds.

NA = Not Applicable

Comments:

Reviewed By: K Bailey Date: 6/21/00

Semivolatile Organics

Site/Project: Site 94C Bomb Burner AR/COC #: 603231 Batch #s: 23473, 23328

Laboratory: GEL Laboratory Report #: 24964 # of Samples: 4 Matrix: Soil

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF >.05	Calib. RSD/ R^2 <20% / 0.99	CCV %D 20%	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		
3	BN	91-58-7	2-Chloronaphthalene	✓	0.80	NA	✓	✓	✓	✓							NA	✓	NA		
3	BN	88-74-4	2-Nitroaniline (o-)		0.01		✓	✓													
3	BN	131-11-3	Dimethylphthalate		0.01		✓	✓													
3	BN	208-96-8	Acenaphthylene		0.90		✓	✓													
3	BN	606-20-2	2,6-Dinitrotoluene		0.20		✓	✓													
3	BN	99-09-2	3-Nitroaniline (m-)		0.01		✓	✓													
3	BN	83-32-9	Acenaphthene		0.90	↓	✓	✓			✓	✓	✓	NA	NA	NA					
3	A	51-28-5	2,4-Dinitrophenol		0.01	✓	✓	✓													
3	A	100-02-7	4-Nitrophenol		0.01	✓	✓	✓			✓	✓	✓	NA	NA	NA					
3	BN	132-64-9	Dibenzofuran		0.80	NA	✓	✓													
3	BN	121-14-2	2,4-Dinitrotoluene		0.20		✓	✓			✓	✓	✓	NA	NA	NA					
3	BN	84-66-2	Diethylphthalate		0.01		✓	✓													
3	BN	005-72-3	4-Chlorophenyl-phenylether		0.40		✓	✓													
3	BN	86-73-7	Fluorene		0.90	↓	✓	✓	↓												
3	BN	100-01-6	4-Nitroaniline (p-)		0.01	✓	✓	✓	25.0												
4	A	534-52-1	4,6-Dinitro-2-methylphenol		0.01	✓	✓	✓	✓												
4	BN	86-30-6	N-Nitrosodiphenylamine (1)		0.01	NA	✓	✓													
4	BN	101-55-3	4-Bromophenyl-phenylether		0.10		✓	✓													
4	BN	18-74-1	Hexachlorobenzene		0.10	↓	✓	✓													
4	A	87-86-5	Pentachlorophenol		0.05	✓	✓	✓			✓	✓	✓	NA	NA	NA					
4	BN	85-01-8	Phenanthrene		0.70	NA	✓	✓													
4	BN	20-12-7	Anthracene		0.70		✓	✓													
4	BN	86-74-8	Carbazole		0.01		✓	✓													
4	BN	84-74-2	Di-n-butylphthalate		0.01		✓	✓													
4	BN	06-44-0	Fluoranthene		0.60		✓	✓													
5	BN	129-00-0	Pyrene		0.60		✓	✓			✓	✓	✓	NA	NA	NA					
5	BN	85-68-7	Butylbenzylphthalate		0.01		✓	✓													
5	BN	91-94-1	3,3'-Dichlorobenzidine		0.01		✓	✓													
5	BN	56-55-3	Benzo(a)anthracene	↓	0.80	↓	✓	✓	↓	↓							↓	↓	↓		

Comments:

olatile Organics

ct: Site 94C Bomb Burner AR/COC #: 603231 Batch #s: 23473, 23228

ry: GEL Laboratory Report #: 24964 # of Samples: 4 Matrix: soil

A	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blanks	LCS	LCS D	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		
						>.05	<20% / 0.99	20%												
	218-01-9	Chrysene	✓	0.70	NA	✓	✓	✓	✓							NA	✓	NA		
N	117-81-7	bis(2-Ethylhexyl)phthalate		0.01		✓	✓													
N	117-84-0	Di-n-octylphthalate		0.01		✓	✓													
N	205-99-2	Benzo(b)fluoranthene		0.70		✓	✓													
N	207-08-9	Benzo(k)fluoranthene		0.70		✓	✓													
N	50-32-8	Benzo(a)pyrene		0.70		✓	✓													
BN	193-39-5	Indeno(1,2,3-cd)pyrene		0.50		✓	✓													
BN	53-70-3	Dibenz(a,h)anthracene		0.40		✓	✓													
BN	191-24-2	Benzo(g,h,i)perylene	↓	0.50	↓	✓	✓	↓	↓							↓	↓	↓		

Surrogate Recovery Outliers

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

MC 1: Nitrobenzene-d5 (BN) SMC 2: 2-Fluorobiphenyl (BN) SMC 3: p-Terphenyl-d14 (BN)
MC 4: Phenol-d6 (A) SMC 5: 2-Fluorophenol (A) SMC 6: 2,4,6-Tribromophenol (A)
~~MC 7: 2-2-Chlorophenol-d4 (A)~~ JWS 6/19/00 ~~SMC 8: 1,2-Dichlorobenzene-d4 (BN)~~

Comments: *Summary

⇒ The CCV %D of 4-nitroaniline was >20% but <40%. All assoc. results were ND. Thus, no data were qualified

Internal Standard Outliers

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

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

Semivolatile Organics (SW 846 Method 8270)

Page 1 of 3

ect: Site 94C Bomb Burner AR/COC #: 603231 Laboratory Sample IDs: 24966-004

ry: GEL Laboratory Report #: 24966

: EPA 8270C

nples: 1 Matrix: Aqueous Batch #s: 23099 (Analysis), 23026 (Prep.)

NA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R²	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	① MS	MSD	MS RPD	Field Dup. RPD	③ Equip. Blanks	Field Blanks		
						>.05	<20% / 0.99	20%												
A	108-95-2	Phenol	✓	0.80	NA	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA		
BN	111-44-4	bis(2-Chloroethyl)ether	✓	0.70		✓	✓													
A	95-57-8	2-Chlorophenol	✓	0.80		✓	✓			✓	✓	✓	NA	NA	NA					
BN	541-73-1	1,3-Dichlorobenzene	✓	0.60		✓	✓													
BN	106-46-7	1,4-Dichlorobenzene	✓	0.50		✓	✓			✓	✓	✓	NA	NA	NA					
BN	95-50-1	1,2-Dichlorobenzene	✓	0.40		✓	✓													
A	95-48-7	2-Methylphenol (o-cresol)	✓	0.70		✓	✓													
BN	108-60-1	bis(2-chloroisopropyl)ether	✓	0.01		✓	✓													
A	106-44-5	4-Methylphenol (m,p-cresol)	✓	0.60		✓	✓													
BN	621-64-7	N-Nitroso-di-n-propylamine	✓	0.50		✓	✓			✓	✓	✓	NA	NA	NA					
BN	67-72-1	Hexachloroethane	✓	0.30		✓	✓													
BN	98-95-3	Nitrobenzene	✓	0.20		✓	✓													
BN	78-59-1	Isophorone	✓	0.40		✓	✓													
A	88-75-5	2-Nitrophenol	✓	0.10		✓	✓													
A	105-67-9	2,4-Dimethylphenol	✓	0.20		✓	✓													
BN	111-91-1	bis(2-Chloroethoxy)methane	✓	0.30		✓	✓													
A	120-83-2	2,4-Dichlorophenol	✓	0.20		✓	✓													
BN	120-82-1	1,2,4-Trichlorobenzene	✓	0.20		✓	✓			✓	✓	✓	NA	NA	NA					
BN	91-20-3	Naphthalene	✓	0.70		✓	✓													
BN	106-47-8	4-Chloroaniline	✓	0.01		✓	✓													
BN	87-68-3	Hexachlorobutadiene	✓	0.01		✓	✓													
A	59-50-7	4-Chloro-3-methylphenol	✓	0.20		✓	✓			✓	✓	✓	NA	NA	NA					
BN	91-57-6	2-Methylnaphthalene	✓	0.40		✓	✓													
BN	77-47-4	Hexachlorocyclopentadiene	✓	0.01		✓	✓													
A	88-06-2	2,4,6-Trichlorophenol	✓	0.20		✓	✓													
A	95-95-4	2,4,5-Trichlorophenol	✓	0.20	↓	✓	✓	↓	↓							↓	↓	↓		

Comments:
MSD performed on a sample from another SDG. All QC criteria were met.

Notes: Shaded rows are RCRA compounds

NA = Not Applicable

Reviewed By: Date: 6/21/00

volatile Organics

oject: Site 94C Bomb Burner AR/COC #: 603231 Batch #s: 23099, 23026

itory: GEL Laboratory Report #: 24966 # of Samples: 1 Matrix: Aqueous

	NA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R²	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		
							>.05	<20% / 0.99	20%												
	BN	91-58-7	2-Chloronaphthalene	✓	0.80	NA	✓	✓	✓	✓							NA	NA	NA		
	BN	88-74-4	2-Nitroaniline (o-)	✓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
	BN	131-11-3	Dimethylphthalate	✓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
	BN	208-96-8	Acenaphthylene	✓	0.90	↓	✓	✓	↓	↓							↓	↓	↓		
	BN	606-20-2	2,6-Dinitrotoluene	✓	0.20	↓	✓	✓	↓	↓							↓	↓	↓		
	BN	99-09-2	3-Nitroaniline (m-)	✓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
	BN	83-32-9	Acenaphthene	✓	0.90	↓	✓	✓	↓	↓	✓	✓	✓	NA	NA	NA	↓	↓	↓		
	A	51-28-5	2,4-Dinitrophenol	✓	0.01	✓	✓	✓	↓	↓							↓	↓	↓		
3	A	100-02-7	4-Nitrophenol	✓	0.01	✓	✓	✓	↓	↓	✓	✓	✓	NA	NA	NA	↓	↓	↓		
3	BN	132-64-9	Dibenzofuran	✓	0.80	NA	✓	✓	↓	↓							↓	↓	↓		
3	BN	121-14-2	2,4-Dinitrotoluene	✓	0.20	✓	✓	✓	↓	↓	✓	✓	✓	NA	NA	NA	↓	↓	↓		
3	BN	84-66-2	Diethylphthalate	✓	0.01	NA	✓	✓	↓	↓							↓	↓	↓		
3	BN	005-72-3	4-Chlorophenyl-phenylether	✓	0.40	↓	✓	✓	↓	↓							↓	↓	↓		
3	BN	86-73-7	Fluorene	✓	0.90	↓	✓	✓	↓	↓							↓	↓	↓		
3	BN	100-01-6	4-Nitroaniline (p-)	✓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
4	A	534-52-1	4,6-Dinitro-2-methylphenol	✓	0.01	✓	✓	✓	↓	↓							↓	↓	↓		
4	BN	86-30-6	N-Nitrosodiphenylamine (1)	✓	0.01	NA	✓	✓	↓	↓							↓	↓	↓		
4	BN	101-55-3	4-Bromophenyl-phenylether	✓	0.10	↓	✓	✓	↓	↓							↓	↓	↓		
4	BN	18-74-1	Hexachlorobenzene	✓	0.10	↓	✓	✓	↓	↓							↓	↓	↓		
4	A	87-86-5	Pentachlorophenol	✓	0.05	✓	✓	✓	↓	↓	✓	✓	✓	NA	NA	NA	↓	↓	↓		
4	BN	85-01-8	Phenanthrene	✓	0.70	NA	✓	✓	↓	↓							↓	↓	↓		
4	BN	20-12-7	Anthracene	✓	0.70	↓	✓	✓	↓	↓							↓	↓	↓		
4	BN	86-74-8	Carbazole	✓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
4	BN	84-74-2	Di-n-butylphthalate	✓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
4	BN	06-44-0	Fluoranthene	✓	0.60	↓	✓	✓	↓	↓							↓	↓	↓		
5	BN	129-00-0	Pyrene	✓	0.60	↓	✓	✓	↓	↓	✓	✓	✓	NA	NA	NA	↓	↓	↓		
5	BN	85-68-7	Butylbenzylphthalate	✓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
5	BN	91-94-1	3,3'-Dichlorobenzidine	✓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
5	BN	56-55-3	Benzo(a)anthracene	✓	0.80	↓	✓	✓	↓	↓							↓	↓	↓		

Comments

olatile Organics

ject: Site 94C Bomb Burn AR/COC #: 603231 Batch #s: 23099, 23026

ory: OEL Laboratory Report #: 24966 # of Samples: 1 Matrix: Aqueous

A	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R²	CCV %D	Method Blanks	LCS	LCS D	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		
						>.05	<20% / 0.99	20%												
BN	218-01-9	Chrysene	✓	0.70	NA	✓	✓	✓	✓							NA	NA	NA		
BN	117-81-7	bis(2-Ethylhexyl)phthalate	✓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
BN	117-84-0	Di-n-octylphthalate	✓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
BN	205-99-2	Benzo(b)fluoranthene	✓	0.70	↓	✓	✓	↓	↓							↓	↓	↓		
BN	207-08-9	Benzo(k)fluoranthene	✓	0.70	↓	✓	✓	↓	↓							↓	↓	↓		
BN	50-32-8	Benzo(a)pyrene	✓	0.70	↓	✓	✓	↓	↓							↓	↓	↓		
BN	193-39-5	Indeno(1,2,3-cd)pyrene	✓	0.50	↓	✓	✓	↓	↓							↓	↓	↓		
BN	53-70-3	Dibenz(a,h)anthracene	✓	0.40	↓	✓	✓	↓	↓							↓	↓	↓		
BN	191-24-2	Benzo(g,h,i)perylene	✓	0.50	✓	✓	✓	✓	✓							↓	✓	✓		
																↓				

Surrogate Recovery Outliers

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

SMC 1: Nitrobenzene-d5 (BN) SMC 2: 2-Fluorobiphenyl (BN) SMC 3: p-Terphenyl-d14 (BN)
SMC 4: Phenol-d6 (A) SMC 5: 2-Fluorophenol (A) SMC 6: 2,4,6-Tribromophenol (A)
~~SMC 7: 2-2-Chlorophenol-d4 (A)~~ PJS 6/14/00 ~~SMC 8: 1,2-Dichlorobenzene-d4 (BN)~~

Comments:

*Summary

⇒ All QC criteria were met. No data were qualified.

Internal Standard Outliers

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

hthalene-d8 (BN) IS 3: Acenaphthene-d10 (BN)
IS 6: Perylene-d12 (BN)

High Explosives (SW 846 Method 8330)

Site/Project: Site 94C Burn Drum AR/COC #: 603231 Laboratory Sample IDs: 24964-005, -006, -007, & -008

Laboratory: GEL Laboratory Report #: 24964

Methods: EPA 8330

# of Samples: 4 Matrix: soil Batch #s: 23804 (Analysis), 23539 (Prep.)

CAS #	NAME	TAL	Intercept	Curve R²	CCV %D	Method Blanks	② LCS	LCSD	LCS RPD	③ MS	MSD	MS RPD	Field. Dup. RPD	Equip. Blanks	Field Blanks		
				.99	20%	U			20%			20%		U	U		
2691-41-0	HMX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	✓	NA		
121-82-4	RDX																
99-35-49	1,3,5-Trinitrobenzene																
99-65-0	1,3-dinitrobenzene																
98-95-3	Nitrobenzene						↓	↓									
479-45-8	Tetryl						63/37	51/37									
118-96-7	2,4,6-trinitrotoluene						✓	✓									
35572-78-2	2-amino-4,6-dinitrotoluene																
19406-51-0	4-amino-2,6-dinitrotoluene																
121-14-2	2,4-dinitrotoluene																
606-20-2	2,6-dinitrotoluene																
88-72-2	2-nitrotoluene																
99-99-0	4-nitrotoluene																
99-08-1	3-nitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
78-11-5	PETN																

NA = Not Applicable

①

Sample	SMC %REC	SMC RT	Sample	SMC %REC	SMC RT
All Passed					

Confirmation

Sample	CAS #	RPD > 25%	Sample	CAS #	RPD > 25%
NA (All ND)					

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

Comments:

① Sample -008 had low surrogate recovery. The sample was re-extracted, and surrogate recovery was w/in QC limits.

② 2nd entry applies to the reanalysis of sample -008.

③ MS/MSD for the reanalysis of -008 was performed on a sample from another SDG.

*Summary

⇒ The LCS/LCSD %Rs of Tetryl were < QC acceptance limits. All assoc. sample results were ND and were qualified "UJ, A."

Reviewed By: Date: 6/21/00

High Explosives (SW 846 Method 8330)

Site/Project: Site 94C Bomb Burner
AR/COC #: 603231
Laboratory Sample IDs: 24966-005
Laboratory: GEL
Laboratory Report #: 24966
Methods: EPA 8330
# of Samples: 1
Matrix: Aqueous
Batch #s: 23383 (Analysis), 23197 (Prep.)

CAS #	NAME	TAL	Intercept	Curve R² .99	CCV %D 20%	Method Blanks U	LCS	LCSD	LCS RPD 20%	① MS	MSD	MS RPD 20%	Field. Dup. RPD	② Equip. Blanks U	Field Blanks U		
2691-41-0	HMX	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA		
121-82-4	RDX	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
99-35-49	1,3,5-Trinitrobenzene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
99-65-0	1,3-dinitrobenzene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
98-95-3	Nitrobenzene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
479-45-8	Tetryl	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
118-96-7	2,4,6-trinitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
35572-78-2	2-amino-4,6-dinitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
19406-51-0	4-amino-2,6-dinitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
121-14-2	2,4-dinitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
606-20-2	2,6-dinitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
88-72-2	2-nitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
99-99-0	4-nitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
99-08-1	3-nitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
78-11-5	PETN																

NA > Not Applicable

Sample	SMC %REC	SMC RT	Sample	SMC %REC	SMC RT
All					
Passed					

Comments:

① MS/MSD were performed on a sample from another SDG. The case narrative stated that all QC criteria were not met.

② Sample B on EB.

*Summary

=> All QC criteria were met. No data were qualified

Confirmation

Sample	CAS #	RPD > 25%	Sample	CAS #	RPD > 25%
NA					
(All ND)					

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

Reviewed By:
Date: 6/21/00

Inorganic Metals

Site/Project: Site 94C Bomb Burner AR/COC #: 603231 Laboratory Sample IDs: 24964-005 to -008

Laboratory: GEL Laboratory Report #: 24964

Methods: EPA 6010B (ICP-AES), EPA 6020 (ICP-MS), EPA 7470A (CVAA)

# of Samples: 4 Matrix: soil Batch #s: 23681 (ICP-AES), 26238 (Ag), 24347 (ICP-MS), 23748 (CVAA)

CAS #/ Analyte	QC Element																			
	TAL	ICV	CCV	ICB (µg/L)	CCB (µg/L)	Method Blanks	LCS	LCSD	LCSD RPD	① MS	MSD	MSD RPD	Rep. RPD	ICS AB	Serial Dilution	Field Dup. RPD	Equip. Blanks (µg/L)	Field Blanks		
7429-90-5 Al																NA	NA	NA		
7440-39-3 Ba	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	NA	✓	NA	↓	0.00155	↓		
7440-41-7 Be	✓	✓	✓	✓	-0.63	✓	↓	↓	↓	↓	↓	↓	↓	✓	↓		✓			
7440-43-9 Cd	✓	✓	✓	✓	✓	✓	↓	↓	↓	↓	↓	↓	↓	✓	↓		✓			
7440-70-2 Ca																				
7440-47-3 Cr	✓	✓	✓	✓	1.24	✓	✓	✓	✓	NA	NA	NA	NA	✓	NA		✓			
7440-48-4 Co																				
7440-50-8 Cu																				
7439-89-6 Fe																				
7439-95-4 Mg																				
7439-96-5 Mn																				
7440-02-0 Ni																				
7440-09-7 K																				
7440-22-4 Ag	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	NA	✓	NA		0.00098			
7440-23-5 Na																				
7440-62-2 V																				
7440-66-6 Zn																				
7439-92-1 Pb	✓	✓	✓	-2.25	-1.67	✓	✓	✓	✓	NA	NA	NA	NA	✓	NA		✓			
7782-49-2 Se	✓	✓	✓	✓	✓	✓	↓	↓	↓	↓	↓	↓	↓	✓	↓		✓			
7440-38-2 As	✓	✓	✓	✓	✓	✓	↓	↓	↓	↓	↓	↓	↓	✓	↓		✓			
7440-36-0 Sb																				
7440-28-0 Tl																				
7439-97-6 Hg	✓	✓	✓	-0.05	-0.06	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA		✓			
Uranium (U)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	✓	✓	NA	↓	✓	↓		
Cyanide CN																				

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

NA = Not Applicable

Comments:

① ICP-AES and Hg MS & Rep. performed on a sample from another SDG. (serial dil. for ICP-AES also).

Reviewed By: Date: 6/21/00

*Summary → See back of this

CB/CCB:

⇒ Cr was detected in the CCB. However, all assoc. results were > 5X the blank conc.. Thus, no data were qualified.

⇒ Be and Pb were detected in the ICB and/or CCB @ negative conc.s. The abs. values were > the DL but < the RL. All assoc. results were > 5X the DL. Thus, no data were qualified.

⇒ Hg was detected in the ICB and CCB @ a negative conc.s. However, the absolute value of the blank conc.s were < the DL. Thus, no data were qualified.

B:

⇒ Ba and Ag were detected. However, all Ba results were > 5X the blank conc., and all Ag results were ND. Thus, no data were qualified.

Inorganic Metals

Site/Project: Site 94C Bomb Burner AR/COC #: 603231 Laboratory Sample IDs: 24966-003

Laboratory: GEL Laboratory Report #: 24966

Methods: EPA 6010B(ICP-AES), EPA 6020(ICP-MS), EPA 7470A(CVAA)

# of Samples: 1 Matrix: Aqueous Batch #s: 23353(ICP-AES), 24348(ICP-MS), 23263(CVAA)

CAS #/ Analyte	QC Element																			
	TAL	ICV	CCV	ICB (µg/L)	CCB (µg/L)	Method Blanks	LCS	LCSD	LCSD RPD	(1) MS	MSD	MSD RPD	(2) Rep. RPD	ICS AB	(2) Serial Dilution	Field Dup. RPD	(3) Equip. Blanks	Field Blanks		
7429-90-5 Al																NA	NA	NA		
7440-39-3 Ba	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA	↓	↓	↓		
7440-41-7 Be	✓	✓	✓	✓	✓	✓	✓	✓	✓	↓	↓	↓	↓	✓	↓					
7440-43-9 Cd	✓	✓	✓	✓	✓	✓	✓	✓	✓	↓	↓	↓	↓	✓	↓					
7440-70-2 Ca																				
7440-47-3 Cr	✓	✓	✓	2.21	✓	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7440-48-4 Co																				
7440-50-8 Cu																				
7439-89-6 Fe																				
7439-95-4 Mg																				
7439-96-5 Mn																				
7440-02-0 Ni																				
7440-09-7 K																				
7440-22-4 Ag	✓	✓	✓	✓	1.17	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7440-23-5 Na																				
7440-62-2 V																				
7440-66-6 Zn																				
7439-92-1 Pb	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7782-49-2 Se	✓	✓	✓	✓	✓	✓	✓	✓	✓	↓	↓	↓	↓	✓	↓					
7440-38-2 As	✓	✓	✓	-3.74	✓	✓	✓	✓	✓	↓	↓	↓	↓	✓	↓					
7440-36-0 Sb																				
7440-28-0 Tl																				
7439-97-6 Hg	✓	✓	✓	✓	-0.06	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA					
Uranium (U)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA	↓	↓	↓		
Cyanide CN																				

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

NA = Not Applicable

Comments:

(1) MS/MSD for Hg performed on a sample from another SDG. (replicate also).

(2) All results < the RL. Thus, criteria do not apply.

(3) Sample is an EB.

Reviewed By: Date: 6/21/00

*Summary → See back of this

ICB/CCB:

- As was detected in the CCB. The assoc. sample result was a detect, <5X the blank conc., and will be qualified "J, B3."

- As & Hg were detected in the ICB and CCB, respectively, e negative conc.s. The abs. val were > the DL but < the RL. The assoc. results were ND and will be qualified "UJ, B3."

- Cr was detected in the ICB. However, the assoc. sample result was ND. Thus, no data were qualifie

ANALYSIS REQUEST AND CHAIN OF CUSTODY

Internal Lab

Page 1 of 2

Batch No. 000743

SAR/WR No.

AR/COC 603231

Dept. No./Mail Stop: 6134/MS1088
Project/Task Manager: Freshour/Henderson
Project Name: Site 94C Bomb Burner
Record Center Code:
Logbook Ref. No.: 1333-3
Service Order No. CFO 021

Date Samples Shipped: 4-26-00
Carrier/Waybill No. 731953
Lab Contact: E Kent
Lab Destination: GEL
SMO Contact/Phone: D Salmi 844-3110
Send Report to SMO: S Jensen 844-3185

SMO USE
Logged By:
Project/Task No.: 7214.0202.14
SMO Authorization:
Location:
Tech Area:
Building:
Room:

☐ Waste Characterization
-RCRA DATE =
-Send preliminary/copy report to:
☑ Released by COC No.: 603232

24964✓.

Location Tech Area
Building Room

Reference LOV(available at SMO)

Sample No.-Fraction	ER Sample ID or Sample Location Detail	Beginning Depth (ft)	ER Site No.	Date/Time(hr) Collected	Sample Matrix	Container Type	Container Volume	Preserve All@4C	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
051783-001	CY94C-GR-011-SS	0	94C	042400 1220	S	AG	4oz	4C	G	SA	VOC (8260)	001
051783-002	CY94C-GR-011-SS	0	94C	042400 1220	S	AG	16oz	4C	G	SA	RCRA METs+Be-U(6010/7471) SVOCs(8270) HE(8330)	005 ~~002~~
051784-001	CY94C-GR-012-SS	0	94C	042400 1225	S	AG	4oz	4C	G	SA	VOC (8260)	~~003~~ 002
051784-002	CY94C-GR-012-SS	0	94C	042400 1225	S	AG	16oz	4C	G	SA	RCRA METs+Be-U(6010/7471) SVOCs(8270) HE(8330)	006 ~~004~~
051785-001	CY94C-GR-013-SS	0	94C	042400 1235	S	AG	4oz	4C	G	SA	VOC (8260)	~~005~~ 003
051785-002	CY94C-GR-013-SS	0	94C	042400 1235	S	AG	16oz	4C	G	SA	RCRA METs+Be-U(6010/7471) SVOCs(8270) HE(8330)	007 ~~006~~
051786-001	CY94C-GR-013-DU	0	94C	042400 1235	S	AG	4oz	4C	G	DU	VOC (8260)	~~007~~ 004
051786-002	CY94C-GR-013-DU	0	94C	042400 1235	S	AG	16oz	4C	G	DU	RCRA METs+Be-U(6010/7471) SVOCs(8270) HE(8330)	008
051787-001	CY94C-GR-001-EB	0	94C	042400 1311	DIW	G	3x40ml	HCl	G	EB	VOC	001-24966
051788-002	CY94C-GR-002-EB	0	94C	042400 1313	DIW	P	500ml	HNO3	G	EB	RCRA Mets+Be-U	002

RMMA ☑ Yes ☐ No Ref. No.
Sample Disposal ☐ Return to Client ☑ Disposal by lab
Turnaround Time ☐ 7 Day ☐ 15 Day ☑ 30 Day
☐ Negotiated
Required Report Date

Sample Tracking Smo Use
Date Entered(mm/dd/yy)
Entered by:
QC inits.

Special Instructions/QC Requirements:
EDD ☑ Yes ☐ No
Raw Data Package ☑ Yes ☐ No
*Send/e-mail report to: *RAD DATA REVIEWED BY M. UNGHAUSER
P Henderson 284-2617

THIS COC RELEASED BY COC 603232

*Please list as separate report.

Abnormal Condition on Receipt

1.8

Sample Team Members

Name	Signature	Init	Company/Organization/Phone/Cellular
M Sanchez	MSanchez	MS	Weston/6135/845-3267

	Org.	Date	Time
1.Relinquished by	6135	4/25/00	
1. Received by	7135	4/25/00	1315
2.Relinquished by SMO	6133	4-26-00	1130
2. Received by	GEL	4-27-00	09:30
3.Relinquished by			
3. Received by			
4.Relinquished by			
4. Received by			
5.Relinquished by			
5. Received by			
6.Relinquished by			
6. Received by			

OFF-SITE LABORATORY
Analysis Request And Chain Of Custody (Continuation)

Page_2_ of _2_

AR/COC- **603231**

24966

Project Name: Site 94C Bomb Burner
Project/Task Manger: Freshour/Henderson
Project/Task No.:

Location Tech Area
Building Room

Reference LOV (available at SMO)

Sample No-Fraction	ER Sample ID or Sample Location detail	Beginning Depth (ft)	ER Site No.	Date/Time (hr) Collected	Sample Matrix	Container Type	Container Volume	Preserv-ative	Collection Method	Sample Type	Parameter & Method Requested	Lab use Lab Sample ID
051789-003	CY94C-GR-003-EB	0	94C	042400 1314	DIW	AG	2x1L	4C	G	EB	SVOCs (8270)	004
051790-004	CY94C-GR-004-EB	0	94C	042400 1315	DIW	AG	4x1L	4C	G	EB	HE(8330)	005
051791-001	CY94C-001-TB	0	94C	042400 1316	DIW	G	3x40ml	HCl	N/A	TB	VOC	002

Abnormal Conditions on Receipt **LAB USE**

Recipient Initials RAD

Contract Verification Review (CVR)

Project Leader FRESHOUR

Project Name CANYONS TEST AREA—SITE 94C

Case No. 7214_02.02.14

AR/COC No. 603231

Analytical Lab GEL

SDG No. 24964

In the tables below, mark any information that is missing or incorrect and give an explanation.

1.0 Analysis Request and Chain of Custody Record and Log-In Information

Line No.	Item	Complete?		If no, explain	Resolved?	
		Yes	No		Yes	No
1.1	All items on COC complete - data entry clerk initialed and dated	X				
1.2	Container type(s) correct for analyses requested	X				
1.3	Sample volume adequate for # and types of analyses requested	X				
1.4	Preservative correct for analyses requested	X				
1.5	Custody records continuous and complete	X				
1.6	Lab sample number(s) provided and SNL sample number(s) cross referenced and correct	X				
1.7	Date samples received	X				
1.8	Condition upon receipt information provided	X				

2.0 Analytical Laboratory Report

Line No.	Item	Complete?		If no, explain	Resolved?	
		Yes	No		Yes	No
2.1	Data reviewed, signature	X				
2.2	Method reference number(s) complete and correct	X				
2.3	QC analysis and acceptance limits provided (MB, LCS, Replicate)	X				
2.4	Matrix spike/matrix spike duplicate data provided(if requested)	X				
2.5	Detection limits provided; PQL and MDL(or IDL), MDA and L_c	X				
2.6	QC batch numbers provided	X				
2.7	Dilution factors provided and all dilution levels reported	X				
2.8	Data reported in appropriate units and using correct significant figures	X				
2.9	Radiochemistry analysis uncertainty (2 sigma error) and tracer recovery (if applicable) reported	NA				
2.10	Narrative provided	X				
2.11	TAT met	X				
2.12	Hold times met	X				
2.13	Contractual qualifiers provided	X				
2.14	All requested result and TIC (if requested) data provided	X				

Contract Verification Review (Continued)

3.0 Data Quality Evaluation

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1 Are reporting units appropriate for the matrix and meet contract specified or project-specific requirements? Inorganics and metals reported as ppm (mg/liter or mg/Kg)? Tritium reported in picocuries per liter with percent moisture for soil samples? Units consistent between QC samples and sample data	X		
3.2 Quantitation limit met for all samples	X		
3.3 Accuracy a) Laboratory control samples accuracy reported and met for all samples	X		
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique	X		
c) Matrix spike recovery data reported and met	X		
3.4 Precision a) Replicate sample precision reported and met for all inorganic and radiochemistry samples	X		
b) Matrix spike duplicate RPD data reported and met for all organic samples	X		
3.5 Blank data a) Method or reagent blank data reported and met for all samples	X		
b) Sampling blank (e.g., field, trip, and equipment) data reported and met	X		
3.6 Contractual qualifiers provided: "J"- estimated quantity; "B"-analyte found in method blank above the MDL for organic or above the PQL for inorganic; "U"- analyte undetected (results are below the MDL, IDL, or MDA (radiochemical)); "H"-analysis done beyond the holding time	X		
3.7 Narrative addresses planchet flaming for gross alpha/beta	NA		
3.8 Narrative included, correct, and complete	X		
3.9 Second column confirmation data provided for methods 8330 (high explosives) and pesticides/PCBs	NA		

Contract Verification Review (Continued)

4.0 Calibration and Validation Documentation

Item	Yes	No	Comments
4.1 GC/MS (8260, 8270, etc.) a) 12-hour tune check provided	X		
b) Initial calibration provided	X		
c) Continuing calibration provided	X		
d) Internal standard performance data provided	X		
e) Instrument run logs provided	X		
4.2 GC/HPLC (8330 and 8010) a) Initial calibration provided	X		
b) Continuing calibration provided	X		
c) Instrument run logs provided	X		
4.3 Inorganics (metals) a) Initial calibration provided	X		
b) Continuing calibration provided	X		
c) ICP interference check sample data provided	X		
d) ICP serial dilution provided	X		
e) Instrument run logs provided	X		
4.4 Radiochemistry a) Instrument run logs provided	NA		

Contract Verification Review (Concluded)

5.0 Problem Resolution

Summarize the findings in the table below. List only samples/fractions for which deficiencies have been noted.

Sample/Fraction No.	Analysis	Problems/Comments/Resolutions

Were deficiencies unresolved? ☐ Yes ☑ No

Based on the review, this data package is complete. ☑ Yes ☐ No

If no, provide: nonconformance report or correction request number ______________ and date correction request was submitted: ____________________

Reviewed by: W. Palencia Date: 6-13-2000 Closed by: ________________________ Date: ____________

Sample Findings Summary

Site: Site 94C

AR/COC: 603229

Organic, Inorganic, Rad
Data Classification: ~~SVOC, Metals~~ KAL 8-10-00

ER Sample ID	Analysis	DV Qualifiers	Comments
SEE ATTACHED TABLE			
Data is Acceptable			
QC measures appear to be adequate			

ER Sample ID - This value is located on the AR/Chain of Custody.

Analysis - Use valid test methods provided below or if the result applies to an individual analyte within a test method, use the CAS number from the analytical data sheet.

DV Qualifiers - The entry will be taken from the list of valid qualifiers and associated comments. If other qualifiers not on the list are needed, contact Tina Sanchez to coordinate adding them to the list.

Comments - This is only to be used if a comment associated with the qualifier is not appropriate, needs modification because of an unusual circumstance, or additional clarification is warranted.

Test Methods - Anions_CE, EPA6010, EPA6020, EPA7470/1, EPA8015B, EPA8081, EPA8260, EPA8260-M3, EPA8270, HACH_ALK, HACH_ NO2, HACH_NO3, MEKC_HE, PCBRISC

Reviewed by: Kevin A Lambert Date: 8-10-00

Sample Number		7440-47-3 (chromium)	7439-92-1 (lead)	7439-97-6 (mercury)		106-46-7 (1,4-dichlorobenzene)	95-48-7 (2-methylphenol)	106-44-5 (4-methylphenol)	67-72-1 (hexachloroethane)	98-95-3 (nitrobenzene)	87-68-3 (hexachlorobutadiene)	88-06-2 (2,4,6-trichlorophenol)	95-95-4 (2,4,5-trichlorophenol)	121-14-2 (2,4-dinitrotoluene)	118-74-1 (hexachlorobenzene)
ARCOC #603229															
Metals and SVOC Analysis															
051631-002 / CY94C-SP01-01		UJ, B3	UJ, B3	UJ, B3		UJ, P	UJ, A, P	UJ, A, P	UJ, P	UJ, A, P	UJ, A, P	UJ, A, P	UJ, A, P	UJ, A, P	UJ, A, P
051633-002 / CY94C-SP01-03		UJ, B3	UJ, B3	UJ, B3		UJ, P	UJ, A, P	UJ, A, P	UJ, P	UJ, A, P	UJ, A, P	UJ, A, P	UJ, A, P	UJ, A, P	UJ, A, P

Kevin A Lambert
8-10-00

MEMORANDUM

DATE: August 10, 2000

TO: File

FROM: Kevin Lambert KAL

SUBJECT: Organic Data Review and Validation
Site 94C, ARCOC No. 603229, SDG No. 25633, and Project/Task No. 7214.02.02.14

See the attached Data Assessment Summary Forms for supporting documentation on the data review and validation.

Summary

The samples were prepared and analyzed with accepted procedures and specified method (VOC – EPA8260, SVOC – EPA 8270, HE – EPA8330, and PCB – EPA8082). Problems were identified with the data package that result in the qualification of data.

1. VOC Analysis: The TCLP VOC analysis for field samples were canceled by SNL due to missed holding times for TCLP VOC extraction. However, VOC analysis on the field QC sample (trip blank) was performed and results were reported. It is not possible to use the trip blank to assess contamination due to shipping and field-handling procedures since VOC analysis for field samples were canceled.

2. SVOC Analysis: The LCS percent recovery (%R) and LCS/LCSD relative percent difference (RPD) for 2-methylphenol, 4-methylphenol, nitrobenzene, hexachlorobutadiene, 2,4,6-trichlorophenol, 2,4,5-trichlorophenol, 2,4-dinitrotoluene, and hexchlorobenzene did not meet QC acceptance criteria. Sample results are non-detect and will be qualified "UJ, A, P." The LCS/LCSD RPD for 1,4-dichlorobenzene, hexachloroethane, pentachlorophenol, and pyridine did not meet QC acceptance criteria. Sample results are non-detect and will be qualified "UJ, P."

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

Holding Times

SVOC, HE, and PCB Analysis: The samples were extracted and analyzed within the prescribed holding times.

Calibration

SVOC, HE, and PCB Analysis: The initial and continuing calibration data met QC acceptance criteria.

Blanks

SVOC, HE, and PCB Analysis: No target analytes were detected in the method blank (MB).

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

SVOC and PCB Analysis: No MS/MSD was run on this sample delivery group (SDG). An MS/MSD was run on another SDG in the analytical batch and met acceptance criteria.

HE Analysis: The MS/MSD met QC acceptance criteria.

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

SVOC Analysis: The LCS/LCSD met QC acceptance criteria except as noted above in the summary section.

HE and PCB Analysis: The LCS/LCSD met QC acceptance criteria.

Surrogates

SVOC, HE, and PCB Analysis: The surrogate recoveries met QC acceptance criteria.

Internal Standards

SVOC Analysis: Internal standards met QC acceptance criteria.

Confirmation

HE and PCB Analysis: Confirmation analysis was not required; sample results are non-detect.

Other QC

SVOC, HE, and PCB Analysis: No equipment blank (EB), field blank (FB), or field duplicate pair was submitted on the ARCOC.

No other specific issues were identified which affect data quality.

Please contact me if you have any questions or comments regarding the review of this package.

MEMORANDUM

DATE: August 10, 2000

TO: File

FROM: Kevin Lambert

SUBJECT: Inorganic Data Review and Validation
Site 94C, ARCOC No. 603229, SDG No. 25633, and Project/Task No. 7214.02.02.14

See the attached Data Assessment Summary Forms for supporting documentation on the data review and validation.

Summary

The samples were prepared and analyzed with accepted procedures and specified methods (ICP - EPA6010B and CVAA - EPA7470A). All analytes were successfully analyzed. Problems were identified with the data package that result in the qualification of data.

1. ICP Analysis: The absolute blank value in the continuing calibration blank (CCB) for chromium and lead were greater than (>) the detection limit (DL) but less than (<) the reporting limit (RL). Sample results are non-detect and will qualified "UJ, B3."
2. CVAA Analysis: The absolute blank value in the CCB for mercury was > the DL but < the RL. Sample results are non-detect and will qualified "UJ, B3."

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

Holding Times

ICP and CVAA Analysis: The samples were analyzed within the prescribed holding times.

Calibration

ICP and CVAA Analysis: Initial and continuing calibration verification data met QC acceptance criteria.

Blanks

ICP Analysis: No target analytes were detected in the initial calibration blank (ICB) except for barium and thallium. Barium and thallium ICB concentrations were < the DL; no data were qualified. No target analytes were detected in the CCB except for chromium, nickel, silver, lead, and arsenic. Chromium and lead were qualified as noted above in the summary section. Nickel and silver CCB concentrations were < the DL; no data were qualified. Arsenic CCB concentration was > the DL, however the sample result is non-detect; no data were qualified. No target analytes were detected in the method blank (MB).

CVAA Analysis: No target analytes were detected in the ICB and MB. Mercury was detected in the CCB and was qualified as noted above in the summary section.

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

ICP and CVAA Analysis: The LCS/LCSD met QC acceptance criteria.

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

ICP Analysis: The MS met QC acceptance criteria. A replicate analysis was performed instead of an MSD.

CVAA Analysis: No MS/MSD was run on this SDG. An MS/MSD was run on another SDG in the analytical batch and met acceptance criteria.

Replicate Analyses

ICP Analysis: The replicate analysis met acceptance criteria. Replicate analysis RPD criteria do not apply when original and replicate sample results are non-detect.

CVAA Analysis: No replicate analysis was run on this SDG. A replicate analysis was run on another SDG in the analytical batch and met acceptance criteria.

ICP Interference Check Sample (ICS) Analysis

ICP Analysis: The ICS data met QC acceptance criteria.

ICP Serial Dilution

The serial dilution met acceptance criteria. Acceptance criteria do not apply when undiluted sample results are < 50x the RL.

Other QC

ICP and CVAA Analysis: No equipment blank (EB), field blank (FB), or field duplicate pair was submitted on the ARCOC.

No other specific issues were identified which affect data quality.

Please contact me if you have any questions or comments regarding the review of this package.

MEMORANDUM

DATE: August 10, 2000

TO: File

FROM: Kevin Lambert KAL

SUBJECT: Radiochemical Data Review and Validation
Site 94C, ARCOC No. 603229, SDG No. 25633, and Project/Task
No. 7214.02.02.14

See the attached Data Assessment Summary Forms for supporting documentation on the data review and validation.

Summary

The samples were prepared and analyzed with accepted procedures and specified methods (Isotopic Uranium – HASL300). All analytes were successfully analyzed. No problems were identified with the data package that result in the qualification of data.

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

Holding Times

The samples were analyzed within the prescribed holding times.

Calibration

Instrument was properly calibrated.

Blanks

No target analytes were detected in the method blank (MB).

Laboratory Control Sample (LCS) Analyses

The LCS met QC acceptance criteria.

Matrix Spike (MS) Analyses

Recovery acceptance criteria do not apply when sample concentration exceeds spike concentration by four or more.

Replicate Analysis

Replicate analysis met QC acceptance criteria.

Other QC

No equipment blank (EB), field blank (FB), or field duplicate was submitted on the ARCOC.

No other specific issues were identified which affect data quality.

Please contact me if you have any questions or comments regarding the review of this package.

Data Validation Summary

Site/Project: Site 94C
Project/Task #: 7214.02.02.14
# of Samples: 7
Matrix: 6 soil, 1 aqueous
AR/COC #: 603229
Laboratory: GEL
Laboratory Report #: 25633/25634
Laboratory Sample IDs: 25633-001, -002, -003/007, -004/008, -005, -006 ; 25634-001 (trip blank)

QC Element	Analysis									
	Organics				Inorganics				RAD	Other
	VOC	SVOC	Pesticide/PCB	HPLC (HE)	ICP/AES	GFAA/AA	CVAA (Hg)	CN		
1. Holding Times/Preservation	TCLP VOC analysis for field samples cancelled by SNL. Not possible to use trip blank to assess contamination due to shipping and field handling procedures.	✓	✓	✓	✓	NA	✓	NA	✓	NA
2. Calibrations		✓	✓	✓	UJ		UJ		✓	
3. Method Blanks		✓	✓	✓	✓		✓		✓	
4. MS/MSD		NA	NA	✓	✓		NA		NA	
5. Laboratory Control Samples		UJ	✓	✓	✓		✓		✓	
6. Replicates					✓		NA		✓	
7. Surrogates		✓	✓	✓						
8. Internal Standards		✓								
9. TCL Compound Identification		✓								
10. ICP Interference Check Sample					✓					
11. ICP Serial Dilution					✓					
12. Carrier/Chemical Tracer Recoveries									✓	
13. Other QC		NA	NA	NA	NA	↓	NA	↓	NA	↓

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

Check (√) = Acceptable
Shaded Cells = Not Applicable (also "NA")
NP = Not Provided
Other:

Reviewed By: Kevin A Lambert
Date: 8-10-00

Semivolatile Organics (SW 846 Method 8270)

Site/Project: Site 94C
AR/COC #: 603229
Laboratory Sample IDs: 25633-003 & -004
Laboratory: GEL
Laboratory Report #: 25633
Methods: EPA1311 (TCLP Leaching), EPA8270
# of Samples: 2
Matrix: soil
Batch #s: 26137

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blanks	① LCS	① LCSD	① LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		
							>.05	<20% / 0.99	20%												
1	A	108-95-2	Phenol		0.80												NA	NA	NA		
1	BN	111-44-4	bis(2-Chloroethyl)ether		0.70									Not							
1	A	95-57-8	2-Chlorophenol		0.80									Run							
1	BN	541-73-1	1,3-Dichlorobenzene		0.60									on this							
1	BN	106-46-7	1,4-Dichlorobenzene	✓	0.50		✓	✓	✓	✓	✓	✓	44 (30)	SDG							
1	BN	95-50-1	1,2-Dichlorobenzene		0.40																
1	A	95-48-7	2-Methylphenol	✓	0.70		✓	✓	✓	✓	34 (41)	✓	50 (30)	Run on							
1	BN	108-60-1	bis(2-chloroisopropyl)ether		0.01									another							
1	A	106-44-5	4-Methylphenol	✓	0.60		✓	✓	✓	✓	25 (33)	✓	52 (30)	SNL SDG.							
1	BN	621-64-7	N-Nitroso-di-n-propylamine		0.50									And met							
1	BN	67-72-1	Hexachloroethane	✓	0.30		✓	✓	✓	✓	✓	✓	44 (30)	criteria							
2	BN	98-95-3	Nitrobenzene	✓	0.20		✓	✓	✓	✓	35 (40)	✓	48 (30)								
2	BN	78-59-1	Isophorone		0.40																
2	A	88-75-5	2-Nitrophenol		0.10																
2	A	105-67-9	2,4-Dimethylphenol		0.20																
2	BN	111-91-1	bis(2-Chloroethoxy)methane		0.30																
2	A	120-83-2	2,4-Dichlorophenol		0.20																
2	BN	120-82-1	1,2,4-Trichlorobenzene		0.20																
2	BN	91-20-3	Naphthalene		0.70																
2	BN	106-47-8	4-Chloroaniline		0.01																
2	BN	87-68-3	Hexachlorobutadiene	✓	0.01		✓	✓	✓	✓	35 (37)	✓	42 (30)								
2	A	59-50-7	4-Chloro-3-methylphenol		0.20																
2	BN	91-57-6	2-Methylnaphthalene		0.40																
3	BN	77-47-4	Hexachlorocyclopentadiene		0.01																
3	A	88-06-2	2,4,6-Trichlorophenol	✓	0.20		✓	✓	✓	✓	32 (47)	✓	54 (30)								
3	A	95-95-4	2,4,5-Trichlorophenol	✓	0.20		✓	✓	✓	✓	32 (51)	✓	52 (30)								

Notes: Shaded rows are RCRA compounds.

Comments: NA - Not Applicable

Reviewed By: Kevin A Lambert
Date: 8-8-00

Semivolatile Organics

Site/Project: Site 94C AR/COC #: 603229 Batch #s: 26137

Laboratory: GEL Laboratory Report #: 25633 # of Samples: 2 Matrix: soil

											0	①	①								
IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		
							>.05	<20% / 0.99	20%												
3	BN	91-58-7	2-Chloronaphthalene		0.80												NA	NA	NA		
3	BN	88-74-4	2-Nitroaniline		0.01																
3	BN	131-11-3	Dimethylphthalate		0.01																
3	BN	208-96-8	Acenaphthylene		0.90																
3	BN	606-20-2	2,6-Dinitrotoluene		0.20																
3	BN	99-09-2	3-Nitroaniline		0.01																
3	BN	83-32-9	Acenaphthene		0.90										SEE						
3	A	51-28-5	2,4-Dinitrophenol		0.01																
3	A	100-02-7	4-Nitrophenol		0.01										Page						
3	BN	132-64-9	Dibenzofuran		0.80																
3	BN	121-14-2	2,4-Dinitrotoluene	✓	0.20		✓	✓	✓	✓	30(44)	✓	57(30)		①						
3	BN	84-66-2	Diethylphthalate		0.01																
3	BN	7005-72-3	4-Chlorophenyl-phenylether		0.40																
3	BN	86-73-7	Fluorene		0.90																
3	BN	100-01-6	4-Nitroaniline		0.01																
4	A	534-52-1	4,6-Dinitro-2-methylphenol		0.01																
4	BN	86-30-6	N-Nitrosodiphenylamine (1)		0.01																
4	BN	101-55-3	4-Bromophenyl-phenylether		0.10																
4	BN	118-74-1	Hexachlorobenzene	✓	0.10		✓	✓	✓	✓	39 (50)	✓	52 (30)								
4	A	87-86-5	Pentachlorophenol	✓	0.05	✓	✓	✓	✓	✓	✓	✓	45 (30)								
4	BN	85-01-8	Phenanthrene		0.70																
4	BN	120-12-7	Anthracene		0.70																
4	BN	86-74-8	Carbazole		0.01																
4	BN	84-74-2	Di-n-butylphthalate		0.01																
4	BN	206-44-0	Fluoranthene		0.60																
5	BN	129-00-0	Pyrene		0.60																
5	BN	85-68-7	Butylbenzylphthalate		0.01																
5	BN	91-94-1	3,3'-Dichlorobenzidine		0.01																
5	BN	56-55-3	Benzo(a)anthracene		0.80												↓	↓	↓		

Comments:

Semivolatile Organics

Site/Project: Site 94C AR/COC #: 603229 Batch #s: 26137

Laboratory: GEL Laboratory Report #: 25633 # of Samples: 2 Matrix: soil

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R²	CCV %D	Method Blanks	① LCS	① LCS D	① LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		
							>.05	<20%/ 0.99	20%												
5	BN	218-01-9	Chrysene		0.70												NA	NA	NA		
5	BN	117-81-7	bis(2-Ethylhexyl)phthalate		0.01																
6	BN	117-84-0	Di-n-octylphthalate		0.01																
6	BN	205-99-2	Benzo(b)fluoranthene		0.70										SEE						
6	BN	207-08-9	Benzo(k)fluoranthene		0.70																
6	BN	50-32-8	Benzo(a)pyrene		0.70										PAGE						
6	BN	193-39-5	Indeno(1,2,3-cd)pyrene		0.50																
6	BN	53-70-3	Dibenz(a,h)anthracene		0.40																
6	BN	191-24-2	Benzo(g,h,i)perylene		0.50										①.						
		110-86-1	Pyridine	✓			✓	✓	✓	✓	✓	✓	39 (30)								
																	↓	↓	↓		

Surrogate Recovery Outliers

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

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

Comments: ① The LCS %R & RPD did not meet acceptance criteria for eight compounds, Sample results are ND and will be qualified "UJ, A, P."
The RPD did not meet acceptance criteria for four compounds. Sample results are ND and will be qualified "UJ, P"

Internal Standard Outliers

Sample	IS 1-area	IS 1-RT	IS 2-area	IS 2-RT	IS 3-area	IS 3-RT	IS 4-area	IS 4-RT	IS 5-area	IS 5-RT	Is 6-area	IS 6-RT
			MET			CRITERIA						

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

High Explosives (SW 846 Method 8330)

Site/Project: Site 94C
AR/COC #: 603229
Laboratory Sample IDs: 25633-007 & -008
Laboratory: GEL
Laboratory Report #: ~~2566~~ 25633 KAL 8-8-00
Methods:
# of Samples: 2
Matrix: soil
Batch #s: 25625

CAS #	NAME	TAL	Intercept	Curve R²	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		
				.99	20%	U			20%			20%		U	U		
2691-41-0	HMX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA		
121-82-4	RDX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
99-35-49	1,3,5-Trinitrobenzene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
99-65-0	1,3-dinitrobenzene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
98-95-3	Nitrobenzene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
479-45-8	Tetryl	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
118-96-7	2,4,6-trinitrotoluene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
35572-78-2	2-amino-4,6-dinitrotoluene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
19406-51-0	4-amino-2,6-dinitrotoluene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
121-14-2	2,4-dinitrotoluene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
606-20-2	2,6-dinitrotoluene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
88-72-2	2-nitrotoluene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
99-99-0	4-nitrotoluene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
99-08-1	3-nitrotoluene	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
78-11-5	PETN																

NA - Not Applicable

Sample	SMC %REC	SMC RT	Sample	SMC %REC	SMC RT
		MET CRITERIA			

Comments:

Confirmation

Sample	CAS #	RPD > 25%	Sample	CAS #	RPD > 25%
	NOT Required				

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

Reviewed By: Kevin A Lambert
Date: 8-8-00

PCBs (SW 846 - Method 8082)

Site/Project: Site 94C
AR/COC #: 603229
Laboratory Sample IDs: 25633-007 & -008
Laboratory: GEL
Laboratory Report #: 25633
Methods:
# of Samples: 2
Matrix: soil
Batch #s: 25799

CAS #	Name	TCL	Intercept	Calib RSD / R^2	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		
				<20% / 0.99	20%				20%			20%					
12674-11-2	Aroclor-1016	✓		✓	✓	✓							NA	NA	NA		
11104-28-2	Aroclor-1221	✓		✓		✓				Not Run							
11141-16-5	Aroclor-1232	✓		✓		✓				on this							
53469-21-9	Aroclor-1242	✓		✓		✓				SDG							
12672-29-6	Aroclor-1248	✓	✓	✓		✓											
11097-69-1	Aroclor-1254	✓		✓		✓				Run on							
11096-82-5	Aroclor-1260	✓		✓	✓	✓	✓	✓	✓	another							
										SDG and							
										met criteria							

Sample	SMC % REC	SMC RT	Sample	SMC % REC	SMC RT
	MET		CRITERIA		

Comments:

Confirmation

Sample	CAS #	RPD > 25%	Sample	CAS #	RPD > 25%
	NOT		Required		
Sample		Results	ND		

Reviewed By: Kevin A Lambert
Date: 8-8-00

Volatile Organics (SW 846 Method 8260)

Page 1 of 2

Site/Project: Site 94C
AR/COC #: 603229
# of Samples: 1
Matrix: 1 aqueous
Laboratory: GEL
Laboratory Report #: 25634
Laboratory Sample IDs: 25634-001 (Trip Blank)
Methods:
Batch #s: 26204

IS	CAS #	Name	TCL	Min. RF	Intercept	① Calib. RF	Calib. RSD/ R²	② CCV %D	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Trip Blanks		
						>.05	<20% / 0.99	20%												
1	74-87-3	Chloromethane	✓	0.10	✓	✓	✓	✓	✓							NA	NA	NA		
1	74-83-9	Bromomethane	✓	0.10	✓	✓	✓	25	✓					Not						
1	75-01-4	vinyl chloride	✓	0.10		✓	✓	✓	✓					Run						
1	75-00-3	Chloroethane	✓	0.01		✓	✓	✓	✓											
1	75-09-2	methylene chloride (10xblk)	✓	0.01	✓	✓	✓	✓	✓					on						
1	67-64-1	acetone(10xblk)	✓	0.01		✓	✓	✓	✓											
1	75-15-0	carbon disulfide	✓	0.10		✓	✓	89	✓											
1	75-35-4	1,1-dichloroethene	✓	0.20		0.15	✓	✓	✓	✓	✓	✓		this						
1	75-34-3	1,1-dichloroethane	✓	0.10		✓	✓	✓	✓											
1	67-66-3	Chloroform	✓	0.20		✓	✓	✓	✓					SDG						
1	107-06-2	1,2-dichloroethane	✓	0.10		✓	✓	41	✓											
1	78-93-3	2-butanone(10xblk)	✓	0.01		✓	✓	-21	✓					Run						
2	71-55-6	1,1,1-trichloroethane	✓	0.10		✓	✓	✓	✓											
2	56-23-5	carbon tetrachloride	✓	0.10		✓	✓	24	✓											
2	75-27-4	Bromodichloromethane	✓	0.20		✓	✓	26	✓					on						
2	78-87-5	1,2-dichloropropane	✓	0.01		✓	✓	✓	✓											
2	10061-01-5	cis-1,3-dichloropropene	✓	0.20		✓	✓	✓	✓					another						
2	79-01-6	Trichloroethene	✓	0.30		0.23	✓	✓	✓	✓	✓	✓								
2	124-48-1	Dibromochloromethane	✓	0.10		✓	✓	✓	✓					SNL SDG						
2	79-00-5	1,1,2-trichloroethane	✓	0.10		✓	✓	✓	✓											
2	71-43-2	Benzene	✓	0.50		✓	✓	✓	✓	✓	✓	✓		And						
2	10061-02-6	trans-1,3-dichloropropene	✓	0.10		✓	✓	26	✓											
2	75-25-2	Bromoform	✓	0.10		✓	✓	✓	✓					Met						
3	108-10-1	4-methyl-2-pentanone	✓	0.10		✓	✓	✓	✓											
3	591-78-6	2-hexanone	✓	0.01		✓	✓	✓	✓					Criteria						
3	127-18-4	Tetrachloroethene	✓	0.20		✓	✓	✓	✓											
3	79-34-5	1,1,2,2-tetrachloroethane	✓	0.30		✓	✓	✓	✓					except						
3	108-88-3	toluene(10xblk)	✓	0.40		✓	✓	✓	✓	✓	✓	✓								
3	108-90-7	Chlorobenzene	✓	0.50		✓	✓	✓	✓	✓	✓	✓		for low						
3	100-41-4	Ethylbenzene	✓	0.10		✓	✓	✓	✓					MSD%R						
3	100-42-5	Styrene	✓	0.30		✓	✓	✓	✓											
3	1330-20-7	xylenes(total)	✓	0.30		✓	✓	✓	✓											
	540-59-0	1,2-dichloroethylene(total)	✓	0.01		✓	✓	✓	✓					for Benzene						
	110-75-8	2-chloroethyl vinyl ether																		
	108-05-4	vinyl acetate				✓	✓	23	✓					RPD met						
														CRITERIA						

Notes: Shaded rows are RCRA compounds.

Comments:

① The RF ≥ 0.01 but < the specified Min RF, Sample results for 1,1-dichloroethene and trichloroethene are ND and will be qualified "UJ"

Reviewed By: Kevin A Lambert

Date: 8-8-00

Volatile Organics

Site/Project: Site 94C AR/COC #: 603229 Batch #s: 26204

Laboratory: GEL Laboratory Report #: 25634 # of Samples: 1 Matrix: Aqueous

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

Sample	SMC 1	SMC 2	SMC 3	IS 1 area	IS 1 RT	IS 2 area	IS 2 RT	IS 3 area	IS 3 RT
		MET				MET			
		CRITERIA				CRITERIA			

SMC 1: 4-Bromofluorobenzene
SMC 2: 1,2-Dichloroethane-d4
SMC 3: Toluene-d8

IS 1: Bromochloromethane
IS 2: 1,4-Difluorobenzene
IS 3: Chlorobenzene-d5

Comments:

② The CCV %D six compounds are > 20% but ≤ 40%, Sample results are ND, No data are qualified
The CCV %D one compound is > 40% but ≤ 60%, Sample results ~~are~~ is KAL 8-8-00 ND and will be qualified "UJ"
The CCV %D one compound is ≥ 60%, Sample result is ND and will be qualified "R"

Note: ~~Field Sample~~ KAL 8-8-00 TCLP VOC analysis on field samples were canceled by SNL due to missed holding times for TCLP VOC extraction. Therefore trip blank does not correspond to any field sample.

Inorganic Metals

Site/Project: Site 94C
AR/COC #: 603229
Laboratory Sample IDs: 25633-003 & -004
Laboratory: GEL
Laboratory Report #: 25633
Methods: EPA 6010B, EPA 7470A
Batch #s: 26818 (ICP), 26057 (CVAA)
# of Samples: 2
Matrix: soil

CAS #/ Analyte	QC Element																				
	TAL	ICV	CCV	③ ICB ug/l	④ CCB ug/l	Method Blanks	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	① Rep. RPD	ICS AB	⑤ Serial Dilution	Field Dup. RPD	Equip. Blanks	Field Blanks			Analysis Date
7429-90-5 Al											NA	NA				NA	NA	NA			6/5/00
7440-39-3 Ba	✓	✓	✓	0.665J	✓	✓	✓	✓	✓	✓			✓	✓	✓						
7440-41-7 Be	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			n/a	✓	NA						
7440-43-9 Cd	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			n/a	✓							
7440-70-2 Ca																					
7440-47-3 Cr	✓	✓	✓	✓	-1.34J	✓	✓	✓	✓	✓			n/a	✓							
7440-48-4 Co																					
7440-50-8 Cu	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓							
7439-89-6 Fe																					
7439-95-4 Mg																					
7439-96-5 Mn																					
7440-02-0 Ni	✓	✓	✓	✓	-1.57J	✓	✓	✓	✓	✓			✓	✓							
7440-09-7 K																					
7440-22-4 Ag	✓	✓	✓	✓	-1.52J	✓	✓	✓	✓	✓			n/a	✓							
7440-23-5 Na																					
7440-62-2 V																					
7440-66-6 Zn	✓	✓	✓	✓		✓	✓	✓	✓	✓			✓	✓							
7439-92-1 Pb	✓	✓	✓	✓	-3.25J	✓	✓	✓	✓	✓			n/a	✓							
7782-49-2 Se	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			n/a	✓							
7440-38-2 As	✓	✓	✓	✓	2.86J	✓	✓	✓	✓	✓			n/a	✓							
7440-36-0 Sb	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			n/a	✓							6/27/00
7440-28-0 Tl	✓	✓	✓	-2.66 J	✓	✓	✓	✓	✓	✓			n/a	✓							
② 7439-97-6 Hg	✓	✓	✓	✓	-0.08J	✓	✓	✓	✓	NA	NA	NA	NA	NA							5/18/00
Cyanide CN																					

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

Comments: NA - Not Applicable

① n/a - RPD criteria does not apply, original and replicate sample results are ND.

Reviewed By: Kevin A Lambert

Date: 8-8-00

SEE OTHERSIDE

② Hg - No MS/MSD was run on this SDG, Run on another SNL SDG and met criteria.
- No Replicate was run on this SDG, Run on another SNL SDG and met criteria.

③ <u>ICB</u>

~~Ba - Blank value ≥ DL, Sample results are < 5x blank value and will be qualified "J, B3."~~ KAL 8-8-00

Ba - Absolute blank value is < the DL, NO data are qualified

Tl - Absolute blank value is < the DL, NO data are qualified

④ <u>CCB</u> KAL 8-8-00

CR - ~~Blank v~~ Absolute blank value > DL but < RL, Sample results are ND and will be qualified "UJ, B3."

Ni - Absolute blank value < DL, No data are qualified.

Ag - " " " " ", " " " "

Pb - Absolute blank value > DL but < RL, Sample results are ND and will be qualified "UJ, B3."

AS - Blank value ≥ DL, Sample results are ND, no data are qualified.

Hg - Absolute blank value > DL but < RL, Sample results are ND and will be qualified "UJ, B3."

⑤ <u>Serial Dilution</u>

Acceptance criteria do not apply when undiluted sample results are < 50x the RL.

Radiochemistry

Site/Project: Site 94C AR/COC #: 603229 Laboratory Sample IDs: 25633-005 & -006

Laboratory: GEL Laboratory Report #: 25633

Methods: DOE EML HASL 300

# of Samples: 2 Matrix: soil Batch #s: 27413

Analyte	QC Element												
	Method Blanks	LCS	① MS	Rep RER	Equip. Blanks	Field Dup. RER	Field Blanks	Sample ID	Isotope	IS/Trace	Sample ID	Isotope	IS/Trace
Criteria	U	20%	25%	<1.0	U	<1.0	U			50-105			50-105
H3					NA	NA	NA						
U-238 ✓	✓	✓	n/a	✓									
U-234 ✓	✓			✓									
U-235/-236 ✓	✓			✓									
Th-232													
Th-228													
Th-230													
Pu-239/-240													
Gross Alpha													
Nonvolatile Beta													
Ra-226													
Ra-28													
Ni-63													
Gamma Spec. Am-241													
Gamma Spec. Cs-137													
Gamma Spec. Co-60													
					↓	↓	↓						

NA- Not Applicable

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

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

Comments:

① n/a - Recovery limits do not apply, sample [c] is > 4X spike [c]

Reviewed By: Kevin A Lambert Date: 8-8-00

Contract Verification Review (CVR)

Project Leader FRESHOUR
Project Name CANYONS TEST AREA –SITE 94C
Case No. 7214_02.02.14
AR/COC No. 603229
Analytical Lab GEL
SDG No. 25633

In the tables below, mark any information that is missing or incorrect and give an explanation.

1.0 Analysis Request and Chain of Custody Record and Log-In Information

Line No.	Item	Complete?		If no, explain	Resolved?	
		Yes	No		Yes	No
1.1	All items on COC complete - data entry clerk initialed and dated	X				
1.2	Container type(s) correct for analyses requested	X				
1.3	Sample volume adequate for # and types of analyses requested	X				
1.4	Preservative correct for analyses requested	X				
1.5	Custody records continuous and complete	X				
1.6	Lab sample number(s) provided and SNL sample number(s) cross referenced and correct	X				
1.7	Date samples received	X				
1.8	Condition upon receipt information provided	X				

2.0 Analytical Laboratory Report

Line No.	Item	Complete?		If no, explain	Resolved?	
		Yes	No		Yes	No
2.1	Data reviewed, signature	X				
2.2	Method reference number(s) complete and correct	X				
2.3	QC analysis and acceptance limits provided (MB, LCS, Replicate)	X				
2.4	Matrix spike/matrix spike duplicate data provided(if requested)	X				
2.5	Detection limits provided; PQL and MDL(or IDL), MDA and L_c	X				
2.6	QC batch numbers provided	X				
2.7	Dilution factors provided and all dilution levels reported	X				
2.8	Data reported in appropriate units and using correct significant figures	X				
2.9	Radiochemistry analysis uncertainty (2 sigma error) and tracer recovery (if applicable) reported	X				
2.10	Narrative provided	X				
2.11	TAT met		X	30 DAY TAT EXCEEDED		X
2.12	Hold times met	X				
2.13	Contractual qualifiers provided	X				
2.14	All requested result and TIC (if requested) data provided	X				

Contract Verification Review (Continued)

3.0 Data Quality Evaluation

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1 Are reporting units appropriate for the matrix and meet contract specified or project-specific requirements? Inorganics and metals reported as ppm (mg/liter or mg/Kg)? Tritium reported in picocuries per liter with percent moisture for soil samples? Units consistent between QC samples and sample data	X		
3.2 Quantitation limit met for all samples	X		
3.3 Accuracy a) Laboratory control samples accuracy reported and met for all samples		X	SEVERAL SVOC ANALYTES OUTSIDE RECOVERY LIMITS
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique	X		
c) Matrix spike recovery data reported and met	X		
3.4 Precision a) Replicate sample precision reported and met for all inorganic and radiochemistry samples	X		
b) Matrix spike duplicate RPD data reported and met for all organic samples	X		
3.5 Blank data a) Method or reagent blank data reported and met for all samples	X		
b) Sampling blank (e.g., field, trip, and equipment) data reported and met		X	METHYLENE CHLORIDE DETECTED IN VOC TRIP BLANK
3.6 Contractual qualifiers provided: "J"- estimated quantity; "B"-analyte found in method blank above the MDL for organic or above the PQL for inorganic; "U"- analyte undetected (results are below the MDL, IDL, or MDA (radiochemical)); "H"-analysis done beyond the holding time	X		
3.7 Narrative addresses planchet flaming for gross alpha/beta	NA		
3.8 Narrative included, correct, and complete	X		
3.9 Second column confirmation data provided for methods 8330 (high explosives) and pesticides/PCBs	X		

Contract Verification Review (Continued)

4.0 Calibration and Validation Documentation

Item	Yes	No	Comments
4.1 GC/MS (8260, 8270, etc.) a) 12-hour tune check provided	X		
b) Initial calibration provided	X		
c) Continuing calibration provided	X		
d) Internal standard performance data provided	X		
e) Instrument run logs provided	X		
4.2 GC/HPLC (8330 and 8010 and 8082) a) Initial calibration provided	X		
b) Continuing calibration provided	X		
c) Instrument run logs provided	X		
4.3 Inorganics (metals) a) Initial calibration provided	X		
b) Continuing calibration provided	X		
c) ICP interference check sample data provided	X		
d) ICP serial dilution provided	X		
e) Instrument run logs provided	X		
4.4 Radiochemistry a) Instrument run logs provided	X		

Contract Verification Review (Concluded)

5.0 Problem Resolution

Summarize the findings in the table below. List only samples/fractions for which deficiencies have been noted.

Sample/Fraction No.	Analysis	Problems/Comments/Resolutions
QC	SVOC	INCOMPLETE QC SUMMARY
QC	METALS	NEGATIVE VALUES REPORTED IN QC SUMMARY
051633-002	SVOC	MISSING SURROGATES ON BOTTOM OF COA (PG.252)
NARRATIVE	ISO-U	NARRATIVE UNSIGNED

Were deficiencies unresolved? ☑ Yes ☐ No

Based on the review, this data package is complete. ☐ Yes ☑ No

If no, provide: nonconformance report or correction request number 2310 and date correction request was submitted: 7-17-2000

Reviewed by: W. Palencia Date: 7-17-2000 Closed by: W. Palencia Date: 7/27/00

ANALYSIS REQUEST AND CHAIN OF CUSTODY

S 32847

Page 1 of ~~2~~ 1 MD

Internal Lab

Batch No. 000822 SAR/WR No.

AR/COC 603229

Dept. No./Mail Stop:	6134/MS1088	Date Samples Shipped:	5-10-00	SMO USE	Logged By:
Project/Task Manager:	Freshour/Henderson	Carrier/Waybill No.	731960		Project/Task No.: 7214.02.02.14
Project Name:	Site 94C Bomb Burner	Lab Contact:	E Kent		SMO Authorization:
Record Center Code:		Lab Destination:	GEL		Location: Tech Area:
Logbook Ref. No.:		SMO Contact/Phone:	D Salmi 844-3110		Building: Room:
Service Order No.	CFO 021	Send Report to SMO:	S Jensen 844-3185		
Location	Tech Area				
Building	Room				

☑ Waste Characterization

-RCRA DATE =

-Send preliminary/copy report to:

Ernie Vinsant

☑ Released by COC No.: 603230

Reference LOV(available at SMO)

25633

Sample No.-Fraction	ER Sample ID or Sample Location Detail	Beginning Depth (ft)	ER Site No.	Date/Time(hr) Collected	Sample Matrix	Container Type	Container Volume	Preserve All@4C	Collection Method	Sample Type	Parameter & Method Requested	
051631-001	CY94C-SP01-01	0	94C	0~~4~~50800 1030 [illegible] 5-11-00	S	AG	4oz	4C	G	SA	TCLP VOCs (8260) 001	KH
051631-002	CY94C-SP01-01	0	94C	0~~4~~50800 1030	S	AG	16oz	4C	G	SA	TCLP Met +Be-Cu-Sb-Ni-Tl-Zn (1311-6010/7471)-HE(8330)-TCLP SVOC(8270)-PCBs 003/007	
051631-003	CY94C-SP01-01	0	94C	0~~4~~50800 1030	S	AG	16oz	4C	G	SA	Iso U 005	
~~051632-001~~	~~CY94C-SP01-02~~	~~0~~	~~94C~~	~~040800 1034~~	~~S~~	~~AG~~	~~4oz~~	~~4C~~	~~G~~	~~SA~~	~~TCLP VOCs (8260)~~ PH SP94-02 returned	
~~051632-002~~	~~CY94C-SP01-02~~	~~0~~	~~94C~~	~~040800 1034~~	~~S~~	~~AG~~	~~16oz~~	~~4C~~	~~G~~	~~SA~~	~~TCLP Met +Be-Cu-Sb-Ni-Tl-Zn(1311-6010/7471)-HE(8330)-TCLP SVOC(8270)-PCBs~~ to soil	
~~051632-003~~	~~CY94C-SP01-02~~	0	94C	~~040800 1034~~	~~S~~	~~AG~~	~~16oz~~	~~4C~~	~~G~~	~~SA~~	~~Iso U~~ pile	
051633-001	CY94C-SP01-03	0	94C	0~~4~~50800 1039	S	AG	4oz	4C	G	TB	TCLP VOC 002	KH
051633-002	CY94C-SP01-03	0	94C	0~~4~~50800 1039	S	AG	16oz	4C	G	SA	TCLP Met +Be-Cu-Sb-Ni-Tl-Zn(1311-6010/7471)-HE(8330)-TCLP SVOC(8270)-PCBs 004/008	
051633-003	CY94C-SP01-03	0	94C	0~~4~~50800 1039	S	AG	16oz	4C	G	SA	Iso U 006	
051634-001	CY94B-GR-018-TB	N/A	94C	0~~4~~50800 1030	DIW	G	3X40ml	HCl	N/A	TB	VOC 25634 001	

RMMA ☑ Yes ☐ No Ref. No.

Sample Disposal ☐ Return to Client ☑ Disposal by lab

Turnaround Time ☐ 7 Day ☐ 15 Day ☑ 30 Day

☐ Negotiated Required Report Date

Sample Tracking Smo Use

Date Entered(mm/dd/yy)

Entered by:

QC inits.

Special Instructions/QC Requirements:

EDD ☑ Yes ☐ No

Raw Data Package ☑ Yes ☐ No

*Send/e-mail report to:

P Henderso 284-2617

RAD DATA REVIEWED [illegible] 5-10-00

*Please list as separate report.

Abnormal Conditions on Receipt

2.8

Sample Team Members	Name	Signature	Init	Company/Organization/Phone/Cellular
	M Sanchez	M Sanchez	MS	Weston/6135/845-3267

1.Relinquished by	Org 6135	Date 5-9-00	Time 1430
1. Received by	Org 6133	Date 5/9/00	Time 1430
2.Relinquished by	Org 6133	Date 5-10-00	Time 1800
2. Received by	Org GEL	Date 5-11-00	Time 09:30
3.Relinquished by	Org.	Date	Time
3. Received by	Org.	Date	Time
4.Relinquished by	Org.	Date	Time
4. Received by	Org.	Date	Time
5.Relinquished by	Org.	Date	Time
5. Received by	Org.	Date	Time
6.Relinquished by	Org.	Date	Time
6. Received by	Org.	Date	Time

Sample Findings Summary

Site: Canyons - 94C

AR/COC: 602819

Data Classification: Organics (EPA 8260A ↓ 8270B/C 8330)

ER Sample ID	Analysis	DV Qualifiers	Comments
050084-005 CY94C-GR-001-EB	4-amino-2,6-dinitrotoluene (19406-51-0)	UJ, P1	EPA 8330 (High Explosives)
050084-006 CY94C-GR-001-EB	SVOCs (EPA 8270C)	UJ, A2	

⇒ Note: See attached spreadsheet for VOC data qualifications.

Data are acceptable.

QC Measures appear to be adequate.

ER Sample ID - This value is located on the AR/Chain of Custody.

Analysis - Use valid test methods provided below or if the result applies to an individual analyte within a test method, use the CAS number from the analytical data sheet.

DV Qualifiers - The entry will be taken from the list of valid qualifiers and associated comments. If other qualifiers not on the list are needed, contact Tina Sanchez to coordinate adding them to the list.

Comments - This is only to be used if a comment associated with the qualifier is not appropriate, needs modification because of an unusual circumstance, or additional clarification is warranted.

Test Methods - Anions_CE, EPA6010, EPA6020, EPA7470/1, EPA8015B, EPA8081, EPA8260, EPA8260-M3, EPA8270, HACH_ALK, HACH_ NO2, HACH_NO3, MEKC_HE, PCBRISC

Reviewed by:

Date: 1/5/00

Data Validation Qualifiers and Descriptive Flags*

Note: Qualifiers may be used in conjunction with descriptive flags [e.g., J, A; UJ, P; U, B].

Qualifiers	Comment
J	The associated value is an estimated quantity.
J1	The method requirements for sample preservation/temperature were not met for the sample analysis. The associated value is an estimated quantity.
J2	The holding time was exceeded for the associated sample analysis. The associated value is an estimated quantity.
UJ	The analyte was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
U	The associated result is less than ten times the concentration in any blank and is determined to be non-detect. The analyte is a common laboratory contaminant.
U1	The associated result is less than five times the concentration in any blank and is determined to be non-detect.
R	The data are unusable for their intended purpose. The analyte may or may not be present. (Note: Resampling and reanalysis is necessary for verification.)

Descriptive Flags	
A	Laboratory accuracy and/or bias measurements for the associated Laboratory Control Sample and/or duplicate (LCS/LCSD) do not meet acceptance criteria.
A1	Laboratory accuracy and/or bias measurements for the associated Surrogate Spike do not meet acceptance criteria.
A2	Laboratory accuracy and/or bias measurements for the associated Matrix Spike and/or duplicate (MS/MSD) do not meet acceptance criteria.
A3	Insufficient quality control data to determine laboratory accuracy.
B	Analyte present in laboratory method blank
B1	Analyte present in trip blank.
B2	Analyte present in equipment blank.
B3	Analyte present in calibration blank.
P	Laboratory precision measurements for the Laboratory Control Sample and duplicate (LCS/LCSD) do not meet acceptance criteria.
P1	Laboratory precision measurements for the Matrix Spike Sample and associated duplicate (MS/MSD) do not meet acceptance criteria.
P2	Insufficient quality control data to determine laboratory precision.

* This is not a definitive list. Other qualifiers are potentially available. Notify Tina Sanchez to revise list.

Updated: September 14, 1999

ARCOC #602819 Organic Analyses (VOCs) ER Sample ID	75-15-0 (carbon disulfide)	75-09-2 (methylene chloride)	75-35-4 (1,1-dichloroethene)	79-01-6 (trichloroethene)																
050074-001 CY94C-GR-001-S				UJ																
050075-001 CY94C-GR-002-S				UJ																
050076-001 CY94C-GR-003-S				UJ																
050077-001 CY94C-GR-004-S				UJ																
050078-001 CY94C-GR-005-S				UJ																
050079-001 CY94C-GR-006-S				UJ																
050080-001 CY94C-GR-007-S				UJ																
050081-001 CY94C-GR-008-S				UJ																
050082-001 CY94C-GR-009-S	5U1,B			UJ																
050083-001 CY94C-GR-009-DU				UJ																
050084-004 CY94C-GR-001-EB		5U,B	UJ	UJ																
050084-008 CY94C-GR-001-TB		5U,B	UJ	UJ																

1/5/00

MEMORANDUM

DATE: January 5, 2000

TO: File

FROM: Kenneth Salaz KAS

SUBJECT: Organic Data Review and Validation
Canyons-94C, ARCOC #602819, Project/Task No. 7214.02.02.14

See the attached Data Assessment Summary Forms for supporting documentation on the data review and validation.

Summary

All samples were prepared and analyzed with accepted procedures and specified methods: EPA8260A (VOCs), EPA8270B/C (SVOCs), and EPA8330 (HEs). Problems were identified with the data package that result in the qualification of data.

1. VOC Analysis: The initial calibration response factors (RFs) of 1,1-dichloroethene and trichloroethene were less than (<) the required minimums. The trichloroethene results of samples 9909377-01, -04, -07, -10, -13, -16, -19, -22, -25, -28, -31, and -35, as well as the 1,1-dichloroethene results of samples -31 and -35, were non-detect (ND) and will be qualified "UJ."

2. VOC Analysis: In the method blank for the equipment blank (EB) and trip blank (TB), methylene chloride was detected. The associated results of samples 9909377-31 and -35 were positive, <10X the blank concentration, < the reporting limit (RL), and will be qualified "5U,B." In the method blank for the field samples, carbon disulfide was detected. The associated result of sample -25 was positive, <5X the blank concentration, < the RL, and will be qualified "5U1,B."

3. SVOC Analysis: The MS/MSD percent recoveries (%RECs) of 2-chlorophenol, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, acenaphthene, 2,4-dinitrotoluene, and pentachlorophenol for the EB were < QC limits. All results of sample 9909377-33 were ND and will be qualified "UJ,A2."

   HE Analysis: The MS/MSD relative percent difference (RPD) of 4-amino-2,6-dinitrotoluene for the EB was greater than (>) QC limits. The associated result of sample 9909377-32 was ND and will be qualified "UJ,P1."

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

Holding Times

All Analyses: All samples were analyzed within the prescribed holding times.

Calibration

VOC Analysis: The initial and continuing calibrations met QC acceptance criteria except as noted above in the summary section and the following. The continuing calibration verification (CCV) percent differences (%Ds) of chloromethane, 4-methyl-2-pentanone, 2-hexanone, and vinyl acetate were outside of QC limits. However, all associated sample results were ND. Thus, no data were qualified.

SVOC Analysis: The initial and continuing calibrations met QC acceptance criteria except as noted above in the summary section and the following. The initial calibration correlation coefficient of m,p-cresol was <0.99 but >0.9. The CCV %Ds of 4-nitrophenol, bis(2-chloroisopropyl)ether, and N-nitroso-di-n-propylamine were <-20%. However, all associated sample results were ND. Thus, no data were qualified.

HE Analysis: The initial and continuing calibrations met QC acceptance criteria.

Blanks

VOC Analysis: No target analytes were detected in the method blanks except as noted above in the summary section.

SVOC/HE Analyses: No target analytes were detected in the method blanks.

Surrogates

VOC/SVOC Analyses: The surrogate %RECs met QC acceptance criteria.

HE Analysis: The surrogate %RECs met QC acceptance criteria except for the following. The surrogate %REC of sample 9909377-32 was > QC limits. However, all results were ND. Thus, no data were qualified.

Internal Standards (ISs)

VOC/SVOC Analyses: The IS areas and retention times (RTs) met QC acceptance criteria.

HE Analysis: No internal standards were required for this method.

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

VOC Analysis: The MS/MSD met QC acceptance criteria except for the following. The MSD %RECs of benzene and toluene were < QC limits. However, the MS %RECs and the MSD RPDs met QC acceptance criteria. Thus, no data were qualified.

SVOC Analysis: The MS/MSD met QC acceptance criteria except as noted above in the summary section.

HE Analysis: The MS/MSD met QC acceptance criteria except as noted above in the summary section and the following. The %RECs of 1,3,5-trinitrobenzene, 2,4,6-trinitrotoluene, and 2,6-dinitrotoluene were > QC limits. However, the associated results were ND. Thus, no data were qualified.

Laboratory Control Samples (LCS/LCSD)

VOC Analysis: The LCS/LCSD met QC acceptance criteria except for the following. The RPD of chlorobenzene was > QC limits. However, the LCS/LCSD %RECs met QC acceptance criteria. Thus, no data were qualified.

SVOC/HE Analyses: The LCS/LCSD met QC acceptance criteria.

Other QC

VOC Analysis: A field duplicate was submitted on the ARCOC. However, all sample results were ND. Thus, RPDs could not be calculated. No target analytes were detected in the equipment blank (EB) or trip blank (TB).

SVOC/HE/PCB Analyses: Field duplicates were submitted on the ARCOC. However, all sample results were ND. Thus, RPDs could not be calculated. No target analytes were detected in the EBs. No field blanks (FBs) were submitted on the ARCOC.

No other specific issues were identified which affect data quality.

Please contact me if you have any questions or comments regarding the review of this package.

Sample Findings Summary

Site: Canyons - 94C

AR/COC: 602819

Data Classification: Inorganics (EPA 6010B ↓ 7470/1A)

ER Sample ID	Analysis	DV Qualifiers	Comments
⇒ Note: See attached spreadsheet	for inorganic data	qualifications.	
	Data are acceptable.		
QC	Measures appear	to be adequate.	

ER Sample ID - This value is located on the AR/Chain of Custody.

Analysis - Use valid test methods provided below or if the result applies to an individual analyte within a test method, use the CAS number from the analytical data sheet.

DV Qualifiers - The entry will be taken from the list of valid qualifiers and associated comments. If other qualifiers not on the list are needed, contact Tina Sanchez to coordinate adding them to the list.

Comments - This is only to be used if a comment associated with the qualifier is not appropriate, needs modification because of an unusual circumstance, or additional clarification is warranted.

Test Methods - Anions_CE, EPA6010, EPA6020, EPA7470/1, EPA8015B, EPA8081, EPA8260, EPA8260-M3, EPA8270, HACH_ALK, HACH_ NO2, HACH_NO3, MEKC_HE, PCBRISC

Reviewed by:

Date: 1/5/00

Data Validation Qualifiers and Descriptive Flags*

Note: Qualifiers may be used in conjunction with descriptive flags [e.g., J, A; UJ, P; U, B].

Qualifiers	Comment
J	The associated value is an estimated quantity.
J1	The method requirements for sample preservation/temperature were not met for the sample analysis. The associated value is an estimated quantity.
J2	The holding time was exceeded for the associated sample analysis. The associated value is an estimated quantity.
UJ	The analyte was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
U	The associated result is less than ten times the concentration in any blank and is determined to be non-detect. The analyte is a common laboratory contaminant.
U1	The associated result is less than five times the concentration in any blank and is determined to be non-detect.
R	The data are unusable for their intended purpose. The analyte may or may not be present. (Note: Resampling and reanalysis is necessary for verification.)

Descriptive Flags	
A	Laboratory accuracy and/or bias measurements for the associated Laboratory Control Sample and/or duplicate (LCS/LCSD) do not meet acceptance criteria.
A1	Laboratory accuracy and/or bias measurements for the associated Surrogate Spike do not meet acceptance criteria.
A2	Laboratory accuracy and/or bias measurements for the associated Matrix Spike and/or duplicate (MS/MSD) do not meet acceptance criteria.
A3	Insufficient quality control data to determine laboratory accuracy.
B	Analyte present in laboratory method blank
B1	Analyte present in trip blank.
B2	Analyte present in equipment blank.
B3	Analyte present in calibration blank.
P	Laboratory precision measurements for the Laboratory Control Sample and duplicate (LCS/LCSD) do not meet acceptance criteria.
P1	Laboratory precision measurements for the Matrix Spike Sample and associated duplicate (MS/MSD) do not meet acceptance criteria.
P2	Insufficient quality control data to determine laboratory precision.

* This is not a definitive list. Other qualifiers are potentially available. Notify Tina Sanchez to revise list.

Updated: September 14, 1999

ARCOC #602819 Inorganic Analyses (RCRA metals+Be) ER Sample ID	7440-22-4 (Ag)	7440-38-2 (As)	7440-43-9 (Cd)	7440-47-3 (Cr)		7439-97-6 (Hg)												
050074-003 CY94C-GR-001-S	J,B					UJ,B3												
050075-003 CY94C-GR-002-S	J,B,B3					UJ,B3												
050076-003 CY94C-GR-003-S	J,B,B3	J,B3				UJ,B3												
050077-003 CY94C-GR-004-S	J,B,B3					UJ,B3												
050078-003 CY94C-GR-005-S	J,B,B3	J,B3				UJ,B3												
050079-003 CY94C-GR-006-S	J,B																	
050080-003 CY94C-GR-007-S	J,B	J,B3				UJ,B3												
050081-003 CY94C-GR-008-S	J,B																	
050082-003 CY94C-GR-009-S	J,B																	
050083-003 CY94C-GR-009-DU	J,B					J,B3												
050084-007 CY94C-GR-001-EB			J,B3	UJ,B3		UJ,B3												

1/5/00

MEMORANDUM

DATE: January 5, 2000

TO: File

FROM: Kenneth Salaz KS

SUBJECT: Inorganic Data Review and Validation
Canyons-94C, ARCOC #602819, Project/Task No. 7214.02.02.14

See the attached Data Assessment Summary Forms for supporting documentation on the data review and validation.

Summary

All samples were prepared and analyzed with accepted procedures and specified methods: EPA6010B (ICP metals) and EPA7470/1A (Hg). Problems were identified with the data package that result in the qualification of data.

1. ICP Analysis: In the initial calibration blank (ICB) and continuing calibration blank (CCB) for the equipment blank (EB), chromium (Cr) was detected at a negative concentration. The associated result of sample 9909377-34 was non-detect (ND) and will be qualified "UJ,B3." Cadmium (Cd) was also detected in the CCB. The associated result of sample -34 was positive, less than (<) 5X the blank concentration, and will be qualified "J,B3." Silver (Ag) was detected in the CCB and method blank for the field samples. The associated results of samples -06, -09, -12, and -15 were positive, <5X the blank concentrations, and will be qualified "J,B,B3." The associated results of samples -03, -18, -21, -24, -27, and -30 will be qualified "J,B." Arsenic (As) was also detected in the ICB and CCB. The associated results of samples -09, -15, and -21 will be qualified "J,B3."

   Hg Analysis: In the ICB and CCB for the EB and the ICB for the field samples, mercury (Hg) was detected at negative concentrations. The absolute values were greater than (>) the detection limit (DL) but < the reporting limit (RL). The associated results of samples 9909377-03, -06, -09, -12, -15, -21, and -34 were ND and will be qualified "UJ,B3." The associated result of sample -30 was positive, <5X the DL, and will be qualified "J,B3."

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

Holding Times

All Analyses: All samples were analyzed within the prescribed holding times.

Calibration

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

Blanks

All Analyses: No target analytes were detected in the blanks except as noted above in the summary section and the following. Beryllium (Be) and As were detected in the CCB for the EB. However, the BE result was ND, and the absolute value of the As concentration was < the DL. Thus, no data were qualified. Barium (Ba), Be, and Cd were detected in the ICB and/or CCB for the field samples. However, the blank concentrations were < the associated DLs or sample results were ND. Thus, no data were qualified.

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

All Analyses: The MSs met QC acceptance criteria. No MSDs were performed. However, replicate analyses were performed as measures of laboratory precision.

Laboratory Control Samples (LCS/LCSD)

ICP Analysis: The LCS/LCSD met QC acceptance criteria except for the following. The LCS percent recoveries (%RECs) of Cd and lead (Pb) were slightly > QC limits. However, the LCSD %RECs and relative percent differences (RPDs) met QC acceptance criteria. Thus, no data were qualified.

Hg Analysis: The LCS/LCSD met QC acceptance criteria.

Replicates

All Analyses: The replicate analyses met QC acceptance criteria.

ICP Interference Check Sample (ICS)

ICP Analysis: The ICS met QC acceptance criteria.

Hg Analysis: No ICS was required for this method.

ICP Serial Dilution

ICP Analysis: The ICP serial dilution met QC acceptance criteria.

Hg Analysis: No serial dilution was required for this method.

<u>Other QC</u>

All Analyses: Field duplicates were submitted on the ARCOC. When possible, RPDs were calculated and are listed on the data validation worksheets. No target analytes were detected in the EBs except Ba and Cd. However, the Ba results were >5X the blank concentration, and the Cd results were ND. Thus, no data were qualified. No field blanks (FBs) were submitted on the ARCOC.

No other specific issues were identified which affect data quality.

Please contact me if you have any questions or comments regarding the review of this package.

Sample Findings Summary

Site: Canyons - 94C AR/COC: 602819 Data Classification: Radiological (EPA900.0 HASL 300)

ER Sample ID	Analysis	DV Qualifiers	Comments
050076-002 CY94C-GR-003-S	13967-70-9 (Cesium-134)	R	
050077-002 CY94C-GR-004-S	↓	↓	
050079-002 CY94C-GR-006-S	↓	↓	
Data	are acceptable (except	as noted above).	
QC	Measures appear	to be adequate.	

ER Sample ID - This value is located on the AR/Chain of Custody.

Analysis - Use valid test methods provided below or if the result applies to an individual analyte within a test method, use the CAS number from the analytical data sheet.

DV Qualifiers - The entry will be taken from the list of valid qualifiers and associated comments. If other qualifiers not on the list are needed, contact Tina Sanchez to coordinate adding them to the list.

Comments - This is only to be used if a comment associated with the qualifier is not appropriate, needs modification because of an unusual circumstance, or additional clarification is warranted.

Test Methods - Anions_CE, EPA6010, EPA6020, EPA7470/1, EPA8015B, EPA8081, EPA8260, EPA8260-M3, EPA8270, HACH_ALK, HACH_ NO2, HACH_NO3, MEKC_HE, PCBRISC

Reviewed by: Date: 1/5/00

Data Validation Qualifiers and Descriptive Flags*

Note: Qualifiers may be used in conjunction with descriptive flags [e.g., J, A; UJ, P; U, B].

Qualifiers	Comment
J	The associated value is an estimated quantity.
J1	The method requirements for sample preservation/temperature were not met for the sample analysis. The associated value is an estimated quantity.
J2	The holding time was exceeded for the associated sample analysis. The associated value is an estimated quantity.
UJ	The analyte was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
U	The associated result is less than ten times the concentration in any blank and is determined to be non-detect. The analyte is a common laboratory contaminant.
U1	The associated result is less than five times the concentration in any blank and is determined to be non-detect.
R	The data are unusable for their intended purpose. The analyte may or may not be present. (Note: Resampling and reanalysis is necessary for verification.)

Descriptive Flags

A	Laboratory accuracy and/or bias measurements for the associated Laboratory Control Sample and/or duplicate (LCS/LCSD) do not meet acceptance criteria.
A1	Laboratory accuracy and/or bias measurements for the associated Surrogate Spike do not meet acceptance criteria.
A2	Laboratory accuracy and/or bias measurements for the associated Matrix Spike and/or duplicate (MS/MSD) do not meet acceptance criteria.
A3	Insufficient quality control data to determine laboratory accuracy.
B	Analyte present in laboratory method blank
B1	Analyte present in trip blank.
B2	Analyte present in equipment blank.
B3	Analyte present in calibration blank.
P	Laboratory precision measurements for the Laboratory Control Sample and duplicate (LCS/LCSD) do not meet acceptance criteria.
P1	Laboratory precision measurements for the Matrix Spike Sample and associated duplicate (MS/MSD) do not meet acceptance criteria.
P2	Insufficient quality control data to determine laboratory precision.

* This is not a definitive list. Other qualifiers are potentially available. Notify Tina Sanchez to revise list.

Updated: September 14, 1999

MEMORANDUM

DATE: January 5, 2000

TO: File

FROM: Kenneth Salaz KAS

SUBJECT: Radiological Data Review and Validation
Canyons-94C, ARCOC #602819, Project/Task No. 7214.02.02.14

See the attached Data Assessment Summary Forms for supporting documentation on the data review and validation.

Summary

All samples were prepared and analyzed with accepted procedures and specified methods: EPA900.0 (Gross Alpha/Beta) and HASL300 (Gamma Spec). A problem was identified with the data package that results in the qualification of data.

1. Gamma Spec Analysis: The negative bias criteria were not met for the Cs-134 results of samples 9909377-08, -11, and -17. The results were negative and less than (<) the associated negative MDAs. Thus, these results will be qualified "R" (unusable).

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

Holding Times

All Analyses: All samples were analyzed within the prescribed holding times.

Calibration

All Analyses: No calibration data were provided. However, the case narrative stated that the instruments were properly calibrated.

Blanks

Gross Alpha/Beta Analysis: In the method blank, gross alpha/beta were detected. However, the blank concentrations were < the associated 2-sigma uncertainties. Thus, no data were qualified.

Gamma Spec Analysis: No target analytes were detected in the method blank except the following. Lead (Pb)-212, Pb-214, potassium (K)-40, radium (Ra)-226, and thorium (Th)-232 were detected. However, the blank concentrations were < the associated 2-sigma uncertainties. Thus, no data were qualified.

Matrix Spike (MS) Analysis

All Analyses: The MSs met QC acceptance criteria.

Laboratory Control Sample (LCS)

All Analyses: The LCSs met QC acceptance criteria.

Replicates

All Analyses: The replicate analysis met QC acceptance criteria.

Tracer Recoveries

All Analyses: No tracers were required for these methods.

Negative Bias

Gross Alpha/Beta Analysis: All results met negative bias QC acceptance criteria.

Gamma Spec Analysis: All results met negative bias QC acceptance criteria except as noted above in the summary section.

Other QC

All Analyses: A field duplicate was submitted on the ARCOC. All replicate error ratios (RERs) were <1. No equipment blank (EB) or field blank (FB) were submitted on the ARCOC.

No other specific issues were identified which affect data quality.

Please contact me if you have any questions or comments regarding the review of this package.

Data Validation Summary

Site/Project: Canyons - 94C ~~Non-ER Septic Systems~~ KMS 12/20/99
Project/Task #: 7214.02.02.14
# of Samples: 35
Matrix: 30 soil/5 aqueous
AR/COC #: 602819
Laboratory Sample IDs: 9909377-01 thru -35
Laboratory: GEL
Laboratory Report #: 9909377

QC Element	Analysis									
	Organics				Inorganics				RAD	Other
	VOC	SVOC	Pesticide/ PCB	HPLC (HE)	ICP/AES	GFAA/ AA	CVAA (Hg)	CN		
1. Holding Times/Preservation	✓	✓	NA	✓	✓	NA	✓	NA	✓	NA
2. Calibrations	UJ	✓		✓	✓		✓		✓	
3. Method Blanks	5U, B 5U1, B	✓		✓	J, B J, B3		J, B3 UJ, B3		✓	
4. MS/MSD	✓	UJ, A2		UJ, P1	✓		✓		✓	
5. Laboratory Control Samples	✓	✓		✓	✓		✓		✓	
6. Replicates					✓		NA		✓	
7. Surrogates	✓	✓		✓						
8. Internal Standards	✓	✓								
9. TCL Compound Identification	✓	✓								
10. ICP Interference Check Sample					✓					
11. ICP Serial Dilution					✓					
12. Carrier/Chemical Tracer Recoveries									NA	
13. Other QC	✓	✓	↓	✓	✓	↓	✓	↓	R	↓

J	=	Estimated	Check (√)	=	Acceptable
U	=	Not Detected	Shaded Cells	=	Not Applicable (also "NA")
UJ	=	Not Detected, Estimated	NP	=	Not Provided
R	=	Unusable	Other		

Reviewed By:

Date: 1/5/00

Volatile Organics (SW 846 Method 8260)

Page 1 of 2

Site/Project: Canyons - 94C
AR/COC #: 602819
# of Samples: 10
Matrix: soil
Laboratory: GEL
Laboratory Report #: 9909377
Laboratory Sample IDs: 9909377-01,-04,-07,-10, -13,-16,-19,-22,-25,-28
Methods: EPA 8260A
Batch #s: 158458

IS	CAS #	Name	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R²	CCV %D	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	① Field Dup. RPD	Equip. Blanks	Trip Blanks	② Method Blank	
						>.05	<20%/ 0.99	20%												
1	74-87-3	Chloromethane	✓	0.10	✓	✓	✓	✓	✓							NA	✓	✓	✓	
1	74-83-9	Bromomethane	↓	0.10	NA	✓	✓	↓	↓							↓	↓	↓	↓	
1	75-01-4	vinyl chloride	↓	0.10	✓	✓	✓	↓	↓							↓	↓	↓	↓	
1	75-00-3	Chloroethane	↓	0.01	NA	✓	✓	↓	↓							↓	↓	↓	↓	
1	75-09-2	methylene chloride (10xblk)	↓	0.01	✓	✓	✓	↓	↓							↓	↓	↓	↓	
1	67-64-1	acetone(10xblk)	↓	0.01	✓	✓	✓	↓	↓							↓	↓	↓	↓	
1	75-15-0	carbon disulfide	↓	0.10	✓	✓	✓	↓	↓							↓	↓	↓	4.7J	
1	75-35-4	1,1-dichloroethene	↓	0.20	NA	✓	✓	↓	↓	✓	✓	✓	✓	✓	✓	↓	↓	↓	✓	
1	75-34-3	1,1-dichloroethane	↓	0.10	↓	✓	✓	↓	↓							↓	↓	↓	↓	
1	67-66-3	Chloroform	↓	0.20	✓	✓	✓	↓	↓							↓	↓	↓	↓	
1	107-06-2	1,2-dichloroethane	↓	0.10	NA	✓	✓	↓	↓							↓	↓	↓	↓	
1	78-93-3	2-butanone(10xblk)	↓	0.01	↓	✓	✓	↓	↓							↓	↓	↓	↓	
2	71-55-6	1,1,1-trichloroethane	↓	0.10	↓	✓	✓	↓	↓							↓	↓	↓	↓	
2	56-23-5	carbon tetrachloride	↓	0.10	↓	✓	✓	↓	↓							↓	↓	↓	↓	
2	75-27-4	Bromodichloromethane	↓	0.20	↓	✓	✓	↓	↓							↓	↓	↓	↓	
2	78-87-5	1,2-dichloropropane	↓	0.01	↓	✓	✓	↓	↓							↓	↓	↓	↓	
2	10061-01-5	cis-1,3-dichloropropene	↓	0.20	↓	✓	✓	↓	↓							↓	↓	↓	↓	
2	79-01-6	Trichloroethene	↓	0.30	↓	0.24	✓	↓	↓	✓	✓	✓	✓	✓	✓	↓	↓	↓	↓	
2	124-48-1	Dibromochloromethane	↓	0.10	↓	✓	✓	↓	↓							↓	↓	↓	↓	
2	79-00-5	1,1,2-trichloroethane	↓	0.10	↓	✓	✓	↓	↓							↓	↓	↓	↓	
2	71-43-2	Benzene	↓	0.50	↓	✓	✓	↓	↓	✓	✓	✓	✓	82.8	✓	↓	↓	↓	↓	
2	10061-02-6	trans-1,3-dichloropropene	↓	0.10	↓	✓	✓	↓	↓							↓	↓	↓	↓	
2	75-25-2	Bromoform	↓	0.10	✓	✓	✓	↓	↓							↓	↓	↓	↓	
3	108-10-1	4-methyl-2-pentanone	↓	0.10	NA	✓	✓	↓	↓							↓	↓	↓	↓	
3	591-78-6	2-hexanone	↓	0.01	↓	✓	✓	↓	↓							↓	↓	↓	↓	
3	127-18-4	Tetrachloroethene	↓	0.20	↓	✓	✓	↓	↓							↓	↓	↓	↓	
3	79-34-5	1,1,2,2-tetrachloroethane	↓	0.30	↓	✓	✓	↓	↓							↓	↓	↓	↓	
3	108-88-3	toluene(10xblk)	↓	0.40	↓	✓	✓	↓	↓	✓	✓	✓	✓	69.6	✓	↓	↓	↓	↓	
3	108-90-7	Chlorobenzene	↓	0.50	↓	✓	✓	↓	↓	✓	✓	17.2	✓	✓	✓	↓	↓	↓	↓	
3	100-41-4	Ethylbenzene	↓	0.10	↓	✓	✓	↓	↓							↓	↓	↓	↓	
3	100-42-5	Styrene	↓	0.30	↓	✓	✓	↓	↓							↓	↓	↓	↓	
3	1330-20-7	xylenes(total)	↓	0.30	↓	✓	✓	↓	↓							↓	↓	↓	↓	
	540-59-0	1,2-dichloroethylene(total)	↓	0.01	↓	✓	✓	↓	↓							↓	↓	↓	↓	
	110-75-8	2-chloroethyl vinyl ether			↓	NA	NA	NA	NA							↓	NA	NA	NA	
		Vinyl Acetate	✓		↓	✓	✓	-28.2	✓							↓	✓	✓	✓	

NA= Not Applical

Notes: Shaded rows are RCRA compounds.

Comments:
① A field dup. was submitted. All results were ND; no RPDs were calculated.
② Method blank applies to samples -25 and -28 only.

Reviewed By:
Date: 1/5/00

*Summary → See back of this page

alibration:

⇒ trichloroethane had an RF < the required minimum. All assoc. results were ND and will be qualified "UJ."

⇒ vinyl acetate had a CCV %D < -20%. All assoc. sample results were ND. Thus, no data were qualified.

CS:

⇒ The LCSD RPD of chlorobenzene was > QC limits. However, both the LCS and LCSD %RECs met QC criteria. Thus, no data were qualified.

SD: —

⇒ The MSD %RECs of benzene and toluene were < QC limits. However, the MS %RECs and the RPDs met QC criteria. Thus, no data were qualified.

ethod Blank:

⇒ Carbon disulfide was detected. The assoc. result of sample -25 was positive, <5x the blank conc., < the RL, and will be qualified "5U1,B."

Volatile Organics (SW 846 Method 8260)

Page 1 of 2

Canyons - 94C KAS 12/2/99
Site/Project: ~~Non-ER Septic Systems~~ AR/COC #: 602819 # of Samples: 2 Matrix: Aqueous
Laboratory: GEL Laboratory Report #: 9909377 Laboratory Sample IDs: 9909377-31(EB), -35(TB)
Methods: EPA 8260A Batch #s: 158501

IS	CAS #	Name	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blks	LCS	① LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	② Equip. Blanks	Trip Blanks		
						>.05	<20% / 0.99	20%												
1	74-87-3	Chloromethane	✓	0.10	✓	✓	✓	35.0	✓		NA	NA	NA	NA	NA	NA	NA	NA		
1	74-83-9	Bromomethane	✓	0.10	✓	✓	✓	✓												
1	75-01-4	vinyl chloride	✓	0.10	NA	✓	✓													
1	75-00-3	Chloroethane	✓	0.01	↓	✓	✓		↓											
1	75-09-2	methylene chloride (10xblk)	✓	0.01	✓	✓	✓		1.7J											
1	67-64-1	acetone(10xblk)	✓	0.01	✓	✓	✓		✓											
1	75-15-0	carbon disulfide	✓	0.10	NA	✓	✓													
1	75-35-4	1,1-dichloroethene	✓	0.20		0.17	✓			✓										
1	75-34-3	1,1-dichloroethane	✓	0.10		✓	✓													
1	67-66-3	Chloroform	✓	0.20		✓	✓													
1	107-06-2	1,2-dichloroethane	✓	0.10		✓	✓													
1	78-93-3	2-butanone(10xblk)	✓	0.01		✓	✓													
2	71-55-6	1,1,1-trichloroethane	✓	0.10		✓	✓													
2	56-23-5	carbon tetrachloride	✓	0.10		✓	✓													
2	75-27-4	Bromodichloromethane	✓	0.20		✓	✓													
2	78-87-5	1,2-dichloropropane	✓	0.01		✓	✓													
2	10061-01-5	cis-1,3-dichloropropene	✓	0.20		✓	✓													
2	79-01-6	Trichloroethene	✓	0.30		0.15	✓			✓										
2	124-48-1	Dibromochloromethane	✓	0.10		✓	✓													
2	79-00-5	1,1,2-trichloroethane	✓	0.10		✓	✓													
2	71-43-2	Benzene	✓	0.50		✓	✓			✓										
2	10061-02-6	trans-1,3-dichloropropene	✓	0.10	↓	✓	✓													
2	75-25-2	Bromoform	✓	0.10	✓	✓	✓	↓												
3	108-10-1	4-methyl-2-pentanone	✓	0.10	NA	✓	✓	26.9												
3	591-78-6	2-hexanone	✓	0.01		✓	✓	28.3												
3	127-18-4	Tetrachloroethene	✓	0.20		✓	✓	✓												
3	79-34-5	1,1,2,2-tetrachloroethane	✓	0.30		✓	✓													
3	108-88-3	toluene(10xblk)	✓	0.40		✓	✓			✓										
3	108-90-7	Chlorobenzene	✓	0.50		✓	✓			✓										
3	100-41-4	Ethylbenzene	✓	0.10		✓	✓													
3	100-42-5	Styrene	✓	0.30		✓	✓													
3	1330-20-7	xylenes(total)	✓	0.30		✓	✓													
	540-59-0	1,2-dichloroethylene(total)	✓	0.01		✓	✓	↓	↓											
	110-75-8	2-chloroethyl vinyl ether				NA	NA	NA	NA											
		Vinyl Acetate	✓		↓	✓	✓	✓	✓		↓	↓	↓	↓	↓	↓	↓	↓		

NA = Not Applicable

Comments:

Notes: Shaded rows are RCRA compounds.

① LCSD, MS, and MSD run w/ samples from another SDG.
② Samples are EB and TB.

Reviewed By: Date: 1/5/00

✱ Summary → See back of this page

alibration:

=> 1,1-dichloroethene and trichloroethene had initial calib. RFs < the required minimums. The assoc. results were ND and will be qualified "UJ."

=> Chloroethane, 4-methyl-2-pentanone, and 2-hexanone had CCV %Ds > 20%. All assoc. results were ND. Thus, no data were qualified

ethod Blank:

=> Methylene chloride was detected. The assoc. sample results were positive, <10X the blank conc., < the RL, and will be qualified "5U,B."

Volatile Organics

Site/Project: Canyons - 94C AR/COC #: 602819 Batch #s: 158458, 158501

Laboratory: GEL Laboratory Report #: 9909377 # of Samples: 12 Matrix: 10 soil / 2 aqueous

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

Sample	SMC 1	SMC 2	SMC 3	IS 1 area	IS 1 RT	IS 2 area	IS 2 RT	IS 3 area	IS 3 RT
All									
Passed									

SMC 1: ~~4-~~Bromofluorobenzene
SMC 2: ~~1,2-Dichloroethane-d4~~
SMC 3: Toluene-d8
Dibromofluoromethane

IS 1: ~~Bromochloromethane~~ Fluorobenzene
IS 2: 1,4-Di~~fluoro~~ Chloro benzene- d4
IS 3: Chlorobenzene-d5

KTS
12/20/99

Comments:

Semivolatile Organics (SW 846 Method 8270)

Page 1 of 3

Site/Project: Canyons - 94C
AR/COC #: 602819
Laboratory Sample IDs: 9909377-03, -06, -09, -12, -15, -18, -21,
" -24, -27, -30
Laboratory: GEL
Laboratory Report #: 9909377
Methods: EPA 8270B
# of Samples: 10
Matrix: Soil
Batch #s: 158295

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R²	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	① Field Dup. RPD	Equip. Blanks	② Field Blanks		
							>.05	<20% / 0.99	20%												
1	A	108-95-2	Phenol	✓	0.80	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	✓	NA		
1	BN	111-44-4	bis(2-Chloroethyl)ether	↓	0.70	↓	✓	✓	↓	↓							↓	↓	↓		
1	A	95-57-8	2-Chlorophenol	↓	0.80	↓	✓	✓	↓	↓	✓	✓	✓	✓	✓	✓	↓	↓	↓		
1	BN	541-73-1	1,3-Dichlorobenzene	↓	0.60	↓	✓	✓	↓	↓							↓	↓	↓		
1	BN	106-46-7	1,4-Dichlorobenzene	↓	0.50	↓	✓	✓	↓	↓	✓	✓	✓	✓	✓	✓	↓	↓	↓		
1	BN	95-50-1	1,2-Dichlorobenzene	↓	0.40	↓	✓	✓	↓	↓							↓	↓	↓		
1	A	95-48-7	2-Methylphenol (o-cresol)	↓	0.70	↓	✓	✓	↓	↓							↓	↓	↓		
1	BN	108-60-1	bis(2-chloroisopropyl)ether	↓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
1	A	106-44-5	4-Methylphenol		0.60	↓	NA	NA	NA	NA							↓	NA	↓		
1	BN	621-64-7	N-Nitroso-di-n-propylamine	✓	0.50	↓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	↓	✓	↓		
1	BN	67-72-1	Hexachloroethane	↓	0.30	↓	✓	✓	↓	↓							↓	↓	↓		
2	BN	98-95-3	Nitrobenzene	↓	0.20	↓	✓	✓	↓	↓							↓	↓	↓		
2	BN	78-59-1	Isophorone	↓	0.40	↓	✓	✓	↓	↓							↓	↓	↓		
2	A	88-75-5	2-Nitrophenol	↓	0.10	↓	✓	✓	↓	↓							↓	↓	↓		
2	A	105-67-9	2,4-Dimethylphenol	↓	0.20	↓	✓	✓	↓	↓							↓	↓	↓		
2	BN	111-91-1	bis(2-Chloroethoxy)methane	↓	0.30	↓	✓	✓	↓	↓							↓	↓	↓		
2	A	120-83-2	2,4-Dichlorophenol	↓	0.20	↓	✓	✓	↓	↓							↓	↓	↓		
2	BN	120-82-1	1,2,4-Trichlorobenzene	↓	0.20	↓	✓	✓	↓	↓	✓	✓	✓	✓	✓	✓	↓	↓	↓		
2	BN	91-20-3	Naphthalene	↓	0.70	↓	✓	✓	↓	↓							↓	↓	↓		
2	BN	106-47-8	4-Chloroaniline	↓	0.01	✓	✓	✓	↓	↓							↓	↓	↓		
2	BN	87-68-3	Hexachlorobutadiene	↓	0.01	NA	✓	✓	↓	↓							↓	↓	↓		
2	A	59-50-7	4-Chloro-3-methylphenol	↓	0.20	↓	✓	✓	↓	↓	✓	✓	✓	✓	✓	✓	↓	↓	↓		
2	BN	91-57-6	2-Methylnaphthalene	↓	0.40	↓	✓	✓	↓	↓							↓	↓	↓		
3	BN	77-47-4	Hexachlorocyclopentadiene	↓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
3	A	88-06-2	2,4,6-Trichlorophenol	↓	0.20	↓	✓	✓	↓	↓							↓	↓	↓		
3	A	95-95-4	2,4,5-Trichlorophenol	↓	0.20	↓	✓	✓	↓	↓							↓	↓	↓		

Notes: Shaded rows are RCRA compounds

NA = Not Applicable

Comments:
① Field dup. was submitted. All results ND. No RPDs calculated.
② No FB submitted on the COC.

Reviewed By:
Date: 1/5/00

Semivolatile Organics

Site/Project: Canyons - 94C AR/COC #: 602819 Batch #s: 158295

Laboratory: GEL Laboratory Report #: 9909377 # of Samples: 10 Matrix: soil

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	① Field Dup. RPD	Equip. Blanks	② Field Blanks		
							>.05	<20% / 0.99	20%												
3	BN	91-58-7	2-Chloronaphthalene	✓	0.80	NA	✓	✓	✓	✓							NA	✓	NA		
3	BN	88-74-4	2-Nitroaniline (o-)		0.01	✓	✓	✓													
3	BN	131-11-3	Dimethylphthalate		0.01	NA	✓	✓													
3	BN	208-96-8	Acenaphthylene		0.90		✓	✓													
3	BN	606-20-2	2,6-Dinitrotoluene		0.20	↓	✓	✓													
3	BN	99-09-2	3-Nitroaniline (m-)		0.01	✓	✓	✓													
3	BN	83-32-9	Acenaphthene		0.90	NA	✓	✓			✓	✓	✓	✓	✓	✓					
3	A	51-28-5	2,4-Dinitrophenol		0.01	✓	✓	✓	↓												
3	A	100-02-7	4-Nitrophenol		0.01	✓	✓	✓	-23.8		✓	✓	✓	✓	✓	✓					
3	BN	132-64-9	Dibenzofuran		0.80	NA	✓	✓	✓												
3	BN	121-14-2	2,4-Dinitrotoluene		0.20		✓	✓			✓	✓	✓	✓	✓	✓					
3	BN	84-66-2	Diethylphthalate		0.01		✓	✓													
3	BN	005-72-3	4-Chlorophenyl-phenylether		0.40		✓	✓													
3	BN	86-73-7	Fluorene		0.90	↓	✓	✓													
3	BN	100-01-6	4-Nitroaniline (p-)		0.01	✓	✓	✓													
4	A	534-52-1	4,6-Dinitro-2-methylphenol		0.01	NA	✓	✓													
4	BN	86-30-6	N-Nitrosodiphenylamine (1)		0.01		✓	✓													
4	BN	101-55-3	4-Bromophenyl-phenylether		0.10		✓	✓													
4	BN	18-74-1	Hexachlorobenzene		0.10		✓	✓													
4	A	87-86-5	Pentachlorophenol		0.05		✓	✓			✓	✓	✓	✓	✓	✓					
4	BN	85-01-8	Phenanthrene		0.70		✓	✓													
4	BN	20-12-7	Anthracene		0.70		✓	✓													
4	BN	86-74-8	Carbazole		0.01		✓	✓													
4	BN	84-74-2	Di-n-butylphthalate		0.01		✓	✓													
4	BN	06-44-0	Fluoranthene		0.60		✓	✓													
5	BN	129-00-0	Pyrene		0.60		✓	✓			✓	✓	✓	✓	✓	✓					
5	BN	85-68-7	Butylbenzylphthalate		0.01		✓	✓													
5	BN	91-94-1	3,3'-Dichlorobenzidine		0.01		✓	✓													
5	BN	56-55-3	Benzo(a)anthracene	↓	0.80	↓	✓	✓	↓	↓							↓	↓	↓		

NA = Not Applicable

Comments:
① Field dup. was submitted. All results ND. No RPDs calculated.
② No [illegible] submitted on the COC

Semivolatile Organics

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Site/Project: Canyons - 94C AR/COC #: 602819 Batch #s: 158295

Laboratory: GEL Laboratory Report #: 9909377 # of Samples: 10 Matrix: soil

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blanks	LCS	LCS D	LCS RPD	MS	MSD	MS RPD	① Field Dup. RPD	Equip. Blanks	② Field Blanks		
							>.05	<20% / 0.99	20%												
5	BN	218-01-9	Chrysene		0.70	NA	✓	✓	✓	✓							NA	✓	NA		
5	BN	117-81-7	bis(2-Ethylhexyl)phthalate		0.01	✓	✓	✓	↓	↓							↓	↓	↓		
6	BN	117-84-0	Di-n-octylphthalate		0.01	NA	✓	✓	↓	↓							↓	↓	↓		
6	BN	205-99-2	Benzo(b)fluoranthene		0.70	✓	✓	✓	↓	↓							↓	↓	↓		
6	BN	207-08-9	Benzo(k)fluoranthene		0.70	NA	✓	✓	↓	↓							↓	↓	↓		
6	BN	50-32-8	Benzo(a)pyrene		0.70	↓	✓	✓	↓	↓							↓	↓	↓		
6	BN	193-39-5	Indeno(1,2,3-cd)pyrene		0.50	↓	✓	✓	↓	↓							↓	↓	↓		
6	BN	53-70-3	Dibenz(a,h)anthracene		0.40	✓	✓	✓	↓	↓							↓	↓	↓		
6	BN	191-24-2	Benzo(g,h,i)perylene		0.50	NA	✓	✓	↓	↓							↓	↓	↓		
	BN	122-66-7	1,2-diphenylhydrazine			↓	✓	✓	↓	↓							↓	↓	↓		
	A	N/2	m,p-cresol			↓	✓	✓	↓	↓							↓	↓	↓		

NA = Not Applicable

Surrogate Recovery Outliers

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

SMC 1: Nitrobenzene-d5 (BN) SMC 2: 2-Fluorobiphenyl (BN) SMC 3: p-Terphenyl-d14 (BN)
SMC 4: Phenol-d6 (A) SMC 5: 2-Fluorophenol (A) SMC 6: 2,4,6-Tribromophenol (A)
~~SMC 7: 2-2-Chlorophenol-d4 (A)~~ KAS 12/21/99 ~~SMC 8: 1,2-Dichlorobenzene-d4 (BN)~~

Comments:

①Field dup. was submitted. All results ND. No RPDs calculated

②No FB submitted on the COC.

*Summary

Calibration:

=> 4-nitrophenol had a CCV %D < -20%. All assoc. sample results were ND. Thus, no data were qualified.

Internal Standard Outliers

Sample	IS 1-area	IS 1-RT	IS 2-area	IS 2-RT	IS 3-area	IS 3-RT	IS 4-area	IS 4-RT	IS 5-area	IS 5-RT	Is 6-area	IS 6-RT
All Passed												

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

KAS 12/20/99

Semivolatile Organics (SW 846 Method 8270)

Page 1 of 3

Site/Project: Canyons - 94C
AR/COC #: ~~9909377~~ 602819
Laboratory Sample IDs: 9909377-33
Laboratory: GEL
Laboratory Report #: 9909377
Methods: EPA 8270C
# of Samples: 1
Matrix: Aqueous
Batch #s: 158291

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Callb. RF	Callb. RSD/ R^2	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	① Equip. Blanks	Field Blanks		
							>.05	<20% / 0.99	20%												
1	A	108-95-2	Phenol	✓	0.80	NA	✓	✓	✓	✓	✓	✓	✓	~~44.4~~ ✓	~~53.4~~ ✓	✓	NA	NA	NA		
1	BN	111-44-4	bis(2-Chloroethyl)ether		0.70		✓	✓						KAS 12/20/99							
1	A	95-57-8	2-Chlorophenol		0.80		✓	✓			✓	✓	✓	51.0	53.3	✓					
1	BN	541-73-1	1,3-Dichlorobenzene		0.60		✓	✓													
1	BN	106-46-7	1,4-Dichlorobenzene		0.50		✓	✓			✓	✓	✓	49.9	53.0	✓					
1	BN	95-50-1	1,2-Dichlorobenzene		0.40		✓	✓													
1	A	95-48-7	2-Methylphenol (o-cresol)		0.70		✓	✓	↓												
1	BN	108-60-1	bis(2-chloroisopropyl)ether	↓	0.01		✓	✓	-25.6	↓											
1	A	106-44-5	4-Methylphenol		0.60		NA	NA	NA	NA											
1	BN	621-64-7	N-Nitroso-di-n-propylamine	✓	0.50		✓	✓	-22.2	✓	✓	✓	✓	✓	✓	✓					
1	BN	67-72-1	Hexachloroethane		0.30		✓	✓	✓												
2	BN	98-95-3	Nitrobenzene		0.20		✓	✓													
2	BN	78-59-1	Isophorone		0.40		✓	✓													
2	A	88-75-5	2-Nitrophenol		0.10		✓	✓													
2	A	105-67-9	2,4-Dimethylphenol		0.20		✓	✓													
2	BN	111-91-1	bis(2-Chloroethoxy)methane		0.30		✓	✓													
2	A	120-83-2	2,4-Dichlorophenol		0.20		✓	✓													
2	BN	120-82-1	1,2,4-Trichlorobenzene		0.20		✓	✓			✓	✓	✓	51.1	✓	✓					
2	BN	91-20-3	Naphthalene		0.70	↓	✓	✓													
2	BN	106-47-8	4-Chloroaniline		0.01	✓	✓	✓													
2	BN	87-68-3	Hexachlorobutadiene		0.01	NA	✓	✓													
2	A	59-50-7	4-Chloro-3-methylphenol		0.20		✓	✓			✓	✓	✓	✓	✓	✓					
2	BN	91-57-6	2-Methylnaphthalene		0.40	↓	✓	✓													
3	BN	77-47-4	Hexachlorocyclopentadiene		0.01	✓	✓	✓													
3	A	88-06-2	2,4,6-Trichlorophenol		0.20	NA	✓	✓													
3	A	95-95-4	2,4,5-Trichlorophenol	↓	0.20	↓	✓	✓	↓	↓							↓	↓	↓		

Notes: Shaded rows are RCRA compounds

NA = Not Applicab

Comments:
① Sample is an EB.

Reviewed By:
Date: 1/5/00

Semivolatile Organics

Site/Project: Canyons - 94C
AR/COC #: 602819
Batch #s: 158291
Laboratory: GEL
Laboratory Report #: 9909377
# of Samples: 1
Matrix: Aqueous

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF >.05	Calib. RSD/R^2 <20%/0.99	CCV %D 20%	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	① Equip. Blanks	Field Blanks		
3	BN	91-58-7	2-Chloronaphthalene	✓	0.80	NA	✓	✓	✓	✓							NA	NA	NA		
3	BN	88-74-4	2-Nitroaniline (o-)	↓	0.01	✓	✓	✓	↓	↓							↓	↓	↓		
3	BN	131-11-3	Dimethylphthalate	↓	0.01	NA	✓	✓	↓	↓							↓	↓	↓		
3	BN	208-96-8	Acenaphthylene	↓	0.90	↓	✓	✓	↓	↓							↓	↓	↓		
3	BN	606-20-2	2,6-Dinitrotoluene	↓	0.20	↓	✓	✓	↓	↓							↓	↓	↓		
3	BN	99-09-2	3-Nitroaniline (m-)	↓	0.01	✓	✓	✓	↓	↓							↓	↓	↓		
3	BN	83-32-9	Acenaphthene	↓	0.90	NA	✓	✓	↓	↓	✓	✓	✓	52.2	55.4	✓	↓	↓	↓		
3	A	51-28-5	2,4-Dinitrophenol	↓	0.01	✓	✓	✓	↓	↓							↓	↓	↓		
3	A	100-02-7	4-Nitrophenol	↓	0.01	NA	✓	✓	-26.1	↓	✓	✓	✓	✓	✓	27.4	↓	↓	↓		
3	BN	132-64-9	Dibenzofuran	↓	0.80	↓	✓	✓	✓	↓							↓	↓	↓		
3	BN	121-14-2	2,4-Dinitrotoluene	↓	0.20	↓	✓	✓	↓	↓	✓	✓	✓	49.0	54.4	✓	↓	↓	↓		
3	BN	84-66-2	Diethylphthalate	↓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
3	BN	005-72-3	4-Chlorophenyl-phenylether	↓	0.40	↓	✓	✓	↓	↓							↓	↓	↓		
3	BN	86-73-7	Fluorene	↓	0.90	↓	✓	✓	↓	↓							↓	↓	↓		
3	BN	100-01-6	4-Nitroaniline (p-)	↓	0.01	✓	✓	✓	↓	↓							↓	↓	↓		
4	A	534-52-1	4,6-Dinitro-2-methylphenol	↓	0.01	✓	✓	✓	↓	↓							↓	↓	↓		
4	BN	86-30-6	N-Nitrosodiphenylamine (1)	↓	0.01	NA	✓	✓	↓	↓							↓	↓	↓		
4	BN	101-55-3	4-Bromophenyl-phenylether	↓	0.10	↓	✓	✓	↓	↓							↓	↓	↓		
4	BN	18-74-1	Hexachlorobenzene	↓	0.10	↓	✓	✓	↓	↓							↓	↓	↓		
4	A	87-86-5	Pentachlorophenol	↓	0.05	✓	✓	✓	↓	↓	✓	✓	✓	44.1	52.1	✓	↓	↓	↓		
4	BN	85-01-8	Phenanthrene	↓	0.70	NA	✓	✓	↓	↓							↓	↓	↓		
4	BN	20-12-7	Anthracene	↓	0.70	↓	✓	✓	↓	↓							↓	↓	↓		
4	BN	86-74-8	Carbazole	↓	0.01	✓	✓	✓	↓	↓							↓	↓	↓		
4	BN	84-74-2	Di-n-butylphthalate	↓	0.01	✓	✓	✓	↓	↓							↓	↓	↓		
4	BN	06-44-0	Fluoranthene	↓	0.60	NA	✓	✓	↓	↓							↓	↓	↓		
5	BN	129-00-0	Pyrene	↓	0.60	↓	✓	✓	↓	↓	✓	✓	✓	✓	✓	✓	↓	↓	↓		
5	BN	85-68-7	Butylbenzylphthalate	↓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
5	BN	91-94-1	3,3'-Dichlorobenzidine	↓	0.01	↓	✓	✓	↓	↓							↓	↓	↓		
5	BN	56-55-3	Benzo(a)anthracene	↓	0.80	↓	✓	✓	↓	↓							↓	↓	↓		

NA = Not Applicable

Comments:
① Sa[illegible]s an EB.

Semivolatile Organics

Site/Project: Canyons-94C AR/COC #: 602819 Batch #s: 158291

Laboratory: GEL Laboratory Report #: 9909377 # of Samples: 1 Matrix: Aqueous

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R²	CCV %D	Method Blanks	LCS	LCS D	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		
							>.05	<20% / 0.99	20%												
5	BN	218-01-9	Chrysene	✓	0.70	NA	✓	✓	✓								NA	NA	NA		
5	BN	117-81-7	bis(2-Ethylhexyl)phthalate	↓	0.01	↓	✓	✓	↓								↓	↓	↓		
6	BN	117-84-0	Di-n-octylphthalate		0.01		✓	✓													
6	BN	205-99-2	Benzo(b)fluoranthene		0.70	✓	✓	✓													
6	BN	207-08-9	Benzo(k)fluoranthene		0.70	NA	✓	✓													
6	BN	50-32-8	Benzo(a)pyrene		0.70	↓	✓	✓													
6	BN	193-39-5	Indeno(1,2,3-cd)pyrene		0.50	✓	✓	✓													
6	BN	53-70-3	Dibenz(a,h)anthracene		0.40	NA	✓	✓													
6	BN	191-24-2	Benzo(g,h,i)perylene		0.50	↓	✓	✓													
	BN	122-66-7	1,2-diphenylhydrazine				✓	✓													
	A	NA	m,p-cresol			✓	✓	0.98													

NA = Not Applicable

Surrogate Recovery Outliers

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

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

Internal Standard Outliers

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

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

Comments: *Summary

Calibration:

⇒ m,p-cresol had an R^2 value < 0.99 but > 0.9. N-nitrosodi-n-propylamine, bis(2-chloroisopropyl)ether, and 4-nitrophenol had CCV %Ds < -20%. All assoc. results were ND. ~~and will be qualified~~" Thus, no data were qualified. KAS 12/20/99

MS/MSD:

⇒ 2-chlorophenol, 1,4-dichlorobenzene, 1,2,4-trichlorobenzene, Acenaphthene, 2,4-dinitrotoluene, Pentachlorophenol, and 4-nitrophenol had %RECs < QC limits. All assoc. results were ND. Thus, all results of sample -33 will be qualified "UJ, AJ."

High Explosives (SW 846 Method 8330)

Site/Project: Canyons-94C
AR/COC #: 602819
Laboratory Sample IDs: 9909377-03, -06, -09, -12, -15, -18, -21,
" -24, -27, -30
Laboratory: GEL
Laboratory Report #: 9909377
Methods: EPA 8330
# of Samples: 10
Matrix: Soil
Batch #s: 158330

CAS #	NAME	TAL	Intercept	Curve R²	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	①Field Dup. RPD	Equip. Blanks	②Field Blanks		
				.99	20%	U			20%			20%		U	U		
2691-41-0	HMX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	✓	NA		
121-82-4	RDX																
99-35-49	1,3,5-Trinitrobenzene																
99-65-0	1,3-dinitrobenzene																
98-95-3	Nitrobenzene																
479-45-8	Tetryl																
118-96-7	2,4,6-trinitrotoluene																
35572-78-2	2-amino-4,6-dinitrotoluene																
19406-51-0	4-amino-2,6-dinitrotoluene																
121-14-2	2,4-dinitrotoluene																
606-20-2	2,6-dinitrotoluene																
88-72-2	2-nitrotoluene																
99-99-0	4-nitrotoluene																
99-08-1	3-nitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		↓			
78-11-5	PETN		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	↓	NA	↓		

NA = Not Applicable

Sample	SMC %REC	SMC RT	Sample	SMC %REC	SMC RT
All Passed					

Comments:

① A field dup. was submitted on the COC. All results ND; No RPDs calculated

② No FB submitted on the COC.

* Summary

⇒ All QC criteria were met. No data were qualified.

Confirmation

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

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

Reviewed By:

Date: 1/5/00

High Explosives (SW 846 Method 8330)

Site/Project: Canyons -94C
AR/COC #: 602819
Laboratory Sample IDs: 9909377-32
Laboratory: GEL
Laboratory Report #: 9909377
Methods: EPA 8330
# of Samples: 1
Matrix: Aqueous
Batch #s: 158327

CAS #	NAME	TAL	Intercept	Curve R^2 .99	CCV %D 20%	Method Blanks U	LCS	LCSD	LCS RPD 20%	MS	MSD	MS RPD 20%	Field. Dup. RPD	① Equip. Blanks U	Field Blanks U		
2691-41-0	HMX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA		
121-82-4	RDX	↓	↓	↓	↓	↓	↓	↓	↓	✓	✓	↓	↓	↓	↓		
99-35-49	1,3,5-Trinitrobenzene	↓	↓	↓	↓	↓	↓	↓	↓	118	✓	↓	↓	↓	↓		
99-65-0	1,3-dinitrobenzene	↓	↓	↓	↓	↓	↓	↓	↓	✓	✓	↓	↓	↓	↓		
98-95-3	Nitrobenzene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
479-45-8	Tetryl	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
118-96-7	2,4,6-trinitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	135	131	↓	↓	↓	↓		
35572-78-2	2-amino-4,6-dinitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	✓	✓	↓	↓	↓	↓		
19406-51-0	4-amino-2,6-dinitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	21.7	↓	↓	↓		
121-14-2	2,4-dinitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	✓	↓	↓	↓		
606-20-2	2,6-dinitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	508	509	↓	↓	↓	↓		
88-72-2	2-nitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	✓	✓	↓	↓	↓	↓		
99-99-0	4-nitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
99-08-1	3-nitrotoluene	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓		
78-11-5	PETN		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	↓	↓	↓		

NA = Not Applicable

Sample	SMC %REC	SMC RT	Sample	SMC %REC	SMC RT
9909377-32	240	✓			
↓ -32MS	280	✓			
↓ -32MSD	290	✓			

Confirmation

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

Comments:
① Sample is an EB.

*Summary

MS/MSD:
⇒ 1,3,5-TNB, 2,4,6-TNT, and 2,6-DNT had %RECs > QC limits. However, all sample results were ND. Thus, no data were qualified
⇒ 4-amino-2,6-DNT had an RPD > QC limits. The assoc. result was ND and will be qualified "UJ, D1."

Surrogates:
⇒ The %REC was > QC limits. All results ND; No data qualified

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

Reviewed By:
Date: 1/5/00

Inorganic Metals

Site/Project: Canyons -94C
AR/COC #: 602819
Laboratory Sample IDs: 9909377-34
Laboratory: GEL
Laboratory Report #: 9909377
Methods: EPA 6010B (ICP), EPA 7470A (Hg)
# of Samples: 1
Matrix: Aqueous
Batch #s: 158446 / 158379

CAS #/ Analyte	QC Element																			
	TAL	ICV	CCV	ICB	CCB	Method Blanks	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	① Rep. RPD	ICS AB	② Serial Dilution	Field Dup. RPD	③ Equip. Blanks	Field Blanks		
7429-90-5 Al																NA	NA	NA		
7440-39-3 Ba	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7440-41-7 Be	✓	✓	✓	✓	0.2	✓	✓	✓	✓	✓				✓						
7440-43-9 Cd	✓	✓	✓	✓	0.5	✓	✓	✓	✓	✓	↓	↓	↓	✓	↓					
7440-70-2 Ca																				
7440-47-3 Cr	✓	✓	✓	-1.1	-1.4	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7440-48-4 Co																				
7440-50-8 Cu																				
7439-89-6 Fe																				
7439-95-4 Mg																				
7439-96-5 Mn																				
7440-02-0 Ni																				
7440-09-7 K																				
7440-22-4 Ag	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7440-23-5 Na																				
7440-62-2 V																				
7440-66-6 Zn																				
7439-92-1 Pb	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7782-49-2 Se	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓						
7440-38-2 As	✓	✓	✓	✓	-4.2	✓	✓	✓	✓	✓	↓	↓	↓	✓	↓					
7440-36-0 Sb																				
7440-28-0 Tl																				
7439-97-6 Hg	✓	✓	✓	-0.1	-0.2	✓	✓	✓	✓	~~NA~~ ✓ PS spike	NA	NA	NA	NA	NA	↓	↓	↓		
Cyanide CN																				

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

NA = Not Applicable

Comments:
① Replicate criteria apply only to sample results > the RL.
② Serial dilution ~~results~~ criteria apply only to results > 50X the RL.
③ Sample is an EB.

Reviewed By: [illegible] Date: 1/5/00

*Summary → See back of this page

ICB/CCB:

⇒ Ag was detected in the CCB for Samples -06, -09, -12, and -15. The assoc. results were positive, < 5X the blank conc., and will be qualified "J, B3."

⇒ As was detected in the ICB. The assoc. results of samples -09, -15, and -21 were pos., < 5X the blank conc., and will be qualified "J, B3."

⇒ Hg was detected in the ICB/CCB @ a negative conc.. The abs. value was > the DL but < the RL. The assoc. results of samples -03, -06, -09, -12, -15, and -21 were ND and will be qualified "UJ, B The assoc. result of -30 was positive, < 5X the DL, and will be qualified "J, B3."

lethod Blank:

⇒ Ag was detected. All assoc. results were pos., < 5X the blank conc., and will be qualified "J, B."

CS:

⇒ Cd and Pb had LCS %RECs slightly > QC limits. However, the LCSD %RECs and RPDs met QC criteria. Thus, no data were qualified.

B:

⇒ Ba and Cd were detected. However, the Ba results were all > 5X the blank conc.s, and the Cd results were all ND. Thus, no data were qualified.

ICB/CCB:

⇒ Cd was detected in the CCB. The assoc. result was pos., <5x the blank conc., and will be qualified "J,B3."

⇒ Cr and Hg were detected in the ICB and CCB @ negative conc.s. The assoc. results were ND and will be qualified "UJ,B3."

⇒ Be and As were detected in the CCB. However, the Be result was ND, and the abs. value of the As con was < the OL. Thus, no data were qualified.

Radiochemistry

Site/Project: Canyons - 94C
AR/COC #: 602819
Laboratory Sample IDs: 9909377-02, -05, -08, -11, -14, -17, -20, -23, -26, -29
Laboratory: GEL
Laboratory Report #: 9909377
Methods: HASL 300 (Gamma Spec), EPA 900.0 (Gross α/β)
# of Samples: 10
Matrix: Soil
Batch #s: 158650 (Gross α/β), 158809 (Gamma Spec)

Analyte	QC Element												
	Method Blanks	LCS	MS	Rep RER	① Equip. Blanks	Field Dup. RER	Field Blanks	Sample ID	Isotope	IS/Trace	Sample ID	Isotope	IS/Trace
Criteria	U	20%	25%	<1.0	U	<1.0	U			50-105			50-105
H3								NA					
U-238													
U-234													
U-235/-236													
Th-232													
Th-228													
Th-230													
Pu-239/-240													
Gross Alpha	0.598	✓	✓	✓	NA	✓	NA						
Nonvolatile Beta	0.763	✓	✓	✓	↓	↓	↓						
Ra-226													
Ra-28													
Ni-63													
Gamma Spec. Am-241	✓	✓	NA	✓	NA	✓	NA						
Gamma Spec. Cs-137	✓	✓	↓	↓	↓	↓	↓						
Gamma Spec. Co-60	✓	✓											
Pb-212/-214	.0411/.0256												
K-40/Ra-226	.261/.0386												
Th-232	.0408		↓	↓	↓	↓	↓						

NA = Not Applicable

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

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

Comments:

① No EB or FB submitted on the COC

* Summary:

Method Blank:

⇒ Gross Alpha/Beta, Pb-212/214, K-40, Ra-226, and Th-232 were detected. However, the blank concs were < the assoc. 2-σ uncertainties. No data qualifi

Negative Bias:

⇒ The Cs-134 results of samples -08, -11, and -17 were < the negative MDAs. Thus, these results will be qualified "R."

Reviewed By:

Date: 1/5/00

Contract Verification Review (CVR)

Project Leader Paul Freshour
Project Name Canyons – Site 94C
Case No. 7214.2216
AR/COC No. 602819
Analytical Lab GEL
SDG No. 9909377 (12345 in STAR)

In the tables below, mark any information that is missing or incorrect and give an explanation.

1.0 Analysis Request and Chain of Custody Record and Log-In Information

Line No.	Item	Complete?		If no, explain	Resolved?	
		Yes	No		Yes	No
1.1	All items on COC complete - data entry clerk initialed and dated	X				
1.2	Container type(s) correct for analyses requested	X				
1.3	Sample volume adequate for # and types of analyses requested	X				
1.4	Preservative correct for analyses requested	X				
1.5	Custody records continuous and complete	X				
1.6	Lab sample number(s) provided and SNL sample number(s) cross referenced and correct	X				
1.7	Date samples received	X		There is a discrepancy of when the samples were received at GEL. The COC was signed 9-13-99; the case narrative says 9-13; the report pages have 9-11.		X
1.8	Condition upon receipt information provided	X				

2.0 Analytical Laboratory Report

Line No.	Item	Complete?		If no, explain	Resolved?	
		Yes	No		Yes	No
2.1	Data reviewed, signature	X				
2.2	Method reference number(s) complete and correct	X				
2.3	QC analysis and acceptance limits provided (MB, LCS, Replicate)	X				
2.4	Matrix spike/matrix spike duplicate data provided(if requested)	X				
2.5	Detection limits provided; PQL and MDL(or IDL), MDA and L_c	X				
2.6	QC batch numbers provided	X				
2.7	Dilution factors provided and all dilution levels reported	X				
2.8	Data reported in appropriate units and using correct significant figures	X				
2.9	Radiochemistry analysis uncertainty (2 sigma error) and tracer recovery (if applicable) reported	X				
2.10	Narrative provided	X				
2.11	TAT met	X				
2.12	Hold times met	X				
2.13	Contractual qualifiers provided	X				
2.14	All requested result and TIC (if requested) data provided	X				

Contract Verification Review (Continued)

3.0 Data Quality Evaluation

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1 Are reporting units appropriate for the matrix and meet contract specified or project-specific requirements? Inorganics and metals reported as ppm (mg/liter or mg/Kg)? Tritium reported in picocuries per liter with percent moisture for soil samples? Units consistent between QC samples and sample data	X		
3.2 Quantitation limit met for all samples	X		
3.3 Accuracy a) Laboratory control samples accuracy reported and met for all samples	X		
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique	X		
c) Matrix spike recovery data reported and met		X	The aqueous SVOC, MS and MSD were outside acceptance limits for 6 and 5 compounds respectively. See page 142
3.4 Precision a) Replicate sample precision reported and met for all inorganic and radiochemistry samples	X		
b) Matrix spike duplicate RPD data reported and met for all organic samples		X	The SVOC had one compound outside the RPD. See page 142
3.5 Blank data a) Method or reagent blank data reported and met for all samples		X	Carbon Disulfide was found in the MB.
b) Sampling blank (e.g., field, trip, and equipment) data reported and met	X		
3.6 Contractual qualifiers provided: "J"- estimated quantity; "B"-analyte found in method blank above the MDL for organic or above the PQL for inorganic; "U"- analyte undetected (results are below the MDL, IDL, or MDA (radiochemical)); "H"-analysis done beyond the holding time	X		
3.7 Narrative addresses planchet flaming for gross alpha/beta	X		
3.8 Narrative included, correct, and complete	X		
3.9 Second column confirmation data provided for methods 8330 (high explosives) and pesticides/PCBs	X		

Contract Verification Review (Continued)

4.0 Calibration and Validation Documentation

Item	Yes	No	Comments
4.1 GC/MS (8260, 8270, etc.) a) 12-hour tune check provided	X		
b) Initial calibration provided	X		
c) Continuing calibration provided	X		
d) Internal standard performance data provided	X		
e) Instrument run logs provided	X		
4.2 GC/HPLC (8330 and 8010) a) Initial calibration provided	X		
b) Continuing calibration provided	X		
c) Instrument run logs provided	X		
4.3 Inorganics (metals) a) Initial calibration provided	X		
b) Continuing calibration provided	X		
c) ICP interference check sample data provided	X		
d) ICP serial dilution provided	X		
e) Instrument run logs provided	X		
4.4 Radiochemistry a) Instrument run logs provided	X		

Contract Verification Review (Concluded)

5.0 Problem Resolution

Summarize the findings in the table below. List only samples/fractions for which deficiencies have been noted.

Sample/Fraction No.	Analysis	Problems/Comments/Resolutions

Were deficiencies unresolved? ☒ Yes ☐ No

Based on the review, this data package is complete. ☒ Yes ☐ No

If no, provide: nonconformance report or correction request number ____________ and date correction request was submitted: ________

Reviewed by: Doug Salmi Date: 10-26-99 Closed by: ____________ Date: ________

Internal Lab

Batch No.

ANALYSIS REQUEST AND CHAIN OF CUSTODY

SAR/WR No.

SMO Use

Page 1 of 3

AR/COC 602819

Dept. No./Mail Stop:	6134/1088	[redacted]		Contract No.:	AJ-2480A
Project/Task Manager:	Paul Freshour	[redacted]		Case No.:	7214.2216
Project Name:	94C-Characterization	Lab Contact:	Edie Kent	SMO Authorization:	Doug Salmi
Record Center Code:		Lab Destination:	GEL	Bill To: Sandia National Laboratories	
Logbook Ref. No.:		SMO Contact/Phone:	Doug Salml/844-3110	Supplier Services Dept.:	
Service Order No.	CFO 736	Send Report to SMO:	Suzl Jensen	P.O. Box 5800 MS 0154	
Location	Tech Area				
Building	Room				

ORIGINAL

9909377/9 Lab Use

Reference LOV(available at SMO)

Sample No.-Fraction	ER Sample ID or Sample Location Detail	Beginning Depth/ft.	ER Site No.	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preser-vative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
050074-001	CY94C-GR-001-S	3	94C	090799/1035	S	AG	4oz	4C	G	MSMSD	VOC	[redacted]
050074-002	CY94C-GR-001-S	3	94C	090799/1035	S	AG	16oz	4C	G	MSMSD ~~SA~~	Gross A/B, Gamma Spec	[redacted]
050074-003	CY94C-GR-001-S	3	94C	090799/1035	S	AG	16oz	4C	G	MSMSD ~~SA~~	RCRA metals+BE,HE,SVOC	[redacted]
050075-001	CY94C-GR-002-S	3	94C	090799/1045	S	AG	4oz	4C	G	SA	VOC	[redacted]
050075-002	CY94C-GR-002-S	3	94C	090799/1045	S	AG	16oz	4C	G	SA	Gross A/B, Gamma Spec	[redacted]
050075-003	CY94C-GR-002-S	3	94C	090799/1045	S	AG	16oz	4C	G	SA	RCRA metals+BE,HE,SVOC	[redacted]
050076-001	CY94C-GR-003-S	3	94C	090799/1055	S	AG	4oz	4C	G	SA	VOC	[redacted]
050076-002	CY94C-GR-003-S	3	94C	090799/1055	S	AG	16oz	4C	G	SA	Gross A/B, Gamma Spec	[redacted]
050076-003	CY94C-GR-003-S	3	94C	090799/1055	S	AG	16oz	4C	G	SA	RCRA metals+BE,HE,SVOC	[redacted]
050077-001	CY94C-GR-004-S	3	94C	090799/1105	S	AG	4oz	4C	G	SA	VOC	[redacted]

RMMA ☒ Yes ☐ No Ref. No.

Sample Disposal ☐ Return to Client ☒ Disposal by lab

Turnaround Time ☒ Normal ☐ Rush

Required Report Date

[redacted]

Special Instructions/QC Requirements

EDD ☒ Yes ☐ No

Raw Data Package ☒ Yes ☐ No

COC # 602834 Releases this COC

Please list as separate report.

[redacted]

Sample Team Members	Name	Signature	Init	Company/Organization/Phone
	Chris Catechis	Ch. Catechis	CC	MDM/6118/845-3267

1.Relinquished by		Org. 6118	Date 9-8-99	Time 1430	4.Relinquished by	Org.	Date	Time
1. Received by	SMO	Org. 7577	Date 9-8-99	Time 1430	4. Received by	Org.	Date	Time
2.Relinquished by	SMO	Org. 7877	Date 9-9-99	Time 1030	5.Relinquished by	Org.	Date	Time
2. Received by		Org. GEL	Date 9-13-99	Time 09:00	5. Received by	Org.	Date	Time
3.Relinquished by		Org.	Date	Time	6.Relinquished by	Org.	Date	Time
3. Received by		Org.	Date	Time	6. Received by	Org.	Date	Time

ORIGINAL

ORIGINAL

Analysis Request And Chain Of Custody (Continuation)

Page 2 of 3

AR/COC- 602819

Project Name: Site 94C Project/Task Manger: Paul Freshour Case No.:

Location Tech Area

Building Room

Reference LOV (available at SMO)

Lab use

Sample No-Fraction	ER Sample ID or Sample Location detail	Depth in Ft	ER Site No.	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preser-vative	Sample Collection Methods	Sample Type	Parameter & Method Requested	Lab Sample ID
050077-002	CY94C-GR-004-S	3	94C	090799/1105	S	AG	16oz	4C	G	SA	Gross A/B, Gamma Spec	
050077-003	CY94C-GR-004-S	3	94C	090799/1105	S	AG	16oz	4C	G	SA	RCRA metals+BE,HE,SVOC	
050078-001	CY94C-GR-005-S	3	94C	090799/1115	S	AG	4oz	4C	G	SA	VOC	
050078-002	CY94C-GR-005-S	3	94C	090799/1115	S	AG	16oz	4C	G	SA	Gross A/B, Gamma Spec	
050078-003	CY94C-GR-005-S	3	94C	090799/1115	S	AG	16oz	4C	G	SA	RCRA metals+BE,HE,SVOC	
050079-001	CY94C-GR-006-S	3	94C	090799/1125	S	AG	4oz	4C	G	SA	VOC	
050079-002	CY94C-GR-006-S	3	94C	090799/1125	S	AG	16oz	4C	G	SA	Gross A/B, Gamma Spec	
050079-003	CY94C-GR-006-S	3	94C	090799/1125	S	AG	16oz	4C	G	SA	RCRA metals+BE,HE,SVOC	
050080-001	CY94C-GR-007-S	3	94C	090799/1135	S	AG	4oz	4C	G	SA	VOC	
050080-002	CY94C-GR-007-S	3	94C	090799/1135	S	AG	16oz	4C	G	SA	Gross A/B, Gamma Spec	
050080-003	CY94C-GR-007-S	3	94C	090799/1135	S	AG	16oz	4C	G	SA	RCRA metals+BE,HE,SVOC	
050081-001	CY94C-GR-008-S	3	94C	090799/1325	S	AG	4oz	4C	G	SA	VOC	
050081-002	CY94C-GR-008-S	3	94C	090799/1325	S	AG	16oz	4C	G	SA	Gross A/B, Gamma Spec	
050081-003	CY94C-GR-008-S	3	94C	090799/1325	S	AG	16oz	4C	G	SA	RCRA metals+BE,HE,SVOC	
050082-001	CY94C-GR-009-S	3	94C	090799/1340	S	AG	4oz	4C	G	SA	VOC	
050082-002	CY94C-GR-009-S	3	94C	090799/1340	S	AG	16oz	4C	G	SA	Gross A/B, Gamma Spec	
050082-003	CY94C-GR-009-S	3	94C	090799/1340	S	AG	16oz	4C	G	SA	RCRA metals+BE,HE,SVOC	
050083-001	CY94C-GR-009-DU	3	94C	090799/1340	S	AG	4oz	4C	G	SA	VOC	
050083-002	CY94C-GR-009-DU	3	94C	090799/1340	S	AG	16oz	4C	G	SA	Gross A/B, Gamma Spec	
050083-003	CY94C-GR-009-DU	3	94C	090799/1340	S	AG	16oz	4C	G	SA	RCRA metals+BE,HE,SVOC	

Abnormal Conditions on Receipt LAB USE

Recipient Initials:

ORIGINAL

ORIGINAL

Analysis Request And Chain Of Custody (Continuation)

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AR/COC- 602819

Project Name: Site 94C | Project/Task Mar Paul Freshour | Case No.:

Location Tech Area

Building Room

Reference LOV (available at SMO)

Lab use

Sample No-Fraction	ER Sample ID or Sample Location detail	Depth in Ft	ER Site Nc	Date/Time Collected	Sampl Matrix	Container Type	Container Volume	Preservative	Sample Collectic Methods	Sampl Type	**Parameter & Method Requested**	Lab Sample ID
050084-004	CY94C-GR-001-EB	3	94C	090799/1315	DIW	G	3x40ml	HCL	G	~~SA~~ EB	VOC	
050084-005	CY94C-GR-001-EB	3	94C	090799/1315	DIW	AG	4x1L	4C	G	~~SA~~ EB	HE	
050084-006	CY94C-GR-001-EB	3	94C	090799/1315	DIW	AG	2x1L	4C	G	~~SA~~ EB	SVOC	
050084-007	CY94C-GR-001-EB	3	94C	090799/1315	DIW	P	500ml	HNO3	G	~~SA~~ EB	RCRA metals+BE	
050084-008	CY94C-GR-001-TB	3	94C	090799/1315	DIW	G	3x40ml	HCL	G	~~SA~~ TB	VOC	

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Annex 2-E

ANNEX 2-E
Risk Screening Assessment

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SWMU 94C: RISK SCREENING ASSESSMENT REPORT

I. Site Description and History

Solid Waste Management Unit (SWMU) 94C, the Bomb Burner Area and Discharge Line, Lurance Canyon Burn Test Site (LCBS), Operable Unit (OU) 1333, at Sandia National Laboratories/New Mexico (SNL/NM), comprises approximately 0.2 acres at an elevation of approximately 6,343 feet above sea level. The site is located on the canyon floor alluvium in the closed upper reaches of the Lurance Canyon drainage. The site is on land owned by Kirtland Air Force Base (KAFB) and leased to the U.S. Department of Energy (DOE). The Bomb Burner Area (SWMU 94C) was established in the central portion of the site within the former location of the Far-Field Dispersion Area (SWMU 65E) (Larson and Palmieri October 1994).

Environmental concern about SWMU 94C is based upon the former Bomb Burner Unit, which was demolished in 1997. SWMU 94C was a corrugated metal discharge line approximately 300 feet long and conveyed water used to extinguish fires at the Bomb Burner Unit to an unlined discharge pit (SWMU 94D). The Bomb Burner was constructed in 1982 and used until 1988 for a series of 23 burn tests involving the exposure of weapons (some containing depleted uranium [DU]) and components to abnormal environments. Several burn tests were also conducted in the Bomb Burner Unit trench.

The annual precipitation for the area, as measured at the Albuquerque International Sunport, is 8.1 inches. No springs or perennial surface-water bodies are located in the vicinity of the site. During most rainfall events, rainfall quickly infiltrates the soil at SWMU 94C. However, 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.

The vicinity of SWMU 94C is unpaved with little native vegetation, and no storm sewers are used to direct surface water. Lurance Canyon drains to the west and intersects the Tijeras Arroyo floodplain. Tijeras Arroyo is the most significant surface-water drainage feature on KAFB. The arroyo originates in Tijeras Canyon, which is bounded by the Sandia Mountains to the north and the Manzano Mountains to the south. The arroyo trends southwest and eventually drains into the Rio Grande.

Based upon data from the Lurance Canyon wells, the groundwater beneath Lurance Canyon occurs under semiconfined to confined conditions in fractured metamorphic rock. The groundwater elevation by SWMU 94C is approximately 150 feet below ground surface (bgs). The only water-supply well within 5 miles is the Burn Site Production well, which is no longer used as a water supply well due to nitrate contamination.

II. Data Quality Objectives

The Data Quality Objectives (DQOs) presented in the OU 1333 Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan, its accompanying SWMU 94C Field Implementation Plan (FIP), and the Voluntary Corrective Action (VCA) plan identified the site-specific RFI and confirmatory sample locations, sample depths, sampling procedures, and analytical requirements. The DQOs outlined the Quality Assurance (QA)/Quality Control (QC) requirements necessary for producing defensible analytical data suitable for risk-assessment purposes. The RFI and confirmatory sampling conducted at SWMU 94C were designed to:

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

Table 1 summarizes the rationale for designing the sampling pattern. The source of potential constituents of concern (COCs) at SWMU 94C was the materials used in testing at the former Bomb Burner.

Table 1
Summary of Sampling Performed to Meet Data Quality Objectives

SWMU 94C Sampling Areas	Potential COC Source	Number of Sampling Locations	Sample Density (samples/acre)	Sampling Location Rationale
Base of trench after removal of discharge line.	Materials used in testing at the former Bomb Burner.	9	45	Evaluate the soil under the discharge line after removal to evaluate if a release had occurred.
Bottom of excavation after removal of the DU seam.	DU from burn testing in the Bomb Burner Unit trench.	5	50	Evaluate soil at the bottom of the DU seam excavation to assure the VCA was satisfactory.

COC = Contaminants of concern.
DU = Depleted uranium.
SWMU = Solid Waste Management Unit.
VCA = Voluntary corrective action.

The RFI soil samples were collected at nine locations in the base of the trench remaining after the removal of the discharge line and the confirmatory soil samples were collected at five locations from the area of the DU seam excavation at SWMU 94C. These samples were identified as CY94C-GR-001-S through CY94C-GR-015-SS. All of the samples were surface-soil samples collected from a depth of 0-1.0 foot bgs using a hand trowel. The ground surface was considered the base of the trench and excavation. The soil samples were collected using the sampling procedures detailed in the SWMU 94C FIP and VCA plan.

The SWMU 94C RFI soil samples were analyzed for all COCs: DU-related radionuclides (U-234, U-235, U-238), gross alpha and gross beta, RCRA metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and high explosive (HE) compounds. The samples were analyzed by General Engineering Laboratories Inc. (GEL), and the on-site SNL/NM Radiation Protection Sample Diagnostic (RPSD) Laboratory. Table 2 summarizes the number and type of confirmatory sampling at SWMU 94C. Table 3 summarizes the analytical methods and some of the data quality requirements from the SWMU 94C FIP and VCA plan.

Four QA/QC samples were collected during the RFI and confirmatory sampling efforts in accordance with the Environmental Restoration (ER) Project Quality Assurance Project Plan. The QA/QC samples consisted of two duplicates and two equipment blanks. Equipment-wash (aqueous rinsate) blanks were prepared at the end of each sampling day. No significant QA/QC problems were identified in the QA/QC samples.

All of the RFI and confirmatory soil sample results were verified/validated by SNL/NM. The off-site laboratory results from GEL were reviewed according to "Data Validation Procedure for Chemical and Radiochemical Data" SNL/NM Environmental Restoration Project Analytical Operating Procedure (AOP) 00-03, Rev. 0 (SNL/NM December 1999)". The data validation reports are presented in the associated SWMU 94C no further action (NFA) proposal. The gamma spectroscopy data from the RPSD Laboratory were reviewed according to "Laboratory Data Review Guidelines," Procedure No: RPSD-02-11, Issue No: 02 (SNL/NM July 1996). The gamma-spectroscopy results are presented in the NFA proposal. The reviews confirmed that the analytical data are defensible and therefore acceptable for use in the NFA proposal. Therefore, the DQOs have been fulfilled.

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

III.1 Introduction

The determination of the nature, migration rate, and extent of contamination at SWMU 94C was based upon an initial conceptual model validated with RFI and confirmatory sampling at the site. The initial conceptual model was developed from archival research, soil sampling, aerial photographs, and radiological surveys. The DQOs contained in the SWMU 94C FIP and VCA plan identified the sample locations, sample density, sample depth, and analytical requirements. The sample data were subsequently used to develop the final conceptual model for SWMU 94C, which is presented in Section 2.5 of the associated NFA proposal. The quality of the data specifically used to determine the nature, migration rate, and extent of contamination are described below.

III.2 Nature of Contamination

Both the nature of contamination and the potential for the degradation of COCs at SWMU 94C were evaluated using laboratory analyses of the soil samples (Section V). The analytical requirements included analyses for DU-related radionuclides, RCRA metals, VOCs, SVOCs, and HE compounds. The analyses characterized any potential contaminants at the site. The analytes and methods listed in Tables 2 and 3 are appropriate to characterize the COCs and any potential degradation products at SWMU 94C.

Table 2
Number of Confirmatory Soil Samples Collected during the SWMU 94C RFI and VCA Confirmatory Sampling

Sample type	Number of Samples	Gross Alpha/Beta	Gamma Spectroscopy	RCRA Metals + Be	VOCs	SVOCs	HE
RFI	9	9	9	9	9	9	9
Confirmatory	5	0	5	3	3	3	3
Duplicates	2	1	1	2	2	2	2
Equipment Blanks	2	0	0	2	2	2	2
Total Samples	18	10	15	16	16	16	16
Analytical laboratory	–	GEL	GEL/RPSD	GEL	GEL	GEL	GEL

Sample numbers: CY94C-GR-001-S through CY94C-GR-015-SS.
Sampling dates: 9/99 and 4/00.
Analysis Request/Chain-of-Custody Records: 602819, 603231, and 603232.
Be = Beryllium.
GEL = General Engineering Laboratories Inc.
HE = High explosive(s).
RCRA = Resource Conservation and Recovery Act.
RFI = RCRA Facility Investigation.
RPSD = Radiation Protection Sample Diagnostics.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
VCA = Voluntary corrective action.
VOC = Volatile organic compound.

Table 3
Summary of Data Quality Requirements

Analytical Requirement	Data Quality Level	GEL	RPSD Laboratory
Gamma Spectroscopy EPA Method 901.1	Defensible	14 samples	not analyzed, only used to screen samples for shipment
Gross Alpha/Gross Beta EPA Method 900.0	Defensible	9 samples	not analyzed
RCRA metals EPA Method 6010/7000	Defensible	12 samples	not analyzed
VOCs EPA Method 8260	Defensible	12 samples	not analyzed
SVOCs EPA Method 8270	Defensible	12 samples	not analyzed
HE compounds EPA Method 8330	Defensible	12 samples	not analyzed

The number of samples does not include QA/QC samples such as duplicates, trip blanks, and equipment blanks.
EPA = U.S. Environmental Protection Agency.
GEL = General Engineering Laboratories Inc.
HE = High explosive(s).
QA/QC = Quality assurance/quality control.
RCRA = Resource Conservation and Recovery Act.
RPSD = Radiation Protection Sample Diagnostic Laboratory.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.

III.3 Rate of Contaminant Migration

SWMU 94C is an inactive site that has been remediated and only minor occurrences of COCs exist in the shallow subsurface. The rate of COC migration from shallow subsurface soil is therefore predominantly dependent on precipitation and occasional surface-water flow as described in Section V. Data available from the Sandia Canyons Groundwater Investigation; numerous SNL/NM monitoring programs for air, water, and radionuclides; various biological surveys; and meteorological monitoring are adequate to characterize the rate of COC migration at SWMU 94C.

III.4 Extent of Contamination

RFI surface soil samples were collected from nine locations in the base of the trench created from the removal of the discharge line and confirmatory soil samples were collected from five locations from the bottom of the excavation of the DU seam at SWMU 94C. The RFI samples were collected to assess whether the drainage line had leaked contaminants to surrounding soil, and the confirmatory samples were collected to verify the adequacy of the VCA. The samples were collected using the sampling density in Table 1.

All soil samples were collected from the ground surface to a maximum depth of one foot. The ground surface was considered the base of the trench and excavation. Sampling at a more extensive variety of depths was not required because the sample results showed no significant contamination in the surface soil at SWMU 94C. Furthermore, the vertical rate of contamination migration was expected to be extremely low for SWMU 94C because of the low precipitation, high evapotranspiration, impermeable vadose zone soils, and the relatively low solubility of the COCs. Therefore, the RFI and confirmatory soil samples are considered representative of the soil potentially contaminated with the COCs and sufficient to determine the vertical extent, if any, of COCs.

In summary, the design of the RFI and confirmatory sampling was appropriate and adequate to determine the nature, migration rate, and extent of residual COCs in soil at SWMU 94C.

IV. Comparison of COCs to Background Screening Levels

Site history and characterization activities are used to identify potential COCs. The SWMU 94C NFA proposal describes the identification of COCs and the sampling that was conducted to determine the concentration levels of those COCs across the site. Generally, COCs that were evaluated in this risk assessment included all detected organics and all inorganic and radiological COCs for which samples were analyzed. If the detection limit of an organic compound was too high (i.e., could adversely affect human health or the environment), the compound was retained. Nondetect organics not included in this assessment were determined to have sufficiently low detection limits to ensure protection of human health and the environment. In order to provide conservatism in this risk assessment, the calculation used only the maximum concentration value of each COC found for the entire site. The SNL/NM maximum background concentration (Dinwiddie September 1997, Garcia November 1998) was selected to provide the background screen listed in Tables 4 and 5. Human health

Table 4
Nonradiological COCs for Human Health and Ecological Risk Assessment at SWMU 94C with Comparison to the Associated SNL/NM Background Screening Value, BCF, Log K_{ow}, and Subpart S Screening Value

COC Name	Maximum Concentration (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)	Subpart S Screening Value^h	Is Individual COC less than 1/10 of the Action Level?
Arsenic	4.15	9.8	Yes	44^c	NA	**Yes**	0.5	**No**
Barium	205	246	Yes	170^d	NA	**Yes**	6000	Yes
Beryllium	0.68	0.75	Yes	19^c	NA	No	0.2	**No**
Cadmium	0.272 J	0.64	Yes	64^c	NA	**Yes**	80	Yes
Chromium, total	16	18.8	Yes	16^c	NA	No	400	Yes
Lead	10.1	18.9	Yes	49^c	NA	**Yes**	–	–
Mercury	0.0217 J	0.055	Yes	5500^c	NA	**Yes**	20	Yes
Selenium	0.746	2.7	Yes	800^e	NA	**Yes**	400	Yes
Silver	0.302 J	<0.5	**Unknown**	0.5^c	NA	No	400	Yes
Uranium	9.28	2.3^f	**No**	20^d	NA	No	–	–
Acetone	0.00847 J	NA	**NA**	0.69^g	-0.24^g	No	8000	Yes
Toluene	0.000331 J	NA	**NA**	10.7^c	2.69^c	No	20,000	Yes

Note: **Bold** indicates the COCs that failed the background screening procedure, and/or are bioaccumulators, and/or failed the Subpart S screening procedure.

[a] From Garcia (November 1998) Canyon Area Soils.

[b] NMED (March 1998).

[c] Yanicak (March 1997).

[d] Neumann (1976).

[e] Callahan et al. (1979).

[f] The Canyons area does not have a total uranium background screening value. The subsurface total uranium background screening value from the North and Southwest Supergroups was used in this risk assessment (most conservative of uranium background screening values).

[g] Howard (1990).

[h] IT Corporation (July 1994).

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

Table 5
Radiological COCs for Human Health and Ecological Risk Assessment at SWMU 94C with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC Name	Maximum Concentration (pCi/g)	SNL/NM Background Concentration (pCi/g)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Is COC a Bioaccumulator?[b] (BCF >40)
Th-232	1.09	1.03	**No**	3000[c]	No[d]
U-235	0.256 (MDA)	0.16	**No**	900[c]	**Yes**
U-238	11.9	2.31	**No**	900[c]	**Yes**

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

[a] From Dinwiddie (September 1997), Canyons Area Soils.

[b] NMED (March 1998).

[c] Baker and Soldat (1992).

[d] Yanicak (March 1997).

BCF = Bioconcentration factor.
COC = Constituent of concern.
MDA = Minimum detectable activity.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

nonradiological COCs were also compared to SNL/NM proposed Subpart S action levels if appropriate (IT July 1994).

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

Table 4 lists nonradiological COCs for the human health and ecological risk assessment at SWMU 94C. Table 5 lists radiological COCs for the human health and ecological risk assessment. All tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997, Garcia November 1998). Sections VI.4, VII.2 and VII.3 provide discussion of Tables 4 and 5.

V. Fate and Transport

The potential release of COCs at SWMU 94C was to subsurface soil as a result of possible waste water leakage along the discharge line leading from the Bomb Burner Unit to the pit located at the southern end of the site. Excavation of the corrugated metal discharge line may have resulted in some movement of COCs within the disturbed soil, but this is not expected to have resulted in significant exposure of COCs at the surface soil. Therefore, wind and surface water are not considered to be potentially significant transport mechanisms for COCs at this site.

Water at SWMU 94C is received as precipitation (rain or occasional snow). Infiltration of this water at the site is enhanced by the coarse nature of the canyon soil (primarily Tesajo-Millett stony sandy loam [USDA 1977]). COCs may be leached deeper into the subsurface soil by the percolation of this water through the soil. Evapotranspiration from the soil, however, reduces the depth of potential percolation. Based upon observations made during the installation of a piezometer in an arroyo channel approximately 300 feet north of SWMU 94C, the alluvium above the bedrock is 57 feet thick. Moist soil was observed in the first 5 feet of alluvium, and the remaining 52 feet (to bedrock) were dry. Groundwater at the site is estimated to be 150 feet bgs. Therefore, infiltration is probably not sufficient to contact groundwater in the area of the LCBS.

Plant roots can take up COCs that are in the soil solution. These COCs may be transported to the aboveground tissues with the xylem stream and may enter the food chain if the plant is consumed by an herbivore, or return to the soil as litter. Because the site has been highly disturbed and little vegetation occurs on the site, food chain uptake is not considered a potentially significant transport mechanism.

The identified COCs at SWMU 94C include both organic and inorganic analytes, with the latter including radionuclides. Because the inorganics are elemental in form, they are generally not considered to be degradable. Radiological COCs, however, undergo decay to stable isotopes or radioactive daughter elements. Other transformations of inorganics may include changes in valence (oxidation/reduction reactions). The rates of such processes are expected to be slow due to the long half-lives of the radionuclides and the aridity of the environment at this site. The organic COCs may degrade 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 due to plants, animals, and microorganisms) may occur; however, biological activity may be limited by the aridity of the environment at this site. Although the organic COCs include VOCs, loss of these COCs from the subsurface soil through volatilization would be slow.

Table 6 summarizes the fate and transport processes that may occur at SWMU 94C. Because the COCs are not expected to occur in the surface soil, neither wind nor surface-water runoff are expected to be significant mechanisms of COC transport. The potential for COCs to leach into groundwater is very low due to the depth to groundwater. Little vegetation occurs at the site; therefore, uptake into the food chain is unlikely to be a significant transport mechanism. The potential for degradation and/or transformation of the COCs is also expected to be low.

Table 6
Summary of Fate and Transport at SWMU 94C

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

SWMU = Solid Waste Management Unit.

VI. Human Health Risk Screening Assessment

VI.1 Introduction

Human health risk screening assessment of this site includes a number of steps that quantitatively evaluate the potential adverse human health effects caused by constituents at the site. The steps to be discussed are:

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 includes two screening procedures. One screening procedure 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 subjected to a second screening procedure, if applicable, that compares the maximum concentration of the COC to the SNL/NM proposed Subpart S action level.
Step 4.	Toxicological parameters are identified and referenced for COCs that were not eliminated during the screening steps.
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 only occurs 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) and the U.S. Department of Energy (DOE) to determine whether further evaluation, and potential site cleanup, is required. Nonradiological COC risk values are also compared to background risk so that an incremental risk can be calculated.
Step 7.	Uncertainties of the above steps are also addressed.

VI.2 Step 1. Site Data

Section I provides the description and history for SWMU 94C. Section II presents a comparison of results to DQOs. Section III discusses the nature, rate, and extent of contamination.

VI.3 Step 2. Pathway Identification

SWMU 94C has been designated a future land use scenario of recreational (DOE et al. October 1995) (see Appendix 1 for default exposure pathways and parameters). Because of the location and the characteristics of the potential contaminants, the primary pathway for human exposure is soil ingestion for the nonradiological COCs and direct gamma exposure for the radiological COCs. The inhalation pathway for both nonradiological and radiological COCs is included because the potential exists to inhale dust and volatiles. Soil ingestion is included for the radiological COCs as well. No water pathways to the groundwater are considered. Depth to groundwater at SWMU 94C is in excess of 150 feet bgs. Because of the lack of surface water or other significant mechanisms for dermal contact, the dermal exposure pathway is not considered significant. No intake routes through plant, meat, or milk ingestion are considered appropriate for the recreational land use scenario. However, plant uptake is considered for the residential land use scenario.

Pathway Identification

Nonradiological Constituents	Radiological Constituents
Soil ingestion	Soil ingestion
Inhalation (dust and volatiles)	Inhalation (dust)
Plant uptake (residential only)	Plant uptake (residential only)
	Direct gamma

VI.4 Step 3. COC Screening Procedures

Step 3 and the two screening procedures are discussed in this section. The first compares the maximum COC concentration to the background screening level. The second compares maximum COC concentrations to SNL/NM proposed Subpart S action levels. This second procedure was applied only to COCs that were not eliminated during the first screening procedure.

VI.4.1 Background Screening Procedure

VI.4.1.1 Methodology

Maximum concentrations of nonradiological COCs were compared to the approved SNL/NM maximum screening level for this area. The SNL/NM maximum background concentration was selected to provide the background screening values in Table 4 and was used to calculate risk attributable to background values in Section VI.6.2 and VI.7. Only the COCs that were detected above their respective SNL/NM maximum background screening levels or that did not have either a quantifiable or a calculated background screening level were considered in further risk assessment analyses.

For radiological COCs that exceeded the SNL/NM background screening levels, background values were subtracted from the individual maximum radionuclide concentrations. Those that did not exceed these background levels were not carried any further in the risk assessment. This approach is consistent with DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE 1993). Radiological COCs that did not have a background value and were detected above the analytical minimum detectable activity were carried through the risk assessment at their maximum levels. The resultant radiological COCs remaining after this step are referred to as background-adjusted radiological COCs.

VI.4.1.2 Results

Tables 4 and 5 show SWMU 94C maximum COC concentrations that were compared to the SNL/NM maximum background values (Dinwiddie September 1997, Garcia November 1998) for the human health risk assessment. For the nonradiological COCs, one constituent was measured at a concentration greater than its respective background screening value. One nonradiological COC had no quantifiable background concentration, so it is not known whether that COC exceeded background. Two nonradiological COCs were organic compounds and did not have corresponding background screening values.

For the radiological COCs, three constituents had measured activity concentrations (or minimum detectable activities) slightly greater than their respective backgrounds (U-238, U-235, and Th-232)

VI.4.2 Subpart S Screening Procedure

VI.4.2.1 Methodology

The maximum concentrations of nonradiological COCs not eliminated during the background screening process were compared with action levels (IT July 1994) calculated using methods and equations promulgated in the proposed RCRA Subpart S (EPA 1990) and Risk Assessment Guidance for Superfund (RAGS) (EPA 1989) documentation. Accordingly, all calculations assumed that receptor doses from both toxic and potentially carcinogenic compounds result most significantly from ingestion of contaminated soil. Because the samples were all taken from the surface and near surface, this assumption is considered valid. If there were ten or fewer COCs and each had a maximum concentration of less than 1/10 the action level, the site was judged to pose no significant health hazard to humans. If there were more than ten COCs, the Subpart S screening procedure was not performed.

VI.4.2.2 Results

One constituent (uranium) that failed the background screening procedure did not have a calculated Subpart S Screening value. Therefore, all nonradiological COCs that were not eliminated during the background screening process for SWMU 94C were carried forward in the risk assessment process and had a calculated hazard quotient (HQ) and excess cancer risk value.

Radiological COCs have no predetermined action levels analogous to proposed Subpart S levels; therefore, this step in the screening process was not performed for radiological COCs.

VI.5 Step 4. Identification of Toxicological Parameters

Tables 7 (nonradiological) and 8 (radiological) list the COCs retained in the risk assessment and the values for the available toxicological information. The toxicological values used for nonradiological COCs in Table 7 were from the Integrated Risk Information System (IRIS) (EPA 1998a) and the Region 9 (EPA 1996) electronic database. Dose conversion factors (DCF) used in determining the excess TEDE values for radiological COCs for the individual pathways were the default values provided in the RESRAD computer code (Yu et al. 1993a) as developed in the following documents:

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

VI.6 Step 5. Exposure Assessment and Risk Characterization

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

Table 7
Toxicological Parameter Values for SWMU 94C Nonradiological COCs

COC Name	RfD_o (mg/kg-d)	Confidence[a]	RfD_{inh} (mg/kg-d)	Confidence[a]	SF_o (mg/kg-day)$^{-1}$	SF_{inh} (mg/kg-day)$^{-1}$	Cancer Class[b]
Silver	5.0E-3[c]	L	–	–	–	–	D
Uranium	3E-3[c]	M	–	–	–	–	–
Acetone	1.0E-1[c]	L	1.0E-1[d]	–	–	–	D
Toluene	2.0E-1[c]	M	1.1E-1[c]	M	–	–	D

[a] Confidence associated with IRIS (EPA 1998a) database values. Confidence: L = low, M = medium.

[b] EPA weight-of-evidence classification system for carcinogenicity (EPA 1989) taken from IRIS (EPA 1998a):
D = Not classifiable as to human carcinogenicity.

[c] Toxicological parameter values from IRIS electronic database (EPA 1998a).

[d] Toxicological parameter values from EPA Region 9 electronic database (EPA 1996).

COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
IRIS = Integrated Risk Information System.
mg/kg-d = Milligram(s) per kilogram day.
(mg/kg-day)$^{-1}$ = Per milligram(s) per kilogram day.
RfD_{inh} = Inhalation chronic reference dose.
RfD_o = Oral chronic reference dose.
SF_{inh} = Inhalation slope factor.
SF_o = Oral slope factor.
SWMU = Solid Waste Management Unit.
– = Information not available.

Table 8
Radiological Toxicological Parameter Values for SWMU 94C COCs Obtained from RESRAD Risk Coefficients[a]

COC Name	SF_o (1/pCi)	SF_{inh} (1/pCi)	SF_{ev} (g/pCi-yr)	Cancer Class[b]
Th-232	3.30E-11	1.90E-08	2.00E-11	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] From 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.
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 shows the equations and parameter input values used in calculating intake values and subsequent HI and excess cancer risk values for the individual exposure pathways. The appendix shows parameters for both recreational and residential land use scenarios. The equations for nonradiological COCs are based upon the RAGS (EPA 1989). Parameters are based upon information from the RAGS (EPA 1989) and other EPA guidance documents and 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 is recreational for this site, risk and TEDE values for a residential land use scenario are also presented. These residential risk and TEDE values are presented only to provide perspective of potential risk to human health under the more restrictive land use scenario.

VI.6.2 Risk Characterization

Table 9 shows an HI of 0.00 for the SWMU 94C nonradiological COCs and no calculated excess cancer risk for the designated recreational land use scenario. The numbers presented included exposure from soil ingestion and dust and volatile inhalation for nonradiological COCs. Table 10 shows an HI of 0.00, and no calculated excess cancer risk assuming the maximum background concentrations of the SWMU 94C associated background constituents for the designated recreational land use scenario.

For the radiological COCs, contribution from the direct gamma exposure pathway is included. For the recreational land use scenario, a TEDE was calculated for an individual who spends 4 hours per week on the site. This resulted in an incremental TEDE of 5.0E-2 millirems (mrem) per year (/yr). In accordance with EPA guidance found in Office of Solid Waste and Emergency Response Directive No. 9200.4-18 (EPA 1997a), an incremental TEDE of 15 mrem/yr is used for the probable land use scenario (recreational in this case); the calculated dose value for SWMU 94C for the recreational land use is well below this guideline. The estimated excess cancer risk is 7.6E-7.

For the residential land use scenario nonradioactive COCs, the HI is 0.03, with no calculated excess cancer risk (Table 9). The numbers in the table included exposure from soil ingestion, dust and volatile inhalation, and plant uptake. Although the EPA (1991) generally recommends that inhalation not be included in a residential land use scenario, this pathway is included because of the potential for soil in Albuquerque, New Mexico, to be eroded and, subsequently, for dust to be present in predominantly residential areas. Because of the nature of the local soil, other exposure pathways are not considered (see Appendix 1). Table 10 shows that for the SWMU 94C associated background constituents, the HI is 0.01 with no calculated excess cancer risk.

Table 9
Risk Assessment Values for SWMU 94C Nonradiological COCs

COC Name	Maximum Concentration (mg/kg)	Recreational Land Use Scenario[a]		Residential Land Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Silver	0.302 J	0.00	–	0.01	–
Uranium	9.28	0.00	–	0.02	–
Acetone	0.00847 J	0.00	–	0.00	–
Toluene	0.000331 J	0.00	–	0.00	–
Total		**0.00**	**–**	**0.03**	**–**

[a] From EPA (1989).

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

Table 10
Risk Assessment Values for SWMU 94C Nonradiological Background Constituents

COC Name	Background Concentration[a] (mg/kg)	Recreational Land Use Scenario[b]		Residential Land Use Scenario[b]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Silver	<0.5	–	–	–	–
Uranium	2.3	0.00	–	0.01	–
Total		**0.00**	**–**	**0.01**	**–**

[a] From Garcia (November 1998), Canyons Area.
[b] From EPA (1989).

COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
– = Information not available.

For the radiological COCs, the incremental TEDE for the residential land use scenario is 1.02 mrem/yr. The guideline 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 SWMU 94C for the residential land use scenario is well below this guideline. Consequently, SWMU 94C is eligible for unrestricted radiological release as the residential land use scenario resulted in an incremental TEDE of less than 75 mrem/yr to the on-site receptor. The estimated excess cancer risk is 1.3E-5. The excess cancer risk from the nonradiological COCs and the radiological COCs is not additive, as noted in the RAGS (EPA 1989).

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

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

For the recreational land use scenario nonradiological COCs, the HI is 0.00 (less than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). There was no excess cancer risk. New Mexico Environment Department (NMED) Guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (NMED March 2000), thus the excess cancer risk for this site is below the suggested acceptable risk value. This assessment also determined risks considering background concentrations of the potential nonradiological COCs for both the recreational and the residential land use scenarios. Assuming the recreational land use scenario, nonradiological COCs the HI is 0.00 with no calculated excess cancer risk. Incremental risk is determined by subtracting risk associated with background from potential COC risk. These numbers are not rounded before the difference is determined and, therefore, may appear to be inconsistent with numbers presented in tables and within the text. For conservatism, the background constituent that does not have a quantified background concentration (silver) is assumed to have an HQ of 0.00. Incremental HI is 0.00 and there is no estimated incremental cancer risk for the recreational land use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs considering a recreational land use scenario.

For radiological COCs of the recreational land use scenario, incremental TEDE is 5.0E-2 mrem/yr, which is significantly less than EPA's numerical guideline of 15 mrem/yr. Incremental estimated excess cancer risk is 7.6E-7.

The calculated HI for the residential land use scenario nonradiological COCs is 0.03, which is below the numerical guidance. There was no calculated excess cancer risk. NMED Guidance states that cumulative excess lifetime cancer risk must be less than 1.0E-5 (NMED March 2000), thus the excess cancer risk for this site is below the suggested acceptable risk value. The HI for associated background for the residential land use scenario is 0.01; there was no estimated excess cancer risk. The incremental HI is 0.02 and there was no estimated incremental cancer risk for the residential land use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs considering a residential land use scenario.

The incremental TEDE for a residential land use scenario from the radiological components is 1.02 mrem/yr, which is significantly less 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 1.3E-5.

VI.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at SWMU 94C was based upon an initial conceptual model that was validated with RFI and confirmatory sampling conducted at the completion of the VCA. The RFI sampling was implemented in accordance with the RFI work plan for OU 1333 (SNL/NM September 1995), the response to the Request for Supplemental Information on the OU 1333 Work Plan (SNL/NM October 1997), and the FIP (SNL/NM August 1999). The confirmatory sampling was implemented in accordance with the VCA plan (SNL/NM March 2000). The DQOs contained in the FIP and VCA plan are appropriate for use in risk-screening assessments. The data collected, based upon sample location, density, and depth, are representative of the site. The analytical requirements and results satisfy the DQOs. Data quality was verified/validated in accordance with SNL/NM procedures (SNL/NM December 1999 and SNL/NM July 1996). Therefore, there is no uncertainty associated with the data quality used to perform the risk screening assessment at SWMU 94C.

Because of the location, history of the site, and future land use (DOE et al. October 1995), there is low uncertainty in the land use scenario and the potentially affected populations that were considered in performing the risk assessment analysis. Because the COCs are found in surface and in near-surface soils and because of the location and physical characteristics of the site, there is little uncertainty in the exposure pathways relevant to the analysis.

An RME approach was used to calculate the risk assessment values. This means that the parameter values in the calculations are conservative and that calculated intakes are probably overestimated. Maximum measured values of COC concentrations are used to provide conservative results.

Table 7 shows the uncertainties (confidence) in nonradiological toxicological parameter values. There is a mixture of estimated values and values from the IRIS (EPA 1998a) and the EPA Region 9 (EPA 1996) electronic database. Where values are not provided, information is not available from the Health Effects Assessment Summary Tables (EPA 1997b), IRIS (EPA 1998a), or the EPA regions (EPA 1996, 1997c). Because of the conservative nature of the RME approach, uncertainties in toxicological values are not expected to change the conclusions from the risk assessment analysis.

Risk assessment values for nonradiological COCs are within the acceptable human health range for both the recreational and residential land use scenario compared to established numerical guidance.

For radiological COCs, the conclusion of the risk assessment is that potential effects on human health for both recreational and residential land use scenarios are within guidelines and are 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 significant with respect to the conclusion reached.

VI.9 Summary

SWMU 94C has identified COCs consisting of some inorganic, organic, and radiological compounds. Because of the location of the site, the designated recreational land use scenario, and the nature of contamination, potential exposure pathways identified for this site included soil ingestion and dust and volatile inhalation for chemical COCs and soil ingestion, dust inhalation, and direct gamma exposure for radionuclides. Plant uptake was included as an exposure pathway for the residential land use scenario.

Using conservative assumptions and an RME approach to risk assessment, calculations for nonradiological COCs show that for the recreational land use scenario, the HI (0.00) is significantly less than the accepted numerical guidance from the EPA. There was no calculated excess cancer risk. Thus, excess cancer risk is also below the acceptable risk value provided by the NMED for a recreational land use scenario (NMED March 1998). The incremental HI is 0.00, and there was no incremental excess cancer risk for the recreational land use scenario. Incremental risk calculations indicate insignificant risk to human health for the recreational land use scenario.

Incremental TEDE and corresponding estimated cancer risk from radiological COCs are much lower than EPA guidance values; the estimated TEDE is 5.02E-2 mrem/yr for the recreational land use scenario. This value is much lower than the EPA's numerical guidance of 15 mrem/yr in EPA guidance (EPA 1997a). The corresponding incremental estimated cancer risk value is 7.6E-7 for the recreational land use scenario. Furthermore, the incremental TEDE for the residential land use scenario that results from a complete loss of institutional control is only 1.02 mrem/yr with an associated risk of 1.3E-5. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, SWMU 94C is eligible for unrestricted radiological release.

Uncertainties associated with the calculations are considered small relative to the conservativeness of risk assessment analysis. It is, therefore, concluded that this site poses insignificant risk to human health under either the recreational or residential land use scenarios.

VII. Ecological Risk Screening Assessment

VII.1 Introduction

This section addresses the ecological risks associated with exposure to constituents of potential ecological concern (COPEC) in soils at SWMU 94C. A component of the NMED Risk-Based Decision Tree is to conduct an ecological screening assessment that corresponds with that presented in EPA's Ecological Risk Assessment Guidance for Superfund (EPA 1997d). The current methodology is tiered and contains an initial scoping assessment followed by a more detailed screening assessment. Initial components of NMED's decision tree (a discussion of DQOs, a data assessment, and evaluations of bioaccumulation and fate-and-transport potential) are addressed in previous sections of this report. Following 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 screening 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 (1998b) 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 primarily focuses on the likelihood of exposure of biota at/or adjacent to the site to be exposed 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 determines whether further examination of potential ecological impacts is necessary.

VII.2.1 Data Assessment

As indicated in Section IV (Tables 4 and 5), inorganic constituents in soil within the 0- to 5-foot depth interval that exceeded background concentrations were as follows:

- Silver
- Uranium
- Th-232
- U-235
- U-238.

The organic analytes detected in the soil at this site were:

- Acetone
- Toluene.

VII.2.2 Bioaccumulation

Among the COPECs listed in Section VII.2.1, only U-235 and U-238 are considered to have bioaccumulation potential in aquatic environments (Section IV, Tables 4 and 5).

It should be noted, however, that as directed by the NMED (NMED March 1998), bioaccumulation for inorganics is assessed exclusively based upon maximum reported bioconcentration factors (BCF) 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 move from the source of contamination to other media or biota is discussed in Section V. As noted in Table 6 (Section V), wind, surface water, and food chain uptake are expected to be of low significance as transport mechanisms for COPECs at this site and migration to groundwater is not anticipated. Loss of VOCs by volatilization is expected to be of low significance, but these organics may slowly degrade in the soil through hydrolysis and biotransformation. Degradation/transformation for the inorganic COPECs and radionuclides is 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 this SWMU and that COPECs also exist at the site. As a consequence, a screening assessment was deemed necessary to predict the potential level of ecological risk associated with the site.

VII.3 Screening Assessment

As concluded in Section VII.2.4, complete ecological pathways and COPECs are associated with this SWMU. The screening 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 screening 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 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.

- Screening Assessment Scientific/Management Decision Point—presents the decision to risk managers based upon the results of the screening assessment.

VII.3.1 Problem Formulation

Problem formulation is the initial stage of the screening assessment that introduces 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 screening assessment) are presented in the "Predictive Ecological Risk Assessment Methodology for SNL/NM ER Program" (IT July 1998) and are not duplicated here.

VII.3.1.1 Ecological Pathways and Setting

SWMU 94C is approximately 0.2 acres in size. The LCBS is located in woodland habitat; however, the natural vegetation at SWMU 94C was removed and the soil was highly disturbed during its operational use. Wildlife use the area, but the small size and disturbed nature of the site make significant transfers of COPECs through the food chain unlikely. Biological and sensitive species surveys of the entire LCBS were conducted in 1991 (Biggs May 1991, Biggs August 1991). No sensitive species were reported to exist at this facility. Although the gray vireo (*Vireo vicinior*), a New Mexico threatened species, has been recorded in the woodland habitats of Lurance Canyon (NMNHP 1995), this species is not known to exist at the LCBS.

Complete ecological pathways may exist at this site through the exposure of plants and wildlife to COPECs in soil. It was assumed that direct uptake of COPECs from soil was the major route of exposure for plants and that exposure of plants to wind-blown soil was minor. Exposure modeling for the wildlife receptors was limited to the food and soil ingestion pathways and external radiation. Because of the lack of surface water at this site, exposure to COPECs through the ingestion of surface water was considered insignificant. Inhalation and dermal contact were also 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

COPECs for SWMU 94C are listed in Section VII.2.1. The COPECs include both organic and inorganic constituents. The two organic COPECs (acetone and toluene) are VOCs. All detected organics were included as COPECs; however, acetone may be a laboratory contaminant, rather than a true site constituent. The inorganics include both radiological and nonradiological analytes. The concentrations of inorganic analytes detected at this site were screened against background concentrations (see Section IV) and those that exceeded the approved SNL/NM background screening levels (Dinwiddie September 1997) for the area were considered to be COPECs. Nonradiological inorganics that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, were not included in this risk assessment as set forth by the EPA (1989). In order to provide conservatism, this ecological risk assessment was based upon the maximum soil concentrations of the COPECs measured in the surface soil. Tables 4 and 5 present maximum concentrations for the COPECs.

VII.3.1.3 Ecological Receptors

As described in detail in IT Corporation (July 1998), a nonspecific perennial plant was selected as the receptor to represent plant species at the site. 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*) were used to represent wildlife use. Because of its opportunistic food habits, the deer mouse was used to represent a mammalian herbivore, omnivore, and insectivore. The burrowing owl was selected to represent a top predator at this site. Although burrowing owls are not expected to exist in the woodland habitat at SWMU 94C, it is used to conservatively represent exposure and risk to other small, predatory birds, such as the western screech owl (*Otus kennicottii*), that may inhabit 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

For nonradiological COPECs, direct uptake from the soil was considered the only significant route of exposure for terrestrial plants. Exposure modeling for the wildlife receptors was limited to food and soil ingestion pathways. Inhalation and dermal contact were considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Drinking water was also considered an insignificant pathway because of the lack of surface water at this site. The deer mouse was 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 was 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 from a diet consisting of only omnivorous mice, the diet of the burrowing owl was modeled with intake of omnivorous mice only. Both species were modeled with soil ingestion comprising 2 percent of the total dietary intake. Table 11 presents the species-specific factors used in modeling exposures in the wildlife receptors. Justification for using 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 were modeled using an area use factor of 1, implying that all food items and soil ingested are from the site being investigated. The maximum measured COPEC concentrations from surface soil samples were used to conservatively estimate potential exposures and risks to plants and wildlife at this site.

For the radiological dose rate calculations, the deer mouse was modeled as an herbivore (100 percent of its diet as plants), and the burrowing owl was modeled as a strict predator on

Table 11
Exposure Factors for Ecological Receptors at SWMU 94C

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] From Silva and Downing (1995).

[e] EPA (1993), based upon the average home range measured in semiarid shrubland in Idaho.

[f] From Dunning (1993).

[g] From Haug et al. (1993).

EPA = U.S. Environmental Protection Agency.
kg = Kilogram(s).
kg/day = Kilogram(s) per day.
SWMU = Solid Waste Management Unit.

small mammals (100 percent of its diet as deer mice). Both were modeled with soil ingestion comprising 2 percent of the total dietary intake. Receptors are exposed to radiation both internally and externally from Th-232, U-235, and U-238. Internal and external dose rates to the deer mouse and the burrowing owl are approximated using modified dose rate models from DOE (1995) as presented in the ecological risk assessment methodology document for the SNL/NM ER Project (IT July 1998). Radionuclide-dependent data for the dose rate calculations were obtained from Baker and Soldat (1992). The external-dose-rate model examines the total-body dose-rate to a receptor residing in soil exposed to radionuclides. The soil surrounding the receptor is assumed to be an infinite medium uniformly contaminated with gamma-emitting radionuclides. The external-dose-rate model is the same for both the deer mouse and the burrowing owl. The internal total-body dose-rate model assumes that a fraction of the radionuclide concentration ingested by a receptor is absorbed by the body and concentrated at the center of a spherical body shape. This provides a conservative estimate for absorbed dose. This concentrated radiation source at the center of the body of the receptor is assumed to be a "point" source. Radiation emitted from this point source is absorbed by the body tissues to contribute to the absorbed dose. Alpha and beta emitters are assumed to transfer 100 percent of their energy to the receptor as they pass through tissues. Gamma-emitting radionuclides only transfer a fraction of their energy to the tissues because gamma rays interact less with matter than do beta or alpha emitters. The external and internal dose rate results are summed to calculate a total dose rate from exposure to Th-232, U-235, and U-238 in soil.

Table 12 presents the transfer factors used in modeling the concentrations of COPECs through the food chain. Table 13 presents maximum concentrations in soil and derived concentrations in tissues of the various food chain elements used to model dietary exposures for each of the wildlife receptors.

VII.3.3 Ecological Effects Evaluation

Table 14 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. Insufficient toxicity information was found to estimate the LOAEL for acetone for plants and the NOAELs for silver, acetone, and toluene for the burrowing owl.

The benchmark used for exposure of terrestrial receptors to radiation was 0.1 rad/day. This value has been recommended by the International Atomic Energy Agency (IAEA 1992) for the protection of terrestrial populations. Because plants and insects are less sensitive to radiation than vertebrates (Whicker and Schultz 1982), the dose of 0.1 rad/day should also offer sufficient protection to other components within the terrestrial habitat of SWMU 94C.

VII.3.4 Risk Characterization

Maximum concentrations in soil and estimated dietary exposures were compared to plant and wildlife benchmark values, respectively. Table 15 presents results of these comparisons. HQs are used to quantify the comparison with benchmarks for plants and wildlife exposure.

Table 12
Transfer Factors Used in Exposure Models for Constituents of Potential Ecological Concern at SWMU 94C

Constituent of Potential Ecological Concern	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Inorganic			
Silver	1.0E+0[a]	2.5E-1[b]	5.0E-3[a]
Uranium	2.3E-2[c]	1.0E+0[d]	1.0E-2[a]
Organic[e]			
Acetone	5.3E+1	1.3E+1	1.0E-8
Toluene	1.0E+0	1.8E+1	1.3E-5

[a] From NCRP (January 1989).

[b] From Stafford et al. (1991).

[c] From IAEA (1994).

[d] Default value.

[e] Soil-to-plant and food-to-muscle transfer factors from equations developed in Travis and Arms (1988). Soil-to-invertebrate transfer factors from equations developed in Connell and Markwell (1990). All three equations based upon relationship of the transfer factor to the log K_{ow} value of compound.

IAEA = International Atomic Energy Agency.
K_{ow} = Octanol-water partition coefficient.
Log = Logarithm (base 10).
NCRP = National Council on Radiation Protection and Measurements.
SWMU = Solid Waste Management Unit.

Table 13
Media Concentrations[a] for Constituents of Potential Ecological Concern at SWMU 94C

Constituent of Potential Ecological Concern	Soil (maximum)[a]	Plant Foliage[b]	Soil Invertebrate[b]	Deer Mouse Tissues[c]
Inorganic				
Silver	3.0E-1	3.0E-1	7.6E-2	3.0E-3
Uranium	9.3E+0	2.1E-1	9.3E+0	1.5E-1
Organic				
Acetone	8.5E-3	4.5E-1	1.1E-1	9.1E-9
Toluene	3.3E-4	3.3E-4	6.0E-3	1.3E-7

[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).

EPA = U.S. Environmental Protection Agency.
SWMU = Solid Waste Management Unit.

Table 14
Toxicity Benchmarks for Ecological Receptors at SWMU 94C

Constituent of Potential Ecological Concern	Plant Benchmark[a,b]	Mammalian NOAELs			Avian NOAELs		
		Mammalian Test Species[c,d]	Test Species NOAEL[d,e]	Deer Mouse NOAEL[e,f]	Avian Test Species[d]	Test Species NOAEL[d,e]	Burrowing Owl NOAEL[e,g]
Inorganic							
Silver	2	Rat	17.8[h]	34.8	–	–	–
Uranium	5	Mouse[i]	3.07	3.19	Black duck	16.0	16.0
Organic							
Acetone	–	Rat	10	19.6	–	–	–
Toluene	200	Mouse	26	27.5	–	–	–

[a] In milligram(s) per kilogram soil dry weight.
[b] From Efroymson et al. (1997).
[c] Body weight for the NOAEL conversion are as follows: laboratory rat, 0.350 kilogram; laboratory mouse, 0.030 kilogram, except where noted.
[d] From Sample et al. (1996).
[e] In milligram(s) per kilogram 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 kilogram 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] Based upon a rat LOAEL of 89 milligram(s) per kilogram body weight per day (EPA 1998a) and an uncertainty factor of 0.2.
[i] Body weight = 0.028 kilograms.
LOAEL = Lowest-observed-adverse-effect level.
NOAEL = No-observed-adverse-effect level
SWMU = Solid waste management unit.
– = Insufficient toxicity data.

Table 15
HQs for Ecological Receptors at SWMU 94C

Constituent of Potential Ecological Concern	Plant HQ	Deer Mouse HQ (Herbivorous)	Deer Mouse HQ (Omnivorous)	Deer Mouse HQ (Insectivorous)	Burrowing Owl HQ
Inorganic					
Silver	1.5E-1	1.4E-3	8.7E-4	3.6E-4	–
Uranium	**1.9E+0**	1.9E-2	2.4E-1	4.6E-1	2.4E-3
Organic					
Acetone	–	3.6E-3	2.2E-3	8.6E-4	–
Toluene	1.7E-6	1.9E-6	1.8E-5	3.4E-5	–
HI[a]	**2.0E+0**	2.4E-2	2.4E-1	4.6E-1	2.4E-3

Note: **Bold** text indicates HQ or HI exceeds unity.

[a] The HI is the sum of individual HQs.

HI = Hazard index.

HQ = Hazard quotient.

SWMU = Solid Waste Management Unit.

– = Insufficient toxicity data available for risk estimation purposes.

Of the four nonradiological COPECs, only uranium had a HQ exceeding unity (i.e., the HQ for uranium exposure in plants). HQs for the burrowing owl could not be determined for silver, acetone, and toluene. As directed by the NMED, HIs were calculated for each of the receptors (the HI is the sum of chemical-specific HQs for all pathways for a given receptor). Of these, only the HI for plants exceeded unity. This HI was 2.0E+0, with uranium accounting for essentially all of this value.

Tables 16 and 17 summarize the internal and external dose rate model results for Th-232, U-235, and U-238. The total radiation dose rates to both the deer mouse and the burrowing owl were predicted to be 2.1E-3 rad/day. The dose rates for the deer mouse and the burrowing owl are considerably less than the benchmark of 0.1 rad/day.

VII.3.5 Uncertainty Assessment

Many uncertainties are associated with the characterization of ecological risks at SWMU 94C. These uncertainties result from assumptions used in calculating risk that could overestimate or underestimate true risk presented at a site. For this risk assessment, assumptions are made that are more likely to overestimate exposures and risk than 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 measured analyte concentrations in soil to evaluate risk, the use of wildlife toxicity benchmarks based upon NOAEL values, the incorporation of strict herbivorous and strict insectivorous diets for predicting the extreme HQ values for the deer mouse, and the use of 1.0 as the area use factor for wildlife receptors regardless of seasonal use or home range size. 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).

Uncertainties associated with the estimation of risk to ecological receptors following exposure to Th-232, U-235, and U-238 are primarily related to those inherent in the radionuclide-specific data. Radionuclide-dependent data are measured values that have associated errors. The dose rate models used for these calculations are based upon conservative estimates on receptor shape, radiation absorption by body tissues, and intake parameters. The goal is to provide a realistic but conservative estimate of a receptor's internal and external exposure to radionuclides in soil.

In the estimation of ecological risk, background concentrations are included as a component of maximum on-site concentrations. For some inorganic COPECs, conservatisms in the modeling of exposure and risk result in predicting risk to ecological receptors when exposed at background concentrations. However, as shown in Table 18, the HQ for plants associated with exposure to background concentrations of uranium accounts for only 24 percent of the HQ at this site. Therefore, the potential exposure of plants to uranium concentrations in excess of background at this site is sufficient to pose a risk to these plants.

Another significant source of uncertainty associated with the prediction of ecological risk at this site is the use of the maximum measured concentrations as the exposure point concentrations. This results in a conservative exposure scenario that does not necessarily reflect actual site conditions. In the case of uranium, it should be noted that both the mean concentration of the

Table 16
Internal and External Dose Rates for Deer Mice Exposed to Radionuclides at SWMU 94C

Radionuclide	Maximum Concentration (pCi/g)	Internal Dose (rad/day)	External Dose (rad/day)	Total Dose (rad/day)
Th-232	1.1E+0	4.4E-7	2.1E-4	2.1E-4
U-235	2.6E-1	2.8E-6	4.2E-6	7.0E-6
U-238	1.2E+1	1.2E-4	1.8E-3	1.9E-3
Total		1.2E-4	2.0E-3	2.1E-3

pCi/g = Picocurie(s) per gram.
SWMU = Solid Waste Management Unit.

Table 17
Internal and External Dose Rates for Burrowing Owls Exposed to Radionuclides at SWMU 94C

Radionuclide	Maximum Concentration (pCi/g)	Internal Dose (rad/day)	External Dose (rad/day)	Total Dose (rad/day)
Th-232	1.1E+0	6.4E-7	2.1E-4	2.1E-4
U-235	2.6E-1	1.1E-6	4.2E-6	5.3E-6
U-238	1.2E+1	4.9E-5	1.8E-3	1.9E-3
Total		5.1E-5	2.0E-3	2.1E-3

pCi/g = Picocurie(s) per gram.
SWMU = Solid Waste Management Unit.

Table 18
HQs for Ecological Receptors Exposed to Background Concentrations at SWMU 94C

Constituent of Potential Ecological Concern	Plant HQ	Deer Mouse HQ (Herbivorous)	Deer Mouse HQ (Omnivorous)	Deer Mouse HQ (Insectivorous)	Burrowing Owl HQ
Silver	1.3E-1	1.1E-3	7.2E-4	3.0E-4	–
Uranium	4.6E-1	4.8E-3	6.0E-2	1.1E-1	5.9E-4
HI[a]	5.9E-1	6.0E-3	6.0E-2	1.1E-1	5.9E-4

Note: **Bold** text indicates HQ or HI exceeds unity.

[a] The HI is the sum of individual HQs.

HI = Hazard index.
HQ = Hazard quotients.
SWMU = Solid Waste Management Unit.
– = Insufficient toxicity data available for risk estimation purposes.

four samples (4.8 milligrams per kilogram [mg/kg]) and the second highest measured concentration (also 4.8 mg/kg) are less than the plant toxicity benchmark for uranium. Therefore, the data for this site indicate that areas within the site where uranium may a potential risk to plants are limited.

Finally, uncertainty exists with regard to the plant toxicity benchmark for uranium due to probable differences in the bioavailability of the uranium between the toxicity study upon which the benchmark was based and the actual field conditions. As is common to most plant toxicity studies, the chemical being tested (in this case, uranium) is freshly added to the soil in a form that is highly available to the plants. Therefore, the bioavailability of the chemical in the experimental condition is typically much greater than that found in field conditions. The single study used by Efroymson et al. (1997) as the basis for the plant toxicity benchmark for uranium used uranyl nitrate ($UO_2(NO_3)_2$) as the soil amendment. It is unlikely that the uranium residues remaining in the soils at SWMU 94C are not as bioavailable as this amendment. Because only one plant toxicity study was available, Efroymson et al. (1997) placed low confidence on the resulting benchmark. It is likely that actual risk to plants from uranium at SWMU 94C is significantly overestimated by the HQs calculated in this screening assessment because of conservatism and uncertainties associated with the plant toxicity benchmark for this COPEC.

Based upon this uncertainty analysis, ecological risks at SWMU 94C are expected to be low. A HQ greater than unity was initially predicted for plant exposure to uranium; however, closer examination of the exposure assumption and toxicity benchmark revealed an overestimation of risk primarily attributed to conservatism in the exposure concentration and in the benchmark value.

VII.3.6 Risk Interpretation

Ecological risks associated with SWMU 94C were estimated through a screening assessment that incorporated site-specific information when available. Overall, risks to ecological receptors are expected to be low because predicted risks associated with exposure to COPECs are based upon calculations using maximum detected values. Predicted risk to plants from exposure to uranium was attributed to using maximum detected values. The average uranium concentration at the site was less than the conservatively estimated plant toxicity benchmark for this COPEC. Based upon this final analysis, ecological risks associated with SWMU 94C are expected to be low.

VII.3.7 Screening 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 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 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) proposes that a default set of exposure routes and associated default parameter values be 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 would be invoked for risk assessments unless site-specific information suggested other parameter values. Because many SNL/NM solid waste management units (SWMU) 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 will facilitate the risk assessments and subsequent review.

The default exposure routes and parameter values suggested 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 proposes that these default exposure routes and parameter values be used in future risk assessments.

At SNL/NM, all SWMUs exist within the boundaries of the Kirtland Air Force Base (KAFB). Approximately 157 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, the biological resources present and proposed land use scenarios for the SNL/NM SWMUs. 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. 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 1989a) 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 shell fish
- 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 does not currently occur any consumption of fish, shell fish, 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 shell fish
- Ingestion of contaminated fruits and vegetables
- Ingestion of contaminated meat, eggs, and dairy products
- Ingestion of contaminated surface water while swimming.

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

For the residential land use scenario, we will include ingestion of contaminated fruits and vegetables because of the potential for residential gardening.

Based upon this evaluation, for future risk assessments, the exposure routes that will be considered are shown in Table 1. Dermal contact is included as a potential exposure pathway in all land use scenarios. However, the potential for dermal exposure to inorganics is not considered significant and will not be included. In general, the dermal exposure pathway is generally considered to not be significant relative to water ingestion and soil ingestion pathways but will be considered for organic components. Because of the lack of toxicological parameter values for this pathway, the inclusion of this exposure pathway into risk assessment calculations may not be possible and may be part of the uncertainty analysis for a site where dermal contact is potentially applicable.

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	Dermal contact	Dermal contact
External exposure to penetrating radiation from ground surfaces	External exposure to penetrating radiation from ground surfaces	Ingestion of fruits and vegetables
		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 equations for calculating potential intakes via these routes are shown below. The equations are from the Risk Assessment Guidance for Superfund (RAGS): Volume 1 (EPA 1989a, 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). Also shown are the default values SNL/NM ER suggests for use in RME risk assessment calculations for industrial, recreational, and residential 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).

Generic Equation for Calculation of Risk Parameter Values

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

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

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

where

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

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.

The evaluation of the carcinogenic health hazard produces a quantitative estimate for excess cancer risk resulting from the constituents of concern (COC) present at the site. This estimate is evaluated for determination of further action by comparison of the quantitative estimate with the potentially acceptable risk range of 1E-6 for Class A and B carcinogens and 1E-5 for Class C 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 due to radioactive compounds produces a quantitative estimate of doses resulting from the COCs present at the site.

The specific equations used for the individual exposure pathways can be found in RAGS (EPA 1989a) and the RESRAD Manual (ANL 1993). Table 2 shows the default parameter values suggested for used by SNL/NM at SWMUs, based upon the selected land use scenario. References are given at the end of the table indicating the source for the chosen parameter values. The intention of SNL/NM is to use default values that are consistent with regulatory guidance and consistent with 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 proposes the described default exposure routes and parameter values for use 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 this scenario has been requested to be considered by the NMED. 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. The values are generally consistent with those proposed by Los Alamos National Laboratory, with a few minor variations. 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 Parameter Values for Various Land Use Scenarios

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure frequency	8 hr/day for 250 day	4 hr/wk for 52 wk/yr	350 day/yr
Exposure duration (yr)	25[a,b]	30[a,b]	30[a,b]
Body weight (kg)	70[a,b]	70 adult[a,b] 15 child	70 adult[a,b] 15 child
Averaging Time (days)			
for carcinogenic compounds (= 70 y x 365 day/yr)	25,550[a]	25,550[a]	25,550[a]
for noncarcinogenic compounds (= ED x 365 day/yr)	9,125	10,950	10,950
Soil Ingestion Pathway			
Ingestion rate	100 mg/day[c]	200 mg/day child 100 mg/day adult	200 mg/day child 100 mg/day adult
Inhalation Pathway			
Inhalation rate (m^3/yr)	5,000[a,b]	260[d]	7,000[a,b,d]
Volatilization factor (m^3/kg)	chemical specific	chemical specific	chemical specific
Particulate emission factor (m^3/kg)	1.32E9[a]	1.32E9[a]	1.32E9[a]
Water Ingestion Pathway			
Ingestion rate (liter/day)	2[a,b]	2[a,b]	2[a,b]
Food Ingestion Pathway			
Ingestion rate (kg/yr)	NA	NA	138[b,d]
Fraction ingested	NA	NA	0.25[b,d]
Dermal Pathway			
Surface area in water (m^2)	2[b,e]	2[b,e]	2[b,e]
Surface area in soil (m^2)	0.53[b,e]	0.53[b,e]	0.53[b,e]
Permeability coefficient	chemical specific	chemical specific	chemical specific

[a] Risk Assessment Guidance for Superfund, Vol. 1, Part B (EPA 1991).

[b] Exposure Factors Handbook (EPA 1989b).

[c] EPA Region VI guidance.

[d] For radionuclides, RESRAD (Argonne National Laboratory, 1993. *Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD*, Version 5.0, ANL/EAD/LD-2, Argonne National Laboratory, Argonne, IL. 1993) is used for human health risk calculations; default parameters are consistent with RESRAD guidance.

[e] Dermal Exposure Assessment (EPA 1992).

ED = Exposure duration.
EPA = U.S. Environmental Protection Agency.
hr = Hour.
kg = Kilogram(s).
m = Meter(s).
mg = Milligram(s).
NA = Not available.
wk = Week.
yr = Year.

References

ANL, see Argonne National Laboratory.

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

DOE, see U.S. Department of Energy.

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