4-1-2000

Justification for Class III Permit Modification April 2000, ER Site 65C, Secondary Detonation Area, Lurance Canyon Explosive Test Site, Operable Unit 1333

Sandia National Laboratories/NM

Sandia National Laboratories

Justification for Class III Permit Modification

April 2000

ER Site 65C
Secondary Detonation Area,
Lurance Canyon Explosive Test Site
Operable Unit 1333

NFA Originally Submitted August 31, 1999

**Environmental
Restoration
Project**

United States Department of Energy
Albuquerque Operations Office

NFA

Justification for
Class III Permit Modification

April 2000

Solid Waste Management Unit 65C
Operable Unit 1333
Round 13

(RCRA Permit No. NM5890110518)

NFA Originally Submitted August 31, 1999

6.0 SWMU 65C

Justification for
Class III Permit Modification

April 2000

Solid Waste Management Unit 65C
Operable Unit 1333
Round 13

NFA Originally Submitted August 31, 1999

6.0 SOLID WASTE MANAGEMENT UNIT 65C, SECONDARY DETONATION AREA, LURANCE CANYON EXPLOSIVES TEST SITE

6.1 Summary

Sandia National Laboratories/New Mexico (SNL/NM) is proposing a risk-based no further action (NFA) decision for Solid Waste Management Unit (SWMU) 65C, Secondary Detonation Area, Operable Unit (OU) 1333. SWMU 65C was used to conduct general explosives tests and burn pit tests on ammonium nitrate slurry bombs, Pioneer capsules, plutonium shipping containers, and a TC-708 emergency denial device. SWMU 65C is located north of the Oil Surface Impoundment (SWMU 13) at the Lurance Canyon Explosives Test Site (LCETS). Review and analysis of all relevant data for SWMU 65C indicate that concentrations of constituents of concern (COC) at this site are less than applicable risk assessment action levels. Thus, SWMU 65C 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 use, 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).

6.2 Description and Operational History

Section 6.2 describes SWMU 65C and discusses its operational history.

6.2.1 Site Description

SWMU 65C is a subunit of SWMU 65, which was identified as the LCETS on the Resource Conservation and Recovery Act (RCRA) Hazardous and Solid Waste Amendments (HSWA) permit. The site is located on U.S. Air Force land withdrawn from the Bureau of Land Management and permitted to the U.S. Department of Energy (DOE) (SNL/NM July 1994a). *This site is situated on the canyon floor alluvium in the upper reaches of the Lurance Canyon* drainage. The Lurance Canyon drainage is surrounded by moderately steep sloping canyon walls, and the immediate topographic relief around the site is over 500 feet (Figure 6.2.1-1). A 25- to 50-foot-wide road cut on the hillsides as a firebreak encircles the site (Figure 6.2.1-2). The canyon floor at the site is isolated by the canyon walls except for the western drainage into the Arroyo del Coyote. Coyote Springs Road follows this drainage and is the main access into the Lurance Canyon (Figure 6.2.1-1).

Because of the complex testing history of the site, the LCETS was subdivided into five subunits as proposed in the "RCRA Facility Investigation [RFI] Work Plan for the OU 1333, Canyons Test Area" (SNL/NM September 1995). The locations of detonations and the types of tests conducted at SWMU 65 were key in determining the five subunits: SWMU 65A (Small Debris Mound), SWMU 65B (Primary Detonation Area), SWMU 65C (Secondary Detonation Area), SWMU 65D (Near-Field Dispersion Area), and SWMU 65E (Far-Field Dispersion Area). Figure 6.2.1-2 shows all of these inactive subunits. Each of the SWMU 65 subunits is

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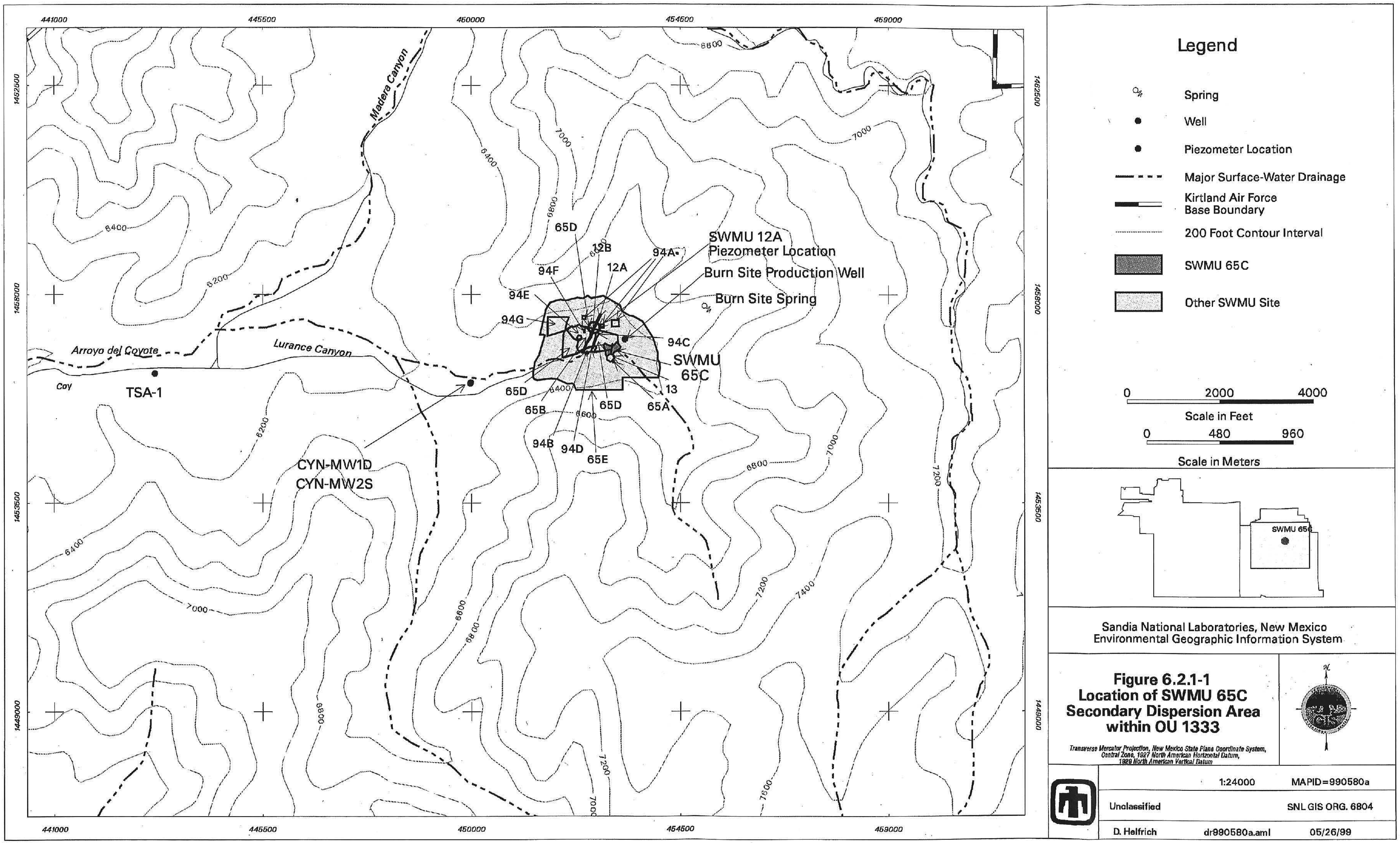

Figure 6.2.1-1
Location of SWMU 65C Secondary Dispersion Area within OU 1333

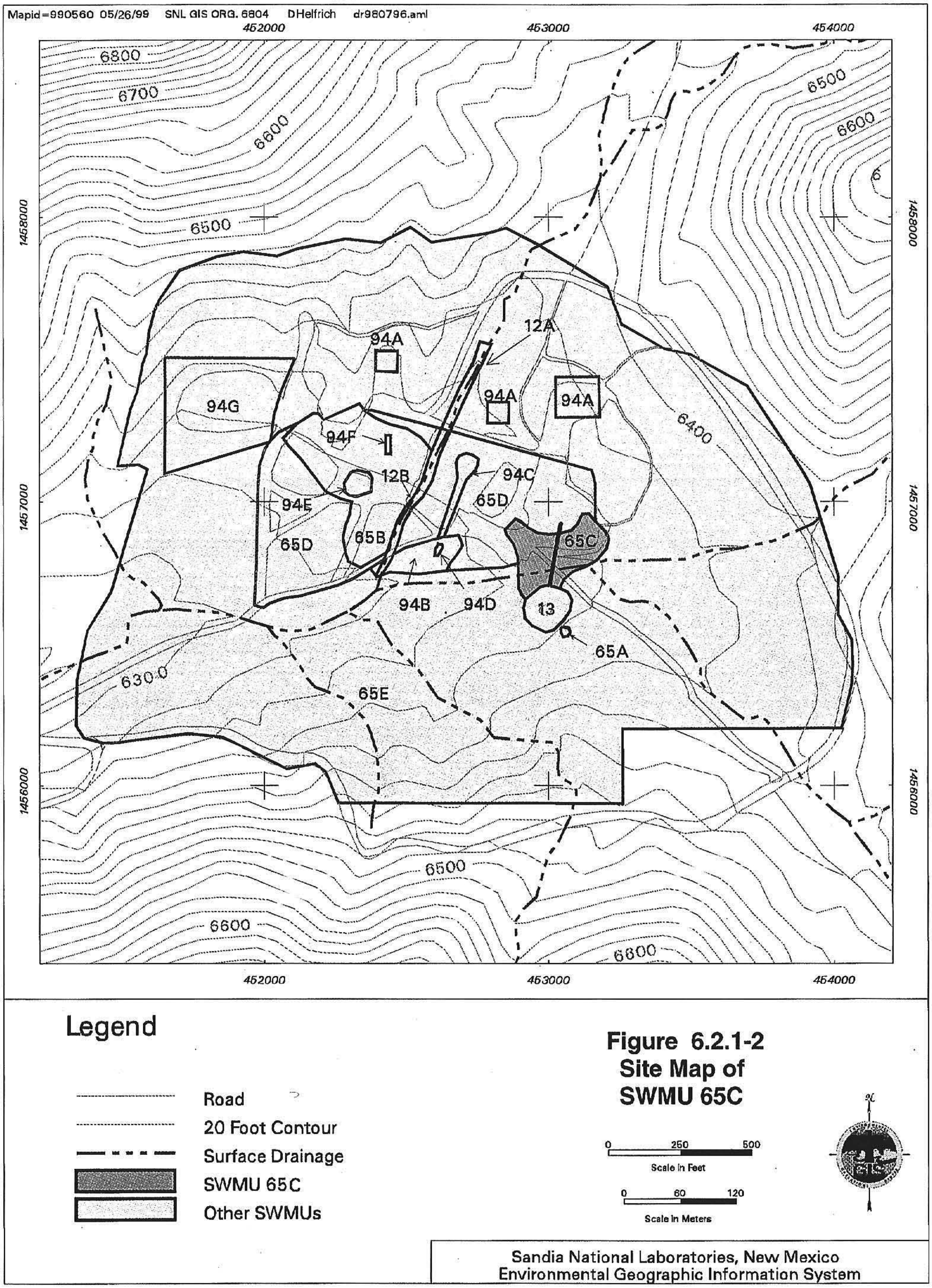

Figure 6.2.1-2
Site Map of
SWMU 65C

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

addressed in a separate NFA proposal. The NFA proposal for SWMU 65E was submitted in September 1998 (SNL/NM September 1998), the NFA proposal for SWMU 65D was submitted in June 1999 (SNL/NM June 1999), and the NFA proposals for SWMUs 65A and 65B are included in this document.

SWMU 65 is currently an inactive site that was used from the late 1960s to the early 1990s for general explosives tests. It is located coincident with SWMU 94, the Lurance Canyon Burn Site (LCBS), which is actively used for testing fire survivability of transportation equipment, storage equipment, simulated weapons, and satellite components. SWMU 94 activities began in the mid-1970s and continue to the present.

SWMU 65C lies on approximately 1.3 acres of land at a mean elevation of 6,355 feet above sea level (SNL/NM April 1995) and is located north of the Oil Surface Impoundment (SWMU 13) in the eastern portion of SWMU 65. The boundaries of this subunit were defined from historical aerial photographs (SNL/NM August 1994) and interview records. SWMU 65C was the burn pit area for the Cloudmaker tests (Littrell February 1969), other ammonium nitrate burn tests involving fuel-rod containers (SNL/NM June 1993), liquid fuel fire and solid rocket propellant burn tests on Pioneer capsules (Foy April 1971, Clark December 1970), plutonium shipping container tests (Stravasnik September 1972), and the TC-708 emergency denial device test (Walkington April 1973). Annex 6-A contains descriptions of the tests conducted at SWMU 65C. Regrading of the soil/sediment since testing activities that ceased in the early 1970s has significantly altered the ground surface at this site, so there is now no evidence of the pits associated with past testing. Materials used in the burn tests include jet propulsion fuel grade 4 and diesel fuels; 2,4,6-trinitrotoluene detonators; ammonium nitrate; polyvinyl chloride; aluminum powder; steel test vessels; Pioneer capsules; polyethylene bottles; Dy-Kem steel-blue layout dye; Celotex insulation; chromel/alumel thermocouples; and solid rocket propellant.

Historical published information regarding the hydrogeology of the Lurance Canyon was summarized in the RFI Work Plan for the OU 1333 (SNL/NM September 1995). Since that time, additional bedrock wells and alluvial piezometers have been installed in the Lurance Canyon, and data collected from the new wells support the hydrologic model of semiconfined to confined groundwater conditions at a depth of approximately 222 feet below ground surface (bgs) beneath the Lurance Canyon SWMUs. The data collected from the alluvial piezometers support the absence of alluvial groundwater. Hydrologic data are collected regularly from the Burn Site Well, CYN-MW1D, 12AUP01 (piezometer), and CYN-MW2S (piezometer). The remainder of this section summarizes the hydrologic conditions at each monitoring well location.

The Burn Site production well was drilled in February 1986 to a total depth of 350 feet bgs (Figure 6.2.1-1). A total of 74 feet of clay, silt, and shale units were encountered overlying the bedrock identified as metamorphic schists and fractured granite. Water-bearing bedrock was encountered at a depth of 222 to 350 feet bgs (New Mexico State Engineer's Office Well Record RG-44986 [April 1986]). Following well completion, the water level rose to 68 feet bgs.

A shallow underflow piezometer was installed in November 1996 in SWMU 12A near the SWMU 65C boundary (Figure 6.2.1-1). The NFA proposal for SWMU 12A has been submitted to the New Mexico Environment Department (NMED) for an NFA decision (SNL/NM May 1997). The piezometer was installed in conformance with an understanding between SNL/NM and the NMED/DOE Oversight Bureau (Dawson August 1996). The subsurface geology of the site is comprised of approximately 55 feet of alluvial sand, silt, and gravel overlying metamorphic phyllite to schist bedrock. The piezometer was completed to a depth of approximately 58 feet bgs and was identified as 12AUP01. 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. The piezometer was instrumented in February 1997 and has been collecting data since that time. In addition, manual checks for the presence of water have been conducted as a verification procedure. No water has been recorded in the piezometer subsequent to its installation.

The Burn Site Spring (Figure 6.2.1-1) is an ephemeral spring or, more accurately, a seep located approximately 2,000 feet northeast of SWMU 65C. The seep discharges small quantities of water from fractures and/or bedding plane permeability within the carbonate rocks (Goodrich [Month unk] 1993). It is hypothesized that the source of the water is from the seasonal recharge of fractures from the surrounding mountain terrain.

A groundwater monitoring well nest was installed in November and December 1997 approximately 3,000 feet west (downgradient) of the LCETS (Figure 6.2.1-1). The groundwater wells were installed in conformance with an understanding between SNL/NM and the NMED (SNL/NM July 1997, SNL/NM September 1997b). This well nest is comprised of a shallow underflow piezometer (CYN-MW2S) and a deep groundwater well (CYN-MW1D). The subsurface geology at the nest location is characterized by approximately 25 feet of alluvial sand, silt, and gravel, unconformably overlying the Manzanita Gneiss. The Manzanita Gneiss is fractured. No water was encountered during drilling in the alluvium, and there has been no recorded measurement of water at CYN-MW2S since its installation. Groundwater was first encountered in CYN-MW1D at a depth of 372 feet bgs, and the static level rose to 320 feet bgs. This indicates semiconfined to confined groundwater conditions similar to those encountered in the Burn Site Well (Figure 6.2.1-1).

In summary, the groundwater beneath the LCETS occurs at depths of at least 222 feet bgs under semiconfined to confined conditions in fractured metamorphic rock. There has been no record to date of shallow groundwater occurring in the alluvium overlying the bedrock.

For a detailed discussion regarding the local setting at SWMU 65C, refer to the RFI Work Plan for OU 1333 (SNL/NM September 1995).

6.2.2 Operational History

Historical aerial photographs indicate that construction of the LCETS had begun by October 1967; by 1971 the test site was in full operation and several structures were visible (SNL/NM August 1994). To protect the surrounding area from accidental fires caused by detonation of explosives or burn testing, a firebreak road was constructed around the site between 1967 and mid-1971 (SNL/NM August 1994).

Interviews with former SNL/NM personnel aided in reconstructing historical operations at SWMU 65. SWMU 65 was established between 1967 and 1969 (Larson and Palmieri August 1994a, Palmieri December 1994b) as an explosives test area designed with a 10,000-foot dispersion radius to provide an adequate buffer for open detonations of up to 10,000 pounds of high explosives (HE) (Gaither et al. May 1993; Author [unk] Date [unk]a; Larson and Palmieri August 1994a, August 1994b). The majority of the open-detonation explosives tests were conducted between 1967 and 1975 (Table 6.2.2-1). All open-detonation explosives tests were concluded by the early 1980s (Larson and Palmieri August 1994b). The frequency of testing at SWMU 65 between 1968 and 1980 has been estimated at 20 tests per year (Gaither et al. May

Table 6.2.2-1
Summary of Tests Conducted at SWMU 65, Lurance Canyon Explosive Test Site

Test Category	Test Type	Test Date	Number of Recorded Tests	Test Materials	Test Location	Reference
General explosives tests	Open-detonation tests	1967 to 1980	260 (20 per year)	Weapons containing HE and DU	Primary and secondary detonation area	65-3 65-10 65-54 65-59
	Ammonium nitrate/fuel rod shipping container test	Between 1967 and 1975	1	Shipping containers for spent fuel rods, ammonium nitrate	Near the LOBP in secondary detonation area	65-3 65-37 65-54
	Penetration tests	Between 1980 and 1985	Unknown	B-61 warhead containing HE and DU	East of camera bunker, west of arroyo in primary detonation area	65-3 65-54 65-63
	Propagation test	Between 1965 and 1979	1	Weapons containing HE	Approximately 1,100 feet SE of Bunker 9830 near SWMU 13	65-61 65-67
Burn pit tests (fuel fire)	Cloudmaker tests	January 1969	3	JP-4 fuel, PVC, TNT, ammonium nitrate, aluminum powder, steel cylinder	Approximately 1,000 feet SE of Bunker 9830 in secondary detonation area	65-32
	Other ammonium nitrate tests	January 1969	2	JP-4 fuel, ammonium nitrate, steel cylinder	SE of Bunker 9830 in secondary detonation area	65-37
	Liquid fuel fire and solid rocket propellant burn tests on pioneer capsules	September 1970	7	JP-4 fuel, TP-H-3062 rocket propellant, Pioneer capsules	SE of Bunker 9830 in secondary detonation area	65-38 65-39
	Plutonium shipping container tests	May to June 1972	5	JP-4 fuel, PVC, polyethylene bottles, Dy-Kem steel-blue layout dye, Celotex insulation, steel containers	Lined fire pit facility in secondary detonation area	65-41
	TC-708 emergency denial device test	February 1973	1	Diesel fuel, PVC, chromel/alumel thermocouples	Approximately 1,000 feet SE of Bunker 9830 in secondary detonation area	65-40

Refer to footnotes at end of table.

Table 6.2.2-1 (Concluded)
Summary of Tests Conducted at SWMU 65, Lurance Canyon Explosive Test Site

Test Category	Test Type	Test Date	Number of Recorded Tests	Test Materials	Test Location	Reference
Miscellaneous Burn tests (nonpetroleum-fuel-fire)	Wood crib fire tests	September 1988 to September 1989	17	Wood, HE, detonators	Graded area south of SWISH Unit in primary detonation area	65-48 65-73
	Liquid oxygen torch tests	January 1984 to April 1985	19	Propane, oxygen as liquid and gas, aluminum powder, nitrogen gas, graphite, steel rods	Graded area within 30 feet of camera bunker in primary detonation area	65-48 65-73
	Rocket propellant tests	January 1984 to August 1993	10	Rocket propellant, empty weapon casings, aluminum	4 locations in primary detonation area and Bomb Burner and CON-CON trenches	65-48 65-72 65-73
Cone tests	Overburden penetration tests	March 1982 to May 1984	22	C-4 HE, sodium-24 isotope ($t_{1/2}$ = 15 hr), uranium dioxide powder, sand, aqueous foam	CON-CON Unit	65-48 65-49
TABS tests	Torch burn tests on weapons	February 1975 to February 1977	12	PBX 9404 HE, DU, beryllium, aluminum	Location A was 45 feet SE of camera bunker in primary detonation area and in Bomb Burner trench	65-50 65-56 65-57
Slow-heat tests	Detonation of HE with heat tape	February 1982 to August 1986	16	PBX 9501, PBX 9404, PBX 9407, HMX, TATB HE; lead tape; chromel/alumel thermocouples; steel test vessel; plywood and vermiculite packaging	Graded area between camera bunker and CON-CON Unit	65-29 65-30 65-31 65-48

65-3 = Gaither et al. May 1993.
65-10 = Author [Unk] Date [Unk]b.
65-29 = Luna October 1985.
65-30 = Luna June 1983.
65-31 = Moore and Luna February 1982.
65-32 = Littrel February 1969.
65-37 = Karas June 1993.
65-38 = Foy April 1971.
65-39 = Clark December 1970.
65-40 = Walkington April 1973.
65-41 = Stravasnik September 1972.
65-48 = SNL/NM August 1986.
65-49 = Church March 1982.
65-50 = Kurowski January 1979.
65-54 = Larson and Palmieri August 1994b.
65-56 = Jercinovic et al. November 1994.
65-57 = Larson August 1994.
65-59 = Larson and Palmieri August 1994a.
65-61 = Palmieri November 1994a.
65-63 = Palmieri December 1994b.
65-67 = Palmieri December 1994a.
65-72 = Palmieri December 1994d.
65-73 = Hickox and Abitz December 1994.
C-4 = Composition-4.
CON-CON = Conical Containment.
DU = Depleted uranium.
HE = High explosive(s).
HMX = 1,3,5,7-tetranitro-1,3,5,7-tetrazacyclooctane.
JP-4 = Jet propulsion fuel grade 4.
LOBP = Large Open Burn Pool.
PBX = Plastic-bonded high explosive.
PVC = Polyvinyl chloride.
SWMU = Solid Waste Management Unit.
SNL/NM = Sandia National Laboratories/New Mexico.
SWISH = Small Wind-Shielded.
$t_{1/2}$ = Half life.
TABS = Torch Activated Burn System.
TATB = Triaminotrinitrobenzene.
TNT = 2,4,6-trinitrotoluene.

1993, Author [unk] Date [unk]b). Based upon information provided in the interviews, open-detonation explosives tests were conducted within the primary (SWMU 65B) and secondary (SWMU 65C) detonation areas (refer to Figure 6.2.1-2).

In addition to open-detonation explosives tests, fuel-fire burn tests of test units containing explosives were conducted at SWMU 65 from 1969 to 1979 in excavated pits (Littrell February 1969, Jercinovic et al. November 1994) (Table 6.2.2-1). Portable pans and engineered burn structures completely replaced burn pit tests by 1979 (Jercinovic et al. November 1994). From the mid-1970s, a variety of nonpetroleum fuel-fire burn tests were conducted. These tests included slow-heat detonations (1983 to 1986) (Luna June 1983, October 1985; Moore and Luna February 1982), Torch-Activated Burn System tests (1975 to 1977) (Kurowski January 1979, Jercinovic et al. November 1994, Larson August 1994), rocket propellant burn tests (1984 to 1993) (Palmieri December 1994d, Hickox and Abitz December 1994), liquid oxygen torch tests (1984 to 1985) (Hickox and Abitz December 1994), and wood crib fire tests (1988 to 1989) (Hickox and Abitz December 1994). Small explosives tests were also conducted in the former Conical Containment (CON-CON) Unit in 1982 (SNL/NM August 1986, Church March 1982). Table 6.2.2-2 correlates the SWMU 65 subunits with the explosives/burn testing programs. Annex 6-A contains a summary of all explosives testing at SWMU 65 and shows the locations of these tests.

6.3 Land Use

Section 6.3 discusses the current and future/proposed land use for SWMU 65C.

6.3.1 Current

SWMU 65C is located with the boundaries of Kirtland Air Force Base (KAFB) (Figure 6.3.1-1) within the active industrial LCBS (SWMU 94).

6.3.2 Future/Proposed

The future/proposed land use for SWMU 65C is recreational (DOE et al. October 1995).

6.4 Investigatory Activities

SWMU 65C has been investigated in a series of three investigations. Section 6.4 describes these activities.

6.4.1 Summary

SWMU 65C was initially investigated 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 began that included background information reviews, interviews, field surveys, and scoping sampling (Investigation #2). From 1995 through

Table 6.2.2-2
Correlation Chart of SWMU 65 Subunits with Explosive/Burn Testing Programs

Subunit Number/Name	Testing Programs	Test Nature of Operational Release	Rationale for Characterization
SWMU 65A Small Debris Mound (soil-covered concrete bunker)	Propagation test (unconfirmed)	Open detonations	Potential release of HE and metals.
SWMU 65B Primary Detonation Area	General explosives tests Open-detonation tests Penetration tests	Open detonations	Potential release of HE, metals, and DU.
	Miscellaneous burn tests Wood crib fire tests Liquid oxygen torch tests Rocket propellant tests	Open burning/ Open detonations	Potential release of HE from wood crib fire tests only.
	Slow-heat tests	Open detonations	Potential release of HE.
	TABS Test Location A	Open burning	Potential release of metals and DU.
SWMU 65C Secondary Detonation Area	General explosives tests Ammonium nitrate/fuel rod Shipping container test	Open detonation/no release	None. No ammonium nitrate residue. Shipping container did not rupture.
	Burn pit tests Cloudmaker tests Other ammonium nitrate tests Liquid fuel fire and solid rocket propellant tests on pioneer capsules Plutonium shipping container tests TC-708 emergency denial device tests	Open burning/open detonations	Potential release of JP-4, diesel fuels, and metals.
SWMU 65D Near-Field Dispersion Area	Miscellaneous burn tests Wood crib fire tests Liquid oxygen torch tests Rocket propellant tests	Open burning/open detonations	Potential release of HE from wood crib fire tests only.
	Cone tests	Detonations/No Release	None. Detonation was contained by CON-CON facility.
	Slow-heat tests	Open detonations	Potential release of HE.
	Dispersion area for general explosives tests	Open detonations	Potential release of HE, metals, and DU.
SWMU 65E Far-Field Dispersion Area	Dispersion area for general explosives tests	Open detonations	Potential release of HE, metals, and DU.

CON-CON = Conical Containment.
DU = Depleted uranium.
HE = High explosive(s).
JP-4 = Jet propulsion fuel grade 4.
SWMU = Solid Waste Management Unit.
TABS = Torch-Activated Burn System.

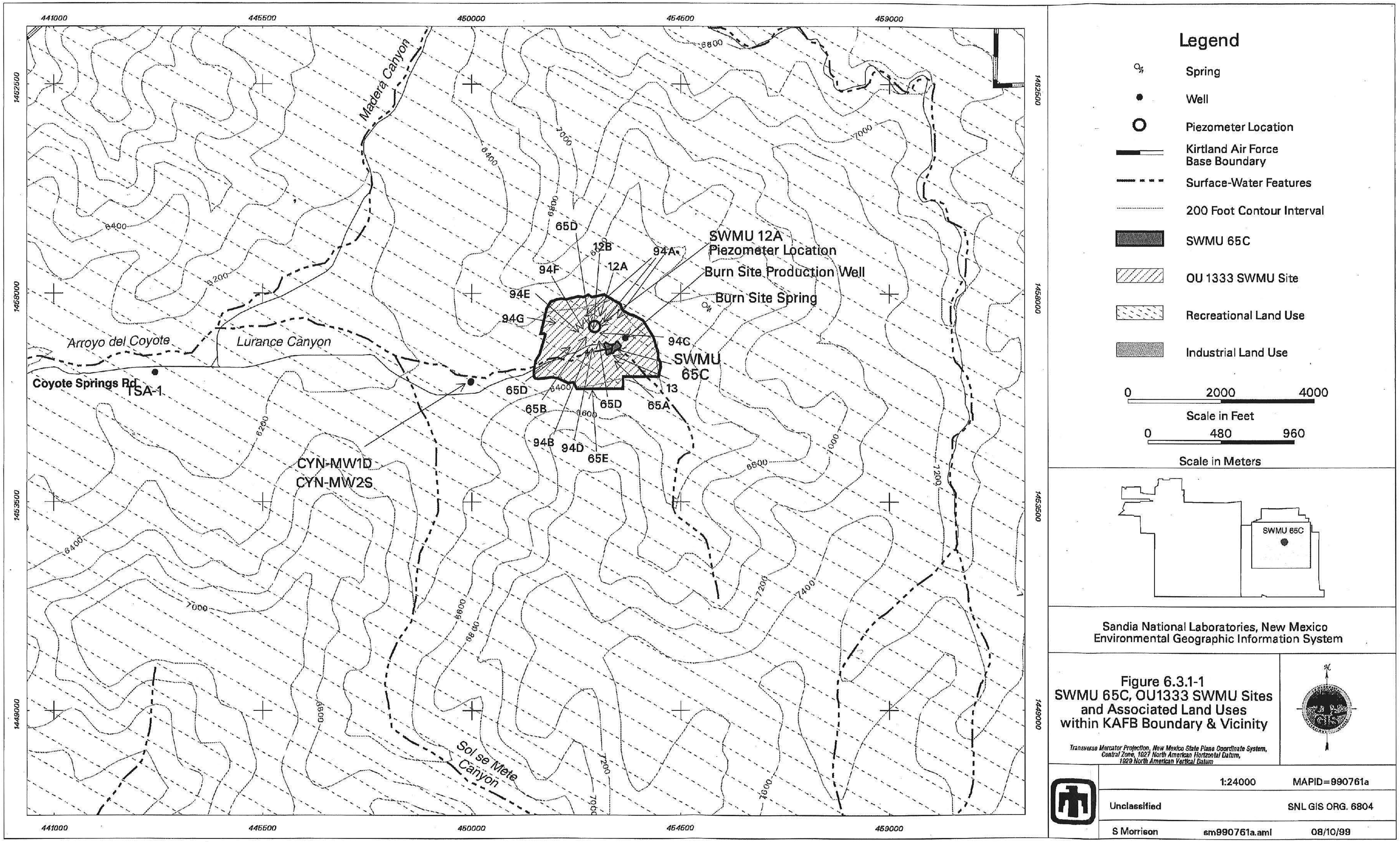

Figure 6.3.1-1
SWMU 65C, OU1333 SWMU Sites and Associated Land Uses within KAFB Boundary & Vicinity

1998 a radiological voluntary corrective measure (VCM) and confirmatory soil sampling were conducted (Investigation #3).

6.4.2 Investigation #1—CEARP

6.4.2.1 Nonsampling Data Collection

SWMU 65 was identified as the LCETS during investigations conducted under the CEARP (DOE September 1987). The CEARP Phase I report documented that both free air and cased explosive charges were detonated at the site, scattering lead and depleted uranium (DU) (DOE September 1987).

6.4.2.2 Sampling Data Collection

No sampling activities were conducted at SWMU 65C as part of the CEARP.

6.4.2.3 Data Gaps

A lack of information prevented calculating of Hazardous Ranking System and Modified Hazard Ranking System migration mode scores. SWMU 65 was not investigated as part of the RCRA Facility Assessment (EPA April 1987).

6.4.2.4 Results and Conclusions

The CERCLA finding under the CEARP was uncertain for Federal Facility Site Discovery and Identification Findings, preliminary assessment, and preliminary site inspection.

6.4.3 Investigation #2—SNL/NM Environmental Restoration Preliminary Investigations

6.4.3.1 Nonsampling Data Collection

This section describes the nonsampling data collected at SWMU 65C.

6.4.3.1.1 Background Review

A background review was conducted to collect available and relevant information regarding SWMU 65C. Background information sources included interviews with SNL/NM staff and contractors familiar with site operational history and existing historical site records and reports. The study was completely documented and has provided traceable references that sustain the integrity of the NFA proposal. Table 6.4.3-1 lists the information sources that were used to assist in evaluating SWMU 65C.

Table 6.4.3-1
Summary of Background Information Review for SWMU 65C

Information Source	Reference
Technical test reports and project log books	• Littrel February 1969 • Clark December 1970 • Foy April 1971 • Stravasnik September 1972 • Walkington April 1973 • Kurowski January 1979 • Moore and Luna February 1982 • Church March 1982 • Luna June 1983 • SNL/NM August 1986
Engineering drawings	• SNL/NM August 1962 • SNL/NM August 1966
Site inspections (field notes, aerial photograph review, site photographs, radiological, UXO/HE, biological, and cultural resource surveys)	• Gaither [Date unk] • Luna October 1985 • Havlena August 1991 • Gaither October 1992 • Oldewage May 1993 • Karas June 1993 • Oldewage December 1993a • Oldewage December 1993b • Oldewage February 1994 • SNL/NM August 1994 • Young September 1994 • Freshour March 1998 • Freshour May 1998
Employee interviews, 19 interviews with 17 facility personnel (current and retired)	• Martz September 1985 • Martz November 1985 • Gaither et al. May 1993 • Young et al. February 1994 • Brouillard June 1994 • Larson August 1994 • Larson and Palmieri August 1994a • Larson and Palmieri August 1994b • Larson and Palmieri August 1994c • Larson and Palmieri October 1994 • 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 December 1994e

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

6.4.3.1.2 UXO/HE Survey

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

6.4.3.1.3 Radiological Survey(s)

SWMU 65 is classified as a radioactive material management area (SNL/NM November 1994). On April 30 and May 4, 1993, the SNL/NM Radiation Protection Office personnel conducted surveys of several sections of road in the Coyote Canyon area. The survey consisted of driving on the roads and performing periodic contamination surveys of the vehicle and taking samples of air from behind the vehicle as it was moving. No contamination was detected on the vehicle using direct scan swipes, 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 Phase I surface gamma radiation survey of SWMU 65 in conjunction with SWMUs 12, 13, and 94 (RUST Geotech Inc. December 1994). All anomalies found during the survey were identified as either point or area sources. Any anomalies occurring within the active, graded portion (SWMU 65D) of the LCBS were designated "94E." However, all anomalies are associated with the LCETS open burning/detonation activities and were slated for a VCM (see Section 6.4.4.2.1). At the time of initial radiological surveys, the five SWMU 65 subunits had not been defined.

A gamma scan survey was performed at 6-foot centers (100-percent coverage) over the surface of the graded portion of the site (SWMU 65D); the remainder of the designated area (SWMU 65E) was surveyed at 10-foot centers (70-percent coverage). Sixty-seven point sources and thirteen area sources of gamma activity 30 percent or greater than the natural background were identified during the survey (SNL/NM September 1997a). No anomalies were found in SWMU 65C (Figure 6.4.3-1). The fragments were found throughout the site but primarily in the hill slopes comprising SWMU 65E. Where fragments were not visible, the response of the radiological survey instruments suggests that the anomalous soil point sources in SWMU 65D were the result of buried DU fragments. These soil area sources were located exclusively in SWMU 65D. The potentially buried DU fragments and soil area sources were further investigated and removed during the subsequent VCM in March 1995 and May, June, and October 1996 (Section 6.4.4.2.1).

In December 1993 (Oldewage December 1993a, December 1993b) and January 1994 (Oldewage February 1994), the SNL/NM RPO personnel conducted followup surveys of the anomalies found by RUST Geotech Inc. The surveys consisted of direct beta/gamma contamination measurements using a Geiger-Mueller pancake probe (Oldewage December 1993a, February 1994). Many of the anomalies had significant radioactivity. However, none of the swipe surveys indicated removable radioactivity above the limits presented in the Radcon Manual, Table 2-2 (1,000 disintegrations per minute [dpm]/100 square centimeters [cm^2] alpha, and 1,000 dpm/100 cm^2 beta/gamma) (Oldewage December 1993b, February 1994). No

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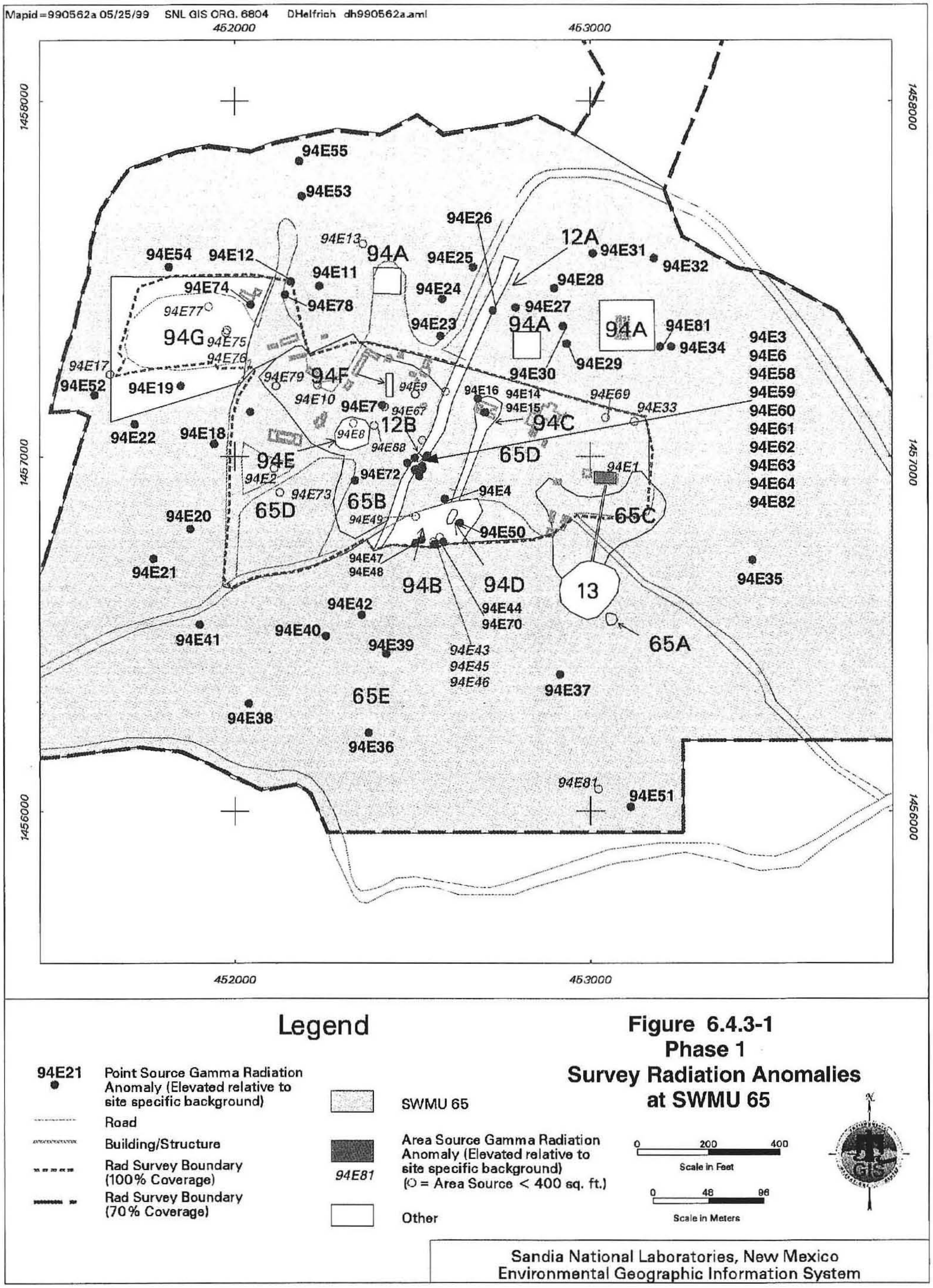

Figure 6.4.3-1
Phase 1
Survey Radiation Anomalies at SWMU 65

anomalies were measured at dose rates above the limit for posting a radiation area (5 millirems [mrem]/hour at 1 foot) (Oldewage December 1993b, February 1994). Therefore, immediate radiological anomaly removal was unnecessary to protect the site workers. All radiological anomalies were scheduled for removal during the subsequent VCM in March 1995 (Section 6.4.4.2.1). No radiological anomalies were located within the boundaries of SWMU 65C.

6.4.3.1.4 Cultural-Resources Survey

A cultural-resources survey of SWMU 65 was conducted as part of the assessment of the Burn Site. Seven cultural resources sites were identified within the boundary of SWMU 65E (Hoagland and Dello-Russo February 1995). As a mitigation measure, all VCM and sampling activities were conducted at least 100 feet away from all cultural-resources boundaries. A U.S. Forest Service archaeologist approved all VCM and sampling locations prior to activity initiation.

6.4.3.1.5 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. Although the site is disturbed, it is surrounded by undisturbed riparian woodland and piñon-juniper woodland vegetation. Searches for small cacti (gramma grass and Wright's pincushion cacti) were not conducted during this survey because the elevation of the site and the potential for cold air drainage in this upper reach of the Lurance Canyon render the presence of these species unlikely (IT February 1995).

6.4.3.1.6 Geophysical Survey(s)

In 1994 surface and borehole geophysical investigations were conducted at two locations in the OU 1333 area to determine the depth of bedrock. Test Location 1 was on the eastern edge of SWMU 65E. Test Location 2 was farther downgradient in the Lurance Canyon near the Sol se Mete Canyon. The seismic results from Test Location 1 suggested that alluvial thickness was between 60 and 80 feet (Bay Geophysical Associates, Inc., October 1994). The thickness of the alluvium in this area is known to range from between 58 feet in the boring for 12AUP01 and 74 feet at the Burn Site Well location.

6.4.3.2 Sampling Data Collection

In July 1995 SWMU 65C was investigated as part of a sitewide scoping sampling program. The purpose of this effort was to obtain preliminary analytical data to support the Environmental Restoration (ER) Project site ranking and prioritization. Three borehole locations were selected within the boundary of SWMU 65C. A surface sample (at 0 to 6 inches) and a subsurface sample (at 10 feet bgs) were collected from each borehole. The SNL/NM ER Chemistry Laboratory analyzed the environmental samples for RCRA metals (plus beryllium) using modified U.S. Environmental Protection Agency (EPA) Method 6010 (EPA November 1986) and for HE using high-performance liquid chromatography.

6.4.3.3 *Data Gaps*

Information gathered from process knowledge, from a review of historical site files, and from personal interviews aided in identifying the most likely COCs at SWMU 65C 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.

6.4.3.4 *Results and Conclusions*

Only barium and lead were detected in the soil samples. Barium concentrations were below the background limit of 246 milligrams (mg)/kilogram (kg). Lead concentrations were below the background limit of 18.9 mg/kg. Arsenic, cadmium, chromium, mercury, selenium, and silver were not detected; however, the method detection limits (MDL) ranged from 0.2 (mercury) to 50 mg/kg (arsenic and selenium). No HE compounds were detected in any of the soil samples at MDLs ranging from 150 to 750 micrograms (μg)/kg. No duplicate samples were analyzed.

6.4.4 Investigation #3—SNL/NM ER VCM and Confirmatory Sampling

6.4.4.1 *Nonsampling Data Collection*

No nonsampling data collection activities were associated with Investigation #3 of SWMU 65C.

6.4.4.2 *Sampling Data Collection*

This section discusses the radiological VCM, site-specific background sampling activities, and confirmatory sampling activities at SWMU 65C.

6.4.4.2.1 *VCM Activities*

VCM activities were conducted during March 1995 and May, June, and October 1996. Resurveying (scanning) was not performed at these sites. Point sources and small area sources were removed in March 1995. Larger area sources were remediated in May, June, and October 1996. No radiological anomalies were located within the boundaries of SWMU 65C.

Cleanup activities included the following:

- Radiation scanning to verify anomaly location removing fragment and/or soil until readings were less than 1.3 times site-specific background levels
- Postcleanup (verification) soil sampling for gamma spectroscopy analysis.

During the initial cleanup, 52 point sources and 4 small area sources were removed. Excavation of two closely spaced sources (94E14 and 94E15) showed them to be linked to one large area source. This area source and nine other large area sources were removed during subsequent cleanup activities. Cleanup was initiated on one area source (94E63) but was discontinued because the lateral and vertical extent of elevated radiation exceeded the capabilities of manual cleanup procedures. A backhoe was used to remediate this area source and the task was completed in October 1996. Figure 6.4.4-1 shows VCM verification sampling locations (postcleanup).

Two new sources were detected in the graded portion of the site (SWMU 65D) during the initial cleanup and were removed at that time. These gamma anomalies were at a depth beyond the detection capabilities of the gamma scintillometers during the initial survey and had become exposed over time from weathering events. Cleanup was completed on all sources and no additional point or area sources were identified during this VCM. However, the majority of SWMU 65E was surveyed at only 70-percent coverage, and additional anomalies could remain. Radiological sources are not regulated under the RCRA HSWA permit.

After radiologically contaminated soils were removed, 21 postcleanup (verification) samples were collected from areas that had exhibited the highest residual gamma radiation readings detected during the Phase I radiological survey. Gamma spectroscopy analysis was performed on these samples to characterize the residual radioactivity remaining in the soil. The radiological COC was DU (uranium-238, uranium-235, and uranium-234). The postcleanup (verification) samples collected at the site are summarized as follows:

Point Source Sample Number			Area Source Sample Number		
94E25SS	94E33SS	94E34SS	94E7SS	94E8SS	94E9SS
94E35SS	94E36SS	94E48SS	94E10SS	94E49SS	94E57SS
94E58SS	94E63SS[a]	94E63SS[a]	94E67SS	94E68SS	94E69SS
94E63ASS	94E63MSS	94E63NSS			
94E63OSS	94E63PSS	94E63PSD[b]			
94E70SS	94E73SS				

[a]Anomaly location sampled on two separate dates.
[b]Sample duplicate.

All point and area sources of gamma activity that were 30 percent of or greater than the natural background were removed from the site with the exception of one area source associated with the large open burn pool (Figure 6.4.4-2), a test structure associated with the SWMU 94 LCBS. This source was not removed because it is contained within the entire concrete structure and will be addressed during decontamination and decommissioning activities. Further radiological characterization is planned for the graded portion (SWMU 65D) at the LCETS. The "Final Report, Survey and Removal of Radioactive Source Contamination at Environmental Restoration Sites, Sandia National Laboratories/New Mexico" summarizes the gamma spectroscopy sample verification data (SNL/NM September 1997a).

The cleanup activities produced soil, metals fragments, and personal protective equipment (PPE) wastes. All waste was containerized in either 30- or 55-gallon drums. A total of 202 waste drums were generated during cleanup activities: 198 soil drums, 1 metals fragments drum, and 3 PPE drums. Waste consolidation was performed to minimize the number of drums produced for each waste stream. SNL/NM Department 7577 (Waste Operations), which packaged and secured waste drums for transfer to Envirocare of Utah, handled the disposal of regulated VCM waste. Nonregulated waste was disposed of using standard SNL/NM-approved waste disposal methods.

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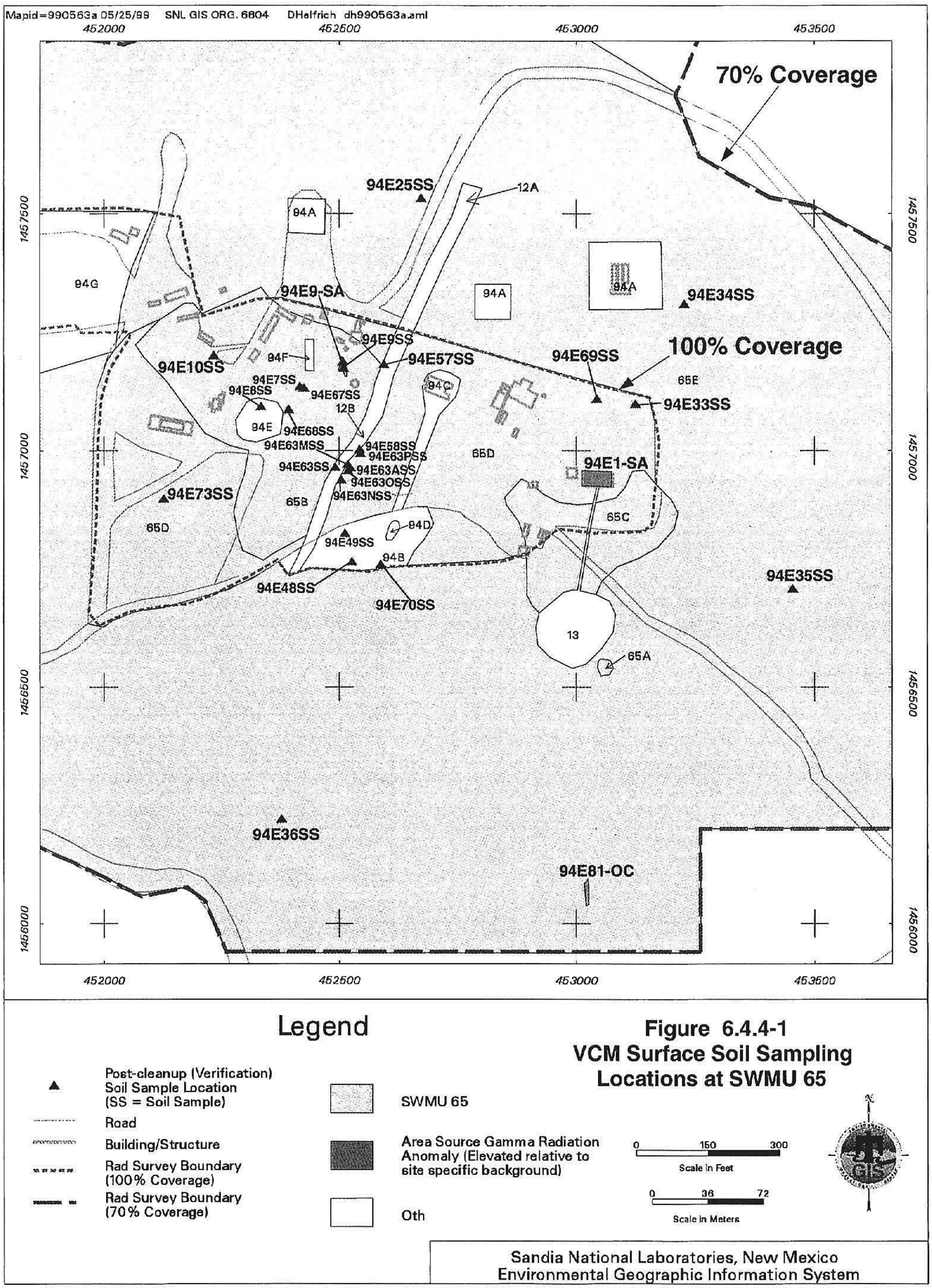

Figure 6.4.4-1
VCM Surface Soil Sampling Locations at SWMU 65

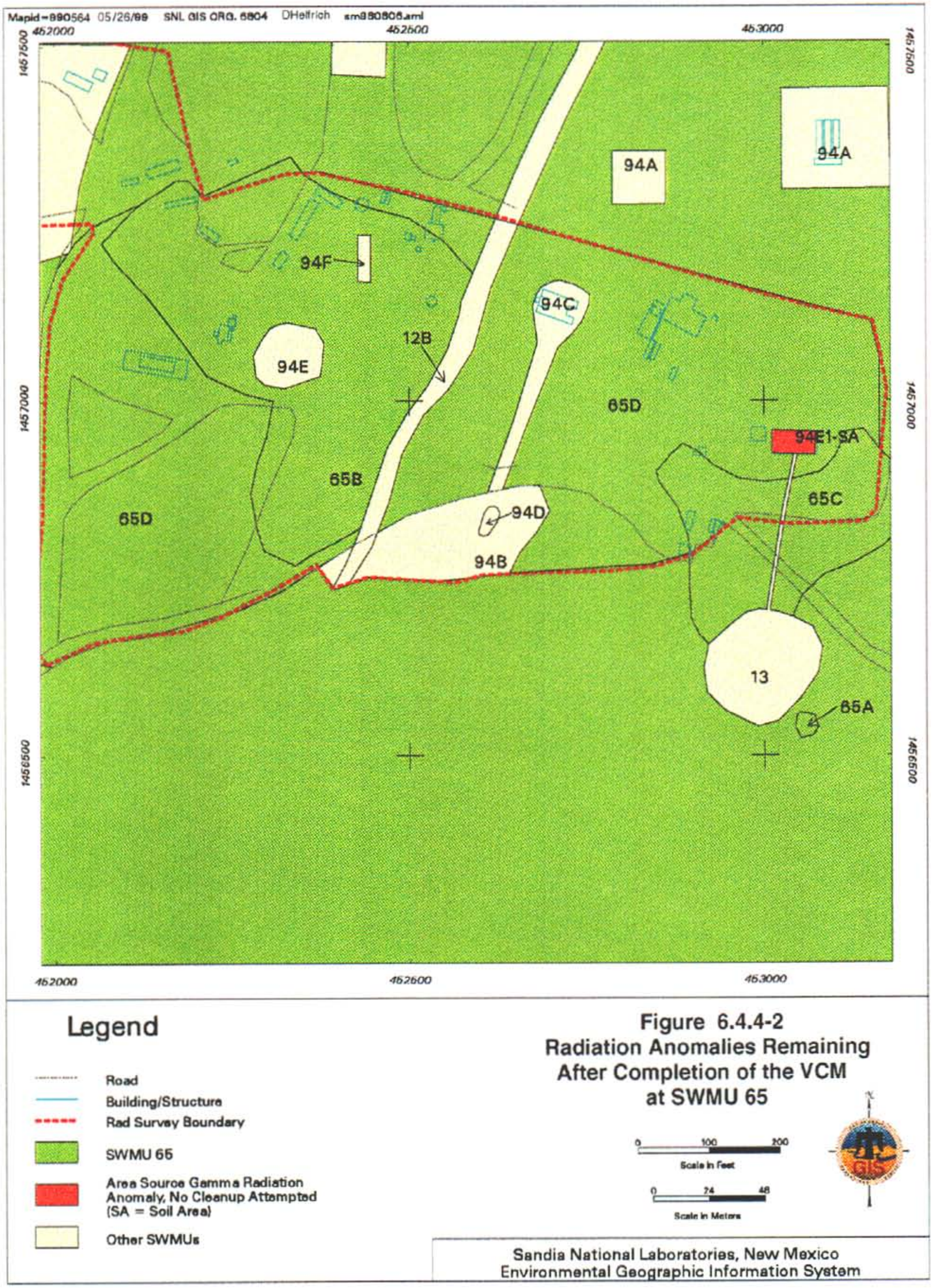

Figure 6.4.4-2
Radiation Anomalies Remaining After Completion of the VCM at SWMU 65

6.4.4.2.2 Site-Specific Background Sampling

SNL/NM conducted background soil and arroyo sediment sampling at the LCETS in June 1996 to establish site-specific background concentrations and activities for metals and radionuclides, respectively. The background sampling activities were performed in accordance with the rationale and procedures described in the OU 1333 RFI Work Plan (SNL/NM September 1995), as reviewed by the NMED. In addition to the analyses specified in the OU 1333 RFI Work Plan, SNL/NM analyzed the samples for isotopic thorium, uranium, and strontium, and gross alpha/gross beta activity. The purpose of the additional analyses was to assess the viability of using gross alpha/gross beta analyses as a low-cost screening tool for future environmental assessment activities by comparing results to more accurate isotopic analysis results. Based upon the Request for Supplemental Information (RSI) (Dinwiddie August 1997, SNL/NM December 1997), additional background soil samples were collected in June 1998 and analyzed for gross alpha/gross beta. SNL/NM chain-of-custody and sample documentation procedures were followed for all samples collected. Figure 6.4.4-3 shows the background soil and arroyo sediment sample locations associated with SWMU 65E, which encompasses SWMU 65C.

In June 1996 surface (at 0 to 0.5 foot bgs) and near-surface (at 0.5 to 1.0 foot bgs) background soil and arroyo sediment samples were collected outside the boundary of SWMU 65E. Five background soil sample locations and six background arroyo sediment sample locations were specified in the OU 1333 Work Plan. In June 1998 additional soil samples (from 0 to 0.5 foot bgs) were collected at 15 locations outside the boundary of SWMU 65E for gross alpha/gross beta analyses. These 15 background soil sample locations were approved by the NMED. Quality assurance (QA)/quality control (QC) samples that were collected include one duplicate soil sample and one duplicate arroyo sediment sample.

The background soil and arroyo sediment samples collected in June 1996 were analyzed off site for RCRA metals plus beryllium, isotopic thorium, uranium, and strontium, and gross alpha/gross beta. The samples collected in June 1996 were also analyzed on site for radionuclides using gamma spectroscopy. Lockheed Analytical Services of Las Vegas, Nevada, analyzed the samples for RCRA metals plus beryllium using EPA Method 6010/7000 (EPA November 1986); for isotopic thorium, uranium, and strontium using alpha spectroscopy and proportional gas counter; and for gross alpha/gross beta using EPA Method 900.0 (EPA November 1986). SNL/NM Department 7713, RPSD Laboratory, analyzed the samples on site for radionuclides using gamma spectroscopy. The background soil samples collected in June 1998 were analyzed off site for gross alpha/gross beta. Core Laboratories, Inc., of Casper, Wyoming, analyzed these samples for gross alpha/gross beta using EPA Method 900.0 (EPA November 1986).

Analytical results for the metals analyses performed on the background soil and arroyo sediment samples that had been collected in June 1996 were included in the formulation of Canyons Area background metals concentrations developed in response to the NMED's RSI to SNL/NM and KAFB for background concentrations of COCs (Zamorski December 1997). Analytical results for the gross alpha/gross beta analyses performed on the background soil samples that had been collected in June 1998 were included in formulating preliminary Canyons Area background gross alpha/gross beta activities developed by the SNL/NM ER Program (Tharp July 1998). Annex 6-B and Annex 6-C respectively present summaries of the metals, radionuclides, isotopic thorium, uranium, and strontium, and gross alpha/gross beta results for the site-specific background soil and arroyo sediment samples collected near SWMU 65C.

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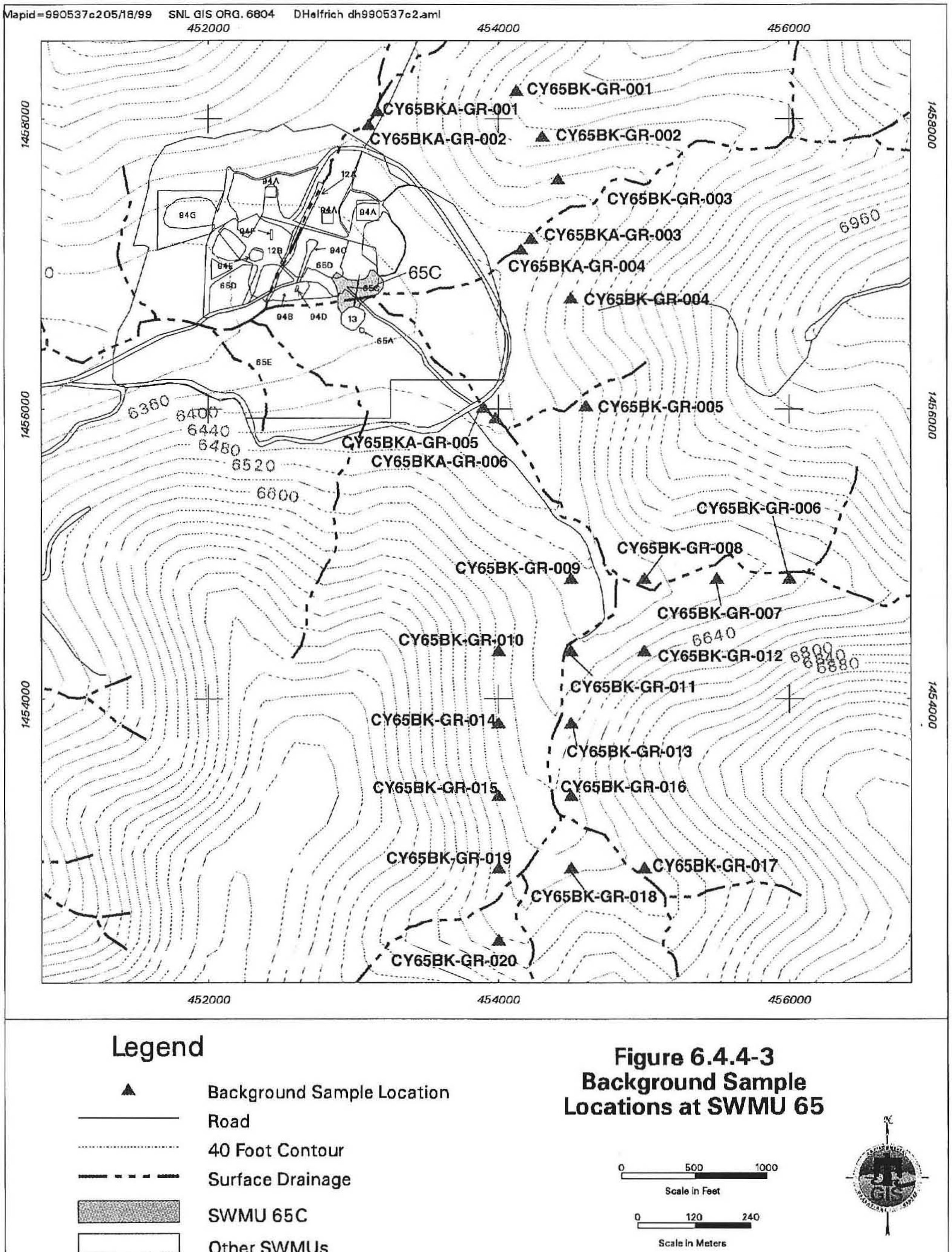

Figure 6.4.4-3
Background Sample Locations at SWMU 65

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

6.4.4.2.3 *Confirmatory Sampling*

In April 1998 SNL/NM conducted confirmatory soil sampling at SWMU 65C in order to determine whether potential COCs were present at levels exceeding background limits at the site and/or were at sufficient levels to pose a risk to human health or the environment. All sampling activities were performed in accordance with the rationale and procedures described in the OU 1333 RFI Work Plan (SNL/NM September 1995), as reviewed by the NMED, and the Field Implementation Plans (FIP) addendum to the Work Plan (SNL/NM March 1998, January 1999). SNL/NM chain-of-custody and sample documentation procedures were followed for all samples collected. Figure 6.4.4-4 shows the confirmatory sample locations associated with SWMU 65C.

In April 1998 surface (at 0 to 0.5 foot bgs) and near-surface to subsurface (at 0.5 to 14.5 feet bgs) soil samples were collected at SWMU 65C from 10 random grid and judgmental borehole locations within a grid pattern. The OU 1333 RFI Work Plan originally proposed three boreholes but the number was increased to ten in response to the NMED's RSI comments. SWMU 65C was gridded into approximate 50- by 50-foot cells that encompasses the entire site. An off-site laboratory error prevented analysis of the samples from borehole Location 1000, 325 and samples were re-collected in February 1999. A total of 40 environmental samples were collected from the ten locations. QA/QC samples included two equipment blanks. Because of poor soil recovery in the boreholes, no duplicate samples were collected.

All soil samples collected in April 1998 were analyzed off site for RCRA metals plus beryllium and for HE, volatile organic compounds (VOC), and semivolatile organic compounds (SVOC). Soil samples collected in February 1999 were analyzed off site for RCRA metals plus beryllium and for HE and SVOCs. Approximately 35 percent of the samples were also analyzed for radionuclides using gamma spectroscopy analysis and for gross alpha/gross beta. Core Laboratories, Inc., of Denver Colorado, analyzed the samples collected in April 1998, and General Engineering Laboratories of Charleston South Carolina, analyzed the samples collected in February 1999. The samples were analyzed for RCRA metals plus beryllium using EPA Method 6010/7000 (EPA November 1986), for HE using EPA Method 8330 (EPA November 1986), for VOCs using EPA Method 8260 (EPA November 1986), for SVOCs using EPA Method 8270 (EPA November 1986), and for gross alpha/gross beta using EPA Method 900.0 (EPA November 1986). SNL/NM Department 7713 (RPSD Laboratory) analyzed the samples on site for radionuclides using gamma spectroscopy.

6.4.4.3 *Data Gaps*

Analytical data from confirmatory sampling are sufficient to characterize the nature and extent of releases of COCs at the site. There are no further data gaps regarding characterization of SWMU 65C.

6.4.4.4 *Results and Conclusions*

In April 1998 and January 1999, representative surface, near-surface, and subsurface soil samples were collected from 10 borehole locations in SWMU 65C in conformance with the RFI Work Plan (SNL/NM September 1995) reviewed by NMED and the FIPs (SNL/NM March 1998, January 1999). Tables 6.4.4-1, 6.4.4-2, 6.4.4-3, 6.4.4-4, and 6.4.4-5 summarize the analytical results for metals, VOCs, SVOCs, and radionuclides (i.e., gamma spectroscopy and gross alpha/gross beta) for all the confirmatory soil samples from SWMU 65C. Annex 6-D contains complete results for the gamma spectroscopy analyses. Tables 6.4.4-6, 6.4.4-7, and 6.4.4-8

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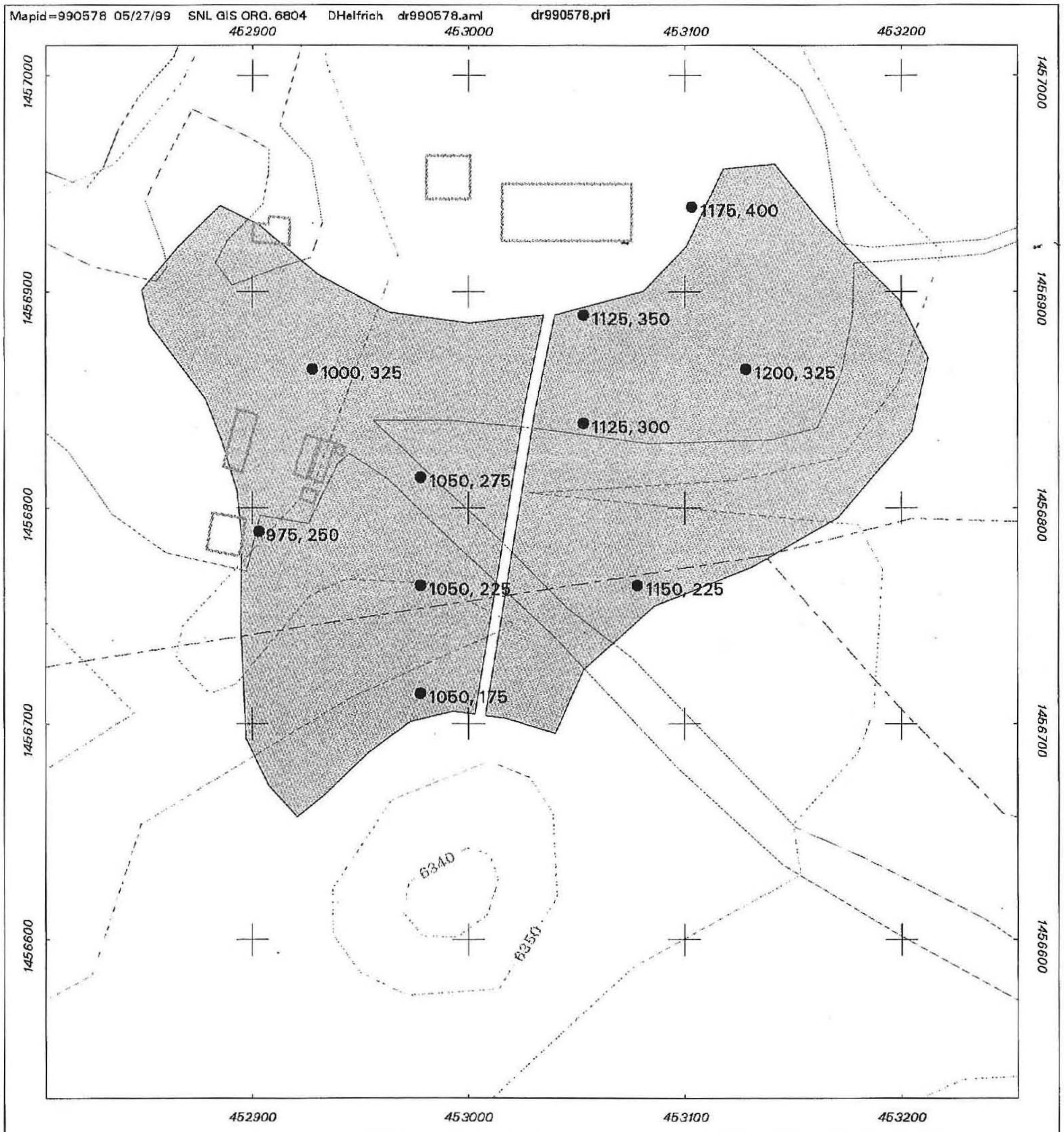

Legend

- Sample Borehole Location
- Road
- Surface Drainage
- 10 Foot Contour
- Building/Structure
- SWMU 65C

Figure 6.4.4-4
Confirmatory Sample Locations at SWMU65C

0 37.5 75
Scale in Feet

0 9 18
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Table 6.4.4-1
Summary of SWMU 65C Confirmatory Soil Sampling Metals Analytical Results, April 1998 and February 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
600213	CY65C-BH-975,350-1-2.5-SS	1–2.5	2.64	141	0.712	ND (0.245)	11.7	3.36	0.0252 J	0.117 J	ND (0.291)
600213	CY65C-BH-975,350-2.5-3-S	2.5–3	3.16	171	0.764	ND (0.245)	13.3	7.82	0.0146 J	0.143 J	ND (0.291)
601634	CY65C-BH-1000,325-1-1.51SS	1–1.5	2.78	135	0.435 J	0.116 J	10.1	8.36	0.00502 J	0.537	0.346 J
601634	CY65C-BH-1000,325-3.5-4-S	3.5–4	2.93	151	0.501	0.121 J	12.8	6.48	0.00892 J	0.447 J	0.359 J
601634	CY65C-BH-1000,325-7-7.5-S	7–7.5	3.08	156	0.493	0.0988 J	11.7	7.34	ND (0.00225)	0.442 J	0.056 J
601634	CY65C-BH-1000,325-13.5-14.5-S	13.5–14.5	2.46	93.8	0.307 J	0.209 J	8.89	5.01	0.0127 J	0.317 J	0.330 J
600213	CY65C-BH-1050,175-0.5-2.5-DU	0–0.5	2.14	117	0.512	ND (0.245)	8.41	4.67	0.0138 J	ND (0.0891)	ND (0.291)
600213	CY65C-BH-1050,175-7.5-9.5-DU	7.5–9.5	2.96	191	0.925	ND (0.245)	14.2	6.19	0.0258 J	ND (0.0891)	ND (0.291)
600213	CY65C-BH-1050,175-3-4-DU	3.0–4	3.02	199	0.749	ND (0.245)	12.2	5.66	0.0166 J	ND (0.0891)	ND (0.291)
600213	CY65C-BH-975,350-5-7-DU	5.0–7.0	2.69	175	0.774	ND (0.245)	13.2	4.42	0.0108 J	ND (0.0891)	ND (0.291)
600213	CY65C-BH-975,350-8-13-DU	8.0–13	2.32	136	0.533	ND (0.245)	10.4	5.12	0.00994 J	ND (0.0891)	ND (0.291)
600213	CY65C-BH-975,350-2.5-3-DU	2.5–3	2.63	161	0.743	ND (0.245)	12.3	4.05	0.0468 J	ND (0.0891)	ND (0.291)
600213	CY65C-BH-975,350-1-2.5-DU	1–2.5	2.25	182	0.641	ND (0.245)	11.4	5.24	0.0131 J	ND (0.0891)	ND (0.291)
600213	CY65C-BH-1050,175-12.5-14.5-DU	12.5–14.5	1.92	175	0.897	ND (0.245)	12.9	5.54	0.0131 J	ND (0.0891)	ND (0.291)
600214	CY65C-BH-1050,225-0.5-1-MS	0.5–1	2.51	121	0.318 J	0.491 J	6.27	8.8	0.0158 J	ND (0.0891)	ND (0.291)
600214	CY65C-BH-1050,225-4-4.5-MS	4–4.5	2.51	86.9	0.192 J	ND (0.245)	4.74	4.41	0.0215 J	ND (0.0891)	ND (0.291)
600214	CY65C-BH-1050,225-9.5-10-S	9.5–10	3.34	174	0.602	ND (0.245)	9.5	8.99	0.0339 J	0.191 J	ND (0.291)
600214	CY65C-BH-1050,225-14-14.5-MS	14–14.5	2.92	164	0.39 J	ND (0.245)	8.94	5.8	0.0269 J	ND (0.0891)	ND (0.291)
600214	CY65C-BH-1075,300-3.5-4-SS	3.5–4	2.26	169	0.417 J	ND (0.245)	8.91	5.19	0.0108 J	0.136 J	ND (0.291)
600214	CY65C-BH-1075,300-6-6.5-S	6–6.5	2.49	163	0.534	ND (0.245)	10.3	8.09	0.0244 J	ND (0.0891)	ND (0.291)
600214	CY65C-BH-1075,300-11-12-S	11.0–12	2.04	117	0.364 J	ND (0.245)	7.57	4.57	0.0094 J	0.126 J	ND (0.291)
600214	CY65C-BH-1075,300-13-14-S	13.0–14	3.46	120	0.441 J	ND (0.245)	6.16	4.15	ND (0.0078)	ND (0.0891)	ND (0.291)
600214	CY65C-BH-1125,300-0-0.5-MS	0–0.5	2.24	86.8	0.191 J	ND (0.245)	6.18	3.66	ND (0.0078)	ND (0.0891)	ND (0.291)
600214	CY65C-BH-1125,300-4-4.5-MS	4–4.5	2.26	97.6	0.228 J	ND (0.245)	5.37	2.73	ND (0.0078)	ND (0.0891)	ND (0.291)
600214	CY65C-BH-1125,300-11-12-MS	11.0–12	1.7	139	0.502	ND (0.245)	8.5	4.94	ND (0.0078)	ND (0.0891)	ND (0.291)
600214	CY65C-BH-1125,300-12-14-MS	12.0–14	1.32	91.3	0.26 J	0.49 J	17.8	3.2	ND (0.0078)	ND (0.0891)	ND (0.291)
600215	CY65C-BH-1125,350-0.5-1-SS	0.5–1	2.07	153	0.42 J	0.402 J	9.31	4.1	0.0148 J	ND (0.0891)	ND (0.291)
600215	CY65C-BH-1125,350-5.5-6-S	5.5–6	1.26	147	0.411 J	0.318 J	7.43	4.24	0.009 J	ND (0.0891)	ND (0.291)
600215	CY65C-BH-1125,350-10.5-11-S	10.5–11	1.72	344	0.208 J	ND (0.245)	8.11	2.58	ND (0.0078)	ND (0.0891)	0.364 J
600215	CY65C-BH-1125,350-13-13.5-S	13–13.5	1.5	117	0.257 J	0.619	9.81	2.96	0.0139 J	ND (0.0891)	ND (0.291)
600215	CY65C-BH-1150,225-0-0.5-SS	0–0.5	1.92	107	0.296 J	ND (0.245)	6.96	4.67	0.0303 J	ND (0.0891)	ND (0.291)
600215	CY65C-BH-1150,225-4-4.5-S	4–4.5	2.91	159	0.472 J	0.262 J	9.43	6.95	0.0245 J	ND (0.0891)	ND (0.291)
600215	CY65C-BH-1200,325-0.5-1-MS	0.5–1	1.63	60.1	0.229 J	ND (0.245)	7.05	3.24	ND (0.0078)	ND (0.0891)	ND (0.291)
600215	CY65C-BH-1200,325-5.5-6-MS	5.5–6	2.24	142	0.493 J	ND (0.245)	8.63	6.98	0.0694 J	ND (0.0891)	ND (0.291)
600215	CY65C-BH-1200,325-7.5-8-MS	7.5–8	1.51	150	0.471 J	ND (0.245)	11.4	7.1	ND (0.0078)	ND (0.0891)	ND (0.291)
600215	CY65C-BH-1175,400-0-0.5-SS	0–0.5	1.96	125	0.519	ND (0.245)	6.34	6.64	ND (0.0078)	ND (0.0891)	ND (0.291)
600215	CY65C-BH-1175,400-5-6-S	5.0–6	3.31	89.8	0.468 J	ND (0.245)	8.35	6.36	ND (0.0078)	ND (0.0891)	ND (0.291)
600215	CY65C-BH-1175,400-11-11.5-S	11–11.5	5.33	105	0.528	ND (0.245)	9.8	5.77	0.0227 J	ND (0.0891)	ND (0.291)

Refer to footnotes at end of table.

Table 6.4.4-1 (Concluded)
Summary of SWMU 65C Confirmatory Soil Sampling Metals Analytical Results, April 1998 and February 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
600215	CY65C-BH-1150,225-9-9.5-S	9–9.5	1.92	98.6	0.193 J	ND (0.245)	6.32	3.21	0.0083 J	ND (0.0891)	ND (0.291)
600215	CY65C-BH-1150,225-14-14.5-S	14–14.5	1.59	107	0.213 J	ND (0.245)	8.44	4.27	0.0433 J	ND (0.0891)	ND (0.291)
Background Soil Concentrations, Canyon Area			9.8	246	0.75	0.64	18.8	18.9	0.055	3	<0.5
Quality Assurance/Quality Control Sample (µg/L)											
600216	CY65C-GR-01-EB	NA	ND (0.00083)	0.00206 J	ND (0.00181)	ND (0.00245)	0.00781 J	ND (0.00093)	ND (0.00005)	ND (0.00089)	ND (0.00291)
601634	CY65C-BH-1000,325-EB	NA	ND (0.00451)	0.00269 J	ND (0.00026)	ND (0.00044)	ND (0.00056)	ND (0.00159)	ND (0.000035)	ND (0.00271)	ND (0.00073)

Note: **Bold** indicates values that exceed background soil concentrations.

[a]EPA November 1986.

[b]Analysis request/chain of custody.

BH = Borehole.
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 = Estimated value (see Data Validation Report, Annex 6-E).
J ( ) = The reported value is greater than or equal to the method detection limit (MDL) but is less than the practical quantitation limit for on-site laboratory analyses or the reporting detection limit for off-site laboratory analyses, shown in parenthesis.
mg/kg = Milligram(s) per kilogram.
MS = Matrix spike.
ND ( ) = Not detected above the MDL, shown in parenthesis.
S = Subsurface.
SS = Surface soil sampling.
SWMU = Solid Waste Management Unit.

Table 6.4.4-2
Summary of SWMU 65C Confirmatory Soil Sampling VOC Analytical Results, April 1998
(Off-site Laboratory)

Sample Attributes			VOCs (EPA Method 8260[a]) (µg/kg)		
Record Number[b]	ER Sample ID (Figure 6.4.4-4)	Sample Depth (ft)	1,2-Dibromo-3-chloropropane	Methylene Chloride	Toluene
600213	CY65C-BH-975,350-0-0.5-SS	0–0.5	ND (0.84)	ND (0.48)	**1.7 J (5)**
600213	CY65C-BH-975,350-3.5-4-S	3.5–4	ND (0.84)	ND (0.48)	**1.4 J (5)**
600213	CY65C-BH-1000,325-0-0.5-SS	0–0.5	ND (0.84)	ND (0.48)	ND (0.66)
600213	CY65C-BH-1000,325-4-4.5-S	4–4.5	ND (0.84)	ND (0.48)	ND (0.66)
600213	CY65C-BH-1050,175-0-0.5-SS	0–0.5	ND (0.84)	ND (0.48)	ND (0.66)
600213	CY65C-BH-1050,175-2.5-3-S	2.5–3	ND (0.84)	ND (0.48)	ND (0.66)
600213	CY65C-BH-1000,325-13.5-14-S	13.5–14	ND (0.84)	ND (0.48)	ND (0.66)
600213	CY65C-BH-975,350-7-7.5-DU	7–7.5	ND (0.84)	ND (0.48)	ND (0.66)
600213	CY65C-BH-975,350-7.5-8-S	7.5–8	ND (0.84)	ND (0.48)	ND (0.66)
600213	CY65C-BH-975,350-13-13.5-DU	13–13.5	ND (0.84)	ND (0.48)	ND (0.66)
600213	CY65C-BH-975,350-0.5-1-DU	0.5–1	ND (0.84)	ND (0.48)	ND (0.66)
600213	CY65C-BH-975,350-3-3.5-DU	3–3.5	ND (0.84)	ND (0.48)	ND (0.66)
600213	CY65C-BH-1000,325-7.5-8-S	7.5–8	ND (0.84)	ND (0.48)	ND (0.66)
600213	CY65C-BH-1000,325-14.5-15-S	14.5–15	ND (0.84)	ND (0.48)	ND (0.66)
600214	CY65C-BH-1050,225-0-0.5-MS	0–0.5	ND (0.84)	**2.9 J (5)**	**3.5 J (5)**
600214	CY65C-BH-1050,225-4.5-5-MS	4.5–5	ND (0.84)	**4.1 J (5)**	ND (0.66)
600214	CY65C-BH-1075,300-0-0.5-SS	0–0.5	ND (0.84)	**4.2 J (5)**	**3.3 J (5)**
600214	CY65C-BH-1075,300-3.5-4-S	3.5–4	ND (0.84)	**3.9 J (5)**	**1.2 J (5)**
600214	CY65C-BH-1125,300-0-0.5-MS	0–0.5	ND (0.84)	**3.2 J (5)**	ND (0.66)
600214	CY65C-BH-1125,300-4.5-5-MS	4.5–5	ND (0.84)	**3.1 J (5)**	ND (0.66)
600214	CY65C-BH-1050,225-9.5-10-S	9.5–10	ND (0.84)	**2.6 J (5)**	**1.4 J (5)**
600214	CY65C-BH-1050,225-14.5-15-S	14.5–15	ND (0.84)	**2.6 J (5)**	**1.0 J (5)**
600214	CY65C-BH-1050,175-9.5-10-S	9.5–10	ND (0.84)	**1.0 J (5)**	ND (0.66)
600214	CY65C-BH-1050,175-14.5-15-S	14.4–15	ND (0.84)	**1.0 J (5)**	**3.6 J (5)**
600214	CY65C-BH-1075,300-9.5-10-S	9.5–10	ND (0.84)	**1.3 J (5)**	ND (0.66)
600214	CY65C-BH-1075,300-14.5-15-S	14.5–15	ND (0.84)	ND (0.48)	ND (0.66)
600214	CY65C-BH-1125,300-5.5-6-MS	5.5–6	ND (0.84)	ND (0.48)	ND (0.66)
600214	CY65C-BH-1125,300-14.5-15-MS	14.5–15	ND (0.84)	ND (0.48)	ND (0.66)
600215	CY65C-BH-1200,325-8-8.5-MS	8–8.5	ND (0.84)	ND (0.48)	ND (0.66)
600215	CY65C-BH-1125,350-0-0.5-SS	0–0.5	ND (0.84)	ND (0.48)	ND (0.66)
600215	CY65C-BH-1125,350-5-5.5-S	5–5.5	ND (0.84)	ND (0.48)	ND (0.66)
600215	CY65C-BH-1150,225-0-0.5-SS	0–0.5	ND (0.84)	ND (0.48)	ND (0.66)
600215	CY65C-BH-1150,225-4.5-5-S	4.5–5	ND (0.84)	ND (0.48)	ND (0.66)
600215	CY65C-BH-1200,325-0-0.5-MS	0–0.5	ND (0.84)	**4.8 J (5)**	ND (0.66)
600215	CY65C-BH-1200,325-5-5.5-MS	5–5.5	ND (0.84)	**1.4 J (5)**	ND (0.66)
600215	CY65C-BH-1175,400-10-10.5-S	10–10.5	ND (0.84)	ND (0.48)	ND (0.66)
600215	CY65C-BH-1175,400-0.5-1-SS	0.5–1	ND (0.84)	ND (0.48)	ND (0.66)
600215	CY65C-BH-1175,400-5.5-6-S	5.5–6	ND (0.84)	ND (0.48)	ND (0.66)
600215	CY65C-BH-1125,300-10-10.5-S	10–10.5	**1.9 J (5)**	**1.3 J (5)**	ND (0.66)
600215	CY65C-BH-1125,325-13.5-14-S	13.5–14	ND (0.84)	**1.1 J (5)**	ND (0.66)
600215	CY65C-BH-1150,225-9.5-10-S	9.5–10	ND (0.84)	**1.2 J (5)**	ND (0.66)

Refer to footnotes at end of table.

Table 6.4.4-2 (Concluded)
Summary of SWMU 65C Confirmatory Soil Sampling VOC Analytical Results, April 1998
(Off-site Laboratory)

Sample Attributes			VOCs (EPA Method 8260[a]) (µg/kg)		
Record Number[b]	ER Sample ID (Figure 6.4.4-4)	Sample Depth (ft)	1,2-Dibromo-3-chloropropane	Methylene Chloride	Toluene
600215	CY65C-BH-1150,225-14-14.5-S	14–14.5	ND (0.84)	**1.6 J (5)**	ND (0.66)
600216	CY65C-GR-01-EB	NA	ND (4.8)	ND (2.0)	ND (2.0)
600216	CY65C-GR-01-TB	NA	ND (4.8)	ND (2.0)	ND (2.0)

Note: **Bold** indicates detected values for VOC analytes.

[a]EPA November 1986.

[b]Analysis request/chain of custody.

BH = Borehole.
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 (MDL) but is less than the practical quantitation limit for on-site laboratory analyses or the reporting detection limit for off-site laboratory analyses, shown in parenthesis.
mg/kg = Milligram(s) per kilogram.
MS = Matrix spike.
NA = Not applicable.
ND ( ) = Not detected above the MDL, shown in parenthesis.
S = Subsurface.
SS = Surface soil sampling.
SWMU = Solid Waste Management Unit.
TB = Trip blank.
VOC = Volatile organic compound.

Table 6.4.4-3
Summary of SWMU 65C Confirmatory Soil Sampling SVOC Analytical Results, April 1998 (Off-site Laboratory)

Sample Attributes			SVOCs (EPA Method 8270[a]) (µg/kg)
Record Number[b]	ER Sample ID (Figure 6.4.4-4)	Sample Depth (ft)	Bis(2-ethylehxyl)phthalate
600213	CY65C-BH-975,350-1-2.5-SS	1–2.5	ND (0.6)
600213	CY65C-BH-975,350-2.5-3-S	2.5–3	ND (0.6)
600213	CY65C-BH-975,350-5-7-S	5–7	ND (0.6)
600213	CY65C-BH-975,350-8-13-S	8–13	ND (0.6)
600213	CY65C-BH-1000,325-1-1.5-SS	1–1.5	ND (0.6)
600213	CY65C-BH-1000,325-3.5-4-S	3.5–4	ND (0.6)
600213	CY65C-BH-1000,325-7-7.5-S	7–7.5	ND (0.6)
600213	CY65C-BH-1000,325-13.5-14-S	13.5–14	ND (0.6)
600213	CY65C-BH-1050,175-0.5-2.5-SS	0.5–2.5	ND (0.6)
600213	CY65C-BH-1050,175-3-4-S	3–4	ND (0.6)
600213	CY65C-BH-1050,175-5-9.5-S	5–9.5	ND (0.6)
600213	CY65C-BH-1050,175-12.5-14.5-S	12.5–14.5	ND (0.6)
600213	CY65C-BH-975,350-1-2.5-DU	1–2.5	ND (0.6)
600213	CY65C-BH-975,350-2.5-3-DU	2.5–3	ND (0.6)
600213	CY65C-BH-975,350-5-7-DU	5–7	ND (0.6)
600213	CY65C-BH-975,350-8-13-DU	8–13	ND (0.6)
600213	CY65C-BH-1050,175-0.5-2.5-DU	0.5–2.5	ND (0.6)
600213	CY65C-BH-1050,175-3-4-DU	3–4	**68 J (330)**
600213	CY65C-BH-1050,175-7.5-9.5-DU	5–9.5	ND (0.6)
600213	CY65C-BH-1050,175-12.5-14.5-DU	12.5–14.5	ND (0.6)
600214	CY65C-BH-1050,225-0.5-1-MS	0–0.5	ND (0.47)
600214	CY65C-BH-1050,225-4-4.5-MS	4–4.5	ND (0.47)
600214	CY65C-BH-1050,225-9.5-10-MS	9.5–10	ND (330)
600214	CY65C-BH-1050,225-14-14.5-MS	14–14.5	ND (330)
600214	CY65C-BH-1075,300-3.5-4-SS	3.5–4	ND (330)
600214	CY65C-BH-1075,300-6-6.5-S	6–6.5	ND (330)
600214	CY65C-BH-1075,300-11-12-S	11–12	ND (330)
600214	CY65C-BH-1075,300-13-14-S	13–14	ND (0.47)
600214	CY65C-BH-1125,300-0-0.5-MS	0–0.5	ND (0.47)
600214	CY65C-BH-1125,300-4-4.5-MS	4–4.5	ND (330)
600214	CY65C-BH-1125,300-12-14-MS	12–14	ND (330)
600214	CY65C-BH-1125,300-11-12-MS	11–12	ND (0.47)
600215	CY65C-BH-1125,350-0.5-1-SS	0–0.5	**43 J (330)**
600215	CY65C-BH-1125,350-5.5-6-S	5.5–6	**35 J (330)**
600215	CY65C-BH-1125,350-10.5-11-S	10.5–11	ND (0.6)
600215	CY65C-BH-1125,350-13-13.5-S	13–13.5	ND (0.6)
600215	CY65C-BH-1150,225-0-0.5-SS	0–0.5	**32 J (330)**
600215	CY65C-BH-1150,225-4-4.5-S	4–4.5	ND (0.6)
600215	CY65C-BH-1150,225-9-9.5-S	9–9.5	ND (0.6)
600215	CY65C-BH-1150,225-14-14.5-S	14–14.5	**49 J (330)**
600215	CY65C-BH-1200,325-0.5-1-MS	0.5–1	ND (0.6)

Refer to footnotes at end of table.

Table 6.4.4-3 (Concluded)
Summary of SWMU 65C Confirmatory Soil Sampling SVOC Analytical Results, April 1998
(Off-site Laboratory)

Sample Attributes			SVOCs (EPA Method 8270)[a] (µg/kg)
Record Number[b]	ER Sample ID (Figure 6.4.4-4)	Sample Depth (ft)	Bis(2-ethylehxyl)phthalate
600215	CY65C-BH-1200,325-5.5-6-MS	5.5–6	ND (0.6)
600215	CY65C-BH-1200,325-7.5-8-MS	7.5–8	ND (0.6)
600215	CY65C-BH-1175,400-0-0.5-SS	0–0.5	ND (0.6)
600215	CY65C-BH-1175,400-5.5-6-S	5.5–6	ND (0.6)
600215	CY65C-BH-1175,400-11-11.5-S	11–11.5	ND (0.6)
Quality Assurance/Quality Control Sample (µg/L)			
600216	CY65C-GR-01-EB	NA	ND (1.0)
601634	CY65C-BH-1000,325-EB	NA	ND (3.7)

Note: **Bold** indicates detected values.

[a]EPA November 1986.

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

BH = Borehole.
CY = Canyon.
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 (MDL) but is less than the practical quantitation limit, shown in parenthesis.
MS = Matrix spike.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
NA = Not applicable.
ND ( ) = Not detected above the MDL, shown in parenthesis.
S = Soil sample.
SWMU = Solid Waste Management Unit.
SVOC = Semivolatile organic compound.

Table 6.4.4-4
Summary of SWMU 65C Confirmatory Soil Sampling Gamma Spectroscopy Analytical Results, March 1998 and February 1999 (On-site Laboratory)

Sample Attributes			Activity (pCi/g)							
			Uranium-238		Thorium-232		Uranium-235		Cesium-137	
Record Number[a]	ER Sample ID (Figure 6.4.4-4)	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
600217	CY65C-GR-975,350-0-0.5-SS	0.0–0.5	ND (3.76E+00)	--	7.76E-01	3.78E-01	ND (2.75E-01)	--	5.55E-02	2.29E-02
600217	CY65C-GR-975,350-1-2.5-S	1.0–2.5	ND (3.20E+00)	--	5.46E-01	2.75E-01	ND (2.36E-01)	--	ND(3.11E-02)	--
600217	CY65C-GR-975,350-5-7-S	5.0–7.0	ND (3.49E+00)	--	7.30E-01	3.57E-01	ND (2.49E-01)	--	ND(3.35E-02)	--
600217	CY65C-GR-975,350-8-13-S	8.0–13.0	ND (3.23E+00)	--	6.67E-01	3.26E-01	ND (2.40E-01)	--	ND(3.25E-02)	--
601635	CY65C-BH-1000,325-1-1.5-SS	1–1.5	4.49E-01	4.39E-01	4.96E-01	2.84E-01	ND (1.93E-01)	--	1.43E-03	9.54E-03
601635	CY65C-BH-1000,325-3.5-4-S	3–5-4	7.41E-01	4.42E-01	6.89E-01	4.22E-01	ND (2.10E-01)	--	ND (3.82E-02)	--
601635	CY65C-BH-1000,325-7-7.5-S	7–7.5	ND (5.14E-01)	--	5.18E-01	2.91E-01	1.65E-01	1.65E-01	ND (3.29E-02)	--
601635	CY65C-BH-1000,325-13.5-14.5-S	13.5–14.5	ND (4.06E-01)	--	2.16E-01	2.07E-01	8.57E-02	1.31E-01	ND (2.55E-02)	--
600217	CY65C-GR-1075,300-0-0.5-SS	0.0–0.5	ND (3.15E+00)	--	8.40E-01	4.49E-01	ND (2.46E-01)	--	7.01E-02	3.45E-02
600217	CY65C-GR-1075,300-4-6-S	4.0–6.0	ND (2.80E+00)	--	3.78E-01	2.04E-01	ND (2.05E-01)	--	ND(2.92E-02)	--
Background Soil Concentrations, Upper Canyons[c]			2.31	NA	1.03	NA	0.16	NA	0.515	NA
Quality Assurance/Quality Control Sample (in pCi/mL)										
600217	CY65C-GR-01-EB	NA	ND (1.65E+00)	--	ND(1.53E-01)	--	ND (1.61E-01)	--	ND(2.33E-02)	--

Note: **Bold** indicates detected values.
[a]Analysis request/chain of custody.
[b]Two standard deviations about the mean detected activity.
[c]Dinwiddie September 1997.

BH = Borehole.
CY = Canyons.
EB = Equipment blank.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
NA = Not applicable.
ND = Not detected above the minimum detectable activity, shown in parenthesis.
pCi/g = Picocurie(s) per gram.
pCi/mL = Picocurie(s) per milliliter.
S = Subsurface soil sample.
SS = Surface soil sample.
SWMU = Solid Waste Management Unit.
-- = Error not calculated for nondetectable results.

Table 6.4.4-5
Summary SWMU 65C Confirmatory Soil Sampling Gross Alpha/Gross Beta
Analytical Results, April 1998 and February 1999
(Off-site laboratory)

Sample Attributes			Activity (pCi/g)			
			Gross Alpha		Gross Beta	
Record Number[a]	ER Sample ID (Figure 6.4.4-4)	Sample Depth (ft)	Result	Error[b]	Result	Error[b]
601634	CY65C-BH-1000,325-1-1.5-SS	1–1.5	16.5	4.5	26.6	3.8
601634	CY65C-BH-1000,325-3.5-4-S	3.5–4	7.87	3.5	20.4	3.4
601634	CY65C-BH-1000,325-7-7.5-S	7–7.5	**18.9**	4.5	25.9	3.5
601634	CY65C-BH-1000,325-13.5-14.5-S	13.5–14.5	11.2	3.8	21.5	3.5
600218	CY65C-GR-1050,275-0-0.5-SS	0.0–0.5	9.2	5.2	21.1	3.5
600218	CY65C-GR-1050,275-5-5.6-S	5.0–5.6	11.6	5.3	23.6	3.5
600218	CY65C-GR-1050,275-12-12.5-S	12.0–12.5	3.3	4.8	15.1	3.3
600218	CY65C-GR-1050,275-14-14.5-S	14.0–4.0	3.6	4.8	8.2	3.1
600218	CY65C-GR-1200,325-1-1.5-SS	1–1.5	3.6	4.8	10.5	3.2
600218	CY65C-GR-1200,325-6-6.5-S	6–6.5	7.3	5.0	32.5	3.8
600218	CY65C-GR-1200,325-7.5-8-S	7.5–8	**23.8**	6.0	28.1	3.6
Background Soil Concentrations, Lower Canyons[c]			18.3	NA	52.7	NA

Note: **Bold** indicates values that exceed background concentrations.
[a]Analysis request/chain of custody.
[b]Two standard deviations about the mean detected activity.
[c]Tharp July 1998.

BH = Borehole.
CY = Canyons.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.
S = Subsurface soil sample.
SS = Surface soil sample.
SWMU = Solid Waste Management Unit.

Table 6.4.4-6
Summary of HE Analysis Detection Limits
Used for SWMU 65C Confirmatory Soil Sampling, April 1998 and February 1999
(Off-site Laboratory)

Compounds	Off-Site Analyses by EPA Method 8330[a] (µg/kg)
1,3,5-trinitrobenzene	6.6–32
1,3-dinitrobenzene	4.1–16
2,4,6-trinitrotoluene	5.7–19
2,4-dinitrotoluene	6.2–17
2,6-dinitrotoluene	6.5–17
2-amino-4,6-dinitrotoluene	6.6–17
2-nitrotoluene	11–41
3-nitrotoluene	7.8–30
4-amino-2,6-dinitrotoluene	5.5–79
4-nitrotoluene	11–31
HMX	5.3–24
Nitrobenzene	5.2–9.0
Pentaerythritol tetranitrate	NA
RDX	9.7–31
Tetryl	7.5–94

[a]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
HE = High explosive(s).
HMX = 1,3,5,7-tetranitro-1,3,5,7-tetrazacyclooctane.
RDX = 1,3,5-trinitro-1,3,5-triazacyclohexane.
Tetryl = 2,4,6-trinitrophenylmethylnitramine.
µg/kg = Microgram(s) per kilogram.

Table 6.4.4-7
Summary of VOC Analytical Detection Limits
Used for SWMU 65C Confirmatory Soil Sampling, April 1998
(Off-site laboratory)

Analyte	MDL (µg/kg)
Acetone	2.2
Benzene	0.25
Bromoform	0.27
2-butanone	2.1
Carbon disulfide	2.2
Carbon tetrachloride	0.22
Chlorobenzene	0.25
Chloroethane	0.72
Chloroform	0.24
Dichlorobromomethane	0.24
1,1-dichloroethane	0.2
1,2-dichloroethane	0.23
1,1-dichloroethene	0.25
Cis-1,2-dichloroethene	0.25
Trans-1,2-dichloroethene	0.19
1,2-dichloropropane	0.23
Cis,-1,3-dichloropropene	0.25
Trans-1,3-dichloropropene	0.22
Ethylbenzene	0.23
2-hexanone	4.4
4-methyl-2-pentanone	2.9
Methyl bromide	0.67
Methyl chloride	0.43
Methylene chloride	0.25
Styrene	0.22
1,1,2,2-tetrachloroethane	0.46
Tetrachloroethene	0.23
Toluene	0.22
Trichloroethylene	0.27
1,1,1-trichloroethane	0.18
1,1,2-trichloroethane	0.24
Vinyl acetate	1.8
Vinyl chloride	0.4
Xylenes (total)	0.62

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

Table 6.4.4-8
Summary of Semivolatile Organic Compound Analytical Detection Limits
Used for SWMU 65C Confirmatory Soil Sampling, April 1998 and February 1999
(Off-Site Laboratory)

Analyte	MDL (µg/kg)
1,2,4-trichlorobenzene	0.5–10
1,2-dichlorobenzene	0.5–10
1,3-dichlorobenzene	0.5–10
1,4-dichlorobenzene	0.6–10
2,4,5-trichlorphenol	0.8–10
2,4,6-trichlorophenol	0.6–10
2,4-dichlorophenol	0.3–10
2,4-dimethylphenol	0.5–10
2,4-dinitrophenol	1.1–20
2,4-dinitrotoluene	0.7–10
2,6-dinitrotoluene	0.6–10
2-chloronaphthalene	0.7–10
2-chlorophenol	0.4–10
2-methyl-4,6-dinitrophenol	0.7–10
2-methylnaphthalene	0.5–10
2-methylphenol	0.5–10
o-nitroaniline (2)	0.6–10
2-nitrophenol	0.5–10
3,3-dichlorobenzidine	0.7–20
m-nitroaniline (3)	0.6–10
4-bromophenyl phenyl ether	0.6–10
4-chloro-3-methylphenol	0.5–10
4-chloroaniline	0.5–20
4-chlorophenyl phenyl ether	0.6–10
4-methylphenol	0.6–10
p-nitroaniline (4)	0.6–10
4-nitrophenol	0.6–10
Acenaphthene	0.6–10
Acenaphthylene	0.5–10
Anthracene	0.6–10
Benzidine	0.4–10
Benzo(a)anthracene	0.5–10
Benzo(a)pyrene	0.7–10
Benzo(b)fluoranthene	0.9–10
Benzo(g,h,i)perylene	1.6–10
Benzo(k)fluoranthene	0.8–10
Benzoic acid	0.5–50
Benzyl alcohol	0.6–10
Bis(2-chloroethoxy) methane	0.3–10
Bis(2-chloroethyl) ether	0.6–10

Refer to footnotes at end of table.

Table 6.4.4-8 (Concluded)
Summary of Semivolatile Organic Compound Analytical Detection Limits
Used for SWMU 65C Confirmatory Soil Sampling, March–April 1998
(Off-Site Laboratory)

Analyte	MDL (µg/kg)
Bis(2-chloroisopropyl) ether	0.6–10
Bis(2-ethylhexyl)phthalate	0.6–10
Butylbenzylphthalate	0.5–10
Chrysene	0.5–10
Dibenzo(a,h)anthracene	1.8–10
Dibenzofuran	0.5–10
Diethylphthalate	0.7–10
Dimethylphthalate	0.5–10
Di-n-butylphthalate	0.5–10
Di-n-octylphthalate	0.6–10
Fluoranthene	0.6–10
Fluorene	0.7–10
Hexachlorobenzene	0.5–10
Hexachlorobutadiene	0.5–10
Hexachlorocyclopentadiene	2.0–10
Hexachloroethane	0.8–10
Indeno(1,2,3-cd)pyrene	1.7–10
Isophorone	0.5–10
Naphthalene	0.5–10
Nitrobenzene	0.5–10
N-nitrosodi-n-propylamine	0.7–10
N-nitrosodiphenylamine	0.6–10
Pentachlorophenol	2.3–20
Phenanthrene	0.6–10
Phenol	0.5–10
Pyrene	0.6–10

µg/kg = Microgram(s) per kilogram.
MDL = Method detection limit.
SWMU = Solid Waste Management Unit.

summarize the detection limits used by the off-site laboratory for analyzing HE, VOCs, and SVOCs, respectively.

Sample numbers are coded to identify specific information regarding the samples. For example, CY65C-GR-100,600-0-0.5-SS designates a sample collected from SWMU 65C in the Canyons Test Area of SNL/NM (CY65C). The grab sample (GR) was collected from grid location 100, 600 at a depth interval of 0 to 0.5 foot bgs and was designated a soil sample (SS). The remainder of this section describes the results of confirmatory sampling at SWMU 65C.

Metals

Table 6.4.4-1 summarizes the metals analysis results for soil samples collected from the ten random grid and judgmental borehole locations at SWMU 65C. The samples consisted of 40 surface, near-surface, and subsurface samples.

Arsenic, cadmium, chromium, lead, selenium, and silver were not detected above the background concentration limit in any of the soil samples collected at SWMU 65C. Barium was detected above the 246 mg/kg background concentration limit in one sample (CY65C-BH-1125,350-10.5-11-S). Beryllium was detected above the 0.75 mg/kg background concentration limit in four samples (CY65C-BH-975,350-2.5-3-S, CY65C-BH-1050,175-7.5-9.5-DU, CY65C-BH-975,350-5-7-DU, and CY65C-BH-1050,175-12.5-14.5-DU). Mercury was detected above the 0.055 mg/kg background concentration limit in one sample (CY65C-BH-1200,325-5.5-6-MS).

HE

Because there are no background concentrations for HE compounds in soil, any detectable HE compounds in the samples collected at SWMU 65B can be considered an indication of contamination. However, no HE compounds were detected in any of the soil samples collected at SWMU 65C. Table 6.4.4-6 summarizes the detection limits used by the off-site laboratory for analyzing HE compounds.

VOCs

Because there are no applicable background concentrations for VOCs in soil, no comparison to the analytical results is possible. Therefore, any detectable VOCs are considered an indication of potential contamination. Only three VOCs (1,2-dibromo-3-chloropropane, methylene chloride, and toluene) were detected at very low estimated concentrations in the soil samples collected at SWMU 65C. Table 6.4.4-2 summarizes the VOC analysis results for soil samples collected from the ten random grid and judgmental borehole locations at SWMU 65C. 1,2-dibromo-3-chloropropane was detected in one sample at a concentration of 1.9 J µg/kg. Methylene chloride was detected in 17 samples at concentrations ranging from 1.0 J µg/kg to 4.8 J µg/kg. Toluene was detected in eight samples at concentrations ranging from 1.0 J µg/kg to 3.6 µg/kg. Table 6.4.4-7 summarizes the detection limits used for analyzing VOCs by the off-site laboratory. Although three VOCs were detected, the concentrations were reported at less than the practical quantitation limit and, therefore, the data are qualified as estimated values.

SVOCs

Because there are no applicable background concentrations for SVOCs in soil, no comparison to the analytical results is possible. Therefore, any detectable SVOCs are considered an indication of potential contamination. Only one SVOC (bis[2-ethylehxyl]phthalate) was detected at low estimated concentrations in the soil samples collected at SWMU 65C. Table 6.4.4-3 summarizes the SVOC analysis results for soil samples collected from the ten random grid and judgmental borehole locations at SWMU 65C. Bis(2-ethylehxyl)phthalate was detected in five samples at concentrations ranging from 32 J µg/kg to 68 J µg/kg. Table 6.4.4-8 summarizes the detection limits used for analyzing SVOCs by the off-site laboratory. Although bis(2-ethylehxyl)phthalate was detected, the concentrations were reported at less than the practical quantitation limit and, therefore, the data are qualified as estimated values.

Radionuclides

Table 6.4.4-4 summarizes the on-site gamma spectroscopy analysis results for the soil samples collected at SWMU 65C. The gamma spectroscopy results indicate that only one sample was detected above the minimum detected activity (MDA) or above the background concentration limits. Uranium-235 was detected at 0.165 picocurie (pCi)/gram (g), above the background concentration limit of 0.16 pCi/g. However, the MDA associated with nondetectable results for uranium-238 and uranium-235 exceeded background in most instances. Although this situation inhibits any comparison to background, uranium-238 and uranium-235 can be compared because both coexist in DU. As a result, any elevated uranium-238 activity would be accompanied by a corresponding elevation in uranium-235 activity. Using this comparison, the nondetectable results obtained for uranium-235 that have MDAs above background in the samples do not show corresponding elevated activities in the results for uranium-238.

Gross Alpha/Gross Beta

Table 6.4.4-5 summarizes the off-site gross alpha and gross beta analysis results for the soil samples collected at SWMU 65C. Gross alpha activity exceeded the background concentration limit of 18.3 pCi/g in two samples with activities of 18.9 pCi/g and 23.8 pCi/g. Gross beta activity did not exceed background in any of the samples that were analyzed.

QA/QC Results

This section briefly describes the data quality assessment for the soil sample results.

Table 6.4.4-1 presents results of the analysis for metals QA/QC samples collected during the confirmatory sampling program at SWMU 65C. The QA/QC samples collected consist of two equipment blanks. The QA/QC sample collected in April 1998 was analyzed off site for metals, VOC, SVOCs, and HE. The QA/QC sample collected in February 1999 was analyzed off site for metals and HE. Very low estimated concentrations of barium and chromium were reported for the equipment blank sample CY65C-GR-01-EB and a very low concentration of barium was detected in the equipment blank sample CY65C-BH-1000,325-EB.

Because of poor soil recovery from the boreholes, no samples were analyzed in replicate off site.

Data Validation

SNL/NM Department 7713 (RPSD Laboratory) reviewed all gamma spectroscopy results according to "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 2 (SNL/NM July 1996). In addition, all off-site laboratory results were reviewed and verified/validated according to "Data Verification/Validation Level 3–DV3" in Attachment C of Technical Operating Procedure 94-03 (SNL/NM July 1994b). Annex 6-E contains off-site data validation reports. The verification/validation process confirmed that the data are acceptable for use in this NFA proposal for SWMU 65C.

6.5 Site Conceptual Model

The site conceptual model for SWMU 65C is based upon the residual COCs identified in the soil samples from the surface, near-surface, and subsurface of the Secondary Detonation Area of the LCETS following a radiological VCM. Although an investigation of the Lurance Canyon main arroyo channel located within the LCETS was conducted simultaneously with the investigation of SWMU 65C, the arroyo sediment assessment results are not included in the site conceptual model developed for SWMU 65C. The Lurance Canyon Arroyo sediment is currently under investigation as part of an SNL/NM sitewide surface-water monitoring program (NMED May 1997, NMED and DOE OB February 1998).

6.5.1 Nature and Extent of Contamination

The COCs at SWMU 65C are metals and radionuclides associated with explosives and burn tests conducted at the site (Annex 6-A) and very low estimated levels of three VOCs and one SVOC. Metal and radionuclide COCs were determined by comparing sample results to background concentrations and activities established for the Canyons Area (Dinwiddie September 1997, Zamorski December 1997). 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 and uranium-238 analyses exceeded background activity limits (see Section 6.4.4.4), nondetect sample results are also considered in identifying potential COCs. In the case of radionuclides, the MDA is used for comparison to background. As a result, metal COCs include barium, beryllium, and mercury. Radionuclide COCs include uranium-235, uranium-238, and gross alpha. Table 6.5.1-1 summarizes the COCs and the sample locations where metals and radionuclides exceeded background. The table does not include the Lurance Canyon Arroyo sediment because the drainage is now separately under investigation (NMED May 1997, NMED and DOE OB February 1998).

The VOC and SVOC COCs were determined on the basis of detectable concentrations of any VOC or SVOC in any soil sample. Because background concentrations for these constituents are not applicable, any detectable VOCs or SVOCs are considered potential contamination. Conversely, nondetect results are not considered for evaluating potential COCs at SWMU 65C. As a result, the VOC COCs are 1,2-dibromo-3-chloropropane; methylene chloride; and toluene and the SVOC COC is bis(2-ethylehxyl)phthalate. Although three VOCs and one SVOC were

Table 6.5.1-1
Summary of COCs for SWMU 65C

COC Type	Number of Samples	COCs Greater Than Background	Maximum Background Limit/Canyons[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
Metals	40 environmental	Ba	246	344	127	CY65C-BH-1125,350-10.5-11-S
		Be	0.75	0.925	0.422	CY65C-BH-975,350-2.5-3-S CY65C-BH-1050,175-7.5-9.5-DU CY65C-BH-975,350-5-7-DU CY65C-BH-1050,175-12.5-14.5-DU
		Hg	0.055	0.0694 J	0.015	CY65C-BH-1200,325-5.5-6-MS
VOCs	40 environmental	1,2-dibromo-3-chloropropane	NA	1.9 J µg/kg	Not calculated[c]	CY65C-BH-125,300-10-10.5-S
		Methylene Chloride	NA	4.8 J µg/kg	Not calculated[c]	CY65C-BH-1050,225-0-0.5-MS CY65C-BH-1050,225-4.5-5-MS CY65C-BH-1075,300-0-0.5-S CY65C-BH-1075-300-3.5-4-S CY65C-BH-1125,300-0-0.5-MS CY65C-BH-1125,300-4.5-5-MS CY65C-BH-1050,225-9.5-10-S CY65C-BH-1050,225-14.5-15-S CY65C-BH-1050,175-9.5-10-S CY65C-BH-1050,175-14.5-15-S CY65C-BH-1075,300-9.5-10-S CY65C-BH-1200,325-0-0.5-MS CY65C-BH-1200,325-5-5.5-MS CY65C-BH-1125,300-10-10.5-S CY65C-BH-1125,325-13.5-14-S CY65C-BH-1150,225-9.5-10-S CY65C-BH-1150,225-14-14.5-S
		Toluene	NA	3.6 J µg/kg	Not calculated[c]	CY65C-BH-975,350-0-0.5-SS CY65C-BH-975,350-3.5-4-S CY65C-BH-1050,225-0-0.5-MS CY65C-BH-1075,300-0-0.5-SS CY65C-BH-1075,300-3.5-4-S CY65C-BH-1050,225-9.5-10-S CY65C-BH-1050,225-14.5-15-S CY65C-BH-1050,175-14.5-15-S
SVOCs	40 environmental	Bis(2-ethylhexyl)phthalate	NA	68 J µg/kg	Not calculated[c]	CY65C-BH-1050,175-3-4-DU CY65C-BH-1125,350-0.5-1-SS CY65C-BH-1125,350-5.5-6-S CY65C-BH-1150,225-0-0.5-SS CY65C-BH-1150,,225-14-14.5-S
Radiological	11 environmental	Uranium-235	0.16 pCi/g	1.65E-01	Not calculated[d]	CY65C-BH-1000,325-7-7.5-S
		Gross Alpha	18.3 pCi/g	23.8	Not calculated[d]	CY65C-BH-1000,325-7-7.5-S CY65C-BH-1200,325-7.5-8-S

[a]From Zamorski December 1997 (for metals); from Dinwiddie September 1997 (for radionuclides).

[b]Average concentration includes all samples. For nondectectable results, the detection limit is used to calculate the average. Does not include arroyo sediment samples.

[c]Includes samples with nondetect results where the MDL or MDA exceeds the approved background limit.

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

BH = Borehole.
COC = Constituent of concern.
CY = Canyon.
MDA = Minimum detectable activities.
MDL = Minimum detection limit.
mg/kg = Milligram(s) per kilogram.
MS = Matrix spike.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.
S = Subsurface soil sample.
SS = Surface soil sample.
SVOC = Semivolatile organic compounds.
SWMU = Solid Waste Management Unit.
VOC = Volatile organic compounds.

detected, the concentrations were reported at less than the practical quantitation limit and, therefore, the data are qualified as estimated values. Table 6.5.1-1 summarizes the COCs and the sample locations where the VOCs and one SVOC were detected.

Forty surface, near-surface, and subsurface environmental samples were collected from 10 random grid and judgmental borehole locations across the approximate 1.3-acre site. In most cases, the COCs were only slightly elevated above the maximum background concentration or activity limits specified for the Canyons Area (Dinwiddie September 1997, Zamorski December 1997). The COCs that exceed background limits typically occur as isolated "hot spots" with no particular COC associations or correlation to particular locations or areas that could be delineated as contaminated.

Barium was elevated above the maximum background concentration (246 mg/kg) at only one of the sample locations. Beryllium was elevated above the maximum background concentration (0.75 mg/kg) at only four of the sample locations. Mercury was elevated above the maximum background concentration (0.055 mg/kg) at only one of the sample locations.

Although SWMU 65C is located within an RMMA and is co-located with SWMU 65E, only one sample exceeded the background concentration limit for uranium-235 and two samples exceeded the background concentration limit for gross alpha. However, uranium-238 and uranium-235 are considered potential COCs at SWMU 65C because the MDA associated with nondetectable results for these isotopes exceeded background in several instances.

6.5.2 Environmental Fate

The primary source of COCs for SWMU 65C was general explosives tests and burn tests conducted on weapons and other devices containing HE. The primary release mechanism of COCs was the detonation and subsequent fallout of test material shrapnel from the explosives and burn test activities. Although HE was involved with the tests conducted at the SWMU 65C, these contaminants are not present at the site. Results of the confirmatory sampling indicate that no HE compounds were detected in the samples from the surface, near-surface, and subsurface soils from the random grid and judgmental borehole locations (see Section 6.4.4.4).

Table 6.5.1-1 summarizes potential COCs for SWMU 65C. Based upon the nature and extent of contamination at the site, metal, VOC, SVOC, and radionuclide COCs occurred at a few isolated locations in the surface, near-surface, and subsurface soils.

Barium was elevated above the maximum background concentration (246 mg/kg) at only one of the sample locations. Beryllium was elevated above the maximum background concentration (0.75 mg/kg) at only four of the sample locations. Mercury was elevated above the maximum background concentration (0.055 mg/kg) at only one of the sample locations. One sample exceeded the background concentration limit for uranium-235 and two samples exceeded the background concentration limit for gross alpha. The MDA for uranium-238 and uranium-235 exceeded the background soil concentration limits in most instances. Three VOCs (1,2-dibromo-3-chloropropane; methylene chloride; and toluene) and one SVOC (bis[2-ethylehxyl]phthalate) were detected at low concentrations at a few sample locations. Although three VOCs and one SVOC were detected, the concentrations were reported at less than the practical quantitation limit and, therefore, the data are qualified as estimated values. In general, no distinct horizontal distribution of contamination is present. All potential COCs were retained in the conceptual model and evaluated in the human health and ecological risk assessments.

Because the LCETS is no longer active, only secondary sources of COCs remain at the site in the form of residual metals, VOCs, SVOCs, and radionuclides in the surface, near-surface, and subsurface soils. The secondary release mechanisms at SWMU 65C are the suspension and/or dissolution of COCs in surface-water runoff and percolation to the vadose zone, direct contact with soil (radionuclides only), dust emissions, and uptake of COCs in the soil by biota (Figure 6.5.2-1). However, the depth to groundwater at the site is approximately 222 feet bgs under semiconfined to confined conditions, which precludes the migration of COCs to the aquifer. In addition, high partitioning coefficients and low mobility in the transporting medium would enhance dilution of the already low COC concentrations. The pathways to receptors are surface water, soil water, air, and soil. Biota are also a pathway through food chain transfers. Annex 6-F, Section V, provides additional discussion of the fate and transport of COCs at SWMU 65C.

The current land use for SWMU 65C is industrial. However, because the future/proposed land use for SWMU 65C 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 route for the recreational user is dermal contact and ingestion/inhalation. Only soil ingestion 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 soil ingestion is considered the major exposure route for biota, in addition to ingesting COCs through food chain transfers or the direct uptake of COCs. Annex 6-F, Section V, provides additional discussion of the exposure routes and receptors at SWMU 65C.

6.6 Site Assessments

The site assessment process for SWMU 65C includes risk screening assessments, followed by risk baseline assessments (as required) for both human health and ecological risk. This section briefly summarizes of the site assessment results. Annex 6-F provides details of the assessment.

6.6.1 Summary

The site assessment concludes that SWMU 65C does not have 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 65C were found to be very low. Section 6.6.2 briefly describes and Annex 6-F provides details of the site assessments.

6.6.2 Screening Assessments

Risk screening assessments were performed for both human health risk and ecological risk for SWMU 65C. The following discusses the results.

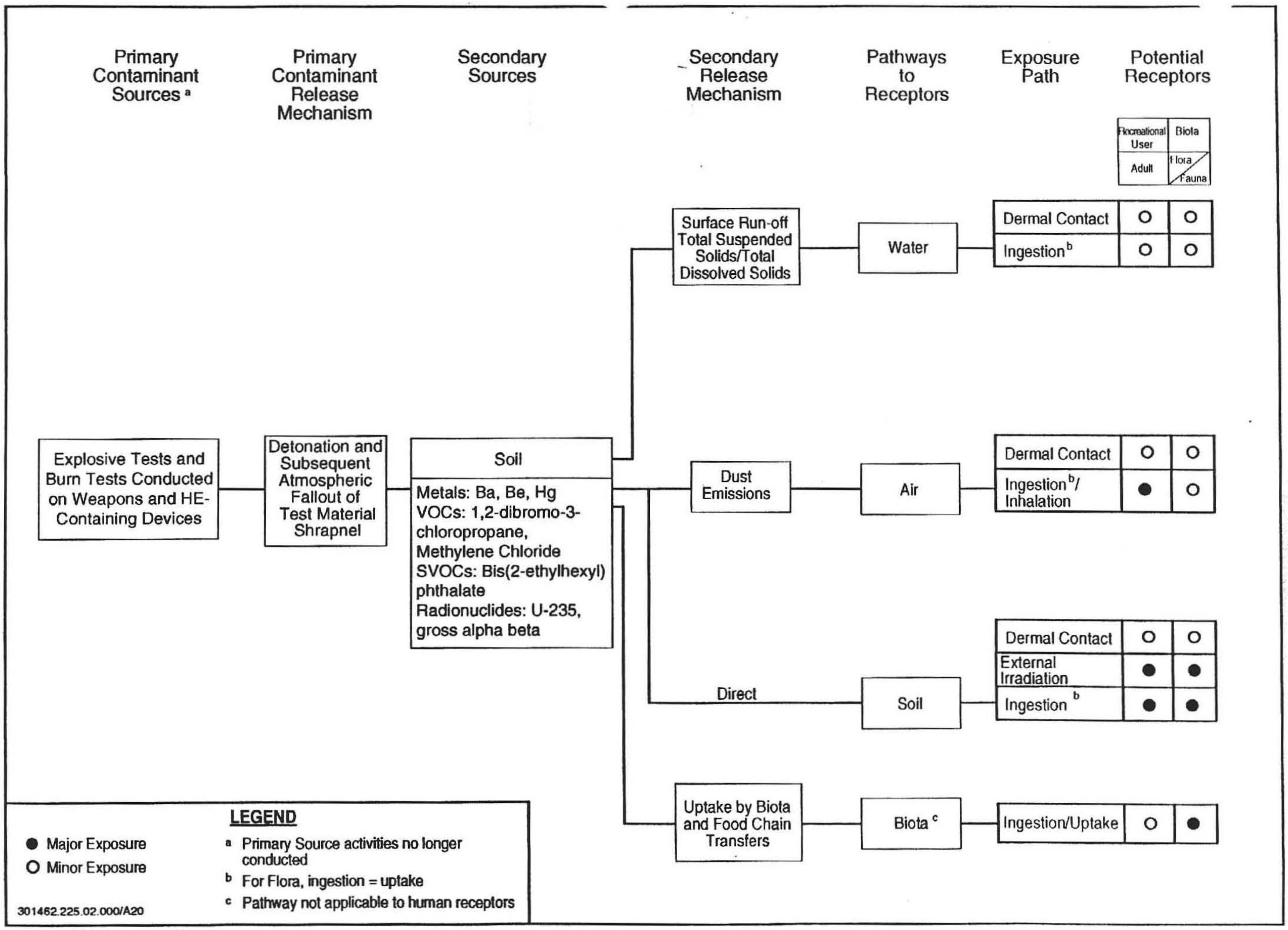

Figure 6.5.2-1

Conceptual Model Flow Diagram for SWMU 65C, Secondary Detonation Area

6.6.2.1 *Human Health*

SWMU 65C has been recommended for recreational land-use (DOE et al. October 1995). Annex 6-F provides a complete discussion of the risk assessment process, results, and uncertainties. Because of the presence of COCs in concentrations or activities greater than background levels, it was necessary to perform a health risk assessment analysis for the site. Besides COC metals, this assessment included any VOCs or SVOCs detected above their reporting limits and any radionuclide COCs detected either above background levels and/or MDAs. The risk assessment process provides a quantitative evaluation of the potential adverse human health effects caused by constituents in the site's soil. The Risk Screening Assessment Report calculated the hazard index (HI) and excess cancer risk for a recreational land-use setting. The excess cancer risk from nonradiological COCs and the radiological COCs is not additive (EPA 1989).

In summary, the HI calculated for SWMU 65C nonradiological COCs is 0.00 for a recreational land-use setting, which is less than the numerical standard of 1.0 suggested by risk assessment guidance (EPA 1989). Incremental risk is determined by subtracting risk associated with background from potential nonradiological COC risk. There is no incremental HI. The total excess cancer risk for SWMU 65C nonradiological COCs is 2E-10 for a recreational land-use setting, which is also below the acceptable risk value provided by the NMED (NMED March 1998). Guidance from the NMED indicates that excess lifetime risk of developing cancer by an individual must be less than 1E-6 for Class A and B carcinogens and less than 1E-5 for Class C carcinogens (NMED March 1998). The incremental cancer risk for SWMU 65C is 1.7E-10.

The incremental total effective dose equivalent for radionuclides for a recreational land-use setting for SWMU 65C is 7E-3 mrem/year (yr), which is well below the recommended dose limit of 15 mrem/yr found in EPA's OSWER Directive No. 9200.4-18 and reflected in SNL/NM's document entitled "RESRAD Input Parameter Assumptions and Justification" (February 1998). The incremental excess cancer risk for radionuclides is 9.1E-8 for a recreational land-use scenario, which is much less than risk values calculated from naturally occurring radiation and from intakes considered background concentration values.

The residential land-use scenarios for this site are provided only for comparison in the Risk Screening Assessment Report (Annex 6-F). The report concludes that SWMU 65C does not have potential to affect human health under a recreational land-use scenario.

6.6.2.2 *Ecological*

An ecological screening assessment that corresponds with the screening procedures in the EPA's Ecological Risk Assessment Guidance for Superfund (EPA 1997) was performed as set forth by the NMED Risk-Based Decision Tree (NMED March 1998). An early step in the evaluation is comparing COC concentrations and identifying potentially bioaccumulative constituents. Annex 6-F, Sections V, VII.2 and VII.3, discuss this. This methodology also requires that a site conceptual model and a food web model be developed and that ecological receptors be selected. Each of these items is presented in the "Predictive Ecological Risk Assessment Methodology" for SNL/NM's ER Program (IT July 1998) and will not be duplicated here. The screen also includes estimation of exposure and ecological risk.

Tables 16, 17, and 18 of Annex 6-F present the results of the ecological risk assessment screen. Site-specific information was incorporated into the screening assessment when such data were available. No hazard quotients greater than unity were predicted. Based upon an evaluation of the uncertainties, ecological risks associated with this site are expected to be very low.

6.6.3 Risk Assessments

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

6.6.3.1 Human Health

Based upon the fact that human health results of the screening assessment summarized in Section 6.6.2.1 indicate that SWMU 65C does not have the potential to affect human health under a recreational land-use setting, a baseline human health risk assessment is not required for SWMU 65C.

6.6.3.2 Ecological

Based upon the fact that ecological results of the screening assessment summarized in Section 6.6.2.2 indicate that SWMU 65C has very low ecological risk, a baseline ecological risk assessment is not required for SWMU 65C.

6.6.4 Other Applicable Assessments

6.6.4.1 Surface Water

As specified in the OU 1333 Work Plan (SNL/NM September 1995), background arroyo sediment samples were collected from the section of the Lurance Canyon Arroyo (and tributaries) immediately upstream from SWMU 65C. The samples were analyzed for metals and radionuclides. Based upon the RSI (Dinwiddie August 1997), the analyses specified for background arroyo sediment samples were expanded to include gross alpha/gross beta. Because investigation of the Lurance Canyon Arroyo has been included in the SNL/NM Surface-Water Monitoring Program (SNL/NM in progress), an assessment of the results obtained for the background arroyo sediment sampling activities is not included in the SWMU 65C NFA. However, Annex 6-C presents a summary of the Lurance Canyon Arroyo background sample results (NMED May 1997, NMED and DOE OB February 1998).

6.6.4.2 Groundwater

Based upon NMED concerns regarding nitrate concentrations detected in groundwater samples collected from the Burn Site Production Well (SNL/NM July 1997, SNL/NM September 1997b) and contaminant concentrations in wastewater stored in aboveground tanks at the Burn Site (Dinwiddie August 1997), investigation of groundwater in the Canyons Area was initiated.

Pursuant to the RSI (Dinwiddie August 1997), the 12A piezometer and the Narrows Well were installed. Since the installation of the 12A piezometer in November 1996, no groundwater has been detected. Pursuant to a notice of deficiency (Garcia March 1998), groundwater samples are collected at the Narrows Well once every three months. Low levels of petroleum hydrocarbons were present in groundwater samples from the first and second monitoring events for this well. No detected compounds exceed federal maximum contaminant levels (MCL) with the exception of nitrate, which is at or just above the MCL of 10 mg/L (DOE November 1998).

6.7 No Further Action Proposal

6.7.1 Rationale

Based upon field investigation data and the human health risk assessment analysis, an NFA is being recommended for SWMU 65C for the following reason: No COCs (metals and radionuclides) were present in concentrations considered hazardous to human health for a recreational land-use scenario.

6.7.2 Criterion

Based upon the evidence provided above, SWMU 65C 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 6-A

ANNEX 6-A
Summary of Testing Activities at SWMU 65,
Lurance Canyon Explosive Test Site

The Lurance Canyon Explosive Test Site (LCETS) was used for explosive testing from the late-1960s to the early 1990s. Testing programs at the LCETS can be grouped into the following six categories:

- General explosive tests
- Burn pit tests (fuel fire)
- Miscellaneous burn tests (nonfuel fire)
- Cone tests
- Torch-activated burn system (TABS)
- Slow-heat tests

The following sections describe the six types of explosive/burn testing associated with Solid Waste Management Unit (SWMU) 65 subunits. Figures 6A-1 and 6A-2 show the general locations of these tests.

A.1 GENERAL EXPLOSIVES TESTS

SWMU 65 was designed with a 10,000-foot dispersion radius to provide an adequate buffer for detonating up to 10,000 pounds (lb) of high explosive (HE) (Gaither et al. May 1993a, Author [unk] Date [unk]a, Larsen and Palmieri August 1994a, Larsen and Palmieri August 1994b). When construction of the SWMU 94 burn structures began in 1977, the explosives testing limit was reduced to 1,000 lb (Martz September 1985). Most of the explosives tests were conducted in the disturbed areas designated SWMU 65B (Larsen and Palmieri August 1994a, Larsen and Palmieri August 1994b), and SWMU 65C (Littrel February 1969, Karas June 1993, Foy April 1971, Clark December 1970, Walkington April 1973, Stravasnik September 1972). Explosives tests were conducted at grade or at 2 to 3 feet above grade (Gaither et al. May 1993b). Fragments may have been widely scattered over the site (Gaither Date [unk.], Gaither October 1992, Martz November 1985, DOE September 1987), and material may also have been driven into the ground at the detonation location (Gaither et al. May 1993a). Metal shrapnel has been found and observed in an area defined by a circular perimeter with an approximate radius of 1,000 feet centered on the primary detonation area (Hickox November 1994). Past test locations are not currently visible because of ongoing grading and construction activities associated with SWMU 94.

Materials that may have been involved in general explosives tests include HE, depleted uranium (DU), lead, aluminum powder, fuel-rod shipping containers, steel slurry vessels, and live and mock weapons (Gaither et al. May 1993a, Gaither Date [unk.], Gaither October 1992, Karas June 1993, Mortz November 1985, Larsen and Palmieri August 1994a, Larsen and Palmieri August 1994b, Palmieri November 1994a, Palmieri December 1994a, Palmieri December 1994b, DOE September 1987). Details on known tests are given below.

A.1.1 <u>Open-Detonation Tests</u>

It is expected that other HE tests were conducted at SWMU 65 for which no specific information is available in the current archive records. Archive records state that 15 to 20 HE tests per year were conducted at SWMU 65 between 1968 and 1980 (Gaither et al. May 1993a, Author [unk]

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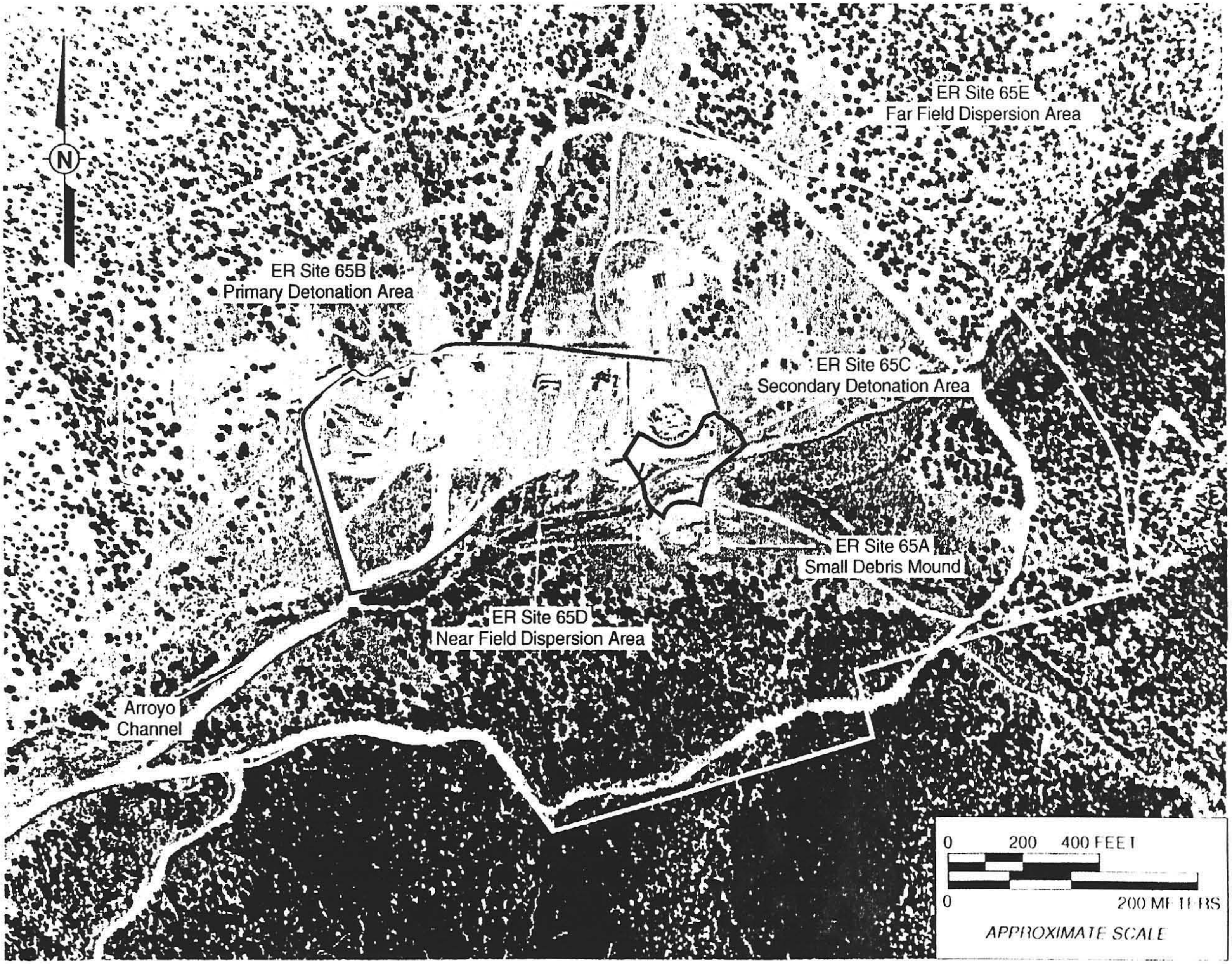

Low-altitude photograph of Lurance Canyon in 1992. ER Site 65 subunits are identified.

Figure 6A-1

SWMU 65, Lurance Canyon Explosive Test Site, Designated Subunits

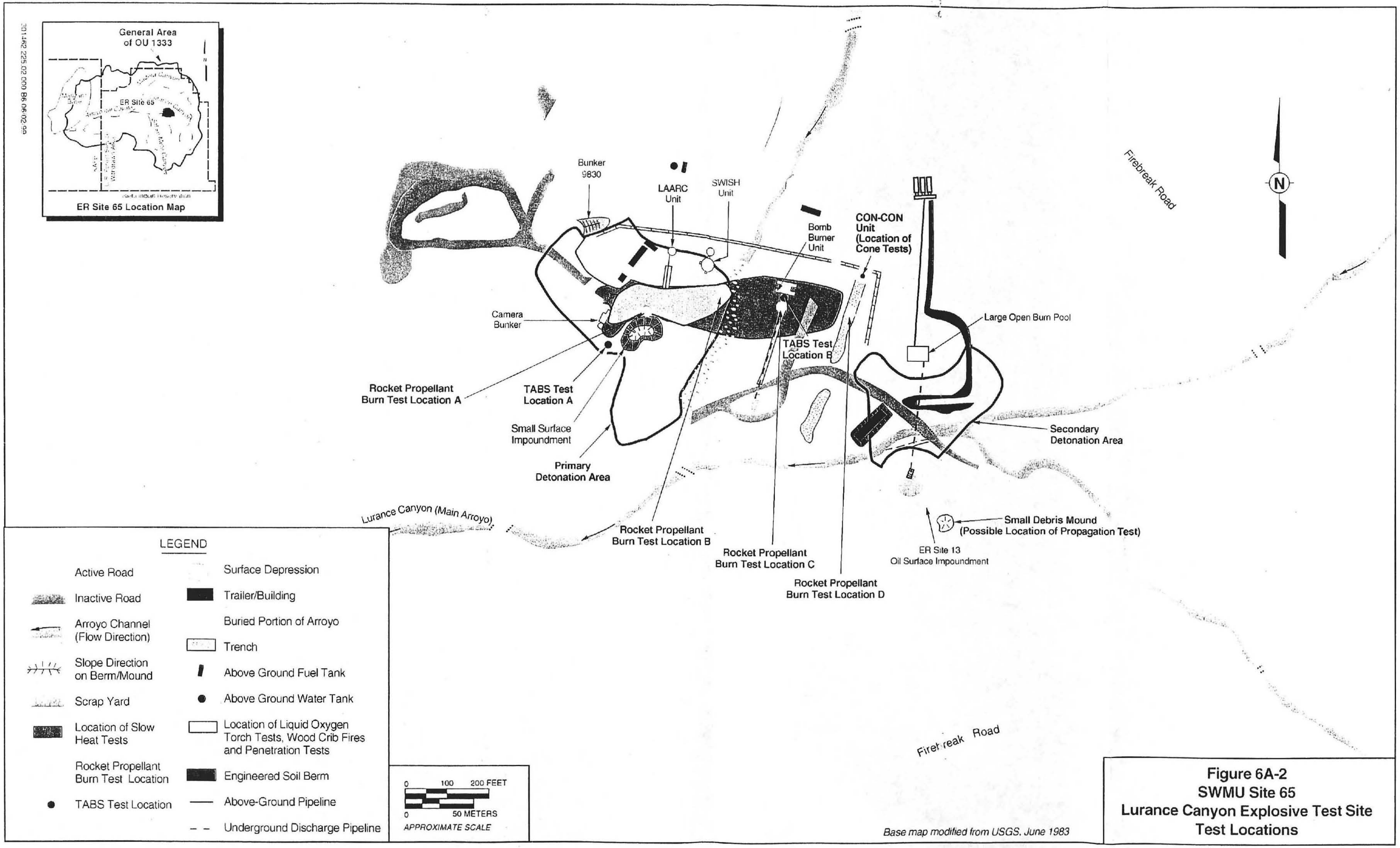

Figure 6A-2
SWMU Site 65
Lurance Canyon Explosive Test Site
Test Locations

Date [unk]a). However, it was not possible to obtain information or specific records on all of these tests.

A.1.2 Ammonium Nitrate/Fuel Rod Shipping Container Test

An explosives test was performed at SWMU 65 with fuel-rod shipping containers and an ammonium nitrate slurry bomb (Gaither et al. May 1993a, Larsen and Palmieri August 1994b, DOE September 1987). The test was conducted with 4,000 lb of ammonium nitrate slurry to evaluate the impact of the detonation on the integrity of two containers. The containers were reportedly dented but not fragmented from the detonation (Gaither et al. May 1993a, Karas June 1993, Larsen and Palmieri August 1994b). A specific location for the test was not given, but large detonations were reported to have taken place in the secondary detonation area (SWMU 65C) near the area now occupied by the Large Open Burn Pool (LOBP) (Palmieri December 1994b).

A.1.3 Penetration Tests

Bullet penetration tests on B-61 warheads containing DU surrounded by HE (Larsen and Palmieri August 1994b) were conducted at SWMU 65B between 1980 and 1985 (Gaither et al. May 1993a, Palmieri December 1994b). These tests consisted of firing a high-velocity projectile into the B-61 warhead to detonate the HE and fragment the weapon (Larsen and Palmieri August 1994b). The tests were conducted in the region between the camera bunker and the northeast-southwest-trending arroyo channel located on the east side of the primary detonation area (Larsen and Palmieri August 1994b).

A.1.4 Propagation Test

One interview record noted that two live weapons were used in a propagation test conducted in a concrete bunker (SWMU 65A) in the area adjacent to SWMU 13, Oil Surface Impoundment. The test may have taken place between 1965 and 1979 (Palmieri December 1994a). One weapon was placed inside the bunker and one was placed outside the bunker (Palmieri November 1994a). The test was designed to determine whether the shock wave created by the detonation of the weapon outside of the bunker could detonate the weapon on the inside. The weapon inside the bunker did not detonate (Palmieri November 1994a). The small debris mound possibly associated with this test is designated SWMU 65A.

A.2 BURN PIT TESTS (FUEL FIRE)

Burn tests were conducted on weapons components, reentry vehicles, ammonium nitrate bombs, and nuclear materials containers at SWMU 65C. Burn tests at SWMU 65 began in approximately 1969 (Littrel February 1969, Karas June 1993) and were initially carried out in excavated pits. The burn pits were replaced by portable pans before 1979 (Jercinovic et al. November 1994). Burn tests in portable pans (Figure 6A-3) will be discussed in SWMU 94 no further action proposals.

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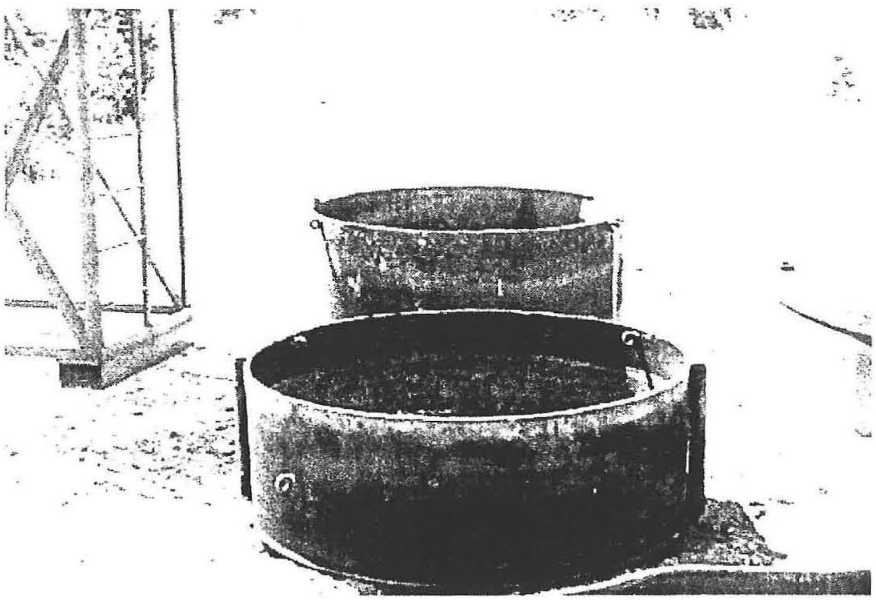

Photograph of portable pans in the southern portion of the scrap yard in April 1995. The pans held JP-4 fuel and water used in small-scale burn tests at SWMU 94.

Figure 6A-3
Photograph of Portable Pan

Burn pits were excavated and lined with black polyethylene or polyvinyl chloride (PVC) film, water was placed in the pit, and a layer of jet fuel composition 4 (JP-4) fuel was placed on the water (Littrel February 1969, Foy April 1971, Stravasnik September 1972, Larsen and Palmieri August 1994b, Jercinovic et al. November 1994, Palmieri November 1994a). Stands or frames that held the test devices were constructed of steel, and sometimes platinum strips were used to separate the test device from the steel frame (in order to avoid reaction between the test device and the frame) or to suspend the device above the pool (Young et al. February 1994, Littrel February 1969, Foy April 1971, Clark December 1970, Walkington April 1973). When thermocouples and other electronic wiring were used to monitor the burn tests, the control wiring was insulated with ceramic and placed on a ceramic-insulated steel frame (Author [unk] June 1993). In some tests, a metal *chimney* was placed over the pool prior to igniting the fuel to eliminate wind effects and control the fire (Jercinovic et al. November 1994).

To control the burn time, the thickness of the JP-4 fuel layer was accurately measured before the test was conducted (Foy April 1971, Walkington April 1973, Stravasnik September 1972). The test pits may have leaked water and fuel through holes in the plastic (Larsen and Palmieri August 1994b) because flames melted exposed parts of the black plastic liner. The pits were left uncovered upon completion of these burn tests (Author [unk] June 1993), and in general, cleanup was not performed (Young et al. February 1994). At the conclusion of the test, the remaining water and fuel were left to evaporate or infiltrate (Larsen E. and Palmieri D. August 1994b, Jercinovic et al. November 1994, Palmieri November 1994a).

The exact locations of the burn pits used during testing cannot be determined, because grading and construction activities related to SWMU 94 erased all evidence of the depressions or features associated with the test locations. However, Based upon technical reports (Littrel February 1969, Walkington April 1973, Stravasnik September 1972) and interpretation of historical aerial photographs (SNL/NM August 1994), burn pits were excavated in the area designated SWMU 65C.

Materials that may have been used in the burn pit tests include JP-4 fuel, diesel fuel, rocket propellant, ammonium nitrate slurry, trinitrotoluene (TNT), chromel/alumel thermocouples, steel shipping containers, Celotex™ insulation, polyethylene containers, PVC, Dy-Kem steel-blue layout dye, argon, and ceramic insulation (Young et al. February 1994, Moore and Luna February 1982, Littrel February 1969, Foy April 1971, Clark December 1970, Walkington April 1973, Stravasnik September 1972). Details on these testing events are given below.

A.2.1 Cloudmaker Tests and Other Ammonium Nitrate Tests

In January 1969, three burn tests were conducted in pits at SWMU 65C to determine the effect of a fuel fire on an ammonium nitrate slurry bomb, referred to as the Cloudmaker (Young et al. February 1994, Littrel February 1969). The slurry mixture contained 50 percent ammonium nitrate, 35 percent aluminum powder, 14 percent water, and 1 percent gums and stabilizers (Littrel February 1969). The first two tests were conducted on the TNT booster charge that was used to detonate the ammonium nitrate slurry; the third test involved detonating the ammonium nitrate. The Cloudmaker burn test used 8,100 lb of slurry (equivalent to 10,500 lb of TNT) that consisted of 50 percent ammonium nitrate (Littrel February 1969) and was detonated 1,000 feet southeast of Bunker 9830. When actual detonation occurred in the third Cloudmaker test, the explosion scattered dust and shrapnel as far as 800 feet in all directions (Littrel February 1969).

One interview record states that additional ammonium nitrate tests were conducted using 15,000-lb ammonium nitrate slurry bombs that were intended to be representative of a portion of a 35,000-lb bomb (Karas June 1993). The purpose of these tests was to determine whether a Composition-4 (C-4) charge would successfully detonate ammonium nitrate. Detonations were successful in tests that were completed in 1969 and 1970 (Karas June 1993). An additional 15,000-lb ammonium nitrate slurry bomb was unexpectedly detonated during a burn test when steam pressure from the slurry built up, popped the relief valve, and detonated the ammonium nitrate (Karas June 1993, Larsen and Palmieri August 1994b). Although a specific location for the tests was not given, it is reported that large HE tests were conducted at SWMU 65C near the area now occupied by the LOBP (Palmieri December 1994b). This is in the same general vicinity as the 1969 Cloudmaker test.

A.2.2 Liquid Fuel Fire and Solid Rocket Propellant Burn Tests on Pioneer Capsules

Burn tests in excavated pits were conducted on Pioneer capsules in 1970 to determine whether the capsule could survive a launch abort (Foy April 1971). The test sequence, carried out at SWMU 65C, consisted of two liquid-fuel-fire tests and three solid rocket propellant tests (two direct-fire tests and one proximity test) and ended with two liquid-fuel-fire tests (Foy April 1971). Rocket propellant tests designated as direct fire involved thermocouples that were directly attached to the propellant block, whereas the proximity test had the thermocouple positioned between two propellant blocks. Approximately 1,400 gallons of JP-4 fuel was used in each liquid fuel test, and one to two 12- by 12- by 18-inch (in.) block(s) of TP-H-3062 rocket propellant was used in each solid propellant fire test (Foy April 1971). In the liquid-fuel-fire tests, Pioneer capsules P-12 and P-19 were preheated to 1,800 degrees Fahrenheit (°F), and P-9 and P-15 were preheated to 1,300°F in an argon atmosphere oven prior to being placed in the fuel fire (Foy April 1971, Clark December 1970). The test reports do not describe the materials used in the construction of the Pioneer capsules.

A.2.3 Plutonium Shipping Container Tests

Several JP-4 fuel fire tests of shipping containers designed to carry plutonium were conducted in excavated pits in 1972. Department of Transportation (DOT) Class II plutonium containers (DOT-6M, DOT-SP5795, and L-10) were tested in a 1,800°F fire for one hour. To assess the integrity of the containers, polyethylene bottles were filled with a Dy-Kem steel-blue layout dye and alcohol solution, were wrapped in Celotex™ insulation, and were placed inside each container. The DOT-6M container failed to retain the solution, but all of the others did retain the solution. A photo included within a test report (Stravasnik September 1972) shows that the location of the test is in the historic arroyo channel located at SWMU 65C. This location conforms to all other known burn pit test locations that were conducted for the Cloudmaker and TC-708 Emergency Denial Device.

A.2.4 TC-708 Emergency Denial Device Tests

In February 1973 a diesel-fuel fire test on a TC-708 Emergency Denial Device was conducted at SWMU 65C in an excavated pit located approximately 1,000 feet southeast of Bunker 9830 (Walkington April 1973). The test report gave no specific information on the test materials or on the use or purpose of the device, but it noted that six chromel/alumel thermocouples (Type K) were attached to the unit and that the unit melted after approximately 4 minutes (min) into the test (Walkington April 1973).

A.3 MISCELLANEOUS BURN TESTS (NONPETROLEUM-FUEL-FIRE)

Miscellaneous burn tests conducted at SWMU 65 include wood crib tests, liquid oxygen torch tests, and rocket propellant tests (Palmieri December 1994d, Hickox and Abitz December 1994). The tests, which began in 1984 and ended in 1993, occurred at SWMU 65B and SWMU 65D. Materials that may have been used in the miscellaneous burn tests include rocket propellant, HE detonators, propane, empty weapon casings, liquid oxygen, aluminum powder, nitrogen gas, graphite, and steel rods (Hickox and Abitz December 1994). The following paragraphs provide additional details on these tests.

A.3.1 Wood Crib Fire Tests

Seventeen wood crib tests were conducted at SWMU 65B from September 1988 to September 1989. These tests consisted of cross stacking 1- by 4-in. by 6-foot-long planks to a height of about 8 feet to make a 6- by 6- by 8-foot stack or crib. A suitcase containing detonators and HE components was placed in the crib and the wood was ignited. The wood fire induced an explosion of the detonators when the HE critical temperature was reached. The purpose of the test was to evaluate the performance of the suitcase by recording the distance that the ejected components traveled. All components had to stay within a specified radius for the suitcase to pass the test. The composition of the components is unknown, but all component parts are believed to have been recovered following the test (Hickox and Abitz December 1994).

A.3.2 Liquid Oxygen Torch Tests

Nineteen liquid oxygen torch tests were conducted at SWMU 65B in 1984 and 1985 to determine whether a torch could simulate a controlled rocket propellant fire (Hickox and Abitz December 1994). The liquid oxygen torch consisted of a nozzle welded to a steel frame. Liquid oxygen and aluminum powder were fed to the nozzle via gas lines and valves with a high-pressure nitrogen gas reservoir. Propane and gaseous oxygen were used as the pilot light system with some testing of the torch involving graphite or steel rods. The only burn product associated with operating the torch was aluminum oxide. Design and proofing tests were conducted in SWMU 65B. The nose cones of reentry vehicles were eventually tested with the torch at Thunder Range (Hickox and Abitz December 1994).

A.3.3 Rocket Propellant Tests

Ten fire tests with rocket propellant and simulated weapons were conducted in 1983 and 1984 at several locations within SWMU 65B and SWMU 65D (Palmieri December 1994d, 65-76). A PII propellant burn rate test was conducted at Location A (Figure 6A-2) on January 12, 1984. This test measured the uninhibited burn rate of the propellant at 6 in. per min, and the inhibited burn rate was measured at 3 in. per min. Propellant used for the inhibited burn rate test contained axle grease to reduce the burn rate of the propellant. Three burn tests with the W-85 weapon casing (no HE present) were conducted in February and March 1984 at Location B

(Figure 6A-2). These tests were conducted to investigate the burn time required to rupture the aluminum weapon casing. Three propellant burn tests were conducted at Location C (Figure 6A-2) with the W-88 weapon casing in May and July of 1987. Specific notes on test results are absent from the test log. One rocket propellant test involving 375 lb of rocket propellant used in the SRAM II missile was conducted at Location C (Figure 6A-2) in August 1993. The test log notes that industrial hygiene personnel were present to monitor for hydrochloric acid. In August and September 1986, two propellant burn tests were conducted at Location D (Figure 6A-2) using the W-31/Y1-3 and W-87/LTU-7 weapon/propellant systems. The test log for the W-31/Y1-3 burn test noted that one propellant cylinder detonated 2 min into the test. A comprehensive list of materials used in these tests was not provided in the test log.

A.4 CONE TESTS

The Conical Containment (CON-CON) Unit was constructed between late 1981 and early 1982 (SNL/NM August 1994) for tests that investigated the penetration of a radioactive tracer (i.e., sodium-24 and uranium dioxide) into unconsolidated overburden. A series of 22 tests were conducted between March 1982 and March 1984 (SNL/NM August 1986, Church March 1982, Palmieri November 1994a). The CON-CON Unit was part of SNL/NM's Nuclear Emergency Search Team project, which studied mitigation techniques for reducing the consequences of an accidental detonation of a nuclear materials explosives dispersal device (Church March 1982).

In constructing the CON-CON Unit, a trench and depression were excavated to a depth of approximately 10 feet, a width of 14.5 feet, and a length of 40 feet (Church March 1982, Jercinovic et al. November 1994). A corrugated culvert was laid down in the excavation (Jercinovic et al. November 1994), and a 17-foot-high steel cone with a base diameter of 6 feet was placed apex down into a port in the center of the culvert (Church March 1982). An 11-foot-long vertical steel cylindrical diagnostic containment section with a diameter of 6 feet was mounted on top of the cone, and the excavation was backfilled to the top of the cone. The southern part of the culvert was left open to allow access for placing the test units at the apex of the cone (Church March 1982, Jercinovic et al. November 1994). A shallow, open trench (30 by 350 feet) extended southward from the culvert opening (SNL/NM August 1994).

The apex of the cone was the location for the C-4 explosives and sodium-24 tracer. The sand or foam overburden material being tested for penetrability was placed over the sodium-24 tracer (Church March 1982, Jercinovic et al. November 1994). The diagnostic containment section was placed above the cone and was equipped with valves to pull air samples, high efficiency particulate air filters, and camera parts (Palmieri December 1994c). The diagnostic containment section contained and measured aerosol and particle dispersion via the activity of the sodium-24 isotope (Palmieri November 1994a).

A total of 22 tests were conducted: one with uranium dioxide powder, seven with sodium-24 tracer (with a half-life of 15 hours (hr) [General Electric Company 1989]), two misfires, and twelve involving instrument calibration, facility seal integrity, and firing system effectiveness. In the tracer tests, a 50- to 150-gram HE charge of C-4 was placed in the cone apex with the sodium-24 tracer (no more than 10 microcuries) positioned directly above the HE (SNL/NM August 1986, Church March 1982, Jercinovic et al. November 1994). Aerosol generated from the C-4 detonation was monitored for radioactivity in the diagnostic containment section (Palmieri November 1994a, Palmieri November 1994b, Palmieri December 1994c).

The CON-CON Unit was dismantled in 1988 (Palmieri and Larsen October 1994) and the Smoke Emissions Reduction Facility (SMERF) was built in the same location (Jercinovic et al. November 1994). The trench that remained from the CON-CON Unit dismantling was widened to accommodate the SMERF (SNL/NM August 1994, Jercinovic et al. November 1994).

A.5 TORCH-ACTIVATED BURN SYSTEM (TABS) TESTS

The TABS test program was conducted from February 1975 to February 1979 to investigate the deflagration-to-detonation transition of HE in weapons, weapon pit damage, dispersal of toxic pit materials, and thermal modeling (Kurowski January 1979). This program consisted of 12 tests with 14 test units that used six different weapon types (B-54, B-57, B-53, B-61, W-44, and W-48). Torches were mounted to the weapons test unit and ignited to determine whether the torch could successfully burn through the weapons casing and ignite and burn the enclosed HE without detonating the weapons. Successful burning was accomplished in all weapons types except one, where three of the five test units detonated. The unsuccessfully tested weapon was not identified. Materials that were involved in the TABS tests include HE, DU, beryllium, and aluminum (Kurowski January 1979, Larsen August 1994).

The TABS test report (Kurowski January 1979) does not identify the location of the individual TABS tests, with the exception of noting that Test V was conducted at the Coyote Test Field on July 28, 1978. Based upon information obtained from Environmental Restoration interview records (Jercinovic et al. November 1994, Larsen August 1994, Palmieri December 1994e), it is known that four of the fourteen tests were conducted at SWMU 60, Bunker Site, and two tests were conducted at SWMU 65. At SWMU 65, one test (Test VI) detonated in the trench of the Bomb Burner Unit (TABS test Location B; Figure 6A-2), and one test took place near the camera bunker (TABS test Location A, SWMU 65B; Figure 6A-2). The TABS test Location B is included with SWMU 94C. The remaining eight tests took place at three locations in Technical Area 2 (Palmieri December 1994e). All of the tests were recorded by movie and still cameras (Kurowski January 1979).

In the TABS tests, a torch was mounted on the weapons component and ignited with a hot-wire device. Torch burn time varied from 10 to 27 seconds (sec) to allow the torch to cut through the weapons casing and ignite the HE (Kurowski January 1979). HE burn time varied from 4 to 7.8 min in the successful burn tests and varied from 11 to 47 sec in the two tests that detonated (Kurowski January 1979). Residue in the weapons and the weapons components continued to burn for approximately 3 to 80 min after the HE was consumed (Kurowski January 1979). For the successful burn test at SWMU 65B, postburn examination of the weapons indicated that the HE was completely consumed (Kurowski January 1979). The weapons in Test VI (TABS Test Location B, Bomb Burner trench, SWMU 94C) detonated 47 sec into the test, dispersing DU fragments that ignited a few small fires northeast of the detonation area (Jercinovic et al. November 1994, Larsen August 1994, Larsen and Palmieri August 1994c). There is no discussion on the dispersal of pit material in the test report (Kurowski January 1979), and test personnel could not discuss the information because of its classified nature (Palmieri December 1994e).

After a TABS test was performed, Sandia National Laboratories/New Mexico health physics personnel conducted radiation surveys of the site (Larsen August 1994). All uncontaminated (i.e., nonradioactive) debris was taken to the scrap yard located in the northwestern corner of the site, and debris contaminated with radioactivity was transported to the Mixed Waste Landfill in Technical Area 3.

A.6 SLOW-HEAT TESTS

Slow-heat tests were conducted between 1982 and 1986 in the general area between the camera bunker and the CON-CON Unit in the primary detonation area and near-field dispersion area (SWMU 65B and SWMU 65D) (Jercinovic et al. November 1994, Palmieri November 1994a). The 11 recorded tests investigated the quantity of HE consumed by detonations induced by slowly heating the test unit with electrical current passed through heat tape (Luna October 1985, Luna June 1983, Moore and Luna February 1982, SNL/NM August 1986). Materials that were involved in the slow-heat tests include HE, steel test vessels, chromel/alumel thermocouples, lead tape, plywood boxes, and vermiculite packaging.

A three-sided concrete block bunker was constructed for the slow-heat tests, and a plywood box was placed in the center (Jercinovic et al. November 1994). The test unit consisted of an 8- or 10-in. steel containment vessel rated at 2,000 to 40,000 lb per square inch that held 6 to 6.5 lb of HE (Luna October 1985, Luna June 1983, Moore and Luna February 1982). Heat tape was wrapped around the containment vessel, and chromel/alumel thermocouples (Type K) were secured to the test vessel with lead (Luna October 1985) or aluminum (Luna June 1983) tape. The test vessel was then sealed in the plywood shipping container and surrounded with vermiculite (Luna October 1985, Luna June 1983, Moore and Luna February 1982). Current was passed through the heat tape to produce a nominal heating rate of 50 degrees Celsius per hr, and the test unit was heated for 4 to 5 hr until the HE detonated (Luna October 1985, Luna June 1983, Moore and Luna February 1982). Vessel fragments and unexpended HE were picked up after completion of the tests (Luna October 1985, Luna June 1983). Undetonated explosives may have been turned over to Kirtland Air Force Base Explosive Ordnance Disposal (Martz September 1985). Because the purpose of the tests was to see how much HE was expended during a slow-heat detonation, unexpended HE was recovered for mass balance calculations (Jercinovic et al. November 1994).

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Annex 6-B

ANNEX 6-B
SWMU 65 Lurance Canyon Explosives Test Site
Site-Specific Background
Soil Sample Results
May–June 1996
June 1998

Table 6B-1
Summary of SWMU 65 Background Soil Sampling Metals Analytical Results, May–June 1996
(Off-Site Laboratory)

Sample Attributes			Metals (EPA 6010/7000)[a] (mg/kg)								
Record Number[b]	ER Sample ID (Figure 2.4.4-3)	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
05191	CY65BK-GR-001-0-SS	0–0.5	6.0	180	0.62 J (1.0)	ND (0.60)	16	14	ND (0.10)	2.4	ND (0.20)
05191	CY65BK-GR-001-0.5-S	0.5–1.0	5.6	170	0.65 J (0.98)	ND (0.59)	16	9.0	ND (0.091)	1.6	ND (0.20)
05191	CY65BK-GR-002-0-SS	0–0.5	4.8	150	0.64 J (0.99)	0.99 J (0.99)	18	16	ND (0.10)	1.9	0.26 J (2.0)
05191	CY65BK-GR-002-0.5-S	0.5–1.0	4.9	150	0.59 J (1.0)	0.61 J (1.0)	16	8.5	ND (0.10)	2.6	ND (0.20)
05191	CY65BK-GR-003-0-SS	0–0.5	3.9	170	0.56 J (0.98)	ND (0.59)	15	12	ND (0.10)	2.5	ND (0.20)
05191	CY65BK-GR-003-0-SD	0–0.5	4.2	170	0.58 J (1.0)	0.64 J (1.0)	14	12	ND (0.10)	2.2	ND (0.20)
05191	CY65BK-GR-003-0.5-S	0.5–1.0	4.0	160	0.62 J (0.98)	ND (0.59)	15	11	ND (0.10)	1.8	ND (0.20)
05191	CY65BK-GR-004-0-SS	0–0.5	6.1	220	0.68 J (0.97)	0.63 J (0.97)	20	14	ND (0.087)	2.0	ND (0.19)
05191	CY65BK-GR-004-0.5-S	0.5–1.0	5.6	210	0.61 J (1.0)	ND (0.60)	17	8.1	ND (0.10)	2.3	ND (0.20)
05191	CY65BK-GR-005-0-SS	0–0.5	6.0	180	0.63 J (0.99)	ND (0.60)	18	10	ND (0.10)	1.8	ND (0.20)
05191	CY65BK-GR-005-0.5-S	0.5–1.0	4.3	230	0.72 J (0.99)	ND (0.60)	20	10	ND (0.095)	1.4	ND (0.20)
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 (in mg/L)											
05191	CY65BK-GR-006-EB	NA	ND (0.0030)	0.0018 J (0.20)	ND (0.0010)	ND (0.0030)	ND (0.0040)	ND (0.0020)	ND (0.00020)	ND (0.0040)	0.0026 J (0.010)

[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
[c]From Zamorski December 1997; contains data set listed above.

BK = Background.
CY = Canyon.
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 (MDL) but is less than the contract required detection limit, shown in parenthesis.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
NA = Not applicable.
ND = Not detected above the MDL, shown in parenthesis.
S = Subsurface soil sample.
SD = Surface soil sample duplicate.
SS = Surface soil sample.
SWMU = Solid waste management unit.

Table 6B-2
Summary of SWMU 65 Background Soil Sampling
Gamma Spectroscopy Analytical Results, May–June 1996
(On-Site Laboratory)

Sample Attributes			Gamma Spectroscopy Activity (pCi/g)							
			Uranium-238		Thorium-232		Uranium-235		Cesium-137	
Record Number[a]	ER Sample ID (Figure 2.4.4-3)	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
05192	CY65BK-GR-001-0-SS	0-0.5	ND (2.88E+00)	--	6.26E-01	3.12E-01	ND (2.03E-01)	--	7.09E-01	1.00E-01
05192	CY65BK-GR-001-0.5-S	0.5-1.0	ND (3.34E+00)	--	7.21E-01	9.93E-01	ND (1.42E-01)	--	3.88E-02	2.52E-02
05192	CY65BK-GR-002-0-SS	0-0.5	ND (2.95E+00)	--	5.72E-01	2.92E-01	ND (2.09E-01)	--	5.52E-01	7.81E-02
05192	CY65BK-GR-002-0.5-S	0.5-1.0	ND (3.34E+00)	--	6.88E-01	3.66E-01	ND (2.25E-01)	--	ND (3.59E-02)	--
05192	CY65BK-GR-003-0-SS	0-0.5	ND (3.60E+00)	--	5.43E-01	2.74E-01	ND (2.37E-01)	--	6.67E-01	1.05E-01
05192	CY65BK-GR-003-0-SD	0-0.5	ND (2.02E+00)	--	5.515E-01	2.80E-01	ND (2.28E-01)	--	7.38E-01	1.14E-01
05192	CY65BK-GR-003-0.5-S	0.5-1.0	ND (3.14E+00)	--	5.59E-01	2.79E-01	ND (2.18E-01)	--	ND (1.96E-02)	--
05192	CY65BK-GR-004-0-SS	0-0.5	1.01E+00	1.20E+00	6.17E-01	3.07E-01	ND (2.25E-01)	--	4.80E-01	7.76E-02
05192	CY65BK-GR-004-0.5-S	0.5-1.0	ND (3.23E+00)	--	6.21	3.08E-01	ND (2.29E-01)	--	1.40E-02	1.54E-02
05192	CY65BK-GR-005-0-SS	0-0.5	ND (3.49E+00)	--	8.22E-01	3.78E-01	ND (2.44E-01)	--	2.15E-01	3.86E-01
05192	CY65BK-GR-005-0.5-S	0.5-1.0	ND (3.45E+00)	--	ND (1.33E-01)	--	ND (2.35E-01)	--	2.00E-02	1.48E-02
Background Soil Concentrations—Upper Canyons[c]			2.31	NA	1.03	NA	0.16	NA	0.515	NA
Quality Assurance/Quality Control Sample (in pCi/L)										
05191	CY65BK-GR-006-EB (off-site laboratory)	NA	0.128 B	0.065	ND (0.039)	--	0.041	0.042	NT	NA

[a] Analysis request/chain-of-custody record.
[b] Two standard deviations above the mean detected activity.
[c] From Dinwiddie September 1997, does not contain data set listed above.

B = Radionuclide detected in associated blank.
BK = Background.
CY = Canyon.
EB = Equipment blank.
ER = Environmental Restoration.
GR = Grab sample.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND = Radionuclide not detected above the minimum detectable activity, shown in parenthesis.
NT = Not tested.
pCi/g = Picocuries per gram.
pCi/L = Picocuries per liter.
S = Subsurface soil sample.
SD = Surface soil sample duplicate.
SS = Surface soil sample.
SWMU = Solid waste management unit.
-- = Error not calculated for nondetectable results.

Table 6B-3
Summary of SWMU 65 Background Soil Sampling
Isotopic Thorium, Uranium, and Strontium Analytical Results, May 1996
(Off-Site Laboratory)

Sample Attributes			Activity (pCi/g)													
Record Number[a]	ER Sample ID (Figure 2.4.4-3)	Sample Depth (ft)	Thorium-228		Thorium-230		Thorium-232		Uranium-233/234		Uranium-235		Uranium-238		Strontium-89/90	
			Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
05191	CY65BK-GR-001-0-SS	0-0.5	0.91	0.11	0.96	0.11	0.864	0.10	0.715B	0.076	0.053B	0.019	0.764	0.079	ND (0.39)B	--
05191	CY65BK-GR-001-0.5-S	0.5-1.0	0.970	0.10	0.912	0.095	1.029	0.10	0.637B	0.072	0.046	0.018	0.731	0.078	ND (0.16)B	--
05191	CY65BK-GR-002-0-SS	0-0.5	0.979	0.10	0.879	0.095	0.881	0.095	0.650B	0.076	0.035B	0.016	0.752	0.083	ND (0.43)B	--
05191	CY65BK-GR-002-0.5-S	0.5-1.0	0.923	0.10	0.896	0.097	0.922	0.099	0.608B	0.075	0.037B	0.017	0.684	0.080	ND (0.41)B	--
05191	CY65BK-GR-003-0-SS	0-0.5	0.824	0.10	0.816	0.097	0.804	0.096	0.612B	0.077	0.0120 B	0.010	0.664	0.081	0.33 B	0.26
05191	CY65BK-GR-003-0-SD	0-0.5	0.832	0.095	0.877	0.094	0.881	0.094	0.680B	0.085	0.028B	0.017	0.667	0.084	0.35 B	0.25
05191	CY65BK-GR-003-0.5-S	0.5-1.0	0.93	0.11	0.907	0.10	0.98	0.11	0.546B	0.071	0.041B	0.018	0.595	0.074	ND (0.44)B	--
05191	CY65BK-GR-004-0-SS	0-0.5	0.861	0.096	1.024	0.10	0.968	0.099	0.709B	0.088	0.075B	0.026	0.864	0.099	ND (0.41)B	--
05191	CY65BK-GR-004-0.5-S	0.5-1.0	0.90	0.11	0.95	0.11	0.826	0.10	0.733B	0.089	0.046B	0.021	0.747	0.090	ND (0.40)B	--
05191	CY65BK-GR-005-0-SS	0-0.5	0.99	0.12	1.05	0.12	0.97	0.12	0.779B	0.10	0.069B	0.030	0.762	0.10	ND (0.52)B	--
05191	CY65BK-GR-005-0.5-S	0.5-1.0	0.98	0.12	1.00	0.12	1.11	0.13	0.763B	0.087	0.047B	0.021	0.742	0.085	ND (0.40)B	--
Background Soil Concentrations—Upper Canyons[c]			NE	--	NE	--	1.03	--	2.31	--	0.16	--	2.31	--	1.08	--
Quality Assurance/Quality Control Sample (in pCi/L)																
05191	CY65BK-GR-006-EB	NA	ND (0.15)	--	ND (0.055)	--	ND (0.039)	--	0.103	0.067	0.041	0.042	0.128	0.065	0.31	0.27

[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.
[c]From Dinwiddie September 1997, does not contain data set listed above.

B = Radionuclide detected in associated blank.
BK = Background.
CY = Canyon.
EB = Equipment blank.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
NA = Not applicable.
NE = Not established.
ND ( ) = Not detected at or above the minimum detectable activity, shown in parenthesis.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
S = Subsurface soil sample.
SD = Surface soil sample duplicate.
SS = Surface soil sample.
SWMU = Solid waste management unit.
-- = Error not calculated for nondetectable results.

Table 6B-4
Summary of SWMU 65 Background Soil Sampling
Gross Alpha and Gross Beta Analytical Results, June 1998

Sample Attributes			Gamma Spectroscopy Activity (pCi/g)			
			Gross Alpha		Gross Beta	
Record Number[a]	ER Sample ID (Figure 2.4.4-3)	Sample Depth (ft)	Result	Error[b]	Result	Error[b]
05192	CY65BK-GR-001-0-SS (on-site laboratory)	0–0.5	ND (4.39E+00)	--	ND (1.95E+01)	--
05192	CY65BK-GR-001-0.5-S (on-site laboratory)	0.5-1.0	ND (4.39E+00)	--	ND (1.95E+01)	--
05192	CY65BK-GR-002-0-SS (on-site laboratory)	0–0.5	ND (4.39E+00)	--	ND (1.95E+01)	--
05192	CY65BK-GR-002-0.5-S (on-site laboratory)	0.5-1.0	ND (4.39E+00)	--	ND (1.95E+01)	--
05192	CY65BK-GR-003-0-SS (on-site laboratory)	0–0.5	ND (4.39E+00)	--	ND (1.95E+01)	--
05192	CY65BK-GR-003-0-SD (on-site laboratory)	0–0.5	ND (4.39E+00)	--	ND (1.95E+01)	--
05192	CY65BK-GR-003-0.5-S (on-site laboratory)	0.5-1.0	ND (4.39E+00)	--	ND (1.95E+01)	--
05192	CY65BK-GR-004-0-SS (on-site laboratory)	0–0.5	ND (4.39E+00)	--	ND (1.95E+01)	--
05192	CY65BK-GR-004-0.5-S (on-site laboratory)	0.5-1.0	ND (4.39E+00)	--	ND (1.95E+01)	--
05192	CY65BK-GR-005-0-SS (on-site laboratory)	0–0.5	ND (4.39E+00)	--	ND (1.95E+01)	--
05192	CY65BK-GR-005-0.5-S (on-site laboratory)	0.5-1.0	ND (4.39E+00)	--	ND (1.95E+01)	--
600318	CY65BK-GR-006-SS	0	3.95	4.29	13.3	3.28
600318	CY65BK-GR-007-SS	0	14.2	5.02	30.4	3.74
600318	CY65BK-GR-008-SS	0	11.1	4.81	19.8	3.46
600318	CY65BK-GR-009-SS	0	9.67	4.71	25.6	3.62
600318	CY65BK-GR-010-SS	0	13.0	4.94	17.8	3.41
600318	CY65BK-GR-011-SS	0	11.1	4.81	18.3	3.42
600318	CY65BK-GR-012-SS	0	13.2	4.95	29.0	3.70
600318	CY65BK-GR-013-SS	0	14.4	5.03	17.1	3.39
600318	CY65BK-GR-014-SS	0	11.8	4.86	28.1	3.68
600318	CY65BK-GR-015-SS	0	15.9	5.13	45.1	4.09
600318	CY65BK-GR-016-SS	0	17.7	5.24	29.1	3.71
600318	CY65BK-GR-017-SS	0	16.8	5.19	42.0	4.02
600318	CY65BK-GR-018-SS	0	5.51	4.40	22.1	3.52
600318	CY65BK-GR-019-SS	0	13.2	4.95	24.4	3.59
600318	CY65BK-GR-020-SS	0	10.9	4.80	17.8	3.41
Background Soil Activity—Canyons Area[c]			18.3	NA	52.7	NA

[a]Analysis request/chain-of-custody record.
[b]Two standard deviations above the mean detected activity.
[c]From Tharp July 1998, contained data from samples CY65BK-GR-006-SS through CY65BK-GR-020-SS.

BK = Background.
CY = Canyon.
ER = Environmental Restoration.
GR = Grab sample.
ft = Foot (feet).
ID = Identification.
NA = Not applicable.
ND = Radionuclide not detected above the minimum detectable activity, shown in parenthesis.
pCi/g = Picocuries per gram.
S = Subsurface soil sample.
SD = Surface soil sample duplicate.
SS = Surface soil sample.
SWMU = Solid waste management unit.
-- = Error not calculated for nondetectable results.

Annex 6-C

ANNEX 6-C
SWMU 65 Lurance Canyon Explosives Test Site
Site-Specific Background
Arroyo Sediment Sample Results
May–June 1996

Table 6C-1
Summary of SWMU 65 Background Arroyo Sediment Sampling Metals Analytical Results, May–June 1996 (Off-Site Laboratory)

Sample Attributes			Metals (EPA 6010/7000)[a] (mg/kg)								
Record Number[b]	ER Sample ID (Figure 2.4.4-3)	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
05227	CY65BKA-GR-001-0-SS	0–0.5	3.8	130	0.42 J (0.98)	ND (0.59)	14	8.7	ND (0.095)	2.5	ND (0.20)
05227	CY65BKA-GR-001-0.5-S	0.5–1.0	3.5	110	0.33 J (0.98)	0.74 J (0.98)	13	6.6	ND (0.10)	2.2	0.20 J (2.0)
05227	CY65BKA-GR-002-0-SS	0–0.5	3.6	110	0.31 J (0.99)	ND (0.60)	11	7.3	ND (0.095)	2.4	ND (0.20)
05227	CY65BKA-GR-002-0-SD	0–0.5	2.3	73	0.20 J (0.98)	ND (0.59)	9.0	4.3	ND (0.10)	2.3	ND (0.20)
05227	CY65BKA-GR-002-0.5-S	0.5–1.0	3.7	130	0.31 J (0.96)	ND (0.58)	11	8.0	ND (0.10)	2.3	ND (0.19)
05227	CY65BKA-GR-003-0-SS	0–0.5	9.6	77	0.27 J (0.98)	ND (0.59)	10	8.0	ND (0.095)	3.0	ND (0.20)
05227	CY65BKA-GR-003-0.5-S	0.5–1.0	3.3	73	0.26 J (1.0)	ND (0.60)	9.4	6.1	ND (0.091)	3.0	0.30 J (2.0)
05227	CY65BKA-GR-004-0-SS	0.5–1.0	3.9	130	0.39 J (0.99)	ND (0.60)	12	9.1	ND (0.095)	2.4	ND (0.20)
05227	CY65BKA-GR-004-0.5-S	0.5–1.0	2.9	400	0.27 J (0.97)	ND (0.58)	9.9	5.8	ND (0.10)	2.6	ND (0.19)
05227	CY65BKA-GR-005-0-SS	0–0.5	4.3	210	0.73 J (0.96)	ND (0.58)	17	18	ND (0.10)	1.9	ND (0.19)
05227	CY65BKA-GR-005-0.5-S	0.5–1.0	3.2	110	0.36 J (0.99)	ND (0.60)	11	8.1	ND (0.10)	2.6	ND (0.20)
05227	CY65BKA-GR-006-0-SS	0–0.5	3.9	150	0.46 J (1.0)	ND (0.60)	12	12	ND (0.10)	2.4	ND (0.20)
05227	CY65BKA-GR-006-0.5-S	0.5–1.0	2.9	73	0.26 J (0.98)	0.64 J (0.98)	10	6.1	ND (0.10)	3.1	ND (0.20)
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 (in mg/L)											
05227	CY65BKA-GR-007-EB	NA	ND (0.0030)	0.0012 J (0.20)	ND (0.0010)	ND (0.0030)	ND (0.0040)	ND (0.0020)	ND (0.00020)	ND (0.0040)	0.0023 J (0.010)

[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
[c]From Zamorski December 1997, contains data set listed above.

BKA = Background arroyo.
CY = Canyon.
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 (MDL) but is less than the contract required detection limit, shown in parenthesis.
mg/kg = Milligrams per kilogram.
mg/L = Milligrams per liter.
NA = Not applicable.
ND = Not detected above the MDL, shown in parenthesis.
S = Subsurface sediment sample.
SD = Surface sediment sample duplicate.
SS = Surface sediment sample.
SWMU = Solid waste management unit.

Table 6C-2
Summary of SWMU 65 Background Arroyo Sediment Sampling Gamma Spectroscopy Analytical Results, May–June 1996 (On-Site Laboratory)

Sample Attributes			Gamma Spectroscopy Activity (pCi/g)							
			Uranium-238		Thorium-232		Uranium-235		Cesium-137	
Record Number[a]	ER Sample ID (Figure 2.4.4-3)	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
05228	CY65BKA-GR-001-0-SS	0-0.5	ND (1.18E+00)	--	4.65E-01	2.18E-01	ND (1.61E-01)	--	1.23E-01	1.76E-01
05228	CY65BKA-GR-001-0.5-S	0.5-1.0	ND (1.02E+00)	--	2.58E-01	3.93E-01	ND (1.40E-01)	--	ND (1.84E-02)	--
05228	CY65BKA-GR-002-0-SS	0-0.5	4.34E-01	7.41E-01	2.47E-01	1.81E-01	ND (1.36E-01)	--	5.38E-02	3.05E-02
05228	CY65BKA-GR-002-0.5-S	0.5-1.0	ND (9.36E-01)	--	2.70E-01	1.99E-01	ND (1.37E-01)	--	ND (1.89E-02)	--
05228	CY65BKA-GR-003-0-SS	0-0.5	8.04E-01	8.42E-01	2.33E-01	1.93E-01	ND (1.43E-01)	--	6.50E-02	2.38E-02
05228	CY65BKA-GR-003-0.5-S	0.5-1.0	ND (1.01E+00)	--	2.73E-01	1.81E-01	ND (1.45E-01)	--	6.95E-02	2.45E-02
05228	CY65BKA-GR-004-0-SS	0-0.5	ND (1.03E+00)	--	2.80E-01	4.11E-01	ND (1.46E-01)	--	1.49E-01	5.76E-02
05228	CY65BKA-GR-004-0.5-S	0.5-1.0	4.79E-01	7.29E-01	2.59E-01	2.88E-01	ND (1.35E-01)	--	4.44E-02	2.74E-02
05228	CY65BKA-GR-005-0-SS	0-0.5	ND (1.66E+00)	--	8.38E-01	4.43E-01	ND (2.29E-01)	--	8.79E-01	1.59E-01
05228	CY65BKA-GR-005-0.5-S	0.5-1.0	ND (9.33E-01)	--	3.11E-01	2.11E-01	ND (1.31E-01)	--	2.39E-01	7.34E-02
05228	CY65BKA-GR-006-0-SS	0-0.5	ND (1.38E+00)	--	3.98E-01	2.50E-01	ND (1.83E-01)	--	6.25E-01	1.06E-01
05228	CY65BKA-GR-006-0.5-S	0.5-1.0	ND (1.21E+00)	--	3.37E-01	2.33E-01	ND (1.65E-01)	--	2.97E-01	6.92E-02
Background Soil Concentrations—Upper Canyons[c]			2.31	NA	1.03	NA	0.16	NA	0.515	NA
Quality Assurance/Quality Control Sample (in pCi/L)										
05227	CY65BKA-GR-007-EB (off-site laboratory)	NA	0.080 B	0.049	ND(0.070)	--	0.036	0.032	NT	NA

[a]Analysis request/chain-of-custody record.
[b]Two standard deviations above the mean detected activity.
[c]From Dinwiddie September 1997, does not contain data set listed above.

BKA = Background arroyo.
CY = Canyon.
EB = Equipment blank.
ER = Environmental Restoration.
ft = Feet.
GR = Grab sample.
ID = Identification.
NA = Not applicable.
ND = Radionuclide not detected above the minimum detectable activity, shown in parenthesis.
NT = Not tested.
pCi/g = Picocuries per gram.
S = Subsurface sediment sample.
SS = Surface sediment sample.
SWMU = Solid waste management unit.
-- = Error not calculated for nondetectable results.

Table 6C-3
Summary of SWMU 65 Background Arroyo Sediment Sampling Isotopic Thorium, Uranium, and Strontium Analytical Results, May–June 1996 (Off-Site Laboratory)

Sample Attributes			Activity (pCi/g)													
Record Number[a]	ER Sample ID (Figure 2.4.4-3)	Sample Depth (ft)	Thorium-228		Thorium-230		Thorium-232		Uranium-233/234		Uranium-235		Uranium-238		Strontium-89/90	
			Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
05227	CY65BKA-GR-001-0-SS	0-0.5	0.927 B	0.096	0.975	0.095	0.880	0.089	0.599	0.099	0.033	0.024	0.81	0.12	ND (1.4)	--
05227	CY65BKA-GR-001-0.5-S	0.5-1.0	0.889 B	0.086	0.934	0.085	0.699	0.071	0.82	0.13	0.110	0.045	0.81	0.13	ND (0.46) B	--
05227	CY65BKA-GR-002-0-SS	0-0.5	0.821 B	0.083	0.878	0.083	0.715	0.073	0.76	0.11	0.057	0.028	0.73	0.11	ND (1.1)	--
05227	CY65BKA-GR-002-0-SD	0-0.5	0.693 B	0.083	0.887	0.093	0.773	0.086	0.74	0.12	0.050	0.030	0.575	0.10	ND (1.0)	--
05227	CY65BKA-GR-002-0.5-S	0.5-1.0	9.30 B	0.52	1.031	0.091	0.739	0.073	0.93	0.13	0.123	0.045	0.79	0.12	ND (1.0)	--
05227	CY65BKA-GR-003-0-SS	0-0.5	0.606B	0.068	0.785	0.075	0.553	0.061	0.81	0.12	0.038	0.025	0.81	0.12	ND (1.2)	--
05227	CY65BKA-GR-003-0.5-S	0.5-1.0	0.494 B	0.059	0.805	0.075	0.494	0.055	0.83	0.12	0.060	0.031	0.89	0.12	ND (1.3)	--
05227	CY65BKA-GR-004-0-SS	0-0.5	1.271 B	0.10	0.873	0.080	0.703	0.069	1.17	0.15	0.139	0.049	0.91	0.13	ND (1.1)	--
05227	CY65BKA-GR-004-0.5-S	0.5-1.0	0.728 B	0.076	0.835	0.080	0.679	0.070	0.75	0.12	0.127	0.046	0.75	0.12	ND (1.2)	--
05227	CY65BKA-GR-005-0-SS	0-0.5	0.976 B	0.091	1.042	0.092	0.949	0.086	0.76	0.11	0.054	0.028	0.74	0.11	ND (0.70)	--
05227	CY65BKA-GR-005-0.5-S	0.5-1.0	0.788 B	0.084	0.904	0.088	0.883	0.087	0.534	0.091	0.034	0.024	0.634	0.099	ND (0.54)	--
05227	CY65BKA-GR-006-0-SS	0-0.5	0.906 B	0.089	0.984	0.091	0.850	0.083	0.614	0.10	0.068	0.036	0.76	0.12	ND (1.2)	--
05227	CY65BKA-GR-006-0.5-S	0.5-1.0	0.802 B	0.089	0.809	0.086	0.707	0.079	0.605	0.10	0.052	0.031	0.83	0.11	ND (1.2)	--
Background Soil Concentrations—Upper Canyons[c]			NE	--	NE	--	1.03	--	2.31	--	0.16	--	2.31	--	1.08	--
Quality Assurance/Quality Control Sample (in pCi/L)																
05227	CY65BKA-GR-007-EB	NA	ND (0.18)	--	ND (0.094)	--	ND (0.070)	--	0.080 B	0.055	0.036	0.032	0.080 B	0.049	ND (0.62)	--

[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.
[c]From Dinwiddie September 1997, does not contain data set listed above.

B = Radionuclide detected in associated blank.
BKA = Background arroyo.
CY = Canyon.
EB = Equipment blank.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
NA = Not applicable.
NE = Not established.
ND ( ) = Not detected at or above the minimum detectable activity, shown in parenthesis.
pCi/g = Picocurie(s) per gram.
pCi/L = Picocurie(s) per liter.
S = Subsurface sediment sample.
SD = Surface sediment sample duplicate.
SNL/NM = Sandia National Laboratories, New Mexico.
SS = Surface sediment sample.
SWMU = Solid waste management unit.
-- = Error not calculated for nondetectable results.

Table 6C-4
Summary of SWMU 65 Background Arroyo Sediment Sampling
Gross Alpha and Gross Beta Analytical Results, May–June 1996
(On-Site Laboratory)

Sample Attributes			Gamma Spectroscopy Activity (pCi/g)			
Record Number[a]	ER Sample ID (Figure 2.4.4-3)	Sample Depth (ft)	Gross Alpha	Error[b]	Gross Beta	Error[b]
05228	CY65BKA-GR-001-0-SS	0-0.5	ND (4.40E+00)	--	ND (1.92E+01)	--
05228	CY65BKA-GR-001-0.5-S	0.5-1.0	ND (4.40E+00)	--	ND (1.92E+01)	--
05228	CY65BKA-GR-002-0-SS	0-0.5	ND (4.40E+00)	--	ND (1.92E+01)	--
05228	CY65BKA-GR-002-0.5-S	0.5-1.0	ND (4.40E+00)	--	ND (1.92E+01)	--
05228	CY65BKA-GR-003-0-SS	0-0.5	ND (4.40E+00)	--	ND (1.92E+01)	--
05228	CY65BKA-GR-003-0.5-S	0.5-1.0	ND (4.40E+00)	--	ND (1.92E+01)	--
05228	CY65BKA-GR-004-0-SS	0-0.5	ND (4.40E+00)	--	ND (1.92E+01)	--
05228	CY65BKA-GR-004-0.5-S	0.5-1.0	ND (4.40E+00)	--	ND (1.92E+01)[c]	--
05228	CY65BKA-GR-005-0-SS	0-0.5	ND (4.40E+00)	--	ND (1.92E+01)	--
05228	CY65BKA-GR-005-0.5-S	0.5-1.0	ND (4.40E+00)	--	ND (1.92E+01)	--
05228	CY65BKA-GR-006-0-SS	0-0.5	ND (4.40E+00)	--	ND (1.92E+01)	--
05228	CY65BKA-GR-006-0.5-S	0.5-1.0	ND (4.40+00)	--	ND (1.92E+01)	--
Background Soil Concentrations—Canyons Area[d]			18.3	NA	52.7	NA

[a]Analysis request/chain-of-custody record.
[b]Two standard deviations above the mean detected activity.
[c]Result exceeds 2-sigma error.
[d]From Tharp July 1998, does not contain data set listed above.

BKA = Background arroyo.
CY = Canyon.
ER = Environmental Restoration.
ft = Feet.
GR = Grab sample.
ID = Identification.
NA = Not applicable.
ND = Radionuclide not detected above the minimum detectable activity, shown in parenthesis.
pCi/g = Picocuries per gram.
S = Subsurface sediment sample.
SS = Surface sediment sample.
SWMU = Solid waste management unit.
-- = Error not calculated for nondetectable results.

Annex 6-D

ANNEX 6-D
Gamma Spectroscopy Results

RUSH

SF 2001-COC (10-97)
Supersedes (5-97) issue

Internal Lab Batch No. 800688 SAR/WR No.

ANALYSIS REQUEST AND CHAIN OF CUSTODY

Press F1 for instructions for each field.

AR/COC- 600217

Dept. No./Mail Stop: 1148
Project/Task Manager: Grace Haggerty
Project Name: ER Site 65C
Record Center Code: ER/1333/65D/DAT
Logbook Ref. No.: ER-0153
Service Order No.: CF0507

Date Samples Shipped: [illegible]
Carrier/Waybill No. [illegible]
Lab Contact: FernandoDominguez
Lab Destination: RPSD Building 881
SMO Contact/Phone: Doug Salmi/848-0963
Send Report to SMO: Grace Haggerty

Contract No.: AJ-2480C
Case No.: 7214.220800
SMO Authorization: [signature]
Bill to: Sandia National Laboratories
Supplier Services, Dept.
P.O. Box 5800 MS 0154

Location: Tech Area NA, Building NA, Room NA

Reference LOV (available at SMO)

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft	ER Site No.	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
040240 - 004	CY65C-GR-1075,300-0-0.5-SS	0-0.5	65C	041498/ 1345	S	M	500 ml	None	G	SA	Gamma Spectroscopy	
040241 - 004	CY65C-GR-1075,300-4-6-S	4-6	65C	041498/ 1400	S	M	500 ml	None	G	SA	Gamma Spectroscopy	
040243 - 004	CY65C-GR-01-EB	NA	65C	041498/ 1630	DIW	M	500 ml	None	G	SA	Gamma Spectroscopy	
040247 - 004	CY65C-GR-975,350-1-2.5-S	1-2.5	65C	041498/ 1445	S	M	500 ml	None	G	SA	Gamma Spectroscopy	
040244 - 004	CY65C-GR-975,350-0-0.5-SS	0-0.5	65C	041498/1430	S	M	500 ml	None	G	SA	Gamma Spectroscopy	
040245 - 004	CY65C-GR-975,350-5-7-S	5-7	65C	041498/ 1510	S	M	500 ml	None	G	SA	Gamma Spectroscopy	
040246 - 004	CY65C-GR-975,350-8-13-S	8-13	65C	041498/1530	S	M	500 ml	None	G	SA	Gamma Spectroscopy	
-												
-												
-												

changed as per D. Salmi

RMMA ☒Yes ☐No Ref. No. ____
Sample Disposal ☒Return to Client ☐Disposal by lab
Turnaround Time ☐Normal ☒Rush Required Report Date ____

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

Special Instructions/QC Requirements
EDD ☐Yes ☒No
Raw data package ☐Yes ☒No
*Please send copy of report to Grace Haggerty/284-2545
*COC#600217 releases COC#'S 600216, 600214, 600213, 600218, 600215
Please list as separate report.

Abnormal Conditions on Receipt

Sample Team Members	Name	Signature	Init	Company/Organization/Phone
	AngelB. Vega	Angel B. Vega	ABV	MDM/6131/844-9081
	Christopher Catechis	Chris Catechis	C.C.	MDM/6131/281-3196

		Org.	Date	Time			Org.	Date
1. Relinquished by	Chris Catechis	6131	4/15/98	14:20	4. Relinquished by			
1. Received by	[signature]	7578	4/15/98	1420	4. Received by			
2. Relinquished by	[signature]	7578	4/15/98	1555	5. Relinquished by			
2. Received by	[signature]	SNL7578	4/15/98	1555	5. Received by			
3. Relinquished by	[signature]	7578	4/16/98	902	6. Relinquished by			
3. Received by	[signature]	7578	4/16/98	902	6. Received by			

Original: To Accompany Samples, Laboratory Copy (White)
1st Copy: To Accompany Samples, Return to SMO (Blue)
2nd Copy: SMO Suspense Copy (Yellow)
3rd Copy: Field Copy (Pink)

05/22/98 08:44 ☎505 844 3126 SNL SMO 008/008

Sandia National Laboratories
Radiation Protection Sample Diagnostics

Sample Analysis Request Form
Page 1 of 1

To be completed by Customer — *Shaded areas are for RPSD use only*

Customer: G HAGEBBly
Organization: 1148
Project Location: ER Site 65C
Phone: 284-2545
Date Results Needed: 4-17-98
Suspect Isotopes: UNK
Case Number: 7214.220900

Hazards/Special Instructions: CAll Sno when Complete.

RusH

CoC 600217

Batch Log Number: 800688
Logged By: Fm
Analysis Type: ☒ Gamma Spec ☐ H-3 ☐ Alpha/Beta ☐ Alpha Spec ☐ Total U ☐ Other

Customer Sample ID	Sample Type	Date/Time Collected	Sample Quantity	Requested Analysis	RPSD Sample ID	Screen cpm	Sample Mass	Remarks / Aliquot Amount
040240-004	Solid	4/14/98 1345	500	γ spec	01	<300	724g	
040241-004	Solid	1400			02		781g	
040243-004	liquid	1630			03		N/A	
040247-004	Solid	1445			04		700g	
040244-004	Solid	1430			05		591g	
040245-004	solid	1510			06		674g	
040246-004	Solid	1530			07	<300	703g	
LCS	—	NOV20	—	γ spec	08	N/A	N/A	

Relinquished by [signature] Date 4/15/98 Received by [signature] Date 4/15/98
Relinquished by [signature] Date 4/16/98 Received by [signature] Date 4/16/98
Relinquished by ______ Date ______ Received by ______ Date ______
Relinquished by ______ Date ______ Received by ______ Date ______

RusH

Survey Number: S04511

RADIOLOGICAL SURVEY FORM

Page 1 of 2

Location	Requester/Dept	Date	Time	Duration
ER 65	W FOUTZ/6133	041498	0900	NA

Purpose	Request #	RWP #	RPIR #
SAMPLE RELEASE TO SMO	NA	RWP0111	NA

Instrument and Probe Type and Serial Number		Surveyor(s) Printed Name	Surveyor(s) Signature
ASP1-HP260-2355		KM BABILON	

#	Item Description/Location	BETA-GAMMA CONTAMINATION Counting Data Attached ☒ Yes ☐ No %Eff 20 /Radionuclide DU				ALPHA CONTAMINATION Counting Data Attached ☒ Yes ☐ No %Eff NA /Radionuclide NA				RADIATION SURVEY Bkg. NA	
		cpm	Bkg cpm	dpm/100 cm² (1)	(2) T/R/F	cpm	Bkg cpm	dpm/100 cm² (1)	(2) T/R/F	mrem/hr (3)	Distance
1,2	Sample ID 40422, 40423	80	80	ND	T						
3,4	Sample ID 40424, 40425	80	80	ND	T						
5,6	Sample ID 40426, 40427	80	80	ND	T						
7,8	Sample ID 40428, 40429	80	80	ND	T						
9,10	Sample ID 40430, 40431	80	80	ND	T						
11	Sample ID 40432	80	80	ND	T						
12	Sample ID 40434	80	80	ND	T						
13	Sample ID 40435	80	80	ND	T						
14	Sample ID 40436	80	80	ND	T						
15	Sample ID 40507	80	80	ND	T						
16	Sample ID 40508	80	80	ND	T						
17	Sample ID 40509	80	80	ND	T						
18	Sample ID 40510	80	80	ND	T						
19	Sample ID 40511	80	80	ND	T						
20	Sample ID 40512	80	80	ND	T						

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

Remarks: This survey is done to release the samples from the ER site to SMO for off-site analysis. The containers held soil, and the outsides of the containers were smeared and frisked. There was no detectable contamination found on the sample containers.

Reviewed by: Date:

RPO401-04c

Page 2 of 2

Survey No. 504511

Radiation Protection Sample Diagnostics (7578) TA-III 6921
Smear Analysis

Date: 4/8/98
Counting Unit Id: 1 (SNL# S674564)
Data file name: C:\LBXL\UNIT1\83510202.XLD
Batch Ended: 4/8/98 17:22
Crosstalk Correction: Applied
ANALYZED BY RT PRESTON
REVIEWED BY: RT Preston 4/08/98 RTP
Batch ID: BURNSITE WEEK, 4/08/98, K. BABILON

Alpha activity action level (DPM): 20.00
Beta activity action level (DPM): 1000.00
Certainty level for MDA and flags: 95.00%
High Voltage Setting: 1360
Application Revision: 3
Application Version: Standard

Alpha efficiency log file: pu238ab
Alpha Efficiency: 43.14%
Alpha to Beta Crosstalk: 10.16%
Alpha Background (CPM): 0.4
Alpha Correction Factor: 1.000
Beta efficiency log file: cl36ab
Beta Efficiency: 54.98%
Beta Into Alpha Crosstalk: 1.36%
Beta Background (CPM): 2.9
Beta Correction Factor: 1.000

	Alpha Activity				Beta Activity				count	Alpha	Beta	Time
ID	DPM	σ	flags	MDA	DPM	σ	flags	MDA	Time	CPM	CPM	Compl
1	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	17:13
2	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	17:14
3	1.58	2.64	<MDA	11.84	-1.79	2.71	<MDA	15.65	1.00	0.60	-0.90	17:15
4	-1.00	2.64	<MDA	11.88	-1.58	2.71	<MDA	15.45	1.00	-0.40	-0.90	17:16
5	-1.00	2.64	<MDA	11.88	-1.58	2.71	<MDA	15.45	1.00	-0.40	-0.90	17:17
6	1.58	2.64	<MDA	11.84	-1.79	2.71	<MDA	15.65	1.00	0.60	-0.90	17:18
7	-1.07	2.67	<MDA	12.16	2.11	3.76	<MDA	15.44	1.00	-0.40	1.10	17:20
8	1.51	2.67	<MDA	12.15	1.91	3.76	<MDA	15.64	1.00	0.60	1.10	17:21
9	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	17:22

Survey Number: S04534

RADIOLOGICAL SURVEY FORM

Page 1 of 6

Location	Requester/Dept.	Date	Time	Duration
ER 65	W FOUTZ/6133	041498	1600	NA

Purpose	Request #	RWP #	RPIR #
SAMPLE RELEASE TO SMO	NA	RWP0111	NA

Instrument and Probe Type and Serial Number		Surveyor(s) Printed Name	Surveyor(s) Signature
ASP1-HP260-2355		KM BABILON	KM Babilon

#	Item Description/Location	BETA-GAMMA CONTAMINATION Counting Data Attached ☒ Yes ☐ No %Eff. 20 /Radionuclide DU				ALPHA CONTAMINATION Counting Data Attached ☒ Yes ☐ No %Eff NA /Radionuclide NA				RADIATION SURVEY Bkg. NA	
		cpm	Bkg cpm	dpm/100 cm² (1)	(2) T/R/F	cpm	Bkg cpm	dpm/100 cm² (1)	(2) T/R/F	mrem/hr (3)	Distance
1	Sample ID 40236	80	80	ND	T						
2	Sample ID 40236	80	80	ND	T						
3	Sample ID 40237	80	80	ND	T						
4	Sample ID 40237	80	80	ND	T						
5	Sample ID 40238	80	80	ND	T						
6	Sample ID 40239	80	80	ND	T						
7	Sample ID 40240	80	80	ND	T						
8	Sample ID 40241	80	80	ND	T						
9	Sample ID 40244	80	80	ND	T						
10	Sample ID 40245	80	80	ND	T						
11	Sample ID 40246	80	80	ND	T						
12	Sample ID 40247	80	80	ND	T						
13	Sample ID 40398	80	80	ND	T						
14	Sample ID 40399	80	80	ND	T						
15	Sample ID 40400	80	80	ND	T						

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

Remarks This survey is done to release the samples from the ER site to SMO for off-site analysis. The containers held soil, and the outsides of the containers were smeared and frisked. There was no detectable contamination found on the sample containers.

Reviewed by: Date:

RADIOLOGICAL SURVEY FORM

Survey # S04532

#	Item Description/Location	BETA-GAMMA ACTIVITY cpm	Bkg. cpm	dpm / 100 cm² (1)	(2) T/R/F	ALPHA ACTIVITY cpm	Bkg. cpm	dpm / 100 cm² (1)	(2) T/R/F	RADIATION SURVEY mrem/hr (3)	Distance
16	Sample ID 40401	80	80	ND	T						
17	Sample ID 40402	80	80	ND	T						
18	Sample ID 40403	80	80	ND	T						
19	Sample ID 40404	80	80	ND	T						
20	Sample ID 40405	80	80	ND	T						
21	Sample ID 40406	80	80	ND	T						
22	Sample ID 40407	80	80	ND	T						
23	Sample ID 40408	80	80	ND	T						
24	Sample ID 40409	80	80	ND	T						
25	Sample ID 40410	80	80	ND	T						
26	Sample ID 40411	80	80	ND	T						
27	Sample ID 40412	80	80	ND	T						
28	Sample ID 40413	80	80	ND	T						
29	Sample ID 40414	80	80	ND	T						
30	Sample ID 40415	80	80	ND	T						
31	Sample ID 40416	80	80	ND	T						
32	Sample ID 40417	80	80	ND	T						
33	Sample ID 40418	80	80	ND	T						
34	Sample ID 40419	80	80	ND	T						

(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., η, α, β

ver 960325

RADIOLOGICAL SURVEY FORM

Survey # S04534
Page 3 of 6

#	Item Description/Location	BETA-GAMMA ACTIVITY				ALPHA ACTIVITY				RADIATION SURVEY	
		cpm	Bkg. Cpm	dpm / 100 cm²[1]	(2) T/R/F	cpm	Bkg. cpm	dpm / 100 cm²[1]	(2) T/R/F	mrem/hr[3]	Distance
35	Sample ID 40420	80	80	ND	T						
36	Sample ID 40421	80	80	ND	T						
37	Sample ID 40448	80	80	ND	T						
38	Sample ID 40449	80	80	ND	T						
39	Sample ID 40450	80	80	ND	T						
40	Sample ID 40451	80	80	ND	T						
41	Sample ID 40452	80	80	ND	T						
42	Sample ID 40453	80	80	ND	T						
43	Sample ID 40454	80	80	ND	T						
44	Sample ID 40538	80	80	ND	T						
45	Sample ID 40539	80	80	ND	T						
46	Sample ID 40540	80	80	ND	T						
47	Sample ID 40541	80	80	ND	T						
48	Sample ID 40526	80	80	ND	T						
49	Sample ID 40527	80	80	ND	T						
50	Sample ID 40528	80	80	ND	T						
51	Sample ID 40529	80	80	ND	T						
52, 53	Sample ID 40530, 40531	80	80	ND	T						
54, 55	Sample ID 40532, 40533	80	80	ND	T						

(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., η, α, β

ver 960325

Survey No. 50 4534

Radiation Protection Sample Diagnostics (7578) TA-III 6921
Smear Analysis

Date: 4/15/98
Counting Unit Id: 1 (SNL# S674564)
Data file name: C:\LBXL\UNIT1\63510402.XLD
Batch Ended: 4/15/98 6:41
Crosstalk Correction: Applied
ANALYZED BY RT PRESTON
REVIEWED BY: RT Preston 4/15/98
Batch ID: ER 65 SAMPLES, 4/14/98, K. BABILON

Alpha activity action level (DPM): 20.00
Beta activity action level (DPM): 1000.00
Certainty level for MDA and flags: 95.00%
High Voltage Setting: 1360
Application Revision: 3
Application Version: Standard

Alpha efficiency log file: pu238ab
Alpha Efficiency: 43.14%
Alpha to Beta Crosstalk: 10.16%
Alpha Background (CPM): 0.4
Alpha Correction Factor: 1.000
Beta efficiency log file: cl36ab
Beta Efficiency: 54.98%
Beta into Alpha Crosstalk: 1.36%
Beta Background (CPM): 2.9
Beta Correction Factor: 1.000

	Alpha Activity				Beta Activity				count	Alpha	Beta	Time
ID	DPM	σ	flags	MDA	DPM	σ	flags	MDA	Time	CPM	CPM	Compl
1	4.10	3.71	<AL	12.13	1.70	3.76	<MDA	15.83	1.00	1.60	1.10	7:38
2	-1.22	2.72	<MDA	12.74	9.50	5.28	<AL	15.43	1.00	-0.40	5.10	7:40
3	4.06	3.72	<AL	12.28	3.54	4.19	<MDA	15.83	1.00	1.60	2.10	7:41
4	-1.07	2.67	<MDA	12.16	2.11	3.76	<MDA	15.44	1.00	-0.40	1.10	7:42
5	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	7:43
6	-1.04	2.65	<MDA	12.01	0.27	3.28	<MDA	15.45	1.00	-0.40	0.10	7:44
7	4.10	3.71	<AL	12.13	1.70	3.76	<MDA	15.83	1.00	1.60	1.10	7:45
8	-1.04	2.65	<MDA	12.01	0.27	3.28	<MDA	15.45	1.00	-0.40	0.10	7:47
9	-0.93	2.63	<MDA	11.53	-5.27	1.98	<MDA	15.45	1.00	-0.40	-2.90	7:48
10	-1.04	2.65	<MDA	12.01	0.27	3.28	<MDA	15.45	1.00	-0.40	0.10	7:49
11	1.44	2.69	<MDA	12.44	5.60	4.58	<AL	15.63	1.00	0.60	3.10	7:50
12	-0.93	2.63	<MDA	11.53	-5.27	1.98	<MDA	15.45	1.00	-0.40	-2.90	7:51
13	1.51	2.67	<MDA	12.15	1.91	3.76	<MDA	15.64	1.00	0.60	1.10	7:52
14	-1.07	2.67	<MDA	12.16	2.11	3.76	<MDA	15.44	1.00	-0.40	1.10	7:54
15	-1.07	2.67	<MDA	12.16	2.11	3.76	<MDA	15.44	1.00	-0.40	1.10	7:55
16	1.58	2.64	<MDA	11.84	-1.79	2.71	<MDA	15.85	1.00	0.60	-0.90	7:56
17	-1.11	2.68	<MDA	12.31	3.96	4.19	<MDA	15.44	1.00	-0.40	2.10	7:57
18	-1.11	2.68	<MDA	12.31	3.96	4.19	<MDA	15.44	1.00	-0.40	2.10	7:58
19	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	7:59
20	-1.00	2.64	<MDA	11.86	-1.58	2.71	<MDA	15.45	1.00	-0.40	-0.90	8:01
21	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.46	1.00	-0.40	-1.90	8:02
22	-1.04	2.65	<MDA	12.01	0.27	3.28	<MDA	15.45	1.00	-0.40	0.10	8:03

Page 5 of 6

Survey No. 504534

Radiation Protection Sample Diagnostics (7578) TA-III 6921
Smear Analysis

Date: 4/15/98
Counting Unit id: 1 (SNL# S674584)
Data file name: C:\LBXL\UNIT1\83510402.XLD
Batch Ended: 4/15/98 8:41
Crosstalk Correction: Applied
ANALYZED BY RT PRESTON
REVIEWED BY: RT Preston 4/15/98
Batch ID: ER 65 SAMPLES, 4/14/98, K. BABILON

Alpha activity action level (DPM): 20.00
Beta activity action level (DPM): 1000.00
Certainty level for MDA and flags: 95.00%
High Voltage Setting: 1360
Application Revision: 3
Application Version: Standard

Alpha efficiency log file: pu238ab
Alpha Efficiency: 43.14%
Alpha to Beta Crosstalk: 10.16%
Alpha Background (CPM): 0.4
Alpha Correction Factor: 1.000
Beta efficiency log file: cl36ab
Beta Efficiency: 54.86%
Beta into Alpha Crosstalk: 1.36%
Beta Background (CPM): 2.9
Beta Correction Factor: 1.000

	Alpha Activity				Beta Activity				count	Alpha	Beta	Time
ID	DPM	σ	flags	MDA	DPM	σ	flags	MDA	Time	CPM	CPM	Compl
23	-1.07	2.67	<MDA	12.16	2.11	3.78	<MDA	15.44	1.00	-0.40	1.10	8:04
24	1.40	2.71	<MDA	12.58	7.45	4.94	<AL	15.63	1.00	0.60	4.10	8:05
25	-1.11	2.68	<MDA	12.31	3.98	4.19	<MDA	15.44	1.00	-0.40	2.10	8:06
26	-1.04	2.65	<MDA	12.01	0.27	3.28	<MDA	15.45	1.00	-0.40	0.10	8:08
27	-1.04	2.65	<MDA	12.01	0.27	3.28	<MDA	15.45	1.00	-0.40	0.10	8:09
28	1.58	2.64	<MDA	11.84	-1.79	2.71	<MDA	15.65	1.00	0.60	-0.90	8:10
29	1.58	2.64	<MDA	11.84	-1.79	2.71	<MDA	15.65	1.00	0.60	-0.90	8:11
30	1.48	2.68	<MDA	12.30	3.76	4.19	<MDA	15.64	1.00	0.60	2.10	8:12
31	-1.11	2.68	<MDA	12.31	3.98	4.19	<MDA	15.44	1.00	-0.40	2.10	8:13
32	-1.07	2.67	<MDA	12.16	2.11	3.78	<MDA	15.44	1.00	-0.40	1.10	8:15
33	-1.07	2.67	<MDA	12.16	2.11	3.78	<MDA	15.44	1.00	-0.40	1.10	8:16
34	-1.00	2.64	<MDA	11.86	-1.58	2.71	<MDA	15.45	1.00	-0.40	-0.90	8:17
35	-1.00	2.64	<MDA	11.86	-1.58	2.71	<MDA	15.45	1.00	-0.40	-0.90	8:18
36	1.65	2.63	<MDA	11.51	-5.48	1.98	<MDA	15.65	1.00	0.60	-2.90	8:19
37	-0.93	2.63	<MDA	11.53	-5.27	1.98	<MDA	15.45	1.00	-0.40	-2.90	8:20
38	-0.93	2.63	<MDA	11.53	-5.27	1.98	<MDA	15.45	1.00	-0.40	-2.90	8:21
39	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	8:23
40	-1.00	2.64	<MDA	11.86	-1.58	2.71	<MDA	15.45	1.00	-0.40	-0.90	8:24
41	-1.04	2.65	<MDA	12.01	0.27	3.28	<MDA	15.45	1.00	-0.40	0.10	8:25
42	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	8:26
43	-1.00	2.64	<MDA	11.86	-1.58	2.71	<MDA	15.45	1.00	-0.40	-0.90	8:27
44	-1.00	2.64	<MDA	11.86	-1.58	2.71	<MDA	15.45	1.00	-0.40	-0.90	8:28

Survey No. 504534

Radiation Protection Sample Diagnostics (7578) TA-III 6921

Smear Analysis

Date: 4/15/98
Counting Unit Id: 1 (SNL# S674554)
Data file name: C:\LBXL\UNIT1\B3510402.XLD
Batch Ended: 4/15/98 8:41
Crosstalk Correction: Applied
ANALYZED BY RT PRESTON
REVIEWED BY: RT Preston 4/15/98
Batch ID: ER 66 SAMPLES, 4/14/98, K. BABILON

Alpha activity action level (DPM): 20.00
Beta activity action level (DPM): 1000.00
Certainty level for MDA and flags: 95.00%
High Voltage Setting: 1360
Application Revision: 3
Application Version: Standard

Alpha efficiency log file: pu238ab
Alpha Efficiency: 43.14%
Alpha to Beta Crosstalk: 10.16%
Alpha Background (CPM): 0.4
Alpha Correction Factor: 1.000

Beta efficiency log file: cl36ab
Beta Efficiency: 54.98%
Beta into Alpha Crosstalk: 1.36%
Beta Background (CPM): 2.9
Beta Correction Factor: 1.000

	Alpha Activity				Beta Activity				count	Alpha	Beta	Time
ID	DPM	σ	flags	MDA	DPM	σ	flags	MDA	Time	CPM	CPM	Compl
45	-1.04	2.65	<MDA	12.01	0.27	3.28	<MDA	15.45	1.00	-0.40	0.10	8:30
46	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	8:31
47	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	8:32
48	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	8:33
49	-0.93	2.63	<MDA	11.53	-5.27	1.98	<MDA	15.45	1.00	-0.40	-2.90	8:34
50	1.62	2.63	<MDA	11.68	-3.63	1.98	<MDA	15.65	1.00	0.60	-1.90	8:35
51	-0.93	2.63	<MDA	11.53	-5.27	1.98	<MDA	15.45	1.00	-0.40	-2.90	8:37
52	-1.00	2.64	<MDA	11.86	-1.58	2.71	<MDA	15.45	1.00	-0.40	-0.90	8:38
53	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	8:39
54	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	8:40
56	1.48	2.68	<MDA	12.30	3.75	4.19	<MDA	15.64	1.00	0.60	2.10	8:41

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [881 Laboratory]
4-15-98 6:01:14 PM

Analyzed by: KS 4/16/98 Reviewed by: 4/16/98

Customer : G.HAGGERTY/D.BISWELL (6134/SMO)
Customer Sample ID : 040240-004
Lab Sample ID : 80068801

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 724.000 gram
Sample Date/Time : 4-14-98 1:45:00 PM
Acquire Start Date/Time : 4-15-98 4:18:14 PM
Detector Name : LAB02
Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	---------	3.51E+00
TH-234	1.25E+00	4.34E-01	6.01E-01
RA-226	1.82E+00	5.84E-01	5.10E-01
PB-214	7.21E-01	1.31E-01	5.04E-02
BI-214	7.04E-01	1.42E-01	6.61E-02
PB-210	Not Detected	---------	3.62E+01
TH-232	8.40E-01	4.49E-01	1.58E-01
RA-228	9.01E-01	2.58E-01	1.40E-01
AC-228	9.09E-01	1.66E+00	8.17E-02
TH-228	7.69E-01	2.74E-01	4.62E-01
RA-224	8.29E-01	3.00E-01	6.48E-02
PB-212	8.92E-01	1.70E-01	1.44E-01
BI-212	9.79E-01	3.52E-01	3.08E-01
TL-208	7.40E-01	7.02E-01	7.19E-02
U-235	Not Detected	---------	2.46E-01
TH-231	Not Detected	---------	2.39E+00
PA-231	Not Detected	---------	4.04E+00
TH-227	Not Detected	---------	3.71E-01
RA-223	Not Detected	---------	2.23E-01
RN-219	Not Detected	---------	3.94E-01
PB-211	Not Detected	---------	8.64E-01
TL-207	Not Detected	---------	1.38E+01
AM-241	Not Detected	---------	5.04E-01
PU-239	Not Detected	---------	4.56E+02
NP-237	Not Detected	---------	3.00E-01
PA-233	Not Detected	---------	6.06E-02
TH-229	Not Detected	---------	2.64E-01

[Summary Report] - Sample ID: : 80068801

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)	
AG-108m	Not Detected	---------	4.22E-02	
AG-110m	Not Detected	---------	3.97E-02	
AM-243	Not Detected	---------	9.38E-02	
BA-133	Not Detected	---------	6.92E-02	
BE-7	2.04E-01	2.37E-01	1.92E-01	
CD-109	~~2.05E+00~~	~~8.93E-01~~	~~1.02E+00~~	NOT DETECTED KET 4/16/98
CD-115	Not Detected	---------	9.84E-02	
CE-139	Not Detected	---------	3.04E-02	
CE-141	Not Detected	---------	5.52E-02	
CE-144	Not Detected	---------	2.49E-01	
CO-56	Not Detected	---------	3.55E-02	
CO-57	Not Detected	---------	3.15E-02	
CO-58	Not Detected	---------	3.47E-02	
CO-60	Not Detected	---------	3.26E-02	
CR-51	Not Detected	---------	2.37E-01	
CS-134	Not Detected	---------	5.09E-02	
CS-137	7.01E-02	3.45E-02	2.17E-02	
EU-152	Not Detected	---------	9.48E-02	
EU-154	Not Detected	---------	1.94E-01	
EU-155	Not Detected	---------	1.55E-01	
FE-59	Not Detected	---------	7.05E-02	
GD-153	Not Detected	---------	1.12E-01	
HG-203	Not Detected	---------	3.24E-02	
I-131	Not Detected	---------	3.36E-02	
IR-192	Not Detected	---------	2.79E-02	
K-40	1.56E+01	2.33E+00	2.70E-01	
KR-85	Not Detected	---------	8.72E+00	
MN-52	Not Detected	---------	3.43E-02	
MN-54	Not Detected	---------	3.50E-02	
MO-99	Not Detected	---------	3.06E-01	
NA-22	Not Detected	---------	4.09E-02	
NA-24	Not Detected	---------	1.18E-01	
NB-95	Not Detected	---------	2.12E-01	
ND-147	Not Detected	---------	2.14E-01	
NI-57	Not Detected	---------	4.03E-02	
NP-239	Not Detected	---------	1.39E-01	
RU-103	Not Detected	---------	2.97E-02	
RU-106	Not Detected	---------	3.05E-01	
SB-122	Not Detected	---------	5.45E-02	
SB-124	Not Detected	---------	3.11E-02	
SB-125	Not Detected	---------	8.56E-02	
SN-113	Not Detected	---------	3.83E-02	
TA-182	Not Detected	---------	1.50E-01	
TA-183	Not Detected	---------	4.97E-01	
TC-99m	Not Detected	---------	6.94E-01	
TL-201	Not Detected	---------	2.45E-01	
XE-133	Not Detected	---------	2.12E-01	
Y-88	Not Detected	---------	2.79E-02	
ZN-65	Not Detected	---------	1.04E-01	
ZR-95	Not Detected	---------	6.18E-02	

```
************************************************************************
*                    Sandia National Laboratories                      *
*  Radiation Protection Sample Diagnostics Program [881 Laboratory]    *
*                      4-16-98  8:13:47 AM                             *
************************************************************************
                                                                       *
  Analyzed by: KG 4/16/98                Reviewed by: [signature] 4/16/98    *
************************************************************************
```

Customer : G.HAGGERTY/D.BISWELL (6134/SMO)
Customer Sample ID : 040241-004
Lab Sample ID : 80068802

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 781.000 gram
Sample Date/Time : 4-14-98 2:00:00 PM
Acquire Start Date/Time : 4-15-98 6:03:29 PM
Detector Name : LAB02
Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	---------	2.80E+00
TH-234	9.32E-01	5.85E-01	4.55E-01
RA-226	1.76E+00	7.21E-01	5.31E-01
PB-214	5.65E-01	4.09E-01	4.35E-02
BI-214	5.37E-01	1.10E-01	5.49E-02
PB-210	Not Detected	---------	2.85E+01
TH-232	3.78E-01	2.04E-01	1.14E-01
RA-228	4.82E-01	2.28E-01	1.20E-01
AC-228	3.86E-01	1.48E-01	7.33E-02
TH-228	5.80E-01	1.98E-01	4.07E-01
RA-224	4.89E-01	2.00E-01	6.80E-02
PB-212	4.31E-01	1.44E-01	1.33E-01
BI-212	5.13E-01	1.81E-01	2.19E-01
TL-208	4.35E-01	1.20E-01	4.94E-02
U-235	Not Detected	---------	2.05E-01
TH-231	Not Detected	---------	1.90E+00
PA-231	Not Detected	---------	3.21E+00
TH-227	Not Detected	---------	2.70E-01
RA-223	Not Detected	---------	1.72E-01
RN-219	Not Detected	---------	3.04E-01
PB-211	Not Detected	---------	6.89E-01
TL-207	Not Detected	---------	1.04E+01
AM-241	Not Detected	---------	3.91E-01
PU-239	Not Detected	---------	3.69E+02
NP-237	Not Detected	---------	2.21E-01
PA-233	Not Detected	---------	4.88E-02
TH-229	Not Detected	---------	2.02E-01

[Summary Report] - Sample ID: : 80068802

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.08E-02
AG-110m	Not Detected	---------	2.65E-02
AM-243	Not Detected	---------	8.28E-02
BA-133	Not Detected	---------	5.76E-02
BE-7	Not Detected	---------	2.03E-01
CD-109	Not Detected	---------	7.50E-01
CD-115	Not Detected	---------	7.63E-02
CE-139	Not Detected	---------	2.47E-02
CE-141	Not Detected	---------	4.47E-02
CE-144	Not Detected	---------	2.03E-01
CO-56	Not Detected	---------	2.93E-02
CO-57	Not Detected	---------	2.53E-02
CO-58	Not Detected	---------	2.65E-02
CO-60	Not Detected	---------	2.63E-02
CR-51	Not Detected	---------	1.98E-01
CS-134	Not Detected	---------	4.26E-02
CS-137	Not Detected	---------	2.92E-02
EU-152	Not Detected	---------	7.62E-02
EU-154	Not Detected	---------	1.42E-01
EU-155	Not Detected	---------	1.19E-01
FE-59	Not Detected	---------	5.39E-02
GD-153	Not Detected	---------	8.60E-02
HG-203	Not Detected	---------	2.60E-02
I-131	Not Detected	---------	2.50E-02
IR-192	Not Detected	---------	2.31E-02
K-40	7.38E+00	1.23E+00	2.28E-01
KR-85	Not Detected	---------	6.94E+00
MN-52	Not Detected	---------	2.93E-02
MN-54	Not Detected	---------	2.91E-02
MO-99	Not Detected	---------	2.57E-01
NA-22	Not Detected	---------	3.29E-02
NA-24	Not Detected	---------	1.04E-01
NB-95	Not Detected	---------	1.56E-01
ND-147	Not Detected	---------	1.74E-01
NI-57	Not Detected	---------	6.99E-02
NP-239	Not Detected	---------	1.06E-01
RU-103	Not Detected	---------	2.36E-02
RU-106	Not Detected	---------	2.38E-01
SB-122	Not Detected	---------	4.06E-02
SB-124	Not Detected	---------	2.63E-02
SB-125	Not Detected	---------	6.69E-02
SN-113	Not Detected	---------	3.11E-02
TA-182	Not Detected	---------	1.15E-01
TA-183	Not Detected	---------	3.93E-01
TC-99m	Not Detected	---------	6.94E-01
TL-201	Not Detected	---------	1.94E-01
XE-133	Not Detected	---------	1.67E-01
Y-88	Not Detected	---------	1.88E-02
ZN-65	Not Detected	---------	8.04E-02
ZR-95	Not Detected	---------	4.55E-02

```
***************************************************************************
*                    Sandia National Laboratories                          *
*    Radiation Protection Sample Diagnostics Program [881 Laboratory]     *
*                        4-15-98  9:30:27 PM                               *
***************************************************************************
                                                                          *
  Analyzed by: KG 4/16/98              Reviewed by: [signature] 4/16/98   *
***************************************************************************
```

Customer : G.HAGGERTY/D.BISWELL (6134/SMO)
Customer Sample ID : 040243-004
Lab Sample ID : 80068803

Sample Description : MARINELLI LIQUID SAMPLE
Sample Quantity : 500.000 mL
Sample Date/Time : 4-14-98 4:30:00 PM
Acquire Start Date/Time : 4-15-98 7:48:25 PM
Detector Name : LAB02
Elapsed Live/Real Time : 6000 / 6001 seconds

Comments:

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Nuclide Name	Activity (pCi/mL)	2-sigma Error	MDA (pCi/mL)
U-238	Not Detected	---------	1.65E+00
TH-234	Not Detected	---------	4.20E-01
RA-226	1.34E-01	1.45E-01	2.58E-01
PB-214	Not Detected	---------	5.01E-02
BI-214	Not Detected	---------	5.45E-02
PB-210	Not Detected	---------	1.37E+01
TH-232	Not Detected	---------	1.53E-01
RA-228	Not Detected	---------	1.42E-01
AC-228	Not Detected	---------	7.78E-02
TH-228	Not Detected	---------	5.13E-01
RA-224	Not Detected	---------	1.07E-01
PB-212	Not Detected	---------	3.76E-02
BI-212	Not Detected	---------	3.43E-01
TL-208	Not Detected	---------	6.90E-02
U-235	Not Detected	---------	1.61E-01
TH-231	Not Detected	---------	1.57E+00
PA-231	Not Detected	---------	2.68E+00
TH-227	Not Detected	---------	1.43E-01
RA-223	Not Detected	---------	1.12E-01
RN-219	Not Detected	---------	2.68E-01
PB-211	Not Detected	---------	6.04E-01
TL-207	Not Detected	---------	8.38E+00
AM-241	Not Detected	---------	2.40E-01
PU-239	Not Detected	---------	2.70E+02
NP-237	Not Detected	---------	1.75E-01
PA-233	Not Detected	---------	4.30E-02
TH-229	Not Detected	---------	1.46E-01

[Summary Report] - Sample ID: : 80068803

Nuclide Name	Activity (pCi/mL)	2-sigma Error	MDA (pCi/mL)
AG-108m	Not Detected	---------	2.55E-02
AG-110m	Not Detected	---------	2.24E-02
AM-243	Not Detected	---------	5.93E-02
BA-133	Not Detected	---------	3.04E-02
BE-7	Not Detected	---------	1.98E-01
CD-109	Not Detected	---------	5.82E-01
CD-115	Not Detected	---------	5.37E-02
CE-139	Not Detected	---------	1.98E-02
CE-141	Not Detected	---------	3.55E-02
CE-144	Not Detected	---------	1.57E-01
CO-56	Not Detected	---------	3.09E-02
CO-57	Not Detected	---------	2.04E-02
CO-58	Not Detected	---------	2.03E-02
CO-60	Not Detected	---------	2.59E-02
CR-51	Not Detected	---------	1.69E-01
CS-134	Not Detected	---------	2.64E-02
CS-137	Not Detected	---------	2.33E-02
EU-152	Not Detected	---------	6.14E-02
EU-154	Not Detected	---------	1.15E-01
EU-155	Not Detected	---------	8.80E-02
FE-59	Not Detected	---------	4.34E-02
GD-153	Not Detected	---------	6.11E-02
HG-203	Not Detected	---------	2.27E-02
I-131	Not Detected	---------	2.46E-02
IR-192	Not Detected	---------	1.91E-02
K-40	Not Detected	---------	3.57E-01
KR-85	Not Detected	---------	7.34E+00
MN-52	Not Detected	---------	2.89E-02
MN-54	Not Detected	---------	2.35E-02
MO-99	Not Detected	---------	2.08E-01
NA-22	Not Detected	---------	2.56E-02
NA-24	Not Detected	---------	9.61E-02
NB-95	Not Detected	---------	8.24E-02
ND-147	Not Detected	---------	1.57E-01
NI-57	Not Detected	---------	5.06E-02
NP-239	Not Detected	---------	7.89E-02
RU-103	Not Detected	---------	2.31E-02
RU-106	Not Detected	---------	2.37E-01
SB-122	Not Detected	---------	4.06E-02
SB-124	Not Detected	---------	2.48E-02
SB-125	Not Detected	---------	5.98E-02
SN-113	Not Detected	---------	2.80E-02
TA-182	Not Detected	---------	6.87E-02
TA-183	Not Detected	---------	2.39E-01
TC-99m	~~2.59E-01~~	~~4.98E-01~~	~~4.50E-01~~ NOT DETECTED KJ 4/16/98
TL-201	Not Detected	---------	1.21E-01
XE-133	Not Detected	---------	1.12E-01
Y-88	Not Detected	---------	2.87E-02
ZN-65	Not Detected	---------	4.95E-02
ZR-95	Not Detected	---------	4.28E-02

```
*****************************************************************************
*                       Sandia National Laboratories                        *
*    Radiation Protection Sample Diagnostics Program [881 Laboratory]      *
*                          4-15-98 11:15:28 PM                              *
*****************************************************************************
                                                                            *
  Analyzed by: KK 4/16/98                  Reviewed by: JJ 4/16/98          *
*****************************************************************************
Customer                   : G.HAGGERTY/D.BISWELL (6134/SMO)
Customer Sample ID         : 040247-004
Lab Sample ID              : 80068804

Sample Description         : MARINELLI SOLID SAMPLE
Sample Quantity            :   700.000  gram
Sample Date/Time           :  4-14-98   2:45:00 PM
Acquire Start Date/Time    :  4-15-98   9:32:32 PM
Detector Name              : LAB02
Elapsed Live/Real Time     :   6000 /   6002 seconds

Comments:
*****************************************************************************
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	---------	3.20E+00
TH-234	1.04E-00	5.28E-01	5.66E-01
RA-226	1.44E+00	5.73E-01	5.46E-01
PB-214	6.77E-01	1.23E-01	4.90E-02
BI-214	6.54E-01	1.31E-01	6.16E-02
PB-210	Not Detected	---------	3.41E+01
TH-232	5.46E-01	2.75E-01	1.44E-01
RA-228	6.58E-01	1.90E-01	1.28E-01
AC-228	6.05E-01	4.01E-01	8.05E-02
TH-228	5.16E-01	2.02E-01	4.56E-01
RA-224	6.18E-01	2.04E-01	7.19E-02
PB-212	6.24E-01	1.49E-01	1.48E-01
BI-212	5.30E-01	2.96E-01	3.03E-01
TL-208	5.50E-01	1.39E-01	6.07E-02
U-235	Not Detected	---------	2.36E-01
TH-231	Not Detected	---------	2.27E+00
PA-231	Not Detected	---------	3.67E+00
TH-227	Not Detected	---------	3.22E-01
RA-223	Not Detected	---------	2.01E-01
RN-219	Not Detected	---------	3.63E-01
PB-211	Not Detected	---------	8.21E-01
TL-207	Not Detected	---------	1.31E+01
AM-241	Not Detected	---------	4.71E-01
PU-239	Not Detected	---------	4.24E+02
NP-237	Not Detected	---------	2.53E-01
PA-233	Not Detected	---------	5.63E-02
TH-229	Not Detected	---------	2.44E-01

[Summary Report] - Sample ID: : 80068804

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	----------	3.68E-02
AG-110m	Not Detected	----------	2.81E-02
AM-243	Not Detected	----------	9.57E-02
BA-133	Not Detected	----------	6.70E-02
BE-7	Not Detected	----------	2.41E-01
CD-109	~~1.58E+00~~	~~6.16E-01~~	~~8.57E-01~~ NOT DETECTED KHT 4/16/98
CD-115	Not Detected	----------	9.06E-02
CE-139	Not Detected	----------	2.80E-02
CE-141	Not Detected	----------	5.24E-02
CE-144	Not Detected	----------	2.39E-01
CO-56	Not Detected	----------	3.53E-02
CO-57	Not Detected	----------	2.92E-02
CO-58	Not Detected	----------	2.96E-02
CO-60	Not Detected	----------	3.11E-02
CR-51	Not Detected	----------	2.24E-01
CS-134	Not Detected	----------	4.76E-02
CS-137	Not Detected	----------	3.11E-02
EU-152	Not Detected	----------	8.79E-02
EU-154	Not Detected	----------	1.70E-01
EU-155	Not Detected	----------	1.44E-01
FE-59	Not Detected	----------	6.48E-02
GD-153	Not Detected	----------	1.03E-01
HG-203	Not Detected	----------	3.03E-02
I-131	Not Detected	----------	3.18E-02
IR-192	Not Detected	----------	2.62E-02
K-40	1.01E+01	1.83E+00	2.67E-01
KR-85	Not Detected	----------	8.16E+00
MN-52	Not Detected	----------	3.25E-02
MN-54	Not Detected	----------	3.29E-02
MO-99	Not Detected	----------	3.02E-01
NA-22	Not Detected	----------	3.71E-02
NA-24	Not Detected	----------	1.23E-01
NB-95	Not Detected	----------	1.91E-01
ND-147	Not Detected	----------	2.03E-01
NI-57	Not Detected	----------	4.22E-02
NP-239	Not Detected	----------	1.29E-01
RU-103	Not Detected	----------	2.75E-02
RU-106	Not Detected	----------	2.73E-01
SB-122	Not Detected	----------	5.06E-02
SB-124	Not Detected	----------	2.82E-02
SB-125	Not Detected	----------	7.84E-02
SN-113	Not Detected	----------	3.57E-02
TA-182	Not Detected	----------	1.40E-01
TA-183	Not Detected	----------	4.85E-01
TC-99m	Not Detected	----------	1.07E+00
TL-201	Not Detected	----------	2.40E-01
XE-133	Not Detected	----------	2.06E-01
Y-88	Not Detected	----------	2.65E-02
ZN-65	Not Detected	----------	1.00E-01
ZR-95	Not Detected	----------	5.28E-02

```
*************************************************************************
*                    Sandia National Laboratories                       *
*   Radiation Protection Sample Diagnostics Program [881 Laboratory]    *
*                       4-16-98  1:00:41 AM                             *
*************************************************************************
                                                                        *
  Analyzed by: KB 4/16/98               Reviewed by: [signature] 4/16/98 *
*************************************************************************
Customer                   : G.HAGGERTY/D.BISWELL (6134/SMO)
Customer Sample ID         : 040244-004
Lab Sample ID              : 80068805

Sample Description         : MARINELLI SOLID SAMPLE
Sample Quantity            :   591.000  gram
Sample Date/Time           :  4-14-98   2:30:00 PM
Acquire Start Date/Time    :  4-15-98  11:17:38 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	---------	3.76E+00
TH-234	1.46E+00	8.37E-01	6.87E-01
RA-226	1.29E+00	7.14E-01	6.55E-01
PB-214	7.50E-01	1.31E-01	5.11E-02
BI-214	6.77E-01	3.41E-01	7.52E-02
PB-210	Not Detected	---------	4.01E+01
TH-232	7.76E-01	3.78E-01	1.52E-01
RA-228	8.90E-01	2.88E-01	1.73E-01
AC-228	7.60E-01	2.23E-01	8.72E-02
TH-228	1.14E+00	5.38E-01	5.02E-01
RA-224	7.78E-01	2.71E-01	8.54E-02
PB-212	7.12E-01	8.24E-01	1.75E-01
BI-212	7.69E-01	3.36E-01	3.41E-01
TL-208	7.40E-01	1.67E-01	7.69E-02
U-235	Not Detected	---------	2.75E-01
TH-231	Not Detected	---------	2.64E+00
PA-231	Not Detected	---------	4.38E+00
TH-227	Not Detected	---------	3.81E-01
RA-223	Not Detected	---------	2.38E-01
RN-219	Not Detected	---------	4.14E-01
PB-211	Not Detected	---------	9.40E-01
TL-207	Not Detected	---------	1.57E+01
AM-241	Not Detected	---------	5.51E-01
PU-239	Not Detected	---------	4.92E+02
NP-237	Not Detected	---------	3.23E-01
PA-233	Not Detected	---------	6.60E-02
TH-229	Not Detected	---------	2.79E-01

[Summary Report] - Sample ID: : 80068805

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)	
AG-108m	Not Detected	---------	4.51E-02	
AG-110m	Not Detected	---------	4.02E-02	
AM-243	Not Detected	---------	9.54E-02	
BA-133	Not Detected	---------	7.72E-02	
BE-7	Not Detected	---------	2.88E-01	
CD-109	~~1.70E+00~~	~~8.37E-01~~	~~1.09E+00~~	NOT DETECTED KGS 4/16/98
CD-115	Not Detected	---------	1.14E-01	
CE-139	Not Detected	---------	3.18E-02	
CE-141	Not Detected	---------	6.17E-02	
CE-144	Not Detected	---------	2.65E-01	
CO-56	Not Detected	---------	4.24E-02	
CO-57	Not Detected	---------	3.38E-02	
CO-58	Not Detected	---------	3.60E-02	
CO-60	Not Detected	---------	3.98E-02	
CR-51	Not Detected	---------	2.71E-01	
CS-134	Not Detected	---------	5.43E-02	
CS-137	5.55E-02	2.29E-02	2.36E-02	
EU-152	Not Detected	---------	1.02E-01	
EU-154	Not Detected	---------	2.08E-01	
EU-155	Not Detected	---------	1.65E-01	
FE-59	Not Detected	---------	7.72E-02	
GD-153	Not Detected	---------	1.19E-01	
HG-203	Not Detected	---------	3.52E-02	
I-131	Not Detected	---------	3.63E-02	
IR-192	Not Detected	---------	3.03E-02	
K-40	1.41E+01	2.53E+00	2.87E-01	
KR-85	Not Detected	---------	1.01E+01	
MN-52	Not Detected	---------	4.00E-02	
MN-54	Not Detected	---------	4.04E-02	
MO-99	Not Detected	---------	3.73E-01	
NA-22	Not Detected	---------	4.52E-02	
NA-24	Not Detected	---------	1.80E-01	
NB-95	Not Detected	---------	2.29E-01	
ND-147	Not Detected	---------	2.52E-01	
NI-57	Not Detected	---------	5.90E-02	
NP-239	Not Detected	---------	1.50E-01	
RU-103	Not Detected	---------	3.30E-02	
RU-106	Not Detected	---------	3.26E-01	
SB-122	Not Detected	---------	6.26E-02	
SB-124	Not Detected	---------	3.36E-02	
SB-125	Not Detected	---------	9.19E-02	
SN-113	Not Detected	---------	4.31E-02	
TA-182	Not Detected	---------	1.67E-01	
TA-183	Not Detected	---------	5.66E-01	
TC-99m	Not Detected	---------	1.57E+00	
TL-201	Not Detected	---------	2.86E-01	
XE-133	Not Detected	---------	2.45E-01	
Y-88	Not Detected	---------	2.88E-02	
ZN-65	Not Detected	---------	1.17E-01	
ZR-95	Not Detected	---------	6.27E-02	

```
***********************************************************************
*                  Sandia National Laboratories                      *
*   Radiation Protection Sample Diagnostics Program [881 Laboratory]  *
*                    4-16-98  2:45:56 AM                              *
***********************************************************************
                                                                      *
  Analyzed by: KA 4/16/98          Reviewed by: [signature] 4/16/98   *
***********************************************************************
```

Customer : G.HAGGERTY/D.BISWELL (6134/SMO)
Customer Sample ID : 040245-004
Lab Sample ID : 80068806

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 674.000 gram
Sample Date/Time : 4-14-98 3:10:00 PM
Acquire Start Date/Time : 4-16-98 1:02:54 AM
Detector Name : LAB02
Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

****

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	---------	3.49E+00
TH-234	1.26E+00	4.50E-01	5.89E-01
RA-226	1.86E+00	4.50E-01	5.68E-01
PB-214	7.06E-01	1.70E-01	4.87E-02
BI-214	6.43E-01	1.33E-01	6.71E-02
PB-210	Not Detected	---------	3.57E+01
TH-232	7.30E-01	3.57E-01	1.48E-01
RA-228	7.38E-01	3.07E-01	1.55E-01
AC-228	7.90E-01	1.99E-01	7.27E-02
TH-228	8.19E-01	2.53E-01	4.91E-01
RA-224	7.47E-01	2.47E-01	7.18E-02
PB-212	7.39E-01	1.62E-01	1.54E-01
BI-212	8.54E-01	4.03E-01	2.83E-01
TL-208	6.93E-01	1.41E-01	6.55E-02
U-235	Not Detected	---------	2.49E-01
TH-231	Not Detected	---------	2.40E+00
PA-231	Not Detected	---------	4.01E+00
TH-227	Not Detected	---------	3.55E-01
RA-223	Not Detected	---------	2.21E-01
RN-219	Not Detected	---------	3.88E-01
PB-211	Not Detected	---------	8.72E-01
TL-207	Not Detected	---------	1.32E+01
AM-241	Not Detected	---------	4.93E-01
PU-239	Not Detected	---------	4.54E+02
NP-237	Not Detected	---------	4.01E-01
PA-233	Not Detected	---------	5.91E-02
TH-229	Not Detected	---------	2.60E+01

[Summary Report] - Sample ID: : 80068806

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	4.04E-02
AG-110m	Not Detected	---------	3.01E-02
AM-243	Not Detected	---------	1.12E-01
BA-133	Not Detected	---------	6.95E-02
BE-7	Not Detected	---------	2.53E-01
CD-109	Not Detected	---------	1.08E+00
CD-115	Not Detected	---------	1.06E-01
CE-139	Not Detected	---------	3.01E-02
CE-141	Not Detected	---------	5.43E-02
CE-144	Not Detected	---------	2.43E-01
CO-56	Not Detected	---------	3.71E-02
CO-57	Not Detected	---------	3.18E-02
CO-58	Not Detected	---------	3.26E-02
CO-60	Not Detected	---------	3.22E-02
CR-51	Not Detected	---------	2.54E-01
CS-134	Not Detected	---------	4.99E-02
CS-137	Not Detected	---------	3.35E-02
EU-152	Not Detected	---------	9.58E-02
EU-154	Not Detected	---------	1.87E-01
EU-155	Not Detected	---------	1.52E-01
FE-59	Not Detected	---------	6.81E-02
GD-153	Not Detected	---------	1.07E-01
HG-203	Not Detected	---------	3.30E-02
I-131	Not Detected	---------	3.24E-02
IR-192	Not Detected	---------	2.83E-02
K-40	1.23E+01	2.36E+00	2.48E-01
KR-85	Not Detected	---------	8.70E+00
MN-52	Not Detected	---------	3.44E-02
MN-54	Not Detected	---------	3.58E-02
MO-99	Not Detected	---------	3.40E-01
NA-22	Not Detected	---------	4.01E-02
NA-24	Not Detected	---------	1.48E-01
NB-95	Not Detected	---------	2.16E-01
ND-147	Not Detected	---------	2.12E-01
NI-57	Not Detected	---------	5.04E-02
NP-239	Not Detected	---------	1.37E-01
RU-103	Not Detected	---------	2.98E-02
RU-106	Not Detected	---------	2.87E-01
SB-122	Not Detected	---------	5.61E-02
SB-124	Not Detected	---------	2.99E-02
SB-125	Not Detected	---------	8.30E-02
SN-113	Not Detected	---------	3.94E-02
TA-182	Not Detected	---------	1.53E-01
TA-183	Not Detected	---------	5.09E-01
TC-99m	Not Detected	---------	1.65E+00
TL-201	Not Detected	---------	2.66E-01
XE-133	Not Detected	---------	2.33E-01
Y-88	Not Detected	---------	2.73E-02
ZN-65	Not Detected	---------	1.05E-01
ZR-95	Not Detected	---------	6.14E-02

```
***************************************************************************
*                     Sandia National Laboratories                        *
*   Radiation Protection Sample Diagnostics Program [881 Laboratory]      *
*                        4-16-98  4:31:07 AM                              *
***************************************************************************
                                                                          *
  Analyzed by: KH 4/16/98              Reviewed by: 4/16/98               *
***************************************************************************
```

Customer : G.HAGGERTY/D.BISWELL (6134/SMO)
Customer Sample ID : 040246-004
Lab Sample ID : 80068807

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 703.000 gram
Sample Date/Time : 4-14-98 3;30:00 PM
Acquire Start Date/Time : 4-16-98 2:48:12 AM
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	---------	3.23E+00
TH-234	1.26E+00	4.76E-01	5.84E-01
RA-226	2.00E+00	7.51E-01	5.40E-01
PB-214	7.43E-01	1.15E-01	4.85E-02
BI-214	7.05E-01	5.45E-01	6.33E-02
PB-210	Not Detected	---------	3.48E+01
TH-232	6.67E-01	3.26E-01	1.41E-01
RA-228	7.42E-01	2.79E-01	1.24E-01
AC-228	6.40E-01	8.33E-01	7.64E-02
TH-228	6.48E-01	2.34E-01	4.92E-01
RA-224	6.62E-01	3.03E-01	7.87E-02
PB-212	6.19E-01	1.65E-01	1.48E-01
BI-212	5.32E-01	3.13E-01	2.86E-01
TL-208	5.81E-01	1.58E-01	6.45E-02
U-235	Not Detected	---------	2.40E-01
TH-231	Not Detected	---------	2.30E+00
PA-231	Not Detected	---------	3.73E+00
TH-227	Not Detected	---------	3.28E-01
RA-223	Not Detected	---------	2.12E-01
RN-219	Not Detected	---------	3.54E-01
PB-211	Not Detected	---------	8.11E-01
TL-207	Not Detected	---------	1.33E+01
AM-241	Not Detected	---------	4.76E-01
PU-239	Not Detected	---------	4.40E+02
NP-237	Not Detected	---------	2.84E-01
PA-233	Not Detected	---------	5.74E-02
TH-229	Not Detected	---------	2.46E-01

[Summary Report] - Sample ID: : 80068807

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.70E-02
AG-110m	Not Detected	---------	3.03E-02
AM-243	Not Detected	---------	9.52E-02
BA-133	Not Detected	---------	6.90E-02
BE-7	Not Detected	---------	2.54E-01
CD-109	Not Detected	---------	9.65E-01
CD-115	Not Detected	---------	9.93E-02
CE-139	Not Detected	---------	2.87E-02
CE-141	Not Detected	---------	5.35E-02
CE-144	Not Detected	---------	2.38E-01
CO-56	Not Detected	---------	3.38E-02
CO-57	Not Detected	---------	3.01E-02
CO-58	Not Detected	---------	2.82E-02
CO-60	Not Detected	---------	3.24E-02
CR-51	Not Detected	---------	2.32E-01
CS-134	Not Detected	---------	4.96E-02
CS-137	Not Detected	---------	3.25E-02
EU-152	Not Detected	---------	9.05E-02
EU-154	Not Detected	---------	1.71E-01
EU-155	Not Detected	---------	1.43E-01
FE-59	Not Detected	---------	6.39E-02
GD-153	Not Detected	---------	1.04E-01
HG-203	Not Detected	---------	3.20E-02
I-131	Not Detected	---------	3.02E-02
IR-192	Not Detected	---------	2.70E-02
K-40	1.05E+01	1.70E+00	2.56E-01
KR-85	Not Detected	---------	8.42E+00
MN-52	Not Detected	---------	3.14E-02
MN-54	Not Detected	---------	3.21E-02
MO-99	Not Detected	---------	3.30E-01
NA-22	Not Detected	---------	3.69E-02
NA-24	Not Detected	---------	1.58E-01
NB-95	Not Detected	---------	2.01E-01
ND-147	Not Detected	---------	2.04E-01
NI-57	Not Detected	---------	9.63E-02
NP-239	Not Detected	---------	1.29E-01
RU-103	Not Detected	---------	2.83E-02
RU-106	Not Detected	---------	2.66E-01
SB-122	Not Detected	---------	5.70E-02
SB-124	Not Detected	---------	2.96E-02
SB-125	Not Detected	---------	8.06E-02
SN-113	Not Detected	---------	3.62E-02
TA-182	Not Detected	---------	1.40E-01
TA-183	Not Detected	---------	5.00E-01
TC-99m	Not Detected	---------	1.80E+00
TL-201	Not Detected	---------	2.47E-01
XE-133	Not Detected	---------	2.24E-01
Y-88	Not Detected	---------	2.75E-02
ZN-65	Not Detected	---------	9.70E-02
ZR-95	Not Detected	---------	5.50E-02

```
*************************************************************************
*                   Sandia National Laboratories                        *
*   Radiation Protection Sample Diagnostics Program [881 Laboratory]    *
*                      4-16-98  7:28:05 AM                              *
*************************************************************************
                                                                        *
  Analyzed by: KAS 4/16/98          Reviewed by: 4/16/98                *
*************************************************************************
```

Customer : G.HAGGERTY/D.BISWELL (6134/SMO)
Customer Sample ID : LAB CONTROL SAMPLE USING CG134
Lab Sample ID : 80068808

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 : 4-16-98 7:15:59 AM
Detector Name : LAB02
Elapsed Live/Real Time : 600 / 605 seconds

Comments:

****

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
U-238	Not Detected	---------	2.12E+04
TH-234	Not Detected	---------	4.59E+03
RA-226	Not Detected	---------	6.31E+03
PB-214	Not Detected	---------	7.22E+02
BI-214	Not Detected	---------	6.56E+02
PB-210	Not Detected	---------	2.67E+05
TH-232	Not Detected	---------	2.25E+03
RA-228	Not Detected	---------	2.57E+03
AC-228	Not Detected	---------	1.53E+03
TH-228	Not Detected	---------	1.06E+05
RA-224	Not Detected	---------	4.03E+03
PB-212	Not Detected	---------	7.52E+03
BI-212	Not Detected	---------	6.38E+04
TL-208	Not Detected	---------	1.39E+04
U-235	Not Detected	---------	1.81E+03
TH-231	Not Detected	---------	2.12E+04
PA-231	Not Detected	---------	3.62E+04
TH-227	Not Detected	---------	2.48E+03
RA-223	Not Detected	---------	1.00E+26
RN-219	Not Detected	---------	5.73E+03
PB-211	Not Detected	---------	1.29E+04
TL-207	Not Detected	---------	2.18E+05
AM-241	8.16E+04	1.48E+04	3.03E+03
PU-239	Not Detected	---------	3.25E+06
NP-237	Not Detected	---------	2.45E+03
PA-233	Not Detected	---------	6.20E+02
TH-229	Not Detected	---------	1.79E+03

[Summary Report] - Sample ID: : 80068808

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
AG-108m	Not Detected	----------	3.29E+02
AG-110m	Not Detected	----------	3.18E+06
AM-243	Not Detected	----------	7.24E+02
BA-133	Not Detected	----------	7.29E+02
BE-7	Not Detected	----------	8.42E+18
CD-109	5.01E+05	2.48E+05	3.18E+05
CD-115	Not Detected	----------	1.00E+26
CE-139	Not Detected	----------	2.10E+08
CE-141	Not Detected	----------	1.00E+26
CE-144	Not Detected	----------	1.37E+06
CO-56	Not Detected	----------	1.62E+13
CO-57	Not Detected	----------	2.32E+05
CO-58	Not Detected	----------	1.25E+14
CO-60	8.10E+04	1.10E+04	4.05E+02
CR-51	Not Detected	----------	1.00E+26
CS-134	Not Detected	----------	3.62E+03
CS-137	7.16E+04	9.51E+03	2.60E+02
EU-152	Not Detected	----------	9.89E+02
EU-154	Not Detected	----------	2.66E+03
EU-155	Not Detected	----------	3.16E+03
FE-59	Not Detected	----------	2.15E+21
GD-153	Not Detected	----------	1.86E+06
HG-203	Not Detected	----------	1.17E+20
I-131	Not Detected	----------	1.00E+26
IR-192	Not Detected	----------	3.74E+13
K-40	Not Detected	----------	1.42E+03
KR-85	Not Detected	----------	1.16E+05
MN-52	Not Detected	----------	1.00E+26
MN-54	Not Detected	----------	1.54E+05
MO-99	Not Detected	----------	1.00E+26
NA-22	Not Detected	----------	1.53E+03
NA-24	Not Detected	----------	1.00E+26
NB-95	Not Detected	----------	1.00E+26
ND-147	Not Detected	----------	1.00E+26
NI-57	Not Detected	----------	1.00E+26
NP-239	Not Detected	----------	9.42E+02
RU-103	Not Detected	----------	1.00E+26
RU-106	Not Detected	----------	5.09E+05
SB-122	Not Detected	----------	1.00E+26
SB-124	Not Detected	----------	1.19E+16
SB-125	Not Detected	----------	7.18E+03
SN-113	Not Detected	----------	5.88E+09
TA-182	Not Detected	----------	1.56E+10
TA-183	Not Detected	----------	1.00E+26
TC-99m	Not Detected	----------	1.00E+26
TL-201	Not Detected	----------	1.00E+26
XE-133	Not Detected	----------	1.00E+26
Y-88	Not Detected	----------	7.73E+09
ZN-65	Not Detected	----------	1.99E+06
ZR-95	Not Detected	----------	3.47E+15

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

Report Date : 4-16-98 7:28:45 AM
QA File : C:\GENIEPC\CAMFILES\LCS2.QAF
Analyst : KIC
Sample ID : 80068808
Sample Quantity : 1.00 Each
Sample Date : 11-01-90 12:00:00 PM
Measurement Date : 4-16-98 7:15:59 AM
Elapsed Live Time : 600 seconds
Elapsed Real Time : 605 seconds

Parameter	Mean	1S Error	New Value	< LU : SD : UD : BS >
AM-241 Activity	8.343E-02	4.270E-03	8.156E-02	< : : : >
CS-137 Activity	7.018E-02	2.073E-03	7.156E-02	< : : : >
CO-60 Activity	7.806E-02	2.904E-03	8.027E-02	< : : : >

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: ________ 4/16/98

Internal Lab

ANALYSIS REQUEST AND CHAIN OF CUSTODY

Batch No 900 380 SAR/WR No. SMO Use

AR/COC 601635

Dept. No./Mail Stop:	6134/~~1118~~ 1147	[redacted]		Contract No.:	
Project/Task Manager:	Canyons/P. Freshour	[redacted]		Case No.:	7214.2209
Project Name:	Canyons - Site 65C	Lab Contact:	F Dominguez	SMO Authorization:	D Jensen
Record Center Code:	ER/13333/DAT	Lab Destination:	RSPD	Bill To: Sandia National Laboratories	
Logbook Ref. No.:	ER-012	SMO Contact/Phone:	D Salmi/~~848-0963~~ 844-5111	Supplier Services Dept.:	
Service Order No	CF0662	Send Report to SMO:	S ~~Montano/848-0963~~ 844-3181	P O Box 5800 MS 0154	
Location	Tech Area N/A				
Building N/A	Room N/A				

C O P Y

Reference LOV(available at SMO)

Lab Use

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	Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
✓044713-003	CY65C-BH-1000-325-1-1.5-SS	1-1 5	65C	2/17/1999 0934	Soil	M	500ml	None	GR	SA	Gamma Spec	[redacted]
✓044714-003	CY65C-BH-1000-325-3 5-4-S	3 5-4	65C	2/17/1999 0940	Soil	M	500ml	None	GR	SA	Gamma Spec	[redacted]
✓044715-003	CY65C-BH-1000-325-7-7 5-S	7-7 5	65C	2/17/1999 0950	Soil	M	500ml	None	GR	SA	Gamma Spec	[redacted]
✓044716-003	CY65C-BH-1000-325-13 5-14 5-S	13 5-14 5	65C	2/17/1999 1017	Soil	M	500ml	None	GR	SA	Gamma Spec	[redacted]

VQ 3/11/99

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 no 5-16-99 by

Raw Data Package ~~Yes~~ ☑ No

Non - Releasing

Please list as separate report.

Sample Team Members	Name	Signature	Init	Company/Organization/Phone
	Gill Baltazar	GB	GB	Weston/6131/971-2769
	Chris Sears	Chris Sears	CS	Weston/6131/971-2769

		Org.	Date	Time			Org.	Date	Time
1.Relinquished by	[signature]	6131	2-18-99	0857	4.Relinquished by	[signature] (SMO)	7578	3/8/99	0923
1. Received by	[signature] (SMO)	7578	2-18-99	0857	4. Received by	[signature]	6133	3/8/99	0923
2.Relinquished by	[signature] 7577 SMO	7577	2-19-99	0858	5.Relinquished by				
2. Received by	[signature]	SNL7577	2/19/99	0858	5. Received by				
3 Relinquished by	[signature]	SNL7577	2/24/99	1445	6.Relinquished by				
3 Received by	[signature] (SMO)	7578	2/24/99	1445	6 Received by				

Sandia National Laboratories
Radiation Protection Sample Diagnostics 60/635

Sample Analysis Request Form
Page 1 of 1

To be completed by Customer

Shaded areas are for RPSD use only

Customer: P. Fresquez
Organization: 6134
Project Location: Canyon
Phone: 845 3108
Date Results Needed: 2-23-99
Suspect Isotopes: Gamma Spec
Case Number: 7214.2205

Hazards/Special Instructions:
Gill Baltazar
971-2765

Batch Log Number: 900380
Logged By: [illegible]
Analysis Type: ☒ Gamma Spec ☐ H-3 ☐ Alpha/Beta ☐ Alpha Spec ☐ Total U ☐ Other

Customer Sample ID	Sample Type	Date/Time Collected	Sample Quantity	Requested Analysis	RPSD Sample ID	Screen cpm	Sample Mass	Remarks / Aliquot Amount
044713-003	Soil	2/17/99 0934	500ml	Gamma Spec	01	<300	708g	
044714-003		0940			02		582g	
044715-003		0950			03		680g	
044716-003		1017			04	<300	893g	
~~044717-003~~								
LCS	—	1Nov90	—	γ Spec	05	N/A	N/A	

Relinquished by [signature] Date 2/19/99 Received by [signature] Date 2/19/99
Relinquished by ______ Date 2/24/99 Received by [signature] Date 2/24/99
Relinquished by ______ Date ______ Received by ______ Date ______
Relinquished by ______ Date ______ Received by ______ Date ______

RPSD-0602-02 3

Survey Number: S16778

RADIOLOGICAL SURVEY FORM

Location Burn site	Requester/Org Paul Freshour \ 6134	Date 2/17/99	Time 1200	Duration 0.5
Purpose Sample release	Request # N\A	RWP # 0309	RPIR # # N\A	

Instrument and Probe Type and Serial Number		Surveyor(s) Printed Name	Surveyor(s) Signature
ASP 1 \ HP 260 \ 2356	N\A	Arthur Tucker	Arthur Tucker
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. N\A	
		cpm	Bkg cpm	dpm/100 cm² (1)	T/R/F (2)	cpm	Bkg. cpm	dpm/100 cm² (1)	T/R/F (2)	mrem/hr (3)	Distance
1	Sample # 44713-001/003	80	80	ND	T	N\A	N\A	N\A	R	N\A	N\A
2	Sample # 44714-001/003	80	80	ND	T	N\A	N\A	N\A	R	N\A	N\A
3	Sample # 44715-001/003	80	80	ND	T	N\A	N\A	N\A	R	N\A	N\A
4	Sample # 44716-001/003	80	80	ND	T	N\A	N\A	N\A	R	N\A	N\A
5	Sample # 44719-004	80	80	ND	T	N\A	N\A	N\A	R	N\A	N\A
6	Sample # 44719-004	80	80	ND	T	N\A	N\A	N\A	R	N\A	N\A
7	Sample # 44720-004	80	80	ND	T	N\A	N\A	N\A	R	N\A	N\A
8	Sample # 44720-004	80	80	ND	T	N\A	N\A	N\A	R	N\A	N\A
9	Sample # 44719-004	80	80	ND	T	N\A	N\A	N\A	R	N\A	N\A
10	Sample # 44721-004	80	80	ND	T	N\A	N\A	N\A	R	N\A	N\A
11	Sample # 44719-004	80	80	ND	T	N\A	N\A	N\A	R	N\A	N\A
12	Sample # 44718-004	80	80	ND	T	N\A	N\A	N\A	R	N\A	N\A

(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: 001/003 samples were surveyed together in same storage bag.

COPY

Reviewed by: Date:

```
*************************************************************************
* Sandia Radioactive Sample Diagnostics Program                2-17-1999 *
*************************************************************************
LSC Analysis Program - version 5.3

Batch Number        : 93015302
Count Protocol      : 1
Client              : BURNSITE SAMPLE RELEASE 2/17 1130 TUCKER  93015302
Laboratory ID       : 6921-2  S/N 405921
Count Date          : 17-Feb-99
Protocol Name       : H3AB -- SWIPE
Region of Interest  : 0-12
Count Time          : 5.0 minutes
Background cpm      : 23.80 +- 4.44
Background tSIE     : 463.3
Background Eff      : 0.414
Systematic Error    : 12.90%
Sample Aliquot      : 1.000 f

H-3 MDA =  2.58E+01 dpm/f
H-3 CL  =  1.23E+01 dpm/f

H-3 Efficiency = 0.9740 - exp(-0.00047*tSIE^1.1600)

Flag Description:

>CL : Result > 2-sigma Error  and  Result > Critical Level.
<CL : Result < 2-sigma Error  and  Result < Critical Level.
@CL : Result < 2-sigma Error  and  Result > Critical Level.
@CL : Result > 2-sigma Error  and  Result < Critical Level.
```

Analyzed by: RT Preston 2/17/99 Reviewed by: RT Preston 2/17/99

S#	RPSD ID	Client ID	cpm	Error	tSIE	Eff	H-3 Activity dpm/f	Error	Flag
2	001	001	2.06E+01	4.65E+00	467	0.417	-7.67E+00	2.28E+01	<CL
3	002	002	2.58E+01	5.01E+00	461	0.413	4.85E+00	2.35E+01	<CL
4	003	003	1.88E+01	4.49E+00	460	0.412	-1.21E+01	2.32E+01	<CL
5	004	004	1.72E+01	4.23E+00	453	0.406	-1.63E+01	2.35E+01	<CL
6	005	005	2.02E+01	4.51E+00	473	0.422	-8.52E+00	2.23E+01	<CL
7	006	006	2.00E+01	4.45E+00	470	0.420	-9.04E+00	2.23E+01	<CL
8	007	007	2.04E+01	4.49E+00	470	0.420	-8.10E+00	2.23E+01	<CL
9	008	008	2.00E+01	4.38E+00	459	0.411	-9.25E+00	2.27E+01	<CL
10	009	009	2.28E+01	4.60E+00	464	0.415	-2.41E+00	2.21E+01	<CL
11	010	010	2.20E+01	4.53E+00	468	0.418	-4.31E+00	2.20E+01	<CL
12	011	011	2.04E+01	4.38E+00	471	0.421	-8.08E+00	2.20E+01	<CL
13	012	012	1.98E+01	4.36E+00	471	0.421	-9.51E+00	2.22E+01	<CL

COPY

Survey 516778
page 3 of 4

```
**********************************************************************
* Sandia Radioactive Sample Diagnostics Program              2-17-1999 *
**********************************************************************
```

LSC Analysis Program - version 5.3

Batch Number	: 93015302
Count Protocol	: 1
Client	: BURNSITE SAMPLE RELEASE 2/17 1130 TUCKER 93015302
Laboratory ID	: 6921-2 S/N 405921
Count Date	: 17-Feb-99
Protocol Name	: H3AB -- SWIPE
Region of Interest	: 20-600
Count Time	: 5.0 minutes
Background cpm	: 6.00 +- 2.19
Background tSIE	: 463.3
Background Eff	: 1.039
Systematic Error	: 8.90%
Sample Aliquot	: 1.000 f

Alpha MDA = 5.43E+00 dpm/f
Alpha CL = 2.46E+00 dpm/f

Alpha Efficiency = 1.0390 - exp(-0.00990*tSIE^1.1780)

Flag Description:

>CL : Result > 2-sigma Error and Result > Critical Level.
<CL : Result < 2-sigma Error and Result < Critical Level.
@CL : Result < 2-sigma Error and Result > Critical Level.
@CL : Result > 2-sigma Error and Result < Critical Level.

S#	RPSD ID	Client ID	cpm	Error	tSIE	Eff	Alpha Activity dpm/f	Alpha Activity Error	Flag
2	001	001	5.80E+00	2.15E+00	467	1.039	-1.92E-01	4.20E+00	<CL
3	002	002	4.40E+00	1.88E+00	461	1.039	-1.54E+00	4.05E+00	<CL
4	003	003	5.40E+00	2.08E+00	460	1.039	-5.77E-01	4.16E+00	<CL
5	004	004	4.80E+00	1.96E+00	453	1.039	-1.15E+00	4.10E+00	<CL
6	005	005	4.40E+00	1.88E+00	473	1.039	-1.54E+00	4.05E+00	<CL
7	006	006	4.20E+00	1.83E+00	470	1.039	-1.73E+00	4.03E+00	<CL
8	007	007	6.20E+00	2.23E+00	470	1.039	1.92E-01	4.27E+00	<CL
9	008	008	4.20E+00	1.83E+00	459	1.039	-1.73E+00	4.03E+00	<CL
10	009	009	4.40E+00	1.88E+00	464	1.039	-1.54E+00	4.05E+00	<CL
11	010	010	2.80E+00	1.50E+00	468	1.039	-3.08E+00	3.82E+00	<CL
12	011	011	4.60E+00	1.92E+00	471	1.039	-1.35E+00	4.07E+00	<CL
13	012	012	3.40E+00	1.65E+00	471	1.039	-2.50E+00	3.92E+00	<CL

```
******************************************************************************
* Sandia Radioactive Sample Diagnostics Program                   2-17-1999 *
******************************************************************************
```

LSC Analysis Program - version 5.3

Batch Number	:	93015302
Count Protocol	:	1
Client	:	BURNSITE SAMPLE RELEASE 2/17 1130 TUCKER 93015302
Laboratory ID	:	6921-2 S/N 405921
Count Date	:	17-Feb-99
Protocol Name	:	H3AB -- SWIPE
Region of Interest	:	12-2000
Count Time	:	5.0 minutes
Background cpm	:	36.20 +- 5.38
Background tSIE	:	463.3
Background Eff	:	0.841
Systematic Error	:	6.30%
Sample Aliquot	:	1.000 f

Beta MDA = 1.56E+01 dpm/f
Beta CL = 7.45E+00 dpm/f

Beta Efficiency = 0.8410 - exp(-0.01319*tSIE^1.1040)

Flag Description:

>CL : Result > 2-sigma Error and Result > Critical Level.
<CL : Result < 2-sigma Error and Result < Critical Level.
@CL : Result < 2-sigma Error and Result > Critical Level.
@CL : Result > 2-sigma Error and Result < Critical Level.

S#	RPSD ID	Client ID	cpm	Error	tSIE	Eff	Beta Activity dpm/f	Beta Activity Error	Flag
2	001	001	4.00E+01	5.66E+00	467	0.841	4.52E+00	1.34E+01	<CL
3	002	002	3.70E+01	5.44E+00	461	0.841	9.51E-01	1.29E+01	<CL
4	003	003	4.20E+01	5.80E+00	460	0.841	6.90E+00	1.37E+01	<CL
5	004	004	3.78E+01	5.50E+00	453	0.841	1.90E+00	1.31E+01	<CL
6	005	005	4.00E+01	5.66E+00	473	0.841	4.52E+00	1.34E+01	<CL
7	006	006	4.00E+01	5.66E+00	470	0.841	4.52E+00	1.34E+01	<CL
8	007	007	3.78E+01	5.50E+00	470	0.841	1.90E+00	1.31E+01	<CL
9	008	008	3.80E+01	5.51E+00	459	0.841	2.14E+00	1.31E+01	<CL
10	009	009	3.22E+01	5.07E+00	464	0.841	-4.76E+00	1.27E+01	<CL
11	010	010	4.02E+01	5.67E+00	468	0.841	4.76E+00	1.34E+01	<CL
12	011	011	3.68E+01	5.42E+00	471	0.841	7.13E-01	1.29E+01	<CL
13	012	012	3.84E+01	5.54E+00	471	0.841	2.62E+00	1.32E+01	<CL

```
*****************************************************************************
*                     Sandia National Laboratories                          *
*    Radiation Protection Sample Diagnostics Program [806 Laboratory]       *
*                        2/19/99  7:52:42 PM                                *
*****************************************************************************
*                                                                           *
* Analyzed by:        2/22/99      Reviewed by:       2/23/99               *
*****************************************************************************
Customer                   : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID         : 044713-003
Lab Sample ID              : 90038001

Sample Description         : MARINELLI SOLID SAMPLE
Sample Quantity            :   708.000  gram
Sample Date/Time           :  2/17/99    9:34:00 AM
Acquire Start Date/Time    :  2/19/99    6:12:28 PM
Detector Name              : LAB01
Elapsed Live/Real Time     :   6000 /    6002 seconds

Comments:
*****************************************************************************
```

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	4.49E-001	4.39E-001	4.60E-001
RA-226	1.30E+000	9.22E-001	5.59E-001
PB-214	6.75E-001	1.53E-001	4.67E-002
BI-214	6.25E-001	1.45E-001	4.41E-002
PB-210	Not Detected	---------	7.67E+000
TH-232	4.96E-001	2.84E-001	1.57E-001
RA-228	4.28E-001	1.98E-001	1.80E-001
AC-228	5.06E-001	1.95E-001	9.35E-002
TH-228	4.94E-001	1.85E-001	4.67E-001
RA-224	7.39E-001	3.26E-001	1.02E-001
PB-212	6.15E-001	1.26E-001	4.07E-002
BI-212	6.18E-001	4.99E-001	3.16E-001
TL-208	5.52E-001	1.93E-001	7.40E-002
U-235	Not Detected	---------	1.93E-001
TH-231	Not Detected	---------	1.99E+000
PA-231	Not Detected	---------	1.29E+000
TH-227	Not Detected	---------	2.72E-001
RA-223	Not Detected	---------	1.31E-001
RN-219	Not Detected	---------	3.30E-001
PB-211	Not Detected	---------	7.05E-001
TL-207	Not Detected	---------	1.39E+001
AM-241	Not Detected	---------	1.91E-001
PU-239	Not Detected	---------	3.46E+002
NP-237	Not Detected	---------	2.38E-001
PA-233	Not Detected	---------	5.53E-002
TH-229	Not Detected	---------	1.56E-001

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

[Summary Report] - Sample ID: : 90038001

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.60E-002
AG-110m	Not Detected	---------	3.12E-002
BA-133	Not Detected	---------	4.85E-002
BE-7	Not Detected	---------	2.31E-001
BI-207	Not Detected	---------	2.76E-002
CD-109	Not Detected	---------	7.91E-001
CD-115	Not Detected	---------	1.30E-001
CE-139	Not Detected	---------	2.43E-002
CE-141	Not Detected	---------	4.37E-002
CE-144	Not Detected	---------	1.84E-001
CO-56	Not Detected	---------	3.46E-002
CO-57	Not Detected	---------	2.35E-002
CO-58	Not Detected	---------	3.29E-002
CO-60	Not Detected	---------	3.83E-002
CR-51	Not Detected	---------	2.28E-001
CS-134	Not Detected	---------	3.25E-002
CS-137	1.43E-002	9.54E-003	2.09E-002
EU-152	Not Detected	---------	7.12E-002
EU-154	Not Detected	---------	1.73E-001
EU-155	Not Detected	---------	1.10E-001
FE-59	Not Detected	---------	6.71E-002
GD-153	Not Detected	---------	6.29E-002
HG-203	Not Detected	---------	2.96E-002
I-131	Not Detected	---------	3.19E-002
IR-192	Not Detected	---------	2.70E-002
K-40	1.14E+001	1.95E+000	2.77E-001
MN-52	Not Detected	---------	4.47E-002
MN-54	Not Detected	---------	3.46E-002
MO-99	Not Detected	---------	4.20E-001
NA-22	Not Detected	---------	4.03E-002
NA-24	Not Detected	---------	4.52E-001
NB-95	Not Detected	---------	1.52E-001
ND-147	Not Detected	---------	2.27E-001
NI-57	Not Detected	---------	1.77E-001
RU-103	Not Detected	---------	2.56E-002
RU-106	Not Detected	---------	2.82E-001
SB-122	Not Detected	---------	7.01E-002
SB-124	Not Detected	---------	2.72E-002
SB-125	Not Detected	---------	7.55E-002
SN-113	Not Detected	---------	3.42E-002
SR-85	Not Detected	---------	3.45E-002
TA-182	Not Detected	---------	1.58E-001
TA-183	Not Detected	---------	2.25E-001
TC-99m	Not Detected	---------	1.64E+001
TL-201	Not Detected	---------	1.50E-001
XE-133	Not Detected	---------	1.60E-001
Y-88	Not Detected	---------	2.85E-002
ZN-65	Not Detected	---------	1.09E-001
ZR-95	Not Detected	---------	5.84E-002

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
2/22/99 8:05:44 AM

Analyzed by: 2/22/99 Reviewed by: 2/23/99

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : 044714-003
Lab Sample ID : 90038002

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 582.000 gram
Sample Date/Time : 2/17/99 9:40:00 AM
Acquire Start Date/Time : 2/19/99 7:54:30 PM
Detector Name : LAB01
Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	7.41E-001	4.42E-001	4.96E-001
RA-226	1.88E+000	1.04E+000	5.82E-001
PB-214	7.31E-001	1.55E-001	5.36E-002
BI-214	6.14E-001	3.07E-001	5.38E-002
PB-210	Not Detected	---------	8.65E+000
TH-232	6.89E-001	4.22E-001	1.63E-001
RA-228	5.96E-001	3.19E-001	1.94E-001
AC-228	5.28E-001	2.16E-001	1.10E-001
TH-228	9.40E-001	3.04E-001	4.90E-001
RA-224	7.09E-001	3.97E-001	1.23E-001
PB-212	6.63E-001	1.38E-001	4.29E-002
BI-212	6.93E-001	4.79E-001	3.11E-001
TL-208	5.25E-001	1.81E-001	8.10E-002
U-235	Not Detected	---------	2.10E-001
TH-231	Not Detected	---------	2.30E+000
PA-231	Not Detected	---------	1.44E+000
TH-227	Not Detected	---------	3.07E-001
RA-223	Not Detected	---------	1.52E-001
RN-219	Not Detected	---------	4.16E-001
PB-211	Not Detected	---------	9.24E-001
TL-207	Not Detected	---------	1.43E+001
AM-241	Not Detected	---------	2.10E-001
PU-239	Not Detected	---------	3.70E+002
NP-237	Not Detected	---------	2.68E-001
PA-233	Not Detected	---------	6.22E-002
TH-229	Not Detected	---------	1.86E-001

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

[Summary Report] - Sample ID: : 90038002

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	4.38E-002
AG-110m	Not Detected	---------	3.42E-002
BA-133	Not Detected	---------	5.23E-002
BE-7	Not Detected	---------	2.77E-001
BI-207	Not Detected	---------	3.26E-002
CD-109	Not Detected	---------	8.80E-001
CD-115	Not Detected	---------	1.57E-001
CE-139	Not Detected	---------	2.64E-002
CE-141	Not Detected	---------	4.89E-002
CE-144	Not Detected	---------	2.04E-001
CO-56	Not Detected	---------	3.62E-002
CO-57	Not Detected	---------	2.59E-002
CO-58	Not Detected	---------	3.84E-002
CO-60	Not Detected	---------	3.90E-002
CR-51	Not Detected	---------	2.59E-001
CS-134	Not Detected	---------	3.99E-002
CS-137	Not Detected	---------	3.82E-002
EU-152	Not Detected	---------	7.68E-002
EU-154	Not Detected	---------	2.11E-001
EU-155	Not Detected	---------	1.18E-001
FE-59	Not Detected	---------	8.41E-002
GD-153	Not Detected	---------	7.40E-002
HG-203	Not Detected	---------	3.34E-002
I-131	Not Detected	---------	3.61E-002
IR-192	Not Detected	---------	2.93E-002
K-40	1.06E+001	1.95E+000	2.91E-001
MN-52	Not Detected	---------	5.62E-002
MN-54	Not Detected	---------	3.95E-002
MO-99	Not Detected	---------	4.74E-001
NA-22	Not Detected	---------	4.53E-002
NA-24	Not Detected	---------	5.97E-001
NB-95	Not Detected	---------	1.74E-001
ND-147	Not Detected	---------	2.44E-001
NI-57	Not Detected	---------	2.17E-001
RU-103	Not Detected	---------	2.88E-002
RU-106	Not Detected	---------	3.28E-001
SB-122	Not Detected	---------	7.96E-002
SB-124	Not Detected	---------	3.35E-002
SB-125	Not Detected	---------	8.27E-002
SN-113	Not Detected	---------	3.82E-002
SR-85	Not Detected	---------	4.06E-002
TA-182	Not Detected	---------	1.85E-001
TA-183	Not Detected	---------	2.50E-001
TC-99m	Not Detected	---------	2.24E+001
TL-201	Not Detected	---------	1.68E-001
XE-133	Not Detected	---------	1.92E-001
Y-88	Not Detected	---------	2.97E-002
ZN-65	Not Detected	---------	1.24E-001
ZR-95	Not Detected	---------	6.75E-002

```
**********************************************************************
*                 Sandia National Laboratories                       *
*   Radiation Protection Sample Diagnostics Program [806 Laboratory] *
*                     2/22/99  8:18:29 AM                            *
**********************************************************************
*                                                                    *
* Analyzed by:          2/22/99       Reviewed by:          2/23/99  *
**********************************************************************
```

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : 044715-003
Lab Sample ID : 90038003

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 680.000 gram
Sample Date/Time : 2/17/99 9:50:00 AM
Acquire Start Date/Time : 2/19/99 9:36:31 PM
Detector Name : LAB01
Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

****

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	---------	5.14E-001
RA-226	1.45E+000	8.22E-001	5.56E-001
PB-214	7.13E-001	1.49E-001	4.82E-002
BI-214	6.44E-001	1.44E-001	4.51E-002
PB-210	Not Detected	---------	7.37E+000
TH-232	5.18E-001	2.91E-001	1.49E-001
RA-228	4.51E-001	2.37E-001	1.51E-001
AC-228	5.24E-001	2.05E-001	9.50E-002
TH-228	8.09E-001	3.68E-001	4.27E-001
RA-224	5.34E-001	2.76E-001	1.28E-001
PB-212	6.03E-001	1.24E-001	4.13E-002
BI-212	6.63E-001	5.70E-001	3.31E-001
TL-208	5.26E-001	1.60E-001	6.97E-002
U-235	1.65E-001	1.65E-001	1.96E-001
TH-231	Not Detected	---------	2.07E+000
PA-231	Not Detected	---------	1.39E+000
TH-227	Not Detected	---------	2.85E-001
RA-223	Not Detected	---------	1.37E-001
RN-219	Not Detected	---------	3.50E-001
PB-211	Not Detected	---------	7.75E-001
TL-207	Not Detected	---------	1.41E+001
AM-241	Not Detected	---------	1.86E-001
PU-239	Not Detected	---------	3.48E+002
NP-237	Not Detected	---------	2.54E-001
PA-233	Not Detected	---------	5.38E-002
TH-229	Not Detected	---------	1.63E-001

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

[Summary Report] - Sample ID: : 90038003

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.76E-002
AG-110m	Not Detected	---------	2.98E-002
BA-133	Not Detected	---------	4.58E-002
BE-7	Not Detected	---------	2.49E-001
BI-207	Not Detected	---------	2.74E-002
CD-109	Not Detected	---------	8.20E-001
CD-115	Not Detected	---------	1.34E-001
CE-139	Not Detected	---------	2.51E-002
CE-141	Not Detected	---------	4.47E-002
CE-144	Not Detected	---------	1.86E-001
CO-56	Not Detected	---------	3.33E-002
CO-57	Not Detected	---------	2.39E-002
CO-58	Not Detected	---------	3.21E-002
CO-60	Not Detected	---------	3.71E-002
CR-51	Not Detected	---------	2.30E-001
CS-134	Not Detected	---------	3.47E-002
CS-137	Not Detected	---------	3.29E-002
EU-152	Not Detected	---------	7.08E-002
EU-154	Not Detected	---------	1.82E-001
EU-155	Not Detected	---------	1.10E-001
FE-59	Not Detected	---------	6.92E-002
GD-153	Not Detected	---------	6.71E-002
HG-203	Not Detected	---------	3.01E-002
I-131	Not Detected	---------	3.37E-002
IR-192	Not Detected	---------	2.67E-002
K-40	9.86E+000	1.79E+000	2.74E-001
MN-52	Not Detected	---------	4.89E-002
MN-54	Not Detected	---------	3.64E-002
MO-99	Not Detected	---------	4.27E-001
NA-22	Not Detected	---------	4.12E-002
NA-24	Not Detected	---------	5.30E-001
NB-95	Not Detected	---------	1.68E-001
ND-147	Not Detected	---------	2.36E-001
NI-57	Not Detected	---------	1.66E-001
RU-103	Not Detected	---------	2.91E-002
RU-106	Not Detected	---------	2.84E-001
SB-122	Not Detected	---------	6.63E-002
SB-124	Not Detected	---------	2.73E-002
SB-125	Not Detected	---------	7.71E-002
SN-113	Not Detected	---------	3.52E-002
SR-85	Not Detected	---------	3.65E-002
TA-182	Not Detected	---------	1.73E-001
TA-183	Not Detected	---------	2.23E-001
TC-99m	Not Detected	---------	2.45E+001
TL-201	Not Detected	---------	1.56E-001
XE-133	Not Detected	---------	1.74E-001
Y-88	Not Detected	---------	3.34E-002
ZN-65	Not Detected	---------	1.16E-001
ZR-95	Not Detected	---------	5.39E-002

```
******************************************************************************
*                        Sandia National Laboratories                        *
*    Radiation Protection Sample Diagnostics Program [806 Laboratory]        *
*                          2/22/99  8:55:32 AM                               *
******************************************************************************
*                                                                            *
* Analyzed by:            2/22/99        Reviewed by:        2/23/99         *
******************************************************************************
Customer                     : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID           : 044716-003
Lab Sample ID                : 90038004

Sample Description           : MARINELLI SOLID SAMPLE
Sample Quantity              :   893.000  gram
Sample Date/Time             :  2/17/99  10:17:00 AM
Acquire Start Date/Time      :  2/19/99  11:18:32 PM
Detector Name                : LAB01
Elapsed Live/Real Time       :   6000 /   6002 seconds

Comments:
******************************************************************************
```

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	---------	4.06E-001
RA-226	1.72E+000	6.95E-001	3.97E-001
PB-214	7.89E-001	1.54E-001	3.87E-002
BI-214	7.27E-001	1.45E-001	3.41E-002
PB-210	Not Detected	---------	6.15E+000
TH-232	2.61E-001	2.07E-001	1.09E-001
RA-228	2.74E-001	1.53E-001	1.21E-001
AC-228	2.69E-001	1.65E-001	7.26E-002
TH-228	3.23E-001	1.44E-001	3.18E-001
RA-224	3.68E-001	2.32E-001	8.69E-002
PB-212	2.55E-001	6.41E-002	3.43E-002
BI-212	3.52E-001	3.44E-001	2.51E-001
TL-208	2.43E-001	1.03E-001	5.58E-002
U-235	8.57E-002	1.31E-001	1.54E-001
TH-231	Not Detected	---------	1.61E+000
PA-231	Not Detected	---------	9.78E-001
TH-227	Not Detected	---------	1.87E-001
RA-223	Not Detected	---------	1.04E-001
RN-219	Not Detected	---------	2.75E-001
PB-211	Not Detected	---------	6.14E-001
TL-207	Not Detected	---------	1.02E+001
AM-241	Not Detected	---------	1.42E-001
PU-239	Not Detected	---------	2.60E+002
NP-237	Not Detected	---------	1.89E-001
PA-233	Not Detected	---------	4.28E-002
TH-229	Not Detected	---------	1.22E-001

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

[Summary Report] - Sample ID: : 90038004

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	2.73E-002
AG-110m	Not Detected	---------	2.30E-002
BA-133	Not Detected	---------	4.12E-002
BE-7	Not Detected	---------	1.72E-001
BI-207	Not Detected	---------	2.04E-002
CD-109	Not Detected	---------	6.28E-001
CD-115	Not Detected	---------	9.78E-002
CE-139	Not Detected	---------	1.96E-002
CE-141	Not Detected	---------	3.49E-002
CE-144	Not Detected	---------	1.49E-001
CO-56	Not Detected	---------	2.55E-002
CO-57	Not Detected	---------	1.85E-002
CO-58	Not Detected	---------	2.45E-002
CO-60	Not Detected	---------	3.05E-002
CR-51	Not Detected	---------	1.81E-001
CS-134	Not Detected	---------	2.87E-002
CS-137	Not Detected	---------	2.55E-002
EU-152	Not Detected	---------	5.54E-002
EU-154	Not Detected	---------	1.29E-001
EU-155	Not Detected	---------	8.62E-002
FE-59	Not Detected	---------	4.86E-002
GD-153	Not Detected	---------	5.13E-002
HG-203	Not Detected	---------	2.28E-002
I-131	Not Detected	---------	2.59E-002
IR-192	Not Detected	---------	2.01E-002
K-40	4.64E+000	8.81E-001	2.01E-001
MN-52	Not Detected	---------	4.03E-002
MN-54	Not Detected	---------	2.63E-002
MO-99	Not Detected	---------	3.12E-001
NA-22	Not Detected	---------	2.86E-002
NA-24	Not Detected	---------	5.20E-001
NB-95	Not Detected	---------	1.18E-001
ND-147	Not Detected	---------	1.67E-001
NI-57	Not Detected	---------	1.54E-001
RU-103	Not Detected	---------	2.03E-002
RU-106	Not Detected	---------	1.99E-001
SB-122	Not Detected	---------	4.73E-002
SB-124	Not Detected	---------	2.16E-002
SB-125	Not Detected	---------	5.91E-002
SN-113	Not Detected	---------	2.70E-002
SR-85	Not Detected	---------	2.61E-002
TA-182	Not Detected	---------	1.32E-001
TA-183	Not Detected	---------	1.71E-001
TC-99m	Not Detected	---------	2.30E+001
TL-201	Not Detected	---------	1.26E-001
XE-133	Not Detected	---------	1.35E-001
Y-88	Not Detected	---------	2.71E-002
ZN-65	Not Detected	---------	8.83E-002
ZR-95	Not Detected	---------	3.58E-002

```
*************************************************************************
*                  Sandia National Laboratories                         *
*   Radiation Protection Sample Diagnostics Program [806 Laboratory]    *
*                     2/20/99  3:43:08 PM                               *
*************************************************************************
*                                                                       *
* Analyzed by:        2/22/99       Reviewed by:          2/23/99       *
*************************************************************************
Customer                    : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID          : LAB CONTROL SAMPLE USING CG134
Lab Sample ID               : 90038005

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     :  2/20/99    3:32:55 PM
Detector Name               : LAB01
Elapsed Live/Real Time      :     600 /     605 seconds

Comments:
*************************************************************************
```

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
U-238	Not Detected	---------	2.65E+003
RA-226	Not Detected	---------	5.24E+003
PB-214	Not Detected	---------	7.09E+002
BI-214	Not Detected	---------	6.34E+002
PB-210	Not Detected	---------	6.95E+004
TH-232	Not Detected	---------	2.26E+003
RA-228	Not Detected	---------	2.89E+003
AC-228	Not Detected	---------	1.77E+003
TH-228	Not Detected	---------	1.34E+005
RA-224	Not Detected	---------	5.78E+003
PB-212	Not Detected	---------	9.06E+003
BI-212	Not Detected	---------	9.02E+004
TL-208	Not Detected	---------	1.93E+004
U-235	Not Detected	---------	1.41E+003
TH-231	Not Detected	---------	1.98E+004
PA-231	Not Detected	---------	1.34E+004
TH-227	Not Detected	---------	2.29E+003
RA-223	Not Detected	---------	1.00E+026
RN-219	Not Detected	---------	6.01E+003
PB-211	Not Detected	---------	1.37E+004
TL-207	Not Detected	---------	2.52E+005
AM-241	8.15E+004	1.41E+004	1.36E+003
PU-239	Not Detected	---------	2.43E+006
NP-237	Not Detected	---------	1.33E+003
PA-233	Not Detected	---------	6.38E+002
TH-229	Not Detected	---------	1.13E+003

[Summary Report] - Sample ID: : 90038005

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
AG-108m	Not Detected	---------	3.52E+002
AG-110m	Not Detected	---------	8.25E+006
BA-133	Not Detected	---------	7.77E+002
BE-7	Not Detected	---------	4.84E+020
BI-207	Not Detected	---------	3.58E+002
CD-109	Not Detected	---------	4.32E+005
CD-115	Not Detected	---------	1.00E+026
CE-139	Not Detected	---------	8.06E+008
CE-141	Not Detected	---------	1.00E+026
CE-144	Not Detected	---------	2.17E+006
CO-56	Not Detected	---------	2.85E+014
CO-57	Not Detected	---------	4.04E+005
CO-58	Not Detected	---------	2.92E+015
CO-60	7.89E+004	1.10E+004	5.23E+002
CR-51	Not Detected	---------	1.00E+026
CS-134	Not Detected	---------	4.82E+003
CS-137	6.88E+004	9.23E+003	3.29E+002
EU-152	Not Detected	---------	8.15E+002
EU-154	Not Detected	---------	3.00E+003
EU-155	Not Detected	---------	2.54E+003
FE-59	Not Detected	---------	1.00E+026
GD-153	Not Detected	---------	2.80E+006
HG-203	Not Detected	---------	1.07E+022
I-131	Not Detected	---------	1.00E+026
IR-192	Not Detected	---------	6.92E+014
K-40	Not Detected	---------	1.67E+003
MN-52	Not Detected	---------	1.00E+026
MN-54	Not Detected	---------	3.39E+005
MO-99	Not Detected	---------	1.00E+026
NA-22	Not Detected	---------	2.00E+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	---------	9.89E+005
SB-122	Not Detected	---------	1.00E+026
SB-124	Not Detected	---------	4.32E+017
SB-125	Not Detected	---------	9.17E+003
SN-113	Not Detected	---------	3.85E+010
SR-85	Not Detected	---------	4.77E+016
TA-182	Not Detected	---------	1.14E+011
TA-183	Not Detected	---------	1.00E+026
TC-99m	Not Detected	---------	1.00E+026
TL-201	Not Detected	---------	1.00E+026
XE-133	Not Detected	---------	1.00E+026
Y-88	Not Detected	---------	7.51E+010
ZN-65	Not Detected	---------	5.39E+006
ZR-95	Not Detected	---------	1.10E+017

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

Report Date : 2/20/99 3:43:11 PM
QA File : C:\GENIE2K\CAMFILES\LCS1.QAF
Analyst : FCD
Sample ID : 90038005
Sample Quantity : 1.00 Each
Sample Date : 11/01/90 12:00:00 PM
Measurement Date : 2/20/99 3:32:55 PM
Elapsed Live Time : 600 seconds
Elapsed Real Time : 605 seconds

Parameter	Mean	1S Error	New Value	< LU : SD : UD : BS >
AM-241 ACTIVITY	8.535E-002	2.596E-003	8.153E-002	< : : : >
CS-137 Activity	6.838E-002	9.776E-004	6.878E-002	< : : : >
CO-60 Activity	7.607E-002	2.658E-003	7.641E-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: 2/22/99

Annex 6-E

ANNEX 6-E
Data Validation Results

✓ checked again 4/2/98

SAMPLE FINDINGS SUMMARY

Site: ER Site 65C

AR/COC: 600213 Data Classification:

Sample/ Fraction No.	Analysis	DV Qualifiers	Comments
CY65C-BH-975,350-1-2.5-SS	7439-92-1	J	Lead. ✓
CY65C-BH-975,350-1-2.5-DU	↓	J	↓ ✓
CY65C-BH-975,350-2.5-3-S	↓	J	↓ ✓
CY65C-BH-975,350-2.5-3-DU	↓	J	↓ ✓
CY65C-BH-975,350-1-2.5-SS	EPA 8270	UJ	Low surrogate recovery.

Sample No./Fraction No. - This value is located on the Chain of Custody in the ER Sample Id field.

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: H. Seeley Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

SITE OR PROJECT ER Site 65C

ANALYTICAL LABORATORY CORE

LABORATORY REPORT # 981057

TASK LEADER Haggerty

NO. OF SAMPLES 34 multi-fraction

CASE NO. 7214.2209

SAMPLE IDS
CY65C-BH-series

COC 600213

DATA ASSESSMENT SUMMARY

		ICP	AA	MERCURY	CYANIDE
1.	HOLDING TIMES	✓	✓	✓	
2.	CALIBRATIONS	✓	✓	✓	
3.	BLANKS	✓	✓	✓	
4.	ICS	✓			
5.	LCS	✓	✓		
6.	DUPLICATE ANALYSIS	✓	✓	✓	
7.	MATRIX SPIKE	✓	✓	✓	
8.	MSA		NA		
9.	SERIAL DILUTION	NA			
10.	SAMPLE VERIFICATION	✓	✓	✓	
11.	OTHER QC	✓	✓	✓	
12.	OVERALL ASSESSMENT	✓	✓	✓	

✓ (check mark) — Acceptable
Other — Qualified:
J - Estimate
UJ - Undetected, estimated
R - Unusable (analyte may or may not be present)

~~ACTION ITEMS:~~ Minor ~~comments, no~~ qualifications
see pg 2

AREAS OF CONCERN:

REVIEWED BY: H. Seeley

DATE REVIEWED: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

~~ACTION ITEMS:~~ As noted in the case narrative, the matrix spike recovery for Arsenic was slightly low, 76.9%. Acceptable criteria was 80-120. Because the MSD recovery was acceptable and the LCS/DCS recoveries were acceptable, no qualification was applied.

The MSD recovery for silver was also low, 51.7%, but again the MS/LCS/DCS recoveries were acceptable. No qualification was applied.

Low levels of lead were noted in the method blank,

AREAS OF CONCERN: however, sample results were all >10x the blank value. No qualifications applied.

Field Duplicate results exceeded 35% RPD for lead in the following pairs. Results were qualified J.

CY65C-BH-975,350-1-2.5-SS
CY65C-BH-975,350-1-2.5DU — 44%

CY65C-BH-975,350-2.5-3-S
CY65C-BH-975,350-2.5-3-DU — 63%

OVERALL DATA QUALITY ASSESSMENT Data appears acceptable ~~without~~ with minor qualifications.

Reviewed By: H. Seeley Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

1.0 HOLDING TIMES

List holding time criteria used to evaluate samples, indicating which samples exceed the holding time. Holding time begins with validated time of sample collection.

Parameter	Holding Time Criteria	Sample ID	Days Holding Time was Exceeded	Action
		NONE		

Were the correct preservatives used? Yes ☑ No ☐

List below samples that were incorrectly preserved.

Sample No.	Type of Samples	Deficiency	Action
	NONE		

Reviewed By: H. Seeley Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

2.0 INSTRUMENT CALIBRATION

2.1 Percent Recovery Criteria

Indicate %Recovery (%R) criteria used to evaluate calibration standards:

Metals: 90-110
Mercury: 80-120
Cyanide:
Other:

List below the analytes which did not meet %R criteria for initial and continuing calibration standards:

Analysis Date	ICV/CCV #	Analyte	%R	Action	Samples Affected
		NONE			

2.2 Analytical Sequence

Did the laboratory use the proper number of standards for calibration as described in the EPA method? Yes ☑ No ☐

Have initial calibrations been performed at the beginning of each analysis and at the frequency indicated by the EPA method? Yes ☑ No ☐

Have continuing calibration standards been analyzed at the beginning of sample analysis and at a minimum frequency indicated by the EPA method and at the end of the analysis sequence? Yes ☑ No ☐

If no for any of the above, outline deviations and actions taken below:

N/A

Reviewed By: H. Seeley Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

Were the correlation coefficients for the calibration curves for AA, Hg, CN, and other spectrophotometric methods ≥0.995? (Check calculations performed for calibration curves.) Yes ☑ No ☐

If no, list: N/A

Date	Analyte	Coefficient	Action	Samples Affected
		NONE		

Check for transcription and calculation errors involving calibration summary forms and raw data. Briefly summarize errors and associated actions when data quality might have been affected.

3.0 BLANK ANALYSIS

3.1 Initial and Continuing Calibration Blanks

Have Initial and Continuing Calibration Blanks (ICB/CCB) been analyzed at the frequency required in the EPA method? Yes ☑ No ☐

If no, summarize problems and resolutions in the narrative report.

List analytes detected in ICB and CCBs below:

NOTE: For soil samples, convert blank values to mg/kg using digestion weights and volumes.

Analysis Date	ICB/CCB No.	Analyte	Conc.	Required Detection Limits	Action Level	Samples Affected
			NONE			

Reviewed By: H. Seeley Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

3.2 Method Blank

Was one method blank analyzed for:

Each of 20 samples? Yes ☑ No ☐

Each digestion batch? Yes ☑ No ☐

Each matrix type? Yes ☑ No ☐

Both AA and ICP when both are used for the same analyte? Yes ☐ No ☐ N/A

or

At the frequency indicated in the EPA method or QAPjP? Yes ☑ No ☐

NOTE: Method blank is the same as the calibration blank for mercury and for wet chemistry analysis.

List analytes detected in method blank samples below. NOTE: For soil samples, be sure to calculate blank values using digestion weights and volumes.

~~Preparation~~ Analysis Date	Analyte	Conc.	Required Detection Limits	Action Level	Samples Affected
6-10-98	Lead	0.145J	0.5	1.5	None
6-12-98	Lead	0.315J	0.5	3.1	None

Is concentration in the method blank below the ~~detection~~ reporting limit? Yes ☑ No ☐

Affected samples: None - results >10x

Reviewed By: H. Seeley Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

3.3 Field/Rinse/Equipment Blanks None Requested

Was a field/equipment blank analyzed as required by the EPA method or QAPjP? Yes ☐ No ☐

List below analytes detected in the field blanks. NOTE: For soil samples, calculate blank values using digestion weights and volumes.

N/A

Collection Date	Blank ID	Analyte	Conc.	Required Detection Limits	Action Level	Samples Affected

4.0 ICP INTERFERENCE CHECK SAMPLE ANALYSIS

Was an ICP interference check sample (ICS) analyzed at the beginning and end of a run or at least twice every 8 hours? (Not required for Ca, Mg, K, and Na) Yes ☑ No ☐

Samples affected: N/A

Are the values of the ICS for solution AB within 80-120%R? Yes ☑ No ☐

If no, is the concentration of Al, Ca, Fe, or Mg lower than in ICS? Yes ☐ No ☐ N/A

Reviewed By: H. Seeley Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

If no, list below all analytes which did not meet %R criteria and in which the concentration of Al, Ca, Fe, or Mg is higher than in the ICS:

Date	Analyte	%R	Action	Samples Affected
			N/A	

Are any results > IDL for those analytes which are not present in the ICS solution A? Yes ☐ No ☑

If yes, results >2 (absolute value of the IDL) indicate either a positive or negative interference and must be qualified.

Samples affected: N/A

Check for transcription/calculation errors. Briefly summarize errors and associated actions when data quality might have been affected.

5.0 LABORATORY CONTROL SAMPLES (LCS)

Was an LCS analyzed at required frequency? Yes ☑ No ☐

Samples affected:

None

Reviewed By: H. Seeley Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

List below any LCS recoveries not within limits.

Preparation Date	Analyte	%R	Action	Samples Affected
			NONE	

6.0 LABORATORY DUPLICATE ANALYSIS

Were laboratory duplicates analyzed at required frequency? Yes ☑ No ☐

Samples affected: N/A

Was laboratory duplicate analysis performed on field or equipment blanks? Yes ☐ No ☑

Samples affected: N/A

Is any value for sample duplicate pair <PQL and the other value >10xPQL? Yes ☐ No ☑

Samples affected: N/A

Reviewed By: H. Seeley Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

List below concentrations of any analyte that did not meet criteria for duplicate precision:

N/A

Sample ID	Matrix	Preparation Date	Analyte	PQL	RPD	Action	Samples Affected
			N/A				

Check for transcription/calculation errors. Briefly summarize errors and associated actions when data quality might have been affected.

N/A

7.0 FIELD DUPLICATE SAMPLE ANALYSIS

Were field duplicates collected at the frequency indicated in the EPA method or QAPjP?
Yes ☑ No ☐

If yes, qualify data associated only with the field duplicate pair. Calculate RPDs for each analyte in which both values are greater than the IDL.

Is any value for sample duplicate < practical quantitation limit (PQL) and other value >10xPQL? Yes ☐ No ☑

Reviewed By: H. Seeley Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

Samples affected: N/A

List below the analytes that do not meet RPD or PQL criteria. Use the same criteria as those used for laboratory duplicate analysis or criteria specified in EPA method or sampling plan.

Sample ID	Matrix	Collection Date	RPD	Control Limit	Action	Samples Affected
398-01/08	S	4-14-98	44	±35%	J	Lead
399-01/08	S	4-14-98	63	±35%	J	Lead

Check for transcription/calculation errors. Briefly summarize errors and associated actions when data quality might have been affects.

N/A

8.0 MATRIX SPIKE ANALYSIS

NOTE: *This matrix spike is a predigestion/predistallation spike.*

Was a matrix spike prepared and analyzed at the required frequency? Yes ☑ No ☐

Reviewed By: H. Sealey Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

Were matrix spikes performed at the concentrations specified by the EPA method? Yes ☑ No ☐

Samples affected: N/A

Was matrix spike analysis performed on field or equipment blanks? Yes ☐ No ☑

If equipment or field blanks are the only aqueous samples, matrix spike analysis may be performed; however, matrix spike samples must be present for the other matrices.

Samples affected: N/A

List below the % recoveries for analytes that did not meet the criteria:

Sample ID	Matrix	~~Preparation~~ Collection Date	Analyte	%R	Action	Samples Affected
399-01	S	4-14-98	As	76.9	None	None
399-01	S	4-14-98	Ag	51.7	None	None

Check for transcription/calculation errors. Also check to ensure matrix spike concentrations are not affected by sample dilutions performed. If matrix spike concentrations are diluted below or close to IDL based on sample dilutions performed, use professional judgment in qualifying data. Ensure that the laboratory performed sample dilutions only when necessary as indicated by QA/QC requirements. Briefly summarize errors and associated actions when data quality might have been affected.

MS or MSD and LCS/DCS acceptable

Reviewed By: H. Seeley Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

NOTE: If preparation blank spikes are analyzed, evaluate recoveries. These recoveries can indicate whether excursions in matrix spike recovery are caused by sample matrix effects or poor digestion efficiencies and/or problems with matrix spike solution. For example, if matrix spike recovery for selenium is 0% and preparation blank spike recovery for selenium is 92%, this may indicate sample matrix effects.

9.0 FURNACE ATOMIC ABSORPTION ANALYSIS

Were duplicate injections present for each sample, including required QC analyses (not required if MSA is done)? Yes ☑ No ☐

Samples affected: N/A

Were postdigestion spikes analyzed for samples, including QC samples? Yes ☑ No ☐ As required

Were postdigestion spikes analyzed at the required concentration? Yes ☑ No ☐

Samples affected: N/A

Was a dilution analyzed for samples with postdigestion spike recovery <40%? Yes ☐ No ☐ N/A

Samples affected: N/A

MSA Analysis (Method of Standard Additions)—MSA is required when serial dilutions are not with ± 10%. Was MSA required for any sample but not performed? Yes ☐ No ☑

Are MSA calculations outside the linear range of the calibration curve? Yes ☐ No ☐ N/A

Reviewed By: H. Searley Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

NOTE: Ensure the spiking concentrations used for MSA analysis were at 50–100% and 150% of sample concentration or absorbance.

Samples affected: N/A

10.0 SERIAL DILUTION ANALYSIS N/A

NOTE: Serial dilution analysis (ICP) is required only for initial concentrations equal to or greater than 10xIDL.

If applicable, was a serial dilution performed for:

Each 20 samples? Yes ☐ No ☐
Each matrix type? Yes ☐ No ☐

Samples affected: N/A

List below results which did not meet criteria of %D <10% for analyte concentrations greater than 50xIDL before dilution:

Analysis Date	Sample ID	Analyte	IDL	%D	Action	Samples Affected

Check for calculation errors and negative interferences.

Reviewed By: H. Seeley Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

11.0 SAMPLE RESULT VERIFICATION

11.1 Verification of Instrumental Parameters

Are instrument detection limits present and verified on a quarterly basis? Yes ☑ No ☐

Are IDLs present for each analyte and each instrument used? Yes ☑ No ☐

Is the IDL greater than the required detection limits for any analyte? Yes ☐ No ☑
(If IDL > required detection limits, flag values less than 5xIDL.)

Samples affected: N/A

Are ICP Interelement Correction Factors established and verified annually? Yes ☑ No ☐

Are ICP Linear Ranges established and verified quarterly? Yes ☑ No ☐

If no for any of the above, review problems and resolutions in narrative report.
N/A

11.2 Reporting Requirements

Were sample results reported down to the PQL? Yes ☑ No ☐

If no, indicate necessary corrections. N/A

Were sample results that were analyzed by ICP for Se, Tl, As, or Pb at least 5xIDL? Yes ☐ No ☐ N/A

Were sample weights, volumes, and dilutions taken into account when reporting sample results and detection limits? Yes ☑ No ☐

Reviewed By: H H. Seeley Date: 11/6/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

If no for any of the above, sample results may be inaccurate. Note necessary changes and if errors are present, request resubmittal of laboratory package.

N/A

Were any sample results higher than the linear range of calibration curve and not subsequently reanalyzed at the appropriate dilution? Yes ☐ No ☑

Samples affected: N/A

11.3 Sample Quantitation

Check a minimum of 10% of positive sample results for transcription/calculation errors. Summarize necessary corrections. If errors are large, request resubmittal of laboratory package.

Comments:

Approved By:* ______________________

Date: ______________________

*Task/Project Leader is responsible for approval of data set.

Reviewed By: H. Seeley Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

SITE OR PROJECT ER Site 65C.
ANALYTICAL LABORATORY CORE
LABORATORY REPORT # 981057
CASE NO. ~~7724~~ 7214.2209

SAMPLE IDS C465C-BH-Series
NO. OF SAMPLES 24 w/ fractions

DATA ASSESSMENT SUMMARY

Describe problems/qualifications below (Action Items and Areas of Concern)

		VOC	SVOC	PEST/PCB	OTHER HE
1.	HOLDING TIMES/PRESERVATION	✓	✓		✓
2.	GC/MS INST. PERFORM.	✓	✓		
3.	CALIBRATIONS/WINDOWS	✓	✓		✓
4.	BLANKS	✓	✓		✓
5.	SURROGATES	✓	✓		✓
6.	MATRIX SPIKE/DUP	✓	✓		✓
7.	LABORATORY CONTROL SAMPLES	✓	✓		✓
8.	INTERNAL STANDARDS	✓	✓		
9.	COMPOUND IDENTIFICATION	✓	✓		✓ correction requested
10.	SYSTEM PERFORMANCE	✓	✓		✓
11.	OVERALL ASSESSMENT	✓	✓		✓

✓ (check mark) — Acceptable: Data had no problems or qualified due to minor problems
N - Data qualified due to major problems
X - Problems, but do not affect data
Qualifiers: J - Estimate
UJ - Undetected, estimated

~~ACTION ITEMS:~~ No qualification for SVOC, HE. & One sample qualified for SVOC. See pg 2.

AREAS OF CONCERN:

Reviewed By: H. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

PROJECT/TASK LEADER: Haggerty

~~ACTION ITEMS:~~ Sample CY65C-BH-975,350-1-2.5-SS qualified for SVOC due to low surrogate recovery. Sample was re-extracted out of holding time w/ acceptable results, however initial data was reported. Qualified as estimated, UJ.

No qualification applied to VOC.

AREAS OF CONCERN: Lab was requested to provide corrected reports for HE analyses. Current reports indicate HMX and/or RDX present as J value. These should all be reported as non-detect. Lab contacted 10/29/98.

1/10/99 - Corrections for HE were rec'd by SMO 1/4/99. All HE results are non-detect.

HS 1/10/99

OVERALL DATA QUALITY ASSESSMENT

Reviewed By: H. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

1.0 HOLDING TIMES AND PRESERVATION

Indicate the holding time criteria below that was used to evaluate the samples.

SW-846, 3rd. ed.
Other: ______

List below samples that were over holding time criteria.

Sample ID	VTSR	Date Analyzed	Action
	NONE		

NOTE: VTSR = Validated time of sample receipt.

Were the correct preservatives used? Yes ☑ No ☐

List below samples that were incorrectly preserved.

Sample No.	Type of Sample	Deficiency	Action
	NONE		

Reviewed By: H. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

2.0 GC/MS TUNING CRITERIA

Has a GC/MS tuning performance been analyzed for every twelve hours of sample analysis for each GC/MS instrument used? Yes ☑ No ☐

Was the correct standard (listed in the EPA Method) used? Yes ☑ No ☐

Have the ion abundance criteria been met for each tune? Yes ☑ No ☐

NOTE: GC/MS abundance criteria is specified by EPA method for GC/MS analysis (EPA 8240A or 8270A).

If no for any of the above, list all the data associated with the tune that either failed criteria or in which there was no tune.

Date/Time	Problem	Sample Affected (Action)
	NONE	

Check for transcription/calculation errors. If errors are present, briefly summarize necessary changes:

N/A

Is the spectra of the mass calibration acceptable? Yes ☑ No ☐

Reviewed By: H. Sachey
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

3.0 GC INSTRUMENT PERFORMANCE.

3.1 DDT Retention Time

Is DDT retention time for packed columns >12 minutes (except for OV-1 and OV-101)?
Yes ☐ No ☐

If no, list below the DDT standards that failed criteria: __________

Affected samples and compounds: __________ NA

3.2 Retention Time Windows

List below compounds that were not within the retention time windows.

Date/Time	Compound	RT	RT Window	Action	Affected Samples

Reviewed By: H. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

3.3 DDT and Endrin Degradation

List below the standards that have a DDT or Endrin breakdown of >20% (or a combined breakdown of >20%).

Date/Time	Standard ID	DDT/Endrin	% Breakdown	Action	Affected Samples
		N/A			

3.4 DBC Retention Time Check

Is the %D between EVAL A and each analysis (quantitation and confirmation) DBC retention time within QC limits (2% for packed column, 0.3% capillary ID <0.32 mm, and 1% for megabore)?

Yes ☐ No ☐

Date	Sample ID	DBC %D	Action

For the above criteria outlined in Sections 8.1–8.4, check for transcription/calculation errors.

If errors are found, list below with necessary corrections: ______________________

Reviewed By: H. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

4.0 INITIAL CALIBRATION

Has initial calibration been performed as required in the EPA method? Yes ☑ No ☐

Were the correct number of standards used to calibrate the instrument? Yes ☑ No ☐

For GC analyses of PCBs and Pesticides, did the laboratory follow the correct 72-hour sequence of analysis?
Yes ☐ No ☐ N/A

List below compounds which did not meet initial calibration criteria outlined by the EPA method.

Instrument ID	Date	Compound	RF/%RSD	Action	Samples Affected
			N/A	NONE	

Check for transcription/calculation errors. If errors are present, summarize necessary corrections below:

N/A

Reviewed By: H. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

5.0 CONTINUING CALIBRATION

Have continuing calibration standards been analyzed at the frequency specified in the EPA method?
Yes ☑ No ☐

List below all compounds which did not meet continuing calibration requirements.

Instrument ID	Date	Compound	RF/%D	Action	Samples Affected
		NONE			

Check for transcription and calculation errors. If errors are found, briefly summarize necessary corrections below:

N/A

Reviewed By: H. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

6.0 BLANK ANALYSES

6.1 Method/Reagent and Instrument Blanks

Has a method/reagent blank been analyzed for each set of samples or for every 20 samples of similar matrix, whichever is more frequent? Yes ☑ No ☐

Has an instrument blank been analyzed at least once every twelve hours for each GC/MS system used?
Yes ☑ No ☐

6.2 Field/Rinse/Equipment Blanks Not Requested

Are there field/rinse/equipment blanks associated with each sampling day or at frequency specified in the sampling plan. Yes ☐ No ☐

List below compounds for which analyses were requested that were detected in any of the blanks analyzed:

Date	Blank ID	Compound	Conc. ( )	PQL ( )	Action Level	Samples Affected (Action)
			NONE			

PQL = Practical Quantitation Limit from EPA Method.

Reviewed By: H. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

Are there any TICs present in the blanks that are also present in the samples? Yes ☐ No ☑
If yes, list below.

N/A

7.0 SURROGATE RECOVERY

Were surrogate recoveries evaluated for each of the samples analyzed by GC or GC/MS?
Yes ☑ No ☐

If surrogate standards other than those presented by SW-846 are used, list below with reference to applicable control limits used to evaluate the percent recoveries.

Surrogate Compound	Control Limits

List below the percent recoveries which did not meet either SW-846 criteria or criteria listed above.

Date	Sample ID/Matrix	Surrogate Compound	%Rec	Action
5-11-98	981057-1	2-Flurophenol	1%	SVOC-UJ 981057-1
↓	↓	NB-d5	7%	↓
↓	↓	Phenol-d6	12%	↓
5-11-98	LCS	2-Fluorophenol	17%	↓

Reviewed By: H. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

If surrogate recovery was outside of control limits, were the samples or method blank reanalyzed?

Yes ☑ No ☐

Are method blank surrogate recoveries outside of limits upon reanalysis? Yes ☐ No ☑

Are transcription/calculation errors present? Yes ☐ No ☑

If yes, note necessary corrections. Sample re-extracted out of hold time. Only initial data reported. Qualified UJ due to low surrogate recovery.

Reviewed By: H. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

8.0 MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) ANALYSIS

Were MS/MSDs analyzed at the frequency required by the EPA method or QAPjP for each matrix type?

Yes ☑ No ☐

List below % recoveries and RPDs of compounds which did not meet criteria. Indicate on chart criteria used to evaluate recoveries and RPDs.

Date	Sample ID/Matrix	Compound	%Rec RPD	Action
		NONE		

Reviewed By: K. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

9.0 LABORATORY CONTROL SAMPLE ANALYSIS

Have laboratory control samples containing a representative number of the compounds of interest been analyzed at the frequency specified in the EPA method or QAPjP?

Yes ☑ No ☐

Evaluate percent recoveries based on control limits established in individual EPA methods, or use established laboratory control limits. List below recoveries of compounds which did not meet criteria with reference to control limits used.

Date	Compound	%Rec	Control Limits	Action	Samples Affected
5-11-98	1,4-DCB	18.9	28-116	None	None

Control Limit Reference: ______

Evaluate RPD based on control limits established in individual EPA methods, or use established laboratory control limits. List below recoveries of compounds which did not meet criteria with reference to control limits used.

Date	Compound	~~%Rec~~ % RPD	Control Limits	Action	Samples Affected
5-11-98	1,4-DCB	127.2%	±20%	None	None
↓	124-TCB	62.8%	↓	↓	↓
↓	2-Clphenol	96.2%	↓	↓	↓
↓	Phenol	64.8%	↓	↓	↓

Control Limit Reference: ______

All recoveries were acceptable, all non-detect, MS/MSD acceptable. Not qualified.

Also, tetryl 67%/~~133%~~ ok
4-A-26-DNT 133/134%.
Non-detect, no qualification

Reviewed By: H. Seeley
Date: 11/6/98

AL/2-94/WP/SNL:SOP3044C.R1

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

10.0 INTERNAL STANDARDS EVALUATION

List below the internal standard areas of samples or blanks which did not meet criteria.

Date	Sample ID	Internal Out	Acceptable Range	Action
		NONE		

Are retention times of the internal standards within 30 seconds of the associated calibration standard?
Yes ☑ No ☐

11.0 TARGET COMPOUND LIST ANALYTES
11.1 GC/MS Analyses

Are the reconstructed ion chromatograms, the mass spectra for the identified compounds, and the data system printouts included? Yes ☑ No ☐

Is chromatographic performance acceptable with respect to:

Baseline stability? Yes ☑ No ☐

Resolution? Yes ☑ No ☐

Peak shape? Yes ☑ No ☐

Full-scale graph (attenuation)? Yes ☑ No ☐

Reviewed By: H. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

Other: N/A

Is the RRT of each reported compound within the limits given in the method of the standard RRT in the continuing calibration? Yes ☐ No ☐ N/A

Are all the ions present in the standard mass spectrum at a relative intensity greater than 10% also present in the mass spectrum? Yes ☑ No ☐

Do sample and standard relative intensities agree within 20%? Yes ☑ No ☐

If no for any of the above, indicate below problems and qualifications made to data:

N/A

11.2 GC Analyses

Are there any transcription/calculation errors between the raw data and the reporting forms?
Yes ☐ No ☑

If yes, review errors and necessary corrections below; if errors are large, resubmittal of laboratory package may be necessary.

N/A

Are retention times of sample compounds within the calculated retention time windows for both quantitation and confirmation analysis? Yes ☑ No ☐

Was GC/MS confirmation performed when required by the EPA method? Yes ☐ No ☐ N/A

If no for any of the above, reject positive results except for retention time windows if associated standard compounds are similarly shifted.

Reviewed By: H. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

Samples affected: N/A

Check chromatograms for false negatives, especially for the multiple peak components (toxaphene and PCBs). If false negatives are apparent and the appropriate PCB standards were not analyzed, or if confirmed analysis was not present, flag the affected data.

Samples affected: N/A

NOTE: Due to the complexities of PCB/pesticide analysis, each analytical run should be reviewed to verify identification and column performance.

12.0 FIELD DUPLICATE ANALYSIS

Were field duplicates submitted for analysis? Yes ☑ No ☐

If yes, calculate RPD and use professional judgment to determine if the data needs to be qualified. List results below.

Date	Sample ID	Compound	Sample Result	Duplicate Result	RPD	Affected Samples
		NONE				

13.0 COMPOUND QUANTITATION/REPORTED DETECTION LIMITS

Are there any transcription/calculation errors from raw data to reported results (check at least 10% of positive results)? Yes ☐ No ☑

In addition, verify that the correct internal standard, quantitation ion, and RRF were used to calculate the result for a minimum of 10% of sample data.

Reviewed By: H. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

13.1 Chromatogram Quality

Were baselines stable? Yes ☑ No ☐

Were any negative peaks or unusual peaks present? Yes ☐ No ☑

Were early eluting peaks resolved to baseline? Yes ☑ No ☐

If incorrect quantitations are evident, note corrections necessary below:

N/A

Are the required quantitation limits (detection limits) adjusted to reflect sample dilutions and for soils, sample moisture? Yes ☑ No ☐

If no, make necessary corrections and note below.

N/A

14.0 TENTATIVELY IDENTIFIED COMPOUNDS

Are Tentatively Identified Compounds (TIC) properly identified with scan number or retention time, estimated concentration, and J qualifier? Yes ☐ No ☐

N/A

Are the mass spectra for TICs and associated "best match" spectra included? Yes ☐ No ☐

Are any TCL compounds listed as TIC compounds? Yes ☐ No ☐

Are each of the ions present in the reference mass spectra with a relative intensity greater than 10% also present in the sample mass spectrum? Yes ☐ No ☐

Reviewed By: H. Seeley
Date: 11/6/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

Do TIC and "best match" standard relative ion intensities agree within 20%? Yes ☐ No ☐ N/A

Comments

Reviewed By: H. Seeley

Date: 11/6/98

Approved By:*

Date

*Data package must be approved by Project/Task Leader.

Records Center Code: ER / 1333 / 65B / DAT

SMO ANALYTICAL DATA ROUTING FORM

Project Name: ER Site 65C

Case No./Service Order: 7214.2209 / CF0507

SNL Task Leader: HAGGERTY

Org/Mail Stop: 6134 / 1148

SMO Project Coordinator: SALMI

Sample Ship Date: 4/16/98

ARCOC	Lab	Lab ID	Preliminary Received	Final Received	EDD Req'd YES	EDD Req'd NO	EDD Rec'd YES	EDD Rec'd NO
600213	CORE	981057 ~~981056~~		6/22/98	X		x	
600217	RPSD	800688		4/16/98		x		x

	Date		
Correction Requested from Lab:	7-29-98	Correction Request #:	1101
Corrections Received:		Requester:	Palencia
Review Complete:	7-29-98	Signature:	W. Palencia
Priority Data Faxed:		Faxed To:	
Preliminary Notification:	6/22/98	Person Notified:	Doug Vetter (IT)
Final Transmittal:	7-29-98	Transmitted To:	Vetter
		Transmitted By:	Palencia
Filed ~~in Records Center~~ TO ER:	8-31-98	Filed By:	Montano

Comments: ~~Raw data in Lorraine's office~~ OK

Received (Records Center) By: ______________________

Contract Verification Review (CVR)

Project Leader HAGGERTY

Project Name ER SITE 65C

Case No. 7214.2209

AR/COC No. 600213

Analytical Lab CORE

SDG No. 981057

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? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? 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	X				
1.7	Date samples received	X				
1.8	Condition upon receipt information provided	X				

2.0 Analytical Laboratory Report

Line No.	Item	Complete? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? 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, LCD)	X				
2.4	Matrix spike/matrix spike duplicate data provided(if requested)	X				
2.5	Detection Limits provided; PQL and MDL(or IDL)	X				
2.6	QC batch numbers provided	X				
2.7	Dilution Factors provided	X				
2.8	Data reported using correct sig. fig. (2 for org.; 3 for inorg.)	X				
2.9	Rad analysis uncertainty provided (2 sigma error)	NA				
2.10	Narrative provided	X				
2.11	TAT met		X	30 DAY TAT MISSED		X
2.12	Hold times met	X				
2.13	Were contractual qualifiers provided	X				
2.14	All requested result data provided		X	10 SAMPLES NOT ANALYZED (SAMPLES #981057-3—981057-12)		X

3.0 Data Quality Evaluation

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1) 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). Units consistent between QC samples and sample data.	X		
3.2) Quantitation limit met for all samples?	X		
3.3) Accuracy a) Laboratory control sample accuracy reported and met for all samples?		X	1,4-DICHLOROBENZENE RECOVERY OUTSIDE QC LIMITS FOR METHOD 8270 LCS—MS/MSD RECOVERY GOOD 2 EXPLOSIVES ANALYTES OUTSIDE QC RECOVERY LIMITS
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique?		X	SEVERAL SVOC SURROGATES OUTSIDE QC RECOVERY LIMITS
c) If requested, matrix spike recovery data reported and met .	X		
3.4) Precision a) Laboratory control sample precision reported and met for all samples? For rad analysis, sample duplicate precision reported and met.		X	MANY SVOC RPDs OUTSIDE QC LIMITS
b) If requested, matrix spike duplicate RPD data reported and met.		X	RPD FOR SILVER HIGH AS NOTED IN CASE NARRATIVE
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?	NA		
3.6) Contractual qualifiers provided: "J"- estimated quantity; "B"-analyte found in method blank; "U"- analyte undetected (results are below the MDL or L_c (rad)); "H"-analysis done beyond the holding time.		X	"J" QUALIFIER OMITTED FOR MERCURY ON SAMPLE #981057-20 "U" QUALIFIER OMITTED FOR TETRYL IN METHOD BLANK
3.7) Narrative included, correct, and complete?	X		

4.0 Data Quality Evaluation Continuation

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

Sample/ Fraction No.	Analysis	Qualifiers	Comments
QC	6010A		RPD FOR Pb ANALYZED ON 6-10-98 & 6-12-98 INCORRECTLY REPORTED AS 0 (PAGE 74)
QC	8260A		LCS/LCD RPD INCORRECTLY REPORTED AS 0 (PAGE 82 & 83)
QC	8330	U	"U" QUALIFIER OMITTED FOR TETRYL IN METHOD BLANK (PAGE 90)
981057-20	6010A	J	"J" QUALIFIER OMITTED FOR MERCURY

Were deficiencies noted. ☹ Yes ☺ No

Based on the review, this data package is complete. ☺ Yes ☹ No

If no, provide : nonconformance report or correction request number 1101 and date correction request was submitted 7-29-98

Reviewed by: W. Palencia Date: 7-29-98 Closed by: ____________ Date: ________

SF 2001-COC (10-97)
Supersedes (5-97) Issue

Internal Lab Batch No.

ANALYSIS REQUEST AND CHAIN OF CUSTODY

SAR/WR No.

Press F1 for instructions for each field.

AR/COC- 600213

Dept. No./Mail Stop: 1148
Project/Task Manager: Grace Haggerty
Project Name: ER Site 65C
Record Center Code: ER/1333/65B/DAT
Logbook Ref. No.: ER-0153
Service Order No.: CFO 507

Date Samples Shipped: 4/16/98 SMO USE
Carrier/Waybill No.: 706246
Lab Contact: Tim Kellog/307-235-5741
Lab Destination: Core-Denver
SMO Contact/Phone: Doug Salmi/848-0963
Send Report to SMO: Grace Haggerty

Contract No.: AJ-2480C
Case No.: 7214.220900
SMO Authorization
Bill to: Sandia National Laboratories
Supplier Services, Dept. ________
P.O. Box 5800 MS 0154

Location — Tech Area NA
Building NA — Room NA

Reference LOV (available at SMO)

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft	ER Site No.	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID (LAB USE)
040398 - 001	CY65C-BH-975,350-1-2.5-SS	1-2.5	65C	041498/1445	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040399 - 001	CY65C-BH-975,350-2.5-3-S	2.5-3	65C	041498/1500	S	G	250 ml	4 C	G	~~SA~~	RCRA Metals+Be,HE,SVOC	
040400 - 001	CY65C-BH-975,350-5-7-S	5-7	65C	041498/1510	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040401 - 001	CY65C-BH-975,350-8-13-S	8-13	65C	041498/1530	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040402 - 001	CY65C-BH-1000,325-1-1.5-SS	1-1.5	65C	041498/1155	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040403 - 001	CY65C-BH-1000,325-3.5-4-S	3.5-4	65C	041498/1205	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040404 - 001	CY65C-BH-1000,325-7-7.5-S	7-7.5	65C	041498/1225	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040405 - 001	CY65C-BH-1000,325-13.5-14.5-S	13.5-14.5	65C	041498/1245	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040406 - 001	CY65C-BH-1050,175-0.5-2.5-SS	0.5-2.5	65C	041498/1030	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040407 - 001	CY65C-BH-1050,175-3-4-S	3-4	65C	041498/1035	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	

RMMA ☒Yes ☐No Ref. No. ____
Sample Disposal ☒Return to Client ☐Disposal by lab
Turnaround Time ☒Normal ☒Rush Required Report Date 15 Day

Sample Tracking — SMO USE
Date Entered (mm/dd/yy) 4/23
Entered by: LA
QC inits.

Special Instructions/QC Requirements
EDD ☒Yes ☐No
Raw data package ☒Yes ☐No
*COC#600217 releases #600213 off-site.
*RCRA Metals+Be(6010/7000),HE(8330) VOC(8260A), SVOC(8270B).
Please list as separate report.

Abnormal Conditions on Receipt LAB USE

Sample Team Members	Name	Signature	Init	Company/Organization/Phone
	Angel B. Vega	Angel B. Vega	ABV	MDM/6131/844-0981
	Christopher Catechis	C. Catechis	C.C.	MDM/6131//284-2553

		Org	Date	Time			Org.	Date
1. Relinquished by	C. Catechis	6131	4/15/98	1520	4. Relinquished by			
1. Received by	[signature]	7578	4/15/98	1520	4. Received by			
2. Relinquished by	[signature]	7578	4/16/98	1400	5. Relinquished by			
2. Received by					5. Received by			
3. Relinquished by					6. Relinquished by			
3. Received by					6. Received by			

Original To Accompany Samples, Laboratory Copy (White) — **1st Copy** To Accompany Samples, Return to SMO (Blue) — **2nd Copy** SMO Suspense Copy (Yellow) — **3rd Copy** Field Copy (Pink)

SF 2001-COC (10-97)

Supersedes (5-97) issue

ANALYSIS REQUEST AND CHAIN OF CUSTODY (Continuation)

Press F1 for instructions for each field.

AR/COC- 600213

Project Name: ER Site 65C	Project/Task Manager: Grace Haggerty	Case No.: 7214.220900

Location Tech Area NA

Building NA Room NA

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preser-vative	Sample Collection Method	Sample Type	Parameter & Method Requested	LAB USE Lab Sample ID
040408 - 001	CY65C-BH-1050,175-7.5-9.5-S	7.5-9.5	65C	041498/ 1045	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040409 - 001	CY65C-BH-1050,175-12.5-14.5-S	12.5-14.5	65C	041498/1055	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040398 - 003	CY65C-BH-975,350-0-0.5-SS	0-0.05	65C	041498/1430	S	AC	125 ml	4 C	G	SA	VOC	
040399 - 003	CY65C-BH-975,350-3.5-4-S	3.5-4	65C	041498/1430	S	AC	125 ml	4 C	G	SA	VOC	
040402 - 003	CY65C-BH-1000,325-0-0.5-SS	0-0.5	65C	041498/1155	S	AC	125 ml	4 C	G	SA	VOC	
040403 - 003	CY65C-BH-1000,325-4-4.5-S	4-4.5	65C	041498/1205	S	AC	125 ml	4 C	G	SA	VOC	
040406 - 003	CY65C-BH-1050,175-0-0.5-SS	0-0.5	65C	041498/1030	S	AC	125 ml	4 C	G	SA	VOC	
040407 - 003	CY65C-BH-1050,175-2.5-3-S	2.5-3	65C	041498/1035	S	AC	125 ml	4 C	G	SA	VOC	
040398 - 008	CY65C-BH-975,350-1-2.5-DU	1-2.5	65C	041498/1445	S	G	250 ml	4 C	G	DU	RCRA Metals + BE, HE, SVOC	
040399 - 008	CY65C-BH-975,350-2.5-3-DU	2.5-3	65C	041498/1500	S	G	250 ml	4 C	G	DU	RCRA Metals + BE, HE, SVOC	
040400 - 008	CY65C-BH-975,350-5-7-DU	5-7	65C	041498/1510	S	G	250 ml	4 C	G	DU	RCRA Metals + BE, HE, SVOC	
040401 - 008	CY65C-BH-975,350-8-13-DU	8-13	65C	041498/1530	S	G	250 ml	4 C	G	DU	RCRA Metals + BE, HE, SVOC	
040541 - 003	CY65C-BH-1000,325-13.5-14-S	13.5-14	65C	041498/1530	S	G	250 ml	4 C	G	SA	VOC	
040540 - 009	CY65C-BH-975,350~~7-7.5-DU~~ -7-7.5 DU	7-7.5	65C	041498/1510	S	G	250 ml	4 C	G	DU	VOC	
040540 - 003	CY65C-BH-975,350-7.5-8-S	7.5-8	65C	041498/1510	S	G	250 ml	4 C	G	SA	VOC	
040541 - 009	CY65C-BH-975,350-13-13.5-DU	13-13.5	65C	041498/1530	S	G	250 ml	4 C	G	DU	VOC	
040406 - 008	CY65C-BH-1050,175-0.5-2.5-DU	0.5-2.5	65C	041498/1030	S	G	250 ml	4 C	G	DU	RCRA Metals + BE, HE, SVOC	
040407 - 008	CY65C-BH-1050,175-3-4-DU	3-4	65C	041498/1035	S	G	250 ml	4 C	G	DU	RCRA Metals + BE, HE, SVOC	
040408 - 008	CY65C-BH-1050,175-7.5-9.5-DU	7.5-9.5	65C	041498/1045	S	G	250 ml	4 C	G	DU	RCRA Metals + BE, HE, SVOC	
040409 - 008	CY65C-BH-1050,175-12.5-14.5-DU	12.5-14.5	65C	041498/1055	S	G	250 ml	4 C	G	DU	RCRA Metals + BE, HE, SVOC	
040398 - 009	CY65C-BH-975,350-0.5-1-DU	0.5-1	65C	041498/1430	S	AC	125 ml	4 C	G	DU	VOC	
040399 - 009	CY65C-BH-975,350-3-3.5-DU	3-3.5	65C	041498/1430	S	AC	125 ml	4 C	G	DU	VOC	
040530 - 003	CY65C-BH-1000,325-7.5-8-S	7.5-8	65C	041498/1225	S	~~AC~~ G	125 ml	4 C	G	SA	VOC	
~~040531 - 003~~	~~CY65C-BH-1050,175-14.5-15-S~~	~~14.5-15~~	~~65C~~	~~041498/1055~~	~~S~~	~~G~~	~~125 ml~~	~~4 C~~	~~G~~	~~SA~~	~~VOC~~	
040526 - 003	CY65C-BH-1000,325-14.5-15-S	14.5-15	65C	041498/1245	S	G	125 ml	4 C	G	SA	VOC	

C.C.

Abnormal Conditions on Receipt LAB USE

Recipient Initials ______

Original To Accompany Samples, Laboratory Copy (White) **1st Copy** To Accompany Samples, Return to SMO (Blue) **2nd Copy** SMO Suspense Copy (Yellow) **3rd Copy** Field Copy (Pink)

✓ checked again
dat. 1/21/99

SAMPLE FINDINGS SUMMARY

Site: ER Site 65C

AR/COC: 600214 Data Classification:

Sample/ Fraction No.	Analysis	DV Qualifiers	Comments
CY65C-BH-1050, 225-9.5-10-S	117-81-7	U	Change PQL to 330. AZ
CY65C-BH-1050, 225-14-14.5-S	↓	↓	↓
CY65C-BH-~~1050~~, ~~225~~-1075, 300-3.5-4-S	↓	↓	↓
CY65C-BH-1075, 300-6-6.5-S	↓	↓	↓
CY65C-BH-1075, 300-11-12-S	↓	↓	↓
CY65C-BH-1125, 300-4-4.5-S	↓	↓	↓
CY65C-BH-1125, 300-13-14-S	↓	↓	↓
CY65C-BH-1050, 225-0.5-1-MS	7440-39-3	J	Barium
↓	7440-22-4	UJ	Silver
↓	7782-49-2	UJ	Selenium

Sample No./Fraction No. - This value is located on the Chain of Custody in the ER Sample Id field.

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: H. Seeley Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

SITE OR PROJECT ER Site 65C
ANALYTICAL LABORATORY CORE
LABORATORY REPORT # 981056
CASE NO. 7214.2209
COC 600214

SAMPLE IDS CY65C-BH-series
NO. OF SAMPLES
14-VOC, 12-SVOC, 12-HE

DATA ASSESSMENT SUMMARY

Describe problems/qualifications below (Action Items and Areas of Concern)

		VOC	SVOC	PEST/PCB	OTHER HE
1.	HOLDING TIMES/PRESERVATION	✓	✓		✓
2.	GC/MS INST. PERFORM.	✓	✓		
3.	CALIBRATIONS/WINDOWS	✓	✓		✓
4.	BLANKS	✓	✓		✓
5.	SURROGATES	✓	✓		✓
6.	MATRIX SPIKE/DUP	✓	✓		✓
7.	LABORATORY CONTROL SAMPLES	✓	✓		✓
8.	INTERNAL STANDARDS	✓	✓		
9.	COMPOUND IDENTIFICATION	✓	✓		✓ as corrected
10.	SYSTEM PERFORMANCE	✓	✓		✓
11.	OVERALL ASSESSMENT	✓	✓		✓

✓ (check mark) — Acceptable: Data had no problems or qualified due to minor problems
N - Data qualified due to major problems
X - Problems, but do not affect data
Qualifiers: J - Estimate
UJ - Undetected, estimated

~~ACTION ITEMS:~~ Data appears acceptable without qualification. ~~SVOC and~~ for HE results incorrect in report; corrections requested from lab. SVOC J values qualified as non-detect.

AREAS OF CONCERN: See pg 2 for comments.

Reviewed By: H. Seeley
Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

PROJECT/TASK LEADER: Haggerty

~~ACTION ITEMS:~~ VOC: Data acceptable without qualifications.

SVOC: 2-ethylhexyl phthalate was reported in several samples, as well as the method blank. Since results are less than 10x blank result, all sample results have been qualified as non-detect, U, at a detection limit of 330 ug/kg. No other qualifications were applied.

~~AREAS OF CONCERN:~~ HE: HMX, and in 4 samples RDX, were reported present in 11 of 12 samples. However, the raw data does not support these results. The lab was contacted 10-29-98 to review and correct the results. As of 11-14-98, corrections have not been received.

No further qualifications were applied. LCS/OCS recoveries for 4-amino-2,6-dinitrotoluene were slightly high. Since results were non-detect, no action was taken. The LCS recovery for tetryl was slightly low, however the OCS and

~~OVERALL DATA QUALITY ASSESSMENT~~ MS/MSD recoveries were acceptable. No qualifications were applied.

1/10/99 - Requested corrections rec'd by SMO 1/4/99. All HE results are non-detect

Reviewed By: H. Seeley
Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

1.0 HOLDING TIMES AND PRESERVATION

Indicate the holding time criteria below that was used to evaluate the samples.

SW-846, 3rd. ed.
Other: __________

List below samples that were over holding time criteria.

Sample ID	VTSR	Date Analyzed	Action
		NONE	

NOTE: VTSR = Validated time of sample receipt.

Were the correct preservatives used? Yes ☑ No ☐

List below samples that were incorrectly preserved.

Sample No.	Type of Sample	Deficiency	Action
	NONE		

Reviewed By: H. Seeley
Date: 11/18/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

2.0 GC/MS TUNING CRITERIA

Has a GC/MS tuning performance been analyzed for every twelve hours of sample analysis for each GC/MS instrument used? Yes ☑ No ☐

Was the correct standard (listed in the EPA Method) used? Yes ☑ No ☐

Have the ion abundance criteria been met for each tune? Yes ☑ No ☐

NOTE: GC/MS abundance criteria is specified by EPA method for GC/MS analysis (EPA 8240A or 8270A).

If no for any of the above, list all the data associated with the tune that either failed criteria or in which there was no tune.

Date/Time	Problem	Sample Affected (Action)
	NONE	

Check for transcription/calculation errors. If errors are present, briefly summarize necessary changes:

N/A

Is the spectra of the mass calibration acceptable? Yes ☑ No ☐

Reviewed By: H. Seeley
Date: 11/14/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

3.0 GC INSTRUMENT PERFORMANCE.

3.1 DDT Retention Time

Is DDT retention time for packed columns >12 minutes (except for OV-1 and OV-101)?
Yes ☐ No ☐

If no, list below the DDT standards that failed criteria: ______

N/A

Affected samples and compounds: ______

3.2 Retention Time Windows

List below compounds that were not within the retention time windows.

Date/Time	Compound	RT	RT Window	Action	Affected Samples

Reviewed By: H. Seeley
Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

3.3 DDT and Endrin Degradation

List below the standards that have a DDT or Endrin breakdown of >20% (or a combined breakdown of >20%).

Date/Time	Standard ID	DDT/Endrin	% Breakdown	Action	Affected Samples
			N/A		

3.4 DBC Retention Time Check

Is the %D between EVAL A and each analysis (quantitation and confirmation) DBC retention time within QC limits (2% for packed column, 0.3% capillary ID <0.32 mm, and 1% for megabore)?

Yes ☐ No ☐

Date	Sample ID	DBC %D	Action

For the above criteria outlined in Sections 8.1–8.4, check for transcription/calculation errors.

If errors are found, list below with necessary corrections: ______

Reviewed By: H. Seeley
Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

4.0 INITIAL CALIBRATION

Has initial calibration been performed as required in the EPA method? Yes ☑ No ☐

Were the correct number of standards used to calibrate the instrument? Yes ☑ No ☐

For GC analyses of PCBs and Pesticides, did the laboratory follow the correct 72-hour sequence of analysis?
Yes ☐ No ☐ N/A

List below compounds which did not meet initial calibration criteria outlined by the EPA method.

Instrument ID	Date	Compound	RF/%RSD	Action	Samples Affected
			NONE		

Check for transcription/calculation errors. If errors are present, summarize necessary corrections below:

N/A

Reviewed By: A. Seeley
Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

5.0 CONTINUING CALIBRATION

Have continuing calibration standards been analyzed at the frequency specified in the EPA method?
Yes ☑ No ☐

List below all compounds which did not meet continuing calibration requirements.

Instrument ID	Date	Compound	RF/%D	Action	Samples Affected
			NONE		

Check for transcription and calculation errors. If errors are found, briefly summarize necessary corrections below:

N/A

Reviewed By: H. Serley
Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

6.0 BLANK ANALYSES

6.1 Method/Reagent and Instrument Blanks

Has a method/reagent blank been analyzed for each set of samples or for every 20 samples of similar matrix, whichever is more frequent? Yes ☑ No ☐

Has an instrument blank been analyzed at least once every twelve hours for each GC/MS system used? Yes ☑ No ☐

6.2 Field/Rinse/Equipment Blanks None Submitted

Are there field/rinse/equipment blanks associated with each sampling day or at frequency specified in the sampling plan. Yes ☐ No ☐ N/A

List below compounds for which analyses were requested that were detected in any of the blanks analyzed:

Date	Blank ID	Compound	Conc. (ug/L)	PQL (ug/kg)	Action Level	Samples Affected (Action)
5-11-98	MB	2-ethylhexyl phthalate	37	330	370 ug/kg	U - all

PQL = Practical Quantitation Limit from EPA Method.

Reviewed By: H. Seeley
Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

Are there any TICs present in the blanks that are also present in the samples? Yes ☐ No ☐
If yes, list below.

N/A

7.0 SURROGATE RECOVERY

Were surrogate recoveries evaluated for each of the samples analyzed by GC or GC/MS?
Yes ☑ No ☐

If surrogate standards other than those presented by SW-846 are used, list below with reference to applicable control limits used to evaluate the percent recoveries.

Surrogate Compound	Control Limits

List below the percent recoveries which did not meet either SW-846 criteria or criteria listed above.

Date	Sample ID/Matrix	Surrogate Compound	%Rec	Action
5-11-98	SVOC-LCS	2,4,6-TBP	126%	Criteria 19-122 - No action

Reviewed By: H. Seeley
Date: 11-17-98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

If surrogate recovery was outside of control limits, were the samples or method blank reanalyzed?

Yes ☐ No ☐ N/A

Are method blank surrogate recoveries outside of limits upon reanalysis? Yes ☐ No ☐ N/A

Are transcription/calculation errors present? Yes ☐ No ☑

If yes, note necessary corrections. N/A

Reviewed By: H. Seeley
Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

8.0 MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) ANALYSIS

Were MS/MSDs analyzed at the frequency required by the EPA method or QAPjP for each matrix type?

Yes ☑ No ☐

List below % recoveries and RPDs of compounds which did not meet criteria. Indicate on chart criteria used to evaluate recoveries and RPDs.

Date	Sample ID/Matrix	Compound	%Rec RPD	Action
		NONE		

Reviewed By: H. Seeley
Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

9.0 LABORATORY CONTROL SAMPLE ANALYSIS

Have laboratory control samples containing a representative number of the compounds of interest been analyzed at the frequency specified in the EPA method or QAPjP?

Yes ☑ No ☐

Evaluate percent recoveries based on control limits established in individual EPA methods, or use established laboratory control limits. List below recoveries of compounds which did not meet criteria with reference to control limits used.

Date	Compound	%Rec	Control Limits	Action	Samples Affected
5-20-98	Tetryl	66.9 / ok	70-130	None	None
5-20-98	4-A-26-DNT	133 / 134	70-130	↓	↓

Control Limit Reference: ______________________

Evaluate RPD based on control limits established in individual EPA methods, or use established laboratory control limits. List below recoveries of compounds which did not meet criteria with reference to control limits used.

Date	Compound	~~%Rec~~ RPD	Control Limits	Action	Samples Affected
5-20-98	Tetryl	26.5%	±20%	None	None

Control Limit Reference: ______________________

Reviewed By: H. Seeley
Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

10.0 INTERNAL STANDARDS EVALUATION

List below the internal standard areas of samples or blanks which did not meet criteria.

Date	Sample ID	Internal Out	Acceptable Range	Action
		NONE		

Are retention times of the internal standards within 30 seconds of the associated calibration standard?
Yes ☑ No ☐

11.0 TARGET COMPOUND LIST ANALYTES
11.1 GC/MS Analyses

Are the reconstructed ion chromatograms, the mass spectra for the identified compounds, and the data system printouts included? Yes ☑ No ☐

Is chromatographic performance acceptable with respect to:

Baseline stability? Yes ☑ No ☐

Resolution? Yes ☑ No ☐

Peak shape? Yes ☑ No ☐

Full-scale graph (attenuation)? Yes ☑ No ☐

Reviewed By: H. Seeley
Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

Other: N/A

Is the RRT of each reported compound within the limits given in the method of the standard RRT in the continuing calibration? Yes ☑ No ☐

Are all the ions present in the standard mass spectrum at a relative intensity greater than 10% also present in the mass spectrum? Yes ☑ No ☐

Do sample and standard relative intensities agree within 20%? Yes ☑ No ☐

If no for any of the above, indicate below problems and qualifications made to data:

N/A

11.2 GC Analyses

Are there any transcription/calculation errors between the raw data and the reporting forms?
Yes ☐ No ☑

If yes, review errors and necessary corrections below; if errors are large, resubmittal of laboratory package may be necessary.

N/A

Are retention times of sample compounds within the calculated retention time windows for both quantitation and confirmation analysis? Yes ☐ No ☐ N/A

Was GC/MS confirmation performed when required by the EPA method? Yes ☐ No ☐ N/A

If no for any of the above, reject positive results except for retention time windows if associated standard compounds are similarly shifted.

Reviewed By: H. Sealey
Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

Samples affected: N/A

Check chromatograms for false negatives, especially for the multiple peak components (toxaphene and PCBs). If false negatives are apparent and the appropriate PCB standards were not analyzed, or if confirmed analysis was not present, flag the affected data.

Samples affected: N/A

NOTE: Due to the complexities of PCB/pesticide analysis, each analytical run should be reviewed to verify identification and column performance.

12.0 FIELD DUPLICATE ANALYSIS None Submitted

Were field duplicates submitted for analysis? Yes ☐ No ☐

If yes, calculate RPD and use professional judgment to determine if the data needs to be qualified. List res. below.

Date	Sample ID	Compound	Sample Result	Duplicate Result	RPD	Affected Samples
		N/A				

13.0 COMPOUND QUANTITATION/REPORTED DETECTION LIMITS

Are there any transcription/calculation errors from raw data to reported results (check at least 10% of positive results)? Yes ☑ No ☐ HE results - see comments page 2

In addition, verify that the correct internal standard, quantitation ion, and RRF were used to calculate the result for a minimum of 10% of sample data.

Reviewed By: H. Seeley
Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

13.1 Chromatogram Quality

Were baselines stable? Yes ☑ No ☐

Were any negative peaks or unusual peaks present? Yes ☐ No ☑

Were early eluting peaks resolved to baseline? Yes ☑ No ☐

If incorrect quantitations are evident, note corrections necessary below:

N/A

Are the required quantitation limits (detection limits) adjusted to reflect sample dilutions and for soils, sample moisture? Yes ☑ No ☐

If no, make necessary corrections and note below.

N/A

14.0 TENTATIVELY IDENTIFIED COMPOUNDS

Are Tentatively Identified Compounds (TIC) properly identified with scan number or retention time, estimated concentration, and J qualifier? Yes ☐ No ☐

N/A

Are the mass spectra for TICs and associated "best match" spectra included? Yes ☐ No ☐

Are any TCL compounds listed as TIC compounds? Yes ☐ No ☐

Are each of the ions present in the reference mass spectra with a relative intensity greater than 10% also present in the sample mass spectrum? Yes ☐ No ☐

Reviewed By: H. Seeley
Date: 11-14-98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

Do TIC and "best match" standard relative ion intensities agree within 20%? Yes ☐ No ☐ N/A

Comments

Reviewed By: H. Seeley

Date: 11-14-98

Approved By:*

Date

*Data package must be approved by Project/Task Leader.

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

SITE OR PROJECT ER Site 65C
ANALYTICAL LABORATORY CORE
LABORATORY REPORT # 981056
TASK LEADER Haggerty
NO. OF SAMPLES 12

CASE NO. 7214.2209
SAMPLE IDS CY65C-BH-series

COC 600214

DATA ASSESSMENT SUMMARY

		ICP	AA	MERCURY	CYANIDE
1.	HOLDING TIMES	✓	✓	✓	
2.	CALIBRATIONS	✓	✓	✓	
3.	BLANKS	✓	✓	✓	
4.	ICS	✓			
5.	LCS	✓	✓		
6.	DUPLICATE ANALYSIS	✓	✓	✓	
7.	MATRIX SPIKE	✓	✓	✓	
8.	MSA		N/A		
9.	SERIAL DILUTION	~~✓~~ N/A			
10.	SAMPLE VERIFICATION	✓	✓	✓	
11.	OTHER QC	✓	✓	✓	
12.	OVERALL ASSESSMENT	✓	✓	✓	

✓ (check mark) — Acceptable
Other — Qualified:
J - Estimate
UJ - Undetected, estimated
R - Unusable (analyte may or may not be present)

~~ACTION ITEMS:~~ Minor qualifications - see comments page 2

~~AREAS OF CONCERN:~~

REVIEWED BY: H. Seeley

DATE REVIEWED: 11-14-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

~~ACTION ITEMS:~~ Qualifications were applied, based on MS/MSD results, to sample CY65C-BH-1050,225-0.5-1-MS for barium, silver, and selenium - (J, UJ). While the MSD for lead was slightly low in CY65C-BH-1075,300-6-6.5-S, no qualification was applied since the MS/LCS/DCS recoveries were acceptable.

No further qualifications were applied.

AREAS OF CONCERN:

OVERALL DATA QUALITY ASSESSMENT

Reviewed By: H. Seeley Date: 11-14-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

1.0 HOLDING TIMES

List holding time criteria used to evaluate samples, indicating which samples exceed the holding time. Holding time begins with validated time of sample collection.

Parameter	Holding Time Criteria	Sample ID	Days Holding Time was Exceeded	Action
		NONE		

Were the correct preservatives used? Yes ☑ No ☐

List below samples that were incorrectly preserved.

Sample No.	Type of Samples	Deficiency	Action
	NONE		

Reviewed By: H. Seeley Date: 11-4-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

2.0 INSTRUMENT CALIBRATION

2.1 Percent Recovery Criteria

Indicate %Recovery (%R) criteria used to evaluate calibration standards:

Metals: 90-110
Mercury: 80-120
Cyanide:
Other:

List below the analytes which did not meet %R criteria for initial and continuing calibration standards:

Analysis Date	ICV/CCV #	Analyte	%R	Action	Samples Affected
		NONE			

2.2 Analytical Sequence

Did the laboratory use the proper number of standards for calibration as described in the EPA method? Yes ☑ No ☐

Have initial calibrations been performed at the beginning of each analysis and at the frequency indicated by the EPA method? Yes ☑ No ☐

Have continuing calibration standards been analyzed at the beginning of sample analysis and at a minimum frequency indicated by the EPA method and at the end of the analysis sequence? Yes ☑ No ☐

If no for any of the above, outline deviations and actions taken below:

N/A

Reviewed By: H. Sealey Date: 11-14-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

Were the correlation coefficients for the calibration curves for AA, Hg, CN, and other spectrophotometric methods ≥0.995? (Check calculations performed for calibration curves.) Yes ☑ No ☐

If no, list: N/A

Date	Analyte	Coefficient	Action	Samples Affected
		NONE		

Check for transcription and calculation errors involving calibration summary forms and raw data. Briefly summarize errors and associated actions when data quality might have been affected.

3.0 BLANK ANALYSIS

3.1 Initial and Continuing Calibration Blanks

Have Initial and Continuing Calibration Blanks (ICB/CCB) been analyzed at the frequency required in the EPA method? Yes ☑ No ☐

If no, summarize problems and resolutions in the narrative report.

List analytes detected in ICB and CCBs below:

NOTE: For soil samples, convert blank values to mg/kg using digestion weights and volumes.

Analysis Date	ICB/CCB No.	Analyte	Conc.	Required Detection Limits	Action Level	Samples Affected
		NONE				

Reviewed By: H. Seeley Date: 11-14-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

3.2 Method Blank

Was one method blank analyzed for:

Each of 20 samples? Yes ☑ No ☐
Each digestion batch? Yes ☑ No ☐
Each matrix type? Yes ☑ No ☐
Both AA and ICP when both are used for the same analyte? Yes ☐ No ☐ N/A
or
At the frequency indicated in the EPA method or QAPjP? Yes ☑ No ☐

NOTE: Method blank is the same as the calibration blank for mercury and for wet chemistry analysis.

List analytes detected in method blank samples below. NOTE: For soil samples, be sure to calculate blank values using digestion weights and volumes.

Preparation Date	Analyte	Conc.	Required Detection Limits	Action Level	Samples Affected
		N/A			

Is concentration in the method blank below the detection limit? Yes ☑ No ☐

Affected samples: No impact.

Reviewed By: H. Seeley Date: 11-14-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

3.3 Field/Rinse/Equipment Blanks

None Submitted

Was a field/equipment blank analyzed as required by the EPA method or QAPjP? Yes ☐ No ☐

List below analytes detected in the field blanks. NOTE: For soil samples, calculate blank values using digestion weights and volumes.

N/A

Collection Date	Blank ID	Analyte	Conc.	Required Detection Limits	Action Level	Samples Affected

4.0 ICP INTERFERENCE CHECK SAMPLE ANALYSIS

Was an ICP interference check sample (ICS) analyzed at the beginning and end of a run or at least twice every 8 hours? (Not required for Ca, Mg, K, and Na) Yes ☑ No ☐

Samples affected: N/A

Are the values of the ICS for solution AB within 80-120%R? Yes ☑ No ☐

If no, is the concentration of Al, Ca, Fe, or Mg lower than in ICS? Yes ☐ No ☐ N/A

Reviewed By: H. Seeley Date: 11-14-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

If no, list below all analytes which did not meet %R criteria and in which the concentration of Al, Ca, Fe, or Mg is higher than in the ICS:

Date	Analyte	%R	Action	Samples Affected
			N/A	

Are any results > IDL for those analytes which are not present in the ICS solution A? Yes ☐ No ☑

If yes, results >2 (absolute value of the IDL) indicate either a positive or negative interference and must be qualified.

Samples affected: N/A

Check for transcription/calculation errors. Briefly summarize errors and associated actions when data quality might have been affected.

5.0 LABORATORY CONTROL SAMPLES (LCS)

Was an LCS analyzed at required frequency? Yes ☑ No ☐

Samples affected: N/A

Reviewed By: H. Seeley Date: 11-14-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

List below any LCS recoveries not within limits.

Preparation Date	Analyte	%R	Action	Samples Affected
		NONE		

6.0 LABORATORY DUPLICATE ANALYSIS

Were laboratory duplicates analyzed at required frequency? Yes ☑ No ☐

Samples affected: N/A

Was laboratory duplicate analysis performed on field or equipment blanks? Yes ☐ No ☑

Samples affected: N/A

Is any value for sample duplicate pair <PQL and the other value >10xPQL? Yes ☐ No ☑

Samples affected: N/A

Reviewed By: H. Seeley Date: 11-14-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

List below concentrations of any analyte that did not meet criteria for duplicate precision:

N/A

Sample ID	Matrix	Preparation Date	Analyte	PQL	RPD	Action	Samples Affected
			N/A				

Check for transcription/calculation errors. Briefly summarize errors and associated actions when data quality might have been affected.

N/A

7.0 FIELD DUPLICATE SAMPLE ANALYSIS None Submitted

Were field duplicates collected at the frequency indicated in the EPA method or QAPjP?
Yes ☐ No ☐

N/A

If yes, qualify data associated only with the field duplicate pair. Calculate RPDs for each analyte in which both values are greater than the IDL.

Is any value for sample duplicate < practical quantitation limit (PQL) and other value >10xPQL? Yes ☐ No ☐

Reviewed By: H-Seeley Date: 11-14-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

Samples affected: ______________________

List below the analytes that do not meet RPD or PQL criteria. Use the same criteria as those used for laboratory duplicate analysis or criteria specified in EPA method or sampling plan.

Sample ID	Matrix	Collection Date	RPD	Control Limit	Action	Samples Affected
			N/A			

Check for transcription/calculation errors. Briefly summarize errors and associated actions when data quality might have been affects.

8.0 MATRIX SPIKE ANALYSIS

NOTE: *This matrix spike is a predigestion/predistallation spike.*

Was a matrix spike prepared and analyzed at the required frequency? Yes ☑ No ☐

Reviewed By: H. Seeley Date: 11-14-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

Were matrix spikes performed at the concentrations specified by the EPA method? Yes ☑ No ☐

Samples affected: N/A

Was matrix spike analysis performed on field or equipment blanks? Yes ☐ No ☑

If equipment or field blanks are the only aqueous samples, matrix spike analysis may be performed; however, matrix spike samples must be present for the other matrices.

Samples affected: N/A

List below the % recoveries for analytes that did not meet the criteria:

Sample ID	Matrix	Analysis ~~Preparation~~ Date	Analyte	%R	Action	Samples Affected
40410-001	S	6-3-98	Ba	-4/-1	J	040410-001
↓	↓	↓	Ag	46/51	UJ	↓
↓	↓	↓	Se	63/75	UJ	↓

Check for transcription/calculation errors. Also check to ensure matrix spike concentrations are not affected by sample dilutions performed. If matrix spike concentrations are diluted below or close to IDL based on sample dilutions performed, use professional judgment in qualifying data. Ensure that the laboratory performed sample dilutions only when necessary as indicated by QA/QC requirements. Briefly summarize errors and associated actions when data quality might have been affected.

Reviewed By: H. Seeley Date: 11-14-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

NOTE: If preparation blank spikes are analyzed, evaluate recoveries. These recoveries can indicate whether excursions in matrix spike recovery are caused by sample matrix effects or poor digestion efficiencies and/or problems with matrix spike solution. For example, if matrix spike recovery for selenium is 0% and preparation blank spike recovery for selenium is 92%, this may indicate sample matrix effects.

9.0 FURNACE ATOMIC ABSORPTION ANALYSIS

Were duplicate injections present for each sample, including required QC analyses (not required if MSA is done)? Yes ☑ No ☐

Samples affected: N/A

Were postdigestion spikes analyzed for samples, including QC samples? Yes ☑ No ☐

Were postdigestion spikes analyzed at the required concentration? Yes ☑ No ☐

Samples affected: N/A

Was a dilution analyzed for samples with postdigestion spike recovery <40%? Yes ☑ No ☐

Samples affected: N/A

MSA Analysis (Method of Standard Additions)—MSA is required when serial dilutions are not with ± 10%. Was MSA required for any sample but not performed? Yes ☐ No ☐ N/A

Are MSA calculations outside the linear range of the calibration curve? Yes ☐ No ☐ N/A

Reviewed By: H. Seeley Date: 11-14-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

NOTE: Ensure the spiking concentrations used for MSA analysis were at 50–100% and 150% of sample concentration or absorbance.

Samples affected: N/A

10.0 SERIAL DILUTION ANALYSIS

NOTE: Serial dilution analysis (ICP) is required only for initial concentrations equal to or greater than 10xIDL.

If applicable, was a serial dilution performed for:

Each 20 samples? Yes ☐ No ☐
Each matrix type? Yes ☐ No ☐

N/A

Samples affected:

List below results which did not meet criteria of %D <10% for analyte concentrations greater than 50xIDL before dilution:

Analysis Date	Sample ID	Analyte	IDL	%D	Action	Samples Affected

Check for calculation errors and negative interferences.

Reviewed By: H Seeley Date: 11-14-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

11.0 SAMPLE RESULT VERIFICATION

11.1 Verification of Instrumental Parameters

Are instrument detection limits present and verified on a quarterly basis? Yes ☑ No ☐

Are IDLs present for each analyte and each instrument used? Yes ☑ No ☐

Is the IDL greater than the required detection limits for any analyte? Yes ☐ No ☑
(If IDL > required detection limits, flag values less than 5xIDL.)

Samples affected: N/A

Are ICP Interelement Correction Factors established and verified annually? Yes ☑ No ☐

Are ICP Linear Ranges established and verified quarterly? Yes ☑ No ☐

If no for any of the above, review problems and resolutions in narrative report.

N/A

11.2 Reporting Requirements

Were sample results reported down to the PQL? Yes ☑ No ☐

If no, indicate necessary corrections. N/A

Were sample results that were analyzed by ICP for Se, Tl, As, or Pb at least 5xIDL? Yes ☐ No ☐ N/A

Were sample weights, volumes, and dilutions taken into account when reporting sample results and detection limits? Yes ☑ No ☐

Reviewed By: H. Sadley Date: 11-14-98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

If no for any of the above, sample results may be inaccurate. Note necessary changes and if errors are present, request resubmittal of laboratory package.

N/A

Were any sample results higher than the linear range of calibration curve and not subsequently reanalyzed at the appropriate dilution? Yes ☐ No ☑

Samples affected: N/A

11.3 Sample Quantitation

Check a minimum of 10% of positive sample results for transcription/calculation errors. Summarize necessary corrections. If errors are large, request resubmittal of laboratory package.

Comments:

Approved By:* ____________________

Date: ____________________

*Task/Project Leader is responsible for approval of data set.

Reviewed By: H. Seeley Date: 11-14-98

Records Center Code: ER / 1333 / 65B / DAT

SMO ANALYTICAL DATA ROUTING FORM

Project Name: ER Site 65C
Case No./Service Order: 7214.2209 /CF0507
SNL Task Leader: HAGGERTY
Org/Mail Stop: 6134 / 1148
SMO Project Coordinator: SALMI
Sample Ship Date: 4/16/98

ARCOC	Lab	Lab ID	Preliminary Received	Final Received	EDD Req'd YES	EDD Req'd NO	EDD Rec'd YES	EDD Rec'd NO
600214	CORE	981056		6/19/98	X		x	

Correction Requested from Lab: Date 6/22/98 4/24/98 6/22/98
Correction Request #: #1022 - Incorrect EDD Sherry Briscoe; 894 – sample receipt ack; #1065 - Incorrect sample #'s

Corrections Received: 7/2/98 8-20-98
Requester: MONTANO

Review Complete: 7/6/98
Signature: [signature]

Priority Data Faxed:
Faxed To:

Preliminary Notification: 6/22/98
Person Notified: Doug Vetter

Final Transmittal: 7/6/98
Transmitted To: Vetter

Transmitted By: Seeley

~~Filed in Records Center~~ TO ER: 8/21/98
Filed By: MONTANO

Comments: ~~Raw data in [illegible] office~~ OK

7/6/98 - Awaiting corrections, CVR to Haggerty 7/7/98

Received (Records Center) By: K Smith

Contract Verification Review (CVR)

Project Leader Grace Haggerty

Project Name ER Site 65C

Case No. 7214-220900

AR/COC No. 600214

Analytical Lab Core - Denver

SDG No. 981056

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? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? 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	x				
1.7	Date samples received	x				
1.8	Condition upon receipt information provided	x				

2.0 Analytical Laboratory Report

Line No.	Item	Complete? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? 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, LCD)	x				
2.4	Matrix spike/matrix spike duplicate data provided(if requested)		x	MS/MSD results for Ba, Pb, and Se not reported.		
2.5	Detection Limits provided; PQL and MDL(or IDL)	x				
2.6	QC batch numbers provided	x				
2.7	Dilution Factors provided	x				
2.8	Data reported using correct sig. fig. (2 for org.; 3 for inorg.)	x				
2.9	Rad analysis uncertainty provided (2 sigma error)		x	Not applicable		
2.10	Narrative provided	x				
2.11	TAT met	x				
2.12	Hold times met	x				
2.13	Were contractual qualifiers provided	x				
2.14	All requested result data provided		x	COC number 040532 thru 040539 are mis-identified on the sample reports and page 2 of the Sample Identification Sheet.	✓	

3.0 Data Quality Evaluation

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1) 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). Units consistent between QC samples and sample data.	X		
3.2) Quantitation limit met for all samples?	X		
3.3) Accuracy a) Laboratory control sample accuracy reported and met for all samples?		X	HE: LCS recovery for 4-amino-2,6-dinitrotoluene slightly high at 132.8%. Tetryl was slightly low at 66.9%. QC limits are 70-130%.
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique?	X		SVOC: Surrogate recovery for 2,4,6-tribromophenol slightly high in the LCS (127%). All recoveries okay in samples and other QC. No qualification.
c) If requested, matrix spike recovery data reported and met .		X	Metals: Silver MS/MSD recoveries low at 49.8% and 51.1%, resp. MS/MSD results not reported for barium, lea, or selenium.
3.4) Precision a) Laboratory control sample precision reported and met for all samples? For rad analysis, sample duplicate precision reported and met.	X		See HE QC report.
b) If requested, matrix spike duplicate RPD data reported and met.	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		Not applicable.
3.6) Contractual qualifiers provided: "J"- estimated quantity; "B"-analyte found in method blank; "U"- analyte undetected (results are below the MDL or L_c (rad)); "H"-analysis done beyond the holding time.	X		
3.6) Narrative included, correct, and complete?	X		

4.0 Data Quality Evaluation Continuation

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

Sample/ Fraction No.	Analysis	Qualifiers	Comments

Were deficiencies noted. Yes No

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

If no, provide : nonconformance report or correction request number 1065 and date correction request was submitted: 7-6-98

Reviewed by: Howard Seeley Date: 7/6/98 Closed by: W. Palencia Date: 8-20-98

SF 2001-COC (10-97)
Supersedes (5-97) issue

Internal Lab Batch No.

ANALYSIS REQUEST AND CHAIN OF CUSTODY

SAR/WR No.

Press F1 for instructions for each field.

AR/COC- 600214

Dept. No./Mail Stop: 1148
Project/Task Manager: Grace Haggerty
Project Name: ER Site 65C
Record Center Code: ER/1333/65B/DAT
Logbook Ref. No.: ER-0153
Service Order No.: CFO 507

Date Samples Shipped: 4/16/98 SMO USE
Carrier/Waybill No.: 706246
Lab Contact: Tim Kellog/307-235-5741
Lab Destination: Core-Denver
SMO Contact/Phone: Doug Salmi/848-0963
Send Report to SMO: Grace Haggerty

Contract No.: AJ-2480C
Case No.: 7214.220900
SMO Authorization
Bill to: Sandia National Laboratories
Supplier Services, Dept. ________
P.O. Box 5800 MS 0154

as per Doug Salmi

Location: Tech Area NA
Building NA Room NA

Reference LOV (available at SMO)

LAB USE

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft	ER Site No.	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
040410 - 001	CY65C-BH-1050,225-0.5-1-MS	0-0.5	65C	041498/1025	S	G	250 ml	4 C	G	MSMSD	RCRA Metals+Be,HE,SVOC	
040411 - 001	CY65C-BH-1050,225-4-4.5-MS	4-4.5	65C	041498/1025	S	G	250 ml	4 C	G	~~MSMSD~~	RCRA Metals+Be,HE,SVOC	
040412 - 001	CY65C-BH-1050,225-9.5-10-MS	9.5-10	65C	041498/1100	S	G	250 ml	4 C	G	~~MSMSD~~	RCRA Metals+Be,HE,SVOC	
040413 - 001	CY65C-BH-1050,225-14-14.5-MS	14-14.5	65C	041498/1130	S	G	250 ml	4 C	G	~~MSMSD~~	RCRA Metals+Be,HE,SVOC	
040414 - 001	CY65C-BH-1075,300-3.5-4-SS	3.5-4	65C	041498/1400	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040415 - 001	CY65C-BH-1075,300-6-6.5-S	6-6.5	65C	041498/1400	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040416 - 001	CY65C-BH-1075,300-11-12-S	11-12	65C	041498/1430	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
042417 - 001	CY65C-BH-1075,300-13-14-S	13-14	65C	041498/1430	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040418 - 001	CY65C-BH-1125,300-0-0.5-MS	0-0.5	65C	041498/1530	S	G	250 ml	4 C	G	~~MSMSD~~	RCRA Metals+Be,HE,SVOC	
040419 - 001	CY65C-BH-1125,300-4-4.5-MS	4-4.5	65C	041498/1540	S	G	250 ml	4 C	G	~~MSMSD~~	RCRA Metals+Be,HE,SVOC	

RMMA ☒Yes ☐No Ref. No. ____
Sample Disposal ☒Return to Client ☐Disposal by lab
Turnaround Time ☒~~Normal~~ ☒Rush Required Report Date 15 Day.

Sample Tracking SMO USE
Date Entered (mm/dd/yy) 4/29/98
Entered by: LA
QC inits. Am

Special Instructions/QC Requirements
EDD ☒Yes ☐No
Raw data package ☒Yes ☐No
*COC #600217 releases #600214 off-site.
*RCRA Metals+Be(6010/7000),HE(8330) VOC(8260A)
Please list as separate report.

Abnormal Conditions on Receipt LAB USE

Sample Team Members	Name	Signature	Init	Company/Organization/Phone
	Angel B. Vega	Angel B Vega	ABV	MDM/6131/844-0981
	Christopher Catechis	Ch Catechis	C.C.	MDM/6131/881-3196

		Org.		Date		Time				Org.	Date
1. Relinquished by	C. Catechis	Org	6131	Date	4/15/98	Time	1525	4. Relinquished by		Org.	Date
1. Received by	D. Dessecil	Org	7578	Date	4/15/98	Time	1525	4. Received by		Org.	Date
2. Relinquished by	D. Dessecil	Org.	7578	Date	4/16/98	Time	1400	5. Relinquished by		Org.	Date
2. Received by		Org.		Date		Time		5. Received by		Org.	Date
3. Relinquished by		Org.		Date		Time		6. Relinquished by		Org.	Date
3. Received by		Org.		Date		Time		6. Received by		Org.	Date

Original: To Accompany Samples, Laboratory Copy (White)
1st Copy: To Accompany Samples, Return to SMO (Blue)
2nd Copy: SMO Suspense Copy (Yellow)
3rd Copy: Field Copy (Pink)

SF 2001-COC (10-97)

Supersedes (5-97) issue

ANALYSIS REQUEST AND CHAIN OF CUSTODY (Continuation)

Press F1 for instructions for each field.

AR/COC- 600214

Project Name: ER Site 65C | Project/Task Manager: Grace Haggerty | Case No.: 7214.220900

Location Tech Area NA

Building NA Room NA

Reference LOV (available at SMO)

LAB USE

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
040420 - 001	CY65C-BH-1125,300-12-14-MS	12-14	65C	041498/1550	S	G	250 ml	4 C	G	~~MSMSD~~	RCRA Metals+Be,HE,SVOC	
040421 - 001	CY65C-BH-1125,300-11-12-MS	11-14	65C	041498/1545	S	G	250 ml	4 C	G	~~MSMSD~~	RCRA Metals+Be,HE,SVOC	
040410 - 003	CY65C-BH-1050,225-0-0.5-MS	0-0.5	65C	041498/1025	S	G	125 ml	4 C	G	MSMSD	VOC	
040411 - 003	CY65C-BH-1050,225-4.5-5-MS	4.5-5	65C	041498/1025	S	G	125 ml	4 C	G	~~MSMSD~~	VOC	
040414 - 003	CY65C-BH-1075,300-0-0.5-SS	0-0.5	65C	041498/1400	S	G	125 ml	4 C	G	SA	VOC	
040415 - 003	CY65C-BH-1075,300-3.5-4-S	3.5-4	65C	041498/1400	S	G	125 ml	4 C	G	SA	VOC	
040418 - 003	CY65C-BH-1125,300-0-0.5-MS	0-0.5	65C	041498/1530	S	G	125 ml	4 C	G	MSMSD	VOC	
040419 - 003	CY65C-BH-1125,300-~~4-5.5~~ 9.5-5 -MS	4.5-5	65C	041498/1530	S	G	125 ml	4 C	G	~~MSMSD~~	VOC	
040532 - 003	CY65C-BH-1050,225-9.5-10-S	9.5-10	65C	041498/ 1100	S	G	125 ml	4 C	G	SA	VOC	
040533 - 003	CY65C-BH-1050,225-14.5-15-S	14.5-15	65C	041498/1130	S	G	125 ml	4 C	G	SA	VOC	
040534 - 003	CY65C-BH-1050,175-9.5-10-S	9.5-10	65C	041498/1045	S	G	125 ml	4 C	G	SA	VOC	
040535 - 003	CY65C-BH-1050,175-14.5-15-S	14.4-15	65C	041498/1055	S	G	125 ml	4 C	G	SA	VOC	
040536 - 003	CY65C-BH-1075,300-9.5-10-S	9.5-10	65C	041498/1400	S	G	125 ml	4 C	G	SA	VOC	
040537 - 003	CY65C-BH-1075,300-14.5-15-S	14.5-15	65C	041498/1400	S	G	125 ml	4 C	G	SA	VOC	
040538 - 003	CY65C-BH-1125,300-5.5-6-MS	5.5-6	65C	041498/1530	S	G	125 ml	4 C	G	~~MSMSD~~	VOC	
040539 - 003	CY65C-BH-1125,300-14.5-15-MS	14.5-15	65C	041498/1530	S	G	125 ml	4 C	G	~~MSMSD~~	VOC	
-												
-												
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-												
-												

Abnormal Conditions on Receipt LAB USE

Recipient Initials

Original To Accompany Samples, Laboratory Copy (White) | **1st Copy** To Accompany Samples, Return to SMO (Blue) | **2nd Copy** SMO Suspense Copy (Yellow) | **3rd Copy** Field Copy (Pink)

SAMPLE FINDINGS SUMMARY

✓ checked again [illegible] 9/7/99

Site: ER Site 65C

AR/COC: 600215 Data Classification:

Sample/ Fraction No.	Analysis	DV Qualifiers	Comments
CY65C-BH-1200, 325-0.5-1	7440-38-2	J	Arsenic
↓	~~[illegible]~~ 7439-92-1	J	Lead
CY65C-BH-1125, 350-0.5-1-SS	479-45-8	UJ	Tetryl
CY65C-BH-1125, 350-5.5-6-5			
CY65C-BH-1125, 350-10.5-11-5			
CY65C-BH-1125, 350-13-13.5-5			
CY65C-BH-1150, 225-0-0.5-SS			
CY65C-BH-1150, 225-4-4.5-5			
CY65C-BH-1150, 225-9-9.5-5			
CY65C-BH-1150, 225-14-14.5-5			
CY65C-BH-1200, 325-0.5-1-MS	↓	↓	↓

Sample No./Fraction No. - This value is located on the Chain of Custody in the ER Sample Id field.

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: H. Seeley Date: 11/11/98

pg 4 c

SAMPLE FINDINGS SUMMARY

Site: ER Site 65 C

AR/COC: 600215 Data Classification:

Sample/ Fraction No.	Analysis	DV Qualifiers	Comments
CY65C-BH-1200, 325-5.5-6-S	479-45-8	UJ	Tetryl
CY65C-BH-1200, 325-7.5-8-S	↓	↓	↓
CY65C-BH-1175, 400-0-0.5-SS	↓	↓	↓
CY65C-BH-1175, 400-5.5-6-S	↓	↓	↓
CY65C-BH-1175, 400-11-11.5-S	↓	↓	↓

Sample No./Fraction No. - This value is located on the Chain of Custody in the ER Sample Id field.

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: H. Seeley Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

SITE OR PROJECT ER Site 65C
ANALYTICAL LABORATORY Core
LABORATORY REPORT # 981055
CASE NO. 7214.2209
COC 600215

SAMPLE IDS CY65C-BH-series
NO. OF SAMPLES 14-VOC
14-SVOC, HE

DATA ASSESSMENT SUMMARY

Describe problems/qualifications below (Action Items and Areas of Concern)

		VOC	SVOC	PEST/PCB	OTHER
1.	HOLDING TIMES/PRESERVATION				
2.	GC/MS INST. PERFORM.				
3.	CALIBRATIONS/WINDOWS				
4.	BLANKS				
5.	SURROGATES				
6.	MATRIX SPIKE/DUP				
7.	LABORATORY CONTROL SAMPLES				
8.	INTERNAL STANDARDS				
9.	COMPOUND IDENTIFICATION				
10.	SYSTEM PERFORMANCE				
11.	OVERALL ASSESSMENT				

✓ (check mark) — Acceptable: Data had no problems or qualified due to minor problems
N - Data qualified due to major problems
X - Problems, but do not affect data
Qualifiers: J - Estimate
UJ - Undetected, estimated

~~ACTION ITEMS:~~ No qualification of VOC, SVOC data. Minor qualification for HE (Tetryl). See pg 2 comments

AREAS OF CONCERN:

Reviewed By: H. Seeley
Date: 11/11/98

AL/2-94/WP/SNL:SOP3044C.R1

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

PROJECT/TASK LEADER: Haggerty

~~ACTION ITEMS~~: VOC and SVOC data appear acceptable without qualifications. While the RPD for MS/MSD recoveries exceeded criteria for several compounds, all recoveries were acceptable and all results were non-detect.

All HE results for tetryl have been qualified as estimated UJ. Tetryl recoveries in the LCS/DCS were consistently below acceptance criteria.

AREAS OF CONCERN: ~~HE Results reported positive values for HE~~
Laboratory reports indicate the presence of HE compounds in almost all samples. These results appear to be incorrect. The lab was contacted 10-29-98 to review the data and provide corrected reports. All HE results should be non-detect.

1/10/99 - Corrections rec'd by SMO 1/4/99. All HE results are non-detect.
HS 1/10/99.

OVERALL DATA QUALITY ASSESSMENT

Reviewed By: H. Seeley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

1.0 HOLDING TIMES AND PRESERVATION

Indicate the holding time criteria below that was used to evaluate the samples.

SW-846, 3rd. ed.
Other: ______

List below samples that were over holding time criteria.

Sample ID	VTSR	Date Analyzed	Action
	NONE		

NOTE: VTSR = Validated time of sample receipt.

Were the correct preservatives used? Yes ☑ No ☐

List below samples that were incorrectly preserved.

Sample No.	Type of Sample	Deficiency	Action
	NONE		

Reviewed By: ______
Date: ______

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

2.0 GC/MS TUNING CRITERIA

Has a GC/MS tuning performance been analyzed for every twelve hours of sample analysis for each GC/MS instrument used? Yes ☑ No ☐

Was the correct standard (listed in the EPA Method) used? Yes ☑ No ☐

Have the ion abundance criteria been met for each tune? Yes ☑ No ☐

NOTE: GC/MS abundance criteria is specified by EPA method for GC/MS analysis (EPA 8240A or 8270A).

If no for any of the above, list all the data associated with the tune that either failed criteria or in which there was no tune.

Date/Time	Problem	Sample Affected (Action)
	NONE	

Check for transcription/calculation errors. If errors are present, briefly summarize necessary changes:

N/A

Is the spectra of the mass calibration acceptable? Yes ☑ No ☐

Reviewed By: H. Seeley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

3.0 GC INSTRUMENT PERFORMANCE.

3.1 DDT Retention Time

Is DDT retention time for packed columns >12 minutes (except for OV-1 and OV-101)?

Yes ☐ No ☐

If no, list below the DDT standards that failed criteria: __________

Affected samples and compounds: __________

N/A

3.2 Retention Time Windows

List below compounds that were not within the retention time windows.

Date/Time	Compound	RT	RT Window	Action	Affected Samples

Reviewed By: H. Seeley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

3.3 DDT and Endrin Degradation

List below the standards that have a DDT or Endrin breakdown of >20% (or a combined breakdown of >20%).

Date/Time	Standard ID	DDT/Endrin	% Breakdown	Action	Affected Samples
		NA			

3.4 DBC Retention Time Check

Is the %D between EVAL A and each analysis (quantitation and confirmation) DBC retention time within QC limits (2% for packed column, 0.3% capillary ID <0.32 mm, and 1% for megabore)?

Yes ☐ No ☐

Date	Sample ID	DBC %D	Action

For the above criteria outlined in Sections 8.1–8.4, check for transcription/calculation errors.

If errors are found, list below with necessary corrections: ____________________

____

____

____

Reviewed By: H. Sexley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

4.0 INITIAL CALIBRATION

Has initial calibration been performed as required in the EPA method? Yes ☑ No ☐

Were the correct number of standards used to calibrate the instrument? Yes ☑ No ☐

For GC analyses of PCBs and Pesticides, did the laboratory follow the correct 72-hour sequence of analysis?
Yes ☐ No ☐ N/A

List below compounds which did not meet initial calibration criteria outlined by the EPA method.

Instrument ID	Date	Compound	RF/%RSD	Action	Samples Affected
			None		

Check for transcription/calculation errors. If errors are present, summarize necessary corrections below:

N/A

Reviewed By: H. Sedley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

5.0 CONTINUING CALIBRATION

Have continuing calibration standards been analyzed at the frequency specified in the EPA method?
Yes ☑ No ☐

List below all compounds which did not meet continuing calibration requirements.

Instrument ID	Date	Compound	RF/%D	Action	Samples Affected
		NONE			

Check for transcription and calculation errors. If errors are found, briefly summarize necessary corrections below:

N/A

Reviewed By: H. Seeley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

6.0 BLANK ANALYSES

6.1 Method/Reagent and Instrument Blanks

Has a method/reagent blank been analyzed for each set of samples or for every 20 samples of similar matrix, whichever is more frequent? Yes ☑ No ☐

Has an instrument blank been analyzed at least once every twelve hours for each GC/MS system used? Yes ☑ No ☐

6.2 Field/Rinse/Equipment Blanks None submitted

Are there field/rinse/equipment blanks associated with each sampling day or at frequency specified in the sampling plan. Yes ☐ No ☐

List below compounds for which analyses were requested that were detected in any of the blanks analyzed:

Date	Blank ID	Compound	Conc. ( )	PQL ( )	Action Level	Samples Affected (Action)
4-29	MB	2-ethhexpht	1.3J	330	13	None
			N/A HJ			

PQL = Practical Quantitation Limit from EPA Method.

All reported results were greater than 10x blank results.

Reviewed By: H. Seeley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

Are there any TICs present in the blanks that are also present in the samples? Yes ☐ No ☐
If yes, list below.

N/A

7.0 SURROGATE RECOVERY

Were surrogate recoveries evaluated for each of the samples analyzed by GC or GC/MS?
Yes ☑ No ☐

If surrogate standards other than those presented by SW-846 are used, list below with reference to applicable control limits used to evaluate the percent recoveries.

Surrogate Compound	Control Limits

List below the percent recoveries which did not meet either SW-846 criteria or criteria listed above.

Date	Sample ID/Matrix	Surrogate Compound	%Rec	Action
		NONE		

Reviewed By: H. Seeley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

If surrogate recovery was outside of control limits, were the samples or method blank reanalyzed?

Yes ☐ No ☐ N/A

Are method blank surrogate recoveries outside of limits upon reanalysis? Yes ☐ No ☐ N/A

Are transcription/calculation errors present? Yes ☐ No ☑

If yes, note necessary corrections. N/A

Reviewed By: H. Seeley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

8.0 MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) ANALYSIS

Were MS/MSDs analyzed at the frequency required by the EPA method or QAPjP for each matrix type?

Yes ☑ No ☐

List below % recoveries and RPDs of compounds which did not meet criteria. Indicate on chart criteria used to evaluate recoveries and RPDs.

Date	Sample ID/Matrix	Compound	%Rec RPD	Action
4-29-98	040430-001	Benzidines	275.3	None

MS recovery acceptable. Also LCS/DCS acceptable. No qualification
RPDs for several compounds exceeded criteria, however all recoveries were acceptable.

Reviewed By: H. Seeley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

9.0 LABORATORY CONTROL SAMPLE ANALYSIS

Have laboratory control samples containing a representative number of the compounds of interest been analyzed at the frequency specified in the EPA method or QAPjP?

Yes ☑ No ☐

Evaluate percent recoveries based on control limits established in individual EPA methods, or use established laboratory control limits. List below recoveries of compounds which did not meet criteria with reference to control limits used.

Date	Compound	%Rec	Control Limits	Action	Samples Affected
5-14-98	Tetryl	64%	70-130	J	All
5-15-98	↓	40 / 58	↓	↓	↓
5-18-98	↓	42 / 59.6	↓	↓	↓

Control Limit Reference: ______________________

Evaluate RPD based on control limits established in individual EPA methods, or use established laboratory control limits. List below recoveries of compounds which did not meet criteria with reference to control limits used.

Date	Compound	%~~Rec~~ RPD	Control Limits	Action	Samples Affected
5-14-98	Tetryl	21.8	20%	J	All
5-15-98	↓	36.7	↓	↓	↓
5-18-98	↓	34.1	↓	↓	↓

Control Limit Reference: ______________________

Reviewed By: H. Seeley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

10.0 INTERNAL STANDARDS EVALUATION

List below the internal standard areas of samples or blanks which did not meet criteria.

Date	Sample ID	Internal Out	Acceptable Range	Action
		NONE		

Are retention times of the internal standards within 30 seconds of the associated calibration standard?
Yes ☑ No ☐

11.0 TARGET COMPOUND LIST ANALYTES
11.1 GC/MS Analyses

Are the reconstructed ion chromatograms, the mass spectra for the identified compounds, and the data system printouts included? Yes ☑ No ☐

Is chromatographic performance acceptable with respect to:

Baseline stability? Yes ☑ No ☐

Resolution? Yes ☑ No ☐

Peak shape? Yes ☑ No ☐

Full-scale graph (attenuation)? Yes ☑ No ☐

Reviewed By: H. Seeley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

Other: ______________________________

Is the RRT of each reported compound within the limits given in the method of the standard RRT in the continuing calibration? Yes ☑ No ☐

Are all the ions present in the standard mass spectrum at a relative intensity greater than 10% also present in the mass spectrum? Yes ☑ No ☐

Do sample and standard relative intensities agree within 20%? Yes ☑ No ☐

If no for any of the above, indicate below problems and qualifications made to data:

N/A

____

____

11.2 GC Analyses

Are there any transcription/calculation errors between the raw data and the reporting forms?
Yes ☐ No ☐ No

If yes, review errors and necessary corrections below; if errors are large, resubmittal of laboratory package may be necessary.

N/A

____

____

Are retention times of sample compounds within the calculated retention time windows for both quantitation and confirmation analysis? Yes ☐ No ☐ N/A

Was GC/MS confirmation performed when required by the EPA method? Yes ☐ No ☐ N/A

If no for any of the above, reject positive results except for retention time windows if associated standard compounds are similarly shifted.

Reviewed By: H. Seeley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

Samples affected: N/A

Check chromatograms for false negatives, especially for the multiple peak components (toxaphene and PCBs). If false negatives are apparent and the appropriate PCB standards were not analyzed, or if confirmed analysis was not present, flag the affected data.

Samples affected: N/A

NOTE: Due to the complexities of PCB/pesticide analysis, each analytical run should be reviewed to verify identification and column performance.

12.0 FIELD DUPLICATE ANALYSIS None Submitted

Were field duplicates submitted for analysis? Yes ☐ No ☐

If yes, calculate RPD and use professional judgment to determine if the data needs to be qualified. List res below.

Date	Sample ID	Compound	Sample Result	Duplicate Result	RPD	Affected Samples
		N/A				

13.0 COMPOUND QUANTITATION/REPORTED DETECTION LIMITS

Are there any transcription/calculation errors from raw data to reported results (check at least 10% of positive results)? Yes ☑ No ☐ All reported HE positive results should be non-detect.

In addition, verify that the correct internal standard, quantitation ion, and RRF were used to calculate the result for a minimum of 10% of sample data.

Reviewed By: H. Seeley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

13.1 Chromatogram Quality

Were baselines stable? Yes ☑ No ☐

Were any negative peaks or unusual peaks present? Yes ☐ No ☑

Were early eluting peaks resolved to baseline? Yes ☑ No ☐

If incorrect quantitations are evident, note corrections necessary below: ______

N/A

______

Are the required quantitation limits (detection limits) adjusted to reflect sample dilutions and for soils, sample moisture? Yes ☑ No ☐

If no, make necessary corrections and note below.

N/A

______

______

14.0 TENTATIVELY IDENTIFIED COMPOUNDS

Are Tentatively Identified Compounds (TIC) properly identified with scan number or retention time, estimated concentration, and J qualifier? Yes ☐ No ☐ N/A

Are the mass spectra for TICs and associated "best match" spectra included? Yes ☐ No ☐ N/A

Are any TCL compounds listed as TIC compounds? Yes ☐ No ☑

Are each of the ions present in the reference mass spectra with a relative intensity greater than 10% also present in the sample mass spectrum? Yes ☐ No ☐ N/A

Reviewed By: H. Sudley
Date: 11/11/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

Do TIC and "best match" standard relative ion intensities agree within 20%? Yes ☐ No ☐ N/A

Comments ______________________________

Reviewed By: H. Sexton

Date: 11/11/98

Approved By:* ______________

Date ______________

*Data package must be approved by Project/Task Leader.

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

SITE OR PROJECT ER S.te 65C

CASE NO. 7274, 2209

ANALYTICAL LABORATORY CORE

SAMPLE IDS CY65C-BH-series -Metals

LABORATORY REPORT # 981055

TASK LEADER Haggerty

NO. OF SAMPLES 14 Metals

COC 600215

DATA ASSESSMENT SUMMARY

		ICP	AA	MERCURY	CYANIDE
1.	HOLDING TIMES				
2.	CALIBRATIONS				
3.	BLANKS				
4.	ICS				
5.	LCS				
6.	DUPLICATE ANALYSIS				
7.	MATRIX SPIKE				
8.	MSA				
9.	SERIAL DILUTION				
10.	SAMPLE VERIFICATION				
11.	OTHER QC				
12.	OVERALL ASSESSMENT				

✓ (check mark) — Acceptable
Other — Qualified:
J - Estimate
UJ - Undetected, estimated
R - Unusable (analyte may or may not be present)

~~ACTION ITEMS:~~ Data appears acceptable w/ minor qualifications

AREAS OF CONCERN:

REVIEWED BY: H. Seyling

DATE REVIEWED: 11/10/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

~~ACTION ITEMS:~~ Sample CY65C-BH-1200,325-0.5-1 designated as MS/MSD. ~~Arsen~~ Arsenic recovery was slightly low for both MS (73%) and MSD (77%). Result was qualified estimated. MS recovery for lead was low (46%) and result was qualified estimated. The MS result for Se was slightly low (73%), but since MSD/LCS/PCS recoveries were acceptable, no qualification was applied.

AREAS OF CONCERN:

OVERALL DATA QUALITY ASSESSMENT

Reviewed By: H. Seeley Date: 11/10/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

1.0 HOLDING TIMES

List holding time criteria used to evaluate samples, indicating which samples exceed the holding time. Holding time begins with validated time of sample collection.

Parameter	Holding Time Criteria	Sample ID	Days Holding Time was Exceeded	Action
		NONE		

Were the correct preservatives used? Yes ☑ No ☐

List below samples that were incorrectly preserved.

Sample No.	Type of Samples	Deficiency	Action
	NONE		

Reviewed By: H. Seeley Date: 11/10/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

2.0 INSTRUMENT CALIBRATION

2.1 Percent Recovery Criteria

Indicate %Recovery (%R) criteria used to evaluate calibration standards:

Metals: 90-110
Mercury: 80-120
Cyanide: ________
Other: ________

List below the analytes which did not meet %R criteria for initial and continuing calibration standards:

Analysis Date	ICV/CCV #	Analyte	%R	Action	Samples Affected
			NONE		

2.2 Analytical Sequence

Did the laboratory use the proper number of standards for calibration as described in the EPA method? Yes ☑ No ☐

Have initial calibrations been performed at the beginning of each analysis and at the frequency indicated by the EPA method? Yes ☑ No ☐

Have continuing calibration standards been analyzed at the beginning of sample analysis and at a minimum frequency indicated by the EPA method and at the end of the analysis sequence? Yes ☑ No ☐

If no for any of the above, outline deviations and actions taken below:

N/A

Reviewed By: H. Seeley Date: 11/10/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

Were the correlation coefficients for the calibration curves for AA, Hg, CN, and other spectrophotometric methods ≥0.995? (Check calculations performed for calibration curves.) Yes ☑ No ☐

If no, list: N/A

Date	Analyte	Coefficient	Action	Samples Affected
		NONE		

Check for transcription and calculation errors involving calibration summary forms and raw data. Briefly summarize errors and associated actions when data quality might have been affected.

3.0 BLANK ANALYSIS

3.1 Initial and Continuing Calibration Blanks

Have Initial and Continuing Calibration Blanks (ICB/CCB) been analyzed at the frequency required in the EPA method? Yes ☑ No ☐

If no, summarize problems and resolutions in the narrative report.

List analytes detected in ICB and CCBs below:

NOTE: For soil samples, convert blank values to mg/kg using digestion weights and volumes.

Analysis Date	ICB/CCB No.	Analyte	Conc.	Required Detection Limits	Action Level	Samples Affected
		NONE				

Reviewed By: H. Seeley Date: 11/10/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

3.2 Method Blank

Was one method blank analyzed for:

Each of 20 samples? Yes ☑ No ☐
Each digestion batch? Yes ☑ No ☐
Each matrix type? Yes ☑ No ☐
Both AA and ICP when both are used for the same analyte? Yes ☐ No ☐ N/A
or
At the frequency indicated in the EPA method or QAPjP? Yes ☑ No ☐

NOTE: Method blank is the same as the calibration blank for mercury and for wet chemistry analysis.

List analytes detected in method blank samples below. NOTE: For soil samples, be sure to calculate blank values using digestion weights and volumes.

Preparation Date	Analyte	Conc.	Required Detection Limits	Action Level	Samples Affected
			NONE		

Is concentration in the method blank below the ~~detection~~ reporting limit? Yes ☑ No ☐

Affected samples: None

Reviewed By: H. Seeley Date: 11/10/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

3.3 Field/Rinse/Equipment Blanks

None submitted

Was a field/equipment blank analyzed as required by the EPA method or QAPjP? Yes ☐ No ☐

List below analytes detected in the field blanks. NOTE: For soil samples, calculate blank values using digestion weights and volumes.

N/A

Collection Date	Blank ID	Analyte	Conc.	Required Detection Limits	Action Level	Samples Affected

4.0 ICP INTERFERENCE CHECK SAMPLE ANALYSIS

Was an ICP interference check sample (ICS) analyzed at the beginning and end of a run or at least twice every 8 hours? (Not required for Ca, Mg, K, and Na) Yes ☑ No ☐

Samples affected: N/A

Are the values of the ICS for solution AB within 80-120%R? Yes ☑ No ☐

If no, is the concentration of Al, Ca, Fe, or Mg lower than in ICS? Yes ☐ No ☐ N/A

Reviewed By: H. Sealey Date: 11/10/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

If no, list below all analytes which did not meet %R criteria and in which the concentration of Al, Ca, Fe, or Mg is higher than in the ICS:

Date	Analyte	%R	Action	Samples Affected
			NONE	

Are any results > IDL for those analytes which are not present in the ICS solution A? Yes ☐ No ☑

If yes, results >2 (absolute value of the IDL) indicate either a positive or negative interference and must be qualified.

Samples affected: N/A

Check for transcription/calculation errors. Briefly summarize errors and associated actions when data quality might have been affected.

5.0 LABORATORY CONTROL SAMPLES (LCS)

Was an LCS analyzed at required frequency? Yes ☑ No ☐

Samples affected:

N/A

Reviewed By: H. Seeley Date: 11/10/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

List below any LCS recoveries not within limits.

Preparation Date	Analyte	%R	Action	Samples Affected
			NONE	

6.0 LABORATORY DUPLICATE ANALYSIS

Were laboratory duplicates analyzed at required frequency? Yes ☑ No ☐

Samples affected: N/A

Was laboratory duplicate analysis performed on field or equipment blanks? Yes ☐ No ☑

Samples affected: N/A

Is any value for sample duplicate pair <PQL and the other value >10xPQL? Yes ☐ No ☑

Samples affected: N/A

Reviewed By: H. Seeley Date: 11/16/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

List below concentrations of any analyte that did not meet criteria for duplicate precision:

N/A

Sample ID	Matrix	Preparation Date	Analyte	PQL	RPD	Action	Samples Affected
			N/A				

Check for transcription/calculation errors. Briefly summarize errors and associated actions when data quality might have been affected.

N/A

7.0 FIELD DUPLICATE SAMPLE ANALYSIS

Were field duplicates collected at the frequency indicated in the EPA method or QAPjP?
Yes ☐ No ☐ None submitted

If yes, qualify data associated only with the field duplicate pair. Calculate RPDs for each analyte in which both values are greater than the IDL.

N/A

Is any value for sample duplicate < practical quantitation limit (PQL) and other value >10xPQL? Yes ☐ No ☐

Reviewed By: A. Sexley Date: 11/10/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

Samples affected: ______________________

List below the analytes that do not meet RPD or PQL criteria. Use the same criteria as those used for laboratory duplicate analysis or criteria specified in EPA method or sampling plan.

Sample ID	Matrix	Collection Date	RPD	Control Limit	Action	Samples Affected
		NA				

Check for transcription/calculation errors. Briefly summarize errors and associated actions when data quality might have been affects.

____

8.0 MATRIX SPIKE ANALYSIS

NOTE: *This matrix spike is a predigestion/predistallation spike.*

Was a matrix spike prepared and analyzed at the required frequency? Yes ☑ No ☐

Reviewed By: H. Seeley Date: 11/10/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

Were matrix spikes performed at the concentrations specified by the EPA method? Yes ☑ No ☐

Samples affected: N/A

Was matrix spike analysis performed on field or equipment blanks? Yes ☐ No ☑

If equipment or field blanks are the only aqueous samples, matrix spike analysis may be performed; however, matrix spike samples must be present for the other matrices.

Samples affected: N/A

List below the % recoveries for analytes that did not meet the criteria:

Sample ID	Matrix	Analysis ~~Preparation~~ Date	Analyte	%R	Action	Samples Affected
040430-1	S	6-9-98	As	73/77	J	040430-1
		6-16-98	Pb	46/46	J	
		6-4-98	Se	73/82	None	None

Check for transcription/calculation errors. Also check to ensure matrix spike concentrations are not affected by sample dilutions performed. If matrix spike concentrations are diluted below or close to IDL based on sample dilutions performed, use professional judgment in qualifying data. Ensure that the laboratory performed sample dilutions only when necessary as indicated by QA/QC requirements. Briefly summarize errors and associated actions when data quality might have been affected.

As - MS & MSD out
Pb - MS very low
Se - Only MS out slightly, results ND, LCS/OCS ok

Reviewed By: H. Seeley Date: 11/10/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

NOTE: If preparation blank spikes are analyzed, evaluate recoveries. These recoveries can indicate whether excursions in matrix spike recovery are caused by sample matrix effects or poor digestion efficiencies and/or problems with matrix spike solution. For example, if matrix spike recovery for selenium is 0% and preparation blank spike recovery for selenium is 92%, this may indicate sample matrix effects.

9.0 FURNACE ATOMIC ABSORPTION ANALYSIS

Were duplicate injections present for each sample, including required QC analyses (not required if MSA is done)? Yes ☑ No ☐

Samples affected: N/A

Were postdigestion spikes analyzed for samples, including QC samples? Yes ☑ No ☐ As required

Were postdigestion spikes analyzed at the required concentration? Yes ☑ No ☐

Samples affected: N/A

Was a dilution analyzed for samples with postdigestion spike recovery <40%? Yes ☐ No ☐

Samples affected: N/A

MSA Analysis (Method of Standard Additions)—MSA is required when serial dilutions are not with ± 10%. Was MSA required for any sample but not performed? Yes ☐ No ☑

Are MSA calculations outside the linear range of the calibration curve? Yes ☐ No ☐ N/A

Reviewed By: H. Seeley Date: 11/10/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

NOTE: Ensure the spiking concentrations used for MSA analysis were at 50–100% and 150% of sample concentration or absorbance.

Samples affected: N/A

10.0 SERIAL DILUTION ANALYSIS

NOTE: Serial dilution analysis (ICP) is required only for initial concentrations equal to or greater than 10xIDL.

If applicable, was a serial dilution performed for:

Each 20 samples? Yes ☐ No ☐
Each matrix type? Yes ☐ No ☐

Samples affected: N/A

List below results which did not meet criteria of %D <10% for analyte concentrations greater than 50xIDL before dilution:

Analysis Date	Sample ID	Analyte	IDL	%D	Action	Samples Affected
			N/A			

Check for calculation errors and negative interferences.

Reviewed By: H. Seeley Date: 11/10/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

11.0 SAMPLE RESULT VERIFICATION

11.1 Verification of Instrumental Parameters

Are instrument detection limits present and verified on a quarterly basis? Yes ☑ No ☐

Are IDLs present for each analyte and each instrument used? Yes ☑ No ☐

Is the IDL greater than the required detection limits for any analyte? Yes ☐ No ☑
(If IDL > required detection limits, flag values less than 5xIDL.)

Samples affected: N/A

Are ICP Interelement Correction Factors established and verified annually? Yes ☑ No ☐

Are ICP Linear Ranges established and verified quarterly? Yes ☑ No ☐

If no for any of the above, review problems and resolutions in narrative report.

N/A

11.2 Reporting Requirements

Were sample results reported down to the PQL? Yes ☑ No ☐

If no, indicate necessary corrections. N/A

Were sample results that were analyzed by ICP for Se, Tl, As, or Pb at least 5xIDL? Yes ☐ No ☐ N/A

Were sample weights, volumes, and dilutions taken into account when reporting sample results and detection limits? Yes ☑ No ☐

Reviewed By: H. Seeley Date: 11/10/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

If no for any of the above, sample results may be inaccurate. Note necessary changes and if errors are present, request resubmittal of laboratory package.

N/A

Were any sample results higher than the linear range of calibration curve and not subsequently reanalyzed at the appropriate dilution? Yes ☐ No ☑

Samples affected: N/A

11.3 Sample Quantitation

Check a minimum of 10% of positive sample results for transcription/calculation errors. Summarize necessary corrections. If errors are large, request resubmittal of laboratory package.

Comments:

Approved By:* ____________________

Date: ____________________

*Task/Project Leader is responsible for approval of data set.

Reviewed By: H. Seeley Date: 11/10/98

Records Center Code: ER / 1333 / 65B / DAT

SMO ANALYTICAL DATA ROUTING FORM

Project Name: ER Site 65C

Case No./Service Order: 7214.2209 / CF0507

SNL Task Leader: HAGGERTY

Org/Mail Stop: 6134 / 1148

SMO Project Coordinator: SALMI

Sample Ship Date: 4/16/98

ARCOC	Lab	Lab ID	Preliminary Received	Final Received	EDD Req'd YES	EDD Req'd NO	EDD Rec'd YES	EDD Rec'd NO
600215	CORE	981055		6/24/98	X		X	

	Date		
Correction Requested from Lab:		Correction Request #:	
Corrections Received:		Requester:	
Review Complete:	~~4-7~~ 7/6/98	Signature:	H. Seeley
Priority Data Faxed:		Faxed To:	
Preliminary Notification:	6/24/98	Person Notified:	Doug Vetter
Final Transmittal:	7/6/98	Transmitted To:	D. Vetter
		Transmitted By:	SEELEY
~~Filed in Records Center:~~ TO ER-	~~7/6/98~~ HS 7/6/98 7-9-98	Filed By:	~~K. LAMBERT~~ HS 7/6/98 Montano

Comments: ~~Raw data in Lorraine's Office~~ OK

Received (Records Center) By:

Contract Verification Review (CVR)

Project Leader Grace Haggerty

Project Name ER Site 65C

Case No. 7214-220900

AR/COC No. 600215

Analytical Lab Core - Denver

SDG No. 981055

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? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? 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	x				
1.7	Date samples received	x				
1.8	Condition upon receipt information provided	x				

2.0 Analytical Laboratory Report

Line No.	Item	Complete? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? 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, LCD)	x				
2.4	Matrix spike/matrix spike duplicate data provided(if requested)	x				
2.5	Detection Limits provided; PQL and MDL(or IDL)	x				
2.6	QC batch numbers provided	x				
2.7	Dilution Factors provided	x				
2.8	Data reported using correct sig. fig. (2 for org.; 3 for inorg.)	x				
2.9	Rad analysis uncertainty provided (2 sigma error)		x	Not applicable		
2.10	Narrative provided	x				
2.11	TAT met	x				
2.12	Hold times met	x				
2.13	Were contractual qualifiers provided	x				
2.14	All requested result data provided	x				

3.0 Data Quality Evaluation

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1) 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). Units consistent between QC samples and sample data.	X		
3.2) Quantitation limit met for all samples?	X		
3.3) Accuracy a) Laboratory control sample 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) If requested, matrix spike recovery data reported and met .		X	Metals: Arsenic MS/MSD recoveries for 040430-001 were slightly low at 72.8% and 76.6, resp. Lead MS recovery low at 45.5% with RPD at 21.6%. Selenium MS slightly low at 72.8%. SVOC: Benzidine MSD recovery high at 235.3% however MS recovery acceptable and sample results were non-detect.
3.4) Precision a) Laboratory control sample precision reported and met for all samples? For rad analysis, sample duplicate precision reported and met.		X	LCS and DCS recoveries were acceptable for tetryl, however the overall RPD was slightly high at 36.7%.
b) If requested, matrix spike duplicate RPD data reported and met.		X	SVOC: The MS and MSD recoveries were acceptable for the following compounds, however the overall RPD was slightly high: chrysene (51.7%), dibenz(a,h)anthracene (52.8%), 1,4-dichlorobenzene (30.1%), 1,2,4-trichlorobenzene (30.6%), and benzoic acid (51.3%).
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		Not applicable.
3.6) Contractual qualifiers provided: "J"- estimated quantity; "B"-analyte found in method blank; "U"- analyte undetected (results are below the MDL or L_c (rad)); "H"-analysis done beyond the holding time.	X		
3.6) Narrative included, correct, and complete?	X	~~X~~	~~Does not address missed extraction holding times.~~ lls 11/10/98

4.0 Data Quality Evaluation Continuation

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

Sample/ Fraction No.	Analysis	Qualifiers	Comments

Were deficiencies noted. ☝ 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: Howard Seeley Date: 7/6/98 Closed by: ______________ Date: ______________

SF 2001-COC (10-97)
Supersedes (5-97) issue

Internal Lab Batch No.

ANALYSIS REQUEST AND CHAIN OF CUSTODY

SAR/WR No.

Press F1 for instructions for each field.

AR/COC- 600215

Dept. No./Mail Stop: 1148	Date Samples Shipped: 4-16-98 SMO USE	Contract No.: AJ-2480C
Project/Task Manager: Grace Haggerty	Carrier/Waybill No.: 706246	Case No.: 7214.220900
Project Name: ER Site 65C	Lab Contact: Tim Kellog/307-235-5741	SMO Authorization
Record Center Code: ER/1333/65B/DAT	Lab Destination: Core-Denver	Bill to: Sandia National Laboratories
Logbook Ref. No.: ER-0153	SMO Contact/Phone: Doug Salmi/848-0963	Supplier Services, Dept.
Service Order No.: CFO 507	Send Report to SMO: Grace Haggerty	P.O. Box 5800 MS 0154

Location Tech Area NA
Building NA Room NA

Reference LOV (available at SMO)

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft	ER Site No.	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID (LAB USE)
040422 - 001	CY65C-BH-1125,350-0.5-1-SS	0-0.5	65C	041398/1015	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040423 - 001	CY65C-BH-1125,350-5.5-6-S	5.5-6	65C	041398/1030	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040424 - 001	CY65C-BH-1125,350-10.5-11-S	10.5-11	65C	041398/1055	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040425 - 001	CY65C-BH-1125,350-13-13.5-S	13-13.5	65C	041398/1120	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040426 - 001	CY65C-BH-1150,225-0-0.5-SS	0-0.5	65C	041398/1430	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040427 - 001	CY65C-BH-1150,225-4-4.5-S	4-4.5	65C	041398/1445	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040428 - 001	CY65C-BH-1150,225-9-9.5-S	9-9.5	65C	041398/1450	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
042429 - 001	CY65C-BH-1150,225-14-14.5-S	14-14.5	65C	041398/1545	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040430 - 001	CY65C-BH-1200,325-0.5-1-MS	0.5-1	65C	041398/1615	S	G	250 ml	4 C	G	MSMSD	RCRA Metals+Be,HE,SVOC	
040431 - 001	CY65C-BH-1200,325-~~0.5-1-MS~~ -5.5-6-MS	5.5-6	65C	041398/1625	S	G	250 ml	4 C	G	~~MSMSD~~ SA	RCRA Metals+Be,HE,SVOC	

ABV

RMMA ☒Yes ☐No Ref. No.

Sample Disposal ☒Return to Client ☐Disposal by lab

Turnaround Time ☒Normal ☐Rush Required Report Date 15 DAY

Sample Tracking SMO USE
Date Entered (mm/dd/yy) 4-22-98
Entered by
QC inits.

Special Instructions/QC Requirements
EDD ☒Yes ☐No
Raw data package ☒Yes ☐No
*COC #600217 releases #6000215 off-site.
*RCRA Metals+Be(6010/7000),HE(8330) SVOC(8270B), VOC(8360A).
Please list as separate report.

Abnormal Conditions on Receipt (LAB USE)

Sample Team Members: Name	Signature	Init	Company/Organization/Phone
Angel B. Vega	Angel B Vega	ABV	MDM/6131/844-0981
Christopher Catechis	Chris Catechis	C.C.	MDM/6131/881-3196

	Org.	Date	Time		Org.	Date
1. Relinquished by Chris Catechis	6131	4/15/98	14:35	4. Relinquished by		
1. Received by D. Susuel	7578	4/15/98	14:35	4. Received by		
2. Relinquished by D. Susuel	7578	4/16/98	1400	5. Relinquished by		
2. Received by				5. Received by		
3. Relinquished by				6. Relinquished by		
3. Received by				6. Received by		

Original To Accompany Samples, Laboratory Copy (White) **1st Copy** To Accompany Samples, Return to SMO (Blue) **2nd Copy** SMO Suspense Copy (Yellow) **3rd Copy** Field Copy (Pink)

SF 2001-COC (10-97)

Supersedes (5-97) issue

ANALYSIS REQUEST AND CHAIN OF CUSTODY (Continuation)

Press F1 for instructions for each field.

AR/COC- **600215**

Project Name: ER Site 65C — Project/Task Manager: Grace Haggerty — Case No.: 7214.220900

Location — Tech Area NA — Building NA — Room NA

Reference LOV (available at SMO) — LAB USE

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
040432 - 001	CY65C-BH-1200,325-7.5-8-MS	7.5-8	65C	041398/1630	S	G	250 ml	4 C	G	~~MSMSD~~ SA	RCRA Metals+Be,HE,SVOC	
040512 - 003	CY65C-BH-1200,325-8-8.5-MS	8-8.5	65C	041398/1630	S	G	250 ml	4 C	G	~~MSMSD~~ SA	VOC	
040422 - 003	CY65C-BH-1125,350-0-0.5-SS	0.05	65C	041398/1015	S	AC	125 ml	4 C	G	SA	VOC	
040423 - 003	CY65C-BH-1125,350-5-5.5-S	5-5.5	65C	041398/1030	S	AC	125 ml	4 C	G	SA	VOC	
040426 - 003	CY65C-BH-1150,225-0-0.5-SS	0-0.5	65C	041398/1430	S	AC	125 ml	4 C	G	SA	VOC	
040427 - 003	CY65C-BH-1150,225-4.5-5-S	4.5-5	65C	041398/1445	S	AC	125 ml	4 C	G	SA	VOC	
040430 - 003	CY65C-BH-1200,325-0-0.5-SS	0-0.5	65C	041398/1615	S	AC	125 ml	4 C	G	MSMSD	VOC	
040431 - 003	CY65C-BH-1200,325-5-5.5-S	5-5.5	65C	041398/1625	S	AC	125 ml	4 C	G	~~MSMSD~~	VOC	
040434 - 001	CY65C-BH-1175,400-0-0.5-SS	0-0.5	65C	041398/1010	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040435 - 001	CY65C-BH-1175,400-5.5-6-S	5.5-6	65C	041398/1030	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040436 - 001	CY65C-BH-1175,400-11-11.5-S	11-11.5	65C	041398/1050	S	G	250 ml	4 C	G	SA	RCRA Metals+Be,HE,SVOC	
040507 - 003	CY65C-BH-1175,400-10-10.5-S	10-10.5	65C	041398/1050	S	G	250 ml	4 C	G	SA	VOC	
040434 - 003	CY65C-BH-1175,400~~-0-0.5-SS~~ -0.5-1-SS	~~0-0.5~~ 0.5-1	65C	041398/1010	S	AC	125 ml	4 C	G	SA	VOC	
040435 - 003	CY65C-BH-1175,400~~-5-5.5-S~~ -5.5-6-S	~~5-5.5~~ 5.5-6	65C	041398/1030	S	AC	125 ml	4 C	G	SA	VOC	
040508 - 003	CY65C-BH-1125,350-10-10.5-S	10-10.5	65C	041398/1055	S	AC	125 ml	4 C	G	SA	VOC	
040509 - 003	CY65C-BH-1125,350-13.5-14-S	~~15.5-16~~ 13.5-14	65C	041398/1120	S	AC	125 ml	4 C	G	SA	VOC	
040510 - 003	CY65C-BH-1150,225-9.5-10-S	9.5-10	65C	041398/1450	S	AC	125 ml	4 C	G	SA	VOC	
040511 - 003	CY65C-BH-1150,225~~-14.5-15-S~~ -14-14.5	~~14.5-15~~ 14-14.5	65C	041398/1545	S	AC	125 ml	4 C	G	SA	VOC	
-												
-												
-												
-												
-												
-												
-												

Abnormal Conditions on Receipt — LAB USE

Recipient Initials ______

Original To Accompany Samples, Laboratory Copy (White) — **1st Copy** To Accompany Samples, Return to SMO (Blue) — **2nd Copy** SMO Suspense Copy (Yellow) — **3rd Copy** Field Copy (Pink)

✓ checked against data 4/[illegible]

SAMPLE FINDINGS SUMMARY

Site: ERSite 65C

AR/COC: 600216 Data Classification:

Sample/ Fraction No.	Analysis	DV Qualifiers	Comments
CY65C-GR-01-EB	EPA8330	UJ	
↓	108-95-2	UJ	Phenol
↓	100-02-7	UJ	4-nitrophenol

Sample No./Fraction No. - This value is located on the Chain of Custody in the ER Sample Id field.

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: [signature] Date: 1/10/99

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

SITE OR PROJECT ER Site 65 C
ANALYTICAL LABORATORY CORE
LABORATORY REPORT # 981054
CASE NO. 7214.2209
COC 600216

SAMPLE IDS CY65C-GR-01-EB
NO. OF SAMPLES 1
HE, SVOC, VOC.

DATA ASSESSMENT SUMMARY

Describe problems/qualifications below (Action Items and Areas of Concern)

		VOC	SVOC	PEST/PCB	OTHER (HE)
1.	HOLDING TIMES/PRESERVATION	✓	✓		✓
2.	GC/MS INST. PERFORM.	✓	✓		N/A
3.	CALIBRATIONS/WINDOWS	✓	✓		✓
4.	BLANKS	✓	✓		✓
5.	SURROGATES	✓	✓		✓
6.	MATRIX SPIKE/DUP	NA	NA		NA
7.	LABORATORY CONTROL SAMPLES	✓	J		J
8.	INTERNAL STANDARDS	✓	✓		N/A
9.	COMPOUND IDENTIFICATION	✓	✓		✓
10.	SYSTEM PERFORMANCE	✓	✓		✓ (J)
11.	OVERALL ASSESSMENT	✓	✓		✓

✓ (check mark) — Acceptable: Data had no problems or qualified due to minor problems
N - Data qualified due to major problems
X - Problems, but do not affect data
Qualifiers: J - Estimate
UJ - Undetected, estimated

~~ACTION ITEMS:~~ VOC data appears acceptable. All HE data qualified as estimated. Two SVOC compounds qualified as estimated. See comments - pg 2.

AREAS OF CONCERN:

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

PROJECT/TASK LEADER: Haggerty

~~ACTION ITEMS:~~ VOC: No data qualified.

SVOC: Sample results for 4-nitrophenol and phenol have been qualified as estimated, UJ, due to low LCS/DCS recoveries.

HE: The analysis report indicates low levels of 2,6-dinitrotoluene, HMX, and RDX (J values). Review of the raw data suggests that these

~~AREAS OF CONCERN:~~ compounds should be reported as non-detect. The lab was contacted by email 10/29/98 to review and provide corrected data reports.

The LCS recoveries were slightly high, while the DCS recoveries were slightly low. All RPD precision results for the LCS/DCS were above criteria (>20%). Surrogate recovery was low in the method blank and DCS, and high in the LCS. These inconsistencies and variations indicate the analytical system is not necessarily in control. Therefore, all results are qualified as estimated, UJ, pending

~~OVERALL DATA QUALITY ASSESSMENT~~ lab response to correction requests.

Corrections for HE rec'd by SMO 1-7-99. All HE results were non-detect and are qualified estimated, UJ. HS 1-10-99

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

1.0 HOLDING TIMES AND PRESERVATION

Indicate the holding time criteria below that was used to evaluate the samples.

SW-846, 3rd. ed.
Other: ______

List below samples that were over holding time criteria.

Sample ID	VTSR	Date Analyzed	Action
NONE			

NOTE: VTSR = Validated time of sample receipt.

Were the correct preservatives used? Yes ☑ No ☐

List below samples that were incorrectly preserved.

Sample No.	Type of Sample	Deficiency	Action
NONE			

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

2.0 GC/MS TUNING CRITERIA

Has a GC/MS tuning performance been analyzed for every twelve hours of sample analysis for each GC/MS instrument used? Yes ☑ No ☐

Was the correct standard (listed in the EPA Method) used? Yes ☑ No ☐

Have the ion abundance criteria been met for each tune? Yes ☑ No ☐

NOTE: GC/MS abundance criteria is specified by EPA method for GC/MS analysis (EPA 8240A or 8270A).

If no for any of the above, list all the data associated with the tune that either failed criteria or in which there was no tune.

Date/Time	Problem	Sample Affected (Action)
	NONE	

Check for transcription/calculation errors. If errors are present, briefly summarize necessary changes:

N/A

Is the spectra of the mass calibration acceptable? Yes ☑ No ☐

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

3.0 GC INSTRUMENT PERFORMANCE.

3.1 DDT Retention Time

Is DDT retention time for packed columns >12 minutes (except for OV-1 and OV-101)?
Yes ☐ No ☐

If no, list below the DDT standards that failed criteria: ______________________

Affected samples and compounds: ______________________

N/A

3.2 Retention Time Windows

List below compounds that were not within the retention time windows.

Date/Time	Compound	RT	RT Window	Action	Affected Samples

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

3.3 DDT and Endrin Degradation

List below the standards that have a DDT or Endrin breakdown of >20% (or a combined breakdown of >20%).

Date/Time	Standard ID	DDT/Endrin	% Breakdown	Action	Affected Samples

N/A

3.4 DBC Retention Time Check

Is the %D between EVAL A and each analysis (quantitation and confirmation) DBC retention time within QC limits (2% for packed column, 0.3% capillary ID <0.32 mm, and 1% for megabore)?

Yes ☐ No ☐

Date	Sample ID	DBC %D	Action

For the above criteria outlined in Sections 8.1–8.4, check for transcription/calculation errors.

If errors are found, list below with necessary corrections: ______

______

______

______

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

4.0 INITIAL CALIBRATION

Has initial calibration been performed as required in the EPA method? Yes ☑ No ☐

Were the correct number of standards used to calibrate the instrument? Yes ☑ No ☐

For GC analyses of PCBs and Pesticides, did the laboratory follow the correct 72-hour sequence of analysis?
Yes ☐ No ☐ N/A

List below compounds which did not meet initial calibration criteria outlined by the EPA method.

Instrument ID	Date	Compound	RF/%RSD	Action	Samples Affected
		NONE			

Check for transcription/calculation errors. If errors are present, summarize necessary corrections below:

N/A

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

5.0 CONTINUING CALIBRATION

Have continuing calibration standards been analyzed at the frequency specified in the EPA method?
Yes ☑ No ☐

List below all compounds which did not meet continuing calibration requirements.

Instrument ID	Date	Compound	RF/%D	Action	Samples Affected
		NONE			

Check for transcription and calculation errors. If errors are found, briefly summarize necessary corrections below:

N/A

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

6.0 BLANK ANALYSES

6.1 Method/Reagent and Instrument Blanks

Has a method/reagent blank been analyzed for each set of samples or for every 20 samples of similar matrix, whichever is more frequent? Yes ☑ No ☐

Has an instrument blank been analyzed at least once every twelve hours for each GC/MS system used? Yes ☑ No ☐

6.2 Field/Rinse/Equipment Blanks

Samples are equipment blanks.

Are there field/rinse/equipment blanks associated with each sampling day or at frequency specified in the sampling plan. Yes ☐ No ☐ N/A

List below compounds for which analyses were requested that were detected in any of the blanks analyzed:

Date	Blank ID	Compound	Conc. ( )	PQL ( )	Action Level	Samples Affected (Action)
			NONE			

PQL = Practical Quantitation Limit from EPA Method.

Reviewed By: H Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

Are there any TICs present in the blanks that are also present in the samples? Yes ☐ No ☑
If yes, list below.

N/A

7.0 SURROGATE RECOVERY

Were surrogate recoveries evaluated for each of the samples analyzed by GC or GC/MS?
Yes ☑ No ☐

If surrogate standards other than those presented by SW-846 are used, list below with reference to applicable control limits used to evaluate the percent recoveries.

Surrogate Compound	Control Limits
3,4-DNT	70-130

List below the percent recoveries which did not meet either SW-846 criteria or criteria listed above.

Date	Sample ID/Matrix	Surrogate Compound	%Rec	Action
5-15-98	Method Blank	3,4-DNT	33%	UJ
↓	LCS	↓	150%	↓
↓	DCS	↓	73%	↓

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

If surrogate recovery was outside of control limits, were the samples or method blank reanalyzed?

Yes ☐ No ☑

Are method blank surrogate recoveries outside of limits upon reanalysis? Yes ☐ No ☐ N/A

Are transcription/calculation errors present? Yes ☐ No ☑

If yes, note necessary corrections. ~~N/A~~ N/A

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

8.0 MATRIX SPIKE/MATRIX SPIKE DUPLICATE (MS/MSD) ANALYSIS Not Requested

Were MS/MSDs analyzed at the frequency required by the EPA method or QAPjP for each matrix type?

Yes ☐ No ☐ N/A

List below % recoveries and RPDs of compounds which did not meet criteria. Indicate on chart criteria used to evaluate recoveries and RPDs.

Date	Sample ID/Matrix	Compound	%Rec RPD	Action
		N/A		

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

9.0 LABORATORY CONTROL SAMPLE ANALYSIS

Have laboratory control samples containing a representative number of the compounds of interest been analyzed at the frequency specified in the EPA method or QAPjP?

Yes ☑ No ☐

Evaluate percent recoveries based on control limits established in individual EPA methods, or use established laboratory control limits. List below recoveries of compounds which did not meet criteria with reference to control limits used.

Date	Compound	%Rec	Control Limits	Action	Samples Affected
~~5-1-98~~	~~2,4-DNP~~				
5-1-98	Phenol	34 / 35	53-131	UJ	CY65C-GR-01-EB
5-1-98	4-Nitrophenol	45 / 41	61-151	UJ	↓
5-15-98	HE	High / Low	70-130	UJ	↓

Control Limit Reference: ______

Evaluate RPD based on control limits established in individual EPA methods, or use established laboratory control limits. List below recoveries of compounds which did not meet criteria with reference to control limits used.

Date	Compound	% RPD ~~%Rec~~	Control Limits	Action	Samples Affected
5-15-98	HE	>20%	±20%	UJ	CY65C-GR-01-EB

Control Limit Reference: ______

HE - multiple compounds outside recovery criteria for LCS/DCS.
All RPDs outside criteria.

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

10.0 INTERNAL STANDARDS EVALUATION

List below the internal standard areas of samples or blanks which did not meet criteria.

Date	Sample ID	Internal Out	Acceptable Range	Action
		NONE		

Are retention times of the internal standards within 30 seconds of the associated calibration standard?
Yes ☑ No ☐

11.0 TARGET COMPOUND LIST ANALYTES
11.1 GC/MS Analyses

Are the reconstructed ion chromatograms, the mass spectra for the identified compounds, and the data system printouts included? Yes ☑ No ☐

Is chromatographic performance acceptable with respect to:

Baseline stability? Yes ☑ No ☐

Resolution? Yes ☑ No ☐

Peak shape? Yes ☑ No ☐

Full-scale graph (attenuation)? Yes ☑ No ☐

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

Other: ______________________________

Is the RRT of each reported compound within the limits given in the method of the standard RRT in the continuing calibration? Yes ☐ No ☐ N/A

Are all the ions present in the standard mass spectrum at a relative intensity greater than 10% also present in the mass spectrum? Yes ☐ No ☐ N/A

Do sample and standard relative intensities agree within 20%? Yes ☐ No ☐ N/A

If no for any of the above, indicate below problems and qualifications made to data:

N/A - no compounds detected

11.2 GC Analyses

Are there any transcription/calculation errors between the raw data and the reporting forms?
Yes ☑ No ☐

If yes, review errors and necessary corrections below; if errors are large, resubmittal of laboratory package may be necessary.

2,6-DNT, HMX, RDX reported on final reports. Indicated as not present in raw data. Lab requested to confirm and correct.

Are retention times of sample compounds within the calculated retention time windows for both quantitation and confirmation analysis? Yes ☐ No ☐ N/A

Was GC/MS confirmation performed when required by the EPA method? Yes ☐ No ☐ N/A

If no for any of the above, reject positive results except for retention time windows if associated standard compounds are similarly shifted.

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM

(Data Verification/Validation Level 3 DV-3)

Samples affected: N/A

Check chromatograms for false negatives, especially for the multiple peak components (toxaphene and PCBs). If false negatives are apparent and the appropriate PCB standards were not analyzed, or if confirmed analysis was not present, flag the affected data.

Samples affected: N/A

NOTE: Due to the complexities of PCB/pesticide analysis, each analytical run should be reviewed to verify identification and column performance.

12.0 FIELD DUPLICATE ANALYSIS N/A

Were field duplicates submitted for analysis? Yes ☐ No ☑

If yes, calculate RPD and use professional judgment to determine if the data needs to be qualified. List results below.

Date	Sample ID	Compound	Sample Result	Duplicate Result	RPD	Affected Samples
		N/A				

13.0 COMPOUND QUANTITATION/REPORTED DETECTION LIMITS

Are there any transcription/calculation errors from raw data to reported results (check at least 10% of positive results)? Yes ☐ No ☐ See 11.0

In addition, verify that the correct internal standard, quantitation ion, and RRF were used to calculate the result for a minimum of 10% of sample data.

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

13.1 Chromatogram Quality

Were baselines stable? Yes ☑ No ☐

Were any negative peaks or unusual peaks present? Yes ☐ No ☑

Were early eluting peaks resolved to baseline? Yes ☑ No ☐

If incorrect quantitations are evident, note corrections necessary below:

N/A

Are the required quantitation limits (detection limits) adjusted to reflect sample dilutions and for soils, sample moisture? Yes ☑ No ☐

If no, make necessary corrections and note below.

N/A

14.0 TENTATIVELY IDENTIFIED COMPOUNDS

Are Tentatively Identified Compounds (TIC) properly identified with scan number or retention time, estimated concentration, and J qualifier? Yes ☐ No ☐ N/A

Are the mass spectra for TICs and associated "best match" spectra included? Yes ☐ No ☐ N/A

Are any TCL compounds listed as TIC compounds? Yes ☐ No ☐ N/A

Are each of the ions present in the reference mass spectra with a relative intensity greater than 10% also present in the sample mass spectrum? Yes ☐ No ☐ N/A

Reviewed By: H. Seeley
Date: 10/30/98

ORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3 DV-3)

Do TIC and "best match" standard relative ion intensities agree within 20%? Yes ☐ No ☐ N/A

Comments

Reviewed By: H. Seeley

Date: 10/30/98

Approved By:*

Date

*Data package must be approved by Project/Task Leader.

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

SITE OR PROJECT ER Site 65 C

CASE NO. 7214.2209

ANALYTICAL LABORATORY CORE

SAMPLE IDS CY65C-GR-01-EB

LABORATORY REPORT # 981054

TASK LEADER Haggerty

NO. OF SAMPLES 1

COC 600216

DATA ASSESSMENT SUMMARY

		ICP	AA	MERCURY	CYANIDE
1.	HOLDING TIMES	✓	✓	✓	
2.	CALIBRATIONS	✓	✓	✓	
3.	BLANKS	✓	✓	✓	
4.	ICS	✓			
5.	LCS	✓	✓		
6.	DUPLICATE ANALYSIS	NA	✓	✓	
7.	MATRIX SPIKE	NA	NA	NA	
8.	MSA		NA		
9.	SERIAL DILUTION	UA			
10.	SAMPLE VERIFICATION	✓	✓	✓	
11.	OTHER QC	✓	✓	✓	
12.	OVERALL ASSESSMENT	✓	✓	✓	

✓ (check mark) — Acceptable

Other — Qualified:
J - Estimate
UJ - Undetected, estimated
R - Unusable (analyte may or may not be present)

ACTION ITEMS:

~~AREAS OF CONCERN:~~ Data appear acceptable. No qualifications applied.

REVIEWED BY: H. Seeley

DATE REVIEWED: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

ACTION ITEMS:

AREAS OF CONCERN:

OVERALL DATA QUALITY ASSESSMENT Data appear acceptable without qualification. Selenium was noted in low levels in method blanks, however sample result was non-detect.

Reviewed By: H. Seeley Date: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

1.0 HOLDING TIMES

List holding time criteria used to evaluate samples, indicating which samples exceed the holding time. Holding time begins with validated time of sample collection.

Parameter	Holding Time Criteria	Sample ID	Days Holding Time was Exceeded	Action
			NONE	

Were the correct preservatives used? Yes ☑ No ☐

List below samples that were incorrectly preserved.

Sample No.	Type of Samples	Deficiency	Action
	NONE		

Reviewed By: H. Seeley Date: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

2.0 INSTRUMENT CALIBRATION

2.1 Percent Recovery Criteria

Indicate %Recovery (%R) criteria used to evaluate calibration standards:

Metals: 90-110
Mercury: 80-120
Cyanide: ______
Other: ______

List below the analytes which did not meet %R criteria for initial and continuing calibration standards:

Analysis Date	ICV/CCV #	Analyte	%R	Action	Samples Affected
		NONE			

2.2 Analytical Sequence

Did the laboratory use the proper number of standards for calibration as described in the EPA method? Yes ☑ No ☐

Have initial calibrations been performed at the beginning of each analysis and at the frequency indicated by the EPA method? Yes ☑ No ☐

Have continuing calibration standards been analyzed at the beginning of sample analysis and at a minimum frequency indicated by the EPA method and at the end of the analysis sequence? Yes ☑ No ☐

If no for any of the above, outline deviations and actions taken below:

N/A

Reviewed By: H. Seeley Date: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

Were the correlation coefficients for the calibration curves for AA, Hg, CN, and other spectrophotometric methods ≥0.995? (Check calculations performed for calibration curves.) Yes ☑ No ☐

If no, list: N/A

Date	Analyte	Coefficient	Action	Samples Affected
		NONE		

Check for transcription and calculation errors involving calibration summary forms and raw data. Briefly summarize errors and associated actions when data quality might have been affected.

3.0 BLANK ANALYSIS

3.1 Initial and Continuing Calibration Blanks

Have Initial and Continuing Calibration Blanks (ICB/CCB) been analyzed at the frequency required in the EPA method? Yes ☑ No ☐

If no, summarize problems and resolutions in the narrative report.

List analytes detected in ICB and CCBs below:

NOTE: For soil samples, convert blank values to mg/kg using digestion weights and volumes.

Analysis Date	ICB/CCB No.	Analyte	Conc.	Required Detection Limits	Action Level	Samples Affected
		NONE				

Reviewed By: H. Seeley Date: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

3.2 Method Blank

Was one method blank analyzed for:

- Each of 20 samples? Yes ☑ No ☐
- Each digestion batch? Yes ☑ No ☐
- Each matrix type? Yes ☑ No ☐
- Both AA and ICP when both are used for the same analyte? Yes ☐ No ☐ N/A
  or
- At the frequency indicated in the EPA method or QAPjP? Yes ☑ No ☐

NOTE: Method blank is the same as the calibration blank for mercury and for wet chemistry analysis.

List analytes detected in method blank samples below. NOTE: For soil samples, be sure to calculate blank values using digestion weights and volumes.

~~Preparation~~ Date Analysis	Analyte	Conc.	Required Detection Limits	Action Level	Samples Affected
5-1-98	Se	0.00154	0.005 mg/L	—	None
5-7-98	Cr	0.0048	0.01	—	None

Is concentration in the method blank below the detection limit? Yes ☑ No ☐

Affected samples: Se results non-detect; Cr result > blank concentration - remains J. Other Cr blanks apply that were non-detect.

Reviewed By: H. Seeley Date: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

3.3 Field/Rinse/Equipment Blanks

Sample IS equipment blank

Was a field/equipment blank analyzed as required by the EPA method or QAPjP? Yes ☐ No ☐ N/A

List below analytes detected in the field blanks. NOTE: For soil samples, calculate blank values using digestion weights and volumes.

Collection Date	Blank ID	Analyte	Conc.	Required Detection Limits	Action Level	Samples Affected
4-14-97	GR-01-EB	Ba	0.002 J	0.01	—	—
		Cr	0.008 J	0.01	—	—

4.0 ICP INTERFERENCE CHECK SAMPLE ANALYSIS

Was an ICP interference check sample (ICS) analyzed at the beginning and end of a run or at least twice every 8 hours? (Not required for Ca, Mg, K, and Na) Yes ☑ No ☐

Samples affected: N/A

Are the values of the ICS for solution AB within 80-120%R? Yes ☑ No ☐

If no, is the concentration of Al, Ca, Fe, or Mg lower than in ICS? Yes ☐ No ☐ N/A

Reviewed By: H. Seeley Date: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

If no, list below all analytes which did not meet %R criteria and in which the concentration of Al, Ca, Fe, or Mg is higher than in the ICS:

Date	Analyte	%R	Action	Samples Affected
			NONE	

Are any results > IDL for those analytes which are not present in the ICS solution A? Yes ☐ No ☑

If yes, results >2 (absolute value of the IDL) indicate either a positive or negative interference and must be qualified.

Samples affected: N/A

Check for transcription/calculation errors. Briefly summarize errors and associated actions when data quality might have been affected.

5.0 LABORATORY CONTROL SAMPLES (LCS)

Was an LCS analyzed at required frequency? Yes ☑ No ☐

Samples affected:

NONE

Reviewed By: H. Seeley Date: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

List below any LCS recoveries not within limits.

Preparation Date	Analyte	%R	Action	Samples Affected
			NONE	

6.0 LABORATORY DUPLICATE ANALYSIS N/A

Were laboratory duplicates analyzed at required frequency? Yes ☐ No ☐

Samples affected: N/A

Was laboratory duplicate analysis performed on field or equipment blanks? Yes ☐ No ☐

Samples affected: N/A

Is any value for sample duplicate pair <PQL and the other value >10xPQL? Yes ☐ No ☐

Samples affected: N/A

Reviewed By: A. Seeley Date: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

List below concentrations of any analyte that did not meet criteria for duplicate precision:

N/A

Sample ID	Matrix	Preparation Date	Analyte	PQL	RPD	Action	Samples Affected
			N/A				

Check for transcription/calculation errors. Briefly summarize errors and associated actions when data quality might have been affected.

N/A

7.0 FIELD DUPLICATE SAMPLE ANALYSIS N/A

Were field duplicates collected at the frequency indicated in the EPA method or QAPjP?
Yes ☐ No ☐ N/A

If yes, qualify data associated only with the field duplicate pair. Calculate RPDs for each analyte in which both values are greater than the IDL.

Is any value for sample duplicate < practical quantitation limit (PQL) and other value >10xPQL? Yes ☐ No ☐
N/A

Reviewed By: H. Seeley Date: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

Samples affected: N/A

List below the analytes that do not meet RPD or PQL criteria. Use the same criteria as those used for laboratory duplicate analysis or criteria specified in EPA method or sampling plan.

Sample ID	Matrix	Collection Date	RPD	Control Limit	Action	Samples Affected
			N/A			

Check for transcription/calculation errors. Briefly summarize errors and associated actions when data quality might have been affects.

N/A

8.0 MATRIX SPIKE ANALYSIS Not requested

NOTE: *This matrix spike is a predigestion/predistallation spike.*

Was a matrix spike prepared and analyzed at the required frequency? Yes ☐ No ☐ N/A

Reviewed By: H. Seeley Date: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

Were matrix spikes performed at the concentrations specified by the EPA method? Yes ☐ No ☐

Samples affected: N/A

Was matrix spike analysis performed on field or equipment blanks? Yes ☐ No ☐ N/A

If equipment or field blanks are the only aqueous samples, matrix spike analysis may be performed; however, matrix spike samples must be present for the other matrices.

Samples affected:

N/A

List below the % recoveries for analytes that did not meet the criteria:

Sample ID	Matrix	Preparation Date	Analyte	%R	Action	Samples Affected
			N/A			

Check for transcription/calculation errors. Also check to ensure matrix spike concentrations are not affected by sample dilutions performed. If matrix spike concentrations are diluted below or close to IDL based on sample dilutions performed, use professional judgment in qualifying data. Ensure that the laboratory performed sample dilutions only when necessary as indicated by QA/QC requirements. Briefly summarize errors and associated actions when data quality might have been affected.

Reviewed By: H. Seeley Date: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

NOTE: If preparation blank spikes are analyzed, evaluate recoveries. These recoveries can indicate whether excursions in matrix spike recovery are caused by sample matrix effects or poor digestion efficiencies and/or problems with matrix spike solution. For example, if matrix spike recovery for selenium is 0% and preparation blank spike recovery for selenium is 92%, this may indicate sample matrix effects.

9.0 FURNACE ATOMIC ABSORPTION ANALYSIS

Were duplicate injections present for each sample, including required QC analyses (not required if MSA is done)? Yes ☑ No ☐

Samples affected: N/A

Were postdigestion spikes analyzed for samples, including QC samples? Yes ☐ No ☐ N/A

Were postdigestion spikes analyzed at the required concentration? Yes ☐ No ☐ N/A

Samples affected: N/A

Was a dilution analyzed for samples with postdigestion spike recovery <40%? Yes ☐ No ☐ N/A

Samples affected: N/A

MSA Analysis (Method of Standard Additions)—MSA is required when serial dilutions are not with ± 10%. Was MSA required for any sample but not performed? Yes ☐ No ☐ N/A

Are MSA calculations outside the linear range of the calibration curve? Yes ☐ No ☐ N/A

Reviewed By: H. Seeley Date: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

NOTE: Ensure the spiking concentrations used for MSA analysis were at 50–100% and 150% of sample concentration or absorbance.

Samples affected: N/A

10.0 SERIAL DILUTION ANALYSIS

NOTE: Serial dilution analysis (ICP) is required only for initial concentrations equal to or greater than 10xIDL.

If applicable, was a serial dilution performed for:

Each 20 samples? Yes ☐ No ☐
Each matrix type? Yes ☐ No ☐

N/A

Samples affected:

List below results which did not meet criteria of %D <10% for analyte concentrations greater than 50xIDL before dilution:

Analysis Date	Sample ID	Analyte	IDL	%D	Action	Samples Affected

Check for calculation errors and negative interferences.

Reviewed By: H. Seeley Date: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

11.0 SAMPLE RESULT VERIFICATION

11.1 Verification of Instrumental Parameters

Are instrument detection limits present and verified on a quarterly basis? Yes ☑ No ☐

Are IDLs present for each analyte and each instrument used? Yes ☑ No ☐

Is the IDL greater than the required detection limits for any analyte? Yes ☐ No ☑
(If IDL > required detection limits, flag values less than 5xIDL.)

Samples affected: N/A

Are ICP Interelement Correction Factors established and verified annually? Yes ☑ No ☐

Are ICP Linear Ranges established and verified quarterly? Yes ☑ No ☐

If no for any of the above, review problems and resolutions in narrative report.
N/A

11.2 Reporting Requirements

Were sample results reported down to the PQL? Yes ☑ No ☐

If no, indicate necessary corrections. N/A

Were sample results that were analyzed by ICP for Se, Tl, As, or Pb at least 5xIDL? Yes ☐ No ☐ N/A

Were sample weights, volumes, and dilutions taken into account when reporting sample results and detection limits? Yes ☑ No ☐

Reviewed By: H. Seeley Date: 10/30/98

INORGANIC DATA ASSESSMENT SUMMARY FORM
(Data Verification/Validation Level 3—DV3)

If no for any of the above, sample results may be inaccurate. Note necessary changes and if errors are present, request resubmittal of laboratory package.

N/A

Were any sample results higher than the linear range of calibration curve and not subsequently reanalyzed at the appropriate dilution? Yes ☐ No ☑

Samples affected: N/A

11.3 Sample Quantitation

Check a minimum of 10% of positive sample results for transcription/calculation errors. Summarize necessary corrections. If errors are large, request resubmittal of laboratory package.

Comments:

Approved By:* ____________________

Date: ____________________

*Task/Project Leader is responsible for approval of data set.

Reviewed By: H. Seeley Date: 10/30/98

Records Center Code: ER / 1333 / 65C / DAT

SMO ANALYTICAL DATA ROUTING FORM

Project Name: ER Site 65C

Case No./Service Order: 7214.2209/CF0507

SNL Task Leader: Haggerty

Org/Mail Stop: 6134 / 1148

SMO Project Coordinator: SALMI

Sample Ship Date: 4/16/98

ARCOC	Lab	Lab ID	Preliminary Received	Final Received	EDD Req'd YES	EDD Req'd NO	EDD Rec'd YES	EDD Rec'd NO
600216	CORE	981054		6/10/98	X		X	
600217	RPSD	800688		4/16/98		x		x

	Date		
Correction Requested from Lab:		Correction Request #:	
Corrections Received:		Requester:	
Review Complete:		Signature:	
Priority Data Faxed:		Faxed To:	
Preliminary Notification:	6/16/98	Person Notified:	Vetter
Final Transmittal:	7/6/98	Transmitted To:	Vetter
		Transmitted By:	Seeley
~~Filed in Records Center:~~ KS	~~7/6/98~~	Filed By:	~~K. Lambert~~ KS
Trans. to ER	7-9-98		Montaño

Comments:

Received (Records Center) By:

CVR-600216

Contract Verification Review (CVR)

Project Leader Grace Haggerty | Project Name ER Site 65C | Case No. 7214-220900

AR/COC No. 600216 | Analytical Lab Core - Denver | SDG No. 981054

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? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? 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	x				
1.7	Date samples received	x				
1.8	Condition upon receipt information provided	x				

2.0 Analytical Laboratory Report

Line No.	Item	Complete? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? 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, LCD)	x				
2.4	Matrix spike/matrix spike duplicate data provided(if requested)	x		Not requested		
2.5	Detection Limits provided; PQL and MDL(or IDL)	x				
2.6	QC batch numbers provided	x				
2.7	Dilution Factors provided	x				
2.8	Data reported using correct sig. fig. (2 for org.; 3 for inorg.)	x				
2.9	Rad analysis uncertainty provided (2 sigma error)		x	Not applicable		
2.10	Narrative provided	x				
2.11	TAT met	x				
2.12	Hold times met	x				
2.13	Were contractual qualifiers provided	x				
2.14	All requested result data provided	x				

3.0 Data Quality Evaluation

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1) 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). Units consistent between QC samples and sample data.	X		
3.2) Quantitation limit met for all samples?	X		
3.3) Accuracy a) Laboratory control sample accuracy reported and met for all samples?		X	SVOC: LCS and DCS recoveries were low for 4-nitrophenol (45%, 41%) and phenol (33.9%, 34.5%). Surrogate recoveries acceptable - sample results were non-detect. HE: LCS recoveries were slightly high for all compounds except 1,3-dinitrobenzene, nitrobenzene, and tetryl. Most compounds also showebd low recoveries in the DCS. The resulting RPDs were high. Re-analysis of the LCS and DCS showed similar results. Likely qualify the detects as estimated, J, and the non-detects as estimated, UJ.
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique?	X		HE is an HPLC technique. The surrogate 3,4-dinitrotoluene showed acceptable recovery in the sample, low recovery in the method blank, and high recovery in the LCS.
c) If requested, matrix spike recovery data reported and met .	X		MS/MSD not requested.
3.4) Precision a) Laboratory control sample precision reported and met for all samples? For rad analysis, sample duplicate precision reported and met.		X	HE: All RPD values were high.
b) If requested, matrix spike duplicate RPD data reported and met.	X		MS/MSD not requested.
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		These samples are equipment blanks. Detected compounds include low levels of barium, chromium, 2,4-dinitrotoluene, HMX, RDX.
3.6) Contractual qualifiers provided: "J"- estimated quantity; "B"-analyte found in method blank; "U"- analyte undetected (results are below the MDL or L_c (rad)); "H"-analysis done beyond the holding time.	X		

3.6)Narrative included, correct, and complete?	X		

4.0 Data Quality Evaluation Continuation

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

Sample/ Fraction No.	Analysis	Qualifiers	Comments

Were deficiencies noted. ☝ 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: Howard Seeley Date: 7/6/98 Closed by: ______________________________ Date: ____________

SF 2001-COC (10-97)
Supersedes (5-97) issue

Internal Lab Batch No. ______

ANALYSIS REQUEST AND CHAIN OF CUSTODY

SAR/WR No. ______

Press F1 for instructions for each field.

AR/COC- 600216

Dept. No./Mail Stop: 1148	Date Samples Shipped: 4/16/98 SMO USE	Contract No.: AJ-2480C
Project/Task Manager: Grace Haggerty	Carrier/Waybill No.: 706246	Case No.: 7214.220900
Project Name: ER Site 65C	Lab Contact: Tim Kellog/307-235-5741	SMO Authorization [signature]
Record Center Code: ER/1333/65C/DAT	Lab Destination: Core-Denver	Bill to: Sandia National Laboratories
Logbook Ref. No.: ER-0153	SMO Contact/Phone: Doug Salmi/848-0963	Supplier Services, Dept. ______
Service Order No.: CFO 507	Send Report to SMO: Grace Haggerty	P.O. Box 5800 MS 0154

Location — Tech Area NA — Building NA — Room NA

Reference LOV (available at SMO)

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft	ER Site No.	Date/Time Collected	Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID (LAB USE)
040236 - 005	CY65C-GR-01-EB	NA	65C	041498/1540	DIW	P	500 ml	HNO3 +4°C	G	EB	RCRA Metals+Be(6010/7000)	
040237 - 006	CY65C-GR-01-EB	NA	65C	041498/1540	DIW	AG	4x1 L	4 C	G	EB	HE (8330)	
040238 - 007	CY65C-GR-01-EB	NA	65C	041498/1540	DIW	AG	2x1 L	4 C	G	EB	SVOC	
040239 - 010	CY65C-GR-01-EB	NA	65C	041498/1545	DIW	G	3x40 ml	4 C+HCl	G	EB	VOC (8260A)	
040636 - 003	CY65C-GR-01-TB	NA	65C	041398/1000	DIW	G	40 ml	Hcl+4°c	G	TB	VOC	
-												
-												
-												
-												
-												

RMMA ☒Yes ☐No Ref. No. ______

Sample Disposal ☒Return to Client ☐Disposal by lab

Turnaround Time ☒Normal ☒Rush Required Report Date 15 DAY

Sample Tracking SMO USE
Date Entered(mm/dd/yy) 4/29
Entered by: [initials]
QC inits. [initials]

Special Instructions/QC Requirements
EDD ☒Yes ☐No
Raw data package ☒Yes ☐No
*COC #600217 releases#600216 off-site.
*RCRA Metals+Be(6010/7000),HE(8330) VOC(8260A)
Please list as separate report.

Abnormal Conditions on Receipt LAB USE

Sample Team Members	Name	Signature	Init	Company/Organization/Phone
	Angel B. Vega	Angel B. Vega	ABV	MDM/6131/844-0981
	Christopher Catechis	Chris Catechis	C.C.	MDM/6131/881-3196

	Org	Date	Time		Org.	Date
1. Relinquished by [signature]	6131	4/15/98	1455	4. Relinquished by		
1. Received by [signature]	5207578	4/15/98	1455	4. Received by		
2. Relinquished by [signature]	7578	4/16/98	1400	5. Relinquished by		
2. Received by				5. Received by		
3. Relinquished by				6. Relinquished by		
3. Received by				6. Received by		

Original To Accompany Samples, Laboratory Copy (White) — **1st Copy** To Accompany Samples, Return to SMO (Blue) — **2nd Copy** SMO Suspense Copy (Yellow) — **3rd Copy** Field Copy (Pink)

Site: Site 65C

AR/COC: 600218 Data Classification: Radiometrics

Sample Fraction No.	Analysis	DV Qualifiers	Comments
No	data	is	qualified
Data	is	acceptable	
QC measures appear	adequate		except
precision	can	be	determined.

Sample No./Fraction No. - This value is located on the Chain of Custody in the ER Sample Id field.

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: 6/12/98

List of Data Qualifiers used in Data Validation and Associated Comment Responses

Qualifier	Comment
A	Laboratory accuracy and/or bias measurements for the associated Laboratory Control Sample (LCS) 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 (MS) do not meet acceptance criteria.
B	Analyte present in laboratory method blank
B1	Analyte present in trip blank.
B2	Analyte present in equipment blank.
B3	Analyte present in continuing calibration blank.
J	The associated value is an estimated quantity. (Note: this qualifier may be used in conjunction with other qualifiers (i.e., A,J)
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.
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.
Q	Quantitation limit reported does not meet Data Quality Objective (DQO) requirements.
R	The data are unusable for their intended purpose (Note: Analyte may or may not be present.)
U	The analyte is a common laboratory contaminant. The associated result is less than ten times the concentration in any blank.
U1	The analyte was also detected in a blank. The associated result is less than five times the concentration in any blank.
UJ	The analyte was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

* This is not a definitive list. Other qualifiers are potentially available, see TOP 94-03. Notify Tina Sanchez to revise list. **Updated:March 10, 1998**

ANALYTICAL RADIOCHEMISTRY DATA VALIDATION CHECKLIST

KHC 6/12/98

Project Name Site 65C				~~Site Name~~ ~~ARCO~~ Case# 7214.220
Laboratory Name/Job No./Batch No. Core / 981061				Chain of Custody No. 600218
Analysis Method EPA 900.0				Parameter List: Gross Alpha/Beta
REVIEW ITEM	**YES**	**NO**	**NA**	**COMMENTS**
A. HOLDING TIMES				
1. Preparation and analysis holding times met?				See CVR Form
2. Short-half life parameters analyzed for and checked?				
B. CALIBRATION VERIFICATION				No data provided in package
1. Detectors numbered and documented?			✓	
2. Frequency: Daily ____, weekly ____, or monthly ____?			✓	
3. Acceptance criteria: Met?			✓	
C. LABORATORY CONTROL SAMPLES				LCS met acceptance criteria
1. Standard: Independent, certified reference material?	✓			
2. Frequency: Each batch?	✓			
3. % Recovery 80-120% or ____?	✓			
D. METHOD BLANK				Analytes met acceptance criteria
1. Frequency: Each batch?	✓			
2. Matrix: Matrix specific?	✓			
3. Preparation: Entire procedure?	✓			
4. Blanks show contamination?		✓		
E. MATRIX SPIKE				No MS/MSD was ~~submitted~~ run on ARCOC group. KHC 6/11/98
1. Frequency: Each batch?			✓	
2. Matrix: Matrix specific?			✓	
3. Preparation: Entire procedure?			✓	
4. % Recovery: 75-125% or ____?			✓	
F. ANALYTICAL YIELDS/OTHER				No data provided in package
1. Tracer: Correct type, recovery met?			✓	
2. Ingrowth and/or decay: Correct factors applied?			✓	
3. Solids density: Planchette loading <5 mg/cm^2?			✓	
G. DUPLICATE				No duplicate was run on ARCOC group
1. Type: Lab or field?			✓	
2. Frequency: Each batch?			✓	
3. Matrix: Matrix specific?			✓	

ANALYTICAL RADIOCHEMISTRY DATA VALIDATION CHECKLIST (CONTINUED)

Project Name					Site Name
Laboratory Name/Job No./Batch No.					Chain of Custody No.
Analysis Method				Parameter List:	
REVIEW ITEM	YES	NO	NA	COMMENTS	
4. Preparation: Entire procedure?			✓		
H. ANALYTE DETECTION					
1. Detection limit sample/batch specific?	✓				
2. Errors evaluated?			✓		
3. False positives/negatives suspected?		✓			

Reviewed by: Kevin A Lambert 6/12/98

(1.) All samples were prepared and analyzed with specified method and accepted procedures.

(2.) All analytes were successfully analyzed. No significant problems were noted. A few minor problems are discussed below

(3) Gross Alpha: The LCS and MB met acceptance criteria. No MS/MSD, Duplicate, EB, or Field blank were ~~[illegible]~~ KAL 6/12 reported. Laboratory and field precision measurements are not available, therefore RPDs can not be assessed. Field contamination can not be assessed since EB + FB were not submitted on ARCOC.

(4) Gross Beta: The LCS and MB met acceptance criteria. No MS/MSD, duplicate (lab or field), Equipment rinsel blank or field blank were reported. Laboratory and field precision can be determined/assessed since no duplicate sample was analyzed. Field contamination can not be assessed since EB and FB were not submitted on ARCOC.

(5) Data is acceptable

(6) QC measures appear to be adequate except precision can not be assessed.

SAMPLE FINDINGS SUMMARY

Site: Canyons - Site 65C

AR/COC: 601634 Data Classification: Organics

Sample Fraction No.	Analysis	DV Qualifiers	Comments
	No Data Qualified		
	Data is acceptable QC measures appear adequate.		
HE CY65C-BH-100-325-EB ~~CY65C-BH~~	EPA 8330 (HE)	UJ, J2	
	Data is acceptable QC measures appear adequate.		

JCC.

Sample No./Fraction No. - This value is located on the Chain of Custody in the ER Sample Id field.

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: [signature] Date: 5-12-99

Site: Canyon-Site 65C

AR/COC: 601634

Data Classification: Inorganic/RAD

Inorganics

Sample Fraction No.	Analysis	DV Qualifiers	Comments
CY65C-BH-1000-325-1-1.5-SS -3.5-4-S -7-7.5-S -13.5-14.5-S	7440-22-4 (silver)	J, B	
CY65C-BH-1000-325-1-1.5-SS -3.5-4-S ~~-7-7.5-S~~ -13.5-14.5-S	7439-97-6 (mercury)	J, B	
	Data is acceptable.		
	QC measures appear adequate.		
RAD CY65C-BH-1000-325-3.5-4-S.	EPA 900.0 (Gross Alpha)	J, B2	
	Data is acceptable		
	QC measures appear adequate.		

Sample No./Fraction No. - This value is located on the Chain of Custody in the ER Sample Id field.

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: [signature] Date: 5-12-99

MEMORANDUM

DATE: May 12, 1999

TO: File

FROM: Matthew Kase m.k

SUBJECT: Organics Data Review and Validation
Site Canyons – site 65C, ARCOC No. 601634, Case No. 7214.2209

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 (SVOC – EPA8270 & HE - EPA8330). All compounds were successfully analyzed. A problem was identified with the data package that resulted in the qualification of data.

1. HE analysis: Sample (9902778 - 06) was extracted after the holding time had expired. Positive sample results will be qualified "J" and non-detects will be qualified "UJ."

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

Holding Times

SVOC analysis: The samples were extracted and analyzed within the prescribed holding times.

HE analysis: The samples were extracted and analyzed within the prescribed holding times except sample 9902778 – 06 was extracted outside the holding time and results will be qualified as noted above in the summary section.

Calibration

SVOC analysis: Initial calibration met QC acceptance criteria. Continuing calibration verification (CCV) met QC acceptance criteria except the relative percent difference (RPD) for bis (2-chloroethyl)ether (20.6%), bis(chloroisopropyl)ether (26.0%) and Dibenz(a,h)anthracene (23.1%) were slightly outside the QC acceptance criteria (20%) but less than 40%. Sample results are non-detect and no data was qualified.

HE analysis: Initial and continuing calibration met QC acceptance criteria.

Blanks

SVOC & HE analysis: No target analytes were detected in the method blanks.

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

SVOC & HE analysis: MS/MSD met QC acceptance criteria.

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

SVOC analysis: LCS/LCSD met QC acceptance criteria.

HE analysis: LCS/LCSD met QC acceptance criteria except the percent recovery (%REC) for tetryl (LCS – 3.23%, LCSD – 1.53%) were outside the QC acceptance criteria. Sample results are non-detect and all other QC meets acceptance criteria; no data was qualified.

Surrogates

SVOC & HE analysis: The surrogate recovery met QC acceptance criteria.

Internal Standards

SVOC analysis: Internal standards met QC acceptance criteria.

HE analysis: Not applicable

Other QC

SVOC analysis: No target analytes were detected in the equipment blank (EB). No trip blank (TB), field blank (FB) or field duplicate pair was submitted on ARCOC.

HE analysis: No target analytes were detected in the equipment blank (EB) except sample 9902778 – 06 was extracted outside the holding time and will be qualified as noted above. No trip blank (TB), field blank (FB) or field duplicate pair was submitted on ARCOC.

No other specific problems were identified which affect data quality.

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

MEMORANDUM

DATE: May 12, 1999

TO: File

FROM: Matthew Kase M.K.

SUBJECT: Inorganic Metals Data Review and Validation
Site Canyons – site 65C, ARCOC No. 601634, Case No. 7214.2209

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 (EPA6010B and EPA7471). All compounds were successfully analyzed. A problem was identified with the data package that resulted in the qualification of data.

1. In the method blank, silver and mercury were observed at an estimated value ("J" coded). All sample results less than five times the blank concentration will be qualified "J" and non-detects will not be qualified.

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

Holding Times

All samples were analyzed within the prescribed holding times.

Calibration

Initial and continuing calibration data met QC acceptance criteria.

Blanks

No target analytes were detected in the method blank except for silver (Ag) and mercury (Hg). Sample results were qualified as noted above in the summary section.

No target analytes were detected in the initial calibration blank and the continuing calibration blank.

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

No MS/MSD was run on the ARCOC group. The MS/MSD acceptability was addressed from another ARCOC group in the batch and met QC acceptance criteria.

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

LCS/LCSD results met QC acceptance criteria.

ICP Serial Dilution

ICP serial dilution was not applicable to the ARCOC.

ICP Interference Check Sample

Interference check sample met QC acceptance criteria.

Other QC

No target analytes were detected in the equipment blank (EB) except barium. Sample results are greater than five times the blank value and no data was qualified.

No trip blank (TB), field blank (FB) or field duplicate pair were submitted on ARCOC.

No other specific problems were identified which affect data quality.

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

MEMORANDUM

DATE: May 12, 1999

TO: File

FROM: Matthew Kase mk

SUBJECT: Radiometric Data Review and Validation
Site Canyons – 65C, ARCOC No. 601634, Case No. 7214.2209

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 (Gross alpha/beta EPA 900.0). All compounds were successfully analyzed. A problem was identified with the data package that resulted in the qualification of data.

1. In the equipment blank, the gross alpha net blank result is greater than zero. Sample results less than five times the blank value will be qualified "J."

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 for all methods.

Blanks

No target analytes were present in the method blank.

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

LCS/LCSD met QC acceptance criteria.

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

MS/MSD met QC acceptance criteria.

Other QC

No target analytes were detected in the equipment blank (EB) except the net gross alpha value was above zero and sample results will be qualified as noted above in the summary section.

No trip blank (TB), field blank (FB) or field duplicate pair was submitted on ARCOC.

No other specific problems 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 Site CSC CASE #: 7214.2209
ARCOC #: 606634
LABORATORY: GEL
LABORATORY REPORT #: 9902778

OF SAMPLES: 8 MATRIX: 4-soil, 4 water
LAB SAMPLE IDs: 9902778-01 → 08

ANALYSIS/ QC ELEMENT	VOC	SVOC	PEST/ PCB	HPLC (HE)	ICP/AES	GFAA/ AA	CVAA (Hg)	CN	RAD	OTHER
1. HOLDING TIMES/ PRESERVATION		✓		UJ	✓		✓		✓	
2. CALIBRATIONS		✓		✓	✓		✓		✓	
3. METHOD BLANKS		✓		✓	J		J		✓	
4. MS/MSD		✓		✓	NA		NA		✓	
5. LABORATORY CONTROL SAMPLES		✓		✓	✓		✓		✓	
6. REPLICATES					✓		✓		✓	
7. SURROGATES		✓		✓						
8. INTERNAL STDS		✓								
9. TCL COMPOUND IDENTIFICATION		✓								
10. ICP INTERFERENCE CHECK SAMPLE					✓					
11. ICP SERIAL DILUTION					✓					
12. CARRIER/CHEM TRACER RECOVERIES									NA	
13. OTHER QC		✓		✓	✓		✓		J	

CHECK MARK (√) – ACCEPTABLE
J – ESTIMATED
U – NOT DETECTED

SHADED CELLS – NOT APPLICABLE
UJ – NOT DETECTED, ESTIMATED
R – UNUSABLE

REVIEWED BY [signature] DATE: 5-12-99

SEMI-VOLATILE ORGANICS: Page 1 of 3

SW-846 - Method 8270

SITE/PROJECT: Canyons - Site 65C ARCOC #: 601634

LABORATORY: GEL LABORATORY REPORT #: 9902778

IS	BNA	CAS #	NAME	Min RF	Intercept	Calib RF	Calib RSD / R²	CCV %D	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Eq. Blks	Field Blks	TAL		
						>.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		✓	✓	20.6	✓	NA	NA	NA	NA	NA	NA		✓		✓		
1	A	95-57-8	2-Chlorophenol	0.80		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		
1	BN	541-73-1	1,3-Dichlorobenzene	0.60		✓	✓	✓	✓	NA	NA	NA	NA	NA	NA		✓		✓		
1	BN	106-46-7	1,4-Dichlorobenzene	0.50		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		
1	BN	95-50-1	1,2-Dichlorobenzene	0.40		✓	✓	✓	✓	NA	NA	NA	NA	NA	NA		✓		✓		
1	A	95-48-7	2-Methylphenol	0.70		✓	✓	✓	✓								✓		✓		
1	BN	108-60-1	bis(2-chloroisopropyl)ether	0.01		✓	✓	26.0 / 20.6	✓								✓		✓		
1	A	106-44-5	4-Methylphenol	0.60		✓	✓	✓	✓	↓	↓	↓	↓	↓	↓		✓		✓		
1	BN	621-64-7	N-Nitroso-di-n-propylamine	0.50		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		
1	BN	67-72-1	Hexachloroethane	0.30		✓	✓	✓	✓	NA	NA	NA	NA	NA	NA		✓		✓		
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		✓	✓	✓	✓	NA	NA	NA	NA	NA	NA		✓		✓		
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		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		
2	BN	91-57-6	2-Methylnaphthalene	0.40		✓	✓	✓	✓	NA	NA	NA	NA	NA	NA		✓		✓		
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	↓	✓	✓	✓	✓	↓	↓	↓	↓	↓	↓	↓	✓	↓	✓		

Comments: NA - Not applicable

REVIEWED BY: [signature] DATE: 5-10-99

SEMI-VOLATILE ORGANICS: Page 2 of 3
SW 846 - Method 8270

SITE/PROJECT: Canyons Site 65C ARCOC #: 601634
LABORATORY: GEL LABORATORY REPORT #: 9903778

IS	BNA	CAS #	NAME	Min RF	Intercept	Calib RF	Calib RSD / R²	CCV RPD	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Eq. Blks	Field Blks			
						>.05	<20% / 0.99	<20%									✓	NA			
3	BN	91-58-7	2-Chloronaphthalene	0.80	NA	✓	✓	✓	✓	NA	NA	NA	NA	NA	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		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				
3	A	51-28-5	2,4-Dinitrophenol	0.01		✓	✓	✓	✓	NA	NA	NA	NA	NA	NA		✓				
3	A	100-02-7	4-Nitrophenol	0.01		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				
3	BN	132-64-9	Dibenzofuran	0.80		✓	✓	✓	✓	NA	NA	NA	NA	NA	NA		✓				
3	**BN**	**121-14-2**	**2,4-Dinitrotoluene**	**0.20**		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				
3	BN	84-66-2	Diethylphthalate	0.01		✓	✓	✓	✓	NA	NA	NA	NA	NA	NA		✓				
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**		✓	✓	✓	✓	↓	↓	↓	↓	↓	↓		✓				
4	**A**	**87-86-5**	**Pentachlorophenol**	**0.05**		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				
4	BN	85-01-8	Phenanthrene	0.70		✓	✓	✓	✓	NA	NA	NA	NA	NA	NA		✓				
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		✓	✓	✓	✓	NA	NA	NA	NA	NA	NA		✓				
5	BN	91-94-1	3,3'-Dichlorobenzidine	0.01		✓	✓	✓	✓								✓				
5	BN	56-55-3	Benzo(a)anthracene	0.80	↓	✓	✓	✓	✓	↓	↓	↓	↓	↓	↓	↓	✓	↓			

Comments:

SEMI-VOLATILE ORGANICS: page 3
SW 846 - Method 8270

SITE PROJECT: Canyons Site CSC ARCOC #: 601634
LABORATORY: GEL LABORATORY REPORT #: 9903778

IS	BNA	CAS #	NAME	Min RF	Intercept	Calib RF	Calib RSD / R^2	CCV RPD	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Eq. Blks	Field Blks			
						>.05	<20% / 0.99	<20%									✓				
5	BN	218-01-9	Chrysene	0.70	NA	✓	✓	✓	✓	NA	NA	NA	NA	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		✓	✓	✓	✓								✓				
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		✓	✓	23.1	✓								✓				
6	BN	191-24-2	Benzo(g,h,i)perylene	0.50		✓	✓	✓	✓	NA	NA						✓				

NA - Not Applicable

Surrogate Recovery Outliers

Sample	SMC 1	SMC 2	SMC 3	SMC 4	SMC 5	SMC 6	SMC 7	SMC 8
	All surrogates met QC acceptance criteria							

Comments:

SMC 1: Nitrobenzene-d5 (BN) SMC 2: 2-Fluorobiphenyl (BN) SMC 3: p-Terphenyl-d14 (BN)
SMC 4: Phenol-d5 (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 internal standards met QC acceptance criteria.											

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)

REVIEWED BY [signature] DATE: 5-12-99

Soil samples

HIGH EXPLOSIVES:
SW846 Method 8330

SITE/PROJECT: Canyons Site 65C ARCOC #: 601634
LABORATORY: GEL LABORATORY REPORT #: 9902778

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

NA - Not Applicable

Sample	SMC %REC	SMC RT		Sample	SMC %REC	SMC RT
	Met QC	acceptance		criteria.		

Comments: ① - Equipment blank was re-extracted outside holding time. Results are ND. Qualify 9902778-06 "US"

Confirmation

Sample	CAS #	RPD > 25%		Sample	CAS #	RPD > 25%

mg/kg = ug/g : [(ug/g) x (sample mass (g) / sample vol. (ml)) x (1000ml / 1liter)] / Dilution Factor = ug / l

REVIEWED BY: [signature] DATE: 5-12-99

INORGANIC METALS:

SITE/PROJECT: Canyons Site 65 ARCOC #: 601634
LABORATORY: GEL LABORATORY REPORT #: 9902778
METHODS: ______

QC Element/ Analyte	ICV	CCV	ICB	CCB	① Method Blks	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	REP RPD	ICS AB	Serial Dilution	Field Dup RPD	Eq. Blks	Field Blks			
7429-90-5 Al	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	~~NA~~	NA	NA	NA	NA	NA			
7440-39-3 Ba	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓			0.00269J				
7440-41-7 Be	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓			✓				
7440-43-9 Cd	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓			✓				
7440-70-2 Ca	NA	NA	NA	NA	NA	NA	NA	NA				NA								
7440-47-3 Cr	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓			✓				
7440-48-4 Co	NA	NA	NA	NA	NA	NA	NA	NA				NA								
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	✓	✓	✓	✓	0.258J	~~[illegible]~~ ✓		✓				✓	✓			✓				
7440-23-5 Na	NA	NA	NA	NA	NA	NA	NA	NA				NA								
7440-62-2 V																				
7440-66-6 Zn																				
	↓	↓	↓	↓	↓	↓	↓	↓				↓								
7439-92-1 Pb	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓			✓				
7782-49-2 Se	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓			✓				
7440-38-2 As	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓			✓				
7440-36-0 Sb	NA	NA	NA	NA	NA	NA	NA	NA				NA								
7440-28-0 Tl	↓	↓	↓	↓	↓	↓	↓	↓				↓								
									↓	↓	↓									
7439-97-6 Hg	✓	✓	✓	✓	0.00469J	✓	✓	✓	NA	NA	NA	✓	✓	✓	↓	✓	✓			
Cyanide CN																				

Comments: ① Silver, Mercury were observed at an estimated (J coded) value in the MB. Barium observed at an estimated value (J coded). } All results <5x the blank value J coded, ND not quali[fied]

RE[VIEW]ED BY [signature] DATE 5-12-99

RADIOCHEMISTRY:

SITE/PROJECT: Canyon Site 65 ARCOC #: 601634
LABORATORY: GEL LABORATORY REPORT #: 9902778
METHODS:

QC Element/ Analyte	Method Blks	LCS	MS	Rep RER	① Eq. Blks	Field Dup RER	Field Blks	-	Sample ID	Isotope	IS/Trace	Sample	Isotope	IS/Trace			
CRITERIA	U	20%	25%	<1.0	U	<1.0	U	-			50-105			50-105			
H3	NA	NA	NA	NA	NA	NA	NA	-									
U-238																	
U-234																	
U-235/236								-									
Th-232																	
Th-228																	
Th-230								-									
Pu-239/240																	
Gross Alpha	✓	✓	✓	✓	1.82			-									
Nonvolatile Beta	✓	✓	✓	✓	✓												
Ra226	NA	NA	NA	NA	NA			-									
Ra228								-									
Gamma Spec								-									
Ni-63								-									
								-									
								-									

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

Comments: ① - Equipment blank results for Gross Alpha (1.82). Sample results <5x the blank value will be qualified "J." 9902778-02 will be J coded.

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

REVIEWED BY [signature] DATE: 5-12-99

Records Center Code: ER / 1333 / DAT

SMO ANALYTICAL DATA ROUTING FORM

Project Name: Canyons – Site 65C **Case No./Service Order:** 7214.2209 / CF066.

SNL Task Leader: FRESHOUR **Org/Mail Stop:** 6134 / 1147

SMO Project Coordinator: SALMI **Sample Ship Date:** 2/18/99

ARCOC	Lab	Lab ID	Preliminary Received	Final Received	EDD Req'd YES	EDD Req'd NO	EDD Rec'd YES	EDD Rec'd NO
601634	GEL	9902778		3/8/99	X		x	

	Date		
Correction Requested from Lab:	4-13-99	Correction Request #:	2107
Corrections Received:	4-21-99	Requester:	Palencia
Review Complete:	4-13-99	Signature:	W. Palencia
Priority Data Faxed:		Faxed To:	
Preliminary Notification:		Person Notified:	
Final Transmittal:	3-19-99	Transmitted To:	Freshour
		Transmitted By:	Palencia
Filed in Records Center/ER:	4-22-99	Filed By:	A. Jensen

Comments: *~~Original and data~~ on other ~~spacesaver.~~* OK

Received (Records Center) By: ______

```
****************************
***   ACTIVITY REPORT    ***
****************************
```

TRANSMISSION OK

TX/RX NO.	4816
CONNECTION TEL	718437661178
CONNECTION ID	GEL
START TIME	04/13 13:26
USAGE TIME	02'54
PAGES	1
RESULT	OK

Date: 4-13-99

No. of Pages: 1
(Including Cover)

Fax to:	Edie Kent	*From:*	Wendy J. Palencia
Org/Company:	GEL	*Org:*	7578
Phone:	(843) 556-8171	*Phone:*	(505) 844-3132
Fax:	(843) 766-1178	*Fax:*	(505) 844-3128

Correction Request

COC: 601634 SDG: 9902778 Tracking No: 2107

NOTE: Edie,
The SVOC narrative fails to address the recovery problems for the LCS/LCD & MS/MSD & RPD problems for 9902778-01MS/MSD.
Please send a corrected narrative.
(this data package is on the current invoice)
Thanks,
Wendy

Contract Verification Review (CVR)

Project Leader FRESHOUR | Project Name CANYONS – SITE 65C | Case No. 7214.2209

AR/COC No. 601634 | Analytical Lab GEL | SDG No. 9902778

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? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? 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? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? 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	HPLC EQUIPMENT BLANK RE-EXTRACTED OUTSIDE HOLDING TIME DUE TO QC PROBLEMS		
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	MANY SVOC LCS/LCD ANALYTES OUTSIDE RECOVERY LIMITS TETRYL OUTSIDE RECOVERY LIMITS IN EXPLOSIVES LCS/LCD
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique		X	SURROGATE FAILED RECOVERY FOR SAMPLE #9902778-06
c) Matrix spike recovery data reported and met		X	MANY SVOC MS/MSD ANALYTES OUTSIDE RECOVERY LIMITS
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	SEVERAL SVOC RPDs FAILED QC CRITERIA
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	X		
3.8 Narrative included, correct, and complete		X	SVOC NARRATIVE FAILS TO ADDRESS RPD & LCS/LCS & MS/MSD RECOVERY PROBLEMS
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	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
ALL	8270	NARRATIVE FAILS TO ADDRESS LCS/LCD & MS/MSD RECOVERY PROBLEMS

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 2107 and date correction request was submitted: 4-13-99

Reviewed by: W. Palencia Date: 4-13-99 Closed by: W. Palencia Date: 4-22-99

Internal Lab

ANALYSIS REQUEST AND CHAIN OF CUSTODY

AR/COC 601634

Batch No SAR/WR No SMO Use

Dept No/Mail Stop	~~6134-1148~~ 1197	Date Samples Shipped	2/18/99	Contract No	AJ-2480A
Project/Task Manager	Canyons/P Freshour	Carrier/Waybill No	717368	Case No	7214 2209
Project Name	Canyons - Site 65C	Lab Contact	Edie Kent	SMO Authorization	
Record Center Code	ER/13333/DAT	Lab Destination	GEL	Bill To Sandia National Laboratories	
Logbook Ref No	ER 012	SMO Contact/Phone	D Salmi ~~848-0565~~ 844-3110	Supplier Services Dept	
Service Order No	CF0662	Send Report to SMO	S Jenson ~~848-0565~~ 844-3184	P O Box 5800 MS 0154	
Location	Tech Area N/A				
Building N/A	Room N/A				

Reference LOV(available at SMO)

Lab Use

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	Preservative	Collection Method	Sample Type	Parameter & Methods Requested	Lab Sample ID
044713-001	CY65C-BH-1000-325-1-1.5-SS	1-1.5	65C	2/17/1999 0934	Soil	AG	500Ml	4C	GR	SA	SVOC Metals* Be HE Gross A/B	[redacted]
044714-001	CY65C-BH-1000-325-3.5-4-S	3.5-4	65C	2/17/1999 0940	Soil	AG	500Ml	4C	GR	SA	SVOC Metals* Be HE Gross A/B	[redacted]
044715-001	CY65C-BH-1000-325-7-7.5-S	7-7.5	65C	2/17/1999 0950	Soil	AG	500Ml	4C	GR	SA	SVOC Metals* Be HE Gross A/B	[redacted]
044716-001	CY65C-BH-1000-325-13.5-14.5-S	13.5-14.5	65C	2/17/1999 1017	Soil	AG	500Ml	4C	GR	SA	SVOC Metals* Be HE Gross A/B	[redacted]
044718-004	CY65C-BH-1000-325-EB	0.0	65C	2/17/1999 1026	Water	P	500ML	4C HNO3	GR	EB	Metals* Be	[redacted]
044719-004	CY65C-BH-1000-325-EB	0.0	65C	2/17/1999 1026	Water	AG	4X1L	4C	GR	EB	HE	[redacted]
044720-004	CY65C-BH-1000-325-EB	0.0	65C	2/17/1999 1026	Water	AG	2X1L	4C	GR	EB	SVOC	[redacted]
044721-004	CY65C-BH-1000-325-EB	0.0	65C	2/17/1999 1026	Water	P	1L	4C HNO3	GR	EB	Gross A/B	[redacted]
												[redacted]
												[redacted]

RMMA ☒ Yes ☐ No Ref No

Sample Disposal ☐ Return to Client ☒ Disposal by lab

Turnaround Time ☒ Normal ☐ Rush

Required Report Date

Sample Tracking / SMO Use: [redacted]

Special Instructions/QC Requirements

EDD ☒ Yes ☐ No

Raw Data Package ☒ Yes ☐ No

Cleared by History data enclosed

* RCRA METALS

Please list as separate report.

Abnormal Conditions on Receipt: [redacted]

Sample Team Members	Name	Signature	Init	Company/Organization/Phone
	Gill Baltazar		GB	Weston/6131/971-2769
	Chris Sears	Chris Sears	CS	Weston/6131/239-7637

1 Relinquished by	Org 6131	Date 2-18-99	Time 0907	4 Relinquished by	Org	Date	Time
1 Received by (SMO)	Org 7578	Date 2-18-99	Time 0907	4 Received by	Org	Date	Time
2 Relinquished by (SMO)	Org 7578	Date 2-18-99	Time 1130	5 Relinquished by	Org	Date	Time
2 Received by	Org	Date	Time	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

Annex 6-F

ANNEX 6-F
Risk Screening Assessment

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (Concluded)

SWMU 65C: RISK SCREENING ASSESSMENT REPORT

I. Site Description and History

SWMU 65C, a subunit of SWMU 65, identified as the Lurance Canyon Explosives Test Site (LCETS), is located on U.S. Air Force land withdrawn from Bureau of Land Management and permitted to the U.S. Department of Energy (DOE) (SNL/NM July 1994a). This site is situated on the canyon floor alluvium in the upper reaches of the Lurance Canyon drainage. The Lurance Canyon drainage is surrounded by moderately steep sloping canyon walls, and the immediate topographic relief around the site is over 500 feet. A 25- to 50-foot-wide road is cut on the hill slopes as a firebreak and encircles the site. The canyon floor at the site is isolated by the canyon walls except for the westward drainage into the Arroyo del Coyote. Coyote Springs Road follows this drainage and is the main access into the Lurance Canyon.

SWMU 65 was used from the late-1960s to the early 1990s for general explosives testing. The location of SWMU 65 is coincident with SWMU 94 (Lurance Canyon Burn Site [LCBS]), which is actively used for testing fire survivability of transportation equipment, storage equipment, simulated weapons, and satellite components. SWMU 94 activities began in the mid-1970s and continue to the present.

Based upon the location of detonations and the types of tests conducted at SWMU 65, the site has been divided into five subunits: SWMU 65A (Small Debris Mound), SWMU 65B (Primary Detonation Area), SWMU 65C (Secondary Detonation Area), SWMU 65D (Near-Field Dispersion Area), and SWMU 65E (Far-Field Dispersion Area). The SWMU 65 subunits are each addressed in separate risk screening assessments.

SWMU 65C lies on approximately 1.3 acres of land at a mean elevation of 6,355 feet above sea level (SNL/NM April 1995) and is located north of the Oil Surface Impoundment (SWMU 13). The boundaries of the subunit were defined from historical aerial photographs and test reports (Littrell February 1969, Walkington April 1973, SNL/NM August 1994). SWMU 65C was the burn pit area for the Cloudmaker tests (Littrell February 1969), other ammonium nitrate burn tests involving fuel-rod containers (SNL/NM June 1993), liquid fuel fire and solid rocket propellant burn tests on Pioneer capsules (Foy April 1971, Clark December 1970), plutonium shipping container tests (Stravasnik 1972), and the TC-708 emergency denial device tests (Walkington April 1973). The ground surface at this site has been significantly changed by grading of the soil/sediment since testing activities ceased in the early 1970s, so there is currently no evidence of the pits associated with past testing.

Historical published information regarding the hydrogeology of the Lurance Canyon has been summarized in the "RCRA [Resource Conservation Recovery Act] Facility Investigation (RFI) Work Plan for the Operable Unit [OU] 1333, Canyons Test Area" (SNL/NM September 1995). Since that time, additional bedrock wells and alluvial piezometers have been installed in the Lurance Canyon, and data collected from the new bedrock wells have supported the hydrologic model of semiconfined to confined groundwater conditions at a depth of approximately 222 feet below ground surface (bgs) beneath the Lurance Canyon SWMUs. The data collected from the alluvial piezometers support the absence of alluvial groundwater. Hydrologic data have been based upon the Burn Site Well, CYN-MW1D, 12AUP01 (piezometer), and CYN-MW2S (piezometer).

In summary, the groundwater beneath the LCETS occurs at depths of at least 222 feet bgs under semiconfined to confined conditions in fractured metamorphic rock. There has been no record to date of shallow groundwater occurring in the alluvium overlying the bedrock.

Historical aerial photographs indicate that construction of the LCETS had begun by October 1967; by 1971 the test site was in full operation, and several structures were visible (SNL/NM August 1994). A fire break road was constructed around the site between 1967 and mid-1971 to protect the surrounding area from accidental fires caused by detonation of explosives or burn testing (SNL/NM August 1994).

Interviews with former Sandia National Laboratories/New Mexico (SNL/NM) personnel have also been used to reconstruct historical operations at SWMU 65. SWMU 65 was established between 1967 and 1969 (Larson and Palmieri August 1994a, Palmieri December 1994a) as an explosives test area designed with a 10,000-foot dispersion radius to provide an adequate buffer for open detonations of up to 10,000 pounds of high explosives (HE) (Gaither et al. May 1993, Author [unk] Date [unk], Larson and Palmieri August 1994a, Larson and Palmieri August 1994b). The majority of the open-detonation explosives tests were conducted between 1967 and 1975. All open-detonation explosives tests were concluded by the early 1980s (Larson and Palmieri August 1994b). The frequency of testing at SWMU 65 between 1968 and 1980 has been estimated at 20 tests per year (Gaither et al. May 1993, Author [unk] Date [unk]). Based upon information provided in the interviews, open-detonation explosives tests were conducted within the primary and secondary detonation areas (SWMU 65B and SWMU 65C, respectively).

In addition to open-detonation explosives tests, fuel-fire burn tests of test units containing explosives were conducted from 1969 to 1979 at SWMU 65 using excavated pits (Littrell February 1969, Jercinovic et al. November 1994). Portable pans and engineered burn structures completely replaced burn pit tests by 1979 (Jercinovic et al. November 1994). From the mid-1970s, a variety of nonpetroleum-fuel-fire burn tests were conducted. These tests included slow-heat detonations (1983 to 1986) (Luna June 1983, Luna October 1985, Moore and Luna February 1982), Torch-Activated Burn System tests (1975 to 1977) (Kurowski January 1979, Jercinovic et al. November 1994, Larson August 1994), rocket propellant burn tests (1984 to 1993) (Palmieri December 1994b, Hickox and Abitz December 1994), liquid oxygen torch tests (1984 to 1985) (Hickox and Abitz December 1994), and wood crib fire tests (1988 to 1989) (Hickox and Abitz December 1994). Small explosives tests were also conducted in the former Conical Containment (CON-CON) Unit in 1982 (SNL/NM August 1986, Church March 1982).

A radiological voluntary corrective measure was completed in October 1996 at the site to remove all point source and area source gamma radiation anomalies (SNL/NM September 1997).

II. Data Quality Objectives

The confirmatory sampling conducted at SWMU 65C was designed to collect adequate samples in order to:

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

Table 1 summarizes the sample location design for SWMU 65C. SWMU 65C is designated the secondary detonation area and the primary source of constituents of concern (COCs) at SWMU 65C was general explosive tests, burn pit tests, liquid fuel fire and solid rocket propellant burn tests on Pioneer capsules, plutonium shipping container tests, and the TC-708 emergency denial device tests. Potential COCs at SWMU 65C include HE, metals, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). Radionuclides are also potential COCs for SWMU 65C because the site is located within a radioactive materials management area. The ground surface at this site has been significantly changed by grading of the soil/sediment since testing activities ceased in the early 1970s, so there is currently no evidence of the pits associated with past testing. Based upon the surficial nature of the contaminant release mechanism at the site, no COCs are anticipated at depths greater than the fill/native interface. Sampling activities were conducted in April 1998.

The number and location of the samples collected depended upon historical information and the findings of previous investigations and remedial activities conducted at the site. Historical information was used to determine the potential impacts to surface and near-surface soils from test activities. Originally three boreholes were planned for SWMU 65C in the OU 1333 RFI work plan (SNL/NM September 1995). Based upon a request for supplemental information from the New Mexico Environment Department (NMED), SNL/NM agreed to expand the number of boreholes to ten (SNL/NM March 1998). A passive soil vapor survey was conducted throughout the site in February and March 1998 (W.L. Gore & Associates, Inc., May 1998). Borehole locations were placed adjacent to soil vapor locations that showed positive results for volatile compounds. Ten boreholes were advanced to a minimum depth of 15 feet bgs or refusal, which ever occurred first.

Table 1
Summary of Sampling Performed to Meet Data Quality Objectives

SWMU 65C Sampling Components	Potential COC Source	Number of Sampling Locations	Sample Density	Sampling Location Rationale
Random grid and judgmental	Test material deposited on original surface and near-surface soil as a result of various tests conducted at the site. Original surface has been significantly changed.	10 boreholes	31 samples/ acre: 10 boreholes selected from judgmental locations based upon the soil vapor survey and a random grid pattern, 40 environmental samples.	To assess the nature and extent of potential contaminant releases from various tests that could have dispersed material throughout the site by collecting surface (0 to 6 inches) and subsurface (6 inches to 15 feet) samples from each judgmental and random borehole location.

COC = Constituent of concern.
SWMU = Solid Waste Management Unit.

Table 2 summarizes the analytical methods and data quality requirements necessary (1) help to provide adequate characterization of hazardous waste or hazardous constituents associated with the materials used in tests conducted at the LCETS and (2) to support risk screening assessments.

A total of ten borehole locations were sampled at SWMU 65C. All soil samples collected in April 1998 were analyzed off site for RCRA metals plus beryllium, HE, VOCs, and SVOCs; and 11 of the 40 soil samples were analyzed for gross alpha and gross beta activity. In addition, ten samples were analyzed on site for gamma spectroscopy. Core Laboratories, Inc., of Denver Colorado, analyzed the samples for RCRA metals plus beryllium using U.S. Environmental Protection Agency (EPA) Method 6010/7000 (EPA November 1986), for HE using EPA Method 8330 (EPA November 1986), for VOCs using EPA Method 8260 (EPA November 1986), for SVOCs using EPA Method 8270 (EPA November 1986), and for gross alpha/gross beta using EPA Method 900.0 (EPA November 1986). SNL/NM Department 7713, Radiation Protection Sample Diagnostic (RPSD) Laboratory, analyzed the samples on site for radionuclides using gamma spectroscopy.

All gamma spectroscopy data were reviewed by SNL/NM Department 7713 (RPSD Laboratory) according to "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 02 (SNL/NM July 1996). On- and off-site laboratory results were reviewed and verified/validated according to "Data Verification/Validation Level 2—DV-2" in Attachment B or "Data Verification/Validation Level 3-DV3" in Attachment C of the Technical Operating Procedure 94-03, Rev. 0 (SNL/NM July 1994b). The reviews confirmed that the data are acceptable for use in the No Further Action (NFA) proposal for SWMU 65C. The data quality objectives (DQO) for SWMU 65C have been met.

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

III.1 Introduction

The determination of the nature, rate, and extent of contamination at SWMU 65C was based upon an initial conceptual model validated with confirmatory sampling at the site. The initial conceptual model was developed from historical background information including site inspections, personal interviews, historical photographs, and numerous field surveys. The DQOs contained in the work plan for OU 1333 (SNL/NM September 1995) and Field Implementation Plan (FIP) addendum to the work plan (SNL/NM March 1998) identified the sample locations, sample density, sample depth, and analytical requirements. The sample data collected were subsequently used to develop the final conceptual model for SWMU 65C, which is presented in Section 5.5 of the associated NFA proposal. However, the Lurance Canyon main arroyo channel has been excluded from the conceptual model for SWMU 65C and will be addressed in subsequent SNL/NM sitewide surface-water characterization activities (SNL/NM in progress). The quality of the data specifically used to determine the nature, rate, and extent of contamination are described.

Table 2
Summary of Data Quality Requirements

Analytical Requirement	Data Quality Level	Radiation Protection Sample Diagnostics Laboratory Department 7713 SNL/NM	Core Laboratories Inc. Denver, Colorado
RCRA metals plus beryllium EPA Method 6010/7000[a]	Level 3	Not applicable	40 samples
HE compounds EPA Method 8330[a] (or equivalent)	Level 3	Not applicable	40 samples
SVOCs EPA Method 8270[a]	Level 3	Not applicable	40 samples
VOCs EPA Method 8260[a]	Level 3	Not applicable	40 samples
Gamma spectroscopy EPA Method 900.1[a]	Level 2	10 samples	Not applicable
Gross alpha/gross beta EPA Method 900.0[a]	Level 2	Not applicable	11 samples

[a]EPA November 1986.
EPA = U.S. Environmental Protection Agency.
HE = High explosive(s).
SVOC = Semivolatile organic compound.
VOC = Volatile organic Compound.
RCRA = Resource Conservation Recovery Act.
SNL/NM = Sandia National Laboratories/New Mexico.

III.2 Nature of Contamination

The nature of contamination at SWMU 65C was determined by soil vapor surveys, analytical testing of soil media, and the potential for degradation of relevant COCs (Section V). The analytical requirements included RCRA metals plus beryllium to characterize nonradiological inorganic constituents potentially released at the site. HE, SVOC, and VOC analyses were performed to characterize any potentially unreacted explosives or fuels materials that could have been released during the various tests conducted at the site; however, no HE compounds were detected in the confirmatory samples collected at SWMU 65C. Gamma spectroscopy and gross alpha/beta analyses were also performed to characterize any depleted uranium potentially released at the site. At the initiation of the field investigation a soil vapor survey was conducted and all soil samples were surveyed for volatile constituents when collected. The results of these surveys indicated that volatile constituents did not appear to be a COC at this site. These analytes and methods are appropriate to characterize the COCs and potential degradation products associated with historical activities conducted at the LCETS.

III.3 Rate of Contaminant Migration

The LCETS is inactive; and therefore, all primary sources of COCs (from explosives tests and burn tests) have been eliminated. As a result, only secondary sources of COCs remain at SWMU 65C in the form of adsorbed metals and radionuclides in the surface and subsurface soil. The rate of COC migration from surficial soil is, therefore, dependent predominantly upon site meteorological and surface hydrologic processes as described in Section V. Data available from SNL/NM's Site-Wide Hydrogeologic Characterization Project (published annually); numerous SNL/NM air, surface water, and radiological monitoring programs; biological surveys; and other governmental atmospheric monitoring at the Kirtland Air Force Base (i.e., National Oceanographic and Atmospheric Administration) are adequate to characterize the rate of the migration of COCs at SWMU 65C.

III.4 Extent of Contamination

Surface and subsurface soil samples were collected from ten boreholes completed at random and judgmental (based upon the soil vapor survey) locations across the approximate 1.3 acres comprising SWMU 65C. These sample locations are deemed appropriate to determine the lateral and vertical extent of the migration of COCs.

The density of random and judgmental grid sample locations was dependent on the size of SWMU 65C (approximately 1.3 acres) and unknown location of the pits previously used for testing activities at the site. The number of samples collected was deemed sufficient to establish the presence of residual COCs in surface and subsurface soils from previous testing activities.

Because of the relatively low solubility of most metals and radionuclides, limited precipitation, and high evapotranspiration, the vertical rate of the migration of contaminants is expected to be extremely low. The ground surface at this site has been significantly changed as a result of grading of the soil/sediment since testing activities ceased in the early 1970s, so there is currently no evidence of the pits associated with past testing. Based upon the surficial nature of the contaminant release mechanism at the site, no COCs are anticipated at depths greater than the fill/native interface. Therefore, random grid and judgmental samples were collected from the ground surface to depths of approximately 15 feet bgs or the fill/native interface.

In summary, the design of the confirmatory sampling was appropriate and adequate to determine the nature, rate, and extent of contamination.

IV. Comparison of COCs to Background Screening Levels

Site history and characterization activities are used to identify potential COCs. The SWMU 65C NFA proposal describes the identification of COCs and the sampling that was conducted in order to determine the concentration levels of those COCs across the site. Generally, COCs evaluated in this risk assessment include all detected organics and radiologicals and all inorganic COCs for which samples were analyzed. If the detection limit of an organic compound was too high (i.e., could possibly cause an adverse effect to human health or the environment), the compound was retained. 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, Zamorski December 1997) was selected to provide the background screen listed in Tables 3 through 6. Human health nonradiological COCs were also compared to SNL/NM proposed Subpart S action levels (Table 3) (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 inorganic and organic compounds.

Table 3 lists nonradiological COCs for the human health risk assessment at SWMU 65C. Table 4 lists nonradiological COCs for the ecological risk assessment. Tables 5 and 6, respectively, list radiological COCs for human health and ecological risk assessment. All tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997, Zamorski December 1997). Section VI.4 discusses Tables 3 and 5. Sections VII.2 and VII.3 discuss Tables 4 and 6.

V. Fate and Transport

The primary releases of COCs at SWMU 65C were to surface soil. Wind, water, and biota are natural mechanisms of COC transport from the primary release point. Both wind and surface-water runoff can transport surface soil particles from the site, potentially carrying COCs with them. However, because the site is situated within the Lurance Canyon in the Manzanita Mountains and is within woodland vegetation, it is protected from strong winds at the ground surface. Therefore, wind is probably not a significant transport mechanism for surface soils.

Water at SWMU 65C is received as precipitation (rain or occasionally snow), which will either infiltrate or form runoff. Infiltration at the site is enhanced by the coarse texture of the canyon soils (Tesajo-Millett stony sandy loam and rock outcrop [USDA 1977]), but the sloping ground surfaces at this site will produce runoff during intense rainfall events and during extended rainfall periods when soils are near saturation from previous rainfall. Surface runoff is to an ephemeral drainage along the southern part of the site, which flows west through the canyon and becomes the Arroyo del Coyote in the lower part of the canyon. Runoff at the site could carry soil particles with adsorbed COCs. The distance of transport would depend upon the size of the particle and the velocity of the water. Because of the moderately steep slopes on portions of the site and the tendency for precipitation to be received as intense downpours during the summer months, the transport of surface soil particles by runoff could be significant.

Water that infiltrates into the soil would continue to percolate through the soil until field capacity is reached. COCs desorbed from the soil particles into the soil solution could be leached deeper into the subsurface soil with this percolation. None of the inorganic COCs at this site

Table 3
Nonradiological COCs for Human Health Risk Assessment at SWMU 65C 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[c]	Is Individual COC less than 1/10 of the Action Level?
Arsenic	5.33	9.8	Yes	44[d]	NA	**Yes**	0.5	**No**
Barium	344	246	**No**	170[e]	NA	**Yes**	6000	Yes
Beryllium	0.925	0.75	**No**	19[d]	NA	No	0.2	**No**
Cadmium	0.619	0.64	Yes	64[d]	NA	**Yes**	80	Yes
Chromium, total[f]	17.8	18.8	Yes	16[d]	NA	No	400	Yes
Lead	8.99	18.9	Yes	49[d]	NA	**Yes**	--	--
Mercury	0.0694 J	0.055	**No**	5500[d]	NA	**Yes**	20	Yes
Selenium	0.537	2.7	Yes	800[g]	NA	**Yes**	400	Yes
Silver	0.364 J	<0.5	**Unknown**	0.5[d]	NA	No	400	Yes
1,2-dibromo-3-chloropropane	0.0019 J	NA	**NA**	11[h]	2.26[h]	No	NC	NA
Methylene chloride	0.0048 J	NA	**NA**	5[i]	1.25[i]	No	90	Yes
Toluene	0.0036 J	NA	**NA**	10.7[d]	2.69[d]	No	20,000	Yes
bis(2-ethylhexyl) phthalate	0.068 J	NA	**NA**	851[j]	7.6[k]	**Yes**	50	Yes

Note: **Bold** indicates the COCs that failed the background and/or Subpart S screening procedures and/or are bioaccumulators.

[a]From Zamorski (December 1997) Canyon Area Soils.
[b]NMED (March 1998).
[c]IT Corporation (July 1994).
[d]Yanicak (March 1997).
[e]Neumann (1976).
[f]Assumed to be chromium VI for Subpart S screening procedure.
[g]Callahan et al. (1979).
[h]Howard (1991).
[i]Howard (1990).
[j]Howard (1989).
[k]Micromedex, Inc (1998).

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.
NC = Not calculated.

NMED = New Mexico Environment Department.
SNL/NM = Sandia National Laboratories/New Mexico
SWMU = Solid Waste Management Unit.
-- = Information not available.

Table 4
Nonradiological COCs for Ecological Risk at SWMU 65C with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

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)
Arsenic	3.16	9.8	Yes	44[c]	NA	**Yes**
Barium	199	246	Yes	170[d]	NA	**Yes**
Beryllium	0.764	0.75	**No**	19[c]	NA	No
Cadmium	0.491 J	0.64	Yes	64[c]	NA	**Yes**
Chromium, total[e]	13.3	18.8	Yes	16[c]	NA	No
Lead	8.8	18.9	Yes	49[c]	NA	**Yes**
Mercury	0.0468 J	0.055	Yes	5500[c]	NA	**Yes**
Selenium	0.537	2.7	Yes	800[f]	NA	**Yes**
Silver	0.359 J	<0.5	**Unknown**	0.5[c]	NA	No
Methylene chloride	0.0048 J	NA	**NA**	5[g]	1.25[g]	No
Toluene	0.0035 J	NA	**NA**	10.7[c]	2.69[c]	No
bis (2-Ethylhexyl) phthalate	0.068 J	NA	**NA**	851[h]	7.6[i]	**Yes**

Note: **Bold** indicates the COCs that failed the background screening procedure and/or are bioaccumulators.
[a]Zamorski (December 1997) Canyons Areas.
[b]NMED (March 1998).
[c]Yanicak (March 1997).
[d]Neumann (1976).
[e]Assumed to be chromium VI for Subpart S screening procedure.
[f]Callahan et al. (1979).
[g]From Howard (1990).
[h]From Howard (1989)
[i]From Micromedex, Inc (1998)

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 (organic COCs do not have accepted background concentrations).
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 Risk Assessment at SWMU 65C 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)	Bioaccumulator?[b] (BCF>40)
Cs-137	0.07	0.52	Yes	3000[c]	**Yes**
Th-232	0.84	1.03	Yes	3000[d]	No[e]
U-234[f]	0.47	2.31	Yes	900[d]	**Yes**
U-235[g]	0.275 (ND)	0.16	**No**	900[d]	**Yes**
U-238[g]	3.76 (ND)	2.31	**No**	900[d]	**Yes**

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

[a]From Dinwiddie (September 1997), Canyons Background.

[b]NMED (March 1998).

[c]From Whicker and Schultz (1992).

[d]From Baker and Soldat (1992).

[e]Yanicak (March 1997).

[f]Concentration calculated from U-238 value using historical U-238/U-234 ratio for SNL/NM area.

[g]Concentration for ND result where MDA is greater than background levels and any measured concentrations.

BCF = Bioconcentration factor.
COC = Constituent of concern.
MDA = Minimum detectable activity (concentration)
ND = Not detected.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

Table 6
Radiological COCs for Ecological Risk Assessment at SWMU 65C 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)	Bioaccumulator?[b] (BCF>40)
Cs-137	0.07	0.52	Yes	3000[c]	**Yes**
Th-232	0.84	1.03	Yes	3000[d]	No[e]
U-234[f]	0.47	2.31	Yes	900[d]	**Yes**
U-235[g]	0.275 (ND)	0.16	**No**	900[d]	**Yes**
U-238[g]	3.76 (ND)	2.31	**No**	900[d]	**Yes**

Note: **Bold** indicates COCs that failed the background screening procedure and/or are bioaccumulators.
[a]From Dinwiddie (September 1997), Canyons Background.
[b]NMED (March 1998).
[c]From Whicker and Schultz (1992).
[d]From Baker and Soldat (1992).
[e]Yanicak (March 1997).
[f]Concentration calculated from U-238 value using historical U-238/U-234 ratio for SNL/NM area.
[g]Concentration for ND result where MDA is greater than background levels and any measured concentrations.

BCF = Bioconcentration factor.
COC = Constituent of concern.
MDA = Minimum detectable activity (concentration)
NMED = New Mexico Environment Department.
ND = Not detected.
pCi/g = Picocurie(s) per gram.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

have a high potential for leaching in soil. Based upon observations made during the installation of a piezometer north (upgradient) of SWMU 65C (in the arroyo channel immediately above SWMU 12B), 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. The Burn Site Well, along the east side of the site, did not encounter groundwater until 230 feet bgs. The depth to groundwater at SWMU 65C is approximately 222 feet bgs. Therefore, infiltration from the surface does not appear to be sufficient to contact groundwater in the area of the LCBS, and it is highly unlikely that percolation will result in the leaching of COCs to groundwater.

Plant roots can take up COCs that are in the soil solution. These COCs could be transported to the aboveground tissues with the xylem stream and could then be consumed by herbivores or returned to the soil as litter. Aboveground litter could be transported from the site of deposition by wind and/or surface water until it is consumed by decomposer organisms. Constituents in plant tissues that are consumed by herbivores could pass through the gut and be returned to the soil in feces either at the site or far from the site, or they could be absorbed into and held in tissues, metabolized, or later excreted. The herbivore could be eaten by a primary carnivore or scavenger and the constituents still held in the consumed tissues would repeat the sequence of absorption, metabolization, excretion, and consumption by higher predators, scavengers, and decomposers. The potential for transport of the constituents within the food chain is dependent upon the mobility of the species that comprise the food chain and the potential for the constituent to be transferred across the links in the food chain. Much of SWMU 65C has been highly disturbed by testing activities and by associated grading and is devoid of vegetation; however, natural vegetation does occur along the southern part of the site. Therefore, food chain uptake is a potential transport mechanism at SWMU 65C.

Degradation of COCs at SWMU 65C could result from biotic or abiotic processes. Inorganic COCs at this site are elemental in form and are, therefore, not considered to be degradable. Radiological COCs, however, undergo decay to stable isotopes or radioactive daughter elements. Other transformations of inorganics could include changes in valence (oxidation/ reduction reactions) or incorporation into organic forms. Degradation processes for organic COCs could include photolysis, hydrolysis, and biotransformation. Photolysis requires light and, therefore, takes place in the air (after volatilization), at the ground surface, or in surface water. Hydrolysis includes chemical transformations in water and could occur in the soil solution. Biotransformation (i.e., transformation caused by plants, animals, and microorganisms) could occur; however, biological activity could be limited by the aridity of the environment at this site.

Table 7 summarizes the fate and transport processes that could occur at SWMU 65C. The site is situated within the Lurance Canyon and is, therefore, sheltered by surrounding slopes and woodland vegetation. Therefore, with the exception of the organics that could volatilize near the soil surface and be released into the air in vapor phase, significant transport of COCs by wind is unlikely. Transport by surface-water runoff, however, could be of greater significance because of the slopes found on the site. Subsurface migration of COCs from leaching is not expected to be significant, and COCs are highly unlikely to contact groundwater. The potential for food chain uptake is low. Inorganic COCs at SWMU 65C are elemental in form and, therefore, they are not considered to be degradable. Decay of radiological COCs is insignificant because of their long half lives. The organic COCs could be transformed by photolysis, hydrolysis, or biotransformation and some could be lost by volatilization.

Table 7
Summary of Fate and Transport at SWMU 65C

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

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

Step 1.	Site data are described that provide information on the potential COCs, as well as the relevant physical characteristics and properties of the site.
Step 2.	Potential pathways are identified by which a representative population might be exposed to the COCs.
Step 3.	The potential intake of these COCs by the representative population is calculated using a tiered approach. The first component of the tiered approach 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 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 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 EPA and the 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 65C. Section II presents comparison of results to DQOs. Section III describes the determination of the nature, rate, and extent of contamination.

VI.3 Step 2. Pathway Identification

SWMU 65C 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 considered to be soil ingestion for the nonradiological COCs and direct gamma exposure for the radiological COCs. The inhalation pathway for both nonradiological and radiological COCs is included because of 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 65C is approximately 222 feet bgs. Because of the lack of surface water or other significant mechanisms for dermal contact, the dermal exposure pathway is considered not to be 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 is discussed in this section and the two screening procedures. The first screening procedure compared the maximum COC concentration to the background screening level. The second screening procedure 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 screen in Table 3 and was used to calculate risk attributable to background in Table 11. Only the COCs that were detected above their respective SNL/NM maximum background screening levels or did not have a quantifiable 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 3 and 5 present SWMU 65C maximum COC concentrations that were compared to the SNL/NM maximum background values (Dinwiddie September 1997, Zamorski December 1997) for the human health risk assessment. For the nonradiological COCs, three constituents were measured at concentrations greater than their respective background. One nonradiological COC had no quantifiable background concentration, so it is not known whether that COC exceeded background. Four COCs were organic compounds and did not have background-screening levels.

For the radiological COCs, two constituents had maximum MDA activity concentrations greater than their respective backgrounds (uranium-235 and uranium-238).

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 were based upon the assumption 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, then the site was judged to pose no significant health hazard to humans. If there were more than ten COCs, then the Subpart S screening procedure was not performed.

VI.4.2.2 Results

Table 3 shows the COCs and the associated proposed Subpart S action level. The table compares the maximum concentration values to 1/10 the proposed Subpart S action level. This methodology was guidance given to SNL/NM from the EPA (EPA 1996a). One COC that failed the background screen (beryllium) is above 1/10 the Subpart S action level. Therefore, all constituents with maximum concentrations above background were carried forward in the risk assessment process, and a hazard quotient (HQ) and excess cancer risk value were calculated.

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 8 (nonradiological) and 9 (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 8 were from the Integrated Risk Information System (IRIS) (EPA 1998a), the Health Effects Assessment Summary Tables (HEAST) (EPA 1997a) and from the Region 9 (EPA 1996c) 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 are 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 8
Toxicological Parameter Values for SWMU 65C 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]
Barium	7E-2[c]	M	1.4E-4[d]	--	--	--	--
Beryllium	2E-3[c]	L to M	5.7E-6[c]	M	--	8.4E+0[c]	B1
Mercury	3E-4[e]	--	8.6E-5[c]	M	--	--	D
Silver	5E-3[c]	L	--	--	--	--	D
1,2-dibromo-3-chloropropane	5.7E-5[d]	--	5.71E-5[c]	M	1.4E+0[e]	2.4E-3[e]	B2
Methylene chloride	6E-2[c]	M	8.6E-1[e]	--	7.5E-3[c]	1.7E-3[c]	B2
Toluene	2E-1[c]	M	1.1E-1[c]	M	--	--	D
bis(2-ethylhexyl) phthalate	2E-2[d]	--	2.2E-2[d]	--	1.4E-2[d]	1.4E-2[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) with the exception of 1,2-dibromo-3-chloropropane which was taken from HEAST (EPA 1997a):

- B1 = Probable human carcinogen. Limited human data available.
- B2 = Probable human carcinogen. Indicates sufficient evidence in animals and inadequate or no evidence in humans.
- D = Not classifiable as to human carcinogenicity.

[c]Toxicological parameter values from IRIS electronic database (EPA 1998a).

[d]Toxicological parameter values from EPA Region 9 electronic database (EPA 1996c)

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

COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
HEAST = Health Effects Assessment Summary Tables.
IRIS = Integrated Risk Information System.
mg/kg-d = Milligram(s) per kilogram day.
(mg/kg-day)$^{-1}$ = Per milligram 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 9
Radiological Toxicological Parameter Values for SWMU 65C 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]
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.
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 10 shows a HI of 0.00 for the SWMU 65C nonradiological COCs and an excess cancer risk of 2E-10 for the designated recreational land-use scenario. The numbers presented included exposure from soil ingestion and dust and volatile inhalation for nonradiological COCs. Table 11 shows a HI of 0.00 and an excess cancer risk of 2E-11 assuming the maximum background concentrations of the SWMU 65C associated background constituents for the designated recreational land-use scenario.

Table 10
Risk Assessment Values for SWMU 65C 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
Barium	344	0.00	--	0.05	--
Beryllium	0.925	0.00	3E-11	0.00	7E-10
Mercury	0.0694 J	0.00	--	0.12	--
Silver	0.364 J	0.00	--	0.02	--
1,2-dibromo-3-chloropropane	0.0019 J	0.00	1E-10	0.03	9E-7
Methylene chloride	0.0048 J	0.00	2E-11	0.00	4E-8
Toluene	0.0036 J	0.00	--	0.00	--
bis (2-Ethylhexyl) phthalate	0.068 J	0.00	4E-11	0.00	2E-9
Total		**0.00**	**2E-10**	**0.2**	**9E-7**

[a]From EPA (1989).
J = Estimated concentration
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
-- = Information not available.

Table 11
Risk Assessment Values for SWMU 65C 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
Barium	246	0.00	--	0.04	--
Beryllium	0.75	0.00	2E-11	0.00	6E-10
Mercury	0.055	0.00	--	0.09	--
Silver	<0.5	--	--	--	--
Total		**0.00**	**2E-11**	**0.1**	**6E-10**

[a]From Zamorski (December 1997), 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, 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 7.0E-03 millirem (mrem)/year (mrem/yr). In accordance with EPA guidance found in Office of Solid Waste and Emergency Response Directive No. 9200.4-18 (EPA 1997b), 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 65C for the recreational land use is well below this guideline. The estimated excess cancer risk is 9.1E-08.

For the residential land-use scenario nonradioactive COCs, the HI is 0.2, and the excess cancer risk is 9E-7 (Table 10). 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 11 shows that for the SWMU 65C associated background constituents, the HI is 0.1 and the excess cancer risk is 6E-10.

For the radiological COCs, the incremental TEDE for the residential land-use scenario is 1.5E-01 mrem/yr. The guideline being used is an excess TEDE of 75 mrem/yr (SNL/NM February 1998) for a complete loss of institutional controls (residential land use in this case); the calculated dose value for SWMU 65C for the residential land-use scenario is well below this guideline. Consequently, SWMU 65C is eligible for unrestricted radiological release because 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 1.6E-06. 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]). Excess cancer risk is estimated at 2E-10. Guidance from the NMED indicates that excess lifetime risk of developing cancer by an individual must be less than 1E-6 for Class A and B carcinogens and less than 1E-5 for Class C carcinogens (NMED March 1998). The excess cancer risk is driven by beryllium and three organics. Beryllium is a Class B1 carcinogen; two of the organics are Class B2 carcinogens. The other organic currently is not classified. Thus, the excess cancer risk for this site is below the suggested acceptable risk value (1E-6). This assessment also determined risks considering background concentrations of the potential nonradiological COCs for both the recreational and residential land-use scenarios. Assuming the recreational land-use scenario, for nonradiological COCs the HI is 0.00 and the excess cancer risk is 2E-11. 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 incremental cancer risk is 1.7E-10 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 in the recreational land-use scenario, incremental TEDE is 7.0E-03 mrem/yr, which is significantly less than the EPA's numerical guideline of 15 mrem/yr. Incremental estimated excess cancer risk is 9.1E-08.

The calculated HI for the residential land-use scenario nonradiological COCs is 0.2, which is below the numerical guidance. Excess cancer risk is estimated at 9E-7. The excess cancer risk is driven by beryllium and three organics. Beryllium is a Class B1 carcinogen; two of the organics are Class B2 carcinogens. The other organic currently is not classified. Therefore, the excess cancer risk for this site is below the suggested acceptable risk value (1E-6). The HI for associated background for the residential land-use scenario is 0.1; the excess cancer risk is estimated at 6E-10. The incremental HI is 0.09 and the incremental cancer risk is 9.4E-7 for the residential land-use scenario. These incremental risk calculations indicate insignificant contribution to human health risk from the COCs considering the residential land-use scenario.

The incremental TEDE for the residential land-use scenario from the radiological components is 1.5E-01 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 1.6E-06.

VI.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at SWMU 65C was based upon an initial conceptual model validated with confirmatory sampling conducted at the site. The confirmatory sampling was implemented in accordance with the RFI work plan for OU 1333 (SNL/NM September 1995) and the FIP addendum to the work plan (SNL/NM March 1998). The DQOs contained in the RFI work plan are appropriate for use in screening risk 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 validated in accordance with SNL/NM procedures (SNL/NM July 1994b, SNL/NM July 1996). Therefore, there is no uncertainty associated with the data quality used to perform the screening risk assessment at SWMU 65C.

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 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 overestimates. Maximum measured values of COC concentrations are used to provide conservative results.

Table 8 shows the uncertainties (confidence) in nonradiological toxicological parameter values. There is a mixture of estimated values and values from the IRIS (EPA 1998a), the HEAST (EPA 1997a), and EPA Region 9 (EPA 1996c) electronic databases. Where values are not provided, information is not available from the HEAST (EPA 1997a), IRIS (EPA 1998a), or the EPA regions (EPA 1996a, 1997c). Because of the conservative nature of the RME approach, uncertainties in toxicological values are not expected to change the conclusion from the risk assessment analysis.

Risk assessment values for nonradiological COCs are within the human health acceptable range for the recreational 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 considered not significant with respect to the conclusion reached.

VI.9 Summary

SWMU 65C 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 constituents 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. Excess cancer risk (2E-10) 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 the incremental cancer risk is 1.7E-10 for the recreational land-use scenario. Incremental risk calculations indicate insignificant risk to human health for a recreational land-use scenario.

Incremental TEDE and corresponding estimated cancer risk from radiological COCs are much less than EPA guidance values; the estimated TEDE is 7.0E-03 mrem/yr for the recreational land-use scenario. This value is much less than the numerical guidance of 15 mrem/yr in EPA guidance (EPA 1997b). The corresponding incremental estimated cancer risk value is 9.1E-08 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 1.5E-01 mrem/yr with an associated risk of 1.6E-06. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, SWMU 65C 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 the recreational land-use scenario.

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 65C. A component of the NMED Risk-Based Decision Tree (March 1998) 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 the NMED's decision tree (a discussion of DQOs, a data assessment, and evaluations of bioaccumulation and fate-and-transport potential) are addressed in Sections II through V of this report. Following the completion of the scoping assessment, a determination is made as to whether a more detailed examination of potential ecological risk is necessary. If deemed necessary, the scoping assessment proceeds to a 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 focuses primarily on the likelihood 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. The scoping risk management decision involves a summary of the scoping results and a determination as to whether further examination of potential ecological impacts is necessary.

VII.2.1 Data Assessment

Among the COPECs listed in Section IV (Table 4), the following inorganic constituents exceeded background concentrations within the 0- to 5-foot depth interval:

- Beryllium

Silver does not have a quantifiable background concentration. Thus, it is unknown if the maximum silver concentration exceeded the background screening level. Therefore, silver is included in the risk analysis for conservatism. Organic analytes that were detected in soil within the 0- to 5-foot depth interval include the following:

- Methylene chloride
- Toluene
- bis(2-ethylhexyl)phthalate

Although uranium-235 and uranium-238 were not detected (Section IV, Table 6), the highest MDAs of these radionuclides exceeded their corresponding background concentrations.

VII.2.2 Bioaccumulation

Among the COPECs listed in Section VII.2.1, the following were considered to have bioaccumulation potential in aquatic environments (Section IV, Tables 4 and 6):

- U-235
- U-238
- bis(2-ethylhexyl)phthalate

It should be noted, however, that as directed by the 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 7 (Section V), wind and foodchain uptake are expected to be of low significance as transport mechanisms for COPECs at this site. Transport by surface water may be of moderate significance. Migration to groundwater is not anticipated. Degradation/transformation for inorganic COPECs and the radionuclides is expected to be of low significance. For the organic COPECs, the potential for transformation is moderate, and loss by volatilization is also expected to occur.

VII.2.4 Scoping Risk Management Decision

Based upon information gathered through the scoping assessment, it was concluded that complete ecological pathways could 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 used to gauge the toxicity of COPECs to specific receptors.
- Risk characterization—characterizes the ecological risk associated with exposure of the receptors to environmental media at the site.
- Uncertainty assessment—discusses uncertainties associated with the estimation of exposure and risk.
- Risk interpretation—evaluates ecological risk in terms of HQs and ecological significance.
- 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 provides the introduction to the risk evaluation process. Components that are addressed in this section include a discussion of ecological pathways and the ecological setting, identification of COPECs, and selection of ecological receptors. The conceptual model, ecological food webs, and ecological endpoints (other components commonly addressed in a screening assessment) are presented in the "Predictive Ecological Risk Assessment Methodology, Environmental Restoration [ER] Program, Sandia National Laboratories, New Mexico" (IT July 1998) and are not duplicated here.

VII.3.1.1 Ecological Pathways and Setting

SWMU 65C is approximately 1.3 acres in size. The site is located in the Lurance Canyon, dominated by woodland habitat; however, much of the habitat at this site has been highly disturbed during its active use and during other activities conducted at the LCBS. Wildlife could use the area, but the small size of the site make significant transfers of COPECs through the food chain pathway unlikely. Biological and sensitive species surveys of the entire LCBS were conducted in 1991 (Biggs May 1991, August 1991). No sensitive species were reported to occur at this facility.

Complete ecological pathways could exist at this site through the exposure of plants and wildlife to COPECs in surface and subsurface soil. Direct uptake of COPECs from soil was assumed to be the major route of exposure for plants, with exposure of plants to wind-blown soil assumed to be minor. For nonradiological COPECs, exposure modeling for the wildlife receptors was limited to the food and soil ingestion pathways. For radiological COPECs, both internal dose resulting from the food and soil ingestion pathways and external dose from the soil medium were evaluated. 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 COPECs at this site.

VII.3.1.2 COPECs

Both radiological and nonradiological COPECs were evaluated for this assessment. The nonradiological COPECs included both inorganic and organic analytes. Inorganic analytes and radionuclides were screened against background concentrations, and those that exceeded the approved SNL/NM background screening levels (Dinwiddie September 1997) for the area were considered to be COPECs. Nondetected inorganic and radiological analytes for which the detection limit (the MDA for radionuclides) exceeded the background screening levels were also retained as COPECs. All organic analytes detected were considered to be COPECs for the site. In order to provide conservatism in this ecological risk assessment, the assessment is based upon the maximum soil concentrations of the COPECs measured at this site. Tables 4 and 6 report maximum COPEC concentrations (or the analyte detection limits). 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).

VII.3.1.3 Ecological Receptors

In an earlier report (IT 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 associate 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 occur in the woodland habitat at SWMU 65C, it is used to conservatively represent exposure and risk to other small predatory birds such as the western screech owl (*Otus kennicottii*) that could 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). Exposure in the burrowing owl from a diet of equal parts herbivorous, omnivorous, and insectivorous mice would be the same as exposure from a diet of only omnivorous mice. Therefore, its diet was modeled with intake entirely of omnivorous mice. Both species were modeled with soil ingestion comprising 2 percent of the total dietary intake. Table 12 presents the species-specific factors used in modeling exposures in the wildlife receptors. Justification for use of the factors presented in this table is described in the ecological risk assessment methodology document (IT July 1998).

Although home range is also included in this table, exposures for this risk assessment 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 provide a conservative estimate of 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 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 uranium-235 and uranium-238. Internal and external dose rates to the deer mouse and the burrowing owl are approximated using modified dose rate models from the "Hanford Site Risk Assessment Methodology" (DOE 1995) as presented in the ecological risk assessment methodology document for the SNL/NM ER Program (IT July 1998). Radionuclide-dependent data for the dose rate calculations were obtained from Baker and Soldat (1992). The external dose rate model examines the total body dose rate to a receptor residing in soil exposed to radionuclides. The soil surrounding the receptor is assumed to be an infinite medium uniformly contaminated with gamma-emitting radionuclides. The external dose rate model is the same for both the deer mouse and the burrowing owl. The internal total body dose rate model assumes that a fraction of the radionuclide concentration ingested by a receptor is absorbed by the body and concentrated at the center of a spherical body shape. This provides for a conservative estimate for absorbed dose. This concentrated radiation source at the center of the body of the receptor is assumed to be a point source. Radiation emitted from this point source is absorbed by the body tissues to contribute to the absorbed dose. Alpha and beta emitters are assumed to transfer 100 percent of their energy to the receptor as they pass through tissues. Gamma-emitting radionuclides 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 uranium-235 and uranium-238 in soil.

Table 13 presents the transfer factors used in modeling the concentrations of COPECs through the food chain. Table 14 presents maximum concentrations in soil and derived concentrations in tissues of the various food chain elements that are used to model dietary exposures for each of the wildlife receptors.

Table 12
Exposure Factors for Ecological Receptors at SWMU 65C

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 kilograms wet weight.
[b]Food intake rates are estimated from the allometric equations presented in Nagy (1987). Units are kilograms 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.

Table 13
Transfer Factors Used in Exposure Models for Constituents of Potential Ecological Concern at SWMU 65C

Constituent of Potential Ecological Concern	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Inorganic			
Beryllium	1.0E-2[a]	1.0E+0[b]	1.0E-3[a]
Silver	1.0E+0[c]	2.5E-1[d]	5.0E-3[c]
Organic[e]			
Methylene chloride	7.3E+0	1.5E+1	3.6E-7
Toluene	1.0E+0	1.8E+1	1.3E-5
bis(2-ethylhexyl)phthalate	1.6E-3	3.2E+1	1.3E+0

[a]From Baes et al. (1984).
[b]Default value.
[c]From NCRP (January 1989).
[d]From Stafford et al. (1991).
[e]For organic constituents, soil-to-plant and food-to-muscle transfer factors are from equations developed in Travis and Arms (1988). Soil-to-invertebrate transfer factors are 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 (K_{ow} = the octanol-water partition coefficient).
SWMU = Solid Waste Management Unit.

Table 14
Media Concentrations[a] for Constituents of Potential Ecological Concern at SWMU 65C

Constituent of Potential Ecological Concern	Soil (maximum)[a]	Plant Foliage[b]	Soil Invertebrate[b]	Deer Mouse Tissues[c]
Inorganic				
Beryllium	7.6E-1	7.6E-3	7.6E-1	1.3E-3
Silver	3.6E-1	3.6E-1	9.0E-2	3.6E-3
Organic				
Methylene chloride	4.8E-3	3.5E-2	7.3E-2	6.1E-8
Toluene	3.5E-3	3.5E-3	6.3E-2	1.3E-6
bis(2-ethylhexyl)phthalate	6.8E-2	1.1E-4	2.2E+0	4.4E+0

[a]In milligrams per kilogram. All are based upon dry weight of the media.
[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 in food times the food-to-muscle transfer factor times the wet weight-dry weight conversion factor of 3.125 (EPA 1993).
SWMU = Solid Waste Management Unit.

VII.3.3 Ecological Effects Evaluation

Table 15 presents 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 LOAELs for methylene chloride and bis(2-ethylhexyl)phthalate for terrestrial plant life and to estimate the NOAELs for beryllium, silver, methylene chloride, and toluene for the burrowing owl.

The benchmark used for exposure of terrestrial receptors to radiation was 0.1 rad per day (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 65C.

VII.3.4 Risk Characterization

Maximum concentrations in soil and estimated dietary exposures were compared to plant and wildlife benchmark values, respectively. Table 16 presents results of these comparisons. HQs are used to quantify the comparison with benchmarks for plants and wildlife exposure. None of the nonradiological COPECs resulted in HQs exceeding unity. However, because of the lack of adequate toxicity information, HQs for plants could not be determined for methylene chloride and bis(2-ethylhexyl)phthalate, and an HQ for the burrowing owl could only be determined for bis(2-ethylhexyl)phthalate. 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). None of the calculated HIs were greater than unity.

Tables 17 and 18 summarize the internal and external dose rate model results for uranium-235 and uranium-238. The total radiation dose rate to the deer mouse was predicted to be 5.3E-5 rad/day, with internal dose rate contributing over 75 percent of the total. Total dose rate to the burrowing owl was predicted to be 2.9E-5 rad/day, with the contribution of the internal dose rate being a little more than half of the total. 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 65C. 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 rather than to underestimate them. These conservative assumptions provide more protection to the ecological resources potentially affected by the site. Conservatisms incorporated into this risk assessment include the use of the maximum measured analyte concentration or maximum MDA 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

Table 15
Toxicity Benchmarks for Ecological Receptors at SWMU 65C

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
Inorganic							
Beryllium	10	Rat	0.66	1.29	---	---	---
Silver	2	Rat	17.8[g]	34.8	---	---	---
Organic							
Methylene chloride	---	Rat	5.85	11.4	---	---	---
Toluene	200	Mouse	26	27.5	---	---	---
bis(2-ethylhexyl)phthalate	---	Mouse	18.3	19.4	Ringed dove	1.1	1.1

[a]In milligrams per kilogram soil.
[b]From Efroymson et al. (1997).
[c]Body weights (in kilogram[s]) for the no-observed-adverse-effect level (NOAEL) conversion are as follows: laboratory rat, 0.35; laboratory mouse, 0.03.
[d]From Sample et al. (1996), except where noted.
[e]In milligrams 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 a rat lowest-observed-adverse-effect level of 89 mg/kg/d (EPA 1998a) and an uncertainty factor of 0.2.

mg/kg/d = Milligram(s) per kilogram day.
SWMU = Solid Waste Management Unit.
--- = Insufficient toxicity data.

Table 16
Hazard Quotients for Ecological Receptors at SWMU 65C

Constituent of Potential Ecological Concern	Plant HQ	Deer Mouse HQ (Herbivorous)	Deer Mouse HQ (Omnivorous)	Deer Mouse HQ (Insectivorous)	Burrowing Owl HQ
Inorganic					
Beryllium	7.6E-2	2.8E-3	4.8E-2	9.4E-2	---
Silver	1.8E-1	1.6E-3	1.0E-3	4.3E-4	---
Organic					
Methylene chloride	---	4.8E-4	7.4E-4	9.9E-4	---
Toluene	1.8E-5	2.0E-5	1.9E-4	3.6E-4	---
bis(2-ethylhexyl)phthalate	---	1.2E-5	8.6E-3	1.7E-2	4.4E-1
HI[a]	2.6E-1	4.9E-3	5.9E-2	1.1E-1	4.4E-1

[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.

Table 17
Internal and External Dose Rates for
Deer Mice Exposed to Radionuclides at SWMU 65C

Radionuclide	Maximum Concentration (pCi/g)	Internal Dose (rad/day)	External Dose (rad/day)	Total Dose (rad/day)
U-235	2.8E-1[a]	3.0E-6	4.5E-6	7.5E-6
U-238	3.8E+0[a]	3.8E-5	7.6E-6	4.6E-5
Total		4.1E-5	1.2E-5	5.3E-5

[a]Analyte not detected. Concentration is the minimum detectable activity.
pCi/g = Picocurie(s) per gram.
rad/day = Rad per day.
SWMU = Solid Waste Management Unit.

Table 18
Internal and External Dose Rates for
Burrowing Owls Exposed to Radionuclides at SWMU 65C

Radionuclide	Maximum Concentration (pCi/g)	Internal Dose (rad/day)	External Dose (rad/day)	Total Dose (rad/day)
U-235	2.8E-1[a]	1.2E-6	4.5E-6	5.7E-6
U-238	3.8E+0[a]	1.5E-5	7.6E-6	2.3E-5
Total		1.7E-5	1.2E-5	2.9E-5

[a]Analyte not detected. Concentration is the minimum detectable activity.
pCi/g = Picocurie(s) per gram.
rad/day = Rad per day.
SWMU = Solid Waste Management Unit.

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 Program (IT July 1998).

Uncertainties associated with the estimation of risk to ecological receptors following exposure to uranium-235 and uranium-238 are primarily related to those inherent in the radionuclide-specific data. The dose rates are based upon the minimum detectable activities for these radionuclides, which exceeded the background activity screening value. The dose rate models used for these calculations are based upon conservative estimates of receptor shape, radiation absorption by body tissues, and intake parameters. The goal is to provide a realistic but conservative estimate of a receptor's exposure to radionuclides in soil, both internally and externally.

Although HQs for the burrowing owl could not be determined for four of the five COPECs at SWMU 65C, it is highly unlikely that the toxicity of beryllium, silver, methylene chloride, or toluene would be at a level required to produce an HQ greater than unity in the owl. This is based upon the observations that the exposure rates (in mg/kg/day) for these COPECs were approximately 66, 48, 1100, and 1200 times greater (respectively) in the deer mouse than in the burrowing owl and that the maximum HQs for these COPECs in the deer mouse were 9.4E-2, 1.6E-3, 9.9E-4, and 3.6E-4 (respectively). Therefore, the toxicities of beryllium and silver would have to be approximately 700 and 30,000 times higher (respectively) in birds than in mammals to produce HQs greater than unity for the burrowing owl. For methylene chloride and toluene, these factors would be greater than a million. In addition, these values are conservatively based upon the assumption of an area use factor of 1.0 for the burrowing owl. Because the home range of the burrowing owl is approximately 27 times larger than the area of SWMU 65C, increasing these differences in avian and mammalian toxicities by an additional factor of 27 would be justified. Therefore, to produce an HQ greater than unity in the burrowing owl, the toxicity of beryllium (the worst case among these four COPECs) would have to be more than 18,000 times higher for the burrowing owl than for the deer mouse (i.e., the toxicity benchmark for the burrowing owl would have to be 5.4E-5 times that of the deer mouse). Most avian toxicity benchmarks are within a range of 0.01 to 100 times the corresponding mammalian toxicity benchmark.

Based upon this uncertainty analysis, the probability that ecological risks exist at SWMU 65C is expected to be extremely low.

VII.3.6 Risk Interpretation

Ecological risks associated with SWMU 65C were estimated through a screening assessment that incorporated site-specific information when available. No risks (as indicated by HQ and HI values exceeding unity) were predicted for any of the ecological receptors. Risks are not expected in those cases where HQs could not be determined because of insufficient toxicity information. Based upon this final analysis, the probability that ecological risk exists from COPEC exposure at SWMU 65C is extremely low.

VII.3.7 Screening Assessment Scientific/Management Decision Point

Once potential ecological risks associated with the site have been assessed, a decision is made as to whether the site should be recommended for NFA or whether additional data should be collected to provide a more thorough assessment of actual ecological risk at the site. With respect to this site, ecological risks were 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 (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.

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

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

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 (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) for noncarcinogenic compounds (= ED x 365 day/yr)	25550[a] 9125	25550[a] 10950	25550[a] 10950
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)	5000[a,b]	260[d]	7000[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 (L/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

***The exposure frequencies for the land-use scenarios are often integrated into the overall contact rate for specific exposure pathways. When not included, the exposure frequency for the industrial land-use scenario is 8 hr/day for 250 day/yr; for the recreational land use, a value of 2 hr/wk for 52 wk/yr is used (EPA 1989b); for a residential land use, all contact rates are given per day for 350 day/yr.

[a]RAGS, Vol 1, Part B (EPA 1991).

[b]Exposure Factors Handbook (EPA 1989b)

[c]EPA Region VI guidance.

[d]For radionuclides, RESRAD (ANL 1993) is used for human health risk calculations; default parameters are consistent with RESRAD guidance.

[e]Dermal Exposure Assessment (EPA 1992).

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