4-1-2000

Justification for Class III Permit Modification April 2000, ER Site 81C, Former Burial Location, New Aerial Cable Site, Operable Unit 1333

Sandia National Laboratories/NM

Sandia National Laboratories

Justification for Class III Permit Modification

April 2000

ER Site 81C
Former Burial Location,
New Aerial Cable Site
Operable Unit 1333

NFA Originally Submitted May 19, 1999

Environmental Restoration Project

United States Department of Energy
Albuquerque Operations Office

Justification for Class III Permit Modification

April 2000

Solid Waste Management Unit 81C
Operable Unit 1333
Round 12

(RCRA Permit No. NM5890110518)

NFA Originally Submitted May 19, 1999

NFA

Justification for
Class III Permit Modification

April 2000

Solid Waste Management Unit 81C
Operable Unit 1333
Round 12

NFA Originally Submitted May 19, 1999

3.0 SOLID WASTE MANAGEMENT UNIT 81C: FORMER BURIAL LOCATION

3.1 Summary

Sandia National Laboratories/New Mexico (SNL/NM) is proposing a risk-based no further action (NFA) decision for Solid Waste Management Unit (SWMU) 81C, Former Burial Location, Operable Unit (OU) 1333. SWMU 81C lies in a depression on the south side of the sled track (SWMU 81A) at the New Aerial Cable Facility (Figure 3.1-1). The actual boundary of SWMU 81C extends further to the east than was originally believed. In addition, based on a request from NMED, two areas north of the sled track were also investigated. Debris from testing activities at SWMU 81A was deposited and partially buried in and around a very steep arroyo at the site since testing began around 1970. Most of this debris was removed in 1987 or 1988. Following this removal action, spent material was no longer disposed of at SWMU 81C. This NFA addresses possible releases from the buried debris. Review and analysis of all relevant data for SWMU 81C indicate that concentrations of constituents of concern (COC) at this site are below applicable risk assessment action levels. Thus, SWMU 81C is proposed for an NFA decision based upon confirmatory sampling data demonstrating that COCs that may have been released from the SWMU into the environment pose an acceptable level of risk under current and projected future land uses as set forth by Criterion 5, which states, "The SWMU/AOC [area of concern] has been characterized or remediated in accordance with current applicable state or federal regulations, and the available data indicate that contaminants pose an acceptable level of risk under current and projected future land use" (NMED March 1998).

3.2 Description and Operational History

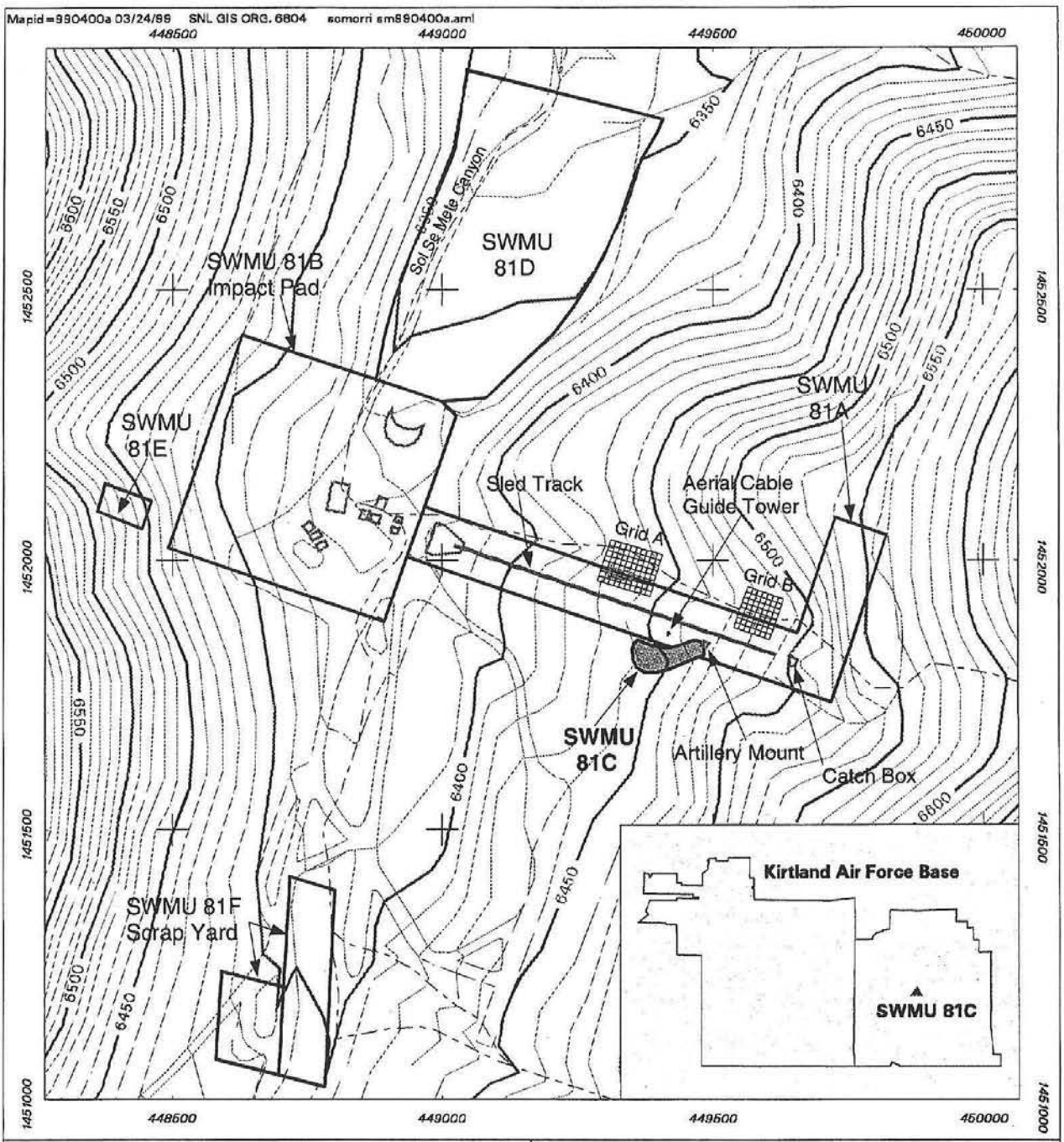
Section 3.2 describes SWMU 81C and discusses its operational history.

3.2.1 Site Description

SWMU 81C is a subunit of SWMU 81, identified as the New Aerial Cable Facility on the Resource Conservation and Recovery Act (RCRA) Hazardous and Solid Waste Amendments (HSWA) permit. SWMU 81C is located on U.S. Air Force (USAF) land withdrawn from the Bureau of Land Management (BLM) and permitted to the U.S. Department of Energy (DOE). The site is located on a western sloping hillside on the east side of the Sol se Mete Canyon at an elevation of approximately 6,450 feet above sea level. The Sol se Mete Canyon drains to the north into the Lurance Canyon, which in turn drains to the west into the Arroyo del Coyote. Coyote Springs Road follows the drainage of the Lurance Canyon and is the main access to the service road in the Sol se Mete Canyon (Figure 3.2.1-1). SWMU 81C is an inactive subunit in an east-west trending shallow former watercourse located south of the active sled track (SWMU 81A) (Figure 3.2.1-2 and Figure 3.2.1-3). In addition to the historical boundary of the former burial location, two areas north of the sled track were also investigated with SWMU 81C, as requested by NMED.

Testing activities at the New Aerial Cable Facility included gravitational accelerated (drop) tests and rocket sled pull-down tests. The rocket pull-down technique uses rocket sleds to accelerate towing cables attached to the test items. The test items are released from the overhead cable as the rockets are ignited and directed toward a target located on the canyon floor.

This page intentionally left blank.



Legend

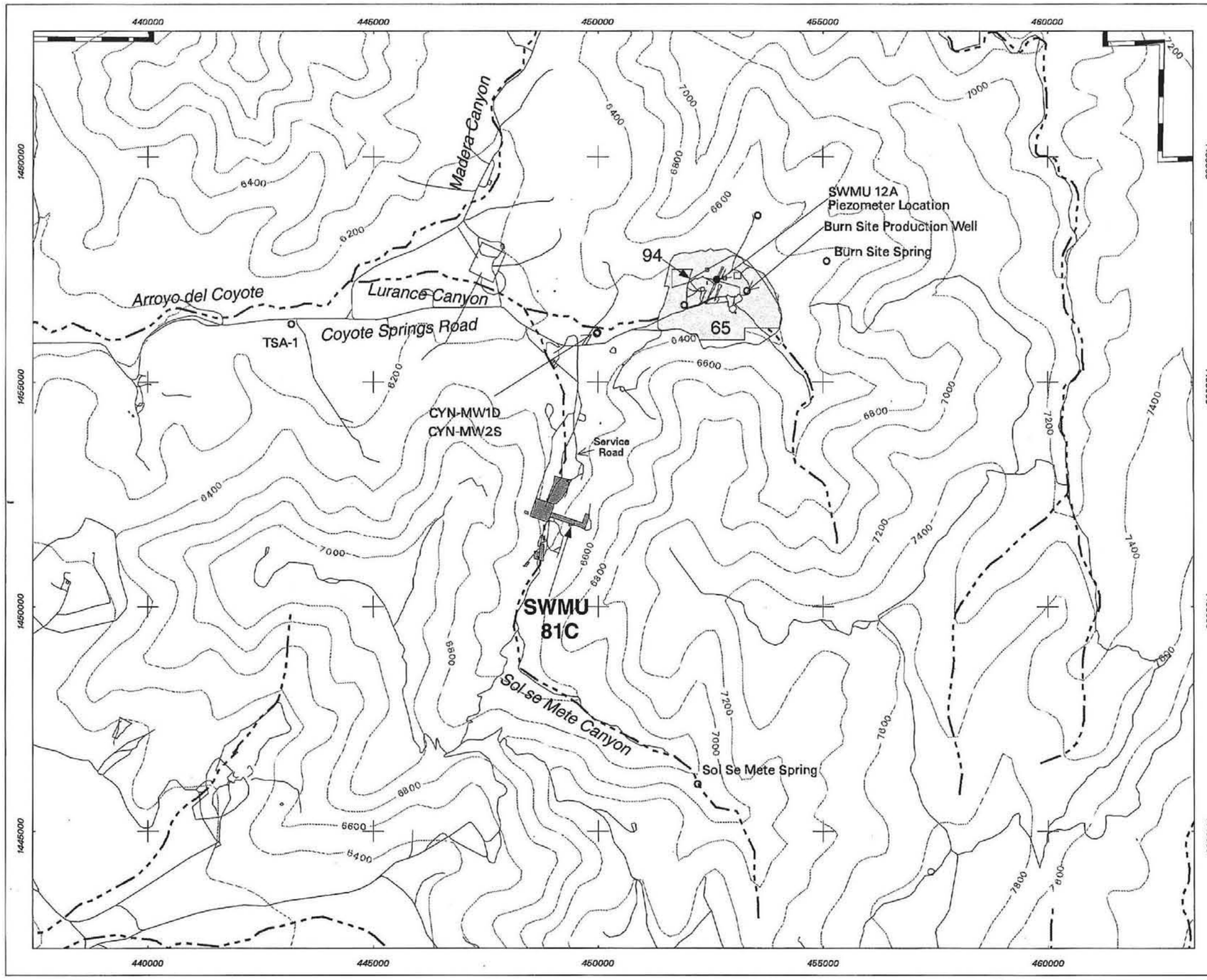
- Road
- 10 Foot Contour (Intermediate)
- 50 Foot Contour (Index)
- Surface Drainage
- Sample Grid Line
- Structure
- Other SWMU
- SWMU 81C

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

0 150 300
Scale in Feet

0 36 72
Scale in Meters

N



Legend

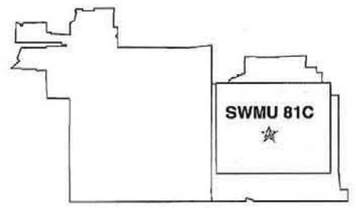
- Well/Spring
- Piezometer Location
- Surface-Water Features
- Road
- Kirtland Air Force Base Boundary
- 200 Foot Contour Interval
- SWMUs 94 & 65 Burn Site
- SWMU 81

0 2400 4800

Scale in Feet

0 576 1152

Scale in Meters



Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Figure 3.2.1-1
Location of SWMU 81C
within Operable Unit 1333

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

	1:28800	MAPID=990512a
Unclassified		SNL GIS ORG. 6804
DRizor	dr990512a.aml	03/24/99

Figure 3.2.1-2
Photograph (looking west) of Lower Section of SWMU 81C

Figure 3.2.1-3
Photograph (looking east) of Upper Section of SWMU 81C

Historical published information regarding the hydrogeology of the Sol se Mete and the Lurance Canyons was summarized in the "RCRA Facility Investigation (RFI) Work Plan for Operable Unit 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 wells have supported the hydrologic model of semiconfined to confined groundwater conditions.

A groundwater monitoring well nest was installed in November and December 1997 approximately 4,350 feet north of SWMU 81C (Figure 3.2.1-1). The groundwater wells were installed in conformance with the documents of understanding between SNL/NM and the NMED OB (SNL/NM July 1997, SNL/NM September 1997). The monitoring 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 fractured Manzanita Gneiss. No water was encountered while drilling activities were conducted in the alluvium, and no water has been recorded at CYN-M2S 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 Production Well.

In summary, based upon data from the nearby Lurance Canyon wells, the groundwater beneath the floor of the Sol se Mete Canyon occurs under semiconfined to confined conditions in fractured metamorphic rock.

For a detailed discussion regarding the local setting at SWMU 81C, refer to the RFI Work Plan for OU 1333 (SNL/NM September 1995). This discussion includes details on the history of the other subunits of SWMU 81 as well as conceptual models and proposed sampling plans.

3.2.2 Operational History

SWMU 81, identified as the New Aerial Cable Site/Burial Site/Dump/Test Area in the HSWA Module, is located on USAF land withdrawn from the BLM and permitted to the DOE (SNL/NM July 1994a). SWMU 81 consists of six subunits (SWMU 81A: New Aerial Cable Site: Catcher Box/Sled Track; SWMU 81B: New Aerial Cable Site: Impact Pad; SWMU 81C: New Aerial Cable Site: Former Burial Location; SWMU 81D: New Aerial Cable Site: Northern Cable Area; SWMU 81E: New Aerial Cable Site: Gun Impact Area; and SWMU 81F: New Aerial Cable Site: Scrap Yard) (Refer to Figure 3.1-1). Construction of the New Aerial Cable Site began in 1970 in response to the need to upgrade the aerial cable facilities that existed at the Old Aerial Cable Site (SWMU 82) (SNL/NM September 1995). The new aerial cable facilities provide impact testing on weapons and other test units that could be subject to detonation (SNL/NM, September 1995). The initial construction activity at SWMU 81 was at the southern cable area and included the placement of the aerial cable anchors on the ridge crests east and west of the Sol se Mete Canyon.

Comprehensive information on the material buried at SWMU 81C is not available. Interview records state that solid debris such as cables, wire, and insulation material from past tests could be present in the buried portion of the natural water course (Martz September 1985, November 1985). Additional debris includes wood, sandbags, weapons casings, camera stands, mirrors,

and high explosive (HE) residue. Interviews state that it was a common practice to push vegetation and soil into nearby arroyos when clearing areas for testing. Wire, cable, and metal debris were observed protruding from the graded surface overlying the buried watercourse.

Specific wastes and volumes of waste disposed of at SWMU 81C are unknown, but all wastes disposed of at the site were reportedly buried (EPA April 1987). Materials disposed of at the site included old rockets (some possibly containing unburned propellant), sleds (essentially a metal frame to hold the rocket motors), cables, scrap metal, and wood. The RCRA Facility Assessment (RFA) also reported that liquid and solid chemicals were supposedly contained in drums before burial, although these materials have since been removed. Drums of other waste materials were placed directly on the soil in the channel and were buried under a soil cap of unknown thickness (EPA April 1987).

3.3 Land Use

This section discusses the current and future land use for SWMU 81C.

3.3.1 Current Land Use

SWMU 81C is located within the boundaries of Kirtland Air Force Base (KAFB) (refer to Figure 3.1-1) within the active industrial New Aerial Cable Facility.

3.3.2 Future/Proposed Land Use

The projected land use for SWMU 81C is recreational (DOE et al. October 1995).

3.4 Investigatory Activities

SWMU 81C has been investigated in a series of four investigations. This section discusses the SWMU 81C investigatory activities.

3.4.1 Summary

SWMU 81C was originally 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 were conducted that included background information reviews, interviews, field surveys, and scoping sampling (Investigation #2). In 1998 a passive soil vapor survey (SVS) and geophysical surveys were conducted to help define the scope of a proposed voluntary corrective measure (VCM) (Investigation #3). Also in 1998, a VCM was conducted to remove remaining buried debris (Investigation #4).

3.4.2 Investigation #1—CEARP

3.4.2.1 Nonsampling Data Collection

SWMU 81 was evaluated during investigations conducted under the CEARP (DOE September 1987) and the RFA (EPA April 1987). The CEARP Phase I report states that debris from testing operations was deposited and partially buried in the arroyo on the south side of the sled track (SWMU 81C). Materials included old rockets (some possibly containing unburned propellant), sleds, cables, scrap metal, and wood.

The RFA report noted that information pertaining to construction, specific wastes, and volumes of waste disposed of at SWMU 81C is not available, but all wastes disposed of at the site were reportedly buried (EPA April 1987). During the visual site inspection, no wastes were observed on the ground surface. No records regarding waste disposal at this site were found during the RFA and CEARP investigations.

3.4.2.2 Sampling Data Collection

No sampling activities were conducted at SWMU 81C as part of the CEARP or RFA.

3.4.2.3 Data Gaps

The calculated Hazard Ranking System (HRS) and Modified HRS migration scores were zero (no surface-water or groundwater use within 3 miles).

3.4.2.4 Results and Conclusions

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

3.4.3 Investigation #2—SNL/NM ER Preliminary Investigations (SNL/NM ER)

3.4.3.1 SNL/NM ER Nonsampling Data Collection

This section describes the nonsampling data collected at SWMU 81C.

3.4.3.1.1 Background Review

A background review was conducted in order to gain available and relevant information regarding SWMU 81C. Background information sources included interviews with SNL/NM staff and contractors familiar with the site's operational history and reviews of existing historical site records and reports. The study was documented completely and has provided traceable references that sustain the integrity of the NFA proposal. Table 3.4.3-1 lists the information sources that were used to assist in evaluating SWMU 81C.

3.4.3.1.2 UXO/HE Survey

In December 1993, KAFB Explosive Ordnance Disposal personnel conducted a visual survey for the presence of unexploded ordnance (UXO) on the ground surface at SWMU 81. The live ordnance found and removed in June 1994 included two experimental flares near the sled track. Ordnance debris at the site included several hundred spent rocket motors and rocket parts. These spent rocket motors have since been removed from the site.

Table 3.4.3-1
Summary of Background Information Review for SWMU 81C

Information Source	Reference
Technical test reports and project log books	Bickel September 1980
Site inspections (field notes, aerial photograph review, site photographs, radiological, UXO/HE, biological, and cultural resource surveys)	SNL/NM April 1985 SNL/NM August 1994 Sullivan August 1994 DOE March 1996
Employee interviews, 3 interviews with 2 facility personnel (current and retired)	Martz September 1985 Martz November 1985 Palmieri May 1992

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

3.4.3.1.3 Radiological Survey(s)

SNL/NM Radiation Protection Office (RPO) has historically performed surveys after impact tests were conducted at SWMU 81 and has found no radioactive material. In April and May 1993, SNL/NM RPO performed a radiation survey of the service road that passes through SWMU 81. The survey consisted of driving the road, performing periodic contamination surveys of the vehicles, and collecting air samples from behind the vehicle. No contamination was detected in the dust kicked up by the vehicle.

SNL/NM RPO conducted a surface gamma radiation survey in January 1994 that included a survey of debris and shrapnel at the site. No anomalies were found in the impact area and no contamination was detected on the debris. One metal fragment, high in natural thorium series, was found buried 2 to 3 inches deep. The metal was of unknown origin. The metal fragment was removed for analysis, effectively decontaminating the area.

In March 1994, RUST Geotech Inc. conducted a surface gamma radiation survey of SWMU 81. The background gamma exposure rates ranged from 9 to 13 microroentgens per hour (μR/hr). Four areas of gamma activity greater than 30 percent above natural background levels were identified. All four anomalies were attributed to outcrops of bedrock. The outcrops exhibited no visible evidence of depleted uranium (DU). The elevated readings are consistent with outcrops

of similar appearance found on other SWMUs and appear to be a natural characteristic of the rock and soil in the area.

Based upon the historical use of DU at SWMU 81, the site had been classified as a radioactive material management area (RMMA). However, based upon the results of the radiological surveys, described above, the site was removed from RMMA status in April 1998 (Vigil April 1998).

3.4.3.1.4 Cultural-Resources Survey

A cultural-resources survey of SWMU 81 was conducted. No cultural resources were found during this survey (DOE March 1996).

3.4.3.1.5 Sensitive-Species Survey

A sensitive-species survey and biological field investigation of SWMU 81 and surrounding support facilities was conducted in September and October 1991. No threatened, endangered, or sensitive species of plants were found at SWMU 81 (Sullivan August 1994).

3.4.3.2 Sampling Data Collection

In July 1995, SWMU 81C was investigated as part of a sitewide scoping sampling program. The purpose of this effort was to obtain preliminary analytical data to support the ER Project site ranking and prioritization. Two sampling locations were selected within the boundary of SWMU 81C. A surface (0 to 6 inches) and a subsurface (6 inches to 1.5 foot) sample were collected at each location. The SNL/NM ER Chemistry Laboratory (ERCL) analyzed the four environmental samples for RCRA metals (plus beryllium) using modified EPA Method 6010 (EPA November 1986) and HE using high performance liquid chromatography (HPLC).

3.4.3.3 Data Gaps

Information gathered from process knowledge, from reviewing historical site files, and from personal interviews aided in identifying the most likely COCs at SWMU 81C 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.

3.4.3.4 Results and Conclusions

Only barium, chromium, and lead were detected in the soil samples. Three of the four barium concentrations were below the background limit of 246 milligrams (mg)/kilogram (kg). Chromium was detected in three of the four samples. Two of the concentrations were estimated; one was above the background concentration limit of 18.8 mg/kg at a concentration of 20 J mg/kg. Lead concentrations were all estimated and ranged between 15 J and 50 J mg/kg, with three of the four exceeding the background concentration limit of 18.9 mg/kg. Arsenic, cadmium, mercury, selenium, and silver were not detected; however, the method

detection limits (MDL) ranged from 0.2 to 50 mg/kg (for mercury and for arsenic and selenium, respectively). 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.

3.4.4 Investigation #3—Preliminary Scoping and Assessment for VCM

3.4.4.1 Scoping and Assessment Nonsampling Data Collection

Geophysical Survey(s)

In March 1998, electromagnetic (EM) surface geophysical surveys were conducted over SWMU 81C (Figure 3.4.4-1 Grid C) and two other small areas on the north side of the sled track (Figure 3.4.4-1 Grids A and B). After the initial processing of the data, additional qualitative surveys were conducted in April 1998 to evaluate the anomalies observed in relation to observable features at the surface. The surveys were designed to detect and delineate buried metallic material disposed of at the site. Figure 3.4.4-1 shows the location of the survey grids. A transit and tape were used to establish all survey grids in the field. The grids consisted of parallel northeast-southwest traverses separated by 5 feet and were marked in the field with survey stakes and plastic stemmed pin flags. The detection depth for significant buried metal (e.g., a single 55-gallon drum) was approximately 10 feet bgs.

Grid A was located on the north side of the sled track in an area where fill material was placed in a depression to allow placement of a concrete storage pad and completion of an access road from the north to this location. The grid was approximately 40 feet wide by 85 feet long and was centered over the concrete pad.

Grid B was also located on the north side of sled track in an area where fill material was placed in a drainage ravine, creating a level area that was probably used for the staging of equipment and area access. The grid was approximately 50 feet wide by 60 feet long and was centered over the level area.

Two sampling grids were established for Grid C (SWMU 81C) because of a change in topography at the head of a channel in the center of the survey area. The western grid was approximately 25 feet wide by 120 feet long and was centered over the historic former burial area at the base of a ravine. The eastern grid was approximately 20 feet wide by 145 feet long and was centered over the area topographically above and directly east of the former burial area.

Prior to conducting the geophysical surveys, the site was cleared of all surface metal that could be removed without significant digging. A small front-end loader was used to remove large steel cables and heavy pieces of scrap steel. Vegetation was also cleared from the survey grids so that each traverse could be walked accurately and consistently.

A Geonics EM-61 high precision metal locator was used to perform the EM surveys. At the base of the channel in Grid C, which was inaccessible to the EM survey instrumentation, surveys were conducted with qualitative instruments, including a Schonstedt magnetic locator and a Garrett CXII metal detector. EM-61 data were acquired every 0.65 foot along the parallel

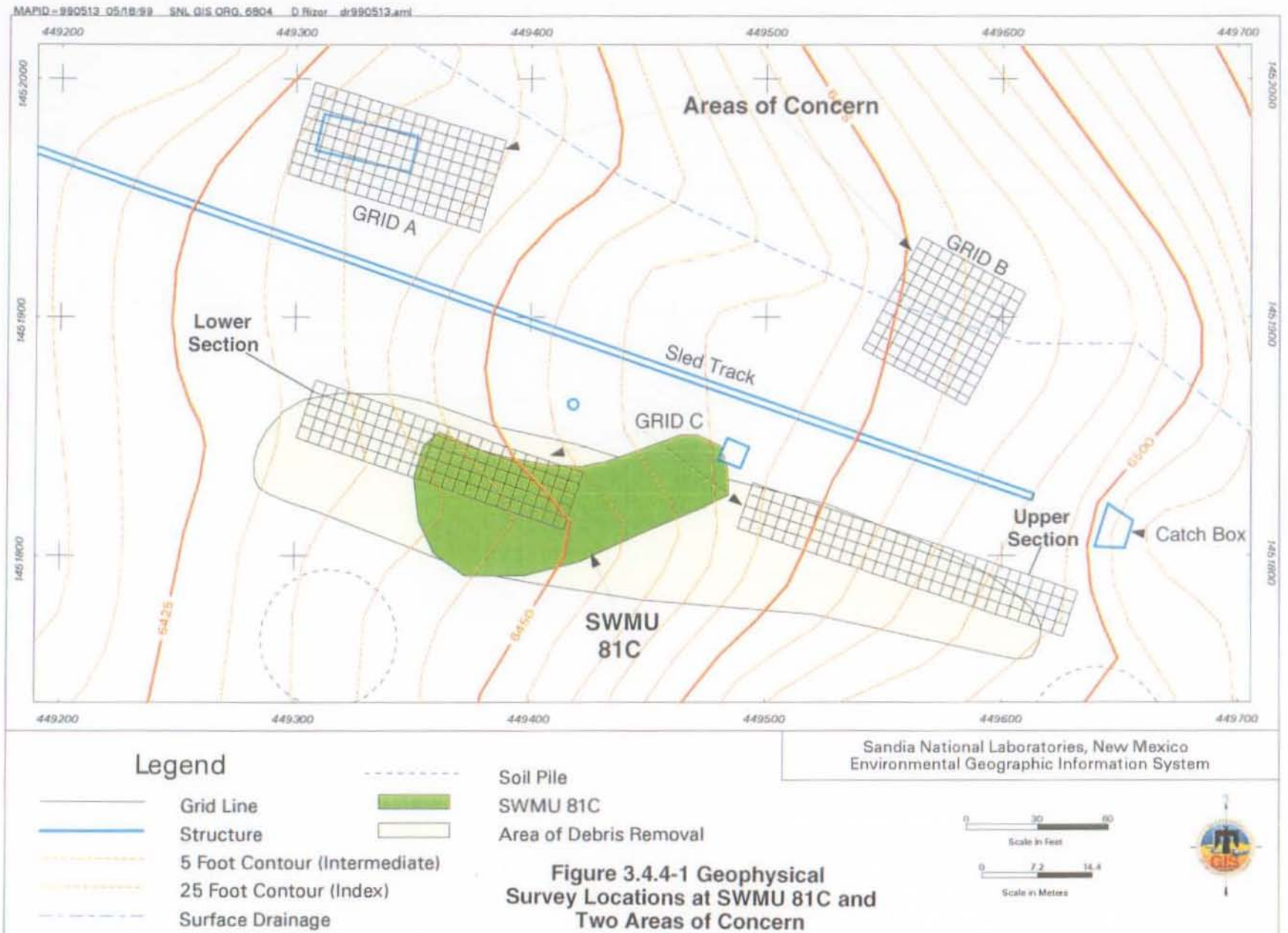


Figure 3.4.4-1 Geophysical Survey Locations at SWMU 81C and Two Areas of Concern

traverses. The data acquisition on each traverse started on a common baseline and extended as far north or south as practical depending upon the terrain. This left one side of each survey with a "ragged" edge.

The EM-61 data were recorded on a data logger and transferred to a personal computer for processing. The DAT 61 program (Geonics Ltd.) was used for data reduction and the Geosoft Mapping and Processing System (Geosoft Inc.) was used for data presentation.

Figure 3.4.4-2 shows the results from the survey over Grid A. Most of the observed response can be attributed to fixtures in a concrete pad or metallic debris uncovered just beneath the ground surface. Only one feature (identified as "?" on Figure 3.4.4-2) of any significant magnitude (>100 mV) that was not explained by a surface source was observed. This feature is small in aerial extent and most likely generated by innocuous debris similar to other debris found at the site. During the VCM a small piece of metal debris was removed from this location.

Figure 3.4.4-3 shows the results from the survey over Grid B. All of the observed response can be attributed to surface objects in the area and no buried subsurface metallic material is suspected in this area.

Figure 3.4.4-4 shows the results from the survey of Grid C. Figure 3.4.4-4 shows both the EM-61 main channel data (all metal) and the EM-61 difference channel data (major concentrations of metal). Both data sets reveal considerable buried material in both the eastern and western portion of the survey area. Within the survey area, a few spent rocket motors and used cables were visible at the surface or partially buried.

The surveys conducted using the qualitative instruments were successful in closing the boundaries of the buried metal in the middle of the survey grids. The approximate extent of some of the buried material is indicated by dashed lines on Figure 3.4.4-4. The eastern extent of the buried material was estimated to be at least 50 feet upslope from the eastern boundary of the survey grid; numerous metallic objects such as cables and spent rocket motors were visible at the surface in this area.

3.4.4.2 Scoping and Assessment Sampling Data Collection

Soil Organic Vapor Survey

A passive soil organic vapor survey was conducted at the site in February and March 1998 to evaluate the potential for organic contamination in the subsurface. The survey was performed over the same area as the surface geophysical surveys, although the SVS was conducted first. Samplers consisted of a cord-like hydrophobic fabric approximately 4 feet long that contained four 40 x 3 millimeters GORE-SORBER Passive Sorbent packets. Each packet contains 40 milligrams (mg) of a granular adsorbent material. On March 5 and 6, 1998, the samplers were installed into holes approximately 36 inches deep by 1.5 inches wide that were made with a small hammer drill or soil coring tool. Forty-six samplers including two duplicates were installed as shown in Figure 3.4.4-5. Sample locations were measured off grids (A, B, and C) along parallel traverse lines spaced 10 feet apart. Sample locations were no closer than 20 feet from

This page intentionally left blank.

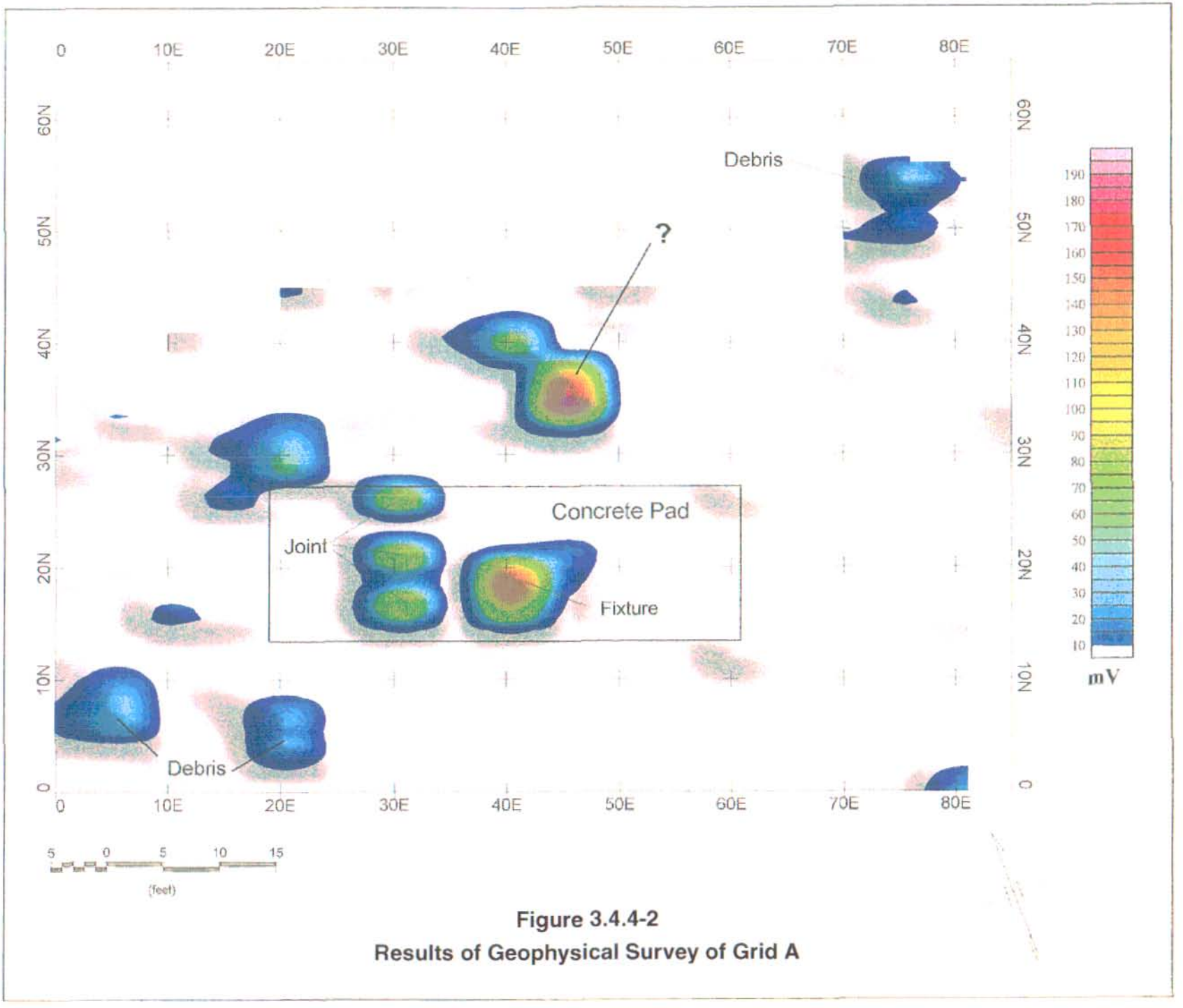


Figure 3.4.4-2
Results of Geophysical Survey of Grid A

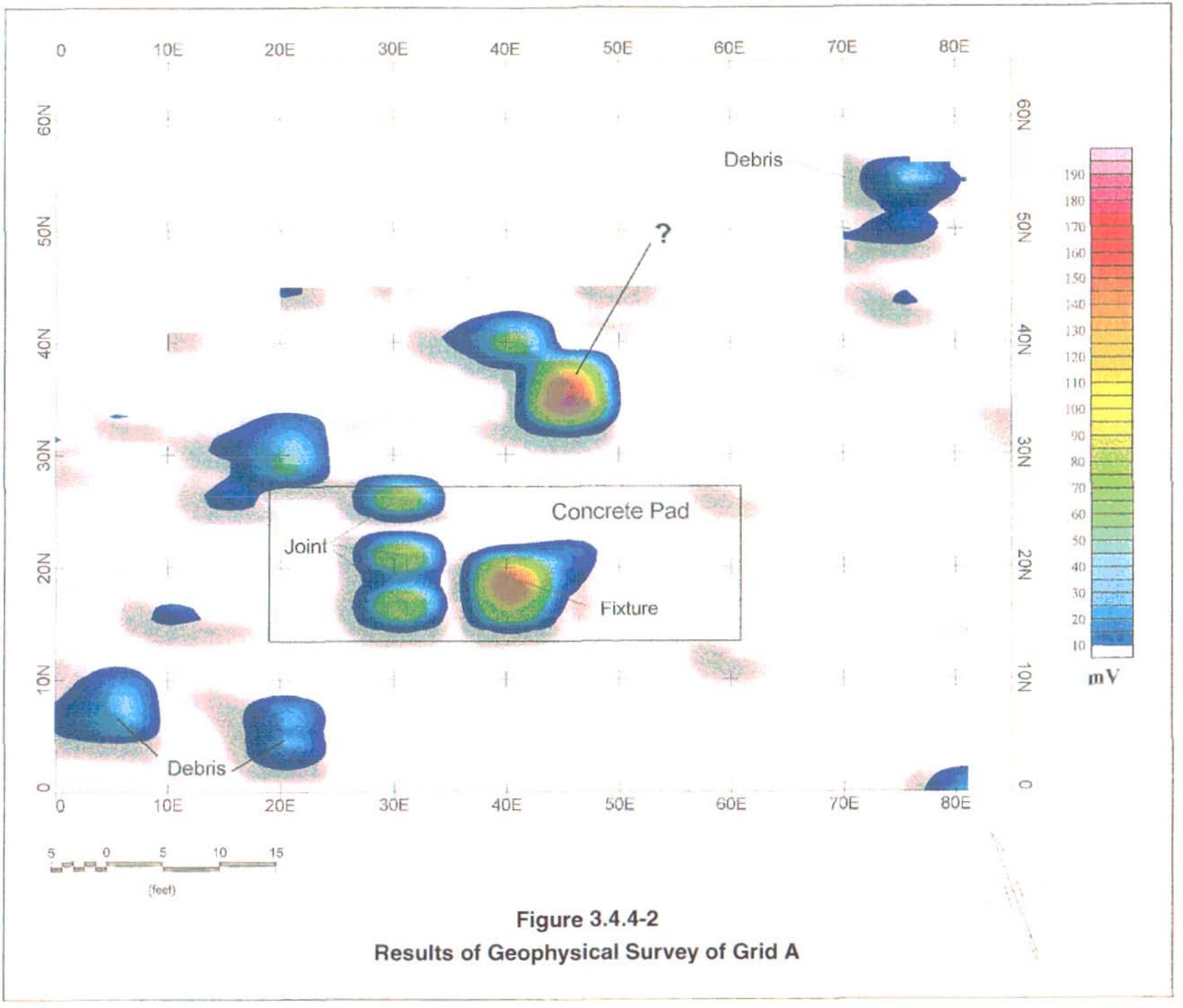


Figure 3.4.4-2
Results of Geophysical Survey of Grid A

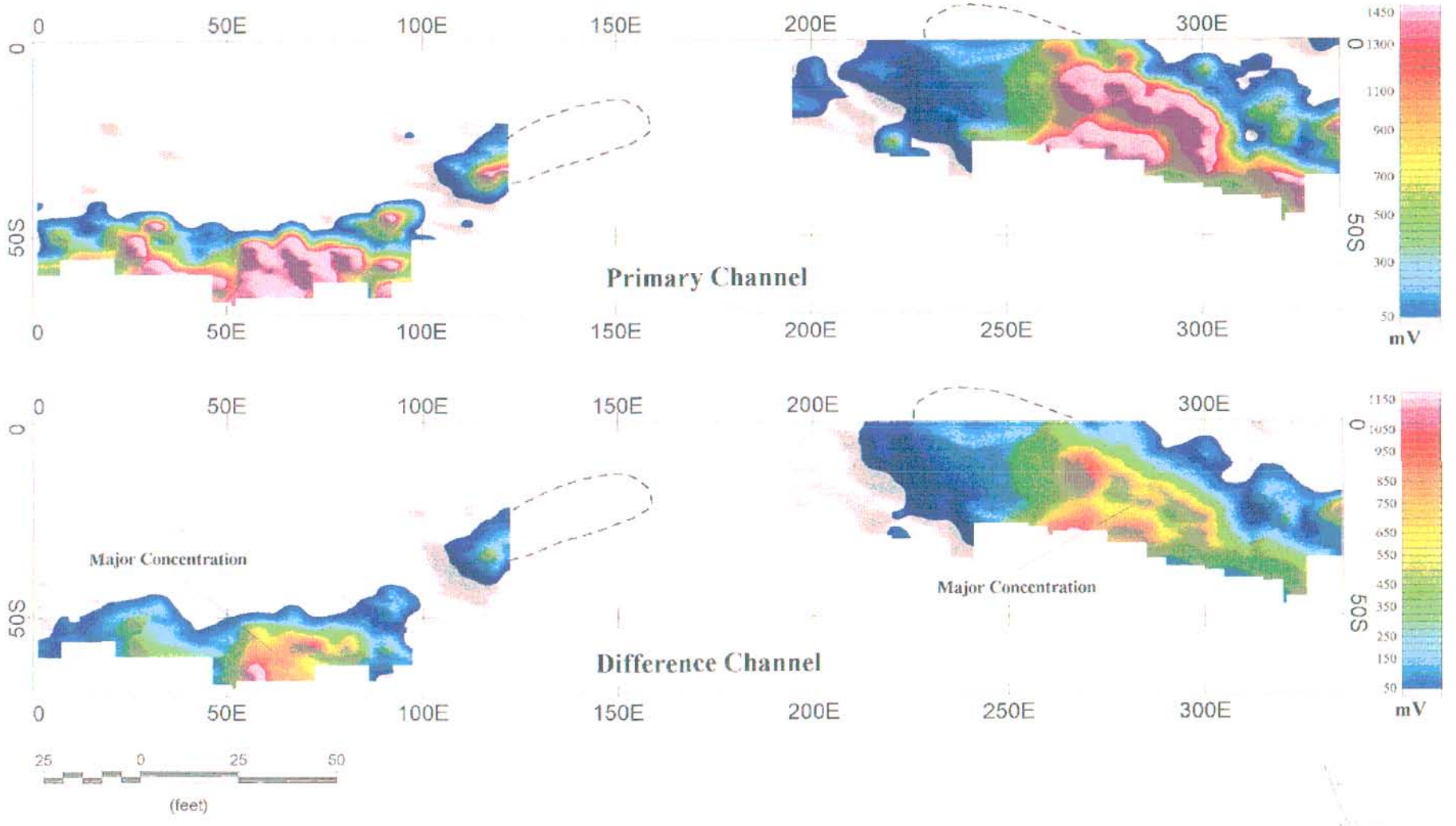


Figure 3.4.4-4
Results of Geophysical Survey of Grid C

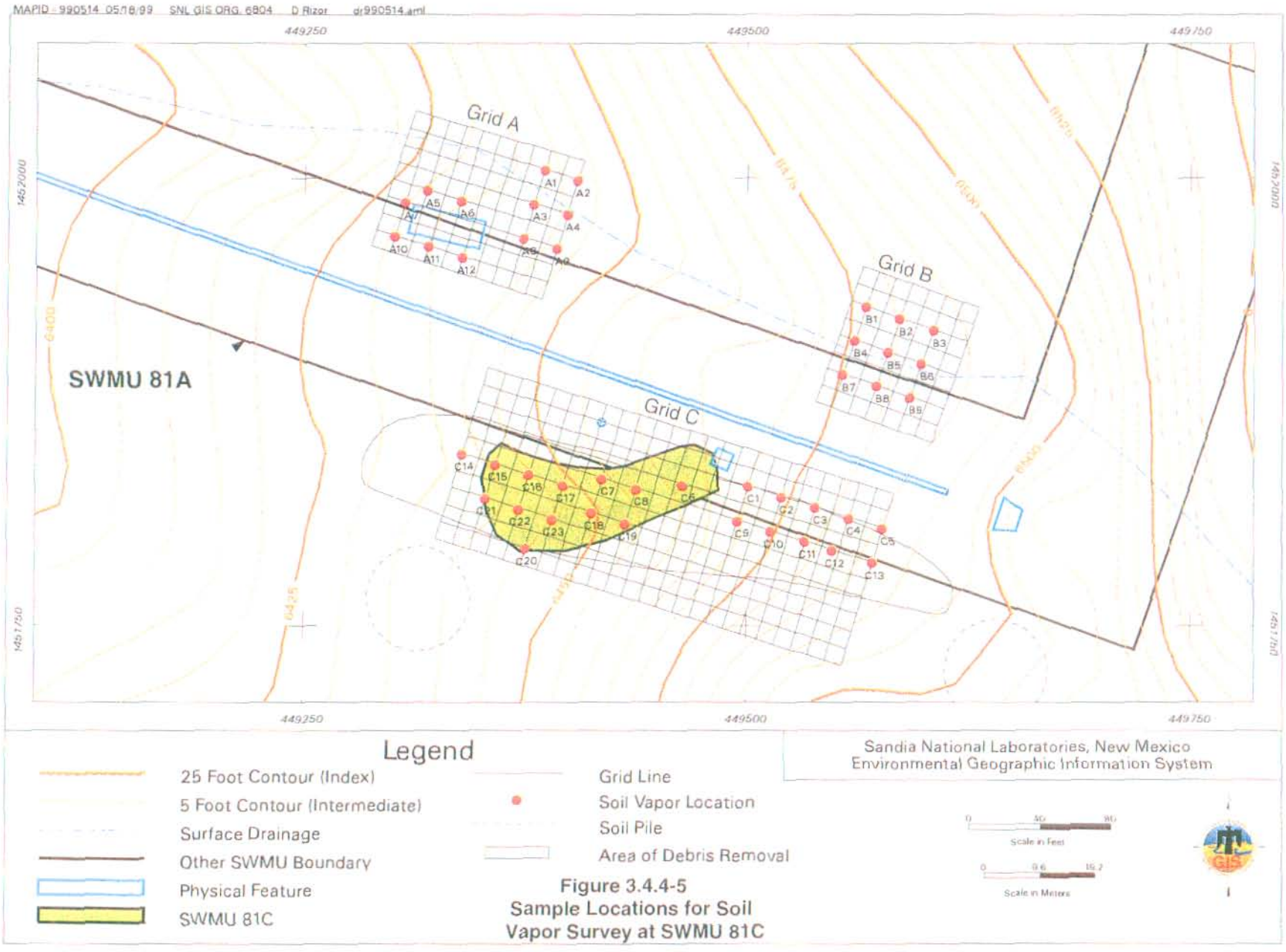


Figure 3.4.4-5
Sample Locations for Soil Vapor Survey at SWMU 81C

the next adjacent point. Two of the 46 locations were background locations south of the Grid C (SWMU 81C) location and are not shown on Figure 3.4.4-5.

On March 20 and 21, 1998, the samplers were removed from the ground and shipped to W. L. Gore & Associates for analytical processing. All samples, including quality assurance (QA)/quality control (QC) trip and method blanks, were analyzed by thermal desorption-gas chromatograph/mass spectrometer for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and HE compounds according to EPA methods modified for vapor analysis (Method 8260A/8270B [EPA November 1986]). All results are in units of micrograms (per sorber) of vapor for all compounds. Annex 3-A includes analytical results for all sample locations and blanks.

The objective of the soil gas survey was to determine whether gross organic compound contamination was present in the subsurface. Although a few compounds were detected at very low ion counts by the survey in these areas, gross organic compound contamination was not detected by the survey. Extremely low levels of organic vapor were detected at a few discrete locations. The majority of the detections were in Grid C, which was excavated as part of the SWMU 81C VCM.

3.4.4.3 Scoping and Assessment Data Gaps

Analytical data derived from the passive SVS were not sufficient to characterize the nature and extent of potential releases of COCs at SWMU 81C.

3.4.4.4 Scoping and Assessment Results and Conclusions

Passive soil vapor sampling and a geophysical survey were sufficient to identify areas of concern at SWMU 81C and to eliminate the two areas north of the sled track (Grids A and B) from further concern but were not sufficient to characterize wastes. Therefore, further investigations were needed to provide complete characterization of possible RCRA wastes.

3.4.5 Investigation #4—SNL/NM ER VCM and Confirmatory Sampling

3.4.5.1 VCM Activities

Between August 17 and October 10, 1998, SNL/NM ER performed VCM activities at SWMU 81C in accordance with the rationale and procedures described in the VCM plan (SNL/NM August 1998). These activities consisted of excavation and physical segregation of debris from the two distinct areas comprising the 0.1-acre former burial location on the south side of the sled track plus approximately 0.4 acre east and west of the site boundary (Figure 3.4.5-1). The work plan called for the removal of the upper 4 feet of soil, but during the excavation process the plan was modified because the debris was buried to depths of up to 12 feet bgs. Site personnel in effect "chased" debris piles to sufficient depth to remove all visible traces of debris at discreet locations. Debris uncovered and removed at SWMU 81C can be grouped into three major categories: 1) rocket motors, 2) steel cable, and 3) miscellaneous metal (both aluminum and ferrous) (Figure 3.4.5-2 and Figure 3.4.5-3).

This page intentionally left blank.

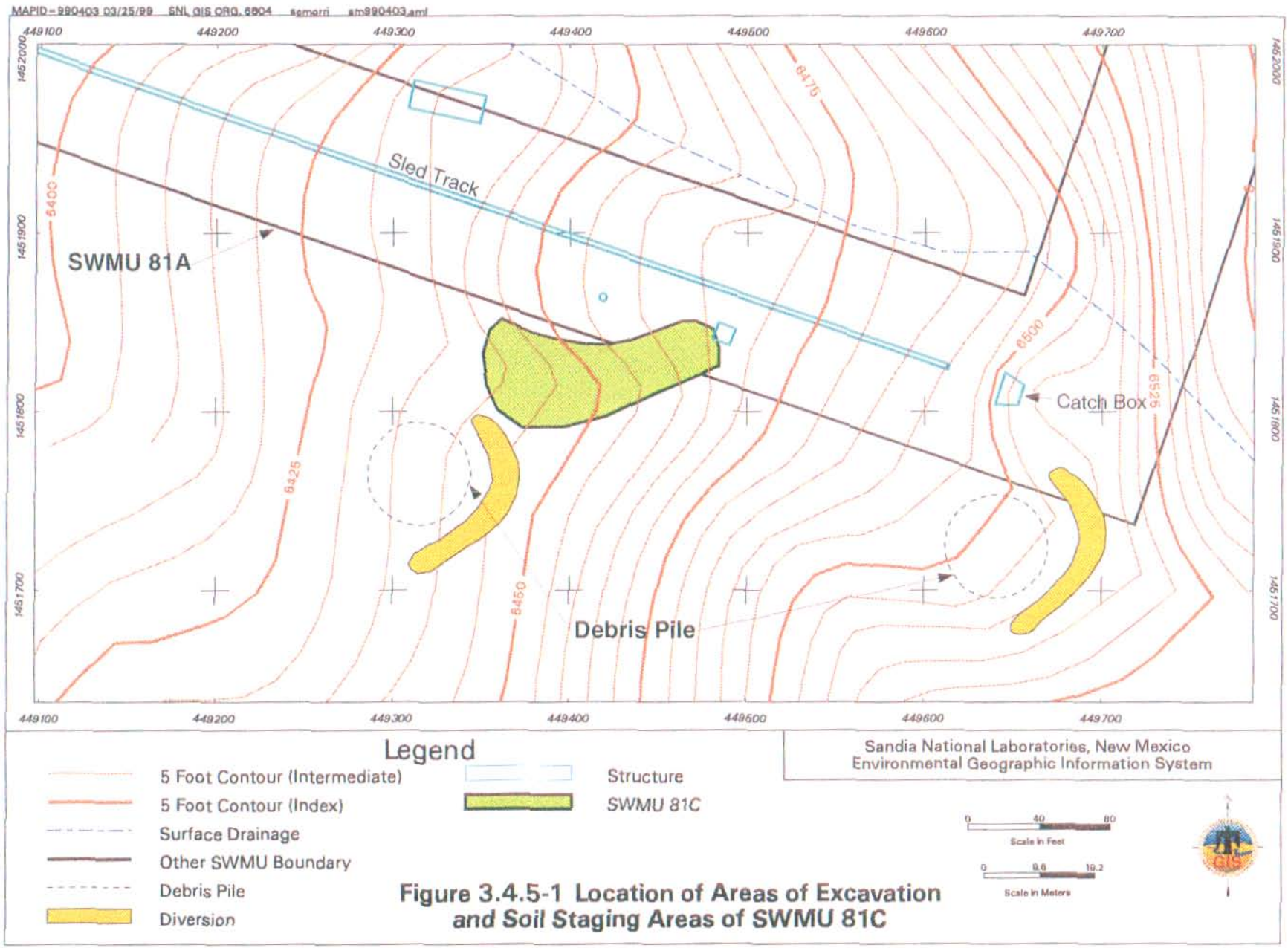


Figure 3.4.5-1 Location of Areas of Excavation and Soil Staging Areas of SWMU 81C

Figure 3.4.5-2
Debris Types at SWMU 81C

Figure 3.4.5-3
Rocket Motors and Debris from SWMU 81C

SWMU 81C was divided into functional lower (Figure 3.4.5-4) and upper (Figure 3.4.5-5) sections because of a natural break in slope. Excavation activities began in the lower section and after the debris from the lower section had been removed, excavation proceeded to the upper section. The upper area proved to be more heavily debris-laden than the lower area. The actual excavation of the soil and debris was accomplished using a track hoe for digging, a front-end loader and dump truck to move the excavated soil, and a crew of technicians to segregate the materials. The bucket of the track hoe held approximately 1 cubic yard of material. After each bucket of material was deposited on the ground site personnel separated the rocket motors from the rest of the debris. The excavated soil was placed in a dump truck and moved to a nearby staging area. After a significant pile of rocket motors and metal debris had accumulated, the technicians loaded the rocket motors and debris into the front-end loader for transport to a staging area. At discrete intervals during the excavation process, a hand-held metal detector was used to survey the excavation to help pinpoint remaining pockets of debris.

Debris and soil from the lower section were initially staged in an area south of the excavation then later the debris was transported to a central staging area. The soil pile generated from the lower section has a volume of approximately 100 cubic yards of soil. Approximately 150 rocket motors were unearthed in the lower section. Soil excavated from the upper section was staged in an area just south of the eastern end of the sled track (SWMU 81A). The soil pile generated from the upper section has a volume of approximately 600 cubic yards. Rocket motors and metal debris from the upper section were moved down the hill to a large staging area in the northern portion of the Sol Se Mete Canyon near SWMU 81B (Figure 3.4.5-6). Approximately 600 rocket motors, 5 tons of steel cable, and 1 ton of metal debris were excavated from the upper section of SWMU 81C.

After completion of the excavation, rocket motors and associated metal debris from the lower section were moved down the hill and combined with debris from the upper section for subsequent recycling.

Following completion of the VCM and receipt of analytical results the excavated soil from the upper section was returned to the excavation. The replacement of this soil was necessary to provide access for fire fighting equipment during current testing activities at the SWMU 81A (Catcher Box/Sled Track).

3.4.5.2 VCM Nonsampling Data Collection

Nonsampling data obtained during the VCM consisted of periodic monitoring of the excavations with a photoionization detector during the excavation process, screening data from a hand-held metal detector, and a second geophysical survey to pinpoint remaining buried debris and to verify remediation goals. This second geophysical survey was conducted on October 1, 1998 in both the upper and lower sections of SWMU 81C. Figures 3.4.5-7 and 3.4.5-8 depict results. After this survey was completed, excavations were performed to extricate the remaining debris and a Garrett CXII metal detector was used to verify removal of the remaining metal debris.

3.4.5.3 VCM Confirmatory Sampling

SNL/NM conducted confirmatory soil sampling at SWMU 81C in September 1998 on the lower section and October 1998 on the upper section to determine whether potential COCs were present at levels exceeding background limits at the site and/or at levels sufficient to pose a risk

This page intentionally left blank.

Figure 3.4.5-4
Lower Section (looking west) of SWMU 81C

Figure 3.4.5-5
Upper Section (looking east) of SWMU 81C

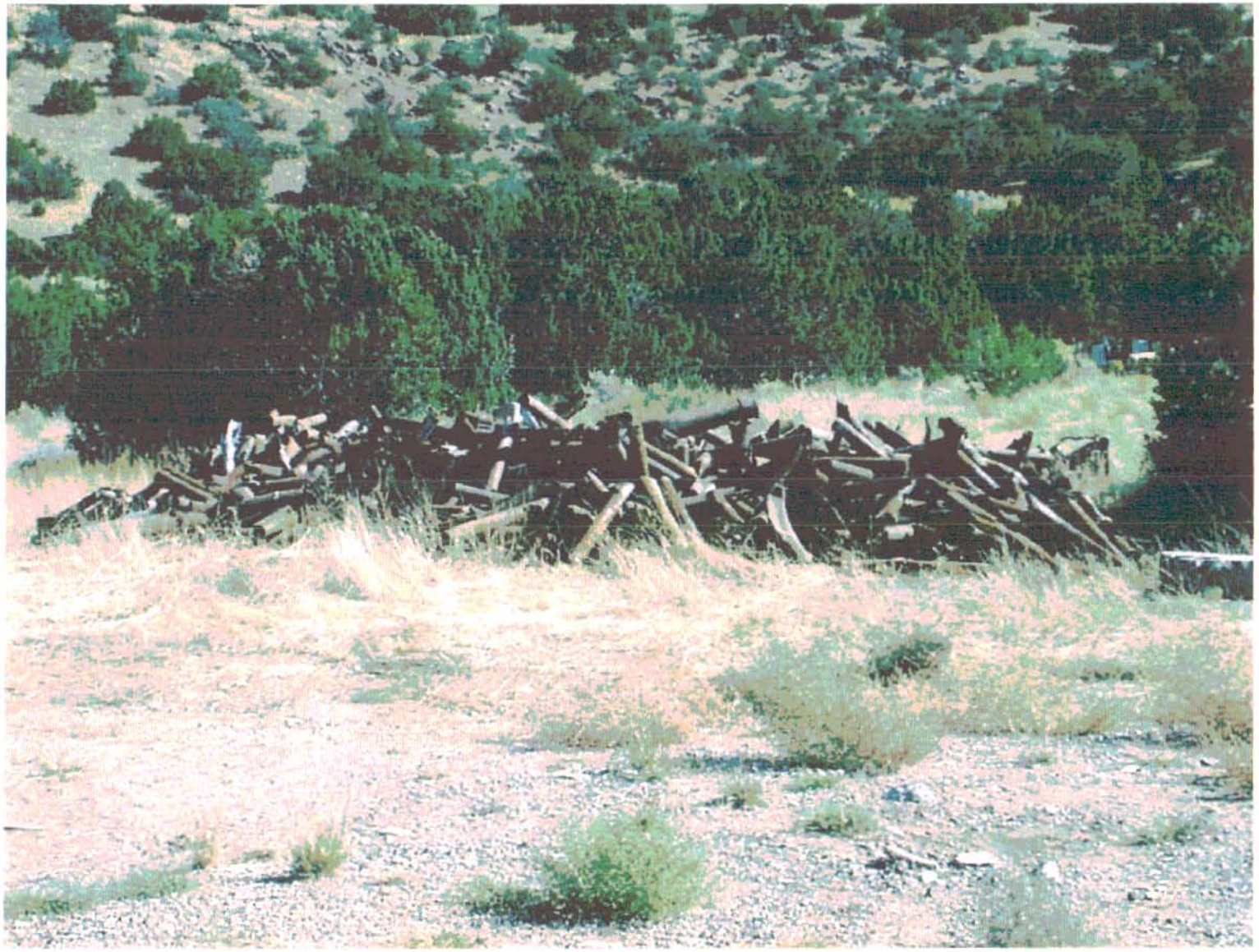


Figure 3.4.5-6
Rocket Motors in Lower Staging Area

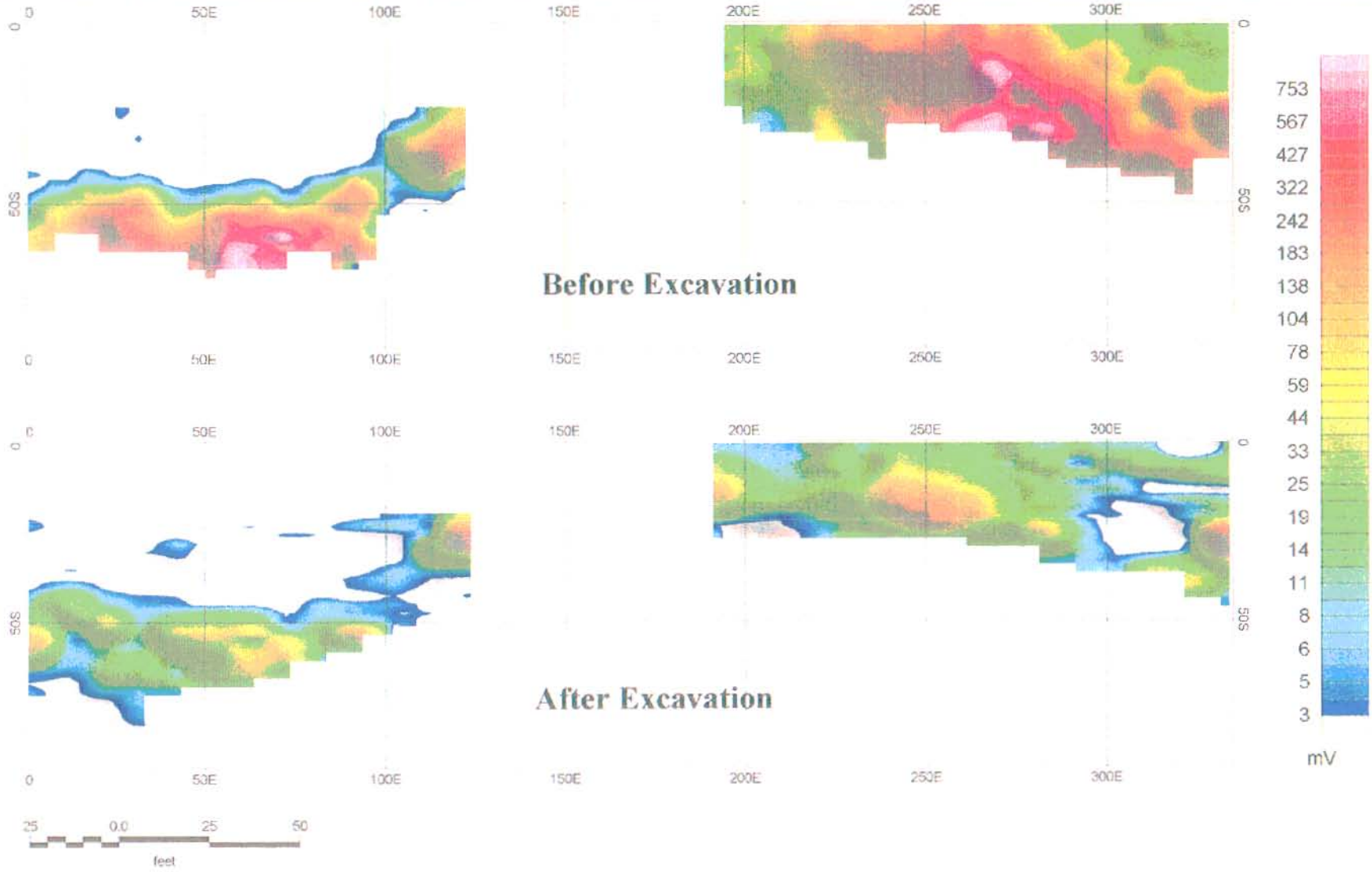


Figure 3.4.5-7
Results of Second Geophysical Survey of SWMU 81C (Difference Channel)

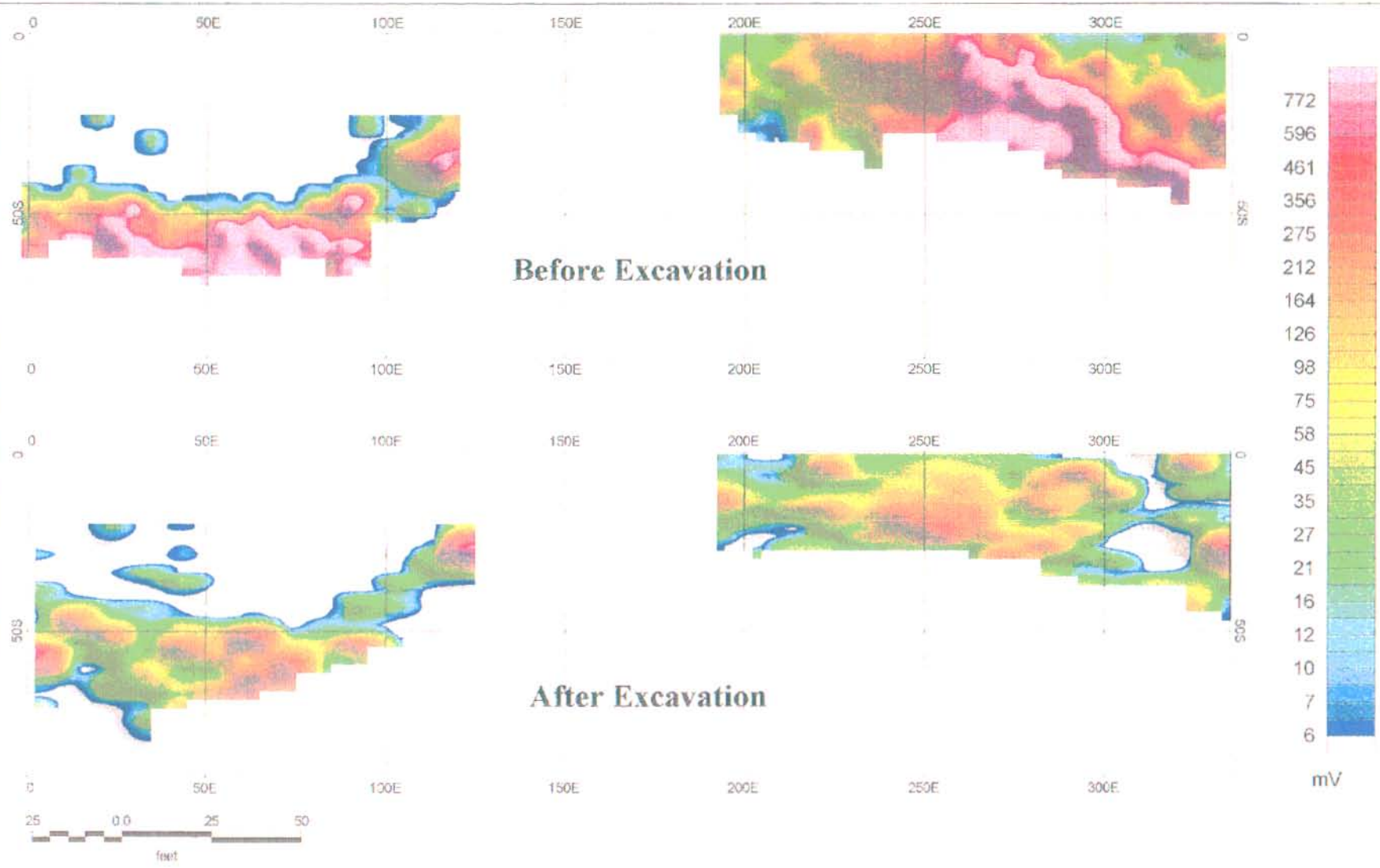


Figure 3.4.5-8
Results of Geophysical Survey of SWMU 81C (Primary Channel)

to human health or the environment. All sampling activities were performed in accordance with the rationale and procedures described in the RFI work plan for OU 1333 (SNL/NM September 1995) and the VCM plan (SNL/NM August 1998). SNL/NM chain-of-custody and sample documentation procedures were followed for all samples that were collected.

After all the debris had been removed, confirmatory soil sampling was performed at both the upper and lower sections of SWMU 81C. A total of 39 soil samples and five duplicate samples were collected from approximately three feet below the bottom of the excavation areas (Figure 3.4.5-9). A three-foot sampling depth was chosen so that the samples were collected from the native soil that was not disturbed by excavation. All soil samples collected in September and October 1998 were analyzed off site for VOCs, SVOCs, metals, HE, and gross alpha and gross beta activity. General Engineering Laboratories of Charleston, South Carolina, analyzed the samples for VOCs using EPA Method 8260 (EPA November 1986), SVOCs using EPA Methods 8270 (EPA November 1986), RCRA metals plus beryllium using EPA Method 6010/7000 (EPA November 1986), HE using EPA Method 8330 (EPA November 1986), and gross alpha and gross beta using EPA Method 900.0 (EPA November 1986). In addition, SNL/NM Department 7713 Radiation Protection Sample Diagnostics [RPSD] Laboratory) also used gamma spectroscopy to analyze the samples on site for radionuclides.

3.4.5.3.1 VCM Data Gaps

Analytical data from confirmatory sampling are sufficient to characterize the nature and extent of historical releases of COCs at the site. There are no further data gaps regarding characterization of SWMU 81C.

3.4.5.3.2 VCM Confirmatory Sampling Results and Conclusions

In September and October 1998 soil samples from the bottom of the excavations were collected from 39 locations at SWMU 81C in conformance with the RFI Work Plan (SNL/NM September 1995) and the VCM Plan (SNL/NM August 1998) as reviewed by NMED.

Tables 3.4.5-1, 3.4.5-2, 3.4.5-4, 3.4.5-6, 3.4.5-8, and 3.4.5-9 summarize the metals, VOC, SVOC, HE, and radionuclide (i.e., gamma spectroscopy, gross alpha, and gross beta) analytical results for all of the confirmatory soil samples collected at SWMU 81C. Annex 3-B contains complete results for the gamma spectroscopy analyses. Tables 3.4.5-3, 3.4.5-5, and 3.4.5-7 summarize the analytical method detection limits for the target analyte list for VOCs, SVOCs, and HE compounds, respectively. Samples were labeled sequentially from 01 through 54, sample numbers 26 through 40 were collected from the soil piles for the purposes of characterizing the excavated soil for disposal and are not included in the data tables for the confirmatory sampling. Section 3.4.5.2 presents data from the soil pile sampling.

Sample numbers are coded to identify specific information regarding the samples. For example, for CY81C-GR-001-SS, CY81C designates a sample collected from SWMU 81C in the Canyons Test Area of SNL/NM. GR indicates that a grab sample was collected from Location 001, and SS designates a soil sample. The remainder of this section describes the results of confirmatory sampling at SWMU 81C.

This page intentionally left blank.

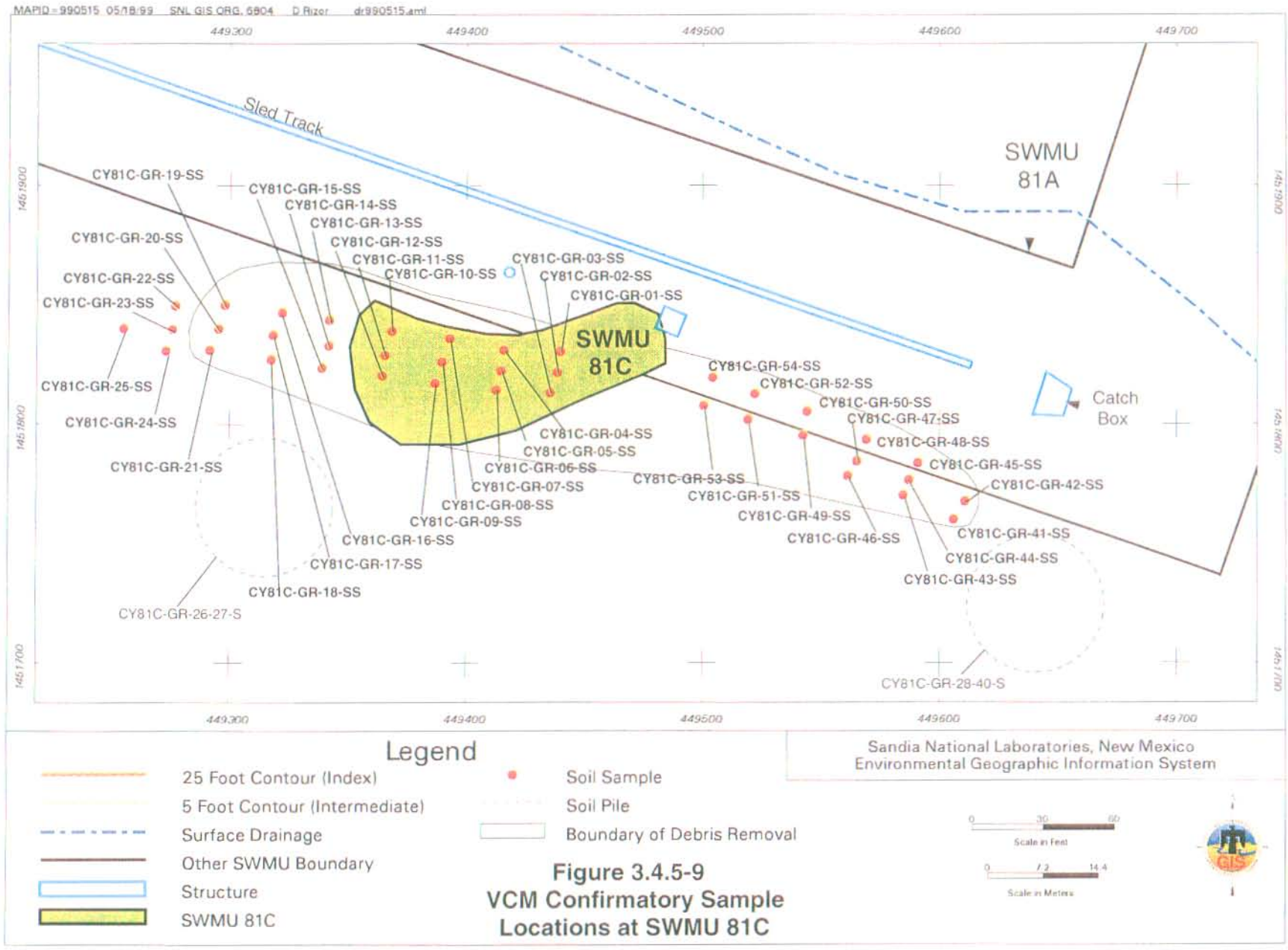


Figure 3.4.5-9
VCM Confirmatory Sample Locations at SWMU 81C

Table 3.4.5-1
Summary of SWMU 81C Confirmatory Soil Sampling Metals Analytical Results, September–October 1998

Sample Attributes			Metals (EPA Method 6010[a]) (mg/kg)								
Record Number[b]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
600788	CY81C-GR-001-SS	0–0.5	**13.5**	192	**0.753**	**0.681**	**20.4**	**46.7**	0.00521 J	1.15	0.104 J
600788	CY81C-GR-002-SS	0–0.5	4.50	**365**	0.558	0.179 J	14.9	14.0	ND (0.00225)	0.87	ND (0.031)
600788	CY81C-GR-003-SS	0–0.5	3.94	**331**	0.421 J	0.273 J	12.7	8.0	0.00435 J	0.524	ND (0.031)
600788	CY81C-GR-004-SS	0–0.5	5.45	194	0.578	**1.67**	**37.7**	**176**	0.0549	1.16	0.0849 J
600788	CY81C-GR-005-SS	0–0.5	5.54	**269**	0.723	0.153 J	15.4	14.1	0.0204 J	1.30	ND (0.031)
600788	CY81C-GR-006-SS	0–0.5	4.21	**487**	0.565	0.115 J	14.9	8.28	ND (0.00225)	0.734	ND (0.031)
600788	CY81C-GR-007-SS	0–0.5	9.27	**347**	0.435 J	ND (0.019)	15.1	12.8	0.0153 J	0.745	0.240 J
600788	CY81C-GR-008-SS	0–0.5	4.4	**496**	0.568	0.202 J	14.1	13.1	0.010 J	0.423 J	0.191 J
600788	CY81C-GR-009-SS	0–0.5	4.51	228	0.636	0.119 J	13.7	14.2	0.00689 J	0.614	0.190 J
600788	CY81C-GR-010-SS	0–0.5	6.89	221	0.567	0.15 J	14.3	10.2	0.0282 J	0.422 J	0.171 J
600788	CY81C-GR-010-DP	0–0.5	7.53	235	0.604	0.162 J	14.0	14.1	0.0141 J	0.992	0.148 J
600788	CY81C-GR-011-SS	0–0.5	4.82	**449**	0.465 J	0.425 J	16.0	9.77	0.00511 J	0.587	0.180 J
600788	CY81C-GR-012-SS	0–0.5	4.33	200	0.571	**0.852**	15.9	**50.1**	0.00894 J	ND (0.135)	0.178 J
600788	CY81C-GR-013-SS	0–0.5	4.61	**294**	0.467 J	0.185 J	13.1	12.7	ND (0.00225)	0.45 J	0.232 J
600788	CY81C-GR-014-SS	0–0.5	4.07	229	0.550	0.517 J	14.8	14.9	0.00729 J	0.671	0.181 J
600788	CY81C-GR-015-SS	0–0.5	4.5	245	0.564	0.562	17.2	**19.4**	0.0107 J	0.386 J	0.171 J
600788	CY81C-GR-016-SS	0–0.5	4.84	**257**	0.688	0.225 J	14.1	17.9	0.0173 J	0.801	0.193 J
600788	CY81C-GR-017-SS	0–0.5	4.73	**253**	0.633	0.379 J	**22.5**	14.9	0.0170 J	0.661	**0.518 J**
600788	CY81C-GR-018-SS	0–0.5	5.56	**259**	0.634	0.263 J	14.3	**19.7**	0.0145 J	0.546 J	0.305 J
600788	CY81C-GR-018-DP	0–0.5	5.14	**256**	0.602	**0.971**	14.5	**19.5**	0.0132 J	0.435 J	ND (0.031)
600788	CY81C-GR-019-SS	0–0.5	3.53	150	0.484 J	0.224 J	11.2	11.3	0.0336	ND (0.135)	ND (0.031)
600788	CY81C-GR-020-SS	0–0.5	4.56	196	0.67	0.450 J	13.7	14.7	**0.0746**	0.341 J	ND (0.031)
600788	CY81C-GR-021-SS	0–0.5	4.69	**321**	0.553	0.502 J	12.7	12.7	**0.0842**	0.300 J	ND (0.031)
Background Soil Concentration—Canyon Area[c]			9.8	246	0.75	0.64	18.8	18.9	0.055	3.0	<0.50
Quality Assurance/Quality Control Samples (all in µg/L)											
600788	CY81C-GR-001-EB	0-0.5	ND (0.00451)	0.00297 J	ND (0.00026)	ND (0.00044)	0.000745 J	ND (0.00159)	ND (0.000035)	ND (0.00271)	ND (0.00073)

Refer to footnotes at end of table.

Tables 3.4.5-1 (Concluded)
Summary of SWMU 81C Confirmatory Soil Sampling Metals Analytical Results, September–October 1998

Sample Attributes			Metals (EPA Method 6010[a]) (mg/kg)								
Record Number[b]	ER Sample ID	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
600789	CY81C-GR-022-SS	0–0.5	8.47	**282**	**1.07**	0.359 J	**25.0**	**48.2**	0.0302 J	ND (0.135)	ND (0.031)
600789	CY81C-GR-023-SS	0–0.5	**5.83**	**279**	0.705	0.314 J	16.1	**38.1**	0.0128 J	ND (0.135)	ND (0.031)
600789	CY81C-GR-023-DU	0–0.5	6.14	**312**	0.670 J	0.312 J	14.7	**19.8**	ND (0.00225)	ND (0.135)	ND (0.031)
600789	CY81C-GR-024-SS	0–0.5	6.41	189	**0.83**	0.200 J	15.5	**30.2**	0.0118 J	ND (0.135)	ND (0.031)
600789	CY81C-GR-025-SS	0–0.5	6.59	195	**0.871**	0.225 J	15.5	**33.5**	0.0257 J	ND (0.135)	ND (0.031)
600789	CY81C-GR-025-DU	0–0.5	5.96	222	0.748	0.0472 J	12.4	**25.0**	0.00978 J	0.698 J	ND (0.031)
600790	CY81C-GR-041-SS	0–0.5	3.76	169	0.556	0.544	10.3	17.2	0.0367 J	0.568	0.0936 J
600790	CY81C-GR-042-SS	0–0.5	4.16	219	0.572	0.482 J	9.55	8.58	0.0492 J	ND (0.135)	0.138 J
600790	CY81C-GR-043-SS	0–0.5	3.81	180	0.557	0.475 J	9.78	9.45	0.0478 J	0.67	0.103 J
600790	CY81C-GR-044-SS	0–0.5	3.52	194	0.590	0.536 J	10.2	11.1	0.0316 J	0.817	0.149 J
600790	CY81C-GR-044-DP	0–0.5	3.71	179	0.582	0.597	11.3	10.9	0.0343 J	0.449 J	0.128 J
600790	CY81C-GR-045-SS	0–0.5	3.59	171	0.565	0.531	9.78	11.1	0.0283 J	0.442 J	0.111 J
600790	CY81C-GR-046-SS	0–0.5	3.91	170	0.636	0.509 J	12.3	13.1	0.0424 J	0.619	0.175 J
600790	CY81C-GR-047-SS	0–0.5	3.9	169	0.605	0.526 J	10.8	10.1	0.0301 J	ND (0.135)	0.130 J
600790	CY81C-GR-048-SS	0–0.5	3.18	158	0.601	0.472 J	10.0	11.8	0.0313 J	0.444 J	0.113 J
600790	CY81C-GR-049-SS	0–0.5	4.05	191	0.668	0.532 J	11.1	17.8	0.0352 J	0.471 J	0.102 J
600790	CY81C-GR-050-SS	0–0.5	4.74	168	0.634	0.619	**30.1**	18.8	0.0375 J	0.604	0.105 J
600790	CY81C-GR-051-SS	0–0.5	6.65	183	0.599	**1.28**	**23.7**	**25.5**	**0.0617 J**	0.541	0.207 J
600790	CY81C-GR-052-SS	0–0.5	4.85	168	0.625	0.598	11.1	**22.6**	0.0306 J	0.498 J	0.140 J
600790	CY81C-GR-053-SS	0–0.5	4.94	153	0.600	0.500 J	12.8	**23.7**	0.0397 J	0.367 J	0.154 J
600790	CY81C-GR-054-SS	0–0.5	7.07	173	0.660	0.594	11.9	**30.3**	0.0362 J	0.704	0.105 J
Average of 81C samples			5.24	240	0.604	0.440	15.0	22.1	0.025	0.51	0.12
Background Soil Concentration—Canyon Area[c]			9.8	246	0.75	0.640	18.8	18.9	0.055	3.0	<0.5
Quality Assurance/Quality Control Samples (all in mg/L)											
600790	CY81C-GR-002-EB	NA	ND (0.00451)	0.00168 J	ND (0.00026)	ND (0.00044)	ND (0.00056)	ND (0.00159)	ND (0.000035)	ND (0.00271)	0.00165 J
600790	CY81C-GR-003-EB	NA	ND (0.00451)	0.00109 J	ND (0.00026)	ND (0.00044)	ND (0.00056)	ND (0.00159)	ND (0.000035)	ND (0.00271)	ND (0.00073)

Note: Numbers in **bold** represent values greater than the respective Canyon Area background concentration.
[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
[c]From Zamorski December 1997.
CY = Canyon.
DP = Duplicate.
DU = Duplicate.
EB = Equipment blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
J = Analyte concentration is less than quantitation limit but greater than or equal to method detection limit.
µg/L = Microgram(s) per liter.
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
ND ( ) = Not detected above the method detection limit, shown in parenthesis.
SS = Surface soil sample.
SWMU = Solid Waste Management Unit.
UTL = Upper tolerance limit.

Table 3.4.5-2
Summary of SWMU 81C Confirmatory Soil Sampling VOC Analytical Results,
September–October 1998

Sample Attributes			VOCs (EPA Method 8260A[a]) (µg/kg)			
Record Number[b]	ER Sample ID	Sample Depth (ft)	Chlorodibromomethane	Chloroform	Dichlorobromomethane	Methylene Chloride
600788	CY81C-GR-001-SS	0.0–0.5	**0.73 J (1.13)**	**6.7 J**	**1.9 J**	ND (0.25)
600788	CY81C-GR-002-SS	0.0–0.5	**0.84 J (1.12)**	**7.4 J**	**2.1 J**	**7.8 J**
600788	CY81C-GR-003-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600788	CY81C-GR-004-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600788	CY81C-GR-005-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600788	CY81C-GR-006-SS	0.0–0.5	**0.59 J (1.07)**	**5.9 J**	**1.6 J**	ND (0.25)
600788	CY81C-GR-007-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600788	CY81C-GR-008-SS	0.0–0.5	ND (0.21)	**6.0 J**	ND (0.24)	ND (0.25)
600788	CY81C-GR-009-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600788	CY81C-GR-010-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600788	CY81C-GR-010-DP	0.0–0.5	**0.71 J (1.09)**	**5.9 J**	ND (0.24)	ND (0.25)
600788	CY81C-GR-011-SS	0.0–0.5	ND (0.21)	**3.8 J**	ND (0.24)	ND (0.25)
600788	CY81C-GR-012-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600788	CY81C-GR-013-SS	0.0–0.5	ND (0.21)	**4.2 J**	ND (0.24)	ND (0.25)
600788	CY81C-GR-014-SS	0.0–0.5	ND (0.21)	**4.5 J**	ND (0.24)	ND (0.25)
600788	CY81C-GR-015-SS	0.0–0.5	ND (0.21)	**2.9 J**	ND (0.24)	ND (0.25)
600788	CY81C-GR-016-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600788	CY81C-GR-017-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600788	CY81C-GR-018-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600788	CY81C-GR-018-DP	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600788	CY81C-GR-019-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600788	CY81C-GR-020-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600788	CY81C-GR-021-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
Quality Assurance/Quality Control Samples (all in µg/L)						
600788	CY81C-GR-001-EB	NA	ND (0.3)	ND (0.7)	ND (0.4)	ND (1.2)
600788	CY81C-GR-001-TB	NA	ND (0.3)	ND (0.7)	ND (0.4)	**2.2 J (5.0)**

Refer to footnotes at end of table.

Table 3.4.5-2 (Continued)
Summary of SWMU 81C Confirmatory Soil Sampling VOC Analytical Results,
September–October 1998

Sample Attributes			VOCs (EPA Method 8260A[a]) (µg/kg)			
Record Number[b]	ER Sample ID	Sample Depth (ft)	Chlorodibromomethane	Chloroform	Dichlorobromomethane	Methylene Chloride
600789	CY81C-GR-022-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600789	CY81C-GR-023-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600789	CY81C-GR-023-DU	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600789	CY81C-GR-024-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600789	CY81C-GR-025-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600789	CY81C-GR-025-DU	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-041-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-042-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-043-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-044-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-044-DP	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-045-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-046-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-047-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-048-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-049-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-050-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-051-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-052-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-053-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
600790	CY81C-GR-054-SS	0.0–0.5	ND (0.21)	ND (0.24)	ND (0.24)	ND (0.25)
Quality Assurance/Quality Control Samples (all in µg/L)						
600789	CY81C-GR-002-EB	NA	ND (0.3)	ND (0.7)	ND (0.4)	ND (1.2)
600789	CY81C-GR-002-TB	NA	ND (0.3)	ND (0.7)	ND (0.4)	ND (1.2)
600790	CY81C-GR-003-EB	NA	ND (0.3)	ND (0.7)	ND (0.4)	ND (1.2)
600790	CY81C-GR-003-TB	NA	ND (0.3)	ND (0.7)	ND (0.4)	**2.2 J (5.0)**

Refer to footnotes at end of table.

Table 3.4.5-2 (Concluded)
Summary of SWMU 81C Confirmatory Soil Sampling VOC Analytical Results,
September–October 1998

Note: Numbers in **bold** represent detected values.
[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
CY = Canyon.
DU = Duplicate sample.
DP = Duplicate.
EB = Equipment blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
J = Analytical result was qualified as an estimation during data validation.
J ( ) = The reported value is greater than or equal to the MDL but is less than the practical quantitation limit, shown in parenthesis.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
NA = Not applicable.
ND = Not detected above the MDL, shown in parenthesis.
SS = Surface soil sample.
SWMU = Solid Waste Management Unit.
TB = Trip blank.
VOC = Volatile organic compound.

Table 3.4.5-3
Summary of VOC Analytical Detection
Limits Used for SWMU 81C Grid Soil Sampling, September–October 1998
(Off-site laboratory)

Analyte	Method Detection Limit (µg/kg)
1,1,1-trichloroethane	0.18
1,1,1,2-tetrachloroethane	0.46
1,1,2-trichloroethane	0.24
1,1–dichloroethane	0.20
1,1-dichloroethylene	0.25
1,2–dichloroethane	0.23
1,2-dichloropropane	0.23
1,2-cis-dichloroethylene	0.25
1,2-trans-dichloroethylene	0.19
2-butanone	2.1
2-hexanone	4.4
4-methyl-2-pentanone	2.9
Acetone	2.2
Benzene	0.25
Bromoform	0.27
Carbon disulfide	2.2
Carbon tetrachloride	0.22
Chlorobenzene	0.25
Chlorodibromomethane	0.21
Chloroethane	0.72
Chloroform	0.24
Dichlorobromomethane	0.24
Ethylbenzene	0.23
Methyl bromide	0.67
Methyl chloride	0.43
Methylene chloride	0.25
Styrene	0.22
Tetrachloroethylene	0.23
Toluene	0.22
Trichloroethylene	0.27
Vinyl acetate	1.8
Vinyl chloride	0.40
Xylenes (total)	0.62
cis-1,3-dichloropropylene	0.25
Trans-1,3-dichloropropylene	0.22

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

Table 3.4.5-4
Summary of SWMU 81C Confirmatory Soil Sampling SVOC Analytical Results,
September–October 1998
(Off-site laboratory)

Sample Attributes			SVOCs (EPA Method 8270[a]) (µg/kg)		
Record Number[b]	ER Sample ID	Sample Depth (ft)	Diethyl Phthalate	Bis(2-ethylhexyl) Phthalate	Phenol
600788	CY81C-GR-001-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-002-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-003-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-004-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-005-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-006-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-007-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-008-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-009-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-010-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-010-DP	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-011SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-012-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-013-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-014-SS	0–0.5	**13,000 J**	ND (10)	ND (10)
600788	CY81C-GR-015-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-016-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-017-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-018-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-018-DP	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-019-SS	0–0.5	**840 J**	ND (10)	ND (10)
600788	CY81C-GR-020-SS	0–0.5	ND (10)	ND (10)	ND (10)
600788	CY81C-GR-021-SS	0–0.5	ND (10)	ND (10)	ND (10)
600789	CY81C-GR-022-SS	0–0.5	**290 J (511)**	ND (10)	ND (10)
600789	CY81C-GR-023-SS	0–0.5	**480**	ND (10)	**240 J**
600789	CY81C-GR-023-DU	0–0.5	ND (10)	ND (10)	ND (10)
600789	CY81C-GR-024-SS	0–0.5	ND (10)	ND (10)	ND (10)
600789	CY81C-GR-025-SS	0–0.5	ND (10)	ND (10)	ND (10)
600789	CY81C-GR-025-DU	0–0.5	ND (10)	ND (10)	ND (10)
600790	CY81C-GR-041-SS	0–0.5	ND (10)	ND (10)	ND (10)
600790	CY81C-GR-042-SS	0–0.5	ND (10)	ND (10)	ND (10)
600790	CY81C-GR-043-SS	0–0.5	ND (10)	ND (10)	ND (10)
600790	CY81C-GR-044-SS	0–0.5	ND (10)	**1,500**	
600790	CY81C-GR-044-DP	0–0.5	**1,700 J**	ND (10)	ND (10)
600790	CY81C-GR-045-SS	0–0.5	ND (10)	ND (10)	ND (10)
600790	CY81C-GR-046-SS	0–0.5	ND (10)	ND (10)	ND (10)
600790	CY81C-GR-047-SS	0–0.5	ND (10)	ND (10)	ND (10)
600790	CY81C-GR-048-SS	0–0.5	ND (10)	ND (10)	ND (10)
600790	CY81C-GR-049-SS	0–0.5	ND (10)	ND (10)	ND (10)
600790	CY81C-GR-050-SS	0–0.5	ND (10)	ND (10)	ND (10)
600790	CY81C-GR-051-SS	0–0.5	**410 J**	ND (10)	ND (10)
600790	CY81C-GR-053-SS	0–0.5	**610 J**	ND (10)	ND (10)
600790	CY81C-GR-054-SS	0–0.5	ND (10)	ND (10)	ND (10)
Quality Assurance/Quality Control Samples (all in µg/L)					
600788	CY81C-GR-001-EB	NA	ND (2.1)	ND (3.7)	ND (0.8)
600789	CY81C-GR-002-EB	NA	ND (2.1)	ND (3.7)	ND (0.8)
600790	CY81C-GR-003-EB	NA	ND (2.1)	ND (3.7)	ND (0.8)

Refer to footnotes at end of table.

Table 3.4.5-4 (Concluded)
Summary of SWMU 81C Confirmatory Soil Sampling SVOC Analytical Results,
September–October 1998
(Off-site laboratory)

Note: Numbers in **bold** represent detected values.
[a]EPA November 1986.
[b]Analysis request/chain-of-custody record.
CY = Canyon.
DP = Duplicate sample.
DU = Duplicate sample.
EB = Equipment blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
J = Analytical result was qualified as an estimation during data validation.
MDL = Method detection limit.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
NA = Not applicable.
ND = Not detected above the MDL, shown in parenthesis.
SS = Surface soil sample.
SWMU = Solid Waste Management Unit.
SVOC = Semivolatile organic compound.
TB = Trip blank.

Table 3.4.5-5
Summary of SVOC Analytical Detection
Limits Used for SWMU 81C Soil Sampling, September–October 1998

Analyte	Method Detection Limit (µg/kg)
1,2,4-trichlorobenzene	10
1,2-dichlorobenzene	10
1,2-diphenylhydrazine	10
1,3-dichlorobenzene	10
1,4-dichlorobenzene	10
2,4,5-trichlorophenol	10
2,4,6-trichlorophenol	10
2,4-dichlorophenol	10
2,4-dimethylphenol	10
2,4-dinitrophenol	20
2,4-dinitrotoluene	10
2,6-dinitrotoluene	10
2-chloronaphthalene	10
2-chlorophenol	10
2-methylnaphthalene	10
2-nitrophenol	10
2-methyl-4,6-dinitrophenol	10
3,3-dichlorobenzidine	20
4-bromophenyl phenyl ether	10
4-chloroaniline	10
4-chlorophenyl phenyl ether	10
4-nitrophenol	10
4-chloro-3-methylphenol	10
Acenaphthene	10
Acenaphthylene	10
Anthracene	10
Benzo(a)anthracene	10
Benzo(a)pyrene	10
Benzo(b)fluoranthene	10
Benzo(g,h,i)perylene	10
Benzo(k)fluoranthene	10
Benzoic acid	50
Benzyl alcohol	10
Butylbenzylphthalate	10
Chrysene	10
Di-n-butylphthalate	10
Di-n-octylphthalate	10
Dibenzo(a,h)anthracene	10
Dibenzofuran	10

Refer to footnotes at end of table.

Table 3.4.5-5 (Concluded)
Summary of SVOC Analytical Detection
Limits Used for SWMU 81C Soil Sampling, September–October 1998

Analyte	Method Detection Limit (µg/kg)
Diethylphthalate	10
Dimethylphthalate	10
Fluoranthene	10
Fluorene	10
Hexachlorobenzene	10
Hexachlorobutadiene	10
Hexachlorocyclopentadiene	10
Hexachloroethane	10
Indeno(1,2,3-cd)pyrene	10
Isophorone	10
n-nitroso-di-n-propylamine	10
n-nitrosodiphenylamine	10
Naphthalene	10
Nitrobenzene	10
Pentachlorophenol	20
Phenanthrene	10
Phenol	10
Pyrene	10
bis(2-chloroethoxy) methane	10
bis(2-chloroethyl) ether	10
bis(2-chloroisopropyl) ether	10
bis(2-ethylhexyl)phthalate	10
m,p-cresol	10
m-nitroaniline	10
o-cresol	10
o-nitroaniline	10
p-nitroaniline	10

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

Table 3.4.5-6
Summary of SWMU 81C Confirmatory Soil Sampling High Explosive Compounds Analytical Results, September - October 1998
(Off-site laboratory)

Sample Attributes			HE (EPA Method 8330)[a] (µg/kg)[b]
Record Number[c]	ER Sample ID	Sample Depth (ft)	m-Dinitrobenzene
600788	CY81C-GR-001-SS	0-0.5	ND (4.1)
600788	CY81C-GR-002-SS	0-0.5	ND (4.1)
600788	CY81C-GR-003-SS	0-0.5	ND (4.1)
600788	CY81C-GR-004-SS	0-0.5	ND (4.1)
600788	CY81C-GR-005-SS	0-0.5	ND (4.1)
600788	CY81C-GR-006-SS	0-0.5	ND (4.1)
600788	CY81C-GR-007-SS	0-0.5	ND (4.1)
600788	CY81C-GR-008-SS	0-0.5	ND (4.1)
600788	CY81C-GR-009-SS	0-0.5	ND (4.1)
600788	CY81C-GR-010-SS	0-0.5	ND (4.1)
600788	CY81C-GR-010-DP	0-0.5	ND (4.1)
600788	CY81C-GR-011SS	0-0.5	ND (4.1)
600788	CY81C-GR-012-SS	0-0.5	ND (4.1)
600788	CY81C-GR-013-SS	0-0.5	ND (4.1)
600788	CY81C-GR-014-SS	0-0.5	ND (4.1)
600788	CY81C-GR-015-SS	0-0.5	ND (4.1)
600788	CY81C-GR-016-SS	0-0.5	ND (4.1)
600788	CY81C-GR-017-SS	0-0.5	ND (4.1)
600788	CY81C-GR-018-SS	0-0.5	ND (4.1)
600788	CY81C-GR-018-DP	0-0.5	ND (4.1)
600788	CY81C-GR-019-SS	0-0.5	ND (4.1)
600788	CY81C-GR-020-SS	0-0.5	ND (4.1)
600788	CY81C-GR-021-SS	0-0.5	ND (4.1)
600789	CY81C-GR-022-SS	0-0.5	ND (4.1)
600789	CY81C-GR-023-SS	0-0.5	ND (4.1)
600789	CY81C-GR-023-DU	0-0.5	ND (4.1)
600789	CY81C-GR-024-SS	0-0.5	ND (4.1)
600789	CY81C-GR-025-SS	0-0.5	ND (4.1)
600789	CY81C-GR-025-DU	0-0.5	ND (4.1)
600790	CY81C-GR-041-SS	0-0.5	**99**
600790	CY81C-GR-042-SS	0-0.5	**100**
600790	CY81C-GR-043-SS	0-0.5	ND (4.1)
600790	CY81C-GR-044-SS	0-0.5	ND (4.1)
600790	CY81C-GR-044-DP	0-0.5	ND (4.1)
600790	CY81C-GR-045-SS	0-0.5	ND (4.1)
600790	CY81C-GR-046-SS	0-0.5	ND (4.1)
600790	CY81C-GR-047-SS	0-0.5	ND (4.1)
600790	CY81C-GR-048-SS	0-0.5	ND (4.1)
600790	CY81C-GR-049-SS	0-0.5	ND (4.1)
600790	CY81C-GR-050-SS	0-0.5	ND (4.1)
600790	CY81C-GR-051-SS	0-0.5	ND (4.1)
600790	CY81C-GR-052-SS	0-0.5	ND (4.1)
600790	CY81C-GR-053-SS	0-0.5	ND (4.1)
600790	CY81C-GR-054-SS	0-0.5	ND (4.1)
Quality Assurance/Quality Control Samples (all in µg/L)			
600788	CY81C-GR-001-EB	NA	ND (0.02)
600789	CY81C-GR-002-EB	NA	0.15J
600790	CY81C-GR-003-EB	NA	0.18J

EB = Equipment blank.
HE = High explosive(s).
J = Analytical result was qualified as an estimation during data validation.
µg/kg = Micrograms per kilogram.
µg/L = Micrograms per liter.
NA = Not applicable.
ND = Not detected above the MDL, shown in parenthesis.

Table 3.4.5-7
Summary of HE Analysis Detection Limits
Used for SWMU 81C Confirmatory Soil Sampling, September-October 1998

Compound	Method Detection Limit (µg/kg)
Sym-trinitrobenzene	6.6
m-dinitrobenzene	4.1
2,4,6-trinitrotoluene	5.7
2,4-dinitrotoluene	6.2
2,6-dinitrotoluene	6.5
2-amino-4,6-dinitrotoluene	6.6
m-nitrotoluene	11
o-nitrotoluene	7.8
4-amino-2,6-dinitrotoluene	5.5
p-nitrotoluene	11
HMX	5.3
Nitrobenzene	5.2
RDX	9.7
Tetryl	7.5

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

Table 3.4.5-8
Summary of SWMU 81C Confirmatory Soil Sampling Gamma Spectroscopy Analytical Results, September–October 1998 (On-site Laboratory)

Sample Attributes			Activity (pCi/g)							
			Uranium-238		Thorium-232		Uranium-235		Cesium-137	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
Lower Section										
600818	CY81C-GR-001-SS	0–0.5	ND (0.741)	--	0.571	0.328	ND (0.216)	--	0.094	0.029
600818	CY81C-GR-002-SS	0–0.5	0.886	0.414	0.365	0.242	ND (0.181)	--	ND (0.023)	--
600818	CY81C-GR-003-SS	0–0.5	0.870	0.529	0.328	0.175	ND (0.186)	--	ND (0.024)	--
600818	CY81C-GR-004-SS	0–0.5	1.03	0.681	0.592	1.11	ND (0.247)	--	0.292	0.0587
600818	CY81C-GR-005-SS	0–0.5	0.487	0.393	0.520	0.299	ND (0.214)	--	0.166	0.279
600818	CY81C-GR-006-SS	0–0.5	0.482	0.311	0.381	0.237	ND (0.198)	--	ND (0.0259)	--
600818	CY81C-GR-007-SS	0–0.5	0.760	0.416	0.345	0.206	0.081	0.092	ND (0.0243)	--
600818	CY81C-GR-008-SS	0–0.5	0.532	0.381	0.407	0.206	0.107	0.162	0.0566	0.0337
600818	CY81C-GR-009-SS	0–0.5	0.640	0.390	0.572	0.298	ND (0.234)	--	**0.575**	0.0972
600818	CY81C-GR-010-SS	0–0.5	0.538	0.377	0.461	0.260	ND (0.191)	--	ND (0.0248)	--
600818	CY81C-GR-010-DP	0–0.5	0.644	0.406	0.485	0.250	0.144	0.162	ND (0.0254)	--
600818	CY81C-GR-011-SS	0–0.5	0.745	0.318	ND (0.104)	--	ND (0.181)	--	ND (0.0109)	--
600818	CY81C-GR-012-SS	0–0.5	ND (0.727)	--	0.573	0.312	ND (0.209)	--	0.104	0.0596
600818	CY81C-GR-013-SS	0–0.5	1.01	0.517	0.445	0.272	0.084	0.164	0.0105	0.0124
600818	CY81C-GR-014-SS	0–0.5	0.479	0.353	0.487	0.248	ND (0.207)	--	0.163	0.0436
600818	CY81C-GR-015-SS	0–0.5	0.581	0.504	0.646	0.352	0.110	0.187	0.160	0.037
600818	CY81C-GR-016-SS	0–0.5	0.590	0.549	0.586	0.321	ND (0.222)	--	0.0362	0.0199
600818	CY81C-GR-017-SS	0–0.5	0.616	0.382	0.524	0.269	ND (0.217)	--	0.0973	0.0271
600818	CY81C-GR-018-SS	0–0.5	0.736	0.437	0.575	0.288	ND (0.123)	--	0.0640	0.0247
600818	CY81C-GR-018-DP	0–0.5	ND (0.762)	--	0.572	0.317	0.144	0.191	0.0655	0.0325
600818	CY81C-GR-019-SS	0–0.5	0.514	0.464	0.640	0.329	ND (0.220)	--	0.0419	0.0228
600818	CY81C-GR-020-SS	0–0.5	0.887	0.567	0.711	0.354	0.118	0.199	0.207	0.0362
600818	CY81C-GR-021-SS	0–0.5	0.639	0.419	0.497	0.259	ND (0.198)	--	0.303	0.0558
600819	CY81C-GR-022-SS	0–0.5	ND (0.535)	--	0.768	0.352	ND (0.204)	--	ND (0.0404)	--
600819	CY81C-GR-023-SS	0–0.5	ND (0.549)	--	0.410	0.340	0.0376	0.175	ND (0.0347)	--
600819	CY81C-GR-023-DU	0–0.5	ND (0.582)	--	0.517	0.350	ND (0.201)	--	ND (0.0359)	--
600819	CY81C-GR-024-SS	0–0.5	0.579	0.542	0.767	0.409	ND (0.191)	--	0.0339	0.0399
600819	CY81C-GR-025-SS	0–0.5	ND (0.577)	--	0.839	0.431	ND (0.212)	--	0.0349	0.0344
600819	CY81C-GR-025-DU	0–0.5	ND (0.609)	--	0.830	0.473	ND (0.213)	--	ND (0.0270)	--

Refer to footnotes at end of table.

Table 3.4.5-8 (Concluded)
Summary of SWMU 81C Confirmatory Soil Sampling Gamma Spectroscopy Analytical Results, September–October 1998 (On-site Laboratory)

Sample Attributes			Activity (pCi/g)							
			Uranium-238		Thorium-232		Uranium-235		Cesium-137	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]	Result	Error[b]	Result	Error[b]
Upper Section										
600820	CY81C-GR-041-SS	0–0.5	0.905	0.417	0.728	0.396	**0.233**	0.191	0.0451	0.0257
600820	CY81C-GR-042-SS	0–0.5	0.329	0.398	0.634	0.709	ND (0.219)	--	ND (0.0306)	--
600820	CY81C-GR-043-SS	0–0.5	ND (0.815)	--	0.675	0.375	ND (0.239)	--	0.0478	0.0211
600820	CY81C-GR-044-SS	0–0.5	0.617	0.510	ND (0.138)	--	ND (0.232)	--	0.0523	0.0240
600820	CY81C-GR-044-DP	0–0.5	0.648	0.358	0.691	0.357	ND (0.243)	--	0.0745	0.0251
600820	CY81C-GR-045-SS	0–0.5	ND (0.647)	--	0.890	0.404	ND (0.240)	--	0.0583	0.0331
600820	CY81C-GR-046-SS	0–0.5	0.538	0.504	0.812	0.434	ND (0.102)	--	0.0424	0.0196
600820	CY81C-GR-047-SS	0–0.5	0.602	0.440	0.883	0.418	ND (0.238)	--	ND (0.0196)	--
600820	CY81C-GR-048-SS	0–0.5	0.785	0.755	0.828	0.419	**0.168**	0.205	0.0242	0.0223
600820	CY81C-GR-049-SS	0–0.5	0.704	0.514	0.749	0.370	ND (0.239)	--	0.00400	0.0115
600820	CY81C-GR-050-SS	0–0.5	0.592	0.462	0.881	0.433	ND (0.233)	--	0.0263	0.0175
600820	CY81C-GR-051-SS	0–0.5	1.04	0.495	0.891	0.434	0.0716	0.078	0.0306	0.0317
600820	CY81C-GR-052-SS	0–0.5	0.789	0.493	0.879	0.430	ND (0.252)	--	0.0358	0.0382
600820	CY81C-GR-053-SS	0–0.5	0.727	0.431	0.812	0.418	0.0886	0.0140	0.0376	0.0194
600820	CY81C-GR-054-SS	0–0.5	0.639	0.545	0.705	0.342	ND (0.201)	--	0.0394	0.0291
Background Soil Activity, Upper Canyons[c]			2.31	NA	1.03	NA	0.16	NA	0.515	NA

Note: **Bold** numbers represent values greater than the respective Canyon Area background activity.

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

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

[c]From Dinwiddie September 1997.

CY = Canyons.
DP = Duplicate sample.
DU = Duplicate.
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.
SS = Surface soil sample.
SWMU = Solid Waste Management Unit.
-- = Error not calculated for nondetectable results.

Table 3.4.5-9
Summary of SWMU 81C Confirmatory Sampling Gross Alpha and Beta Analysis, September–October 1998
(Off-site laboratory)

Sample Attributes			Activity (pCi/g)			
			Gross Alpha		Gross Beta	
Record Number[a]	ER Sample ID	Sample Depth (ft)	Result	Error[b]	Result	Error[b]
Lower Section						
600788	CY81C-GR-001-SS	0–0.5	14.1	3.6	23.8	3.6
600788	CY81C-GR-002-SS	0–0.5	11.1	3.6	15.2	3.46
600788	CY81C-GR-003-SS	0–0.5	12.9	4.2	10.1	3.18
600788	CY81C-GR-004-SS	0–0.5	**22.7**	4.84	21.0	3.86
600788	CY81C-GR-005-SS	0–0.5	**23.6**	5.01	19.2	3.6
600788	CY81C-GR-006-SS	0–0.5	10.5	3.94	11.8	3.01
600788	CY81C-GR-007-SS	0–0.5	7.83	3.68	7.55	2.72
600788	CY81C-GR-008-SS	0–0.5	16.5	4.61	15.7	3.13
600788	CY81C-GR-009-SS	0–0.5	**20.5**	4.93	23.6	4.05
600788	CY81C-GR-010-SS	0–0.5	13.7	4.44	10.5	2.99
600788	CY81C-GR-010-DP	0–0.5	13.2	4.26	12.5	3.33
600788	CY81C-GR-011-SS	0–0.5	6.93	3.28	10.5	3.04
600788	CY81C-GR-012-SS	0–0.5	15.8	4.23	14.6	3.76
600788	CY81C-GR-013-SS	0–0.5	9.50	4.07	15.1	3.51
600788	CY81C-GR-014-SS	0–0.5	15.5	3.95	21.0	3.57
600788	CY81C-GR-015-SS	0–0.5	14.1	3.82	17.4	3.56
600788	CY81C-GR-016-SS	0–0.5	8.53	3.31	15.4	3.64
600788	CY81C-GR-017-SS	0–0.5	12.3	4.2	14.2	3.54
600788	CY81C-GR-018-SS	0–0.5	14.2	3.92	15.0	3.46
600788	CY81C-GR-018-DP	0–0.5	14.5	3.96	15.8	3.35
600788	CY81C-GR-019-SS	0–0.5	14.0	3.91	20.5	3.95
600788	CY81C-GR-020-SS	0–0.5	17.4	4.71	17.7	3.77
600788	CY81C-GR-021-SS	0–0.5	7.37	3.13	13.8	3.70
600789	CY81C-GR-022-SS	0–0.5	16.4	4.27	20.0	3.81
600789	CY81C-GR-023-SS	0–0.5	13.1	3.74	15.9	3.63
600789	CY81C-GR-023-DU	0–0.5	13.9	4.01	15.2	3.53
600789	CY81C-GR-024-SS	0–0.5	**19.0**	4.43	18.6	3.74
600789	CY81C-GR-025-SS	0–0.5	18.1	4.52	22.3	3.93
600789	CY81C-GR-025-DP	0–0.5	10.6	3.37	22.4	3.76
Upper Section						
600790	CY81C-GR-041-SS	0–0.5	13.6	3.56	18.9	3.23
600790	CY81C-GR-042-SS	0–0.5	12.7	3.52	18.6	3.50
600790	CY81C-GR-043-SS	0–0.5	15.8	3.80	14.9	3.21
600790	CY81C-GR-044-SS	0–0.5	16.7	4.09	22.6	3.67
600790	CY81C-GR-044-DP	0–0.5	11.7	3.51	22.0	3.65

Refer to footnotes at end of table.

Table 3.4.5-9 (Concluded)
Summary of SWMU 81C Confirmatory Sampling Gross Alpha and Beta Analysis,
September–October 1998
(Off-site laboratory)

Sample Attributes			Activity (pCi/g)			
Record Number[a]	ER Sample ID	Sample Depth (ft)	Gross Alpha		Gross Beta	
			Result	Error[b]	Result	Error[b]
600790	CY81C-GR-045-SS	0–0.5	15.5	4.05	20.7	3.55
600790	CY81C-GR-046-SS	0–0.5	14.8	4.02	22.8	3.80
600790	CY81C-GR-047-SS	0–0.5	11.7	3.62	20.0	3.85
600790	CY81C-GR-048-SS	0–0.5	10.3	3.31	20.2	3.30
600790	CY81C-GR-049-SS	0–0.5	17.9	3.97	26.2	3.51
600790	CY81C-GR-050-SS	0–0.5	12.5	3.41	21.6	3.48
600790	CY81C-GR-051-SS	0–0.5	17.6	3.96	20.6	3.16
600790	CY81C-GR-052-SS	0–0.5	14.2	3.99	18.7	3.67
600790	CY81C-GR-053-SS	0–0.5	14.1	3.96	22.4	3.77
600790	CY81C-GR-054-SS	0–0.5	16.3	4.37	24.8	3.99
Background Soil Activity, Canyons Area[c]			18.3	NA	52.7	NA

[a]Analysis request/chain-of-custody record.
[b]Two standard deviations about the mean detected activity.
[c]From Tharp July 1998.
CY = Canyon.
DP = Duplicate sample.
DU = Duplicate sample.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
NA = Not applicable.
pCi/g = Picocurie(s) per gram.
SS = Surface soil sample.
SWMU = Solid Waste Management Unit.

Metals

Table 3.4.5-1 summarizes the metals analysis results for the 39 confirmatory soil samples and five duplicate samples collected from SWMU 81C.

Arsenic concentrations ranged from 3.18 to 13.5 mg/kg. Only sample CY81C-GR-001-SS exhibited a detected concentration (13.5 mg/kg) above the NMED approved background concentration limit of 9.8 mg/kg.

Barium concentrations ranged from 150 to 496 mg/kg. Sixteen of the 44 samples exhibited concentrations greater than the NMED approved background concentration limit of 246 mg/kg.

Beryllium concentrations ranged from 0.421 to 1.07 mg/kg. Four of the 44 samples exhibited concentrations greater than the NMED approved background concentration limit of 0.75 mg/kg.

Cadmium concentrations ranged from ND (0.019) to 1.67 mg/kg. Twenty-two of the 44 values are estimated values. Five of the 44 samples exhibited concentrations greater than the NMED approved background concentration limit of 0.64 mg/kg.

Chromium concentrations ranged from 9.55 to 37.7 mg/kg. Six of the 44 samples exhibited concentrations greater than the NMED approved background concentration limit of 18.8 mg/kg.

Lead concentrations ranged from 0.45 J to 176 mg/kg. Sixteen of the 44 samples exhibited concentrations greater than the NMED approved background concentration limit of 18.9 mg/kg.

Mercury concentrations ranged from ND (0.00225) to 0.0842 mg/kg. Thirty-nine of the 44 sample concentrations were either non-detects or estimated values. Three of the 44 samples exhibited concentrations greater than the NMED approved background concentration limit of 0.055 mg/kg.

Selenium concentrations ranged from ND (0.135) to 1.30 mg/kg and all detected concentrations were below the NMED approved background concentration limit of 3.0 mg/kg.

Silver concentrations ranged from ND (0.031) to 0.518 J mg/kg. The results from all 44 samples were either estimated values or nondetects. One sample exhibited a concentration greater than the nonquantified background concentration limit of <0.5 mg/kg.

VOCs

Because there are no background concentrations for VOCs in soil, any detectable VOCs in the samples collected at SWMU 81C can be considered an indication of contamination. Four VOCs (chlorodibromomethane, chloroform, dichlorobromomethane, and methylene chloride) were detected at SWMU 81C. The following briefly describes the VOC analytical results for SWMU 81C.

Table 3.4.5-2 summarizes the off-site VOC analysis for the 39 soil samples and five duplicate samples collected. Four VOCs were detected, chlorodibromomethane, chloroform, dichlorobromomethane, and methylene chloride, in a few samples at SWMU 81C. All four of the

VOCs detected at SWMU 81C were reported with values at concentrations less than the practical quantitation limit and were, thus, qualified J (estimated values).

The upper section of SWMU 81C , which contained most of the expended rocket motors and debris, yielded no levels of VOCs above detection limits. The only VOC associated with samples from the upper section was methylene chloride at 2.2 µg/L J from the associated trip blank. Methylene chloride is a common laboratory contaminant. Table 3.4.5-3 summarizes the detection limits used for analyzing VOCs by the off-site laboratory.

SVOCs

Because there are no applicable background concentrations for SVOCs in soil any detectable SVOCs in the samples collected at SWMU 81C can be considered an indicator of contamination. Three SVOCs (diethyl phthalate, bis[2-ethylhexyl phthalate], and phenol) were detected in a few samples at SWMU 81C. The following briefly describes the SVOC analytical results.

Table 3.4.5-4 summarizes the off-site SVOC analysis for the 39 soil samples and five duplicate samples collected. Bis(2-ethylhexyl) phthalate was detected in only one sample from the upper section of SWMU 81C at 1,500 µg/kg. Diethyl phthalate was detected in seven samples, four from the lower section and three from the upper section. The maximum concentration of diethyl phthalate was 13,000 J µg/kg. All concentrations were estimated within the exception of 480 µg/kg in Sample CY81C-GR-023-SS, but diethyl phthalate was not seen in the duplicate sample from this location. Phenol was detected in one sample, CY81C-GR-023-SS at 240 J µg/kg. Table 3.4.5-5 summarizes the detection limits used for analyzing SVOCs by the off-site laboratory.

HE

Because there are no applicable background concentrations for HE in soil any detectable HE in the samples collected at SWMU 81C can be considered an indicator of contamination.

Table 3.4.5-6 summarizes the off-site HE analysis for the 39 soil samples and five duplicate samples collected. One HE compound (m-dinitrobenzene) was detected in two samples (CY81C-GR-41-SS and CY81C-GR-42-SS) at concentrations of 99 µg/kg and 100 µg/kg, respectively. Table 3.4.5-7 summarizes the detection limits used for analyzing HE compounds by the off-site laboratory.

Radionuclides

Table 3.4.5-8 summarizes the on-site gamma spectroscopy analysis results for the 39 soil samples and five duplicate samples. The gamma spectroscopy results indicate that gamma activity was detected above the background concentration limits in only three samples (CY81C-GR-009-SS, CY81C-GR-041-SS and CY81C-GR-048-SS). In Samples CY81C-GR-041-SS and CY81C-GR-048-SS gamma activity at levels of 0.233 pCi/g and 0.168 pCi/g, respectively, was attributable to uranium-235 which exceeded the 0.16 pCi/g background level. However, the minimum detectable activities (MDA) associated with nondetectable results for uranium-235

exceeded background in all instances except Samples CY81C-GR-018-SS and CY81C-GR-046-SS. Although this situation inhibits any comparison to background, uranium-238 and uranium-235 results 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. Gamma activity attributable to cesium-137 exceeded the 0.515 pCi/g background level only in sample CY81C-GR-009-SS (0.575 pCi/g). Gamma activity attributable to uranium-238 and thorium-232 was either not detected above the MDA or not detected above background.

Gross Alpha and Gross Beta

Table 3.4.5-9 summarizes the off-site gross alpha and gross beta analysis results for 39 soil samples and five duplicate samples. Gross beta activity did not exceed background in any of the samples that were analyzed. Gross alpha activity slightly exceeded background in four samples (CY81C-GR-004-SS, CY81C-GR-005-SS, CY81C-GR-009-SS, and CY81C-GR-024-SS).

3.4.5.4 Soil Pile Sampling

SNL/NM conducted soil sampling at the soil piles generated from the VCM at SWMU 81C in September 1998 to determine whether potential COCs were present at levels exceeding background limits at the site and/or at levels sufficient 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 RFI work plan for OU 1333 (SNL/NM September 1995) and the VCM Plan (SNL/NM August 1998). SNL/NM chain-of-custody and sample documentation procedures were followed for all samples that were collected.

After the excavation for the VCM was completed, soil sampling was performed at both the upper (approximately 600 cubic yards) and lower (approximately 100 cubic yards) soil piles of SWMU 81C. A total of 15 soil samples, 13 from the upper soil pile and two from the lower soil pile, were collected (Figure 3.4.5-9). All soil samples collected in September 1998 were analyzed off site for VOCs, SVOCs, Metals, HE, and gross alpha and gross beta activity. General Engineering Laboratories of Charleston, South Carolina, analyzed the samples for VOCs using EPA Method 8260 (EPA November 1986), SVOCs using EPA Methods 8270 (EPA November 1986), RCRA metals plus beryllium using EPA Method 6010/7000 (EPA November 1986), HE using EPA Method 8330 (EPA November 1986), and gross alpha and gross beta using EPA Method 900.0 (EPA November 1986). In addition, SNL/NM Department 7713 RPSD Laboratory also used gamma spectroscopy to analyze the samples on site for radionuclides.

3.4.5.4.1 Soil Pile Sampling Data Gaps

Analytical data from soil pile sampling are sufficient to characterize the level of contamination in the excavated soil. There are no further data gaps regarding characterization of the soil piles from SWMU 81C.

3.4.5.4.2 Soil Pile Sampling Results and Conclusions

In September 1998 soil samples from the upper and lower soil piles were collected from 15 locations throughout the piles. Thirteen samples were collected from the large upper soil pile and two samples were collected from the small lower soil pile.

Tables 3.4.5-10, 3.4.5-11, 3.4.5-12, and 3.4.5-13 summarize the metals, SVOC, and radionuclide (i.e., gross alpha and gross beta, and gamma spectroscopy) analytical results for all of the soil samples collected from the soil piles at SWMU 81C. Annex 3-B contains complete results for the gamma spectroscopy analyses. Analytical method detection limits were the same as those listed in Tables 3.4.5-3, 3.4.5-5, and 3.4.5-7 for the VOCs, SVOCs, and HE compounds, respectively. The remainder of this section describes the results of soil pile sampling at SWMU 81C.

Metals

Table 3.4.5-10 summarizes the metals analysis for the 15 soil samples collected from the soil piles from SWMU 81C.

Arsenic, chromium, mercury, selenium, and silver were not detected above the NMED approved background concentration limits in any of the soil pile samples collected at SWMU 81C. Barium was detected above the NMED approved background concentration limits of 246 mg/kg in two samples (CY81C-GR-026-S and CY81C-GR-027-S). Beryllium was detected above the NMED approved background concentration limits of 0.75 mg/kg in three samples (CY81C-GR-028-S, CY81C-GR-039-S and CY81C-GR-040-S). Cadmium was detected above the NMED approved background concentration limits of 0.64 mg/kg in two samples (CY81C-GR-026-S and CY81C-GR-027-S). Lead was detected above the NMED approved background concentration limits of 18.9 mg/kg in four samples (CY81C-GR-026-S, CY81C-GR-027-S, CY81C-GR-034-S, and CY81C-GR-039-S).

VOCs

Because there are no background concentrations for VOCs in soil, any detectable VOC in the samples collected from the soil piles at SWMU 81C can be considered an indication of contamination. However, no VOCs were detected in the 15 soil samples collected from the soil piles at SWMU 81C.

SVOCs

Because there are no background concentrations for SVOCs in soil, any detectable SVOC in the samples collected from the soil piles at SWMU 81C can be considered an indication of contamination. One SVOC, diethyl phthalate, was detected in three of the samples (CY81C-GR-028-S, CY81C-GR-031-S, and CY81C-GR-033-S) collected from the soil piles at SWMU 81C. Table 3.4.5-11 summarizes the off-site SVOC analysis for the 15 soil samples collected from the soil piles at SWMU 81C.

Table 3.4.5-10
Summary of SWMU 81C Soil Pile Sampling Metals Analytical Results,
September–October 1998

Sample Attributes			Metals (EPA 6010/7000)[a] (mg/kg)[b]								
Record Number[c]	ER Sample ID (Figure 3.4.5-9)	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
600789	CY81C-GR-026-S	0.0–0.5	4.90	**274**	0.641	**1.09**	15.8	**20.3**	0.00768 J (0.0320)	ND (0.135)	ND (0.031)
600789	CY81C-GR-027-S	0.0–0.5	4.46	**270**	0.625	**0.802**	15.7	**22.5**	0.00296 J (0.0329)	ND (0.135)	ND (0.031)
600789	CY81C-GR-028-S	0.0–0.5	4.85	204	**0.787**	0.325 J (0.528)	16.4	16.4	0.0143 J (0.0346)	ND (0.135)	ND (0.031)
600789	CY81C-GR-029-S	0.0–0.5	4.13	196	0.745	0.323 J (0.489)	15.9	13.7	0.00959 J (0.0342)	ND (0.135)	ND (0.031)
600789	CY81C-GR-030-S	0.0–0.5	4.08	185	0.692	0.367 J (0.527)	14.9	13.3	0.0111 J (0.0325)	ND (0.135)	ND (0.031)
600789	CY81C-GR-031-S	0.0–0.5	4.36	183	0.739	0.317 J (0.522)	15.2	15.5	0.00671 J (0.0327)	ND (0.135)	ND (0.031)
600789	CY81C-GR-032-S	0.0–0.5	4.08	175	0.698	0.311 J (0.518)	13.7	13.5	0.0104 J (0.0341)	ND (0.135)	ND (0.031)
600789	CY81C-GR-033-S	0.0–0.5	4.74	189	0.737	0.321 J (0.499)	15.0	15.6	0.0235 J (0.0356)	ND (0.135)	ND (0.031)
600789	CY81C-GR-034-S	0.0–0.5	4.65	204	0.728	0.374 J (0.527)	15.1	**19.1**	0.0136 J (0.0305)	ND (0.135)	ND (0.031)
600789	CY81C-GR-035-S	0.0–0.5	4.96	192	0.737	0.414 J (0.502)	14.6	15.4	0.00668 J (0.0334)	ND (0.135)	ND (0.031)
600789	CY81C-GR-036-S	0.0–0.5	5.45	186	0.730	0.365 J (0.527)	17.1	18.3	0.0107 J (0.0339)	ND (0.135)	ND (0.031)
600789	CY81C-GR-037-S	0.0–0.5	4.51	198	0.698	0.406 J (0.501)	15.5	14.1	0.00912 J (0.0351)	ND (0.135)	ND (0.031)
600789	CY81C-GR-038-S	0.0–0.5	5.32	189	0.728	0.385 J (0.521)	14.7	15.9	0.00637 J (0.0335)	ND (0.135)	ND (0.031)
600789	CY81C-GR-039-S	0.0–0.5	5.39	203	**0.781**	0.436 J (0.493)	15.3	**20.1**	0.0276 J (0.0345)	ND (0.135)	ND (0.031)
600789	CY81C-GR-040-S	0.0–0.5	4.69	198	**0.765**	0.390 J (0.516)	14.9	16.6	0.0311 J (0.0345)	ND (0.135)	ND (0.031)
Background Soil Concentrations, Canyon Area			9.8	246	0.75	0.64	18.8	18.9	0.055	3.0	<0.5

Table 3.4.5-10 (Concluded)
Summary of SWMU 81C Soil Pile Sampling Metals Analytical Results,
September–October 1998

[a]EPA November 1986.
[b]Values in bold exceed background soil concentrations.
[c]Analysis request/chain of custody.
[d]From Zamorski December 1997.

CY = Canyon.
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 = Milligrams per kilogram.
ND ( ) = Not detected above the MDL, shown in parenthesis.
S = Soil sample.
SWMU = Solid waste management unit.

Table 3.4.5-11
Summary of SWMU 81C Soil Pile Sampling SVOC Analytical Results,
September 1998

Sample Attributes			SVOCs (EPA Method 8270)[a] (µg/kg)[b]
Record Number[c]	ER Sample ID	Sample Depth (ft)	Diethyl Phthalate
600789	CY81C-GR-026-S	0.0–0.5	ND (346)
600789	CY81C-GR-027-S	0.0–0.5	ND (346)
600789	CY81C-GR-028-S	0.0–0.5	**240 J (365)**
600789	CY81C-GR-029-S	0.0–0.5	ND (357)
600789	CY81C-GR-030-S	0.0–0.5	ND (357)
600789	CY81C-GR-031-S	0.0–0.5	**240 J (357)**
600789	CY81C-GR-032-S	0.0–0.5	ND (357)
600789	CY81C-GR-033-S	0.0–0.5	**900**
600789	CY81C-GR-034-S	0.0–0.5	**ND (357)**
600789	CY81C-GR-035-S	0.0–0.5	ND (353)
600789	CY81C-GR-036-S	0.0–0.5	ND (357)
600789	CY81C-GR-037-S	0.0–0.5	ND (350)
600789	CY81C-GR-038-S	0.0–0.5	ND (353)
600789	CY81C-GR-039-S	0.0–0.5	ND (353)
600789	CY81C-GR-040-S	0.0–0.5	ND (350)

[a]EPA November 1986.
[b]Numbers in bold represent detected values.
[c]Analysis request/chain-of-custody record.
CY = Canyon.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
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.
µg/kg = Microgram(s) per kilogram.
ND = Not detected above the MDL, shown in parenthesis.
S = Soil sample.
SWMU = Solid waste management unit.
SVOC = Semivolatile organic compound.

Table 3.4.5-12
Summary of SWMU 81C Soil Pile Sampling Gamma Spectroscopy Analytical Results, September 1998

Sample Attributes			Gamma Spectroscopy Activity (pCi/g)[b]							
			Uranium-238		Thorium-232		Uranium-235		Cesium-137	
Record Number[a]	ER Sample ID (Figure 3.4.5-9)	Sample Depth (ft)	Results	Error[b]	Results	Error[b]	Results	Error[b]	Results	Error
600820	CY81C-GR-026-S	0.0–0.5	ND (0.528)		0.598	+/-0.357	ND (0.194)		0.0523	+/- 0.0162
600820	CY81C-GR-027-S	0.0–0.5	ND (0.499)		0.565	+/-0.339	ND (0.121)		0.0593	+/- 0.0348
600820	CY81C-GR-028-S	0.0–0.5	0.417	+/-0.368	0.723	+/-0.384	ND (0.194)		0.0357	+/- 0.0344
600820	CY81C-GR-029-S	0.0–0.5	0.602	+/-0.478	0.681	+/-0.390	0.0970	+/-0.165	0.0368	+/- 0.0278
600820	CY81C-GR-030-S	0.0–0.5	0.821	+/-0.397	0.711	+/-0.394	ND (0.200)		0.0251	+/- 0.0380
600820	CY81C-GR-031-S	0.0–0.5	ND (0.538)		0.640	+/-0.399	0.0995	+/-0.172	0.0295	+/- 0.0332
600820	CY81C-GR-032-S	0.0–0.5	ND (0.553)		0.692	+/-0.422	ND (0.202)		0.0353	+/- 0.0339
600820	CY81C-GR-033-S	0.0–0.5	0.619	+/-0.461	0.778	+/-0.447	ND (0.210)		0.0395	+/- 0.0244
600820	CY81C-GR-034-S	0.0–0.5	ND (0.575)		0.818	+/-0.451	ND (0.209)		0.0492	+/- 0.0373
600820	CY81C-GR-035-S	0.0–0.5	0.523	+/-0.537	0.847	+/-0.460	ND (0.201)		0.0443	+/- 0.0362
600820	CY81C-GR-036-S	0.0–0.5	ND (0.521)		0.694	+/-0.392	ND (0.193)		0.0361	+/- 0.0304
600820	CY81C-GR-037-S	0.0–0.5	0.509	+/-0.430	0.843	+/-0.432	ND (0.0992)		0.0468	+/- 0.0387
600820	CY81C-GR-038-S	0.0–0.5	ND (0.550)		0.762	+/-0.415	0.146	+/-0.172	0.0376	+/- 0.0267
600820	CY81C-GR-039-S	0.0–0.5	ND (0.549)		0.732	+/-0.441	0.101	+/-0.172	0.0391	+/- 0.0348
600820	CY81C-GR-040-S	0.0–0.5	0.323	+/-0.356	ND (0.152)		ND (0.197)		0.0382	+/- 0.0370
Background Soil Activity, Upper Canyons[c]			2.31	NA	1.03	NA	0.16	NA	0.515	NA

[a]Analysis request/chain of custody
[b]Two standard deviations about the mean detected activity.
[c]Dinwiddie September 1997.
CY = Canyons.
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.
S = Subsurface soil sample.
SWMU = Solid waste management unit.
-- = Error not calculated for nondetectable results.

Table 3.4.5-13
Summary of SWMU 81C Soil Pile Sampling Gross Alpha and Beta Analysis,
September 1998

Sample Attributes			Activity (pCi/g) [b]			
			Gross Alpha		Beta	
Record Number [a]	ER Sample ID	Sample Depth (ft)	Results	Error [b]	Results	Error [b]
Inside Bunker						
600789	CY81C-GR-026-S	0.0–0.5	19.3	+/- 4.82	30.7	+/- 4.44
600789	CY81C-GR-027-S	0.0–0.5	14.2	+/- 4.24	15.9	+/- 3.88
600789	CY81C-GR-028-S	0.0–0.5	10.6	+/- 3.52	17.7	+/- 3.21
600789	CY81C-GR-029-S	0.0–0.5	10.7	+/- 3.49	17.6	+/- 3.42
600789	CY81C-GR-030-S	0.0–0.5	13.0	+/- 3.89	21.5	+/- 3.57
600789	CY81C-GR-031-S	0.0–0.5	11.1	+/- 3.61	19.1	+/- 3.57
600789	CY81C-GR-032-S	0.0–0.5	11.6	+/- 3.68	21.6	+/- 3.48
600789	CY81C-GR-033-S	0.0–0.5	7.86	+/- 3.08	20.3	+/- 3.63
600789	CY81C-GR-034-S	0.0–0.5	7.36	+/- 2.98	20.7	+/- 3.48
600789	CY81C-GR-035-S	0.0–0.5	9.07	+/- 3.34	19.8	+/- 3.63
600789	CY81C-GR-036-S	0.0–0.5	11.3	+/- 3.51	16.1	+/- 3.76
600789	CY81C-GR-037-S	0.0–0.5	15.3	+/- 4.33	19.0	+/- 3.78
600789	CY81C-GR-038-S	0.0–0.5	15.6	+/- 4.30	25.3	+/- 3.91
600789	CY81C-GR-039-S	0.0–0.5	17.9	+/- 4.48	20.6	+/- 3.89
600789	CY81C-GR-040-S	0.0–0.5	14.0	+/- 3.97	20.5	+/- 3.75
Background Soil Concentrations, Canyon [d]			18.3	NA	52.7	NA

[a]Analysis request/chain of custody.
[b]Two standard deviations above the mean detected activity.
[c]From Tharp July 1998.
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.
SWMU = Solid waste management unit.

HE

Because there are no background concentrations for HE compounds in soil, any detectable HE compounds in the samples collected from the soil piles at SWMU 81C can be considered an indication of contamination. However, no HE compounds were detected in the 15 soil samples collected from the soil piles at SWMU 81C.

Radionuclides

Table 3.4.5-12 summarizes the on-site gamma spectroscopy analysis results for 15 soil samples collected from the soil piles at SWMU 81C. The gamma spectroscopy results indicate that no gamma activity was detected above the MDA or background concentration. However, the MDA associated with nondetectable results for 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 results, 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 and Gross Beta

Table 3.4.5-13 summarizes the off-site gross alpha and gross beta analysis results for the 15 soil samples collected from the soil piles from SWMU 81C. Gross alpha activity and gross beta activity did not exceed background in any of the samples that were analyzed.

3.4.5.5 Data Quality

QA/QC Results

Tables 3.4.5-1, 3.4.5-2, 3.4.5-4, and 3.4.5-6 present results of the analysis of metals, VOCs, SVOCs, and HE QA/QC samples that were collected during the confirmatory sampling program at SWMU 81C. These QA/QC samples consisted of three equipment blanks and three trip blanks. The equipment blanks were analyzed off site for metals, VOCs, HE, and SVOCs and the trip blanks were analyzed for VOCs. No VOCs or SVOCs were detected in any of the three equipment blanks. Very low estimated levels of one HE compound (m-dinitrobenzene) were detected in the two equipment blanks. Metals concentrations all three equipment blanks were at less than detection limits for all analytes except barium and chromium. The concentrations were below the practical detection limit, and were qualified J (estimated value). One HE compound (m-p-nitrobenzene) was detected in two of the equipment blanks at very low estimated concentrations. Methylene chloride was detected in two of the three trip blanks. No QA/QC samples were collected for radionuclide analyses.

To assess the precision of soil sampling procedures, five soil samples were collected and analyzed in replicate off site. Relative percent differences (RPD) were calculated from the data and are shown in Table 3.4.5-14. Because some of results for the sample pairs are

Table 3.4.5-14
Summary of SWMU 81C Field Duplicate Relative Percent Differences

Sample Attributes			Relative Percent Difference					
Record Number[a]	ER Sample ID (Figure 3.4.5-9)	Sample Depth (ft)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead
600788	CY81C-GR-010-SS CY81C-GR-010-DP (off-site laboratory)	0.0–0.5	8.9	6.1	6.3	7.7	2.1	32.1
600788	CY81C-GR-018-SS CY81C-GR-018-DP (off-site laboratory)	0.0–0.5	7.8	1.2	5.2	114.7	1.4	1.0
600789	CY81C-GR-023-SS CY81C-GR-023-DU (off-site laboratory)	0.0–0.5	5.2	11.2	5.1	0.6	9.1	63.2
600789	CY81C-GR-025-SS CY81C-GR-025-DU (off-site laboratory)	0.0–0.5	10.0	12.9	15.2	130.6	22.2	29.1
600790	CY81C-GR-044-SS CY81C-GR-044-DP (off-site laboratory)	0.0–0.5	5.2	8.0	1.3	10.7	10.2	1.8

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

nondetect, RPDs could not be calculated for all samples for mercury, selenium, and silver. The corresponding RPDs ranged from 5.2 to 10.0 percent for arsenic, from 1.2 to 12.9 percent for barium, from 1.3 to 15.2 percent for beryllium, from 0.6 to 130.6 percent for cadmium, from 1.4 to 22.2 percent for chromium, and from 1.0 to 63.2 percent for lead in the five sample duplicate pairs. With the exception of cadmium and lead the results obtained for the five sample duplicate pairs are in good agreement for a soil matrix.

Data Validation

All off-site laboratory results were reviewed and verified/validated according to "Data Verification/Validation Level 3—DV-3" in Attachment C of the Technical Operating Procedure 94-03, Rev. 0 (SNL/NM July 1994b). In addition SNL/NM Department 7713 (RPSD Laboratory) reviewed all gamma spectroscopy results according to "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 2 (SNL/NM July 1996). Annex 3-C contains off-site data validation reports. The verification/validation process confirmed that the data are acceptable for use in this NFA proposal for SWMU 81C.

During data validation, qualifications were applied to VOC sample data due to blank contamination. Methylene chloride detections in 13 samples were qualified as "nondetects" due to trip blank contamination.

3.5 Site Conceptual Model

The site conceptual model for SWMU 81C is based upon residual COCs identified in the soil samples collected from the base of the excavation following the VCM. This section summarizes the nature and extent of contamination and the environmental fate of COCs.

3.5.1 Nature and Extent of Contamination

The primary COCs at SWMU 81C are metals associated with the disposal of spent rocket motors and metallic debris from rocket sled tests. Low estimated concentrations of four VOCs, three SVOCs, and one HE compound were also detected in a few samples. Gamma activities were detected above background in a few samples. Metal and radionuclide COCs were determined by comparing sample results to background concentrations and to 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 analyses exceed background activity limits (see Table 3.4.5-8), 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 arsenic, barium, beryllium, cadmium, chromium, lead, mercury, and silver. Radionuclide COCs include uranium-235 and cesium-137. Table 3.5.1-1 lists the COCs and the sample locations where they were detected.

Thirty-nine samples and five duplicate samples were collected from the base of the excavations at SWMU 81C. In most cases the COCs are only slightly elevated above background concentrations or activity limits specified for the Canyons Area (Dinwiddie September 1997, Zamorski December 1997). The COCs that exceed background limits typically occur as isolated

Table 3.5.1-1
Summary of COCs for SWMU 81C

COC Type	Number of Samples	COCs Greater Than Background	Maximum Background Limit/Canyons Area[a] (mg/kg except where noted)	Maximum Concentration (mg/kg except where noted)	Average Concentration[b] (mg/kg except where noted)	Sampling Locations Where Background Concentration Exceeded[c]
Metals	54 environmental; 5 duplicates	Arsenic	9.8	13.5	5.10	CY81C-GR-001-SS
		Barium	246	496	230	CY81C-GR-002-SS CY81C-GR-003-SS CY81C-GR-005-SS CY81C-GR-006-SS CY81C-GR-007-SS CY81C-GR-008-SS CY81C-GR-011-SS CY81C-GR-013-SS CY81C-GR-016-SS CY81C-GR-017-SS CY81C-GR-018-SS CY81C-GR-018-DP CY81C-GR-021-SS CY81C-GR-022-SS CY81C-GR-023-SS CY81C-GR-023-DU CY81C-GR-026-S CY81C-GR-027-S
		Beryllium	0.75	1.07	0.63	CY81C-GR-001-SS CY81C-GR-022-SS CY81C-GR-024-SS CY81C-GR-025-SS CY81C-GR-028-S CY81C-GR-039-S CY81C-GR-040-S
		Cadmium	0.64	1.67	0.44	CY81C-GR-001-SS CY81C-GR-004-SS CY81C-GR-012-SS CY81C-GR-018-DP CY81C-GR-026-S CY81C-GR-027-S CY81C-GR-051-SS

Refer to footnotes at end of table.

Table 3.5.1-1 (Continued)
Summary of COCs for SWMU 81C

COC Type	Number of Samples	COCs Greater Than Background	Maximum Background Limit/Canyons Area[a] (mg/kg except where noted)	Maximum Concentration (mg/kg except where noted)	Average Concentration[b] (mg/kg except where noted)	Sampling Locations Where Background Concentration Exceeded[c]
Metals (Continued)	54 environmental; 5 duplicates	Chromium	18.8	37.7	15.55	CY81C-GR-001-SS CY81C-GR-004-SS CY81C-GR-017-SS CY81C-GR-022-SS CY81C-GR-050-SS CY81C-GR-051-SS
		Lead	18.9	176	20.74	CY81C-GR-001-SS CY81C-GR-004-SS CY81C-GR-012-SS CY81C-GR-015-SS CY81C-GR-018-SS CY81C-GR-018-DP CY81C-GR-022-SS CY81C-GR-023-SS CY81C-GR-023-DU CY81C-GR-024-SS CY81C-GR-025-SS CY81C-GR-025-DU CY81C-GR-026-S CY81C-GR-027-S CY81C-GR-034-S CY81C-GR-039-S CY81C-GR-051-SS CY81C-GR-052-SS CY81C-GR-053-SS CY81C-GR-054-SS
		Mercury	0.055	0.0842	0.02	CY81C-GR-020-SS CY81C-GR-021-SS CY81C-GR-051-SS
		Selenium	3.0	1.3	0.43	All samples were less than NMED approved background concentration
		Silver	<0.5	0.518 J	Not calculated	CY81C-GR-017-SS

Refer to footnotes at end of table.

Table 3.5.1-1 (Continued)
Summary of COCs for SWMU 81C

COC Type	Number of Samples	COCs Greater Than Background	Maximum Background Limit/Canyons Area[a] (mg/kg except where noted)	Maximum Concentration (mg/kg except where noted)	Average Concentration[b] (mg/kg except where noted)	Sampling Locations Where Background Concentration Exceeded[c]
VOC	54 environmental; 5 duplicates	Chlorodibromomethane	NA	0.84 J (1.12) µg/kg	Not calculated	CY81C-GR-001-SS CY81C-GR-002-SS CY81C-GR-006-SS CY81C-GR-010-DP
		Chloroform	NA	7.4 J (1.12) µg/kg	Not calculated	CY81C-GR-001-SS CY81C-GR-002-SS CY81C-GR-006-SS CY81C-GR-008-SS CY81C-GR-010-DP CY81C-GR-011-SS CY81C-GR-013-SS CY81C-GR-014-SS CY81C-GR-015-SS
	54 environmental; 5 duplicates	Dichlorobromomethane	NA	2.1 J µg/kg	Not calculated	CY81C-GR-001-SS CY81C-GR-002-SS CY81C-GR-006-SS
		Methylene Chloride	NA	7.8 J µg/kg	Not calculated	CY81C-GR-002-SS
SVOC	54 environmental; 5 duplicates	Diethyl Phthalate	NA	13,000 J µg/kg	Not calculated	CY81C-GR-014-SS CY81C-GR-019-SS CY81C-GR-022-SS CY81C-GR-023-SS CY81C-GR-028-S CY81C-GR-031-S CY81C-GR-034-S CY81C-GR-044-DP CY81C-GR-051-SS CY81C-GR-053-SS
		Bis(2-ethylhexyl)phthalate	NA	1,500 µg/kg	Not calculated	CY81C-GR-044-SS
		Phenol	NA	240 J µg/kg	Not calculated	CY81C-GR-023-SS
HE	54 environmental; 5 duplicates	m-dinitrobenzene	NA	100 µg/kg	Not calculated	CY81C-GR-041-SS CY81C-GR-042-SS

Refer to footnotes at end of table.

Table 3.5.1-1 (Concluded)
Summary of COCs for SWMU 81C

COC Type	Number of Samples	COCs Greater Than Background	Maximum Background Limit/Canyons Area[a] (mg/kg except where noted)	Maximum Concentration (mg/kg except where noted)	Average Concentration[b] (mg/kg except where noted)	Sampling Locations Where Background Concentration Exceeded[c]
Radionuclides	54 environmental; 5 duplicates	U-235	0.16 pCi/g	0.252	Not Calculated[d]	CY81C-GR-041-SS CY81C-GR-048-SS
		Cs-137	0.515 pCi/g	0.575 pCi/g	Not Calculated[d]	CY81C-GR-009-SS

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

[b]Average concentration includes all samples. For nondetectable results, the detection limit is used to calculate the average.

[c]Includes all samples with detectable concentrations (for VOCs and SVOCs) or all samples with nondetectable results where the MDA exceeds background (for radionuclides).

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

COC = Constituent of concern.
CY = Canyon.
DP = Duplicate sample.
GR = Grab sample.
J ( ) = Reported value is greater than or equal to the method detection limit but is less than the practical quantitation limit, shown in parenthesis.
µg/kg = Micrograms per kilogram.
MDA = Minimum detectable activities.
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
ND ( ) = Not detected at or above the method detection limit, shown in parenthesis.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
S = Soil pile sample.
SS = Surface soil sample.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
VOC = Volatile organic compound.

"hot spots" with no particular COC associations or correlation to particular locations or areas of the excavations that could be delineated as contaminated.

Potential COCs were determined on the basis of detectable concentrations of VOCs, SVOCs, and HE in any soil sample. Because background concentrations for these constituents are not applicable, any detectable VOCs, SVOCs, or HE are considered potential contamination. Conversely, analytical results of samples that yielded no detections were not considered in evaluating potential COCs at SWMU 81C. As a result, VOC COCs included chlorodibromomethane, chloroform, dichlorobromomethane, and methylene chloride. SVOC COCs included diethyl phthalate, bis(2-ethylhexyl) phthalate, and phenol. HE COCs included m-dinitrobenzene. Table 3.5.1-1 lists these COCs and the sample locations where they were detected.

Because the concentrations of VOCs detected were below the laboratory practical quantitation limit, all VOCs were qualified as estimated values. Because the concentrations do not vary with sample location and the VOCs are common laboratory contaminants, it is believed that the VOCs do not result from contamination from activities conducted at SWMU 81C. Because the locations of the SVOC detections are sporadic, the SVOCs are common laboratory contaminants, and most concentrations were detected below the laboratory practical quantitation limit, it is believed that the SVOCs do not result from contamination from activities conducted at SWMU 81C. Because the concentration of the one HE compound detected in only two samples is very low, it is believed that the HE represents only very minor isolated residual contamination.

The MDA associated with most uranium-235 analyses were above background. Cesium-137 was detected above the maximum background activity in one sample location. All elevated activities are believed to be naturally occurring at SWMU 81C.

3.5.2 Environmental Fate

The primary source of COCs at SWMU 81C was debris buried in the shallow water course on the south side of the sled track. The buried debris was removed from the water course during the VCM activities (Figure 3.5.2-1). The primary release mechanism of COCs to the surface and subsurface soils is loss of containment due to degradation of metal debris that may have occurred before the debris was removed during the VCM.

Table 3.5.1-1 summarizes potential COCs for SWMU 81C. Based upon the nature and extent of contamination at the site (Section 3.5.1), metals, VOC, SVOC, and HE COCs occur sporadically at low concentrations in surface soils at the base of the excavation. No distinct vertical or horizontal distribution of contamination is present. As discussed in Section 3.5.1 radionuclides are also potential COCs for SWMU 81C. All potential COCs were retained in the conceptual model and were evaluated in the human health and ecological risk assessments.

The current land use for SWMU 81C is industrial. However, because the future land use for SWMU 81C 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 ingestion of soil is considered a major exposure route for the recreational user. Potential biota receptors include flora and fauna at the site. Similar to the recreational user, direct ingestion of soil is considered

This page intentionally left blank.

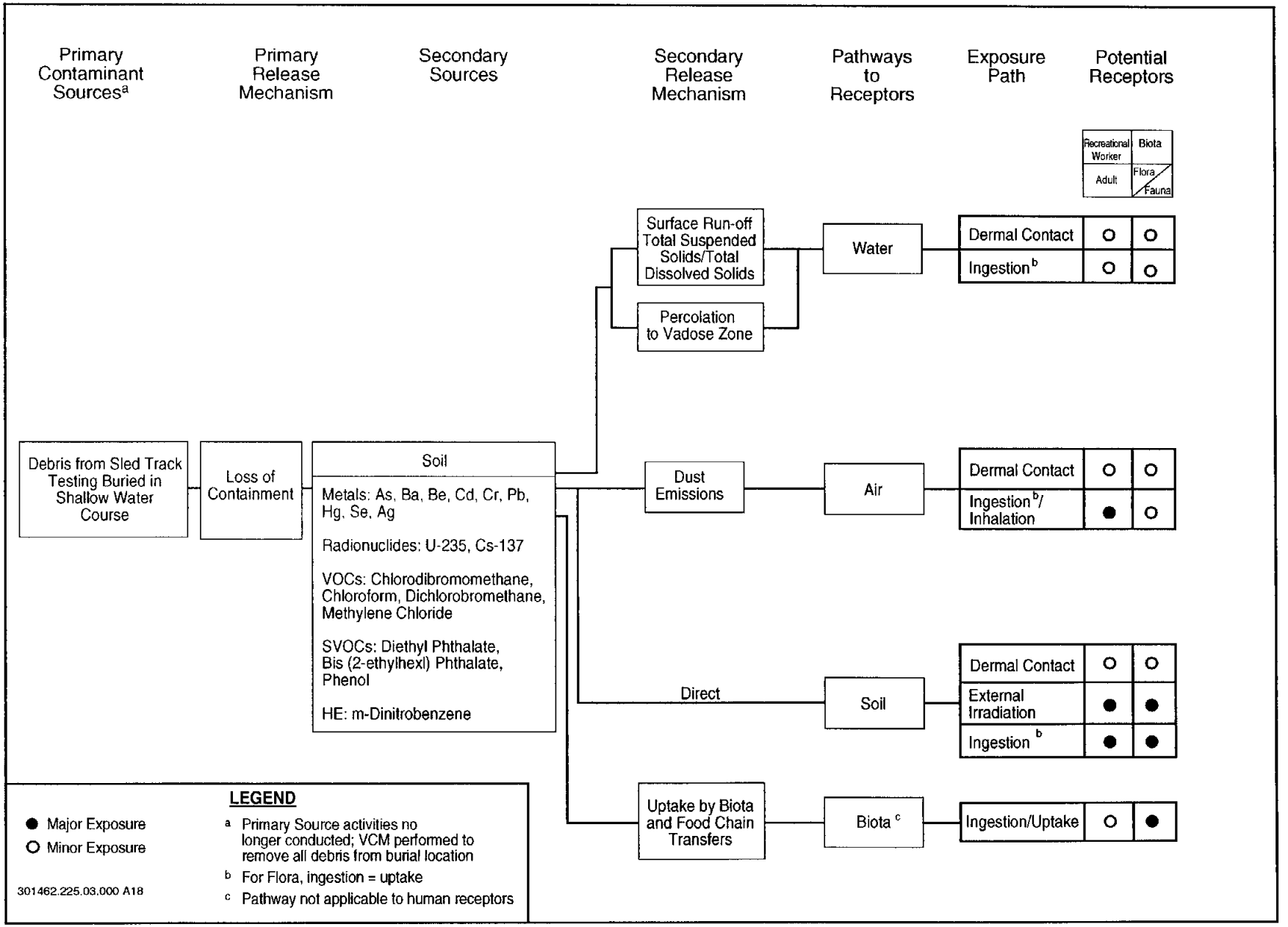


Figure 3.5.2-1

Conceptual Model Flow Diagram for SWMU 81C, Former Burial Location

the major exposure route for biota, in addition to ingestion through food chain transfers or direct uptake. Annex 3-D, Section V, provides additional discussion of the exposure routes and receptors at SWMU 81C.

3.6 Site Assessments

Site assessment at SWMU 81C includes risk screening assessments followed by risk baseline assessments (as required) for both human health and ecological risk. The following sections summarize the site assessment results. Annex 3-D provides details of the site assessment.

3.6.1 Summary

The site assessment concludes that SWMU 81C has no significant potential to affect human health under a recreational land use scenario. After considering the uncertainties associated with the available data and modeling assumptions, ecological risks associated with SWMU 81C were found to be very low. Section 3.6 briefly describes and Annex 3-D provides details of the site screening assessments.

3.6.2 Screening Assessments

Risk screening assessments were performed for both human health risk and ecological risk for SWMU 81C. This section briefly summarizes the risk screening assessments.

3.6.2.1 Human Health

SWMU 81C has been recommended for recreational land use (DOE et al. October 1995). Annex 3-D provides a complete discussion of the risk assessment process, results, and uncertainties. Because COCs are present in concentrations or activities greater than background levels, it was necessary to perform a health risk assessment analysis for the site. This assessment included any detected VOCs or SVOCs and any radionuclide compounds detected either above background levels and/or above 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 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 81C 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. The incremental HI is 0.00. The excess cancer risk for SWMU 81C nonradiological COCs is 8E-7 for a recreational land use setting. 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). Thus, the excess cancer risk for this site is below the suggested acceptable risk value (1E-6). The incremental excess cancer risk is 2.07E-7.

The incremental total effective dose equivalent (TEDE) for radionuclides for a recreational land use setting for SWMU 81C is 5.6E-3 millirems (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 (1997a) and reflected in a document entitled "Sandia National Laboratories/New Mexico Environmental Restoration Project—RESRAD Input Parameter Assumptions and Justification" (SNL/NM February 1998). The incremental excess cancer risk for the radionuclides is 7.0E-8 for the recreational land-use scenario, which is much less than risk values calculated from naturally occurring radiation and from intakes considered as background concentration values.

The residential land use scenarios for this site are provided only for comparison in the Risk Assessment Report (Annex 3-D). The report concludes that SWMU 81C does not have potential to affect human health under a recreational land use scenario.

3.6.2.2 Ecological

An ecological screening assessment that corresponds with the screening procedures (NMED March 1998) in the EPA's Ecological Risk Assessment Guidance for Superfund (EPA 1997b) was performed as set forth by the NMED Risk-Based Decision Tree. An early step in the evaluation compared COC concentrations and identified potentially bioaccumulative constituents (see Annex 3-D, Sections III, VI, VII.2, and VII.3). This methodology also required developing a site conceptual model and a food web model as well as selecting ecological receptors. Each of these items was presented in the "Predictive Ecological Risk Assessment Methodology for SNL/NM ER Program, Sandia National Laboratories/New Mexico" (IT July 1998) and will not be duplicated here. The screening also includes the estimation of exposure and ecological risk.

Tables 14, 15, 16, and 17 of Annex 3-D present the results of the ecological risk assessment screen. Site-specific information was incorporated into the screening assessment when such data were available. Hazard quotients greater than unity were originally predicted; however, closer examination of the exposure assumptions revealed an overestimation of risk primarily attributed to exposure concentration (maximum COC concentration was used in estimating risk), exposure setting (area use factors of one were assumed), and background risk. Based upon an evaluation of these uncertainties, ecological risks associated with this site are expected to be very low.

3.6.3 Baseline Risk Assessments

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

3.6.3.1 Human Health

Based upon the fact that human health results of the screening assessment summarized in Section 3.6.2.1 indicate that SWMU 81C does not have potential to affect human health under a recreational land use setting, a baseline human health risk assessment is not required for SWMU 81C.

3.6.3.2 Ecological

Based upon the fact that ecological results of the screening assessment summarized in Section 3.6.2.2 indicate that SWMU 81C has very low ecological risk, a baseline ecological risk assessment is not required for SWMU 81C.

3.6.4 Other Applicable Assessments

No other applicable assessments have been conducted at SWMU 81C.

3.7 No Further Action Proposal

3.7.1 Rationale

Based upon field investigation data and the human health risk assessment analysis, an NFA is recommended for SWMU 81C for the following reason: No COCs (particularly VOCs, SVOCs, or radionuclides) were present in concentrations considered hazardous to human health for a recreational land use scenario.

3.7.2 Criterion

Based upon the evidence provided above, SWMU 81C 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."

REFERENCES

Bickel, D.C., September 1980. "Decelerator Testing at Sandia National Laboratories—Coyote Canyon Test Complex," SAND8O-2097, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

Biggs, J., May 1991. "Sensitive Species Survey for Sandia National Laboratories Burn Site, Kirtland Air Force Base, New Mexico," CGI Report *#8067AF*, The Chambers Group, Inc., Albuquerque, New Mexico.

Dawson, L. (Sandia National Laboratories/New Mexico). Memorandum to Distribution, Record of Verbal communication for the NMED/DOE Operations Bureau and SNL/NM Project Meetings on Lurance Canyon Burn Site Groundwater Issues Rounds 1 and 2, Sandia National Laboratories/New Mexico. August 15, 1996.

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

DOE, see U.S. Department of Energy.

EPA, see U.S. Environmental Protection Agency.

Hoagland, S. and R. Dello-Russo, February 1995. "Cultural Resources Investigation for Sandia National Laboratories/New Mexico, Environmental Restoration Program, Kirtland Air Force Base, New Mexico," Butler Service Group, Albuquerque, New Mexico.

IT, see IT Corporation.

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

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

Martz, M.K. Memorandum to Sandia National Laboratories CEARP File, Personal Interview (unpublished), ER7585/1333/065/INT/95-015, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico. September 24, 1985.

Martz, M.K. Memorandum to Sandia National Laboratories CEARP File, Personal Interview (unpublished), ER7585/1333/065/INT/95-014, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico. November 1985.

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

Palmieri, D. (IT Corporation), Interview (unpublished) conducted for Environmental Restoration Project, Department 7585, Sandia National Laboratories, ER/1333 081/INT/95-014, Albuquerque, May 1992.

Sandia National Laboratories/New Mexico (SNL/NM), July 1994a. "Ownership (Land Use), Canyons Test Area—ADS 1333," GIS Group, Environmental Restoration Project, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

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

Sandia National Laboratories/New Mexico (SNL/NM), August 1994. "Historical Aerial Photo Interpretation of the Canyons Test Area, OU 1333," Environmental Restoration Project, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), September 1995. "RCRA Facility Investigation Work Plan for Operable Unit 1333, Canyons Test Area," Environmental Restoration Project, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

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

Sandia National Laboratories/New Mexico (SNL/NM), July 1997. "Bullets of Understanding for Nitrate Assessment at the Lurance Canyon Explosive Test Site (ER Site 65) OU 1333, Canyons Test Area, July 1, 1997," Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), September 1997. "Bullets of Understanding for Construction of Lurance Canyon Burn Site 'Narrows' Wells, OU 1333, Canyons Test Area, September 24, 1997," Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

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

Sandia National Laboratories/New Mexico (SNL/NM), March 1998. "Field Implementation Plan for OU 1333 Lurance Canyon Burn Site, SWMU 94A Sampling," Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), April 1998. "Electromagnetic Surveys at ER Site 81C," Environmental Restoration Project, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), August 1998. "Voluntary Corrective Measure Plan for Excavation and Debris Removal at Environmental Restoration SWMU 81C Former Burial Location, Operable Unit 1333, Canyons Test Area," Environmental Restoration Project, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

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

Sullivan, R.M., August 1994. "Biological Investigation of the Sandia National Laboratories Sol Se Mete Aerial Cable Facility," Sandia National Laboratories, Albuquerque, New Mexico.

Tharp, T.L. (Sandia National Laboratories/New Mexico). Memorandum to Environmental Restoration Project Files, "Gross Alpha/Beta Background Data Statistical Analysis for OU 1333, Canyons," Sandia National Laboratories, Albuquerque, New Mexico. July 1998.

U.S. Department of Energy (DOE), October 1995. "Workbook: Future Use Management Area 1," prepared by Future Use Logistics and Support Working Group in cooperation with the U.S. Department of Energy Affiliates and U.S. Air Force, Albuquerque, New Mexico.

U. S. Department of Energy (DOE), March 1996. "Environmental Assessment of the Environmental Restoration Project at Sandia National Laboratories/New Mexico," DOE/EA-1140, Kirtland Area Office, U.S. Department of Energy, Albuquerque, New Mexico.

U.S. Department of Energy (DOE), Albuquerque Operations Office, Environmental Safety and Health Division, Environmental Program Branch, September 1987, draft. "Comprehensive

Environmental Assessment and Response Program (CEARP) Phase 1: Installation Assessment, Sandia National Laboratories, Albuquerque," Albuquerque Operations Office, U.S. Department of Energy, Albuquerque, New Mexico.

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

U.S. Environmental Protection Agency (EPA), April 1987. "Final RCRA Facility Assessment Report of Solid Waste Management Units at Sandia National Laboratories, Albuquerque, New Mexico," Contract No. 68-01-7038, Region 6, U.S. Environmental Protection Agency, Dallas, Texas.

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

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

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

Vigil, F. (Sandia National Laboratories/New Mexico). "Abolishment of RMMA # ER-81," Memorandum to Sharissa Young (Pollution Prevention and Hazardous Waste Management), Sandia National Laboratories/New Mexico, Albuquerque, New Mexico. April 6, 1998.

Zamorski, M.J. (U.S. Department of Energy). Letter to R.S. Dinwiddie (New Mexico Environment Department), "Department of Energy/Sandia National Laboratories Response to the NMED Request for Supplemental Information for the *Background Concentrations of Constituents of Concern to the Sandia National Laboratories/New Mexico Environmental Restoration Project and the Kirtland Air Force Base Installation Restoration Program* Report." December 3, 1997.

ANNEX 3-A
Summary of Gore-Sorber Passive Soil Gas Results
May 8, 1998

W. L. GORE & ASSOCIATES, INC.
100 CHESAPEAKE BLVD., P.O. BOX 10 • ELKTON, MARYLAND 21922-0010 • PHONE: 410/392-7600
FAX: 410/506-4780

GORE-SORBER® Screening Survey Final Report

OU 1333 Burn Site & OU 1333 New Aerial Cable Site
Albuquerque, NM

May 8, 1998

Gore Production Order No. 093733

Prepared For:
Sandia National Laboratories
6121 Indian School Road NE, Suite 105
Albuquerque, NM 87110

W.L. Gore & Associates, Inc.

Written/Submitted by:
Jay W. Hodny, M.S., Project Manager

Reviewed/Approved by:
Ray F. Fenstermacher, P.G., Project Manager

Analytical Data Reviewed by:
Jim E. Whetzel, Chemist

I:\MAPPING\PROJECTS\093733\980508R.DOC

GORE-SORBER® Screening Survey
Final Report

REPORT DATE: May 8, 1998 **AUTHOR:** JWH

SITE INFORMATION

Site Reference: OU 1333 Burn Site, Albuquerque, NM
Customer Purchase Order Number: BC-0262
Gore Production Order Number: 093733 **Gore Site Code:** ALR, ALS, ALZ

FIELD PROCEDURES

 # Modules shipped: 343
Installation Date(s): 2-24,25,26,27-98 and 3-2,3,5,6-98
 # Modules Installed: 308 + 11 duplicates = 319 total
Field work performed by: Sandia National Laboratories

Retrieval date(s): 3-11,12,13,14,17,19,20,23-98
Exposure Time: approximately 18 **[days]**
 # Modules Retrieved: 318 **# Trip Blanks Returned:** 2*
 # Modules Lost in Field: 1
 # Unused Modules: 15**

Date/Time Received by Gore: 3-19,27-98 @ 11:46am and 3:10am **By:** TC,JL
Recorded Cooler/Water Temperature Control Blank temperature: 7.2, 14.6, 17, 18 **[°C]**
Chain of Custody Form attached: √
Chain of Custody discrepancies: None
Comments:
* Modules #150928 and #150929 were identified as trip blanks on Page 1 of the Chain of Custody. Modules #150930, -931, and -932 had TB written on jar lid and Gore considered them as trip blanks. Two modules, #150926 and -927 had BK1 and BK2 written on the jar lids, respectively. These were treated as "unknown" blanks. Module #150649 was identified as a field blank. Module #150753 was lost.
** A total of fifteen modules were not returned and are unaccounted for.

GORE-SORBER® Screening Survey
Final Report

ANALYTICAL PROCEDURES

W.L. Gore & Associates' Screening Module Laboratory operates under the guidelines of its Quality Assurance Manual, Operating Procedures and Methods. The quality assurance program is consistent with Good Laboratory Practices (GLP) and ISO Guide 25, "General Requirements for the Competence of Calibration and Testing Laboratories", third edition, 1990. The Laboratory is audited regularly by a quality system design, development and auditing company.

Instrumentation consists of state of the art gas chromatographs equipped with mass selective detectors, coupled with automated thermal desorption units. Sample preparation simply involves cutting the tip off the bottom of the sample module and transferring one or more exposed sorbent containers (sorbers, each containing 40mg of a suitable granular adsorbent) to a thermal desorption tube for analysis. Sorbers remain clean and protected from dirt, soil, and ground water by the insertion/retrieval cord, and require no further sample preparation. Samples remain frozen until analysis and unanalyzed sorbers are archived in the freezer for potential future analysis.

Analytical Method Quality Assurance:
The analytical method employed is a modified EPA method 8260A/8270B. Before each run sequence, two instrument blanks, a sorber containing 5µg BFB (Bromofluorobenzene), and a method blank are analyzed. The BFB mass spectra must meet the criteria set forth in the method before samples can be analyzed. A method blank and a sorber containing BFB is also analyzed after every 30 samples and/or trip blanks. Standards containing the selected target compounds at three calibration levels of 5, 20, and 50µg are analyzed at the beginning of each run. The criterion for each target compound is less than 35% RSD (relative standard deviation). If this criterion is not met for any target compound, the analyst has the option of generating second- or third-order standard curves, as appropriate. A second-source reference standard, at a level of 20µg per target compound, is analyzed after every ten samples and/or trip blanks, and at the end of the run sequence. Positive identification of target compounds is determined by 1) the presence of the target ion and at least two secondary ions; 2) retention time versus reference standard; and, 3) the analyst's judgment.

NOTE: All data have been archived. Any replicate sorbers not used in the initial analysis will be discarded fifteen (15) days from the date of analysis.

Laboratory analysis: thermal desorption, gas chromatography, mass selective detection
Quality Assurance Level: 2 (ANA-4/GS3; A1)
Instrument ID: #3,4 **Chemist:** JW **Data Subdirectory:** 093733
Compounds/mixtures requested: A1 and A6 Target Compounds Lists
Deviations from Standard Method: A total of three analytical runs were required to complete the analysis. Method deviations occurred in the first run where the 50 ug octane response was dropped from calibration due to poor linearity. No deviations occurred in the second run. Deviations noted from the third run are as follows: 1) no data were reported for the seventh BFB tuning analysis due to ATD error, data was inadvertently overwritten, and 2) the fifth explosives reference standard was prepared incorrectly.
Comments: Soil vapor analytes and abbreviations are tabulated in the Data Table Key (page 6).

GORE-SORBER® Screening Survey
Final Report

DATA TABULATION

 # CONTOUR MAPS ENCLOSED: Five (5) B-sized color contour maps for the OU 1333 Burn Site and two (2) B-sized color contour maps for the OU 1333 New Aerial Cable Site

LIST OF MAPS ENCLOSED:

Burn Site

- Benzene, Toluene, Ethyl benzene, and total Xylenes (BTEX)
- 1,2,4- & 1,3,5-Trimethylbenzenes
- Naphthalene and 2-Methylnaphthalene
- Octane
- Combined Explosive Compounds

New Aerial Cable Site

- Benzene, Toluene, Ethyl benzene, and total Xylenes (BTEX)
- Octane

NOTE: All data values presented in Appendix A represent masses of compound(s) desorbed from the GORE-SORBER Screening Modules received and analyzed by W.L. Gore, as identified in the Chain of Custody (Appendix A). The measurement traceability and instrument performance are reproducible and accurate for the measurement process documented. Semi-quantitation of the compound mass is based on either a single-level (QA Level 1) or three-level (QA Level 2) standard calibration.

General Comments:

- This survey reports soil gas mass levels present in the vapor phase. Vapors are subject to a variety of attenuation factors during migration away from the source concentration to the module. Thus, mass levels reported from the module will often be less than concentrations reported in soil and groundwater matrix data. In most instances, the soil gas masses reported on the modules compare favorably with concentrations reported in the soil or groundwater (e.g., where soil gas levels are reported at greater levels relative to other sampled locations on the site, matrix data should reveal the same pattern, and vice versa). However, due to a variety of factors, a perfect comparison between matrix data and soil gas levels can rarely be achieved.
- Soil gas signals reported by this method cannot be identified to soil adsorbed, groundwater, and/or free-product contamination. The soil gas signal reported from each module can evolve from all of these sources. Differentiation between soil and groundwater contamination can only be achieved with prior knowledge of the site history (i.e., the site is known to have groundwater contamination only).

GORE-SORBER® Screening Survey
Final Report

- Currently, soil gas surveys are not designed to replace soil or groundwater matrix sampling. Following a soil gas survey, matrix sampling is recommended in select areas to establish the nature of the contamination (i.e., soil, groundwater, or both), and the relationship to the soil gas levels.
- QA/QC trip blank modules were provided to document contamination occurring that was not part of the soil gas signal of interest (i.e., impact during module shipment, installation and retrieval, and storage). The trip blanks are identically manufactured and packaged soil gas modules to those modules placed in the subsurface. However, the trip blanks remain unopened during all phases of the soil gas survey. Levels reported on the trip blanks may indicate potential impact to modules other than the contaminant source of interest.
- Unresolved peak envelopes (UPEs) are represented as a series of compound peaks clustered together around a central GC elution time in the total ion chromatogram. Typically, UPEs are indicative of complex fluid mixtures that are present in the subsurface. UPEs observed early in the chromatogram are considered to indicate the presence of more volatile fluids, while UPEs observed later in the chromatogram may indicate the presence of less volatile fluids. Multiple UPEs may indicate the presence of multiple complex fluids. Attenuation of the VOC/SVOC soil gas components may suggest the presence of a less volatile fluid, when in fact, a more volatile fluid existed but the volatile components have weathered away.

Project Specific Comments:

- Typically, the minimum (gray) contour level, for each mapped analyte or group of analytes, is set at the maximum blank level observed or the method detection limit, whichever is greater. The maximum contour level is set at the maximum value observed. Gore applied the minimum contour criteria, based on all modules referred to as blanks, to both areas mapped for those compound(s) selected for mapping. The maximum level observed, was applied per area per compound(s) mapped.
- At the request of Sandia National Laboratory, all modules were analyzed for the A1 standard target compound list. In addition, a select set of modules were analyzed for target explosive compounds. Therefore, the Burn Site contour map of the target explosive results reflects the difference in the number of modules analyzed.
- No mappable levels of naphthalene and 2-methylnaphthalene, combined trimethylbenzenes, or combined target explosives were present in the OU1333 New Aerial Cable Site dataset.
- Stacked total ion chromatograms (TICs) are included in Appendix A. The last three digits of each module number are incorporated into the TIC identification (e.g.: ALZ803TC.D represents module #150803).
- Nominal trip and field blank levels were reported for a few target compounds. No detectable levels of target analytes were reported in the method blanks.
- The mapped spatial patterns revealed some small isolated soil gas plumes. The petroleum related compounds selected for mapping were observed in highest levels at location #150726. The target explosive compounds were observed in greatest levels in the area encompassing modules #150717 and #150718.

GORE-SORBER® Screening Survey
Final Report
KEY TO DATA TABLE
OU 1333 Burn Site, Albuquerque, NM

UNITS	
µg	micrograms (per sorber), reported for compounds
MDL	method detection limit
bdl	below detection limit
nd	non-detect
ANALYTES	
BTEX	combined masses of benzene, toluene, ethylbenzene and total xylenes
BENZ	benzene
TOL	toluene
EtBENZ	ethylbenzene
mpXYL	m-, p-xylene
oXYL	o-xylene
C11,C13&C15	combined masses of undecane, tridecane, and pentadecane (C11+C13+C15)
UNDEC	undecane
TRIDEC	tridecane
PENTADEC	pentadecane
TMBs	combined masses of 1,3,5-trimethylbenzene and 1,2,4-trimethylbenzene
135TMB	1,3,5-trimethylbenzene
124TMB	1,2,4-trimethylbenzene
ct12DCE	cis- & trans-1,2-dichloroethene
t12DCE	trans-1,2-dichloroethene
c12DCE	cis-1,2-dichloroethene
NAPH&2-MN	combined masses of naphthalene and 2-methyl naphthalene
NAPH	naphthalene
2MeNAPH	2-methyl naphthalene
MTBE	methyl t-butyl ether
11DCA	1,1-dichloroethane
$CHCl_3$	chloroform
111TCA	1,1,1-trichloroethane
12DCA	1,2-dichloroethane
CCl_4	carbon tetrachloride
TCE	trichloroethene
OCT	octane
PCE	tetrachloroethene
ClBENZ	chlorobenzene
14DCB	1,4-dichlorobenzene
NiBENZ	nitrobenzene
2NiTOL	2-nitrotoluene
3NiTOL	3-nitrotoluene
4NiTOL	4-nitrotoluene
13DNB	1,3-dinitrobenzene
26DNT	2,6-dinitrotoluene
24DNT	2,4-dinitrotoluene
135TNB	1,3,5-trinitrobenzene
246TNT	2,4,6-trinitrotoluene
4Amino26DNT	4-amino-2,6-dinitrotoluene
2Amino46DNT	2-amino-4,6-dinitrotoluene
BLANKS	
TBn	unexposed trip blanks, travels with the exposed modules
method blank	QA/QC module, documents analytical conditions during analysis

GORE-SORBER® Screening Survey Chain of Custody

For W.L. Gore & Associates use only
Production Order # 93733

GORE

W. L. Gore & Associates, Inc., Environmental Products Group
101 Lewisville Road • Elkton, Maryland 21921 • Tel: (410) 392-3300 • Fax (410) 996-3325

Instructions: Customer must complete ALL shaded cells

Customer Name: Sandia National Laboratories	Site Name: Burn Site, ER site 6
Address: P.O. Box 5130 Albuquerque, NM 87185	Site Address: Alb, NM
	Project Manager: Paul Freshour (505) 845-3108
Phone: (505) 284-2553	Customer Project No.:
FAX: (505) 296-3289	Customer P.O. #: BL-0262 Quote #: 12154

Serial # of Modules Shipped			# of Modules for Installation 308	# of Trip Blanks 35
# 150634	through	# 150694 Box 1,2,3	Total Modules Shipped: 343	Pieces
# 150700	through	# 150781 Box 3,4,5,6	Total Modules Received: 343	Pieces
# 150787	through	# 150786	Total Modules Installed:	Pieces
# 150882	through	# 150974	Serial # of Trip Blanks (*Client Decides*)	# 150928
# 150980	through	# 150996	# 150929 #	#

GORE ANALYTICAL OPTION:			
[A4 / A6]	#	#	#
	#	#	#

Installation Performed By: Name (*please print*): W Foutz Company/Affiliation: SNL/NM	Installation Method(s) (*circle those that apply*): (Slide Hammer) (Hammer Drill) Auger Other: GeoProbe
Installation Start Date and Time: 2-24-98 / / 9:50 (AM) PM	
Installation Complete Date and Time: / / : AM PM	
Retrieval Performed By: Name (*please print*): Walt Foutz Company/Affiliation: Sandia National Lab.	Total Modules Retrieved: ___ Pieces Total Modules Lost in Field: ___ Pieces Total Unused Modules Returned: ___ Pieces
Retrieval Start Date and Time: March / 11 / 1998 3:30 AM (PM)	
Retrieval Complete Date and Time: / / : AM PM	

Relinquished By	Date	Time	Received By	Date	Time
Relinquished By: J. Lucchini Affiliation: W.L. Gore & Associates, Inc.	2/13/98	12:00	Received By: W Foutz Affiliation: SNL ER	2/27/98	1600
Relinquished By: W Foutz Affiliation: SNL	3/18/98	1130	Received By: Affiliation:		
Relinquished By: W Foutz Affiliation: SNL	3/26/98	1600	Received By: John Lucchini Affiliation: W.L. Gore & Associates, Inc.	3/27/98	3:10 pm
			Temperature of Samples When Received By Gore	18°/17°/14.6°C	

#970 ... / 9708... / 970...

Passive Soil Vapor Screening
Installation and Retrieval Form
GORE-SORBER

Sandia National Laboratories
OU 1333 New Aerial Cable Site, 81C
Project Leader: Sharissa Young
ATL: Mark Thacker (505) 284-2575

page 1 of 1
ER Site #: 81C

Recorder: S. Young
Date: 3/5/98

Line #	ER Sample Identification	GORE Sample Number	Depth Installed (inches)	Installation Date/Time	Retrieval Date/Time	Comments: Evidence of Hydrocarbons or Odor; Other
1	CY81C-A1-01-PSV	150946 ✓	36	3/6/98 1550	3/20/98 14:55	3/5/98
2	CY81C-A2-01-PSV	150947 ✓	36	" 1553	3-20-98/14:56	
3	CY81C-A3-01-PSV	150948 ✓	36	" 1554	" /14:57	
4	CY81C-A4-01-PSV	150949 ✓	36	" 1559	" /14:58	↓
mT 5	CY81C-A5-01-PSV	150950 ✓	36	3/6/98 1440		3/6/98 (light diesel odor)
6	CY81C-A6-01-PSV	150951 ✓	36	3/6/98 1617	3-20-98/15:09	3/5/98
7	CY81C-A7-01-PSV	150952 ✓	36	" 1619	3-20-98/15:08	
	~~5Y, A8~~	453			3-20-98/15:01	
8	CY81C-A8-01-PSV	150953 ✓	30"	" 1602	3-20-98/15:00	
9	CY81C-A9-01-PSV	150954 ✓	36	" 1605	3-20-98/15:03	
10	CY81C-A10-01-PSV	150955 ✓	36	" 1610	3-20-98/15:04	
11	CY81C-A11-01-PSV	150956 ✓	36	" 1613	3-20-98/15:03	
12	CY81C-A12-01-PSV	150957 ✓	36"	" 1615	3-20-98/15:02	"
13	CY81C-A7-DU-PSV	150952 ✓	36	" 1621	3-20-98/15:08	DUPLICATE

✓ Note Gore No. 150959 is the Trip Blank

Passive Soil Vapor Screening
Installation and Retrieval Form
GORE-SORBER

Sandia National Laboratories
OU 1333 New Aerial Cable Site, 81C
Project Leader: Sharissa Young
ATL: Mark Thacker (505) 284-2575

page 1 of 1

ER Site #: 81C

Recorder: S. YOUNG

Date: 3/5/98

Line #	ER Sample Identification	GORE Sample Number	Depth Installed (inches)	Installation Date/Time	Retrieval Date/Time	Comments: Evidence of Hydrocarbons or Odor; Other
1	CY81C-B1-01-PSV	~~150936~~ 150945	36	3/8/98 1540	3-20-98/15:16	
2	CY81C-B2-01-PSV	150944	36	3/8/98 1539	3-20-98/15:17	
3	CY81C-B3-01-PSV	150943	36	3/8/98 1536	3-20-98/15:19	
4	CY81C-B4-01-PSV	150942	36	3/8/98 1533	3-20-98/15:25	
5	CY81C-B5-01-PSV	150941	36	3/8/98 1534	3-20-98/15:23	
6	CY81C-B5-DU-PSV	150940	36	3/8/98 1534	3-20-98/15:23	DUPLICATE INSTALLED IN SAME HOLE
7	CY81C-B6-01-PSV	150939	36	3/8/98 1536	3-20-98/15:25	
8	CY81C-B7-01-PSV	150938	36	3/8/98 1530	3-20-98/15:27	
9	CY81C-B8-01-PSV	150937	36	3/8/98 1528	3-20-98/15:28	
10	CY81C-B9-01-PSV	150936	36	3/8/98 1525	3-20-98/15:29	
				6-all installed on 3/6/98		

Passive Soil Vapor Screening
Installation and Retrieval Form
GORE-SORBER

Sandia National Laboratories
OU 1333 New Aerial Cable Site, 81C
Project Leader: Sharissa Young
ATL: Mark Thacker (505) 284-2575

page 1 of 2
ER Site #: 81C

Recorder: S YOUNG
Date: 3/6/98

Line #	ER Sample Identification	GORE Sample Number	Depth Installed (inches)	Installation Date/Time	Retrieval Date/Time	Comments: Evidence of Hydrocarbons or Odor; Other
	CY81C-C1-01-PSV	150960	36	3/6/98 1042	3/23/98 1458	
	CY81C-C2-01-PSV	150961	36	1036	1457	
	CY81C-C3-01-PSV	150962	30	1035	1456	
	CY81C-C4-01-PSV	150963	30	1022	1455	
	CY81C-C5-01-PSV	150964	36	1020	5/23/98 1454	
	CY81C-C6-01-PSV	150965	36	1046	1527	
	CY81C-C7-01-PSV	150966	33	1053	1525	rock plug (No core)
	CY81C-C8-01-PSV	150967	36	1044	5/[illegible] 1526	
	CY81C-C9-01-PSV	150968	36	1040	1459	
	CY81C-C10-01-PSV	150969	36	1038	1500	
	CY81C-C11-01-PSV	150970	30	1032	1501	
	CY81C-C12-01-PSV	150971	36	1029	1503	
	CY81C-C13-01-PSV	150972	36	1025	1508	
	CY81C-C14-01-PSV	150973	36	1109	1518	
	CY81C-C15-01-PSV	150974	36	1106	1520	

Passive Soil Vapor Screening
Installation and Retrieval Form
GORE-SORBER

Sandia National Laboratories
OU 1333 New Aerial Cable Site, 81C
Project Leader: Sharissa Young
ATL: Mark Thacker (505) 284-2575

page 2 of 2
ER Site #: 81C

Recorder: S Young
Date: 3/6/98

Line #	ER Sample Identification	GORE Sample Number	Depth Installed (inches)	Installation Date/Time	Retrieval Date/Time	Comments: Evidence of Hydrocarbons or Odor; Other
	CY81C-C16-01-PSV	150980	33	3/6/98 1101	3/23/98 1521	
	CY81C-C17-01-PSV	150981	36	1104	1522	rock plug
	CY81C-C18-01-PSV	150982	24	1050	1531	
	CY81C-C18-DU-PSV	150983	24	1050	1532	DUPLICATE
	CY81C-C19-01-PSV	150984	30	1048	1530	
	CY81C-C20-01-PSV	150985	33	1057	1535	rock plug
	CY81C-C21-01-PSV	150986	36	1107	1536	
	CY81C-C22-01-PSV	150987	36"	1059	1537	rock plug
	CY81C-C23-01-PSV	150988	24"	1055	1534	rock plug
	~~CY81C-C24-01-PSV~~	~~150989~~				
	CY81C-A5-01-PSV	150958	36"	1140	1545	Lifted twice (see p1)
=	CY81C-BK1-PSV	150926	18"	1127	1600	Background
=	CY81C-BK2-PSV	150927	36"	1135	1610	Background.

= - separate box (12) in other cooler.

Internal Lab
Batch No. _____

ANALYSIS REQUEST AND CHAIN OF CUSTODY

PAGE 1 of 4

AR/COC- 06572

SF 2001-COC (6-95)

Dept. No./Mail Stop: 6133/1147
Project/Task Manager: S. YOUNG/P. FRESHOUR
Project Name: 81C VCM
Record Center Code: ER/1333_81C/DAT
Logbook Ref No:
Service Order No.: N/A

Date Samples Shipped:
Carrier/Waybill No.:
Lab Contact: DAVE FISHER
Lab Destination: W.L. GORE+ASSOC.
SMO Contact/Phone: N/A
Send Report to SMO N/A

Contract No.:
Case No.: 7214.130
SMO Authorization: WBS
Bill to: Sandia National Laboratories
Supplier Services Department
P.O. Box 5800 MS 0154
Albuquerque, NM 87185-0154

Parameter & Method Requested

VOCs by TD-GC/MS
SVOCs by TD-GC/MS
HE by TD-GC/MS

Location
Tech Area CANYONS
Building N/A Room N/A

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO): Sample Matrix	Container: Type	Container: Volume	Preservative	Sample Collection Method	Sample Type	VOCs by TD-GC/MS	SVOCs by TD-GC/MS	HE by TD-GC/MS	Lab Sample ID
150946-001	CY81C-A1-01-PSV	36"	81C	3/20/98 1455	VAPOR	GORE	N/A	4°C	PSV	SA	X	X	X	
150947-001	CY81C-A2-01-PSV	36"	81C	3/20/98 1456	"	"	"	"	"	"	X	X	X	
150948-001	CY81C-A3-01-PSV	36"	81C	3/20/98 1457	"	"	"	"	"	"	X	X	X	
150949-001	CY81C-A4-01-PSV	36"	81C	3/20/98 1458	"	"	"	"	"	"	X	X	X	
~~150958-001~~	~~CY81C-A5-01-PSV~~	36"	81C	3/20/98 1545	"	"	"	"	"	"			441	3/24/98
150950-001	CY81C-A6-01-PSV	36"	81C	3/20/98 1509	"	"	"	"	"	"				
150951-001	CY81C-A7-01-PSV	36"	81C	3/20/98 1508	"	"	"	"	"	"				
150953-001	CY81C-A8-01-PSV	30"	81C	3/20/98 1500	"	"	"	"	"	"				
150954-001	CY81C-A9-01-PSV	36"	81C	3/20/98 1503	"	"	"	"	"	"				
150955-001	CY81C-A10-01-PSV	36"	81C	3/20/98 1504	"	"	"	"						

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 Initials _____

Special Instructions/QC Requirements

Abnormal Conditions on Receipt

Sample Team Members	Name	Signature	Init	Company/Organization/Phone
	SHARISSA YOUNG	Sharissa Young	SY	SNL/6133 5-3272
	PAUL FRESHOUR			

1. Relinquished by	Org.	Date	Time	4. Relinquished by	Org.	Date	Time
1. Received by	Org.	Date	Time	4. Received by	Org.	Date	Time
2. Relinquished by	Org.	Date	Time	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

WHITE - To Accompany Samples, Laboratory Copy BLUE- To Accompany Samples, Return to SMO YELLOW- SMO Suspense Copy PINK- Field Copy

SF 2001-COD (12-96)
Supersedes (10-94) issue

ANALYSIS REQUEST AND CHAIN OF CUSTODY
CONTINUATION FORM

AR/COC-

Project Name: 81C VCM Project/Task Manager: S. Young / M. Thacker Case No.: 7214.130

Location Tech Area: Canyons

Building: N/A Room: N/A

Reference LOV (available at SMO)

Parameter & Method Requested

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	VOC's by TO-GC/MS	TVOCs by TO-GC/MS	HE By TO-GC/MS								Lab Sample ID
150956-001	CY81C-A11-01-PSV	36"	81C	3/20/98 1503	Vapor	Gore	N/A	4°C	PSV	SA	X	X	X								
150957-001	CY81C-A12-01-PSV	36"	81C	3/20/98 1502	"	"	"	"	"	"	X	X	X								
150952-001	CY81C-A7-DU-PSV	36"	81C	3/20/98 1508	"	"	"	"	"	"	X	X	X								
150945-001	CY81C-B1-01-PSV	36"	81C	3/20/98 1516	"	"	"	"	"	"	X	X	X								
150944-001	CY81C-B2-01-PSV	36"	81C	3/20/98 1517	"	"	"	"	"	"	X	X	X								
150943-001	CY81C-B3-01-PSV	36"	81C	3/20/98 1519	"	"	"	"	"	"	X	X	X								
150942-001	CY81C-B4-01-PSV	36"	81C	3/20/98 1525	"	"	"	"	"	"	X	X	X								
150941-001	CY81C-B5-01-PSV	36"	81C	3/20/98 1523	"	"	"	"	"	"	X	X	X								
150940-001	CY81C-B5-DU-PSV	36"	81C	3/20/98 1523	"	"	"	"	"	"	X	X	X								
150939-001	CY81C-B6-01-PSV	36"	81C	3/20/98 1525	"	"	"	"	"	"	X	X	X								
150938-001	CY81C-B7-01-PSV	36"	81C	3/20/98 1527	"	"	"	"	"	"	X	X	X								
150937-001	CY81C-B8-01-PSV	36"	81C	3/20/98 1528	"	"	"	"	"	"	X	X	X								
150936-001	CY81C-B9-01-PSV	36"	81C	3/20/98 1529	"	"	"	"	"	"	X	X	X								
150960-001	CY81C-C1-01-PSV	36"	81C	3/23/98 1458	"	"	"	"	"	"	X	X	X								
150961-001	CY81C-C2-01-PSV	36"	81C	3/23/98 1457	"	"	"	"	"	"	X	X	X								
150962-001	CY81C-C3-01-PSV	30"	81C	3/23/98 1456	"	"	"	"	"	"	X	X	X								
150963-001	CY81C-C4-01-PSV	30"	81C	3/23/98 1455	"	"	"	"	"	"	X	X	X								
150964-001	CY81C-C5-01-PSV	36"	81C	3/23/98 1454	"	"	"	"	"	"	X	X	X								

Abnormal Conditions on Receipt

Recipient Initials:

WHITE - To Accompany Samples, Laboratory Copy BLUE - To Accompany Samples, Return to SMO YELLOW - SMO Suspense Copy PINK - Field Copy

SF 2001-COD (12-96)
Supersedes (10-94) issue

ANALYSIS REQUEST AND CHAIN OF CUSTODY CONTINUATION FORM

AR/COC-

Project Name: SICVCM Project/Task Manager: S. Young / M. Thacker Case No.: 7214.130

Location: Tech Area	Building	Room	Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO): Sample Matrix	Container: Type	Container: Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested: VOCs by TO-GC/MS	SVOCs by TO-GC/MS	HE by TO-GC/MS	Lab Sample ID
Canyons	N/A	N/A	150965-001	CySIC-C6-01-PSV	36"	SIC	3/23/98 1527	Vapor	Gave	N/A	4°C	PSV	SA	X	X	X	
			150966-001	CySIC-C7-01-PSV	33"	SIC	3/23/98 1525	"	"	"	"	"	"	X	X	X	
			150967-001	CySIC-C8-01-PSV	36"	SIC	3/23/98 1526	"	"	"	"	"	"	X	X	X	
			150968-001	CySIC-C9-01-PSV	36"	SIC	3/23/98 1459	"	"	"	"	"	"	X	X	X	
			150969-001	CySIC-C10-01-PSV	36"	SIC	3/23/98 1500	"	"	"	"	"	"	X	X	X	
			150970-001	CySIC-C11-01-PSV	30"	SIC	3/23/98 1501	"	"	"	"	"	"	X	X	X	
			150971-001	CySIC-C12-01-PSV	36"	SIC	3/23/98 1503	"	"	"	"	"	"	X	X	X	
			150972-001	CySIC-C13-01-PSV	36"	SIC	3/23/98 1508	"	"	"	"	"	"	X	X	X	
			150973-001	CySIC-C14-01-PSV	36"	SIC	3/23/98 1518	"	"	"	"	"	"	X	X	X	
			150974-001	CySIC-C15-01-PSV	36"	SIC	3/23/98 1520	"	"	"	"	"	"	X	X	X	
			150980-001	CySIC-C16-01-PSV	33"	SIC	3/23/98 1521	"	"	"	"	"	"	X	X	X	
			150981-001	CySIC-C17-01-PSV	36"	SIC	3/23/98 1522	"	"	"	"	"	"	X	X	X	
			150982-001	CySIC-C18-01-PSV	24"	SIC	3/23/98 1531	"	"	"	"	"	"	X	X	X	
			150983-001	CySIC-C18-DU-PSV	24"	SIC	3/23/98 1532	"	"	"	"	"	"	X	X	X	
			150984-001	CySIC-C19-01-PSV	30"	SIC	3/23/98 1530	"	"	"	"	"	"	X	X	X	
			150985-001	CySIC-C20-01-PSV	33"	SIC	3/23/98 1535	"	"	"	"	"	"	X	X	X	
			150986-001	CySIC-C21-01-PSV	36"	SIC	3/23/98 1538	"	"	"	"	"	"	X	X	X	
			150987-001	CySIC-C22-01-PSV	36"	SIC	3/23/98 1537	"	"	"	"	"	"	X	X	X	

Abnormal Conditions on Receipt:

Received by:

WHITE- To Accompany Samples, Laboratory Copy BLUE- To Accompany Samples, Return to SMO YELLOW- SMO Suspense Copy PINK- Field Copy

SF 2001-COD (12-96)
Supersedes (10-94) Issue

ANALYSIS REQUEST AND CHAIN OF CUSTODY CONTINUATION FORM

AR/COC-

Project Name: SIC VCM Project/Task Manager: S. Young / M. Thacker Case No.: 7214.130

Location Tech Area Sanyans

Building N/A Room N/A

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO)						Parameter & Method Requested			Lab Sample ID
					Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	VOCs by TO-15/MS	SVOCs by TO-13/MS	HE by TO-15/MS	
150958-001	CYSIC-C23-01-PSV	24"	SIC	3/23/98 1534	Vapor	Core	N/A	4°C	PSV	SA	X	X	X	
150959-001	CYSIC-AS-01-PSV	36"	SIC	3/23/98 1545	"	"	"	"	"	"	X	X	X	
150926-001	CYSIC-BK1-PSV	18"	SIC	3/23/98 1600	"	"	"	"	"	"	X	X	X	
150927-001	CYSIC-BK2-PSV	36"	SIC	3/23/98 1610	"	"	"	"	"	"	X	X	X	
														LAB USE

Abnormal Conditions on Receipt

Recipient Initials

WHITE - To Accompany Samples, Laboratory Copy BLUE- To Accompany Samples, Return to SMO YELLOW- SMO Suspense Copy PINK- Field Copy

GORE SORBER SCREENING SURVEY ANALYTICAL RESULTS
SANDIA NATIONAL LABORATORY, ALBUQUERQUE, NM
STANDARD TARGET LIST VOCs/SVOCs EXPLOSIVES (A6)
OU1333 BURN SITE, ALBUQUERQUE, NM
SITE ALZ - PRODUCTION ORDER #093733

DATE	MODULE								
ANALYZED	NUMBER	BTEX, ug	BENZ, ug	EtBENZ, ug	TOL, ug	mpXYL, ug	oXYL, ug	C11, C13, &C15, ug	PENTADEC, ug
	MDL=	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.03
04/02/98	150902	nd	nd	nd	nd	nd	nd	nd	nd
04/02/98	150903	0.03	nd	nd	nd	0.03	nd	nd	nd
04/02/98	150904	nd	nd	nd	nd	nd	nd	nd	nd
04/02/98	150905	nd	nd	nd	nd	nd	nd	nd	nd
04/02/98	150906	bdl	nd	nd	nd	bdl	nd	nd	nd
04/02/98	150907	nd	nd	nd	nd	nd	nd	nd	nd
04/02/98	150908	nd	nd	nd	nd	nd	nd	nd	nd
04/02/98	150909	0.30	nd	0.02	0.07	0.12	0.08	nd	nd
04/03/98	150910	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	150911	0.41	0.07	0.04	0.08	0.17	0.05	0.04	bdl
04/03/98	150912	0.04	nd	nd	nd	0.04	nd	nd	nd
04/03/98	150913	0.12	nd	nd	nd	0.09	bdl	bdl	nd
04/03/98	150914	0.40	0.14	0.05	nd	0.16	0.05	0.68	0.05
04/03/98	150915	0.41	nd	0.05	0.11	0.20	0.06	0.04	nd
04/03/98	150916	nd	nd	nd	nd	nd	nd	bdl	bdl
04/03/98	150917	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	150918	0.09	nd	nd	0.09	nd	nd	nd	nd
04/03/98	150919	0.06	nd	nd	nd	0.04	bdl	bdl	nd
04/03/98	150920	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	150921	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	150922	0.02	nd	nd	nd	0.02	nd	nd	nd
04/03/98	150923	0.30	nd	nd	0.30	nd	nd	nd	nd
04/03/98	150924	nd	nd	nd	nd	nd	nd	0.04	bdl
04/03/98	150925	nd	nd	nd	nd	nd	nd	0.03	bdl
04/03/98	150926	nd	nd	nd	nd	nd	nd	bdl	bdl
04/03/98	150927	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	150930	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	150931	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	150931	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	150936	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	150937	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	150938	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	150939	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	150940	0.05	nd	nd	0.05	nd	nd	bdl	bdl
04/03/98	150941	nd	nd	nd	nd	nd	nd	0.02	bdl
04/03/98	150942	nd	nd	nd	nd	nd	nd	0.04	0.04
04/03/98	150943	nd	nd	nd	nd	nd	nd	0.03	bdl
04/03/98	150944	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	150945	0.09	nd	nd	0.09	nd	nd	0.02	bdl
04/03/98	150946	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	150947	0.14	nd	nd	0.14	nd	nd	nd	nd
04/03/98	150948	nd	nd	nd	nd	nd	nd	0.07	nd
04/03/98	150949	nd	nd	nd	nd	nd	nd	nd	nd
04/04/98	150950	nd	nd	nd	nd	nd	nd	nd	nd
04/04/98	150951	nd	nd	nd	nd	nd	nd	bdl	bdl
04/04/98	150952	nd	nd	nd	nd	nd	nd	0.02	bdl
04/04/98	150953	nd	nd	nd	nd	nd	nd	nd	nd
04/04/98	150954	0.44	0.10	nd	0.17	0.13	0.04	0.02	bdl
04/04/98	150955	nd	nd	nd	nd	nd	nd	nd	nd
04/04/98	150956	nd	nd	nd	nd	nd	nd	nd	nd
04/04/98	150957	nd	nd	nd	nd	nd	nd	nd	nd
04/04/98	150958	0.07	nd	nd	0.07	nd	nd	0.02	nd
04/04/98	150959	nd	nd	nd	nd	nd	nd	nd	nd
04/04/98	150960	nd	nd	nd	nd	nd	nd	nd	nd
04/04/98	150961	nd	nd	nd	nd	nd	nd	nd	nd

GORE SORBER SCREENING SURVEY ANALYTICAL RESULTS
SANDIA NATIONAL LABORATORY, ALBUQUERQUE, NM
STANDARD TARGET LIST VOCs/SVOCs EXPLOSIVES (A6)
OU1333 BURN SITE, ALBUQUERQUE, NM
SITE ALZ - PRODUCTION ORDER #093733

DATE ANALYZED	MODULE NUMBER	BTEX, ug	BENZ, ug	EtBENZ, ug	TOL, ug	mpXYL, ug	oXYL, ug	C11, C13, &C15, ug	PENTADEC, ug
	MDL=	0.02	0.03	0.02	0.03	0.02	0.03	0.02	0.03
04/04/98	150962	nd	nd	nd	nd	nd	nd	nd	nd
04/04/98	150963	nd	nd	nd	nd	nd	nd	nd	nd
04/04/98	150964	0.07	nd	nd	0.07	nd	nd	nd	nd
04/04/98	150965	0.12	nd	nd	0.11	bdl	nd	bdl	nd
04/04/98	150966	nd	nd	nd	nd	nd	nd	nd	nd
04/04/98	150967	0.20	nd	nd	0.09	0.09	bdl	nd	nd
04/04/98	150968	0.20	0.06	nd	0.13	0.02	nd	0.11	0.11
04/04/98	150969	0.23	0.06	nd	0.15	0.03	nd	nd	nd
04/04/98	150970	0.11	0.06	nd	0.05	nd	nd	nd	nd
04/04/98	150971	nd	nd	nd	nd	nd	nd	nd	nd
04/04/98	150972	nd	nd	nd	nd	nd	nd	nd	nd
04/04/98	150973	0.15	nd	nd	nd	0.12	0.04	bdl	nd
04/04/98	150974	nd	nd	nd	nd	nd	nd	nd	nd
04/04/98	150980	0.61	0.07	nd	0.44	0.11	nd	0.02	nd
04/04/98	150981	0.05	nd	nd	0.05	nd	nd	nd	nd
04/06/98	150982	0.29	nd	nd	0.26	0.03	nd	nd	nd
04/06/98	150983	0.67	nd	nd	0.59	0.08	nd	nd	nd
04/06/98	150984	0.26	nd	nd	0.21	0.05	nd	nd	nd
04/06/98	150985	0.26	nd	bdl	0.20	0.05	nd	nd	nd
04/06/98	150986	0.33	nd	nd	0.09	0.12	0.12	nd	nd
04/06/98	150987	nd	nd	nd	nd	nd	nd	nd	nd
04/06/98	150988	0.56	0.08	0.03	0.29	0.12	0.04	0.03	bdl
03/30/98	method blank	nd	nd	nd	nd	nd	nd	nd	nd
03/31/98	method blank	nd	nd	nd	nd	nd	nd	nd	nd
04/01/98	method blank	nd	nd	nd	nd	nd	nd	nd	nd
04/02/98	method blank	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	method blank	nd	nd	nd	nd	nd	nd	nd	nd
04/03/98	method blank	nd	nd	nd	nd	nd	nd	nd	nd
04/06/98	method blank	nd	nd	nd	nd	nd	nd	nd	nd
		BTEX, ug	BENZ, ug	EtBENZ, ug	TOL, ug	mpXYL, ug	oXYL, ug	C11, C13, &C15, ug	PENTADEC, ug
	Maximum	1.14	0.17	0.12	0.59	0.38	0.14	0.68	0.24

GORE SORBER SCREENING SURVEY ANALYTICAL RESULTS
SANDIA NATIONAL LABORATORY, ALBUQUERQUE, NM
STANDARD TARGET LIST VOCs/SVOCs EXPLOSIVES (A6)
OU1333 BURN SITE, ALBUQUERQUE, NM
SITE ALZ - PRODUCTION ORDER #093733

MODULE NUMBER	UNDEC, ug	TRIDEC, ug	TMBs, ug	124TMB, ug	135TMB, ug	ct12DCE, ug	t12DCE, ug	c12DCE, ug	NAPH&2-MN, ug
MDL=	0.04	0.02	0.02	0.02	0.02	0.02	0.05	0.02	0.03
150902	nd	nd	nd	nd	nd	nd	nd	nd	nd
150903	nd	nd	nd	nd	nd	nd	nd	nd	nd
150904	nd	nd	nd	nd	nd	nd	nd	nd	nd
150905	nd	nd	nd	nd	nd	nd	nd	nd	nd
150906	nd	nd	nd	nd	nd	nd	nd	nd	nd
150907	nd	nd	nd	nd	nd	nd	nd	nd	nd
150908	nd	nd	nd	nd	nd	nd	nd	nd	nd
150909	nd	nd	nd	nd	nd	nd	nd	nd	nd
150910	nd	nd	nd	nd	nd	nd	nd	nd	nd
150911	bdl	nd	0.08	0.05	0.03	nd	nd	nd	nd
150912	nd	nd	nd	nd	nd	nd	nd	nd	nd
150913	bdl	nd	0.05	0.04	bdl	nd	nd	nd	nd
150914	0.41	0.23	0.21	0.16	0.06	nd	nd	nd	0.10
150915	0.04	nd	0.09	0.06	0.04	nd	nd	nd	nd
150916	bdl	nd	nd	nd	nd	nd	nd	nd	nd
150917	nd	nd	nd	nd	nd	nd	nd	nd	nd
150918	nd	nd	nd	nd	nd	nd	nd	nd	nd
150919	bdl	nd	0.03	bdl	bdl	nd	nd	nd	nd
150920	nd	nd	nd	nd	nd	nd	nd	nd	nd
150921	nd	nd	nd	nd	nd	nd	nd	nd	nd
150922	nd	nd	bdl	bdl	nd	nd	nd	nd	nd
150923	nd	nd	nd	nd	nd	nd	nd	nd	nd
150924	nd	bdl	nd	nd	nd	nd	nd	nd	nd
150925	bdl	nd	nd	nd	nd	nd	nd	nd	nd
150926	nd	nd	nd	nd	nd	nd	nd	nd	nd
150927	nd	nd	nd	nd	nd	nd	nd	nd	nd
150930	nd	nd	nd	nd	nd	nd	nd	nd	nd
150931	nd	nd	nd	nd	nd	nd	nd	nd	nd
150931	nd	nd	nd	nd	nd	nd	nd	nd	nd
150936	nd	nd	nd	nd	nd	nd	nd	nd	nd
150937	nd	nd	nd	nd	nd	nd	nd	nd	nd
150938	nd	nd	nd	nd	nd	nd	nd	nd	nd
150939	nd	nd	nd	nd	nd	nd	nd	nd	nd
150940	nd	nd	nd	nd	nd	nd	nd	nd	nd
150941	nd	nd	nd	nd	nd	nd	nd	nd	nd
150942	nd	nd	nd	nd	nd	nd	nd	nd	nd
150943	nd	nd	nd	nd	nd	nd	nd	nd	nd
150944	nd	nd	nd	nd	nd	nd	nd	nd	nd
150945	bdl	nd	nd	nd	nd	nd	nd	nd	nd
150946	nd	nd	nd	nd	nd	nd	nd	nd	nd
150947	nd	nd	nd	nd	nd	nd	nd	nd	nd
150948	0.07	nd	nd	nd	nd	nd	nd	nd	nd
150949	nd	nd	nd	nd	nd	nd	nd	nd	nd
150950	nd	nd	nd	nd	nd	nd	nd	nd	nd
150951	nd	nd	nd	nd	nd	nd	nd	nd	nd
150952	nd	nd	nd	nd	nd	nd	nd	nd	nd
150953	nd	nd	nd	nd	nd	nd	nd	nd	nd
150954	bdl	nd	0.06	0.03	0.02	nd	nd	nd	nd
150955	nd	nd	nd	nd	nd	nd	nd	nd	nd
150956	nd	nd	nd	nd	nd	nd	nd	nd	nd
150957	bdl	nd	nd	nd	nd	nd	nd	nd	nd
150958	bdl	bdl	nd	nd	nd	nd	nd	nd	nd
150959	nd	nd	nd	nd	nd	nd	nd	nd	nd
150960	nd	nd	nd	nd	nd	nd	nd	nd	nd
150961	nd	nd	nd	nd	nd	nd	nd	nd	nd

GORE SORBER SCREENING SURVEY ANALYTICAL RESULTS
SANDIA NATIONAL LABORATORY, ALBUQUERQUE, NM
STANDARD TARGET LIST VOCs/SVOCs EXPLOSIVES (A6)
OU1333 BURN SITE, ALBUQUERQUE, NM
SITE ALZ - PRODUCTION ORDER #093733

MODULE NUMBER	UNDEC, ug	TRIDEC, ug	TMBs, ug	124TMB, ug	135TMB, ug	ct12DCE, ug	t12DCE, ug	c12DCE, ug	NAPH&2-MN, ug
MDL=	0.04	0.02	0.02	0.02	0.02	0.02	0.05	0.02	0.03
150962	nd	nd	nd	nd	nd	nd	nd	nd	nd
150963	nd	nd	nd	nd	nd	nd	nd	nd	nd
150964	nd	nd	nd	nd	nd	nd	nd	nd	nd
150965	bdl	nd	nd	nd	nd	nd	nd	nd	nd
150966	nd	nd	nd	nd	nd	nd	nd	nd	nd
150967	nd	nd	0.03	bdl	bdl	nd	nd	nd	nd
150968	nd	nd	nd	nd	nd	nd	nd	nd	nd
150969	nd	nd	nd	nd	nd	nd	nd	nd	nd
150970	nd	nd	nd	nd	nd	nd	nd	nd	nd
150971	nd	nd	nd	nd	nd	nd	nd	nd	nd
150972	nd	nd	nd	nd	nd	nd	nd	nd	nd
150973	bdl	nd	0.07	0.05	0.03	nd	nd	nd	nd
150974	nd	nd	nd	nd	nd	nd	nd	nd	nd
150980	bdl	nd	0.02	0.02	nd	nd	nd	nd	nd
150981	nd	nd	nd	nd	nd	nd	nd	nd	nd
150982	nd	nd	nd	nd	nd	nd	nd	nd	nd
150983	nd	nd	0.02	bdl	nd	nd	nd	nd	nd
150984	nd	nd	nd	nd	nd	nd	nd	nd	nd
150985	nd	nd	bdl	bdl	nd	nd	nd	nd	nd
150986	nd	nd	bdl	bdl	nd	nd	nd	nd	nd
150987	nd	nd	nd	nd	nd	nd	nd	nd	nd
150988	bdl	nd	0.03	0.03	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd
	UNDEC, ug	TRIDEC, ug	TMBs, ug	124TMB, ug	135TMB, ug	ct12DCE, ug	t12DCE, ug	c12DCE, ug	NAPH&2-MN, ug
Maximum	0.41	0.23	0.21	0.16	0.06	0.00	0.00	0.00	0.10

GORE SORBER SCREENING SURVEY ANALYTICAL RESULTS
SANDIA NATIONAL LABORATORY, ALBUQUERQUE, NM
STANDARD TARGET LIST VOCs/SVOCs EXPLOSIVES (A6)
OU1333 BURN SITE, ALBUQUERQUE, NM
SITE ALZ - PRODUCTION ORDER #093733

MODULE NUMBER	Combined PAHs, ug	NAPH, ug	MTBE, ug	2MeNAPH, ug	11DCA, ug	CHCl3, ug	111TCA, ug	12DCA, ug	CCl4, ug
MDL=	0.03	0.03	0.16	0.03	0.01	0.01	0.02	0.02	0.04
150902	nd	nd	nd	nd	nd	nd	nd	nd	nd
150903	nd	nd	nd	nd	nd	nd	nd	nd	nd
150904	nd	nd	nd	nd	nd	nd	nd	nd	nd
150905	nd	nd	nd	nd	nd	nd	nd	nd	nd
150906	nd	nd	nd	nd	nd	nd	nd	nd	nd
150907	nd	nd	nd	nd	nd	nd	nd	nd	nd
150908	nd	nd	nd	nd	nd	nd	nd	nd	nd
150909	nd	nd	nd	nd	nd	nd	nd	nd	nd
150910	nd	nd	nd	nd	nd	nd	nd	nd	nd
150911	nd	nd	nd	nd	nd	nd	nd	nd	nd
150912	nd	nd	nd	nd	nd	nd	nd	nd	nd
150913	nd	nd	nd	nd	nd	nd	nd	nd	nd
150914	0.10	0.05	nd	0.05	nd	nd	0.09	nd	0.14
150915	nd	nd	nd	nd	nd	nd	nd	nd	nd
150916	nd	nd	nd	nd	nd	nd	nd	nd	nd
150917	nd	nd	nd	nd	nd	nd	nd	nd	nd
150918	nd	nd	nd	nd	nd	nd	nd	nd	nd
150919	nd	nd	nd	nd	nd	nd	nd	nd	nd
150920	nd	nd	nd	nd	nd	nd	nd	nd	nd
150921	nd	nd	nd	nd	nd	nd	nd	nd	nd
150922	nd	nd	nd	nd	nd	nd	nd	nd	nd
150923	nd	nd	nd	nd	nd	0.05	nd	nd	nd
150924	nd	nd	nd	nd	nd	nd	nd	nd	nd
150925	nd	nd	nd	nd	nd	nd	nd	nd	nd
150926	nd	nd	nd	nd	nd	nd	nd	nd	nd
150927	nd	nd	nd	nd	nd	nd	nd	nd	nd
150930	nd	nd	nd	nd	nd	nd	nd	nd	nd
150931	nd	nd	nd	nd	nd	nd	nd	nd	nd
150931	nd	nd	nd	nd	nd	nd	nd	nd	nd
150936	nd	nd	nd	nd	nd	nd	nd	nd	nd
150937	nd	nd	nd	nd	nd	nd	nd	nd	nd
150938	nd	nd	nd	nd	nd	nd	nd	nd	nd
150939	nd	nd	nd	nd	nd	nd	nd	nd	nd
150940	nd	nd	nd	nd	nd	0.24	nd	nd	nd
150941	nd	nd	nd	nd	nd	0.23	nd	nd	nd
150942	nd	nd	nd	nd	nd	nd	nd	nd	nd
150943	nd	nd	nd	nd	nd	nd	nd	nd	nd
150944	nd	nd	nd	nd	nd	nd	nd	nd	nd
150945	nd	nd	nd	nd	nd	nd	nd	nd	nd
150946	nd	nd	nd	nd	nd	nd	nd	nd	nd
150947	nd	nd	nd	nd	nd	nd	nd	nd	nd
150948	nd	nd	nd	nd	nd	nd	nd	nd	nd
150949	nd	nd	nd	nd	nd	nd	nd	nd	nd
150950	nd	nd	nd	nd	nd	nd	nd	nd	nd
150951	nd	nd	nd	nd	nd	nd	nd	nd	nd
150952	nd	nd	nd	nd	nd	nd	nd	nd	nd
150953	nd	nd	nd	nd	nd	nd	nd	nd	nd
150954	nd	nd	nd	nd	nd	nd	nd	nd	nd
150955	nd	nd	nd	nd	nd	nd	nd	nd	nd
150956	nd	nd	nd	nd	nd	nd	nd	nd	nd
150957	nd	nd	nd	nd	nd	nd	nd	nd	nd
150958	nd	nd	nd	nd	nd	nd	nd	nd	nd
150959	nd	nd	nd	nd	nd	nd	nd	nd	nd
150960	nd	nd	nd	nd	nd	nd	nd	nd	nd
150961	nd	nd	nd	nd	nd	nd	nd	nd	nd

GORE SORBER SCREENING SURVEY ANALYTICAL RESULTS
SANDIA NATIONAL LABORATORY, ALBUQUERQUE, NM
STANDARD TARGET LIST VOCs/SVOCs EXPLOSIVES (A6)
OU1333 BURN SITE, ALBUQUERQUE, NM
SITE ALZ - PRODUCTION ORDER #093733

MODULE NUMBER	Combined PAHs, ug	NAPH, ug	MTBE, ug	2MeNAPH, ug	11DCA, ug	CHCl3, ug	111TCA, ug	12DCA, ug	CCl4, ug
MDL=	0.03	0.03	0.16	0.03	0.01	0.01	0.02	0.02	0.04
150962	nd	nd	nd	nd	nd	nd	nd	nd	nd
150963	nd	nd	nd	nd	nd	nd	nd	nd	nd
150964	nd	nd	nd	nd	nd	nd	nd	nd	nd
150965	nd	nd	nd	nd	nd	nd	nd	nd	nd
150966	nd	nd	nd	nd	nd	nd	nd	nd	nd
150967	nd	nd	nd	nd	nd	nd	nd	nd	nd
150968	nd	nd	nd	nd	nd	nd	nd	nd	nd
150969	nd	nd	nd	nd	nd	nd	nd	nd	nd
150970	nd	nd	nd	nd	nd	nd	nd	nd	nd
150971	nd	nd	nd	nd	nd	nd	nd	nd	nd
150972	nd	nd	nd	nd	nd	nd	nd	nd	nd
150973	nd	nd	nd	nd	nd	nd	nd	nd	nd
150974	nd	nd	nd	nd	nd	nd	nd	nd	nd
150980	nd	nd	nd	nd	nd	nd	nd	nd	nd
150981	nd	nd	nd	nd	nd	nd	nd	nd	nd
150982	nd	nd	nd	nd	nd	nd	nd	nd	nd
150983	nd	nd	nd	nd	nd	nd	nd	nd	nd
150984	nd	nd	nd	nd	nd	nd	nd	nd	nd
150985	nd	nd	nd	nd	nd	nd	nd	nd	nd
150986	nd	nd	nd	nd	nd	nd	nd	nd	nd
150987	nd	nd	nd	nd	nd	nd	nd	nd	nd
150988	nd	nd	nd	nd	nd	nd	0.05	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd
	Combined PAHs, ug	NAPH, ug	MTBE, ug	2MeNAPH, ug	11DCA, ug	CHCl3, ug	111TCA, ug	12DCA, ug	CCl4, ug
Maximum	0.10	0.05	0.00	0.06	0.00	0.24	0.09	0.00	0.14

GORE SORBER SCREENING SURVEY ANALYTICAL RESULTS
SANDIA NATIONAL LABORATORY, ALBUQUERQUE, NM
STANDARD TARGET LIST VOCs/SVOCs EXPLOSIVES (A6)
OU1333 BURN SITE, ALBUQUERQUE, NM
SITE ALZ - PRODUCTION ORDER #093733

MODULE NUMBER	TCE, ug	OCT, ug	PCE, ug	CIBENZ, ug	14DCB, ug	NiBENZ, ug	2NiTOL, ug	3NiTOL, ug	4NiTOL, ug	13DNB, ug
MDL=	0.02	0.02	0.03	0.02	0.02	0.09	0.05	0.08	0.11	0.18
150902	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150903	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150904	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150905	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150906	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150907	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150908	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150909	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150910	nd	0.08	nd	nd	nd	nd	nd	nd	nd	nd
150911	nd	0.25	nd	nd	nd	nd	nd	nd	nd	nd
150912	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150913	nd	0.07	nd	nd	nd	nd	nd	nd	nd	nd
150914	nd	0.29	nd	nd	nd	nd	nd	nd	nd	nd
150915	nd	0.32	nd	nd	nd	nd	nd	nd	nd	nd
150916	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150917	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150918	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150919	nd	0.10	nd	nd	nd	nd	nd	nd	nd	nd
150920	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150921	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150922	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150923	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150924	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150925	nd	0.08	nd	nd	nd	nd	nd	nd	nd	nd
150926	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150927	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150930	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150931	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150931	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150936	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150937	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150938	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150939	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150940	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150941	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150942	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150943	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150944	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150945	nd	nd	nd	nd	bdl	nd	nd	nd	nd	nd
150946	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150947	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150948	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150949	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150950	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150951	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150952	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150953	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150954	nd	0.21	nd	nd	nd	nd	nd	nd	nd	nd
150955	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150956	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150957	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150958	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150959	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150960	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150961	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

GORE SORBER SCREENING SURVEY ANALYTICAL RESULTS
SANDIA NATIONAL LABORATORY, ALBUQUERQUE, NM
STANDARD TARGET LIST VOCs/SVOCs EXPLOSIVES (A6)
OU1333 BURN SITE, ALBUQUERQUE, NM
SITE ALZ - PRODUCTION ORDER #093733

MODULE NUMBER	TCE, ug	OCT, ug	PCE, ug	ClBENZ, ug	14DCB, ug	NiBENZ, ug	2NiTOL, ug	3NiTOL, ug	4NiTOL, ug	13DNB, ug
MDL=	0.02	0.02	0.03	0.02	0.02	0.09	0.05	0.08	0.11	0.18
150962	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150963	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150964	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150965	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150966	nd	0.05	nd	nd	nd	nd	nd	nd	nd	nd
150967	nd	0.07	nd	nd	nd	nd	nd	nd	nd	nd
150968	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150969	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150970	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150971	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150972	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150973	nd	0.22	nd	nd	nd	nd	nd	nd	nd	nd
150974	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150980	bdl	0.06	nd	nd	bdl	nd	nd	nd	nd	nd
150981	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150982	nd	0.11	nd	nd	nd	nd	nd	nd	nd	nd
150983	nd	0.12	nd	nd	nd	nd	nd	nd	nd	nd
150984	nd	0.04	nd	nd	nd	nd	nd	nd	nd	nd
150985	nd	0.11	nd	nd	nd	nd	nd	nd	nd	nd
150986	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
150987	nd	0.13	nd	nd	nd	nd	nd	nd	nd	nd
150988	0.03	0.14	nd	nd	0.04	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
method blank	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
	TCE, ug	OCT, ug	PCE, ug	ClBENZ, ug	14DCB, ug	NiBENZ, ug	2NiTOL, ug	3NiTOL, ug	4NiTOL, ug	13DNB, ug
Maximum	0.03	0.32	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00

GORE SORBER SCREENING SURVEY ANALYTICAL RESULTS
SANDIA NATIONAL LABORATORY, ALBUQUERQUE, NM
STANDARD TARGET LIST VOCs/SVOCs EXPLOSIVES (A6)
OU1333 BURN SITE, ALBUQUERQUE, NM
SITE ALZ - PRODUCTION ORDER #093733

MODULE						
NUMBER	26DNT, ug	24DNT, ug	135TNB, ug	246TNT, ug	4Amino26DNT	2Amino46DNT
MDL=	0.12	0.14	0.14	0.16	0.23	0.21
150902	nd	nd	nd	nd	nd	nd
150903	nd	nd	nd	nd	nd	nd
150904	nd	nd	nd	nd	nd	nd
150905	nd	nd	nd	nd	nd	nd
150906	nd	nd	nd	nd	nd	nd
150907	nd	nd	nd	nd	nd	nd
150908	nd	nd	nd	nd	nd	nd
150909	nd	nd	nd	nd	nd	nd
150910	nd	nd	nd	nd	nd	nd
150911	nd	nd	nd	nd	nd	nd
150912	nd	nd	nd	nd	nd	nd
150913	nd	nd	nd	nd	nd	nd
150914	nd	nd	nd	nd	nd	nd
150915	nd	nd	nd	nd	nd	nd
150916	nd	nd	nd	nd	nd	nd
150917	nd	nd	nd	nd	nd	nd
150918	nd	nd	nd	nd	nd	nd
150919	nd	nd	nd	nd	nd	nd
150920	nd	nd	nd	nd	nd	nd
150921	nd	nd	nd	nd	nd	nd
150922	nd	nd	nd	nd	nd	nd
150923	nd	nd	nd	nd	nd	nd
150924	nd	nd	nd	nd	nd	nd
150925	nd	nd	nd	nd	nd	nd
150926	nd	nd	nd	nd	nd	nd
150927	nd	nd	nd	nd	nd	nd
150930	nd	nd	nd	nd	nd	nd
150931	nd	nd	nd	nd	nd	nd
150931	nd	nd	nd	nd	nd	nd
150936	nd	nd	nd	nd	nd	nd
150937	nd	nd	nd	nd	nd	nd
150938	nd	nd	nd	nd	nd	nd
150939	nd	nd	nd	nd	nd	nd
150940	nd	nd	nd	nd	nd	nd
150941	nd	nd	nd	nd	nd	nd
150942	nd	nd	nd	nd	nd	nd
150943	nd	nd	nd	nd	nd	nd
150944	nd	nd	nd	nd	nd	nd
150945	nd	nd	nd	nd	nd	nd
150946	nd	nd	nd	nd	nd	nd
150947	nd	nd	nd	nd	nd	nd
150948	nd	nd	nd	nd	nd	nd
150949	nd	nd	nd	nd	nd	nd
150950	nd	nd	nd	nd	nd	nd
150951	nd	nd	nd	nd	nd	nd
150952	nd	nd	nd	nd	nd	nd
150953	nd	nd	nd	nd	nd	nd
150954	nd	nd	nd	nd	nd	nd
150955	nd	nd	nd	nd	nd	nd
150956	nd	nd	nd	nd	nd	nd
150957	nd	nd	nd	nd	nd	nd
150958	nd	nd	nd	nd	nd	nd
150959	nd	nd	nd	nd	nd	nd
150960	nd	nd	nd	nd	nd	nd
150961	nd	nd	nd	nd	nd	nd

ANNEX 3-B
Gamma Spectroscopy Results

Sandia National Laboratories
Radiation Protection Sample Diagnostics

Sample Analysis Request Form
Page 1 of 2

To be completed by Customer

Shaded areas are for RPSD use only

Customer: Paul Freshour
Organization: 6134
Project Location: 816 VCM Sampling
Phone: 845-0868
Date Results Needed: 10-2-98
Suspect Isotopes: GNK
Case Number: 7214.2213

Hazards/Special Instructions:

CoC 600818

Batch Log Number: 801996
Logged By: JM

Analysis Type:
- [X] 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
042373-004	Soil	92298/0920	500 ml	Gamma Spectroscopy	01	<300	680	
042374-004		92298/1000			02		829	
042375-004		92298/1005			03		796	
042376-004		92298/1025			04		561	
042377-004		92298/1045			05		714	
042378-004		92298/1055			06		758	
042379-004		92298/1110			07		737	
042380-004		92298/1120			08		792	
042381-004		92298/1140			09		639	
042382-004		92298/1345			10		791	
042383-004		92298/1345			11		811	
042384-004		92298/1900			12		853	
042385-004		92298/1415			13	<300	762	

Relinquished by		Date 9-23-98	Received by		Date 9/23/98
Relinquished by		Date 10-5-98	Received by		Date 10/5/98
Relinquished by		Date	Received by		Date
Relinquished by		Date	Received by		Date

RPSD-0602-02.3

Sandia National Laboratories
Radiation Protection Sample Diagnostics

Sample Analysis Request Form
Page 2 of 2

To be completed by Customer

Shaded areas are for RPSD use only

Customer: Paul Freshour
Organization: 6134
Project Location: 81C UCM Sampling
Phone: 845-0868
Date Results Needed: 10-2-98
Suspect Isotopes: UNK
Case Number: 7214.2213

Hazards/Special Instructions:

CoC 600818

Batch Log Number: 801996
Logged By: JW
Analysis Type: [X] 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
042386-004	Soil	92298/1425	500 ml	Gamma Spectroscopy	14	2300	776	
042387-004	↓	92898/1445	↓	↓	15	↓	753	
042388-004		92298/1450			16		709	
042389-004		92298/1500			17		669	
042390-004		92398/0915			18		688	
042391-004		92398/0920			19		645	
042392-004		92398/0920			20		675	
042393-004		92398/0935			21		704	
042394-004		92398/0945			22	↓	655	
042395-004	↓	92398/0955	↓	↓	23	<300	840	
LCS	—	1/30/90	—	γ spec	24	N/A	N/A	

Relinquished by _____ Date _____ Received by _____ Date _____
Relinquished by _____ Date _____ Received by _____ Date _____
Relinquished by _____ Date _____ Received by _____ Date _____
Relinquished by _____ Date _____ Received by _____ Date _____

SF 2000-COC (10-07)

Supersedes (5-97) issue

Internal Lab Batch No. 80/996

ANALYSIS REQUEST AND CHAIN OF CUSTODY

SAR/WR No.

Press F1 for instructions for each field.

AR/COC- 600818

Dept. No./Mail Stop: 6134/1148
Project/Task Manager: Paul Freshour
Project Name: 81C VCM SAMPLING
Record Center Code: ER/OU1333/DAT
Logbook Ref. No.:
Service Order No.: CF0607

Lab Contact: Fernando Dominquez
Lab Destination: RPSD Building 881
SMO Contact/Phone: Doug Salmi/844-3110
Send Report to SMO: Doug Salmi

Contract No.:A-J-2480A
Case No.: 7214/2215
SMO Authorization
Bill to: Sandia National Laboratories
Supplier Services, Dept.
P.O. Box 5800 MS 0154

Location Tech Area Canyons
Building NA Room NA

LAB USE

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft	ER Site No	Date/Time Collected	Reference LOV (available at SMO): Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
042373-004	CY-81C-GR-001-SS	1.3	81C	9/22/98 0820	S	GM	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042374-004	CY81C-GR-002-SS	1.3	81C	9/22/98 1000	S	GM	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042375-004	CY81C-GR-003-SS	1.3	81C	9/22/98 1005	S	GM	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042376-004	CY81C-GR-004-SS	1.3	81C	9/22/98 1025	S	GM	500 ml	None	G	SA	GAMMA SPECTROSCOPY	

RMMA ☐Yes ☒No Ref. No.

Sample Disposal ☐Return to Client ☒Disposal by lab

Sample Tracking
Date Entered/Verified
Entered By

Special Instructions/QC Requirements
EDD ☒Yes ☐No
Raw data package ☒Yes ☐No

Turnaround Time ☒Normal ☐Rush Required Report Date

	Name	Signature	Init	Company/Organization/Phone
Sample Team Members	Gil Baltazar		GB	Weston/6131/971-2769
	Chris Catechis		CC	MDM/6131/881-3196
	Concetta Cassiato		CC	MDM/6131/884-2249

Please list as separate report.

	Org.	Date	Time		Org.	Date
1. Relinquished by	6131	9-23-98	14 53	4. Relinquished by		
1. Received by	7577	9-23-98	14:54	4. Received by		
2. Relinquished by	7577	9-23-98	1545	5. Relinquished by		
2. Received by	SM2757	9-23-98	1545	5. Received by		
3. Relinquished by	7578	10-5-98	1255	6. Relinquished by		
3. Received by	7577	10-5-98	1255	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 (9-97) Issue

BATCH # 801996

ANALYSIS REQUEST AND CHAIN OF CUSTODY (Continuation)

Press F1 for instructions for each field.

AR/COC- 600818

Project Name: 81C VCM Sampling   Project/Task Manager: Paul Freshour   Case No.: 7214/2213

Location   Tech Area Canyons

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
042377 - 004	CY81C-GR-005-SS	1.1	81C	9/22/98 1045	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042378 - 004	CY81C-GR-006-SS	1.2	81C	9/22/98 1055	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042379 - 004	CY81C-GR-007-SS	1.2	81C	9/22/98 1110	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042380 - 004	CY81C-GR-008-SS	1.2	81C	9/22/98 1120	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042381 - 004	CY81C-GR-009-SS	1.3	81C	9/22/98 1140	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042382 - 004	CY81C-GR-010-SS	1.3	81C	9/22/98 1345	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042383 - 004	CY81C-GR-010-DP	1.3	81C	9/22/98 1345	S	G M	500 ml	None	G	DU	GAMMA SPECTROSCOPY	
042384 - 004	CY81C-GR-011-SS	1.3	81C	9/22/98 1400	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042385 - 004	CY81C-GR-012-SS	1.3	81C	9/22/98 1415	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042386 - 004	CY81C-GR-013-SS	1.3	81C	9/22/98 1425	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042387 – 004	CY81C-GR-014-SS	1.3	81C	9/22/98 1445	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042388 - 004	CY81C-GR-015-SS	1.2	81C	9/22/98 1450	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042389 - 004	CY81C-GR-016-SS	1.2	81C	9/22/98 1500	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042390 - 004	CY81C-GR-017-SS	1.6	81C	9/23/98 0915	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042391 - 004	CY81C-GR-018-SS	1.3	81C	9/23/98 0920	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042392 - 004	CY81C-GR-018-DP	1.3	81C	9/23/98 0920	S	G M	500 ml	None	G	DU	GAMMA SPECTROSCOPY	
042393 -004	CY81C-GR-019SS	1.4	81C	9/23/98 0935	S	G M	420 ml 500ml	None	G	SA	GAMMA SPECTROSCOPY	
042394 - 004	CY81C-GR-020-SS	1.0	81C	9/23/98 0945	S	G M	600 ml	None	G	SA	GAMMA SPECTROSCOPY	
042395 - 004	CY81C-GR-021-SS	1.2	81C	9/23/98 0955	S	G M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	

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)

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-26-98 8:53:31 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042373-004
Lab Sample ID : 80199601

CY81C-GR-001-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 680.000 gram
Sample Date/Time : 9-22-98 9:20:00 AM
Acquire Start Date/Time : 9-26-98 7:10:51 PM
Detector Name : LAB02
Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	---	7.41E-01
RA-226	1.91E+00	6.34E-01	5.26E-01
PB-214	6.86E-01	4.73E-01	4.46E-02
BI-214	5.94E-01	1.18E-01	3.88E-02
PB-210	Not Detected	---	3.18E+01
TH-232	5.71E-01	3.28E-01	1.54E-01
RA-228	6.30E-01	1.57E-01	1.19E-01
AC-228	6.06E-01	1.15E+00	2.65E-01
TH-228	Not Detected	---	7.89E-01
RA-224	6.61E-01	2.43E-01	5.81E-02
PB-212	5.67E-01	8.23E-01	3.73E-02
BI-212	6.54E-01	3.71E-01	2.57E-01
TL-208	5.70E-01	1.34E-01	5.85E-02
U-235	Not Detected	---	2.16E-01
TH-231	Not Detected	---	2.10E+00
PA-231	Not Detected	---	3.60E+00
TH-227	Not Detected	---	3.12E-01
RA-223	Not Detected	---	2.41E-01
RN-219	Not Detected	---	3.37E-01
PB-211	Not Detected	---	7.74E-01
TL-207	Not Detected	---	1.22E+01
AM-241	Not Detected	---	4.38E-01
PU-239	Not Detected	---	4.13E+02
NP-237	Not Detected	---	3.01E-01
PA-233	Not Detected	---	5.31E-02
TH-229	Not Detected	---	2.28E-01

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

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

[Summary Report] - Sample ID: : 80199601

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.54E-02
AG-110m	Not Detected	---------	3.73E-02
BA-133	Not Detected	---------	6.70E-02
BE-7	Not Detected	---------	2.47E-01
CD-109	Not Detected	---------	1.03E+00
CD-115	Not Detected	---------	2.39E-01
CE-139	Not Detected	---------	2.67E-02
CE-141	Not Detected	---------	5.44E-02
CE-144	Not Detected	---------	2.28E-01
CO-56	Not Detected	---------	3.01E-02
CO-57	Not Detected	---------	2.80E-02
CO-58	Not Detected	---------	2.94E-02
CO-60	Not Detected	---------	3.26E-02
CR-51	Not Detected	---------	2.39E-01
CS-134	Not Detected	---------	4.48E-02
CS-137	9.42E-02	2.92E-02	2.02E-02
EU-152	Not Detected	---------	8.37E-02
EU-154	Not Detected	---------	1.64E-01
EU-155	Not Detected	---------	1.36E-01
FE-59	Not Detected	---------	6.55E-02
GD-153	Not Detected	---------	9.74E-02
HG-203	Not Detected	---------	3.01E-02
I-131	Not Detected	---------	3.95E-02
IR-192	Not Detected	---------	2.66E-02
K-40	8.52E+00	1.43E+00	2.39E-01
KR-85	Not Detected	---------	7.65E+00
MN-52	Not Detected	---------	4.29E-02
MN-54	Not Detected	---------	2.91E-02
MO-99	Not Detected	---------	6.10E-01
NA-22	Not Detected	---------	3.39E-02
NA-24	Not Detected	---------	3.46E+00
NB-95	Not Detected	---------	3.36E-01
ND-147	Not Detected	---------	2.39E-01
NI-57	Not Detected	---------	1.81E-01
NP-239	Not Detected	---------	1.23E-01
RU-103	Not Detected	---------	2.82E-02
RU-106	Not Detected	---------	2.43E-01
SB-122	Not Detected	---------	1.02E-01
SB-124	Not Detected	---------	2.62E-02
SB-125	Not Detected	---------	7.60E-02
SN-113	Not Detected	---------	3.46E-02
TA-182	Not Detected	---------	1.43E-01
TA-183	Not Detected	---------	6.83E-01
TC-99m	Not Detected	---------	5.85E+03
TL-201	Not Detected	---------	4.54E-01
XE-133	Not Detected	---------	5.26E-01
Y-88	Not Detected	---------	2.27E-02
ZN-65	Not Detected	---------	9.77E-02
ZR-95	Not Detected	---------	4.88E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-26-98 10:38:16 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042374-004
Lab Sample ID : 80199602

CY81C-GE-002-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 829.000 gram
Sample Date/Time : 9-22-98 10:00:00 AM
Acquire Start Date/Time : 9-26-98 8:55:39 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	8.86E-01	4.14E-01	4.70E-01
RA-226	1.76E+00	1.43E+00	4.14E-01
PB-214	7.56E-01	1.22E-01	3.15E-02
BI-214	6.75E-01	1.25E-01	3.09E-02
PB-210	Not Detected	---------	2.56E+01
TH-232	3.65E-01	2.42E-01	1.14E-01
RA-228	3.70E-01	1.53E-01	9.29E-02
AC-228	Not Detected	---------	1.33E-01
TH-228	4.86E-01	1.76E-01	3.46E-01
RA-224	3.59E-01	1.36E-01	5.97E-02
PB-212	3.77E-01	7.14E-02	3.17E-02
BI-212	4.92E-01	6.15E-01	2.02E-01
TL-208	3.32E-01	4.70E-01	4.98E-02
U-235	Not Detected	---------	1.81E-01
TH-231	Not Detected	---------	1.72E+00
PA-231	Not Detected	---------	2.93E+00
TH-227	Not Detected	---------	2.37E-01
RA-223	Not Detected	---------	2.01E-01
RN-219	Not Detected	---------	2.73E-01
PB-211	Not Detected	---------	5.98E-01
TL-207	Not Detected	---------	9.18E+00
AM-241	Not Detected	---------	3.62E-01
PU-239	Not Detected	---------	3.33E+02
NP-237	Not Detected	---------	2.94E-01
PA-233	Not Detected	---------	4.14E-02
TH-229	Not Detected	---------	1.92E-01

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

[Summary Report] - Sample ID: : 80199602

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	2.78E-02
AG-110m	Not Detected	---------	2.08E-02
BA-133	Not Detected	---------	5.98E-02
BE-7	Not Detected	---------	1.82E-01
CD-109	Not Detected	---------	9.22E-01
CD-115	Not Detected	---------	1.84E-01
CE-139	Not Detected	---------	2.24E-02
CE-141	Not Detected	---------	4.48E-02
CE-144	Not Detected	---------	1.90E-01
CO-56	Not Detected	---------	2.52E-02
CO-57	Not Detected	---------	2.29E-02
CO-58	Not Detected	---------	2.31E-02
CO-60	Not Detected	---------	2.35E-02
CR-51	Not Detected	---------	1.93E-01
CS-134	Not Detected	---------	4.08E-02
CS-137	Not Detected	---------	2.31E-02
EU-152	Not Detected	---------	6.84E-02
EU-154	Not Detected	---------	1.28E-01
EU-155	Not Detected	---------	1.14E-01
FE-59	Not Detected	---------	4.87E-02
GD-153	Not Detected	---------	8.15E-02
HG-203	Not Detected	---------	2.48E-02
I-131	Not Detected	---------	3.07E-02
IR-192	Not Detected	---------	2.05E-02
K-40	4.81E+00	1.23E+00	2.02E-01
KR-85	Not Detected	---------	5.87E+00
MN-52	Not Detected	---------	3.83E-02
MN-54	Not Detected	---------	2.50E-02
MO-99	Not Detected	---------	4.82E-01
NA-22	Not Detected	---------	2.81E-02
NA-24	Not Detected	---------	3.22E+00
NB-95	Not Detected	---------	2.58E-01
ND-147	Not Detected	---------	1.88E-01
NI-57	Not Detected	---------	1.52E-01
NP-239	Not Detected	---------	1.02E-01
RU-103	Not Detected	---------	2.15E-02
RU-106	Not Detected	---------	1.96E-01
SB-122	Not Detected	---------	8.68E-02
SB-124	Not Detected	---------	2.10E-02
SB-125	Not Detected	---------	5.89E-02
SN-113	Not Detected	---------	2.73E-02
TA-182	Not Detected	---------	1.23E-01
TA-183	Not Detected	---------	5.69E-01
TC-99m	Not Detected	---------	5.44E+03
TL-201	Not Detected	---------	3.83E-01
XE-133	Not Detected	---------	4.56E-01
Y-88	Not Detected	---------	1.96E-02
ZN-65	Not Detected	---------	8.35E-02
ZR-95	Not Detected	---------	3.93E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-01-98 9:18:06 AM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042375-004
Lab Sample ID : 80199603

CY81C-GR-003-SS

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 796.000 gram
Sample Date/Time : 9-22-98 10:05:00 AM
Acquire Start Date/Time : 9-26-98 10:40:24 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	8.70E-01	5.29E-01	4.32E-01
RA-226	1.74E+00	5.05E-01	4.50E-01
PB-214	7.99E-01	8.61E-01	3.36E-02
BI-214	7.04E-01	1.26E-01	3.33E-02
PB-210	Not Detected	---	2.63E+01
TH-232	3.28E-01	1.75E-01	1.05E-01
RA-228	2.71E-01	1.17E-01	1.15E-01
AC-228	Not Detected	---	1.36E-01
TH-228	5.21E-01	1.81E-01	3.44E-01
RA-224	3.60E-01	1.36E-01	6.95E-02
PB-212	3.46E-01	7.38E-02	3.32E-02
BI-212	5.42E-01	5.08E-01	2.03E-01
TL-208	3.46E-01	1.00E-01	4.52E-02
U-235	Not Detected	---	1.86E-01
TH-231	Not Detected	---	1.78E+00
PA-231	Not Detected	---	3.08E+00
TH-227	Not Detected	---	2.43E-01
RA-223	Not Detected	---	2.13E-01
RN-219	Not Detected	---	2.93E-01
PB-211	Not Detected	---	6.71E-01
TL-207	Not Detected	---	9.54E+00
AM-241	Not Detected	---	3.81E-01
PU-239	Not Detected	---	3.47E+02
NP-237	Not Detected	---	2.61E-01
PA-233	Not Detected	---	4.38E-02
TH-229	Not Detected	---	1.91E-01

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

[Summary Report] - Sample ID: : 80199603

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	2.79E-02
AG-110m	Not Detected	---------	2.11E-02
BA-133	Not Detected	---------	6.32E-02
BE-7	Not Detected	---------	1.91E-01
CD-109	Not Detected	---------	8.89E-01
CD-115	Not Detected	---------	1.93E-01
CE-139	Not Detected	---------	2.37E-02
CE-141	Not Detected	---------	4.65E-02
CE-144	Not Detected	---------	1.90E-01
CO-56	Not Detected	---------	2.54E-02
CO-57	Not Detected	---------	2.39E-02
CO-58	Not Detected	---------	2.52E-02
CO-60	Not Detected	---------	2.45E-02
CR-51	Not Detected	---------	2.07E-01
CS-134	Not Detected	---------	4.27E-02
CS-137	Not Detected	---------	2.41E-02
EU-152	Not Detected	---------	7.12E-02
EU-154	Not Detected	---------	1.29E-01
EU-155	Not Detected	---------	1.16E-01
FE-59	Not Detected	---------	5.01E-02
GD-153	Not Detected	---------	8.16E-02
HG-203	Not Detected	---------	2.57E-02
I-131	Not Detected	---------	3.29E-02
IR-192	Not Detected	---------	2.21E-02
K-40	5.17E+00	9.12E-01	2.29E-01
KR-85	Not Detected	---------	6.16E+00
MN-52	Not Detected	---------	3.96E-02
MN-54	Not Detected	---------	2.55E-02
MO-99	Not Detected	---------	5.17E-01
NA-22	Not Detected	---------	2.92E-02
NA-24	Not Detected	---------	3.51E+00
NB-95	Not Detected	---------	2.68E-01
ND-147	Not Detected	---------	1.95E-01
NI-57	Not Detected	---------	1.62E-01
NP-239	Not Detected	---------	1.04E-01
RU-103	Not Detected	---------	2.32E-02
RU-106	Not Detected	---------	2.01E-01
SB-122	Not Detected	---------	1.01E-01
SB-124	Not Detected	---------	2.31E-02
SB-125	Not Detected	---------	6.21E-02
SN-113	Not Detected	---------	2.97E-02
TA-182	Not Detected	---------	1.19E-01
TA-183	Not Detected	---------	6.02E-01
TC-99m	Not Detected	---------	6.91E+03
TL-201	Not Detected	---------	3.96E-01
XE-133	Not Detected	---------	4.82E-01
Y-88	Not Detected	---------	2.09E-02
ZN-65	Not Detected	---------	8.15E-02
ZR-95	Not Detected	---------	4.19E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-27-98 2:07:56 AM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042376-004
Lab Sample ID : 80199604

CY81C-GR-004-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 561.000 gram
Sample Date/Time : 9-22-98 10:25:00 AM
Acquire Start Date/Time : 9-27-98 12:25:11 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	1.03E+00	6.81E-01	6.73E-01
RA-226	1.88E+00	8.24E-01	6.12E-01
PB-214	8.06E-01	1.34E+00	5.13E-02
BI-214	7.60E-01	1.47E-01	4.66E-02
PB-210	Not Detected	---	3.58E+01
TH-232	5.92E-01	1.11E+00	1.55E-01
RA-228	5.24E-01	1.91E-01	1.35E-01
AC-228	5.74E-01	2.44E-01	3.18E-01
TH-228	8.80E-01	2.02E-01	5.52E-01
RA-224	6.06E-01	2.19E-01	8.02E-02
PB-212	5.94E-01	5.08E-01	4.11E-02
BI-212	6.12E-01	3.23E-01	3.03E-01
TL-208	5.33E-01	1.54E-01	6.99E-02
U-235	Not Detected	---	2.47E-01
TH-231	Not Detected	---	2.43E+00
PA-231	Not Detected	---	4.05E+00
TH-227	Not Detected	---	3.53E-01
RA-223	Not Detected	---	2.72E-01
RN-219	Not Detected	---	3.98E-01
PB-211	Not Detected	---	9.24E-01
TL-207	Not Detected	---	1.35E+01
AM-241	Not Detected	---	5.17E-01
PU-239	Not Detected	---	4.73E+02
NP-237	Not Detected	---	3.98E-01
PA-233	Not Detected	---	6.15E-02
TH-229	Not Detected	---	2.65E-01

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

[Summary Report] - Sample ID: : 80199604

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	4.01E-02
AG-110m	Not Detected	---------	5.94E-02
BA-133	Not Detected	---------	7.82E-02
BE-7	Not Detected	---------	2.88E-01
CD-109	~~1.90E+00~~	~~8.92E-01~~	~~1.36E+00~~ not detected JJ 10/1/98
CD-115	Not Detected	---------	2.90E-01
CE-139	Not Detected	---------	3.18E-02
CE-141	Not Detected	---------	6.15E-02
CE-144	Not Detected	---------	2.65E-01
CO-56	Not Detected	---------	3.51E-02
CO-57	Not Detected	---------	3.28E-02
CO-58	Not Detected	---------	3.26E-02
CO-60	Not Detected	---------	3.47E-02
CR-51	Not Detected	---------	2.74E-01
CS-134	Not Detected	---------	5.49E-02
CS-137	2.92E-01	5.87E-02	2.42E-02
EU-152	Not Detected	---------	9.78E-02
EU-154	Not Detected	---------	1.85E-01
EU-155	Not Detected	---------	1.61E-01
FE-59	Not Detected	---------	6.75E-02
GD-153	Not Detected	---------	1.14E-01
HG-203	Not Detected	---------	3.63E-02
I-131	Not Detected	---------	4.50E-02
IR-192	Not Detected	---------	3.05E-02
K-40	9.62E+00	1.64E+00	3.13E-01
KR-85	Not Detected	---------	8.98E+00
MN-52	Not Detected	---------	5.42E-02
MN-54	Not Detected	---------	3.47E-02
MO-99	Not Detected	---------	7.37E-01
NA-22	Not Detected	---------	4.01E-02
NA-24	Not Detected	---------	5.37E+00
NB-95	Not Detected	---------	3.94E-01
ND-147	Not Detected	---------	2.61E-01
NI-57	Not Detected	---------	4.30E-01
NP-239	Not Detected	---------	1.44E-01
RU-103	Not Detected	---------	3.38E-02
RU-106	Not Detected	---------	2.85E-01
SB-122	Not Detected	---------	1.34E-01
SB-124	Not Detected	---------	3.22E-02
SB-125	Not Detected	---------	9.25E-02
SN-113	Not Detected	---------	4.00E-02
TA-182	Not Detected	---------	1.64E-01
TA-183	Not Detected	---------	8.32E-01
TC-99m	Not Detected	---------	1.09E+04
TL-201	Not Detected	---------	5.35E-01
XE-133	Not Detected	---------	6.61E-01
Y-88	Not Detected	---------	3.07E-02
ZN-65	Not Detected	---------	1.10E-01
ZR-95	Not Detected	---------	5.65E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-27-98 3:52:55 AM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042377-004
Lab Sample ID : 80199605

CY81C-GR-005-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 714.000 gram
Sample Date/Time : 9-22-98 10:45:00 AM
Acquire Start Date/Time : 9-27-98 2:10:08 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	4.87E-01	3.93E-01	5.69E-01
RA-226	1.97E+00	8.19E-01	5.64E-01
PB-214	7.40E-01	1.74E-01	4.00E-02
BI-214	6.91E-01	3.80E-01	3.70E-02
PB-210	Not Detected	---	3.22E+01
TH-232	5.20E-01	2.99E-01	1.41E-01
RA-228	6.44E-01	2.39E-01	1.18E-01
AC-228	5.86E-01	2.68E-01	2.50E-01
TH-228	7.72E-01	2.48E-01	4.28E-01
RA-224	5.56E-01	1.90E-01	7.29E-02
PB-212	5.83E-01	1.68E-01	3.79E-02
BI-212	7.51E-01	3.74E-01	2.44E-01
TL-208	5.17E-01	1.10E-01	5.61E-02
U-235	Not Detected	---	2.14E-01
TH-231	Not Detected	---	2.15E+00
PA-231	Not Detected	---	3.66E+00
TH-227	Not Detected	---	3.15E-01
RA-223	Not Detected	---	2.45E-01
RN-219	Not Detected	---	3.31E-01
PB-211	Not Detected	---	7.37E-01
TL-207	Not Detected	---	1.15E+01
AM-241	Not Detected	---	4.38E-01
PU-239	Not Detected	---	4.13E+02
NP-237	Not Detected	---	3.57E-01
PA-233	Not Detected	---	5.42E-02
TH-229	Not Detected	---	2.31E-01

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

[Summary Report] - Sample ID: : 80199605

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.60E-02
AG-110m	Not Detected	---------	4.43E-02
BA-133	Not Detected	---------	6.69E-02
BE-7	Not Detected	---------	2.39E-01
CD-109	Not Detected	---------	1.21E+00
CD-115	Not Detected	---------	2.52E-01
CE-139	Not Detected	---------	2.74E-02
CE-141	Not Detected	---------	5.35E-02
CE-144	Not Detected	---------	2.24E-01
CO-56	Not Detected	---------	2.92E-02
CO-57	Not Detected	---------	2.73E-02
CO-58	Not Detected	---------	2.71E-02
CO-60	Not Detected	---------	3.03E-02
CR-51	Not Detected	---------	2.35E-01
CS-134	Not Detected	---------	4.59E-02
CS-137	1.66E-01	2.79E-01	2.15E-02
EU-152	Not Detected	---------	8.16E-02
EU-154	Not Detected	---------	1.67E-01
EU-155	Not Detected	---------	1.34E-01
FE-59	Not Detected	---------	6.21E-02
GD-153	Not Detected	---------	9.74E-02
HG-203	Not Detected	---------	3.01E-02
I-131	Not Detected	---------	3.87E-02
IR-192	Not Detected	---------	2.59E-02
K-40	8.24E+00	1.58E+00	2.62E-01
KR-85	Not Detected	---------	7.23E+00
MN-52	Not Detected	---------	4.53E-02
MN-54	Not Detected	---------	2.92E-02
MO-99	Not Detected	---------	6.73E-01
NA-22	Not Detected	---------	3.43E-02
NA-24	Not Detected	---------	4.55E+00
NB-95	Not Detected	---------	3.55E-01
ND-147	Not Detected	---------	2.48E-01
NI-57	Not Detected	---------	1.98E-01
NP-239	Not Detected	---------	1.20E-01
RU-103	Not Detected	---------	2.65E-02
RU-106	Not Detected	---------	2.52E-01
SB-122	Not Detected	---------	1.13E-01
SB-124	Not Detected	---------	2.69E-02
SB-125	Not Detected	---------	7.35E-02
SN-113	Not Detected	---------	3.38E-02
TA-182	Not Detected	---------	1.36E-01
TA-183	Not Detected	---------	7.07E-01
TC-99m	Not Detected	---------	1.11E+04
TL-201	Not Detected	---------	4.78E-01
XE-133	Not Detected	---------	5.83E-01
Y-88	Not Detected	---------	2.22E-02
ZN-65	Not Detected	---------	9.43E-02
ZR-95	Not Detected	---------	5.11E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-01-98 1:08:37 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042378-004
Lab Sample ID : 80199606

CY81C-GR-006-SS

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 758.000 gram
Sample Date/Time : 9-22-98 10:55:00 AM
Acquire Start Date/Time : 9-27-98 3:55:04 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	4.82E-01	3.11E-01	5.13E-01
RA-226	1.76E+00	5.20E-01	4.57E-01
PB-214	7.60E-01	1.37E-01	3.72E-02
BI-214	6.45E-01	4.18E-01	3.39E-02
PB-210	Not Detected	---	2.88E+01
TH-232	3.81E-01	2.37E-01	1.10E-01
RA-228	4.30E-01	1.42E-01	1.02E-01
AC-228	4.61E-01	1.90E-01	2.37E-01
TH-228	7.25E-01	2.88E-01	3.76E-01
RA-224	3.93E-01	1.55E-01	6.52E-02
PB-212	4.40E-01	9.29E-02	3.27E-02
BI-212	4.81E-01	2.96E-01	2.33E-01
TL-208	3.96E-01	6.44E-01	5.46E-02
U-235	Not Detected	---	1.98E-01
TH-231	Not Detected	---	1.89E+00
PA-231	Not Detected	---	3.27E+00
TH-227	Not Detected	---	2.70E-01
RA-223	Not Detected	---	2.19E-01
RN-219	Not Detected	---	3.02E-01
PB-211	Not Detected	---	7.07E-01
TL-207	Not Detected	---	9.85E+00
AM-241	Not Detected	---	3.92E-01
PU-239	Not Detected	---	3.68E+02
NP-237	Not Detected	---	2.92E-01
PA-233	Not Detected	---	4.54E-02
TH-229	Not Detected	---	2.10E-01

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

[Summary Report] - Sample ID: : 80199606

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---	3.10E-02
AG-110m	Not Detected	---	2.31E-02
BA-133	Not Detected	---	6.31E-02
BE-7	Not Detected	---	2.11E-01
CD-109	Not Detected	---	9.96E-01
CD-115	Not Detected	---	2.21E-01
CE-139	Not Detected	---	2.56E-02
CE-141	Not Detected	---	4.94E-02
CE-144	Not Detected	---	2.02E-01
CO-56	Not Detected	---	2.80E-02
CO-57	Not Detected	---	2.54E-02
CO-58	Not Detected	---	2.53E-02
CO-60	Not Detected	---	2.62E-02
CR-51	Not Detected	---	2.06E-01
CS-134	Not Detected	---	4.19E-02
CS-137	Not Detected	---	2.59E-02
EU-152	Not Detected	---	7.59E-02
EU-154	Not Detected	---	1.43E-01
EU-155	Not Detected	---	1.17E-01
FE-59	Not Detected	---	5.38E-02
GD-153	Not Detected	---	8.87E-02
HG-203	Not Detected	---	2.79E-02
I-131	Not Detected	---	3.24E-02
IR-192	Not Detected	---	2.26E-02
K-40	6.43E+00	1.50E+00	2.41E-01
KR-85	Not Detected	---	6.56E+00
MN-52	Not Detected	---	4.54E-02
MN-54	Not Detected	---	2.68E-02
MO-99	Not Detected	---	6.13E-01
NA-22	Not Detected	---	3.06E-02
NA-24	Not Detected	---	4.89E+00
NB-95	Not Detected	---	3.08E-01
ND-147	Not Detected	---	2.19E-01
NI-57	Not Detected	---	2.13E-01
NP-239	Not Detected	---	1.06E-01
RU-103	Not Detected	---	2.45E-02
RU-106	Not Detected	---	2.22E-01
SB-122	Not Detected	---	1.03E-01
SB-124	Not Detected	---	2.26E-02
SB-125	Not Detected	---	6.78E-02
SN-113	Not Detected	---	2.93E-02
TA-182	Not Detected	---	1.23E-01
TA-183	Not Detected	---	6.47E-01
TC-99m	Not Detected	---	1.22E+04
TL-201	Not Detected	---	4.30E-01
XE-133	Not Detected	---	5.16E-01
Y-88	Not Detected	---	2.09E-02
ZN-65	Not Detected	---	8.42E-02
ZR-95	Not Detected	---	4.69E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-01-98 1:15:26 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042379-004
Lab Sample ID : 80199607

CY81C-GR-007-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 737.000 gram
Sample Date/Time : 9-22-98 11:10:00 AM
Acquire Start Date/Time : 9-27-98 5:39:56 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	7.60E-01	4.16E-01	4.92E-01
RA-226	Not Detected	---	4.38E-01
PB-214	8.41E-01	1.38E-01	3.71E-02
BI-214	7.23E-01	2.38E-01	3.36E-02
PB-210	Not Detected	---	2.76E+01
TH-232	3.45E-01	2.06E-01	1.27E-01
RA-228	3.18E-01	1.19E-01	9.71E-02
AC-228	3.30E-01	2.07E-01	2.45E-01
TH-228	2.70E-01	1.73E-01	4.05E-01
RA-224	3.52E-01	2.10E-01	6.18E-02
PB-212	3.43E-01	6.89E-02	3.21E-02
BI-212	3.45E-01	4.91E-01	1.95E-01
TL-208	2.85E-01	8.03E-02	4.98E-02
U-235	8.09E-02	9.22E-02	1.16E-01
TH-231	Not Detected	---	1.93E+00
PA-231	Not Detected	---	3.18E+00
TH-227	Not Detected	---	2.43E-01
RA-223	Not Detected	---	2.19E-01
RN-219	Not Detected	---	3.07E-01
PB-211	Not Detected	---	6.95E-01
TL-207	Not Detected	---	9.99E+00
AM-241	Not Detected	---	3.82E-01
PU-239	Not Detected	---	3.63E+02
NP-237	Not Detected	---	2.76E-01
PA-233	Not Detected	---	4.61E-02
TH-229	Not Detected	---	2.01E-01

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

[Summary Report] - Sample ID: : 80199607

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	2.90E-02
AG-110m	Not Detected	---------	2.13E-02
BA-133	Not Detected	---------	6.72E-02
BE-7	Not Detected	---------	2.11E-01
CD-109	Not Detected	---------	9.41E-01
CD-115	Not Detected	---------	2.15E-01
CE-139	Not Detected	---------	2.49E-02
CE-141	Not Detected	---------	4.90E-02
CE-144	Not Detected	---------	2.05E-01
CO-56	Not Detected	---------	2.59E-02
CO-57	Not Detected	---------	2.44E-02
CO-58	Not Detected	---------	2.47E-02
CO-60	Not Detected	---------	2.25E-02
CR-51	Not Detected	---------	2.17E-01
CS-134	Not Detected	---------	4.49E-02
CS-137	Not Detected	---------	2.43E-02
EU-152	Not Detected	---------	7.27E-02
EU-154	Not Detected	---------	1.33E-01
EU-155	Not Detected	---------	1.17E-01
FE-59	Not Detected	---------	4.49E-02
GD-153	Not Detected	---------	8.62E-02
HG-203	Not Detected	---------	2.59E-02
I-131	Not Detected	---------	3.41E-02
IR-192	Not Detected	---------	2.28E-02
K-40	4.22E+00	7.79E-01	2.36E-01
KR-85	Not Detected	---------	6.37E+00
MN-52	Not Detected	---------	4.00E-02
MN-54	Not Detected	---------	2.46E-02
MO-99	Not Detected	---------	5.90E-01
NA-22	Not Detected	---------	2.74E-02
NA-24	Not Detected	---------	4.90E+00
NB-95	Not Detected	---------	2.81E-01
ND-147	Not Detected	---------	2.10E-01
NI-57	Not Detected	---------	3.93E-01
NP-239	Not Detected	---------	1.05E-01
RU-103	Not Detected	---------	2.40E-02
RU-106	Not Detected	---------	2.18E-01
SB-122	Not Detected	---------	1.02E-01
SB-124	Not Detected	---------	2.41E-02
SB-125	Not Detected	---------	6.39E-02
SN-113	Not Detected	---------	3.06E-02
TA-182	Not Detected	---------	1.29E-01
TA-183	Not Detected	---------	6.36E-01
TC-99m	Not Detected	---------	1.41E+04
TL-201	Not Detected	---------	4.34E-01
XE-133	Not Detected	---------	5.43E-01
Y-88	Not Detected	---------	2.10E-02
ZN-65	Not Detected	---------	8.89E-02
ZR-95	Not Detected	---------	4.01E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-27-98 3:10:33 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042380-004
Lab Sample ID : 80199608

CY81C-GR-005-SS

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 792.000 gram
Sample Date/Time : 9-22-98 11:20:00 AM
Acquire Start Date/Time : 9-27-98 1:27:51 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	5.32E-01	3.81E-01	4.74E-01
RA-226	1.65E+00	6.71E-01	4.59E-01
PB-214	7.27E-01	4.22E-01	3.49E-02
BI-214	7.26E-01	2.22E-01	3.40E-02
PB-210	Not Detected	---	2.72E+01
TH-232	4.07E-01	2.06E-01	1.01E-01
RA-228	3.49E-01	1.34E-01	9.93E-02
AC-228	4.09E-01	1.85E-01	2.28E-01
TH-228	5.30E-01	9.15E-01	3.59E-01
RA-224	3.76E-01	1.44E-01	6.04E-02
PB-212	4.08E-01	3.94E-01	3.18E-02
BI-212	4.77E-01	2.28E-01	2.34E-01
TL-208	3.30E-01	9.85E-02	4.50E-02
U-235	1.07E-01	1.62E-01	1.90E-01
TH-231	Not Detected	---	1.81E+00
PA-231	Not Detected	---	3.13E+00
TH-227	Not Detected	---	2.52E-01
RA-223	Not Detected	---	2.19E-01
RN-219	Not Detected	---	2.94E-01
PB-211	Not Detected	---	6.63E-01
TL-207	Not Detected	---	9.30E+00
AM-241	Not Detected	---	3.62E-01
PU-239	Not Detected	---	3.54E+02
NP-237	Not Detected	---	2.83E-01
PA-233	Not Detected	---	4.65E-02
TH-229	Not Detected	---	2.04E-01

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

[Summary Report] - Sample ID: : 80199608

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---	2.99E-02
AG-110m	Not Detected	---	3.03E-02
BA-133	Not Detected	---	6.04E-02
BE-7	Not Detected	---	2.03E-01
CD-109	Not Detected	---	9.67E-01
CD-115	Not Detected	---	2.42E-01
CE-139	Not Detected	---	2.42E-02
CE-141	Not Detected	---	4.70E-02
CE-144	Not Detected	---	1.94E-01
CO-56	Not Detected	---	2.52E-02
CO-57	Not Detected	---	2.37E-02
CO-58	Not Detected	---	2.49E-02
CO-60	Not Detected	---	2.55E-02
CR-51	Not Detected	---	1.96E-01
CS-134	Not Detected	---	4.30E-02
CS-137	5.66E-02	3.37E-02	1.76E-02
EU-152	Not Detected	---	7.08E-02
EU-154	Not Detected	---	1.39E-01
EU-155	Not Detected	---	1.17E-01
FE-59	Not Detected	---	4.99E-02
GD-153	Not Detected	---	8.56E-02
HG-203	Not Detected	---	2.50E-02
I-131	Not Detected	---	3.40E-02
IR-192	Not Detected	---	2.20E-02
K-40	5.52E+00	9.54E-01	2.28E-01
KR-85	Not Detected	---	6.28E+00
MN-52	Not Detected	---	4.24E-02
MN-54	Not Detected	---	2.69E-02
MO-99	Not Detected	---	6.55E-01
NA-22	Not Detected	---	3.12E-02
NA-24	Not Detected	---	7.10E+00
NB-95	Not Detected	---	3.09E-01
ND-147	Not Detected	---	2.13E-01
NI-57	Not Detected	---	4.10E-01
NP-239	Not Detected	---	1.04E-01
RU-103	Not Detected	---	2.36E-02
RU-106	Not Detected	---	2.11E-01
SB-122	Not Detected	---	1.08E-01
SB-124	Not Detected	---	2.29E-02
SB-125	Not Detected	---	6.08E-02
SN-113	Not Detected	---	2.87E-02
TA-182	Not Detected	---	1.26E-01
TA-183	Not Detected	---	6.25E-01
TC-99m	Not Detected	---	3.32E+04
TL-201	Not Detected	---	4.62E-01
XE-133	Not Detected	---	5.82E-01
Y-88	Not Detected	---	2.11E-02
ZN-65	Not Detected	---	8.59E-02
ZR-95	Not Detected	---	4.38E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-27-98 4:55:24 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042381-004
Lab Sample ID : 80199609

CY81C-GR-009-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 639.000 gram
Sample Date/Time : 9-22-98 11:40:00 AM
Acquire Start Date/Time : 9-27-98 3:12:42 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	6.40E-01	3.90E-01	6.62E-01
RA-226	1.81E+00	7.33E-01	5.97E-01
PB-214	7.42E-01	1.43E-01	4.68E-02
BI-214	6.55E-01	1.27E-01	4.41E-02
PB-210	Not Detected	---	3.52E+01
TH-232	5.72E-01	2.98E-01	1.53E-01
RA-228	7.34E-01	2.95E-01	1.41E-01
AC-228	6.29E-01	2.45E-01	2.81E-01
TH-228	5.51E-01	9.30E-01	5.10E-01
RA-224	5.49E-01	2.23E-01	7.89E-02
PB-212	6.22E-01	3.11E-01	3.98E-02
BI-212	7.19E-01	3.99E-01	2.50E-01
TL-208	5.92E-01	7.99E-01	6.58E-02
U-235	Not Detected	---	2.34E-01
TH-231	Not Detected	---	2.38E+00
PA-231	Not Detected	---	3.93E+00
TH-227	Not Detected	---	3.44E-01
RA-223	Not Detected	---	2.71E-01
RN-219	Not Detected	---	3.90E-01
PB-211	Not Detected	---	8.85E-01
TL-207	Not Detected	---	1.21E+01
AM-241	Not Detected	---	4.76E-01
PU-239	Not Detected	---	4.45E+02
NP-237	Not Detected	---	3.47E-01
PA-233	Not Detected	---	5.98E-02
TH-229	Not Detected	---	2.51E-01

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

[Summary Report] - Sample ID: : 80199609

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---	3.72E-02
AG-110m	Not Detected	---	7.34E-02
BA-133	Not Detected	---	7.22E-02
BE-7	Not Detected	---	2.75E-01
CD-109	~~1.47E+00~~	~~7.16E-01~~	~~1.18E+00~~
CD-115	Not Detected	---	3.22E-01
CE-139	Not Detected	---	3.09E-02
CE-141	Not Detected	---	5.86E-02
CE-144	Not Detected	---	2.42E-01
CO-56	Not Detected	---	3.39E-02
CO-57	Not Detected	---	3.01E-02
CO-58	Not Detected	---	3.17E-02
CO-60	Not Detected	---	3.39E-02
CR-51	Not Detected	---	2.69E-01
CS-134	Not Detected	---	4.96E-02
CS-137	5.75E-01	9.72E-02	2.23E-02
EU-152	Not Detected	---	8.96E-02
EU-154	Not Detected	---	1.72E-01
EU-155	Not Detected	---	1.46E-01
FE-59	Not Detected	---	6.54E-02
GD-153	Not Detected	---	1.08E-01
HG-203	Not Detected	---	3.53E-02
I-131	Not Detected	---	4.59E-02
IR-192	Not Detected	---	2.98E-02
K-40	9.54E+00	2.74E+00	2.73E-01
KR-85	Not Detected	---	8.28E+00
MN-52	Not Detected	---	5.83E-02
MN-54	Not Detected	---	3.35E-02
MO-99	Not Detected	---	8.07E-01
NA-22	Not Detected	---	3.80E-02
NA-24	Not Detected	---	9.31E+00
NB-95	Not Detected	---	4.28E-01
ND-147	Not Detected	---	2.77E-01
NI-57	Not Detected	---	5.05E-01
NP-239	Not Detected	---	1.32E-01
RU-103	Not Detected	---	3.14E-02
RU-106	Not Detected	---	2.81E-01
SB-122	Not Detected	---	1.49E-01
SB-124	Not Detected	---	3.13E-02
SB-125	Not Detected	---	8.90E-02
SN-113	Not Detected	---	4.04E-02
TA-182	Not Detected	---	1.51E-01
TA-183	Not Detected	---	8.19E-01
TC-99m	Not Detected	---	4.91E+04
TL-201	Not Detected	---	5.99E-01
XE-133	Not Detected	---	7.20E-01
Y-88	Not Detected	---	2.76E-02
ZN-65	Not Detected	---	1.02E-01
ZR-95	Not Detected	---	5.48E-02

Not detected XX 10/1/98

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-01-98 1:26:58 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042382-004
Lab Sample ID : 80199610

CY81C-GR-010-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 791.000 gram
Sample Date/Time : 9-22-98 1:45:00 PM
Acquire Start Date/Time : 9-27-98 4:57:33 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	5.38E-01	3.77E-01	4.69E-01
RA-226	1.44E+00	5.09E-01	4.76E-01
PB-214	6.02E-01	1.20E-01	3.88E-02
BI-214	5.55E-01	7.40E-01	3.39E-02
PB-210	Not Detected	---	2.60E+01
TH-232	4.61E-01	2.60E-01	1.07E-01
RA-228	4.31E-01	2.60E-01	1.30E-01
AC-228	4.62E-01	1.80E-01	2.27E-01
TH-228	4.56E-01	1.79E-01	3.40E-01
RA-224	4.61E-01	1.61E-01	5.51E-02
PB-212	4.87E-01	9.65E-02	3.08E-02
BI-212	5.18E-01	9.87E-02	2.52E-01
TL-208	4.19E-01	1.74E-01	5.17E-02
U-235	Not Detected	---	1.91E-01
TH-231	Not Detected	---	1.83E+00
PA-231	Not Detected	---	3.06E+00
TH-227	Not Detected	---	2.67E-01
RA-223	Not Detected	---	2.22E-01
RN-219	Not Detected	---	2.88E-01
PB-211	Not Detected	---	6.58E-01
TL-207	Not Detected	---	9.52E+00
AM-241	Not Detected	---	3.71E-01
PU-239	Not Detected	---	3.52E+02
NP-237	Not Detected	---	2.62E-01
PA-233	Not Detected	---	4.43E-02
TH-229	Not Detected	---	2.00E-01

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

[Summary Report] - Sample ID: : 80199610

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---	3.08E-02
AG-110m	Not Detected	---	2.29E-02
BA-133	Not Detected	---	5.73E-02
BE-7	Not Detected	---	1.99E-01
CD-109	Not Detected	---	8.95E-01
CD-115	Not Detected	---	2.47E-01
CE-139	Not Detected	---	2.44E-02
CE-141	Not Detected	---	4.72E-02
CE-144	Not Detected	---	1.98E-01
CO-56	Not Detected	---	2.63E-02
CO-57	Not Detected	---	2.45E-02
CO-58	Not Detected	---	2.50E-02
CO-60	Not Detected	---	2.47E-02
CR-51	Not Detected	---	1.97E-01
CS-134	Not Detected	---	3.95E-02
CS-137	Not Detected	---	2.48E-02
EU-152	Not Detected	---	7.30E-02
EU-154	Not Detected	---	1.41E-01
EU-155	Not Detected	---	1.19E-01
FE-59	Not Detected	---	5.40E-02
GD-153	Not Detected	---	8.61E-02
HG-203	Not Detected	---	2.14E-02
I-131	Not Detected	---	3.43E-02
IR-192	Not Detected	---	2.16E-02
K-40	6.73E+00	1.11E+00	2.11E-01
KR-85	Not Detected	---	6.28E+00
MN-52	Not Detected	---	4.19E-02
MN-54	Not Detected	---	2.58E-02
MO-99	Not Detected	---	6.12E-01
NA-22	Not Detected	---	2.82E-02
NA-24	Not Detected	---	7.16E+00
NB-95	Not Detected	---	3.31E-01
ND-147	Not Detected	---	2.09E-01
NI-57	Not Detected	---	4.23E-01
NP-239	Not Detected	---	1.07E-01
RU-103	Not Detected	---	2.27E-02
RU-106	Not Detected	---	2.13E-01
SB-122	Not Detected	---	1.08E-01
SB-124	Not Detected	---	2.25E-02
SB-125	Not Detected	---	6.24E-02
SN-113	Not Detected	---	2.98E-02
TA-182	Not Detected	---	1.20E-01
TA-183	Not Detected	---	6.36E-01
TC-99m	Not Detected	---	3.86E+04
TL-201	Not Detected	---	4.51E-01
XE-133	Not Detected	---	6.07E-01
Y-88	Not Detected	---	1.91E-02
ZN-65	Not Detected	---	8.11E-02
ZR-95	Not Detected	---	4.24E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-27-98 8:25:04 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042383-004
Lab Sample ID : 80199611

CYPIC-GR-010-DP

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 811.000 gram
Sample Date/Time : 9-22-98 1:45:00 PM
Acquire Start Date/Time : 9-27-98 6:42:24 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	6.44E-01	4.06E-01	4.91E-01
RA-226	1.65E+00	7.51E-01	4.83E-01
PB-214	6.32E-01	4.34E-01	3.40E-02
BI-214	5.78E-01	1.09E-01	3.05E-02
PB-210	Not Detected	---	2.68E+01
TH-232	4.85E-01	2.50E-01	1.22E-01
RA-228	4.69E-01	1.37E-01	9.92E-02
AC-228	5.20E-01	1.98E-01	2.21E-01
TH-228	5.84E-01	1.95E-01	3.48E-01
RA-224	4.58E-01	1.95E-01	5.30E-02
PB-212	4.85E-01	3.46E-01	3.20E-02
BI-212	5.56E-01	3.36E-01	2.25E-01
TL-208	4.30E-01	1.04E-01	5.33E-02
U-235	1.44E-01	1.62E-01	1.90E-01
TH-231	Not Detected	---	1.80E+00
PA-231	Not Detected	---	3.10E+00
TH-227	Not Detected	---	2.61E-01
RA-223	Not Detected	---	2.10E-01
RN-219	Not Detected	---	2.89E-01
PB-211	Not Detected	---	6.61E-01
TL-207	Not Detected	---	9.97E+00
AM-241	Not Detected	---	3.72E-01
PU-239	Not Detected	---	3.44E+02
NP-237	Not Detected	---	2.67E-01
PA-233	Not Detected	---	4.64E-02
TH-229	Not Detected	---	2.00E-01

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

[Summary Report] - Sample ID: : 80199611

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.10E-02
AG-110m	Not Detected	---------	2.33E-02
BA-133	Not Detected	---------	5.70E-02
BE-7	Not Detected	---------	1.99E-01
CD-109	Not Detected	---------	9.12E-01
CD-115	Not Detected	---------	2.57E-01
CE-139	Not Detected	---------	2.34E-02
CE-141	Not Detected	---------	4.77E-02
CE-144	Not Detected	---------	1.96E-01
CO-56	Not Detected	---------	2.59E-02
CO-57	Not Detected	---------	2.50E-02
CO-58	Not Detected	---------	2.45E-02
CO-60	Not Detected	---------	2.40E-02
CR-51	Not Detected	---------	1.91E-01
CS-134	Not Detected	---------	4.01E-02
CS-137	Not Detected	---------	2.54E-02
EU-152	Not Detected	---------	7.46E-02
EU-154	Not Detected	---------	1.43E-01
EU-155	Not Detected	---------	1.18E-01
FE-59	Not Detected	---------	4.91E-02
GD-153	Not Detected	---------	8.51E-02
HG-203	Not Detected	---------	2.59E-02
I-131	Not Detected	---------	3.30E-02
IR-192	Not Detected	---------	2.16E-02
K-40	6.11E+00	1.35E+00	2.18E-01
KR-85	Not Detected	---------	6.29E+00
MN-52	Not Detected	---------	4.56E-02
MN-54	Not Detected	---------	2.64E-02
MO-99	Not Detected	---------	6.32E-01
NA-22	Not Detected	---------	2.95E-02
NA-24	Not Detected	---------	7.53E+00
NB-95	Not Detected	---------	3.28E-01
ND-147	Not Detected	---------	2.04E-01
NI-57	Not Detected	---------	4.43E-01
NP-239	Not Detected	---------	1.06E-01
RU-103	Not Detected	---------	2.45E-02
RU-106	Not Detected	---------	2.15E-01
SB-122	Not Detected	---------	1.04E-01
SB-124	Not Detected	---------	2.36E-02
SB-125	Not Detected	---------	6.15E-02
SN-113	Not Detected	---------	3.00E-02
TA-182	Not Detected	---------	1.24E-01
TA-183	Not Detected	---------	6.42E-01
TC-99m	Not Detected	---------	4.67E+04
TL-201	Not Detected	---------	4.59E-01
XE-133	Not Detected	---------	5.67E-01
Y-88	Not Detected	---------	2.01E-02
ZN-65	Not Detected	---------	8.41E-02
ZR-95	Not Detected	---------	4.31E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-27-98 10:09:50 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042384-004
Lab Sample ID : 80199612

CY81C-GR-011-SS

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 853.000 gram
Sample Date/Time : 9-22-98 2:00:00 PM
Acquire Start Date/Time : 9-27-98 8:27:13 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	7.45E-01	3.18E-01	4.47E-01
RA-226	2.01E+00	5.96E-01	4.38E-01
PB-214	7.59E-01	1.28E-01	3.42E-02
BI-214	7.48E-01	1.64E-01	3.22E-02
PB-210	Not Detected	---	2.63E+01
TH-232	Not Detected	---	1.04E-01
RA-228	3.50E-01	2.06E-01	1.01E-01
AC-228	Not Detected	---	1.24E-01
TH-228	Not Detected	---	6.65E-01
RA-224	3.34E-01	1.41E-01	5.40E-02
PB-212	3.02E-01	6.46E-02	2.92E-02
BI-212	3.19E-01	2.28E-01	1.72E-01
TL-208	3.19E-01	9.90E-02	4.67E-02
U-235	Not Detected	---	1.81E-01
TH-231	Not Detected	---	1.78E+00
PA-231	Not Detected	---	2.91E+00
TH-227	Not Detected	---	2.25E-01
RA-223	Not Detected	---	2.04E-01
RN-219	Not Detected	---	2.74E-01
PB-211	Not Detected	---	6.05E-01
TL-207	Not Detected	---	9.09E+00
AM-241	Not Detected	---	1.66E-01
PU-239	Not Detected	---	3.31E+02
NP-237	Not Detected	---	2.62E-01
PA-233	Not Detected	---	4.30E-02
TH-229	Not Detected	---	1.87E-01

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

[Summary Report] - Sample ID: : 80199612

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---	2.56E-02
AG-110m	Not Detected	---	2.22E-02
BA-133	Not Detected	---	5.97E-02
BE-7	Not Detected	---	1.87E-01
CD-109	Not Detected	---	8.96E-01
CD-115	Not Detected	---	2.28E-01
CE-139	Not Detected	---	2.29E-02
CE-141	Not Detected	---	4.61E-02
CE-144	Not Detected	---	1.87E-01
CO-56	Not Detected	---	2.37E-02
CO-57	Not Detected	---	2.27E-02
CO-58	Not Detected	---	2.25E-02
CO-60	Not Detected	---	2.34E-02
CR-51	Not Detected	---	1.82E-01
CS-134	Not Detected	---	4.20E-02
CS-137	Not Detected	---	1.09E-02
EU-152	Not Detected	---	6.77E-02
EU-154	Not Detected	---	1.19E-01
EU-155	Not Detected	---	1.12E-01
FE-59	Not Detected	---	4.77E-02
GD-153	Not Detected	---	7.81E-02
HG-203	Not Detected	---	2.40E-02
I-131	Not Detected	---	3.29E-02
IR-192	Not Detected	---	2.04E-02
K-40	4.63E+00	8.28E-01	2.00E-01
KR-85	Not Detected	---	5.86E+00
MN-52	Not Detected	---	4.00E-02
MN-54	Not Detected	---	2.44E-02
MO-99	Not Detected	---	5.93E-01
NA-22	Not Detected	---	2.85E-02
NA-24	Not Detected	---	7.55E+00
NB-95	Not Detected	---	2.86E-01
ND-147	Not Detected	---	1.85E-01
NI-57	Not Detected	---	4.27E-01
NP-239	Not Detected	---	1.00E-01
RU-103	Not Detected	---	2.19E-02
RU-106	Not Detected	---	1.94E-01
SB-122	Not Detected	---	9.70E-02
SB-124	Not Detected	---	2.21E-02
SB-125	Not Detected	---	5.99E-02
SN-113	Not Detected	---	2.79E-02
TA-182	Not Detected	---	1.16E-01
TA-183	Not Detected	---	6.13E-01
TC-99m	Not Detected	---	5.30E+04
TL-201	Not Detected	---	4.32E-01
XE-133	Not Detected	---	5.80E-01
Y-88	Not Detected	---	2.11E-02
ZN-65	Not Detected	---	7.81E-02
ZR-95	Not Detected	---	3.96E-02

Sandia National Laboratories

Radiation Protection Sample Diagnostics Program [806 Laboratory]

10-01-98 1:48:30 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042385-004
Lab Sample ID : 80199613

CY81C-GR-012-SS

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 762.000 gram
Sample Date/Time : 9-22-98 2:15:00 PM
Acquire Start Date/Time : 9-27-98 10:11:59 PM
Detector Name : LAB02
Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	---	7.27E-01
RA-226	1.52E+00	3.76E-01	5.13E-01
PB-214	7.68E-01	2.82E-01	3.90E-02
BI-214	6.72E-01	9.37E-01	3.76E-02
PB-210	Not Detected	---	3.10E+01
TH-232	5.73E-01	3.12E-01	1.29E-01
RA-228	6.45E-01	2.38E-01	1.22E-01
AC-228	6.74E-01	2.12E-01	2.38E-01
TH-228	6.87E-01	2.24E-01	4.12E-01
RA-224	6.86E-01	2.37E-01	6.72E-02
PB-212	5.98E-01	4.01E-01	3.39E-02
BI-212	8.50E-01	4.05E-01	2.64E-01
TL-208	5.73E-01	6.65E-01	5.77E-02
U-235	Not Detected	---	2.09E-01
TH-231	Not Detected	---	2.04E+00
PA-231	Not Detected	---	3.49E+00
TH-227	Not Detected	---	3.05E-01
RA-223	Not Detected	---	2.48E-01
RN-219	Not Detected	---	3.29E-01
PB-211	Not Detected	---	7.55E-01
TL-207	Not Detected	---	1.11E+01
AM-241	Not Detected	---	4.09E-01
PU-239	Not Detected	---	3.93E+02
NP-237	Not Detected	---	3.43E-01
PA-233	Not Detected	---	5.03E-02
TH-229	Not Detected	---	2.28E-01

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

[Summary Report] - Sample ID: : 80199613

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.53E-02
AG-110m	Not Detected	---------	3.73E-02
BA-133	Not Detected	---------	6.56E-02
BE-7	Not Detected	---------	2.27E-01
CD-109	Not Detected	---------	9.35E-01
CD-115	Not Detected	---------	3.04E-01
CE-139	Not Detected	---------	2.67E-02
CE-141	Not Detected	---------	5.24E-02
CE-144	Not Detected	---------	2.20E-01
CO-56	Not Detected	---------	2.83E-02
CO-57	Not Detected	---------	2.75E-02
CO-58	Not Detected	---------	2.88E-02
CO-60	Not Detected	---------	2.82E-02
CR-51	Not Detected	---------	2.30E-01
CS-134	Not Detected	---------	4.47E-02
CS-137	1.04E-01	5.96E-02	1.93E-02
EU-152	Not Detected	---------	8.20E-02
EU-154	Not Detected	---------	1.63E-01
EU-155	Not Detected	---------	1.33E-01
FE-59	Not Detected	---------	6.44E-02
GD-153	Not Detected	---------	9.55E-02
HG-203	Not Detected	---------	2.96E-02
I-131	Not Detected	---------	4.10E-02
IR-192	Not Detected	---------	2.46E-02
K-40	1.01E+01	1.58E+00	2.38E-01
KR-85	Not Detected	---------	7.20E+00
MN-52	Not Detected	---------	4.75E-02
MN-54	Not Detected	---------	2.99E-02
MO-99	Not Detected	---------	7.79E-01
NA-22	Not Detected	---------	3.38E-02
NA-24	Not Detected	---------	1.06E+01
NB-95	Not Detected	---------	3.92E-01
ND-147	Not Detected	---------	2.39E-01
NI-57	Not Detected	---------	4.96E-01
NP-239	Not Detected	---------	1.19E-01
RU-103	Not Detected	---------	2.64E-02
RU-106	Not Detected	---------	2.38E-01
SB-122	Not Detected	---------	1.35E-01
SB-124	Not Detected	---------	2.60E-02
SB-125	Not Detected	---------	7.27E-02
SN-113	Not Detected	---------	3.39E-02
TA-182	Not Detected	---------	1.36E-01
TA-183	Not Detected	---------	7.27E-01
TC-99m	Not Detected	---------	7.26E+04
TL-201	Not Detected	---------	5.48E-01
XE-133	Not Detected	---------	7.17E-01
Y-88	Not Detected	---------	2.22E-02
ZN-65	Not Detected	---------	9.23E-02
ZR-95	Not Detected	---------	5.08E-02

Sandia National Laboratories

Radiation Protection Sample Diagnostics Program [806 Laboratory]

9-28-98 1:39:37 AM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042386-004
Lab Sample ID : 80199614

CY81C-GR-013-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 776.000 gram
Sample Date/Time : 9-22-98 2:25:00 PM
Acquire Start Date/Time : 9-27-98 11:56:59 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	1.01E+00	5.17E-01	5.11E-01
RA-226	1.48E+00	5.19E-01	4.55E-01
PB-214	7.22E-01	1.25E-01	3.60E-02
BI-214	6.78E-01	1.21E-01	3.10E-02
PB-210	Not Detected	---	2.75E+01
TH-232	4.45E-01	2.72E-01	1.26E-01
RA-228	3.85E-01	1.46E-01	9.88E-02
AC-228	Not Detected	---	1.36E-01
TH-228	4.43E-01	1.65E-01	3.72E-01
RA-224	4.29E-01	1.54E-01	5.77E-02
PB-212	4.04E-01	4.34E-01	3.10E-02
BI-212	2.70E-01	3.07E-01	2.43E-01
TL-208	3.80E-01	1.12E-01	5.07E-02
U-235	8.45E-02	1.64E-01	1.92E-01
TH-231	Not Detected	---	1.83E+00
PA-231	Not Detected	---	3.12E+00
TH-227	Not Detected	---	2.60E-01
RA-223	Not Detected	---	2.18E-01
RN-219	Not Detected	---	2.92E-01
PB-211	Not Detected	---	6.68E-01
TL-207	Not Detected	---	9.81E+00
AM-241	Not Detected	---	3.73E-01
PU-239	Not Detected	---	3.49E+02
NP-237	Not Detected	---	2.83E-01
PA-233	Not Detected	---	4.49E-02
TH-229	Not Detected	---	1.99E-01

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

[Summary Report] - Sample ID: : 80199614

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---	2.93E-02
AG-110m	Not Detected	---	2.51E-02
BA-133	Not Detected	---	6.08E-02
BE-7	Not Detected	---	2.11E-01
CD-109	~~2.45E+00~~	~~6.43E-01~~	~~9.66E-01~~ not detected JSS 10/1/98
CD-115	Not Detected	---	2.66E-01
CE-139	Not Detected	---	2.46E-02
CE-141	Not Detected	---	4.81E-02
CE-144	Not Detected	---	1.97E-01
CO-56	Not Detected	---	2.64E-02
CO-57	Not Detected	---	2.41E-02
CO-58	Not Detected	---	2.39E-02
CO-60	Not Detected	---	2.62E-02
CR-51	Not Detected	---	2.19E-01
CS-134	Not Detected	---	4.30E-02
CS-137	1.05E-02	1.24E-02	1.56E-02
EU-152	Not Detected	---	7.17E-02
EU-154	Not Detected	---	1.35E-01
EU-155	Not Detected	---	1.18E-01
FE-59	Not Detected	---	5.22E-02
GD-153	Not Detected	---	8.44E-02
HG-203	Not Detected	---	2.61E-02
I-131	Not Detected	---	3.36E-02
IR-192	Not Detected	---	2.28E-02
K-40	5.72E+00	1.04E+00	2.21E-01
KR-85	Not Detected	---	6.30E+00
MN-52	Not Detected	---	4.60E-02
MN-54	Not Detected	---	2.65E-02
MO-99	Not Detected	---	6.99E-01
NA-22	Not Detected	---	2.63E-02
NA-24	Not Detected	---	9.82E+00
NB-95	Not Detected	---	3.39E-01
ND-147	Not Detected	---	2.07E-01
NI-57	Not Detected	---	5.05E-01
NP-239	Not Detected	---	1.05E-01
RU-103	Not Detected	---	2.41E-02
RU-106	Not Detected	---	2.17E-01
SB-122	Not Detected	---	1.17E-01
SB-124	Not Detected	---	2.40E-02
SB-125	Not Detected	---	6.59E-02
SN-113	Not Detected	---	3.03E-02
TA-182	Not Detected	---	1.24E-01
TA-183	Not Detected	---	6.72E-01
TC-99m	Not Detected	---	7.80E+04
TL-201	Not Detected	---	4.94E-01
XE-133	Not Detected	---	6.44E-01
Y-88	Not Detected	---	2.34E-02
ZN-65	Not Detected	---	8.43E-02
ZR-95	Not Detected	---	4.45E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-28-98 3:24:32 AM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042387-004
Lab Sample ID : 80199615

CY81C-GR-014-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 753.000 gram
Sample Date/Time : 9-22-98 2:45:00 PM
Acquire Start Date/Time : 9-28-98 1:41:45 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	4.79E-01	3.53E-01	5.53E-01
RA-226	1.68E+00	6.71E-01	4.86E-01
PB-214	6.93E-01	1.34E-01	3.78E-02
BI-214	6.71E-01	5.60E-01	3.82E-02
PB-210	Not Detected	---	3.04E+01
TH-232	4.87E-01	2.48E-01	1.30E-01
RA-228	6.00E-01	2.10E-01	1.26E-01
AC-228	5.92E-01	4.93E-01	2.40E-01
TH-228	5.55E-01	2.14E-01	4.30E-01
RA-224	6.19E-01	1.93E-01	5.18E-02
PB-212	5.76E-01	9.87E-02	3.56E-02
BI-212	5.43E-01	3.27E-01	2.61E-01
TL-208	4.91E-01	7.57E-01	5.52E-02
U-235	Not Detected	---	2.07E-01
TH-231	Not Detected	---	2.00E+00
PA-231	Not Detected	---	3.47E+00
TH-227	Not Detected	---	2.96E-01
RA-223	Not Detected	---	2.36E-01
RN-219	Not Detected	---	3.38E-01
PB-211	Not Detected	---	7.45E-01
TL-207	Not Detected	---	1.05E+01
AM-241	Not Detected	---	4.18E-01
PU-239	Not Detected	---	3.88E+02
NP-237	Not Detected	---	2.90E-01
PA-233	Not Detected	---	4.80E-02
TH-229	Not Detected	---	2.15E-01

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

[Summary Report] - Sample ID: : 80199615

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.33E-02
AG-110m	Not Detected	---------	4.19E-02
BA-133	Not Detected	---------	6.28E-02
BE-7	Not Detected	---------	2.35E-01
CD-109	~~1.45E+00~~	~~6.60E-01~~	~~9.91E-01~~ not detected JS 10/1/98
CD-115	Not Detected	---------	3.10E-01
CE-139	Not Detected	---------	2.74E-02
CE-141	Not Detected	---------	5.18E-02
CE-144	Not Detected	---------	2.17E-01
CO-56	Not Detected	---------	2.95E-02
CO-57	Not Detected	---------	2.66E-02
CO-58	Not Detected	---------	2.83E-02
CO-60	Not Detected	---------	3.22E-02
CR-51	Not Detected	---------	2.38E-01
CS-134	Not Detected	---------	4.49E-02
CS-137	1.63E-01	4.36E-02	1.94E-02
EU-152	Not Detected	---------	7.91E-02
EU-154	Not Detected	---------	1.52E-01
EU-155	Not Detected	---------	1.30E-01
FE-59	Not Detected	---------	6.05E-02
GD-153	Not Detected	---------	9.14E-02
HG-203	Not Detected	---------	2.88E-02
I-131	Not Detected	---------	3.78E-02
IR-192	Not Detected	---------	2.50E-02
K-40	9.28E+00	1.67E+00	2.38E-01
KR-85	Not Detected	---------	7.26E+00
MN-52	Not Detected	---------	4.75E-02
MN-54	Not Detected	---------	2.84E-02
MO-99	Not Detected	---------	7.51E-01
NA-22	Not Detected	---------	3.34E-02
NA-24	Not Detected	---------	1.24E+01
NB-95	Not Detected	---------	3.91E-01
ND-147	Not Detected	---------	2.38E-01
NI-57	Not Detected	---------	5.65E-01
NP-239	Not Detected	---------	1.17E-01
RU-103	Not Detected	---------	2.65E-02
RU-106	Not Detected	---------	2.49E-01
SB-122	Not Detected	---------	1.29E-01
SB-124	Not Detected	---------	2.62E-02
SB-125	Not Detected	---------	6.85E-02
SN-113	Not Detected	---------	3.21E-02
TA-182	Not Detected	---------	1.32E-01
TA-183	Not Detected	---------	7.50E-01
TC-99m	Not Detected	---------	1.01E+05
TL-201	Not Detected	---------	5.53E-01
XE-133	Not Detected	---------	6.96E-01
Y-88	Not Detected	---------	2.20E-02
ZN-65	Not Detected	---------	9.17E-02
ZR-95	Not Detected	---------	4.82E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-28-98 5:09:28 AM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042388-004
Lab Sample ID : 80199616

CY81C-GR-015-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 709.000 gram
Sample Date/Time : 9-22-98 2:50:00 PM
Acquire Start Date/Time : 9-28-98 3:26:47 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	5.81E-01	5.04E-01	5.74E-01
RA-226	1.71E+00	5.65E-01	5.16E-01
PB-214	7.14E-01	2.47E-01	4.19E-02
BI-214	6.78E-01	1.71E-01	3.92E-02
PB-210	Not Detected	---	3.21E+01
TH-232	6.46E-01	3.52E-01	1.34E-01
RA-228	6.72E-01	1.94E-01	1.29E-01
AC-228	6.15E-01	2.35E-01	2.54E-01
TH-228	4.94E-01	1.96E-01	4.37E-01
RA-224	7.42E-01	2.27E-01	5.84E-02
PB-212	6.45E-01	1.18E-01	3.68E-02
BI-212	6.11E-01	2.82E-01	2.81E-01
TL-208	5.66E-01	1.27E-01	5.85E-02
U-235	1.10E-01	1.87E-01	2.19E-01
TH-231	Not Detected	---	2.07E+00
PA-231	Not Detected	---	3.61E+00
TH-227	Not Detected	---	3.22E-01
RA-223	Not Detected	---	2.60E-01
RN-219	Not Detected	---	3.45E-01
PB-211	Not Detected	---	7.90E-01
TL-207	Not Detected	---	1.20E+01
AM-241	Not Detected	---	4.33E-01
PU-239	Not Detected	---	4.02E+02
NP-237	Not Detected	---	3.62E-01
PA-233	Not Detected	---	5.34E-02
TH-229	Not Detected	---	2.28E-01

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

[Summary Report] - Sample ID: : 80199616

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.41E-02
AG-110m	Not Detected	---------	4.41E-02
BA-133	Not Detected	---------	6.63E-02
BE-7	Not Detected	---------	2.47E-01
CD-109	Not Detected	---------	1.02E+00
CD-115	Not Detected	---------	3.41E-01
CE-139	Not Detected	---------	2.80E-02
CE-141	Not Detected	---------	5.47E-02
CE-144	Not Detected	---------	2.20E-01
CO-56	Not Detected	---------	3.20E-02
CO-57	Not Detected	---------	2.79E-02
CO-58	Not Detected	---------	2.88E-02
CO-60	Not Detected	---------	3.28E-02
CR-51	Not Detected	---------	2.48E-01
CS-134	Not Detected	---------	4.62E-02
CS-137	1.60E-01	3.70E-02	2.12E-02
EU-152	Not Detected	---------	8.30E-02
EU-154	Not Detected	---------	1.57E-01
EU-155	Not Detected	---------	1.36E-01
FE-59	Not Detected	---------	6.28E-02
GD-153	Not Detected	---------	9.73E-02
HG-203	Not Detected	---------	3.07E-02
I-131	Not Detected	---------	4.11E-02
IR-192	Not Detected	---------	2.69E-02
K-40	9.58E+00	1.54E+00	2.39E-01
KR-85	Not Detected	---------	7.61E+00
MN-52	Not Detected	---------	5.00E-02
MN-54	Not Detected	---------	3.24E-02
MO-99	Not Detected	---------	8.58E-01
NA-22	Not Detected	---------	3.45E-02
NA-24	Not Detected	---------	1.31E+01
NB-95	Not Detected	---------	4.31E-01
ND-147	Not Detected	---------	2.50E-01
NI-57	Not Detected	---------	5.85E-01
NP-239	Not Detected	---------	1.22E-01
RU-103	Not Detected	---------	2.85E-02
RU-106	Not Detected	---------	2.65E-01
SB-122	Not Detected	---------	1.56E-01
SB-124	Not Detected	---------	2.66E-02
SB-125	Not Detected	---------	7.57E-02
SN-113	Not Detected	---------	3.59E-02
TA-182	Not Detected	---------	1.38E-01
TA-183	Not Detected	---------	7.86E-01
TC-99m	Not Detected	---------	1.28E+05
TL-201	Not Detected	---------	5.99E-01
XE-133	Not Detected	---------	7.71E-01
Y-88	Not Detected	---------	2.16E-02
ZN-65	Not Detected	---------	9.47E-02
ZR-95	Not Detected	---------	5.02E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-28-98 6:54:19 AM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

CY81C-GR-016-55

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042389-004
Lab Sample ID : 80199617

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 669.000 gram
Sample Date/Time : 9-22-98 3:00:00 PM
Acquire Start Date/Time : 9-28-98 5:11:37 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	5.90E-01	5.49E-01	5.55E-01
RA-226	1.90E+00	5.76E-01	5.59E-01
PB-214	7.40E-01	1.38E-01	4.39E-02
BI-214	6.78E-01	2.27E-01	4.23E-02
PB-210	Not Detected	---	3.26E+01
TH-232	5.86E-01	3.21E-01	1.29E-01
RA-228	5.56E-01	1.78E-01	1.41E-01
AC-228	5.72E-01	2.28E-01	2.70E-01
TH-228	6.11E-01	2.21E-01	4.47E-01
RA-224	5.28E-01	1.92E-01	7.69E-02
PB-212	5.48E-01	1.11E-01	3.79E-02
BI-212	5.94E-01	9.98E-01	2.87E-01
TL-208	4.88E-01	1.22E-01	6.03E-02
U-235	Not Detected	---	2.22E-01
TH-231	Not Detected	---	2.17E+00
PA-231	Not Detected	---	3.56E+00
TH-227	Not Detected	---	3.08E-01
RA-223	Not Detected	---	2.56E-01
RN-219	Not Detected	---	3.46E-01
PB-211	Not Detected	---	7.72E-01
TL-207	Not Detected	---	1.24E+01
AM-241	Not Detected	---	4.34E-01
PU-239	Not Detected	---	4.07E+02
NP-237	Not Detected	---	3.08E-01
PA-233	Not Detected	---	5.43E-02
TH-229	Not Detected	---	2.40E-01

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

[Summary Report] - Sample ID: : 80199617

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.58E-02
AG-110m	Not Detected	---------	3.12E-02
BA-133	Not Detected	---------	6.87E-02
BE-7	Not Detected	---------	2.51E-01
CD-109	Not Detected	---------	1.05E+00
CD-115	Not Detected	---------	3.54E-01
CE-139	Not Detected	---------	2.79E-02
CE-141	Not Detected	---------	5.52E-02
CE-144	Not Detected	---------	2.29E-01
CO-56	Not Detected	---------	3.20E-02
CO-57	Not Detected	---------	2.85E-02
CO-58	Not Detected	---------	3.09E-02
CO-60	Not Detected	---------	3.22E-02
CR-51	Not Detected	---------	2.48E-01
CS-134	Not Detected	---------	4.81E-02
CS-137	3.62E-02	1.99E-02	1.94E-02
EU-152	Not Detected	---------	8.48E-02
EU-154	Not Detected	---------	1.66E-01
EU-155	Not Detected	---------	1.38E-01
FE-59	Not Detected	---------	6.42E-02
GD-153	Not Detected	---------	1.01E-01
HG-203	Not Detected	---------	3.16E-02
I-131	Not Detected	---------	4.24E-02
IR-192	Not Detected	---------	2.63E-02
K-40	8.70E+00	2.21E+00	2.72E-01
KR-85	Not Detected	---------	7.89E+00
MN-52	Not Detected	---------	4.98E-02
MN-54	Not Detected	---------	1.29E-02
MO-99	Not Detected	---------	8.61E-01
NA-22	Not Detected	---------	3.61E-02
NA-24	Not Detected	---------	1.40E+01
NB-95	Not Detected	---------	4.17E-01
ND-147	Not Detected	---------	2.55E-01
NI-57	Not Detected	---------	6.37E-01
NP-239	Not Detected	---------	1.24E-01
RU-103	Not Detected	---------	2.87E-02
RU-106	Not Detected	---------	2.64E-01
SB-122	Not Detected	---------	1.43E-01
SB-124	Not Detected	---------	2.81E-02
SB-125	Not Detected	---------	7.26E-02
SN-113	Not Detected	---------	3.50E-02
TA-182	Not Detected	---------	1.43E-01
TA-183	Not Detected	---------	8.00E-01
TC-99m	Not Detected	---------	1.56E+05
TL-201	Not Detected	---------	5.93E-01
XE-133	Not Detected	---------	7.92E-01
Y-88	Not Detected	---------	2.32E-02
ZN-65	Not Detected	---------	9.56E-02
ZR-95	Not Detected	---------	5.42E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-28-98 9:45:28 AM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042390-004
Lab Sample ID : 80199618

CY81C - GR - 017 - 55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 688.000 gram
Sample Date/Time : 9-23-98 9:15:00 AM
Acquire Start Date/Time : 9-28-98 8:02:42 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	6.16E-01	3.82E-01	5.76E-01
RA-226	2.15E+00	4.58E-01	5.76E-01
PB-214	7.89E-01	1.50E-01	4.29E-02
BI-214	7.31E-01	2.23E-01	4.22E-02
PB-210	Not Detected	---	3.20E+01
TH-232	5.24E-01	2.69E-01	1.52E-01
RA-228	6.47E-01	2.35E-01	1.26E-01
AC-228	6.79E-01	2.32E-01	2.61E-01
TH-228	9.07E-01	2.61E-01	4.48E-01
RA-224	6.35E-01	2.08E-01	6.89E-02
PB-212	6.65E-01	2.15E-01	3.88E-02
BI-212	7.11E-01	2.77E-01	2.65E-01
TL-208	6.33E-01	4.34E-01	6.16E-02
U-235	Not Detected	---	2.17E-01
TH-231	Not Detected	---	2.27E+00
PA-231	Not Detected	---	3.72E+00
TH-227	Not Detected	---	3.34E-01
RA-223	Not Detected	---	2.60E-01
RN-219	Not Detected	---	3.39E-01
PB-211	Not Detected	---	7.75E-01
TL-207	Not Detected	---	1.18E+01
AM-241	Not Detected	---	4.60E-01
PU-239	Not Detected	---	4.22E+02
NP-237	Not Detected	---	3.35E-01
PA-233	Not Detected	---	5.65E-02
TH-229	Not Detected	---	2.39E-01

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

[Summary Report] - Sample ID: : 80199618

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.63E-02
AG-110m	Not Detected	---------	3.86E-02
BA-133	Not Detected	---------	6.98E-02
BE-7	Not Detected	---------	2.43E-01
CD-109	Not Detected	---------	1.14E+00
CD-115	Not Detected	---------	2.94E-01
CE-139	Not Detected	---------	2.81E-02
CE-141	Not Detected	---------	5.42E-02
CE-144	Not Detected	---------	2.30E-01
CO-56	Not Detected	---------	3.13E-02
CO-57	Not Detected	---------	2.92E-02
CO-58	Not Detected	---------	2.92E-02
CO-60	Not Detected	---------	3.02E-02
CR-51	Not Detected	---------	2.41E-01
CS-134	Not Detected	---------	4.87E-02
CS-137	9.73E-02	2.71E-02	2.10E-02
EU-152	Not Detected	---------	8.69E-02
EU-154	Not Detected	---------	1.67E-01
EU-155	Not Detected	---------	1.42E-01
FE-59	Not Detected	---------	6.47E-02
GD-153	Not Detected	---------	1.03E-01
HG-203	Not Detected	---------	3.17E-02
I-131	Not Detected	---------	4.05E-02
IR-192	Not Detected	---------	2.67E-02
K-40	1.02E+01	1.66E+00	2.39E-01
KR-85	Not Detected	---------	7.76E+00
MN-52	Not Detected	---------	4.94E-02
MN-54	Not Detected	---------	3.13E-02
MO-99	Not Detected	---------	7.52E-01
NA-22	Not Detected	---------	3.54E-02
NA-24	Not Detected	---------	7.48E+00
NB-95	Not Detected	---------	4.00E-01
ND-147	Not Detected	---------	2.44E-01
NI-57	Not Detected	---------	2.74E-01
NP-239	Not Detected	---------	1.28E-01
RU-103	Not Detected	---------	3.01E-02
RU-106	Not Detected	---------	2.56E-01
SB-122	Not Detected	---------	1.31E-01
SB-124	Not Detected	---------	2.90E-02
SB-125	Not Detected	---------	7.82E-02
SN-113	Not Detected	---------	3.57E-02
TA-182	Not Detected	---------	1.47E-01
TA-183	Not Detected	---------	7.66E-01
TC-99m	Not Detected	---------	2.66E+04
TL-201	Not Detected	---------	5.22E-01
XE-133	Not Detected	---------	6.61E-01
Y-88	Not Detected	---------	2.51E-02
ZN-65	Not Detected	---------	9.73E-02
ZR-95	Not Detected	---------	5.74E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-28-98 11:36:52 AM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

CY81C-GR-018-55

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042391-004
Lab Sample ID : 80199619

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 645.000 gram
Sample Date/Time : 9-23-98 9:20:00 AM
Acquire Start Date/Time : 9-28-98 9:54:04 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	7.36E-01	4.37E-01	5.91E-01
RA-226	1.91E+00	5.43E-01	5.05E-01
PB-214	7.50E-01	1.49E-01	4.59E-02
BI-214	6.55E-01	1.35E-01	4.03E-02
PB-210	Not Detected	---	3.35E+01
TH-232	5.75E-01	2.88E-01	1.45E-01
RA-228	6.06E-01	1.85E-01	1.24E-01
AC-228	6.12E-01	2.40E-01	2.79E-01
TH-228	6.97E-01	1.33E+00	4.50E-01
RA-224	6.47E-01	2.24E-01	6.65E-02
PB-212	6.02E-01	1.58E-01	3.89E-02
BI-212	7.07E-01	4.48E-01	2.28E-01
TL-208	5.10E-01	1.29E-01	6.34E-02
U-235	Not Detected	---	1.23E-01
TH-231	Not Detected	---	2.25E+00
PA-231	Not Detected	---	3.76E+00
TH-227	Not Detected	---	3.30E-01
RA-223	Not Detected	---	2.55E-01
RN-219	Not Detected	---	3.57E-01
PB-211	Not Detected	---	8.39E-01
TL-207	Not Detected	---	1.18E+01
AM-241	Not Detected	---	4.45E-01
PU-239	Not Detected	---	4.31E+02
NP-237	Not Detected	---	3.42E-01
PA-233	Not Detected	---	5.52E-02
TH-229	Not Detected	---	2.34E-01

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

[Summary Report] - Sample ID: : 80199619

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.56E-02
AG-110m	Not Detected	---------	3.74E-02
BA-133	Not Detected	---------	7.01E-02
BE-7	Not Detected	---------	2.54E-01
CD-109	Not Detected	---------	1.17E+00
CD-115	Not Detected	---------	3.03E-01
CE-139	Not Detected	---------	3.00E-02
CE-141	Not Detected	---------	5.64E-02
CE-144	Not Detected	---------	2.38E-01
CO-56	Not Detected	---------	3.26E-02
CO-57	Not Detected	---------	2.94E-02
CO-58	Not Detected	---------	3.21E-02
CO-60	Not Detected	---------	3.06E-02
CR-51	Not Detected	---------	2.43E-01
CS-134	Not Detected	---------	4.83E-02
CS-137	6.40E-02	2.47E-02	2.20E-02
EU-152	Not Detected	---------	8.77E-02
EU-154	Not Detected	---------	1.65E-01
EU-155	Not Detected	---------	1.38E-01
FE-59	Not Detected	---------	6.33E-02
GD-153	Not Detected	---------	1.01E-01
HG-203	Not Detected	---------	3.26E-02
I-131	Not Detected	---------	4.10E-02
IR-192	Not Detected	---------	2.68E-02
K-40	9.31E+00	2.16E+00	2.40E-01
KR-85	Not Detected	---------	7.87E+00
MN-52	Not Detected	---------	5.07E-02
MN-54	Not Detected	---------	3.29E-02
MO-99	Not Detected	---------	7.91E-01
NA-22	Not Detected	---------	3.64E-02
NA-24	Not Detected	---------	8.08E+00
NB-95	Not Detected	---------	4.01E-01
ND-147	Not Detected	---------	2.48E-01
NI-57	Not Detected	---------	5.25E-01
NP-239	Not Detected	---------	1.24E-01
RU-103	Not Detected	---------	2.86E-02
RU-106	Not Detected	---------	2.52E-01
SB-122	Not Detected	---------	1.25E-01
SB-124	Not Detected	---------	2.84E-02
SB-125	Not Detected	---------	8.07E-02
SN-113	Not Detected	---------	3.48E-02
TA-182	Not Detected	---------	1.44E-01
TA-183	Not Detected	---------	7.55E-01
TC-99m	Not Detected	---------	3.27E+04
TL-201	Not Detected	---------	5.46E-01
XE-133	Not Detected	---------	6.69E-01
Y-88	Not Detected	---------	2.46E-02
ZN-65	Not Detected	---------	9.67E-02
ZR-95	Not Detected	---------	5.55E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-28-98 1:23:45 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042392-004
Lab Sample ID : 80199620 CY8/C-GR-018-D8

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 675.000 gram
Sample Date/Time : 9-23-98 9:20:00 AM
Acquire Start Date/Time : 9-28-98 11:41:04 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	---	7.62E-01
RA-226	1.78E+00	8.52E-01	5.71E-01
PB-214	7.67E-01	1.48E-01	4.32E-02
BI-214	6.64E-01	4.75E-01	3.93E-02
PB-210	Not Detected	---	3.13E+01
TH-232	5.72E-01	3.17E-01	1.32E-01
RA-228	6.45E-01	2.58E-01	1.30E-01
AC-228	Not Detected	---	1.81E-01
TH-228	5.47E-01	1.99E-01	4.35E-01
RA-224	6.21E-01	2.67E-01	6.71E-02
PB-212	6.11E-01	2.60E-01	3.81E-02
BI-212	6.66E-01	5.21E-01	2.89E-01
TL-208	5.68E-01	1.37E-01	5.86E-02
U-235	1.44E-01	1.91E-01	2.24E-01
TH-231	Not Detected	---	2.16E+00
PA-231	Not Detected	---	3.63E+00
TH-227	Not Detected	---	3.22E-01
RA-223	Not Detected	---	2.59E-01
RN-219	Not Detected	---	3.42E-01
PB-211	Not Detected	---	7.73E-01
TL-207	Not Detected	---	1.24E+01
AM-241	Not Detected	---	4.43E-01
PU-239	Not Detected	---	4.11E+02
NP-237	Not Detected	---	3.37E-01
PA-233	Not Detected	---	5.33E-02
TH-229	Not Detected	---	2.40E-01

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

[Summary Report] - Sample ID: : 80199620

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.69E-02
AG-110m	Not Detected	---------	3.58E-02
BA-133	Not Detected	---------	6.83E-02
BE-7	Not Detected	---------	2.56E-01
CD-109	Not Detected	---------	1.15E+00
CD-115	Not Detected	---------	3.01E-01
CE-139	Not Detected	---------	2.85E-02
CE-141	Not Detected	---------	5.50E-02
CE-144	Not Detected	---------	2.25E-01
CO-56	Not Detected	---------	3.09E-02
CO-57	Not Detected	---------	2.91E-02
CO-58	Not Detected	---------	2.98E-02
CO-60	Not Detected	---------	3.12E-02
CR-51	Not Detected	---------	2.48E-01
CS-134	Not Detected	---------	4.69E-02
CS-137	6.55E-02	3.25E-02	2.12E-02
EU-152	Not Detected	---------	8.67E-02
EU-154	Not Detected	---------	1.72E-01
EU-155	Not Detected	---------	1.43E-01
FE-59	Not Detected	---------	6.51E-02
GD-153	Not Detected	---------	1.01E-01
HG-203	Not Detected	---------	3.17E-02
I-131	Not Detected	---------	4.05E-02
IR-192	Not Detected	---------	2.68E-02
K-40	9.52E+00	2.63E+00	2.70E-01
KR-85	Not Detected	---------	7.77E+00
MN-52	Not Detected	---------	5.38E-02
MN-54	Not Detected	---------	3.14E-02
MO-99	Not Detected	---------	8.09E-01
NA-22	Not Detected	---------	3.61E-02
NA-24	Not Detected	---------	8.54E+00
NB-95	Not Detected	---------	3.97E-01
ND-147	Not Detected	---------	2.56E-01
NI-57	Not Detected	---------	4.99E-01
NP-239	Not Detected	---------	1.28E-01
RU-103	Not Detected	---------	2.82E-02
RU-106	Not Detected	---------	2.60E-01
SB-122	Not Detected	---------	1.37E-01
SB-124	Not Detected	---------	2.78E-02
SB-125	Not Detected	---------	7.83E-02
SN-113	Not Detected	---------	3.62E-02
TA-182	Not Detected	---------	1.42E-01
TA-183	Not Detected	---------	7.53E-01
TC-99m	Not Detected	---------	4.02E+04
TL-201	Not Detected	---------	5.52E-01
XE-133	Not Detected	---------	6.69E-01
Y-88	Not Detected	---------	2.44E-02
ZN-65	Not Detected	---------	9.81E-02
ZR-95	Not Detected	---------	5.32E-02

Sandia National Laboratories

Radiation Protection Sample Diagnostics Program [806 Laboratory]

9-28-98 3:19:29 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042393-004
Lab Sample ID : 80199621

CY81C-GR-019-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 704.000 gram
Sample Date/Time : 9-23-98 9:35:00 AM
Acquire Start Date/Time : 9-28-98 1:36:46 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	5.14E-01	4.64E-01	5.23E-01
RA-226	2.08E+00	7.97E-01	5.59E-01
PB-214	7.80E-01	1.43E-01	4.17E-02
BI-214	6.55E-01	1.26E-01	3.73E-02
PB-210	Not Detected	---	3.20E+01
TH-232	6.40E-01	3.29E-01	1.35E-01
RA-228	6.40E-01	2.03E-01	1.14E-01
AC-228	6.13E-01	3.13E-01	2.56E-01
TH-228	7.48E-01	2.33E-01	4.26E-01
RA-224	6.60E-01	2.22E-01	6.16E-02
PB-212	6.31E-01	1.08E-01	3.65E-02
BI-212	7.26E-01	2.97E-01	2.70E-01
TL-208	5.43E-01	1.14E-01	5.83E-02
U-235	Not Detected	---	2.20E-01
TH-231	Not Detected	---	2.14E+00
PA-231	Not Detected	---	3.57E+00
TH-227	Not Detected	---	3.23E-01
RA-223	Not Detected	---	2.48E-01
RN-219	Not Detected	---	3.55E-01
PB-211	Not Detected	---	7.80E-01
TL-207	Not Detected	---	1.24E+01
AM-241	Not Detected	---	4.36E-01
PU-239	Not Detected	---	4.15E+02
NP-237	Not Detected	---	3.04E-01
PA-233	Not Detected	---	5.31E-02
TH-229	Not Detected	---	2.36E-01

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

[Summary Report] - Sample ID: : 80199621

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---	3.61E-02
AG-110m	Not Detected	---	3.26E-02
BA-133	Not Detected	---	6.83E-02
BE-7	Not Detected	---	2.35E-01
CD-109	Not Detected	---	1.04E+00
CD-115	Not Detected	---	3.03E-01
CE-139	Not Detected	---	2.82E-02
CE-141	Not Detected	---	5.51E-02
CE-144	Not Detected	---	2.23E-01
CO-56	Not Detected	---	3.21E-02
CO-57	Not Detected	---	2.85E-02
CO-58	Not Detected	---	2.92E-02
CO-60	Not Detected	---	3.01E-02
CR-51	Not Detected	---	2.48E-01
CS-134	Not Detected	---	4.59E-02
CS-137	4.19E-02	2.28E-02	1.90E-02
EU-152	Not Detected	---	8.48E-02
EU-154	Not Detected	---	1.67E-01
EU-155	Not Detected	---	1.35E-01
FE-59	Not Detected	---	6.54E-02
GD-153	Not Detected	---	1.00E-01
HG-203	Not Detected	---	3.08E-02
I-131	Not Detected	---	3.82E-02
IR-192	Not Detected	---	2.62E-02
K-40	1.07E+01	1.73E+00	2.45E-01
KR-85	Not Detected	---	7.48E+00
MN-52	Not Detected	---	4.76E-02
MN-54	Not Detected	---	2.92E-02
MO-99	Not Detected	---	7.97E-01
NA-22	Not Detected	---	3.74E-02
NA-24	Not Detected	---	9.57E+00
NB-95	Not Detected	---	4.03E-01
ND-147	Not Detected	---	2.56E-01
NI-57	Not Detected	---	5.45E-01
NP-239	Not Detected	---	1.22E-01
RU-103	Not Detected	---	2.77E-02
RU-106	Not Detected	---	2.56E-01
SB-122	Not Detected	---	1.37E-01
SB-124	Not Detected	---	2.71E-02
SB-125	Not Detected	---	7.37E-02
SN-113	Not Detected	---	3.34E-02
TA-182	Not Detected	---	1.49E-01
TA-183	Not Detected	---	7.65E-01
TC-99m	Not Detected	---	4.70E+04
TL-201	Not Detected	---	5.45E-01
XE-133	Not Detected	---	6.99E-01
Y-88	Not Detected	---	2.08E-02
ZN-65	Not Detected	---	9.89E-02
ZR-95	Not Detected	---	5.06E-02

Sandia National Laboratories

Radiation Protection Sample Diagnostics Program [806 Laboratory]

9-28-98 5:08:35 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042394-004
Lab Sample ID : 80199622

CYSIC-GR-030-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 655.000 gram
Sample Date/Time : 9-23-98 9:45:00 AM
Acquire Start Date/Time : 9-28-98 3:25:52 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	8.87E-01	5.67E-01	6.21E-01
RA-226	2.15E+00	8.64E-01	6.36E-01
PB-214	7.84E-01	1.48E-01	4.56E-02
BI-214	7.17E-01	7.08E-01	3.96E-02
PB-210	Not Detected	---	3.49E+01
TH-232	7.11E-01	3.54E-01	1.42E-01
RA-228	5.96E-01	1.83E-01	1.53E-01
AC-228	Not Detected	---	1.95E-01
TH-228	6.15E-01	2.24E-01	4.86E-01
RA-224	6.24E-01	2.09E-01	7.02E-02
PB-212	6.69E-01	2.87E-01	4.02E-02
BI-212	7.09E-01	3.75E-01	3.00E-01
TL-208	6.23E-01	1.52E-01	6.65E-02
U-235	1.18E-01	1.99E-01	2.32E-01
TH-231	Not Detected	---	2.26E+00
PA-231	Not Detected	---	3.81E+00
TH-227	Not Detected	---	3.45E-01
RA-223	Not Detected	---	2.69E-01
RN-219	Not Detected	---	3.71E-01
PB-211	Not Detected	---	8.29E-01
TL-207	Not Detected	---	1.31E+01
AM-241	Not Detected	---	4.69E-01
PU-239	Not Detected	---	4.37E+02
NP-237	Not Detected	---	3.32E-01
PA-233	Not Detected	---	5.65E-02
TH-229	Not Detected	---	2.50E-01

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

[Summary Report] - Sample ID: : 80199622

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---	3.86E-02
AG-110m	Not Detected	---	5.06E-02
BA-133	Not Detected	---	7.08E-02
BE-7	Not Detected	---	2.73E-01
CD-109	Not Detected	---	1.13E+00
CD-115	Not Detected	---	3.37E-01
CE-139	Not Detected	---	2.93E-02
CE-141	Not Detected	---	5.76E-02
CE-144	Not Detected	---	2.47E-01
CO-56	Not Detected	---	3.35E-02
CO-57	Not Detected	---	3.11E-02
CO-58	Not Detected	---	3.19E-02
CO-60	Not Detected	---	3.12E-02
CR-51	Not Detected	---	2.56E-01
CS-134	Not Detected	---	5.01E-02
CS-137	2.07E-01	3.62E-02	2.41E-02
EU-152	Not Detected	---	9.26E-02
EU-154	Not Detected	---	1.78E-01
EU-155	Not Detected	---	1.43E-01
FE-59	Not Detected	---	6.81E-02
GD-153	Not Detected	---	1.03E-01
HG-203	Not Detected	---	3.37E-02
I-131	Not Detected	---	4.36E-02
IR-192	Not Detected	---	2.71E-02
K-40	1.07E+01	1.77E+00	2.79E-01
KR-85	Not Detected	---	7.92E+00
MN-52	Not Detected	---	5.16E-02
MN-54	Not Detected	---	3.52E-02
MO-99	Not Detected	---	8.53E-01
NA-22	Not Detected	---	4.02E-02
NA-24	Not Detected	---	1.07E+01
NB-95	Not Detected	---	4.36E-01
ND-147	Not Detected	---	2.59E-01
NI-57	Not Detected	---	5.63E-01
NP-239	Not Detected	---	1.29E-01
RU-103	Not Detected	---	3.08E-02
RU-106	Not Detected	---	2.88E-01
SB-122	Not Detected	---	1.37E-01
SB-124	Not Detected	---	2.94E-02
SB-125	Not Detected	---	8.01E-02
SN-113	Not Detected	---	3.85E-02
TA-182	Not Detected	---	1.48E-01
TA-183	Not Detected	---	8.23E-01
TC-99m	Not Detected	---	6.25E+04
TL-201	Not Detected	---	5.93E-01
XE-133	Not Detected	---	7.51E-01
Y-88	Not Detected	---	2.37E-02
ZN-65	Not Detected	---	1.03E-01
ZR-95	Not Detected	---	5.68E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-28-98 6:55:28 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : 042395-004
Lab Sample ID : 80199623

CY81C-GR-021-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 840.000 gram
Sample Date/Time : 9-23-98 9:55:00 AM
Acquire Start Date/Time : 9-28-98 5:12:37 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	6.39E-01	4.19E-01	4.68E-01
RA-226	1.65E+00	4.88E-01	4.18E-01
PB-214	7.65E-01	1.29E-01	3.70E-02
BI-214	6.97E-01	1.62E-01	3.41E-02
PB-210	Not Detected	---	2.90E+01
TH-232	4.97E-01	2.59E-01	1.22E-01
RA-228	5.05E-01	1.79E-01	1.12E-01
AC-228	4.90E-01	1.75E-01	2.13E-01
TH-228	5.04E-01	1.80E-01	3.95E-01
RA-224	5.14E-01	2.05E-01	5.73E-02
PB-212	4.61E-01	8.13E-02	3.41E-02
BI-212	4.59E-01	5.70E-01	2.06E-01
TL-208	4.28E-01	1.04E-01	4.99E-02
U-235	Not Detected	---	1.98E-01
TH-231	Not Detected	---	1.94E+00
PA-231	Not Detected	---	3.18E+00
TH-227	Not Detected	---	2.66E-01
RA-223	Not Detected	---	2.30E-01
RN-219	Not Detected	---	3.21E-01
PB-211	Not Detected	---	7.18E-01
TL-207	Not Detected	---	9.98E+00
AM-241	Not Detected	---	4.05E-01
PU-239	Not Detected	---	3.66E+02
NP-237	Not Detected	---	2.72E-01
PA-233	Not Detected	---	4.60E-02
TH-229	Not Detected	---	2.00E-01

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

[Summary Report] - Sample ID: : 80199623

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	2.96E-02
AG-110m	Not Detected	---------	4.92E-02
BA-133	Not Detected	---------	6.13E-02
BE-7	Not Detected	---------	2.29E-01
CD-109	Not Detected	---------	9.27E-01
CD-115	Not Detected	---------	2.74E-01
CE-139	Not Detected	---------	2.51E-02
CE-141	Not Detected	---------	4.86E-02
CE-144	Not Detected	---------	2.03E-01
CO-56	Not Detected	---------	2.55E-02
CO-57	Not Detected	---------	2.51E-02
CO-58	Not Detected	---------	2.67E-02
CO-60	Not Detected	---------	2.49E-02
CR-51	Not Detected	---------	2.08E-01
CS-134	Not Detected	---------	4.26E-02
CS-137	3.03E-01	5.58E-02	1.94E-02
EU-152	Not Detected	---------	7.48E-02
EU-154	Not Detected	---------	1.37E-01
EU-155	Not Detected	---------	1.23E-01
FE-59	Not Detected	---------	5.21E-02
GD-153	Not Detected	---------	8.85E-02
HG-203	Not Detected	---------	2.74E-02
I-131	Not Detected	---------	3.59E-02
IR-192	Not Detected	---------	2.26E-02
K-40	6.98E+00	1.12E+00	1.94E-01
KR-85	Not Detected	---------	6.54E+00
MN-52	Not Detected	---------	4.65E-02
MN-54	Not Detected	---------	2.62E-02
MO-99	Not Detected	---------	6.35E-01
NA-22	Not Detected	---------	2.91E-02
NA-24	Not Detected	---------	8.42E+00
NB-95	Not Detected	---------	3.40E-01
ND-147	Not Detected	---------	2.24E-01
NI-57	Not Detected	---------	4.39E-01
NP-239	Not Detected	---------	1.11E-01
RU-103	Not Detected	---------	2.50E-02
RU-106	Not Detected	---------	2.26E-01
SB-122	Not Detected	---------	1.19E-01
SB-124	Not Detected	---------	2.41E-02
SB-125	Not Detected	---------	6.59E-02
SN-113	Not Detected	---------	3.23E-02
TA-182	Not Detected	---------	1.22E-01
TA-183	Not Detected	---------	7.15E-01
TC-99m	Not Detected	---------	6.40E+04
TL-201	Not Detected	---------	5.09E-01
XE-133	Not Detected	---------	6.37E-01
Y-88	Not Detected	---------	2.06E-02
ZN-65	Not Detected	---------	8.12E-02
ZR-95	Not Detected	---------	4.52E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9-28-98 7:09:52 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/R.PARKER (6134/SMO)
Customer Sample ID : LAB CONTROL SAMPLE USING CG134
Lab Sample ID : 80199624

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 : 9-28-98 6:57:49 PM
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	---	4.48E+03
RA-226	Not Detected	---	6.25E+03
PB-214	Not Detected	---	6.95E+02
BI-214	Not Detected	---	6.25E+02
PB-210	Not Detected	---	2.65E+05
TH-232	Not Detected	---	2.27E+03
RA-228	Not Detected	---	2.52E+03
AC-228	Not Detected	---	1.54E+03
TH-228	Not Detected	---	1.20E+05
RA-224	Not Detected	---	4.41E+03
PB-212	Not Detected	---	8.75E+03
BI-212	Not Detected	---	7.48E+04
TL-208	2.70E+03	4.98E+03	8.77E+03
U-235	Not Detected	---	1.68E+03
TH-231	Not Detected	---	2.06E+04
PA-231	Not Detected	---	3.51E+04
TH-227	Not Detected	---	2.56E+03
RA-223	Not Detected	---	1.00E+26
RN-219	Not Detected	---	5.91E+03
PB-211	Not Detected	---	1.34E+04
TL-207	Not Detected	---	2.13E+05
AM-241	7.87E+04	1.45E+04	3.08E+03
PU-239	Not Detected	---	3.19E+06
NP-237	Not Detected	---	2.40E+03
PA-233	Not Detected	---	6.11E+02
TH-229	Not Detected	---	1.73E+03

[Summary Report] - Sample ID: : 80199624

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
AG-108m	Not Detected	---------	3.29E+02
AG-110m	Not Detected	---------	5.03E+06
BA-133	Not Detected	---------	7.32E+02
BE-7	Not Detected	---------	7.22E+19
CD-109	5.49E+05	6.35E+05	4.57E+05
CD-115	Not Detected	---------	1.00E+26
CE-139	Not Detected	---------	4.60E+08
CE-141	Not Detected	---------	1.00E+26
CE-144	Not Detected	---------	2.02E+06
CO-56	Not Detected	---------	6.80E+13
CO-57	Not Detected	---------	3.46E+05
CO-58	Not Detected	---------	6.03E+14
CO-60	8.16E+04	1.11E+04	3.44E+02
CR-51	Not Detected	---------	1.00E+26
CS-134	Not Detected	---------	4.07E+03
CS-137	7.19E+04	9.56E+03	2.69E+02
EU-152	Not Detected	---------	9.90E+02
EU-154	Not Detected	---------	2.74E+03
EU-155	Not Detected	---------	3.37E+03
FE-59	Not Detected	---------	2.76E+22
GD-153	Not Detected	---------	2.91E+06
HG-203	Not Detected	---------	1.36E+21
I-131	Not Detected	---------	1.00E+26
IR-192	Not Detected	---------	1.70E+14
K-40	Not Detected	---------	1.62E+03
KR-85	Not Detected	---------	1.16E+05
MN-52	Not Detected	---------	1.00E+26
MN-54	Not Detected	---------	2.15E+05
MO-99	Not Detected	---------	1.00E+26
NA-22	Not Detected	---------	1.59E+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	---------	9.31E+02
RU-103	Not Detected	---------	1.00E+26
RU-106	Not Detected	---------	6.88E+05
SB-122	Not Detected	---------	1.00E+26
SB-124	Not Detected	---------	7.91E+16
SB-125	Not Detected	---------	7.92E+03
SN-113	Not Detected	---------	1.59E+10
TA-182	Not Detected	---------	4.09E+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	---------	2.27E+10
ZN-65	Not Detected	---------	3.06E+06
ZR-95	Not Detected	---------	2.05E+16

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

Report Date : 9-28-98 7:10:33 PM
QA File : C:\GENIEPC\CAMFILES\LCS2.QAF
Analyst : FCD
Sample ID : 80199624
Sample Quantity : 1.00 Each
Sample Date : 11-01-90 12:00:00 PM
Measurement Date : 9-28-98 6:57:49 PM
Elapsed Live Time : 600 seconds
Elapsed Real Time : 605 seconds

Parameter	Mean	1S Error	New Value	< LU	SD	UD	BS >
AM-241 Activity	8.220E-02	4.236E-03	7.869E-02	<	:	:	>
CS-137 Activity	7.045E-02	2.025E-03	7.194E-02	<	:	:	>
CO-60 Activity	7.838E-02	2.208E-03	8.089E-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: 10/1/98

SF 2004-COC (10-97)

Supersedes (5-97) Issue

Internal Lab Batch No. 802016 HA Fm

ANALYSIS REQUEST AND CHAIN OF CUSTODY

SAR/WR No.

Press F1 for instructions for each field.

AR/COC- 600819

Dept. No./Mail Stop: 6134/1148
Project/Task Manager: Paul Freshour
Project Name: 81C VCM SAMPLING
Record Center Code: ER/OU1333/DAT
Logbook Ref. No.: __
Service Order No.: CF0607

Date Samples Shipped: 9/25/98 SMO USE:
Carrier/Waybill No.: HC
Lab Contact: Fernando Dominquez
Lab Destination: RPSD Building 881
SMO Contact/Phone: Doug Salmi/844-3110
Send Report to SMO: Doug Salmi

Contract No.:
Case No.: 7214/2213
SMO Authorization:
Bill to: Sandia National Laboratories
Supplier Services, Dept. _____
P.O. Box 5800 MS 0154

Location Tech Area Canyons
Building NA Room NA

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO) Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	LAB USE Lab Sample ID
042398 - 004	CY81C-GR-022S	2.0	81C	9/23/98 1445	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042399 - 004	CY81C-GR-023-S	2.0	81C	9/23/98 1445	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042400 - 004	CY81C-GR-023-DU	2.0	81C	9/23/98 1445	S	M	500 ml	None	G	DU	GAMMA SPECTROSCOPY	

RMMA ☐Yes ☒No Ref. No. __
Sample Disposal ☐Return to Client ☒Disposal by lab

Sample Tracking SMO USE
Date Entered (mm/dd/yy)
Entered by:

Special Instructions/QC Requirements
EDD ☒Yes ☐No
Raw data package ☒Yes ☐No

Abnormal Conditions on Receipt LAB USE

Turnaround Time ☒Normal ☐Rush Required Report Date
QC Inits.

	Name	Signature	Init	Company/Organization/Phone
Sample Team Members	Gill Baltazar		GB	Weston/6131/971-2769
	Chris Catechis		CC	MDM/6131/881-3196
	~~Concetta Cassiato~~		CC	~~MDM/6131/884-2249~~

Please list as separate report.

1. Relinquished by		Org. 6131	Date 9-25-98	Time 0945	4. Relinquished by	Org.	Date
1. Received by		Org. 7577	Date 9/25/98	Time 0945	4. Received by	Org.	Date
2. Relinquished by		Org. 7577	Date 9.25.98	Time 1330	5. Relinquished by	Org.	Date
2. Received by		Org. SNL7578	Date 9/25/98	Time 1330	5. Received by	Org.	Date
3. Relinquished by		Org. SNL7578	Date 10/5/98	Time 1303	6. Relinquished by	Org.	Date
3. Received by	SMO	Org. 7877	Date 10/5/98	Time 1303	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 2004-COC (10-97)
Supersedes (5-97) issue

BATCH # 802016

ANALYSIS REQUEST AND CHAIN OF CUSTODY (Continuation)

Press F1 for instructions for each field.

AR/COC- 600819

Project Name: 81C VCM Sampling | Project/Task Manager: Paul Freshour | Case No.: 7214/2213

Location Tech Area: Canyons | Building: NA | Room: NA

Sample No. – Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO): Sample Matrix	Container: Type	Container: Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	LAB USE: Lab Sample ID
042401 - 004	CY81C-GR-024-S	0.0	81C	9/24/98 1415	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042402- 004	CY81C-GR-025-S	0.0	81C	9/24/98 1420	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042403 - 004	CY-81C-GR-025-DU	0.0	81C	9/24/98 1420	S	M	500 ml	None	G	DU	GAMMA SPECTROSCOPY	
042404 - 004	CY81C-GR-026-S (Soil Pile)	0.0	81C	9/24/98 0950	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042405 - 004	CY81C-GR-027-S (Soil Pile)	0.0	81C	9/24/98 1025	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042406 - 004	CY81C-GR-028-S (Soil Pile)	0.0	81C	9/24/98 1300	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042407 - 004	CY81C-GR-029-S (Soil Pile)	0.0	81C	9/24/98 1305	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042408 - 004	CY81C-GR-030-S (Soil Pile)	0.0	81C	9/24/98 1310	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042409 - 004	CY81C-GR-031-S (Soil Pile)	0.0	81C	9/24/98 1320	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042410 - 004	CY81C-GR-032-S (Soil Pile)	0.0	81C	9/24/98 1325	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042411 - 004	CY81C-GR-033-S (Soil Pile)	0.0	81C	9/24/98 1330	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042412 - 004	CY81C-GR-034-S (Soil Pile)	0.0	81C	9/24/98 1335	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042413 - 004	CY81C-GR-035-S (Soil Pile)	0.0	81C	9/24/98 1340	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042414 - 004	CY81C-GR-036-S (Soil Pile)	0.0	81C	9/24/98 1345	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042415 - 004	CY81C-GR-037-S (Soil Pile)	0.0	81C	9/24/98 1350	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042416 - 004	CY81C-GR-038-S (Soil Pile)	0.0	81C	9/24/98 1355	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042417 - 004	CY81C-GR-039-S (Soil Pile)	0.0	81C	9/24/98 1400	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	

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)

SF 2001-COC (10-97)

Supersedes (5-97) issue

BATCH #802016

ANALYSIS REQUEST AND CHAIN OF CUSTODY (Continuation)

Press F1 for instructions for each field.

AR/COC- 600819

Project Name: 81C VCM SAMPLING | Project/Task Manager: Paul Freshour | Case No.: 7214.2213

Location — Tech Area: Canyons; Building: NA; Room: NA

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in FL	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)
042421 - 004	CY81C-GR-040-S	2.0	81C	9/24/98 1405	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
-												
-												
-												
-												
-												
-												
-												
-												
-												
-												
-												
-												
-												
-												
-												
-												
-												
-												
-												
-												
-												
-												
-												

Reference LOV (available at SMO)

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)

Sandia National Laboratories
Radiation Protection Sample Diagnostics

Sample Analysis Request Form
Page 1 of 2

To be completed by Customer

Shaded areas are for RPSD use only

Customer: PAUL FRESHOUR
Organization: 6134
Project Location: BIC
Phone: 845-3104
Date Results Needed: 10-2-98
Suspect Isotopes: UNK
Case Number: 7214.2213

Hazards/Special Instructions: 100 min count γ spec.

CoC 600819

Batch Log Number: 802016
Logged By: JM

Analysis Type:
- [X] 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
042398-004	Soil	9/25/98 1140	500ml	Gamma Spec.	01	<300	660	
042399-004		9/25/98 1445			02		603	
042400-004		9/25/98 1445			03		571	
042401 004		1415			04		723	
042402 004		1420			05		680	
042403 004		1420			06		645	
042404 004		0150			07		740	
042405 004		1025			08		762	816
042406 004		1300			09		781	
042407 004		1305			10		795	
042408 004		1310			11		723	
042409 004		1320			12		763	
042410 004		1325			13	<300	740	

Relinquished by [signature] Date 9-25-98 Received by [signature] Date 9-25-98
Relinquished by [signature] Date 10/5/98 Received by [signature] Date 10/5/98
Relinquished by _____ Date _____ Received by _____ Date _____
Relinquished by _____ Date _____ Received by _____ Date _____

Sandia National Laboratories
Radiation Protection Sample Diagnostics

Sample Analysis Request Form

To be completed by Customer

Shaded areas are for RPSD use only

Customer: P. FRestour
Organization: 6134
Project Location: 81C
Phone: 850866
Date Results Needed: 10-2-98
Suspect Isotopes: UNK
Case Number: 7214.2213

Hazards/Special Instructions: C.C 600819

Batch Log Number: 802016
Logged By: JM

Analysis Type:
- [x] 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
042411-004	Soil	5/21/98 1330	500ml	Gamma Spec	14	<300	712	
042412-004		1335			15		710	
042413-004		1340			16		783	
042414-004		1345			17		764	
042415-004		1350			18		762	
042416-004		1355			19		736	
042417-004		1400			20		743	
042421-004		5/21/98 1405			21	<300	776	
LCS	—	10/05/90	—	γ spec	22	N/A	N/A	

Relinquished by _____ Date _____ Received by _____ Date _____
Relinquished by _____ Date _____ Received by _____ Date _____
Relinquished by _____ Date _____ Received by _____ Date _____
Relinquished by _____ Date _____ Received by _____ Date _____

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9/28/98 1:23:12 PM

Analyzed by: 10/1/98 Reviewed by: 10/2/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : 042398-004
Lab Sample ID : 80201601

C/810-GR-022-22

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 660.000 gram
Sample Date/Time : 9/23/98 2:45:00 PM
Acquire Start Date/Time : 9/28/98 11:42:58 AM
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	---------	5.35E-001
RA-226	1.68E+000	9.46E-001	5.68E-001
PB-214	6.94E-001	1.44E-001	4.82E-002
BI-214	6.65E-001	1.54E-001	5.11E-002
PB-210	Not Detected	---------	8.28E+000
TH-232	7.68E-001	3.52E-001	1.56E-001
RA-228	7.33E-001	2.87E-001	1.70E-001
AC-228	7.74E-001	2.19E-001	8.75E-002
TH-228	7.37E-001	2.88E-001	4.80E-001
RA-224	9.94E-001	4.53E-001	1.26E-001
PB-212	7.67E-001	1.85E-001	1.64E-001
BI-212	7.70E-001	5.35E-001	2.84E-001
TL-208	5.60E-001	1.84E-001	8.72E-002
U-235	Not Detected	---------	2.04E-001
TH-231	Not Detected	---------	7.29E+000
PA-231	Not Detected	---------	1.30E+000
TH-227	Not Detected	---------	3.09E-001
RA-223	Not Detected	---------	1.62E-001
RN-219	Not Detected	---------	3.74E-001
PB-211	Not Detected	---------	8.70E-001
TL-207	Not Detected	---------	1.39E+001
AM-241	Not Detected	---------	1.93E-001
PU-239	Not Detected	---------	3.59E+002
NP-237	Not Detected	---------	2.54E-001
PA-233	Not Detected	---------	5.76E-002
TH-229	Not Detected	---------	1.70E-001

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

[Summary Report] - Sample ID: : 80201601

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	4.08E-002
AG-110m	Not Detected	---------	3.72E-002
BA-133	Not Detected	---------	4.64E-002
BE-7	Not Detected	---------	2.73E-001
CD-109	Not Detected	---------	8.74E-001
CD-115	Not Detected	---------	3.23E-001
CE-139	Not Detected	---------	2.48E-002
CE-141	Not Detected	---------	5.00E-002
CE-144	Not Detected	---------	1.97E-001
CO-56	Not Detected	---------	3.62E-002
CO-57	Not Detected	---------	2.51E-002
CO-58	Not Detected	---------	3.38E-002
CO-60	Not Detected	---------	4.15E-002
CR-51	Not Detected	---------	2.59E-001
CS-134	Not Detected	---------	3.67E-002
CS-137	Not Detected	---------	4.04E-002
EU-152	Not Detected	---------	7.44E-002
EU-154	Not Detected	---------	1.95E-001
EU-155	Not Detected	---------	1.18E-001
FE-59	Not Detected	---------	8.11E-002
GD-153	Not Detected	---------	7.03E-002
HG-203	Not Detected	---------	3.33E-002
I-131	Not Detected	---------	4.38E-002
IR-192	Not Detected	---------	2.84E-002
K-40	1.06E+001	1.83E+000	5.31E-001
MN-52	Not Detected	---------	6.54E-002
MN-54	Not Detected	---------	3.55E-002
MO-99	Not Detected	---------	8.80E-001
NA-22	Not Detected	---------	4.33E-002
NA-24	Not Detected	---------	8.18E+000
NB-95	Not Detected	---------	2.80E-001
ND-147	Not Detected	---------	2.81E-001
NI-57	Not Detected	---------	5.89E-001
RU-103	Not Detected	---------	2.99E-002
RU-106	Not Detected	---------	2.89E-001
SB-122	Not Detected	---------	1.40E-001
SB-124	Not Detected	---------	3.01E-002
SB-125	Not Detected	---------	8.08E-002
SN-113	Not Detected	---------	3.89E-002
SR-85	Not Detected	---------	3.80E-002
TA-182	Not Detected	---------	1.77E-001
TA-183	Not Detected	---------	3.20E-001
TC-99m	Not Detected	---------	1.86E+004
TL-201	Not Detected	---------	2.88E-001
XE-133	Not Detected	---------	3.82E-001
Y-88	Not Detected	---------	3.31E-002
ZN-65	Not Detected	---------	1.19E-001
ZR-95	Not Detected	---------	6.20E-002

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9/28/98 3:05:34 PM

Analyzed by: 10/1/98 Reviewed by: 10/2/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : 042399-004
Lab Sample ID : 80201602

CY98-GR-003-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 603.000 gram
Sample Date/Time : 9/23/98 2:53:00 PM
Acquire Start Date/Time : 9/28/98 1:25:23 PM
Detector Name : LAB01
Elapsed Live/Real Time : 6000 / 6001 seconds

Comments:

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	---	5.49E-001
RA-226	1.97E+000	1.04E+000	5.74E-001
PB-214	6.73E-001	1.48E-001	5.54E-002
BI-214	6.11E-001	1.50E-001	4.96E-002
PB-210	Not Detected	---	7.85E+000
TH-232	4.10E-001	3.40E-001	1.40E-001
RA-228	4.93E-001	2.60E-001	1.54E-001
AC-228	4.48E-001	2.02E-001	9.56E-002
TH-228	7.56E-001	2.90E-001	4.81E-001
RA-224	5.68E-001	4.55E-001	1.32E-001
PB-212	5.20E-001	1.63E-001	1.79E-001
BI-212	5.39E-001	4.39E-001	2.92E-001
TL-208	4.27E-001	1.60E-001	8.74E-002
U-235	3.76E-002	1.75E-001	2.03E-001
TH-231	Not Detected	---	7.10E+000
PA-231	Not Detected	---	1.30E+000
TH-227	Not Detected	---	2.83E-001
RA-223	Not Detected	---	1.60E-001
RN-219	Not Detected	---	3.64E-001
PB-211	Not Detected	---	8.34E-001
TL-207	Not Detected	---	1.39E+001
AM-241	Not Detected	---	1.95E-001
PU-239	Not Detected	---	3.61E+002
NP-237	Not Detected	---	2.48E-001
PA-233	Not Detected	---	5.98E-002
TH-229	Not Detected	---	1.62E-001

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

[Summary Report] - Sample ID: : 80201602

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.81E-002
AG-110m	Not Detected	---------	3.33E-002
BA-133	Not Detected	---------	4.89E-002
BE-7	Not Detected	---------	2.58E-001
CD-109	Not Detected	---------	8.23E-001
CD-115	Not Detected	---------	3.03E-001
CE-139	Not Detected	---------	2.53E-002
CE-141	Not Detected	---------	4.92E-002
CE-144	Not Detected	---------	1.96E-001
CO-56	Not Detected	---------	3.59E-002
CO-57	Not Detected	---------	2.48E-002
CO-58	Not Detected	---------	3.39E-002
CO-60	Not Detected	---------	3.71E-002
CR-51	Not Detected	---------	2.67E-001
CS-134	Not Detected	---------	3.65E-002
CS-137	Not Detected	---------	3.47E-002
EU-152	Not Detected	---------	7.29E-002
EU-154	Not Detected	---------	1.81E-001
EU-155	Not Detected	---------	1.10E-001
FE-59	Not Detected	---------	8.04E-002
GD-153	Not Detected	---------	6.49E-002
HG-203	Not Detected	---------	3.20E-002
I-131	Not Detected	---------	4.10E-002
IR-192	Not Detected	---------	2.98E-002
K-40	8.16E+000	1.54E+000	5.66E-001
MN-52	Not Detected	---------	5.84E-002
MN-54	Not Detected	---------	3.79E-002
MO-99	Not Detected	---------	7.51E-001
NA-22	Not Detected	---------	4.80E-002
NA-24	Not Detected	---------	8.92E+000
NB-95	Not Detected	---------	2.63E-001
ND-147	Not Detected	---------	2.73E-001
NI-57	Not Detected	---------	6.04E-001
RU-103	Not Detected	---------	2.77E-002
RU-106	Not Detected	---------	2.97E-001
SB-122	Not Detected	---------	1.38E-001
SB-124	Not Detected	---------	2.94E-002
SB-125	Not Detected	---------	8.16E-002
SN-113	Not Detected	---------	3.86E-002
SR-85	Not Detected	---------	3.90E-002
TA-182	Not Detected	---------	1.79E-001
TA-183	Not Detected	---------	3.26E-001
TC-99m	Not Detected	---------	2.23E+004
TL-201	Not Detected	---------	2.73E-001
XE-133	Not Detected	---------	3.86E-001
Y-88	Not Detected	---------	3.76E-002
ZN-65	Not Detected	---------	1.20E-001
ZR-95	Not Detected	---------	6.10E-002

****

Sandia National Laboratories

Radiation Protection Sample Diagnostics Program [806 Laboratory]

9/28/98 5:15:48 PM

****

Analyzed by: 10/1/98 Reviewed by: 10/2/98

****

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : 042400-004
Lab Sample ID : 80201603

CYSIC-GR-023-DP

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 571.000 gram
Sample Date/Time : 9/23/98 2:55:00 PM
Acquire Start Date/Time : 9/28/98 3:35:35 PM
Detector Name : LAB01
Elapsed Live/Real Time : 6000 / 6001 seconds

Comments:

****

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	---	5.82E-001
RA-226	1.63E+000	8.91E-001	5.76E-001
PB-214	6.94E-001	1.57E-001	5.54E-002
BI-214	6.12E-001	1.49E-001	4.83E-002
PB-210	Not Detected	---	8.24E+000
TH-232	5.17E-001	3.50E-001	1.55E-001
RA-228	4.41E-001	2.48E-001	1.65E-001
AC-228	Not Detected	---	2.14E-001
TH-228	Not Detected	---	7.13E-001
RA-224	5.64E-001	3.24E-001	1.51E-001
PB-212	5.26E-001	1.62E-001	1.90E-001
BI-212	5.20E-001	4.66E-001	3.46E-001
TL-208	5.01E-001	1.58E-001	8.71E-002
U-235	Not Detected	---	2.01E-001
TH-231	Not Detected	---	7.60E+000
PA-231	Not Detected	---	1.39E+000
TH-227	Not Detected	---	2.92E-001
RA-223	Not Detected	---	1.73E-001
RN-219	Not Detected	---	3.75E-001
PB-211	Not Detected	---	8.42E-001
TL-207	Not Detected	---	1.46E+001
AM-241	Not Detected	---	2.08E-001
PU-239	Not Detected	---	3.72E+002
NP-237	Not Detected	---	2.48E-001
PA-233	Not Detected	---	5.89E-002
TH-229	Not Detected	---	1.72E-001

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

[Summary Report] - Sample ID: : 80201603

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.99E-002
AG-110m	Not Detected	---------	3.14E-002
BA-133	Not Detected	---------	5.14E-002
BE-7	Not Detected	---------	2.72E-001
CD-109	Not Detected	---------	8.35E-001
CD-115	Not Detected	---------	3.27E-001
CE-139	Not Detected	---------	2.57E-002
CE-141	Not Detected	---------	4.84E-002
CE-144	Not Detected	---------	1.97E-001
CO-56	Not Detected	---------	3.98E-002
CO-57	Not Detected	---------	2.52E-002
CO-58	Not Detected	---------	3.69E-002
CO-60	Not Detected	---------	3.86E-002
CR-51	Not Detected	---------	2.79E-001
CS-134	Not Detected	---------	3.97E-002
CS-137	Not Detected	---------	3.59E-002
EU-152	Not Detected	---------	7.46E-002
EU-154	Not Detected	---------	1.91E-001
EU-155	Not Detected	---------	1.16E-001
FE-59	Not Detected	---------	8.01E-002
GD-153	Not Detected	---------	6.88E-002
HG-203	Not Detected	---------	3.31E-002
I-131	Not Detected	---------	4.71E-002
IR-192	Not Detected	---------	2.94E-002
K-40	7.62E+000	1.57E+000	6.17E-001
MN-52	Not Detected	---------	7.51E-002
MN-54	Not Detected	---------	3.80E-002
MO-99	Not Detected	---------	8.07E-001
NA-22	Not Detected	---------	4.14E-002
NA-24	Not Detected	---------	9.09E+000
NB-95	Not Detected	---------	2.82E-001
ND-147	Not Detected	---------	2.76E-001
NI-57	Not Detected	---------	6.76E-001
RU-103	Not Detected	---------	2.99E-002
RU-106	Not Detected	---------	3.04E-001
SB-122	Not Detected	---------	1.40E-001
SB-124	Not Detected	---------	3.47E-002
SB-125	Not Detected	---------	8.47E-002
SN-113	Not Detected	---------	3.95E-002
SR-85	Not Detected	---------	4.06E-002
TA-182	Not Detected	---------	1.74E-001
TA-183	Not Detected	---------	3.52E-001
TC-99m	Not Detected	---------	2.82E+004
TL-201	Not Detected	---------	2.96E-001
XE-133	Not Detected	---------	4.35E-001
Y-88	Not Detected	---------	3.83E-002
ZN-65	Not Detected	---------	1.17E-001
ZR-95	Not Detected	---------	6.17E-002

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9/28/98 6:57:51 PM

Analyzed by: 10/1/98 Reviewed by: 10/1/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : 042401-004
Lab Sample ID : 80201604

CY81C-GR-024-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 723.000 gram
Sample Date/Time : 9/23/98 2:15:00 PM
Acquire Start Date/Time : 9/28/98 5:17:37 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	5.79E-001	5.42E-001	4.51E-001
RA-226	1.52E+000	8.74E-001	5.51E-001
PB-214	7.25E-001	4.90E-001	4.92E-002
BI-214	6.27E-001	3.06E-001	4.72E-002
PB-210	2.57E+000	2.05E+000	5.13E+000
TH-232	7.67E-001	4.09E-001	1.64E-001
RA-228	7.22E-001	2.89E-001	1.47E-001
AC-228	Not Detected	---------	8.93E-002
TH-228	6.78E-001	2.70E-001	4.41E-001
RA-224	8.16E-001	3.91E-001	1.18E-001
PB-212	6.87E-001	1.62E-001	1.51E-001
BI-212	9.04E-001	5.10E-001	2.69E-001
TL-208	6.28E-001	9.10E-001	7.54E-002
U-235	Not Detected	---------	1.91E-001
TH-231	Not Detected	---------	7.22E+000
PA-231	Not Detected	---------	1.24E+000
TH-227	Not Detected	---------	2.83E-001
RA-223	Not Detected	---------	1.64E-001
RN-219	Not Detected	---------	3.65E-001
PB-211	Not Detected	---------	8.66E-001
TL-207	Not Detected	---------	1.32E+001
AM-241	Not Detected	---------	1.92E-001
PU-239	Not Detected	---------	3.44E+002
NP-237	Not Detected	---------	2.51E-001
PA-233	Not Detected	---------	5.45E-002
TH-229	Not Detected	---------	1.68E-001

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

[Summary Report] - Sample ID: : 80201604

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.93E-002
AG-110m	Not Detected	---------	3.60E-002
BA-133	Not Detected	---------	4.84E-002
BE-7	Not Detected	---------	2.45E-001
CD-109	Not Detected	---------	8.40E-001
CD-115	Not Detected	---------	3.38E-001
CE-139	Not Detected	---------	2.49E-002
CE-141	Not Detected	---------	4.76E-002
CE-144	Not Detected	---------	1.92E-001
CO-56	Not Detected	---------	3.50E-002
CO-57	Not Detected	---------	2.47E-002
CO-58	Not Detected	---------	3.34E-002
CO-60	Not Detected	---------	3.63E-002
CR-51	Not Detected	---------	2.59E-001
CS-134	Not Detected	---------	3.53E-002
CS-137	3.39E-002	3.99E-002	2.11E-002
EU-152	Not Detected	---------	7.40E-002
EU-154	Not Detected	---------	1.88E-001
EU-155	Not Detected	---------	1.15E-001
FE-59	Not Detected	---------	7.58E-002
GD-153	Not Detected	---------	6.52E-002
HG-203	Not Detected	---------	3.14E-002
I-131	Not Detected	---------	3.99E-002
IR-192	Not Detected	---------	2.70E-002
K-40	1.04E+001	3.67E+000	5.06E-001
MN-52	Not Detected	---------	6.37E-002
MN-54	Not Detected	---------	1.87E-002
MO-99	Not Detected	---------	8.26E-001
NA-22	Not Detected	---------	4.28E-002
NA-24	Not Detected	---------	1.18E+001
NB-95	Not Detected	---------	2.67E-001
ND-147	Not Detected	---------	2.66E-001
NI-57	Not Detected	---------	5.99E-001
RU-103	Not Detected	---------	2.71E-002
RU-106	Not Detected	---------	2.84E-001
SB-122	Not Detected	---------	1.41E-001
SB-124	Not Detected	---------	2.88E-002
SB-125	Not Detected	---------	8.04E-002
SN-113	Not Detected	---------	3.59E-002
SR-85	Not Detected	---------	3.74E-002
TA-182	Not Detected	---------	1.68E-001
TA-183	Not Detected	---------	3.29E-001
TC-99m	Not Detected	---------	3.59E+004
TL-201	Not Detected	---------	2.83E-001
XE-133	Not Detected	---------	4.11E-001
Y-88	Not Detected	---------	3.25E-002
ZN-65	Not Detected	---------	1.17E-001
ZR-95	Not Detected	---------	5.61E-002

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program (806 Laboratory)
9/28/98 8:39:53 PM

Analyzed by: 10/1/98 Reviewed by: AM 10/2/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : 042402-004
Lab Sample ID : 80201605 CY81C-GR-025-55

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 680.000 gram
Sample Date/Time : 9/23/98 2:20:00 PM
Acquire Start Date/Time : 9/28/98 6:59:40 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	---------	5.77E-001
RA-226	Not Detected	---------	5.94E-001
PB-214	7.77E-001	1.61E-001	5.63E-002
BI-214	6.84E-001	8.25E-001	4.77E-002
PB-210	Not Detected	---------	8.39E+000
TH-232	8.39E-001	4.31E-001	1.64E-001
RA-228	7.90E-001	3.13E-001	1.58E-001
AC-228	8.29E-001	2.58E-001	9.39E-002
TH-228	1.15E+000	8.85E-001	4.85E-001
RA-224	9.16E-001	4.01E-001	1.26E-001
PB-212	8.27E-001	7.26E-001	1.60E-001
BI-212	9.68E-001	5.45E-001	3.64E-001
TL-208	6.71E-001	1.86E-001	8.58E-002
U-235	Not Detected	---------	2.12E-001
TH-231	Not Detected	---------	7.76E+000
PA-231	Not Detected	---------	1.40E+000
TH-227	Not Detected	---------	3.18E-001
RA-223	Not Detected	---------	1.80E-001
RN-219	Not Detected	---------	3.68E-001
PB-211	Not Detected	---------	8.55E-001
TL-207	Not Detected	---------	1.57E+001
AM-241	Not Detected	---------	2.13E-001
PU-239	Not Detected	---------	3.87E+002
NP-237	Not Detected	---------	2.64E-001
PA-233	Not Detected	---------	5.73E-002
TH-229	Not Detected	---------	1.72E-001

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

[Summary Report] - Sample ID: : 80201605

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	4.23E-002
AG-110m	Not Detected	---------	3.72E-002
BA-133	Not Detected	---------	5.10E-002
BE-7	Not Detected	---------	2.58E-001
CD-109	Not Detected	---------	8.88E-001
CD-115	Not Detected	---------	3.71E-001
CE-139	Not Detected	---------	2.69E-002
CE-141	Not Detected	---------	5.08E-002
CE-144	Not Detected	---------	2.10E-001
CO-56	Not Detected	---------	3.89E-002
CO-57	Not Detected	---------	2.59E-002
CO-58	Not Detected	---------	3.67E-002
CO-60	Not Detected	---------	3.92E-002
CR-51	Not Detected	---------	2.70E-001
CS-134	Not Detected	---------	4.06E-002
CS-137	3.49E-002	3.44E-002	2.66E-002
EU-152	Not Detected	---------	7.78E-002
EU-154	Not Detected	---------	2.05E-001
EU-155	Not Detected	---------	1.21E-001
FE-59	Not Detected	---------	8.41E-002
GD-153	Not Detected	---------	7.13E-002
HG-203	Not Detected	---------	3.32E-002
I-131	Not Detected	---------	4.26E-002
IR-192	Not Detected	---------	2.92E-002
K-40	1.36E+001	2.30E+000	5.59E-001
MN-52	Not Detected	---------	6.83E-002
MN-54	Not Detected	---------	3.87E-002
MO-99	Not Detected	---------	9.73E-001
NA-22	Not Detected	---------	4.96E-002
NA-24	Not Detected	---------	1.21E+001
NB-95	Not Detected	---------	3.07E-001
ND-147	Not Detected	---------	2.79E-001
NI-57	Not Detected	---------	6.70E-001
RU-103	Not Detected	---------	3.16E-002
RU-106	Not Detected	---------	3.11E-001
SB-122	Not Detected	---------	1.60E-001
SB-124	Not Detected	---------	3.22E-002
SB-125	Not Detected	---------	8.44E-002
SN-113	Not Detected	---------	3.98E-002
SR-85	Not Detected	---------	4.06E-002
TA-182	Not Detected	---------	1.84E-001
TA-183	Not Detected	---------	3.69E-001
TC-99m	Not Detected	---------	4.64E+004
TL-201	Not Detected	---------	3.12E-001
XE-133	Not Detected	---------	4.48E-001
Y-88	Not Detected	---------	3.22E-002
ZN-65	Not Detected	---------	1.26E-001
ZR-95	Not Detected	---------	6.40E-002

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
9/28/98 10:21:56 PM

Analyzed by: 10/1/98 Reviewed by: 10/2/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : 042403-004
Lab Sample ID : 80201606 CY81C-GR-025-DP

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 645.000 gram
Sample Date/Time : 9/23/98 2:20:00 PM
Acquire Start Date/Time : 9/28/98 8:41:42 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	---------	6.09E-001
RA-226	1.93E+000	8.69E-001	6.16E-001
PB-214	7.32E-001	1.48E-001	5.27E-002
BI-214	6.38E-001	1.63E-001	5.51E-002
PB-210	Not Detected	---------	8.85E+000
TH-232	8.30E-001	4.73E-001	1.71E-001
RA-228	8.02E-001	1.40E+000	1.60E-001
AC-228	7.89E-001	2.66E-001	1.02E-001
TH-228	8.07E-001	3.00E-001	5.37E-001
RA-224	9.33E-001	3.94E-001	1.16E-001
PB-212	8.12E-001	4.37E-001	1.69E-001
BI-212	8.46E-001	6.81E-001	3.03E-001
TL-208	7.34E-001	1.87E-001	8.55E-002
U-235	Not Detected	---------	2.13E-001
TH-231	Not Detected	---------	7.66E+000
PA-231	Not Detected	---------	1.45E+000
TH-227	Not Detected	---------	3.24E-001
RA-223	Not Detected	---------	1.80E-001
RN-219	Not Detected	---------	4.17E-001
PB-211	Not Detected	---------	9.24E-001
TL-207	Not Detected	---------	1.49E+001
AM-241	Not Detected	---------	2.00E-001
PU-239	Not Detected	---------	3.91E+002
NP-237	Not Detected	---------	2.76E-001
PA-233	Not Detected	---------	6.31E-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: : 80201606

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	4.38E-002
AG-110m	Not Detected	---------	4.00E-002
BA-133	Not Detected	---------	5.19E-002
BE-7	Not Detected	---------	2.77E-001
CD-109	Not Detected	---------	9.14E-001
CD-115	Not Detected	---------	3.81E-001
CE-139	Not Detected	---------	2.63E-002
CE-141	Not Detected	---------	5.29E-002
CE-144	Not Detected	---------	2.12E-001
CO-56	Not Detected	---------	3.92E-002
CO-57	Not Detected	---------	2.71E-002
CO-58	Not Detected	---------	3.55E-002
CO-60	Not Detected	---------	4.32E-002
CR-51	Not Detected	---------	2.75E-001
CS-134	Not Detected	---------	3.76E-002
CS-137	Not Detected	---------	2.70E-002
EU-152	Not Detected	---------	8.10E-002
EU-154	Not Detected	---------	2.09E-001
EU-155	Not Detected	---------	1.24E-001
FE-59	Not Detected	---------	8.91E-002
GD-153	Not Detected	---------	7.14E-002
HG-203	Not Detected	---------	3.47E-002
I-131	Not Detected	---------	4.68E-002
IR-192	Not Detected	---------	3.02E-002
K-40	1.31E+001	2.16E+000	5.64E-001
MN-52	Not Detected	---------	6.78E-002
MN-54	Not Detected	---------	4.22E-002
MO-99	Not Detected	---------	1.01E+000
NA-22	Not Detected	---------	4.94E-002
NA-24	Not Detected	---------	1.51E+001
NB-95	Not Detected	---------	3.14E-001
ND-147	Not Detected	---------	2.87E-001
NI-57	Not Detected	---------	7.49E-001
RU-103	Not Detected	---------	3.30E-002
RU-106	Not Detected	---------	3.31E-001
SB-122	Not Detected	---------	1.63E-001
SB-124	Not Detected	---------	3.15E-002
SB-125	Not Detected	---------	9.03E-002
SN-113	Not Detected	---------	3.99E-002
SR-85	Not Detected	---------	4.30E-002
TA-182	Not Detected	---------	1.90E-001
TA-183	Not Detected	---------	3.49E-001
TC-99m	Not Detected	---------	5.70E+004
TL-201	Not Detected	---------	3.35E-001
XE-133	Not Detected	---------	4.65E-001
Y-88	Not Detected	---------	3.04E-002
ZN-65	Not Detected	---------	1.26E-001
ZR-95	Not Detected	---------	6.75E-002

SF 2004-COC (10-97)

Supersedes (5-97) issue BATCH # 802095

ANALYSIS REQUEST AND CHAIN OF CUSTODY (Continuation)

Press F1 for instructions for each field.

AR/COC- 600820

Project Name: 81C VCM Sampling | Project/Task Manager: Paul Freshour | Case No.: 7214/2213

Location | Tech Area Canyons | Building NA | Room NA

Sample No. -- Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO)						LAB USE	
					Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
042425 - 004	CY81C-GR-044-SS	3'-0"	81C	100598/1405	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042426 - 004	CY81C-GR-044-DP	3'-0"	81C	100598/1405	S	M	500 ml	None	G	DU	GAMMA SPECTROSCOPY	
042427 - 004	CY81C-GR-045-SS	3'-0"	81C	" 1420	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042428 - 004	CY81C-GR-046-SS	3'-0"	81C	" 1430	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042429 - 004	CY81C-GR-047-SS	3'-0"	81C	" 1440	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042230 - 004	CY81C-GR-048-SS	3'-0"	81C	" 1445	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042231 - 004	CY81C-GR-049-SS	3'-0"	81C	" 1455	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042232 - 004	CY81C-GR-050-SS	3'-0"	81C	" 1505	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042233 - 004	CY81C-GR-051-SS	3'-0"	81C	" 1510	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042334 - 004	CY81C-GR-052-SS	3'-0"	81C	" 1515	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042335 - 004	CY81C-GR-053-SS	3'-0"	81C	" 1525	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042336 - 004	CY-81C-GR-054-SS	3'-0"	81C	" 1530	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	

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)

SF 2004 COC (10-97)

Supersedes (5-87) Issue

Internal Lab Batch No. 802095

ANALYSIS REQUEST AND CHAIN OF CUSTODY

SAR/WR No.

Press F1 for instructions for each field.

AR/COC- 600820

Dept. No./Mail Stop: 6134/1148
Project/Task Manager: Paul Freshour
Project Name: 81C VCM SAMPLING
Record Center Code: ER/OU1333/DAT
Logbook Ref. No.: __
Service Order No.: CF0628

Date Samples Shipped: 10/6/98 SMO USE
Carrier/Waybill No.: HC
Lab Contact: Fernando Dominquez
Lab Destination: RPSD Building 881
SMO Contact/Phone: Doug Salmi/844-3110
Send Report to SMO: Doug Salmi

Contract No.:
Case No.: 7214/2215
SMO Authorization
Bill to: Sandia National Laboratories
Supplier Services, Dept. _____
P.O. Box 5800 MS 0154

Location Tech Area Canyons
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	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	LAB USE Lab Sample ID
~~042421 - 004~~	~~CY81C-GR-040-SS~~		~~81C~~	~~100598 1330~~	~~S~~	~~M~~	~~500 ml~~	~~None~~	~~G~~	~~SA~~	~~GAMMA SPECTROSCOPY~~	
042422 - 004	CY81C-GR-041-SS	3'-0"	81C	100598 1336	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042423 - 004	CY81C-GR-042-SS	3'-0"	81C	" 1345	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	
042424 - 004	CY81C-GR-043-SS	3'-0"	81C	100598 1400	S	M	500 ml	None	G	SA	GAMMA SPECTROSCOPY	

RMMA ☐Yes ☒No Ref. No. __
Sample Disposal ☒Return to Client ☐Disposal by lab

Sample Tracking SMO USE
Date Entered (mm/dd/yy)
Entered by:

Special Instructions/QC Requirements
EDD ☒Yes ☐No
Raw data package ☒Yes ☐No

Abnormal Conditions on Receipt LAB USE

Turnaround Time ☒Normal ☐Rush Required Report Date

QC Inits

	Name	Signature	Init	Company/Organization/Phone
Sample Team Members	Concetta Corciato	Concetta Corciato	CC	MDM 6131 540-9143
	Chris Catechis	Chris Catechis	CC	MDM 6131 881-3196
	William J Gibson Jr	William J Gibson	WJG	MDM 6131 891-3196

Please list as separate report.

1. Relinquished by	Concetta Corciato	Org. 6131	Date 10/6/98	Time 1105	4. Relinquished by	Org.	Date
1. Received by	SMO	Org. 7577	Date 10/6/98	Time 1105	4. Received by	Org.	Date
2. Relinquished by	SMO	Org. 7577	Date 10-6-98	Time 1400	5. Relinquished by	Org.	Date
2. Received by		Org. 7578	Date 10-6-98	Time 1400	5. Received by	Org.	Date
3. Relinquished by		Org. SNL7578	Date 10/12/98	Time 1015	6. Relinquished by	Org.	Date
3. Received by		Org. 7577	Date 10/12/98	Time 1015	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)

Sandia National Laboratories
Radiation Protection Sample Diagnostics

ER SITE 81C

Sample Analysis Request Form
Page 1 of 2

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

Customer: Paul Freshour
Organization: 6134 (845-3108)
Project Location: ER 81C
Phone: 845-3108
Date Results Needed: 10-13-98
Suspect Isotopes: UNK
Other Information: AR COC 600820

Hazards/Special Instructions:

CASE # 7214.2213

Batch Log Number: 802095
Logged By: JM

Analysis Type:
- [X] Gamma Spec
- [ ] H-3
- [ ] Alpha/Beta
- [ ] Alpha Spec
- [ ] Total U
- [ ] Other

LIMS Login
Results Faxed
Sample Disposal

Customer Sample ID	Sample Type	Date/Time Collected	Sample Volume	Requested Analysis	RPSD Sample ID	Rad Scan CPM	Sample Weight	Remarks
CY81C-GR-041-SS	S	100598 1336	500ml	Gamma Spec.	01	<300	753	LCS-80209516
CY81C-GR-042-SS	S	100598 1345	500ml		02		669	
CY81C-GR-043-SS	S	100598 1400	500ml		03		639	
CY81C-GR-044-SS	S	100598 1405	500ml		04		646	
CY81C-GR-045-SS 044 DP	S	100598 1405	500ml		05		643	
CY81C-GR-045-SS	S	1420	500ml		06		685	
CY81C-GR-046-SS	S	1430	500ml		07		631	
CY81C-GR-047-SS	S	1440	500ml		08		689	
CY81C-GR-048-SS	S	1445	500ml		09		720	
CY81C-GR-049-SS	S	1455	500ml		10		633	
CY81C-GR-050-SS	S	1505	500ml		11		707	
CY81C-GR-051-SS	S	1510	500ml		12		742	
CY81C-GR-052-SS	S	1515	500ml		13		637	
CY81C-GR-053-SS	S	1525	500ml		14		741	
CY81C-GR-054-SS	S	1530	500ml		15	<300	798	

Relinquished by		Date 10-6-98	Time 1400	Received by		Date 10/6/98	Time 1700
Relinquished by		Date 10/12/98	Time 1015	Received by		Date 10/12/98	Time 1015
Relinquished by		Date	Time	Received by		Date	Time
		Date	Time	Received by		Date	Time

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-08-98 9:24:56 AM

Analyzed by: 10/9/98 Reviewed by: 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-041-SS
Lab Sample ID : 80209501

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 753.000 gram
Sample Date/Time : 10-05-98 1:36:00 PM
Acquire Start Date/Time : 10-08-98 7:42:05 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	9.05E-01	4.17E-01	5.33E-01
RA-226	1.87E+00	1.12E+00	4.94E-01
PB-214	7.49E-01	1.37E-01	4.08E-02
BI-214	6.69E-01	1.54E-01	3.94E-02
PB-210	Not Detected	---	3.23E+01
TH-232	7.28E-01	3.96E-01	1.34E-01
RA-228	7.42E-01	2.06E-01	1.24E-01
AC-228	7.73E-01	3.80E-01	7.25E-02
TH-228	7.68E-01	2.43E-01	4.63E-01
RA-224	7.46E-01	2.26E-01	6.81E-02
PB-212	7.73E-01	1.36E-01	3.48E-02
BI-212	7.37E-01	2.92E-01	2.59E-01
TL-208	6.65E-01	1.20E+00	6.30E-02
U-235	2.33E-01	1.91E-01	2.24E-01
TH-231	Not Detected	---	2.06E+00
PA-231	Not Detected	---	3.61E+00
TH-227	Not Detected	---	3.28E-01
RA-223	Not Detected	---	2.18E-01
RN-219	Not Detected	---	3.50E-01
PB-211	Not Detected	---	7.85E-01
TL-207	Not Detected	---	1.17E+01
AM-241	Not Detected	---	4.20E-01
PU-239	Not Detected	---	4.12E+02
NP-237	Not Detected	---	2.72E-01
PA-233	Not Detected	---	5.20E-02
TH-229	Not Detected	---	2.33E-01

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

[Summary Report] - Sample ID: : 80209501

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.68E-02
AG-110m	Not Detected	---------	3.31E-02
BA-133	Not Detected	---------	6.52E-02
BE-7	Not Detected	---------	2.25E-01
CD-109	~~1.47E+00~~	~~5.20E-01~~	9.25E-01 Not detected 10/9/95
CD-115	Not Detected	---------	1.46E-01
CE-139	Not Detected	---------	2.81E-02
CE-141	Not Detected	---------	5.23E-02
CE-144	Not Detected	---------	2.26E-01
CO-56	Not Detected	---------	2.75E-02
CO-57	Not Detected	---------	2.85E-02
CO-58	Not Detected	---------	2.91E-02
CO-60	Not Detected	---------	3.07E-02
CR-51	Not Detected	---------	2.20E-01
CS-134	Not Detected	---------	4.52E-02
CS-137	4.51E-02	2.57E-02	2.12E-02
EU-152	Not Detected	---------	8.53E-02
EU-154	Not Detected	---------	1.69E-01
EU-155	Not Detected	---------	1.43E-01
FE-59	Not Detected	---------	6.00E-02
GD-153	Not Detected	---------	9.72E-02
HG-203	Not Detected	---------	1.71E-02
I-131	Not Detected	---------	3.14E-02
IR-192	Not Detected	---------	2.52E-02
K-40	1.18E+01	1.83E+00	3.40E-01
KR-85	Not Detected	---------	7.40E+00
MN-52	Not Detected	---------	3.71E-02
MN-54	Not Detected	---------	2.99E-02
MO-99	Not Detected	---------	4.09E-01
NA-22	Not Detected	---------	3.78E-02
NA-24	Not Detected	---------	6.22E-01
NB-95	Not Detected	---------	2.58E-01
ND-147	Not Detected	---------	2.04E-01
NI-57	Not Detected	---------	1.63E-01
NP-239	Not Detected	---------	1.26E-01
RU-103	Not Detected	---------	2.77E-02
RU-106	Not Detected	---------	2.55E-01
SB-122	Not Detected	---------	7.07E-02
SB-124	Not Detected	---------	2.65E-02
SB-125	Not Detected	---------	7.31E-02
SN-113	Not Detected	---------	3.44E-02
TA-182	Not Detected	---------	1.40E-01
TA-183	Not Detected	---------	5.26E-01
TC-99m	Not Detected	---------	6.19E+01
TL-201	Not Detected	---------	3.20E-01
XE-133	Not Detected	---------	3.22E-01
Y-88	Not Detected	---------	2.33E-02
ZN-65	Not Detected	---------	9.62E-02
ZR-95	Not Detected	---------	5.34E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-08-98 11:10:26 AM

Analyzed by: 10/9/98 Reviewed by: 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-042-SS
Lab Sample ID : 80209502

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 669.000 gram
Sample Date/Time : 10-05-98 1:45:00 PM
Acquire Start Date/Time : 10-08-98 9:27:13 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	3.29E-01	3.98E-01	5.27E-01
RA-226	1.65E+00	7.76E-01	5.86E-01
PB-214	6.98E-01	1.25E-01	4.26E-02
BI-214	5.99E-01	1.16E-01	4.23E-02
PB-210	Not Detected	---	3.25E+01
TH-232	6.34E-01	7.09E-01	1.32E-01
RA-228	6.89E-01	1.81E-01	1.22E-01
AC-228	7.23E-01	1.92E-01	7.47E-02
TH-228	7.20E-01	2.45E-01	4.46E-01
RA-224	6.81E-01	2.22E-01	7.64E-02
PB-212	6.12E-01	1.15E-01	3.97E-02
BI-212	8.06E-01	3.36E-01	2.53E-01
TL-208	5.56E-01	4.29E-01	6.52E-02
U-235	Not Detected	---	2.19E-01
TH-231	Not Detected	---	2.12E+00
PA-231	Not Detected	---	3.57E+00
TH-227	Not Detected	---	3.27E-01
RA-223	Not Detected	---	2.23E-01
RN-219	Not Detected	---	3.42E-01
PB-211	Not Detected	---	7.62E-01
TL-207	Not Detected	---	1.16E+01
AM-241	Not Detected	---	4.52E-01
PU-239	Not Detected	---	4.18E+02
NP-237	Not Detected	---	2.56E-01
PA-233	Not Detected	---	5.37E-02
TH-229	Not Detected	---	2.43E-01

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

[Summary Report] - Sample ID: : 80209502

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.72E-02
AG-110m	Not Detected	---------	2.85E-02
BA-133	Not Detected	---------	6.64E-02
BE-7	Not Detected	---------	2.26E-01
CD-109	Not Detected	---------	8.70E-01
CD-115	Not Detected	---------	1.50E-01
CE-139	Not Detected	---------	2.80E-02
CE-141	Not Detected	---------	5.23E-02
CE-144	Not Detected	---------	2.23E-01
CO-56	Not Detected	---------	3.11E-02
CO-57	Not Detected	---------	2.81E-02
CO-58	Not Detected	---------	3.00E-02
CO-60	Not Detected	---------	3.24E-02
CR-51	Not Detected	---------	2.33E-01
CS-134	Not Detected	---------	4.65E-02
CS-137	Not Detected	---------	3.06E-02
EU-152	Not Detected	---------	8.43E-02
EU-154	Not Detected	---------	1.71E-01
EU-155	Not Detected	---------	1.36E-01
FE-59	Not Detected	---------	6.34E-02
GD-153	Not Detected	---------	1.02E-01
HG-203	Not Detected	---------	3.03E-02
I-131	Not Detected	---------	3.35E-02
IR-192	Not Detected	---------	2.56E-02
K-40	9.61E+00	1.58E+00	3.56E-01
KR-85	Not Detected	---------	7.84E+00
MN-52	Not Detected	---------	3.63E-02
MN-54	Not Detected	---------	3.06E-02
MO-99	Not Detected	---------	4.21E-01
NA-22	Not Detected	---------	3.55E-02
NA-24	Not Detected	---------	6.60E-01
NB-95	Not Detected	---------	2.60E-01
ND-147	Not Detected	---------	2.18E-01
NI-57	~~2.02E-01~~	~~8.03E-02~~	8.66E-02
NP-239	Not Detected	---------	1.25E-01
RU-103	Not Detected	---------	2.67E-02
RU-106	Not Detected	---------	2.39E-01
SB-122	Not Detected	---------	7.67E-02
SB-124	Not Detected	---------	2.83E-02
SB-125	Not Detected	---------	7.49E-02
SN-113	Not Detected	---------	3.47E-02
TA-182	Not Detected	---------	1.40E-01
TA-183	Not Detected	---------	5.69E-01
TC-99m	Not Detected	---------	7.33E+01
TL-201	Not Detected	---------	3.29E-01
XE-133	Not Detected	---------	3.36E-01
Y-88	Not Detected	---------	2.40E-02
ZN-65	Not Detected	---------	9.32E-02
ZR-95	Not Detected	---------	5.26E-02

Not detected
10/9/98

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-08-98 12:55:17 PM

* Analyzed by: 10/9/98 Reviewed by: 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-043-SS
Lab Sample ID : 80209503

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 639.000 gram
Sample Date/Time : 10-05-98 2:00:00 PM
Acquire Start Date/Time : 10-08-98 11:12:37 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	---	8.15E-01
RA-226	1.72E+00	6.87E-01	5.72E-01
PB-214	7.57E-01	6.45E-01	4.56E-02
BI-214	7.15E-01	1.81E-01	4.42E-02
PB-210	Not Detected	---	3.50E+01
TH-232	6.75E-01	3.75E-01	1.31E-01
RA-228	6.48E-01	2.05E-01	1.39E-01
AC-228	7.21E-01	2.56E-01	7.70E-02
TH-228	8.44E-01	2.62E-01	4.88E-01
RA-224	7.07E-01	2.43E-01	7.42E-02
PB-212	7.03E-01	3.75E-01	4.09E-02
BI-212	7.39E-01	4.41E-01	2.76E-01
TL-208	6.61E-01	1.49E-01	6.45E-02
U-235	Not Detected	---	2.39E-01
TH-231	Not Detected	---	2.34E+00
PA-231	Not Detected	---	3.95E+00
TH-227	Not Detected	---	3.58E-01
RA-223	Not Detected	---	2.32E-01
RN-219	Not Detected	---	3.71E-01
PB-211	Not Detected	---	8.45E-01
TL-207	Not Detected	---	1.33E+01
AM-241	Not Detected	---	4.73E-01
PU-239	Not Detected	---	4.36E+02
NP-237	Not Detected	---	2.68E-01
PA-233	Not Detected	---	5.76E-02
TH-229	Not Detected	---	2.59E-01

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

[Summary Report] - Sample ID: : 80209503

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.88E-02
AG-110m	Not Detected	---------	3.58E-02
BA-133	Not Detected	---------	7.29E-02
BE-7	Not Detected	---------	2.60E-01
CD-109	Not Detected	---------	9.11E-01
CD-115	Not Detected	---------	1.66E-01
CE-139	Not Detected	---------	3.03E-02
CE-141	Not Detected	---------	5.63E-02
CE-144	Not Detected	---------	2.39E-01
CO-56	Not Detected	---------	3.52E-02
CO-57	Not Detected	---------	3.00E-02
CO-58	Not Detected	---------	3.15E-02
CO-60	Not Detected	---------	3.38E-02
CR-51	Not Detected	---------	2.46E-01
CS-134	Not Detected	---------	5.03E-02
CS-137	4.78E-02	2.11E-02	2.20E-02
EU-152	Not Detected	---------	8.99E-02
EU-154	Not Detected	---------	1.78E-01
EU-155	Not Detected	---------	1.52E-01
FE-59	Not Detected	---------	7.05E-02
GD-153	Not Detected	---------	1.08E-01
HG-203	Not Detected	---------	3.22E-02
I-131	Not Detected	---------	3.47E-02
IR-192	Not Detected	---------	2.75E-02
K-40	1.16E+01	1.82E+00	3.90E-01
KR-85	Not Detected	---------	8.27E+00
MN-52	Not Detected	---------	4.29E-02
MN-54	Not Detected	---------	3.40E-02
MO-99	Not Detected	---------	4.98E-01
NA-22	Not Detected	---------	3.86E-02
NA-24	Not Detected	---------	7.33E-01
NB-95	Not Detected	---------	2.88E-01
ND-147	Not Detected	---------	2.31E-01
NI-57	Not Detected	---------	1.75E-01
NP-239	Not Detected	---------	1.37E-01
RU-103	Not Detected	---------	2.81E-02
RU-106	Not Detected	---------	2.83E-01
SB-122	Not Detected	---------	7.94E-02
SB-124	Not Detected	---------	3.02E-02
SB-125	Not Detected	---------	8.39E-02
SN-113	Not Detected	---------	3.75E-02
TA-182	Not Detected	---------	1.58E-01
TA-183	Not Detected	---------	6.08E-01
TC-99m	Not Detected	---------	9.44E+01
TL-201	Not Detected	---------	3.49E-01
XE-133	Not Detected	---------	3.58E-01
Y-88	Not Detected	---------	2.42E-02
ZN-65	Not Detected	---------	1.09E-01
ZR-95	Not Detected	---------	5.47E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-08-98 2:40:08 PM

Analyzed by: 10/9/98 Reviewed by: AJM 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-044-SS
Lab Sample ID : 80209504

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 646.000 gram
Sample Date/Time : 10-05-98 2:05:00 PM
Acquire Start Date/Time : 10-08-98 12:57:26 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	6.17E-01	5.10E-01	6.00E-01
RA-226	2.22E+00	6.85E-01	5.64E-01
PB-214	7.71E-01	1.35E-01	4.77E-02
BI-214	7.03E-01	1.40E-01	4.42E-02
PB-210	Not Detected	---	3.67E+01
TH-232	Not Detected	---	1.38E-01
RA-228	7.38E-01	3.41E-01	1.57E-01
AC-228	6.86E-01	3.12E-01	8.29E-02
TH-228	7.04E-01	2.33E-01	4.54E-01
RA-224	8.14E-01	2.53E-01	8.25E-02
PB-212	7.34E-01	1.35E-01	4.08E-02
BI-212	9.38E-01	4.90E-01	3.06E-01
TL-208	6.97E-01	1.38E-01	6.57E-02
U-235	Not Detected	---	2.32E-01
TH-231	Not Detected	---	2.38E+00
PA-231	Not Detected	---	3.80E+00
TH-227	Not Detected	---	3.62E-01
RA-223	Not Detected	---	2.35E-01
RN-219	Not Detected	---	3.78E-01
PB-211	Not Detected	---	8.53E-01
TL-207	Not Detected	---	1.23E+01
AM-241	Not Detected	---	4.78E-01
PU-239	Not Detected	---	4.47E+02
NP-237	~~5.39E-01~~	~~1.92E-01~~	2.85E-01 Not Detected 10/9/98
PA-233	Not Detected	---	5.88E-02
TH-229	Not Detected	---	2.58E-01

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

[Summary Report] - Sample ID: : 80209504

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.94E-02
AG-110m	Not Detected	---------	3.60E-02
BA-133	Not Detected	---------	7.22E-02
BE-7	Not Detected	---------	2.56E-01
CD-109	Not Detected	---------	9.69E-01
CD-115	Not Detected	---------	1.70E-01
CE-139	Not Detected	---------	3.06E-02
CE-141	Not Detected	---------	5.51E-02
CE-144	Not Detected	---------	2.44E-01
CO-56	Not Detected	---------	3.41E-02
CO-57	Not Detected	---------	2.99E-02
CO-58	Not Detected	---------	3.23E-02
CO-60	Not Detected	---------	3.36E-02
CR-51	Not Detected	---------	2.45E-01
CS-134	Not Detected	---------	5.04E-02
CS-137	5.23E-02	2.40E-02	2.25E-02
EU-152	Not Detected	---------	8.96E-02
EU-154	Not Detected	---------	1.82E-01
EU-155	Not Detected	---------	1.54E-01
FE-59	Not Detected	---------	6.61E-02
GD-153	Not Detected	---------	1.09E-01
HG-203	Not Detected	---------	3.25E-02
I-131	Not Detected	---------	3.72E-02
IR-192	Not Detected	---------	2.74E-02
K-40	1.19E+01	1.94E+00	3.85E-01
KR-85	Not Detected	---------	8.56E+00
MN-52	Not Detected	---------	4.06E-02
MN-54	Not Detected	---------	3.41E-02
MO-99	Not Detected	---------	4.96E-01
NA-22	Not Detected	---------	4.28E-02
NA-24	Not Detected	---------	8.87E-01
NB-95	Not Detected	---------	2.95E-01
ND-147	Not Detected	---------	2.35E-01
NI-57	Not Detected	---------	1.10E-01
NP-239	Not Detected	---------	1.39E-01
RU-103	Not Detected	---------	2.96E-02
RU-106	Not Detected	---------	2.88E-01
SB-122	Not Detected	---------	8.50E-02
SB-124	Not Detected	---------	3.06E-02
SB-125	Not Detected	---------	7.97E-02
SN-113	Not Detected	---------	3.80E-02
TA-182	Not Detected	---------	1.50E-01
TA-183	Not Detected	---------	6.21E-01
TC-99m	Not Detected	---------	1.13E+02
TL-201	Not Detected	---------	3.66E-01
XE-133	Not Detected	---------	3.57E-01
Y-88	Not Detected	---------	2.85E-02
ZN-65	Not Detected	---------	1.04E-01
ZR-95	Not Detected	---------	5.62E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-08-98 6:29:18 PM

Analyzed by: 10/9/98 Reviewed by: 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-044-DP
Lab Sample ID : 80209505

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 643.000 gram
Sample Date/Time : 10-05-98 2:05:00 PM
Acquire Start Date/Time : 10-08-98 4:46:28 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	6.48E-01	3.58E-01	5.72E-01
RA-226	1.48E+00	7.81E-01	5.62E-01
PB-214	7.38E-01	1.70E-01	4.67E-02
BI-214	7.13E-01	1.37E-01	4.76E-02
PB-210	Not Detected	---	3.43E+01
TH-232	6.91E-01	3.57E-01	1.48E-01
RA-228	7.63E-01	2.12E-01	1.44E-01
AC-228	7.62E-01	1.75E-01	8.42E-02
TH-228	6.58E-01	2.35E-01	5.17E-01
RA-224	6.75E-01	2.16E-01	7.64E-02
PB-212	7.60E-01	1.39E-01	4.16E-02
BI-212	7.74E-01	3.71E-01	3.14E-01
TL-208	6.85E-01	6.34E-01	6.78E-02
U-235	Not Detected	---	2.43E-01
TH-231	Not Detected	---	2.33E+00
PA-231	Not Detected	---	3.99E+00
TH-227	Not Detected	---	3.66E-01
RA-223	Not Detected	---	2.44E-01
RN-219	Not Detected	---	3.96E-01
PB-211	Not Detected	---	8.91E-01
TL-207	Not Detected	---	1.32E+01
AM-241	Not Detected	---	4.80E-01
PU-239	Not Detected	---	4.52E+02
NP-237	Not Detected	---	2.85E-01
PA-233	Not Detected	---	5.71E-02
TH-229	Not Detected	---	2.52E-01

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

[Summary Report] - Sample ID: : 80209505

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	4.11E-02
AG-110m	Not Detected	---------	3.80E-02
BA-133	Not Detected	---------	7.12E-02
BE-7	Not Detected	---------	2.62E-01
CD-109	~~1.02E+00~~	~~6.05E-01~~	9.70E-01 Not detected 10/2/98
CD-115	Not Detected	---------	1.75E-01
CE-139	Not Detected	---------	3.03E-02
CE-141	Not Detected	---------	5.81E-02
CE-144	Not Detected	---------	2.53E-01
CO-56	Not Detected	---------	3.30E-02
CO-57	Not Detected	---------	3.13E-02
CO-58	Not Detected	---------	3.12E-02
CO-60	Not Detected	---------	3.47E-02
CR-51	Not Detected	---------	2.45E-01
CS-134	Not Detected	---------	5.03E-02
CS-137	7.45E-02	2.51E-02	2.15E-02
EU-152	Not Detected	---------	9.38E-02
EU-154	Not Detected	---------	1.90E-01
EU-155	Not Detected	---------	1.53E-01
FE-59	Not Detected	---------	6.94E-02
GD-153	Not Detected	---------	1.10E-01
HG-203	Not Detected	---------	3.36E-02
I-131	Not Detected	---------	3.78E-02
IR-192	Not Detected	---------	2.74E-02
K-40	1.21E+01	2.17E+00	4.04E-01
KR-85	Not Detected	---------	8.47E+00
MN-52	Not Detected	---------	4.39E-02
MN-54	Not Detected	---------	3.40E-02
MO-99	Not Detected	---------	5.08E-01
NA-22	Not Detected	---------	3.74E-02
NA-24	Not Detected	---------	1.01E+00
NB-95	Not Detected	---------	3.08E-01
ND-147	Not Detected	---------	2.44E-01
NI-57	Not Detected	---------	2.09E-01
NP-239	Not Detected	---------	1.38E-01
RU-103	Not Detected	---------	3.09E-02
RU-106	Not Detected	---------	2.86E-01
SB-122	Not Detected	---------	9.28E-02
SB-124	Not Detected	---------	3.04E-02
SB-125	Not Detected	---------	8.20E-02
SN-113	Not Detected	---------	3.90E-02
TA-182	Not Detected	---------	1.51E-01
TA-183	Not Detected	---------	6.27E-01
TC-99m	Not Detected	---------	1.80E+02
TL-201	Not Detected	---------	3.83E-01
XE-133	Not Detected	---------	3.92E-01
Y-88	Not Detected	---------	2.53E-02
ZN-65	Not Detected	---------	1.02E-01
ZR-95	Not Detected	---------	5.90E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-08-98 8:14:18 PM

Analyzed by: 10/9/98 Reviewed by: AJM 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-045-SS
Lab Sample ID : 80209506

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 685.000 gram
Sample Date/Time : 10-05-98 2:20:00 PM
Acquire Start Date/Time : 10-08-98 6:31:28 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	---------	6.47E-01
RA-226	1.74E+00	5.92E-01	5.44E-01
PB-214	8.14E-01	1.42E-01	4.62E-02
BI-214	7.60E-01	9.63E-01	4.17E-02
PB-210	Not Detected	---------	3.53E+01
TH-232	8.90E-01	4.04E-01	1.29E-01
RA-228	8.56E-01	2.25E-01	1.35E-01
AC-228	8.13E-01	5.82E-01	8.03E-02
TH-228	Not Detected	---------	4.86E-01
RA-224	7.61E-01	2.66E-01	7.53E-02
PB-212	8.02E-01	1.44E-01	4.00E-02
BI-212	8.78E-01	4.09E-01	3.20E-01
TL-208	7.06E-01	1.48E-01	7.06E-02
U-235	Not Detected	---------	2.40E-01
TH-231	Not Detected	---------	2.31E+00
PA-231	Not Detected	---------	3.91E+00
TH-227	Not Detected	---------	3.59E-01
RA-223	Not Detected	---------	2.38E-01
RN-219	Not Detected	---------	3.94E-01
PB-211	Not Detected	---------	8.59E-01
TL-207	Not Detected	---------	1.29E+01
AM-241	Not Detected	---------	4.83E-01
PU-239	Not Detected	---------	4.50E+02
NP-237	Not Detected	---------	2.87E-01
PA-233	Not Detected	---------	5.74E-02
TH-229	Not Detected	---------	2.50E-01

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

[Summary Report] - Sample ID: : 80209506

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	4.03E-02
AG-110m	Not Detected	---------	3.71E-02
BA-133	Not Detected	---------	7.16E-02
BE-7	Not Detected	---------	2.53E-01
CD-109	Not Detected	---------	9.77E-01
CD-115	Not Detected	---------	1.83E-01
CE-139	Not Detected	---------	3.05E-02
CE-141	Not Detected	---------	5.72E-02
CE-144	Not Detected	---------	2.48E-01
CO-56	Not Detected	---------	3.14E-02
CO-57	Not Detected	---------	3.10E-02
CO-58	Not Detected	---------	3.12E-02
CO-60	Not Detected	---------	3.42E-02
CR-51	Not Detected	---------	2.48E-01
CS-134	Not Detected	---------	4.99E-02
CS-137	5.83E-02	3.31E-02	2.10E-02
EU-152	Not Detected	---------	9.27E-02
EU-154	Not Detected	---------	1.87E-01
EU-155	Not Detected	---------	1.51E-01
FE-59	Not Detected	---------	7.14E-02
GD-153	Not Detected	---------	1.05E-01
HG-203	Not Detected	---------	3.24E-02
I-131	Not Detected	---------	3.67E-02
IR-192	Not Detected	---------	2.77E-02
K-40	1.27E+01	2.10E+00	3.78E-01
KR-85	Not Detected	---------	8.17E+00
MN-52	Not Detected	---------	3.68E-02
MN-54	Not Detected	---------	1.69E-02
MO-99	Not Detected	---------	5.12E-01
NA-22	Not Detected	---------	3.92E-02
NA-24	Not Detected	---------	1.13E+00
NB-95	Not Detected	---------	3.06E-01
ND-147	Not Detected	---------	2.39E-01
NI-57	Not Detected	---------	1.08E-01
NP-239	Not Detected	---------	1.35E-01
RU-103	Not Detected	---------	2.98E-02
RU-106	Not Detected	---------	2.94E-01
SB-122	Not Detected	---------	8.45E-02
SB-124	Not Detected	---------	2.90E-02
SB-125	Not Detected	---------	7.87E-02
SN-113	Not Detected	---------	3.77E-02
TA-182	Not Detected	---------	1.57E-01
TA-183	Not Detected	---------	6.33E-01
TC-99m	Not Detected	---------	2.11E+02
TL-201	Not Detected	---------	3.68E-01
XE-133	Not Detected	---------	3.97E-01
Y-88	Not Detected	---------	2.05E-02
ZN-65	Not Detected	---------	1.06E-01
ZR-95	Not Detected	---------	5.46E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-08-98 9:59:12 PM

Analyzed by: 10/9/98 Reviewed by: 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-046-SS
Lab Sample ID : 80209507

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 631.000 gram
Sample Date/Time : 10-05-98 2:30:00 PM
Acquire Start Date/Time : 10-08-98 8:16:27 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	5.38E-01	5.04E-01	5.75E-01
RA-226	1.84E+00	5.90E-01	5.48E-01
PB-214	7.69E-01	1.55E-01	4.98E-02
BI-214	7.03E-01	1.87E-01	4.53E-02
PB-210	Not Detected	---------	3.51E+01
TH-232	8.12E-01	4.34E-01	1.55E-01
RA-228	8.71E-01	2.66E-01	1.37E-01
AC-228	9.01E-01	7.58E-01	7.75E-02
TH-228	9.53E-01	2.76E-01	4.94E-01
RA-224	7.70E-01	2.61E-01	8.45E-02
PB-212	8.11E-01	2.14E-01	4.26E-02
BI-212	9.15E-01	6.34E-01	3.15E-01
TL-208	7.40E-01	3.84E-01	7.37E-02
U-235	Not Detected	---------	1.02E-01
TH-231	Not Detected	---------	2.43E+00
PA-231	Not Detected	---------	4.05E+00
TH-227	Not Detected	---------	3.76E-01
RA-223	Not Detected	---------	2.57E-01
RN-219	Not Detected	---------	3.79E-01
PB-211	Not Detected	---------	8.69E-01
TL-207	Not Detected	---------	1.37E+01
AM-241	Not Detected	---------	5.06E-01
PU-239	Not Detected	---------	4.66E+02
NP-237	Not Detected	---------	2.81E-01
PA-233	Not Detected	---------	6.16E-02
TH-229	Not Detected	---------	2.71E-01

[Summary Report] - Sample ID: : 80209507

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	4.29E-02
AG-110m	Not Detected	---------	3.67E-02
BA-133	Not Detected	---------	7.27E-02
BE-7	Not Detected	---------	2.72E-01
CD-109	Not Detected	---------	9.57E-01
CD-115	Not Detected	---------	1.92E-01
CE-139	Not Detected	---------	3.11E-02
CE-141	Not Detected	---------	5.87E-02
CE-144	Not Detected	---------	2.55E-01
CO-56	Not Detected	---------	3.36E-02
CO-57	Not Detected	---------	3.13E-02
CO-58	Not Detected	---------	3.26E-02
CO-60	Not Detected	---------	3.39E-02
CR-51	Not Detected	---------	2.57E-01
CS-134	Not Detected	---------	5.02E-02
CS-137	4.24E-02	1.96E-02	2.13E-02
EU-152	Not Detected	---------	9.37E-02
EU-154	Not Detected	---------	1.98E-01
EU-155	Not Detected	---------	1.59E-01
FE-59	Not Detected	---------	7.24E-02
GD-153	Not Detected	---------	1.12E-01
HG-203	Not Detected	---------	3.40E-02
I-131	Not Detected	---------	3.89E-02
IR-192	Not Detected	---------	2.90E-02
K-40	1.32E+01	3.55E+00	4.08E-01
KR-85	Not Detected	---------	8.63E+00
MN-52	Not Detected	---------	4.31E-02
MN-54	Not Detected	---------	1.72E-02
MO-99	Not Detected	---------	5.51E-01
NA-22	Not Detected	---------	4.44E-02
NA-24	Not Detected	---------	1.28E+00
NB-95	Not Detected	---------	3.24E-01
ND-147	Not Detected	---------	2.57E-01
NI-57	Not Detected	---------	2.41E-01
NP-239	Not Detected	---------	1.42E-01
RU-103	Not Detected	---------	3.10E-02
RU-106	Not Detected	---------	2.96E-01
SB-122	Not Detected	---------	9.27E-02
SB-124	Not Detected	---------	2.97E-02
SB-125	Not Detected	---------	8.38E-02
SN-113	Not Detected	---------	3.88E-02
TA-182	Not Detected	---------	1.59E-01
TA-183	Not Detected	---------	6.81E-01
TC-99m	Not Detected	---------	2.62E+02
TL-201	Not Detected	---------	3.89E-01
XE-133	Not Detected	---------	4.29E-01
Y-88	Not Detected	---------	2.70E-02
ZN-65	Not Detected	---------	1.06E-01
ZR-95	Not Detected	---------	5.98E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-08-98 11:44:07 PM

Analyzed by: 10/9/98 Reviewed by: 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-047-SS
Lab Sample ID : 80209508

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 689.000 gram
Sample Date/Time : 10-05-98 2:40:00 PM
Acquire Start Date/Time : 10-08-98 10:01:20 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	6.02E-01	4.40E-01	5.74E-01
RA-226	1.87E+00	4.32E-01	5.72E-01
PB-214	7.44E-01	1.42E-01	4.80E-02
BI-214	6.86E-01	1.30E-01	4.20E-02
PB-210	Not Detected	---	3.68E+01
TH-232	8.83E-01	4.18E-01	1.35E-01
RA-228	7.94E-01	1.37E+00	1.36E-01
AC-228	8.53E-01	1.87E-01	8.28E-02
TH-228	9.52E-01	4.01E-01	4.63E-01
RA-224	8.57E-01	2.87E-01	6.61E-02
PB-212	8.75E-01	1.43E-01	3.98E-02
BI-212	7.00E-01	4.54E-01	3.09E-01
TL-208	7.76E-01	1.28E+00	6.91E-02
U-235	Not Detected	---	2.38E-01
TH-231	Not Detected	---	2.32E+00
PA-231	Not Detected	---	3.98E+00
TH-227	Not Detected	---	3.70E-01
RA-223	Not Detected	---	2.44E-01
RN-219	Not Detected	---	3.82E-01
PB-211	Not Detected	---	8.59E-01
TL-207	Not Detected	---	1.32E+01
AM-241	Not Detected	---	4.76E-01
PU-239	Not Detected	---	4.44E+02
NP-237	~~4.79E-01~~	~~1.03E-01~~	2.91E-01 not detected
PA-233	Not Detected	---	5.68E-02
TH-229	Not Detected	---	2.55E-01

10/9/98

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

[Summary Report] - Sample ID: : 80209508

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.87E-02
AG-110m	Not Detected	---------	3.42E-02
BA-133	Not Detected	---------	6.95E-02
BE-7	Not Detected	---------	2.56E-01
CD-109	Not Detected	---------	9.90E-01
CD-115	Not Detected	---------	1.92E-01
CE-139	Not Detected	---------	3.02E-02
CE-141	Not Detected	---------	5.77E-02
CE-144	Not Detected	---------	2.45E-01
CO-56	Not Detected	---------	3.20E-02
CO-57	Not Detected	---------	3.08E-02
CO-58	Not Detected	---------	3.11E-02
CO-60	Not Detected	---------	3.36E-02
CR-51	Not Detected	---------	2.47E-01
CS-134	Not Detected	---------	4.92E-02
CS-137	Not Detected	---------	1.96E-02
EU-152	Not Detected	---------	9.22E-02
EU-154	Not Detected	---------	1.78E-01
EU-155	Not Detected	---------	1.49E-01
FE-59	Not Detected	---------	6.65E-02
GD-153	Not Detected	---------	1.06E-01
HG-203	Not Detected	---------	3.26E-02
I-131	Not Detected	---------	3.77E-02
IR-192	Not Detected	---------	2.69E-02
K-40	1.41E+01	2.18E+00	3.73E-01
KR-85	Not Detected	---------	8.24E+00
MN-52	Not Detected	---------	4.20E-02
MN-54	Not Detected	---------	1.72E-02
MO-99	Not Detected	---------	5.49E-01
NA-22	Not Detected	---------	4.07E-02
NA-24	Not Detected	---------	1.22E+00
NB-95	Not Detected	---------	3.23E-01
ND-147	Not Detected	---------	2.26E-01
NI-57	Not Detected	---------	2.22E-01
NP-239	Not Detected	---------	1.34E-01
RU-103	Not Detected	---------	2.96E-02
RU-106	Not Detected	---------	2.85E-01
SB-122	Not Detected	---------	8.79E-02
SB-124	Not Detected	---------	2.99E-02
SB-125	Not Detected	---------	8.17E-02
SN-113	Not Detected	---------	3.73E-02
TA-182	Not Detected	---------	1.50E-01
TA-183	Not Detected	---------	6.36E-01
TC-99m	Not Detected	---------	3.06E+02
TL-201	Not Detected	---------	3.83E-01
XE-133	Not Detected	---------	4.14E-01
Y-88	Not Detected	---------	3.00E-02
ZN-65	Not Detected	---------	1.03E-01
ZR-95	Not Detected	---------	5.48E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-09-98 1:29:02 AM

Analyzed by: 10/9/98 Reviewed by: 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-048-SS
Lab Sample ID : 80209509

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 720.000 gram
Sample Date/Time : 10-05-98 2:45:00 PM
Acquire Start Date/Time : 10-08-98 11:46:14 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	7.85E-01	7.55E-01	6.31E-01
RA-226	2.21E+00	8.86E-01	5.71E-01
PB-214	7.81E-01	1.36E-01	4.56E-02
BI-214	6.88E-01	7.61E-01	4.02E-02
PB-210	Not Detected	---	3.34E+01
TH-232	8.28E-01	4.19E-01	1.38E-01
RA-228	8.72E-01	2.38E-01	1.36E-01
AC-228	8.22E-01	7.73E-01	9.16E-02
TH-228	6.25E-01	8.08E-01	4.78E-01
RA-224	8.14E-01	2.36E-01	7.97E-02
PB-212	8.33E-01	1.48E-01	4.11E-02
BI-212	1.05E+00	1.54E+00	2.96E-01
TL-208	7.81E-01	1.61E-01	6.42E-02
U-235	1.68E-01	2.05E-01	2.39E-01
TH-231	Not Detected	---	2.29E+00
PA-231	Not Detected	---	3.83E+00
TH-227	Not Detected	---	3.58E-01
RA-223	Not Detected	---	2.42E-01
RN-219	Not Detected	---	3.64E-01
PB-211	Not Detected	---	8.31E-01
TL-207	Not Detected	---	1.33E+01
AM-241	Not Detected	---	4.66E-01
PU-239	Not Detected	---	4.43E+02
NP-237	~~6.19E-01~~	~~2.31E-01~~	3.04E-01 Not detected 10/9/98
PA-233	Not Detected	---	5.53E-02
TH-229	Not Detected	---	2.55E-01

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

[Summary Report] - Sample ID: : 80209509

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	4.06E-02
AG-110m	Not Detected	---------	3.40E-02
BA-133	Not Detected	---------	6.92E-02
BE-7	Not Detected	---------	2.48E-01
CD-109	Not Detected	---------	1.03E+00
CD-115	Not Detected	---------	1.90E-01
CE-139	Not Detected	---------	2.91E-02
CE-141	Not Detected	---------	5.70E-02
CE-144	Not Detected	---------	2.38E-01
CO-56	Not Detected	---------	3.19E-02
CO-57	Not Detected	---------	3.02E-02
CO-58	Not Detected	---------	3.06E-02
CO-60	Not Detected	---------	3.30E-02
CR-51	Not Detected	---------	2.50E-01
CS-134	Not Detected	---------	4.68E-02
CS-137	2.42E-02	2.23E-02	2.27E-02
EU-152	Not Detected	---------	9.04E-02
EU-154	Not Detected	---------	1.87E-01
EU-155	Not Detected	---------	1.49E-01
FE-59	Not Detected	---------	6.63E-02
GD-153	Not Detected	---------	1.07E-01
HG-203	Not Detected	---------	3.20E-02
I-131	Not Detected	---------	3.67E-02
IR-192	Not Detected	---------	2.74E-02
K-40	1.41E+01	2.18E+00	3.42E-01
KR-85	Not Detected	---------	8.20E+00
MN-52	Not Detected	---------	4.05E-02
MN-54	Not Detected	---------	1.85E-02
MO-99	Not Detected	---------	5.56E-01
NA-22	Not Detected	---------	4.23E-02
NA-24	Not Detected	---------	1.40E+00
NB-95	Not Detected	---------	3.17E-01
ND-147	Not Detected	---------	2.31E-01
NI-57	Not Detected	---------	1.11E-01
NP-239	Not Detected	---------	1.33E-01
RU-103	Not Detected	---------	2.94E-02
RU-106	Not Detected	---------	2.67E-01
SB-122	Not Detected	---------	9.05E-02
SB-124	Not Detected	---------	2.80E-02
SB-125	Not Detected	---------	7.71E-02
SN-113	Not Detected	---------	3.61E-02
TA-182	Not Detected	---------	1.44E-01
TA-183	Not Detected	---------	6.34E-01
TC-99m	Not Detected	---------	3.62E+02
TL-201	Not Detected	---------	3.84E-01
XE-133	Not Detected	---------	4.15E-01
Y-88	Not Detected	---------	2.81E-02
ZN-65	Not Detected	---------	9.76E-02
ZR-95	Not Detected	---------	5.31E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-09-98 3:14:05 AM

Analyzed by: 10/9/98 Reviewed by: 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-049-SS
Lab Sample ID : 80209510

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 633.000 gram
Sample Date/Time : 10-05-98 2:55:00 PM
Acquire Start Date/Time : 10-09-98 1:31:18 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	7.04E-01	5.14E-01	6.18E-01
RA-226	1.60E+00	8.37E-01	5.54E-01
PB-214	8.02E-01	1.40E-01	4.35E-02
BI-214	6.77E-01	1.44E-01	4.61E-02
PB-210	Not Detected	---	3.61E+01
TH-232	7.49E-01	3.70E-01	1.54E-01
RA-228	8.98E-01	1.63E+00	1.35E-01
AC-228	8.08E-01	2.88E-01	7.95E-02
TH-228	6.08E-01	3.13E-01	5.17E-01
RA-224	8.68E-01	2.93E-01	8.73E-02
PB-212	8.22E-01	2.47E-01	4.19E-02
BI-212	1.04E+00	4.34E-01	2.94E-01
TL-208	7.45E-01	1.54E-01	6.71E-02
U-235	Not Detected	---	2.39E-01
TH-231	Not Detected	---	2.39E+00
PA-231	Not Detected	---	4.01E+00
TH-227	Not Detected	---	3.76E-01
RA-223	Not Detected	---	2.54E-01
RN-219	Not Detected	---	3.88E-01
PB-211	Not Detected	---	8.84E-01
TL-207	Not Detected	---	1.36E+01
AM-241	Not Detected	---	5.02E-01
PU-239	Not Detected	---	4.72E+02
NP-237	~~5.04E-01~~	~~1.89E-01~~	3.01E-01 Not detected 10/9/98
PA-233	Not Detected	---	5.81E-02
TH-229	Not Detected	---	2.76E-01

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

[Summary Report] - Sample ID: : 80209510

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	4.23E-02
AG-110m	Not Detected	---------	3.71E-02
BA-133	Not Detected	---------	7.36E-02
BE-7	Not Detected	---------	2.67E-01
CD-109	Not Detected	---------	1.03E+00
CD-115	Not Detected	---------	2.06E-01
CE-139	Not Detected	---------	3.11E-02
CE-141	Not Detected	---------	5.74E-02
CE-144	Not Detected	---------	2.56E-01
CO-56	Not Detected	---------	3.44E-02
CO-57	Not Detected	---------	3.11E-02
CO-58	Not Detected	---------	3.40E-02
CO-60	Not Detected	---------	3.45E-02
CR-51	Not Detected	---------	2.60E-01
CS-134	Not Detected	---------	5.06E-02
CS-137	4.00E-02	1.15E-02	2.17E-02
EU-152	Not Detected	---------	9.31E-02
EU-154	Not Detected	---------	1.95E-01
EU-155	Not Detected	---------	1.58E-01
FE-59	Not Detected	---------	6.84E-02
GD-153	Not Detected	---------	1.14E-01
HG-203	Not Detected	---------	3.37E-02
I-131	Not Detected	---------	3.88E-02
IR-192	Not Detected	---------	2.81E-02
K-40	1.33E+01	2.08E+00	4.05E-01
KR-85	Not Detected	---------	8.79E+00
MN-52	Not Detected	---------	4.11E-02
MN-54	Not Detected	---------	3.63E-02
MO-99	Not Detected	---------	5.76E-01
NA-22	Not Detected	---------	4.21E-02
NA-24	Not Detected	---------	1.46E+00
NB-95	Not Detected	---------	3.37E-01
ND-147	Not Detected	---------	2.47E-01
NI-57	Not Detected	---------	1.33E-01
NP-239	Not Detected	---------	1.40E-01
RU-103	Not Detected	---------	2.92E-02
RU-106	Not Detected	---------	2.95E-01
SB-122	Not Detected	---------	9.82E-02
SB-124	Not Detected	---------	3.11E-02
SB-125	Not Detected	---------	8.46E-02
SN-113	Not Detected	---------	3.96E-02
TA-182	Not Detected	---------	1.55E-01
TA-183	Not Detected	---------	6.86E-01
TC-99m	Not Detected	---------	4.56E+02
TL-201	Not Detected	---------	4.04E-01
XE-133	Not Detected	---------	4.39E-01
Y-88	Not Detected	---------	2.81E-02
ZN-65	Not Detected	---------	1.06E-01
ZR-95	Not Detected	---------	5.84E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-09-98 4:59:07 AM

Analyzed by: 10/9/98 Reviewed by: 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-050-SS
Lab Sample ID : 80209511

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 707.000 gram
Sample Date/Time : 10-05-98 3:05:00 PM
Acquire Start Date/Time : 10-09-98 3:16:19 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	5.92E-01	4.62E-01	5.81E-01
RA-226	1.82E+00	7.97E-01	5.57E-01
PB-214	7.79E-01	1.35E-01	4.25E-02
BI-214	6.86E-01	8.01E-01	4.13E-02
PB-210	Not Detected	---	3.47E+01
TH-232	8.81E-01	4.33E-01	1.37E-01
RA-228	8.71E-01	2.83E-01	1.43E-01
AC-228	8.35E-01	1.94E-01	7.84E-02
TH-228	1.03E+00	2.94E-01	4.59E-01
RA-224	8.44E-01	2.82E-01	7.50E-02
PB-212	8.37E-01	1.50E-01	4.00E-02
BI-212	9.04E-01	4.35E-01	3.11E-01
TL-208	8.26E-01	1.73E-01	6.42E-02
U-235	Not Detected	---	2.33E-01
TH-231	Not Detected	---	2.28E+00
PA-231	Not Detected	---	3.80E+00
TH-227	Not Detected	---	3.59E-01
RA-223	Not Detected	---	2.43E-01
RN-219	Not Detected	---	3.66E-01
PB-211	Not Detected	---	8.26E-01
TL-207	Not Detected	---	1.27E+01
AM-241	Not Detected	---	4.73E-01
PU-239	Not Detected	---	4.42E+02
NP-237	~~4.48E-01~~	~~1.78E-01~~	2.91E-01 Not detected 10/9/98
PA-233	Not Detected	---	5.44E-02
TH-229	Not Detected	---	2.49E-01

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

[Summary Report] - Sample ID: : 80209511

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.85E-02
AG-110m	Not Detected	---------	3.23E-02
BA-133	Not Detected	---------	6.89E-02
BE-7	Not Detected	---------	2.52E-01
CD-109	Not Detected	---------	9.91E-01
CD-115	Not Detected	---------	2.02E-01
CE-139	Not Detected	---------	2.89E-02
CE-141	Not Detected	---------	5.62E-02
CE-144	Not Detected	---------	2.44E-01
CO-56	Not Detected	---------	3.23E-02
CO-57	Not Detected	---------	2.99E-02
CO-58	Not Detected	---------	3.04E-02
CO-60	Not Detected	---------	3.39E-02
CR-51	Not Detected	---------	2.36E-01
CS-134	Not Detected	---------	4.77E-02
CS-137	2.63E-02	1.75E-02	2.07E-02
EU-152	Not Detected	---------	8.94E-02
EU-154	Not Detected	---------	1.77E-01
EU-155	Not Detected	---------	1.47E-01
FE-59	Not Detected	---------	6.64E-02
GD-153	Not Detected	---------	1.06E-01
HG-203	Not Detected	---------	3.23E-02
I-131	Not Detected	---------	3.73E-02
IR-192	Not Detected	---------	2.65E-02
K-40	1.36E+01	2.69E+00	3.65E-01
KR-85	Not Detected	---------	8.28E+00
MN-52	Not Detected	---------	4.17E-02
MN-54	Not Detected	---------	1.54E-02
MO-99	Not Detected	---------	5.40E-01
NA-22	Not Detected	---------	3.66E-02
NA-24	Not Detected	---------	1.56E+00
NB-95	Not Detected	---------	3.25E-01
ND-147	Not Detected	---------	2.43E-01
NI-57	Not Detected	---------	2.50E-01
NP-239	Not Detected	---------	1.33E-01
RU-103	Not Detected	---------	2.88E-02
RU-106	Not Detected	---------	2.62E-01
SB-122	Not Detected	---------	9.01E-02
SB-124	Not Detected	---------	2.80E-02
SB-125	Not Detected	---------	8.15E-02
SN-113	Not Detected	---------	3.67E-02
TA-182	Not Detected	---------	1.46E-01
TA-183	Not Detected	---------	6.50E-01
TC-99m	Not Detected	---------	5.15E+02
TL-201	Not Detected	---------	3.93E-01
XE-133	Not Detected	---------	4.35E-01
Y-88	Not Detected	---------	2.54E-02
ZN-65	Not Detected	---------	9.91E-02
ZR-95	Not Detected	---------	5.61E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-09-98 6:44:12 AM

Analyzed by: 10/9/98 Reviewed by: 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-051-SS
Lab Sample ID : 80209512

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 742.000 gram
Sample Date/Time : 10-05-98 3:10:00 PM
Acquire Start Date/Time : 10-09-98 5:01:23 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	1.04E+00	4.95E-01	5.71E-01
RA-226	Not Detected	---	5.57E-01
PB-214	7.75E-01	1.30E-01	4.17E-02
BI-214	7.09E-01	1.42E-01	4.30E-02
PB-210	Not Detected	---	3.37E+01
TH-232	8.91E-01	4.34E-01	1.41E-01
RA-228	8.83E-01	2.05E-01	1.39E-01
AC-228	8.96E-01	1.88E-01	7.59E-02
TH-228	9.23E-01	2.78E-01	4.58E-01
RA-224	8.44E-01	3.24E-01	6.26E-02
PB-212	7.89E-01	1.37E-01	3.79E-02
BI-212	7.73E-01	4.25E-01	2.87E-01
TL-208	7.09E-01	1.57E-01	6.14E-02
U-235	7.16E-02	7.80E-02	1.28E-01
TH-231	Not Detected	---	2.20E+00
PA-231	Not Detected	---	3.69E+00
TH-227	Not Detected	---	3.39E-01
RA-223	Not Detected	---	2.35E-01
RN-219	Not Detected	---	3.48E-01
PB-211	Not Detected	---	8.06E-01
TL-207	Not Detected	---	1.27E+01
AM-241	Not Detected	---	4.53E-01
PU-239	Not Detected	---	4.23E+02
NP-237	Not Detected	---	2.99E-01
PA-233	Not Detected	---	5.30E-02
TH-229	Not Detected	---	2.45E-01

[Summary Report] - Sample ID: : 80209512

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.78E-02
AG-110m	Not Detected	---------	3.14E-02
BA-133	Not Detected	---------	6.70E-02
BE-7	Not Detected	---------	2.45E-01
CD-109	~~1.92E+00~~	~~7.85E-01~~	1.02E+00
CD-115	Not Detected	---------	1.94E-01
CE-139	Not Detected	---------	2.88E-02
CE-141	Not Detected	---------	5.48E-02
CE-144	Not Detected	---------	2.31E-01
CO-56	Not Detected	---------	3.22E-02
CO-57	Not Detected	---------	2.91E-02
CO-58	Not Detected	---------	2.92E-02
CO-60	Not Detected	---------	2.83E-02
CR-51	Not Detected	---------	2.37E-01
CS-134	Not Detected	---------	4.63E-02
CS-137	3.06E-02	3.17E-02	1.99E-02
EU-152	Not Detected	---------	8.70E-02
EU-154	Not Detected	---------	1.75E-01
EU-155	Not Detected	---------	1.43E-01
FE-59	Not Detected	---------	6.47E-02
GD-153	Not Detected	---------	1.03E-01
HG-203	Not Detected	---------	3.09E-02
I-131	Not Detected	---------	3.50E-02
IR-192	Not Detected	---------	2.60E-02
K-40	1.26E+01	2.00E+00	3.49E-01
KR-85	Not Detected	---------	7.78E+00
MN-52	Not Detected	---------	4.25E-02
MN-54	Not Detected	---------	1.65E-02
MO-99	Not Detected	---------	5.37E-01
NA-22	Not Detected	---------	3.87E-02
NA-24	Not Detected	---------	1.71E+00
NB-95	Not Detected	---------	3.12E-01
ND-147	Not Detected	---------	2.37E-01
NI-57	Not Detected	---------	1.33E-01
NP-239	Not Detected	---------	1.27E-01
RU-103	Not Detected	---------	2.85E-02
RU-106	Not Detected	---------	2.52E-01
SB-122	Not Detected	---------	8.69E-02
SB-124	Not Detected	---------	2.80E-02
SB-125	Not Detected	---------	7.53E-02
SN-113	Not Detected	---------	3.59E-02
TA-182	Not Detected	---------	1.43E-01
TA-183	Not Detected	---------	6.31E-01
TC-99m	Not Detected	---------	6.13E+02
TL-201	Not Detected	---------	3.94E-01
XE-133	Not Detected	---------	4.28E-01
Y-88	Not Detected	---------	2.40E-02
ZN-65	Not Detected	---------	9.78E-02
ZR-95	Not Detected	---------	5.29E-02

Not detected
D 10/9/98

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-09-98 8:29:15 AM

Analyzed by: 10/9/98 Reviewed by: 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-052-SS
Lab Sample ID : 80209513

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 637.000 gram
Sample Date/Time : 10-05-98 3:15:00 PM
Acquire Start Date/Time : 10-09-98 6:46:30 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	7.89E-01	4.93E-01	6.12E-01
RA-226	1.53E+00	5.43E-01	5.83E-01
PB-214	8.12E-01	1.58E-01	4.77E-02
BI-214	7.03E-01	1.30E-01	4.26E-02
PB-210	Not Detected	---	3.69E+01
TH-232	8.79E-01	4.30E-01	1.44E-01
RA-228	8.46E-01	2.97E-01	1.44E-01
AC-228	Not Detected	---	7.99E-02
TH-228	9.49E-01	2.82E-01	5.18E-01
RA-224	9.64E-01	3.08E-01	7.90E-02
PB-212	8.37E-01	1.51E-01	4.08E-02
BI-212	Not Detected	---	3.28E-01
TL-208	7.44E-01	1.38E-01	7.05E-02
U-235	Not Detected	---	2.52E-01
TH-231	Not Detected	---	2.53E+00
PA-231	Not Detected	---	4.14E+00
TH-227	Not Detected	---	3.79E-01
RA-223	Not Detected	---	2.65E-01
RN-219	Not Detected	---	3.93E-01
PB-211	Not Detected	---	8.84E-01
TL-207	Not Detected	---	1.29E+01
AM-241	Not Detected	---	4.98E-01
PU-239	Not Detected	---	4.78E+02
NP-237	Not Detected	---	2.98E-01
PA-233	Not Detected	---	5.90E-02
TH-229	Not Detected	---	2.63E-01

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

[Summary Report] - Sample ID: : 80209513

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---	4.36E-02
AG-110m	Not Detected	---	3.68E-02
BA-133	Not Detected	---	7.31E-02
BE-7	Not Detected	---	2.71E-01
CD-109	Not Detected	---	1.01E+00
CD-115	Not Detected	---	2.21E-01
CE-139	Not Detected	---	3.09E-02
CE-141	Not Detected	---	6.10E-02
CE-144	Not Detected	---	2.54E-01
CO-56	Not Detected	---	3.65E-02
CO-57	Not Detected	---	3.27E-02
CO-58	Not Detected	---	3.36E-02
CO-60	Not Detected	---	3.81E-02
CR-51	Not Detected	---	2.57E-01
CS-134	Not Detected	---	5.01E-02
CS-137	3.58E-02	3.82E-02	2.23E-02
EU-152	Not Detected	---	9.78E-02
EU-154	Not Detected	---	2.00E-01
EU-155	Not Detected	---	1.56E-01
FE-59	Not Detected	---	6.91E-02
GD-153	Not Detected	---	1.11E-01
HG-203	Not Detected	---	3.47E-02
I-131	Not Detected	---	4.00E-02
IR-192	Not Detected	---	2.79E-02
K-40	1.35E+01	2.07E+00	4.00E-01
KR-85	Not Detected	---	8.91E+00
MN-52	Not Detected	---	4.38E-02
MN-54	Not Detected	---	3.69E-02
MO-99	Not Detected	---	6.07E-01
NA-22	Not Detected	---	4.15E-02
NA-24	Not Detected	---	1.81E+00
NB-95	Not Detected	---	3.53E-01
ND-147	Not Detected	---	2.57E-01
NI-57	Not Detected	---	1.43E-01
NP-239	Not Detected	---	1.39E-01
RU-103	Not Detected	---	3.05E-02
RU-106	Not Detected	---	2.88E-01
SB-122	Not Detected	---	6.56E-02
SB-124	Not Detected	---	3.07E-02
SB-125	Not Detected	---	8.37E-02
SN-113	Not Detected	---	3.92E-02
TA-182	Not Detected	---	1.61E-01
TA-183	Not Detected	---	7.04E-01
TC-99m	Not Detected	---	8.31E+02
TL-201	Not Detected	---	4.40E-01
XE-133	Not Detected	---	4.74E-01
Y-88	Not Detected	---	2.74E-02
ZN-65	Not Detected	---	1.07E-01
ZR-95	Not Detected	---	6.12E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-09-98 10:14:09 AM

Analyzed by: 10/9/98 Reviewed by:

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-053-SS
Lab Sample ID : 80209514

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 741.000 gram
Sample Date/Time : 10-05-98 3:25:00 PM
Acquire Start Date/Time : 10-09-98 8:31:23 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	7.27E-01	4.31E-01	5.99E-01
RA-226	Not Detected	---	4.98E-01
PB-214	7.57E-01	1.41E-01	4.37E-02
BI-214	6.86E-01	1.42E-01	4.08E-02
PB-210	Not Detected	---	3.47E+01
TH-232	8.12E-01	4.18E-01	1.30E-01
RA-228	8.22E-01	2.04E-01	1.30E-01
AC-228	9.40E-01	2.28E-01	7.56E-02
TH-228	8.43E-01	2.53E-01	4.73E-01
RA-224	8.59E-01	2.77E-01	7.21E-02
PB-212	Not Detected	---	3.98E-02
BI-212	8.98E-01	5.03E-01	2.88E-01
TL-208	8.24E-01	1.59E-01	6.47E-02
U-235	8.86E-02	1.40E-02	9.10E-02
TH-231	Not Detected	---	2.24E+00
PA-231	Not Detected	---	3.72E+00
TH-227	Not Detected	---	3.56E-01
RA-223	Not Detected	---	2.43E-01
RN-219	Not Detected	---	3.72E-01
PB-211	Not Detected	---	8.33E-01
TL-207	Not Detected	---	1.25E+01
AM-241	Not Detected	---	4.73E-01
PU-239	Not Detected	---	4.43E+02
NP-237	Not Detected	---	2.93E-01
PA-233	Not Detected	---	5.56E-02
TH-229	Not Detected	---	2.45E-01

[Summary Report] - Sample ID: : 80209514

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.86E-02
AG-110m	Not Detected	---------	3.25E-02
BA-133	Not Detected	---------	6.62E-02
BE-7	Not Detected	---------	2.42E-01
CD-109	~~1.76E+00~~	~~6.20E-01~~	9.99E-01 Not detected 10/9/98
CD-115	Not Detected	---------	2.05E-01
CE-139	Not Detected	---------	2.94E-02
CE-141	Not Detected	---------	5.46E-02
CE-144	Not Detected	---------	2.37E-01
CO-56	Not Detected	---------	3.22E-02
CO-57	Not Detected	---------	3.02E-02
CO-58	Not Detected	---------	2.98E-02
CO-60	Not Detected	---------	3.62E-02
CR-51	Not Detected	---------	2.40E-01
CS-134	Not Detected	---------	4.65E-02
CS-137	3.76E-02	1.94E-02	1.83E-02
EU-152	Not Detected	---------	9.03E-02
EU-154	Not Detected	---------	1.78E-01
EU-155	Not Detected	---------	1.49E-01
FE-59	Not Detected	---------	6.63E-02
GD-153	Not Detected	---------	1.04E-01
HG-203	Not Detected	---------	3.16E-02
I-131	Not Detected	---------	3.69E-02
IR-192	Not Detected	---------	2.66E-02
K-40	1.44E+01	3.01E+00	3.51E-01
KR-85	Not Detected	---------	7.98E+00
MN-52	Not Detected	---------	4.12E-02
MN-54	Not Detected	---------	3.28E-02
MO-99	Not Detected	---------	5.35E-01
NA-22	Not Detected	---------	3.85E-02
NA-24	Not Detected	---------	1.95E+00
NB-95	Not Detected	---------	3.36E-01
ND-147	Not Detected	---------	2.35E-01
NI-57	Not Detected	---------	2.50E-01
NP-239	Not Detected	---------	1.34E-01
RU-103	Not Detected	---------	2.84E-02
RU-106	Not Detected	---------	2.57E-01
SB-122	Not Detected	---------	9.80E-02
SB-124	Not Detected	---------	2.83E-02
SB-125	Not Detected	---------	7.85E-02
SN-113	Not Detected	---------	3.71E-02
TA-182	Not Detected	---------	1.47E-01
TA-183	Not Detected	---------	6.67E-01
TC-99m	Not Detected	---------	8.56E+02
TL-201	Not Detected	---------	4.15E-01
XE-133	Not Detected	---------	4.55E-01
Y-88	Not Detected	---------	2.38E-02
ZN-65	Not Detected	---------	1.01E-01
ZR-95	Not Detected	---------	5.34E-02

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-09-98 11:59:05 AM

* Analyzed by: 10/9/98 Reviewed by: 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : CY81C-GR-054-SS
Lab Sample ID : 80209515

Sample Description : MARINELLI SOLID SAMPLE
Sample Quantity : 798.000 gram
Sample Date/Time : 10-05-98 3:30:00 PM
Acquire Start Date/Time : 10-09-98 10:16:17 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	6.39E-01	5.45E-01	5.27E-01
RA-226	1.72E+00	4.81E-01	4.54E-01
PB-214	7.13E-01	1.18E-01	3.92E-02
BI-214	5.92E-01	1.11E-01	3.32E-02
PB-210	Not Detected	---	3.11E+01
TH-232	7.05E-01	3.42E-01	1.21E-01
RA-228	7.38E-01	2.00E-01	1.26E-01
AC-228	7.25E-01	1.60E-01	6.82E-02
TH-228	7.03E-01	2.18E-01	4.14E-01
RA-224	7.64E-01	2.48E-01	5.25E-02
PB-212	6.98E-01	1.24E-01	3.42E-02
BI-212	7.71E-01	3.01E-01	2.81E-01
TL-208	6.53E-01	5.46E-01	5.79E-02
U-235	Not Detected	---	2.01E-01
TH-231	Not Detected	---	1.97E+00
PA-231	Not Detected	---	3.36E+00
TH-227	Not Detected	---	3.08E-01
RA-223	Not Detected	---	2.21E-01
RN-219	Not Detected	---	3.32E-01
PB-211	Not Detected	---	7.39E-01
TL-207	Not Detected	---	1.09E+01
AM-241	Not Detected	---	4.29E-01
PU-239	Not Detected	---	3.98E+02
NP-237	Not Detected	---	3.48E-01
PA-233	Not Detected	---	4.95E-02
TH-229	Not Detected	---	2.19E-01

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

[Summary Report] - Sample ID: : 80209515

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.37E-02
AG-110m	Not Detected	---------	3.03E-02
BA-133	Not Detected	---------	6.24E-02
BE-7	Not Detected	---------	2.25E-01
CD-109	~~1.47E+00~~	~~5.40E-01~~	8.60E-01
CD-115	Not Detected	---------	1.86E-01
CE-139	Not Detected	---------	2.70E-02
CE-141	Not Detected	---------	4.92E-02
CE-144	Not Detected	---------	2.18E-01
CO-56	Not Detected	---------	2.95E-02
CO-57	Not Detected	---------	2.72E-02
CO-58	Not Detected	---------	2.78E-02
CO-60	Not Detected	---------	2.79E-02
CR-51	Not Detected	---------	2.18E-01
CS-134	Not Detected	---------	4.14E-02
CS-137	3.94E-02	2.91E-02	1.82E-02
EU-152	Not Detected	---------	8.13E-02
EU-154	Not Detected	---------	1.55E-01
EU-155	Not Detected	---------	1.30E-01
FE-59	Not Detected	---------	6.13E-02
GD-153	Not Detected	---------	9.24E-02
HG-203	Not Detected	---------	2.91E-02
I-131	Not Detected	---------	3.51E-02
IR-192	Not Detected	---------	2.40E-02
K-40	1.13E+01	1.73E+00	3.28E-01
KR-85	Not Detected	---------	7.11E+00
MN-52	Not Detected	---------	4.18E-02
MN-54	Not Detected	---------	2.97E-02
MO-99	Not Detected	---------	5.30E-01
NA-22	Not Detected	---------	3.37E-02
NA-24	Not Detected	---------	1.83E+00
NB-95	Not Detected	---------	2.94E-01
ND-147	Not Detected	---------	2.17E-01
NI-57	Not Detected	---------	2.45E-01
NP-239	Not Detected	---------	1.18E-01
RU-103	Not Detected	---------	2.50E-02
RU-106	Not Detected	---------	2.55E-01
SB-122	Not Detected	---------	8.65E-02
SB-124	Not Detected	---------	2.58E-02
SB-125	Not Detected	---------	6.69E-02
SN-113	Not Detected	---------	3.27E-02
TA-182	Not Detected	---------	1.32E-01
TA-183	Not Detected	---------	6.15E-01
TC-99m	Not Detected	---------	9.69E+02
TL-201	Not Detected	---------	3.85E-01
XE-133	Not Detected	---------	4.24E-01
Y-88	Not Detected	---------	2.23E-02
ZN-65	Not Detected	---------	8.88E-02
ZR-95	Not Detected	---------	4.93E-02

not detected
10/5/98

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
10-09-98 12:51:44 PM

Analyzed by: 10/9/98 Reviewed by: 10/9/98

Customer : P.FRESHOUR/D.PERRY (6134/SMO)
Customer Sample ID : LAB CONTROL SAMPLE USING CG134
Lab Sample ID : 80209516

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 : 10-09-98 12:39:50 PM
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	---	4.48E+03
RA-226	Not Detected	---	6.12E+03
PB-214	Not Detected	---	7.16E+02
BI-214	Not Detected	---	6.33E+02
PB-210	Not Detected	---	2.63E+05
TH-232	Not Detected	---	2.26E+03
RA-228	Not Detected	---	2.61E+03
AC-228	Not Detected	---	1.50E+03
TH-228	Not Detected	---	1.21E+05
RA-224	Not Detected	---	3.66E+03
PB-212	Not Detected	---	8.78E+03
BI-212	Not Detected	---	7.73E+04
TL-208	Not Detected	---	1.65E+04
U-235	Not Detected	---	1.73E+03
TH-231	Not Detected	---	2.06E+04
PA-231	Not Detected	---	3.50E+04
TH-227	Not Detected	---	2.49E+03
RA-223	Not Detected	---	1.00E+26
RN-219	Not Detected	---	5.82E+03
PB-211	Not Detected	---	1.30E+04
TL-207	Not Detected	---	2.19E+05
AM-241	8.15E+04	1.46E+04	3.20E+03
PU-239	Not Detected	---	3.11E+06
NP-237	Not Detected	---	2.34E+03
PA-233	Not Detected	---	6.15E+02
TH-229	Not Detected	---	1.75E+03

[Summary Report] - Sample ID: : 80209516

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
AG-108m	Not Detected	---------	3.26E+02
AG-110m	Not Detected	---------	5.19E+06
BA-133	Not Detected	---------	7.42E+02
BE-7	Not Detected	---------	8.19E+19
CD-109	Not Detected	---------	5.87E+05
CD-115	Not Detected	---------	1.00E+26
CE-139	Not Detected	---------	4.98E+08
CE-141	Not Detected	---------	1.00E+26
CE-144	Not Detected	---------	2.05E+06
CO-56	Not Detected	---------	7.52E+13
CO-57	Not Detected	---------	3.58E+05
CO-58	Not Detected	---------	6.80E+14
CO-60	7.93E+04	1.47E+04	4.32E+02
CR-51	Not Detected	---------	1.00E+26
CS-134	Not Detected	---------	4.11E+03
CS-137	7.21E+04	1.12E+04	2.76E+02
EU-152	Not Detected	---------	9.98E+02
EU-154	Not Detected	---------	2.73E+03
EU-155	Not Detected	---------	3.34E+03
FE-59	Not Detected	---------	3.24E+22
GD-153	Not Detected	---------	2.95E+06
HG-203	Not Detected	---------	1.60E+21
I-131	Not Detected	---------	1.00E+26
IR-192	Not Detected	---------	1.91E+14
K-40	Not Detected	---------	1.62E+03
KR-85	Not Detected	---------	1.19E+05
MN-52	Not Detected	---------	1.00E+26
MN-54	Not Detected	---------	2.16E+05
MO-99	Not Detected	---------	1.00E+26
NA-22	Not Detected	---------	1.77E+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	---------	9.25E+02
RU-103	Not Detected	---------	1.00E+26
RU-106	Not Detected	---------	6.83E+05
SB-122	Not Detected	---------	1.00E+26
SB-124	Not Detected	---------	8.95E+16
SB-125	Not Detected	---------	8.10E+03
SN-113	Not Detected	---------	1.68E+10
TA-182	Not Detected	---------	4.43E+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	---------	2.22E+10
ZN-65	Not Detected	---------	3.16E+06
ZR-95	Not Detected	---------	2.37E+16

****

* Sandia National Laboratories *

* Radiation Protection Sample Diagnostics Program *

* Quality Assurance Report *

****

Report Date : 10-09-98 12:52:24 PM
QA File : C:\GENIEPC\CAMFILES\LCS2.QAF
Analyst : FCD
Sample ID : 80209516
Sample Quantity : 1.00 Each
Sample Date : 11-01-90 12:00:00 PM
Measurement Date : 10-09-98 12:39:50 PM
Elapsed Live Time : 600 seconds
Elapsed Real Time : 605 seconds

Parameter	Mean	1S Error	New Value	< LU	SD	UD	BS >
AM-241 Activity	8.216E-02	4.219E-03	8.152E-02	<	:	:	: >
CS-137 Activity	7.046E-02	2.021E-03	7.206E-02	<	:	:	: >
CO-60 Activity	7.839E-02	2.204E-03	7.926E-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: 10/9/98

ANNEX 3-C
Level 3 Validation of Off-Site Laboratory Results

Site: BIC

3-11-99

AR/COC: 600789 Data Classification: organics

Sample Fraction No.	Analysis & Test	DV Qualifiers	MS Recoveries from Field Samples ND → Comments
CY BIC-GR-022-SS	1,1 dichloroethene (75-35-4) Benzene (71-43-2)	UJ	outside recovery limits for VOC matrix spike, Field Samples ND.
023-SS, 023-SD			
024-SS, 025-SS, 025-DU			
026-S (Soil Fld)			
027-S (Soil Fld)			
028-S (Soil Fld)			
029-S (Soil Fld)			
030-S (Soil Fld)			
031-S (Soil Fld)			
032-SC (Soil Fld)			
033-S (Soil Fld)			
034-S (Soil Fld)			
035-S (Soil Fld)			
036-S (Soil Fld)			
037-S (Soil Fld)			
038-S (Soil Fld)			
039-S (Soil Fld)			
040-S (Soil Fld)			
CY BIC-GR-002-EB			
" " 002-TB			
CY BIC-GR-002-EB	E7-86-5 Pentachlorophenol	UJ	RPD above acceptance limits Sample results qualified UJ, Analyte concentration. UJ ND in all Field Samples.
CY BIC-GR-022-SS	Methylene chloride (75-09-02)	9.2(4)	Methylene chloride and chloroform (detected in some VOC blanks) Data qualified
-023SS	Chloroform (67-66-3)	1.4(4)	
	Chloroform (67-66-3)	1.4(4)	

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, EPA7470T, EPA8015B, EPA8081, EPA8260, EPA8260-M3, EPA8270, HACH_ALK, HACH_NO2, HACH_NO3, MEKC_HE, PCBRISC

Reviewed by: E Tal Montes Date: 2/1/99

Site: BIC

AR/COC: 600787

Data Classification: organics (continued)

Sample Fraction No.	Analysis	DV Qualifiers	Comments
BIC-ER-023-DJ	methylene chloride (75-09-02) chloroform (67-66-03)	5.42'(4) 1.18(4)	methylene chloride and chloroform detected in some VOC blanks. Data qualified.
-024-SS		5.18(4) 1.04(4)	
025 SS		5.24(4) 1.04(4)	
025 DJ		5.45(4) —	
27-SS (soil pile)		5.24(4) —	
28-SS		7.24(4) —	
29-SS		7.24(4) —	
30-SS		5.41(4) —	
31-SS		5.3(4) —	
32-SS		5.42(4) —	
33-SS		5.37(4) —	

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: E Ted Monks Date: 2/1/99

Site: BIC

ETM 3-11-99

AR/COC: 600789 Data Classification: Organics (continued)

Sample Fraction No.	Analysis	DV Qualifiers	Comments
CY BIC-GR = 034-55	methylene chloride (75-09-2) chloroform (67-66-3)	5.2(4) —	methylene chloride and chloroform detected in some VOC blanks. Data qualified.
35-55		5.2(4) 1.05(4)	
36-55		5.49(4) 1.106(4)	
37-55		5.04(4) 1.01(4)	
38-55		5.36(4) —	
39-55		1.09(4) 5.464(4)	
40-55		1.09(4) 5.45(4)	
	Data	is acceptable	
	QC measures	appear to be	
	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: E Tod Martin Date: 2/1/99

Site: BIC

AR/COC: 660789 Data Classification: Inorganics

Sample Fraction No.	Analysis	DV Qualifiers	Comments
CYBIC-GR-625-D	7782-49-2 selenium	.698J	Blank Concentration > IDL, CRL Sample concentration < 5x blank concentration. Qualify J.
	Data	IS	Acceptable
	QC Measures		Appear to be
	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'I, EPA8015B. EPA8081. EPA8260. EPA8260-M3. EPA8270. HACH_ALK. HACH_ NO2. HACH_NO3. MEKC_HE. PCBRISC

Reviewed by: ETD Member Date: 2-1-99

Site: 81C

organics
correct
3-4-99

AR/COC: 600789

Data Classification: ~~HE~~ ETM

Sample Fraction No.	Analysis	DV Qualifiers	Comments
ETM ~~042418-003/~~ 3-4-99 CY81C-GA-002-EB	~~EPA~~ HE 8330	UJ	Hold Time exceeded for sample Extraction within ~~hold time~~
" ↓ "	m-dinitrobenzene 528-29-0	.15 ~~J~~ J	Positive result for analyte in sample which exceeded hold time
	Data	is	Acceptable
	QC measures	Appear	to be
	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: E Todd Monk Date: 2-1-99

Site: 81 C (SEE CONTROL COPY) ETW

AR/COC: 600789 Data Classification: VOC SVOC's 5-11-99

Sample Fraction No.	Analysis	DV Qualifiers	Comments
Voc Samples	Benzene 71-43-2	UJ	outside recovery limits for voc matrix spike
VOC Samples	1,1 dichloroethene 75-35-4	UJ	Recoveries were lower than lower acceptance limits
			Samples were non detect Qualify results UJ
042398-001/CY81C GR22455 ethers 23, 23N, 24, 34, 40	75-09-2 (methylene chloride)	4	methylene Chloride, chloroform, xylenes detected in VOC blanks, Xylene ND in all samples. Reports (4)
" "	67-66-3 (Chloroform)	4	
042403-001/CY81-GR-02504 ethers 25, 27, 28-34, 38	75-09-02 (methylene chloride)	4	" " 5-11-99 "
" "	67-66-03 (Chloroform)	4	(")
042403-001/CY81CGR24455	(75-09-02) methylene chloride	4	" "
" "	(67-66-03) Chloroform	4	
SVOC's ↓ SVOC Samples Batch 152304	87-86-5 Pentachlorophenol	UJ	RPD above acceptance limits. Samples results qualified "UJ". Analyte is ND in all samples.
	Data	Is	Acceptable

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, EPA7470T, EPA8015B, EPA8081, EPA8260, EPA8260-MS, EPA8270, HACH_ALK, HACH_NO2, HACH_NO3, MEKC_HE, PCBRISC

Reviewed by: E Tod Mowbray Date: 2/1/99

Site: 81C

AR/COC: 600789 Data Classification: Inorganics

Sample Fraction No.	Analysis	DV Qualifiers	Comments
~~024403-001~~ CY81C-GR-025-04	7782-49-2 (Selenium)	.698 J	Blank conc > IDL. Sample conc < 5x blank conc. Qualify "J"
~~Inorganics Samples~~	~~Cadmium 7440-43-9~~	~~.570J~~	IB
Inorganics Samples	(Selenium) 7782-49-2	.3685	Blank conc > IDL Sample conc < 5x blank conc. Qualify detects "J"
Inorganics Samples	(mercury) 7439-97-6	.034J	
ETM 3-11-99	Data	Is	Acceptable
	QC	Measures	Appear
	to	be	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'I, EPA8015B, EPA8081, EPA8260, EPA8260-M5, EPA8270, HACH_ALK, HACH_NO2, HACH_NO3, MEKC_HE, PCBRISC

Reviewed by: ET Sanchez Date: 2-1-99

Site: 81C

Lab Report/AR/COC: 9809878/600789 Data Classification: Radiometrics (GAB)

Sample Fraction No.	Analysis	DV Qualifiers	Comments
	No Data Were Qualified		
	Data	Is	Acceptable
	QC Measures		Appear to be
	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: E Tod Mortensen Date: 2-1-99

MEMORANDUM

DATE: February 2, 1999

TO: File

FROM: Tod Monks TM

SUBJECT: Organic Data Review and Validation
Site 81-C, ARCOC No. 600789, Case No. 7214.2213

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 (HE – EPA8330, EPA8260A, and EPA8270). All compounds were successfully analyzed. Problems identified with the organics methods listed above that resulted in the qualification of data are presented below.

HE - EPA8330

1. The equipment blank (CY81C-GR-002-EB) hold time had expired. The seven day sample holding time was exceeded. The extraction holding time was met. All non-detect sample results were qualified "UJ" and the estimated values were qualified "J". EPM 3-11-99 No analytes were detected in field samples with exception of m-Dinitrobenzene which was qualified J. EPM 3-11-99

Data is acceptable.

VOCs - EPA8260A

1. Continuing calibration met criteria except for 2-hexanone, tetrachloroethene, and 1,1, 2,2 tetrachloroethane. The relative percent difference was slightly high. Analytes were non-detect in samples. No data were qualified.

2. Target analytes including methylene chloride, chloroform, and xylenes were detected in many VOC blanks. All detected sample results were qualified "U". Methylene chloride which is a common laboratory contaminant and chloroform were detected in some samples. Xylenes were non-detect in all samples.

3. MS/MSD percent recovery met acceptance criteria except for all analytes except 1,1 dichloroethylene and benzene which were outside the recovery limits for the VOC matrix spike. The recoveries were lower than the lower acceptance limits and the samples were non-detect. Sample results ~~from the affected batch (132304)~~ were qualified UJ. EPM 3-11-99

SVOCs - EPA8270

1. The LCSD RPD for the target analyte pentachlorophenol was above the acceptance criteria of 20%. The analyte was non-detect in all samples. All associated non-detect results were qualified "UJ".

Data is acceptable. QC measures appear to be adequate.

The following sections discuss the data review and validation.

Holding Times

The samples were extracted and analyzed within the prescribed holding times except as noted above.

Calibration

Initial and continuing calibration met acceptance criteria except as noted above.

Blanks

No target analytes were detected above the reporting limit in the method blanks.

Surrogates

The surrogate data met acceptance limits for site samples.

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

The MS/MSD met acceptance criteria except where noted above.

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

The LCS/LCSDs for the site samples met acceptance criteria except where noted above.

Other QC

No HE target analytes were detected in the equipment blank except for one compound (dinitrobenzene) observed at estimated values ("J" coded). The estimated value of dinitrobenzene was qualified U. Dinitrobenzene was not detected in any of the sample locations.

The LCS/LCSD met criteria for percent recovery except for the target analyte 4-Nitrophenol which was above the acceptance criteria level for the LCS. The analyte was non-detect in all samples. No data were qualified.

Data is acceptable. QC measures appear to be adequate.

No other specific issues were identified which affect data quality.

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

MEMORANDUM

DATE: February 2, 1999

TO: File

FROM: Tod Monks TM

SUBJECT: Radiometric Data Review and Validation
Site 81-C, ARCOC No. 600789, Case No. 7214.2213

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 – EPA900.0). All compounds were successfully analyzed. No problems were identified with the data package that result in the qualification of data. Data is acceptable and QC measures appear to be adequate.

The following sections discuss the data review and validation.

Holding Times

The samples were analyzed within the prescribed holding times.

Calibration

Calibration met acceptance criteria for the method.

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

The LCS/LCSD met acceptance criteria for the method.

Blanks

No target analytes were detected above the reporting limits in the method blank.

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

The MS/MSD met acceptance criteria for the method.

Duplicate

The duplicate error ratio (DER) met acceptance criteria (< 1.0) for gross alpha and gross beta.

Other QC

No data were qualified. Data is acceptable. QC measures appear to be acceptable.

No other specific issues were identified which affect data quality.

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

Site: 81 C

corrected 2/... 3-11-99

AR/COC: 600787

Data Classification: organics (continued)

Sample Fraction No.	Analysis	DV Qualifiers	Comments
C4 81C-GR-023-DU	methylene chloride (75-09-02) chloroform (67-66-03)	5.42(4) 1.18(4)	methylene chloride and chloroform detected in some VOC blanks. Data qualified.
-024-SS		5.18(4) 1.04(4)	
025 SS		5.24(4) 1.04(4)	
025 DU		5.45(4) —	
27-SS	(soil pile)	5.24(4) —	
28-SS		7.24(4) —	
29-SS		7.24(4) —	
30-SS		5.41(4) —	
31-SS		5.3(4) —	
32-SS		5.42(4) —	
33-SS		5.37(4) —	

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: E Ted Monks   Date: 2/1/99

Site: EIC

Corrected 3-11-99

AR/COC: 600789 Data Classification: organics

Sample Fraction No.	Analysis	DV Qualifiers	Comments
CYEIC-GR-022SS, 023SS, 023DW	1,1 dichloroethene (75-35-4) Benzene (71-43-2)	UJ	MS Recoveries low. Field Samples ND → outside recovery limits for VOC matrix spike. Field Samples ND.
024SS, 025SS, 025DW	↓	↓	↓
026-S (Soil Pile), 027-S (Soil Pile), 028-S (Soil Pile)	↓	↓	↓
029-S (Soil Pile), 030-S (Soil Pile), 031-S (Soil Pile)	↓	↓	↓
032-S (Soil Pile), 033-S (Soil Pile), 034-S (Soil Pile)	↓	↓	↓
035-S (Soil Pile), 036-S (Soil Pile), 037-S (Soil Pile)	↓	↓	↓
038-S (Soil Pile), 039-S (Soil Pile), 040-S (Soil Pile)	↓	↓	↓
CYEIC-GR-001-EB, " " 002-TB	↓	↓	↓
CYEIC-GR-002-EB	87-86-5 Pentachlorophenol	UJ	RPD above acceptance limits. Sample results qualified UJ. Analyte concentration is ND in all Field Samples.
CYEIC-GR-022-SS	Methylene chloride (75-09-02) Chloroform (67-66-03)	7.2U(4) 1.4U(4)	Methylene chloride and chloroform detected in some VOC blanks) Data qualified
↓ -023SS	Chloroform (67-66-03)	— 1.4U(4)	↓

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: E Tal Montes Date: 2/1/99

DATA VALIDATION SUMMARY:

SITE/PROJECT: 81 C CASE #: 7214 2213
ARCOC #: 600789
LABORATORY: GEL
LABORATORY REPORT #: 9809 878

OF SAMPLES: 63 5 MATRIX: 5.1 Aqueous
LAB SAMPLE IDs: See ARCOC

ANALYSIS/ QC ELEMENT	VOC	SVOC	PEST/ PCB	HPLC (HE)	ICP/AES	GFAA/ AA	CVAA (Hg)	CN	RAD	OTHER
1. HOLDING TIMES/ PRESERVATION	✓	✓	NA	UJ, J	✓	NA	~~✓~~	NA	✓	NA
2. CALIBRATIONS	UJ	✓		✓	✓		✓		✓	
3. METHOD BLANKS	U	✓		~~UJ~~	J		J		✓	
4. MS/MSD	UJ	✓		✓ J 11-95 ✓			✓		✓	
5. LABORATORY CONTROL SAMPLES	✓	UJ		✓	✓		✓		✓	
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									✓	
13. OTHER QC	✓		↓	✓		↓		↓	✓	↓

CHECK MARK (√) – ACCEPTABLE
J – ESTIMATED
U – NOT DETECTED

SHADED CELLS – NOT APPLICABLE
UJ – NOT DETECTED. ESTIMATED
R – UNUSABLE

REVIEWED BY: E Ted Mooka DATE: 2/1/99

SW846 Method 8330

Samples:

Number 1 Matrix: Water Number 21 Matrix: Soil

QC BLK Eq/Trip

Name	CAS #	CCV RPD	PB	Field blank	Field Dup	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Curve R^2
		15%	U	U				20%	25%	25%	20%	.995
HMX	2691-41-0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
RDX	121-82-4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
1,2,3-Trinitrobenzene	99-35-4											
1,3-dinitrobenzene	99-64-0	✓	✓	.15 ✓	✓	✓	✓	✓	✓	✓	✓	✓
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	1946-51-0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
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											

Sample	SMC % rec	SMC RT	Sample	SMC % rec	SMC RT
		not Criteria			

Conformation

Sample	CAS #	% diff > 25%	Sample	CAS #	% diff > 25%
		2% Conformation necessary			

* # Hold Time exceeded for explosive, sample # 9805878-63 (542418-003) UJ - entire sample which have ND results.

J code dinitrobenzene in EB

Batch 133375 8/21/98 Blank Conc .15 DL .02 RL .104

SW-846 - Method 8260

Samples:

Number 21 Matrix: Soil Number 2 Matrix: DI Water

IS	GC/MS		Min RF	Int	Calib RSD 20% ✓	Calib RF >.05 ✓	CCV RPD 20%	CCV RF >.05	CCB PB	Field Blank	Field Dup (EB/TB)	MS	MSD	MS RPD	LCS ✓	LCSD ✓	LCS RPD ✓
	Name	CAS #															
1	Chloromethane	74-87-3	0.10														
1	Bromomethane	74-83-9	0.10														
1	vinyl chloride	75-01-4	0.10														
1	Chloroethane	75-00-3	0.01														
1	methylene chloride (10xblk)	75-09-2	0.01						J, UJ		J						
1	acetone(10xblk)	67-64-1	0.01														
1	carbon disulfide	75-15-0	0.10														
1	1,1-dichloroethene	75-35-4	0.20									83.3	✓	✓			
1	1,1-dichloroethane	75-34-3	0.10														
1	Chloroform	67-66-3	0.20						J, UJ	.83/✓	J, UJ						
1	1,2-dichloroethane	107-06-2	0.10														
1	2-butanone(10xblk)	78-93-3	0.01														
2	1,1,1-trichloroethane	71-55-6	0.10														
2	carbon tetrachloride	56-23-5	0.10														
2	Bromodichloromethane	75-27-4	0.20														
2	1,2-dichloropropane	78-87-5	0.01														
2	cis-1,3-dichloropropene	10061-01-5	0.20														
2	Trichloroethene	79-01-6	0.30														
2	Dibromochloromethane	124-48-1	0.10									✓	✓	✓			
2	1,1,2-trichloroethane	79-00-5	0.10														
2	Benzene	71-43-2	0.50									72.1					
2	trans-1,3-dichloropropene	10061-02-6	0.10									72.1	✓	✓			
2	Bromoform	75-25-2	0.10				✓					67m					
3	4-methyl-2-pentanone	108-10-1	0.10				26.3										
3	2-hexanone	591-78-6	0.01				23.1										
3	Tetrachloroethene	127-18-4	0.20				27.3										
3	1,1,2,2-tetrachloroethane	79-34-5	0.30														
3	toluene(10xblk)	108-88-3	0.40									✓	✓	✓			
3	Chlorobenzene	108-90-7	0.50									✓	✓	✓			
3	Ethylbenzene	100-41-4	0.10														
3	Styrene	100-42-5	0.30														
3	xylenes(total)	1330-20-7	0.30						UJ		UJ						
	1,2-dichloroethylene(total)	540-59-0	0.01														

* methylene chloride, chloroform, xylenes detected in many VOC blanks.

* VOC matrix spike outside recovery limits for VOC MS/MSD for 1,1 Dichloroethylene and Benzene

* See Sample Findings Summary

Env * No data qualified due to low matrix spike recoveries. Within (70-130 na

* No data qualified due to RPD exceedance. Analyte results are ND.

3-11-99

Surrogate Recovery and Internal Standard Outliers

Sample	SMC 1	SMC 2	SMC 3	IS 1-area	IS 1-RT	IS 2-area	IS 2-RT	IS 3- area	IS 3- RT

Met criteria

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

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

SW 846 - Method 8270 : page 2

QC BLK — Eq/Trip

IS	CAS #	NAME	Min RF	Int	Calib RSD/slope	Calib RF/slope	CCV RPD/RF	CCV RF	CCB	Field blank	Field Dup	MS	MSD	MSD RPD	LCS	LCSD	LCS RPD
3	91-58-7	2-Chloronaphthalene	0.80	/			✓		✓	✓	✓						
3	88-74-4	2-Nitroaniline	0.01														
3	131-11-3	Dimethylphthalate	0.01														
3	208-96-8	Acenaphthylene	0.90														
3	606-20-2	2,6-Dinitrotoluene	0.20														
3	99-09-2	3-Nitroaniline	0.01														
3	83-32-9	Acenaphthene	0.90									✓	✓	✓	✓	✓	✓
3	51-28-5	2,4-Dinitrophenol	0.01									✓	✓	✓		✓	✓
3	100-02-7	4-Nitrophenol	0.01									✓	✓	✓	137	✓	✓
3	132-64-9	Dibenzofuran	0.80														
3	121-14-2	2,4-Dinitrotoluene	0.20														
3	84-66-2	Diethylphthalate	0.01														
3	7005-72-3	4-Chlorophenyl-phenylether	0.40														
3	86-73-7	Fluorene	0.90														
3	100-01-6	4-Nitroaniline	0.01														
4	534-52-1	4,6-Dinitro-2-methylphenol	0.01														
4	86-30-6	N-Nitrosodiphenylamine (1)	0.01														
4	101-55-3	4-Bromophenyl-phenylether	0.10														
4	118-74-1	Hexachlorobenzene	0.10														
4	87-86-5	Pentachlorophenol	0.05									✓	✓	✓	✓	✓	40.4
4	85-01-8	Phenanthrene	0.70														
4	120-12-7	Anthracene	0.70														
4	86-74-8	Carbazole	0.01														
4	84-74-2	Di-n-butylphthalate	0.01														
4	206-44-0	Fluoranthene	0.60														
5	129-00-0	Pyrene	0.60									✓	✓	✓	✓	✓	✓
5	85-68-7	Butylbenzylphthalate	0.01														
5	91-94-1	3,3'-Dichlorobenzidine	0.01														
5	56-55-3	Benzo(a)anthracene	0.80	↓	↓	↓	↓		↓	↓	↓						

* VOC narrative incorrectly states that MS/MSD RPD for 4-N-Nitrophenol is outside QC Limits.
* No data qualified due to elevated LCS recovery of 4-Nitrophenol. Analyte results are ND.
* Results for Pentachlorophenol qualified UJ.

SW-846 - Method 8270

Samples:

Number 21 Matrix: Soil Number 1 Matrix: Water Eq/Trip

IS	CAS#	Name	Min RF	Int	Calib RSD/Slope	Calib RF/Slope	CCV RPD/LF	CCB	Field Blank:	Field Dup	MS	MSD	MSD RPD	LCS	LCSD	LCS RPD
1	108-95-2	Phenol	0.80								✓	✓	✓	✓	✓	✓
1	111-44-4	bis(2-Chloroethyl)ether	0.70													
1	95-57-8	2-Chlorophenol	0.80								✓	✓	✓	✓	✓	✓
1	541-73-1	1,3-Dichlorobenzene	0.60													
1	106-46-7	1,4-Dichlorobenzene	0.50								✓	✓	✓	✓	✓	✓
1	95-50-1	1,2-Dichlorobenzene	0.40													
1	95-48-7	2-Methylphenol	0.70													
1	108-60-1	2,2'-oxybis(1-Chloropropane)	0.01													
1	106-44-5	4-Methylphenol	0.60													
1	621-64-7	N-Nitroso-di-n-propylamine	0.50								✓	✓	✓	✓	✓	✓
1	67-72-1	Hexachloroethane	0.30													
2	98-95-3	Nitrobenzene	0.20													
2	78-59-1	Isophorone	0.40													
2	88-75-5	2-Nitrophenol	0.10													
2	105-67-9	2,4-Dimethylphenol	0.20													
2	111-91-1	bis(2-Chloroethoxy)methane	0.30													
2	120-83-2	2,4-Dichlorophenol	0.20													
2	120-82-1	1,2,4-Trichlorobenzene	0.20								✓	✓	✓	✓	✓	✓
2	91-20-3	Naphthalene	0.70													
2	106-47-8	4-Chloroaniline	0.01													
2	87-68-3	Hexachlorobutadiene	0.01													
2	59-50-7	4-Chloro-3-methylphenol	0.20								✓	✓	✓	✓	✓	✓
2	91-57-6	2-Methylnaphthalene	0.40													
3	77-47-4	Hexachlorocyclopentadiene	0.01													
3	88-06-2	2,4,6-Trichlorophenol	0.20													
3	95-95-4	2,4,5-Trichlorophenol	0.20													

SW 846 - Method 8270 , page 3

Eq/Trip

IS	CAS #	NAME	Min RF	Init	Calib RSD	Calib RF/Slope	CCV RPD	CCV RF	CCB	Field blank	Field Dup	MS	MSD	MSD RPD	LCS	LCSD	LCS RPD
5	218-01-9	Chrysene	0.70														
5	117-81-7	bis(2-Ethylhexyl)phthalate	0.01														
6	117-84-0	Di-n-octylphthalate	0.01														
6	205-99-2	Benzo(b)fluoranthene	0.70														
6	207-08-9	Benzo(k)fluoranthene	0.70														
6	50-32-8	Benzo(a)pyrene	0.70														
6	193-39-5	Indeno(1,2,3-cd)pyrene	0.50														
6	53-70-3	Dibenz(a,h)anthracene	0.40														
6	191-24-2	Benzo(g,h,i)perylene	0.50														

Surrogate Recovery Outliers

Sample	SMC 1	SMC 2	SMC 3	SMC 4	SMC 5	SMC 6	SMC 7	SMC 8
			OK	not				
				Criteria				

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

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
				ok	not							
						Criteria						

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

MEMORANDUM

DATE: February 2, 1999

TO: File

FROM: Tod Monks TM

SUBJECT: Inorganic Data Review and Validation
Site 81-C, ARCOC No. 600789, Case No. 7214.2213

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

Summary

The samples were prepared and analyzed with accepted procedures and specified methods (Metals – EPA6010B and EPA7471). All compounds were successfully analyzed. Problems which were identified within the data package that result in the qualification of data are listed below.

1. Silver and selenium were detected in QC blanks. The detection of silver did not result in the qualification of data as the sample results for silver were greater than 5X the blank value. In the case of selenium, the blank concentration, .6985 mg/kg was greater than the IDL and the sample concentration was less than 5 X the blank concentration. Results were qualified "J".

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

Holding Times

The sample was analyzed within the prescribed holding times.

Calibration

Initial and continuing calibration met acceptance criteria for all methods.

Blanks

No target analytes were detected above reporting limits in the method blanks except for selenium (discussed above). Several analytes (Barium, cadmium, selenium, and Mercury) were observed at estimated values (i.e., "J" coded) in field blanks. For barium, sample results were greater than 5 times the blank concentration. Therefore, no data were qualified. For ~~cadmium, mercury, and selenium sample results are less~~

Silver was not detected in field samples. No action was taken.

3-11-99

than 5 times the blank value. All detected results less than five times the blank concentration are estimated "J".

ICP Interference Check Sample (ICS) Analysis

The ICS met QC acceptance limits.

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

The LCS/LCSD met acceptance criteria.

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

The MS/MSD met acceptance criteria.

Other QC

Data is acceptable. QC measures appear to be adequate.
No other specific issues were identified which affect data quality.

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

Inorganic Metals

Samples:

1 1 10B Method: ICP Number 21 Matrix: Soil Prep: _____

10 B Method: ICP Number 1 Matrix: Water Prep: _____

7471 Hg Method: CVAA Number 21 Matrix: Soil Prep: _____

QC Blk EB/Trip BLK

Analyte	ICV	CCV	ICB	CCB	PB	Field Blks	LCS	LCSD	LCS RPD	MS	MSD	MSD RPD	REP RPD	ICS AB	Ser dil
7429-90-5 Al	✓						CT								
7440-39-3 Ba	✓	✓	✓	✓	✓	.0160	✓	✓	✓	✓	✓	✓	✓	✓	✓
7440-41-7 Be	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7440-43-9 Cd	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7440-70-2 Ca					✓	.958 J									
7440-47-3 Cr	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7440-48-4 Co						CT									
7440-50-8 Cu															
7439-89-6 Fe															
7439-95-4 Mg															
7439-96-5 Mn															
7440-02-0 Ni															
7440-09-7 K						CT									
7440-22-4 Ag	✓	✓	✓	✓	.00165	.00165 ✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7440-23-5 Na															
7440-62-2 V															
7440-66-6 Zn															
	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7439-92-1 Pb	✓	✓	✓	✓	.698 ✓	.368 J ✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7782-49-2 Se	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7440-38-2 As															
7440-36-0 Sb															
7440-28-0 Tl															
	✓	✓	✓	✓	✓	✓ .00115	✓	✓	✓	✓	✓	✓	✓	✓	✓
7439-97-6 Hg															
						CT									
Cyanide CN															

QC Blanks

		Blank Conc ug/kg	DL	Sample conc
Batch 132319	Silver	.00154	.031	.00165
Batch 132531	Selenium	.275	.135	.698

- No Data qualified

Blank > DL sample conc < 5X blank conc. qualify .698 J

042403-001/C4S1C-GR-025-D4

Radiochemistry

Samples: Cross Alpha Beta

Method: EPA 900 Number 21 Matrix: Soil Prep: _____

Method: _____ Number _____ Matrix: _____ Prep: _____

Method: _____ Number _____ Matrix: _____ Prep: _____

Method: _____ Number _____ Matrix: _____ Prep: _____

Radiochem	Rep RER	PB	Field Dup	Field Blank	LCS	MS	-	Sample	Isotope	IS Trace	Sample	Isotope	IS Trace
CRITERIA	<1.0	U		U	20%	25%	-			50-105			50-105
H3							-						
U-238													
U-234													
U-235/236							-						
Th-232													
Th-228													
Th-230							-						
Pu-239/240	✓	✓	✓		✓	✓							
GAB							-						
Ra226							-						
Ra228							-						
Gamma							-						
Ni-63							-						
							-						
							-						

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

Internal Lab Batch No. N/A

ANALYSIS REQUEST AND CHAIN OF CUSTODY

SAR/WR No.

Press F1 for instructions for each field.

AR/COC- 600789

Dept. No./Mail Stop: 6134/1148
Project/Task Manager: Paul Freshour
Project Name: 81C VCM SAMPLING
Record Center Code: ER/OU1333/DAT
Logbook Ref. No.: —
Service Order No.: CF0607

Date Samples Shipped: 9/25/98 SMO USE
Carrier/Waybill No.: 712273
Lab Contact: Edie Kent
Lab Destination: GEL
SMO Contact/Phone: Doug Salmi/844-3110
Send Report to SMO: Doug Salmi / Suzi Montaño

Contract No.: AJ-2480A
Case No.: 7214/2213
SMO Authorization
Bill to: Sandia National Laboratories
Supplier Services, Dept. _____
P.O. Box 5800 MS 0154

Location — Tech Area: Canyons — 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	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested (9809878)	LAB USE Lab Sample ID
042398 - 001	CY81C-GR-022SS	2.0	81C	9/23/98 1445	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	1
042398 - 002	CY81C-GR-022-SS	2.0	81C	9/23/98 1445	S	AG	120 ml	4 C	G	SA	VOC	2
042398 - 003	CY81C-GR-022-SS	2.0	81C	9/23/98 1445	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	3
042399 - 001	CY81C-GR-023-SS	2.0	81C	9/23/98 1453	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	4
042399 - 002	CY81C-GR-023-SS	2.0	81C	9/23/98 1453	S	AG	120 ml	4 C	G	SA	VOC	5
042399 - 003	CY81C-GR-023-SS	2.0	81C	9/23/98 1453	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	6
042400 - 001	CY81C-GR-023-DU	2.0	81C	9/23/98 1455	S	AG	500 ml	4 C	G	DU	METALS, HE, SVOC	7
042400 - 002	CY81C-GR-023-DU	2.0	81C	9/23/98 1455	S	AG	120 ml	4 C	G	DU	VOC	8
042400 - 003	CY81C-GR-023-DU	2.0	81C	9/23/98 1455	S	AG	250 ml	4 C	G	DU	GROSS ALPHA/BETA	9

RMMA ☐Yes ☒No Ref. No. —
Sample Disposal ☐Return to Client ☒Disposal by lab

Sample Tracking SMO USE
Date Entered (mm/dd/yy) _____
Entered by: _____

Special Instructions/QC Requirements
EDD ☒Yes ☐No
Raw data package ☒Yes ☐No

Abnormal Conditions on Receipt SMO use

Turnaround Time ☒Normal ☐Rush Required Report Date _____ QC Inits. _____

	Name	Signature	Init	Company/Organization/Phone
Sample Team Members	Gil Baltazar		GB	Weston/6131/971-2769
	Chris Catechis		CC	MDM/6131/881-3196
	~~Concetta Cecciato~~		CC	MDM/6131/884-2249

Please list as separate report.

1. Relinquished by		Org. 6131	Date 9-25-98	Time 1005	4. Relinquished by	Org.	Date
1. Received by		Org. 7577	Date 9/25/98	Time 1005	4. Received by	Org.	Date
2. Relinquished by		Org. 7578	Date 9-25-98	Time 1215	5. Relinquished by	Org.	Date
2. Received by	Bonnie Hervey	Org. GEL	Date 9/28/98	Time 0900	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) bove

ANALYSIS REQUEST AND CHAIN OF CUSTODY (Continuation)

Press F1 for instructions for each field.

AR/COC- 600789

Project Name: 81C VCM Sampling | Project/Task Manager: Paul Freshour | Case No.: 7214/2213

Location | Tech Area Canyons | Building NA | Room NA

Sample No. – Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO)						Parameter & Method Requested	LAB USE
					Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type		Lab Sample ID
042401 - 001	CY81C-GR-024-SS	2.5	81C	9/24/98 1415	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	10
042401 - 002	CY81C-GR-024-SS	2.5	81C	9/24/98 1415	S	AG	120 ml	4 C	G	SA	VOC	11
042401 - 003	CY81C-GR-024-SS	2.5	81C	9/24/98 1415	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	12
042402- 001	CY81C-GR-025-SS	2.5	81C	9/24/98 1420	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	13
042402 - 002	CY81C-GR-025-SS	2.5	81C	9/24/98 1420	S	AG	120 ml	4 C	G	SA	VOC	14
042402 - 003	CY81C-GR-025-SS	2.5	81C	9/24/98 1420	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	15
042403 - 001	CY81C-GR-025-DU	2.5	81C	9/24/98 1420	S	AG	500 ml	4 C	G	DU	METALS, HE, SVOC	16
042403 - 002	CY81C-GR-025-DU	2.5	81C	9/24/98 1420	S	AG	120 ml	4 C	G	DU	VOC	17
042403 - 003	CY81C-GR-025-DU	2.5	81C	9/24/98 1420	S	AG	250 ml	4 C	G	DU	GROSS ALPHA/BETA	18
042404 - 001	CY81C-GR-026-S (soil pile)	0.6	81C	9/24/98 0950	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	19
042404 - 002	CY81C-GR-026-S(soil pile)	0.5	81C	9/24/98 0950	S	AG	120 ml	4 C	G	SA	VOC	20
042404 - 003	CY81C-GR-026-S(soil pile)	0.5	81C	9/24/98 0950	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	21
042405 - 001	CY81C-GR-027-S(soil pile)	0.5	81C	9/24/98 1025	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	22
042405 - 002	CY81C-GR-027-S(soil pile)	0.5	81C	9/24/98 1025	S	AG	120 ml	4 C	G	SA	VOC	23
042405 - 003	CY81C-GR-027-S(soil pile)	0.5	81C	9/24/98 1025	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	24
042406 - 001	CY81C-GR-028-S (Soil Pile)	0.5	81C	9/24/98 1300	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	25
042406 - 002	CY81C-GR-028-S (Soil Pile)	0.5	81C	9/24/98 1300	S	AG	120 ml	4 C	G	SA	VOC	26
042406 - 003	CY81C-GR-028-S (Soil Pile)	0.5	81C	9/24/98 1300	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	27
042407 - 001	CY81C-GR-029-S (Soil Pile)	0.5	81C	9/24/98 1305	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	28
042407 - 002	CY81C-GR--029-S(Soil Pile)	0.5	81C	9/24/98 1305	S	AG	120 ml	4 C	G	SA	VOC	29
042407 - 003	CY81C-GR-029-S (Soil Pile)	0.5	81C	9/24/98 1305	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	30

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)

6F 2001-COC (10-97)

Supersedes (5-97) blue

ANALYSIS REQUEST AND CHAIN OF CUSTODY (Continuation)

Press F1 for instructions for each field.

AR/COC- 600789

Project Name: 81C VCM Sampling | Project/Task Manager: Paul Freshour | Case No.: 7214/2213

Location | Tech Area: Canyons | Building: NA | Room: NA

Sample No. – Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO): Sample Matrix	Container: Type	Container: Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	LAB USE: Lab Sample ID
042415 - 001	CY81C-GR-037-S (Soil Pile)	0.5	81C	9/24/98 1350	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	52
042415 - 002	CY81C-GR-037-S (Soil Pile)	0.5	81C	9/24/98 1350	S	AG	120 ml	4 C	G	SA	VOC	53
042415 - 003	CY81C-GR-037-S (Soil Pile)	0.5	81C	9/24/98 1350	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	54
042416 - 001	CY81C-GR-038-S(Soil Pile)	0.5	81C	9/24/98 1355	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	55
042416 - 002	CY81C-GR-038-S(Soil Pile)	0.5	81C	9/24/98 1355	S	AG	120 ml	4 C	G	SA	VOC	56
042416- 003	CY81C-GR-038-S(Soil Pile)	0.5	81C	9/24/98 1355	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	57
042417 - 001	CY81C-GR-039-S(Soil Pile)	0.5	81C	9/24/98 1400	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	58
042417 - 002	CY81C-GR-039-S(Soil Pile)	0.5	81C	9/24/98 1400	S	AG	120 ml	4 C	G	SA	VOC	59
042417 - 003	CY81C-GR-039-S(Soil Pile)	0.5	81C	9/24/98 1400	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	60
042418 - 001	CY81C-GR-002-EB	0.5	81C	9/24/98 1455	DIW	P	500 ml	HNO3	G	EB	METALS	61
042418 - 002	CY81C-GR-002-EB	NA	81C	9/24/98 1500	DIW	G	3x40 ml	HCL	G	EB	VOC	62
042418 - 003	CY81C-GR-002-EB	NA	81C	9/24/98 1445	DIW	AG	4x1L ✓	None	G	EB	HE	63
042418 - 005	CY81C-GR-002-EB	NA	81C	9/24/98 1450	DIW	AG	2x1L	None	G	EB	SVOC	64
042419 - 001	CY81C-GR-002-TB	NA	81C	9/24/98 1440	DIW	G	3x40 ml	HCL	G	TB	VOC	65
042421-001	CY81C-GR-040-S(Soil Pile)	.5	81C	9/24/98 1405	S	AG	500ml	4°C	G	SA	METALS, HE, SVOC	66
042421-002	CY81C-GR-040-S(Soil Pile)	.5	81C	9/24/98 1405	S	AG	120ml	4°C	G	SA	VOC	67
042421-003	CY81C-GR-040-S(Soil Pile)	.5	81C	9/24/98 1405	S	AG	250ml	4°C	G	SA	GROSS Alpha/Beta	68

Abnormal Conditions on Receipt:

Recipient Initials:

LAB USE

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- 600789

Project Name: 81C VCM Sampling | Project/Task Manager: Paul Freshour | Case No.: 7214/2213

Location | Tech Area Canyons | Building NA | Room NA

Sample No. – Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO)						LAB USE
					Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
042408 - 001	CY81C-GR-030-S (Soil Pile)	0.5	81C	9/24/98 1310	S	AG	500 ml	4 C	G	MSMSD	METALS, HE, SVOC	31
042408 - 002	CY81C-GR-030S (Soil Pile)	0.5	81C	9/24/98 1310	S	AG	120 ml	4 C	G	MSMSD	VOC	32
042408 - 003	CY81C-GR-030-S (Soil Pile)	0.5	81C	9/24/98 1310	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	33
042409 - 001	CY81C-GR-031-S (Soil Pile)	0.5	81C	9/24/98 1320	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	34
042409 - 002	CY81C-GR-031-S (Soil Pile)	0.5	81C	9/24/98 1320	S	AG	120 ml	4 C	G	SA	VOC	35
042409 - 003	CY81C-GR-031-S (Soil Pile)	0.5	81C	9/24/98 1320	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	36
042410 - 001	CY81C-GR-032-S (Soil Pile)	0.5	81C	9/24/98 1325	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	37
042410 - 002	CY81C-GR-032-S (Soil Pile)	0.5	81C	9/24/98 1325	S	AG	120 ml	4 C	G	SA	VOC	38
042410 - 003	CY81C-GR-032-S (Soil Pile)	0.5	81C	9/24/98 1325	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	39
042411 - 001	CY81C-GR-033-S (Soil Pile)	0.5	81C	9/24/98 1330	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	40
042411 - 002	CY81C-GR-033-S (Soil Pile)	0.5	81C	9/24/98 1330	S	AG	120 ml	4 C	G	SA	VOC	41
042411 - 003	CY81C-GR-033-S (Soil Pile)	0.5	81C	9/24/98 1330	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	42
042412 - 001	CY81C-GR-034-S (Soil Pile)	0.5	81C	9/24/98 1335	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	43
042412 - 002	CY81C-GR-034-S (Soil Pile)	0.5	81C	9/24/98 1335	S	AG	120 ml	4 C	G	SA	VOC	44
042412 - 003	CY81C-GR-034-S (Soil Pile)	0.5	81C	9/24/98 1335	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	45
042413 - 001	CY81C-GR-035-S (Soil Pile)	0.5	81C	9/24/98 1340	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	46
042413 - 002	CY81C-GR-035-S (Soil Pile)	0.5	81C	9/24/98 1340	S	AG	120 ml	4 C	G	SA	VOC	47
042413 003	CY81C-GR-035-S (Soil Pile)	0.5	81C	9/24/98 1340	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	48
042414 - 001	CY81C-GR-036-S (Soil Pile)	0.5	81C	9/24/98 1345	S	AG	500 ml	4 C	G	SA	METALS, HE,SVOC	49
042414 - 002	CY81C-GR-036-S (Soil Pile)	0.5	81C	9/24/98 1345	S	AG	120 ml	4 C	G	SA	VOC	50
042414 - 003	CY81C-GR-036-S (Soil Pile)	0.5	81C	9/24/98 1345	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	51

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)

4.[redacted]ta 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
9809878-63	8330	H	NARRATIVE FAILS TO ADDRESS MISSED HOLDING TIME
9809878-63	8330		NARRATIVE INCORRECTLY STATES NITROBENZENE WAS OUTSIDE RECOVERY LIMITS FOR AQUEOUS LCSD
MS/MSD	8270		SVOC NARRATIVE INCORRECTLY STATES 4-NITROPHENOL RPD OUTSIDE QC LIMITS
MS/MSD	8260		NARRATIVE DOES NOT ADDRESS 1,1-DICHLOROETHYLENE & BENZENE

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 1448 and date correction request was submitted 11-9-98

Reviewed by: W. Palencia Date: 11-3-98 Closed by: W. Palencia Date: 12-8-98

			9809878-63 SVOC NARRATIVE INCORRECTLY STATES MS/MSD RPD FOR 4-NITROPHENOL OUTSIDE QC LIMITS VOC NARRATIVE DOES NOT ADDRESS ALL ANALYTES OUTSIDE RECOVERY LIMITS IN MS/MSD

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	4-NITROPHENOL OUTSIDE RECOVERY LIMITS FOR SVOC LCS/LCD
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	1,1-DICHLOROETHYLENE, BENZENE & CHLOROBENZENE OUTSIDE RECOVERY LIMITS FOR VOA MS/MSD
3.4) Precision a) Laboratory control sample precision reported and met for all samples? For rad analysis, sample duplicate precision reported and met.		X	RPD FOR PENTACHLOROPHENOL FOR SVOC LCS/LCD (AQUEOUS) OUTSIDE ACCEPTANCE RANGE
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	METHYLENE CHLORIDE, CHLOROFORM & XYLENES DETECTED IN MANY VOC METHOD BLANKS
b) Sampling blank (e.g., field, trip, and equipment) data reported and met?		X	m-DINITROBENZENE DETECTED IN EXPLOSIVES EQUIPMENT BLANK EXTRACTION HOLD TIME MISSED FOR EXPLOSIVES EQUIPMENT BLANK
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		
3.7) Narrative included, correct, and complete?			EXPLOSIVES NARRATIVE INCORRECTLY STATES NITROBENZENE WAS OUTSIDE RECOVERY LIMITS FOR AQUEOUS LCSD NARRATIVE FAILS TO ADDRESS MISSED HOLD TIME FOR SAMPLE#

Contract Verification Review (CVR)

Project Leader FRESHOUR | Project Name 81C VCM SAMPLING | Case No. 7214.2213

AR/COC No. 600789 | Analytical Lab GEL | SDG No. 9809878/8SL07

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	SAMPLE RECEIPT DATE SIGNED BY LAB PERSONNEL DIFFERENT THAN SAMPLE CHECKLIST DATE		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				
2.10	Narrative provided	X				
2.11	TAT met	X				
2.12	Hold times met		X	HOLD TIME EXCEEDED FOR EXPLOSIVE SAMPLE #9809878-63 (042418-003)		X
2.13	Were contractual qualifiers provided	X				
2.14	All requested result data provided	X				

SAMPLE FINDINGS SUMMARY

Site: 81C

AR/COC: 600788 Data Classification:

Sample/ Fraction No.	Analysis	DV Qualifiers	Comments
CY81C-GR-001 -SS	7440-22-4 (Ag)	JB	
CY81C-GR-001 -SS	"	JB	
CY81C-GR-002 -SS	"	JB	
CY81C-GR-010 -DP	"	"	
CY81C-GR-012 -SS	"	"	
CY81C-GR-015 -SS	"	"	
CY81C-GR-001 -EB	7440-39-3 (Ba)	JB	

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: Date: 2/25/99

ORGANICS

SAMPLE FINDINGS SUMMARY

COC: 600788

Corrected 3/25/99 MH

Sample Number	methylene chloride (75-09-2)	chloroform (67-66-3)	dichlorobromomethane (75-27-4)	acetone (67-64-1)	SVOC	4-nitrophenol (100-02-7)	2,4-dinitrophenol (51-28-5)	diethylphthalate (84-66-2)	dibenzofuran (132-64-9)	4,6-dinitro-2-methylphenol (534-52-1	N-nitrosodiphenylamine (86-30-6)	4-bromophenyl-phenylether (101-55-	hexachlorobenzene (118-74-1)	pentachlorophenol (87-86-5)	phenanthrene (85-01-8)	anthracene (120-12-7)	carbazole (86-74-8)	di-n-butylphthalate (84-74-2)	fluoranthene (206-44-0)		
CY81-GR-001-SS	UJ	J	J	UJ					UJ												
CY81-GR-002-SS	UJ	J	J	UJ					UJ												
CY81-GR-003-SS	UJ	UJ	UJ	UJ					UJ												
CY81-GR-004-SS	UJ	UJ	UJ	UJ					UJ												
CY81-GR-005-SS	UJ	UJ	UJ	UJ					UJ												
CY81-GR-006-SS	UJ	J	J	UJ					UJ												
CY81-GR-007-SS	UJ	UJ	UJ	UJ					UJ												
CY81-GR-008-SS	UJ	J	UJ	UJ					UJ												
CY81-GR-009-SS	UJ	UJ	UJ	UJ					UJ												
CY81-GR-010-SS	UJ	UJ	UJ	UJ					UJ												
CY81-GR-010-DP	UJ	J	UJ	UJ					UJ												
CY81-GR-011-SS	UJ	J	UJ	UJ					UJ												
CY81-GR-012-SS	UJ	UJ	UJ	UJ					UJ												
CY81-GR-013-SS	UJ	J	UJ	UJ					UJ												
CY81-GR-014-SS	UJ	J	UJ	UJ				J,A	UJ												
CY81-GR-015-SS	UJ	UJ	UJ	UJ					UJ												
CY81-GR-016-SS	UJ	J	UJ	UJ					UJ												
CY81-GR-017-SS	5.31U	U		UJ					UJ												
CY81-GR-018-SS	5.50U	U		UJ					UJ												
CY81-GR-018-DP	5.41U	U		UJ					UJ												
CY81-GR-019-SS	5.41U						UJ	J,A													
CY81-GR-020-SS	5.75U	U		UJ			UJ														
CY81-GR-021-SS	5.22U	U		UJ			UJ														
CY81-GR-001-EB				UJ		UJ	UJ			UJ,A	UJ,A	UJ,A	UJ,A	UJ,A	UJ,A	UJ,A	UJ,A	UJ,A	UJ,A		
CY81-GR-001-TB				UJ																	

3/25

HE- 8330

SAMPLE FINDINGS SUMMARY

COC: 600788 Sample Number	HMX (2691-41-0)	RDX (121-82-4)	1,2,3-trinitrobenzene (99-35-4)	1,3-dinitrobenzene (99-64-0)	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 (1946-51-0)	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)							
CY81-GR-001-EB	UJ2	UJ2	UJ2	J2	UJ2	UJ2	UJ2	UJ2	UJ2	UJ2	UJ2	UJ2	UJ2	UJ2							

DATA VALIDATION SUMMARY:

SITE/PROJECT: 81C CASE #: 7214.1148
ARCOC #: 600788
LABORATORY: CEL
LABORATORY REPORT #: 480983 1

OF SAMPLES: 23 MATRIX: Soil
LAB SAMPLE IDs: CY81C-GR-021 thru - 021

ANALYSIS/ QC ELEMENT	VOC	SVOC	PEST/ PCB	HPLC (HE)	ICP/AES	GFAA/ AA	CVAA (Hg)	CN	RAD	OTHER
1. HOLDING TIMES/ PRESERVATION	✓	✓		✓	✓		✓		✓	
2. CALIBRATIONS	~~✓~~ J	J		✓	✓		✓		✓	
3. METHOD BLANKS	J	✓		✓	J		✓		✓	
4. MS/MSD	✓	✓		✓	✓		✓		✓	
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										
13. OTHER QC	J				✓		✓			

CHECK MARK (✓) – ACCEPTABLE
J – ESTIMATED
U – NOT DETECTED

SHADED CELLS – NOT APPLICABLE
UJ – NOT DETECTED, ESTIMATED
R – UNUSABLE

REVIEWED BY: _____ DATE: 4/15/99

DATA VALIDATION SUMMARY:

SITE/PROJECT: 816 CASE #: 7214.1148
ARCOC #: 602788
LABORATORY: CEL
LABORATORY REPORT #: 9809831

OF SAMPLES: 2 MATRIX: Water
LAB SAMPLE IDs: CY81L-GR-001EB
CY81L-GR-001TB

ANALYSIS/ QC ELEMENT	VOC	SVOC	PEST/ PCB	HPLC (HE)	ICP/AES	GFAA/ AA	CVAA (Hg)	CN	RAD	OTHER
1. HOLDING TIMES/ PRESERVATION				J	✓		✓		—	
2. CALIBRATIONS	✓	J		✓	—		✓		—	
3. METHOD BLANKS	✓	✓		✓	JB		✓		—	
4. MS/MSD	✓	✓		✓	✓		✓		—	
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										
13. OTHER QC		J			~~JB~~					

CHECK MARK (✓) – ACCEPTABLE
J – ESTIMATED
U – NOT DETECTED
SHADED CELLS – NOT APPLICABLE
UJ – NOT DETECTED, ESTIMATED
R – UNUSABLE

REVIEWED BY: _____ DATE: 2/25/99

MEMORANDUM

Date: 02/25/99

To: File

From: Marcia Hilchey

Subject: Radiometric Data Review and Validation
Site: 81C
AR/COC: 600788
Case: 7214.1148
Laboratory: GEL
SDG: 9809831

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 components were successfully analyzed.

No problems were identified with the data package that result in the qualification of data.

Holding Times

The samples were analyzed within the prescribed holding times.

Calibration

Calibration met acceptance criteria.

Laboratory Control Sample Analyses

The LCS met acceptance criteria.

Blanks

No target analytes were detected above the reporting limits in the method blank.

Matrix Spike Analysis

The matrix spike sample met acceptance criteria.

Replicate

The laboratory duplicate met the QC acceptance criteria.

Other QC

No field QC samples were submitted with this AR/COC.

No other specific issues were identified which affect data quality.

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

2/25/99

Memorandum

Date: 02/25/99

To: File

From: Marcia Hilchey

Subject: Inorganic Data Review and Validation
Site: 81C
AR/COC: 600788
Case: 7214.1148
Laboratory: GEL
SDG: 9809831

See 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 with specified methods. All components were successfully analyzed.

Samples results were qualified due to blank contamination.

Holding Times

The samples were analyzed within the prescribed holding times.

Calibration

Initial and continuing calibration met QC acceptance criteria for both the ICP and CVAA methods.

Blanks

The initial calibration blank was free of target analytes above reporting limits in both ICP and CVAA analyses.

In the continuing calibration blank, silver was detected above the reporting limit, resulting in sample result qualifications. Other elements were detected in the CCB, but did not result in qualified sample results.

The method blank run for the mercury analysis (CVAA) detected no mercury above reporting limits.

Matrix Spike Analysis

The MS sample met QC acceptance criteria for the soils analyses for both methods. The MS sample for the water analysis was from a different SDG and the narrative noted that all acceptance criteria were met.

Laboratory Control/Laboratory Control Duplicate Samples

The LCS/LCSD samples met QC acceptance criteria for both methods.

ICP Interference check sample (ICS) Analysis

The ICS met all QC acceptance criteria for both water and soil analyses.

Laboratory Replicate Analysis

No sample was identified as a laboratory replicate, however, the MSD RPD met replicate acceptance criteria.

Other QC

Serial dilutions were not run on samples with analytes results greater than 50 times the PQL. No qualifications were applied as a result.

Barium and chromium were detected in the equipment blank, but the values were not high enough to result in sample data qualifications.

The RPD for the field duplicate met acceptance criteria.

No other specific issues were identified which affect data quality.

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

2/25/99

Memorandum

Date: 02/25/99

To: File

From: Marcia Hilchey

Subject: Organic Data Review and Validation
Site: 81C
AR/COC: 600788
Case: 7214.1148
Laboratory: GEL
SDG: 9809831

See 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 with specified methods (SVOC EPA 8270, VOC EPA 8260, HE EPA 8330). All compounds were successfully analyzed.

VOC: Qualifications were applied to VOC data as a result of blank contamination.

Qualifications were applied to VOC data due to field duplicate RPD acceptance criteria failure.

Qualifications were applied to VOC data due to CCV acceptance criteria failure of acetone.

SVOC: Qualifications were applied to SVOC data due to failure to meet initial and continuing calibration acceptance criteria.

Qualifications were applied to SVOC data due to failure to meet laboratory control sample acceptance criteria.

HE: Qualifications were applied to HE data due to failure to meet holding time criteria.

Case Narratives

SVOC: The case narrative indicates that sample CY81-GR-014-SS was reanalyzed and that both analysis results are reported. The data package does not contain results for the reanalysis.

HE: The case narrative states that recovery was low for the LCSD sample in the water analysis for nitrobenzene. There is no indication of this problem in the QC summary.

Holding Times

The samples for SVOC analyses were analyzed within the prescribed holding times.

Holding time was exceeded by two hours for the VOC rerun analysis of sample CY81-GR-019-SS. The original sample was reanalyzed due to lab QC failure. The reanalysis results were similar to the original and the laboratory QC was acceptable, so the reanalysis results were reported. No qualifications were applied.

The equipment blank for HE analysis exceeded holding time criteria. Sample results were qualified. All other HE samples were analyzed within the prescribed holding time.

Calibration

VOC: Initial and continuing calibration met acceptance criteria, except for the CCV analysis for acetone on all soils analysis runs. Sample data were qualified as a result.

SVOC: ICV and CCV acceptance criteria were not met for 4-nitrophenol and 2,4-dinitrophenol for the analysis of the equipment blank (CY81-GR-001-EB). ICV and CCV acceptance criteria were not met for 2,4-dinitrophenol for the analysis of samples CY81-GR-019,-020, and -021. ICV acceptance criteria were not met for dibenzofuran for the analysis of samples CY81-GR-001 through CY81-GR-018DP. Qualifications were applied to the data.

HE: Initial and continuing calibration acceptance criteria were met.

Blanks

VOC: Methylene chloride and chloroform were present in the method blanks, resulting in data qualifications. The trip blank was contaminated with trichloroethene, but none was detected in the samples, so no data were qualified as a result.

SVOC: No target analytes were detected above reporting limits in the method blanks or equipment blank.

HE: No target analytes were detected above reporting limits in the method blank. 1,3-dinitrobenzene was detected in the equipment blank, but none was detected in the samples, so no data were qualified.

Surrogates

Surrogate recoveries met all acceptance criteria for all VOC and HE methods. SVOC surrogate p-terphenyl-d14 had high recovery for one sample, but no qualifications were applied.

Matrix Spike/Matrix Spike Duplicates (MS/MSD)

MS/MSD acceptance criteria were met for all organic methods.

Internal Standards

Internal standard acceptance criteria were met for all organic methods.

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

VOC: LCS/LCSD samples met all acceptance criteria.

SVOC: The RPD for the LCSD sample for the equipment blank (CY81-GR-001-EB) was high. All associated analyte results were qualified UJ. Recovery was high for 4-nitrophenol in the soils analyses. No results were qualified as all results were ND.

HE: LCS/LCSD samples met all acceptance criteria.

Other QC

corrected 3/25/99 MH

VOC: RPD acceptance criteria for the field duplicate associated with samples CY81-GR-001 through CY81-GR-016 were not met for chloroform or dichlorobromomethane. Associated sample results were qualified.

Please note that several samples were diluted for the SVOC analysis. Refer to the case narrative for an explanation of the reasons for these dilutions.

No other specific issues were identified which affect data quality.

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

3/25/99

HOLDING TIME/PRESERVATION:

SITE/PROJECT: Site 68 ARCOC #: 600788
LABORATORY: GEL LABORATORY REPORT #: 8SL08

Sample ID	Holding Time Criteria	Days Holding Time was Exceeded	Preservation Criteria	Preservation Deficiency	Comments
9809831-72	7 days	<2 X	—	—	HE
9809831-62R	14 days	2 hrs	—	—	VOA

REVIEWED BY: _____ DATE: 2/25/99

VOLATILE ORGANICS:
SW-846 - Method 8260

SITE/PROJECT: 81C ARCOC #: 600788 H_2O
LABORATORY: GEL LABORATORY REPORT #: 9809831

IS	GC/MS		Min RF	Intercept	Calib RF	Calib RSD / R^2	CCV %D	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Eq. Blks	Trip Blks		
							10/2					n/a	n/a	n/a	n/a				
	Name	CAS #			>.05	<20% / 0.99	<20%	✓								✓			
1	Chloromethane	74-87-3	0.10		✓	✓	22												
1	Bromomethane	74-83-9	0.10																
1	vinyl chloride	75-01-4	0.10																
1	Chloroethane	75-00-3	0.01																
1	methylene chloride (10xblk)	75-09-2	0.01														.22		
1	acetone(10xblk)	67-64-1	0.01				23												
1	carbon disulfide	75-15-0	0.10																
1	1,1-dichloroethene	75-35-4	0.20						✓	✓	✓								
1	1,1-dichloroethane	75-34-3	0.10																
1	Chloroform	67-66-3	0.20																
1	1,2-dichloroethane	107-06-2	0.10				27												
1	2-butanone(10xblk)	78-93-3	0.01																
2	1,1,1-trichloroethane	71-55-6	0.10																
2	carbon tetrachloride	56-23-5	0.10																
2	Bromodichloromethane	75-27-4	0.20																
2	1,2-dichloropropane	78-87-5	0.01																
2	cis-1,3-dichloropropene	10061-01-5	0.20																
2	Trichloroethene	79-01-6	0.30						✓	✓	✓						4.2		
2	Dibromochloromethane	124-48-1	0.10																
2	1,1,2-trichloroethane	79-00-5	0.10																
2	Benzene	71-43-2	0.50						✓	✓	✓								
2	trans-1,3-dichloropropene	10061-02-6	0.10																
2	Bromoform	75-25-2	0.10																
3	4-methyl-2-pentanone	108-10-1	0.10				26												
3	2-hexanone	591-78-6	0.01																
3	Tetrachloroethene	127-18-4	0.20																
3	1,1,2,2-tetrachloroethane	79-34-5	0.30																
3	toluene(10xblk)	108-88-3	0.40						✓	✓	✓								
3	Chlorobenzene	108-90-7	0.50						✓	✓	✓								
3	Ethylbenzene	100-41-4	0.10																
3	Styrene	100-42-5	0.30																
3	xylenes(total)	1330-20-7	0.30																
	1,2-dichloroethylene(total)	540-59-0	0.01																
	2-chloroethyl vinyl ether	110-75-8			✓	✓		✓								✓			

REVIEWED BY: _____ DATE: 2/18/99

VOLATILE ORGANICS: page 2
SW-846 - Method 8260

SITE/PROJECT: 81C ARCOC #: 600788
LABORATORY: GEL LABORATORY REPORT #: 9809831

Surrogate Recovery and Internal Standard Outliers

Sample	SMC 1	SMC 2	SMC 3	IS 1-area	IS 1-RT	IS 2-area	IS 2-RT	IS 3- area	IS 3- RT			
				OK								

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

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

REVIEWED BY [signature] DATE: 2/18/99

RADIOCHEMISTRY:

SITE/PROJECT: 81C ARCOC #: 600788
LABORATORY: GEL LABORATORY REPORT #: 9809831
METHODS: GAB 900.0

n/a n/a n/a

QC Element/ Analyte	Method Blks	LCS	MS	Rep RER	Eq. Blks	Field Dup	Field Blks	·	Sample	Isotope	IS/Trace	Sample	Isotope	IS/Trace				
CRITERIA	U	20%	25%	<1.0	U	<1.0	U	·			50-105			50-105				
HJ								·										
U-238																		
U-234																		
U-235/236								·										
Th-232																		
Th-228																		
Th-230								·										
Pu-239/240																		
GAB	✓	✓	✓	✓				·										
Ra226								·										
Ra228								·										
Gamma								·										
Ni-63								·										
								·										
								·										

REVIEWED BY: _____ DATE: 2/18/99

INORGANIC METALS:

SITE/PROJECT: 16 81C ARCOC #: 600788
LABORATORY: CEL LABORATORY REPORT #: 9809831 water
METHODS: ICP, CVAA

QC Element/ Analyte	ICV	CCV	ICB	CCB mg/l	Method Blks	LCS	LCSD	LCSD RPD	MS ✓	MSD ✓	MSD RPD ✓	REP RPD n/a	ICS AB	Serial Dilution n/a	Field Dup RPD n/a	Eq Blks *	Field Blks n/a			
7429-90-5 Al																				
7440-39-3 Ba	✓	✓	✓	0.3	✓	✓	✓	✓					✓							
7440-41-7 Be	✓	✓	✓	0.3	✓	✓	✓	✓					✓							
7440-43-9 Cd	✓	✓	✓	✓	✓	✓	✓	✓					✓							
7440-70-2 Ca																				
7440-47-3 Cr	✓	✓	✓	✓	✓	✓	✓	✓					✓							
7440-48-4 Co																				
7440-50-8 Cu																				
7439-89-6 Fe																				
7439-95-4 Mg																				
7439-96-5 Mn																				
7440-02-0 Ni																				
7440-09-7 K																				
7440-22-4 Ag	✓	✓	✓	✓	✓	✓	✓	✓					✓							
7440-23-5 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																				
7440-28-0 Tl																				
7439-97-6 Hg	✓	✓	✓	✓	✓	✓	✓	✓												
Cyanide CN																				

* sample is equip. blank

REVIEWED BY: _____ DATE: 2/15/99

~~INORGANIC METALS~~

SITE/PROJECT: S.C 6816 ARCOC #: 600788 soils
LABORATORY: GEL LABORATORY REPORT #: 9809831
METHODS: ICP CVAA

QC Element/ Analyte	ICV	CCV	ICB mg/l	CCB	Method Blks	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	REP RPD n/a	ICS AB	Serial Dilution n/a	Field Dup RPD ~~n/a~~	Eq Blks mg/l	Field Blks n/a			
7429-90-5 Al																				
7440-39-3 Ba	✓	✓	.004	.004	✓	✓	✓	✓	✓	✓	✓		✓		✓	.0049				
7440-41-7 Be	✓	✓	<.003	.003	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓				
7440-43-9 Cd	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓				
7440-70-2 Ca							✓													
7440-47-3 Cr	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	.00015				
7440-48-4 Co																				
7440-50-8 Cu																				
7439-89-6 Fe																				
7439-95-4 Mg																				
7439-96-5 Mn																				
7440-02-0 Ni																				
7440-09-7 K																				
7440-22-4 Ag	✓	✓	✓	.016	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓				
7440-23-5 Na																				
7440-62-2 V																				
7440-66-6 Zn																				
7439-92-1 Pb	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓				
7782-49-2 Se	✓	✓	.026	.031	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓				
7440-38-2 As	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓				
7440-36-0 Sb																				
7440-28-0 Tl																				
7439-97-6 Hg	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓				
Cyanide CN																				

REVIEWED BY: _____ DATE: 6/25/94

HIGH EXPLOSIVES:
SW846 Method 8330

SITE/PROJECT: 81C ARCOC #: 600788-soils
LABORATORY: GEL LABORATORY REPORT #: 9809831

Name	CAS #	Curve R^2	CCV RPD	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Eq. Blks	Field Blks			
		.995	~~15%~~ 20	U	✓	✓	20%	25%	25%	20%	n/a	U	U			
HMX	2691-41-0	✓	✓	✓			✓	✓	✓	✓		✓				
RDX	121-82-4			✓								✓				
1,2,3-Trinitrobenzene	99-35-4			✓								✓				
1,3-dinitrobenzene	99-64-0			~~0.18 H~~ ✓								0.18 H				
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	1946-51-0															
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															

Sample	SMC %REC	SMC RT		Sample	SMC %REC	SMC RT
		OK				

Confirmation

Sample	CAS #	% diff > 25%	Sample	CAS #	% diff >25%

REVIEWED BY: _____ DATE: 2/18/99

HIGH EXPLOSIVES:
SW846 Method 8330

SITE/PROJECT: 816 ARCOC #: 600788-water
LABORATORY: CEC LABORATORY REPORT #: 9807831

Name	CAS #	Curve R^2	CCV RPD	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Eq. Blks	Field Blks			
		995	~~15%~~ 30	U			20%	25%	25%	20%		U	U			
HMX	2691-41-0	✓	✓	✓	✓	✓	✓									
RDX	121-82-4															
1,2,3-Trinitrobenzene	99-35-4															
1,3-dinitrobenzene	99-64-0															
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	1946-51-0															
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															

Sample	SMC %REC	SMC RT		Sample	SMC %REC	SMC RT
			OK			

Confirmation

Sample	CAS #	% diff > 25%	Sample	CAS #	% diff >25%

REVIEWED BY: _____ DATE: 2/18/99

SEMI-VOLATILE ORGANICS:
SW-846 - Method 8270

SITE/PROJECT: 81C ARCOC #: 600788 water
LABORATORY: GEL LABORATORY REPORT #: 780983/

IS	CAS#	Name	Min RF	Intercept	Calib RSD	Calib RF	CCV RPD (10/1)	Method Blks	Field Blks (n/a)	Field Dup (n/a)	MS (n/a)	MSD (n/a)	MSD RPD (n/a)	LCS	LCSD	CCV RPD (10/2)			LCS RPD
1	108-95-2	Phenol	0.80		✓	✓	✓	✓						✓	✓	✓			✓
1	111-44-4	bis(2-Chloroethyl)ether	0.70																
1	95-57-8	2-Chlorophenol	0.80											✓	✓				✓
1	541-73-1	1,3-Dichlorobenzene	0.60																
1	106-46-7	1,4-Dichlorobenzene	0.50											✓	✓				✓
1	95-50-1	1,2-Dichlorobenzene	0.40																
1	95-48-7	2-Methylphenol	0.70																
1	108-60-1	2,2'-oxybis(1-Chloropropane)	0.01																
1	106-44-5	4-Methylphenol	0.60											✓					
1	621-64-7	N-Nitroso-di-n-propylamine	0.50											✓	✓				✓
1	67-72-1	Hexachloroethane	0.30				⊥												
2	98-95-3	Nitrobenzene	0.20				37.2												
2	78-59-1	Isophorone	0.40				✓												
2	88-75-5	2-Nitrophenol	0.10																
2	105-67-9	2,4-Dimethylphenol	0.20																
2	111-91-1	bis(2-Chloroethoxy)methane	0.30																
2	120-83-2	2,4-Dichlorophenol	0.20																
2	120-82-1	1,2,4-Trichlorobenzene	0.20											✓	✓				✓
2	91-20-3	Naphthalene	0.70																
2	106-47-8	4-Chloroaniline	0.01																
2	87-68-3	Hexachlorobutadiene	0.01																
2	59-50-7	4-Chloro-3-methylphenol	0.20											✓	✓				-
2	91-57-6	2-Methylnaphthalene	0.40																
3	77-47-4	Hexachlorocyclopentadiene	0.01																
3	88-06-2	2,4,6-Trichlorophenol	0.20				-												
3	95-95-4	2,4,5-Trichlorophenol	0.20		↓	↓	28.4	↓								✓			

REVIEWED BY: _____ DATE: 2/18/99

SEMI-VOLATILE ORGANICS: page 2
SW 846 - Method 8270

SITE/PROJECT: 81C ARCOC #: 600788 water
LABORATORY: CEC LABORATORY REPORT #: 7809831

IS	CAS #	NAME	Min RF	Int	Calib RSD	Calib RF	CCV RPD (10/1)	CCV RF/RPD (10/2)	DFTPP	Field blank (n/a)	Field Dup (n/a)	MS (n/a)	MSD (n/a)	MSD RPD (n/a)	LCS	LCSD	LCS RPD
3	91-58-7	2-Chloronaphthalene	0.80		✓	✓	✓	✓	✓								
3	88-74-4	2-Nitroaniline	0.01				27.5	✓									
3	131-11-3	Dimethylphthalate	0.01				✓	✓									
3	208-96-8	Acenaphthylene	0.90				✓	✓									
3	606-20-2	2,6-Dinitrotoluene	0.20				40.1	21.4									
3	99-09-2	3-Nitroaniline	0.01				27.1	✓									
3	83-32-9	Acenaphthene	0.90		⊥		✓	⊥							✓	✓	–
3	51-28-5	2,4-Dinitrophenol	0.01		31.7		25.6										
3	100-02-7	4-Nitrophenol	0.01		✓		48.3								✓	✓	✓
3	132-64-9	Dibenzofuran	0.80				✓										
3	121-14-2	2,4-Dinitrotoluene	0.20				29.1								✓	✓	–
3	84-66-2	Diethylphthalate	0.01				✓										
3	7005-72-3	4-Chlorophenyl-phenylether	0.40														
3	86-73-7	Fluorene	0.90		⊥			⊥									
3	100-01-6	4-Nitroaniline	0.01		21.8			22.4									
4	534-52-1	4,6-Dinitro-2-methylphenol	0.01		31.5			24.0									
4	86-30-6	N-Nitrosodiphenylamine (1)	0.01		✓			✓									
4	101-55-3	4-Bromophenyl-phenylether	0.10					✓									
4	118-74-1	Hexachlorobenzene	0.10					✓									
4	87-86-5	Pentachlorophenol	0.05					✓							✓	✓	40.4
4	85-01-8	Phenanthrene	0.70					✓									
4	120-12-7	Anthracene	0.70					✓									
4	86-74-8	Carbazole	0.01		⊥		⊥	53.3									
4	84-74-2	Di-n-butylphthalate	0.01		21.4		22.1	✓									
4	206-44-0	Fluoranthene	0.60		✓		✓										
5	129-00-0	Pyrene	0.60												✓	✓	–
5	85-68-7	Butylbenzylphthalate	0.01														
5	91-94-1	3,3'-Dichlorobenzidine	0.01														
5	56-55-3	Benzo(a)anthracene	0.80		↓	↓	↓	↓	↓								

REVIEWED BY: _____ DATE: 2/18/99

SEMI-VOLATILE ORGANICS: page 3
SW 846 - Method 8270

SITE/PROJECT: 81C ARCOC #: 600788 water
LABORATORY: GEL LABORATORY REPORT #: 980983J

IS	CAS #	NAME	Min RF	Int	Calib RSD	Calib RF	CCV RPD 10/2	CCV RF (R) 10/1	CCB (R)	Field blank n/a	Field Dup n/a	MS n/a	MSD n/a	MSD RPD n/a	LCS ✓	LCSD ✓	LCS RPD
5	218-01-9	Chrysene	0.70		✓	✓	✓	✓	✓								
5	117-81-7	bis(2-Ethylhexyl)phthalate	0.01		20.1		✓										
6	117-84-0	Di-n-octylphthalate	0.01		✓		✓										
6	205-99-2	Benzo(b)fluoranthene	0.70				27.0										
6	207-08-9	Benzo(k)fluoranthene	0.70				20.51										
6	50-32-8	Benzo(a)pyrene	0.70				✓										
6	193-39-5	Indeno(1,2,3-cd)pyrene	0.50				23.2										
6	53-70-3	Dibenz(a,h)anthracene	0.40				29.5										
6	191-24-2	Benzo(g,h,i)perylene	0.50		↓	↓	26.4	↓	↓								

Surrogate Recovery Outliers

Sample	SMC 1	SMC 2	SMC 3	SMC 4	SMC 5	SMC 6	SMC 7	SMC 8
			OK					

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

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
				OK								

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

REVIEWED BY: _____ DATE: 2/18/99

SEMI-VOLATILE ORGANICS:
SW-846 - Method 8270

SITE/PROJECT: 81C ARCOC #: 600788 soils
LABORATORY: CEL LABORATORY REPORT #: 9807831

IS	CAS#	Name	Min RF	Intercept	Calib RSD (MSD1)	Calib RF (MSD1)	CCV RPD (MSD1)	Method Blks	Field Blks	Field Dup	MS	MSD	MSD RPD	LCS	LCSD	ICV RSD (MSD7)	ICV RF (MSD7)	CCV RPD (MSD7 10/14)	LCS RPD	CCV RPD (MSD7 10/15)
1	108-95-2	Phenol	0.80		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓		✓	
1	111-44-4	bis(2-Chloroethyl)ether	0.70		23.7															
1	95-57-8	2-Chlorophenol	0.80		✓						✓	✓	✓	✓	✓			✓	✓	
1	541-73-1	1,3-Dichlorobenzene	0.60																	
1	106-46-7	1,4-Dichlorobenzene	0.50								✓	✓	✓	✓	✓				✓	
1	95-50-1	1,2-Dichlorobenzene	0.40																	
1	95-48-7	2-Methylphenol	0.70																	
1	108-60-1	2,2'-oxybis(1-Chloropropane)	0.01																	
1	106-44-5	4-Methylphenol	0.60																	
1	621-64-7	N-Nitroso-di-n-propylamine	0.50								✓	✓	✓	✓	✓				✓	
1	67-72-1	Hexachloroethane	0.30																	
2	98-95-3	Nitrobenzene	0.20																	
2	78-59-1	Isophorone	0.40																	
2	88-75-5	2-Nitrophenol	0.10																	
2	105-67-9	2,4-Dimethylphenol	0.20																	
2	111-91-1	bis(2-Chloroethoxy)methane	0.30																	
2	120-83-2	2,4-Dichlorophenol	0.20																	
2	120-82-1	1,2,4-Trichlorobenzene	0.20								✓	✓	✓	✓	✓				✓	
2	91-20-3	Naphthalene	0.70																	
2	106-47-8	4-Chloroaniline	0.01																	
2	87-68-3	Hexachlorobutadiene	0.01																	
2	59-50-7	4-Chloro-3-methylphenol	0.20								✓	✓	✓	✓	✓				✓	
2	91-57-6	2-Methylnaphthalene	0.40																	
3	77-47-4	Hexachlorocyclopentadiene	0.01																	24.1
3	88-06-2	2,4,6-Trichlorophenol	0.20																	✓
3	95-95-4	2,4,5-Trichlorophenol	0.20		✓	✓	✓	✓	✓							✓	✓			✓

REVIEWED BY: _____ DATE: 2/18/99

SEMI-VOLATILE ORGANICS: page 2
SW 846 - Method 8270

SITE/PROJECT: 81C ARCOC #: 600788 soils
LABORATORY: GEL LABORATORY REPORT #: 9809831

IS	CAS #	NAME	Min RF	Int	Calib RSD (MSD1)	Calib RF (MSD1)	CCV RPD (MSD1)	CCV RF/RPD (MSD1 10/14)	CCB PB	Field blank equiv	Field Dup n/a	MS	MSD	MSD RPD	LCS	LCSD	LCS RPD	ICV RPD (MSD7)	ICV RF (MSD7 10/14)	CCV RPD (MSD7 10/15)
3	91-58-7	2-Chloronaphthalene	0.80		✓	✓	✓		✓	✓		✓	✓	✓	✓	✓		✓	✓	✓
3	88-74-4	2-Nitroaniline	0.01		✓		✓					✓	✓	✓	✓	✓		✓		✓
3	131-11-3	Dimethylphthalate	0.01		✓		✓					✓	✓	✓	✓	✓		✓		✓
3	208-96-8	Acenaphthylene	0.90		27.0		✓	25.4							✓	✓		✓		25.3
3	606-20-2	2,6-Dinitrotoluene	0.20		21.7		25.5								✓	✓		✓		✓
3	99-09-2	3-Nitroaniline	0.01		✓		✓								✓			✓		-
3	83-32-9	Acenaphthene	0.90		✓		✓					✓	✓	✓	✓	✓	✓	✓		-
3	51-28-5	2,4-Dinitrophenol	0.01		29.0		28.3					✓	✓	-	✓	✓	✓	✓		✓
3	100-02-7	4-Nitrophenol	0.01		34.3		✓					✓	✓	✓	137*	130*	✓	✓		✓
3	132-64-9	Dibenzofuran	0.80		✓			24.5										56.5		24.
3	121-14-2	2,4-Dinitrotoluene	0.20		✓							✓	✓	✓	✓	✓	✓	✓		✓
3	84-66-2	Diethylphthalate	0.01		✓													✓		21
3	7005-72-3	4-Chlorophenyl-phenylether	0.40		20.5													✓		✓
3	86-73-7	Fluorene	0.90		20.2													✓		✓
3	100-01-6	4-Nitroaniline	0.01		✓													✓		-
4	534-52-1	4,6-Dinitro-2-methylphenol	0.01		✓													39.0		✓
4	86-30-6	N-Nitrosodiphenylamine (1)	0.01		21.0													✓		✓
4	101-55-3	4-Bromophenyl-phenylether	0.10		✓		20.3											✓		2
4	118-74-1	Hexachlorobenzene	0.10		✓		✓											✓		✓
4	87-86-5	Pentachlorophenol	0.05		26.2							✓	✓	✓	✓	✓	✓	20.5		✓
4	85-01-8	Phenanthrene	0.70		24.0													✓		✓
4	120-12-7	Anthracene	0.70		25.0													✓		✓
4	86-74-8	Carbazole	0.01		✓													✓		✓
4	84-74-2	Di-n-butylphthalate	0.01		25.3													✓		✓
4	206-44-0	Fluoranthene	0.60		✓													✓		✓
5	129-00-0	Pyrene	0.60		✓							✓	✓	✓	✓	✓	✓	✓		✓
5	85-68-7	Butylbenzylphthalate	0.01		✓													✓		✓
5	91-94-1	3,3'-Dichlorobenzidine	0.01		✓													✓		✓
5	56-55-3	Benzo(a)anthracene	0.80		✓	✓	✓		✓	✓								✓	✓	-

REVIEWED BY: _____ DATE: 4/18/99

* 10/13 only

SEMI-VOLATILE ORGANICS: page 3
SW 846 - Method 8270

SITE/PROJECT: 81C ARCOC #: 600788
LABORATORY: CEL LABORATORY REPORT #: 9809831

IS	CAS #	NAME	Min RF	Int	Calib RSD (MSD1)	Calib RF (MSD1)	CCV RPD (MSD1)	CCV RFRD (MSD1 lo/y)	CCB PB	Field blank (equip n/a)	Field Dup	MS	MSD	MSD RPD	LCS	LCSD	LCS RPD	ICV RPD (MSD7)	ICV RF (MSD7)	CCV RPD (MSD1 lo/y)
5	218-01-9	Chrysene	0.70		✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓	-	✓	✓
5	117-81-7	bis(2-Ethylhexyl)phthalate	0.01		✓		✓	✓										✓		✓
6	117-84-0	Di-n-octylphthalate	0.01		✓		✓	✓										✓		✓
6	205-99-2	Benzo(b)fluoranthene	0.70		✓		✓	22.4										✓		23.
6	207-08-9	Benzo(k)fluoranthene	0.70		20.0		✓	24.9										✓		21.
6	50-32-8	Benzo(a)pyrene	0.70		✓		✓	✓										✓		✓
6	193-39-5	Indeno(1,2,3-cd)pyrene	0.50		✓		22.1	✓										20.8		
6	53-70-3	Dibenz(a,h)anthracene	0.40		✓		✓	✓										24.5		22.
6	191-24-2	Benzo(g,h,i)perylene	0.50		✓		24.8	20.1										✓		25.

Surrogate Recovery Outliers

Sample	SMC 1	SMC 2	SMC 3	SMC 4	SMC 5	SMC 6	SMC 7	SMC 8
9809831-32			130					

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

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
				n/a								

IS 1: 1,4-Dichlorobenzene-d4 IS 2: Naphthalene-d8 IS 3: Acenaphthlene-d10
IS 4: Phenathrene-d10 IS 5: Chrysene-d12 IS 6: Perylene-d12

REVIEWED BY: _____ DATE: 2/18/99

VOLATILE ORGANICS: page 2
SW-846 - Method 8260

SITE/PROJECT: 81C ARCOC #: 600788
LABORATORY: GEL LABORATORY REPORT #: 9809831

Surrogate Recovery and Internal Standard Outliers

Sample	SMC 1	SMC 2	SMC 3	IS 1-area	IS 1-RT	IS 2-area	IS 2-RT	IS 3- area	IS 3- RT			
				n/a								

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

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

REVIEWED BY: _____ DATE: 2/18/99

VOLATILE ORGANICS:
SW-846 - Method 8260

SITE/PROJECT: 81C ARCOC #: 600788 30

LABORATORY: CEL LABORATORY REPORT #: 9809831

9/8 PB	9/7 PB	9/6 PB	IS	GC/MS Name	CAS #	Min RF	Intercept n/a	Calib RF >.05	Calib RSD / R² <20% / 0.99	CCV %D <20% 10/5	Method Blks 10/5	LCS 10/5	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Bottle Blks	Trip Blks	CCV 10/6 AM	CCV 10/7 PM	CCV 10/8
				Name	CAS #																		
			1	Chloromethane	74-87-3	0.10		✓	✓	27.4	✓								✓		✓	·	27
			1	Bromomethane	74-83-9	0.10				✓	✓										34	27	✓
			1	vinyl chloride	75-01-4	0.10				✓	✓										✓	✓	✓
			1	Chloroethane	75-00-3	0.01				✓	✓										✓	✓	✓
2.6	2.3	3.2	1	methylene chloride (10xblk)	75-09-2	0.01				✓	4.6										✓	✓	✓
			1	acetone(10xblk)	67-64-1	0.01				52	✓									.22	76	63	31
			1	carbon disulfide	75-15-0	0.10				✓											✓	✓	✓
			1	1,1-dichloroethene	75-35-4	0.20				✓		✓	✓	✓	✓	✓	✓				✓	✓	✓
			1	1,1-dichloroethane	75-34-3	0.10				✓											✓	✓	✓
53	1.1	.68	1	Chloroform	67-66-3	0.20				✓											✓	✓	✓
			1	1,2-dichloroethane	107-06-2	0.10				✓											✓	✓	✓
			1	2-butanone(10xblk)	78-93-3	0.01				✓											✓	✓	✓
			2	1,1,1-trichloroethane	71-55-6	0.10				43											28	23	
			2	carbon tetrachloride	56-23-5	0.10				✓											✓	✓	
			2	Bromodichloromethane	75-27-4	0.20																	
			2	1,2-dichloropropane	78-87-5	0.01																	
			2	cis-1,3-dichloropropene	10061-01-5	0.20																	
			2	Trichloroethene	79-01-6	0.30						✓	✓	✓	✓	✓	✓			4.2	42		
			2	Dibromochloromethane	124-48-1	0.10																	
			2	1,1,2-trichloroethane	79-00-5	0.10																	
			2	Benzene	71-43-2	0.50						✓	✓	✓	✓	✓	✓						
			2	trans-1,3-dichloropropene	10061-02-6	0.10																	
			2	Bromoform	75-25-2	0.10																	
			3	4-methyl-2-pentanone	108-10-1	0.10																	
			3	2-hexanone	591-78-6	0.01				31												26	25
			3	Tetrachloroethene	127-18-4	0.20				✓													
			3	1,1,2,2-tetrachloroethane	79-34-5	0.30																	
			3	toluene(10xblk)	108-88-3	0.40						✓	✓	✓	✓	✓	✓						
			3	Chlorobenzene	108-90-7	0.50						✓	✓	✓	✓	✓	✓						
			3	Ethylbenzene	100-41-4	0.10																	
			3	Styrene	100-42-5	0.30																	
94			3	xylenes(total)	1330-20-7	0.30																	
				1,2-dichloroethylene(total)	540-59-0	0.01																	
				2-chloroethyl vinyl ether	110-75-8					22													

REVIEWED BY: _____ DATE: 2/18/99

SF 2001-COC (10-97)

Supersedes (5-97) Issue

Internal Lab Batch No. N/A

ANALYSIS REQUEST AND CHAIN OF CUSTODY

SAR/WR No.

Press F1 for instructions for each field.

ABICOC- 600788

Dept. No./Mail Stop: 6134/1148
Project/Task Manager: Paul Freshour
Project Name: 81C VCM SAMPLING
Record Center Code: ER/OU1333/DAT
Logbook Ref. No.: —
Service Order No.: CF0607

Date Samples Shipped: 9/24/98 SMO USE
Carrier/Waybill No.: [illegible]
Lab Contact: Edie Kent
Lab Destination: GEL
SMO Contact/Phone: Doug Salmi/844-3110
Send Report to SMO: Doug Salmi

Contract No.: AJ-2480A
Case No.: 7214/2213
SMO Authorization: [signature]
Bill to: Sandia National Labs
Supplier Services, Dept. —
P.O. Box 5800 MS 0154

600788

Location Tech Area Canyons
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	Preservative	Sam. Collec Meth	Samp Type	Parameter & Method Requested	LAB USE Lab Sample ID
042373-001	CY81C-GR-001-SS	1.3	81C	9/22/98 0920	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042373-002	CY81C-GR-001-SS	1.3	81C	9/22/98 0920	S	AG	120 ml	4 C	G	SA	VOC	
042373-003	CY81C-GR-001-SS	1.3	81C	9/22/98 0920	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042374-001	CY81C-GR-002-SS	1.3	81C	9/22/98 1000	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042374-002	CY81C-GR-002-SS	1.3	81C	9/22/98 1000	S	AG	120 ml	4 C	G	SA	VOC	
042374-003	CY81C-GR-002-SS	1.3	81C	9/22/98 1000	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042375-001	CY81C-GR-003-SS	1.3	81C	9/22/98 1005	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042375-002	CY81C-GR-003-SS	1.3	81C	9/22/98 1005	S	AG	120 ml	4 C	G	SA	VOC	
042375-003	CY81C-GR-003-SS	1.3	81C	9/22/98 1005	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042376-001	CY81C-GR-004-SS	1.3	81C	9/22/98 1025	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	

RMMA ☐Yes ☒No Ref. No. —
Sample Disposal ☐Return to Client ☒Disposal by lab

Sample Tracking SMO USE
Date Entered (mm/dd/yy): 9/24/98
Entered by: [illegible]

Special Instructions/QC Requirements
EDD ☒Yes ☐No
Raw data package ☒Yes ☐No

Abnormal Conditions on Receipt SMO USE

Turnaround Time ☒Normal ☐Rush Required Report Date

QC Initiated

	Name	Signature	Init	Company/Organization/Phone
Sample Team Members	Gill Baltazar	[signature]	GB	Weston/6131/971-2769
	Chris Catechis	[signature]	CC	MDM/6131/881-3196
	~~Conoetta Cassiato~~		CC	MDM/6131/884-2249

Please list as separate report.

	Org.	Date	Time		Org.	Date
1. Relinquished by [signature]	6121	9-23-98	1540	4. Relinquished by		
1. Received by [signature]	7577	9-23-98	1547	4. Received by		
2. Relinquished by [signature]	7577	9-24-98	1230	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- 600788

Project Name: 81C VCM Sampling | Project/Task Manager: Paul Freshour | Case No.: 7214/2213

Location | Tech Area Canyons | Building NA | Room NA

Sample No. – Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO)						LAB USE	
					Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
042376 - 002	CY81C-GR-004-SS	1.3	81C	9/22/98 1025	S	AG	120 ml	4 C	G	SA	VOC	
042376 - 003	CY81C-GR-004-SS	1.3	81C	9/22/98 1025	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042377 - 001	CY81C-GR-005-SS	1.1	81C	9/22/98 1045	S	AG	500 ml	4 C	G	SA	METALS, HE,SVOC	
042377 - 002	CY81C-GR-005-SS	1.1	81C	9/22/98 1045	S	AG	120 ml	4 C	G	SA	VOC	
042377 - 003	CY81C-GR-005-SS	1.1	81C	9/22/98 1045	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042378 - 001	CY81C-GR-006-SS	1.2	81C	9/22/98 1055	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042378 - 002	CY81C-GR--006-SS	1.2	81C	9/22/98 1055	S	AG	120 ml	4 C	G	SA	VOC	
042378 - 003	CY81C-GR-006-SS	1.2	81C	9/22/98 1055	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042379 - 001	CY81C-GR-007-SS	1.2	81C	9/22/98 1110	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042379 - 002	CY81C-GR-007-SS	1.2	81C	9/22/98 1110	S	AG	120 ml	4 C	G	SA	VOC	
042379 - 003	CY81C-GR-007-SS	1.2	81C	9/22/98 1110	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042380 - 001	CY81C-GR-008-SS	1.2	81C	9/22/98 1120	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042380- 002	CY81C-GR-008-SS	1.2	81C	9/22/98 1120	S	AG	120 ml	4 C	G	SA	VOC	
042380 - 003	CY81C-GR-008-SS	1.2	81C	9/22/98 1120	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042381 - 001	CY81C-GR-009-SS	1.3	81C	9/22/98 1140	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042381 - 002	CY81C-GR-009-SS	1.3	81C	9/22/98 1140	S	AG	120 ml	4 C	G	SA	VOC	
042381 - 003	CY81C-GR-009-SS	1.3	81C	9/22/98 1140	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042382- 001	CY81C-GR-010-SS	1.3	81C	9/22/98 1345	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042382- 002	CY81C-GR-010-SS	1.3	81C	9/22/98 1345	S	AG	120 ml	4 C	G	SA	VOC	
042382 - 003	CY81C-GR-010-SS	1.3	81C	9/22/98 1345	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042383 - 001	CY81C-GR-010-DP	1.3	81C	9/22/98 1345	S	AG	500 ml	4 C	G	DU	METALS, HE, SVOC	
042383 - 002	CY81C-GR-010-DP	1.3	81C	9/22/98 1345	S	AG	120 ml	4 C	G	DU	VOC	
042383 - 003	CY81C-GR-010-DP	1.3	81C	9/22/98 1345	S	AG	250 ml	4 C	G	DU	GROSS ALPHA/BETA	
042384 - 001	CY81C-GR-011-SS	1.3	81C	9/22/98 1400	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042384 - 002	CY81C-GR-011-SS	1.3	81C	9/22/98 1400	S	AG	120 ml	4 C	G	SA	VOC	
042384 - 003	CY81C-GR-011-SS	1.3	81C	9/22/98 1400	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	

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- 600788

Project Name: 81C VCM Sampling | Project/Task Manager: Paul Freshour | Case No.: 7214/2213

Location Tech Area Canyons | Building NA | Room NA

Sample No. – Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO)						LAB USE
					Sample Matrix	Container Typ	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
042385 - 001	CY81C-GR-012-SS	1.3	81C	9/22/98 1415	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042385 - 002	CY81C-GR-012-SS	1.3	81C	9/22/98 1415	S	AG	120 ml	4 C	G	SA	VOC	
042385 - 003	CY81C-GR-012-SS	1.3	81C	9/22/98 1415	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042386 - 001	CY81C-GR-013-SS	1.3	81C	9/22/98 1425	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042386 - 002	CY81C-GR-013-SS	1.3	81C	9/22/98 1425	S	AG	120 ml	4 C	G	SA	VOC	
042386 - 003	CY81C-GR-013-SS	1.3	81C	9/22/98 1425	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042387 – 001	CY81C-GR-014-SS	1.3	81C	9/22/98 1445	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042387 - 002	CY81C-GR-014-SS	1.3	81C	9/22/98 1445	S	AG	120 ml	4 C	G	SA	VOC	
042387 - 003	CY81C-GR-014-SS	1.3	81C	9/22/98 1445	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042388 - 001	CY81C-GR-015-SS	1.2	81C	9/22/98 1450	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042388 - 002	CY81C-GR-015-SS	1.2	81C	9/22/98 1450	S	AG	120 ml	4 C	G	SA	VOC	
042388 - 003	CY81C-GR-015-SS	1.2	81C	9/22/98 1450	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042389 - 001	CY81C-GR-016-SS	1.2	81C	9/22/98 1500	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042389 - 002	CY81C-GR-016-SS	1.2	81C	9/22/98 1500	S	AG	120 ml	4 C	G	SA	VOC	
042389 - 003	CY81C-GR-016-SS	1.2	81C	9/22/98 1500	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042390 - 001	CY81C-GR-017-SS	1.6	81C	9/23/98 0915	S	AG	500 ml	4 C	G	MSMSD	METALS, HE, SVOC	
042390 - 002	CY81C-GR-017-SS	1.6	81C	9/23/98 0915	S	AG	120 ml	4 C	G	MSMSD	VOC	
042390 - 003	CY81C-GR-017-SS	1.6	81C	9/23/98 0915	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042391 - 001	CY81C-GR-018-SS	1.3	81C	9/23/98 0920	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042391 - 002	CY81C-GR-018-SS	1.3	81C	9/23/98 0920	S	AG	120 ml	4 C	G	SA	VOC	
042391 - 003	CY81C-GR-018-SS	1.3	81C	9/23/98 0920	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042392 - 001	CY81C-GR-018-DP	1.3	81C	9/23/98 0920	S	AG	500 ml	4 C	G	DU	METALS, HE, SVOC	
042392 - 002	CY81C-GR-018-DP	1.3	81C	9/23/98 0920	S	AG	120 ml	4 C	G	DU	VOC	
042392 - 003	CY81C-GR-018-DP	1.3	81C	9/23/98 0920	S	AG	250 ml	4 C	G	DU	GROSS ALPHA/BETA	
042393 - 001	CY81C-GR-019SS	1.4	81C	9/23/98 0935	S	AG	120 ml	4 C	G	SA	METALS,HE,SVOC	
042393 - 002	CY81C-GR-019-SS	1.4	81C	9/23/98 0935	S	AG	120 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)

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- 600788

Project Name: 81C VCM Sampling | Project/Task Manager: Paul Freshour | Case No.: 7214/2213

Location | Tech Area: Canyons | Building: NA | Room: NA

Sample No. – Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO)						LAB USE	
					Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
042393 - 003	CY81C-GR-019-SS	1.4	81C	9/23/98 0935	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042394 - 001	CY81C-GR-020-SS	1.0	81C	9/23/98 0945	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	-5
042394 - 002	CY81C-GR-020-SS	1.0	81C	9/23/98 0945	S	AG	120 ml	4 C	G	SA	VOC	
042394 - 003	CY81C-GR-020-SS	1.0	81C	9/23/98 0945	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042395 - 001	CY81C-GR-021-SS	1.2	81C	9/23/98 0955	S	AG	500 ml	4 C	G	SA	METALS, HE, SVOC	
042395 - 002	CY81C-GR-021-SS	1.2	81C	9/23/98 0955	S	AG	120 ml	4 C	G	SA	VOC	
042395 - 003	CY81C-GR-021-SS	1.2	81C	9/23/98 0955	S	AG	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042396 - 001	CY81C-GR-001-EB	NA	81C	9/23/98 1025	DIW	P	500 ml	HNO3	G	EB	METALS	
042396 - 002	CY81C-GR-001-EB	NA	81C	9/23/98 1025	DIW	AG	3x40 ml	HCL	G	EB	VOC	
042396 - 003	CY81C-GR-001-EB	NA	81C	9/23/98 1025	DIW	AG	4x1 L	None	G	EB	HE	
042396 - 005	CY81C-GR-001-EB	NA	81C	9/23/98 1025	DIW	AG	2x1 L	None	G	EB	SVOC	
042397 - 001	CY81C-GR-001-TB	NA	81C	9/23/98 1025	DIW	G	3x40 ml	HCL	G	TB	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)

Site: 81C

AR/COC: 600790 Data Classification: All

Sample Fraction No.	Analysis	DV Qualifiers	Comments
	See Attached		
	Table		
	Data is acceptable		
	QC measures are 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: Kevin A Lambert Date: 2-25-99

Sample Number		206-44-0 (fluoranthene)	108-60-1 (bis[2-chloroisopropyl]ether)	91-94-1 (3,3'-dichlorobenzidine)	84-66-2 (diethylphthalate)		99-65-0 (1,3-dinitrobenzene)	479-45-8 (tetryl)		7439-97-6 (mercury)
ARCOC #600790										
SVOc, HE, & Metals Analysis										
CY81C-GR-41-SS		UJ	UJ	UJ	UJ		J	UJ		J,B
CY81C-GR-42-SS		UJ	UJ	UJ	UJ		J	UJ		J,B
CY81C-GR-43-SS		UJ	UJ	UJ	UJ		UJ	UJ		J,B
CY81C-GR-44-SS		UJ	UJ	UJ	UJ		UJ	UJ		J,B
CY81C-GR-44-DP		UJ	UJ	UJ	J		UJ	UJ		J,B
CY81C-GR-45-SS		UJ	UJ	UJ	UJ		UJ	UJ		J,B
CY81C-GR-46-SS		UJ	UJ	UJ	UJ		UJ	UJ		J,B
CY81C-GR-47-SS		UJ	UJ	UJ	UJ		UJ	UJ		J,B
CY81C-GR-48-SS		UJ	UJ	UJ	UJ		UJ	UJ		J,B
CY81C-GR-49-SS		UJ	UJ	UJ	UJ		UJ	UJ		J,B
CY81C-GR-50-SS		UJ	UJ	UJ	UJ		UJ	UJ		J,B
CY81C-GR-51-SS		UJ	UJ	UJ	J		UJ	UJ		J,B
CY81C-GR-52-SS		UJ	UJ	UJ	UJ		UJ	UJ		J,B
CY81C-GR-53-SS		UJ	UJ	UJ	J		UJ	UJ		J,B
CY81C-GR-54-SS		UJ	UJ	UJ	UJ		UJ	UJ		J,B

2-25-99

MEMORANDUM

DATE: February 25, 1999

TO: File

FROM: Kevin Lambert KAL

SUBJECT: Organic Data Review and Validation
Site 81C, ARCOC No. 600790, Case No. 7214.2213

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

Summary

The samples were prepared and analyzed with accepted procedures and specified method (VOC – EPA8260, SVOC – EPA8270, and HE – EPA8330). All compounds were successfully analyzed. Problems were identified with the data package that result in the qualification of data.

1. SVOC analysis: The initial calibration response factor (RF) for fluoranthene was below the QC acceptance criteria for the minimum RF. Sample results are non-detect and will be qualified "UJ."

2. SVOC analysis: The continuing calibration verification (CCV) relative percent difference (RPD) for bis(2-chloroisopropyl)ether and 3,3'-dichlorobenzidine was outside the QC acceptance criteria. Sample results are non-detect and will be qualified "UJ."

3. SVOC analysis: For the field duplicate pair, the difference between the original result and the duplicate result is greater than the reporting limit (RL) for diethylphthalate. Positive sample results will be qualified "J" and non-detects will be qualified "UJ."

4. HE analysis: The initial calibration intercept for 1,3-dinitrobenzene and tetryl was greater than three times the instrument detection limit (IDL). Positive sample results for 1,3-dinitrobenzene will be qualified "J" and non-detects will be qualified "UJ." Sample results for tetryl are non-detect and 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

The samples were extracted and analyzed within the prescribed holding times for all method.

Calibration

SVOC Analysis: The initial and continuing calibration met QC acceptance criteria except as noted above in the summary section. Also, the initial calibration RF for acenaphthene (0.86) was slightly below the QC acceptance criteria for the minimum RF (0.90). All other QC met criteria and sample results are non-detect; no data was qualified. In addition, the initial calibration relative standard deviation (RSD) for 4,6-dinitro-2-methylphenol (26.2) was slightly above the QC acceptance criteria (20). All other QC met criteria and sample results are non-detect; no data was qualified. Finally, the continuing calibration RPD for 3-nitroaniline (-20.4) was slightly outside the QC acceptance criteria. All other QC met criteria and sample results are non-detect; no data was qualified.

VOC Analysis: The initial calibration met QC acceptance criteria except the RF for trichloroethene (0.26) was slightly below the QC acceptance criteria for the minimum RF (0.30). All other QC met criteria and sample results are non-detect; no data was qualified. The continuing calibration met QC acceptance criteria except the RPD for chloroethane (-25.1), 1,1,1-trichloroethane (-26.9), carbon tetrachloride (-29.7), 1,1,2-trichloroethane (-24.1), 4-methyl-2-petanone (39.2), 2-hexanone (22.0), 1,1,2,2-tetrachloroethane (26.3), and vinyl acetate (-24.8) was slightly outside the QC acceptance criteria (20). All other QC met criteria and sample results are non-detect; no data was qualified.

HE Analysis: The initial and continuing calibration met QC acceptance criteria except as noted above in the summary section.

Blanks

SVOC & HE Analysis: No target analytes were detected in the method blanks.

VOC Analysis: No target analytes were observed in the method blanks except for methylene chloride. Sample results are non-detect; no data was qualified.

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

SVOC & HE Analysis: The LCS/LCSD met QC acceptance criteria.

VOC Analysis: The LCS/LCSD met QC acceptance criteria except the LCSD RPD for benzene was outside the acceptance limit. All other QC met criteria and sample results are non-detect; no data was qualified.

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

The MS/MSD met QC acceptance criteria for all methods.

Surrogates

The surrogate recoveries met QC acceptance limits for all methods.

Internal Standards

SVOC & VOC Analysis: The internal standards met QC acceptance limits for all methods.

HE Analysis: Not Applicable

Other QC

SVOC Analysis: The field duplicate pair met QC acceptance criteria except as noted above in the summary section. No target analytes were detected in the equipment blank (EB). No field blank (FB) was submitted on ARCOC.

VOC Analysis: The field duplicate pair met QC acceptance criteria. No target analytes were detected in the EB except tetrachloroethene was observed at an estimated value ('J" coded). Sample results are non-detect; no data was qualified. No target analytes were detected in the trip blank (TB) except methylene chloride was observed at an estimated value ('J" coded). Sample results are non-detect; no data was qualified.

HE Analysis: The field duplicate pair met QC acceptance criteria. No target analytes were detected in the EB. No FB was submitted on ARCOC.

No other specific issues were identified which affect data quality.

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

MEMORANDUM

DATE: February 25, 1999

TO: File

FROM: Kevin Lambert KL

SUBJECT: Inorganic Data Review and Validation
Site 81C, ARCOC No. 600790, Case No. 7214.2213

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

Summary

The samples were prepared and analyzed with accepted procedures and specified methods (Metals – EPA6010/7000 series). All compounds were successfully analyzed. A minor problem was identified with the data package that result in the qualification of data.

1. In the method blank, mercury was observed at estimated value ("J" coded). Sample results are less than five times the blank concentration and 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.

Calibration

Initial and continuing calibration met QC acceptance criteria for all methods.

Blanks

No target analytes were observed in the method blank except as noted above in the summary section.

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

The LCS/LCSD met QC acceptance criteria for all methods.

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

The MS/MSD met QC acceptance criteria for all methods.

ICP Interference Check Sample (ICS) Analysis

The ICS met QC acceptance criteria.

Serial Dilution

The serial dilution met QC acceptance criteria.

Other QC

The field duplicate pair met QC acceptance criteria. No target analytes were detected in the equipment blank (EB) except barium was observed at an estimated value ("J" coded). Sample results for barium are greater than five time the blank concentration; no data was qualified. No field blank (FB) was submitted on ARCOC

No other specific issues were identified which affect data quality.

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

MEMORANDUM

DATE: February 25, 1999

TO: File

FROM: Kevin Lambert KAL

SUBJECT: Radiometric Data Review and Validation
Site 81C, ARCOC No. 600790, Case No. 7214.2213

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 – EPA900.0). All compounds were successfully analyzed. No problems were identified with the data package that result in the qualification of data.

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

Holding Times

The samples were analyzed within the prescribed holding times.

Blanks

No target analytes were detected in the method blank.

Laboratory Control Sample (LCS) Analyses

The LCS met QC acceptance criteria.

Matrix Spike (MS) Analyses

The MS met QC acceptance criteria.

Replicate

The laboratory replicate met QC acceptance criteria.

Other QC

The field duplicate met QC acceptance criteria. No equipment blank (EB) or field blank (FB) was submitted on ARCOC.

No other specific issues were identified which affect data quality.

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

DATA VALIDATION SUMMARY:

SITE/PROJECT: Site 81C CASE #: 7214.2213 # OF SAMPLES: 50 MATRIX: 45 soil & 5 aqueous
ARCOC #: 600790
LABORATORY: GEL
LABORATORY REPORT #: 81C06(8A241) - 981024I
LAB SAMPLE IDs: 981024I-01 to -45
981024I-46 to -49 (EB)
981024I-50 (TB)

ANALYSIS/ QC ELEMENT	VOC	SVOC	PEST/ PCB	HPLC (HE)	ICP/AES	GFAA/ AA	CVAA (Hg)	CN	RAD	OTHER
1. HOLDING TIMES/ PRESERVATION	✓	✓	NA	✓	✓	NA	✓	NA	✓	
2. CALIBRATIONS	✓	UJ		J, UJ	✓		✓		✓	
3. METHOD BLANKS	✓	✓		✓	✓		J		✓	
4. MS/MSD	✓	✓		✓	✓		✓		✓	
5. LABORATORY CONTROL SAMPLES	✓	✓		✓	✓		✓		✓	
6. REPLICATES					✓		✓		✓	
7. SURROGATES	✓	✓		✓						
8. INTERNAL STDS	✓	✓		NA	NA		NA		NA	
9. TCL COMPOUND IDENTIFICATION	✓	NA								
10. ICP INTERFERENCE CHECK SAMPLE					✓					
11. ICP SERIAL DILUTION					✓					
12. CARRIER/CHEM TRACER RECOVERIES									NA	
13. OTHER QC	✓	J, UJ		✓	✓		✓		✓	

CHECK MARK (√) – ACCEPTABLE
J – ESTIMATED
U – NOT DETECTED
SHADED CELLS – NOT APPLICABLE
UJ – NOT DETECTED. ESTIMATED
R – UNUSABLE
NA - Not Applicable

REVIEWED BY: Kevin A Lambert DATE: 2-25-99

Sample IDs

9810241-01, -04, -07, -10, -13, -16, -19, -22
-25, -28, -31, -34, -40, -43, -49

SEMI-VOLATILE ORGANICS:
SW-846 - Method 8270

SITE/PROJECT: Site 81C ARCOC #: 600790
LABORATORY: GEL LABORATORY REPORT #: 9810241

IS	BNA	CAS #	NAME	Min RF	Intercept (①)	Calib RF (①)	Calib RSD / R^2 (②)	CCV RPD (③)	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Eq. Blks	Field Blks			
					NA	>.05	<20% / 0.99	<20%										NA			
1	A	108-95-2	Phenol	0.80		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
1	BN	111-44-4	bis(2-Chloroethyl)ether	0.70		✓	✓	✓		NA	→	→	→	→	→						
1	A	95-57-8	2-Chlorophenol	0.80		✓	✓	✓		✓	✓	✓	✓	✓	✓						
1	BN	541-73-1	1,3-Dichlorobenzene	0.60		✓	✓	✓		NA	→	→	→	→	→						
1	BN	106-46-7	1,4-Dichlorobenzene	0.50		✓	✓	✓		✓	✓	✓	✓	✓	✓						
1	BN	95-50-1	1,2-Dichlorobenzene	0.40		✓	✓	✓		NA	→	→	→	→	→						
1	A	95-48-7	2-Methylphenol	0.70		✓	✓	✓		↓	↓	↓	↓	↓	↓						
1	BN	108-60-1	bis(2-chloroisopropyl)ether	0.01		✓	✓	-44.6		↓	↓	↓	↓	↓	↓						
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	→	→	→	→	→						
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	→	→	→	→	→						
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

① Two compounds did not meet criteria. RFs slightly below criteria. All other QC met criteria. Sample results ND, No data qualified, exce
one compound (fluoranthene) will be "UJ" coded.

② One compound did not meet criteria. RSD slightly above criteria. All other QC met criteria. Sample results
No data qualified

③ Three compounds did not meet criteria. One RPD slightly above criteria, No data qualified. One RPD > 40%, sample resu
ND and will be "UJ" coded. One RPD > 60% sample results ND and will be "R" coded

REVIEWED BY: Kenneth Lambert DATE: 2-25-99

"UJ" 2-23-99 KHL

SEMI-VOLATILE ORGANICS: page 2
SW 846 - Method 8270

SITE/PROJECT: Site 81C ARCOC #: 600790
LABORATORY: GEL LABORATORY REPORT #: 9810241

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
					NA	>.05	<20% / 0.99	<20%									✓	NA
3	BN	91-58-7	2-Chloronaphthalene	0.80		✓	✓	✓	✓	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		✓	✓	✓		✓ KM 2-23-99								
3	BN	606-20-2	2,6-Dinitrotoluene	0.20		✓	✓	✓										
3	BN	99-09-2	3-Nitroaniline	0.01		✓	✓	-20.4										
3	BN	83-32-9	Acenaphthene	0.90		0.86	✓	✓		✓	✓	✓	✓	✓	✓			
3	A	51-28-5	2,4-Dinitrophenol	0.01		✓	✓	✓		NA	→	→	→	→	→			
3	A	100-02-7	4-Nitrophenol	0.01		✓	✓	✓		✓	✓	✓	✓	✓	✓			
3	BN	132-64-9	Dibenzofuran	0.80		✓	✓	✓		NA	→	→	→	→	→			
3	BN	121-14-2	2,4-Dinitrotoluene	0.20		✓	✓	✓		✓	✓	✓	✓	✓	✓			
3	BN	84-66-2	Diethylphthalate	0.01		✓	✓	✓		NA	→	→	→	→	→	1900 J 330 2-25-99 KM		
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		✓	~~26.2~~ ✓ 2-23-99 KM	✓										
4	A	534-52-1	4,6-Dinitro-2-methylphenol	0.01		✓	26.2	✓										
4	BN	86-30-6	N-Nitrosodiphenylamine (1)	0.01		✓	✓	✓		✓ KM 2-23-99								
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	→	→	→	→	→			
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		0.099	✓	✓		✓	✓	✓	✓	✓	✓			
5	BN	129-00-0	Pyrene	0.60		✓	✓	✓		✓	✓	✓	✓	✓	✓			
5	BN	85-68-7	Butylbenzylphthalate	0.01		✓	✓	✓		NA	→	→	→	→	→			
5	BN	91-94-1	3,3'-Dichlorobenzidine	0.01		✓	✓	-71.4										
5	BN	56-55-3	Benzo(a)anthracene	0.80		✓	✓	✓		✓	✓	✓	✓	✓	✓			

Comments: ⊕ The difference between the original result and replicate result is greater than RL for Diethylphth. Positive results will be "J" coded and non-detects are "UJ" coded.

REVIEWED BY: Kevin A. Lambert DATE: 2-25-99

SEMI-VOLATILE ORGANICS: page 3
SW 846 - Method 8270

SITE/PROJECT: Site 81C ARCOC #: 600790
LABORATORY: GEL LABORATORY REPORT #: 9810241

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			
					NA	>.05	<20% / 0.99	<20%									✓	NA			
5	BN	218-01-9	Chrysene	0.70		✓	✓	✓	✓	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		✓	✓	✓													
6	BN	191-24-2	Benzo(g,h,i)perylene	0.50	↓	✓	✓	✓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓			

Surrogate Recovery Outliers

Sample	SMC 1	SMC 2	SMC 3	SMC 4	SMC 5	SMC 6	SMC 7	SMC 8
			Met 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
					Met 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: Kevin A. Lambert DATE: 2-25-99

VOLATILE ORGANICS:
SW-846 - Method 8260

Sample IDs
9810241-02, -05, -08, -11, -14, -17, -20, -23, -26, -29, -32, -35, -38, -41, -44, -47, -50

SITE/PROJECT: Site 81C ARCOC #: 600790
LABORATORY: GEL LABORATORY REPORT #: 9810241 (4) 2-25-99

IS	GC/MS		Min RF	Intercept	(1) Calib RF	Calib RSD / R^2	(2) CCV RPD	(3) Method Blks	LCS	LCSD	(3) LCS RPD	MS	MSD	MS RPD	Field Dup RPD	(5) Eq. Blks	(6) Trip Blks			
	Name	CAS #			>.05	<20% / 0.99	<20%													
1	Chloromethane	74-87-3	0.10		✓	✓	✓	✓							✓	✓	✓			
1	Bromomethane	74-83-9	0.10	✓	✓	✓	✓									✓	✓			
1	vinyl chloride	75-01-4	0.10		✓	✓	✓									✓	✓			
1	Chloroethane	75-00-3	0.01		✓	✓	-25.1									✓	✓			
1	methylene chloride (10xblk)	75-09-2	0.01	✓		✓	✓	1.2								✓	2.2J			
1	acetone(10xblk)	67-64-1	0.01	✓	✓	✓	✓	✓								✓	✓			
1	carbon disulfide	75-15-0	0.10		✓	✓	✓									✓	✓			
1	1,1-dichloroethene	75-35-4	0.20		✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓			
1	1,1-dichloroethane	75-34-3	0.10		✓	✓	✓									✓	✓			
1	Chloroform	67-66-3	0.20		✓	✓	✓									✓	✓			
1	1,2-dichloroethane	107-06-2	0.10		✓	✓	✓									✓	✓			
1	2-butanone(10xblk)	78-93-3	0.01		✓	✓	✓									✓	✓			
2	1,1,1-trichloroethane	71-55-6	0.10		✓	✓	-26.9									✓	✓			
2	carbon tetrachloride	56-23-5	0.10		✓	✓	-29.7									✓	✓			
2	Bromodichloromethane	75-27-4	0.20		✓	✓	✓									✓	✓			
2	1,2-dichloropropane	78-87-5	0.01		✓	✓	✓									✓	✓			
2	cis-1,3-dichloropropene	10061-01-5	0.20		✓	✓	✓									✓	✓			
2	Trichloroethene	79-01-6	0.30		0.26	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓			
2	Dibromochloromethane	124-48-1	0.10		✓	✓	✓									✓	✓			
2	1,1,2-trichloroethane	79-00-5	0.10		✓	✓	24.1									✓	✓			
2	Benzene	71-43-2	0.50		✓	✓	✓		✓	✓	29.6	✓	✓	✓		✓	✓			
2	trans-1,3-dichloropropene	10061-02-6	0.10		✓	✓	✓									✓	✓			
2	Bromoform	75-25-2	0.10		✓	✓	✓									✓	✓			
3	4-methyl-2-pentanone	108-10-1	0.10		✓	✓	39.2									✓	✓			
3	2-hexanone	591-78-6	0.01		✓	✓	22.0									✓	✓			
3	Tetrachloroethene	127-18-4	0.20		✓	✓	✓									0.75J	✓			
3	1,1,2,2-tetrachloroethane	79-34-5	0.30		✓	✓	26.3									✓	✓			
3	toluene(10xblk)	108-88-3	0.40		✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓			
3	Chlorobenzene	108-90-7	0.50		✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓			
3	Ethylbenzene	100-41-4	0.10		✓	✓	✓									✓	✓			
3	Styrene	100-42-5	0.30		✓	✓	✓									✓	✓			
3	xylenes(total)	1330-20-7	0.30		✓	✓	✓									✓	✓			
	1,2-dichloroethylene(total)	540-59-0	0.01		✓	✓														
	2-chloroethyl vinyl ether	110-75-8																		
	vinyl acetate	108-05-4			✓	✓	-24.8	✓								✓	✓			
	1,2-trans-dichloroethylene	156-60-5						✓								✓	✓			
	1,2-cis-dichloroethylene	156-59-2						✓								✓	✓			

Comments: (1) Met criteria except one compd, Value within rounding error, Sample results ND, No data qualified
(2) Met criteria except 8 compds, Values < 40%, Sample results ND, No data qualified
(3) No analytes above RL except one compd. Sample results ND, No data qualified.

REVIEWED BY: Kevin A Lambert DATE: 2-25-99

VOLATILE ORGANICS: page 2
SW-846 - Method 8260

SITE/PROJECT: Site 81C ARCOC #: 600790
LABORATORY: GEL LABORATORY REPORT #: 9810241

Surrogate Recovery and Internal Standard Outliers

Sample	SMC 1	SMC 2	SMC 3	IS 1-area	IS 1-RT	IS 2-area	IS 2-RT	IS 3- area	IS 3- RT			
					Met							
					Criteria							

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

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

Comments:
(4) Met criteria except one compd, RPD slightly above control limit, Sample results ND, No data qualified
(5) No analytes above RL, but one compd observed at estimated value ("J"), Sample results ND, No data qualified
(6) No analyte above RL, but one compd observed at estimated value ("J"), Sample results ND, No data qualified

REVIEWED BY Kevin A Lambert DATE: 2-25-99

HIGH EXPLOSIVES:
SW846 Method 8330

Sample LDS
9810241-01, -04, -07, -10, -13, -19, -22, -25, -28, -31, -34, -37, -40, -43, -4

SITE/PROJECT: Site SIC ARCOC #: 600790
LABORATORY: GEL LABORATORY REPORT #: 9810241

~~Technical~~ 2-19-99 KAL

(2) (3) 2-19-99 KAL

NAME	CAS #	Curve R^2	CCV RPD	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Eq. Blks	Field Blks	Intercept	3X IDL	
		.99	20%	U			20%			20%		U	U			
HMX	2691-41-0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	✓		
RDX	121-82-4	✓	✓	✓										↓		
1,3,5-Trinitrobenzene	99-35-4	✓	✓	✓										↓		
1,3-dinitrobenzene	99-65-0 ~~KAL~~	✓	✓	✓										14.9	12.3	
Nitrobenzene	98-95-3	✓	✓	✓										✓		
Tetryl	479-45-8	✓	✓	✓										29.6	22.5	
2,4,6-trinitrotoluene	118-96-7	✓	✓	✓										✓		
2-amino-4,6-dinitrotoluene	35572-78-2	✓	✓	✓										↓		
4-amino-2,6-dinitrotoluene	1946-51-0	✓	✓	✓												
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	→									NA	↓	↓		

Sample	SMC %REC	SMC RT		Sample	SMC %REC	SMC RT
		Met Coelessia				

(1) Confirmation

Sample	CAS #	RPD > 25%		Sample	CAS #	~~RPD > 25%~~
		Not Reported				

Comments:
(1) Case narrative states positive analyte confirmation was accomplished but no data was reported.
(2) 1,3-dinitrobenzene sample results for 9810241-01 & -04 will be "J" coded and non-detects will be "UJ" coded for the remainining sample results
(3) Tetryl is non-detect all samples and will be "UJ" coded

REVIEWED BY: Kevin A Lambert DATE: 2-25-99

INORGANIC METALS:

Sample IDs
9810241-01, -04, -07, -10, -13, -16, -1
-22, -25, -28, -31, -34, -37, -4
-43, -46

SITE/PROJECT: Site 81C ARCOC #: 600790
LABORATORY: GEL LABORATORY REPORT #: 9810241
METHODS: EPA 6010/7000 series

QC Element/ Analyte	ICV	CCV	ICB	CCB	Method Blks (1)	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	REP RPD	ICS AB	Serial Dilution	Field Dup RPD	Eq. Blks (2)	Field Blks			
7429-90-5 Al												NA					NA			
7440-39-3 Ba	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	0.00109 J				
7440-41-7 Be	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	NA	✓	✓				
7440-43-9 Cd	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	NA	✓	✓				
7440-70-2 Ca																				
7440-47-3 Cr	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	NA	✓	✓				
7440-48-4 Co																				
7440-50-8 Cu																				
7439-89-6 Fe																				
7439-95-4 Mg																				
7439-96-5 Mn																				
7440-02-0 Ni																				
7440-09-7 K																				
7440-22-4 Ag	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	NA	✓	✓				
7440-23-5 Na																				
7440-62-2 V																				
7440-66-6 Zn																				
7439-92-1 Pb	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	NA	✓	✓				
7782-49-2 Se	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	NA	✓	✓				
7440-38-2 As	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	NA	✓	✓				
7440-36-0 Sb																				
7440-28-0 Tl																				
7439-97-6 Hg	✓	✓	✓	✓	0.0172 J	✓	✓	✓	✓	✓	✓		NA	NA	✓	✓				
Cyanide CN																				

NA - Not Applicable

Comments: (1) Hg sample results are < 5x blank [c] (0.0860 mg/kg). All sample results will be qualified as estimated "J".

(2) Ba sample results are > 5x blank [c]; no data qualified

REVIEWED BY: Kevin A Lambert DATE: 2-25-99

RADIOCHEMISTRY:

Sample IDs
9810241-03, -06, -09, -12, -15, -18, -21, -24, -27, -30, -33, -36, -39, -42, -45

SITE/PROJECT: Site 81C ARCOC #: 600790
LABORATORY: GEL LABORATORY REPORT #: 9810241
METHODS: EPA 900.0 (Gross Alpha/Beta)

QC Element/ Analyte	Method Blks	LCS	MS	Rep RER	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	-									
U-238																	
U-234																	
U-235/236								-									
Th-232																	
Th-228																	
Th-230								-									
Pu-239/240																	
Gross Alpha	✓	✓	✓	✓		✓		-									
Nonvolatile Beta	✓	✓	✓	✓		✓											
Ra226								-									
Ra228								-									
Gamma Spec								-									
Ni-63								-									
								-									
								-									

No 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:
Met Criteria
No data qualified

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

REVIEWED BY: Kevin H Lambert DATE: 2-25-99

Contract Verification Review (CVR)

Project Leader PAUL FRESHOUR Project Name 81C VCM SAMPLING Case No. 7214.2213

AR/COC No. 600790 Analytical Lab GEL SDG No. 8SL06 (8A241)

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				
2.10	Narrative provided	X				
2.11	TAT met	X				
2.12	Hold times met	X		Sample 042236-112 out by 11 minutes; time not given for HE analysis		
2.13	Were contractual qualifiers provided		X	"B" not provided for Mercury and Methylene Chloride		
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		
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 DUP RPD% high for Benzene
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	2-Hexanone, Beryllium detected in aqueous method blanks Methylene Chloride, Mercury detected in soil method blanks
b) Sampling blank (e.g., field, trip, and equipment) data reported and met?		X	Barium, 2-Hexanone, Methylene Chloride, Tetrachloroethylene detected in EB 2-Hexanone, Methylene Chloride detected in TB
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	"B" not provided for Methylene Chloride
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
All soil voc samples	8260	B	Methylene Chloride detected in soil method blank—associated sample not qualified with "B"
All soil Mercury samples	7471	B	Mercury detected in soil method blank—associated samples not qualified with "B"
All HE soil samples	8330		Extraction time not provided

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 1550 and date correction request was submitted 12/01/98

Reviewed by: [signature] Date: 11/30/98 Closed by: [signature] Date: 02-02-99

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- 600790

Dept. No./Mail Stop: 6134/1148
Project/Task Manager: Paul Freshour
Project Name: 81C VCM SAMPLING
Record Center Code: ER/OU1333/DAT
Logbook Ref. No.: __
Service Order No.: CF0628

Date Samples Shipped: 10/6/98 (SMO USE)
Carrier/Waybill No.: 713405
Lab Contact: Edie Kent
Lab Destination: GEL
SMO Contact/Phone: Doug Salmi/844-3110
Send Report to SMO: Doug Salmi

Contract No.: AJ-2480A
Case No.: 7214/2213
SMO Authorization: Douglas Salmi
Bill to: Sandia National Laboratories
Supplier Services, Dept. _____
P.O. Box 5800- MS 0154

Q-35325
CSL06
~~GA244~~

Location — Tech Area: Canyons — 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	Preservative	Sample Collection Method	Sample Type	Reference LOV (available at SMO) Parameter & Method Requested	Lab Sample ID
[redacted]	[redacted]										9810241%	LAB USE
[redacted]	[redacted]											
[redacted]	[redacted]											
042422 - 001	CY81C-GR-041-SS	3ft	81C	100598 1336	S	G	500 ml	4 C	G	SA	METALS, HE, SVOC	
042422 - 002	CY81C-GR-041-SS		81C	" 1336	S	G	120 ml	4 C	G	MSMSD	VOC	
042422 - 003	CY81C-GR-041-SS		81C	" 1336	S	G	250 ml	4 C	G	MSMSD	GROSS ALPHA/BETA	
042423 - 001	CY81C-GR-042-SS		81C	" 1345	S	G	500 ml	4 C	G	SA	METALS, HE, SVOC	
042423 - 002	CY81C-GR-042-SS		81C	" 1345	S	G	120 ml	4 C	G	SA	VOC	
042423 - 003	CY81C-GR-042-SS		81C	" 1395	S	G	250 ml	4 C	G	SA	GROSS ALPHA/BETA	

RMMA ☐Yes ☒No Ref. No. __

Sample Disposal ☐Return to Client ☒Disposal by lab

Sample Tracking (SMO USE)
Date Entered (mm/dd/yy):
Entered by:

Special Instructions/QC Requirements
EDD ☒Yes ☐No
Raw data package ☒Yes ☐No

Abnormal Conditions on Receipt (LAB USE)

Turnaround Time ☒Normal ☐Rush Required Report Date

QC Initials:

	Name	Signature	Init	Company/Organization/Phone
Sample Team Members	Concetta Carriato	Concetta Carriato	CC	MDM 6131 540-9143
	Chris Catechis	Chris Catechis	CC	MDM 6131 881-3196
	William J Gibson Jr.	William J Gibson Jr.	WJG	MDM 6131 881-3196

Please list as separate report.

1. Relinquished by	Concetta Carriato	Org. 6131	Date 10-06-98	Time 1100	4. Relinquished by		Org.	Date
1. Received by	SMO	Org. 7577	Date 10/6/98	Time 1100	4. Received by		Org.	Date
2. Relinquished by	Chris Catechis	Org. 7578	Date 10/6/98	Time 1200	5. Relinquished by		Org.	Date
2. Received by	Bonnie Terry	Org. GEL	Date 10/7/98	Time 0900	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- 600790

Project Name: 81C VCM Sampling Project/Task Manager: Paul Freshour Case No.: 7214/2213

Location Tech Area Canyons

Building NA Room NA

Sample No. – Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO)						Parameter & Method Requested	LAB US Lab Samp ID
					Sample Matrix	Container Type	Container Volume	Preservative	Sample Collection Method	Sample Type		
042424 - 001	CY81C-GR-043-SS	3ft	81C	10/29/98 1400	S	G	500 ml	4 C	G	SA	METALS, HE, SVOC	
042424 - 002	CY81C-GR-043-SS		81C	" 1400	S	G	120 ml	4 C	G	SA	VOC	
042424 - 003	CY81C-GR-043-SS		81C	" 1400	S	G	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042425 - 001	CY81C-GR-044-SS		81C	" 1405	S	G	500 ml	4 C	G	SA	METALS, HE,SVOC	
042425 - 002	CY81C-GR-044-SS		81C	" 1405	S	G	120 ml	4 C	G	SA	VOC	
042425 - 003	CY81C-GR-044-SS		81C	" 1405	S	G	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042426 - 001	CY81C-GR-044-DP		81C	" 1405	S	G	500 ml	4 C	G	DU	METALS, HE, SVOC	
042426 - 002	CY81C-GR-044-DP		81C	" 1405	S	G	120 ml	4 C	G	DU	VOC	
042426 - 003	CY81C-GR-044-DP		81C	" 1405	S	G	250 ml	4 C	G	DU	GROSS ALPHA/BETA	
042427 - 001	CY81C-GR-045-SS		81C	" 1420	S	G	500 ml	4 C	G	SA	METALS, HE, SVOC	
042427 - 002	CY81C-GR-045-SS		81C	" 1420	S	G	120 ml	4 C	G	SA	VOC	
042427 - 003	CY81C-GR-045-SS		81C	" 1420	S	G	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042428 - 001	CY81C-GR-046-SS		81C	" 1430	S	G	500 ml	4 C	G	SA	METALS, HE, SVOC	
042428 - 002	CY81C-GR-046-SS		81C	" 1430	S	G	120 ml	4 C	G	SA	VOC	
042428 - 003	CY81C-GR-046-SS		81C	" 1430	S	G	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042429 - 001	CY81C-GR-047-SS		81C	" 1440	S	G	500 ml	4 C	G	SA	METALS, HE, SVOC	
042429 - 002	CY81C-GR-047-SS		81C	" 1440	S	G	120 ml	4 C	G	SA	VOC	
042429 - 003	CY81C-GR-047-SS		81C	" 1440	S	G	250 ml	4 C	G	SA	GROSS ALPHA/BETA	
042230 - 001	CY81C-GR-048-SS		81C	" 1445	S	G	500 ml	4 C	G	SA	METALS, HE, SVOC	
042230 - 002	CY81C-GR-048-SS		81C	" 1445	S	G	120 ml	4 C	G	SA	VOC	
042230 - 003	CY81C-GR-048-SS		81C	" 1445	S	G	250 ml	4 C	G	SA	GROSS ALPHA/BETA	

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)

SF 2001-COC (10-97)

Supersedes (5-97) issue 10-05-98

ANALYSIS REQUEST AND CHAIN OF CUSTODY (Continuation)

Press F1 for instructions for each field.

AR/COC- 600790

Project Name: 81C VCM Baseline Sampling | Project/Task Manager: Paul Freshour | Case No.: 7214/2213

Location | Tech Area Canyons | Building NA | Room NA

Sample No. – Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO) Sample Matrix	Container Typ	Container Volume	Preservative	Sample Collection Method	Sample Type	Parameter & Method Requested	LAB USE Lab Sample ID
042231 - 001	CY81C-GR-049-SS	3 ft	81C	10/5/98 1455	S	G	500 ml	4 C	G	SA	METALS, HE, SVOC	28
042231 - 002	CY81C-GR-049-SS		81C	" 1455	S	G	120 ml	4 C	G	SA	VOC	29
042231 - 003	CY81C-GR-049-SS		81C	" 1455	S	G	250 ml	4 C	G	SA	GROSS ALPHA/BETA	30
042232 - 001	CY81C-GR-050-SS		81C	" 1505	S	G	500 ml	4 C	G	SA	METALS, HE, SVOC	31
042232 - 002	CY81C-GR-050-SS		81C	" 1505	S	G	120 ml	4 C	G	SA	VOC	32
042232 - 003	CY81C-GR-050-SS		81C	" 1505	S	G	250 ml	4 C	G	SA	GROSS ALPHA/BETA	33
042233 - 001	CY81C-GR-051-SS		81C	" 1510	S	G	500 ml	4 C	G	SA	METALS, HE, SVOC	34
042233 - 002	CY81C-GR-051-SS		81C	" 1510	S	G	120 ml	4 C	G	SA	VOC	35
042233 - 003	CY81C-GR-051-SS		81C	" 1510	S	G	250 ml	4 C	G	SA	GROSS ALPHA/BETA	36
042234 - 001	CY81C-GR-052-SS		81C	" 1515	S	G	500 ml	4 C	G	SA	METALS, HE	37
042234 - 002	CY81C-GR-052-SS		81C	" 1515	S	G	120 ml	4 C	G	SA	VOC	38
042234 - 003	CY81C-GR-052-SS		81C	" 1515	S	G	250 ml	4 C	G	SA	GROSS ALPHA/BETA	39
042235 - 001	CY81C-GR-053-SS		81C	" 1525	S	G	500 ml	4 C	G	SA	METALS, HE, SVOC	40
042235 - 002	CY81C-GR-053-SS		81C	" 1525	S	G	120 ml	4 C	G	SA	VOC	41
042235 - 003	CY81C-GR-053-SS		81C	" 1525	S	G	250 ml	4 C	G	SA	GROSS ALPHA/BETA	42
042236 - 001	CY-81C-GR-054-SS		81C	" 1530	S	G	500 ml	4 C	G	SA	METALS, HE, SVOC	43
042236 - 002	CY-81C-GR-054-SS		81C	" 1530	S	G	120 ml	4 C	G	SA	VOC	44
042236 - 003	CY-81C-GR-054-SS		81C	" 1530	S	G	250 ml	4 C	G	SA	GROSS ALPHA/BETA	45
042237 - 001	CY81C-GR-003-EB	NA	81C	" 1540	DIW	P	500 ml	HNO3	G	EB	METALS	46
042237 - 002	CY81C-GR-003-EB	NA	81C	" 1542	DIW	G	3x40 ml	HCL	G	EB	VOC	47
042237 - 003	CY81C-GR-003-EB	NA	81C	" 1538	DIW	AG	4x1 L	4 C	G	EB	HE	48
042237 - 005	CY81C-GR-003-EB	NA	81C	" 1535	DIW	AG	2x1 L	4 C	G	EB	SVOC	49
042242 - 001	CY81C-GR-003-TB	NA	81C	" 1545	DIW	G	3x40 ml	HCL	G	TB	VOC	50

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)

ANNEX 3-D
Risk Screening Assessment

TABLE OF CONTENTS

I. Site Description and History 1
II. Data Quality Objectives 2
III. Determination of Nature, Rate, and Extent of Contamination 4
III.1 Introduction 4
III.2 Nature of Contamination 4
III.3 Rate of Contamination 4
III.4 Extent of Contamination 5
IV. Comparison of COCs to Background Screening Levels 5
V. Fate and Transport 8
VI. Human Health Risk Screening Assessment 10
VI.1 Introduction 10
VI.2 Step 1. Site Data 10
VI.3 Step 2. Pathway Identification 10
VI.4 Step 3. COC Screening Procedures 11
VI.4.1 Background Screening Procedure 11
VI.4.2 Subpart S Screening Procedure 12
VI.5 Step 4. Identification of Toxicological Parameters 12
VI.6 Step 5. Exposure Assessment and Risk Characterization 14
VI.6.1 Exposure Assessment 15
VI.6.2 Risk Characterization 15
VI.7 Step 6. Comparison of Risk Values to Numerical Guidelines 17
VI.8 Step 7. Uncertainty Discussion 18
VI.9 Summary 19
VII. Ecological Risk Screening Assessment 20
VII.1 Introduction 20
VII.2 Scoping Assessment 20
VII.2.1 Data Assessment 20
VII.2.2 Bioaccumulation 21
VII.2.3 Fate and Transport Potential 22
VII.2.4 Scoping Risk-Management Decision 22
VII.3 Screening Assessment 22
VII.3.1 Problem Formulation 23
VII.3.2 Exposure Estimation 24
VII.3.3 Ecological Effects Evaluation 26
VII.3.4 Risk Characterization 31
VII.3.5 Uncertainty Assessment 31
VII.3.6 Risk Interpretation 34
VII.3.7 Screening Assessment Scientific/Management Decision Point 36
VIII. References 36

LIST OF TABLES

Table		Page
1	Summary of Sampling Performed to Meet Data Quality Objectives	3
2	Summary of Data Quality Requirements	3
3	Nonradiological COCs for Human Health and Ecological Risk Assessment at SWMU 81C with Comparison to the Associated SNL/NM Background Screening Value, BCF, Log K_{ow}, and Subpart S Screening Value	6
4	Radiological COCs for Human Health and Ecological Risk Assessment at SWMU 81C with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}	7
5	Summary of Fate and Transport at SWMU 81C	9
6	Toxicological Parameter Values for SWMU 81C Nonradiological COCs	13
7	Radiological Toxicological Parameter Values for SWMU 81C COCs Obtained from RESRAD Risk Coefficients	14
8	Risk Assessment Values for SWMU 81C Nonradiological COCs	16
9	Risk Assessment Values for SWMU 81C Nonradiological Background Constituents	17
10	Exposure Factors for Ecological Receptors at SWMU 81C	25
11	Transfer Factors Used in Exposure Models for Constituents of Potential Ecological Concern at SWMU 81C	27
12	Media Concentrations for Constituents of Potential Ecological Concern at SWMU 81C	28
13	Toxicity Benchmarks for Ecological Receptors at SWMU 81C	29
14	Hazard Quotients for Ecological Receptors at SWMU 81C	32
15	Internal and External Dose Rates for Deer Mice Exposed to Radionuclides at SWMU 81C	33
16	Internal and External Dose Rates for Burrowing Owls Exposed to Radionuclides at SWMU 81C	33
17	HQs for Ecological Receptors Exposed to Background Concentrations at SWMU 81C	35

SWMU 81C: RISK SCREENING ASSESSMENT

I. Site Description and History

Solid Waste Management Unit (SWMU) 81C, a subunit of SWMU 81, is referred to as the New Aerial Cable Facility on the Resource Conservation and Recovery Act (RCRA) Hazardous and Solid Waste Amendment permit. SWMU 81C 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). The site is located on a western sloping hillside on the east side of Sol se Mete Canyon. Sol se Mete Canyon drains to the north into Lurance Canyon, which in turn drains to the west to the Arroyo del Coyote. Coyote Springs Road follows the drainage of the Lurance Canyon and is the main access to the service road in Sol se Mete Canyon. SWMU 81C is an inactive subunit south of the active sled track (SWMU 81A). Testing activities at the Aerial Cable Facility include gravitational accelerated (drop) tests and rocket sled pull-down tests. The pull-down technique uses towing cables to accelerate rocket sleds carrying the test items. The test items are released from the overhead cable as the rockets are ignited and directed toward a target, which is usually located on the canyon floor.

Historical published information regarding the hydrogeology of Sol se Mete and Lurance Canyon has been summarized in the "RCRA 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) in 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 floor of the Sol se Mete Canyon occurs at depths of approximately 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 81C, refer to the RFI work plan for OU 1333 (SNL/NM September 1995).

Construction of the New Aerial Cable Site, SWMU 81, began in 1970 in response to the need to upgrade the aerial cable facilities that existed at the Old Aerial Cable Site (SWMU 82) (SNL/NM September 1995). The new aerial cable facilities provide impact testing on weapons and other test units that may be subject to detonation (SNL/NM September 1995). A 1971 historical aerial photograph shows that at that time SWMU 81 was active and had three main features: cables suspended between the east and west ridge tops, a concrete impact pad, and a 600-foot-long sled track (SNL/NM August 1994). A smooth-track cable was added to the southern cable Area I in 1977 to allow additional trolley simulated aerial flight tests by all three branches of the military service.

A 1983 historical aerial photograph shows that the site had several additional features such as storage shed, concrete pads, winches, pulleys, cables, and a fire scar caused by a runaway rocket motor to the east of the sled track (SNL/NM August 1994). The sheds, trailers, and camera bunkers in the southern cable area (referred to in other documents as the arena) were used for equipment storage and had never been used for tests. There were no visible signs of spill or contamination in or near these support structures (SNL/NM September 1995). Several of the concrete blocks around the impact pad were used as anchors for a net that was suspended at the impact pad. No hazardous materials were ever stored or noted at the winch sites associated with SWMU 81. There is no evidence that hazardous constituents had ever been used or released at these support structures. No fuel storage areas or fuel spills have been identified (SNL/NM September 1995). In addition to the former burial location, two other areas on the north side of the sled track exhibit evidence of fill material (Figure 2-2 of the 81C Voluntary Corrective Measure [VCM] Plan). These areas are not officially part of SWMU 81C but have been included because of the evidence of fill material.

Comprehensive information on the material buried at SWMU 81C is not available. Interview records state that solid debris such as cables, wire, and insulation material from past tests may be present in the buried portion of the natural water course (Martz 1985a, b). Additional debris may include wood, sandbags, weapon casings, camera stands, mirrors, and high explosives residue. Interviews verify that it was a common practice to push vegetation and soil into nearby arroyos when clearing areas for testing. Wire, cable, and metal debris have been observed protruding from the graded surface overlying the buried watercourse.

II. Data Quality Objectives

The confirmatory sampling conducted at SWMU 81C was designed to collect adequate samples to:

- Determine whether hazardous waste or hazardous constituents have been released at the site
- Characterize the nature and extent of any releases
- Provide sufficient Level 3 analytical data to support risk screening assessments.

Table 1 summarizes the sample location designations at SWMU 81C. The source of potential constituents of concern (COCs) is expended rocket motors and related pieces of scrap metal associated with the pull-down tests conducted at the SWMU 81A sled track. Table 2 summarizes the analytical methods and data quality requirements necessary (1) to adequately characterize hazardous constituents derived from expended rocket motors and metal debris and (2) to support risk screening assessments.

Table 1
Summary of Sampling Performed to Meet Data Quality Objectives

Site	Potential COC Source	Area of Site (acres)	Number of Sampling Locations	Sample Density (samples/acre)	Sampling Location Rationale
SWMU 81C	Expended rocket motors and related scrap metal	0.5	39	78	Sample locations based upon geophysical surveys that identified the distribution of buried metal debris at the SWMU 81C former burial location.

COC = Constituents of concern.
SWMU = Solid Waste Management Unit.

Table 2
Summary of Data Quality Requirements

Analytical Requirement	Data Quality Level	GEL	Radiation Protection Sample Diagnostics Laboratory Department 7713 SNL/NM
TAL metals EPA Method 6010/7000[a]	Level 3	39 samples 5 duplicates	Not applicable
VOCs EPA Method 8260[a]	Level 3	39 samples 5 duplicates	Not applicable
SVOCs EPA Method 8270[a]	Level 3	39 samples 5 duplicates	Not applicable
HE compounds EPA Method 8330[a]	Level 3	39 samples 5 duplicates	Not applicable
Gross alpha/gross beta EPA Method 900.0[a]	Level 3	39 samples 5 duplicates	Not applicable
Gamma spectroscopy EPA Method 901.1[a]	Level 2	Not applicable	39 samples 5 duplicates

[a]EPA (November 1986).
EPA = U.S. Environmental Protection Agency.
GEL = General Engineering Laboratories.
HE = High explosives.
TAL = Target analyte list.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.

All off-site laboratory results were reviewed and verified/validated against the "Data Verification/ Validation Level 3-DV-3" in Attachment C of the Technical Operating Procedure 94-03, Rev. 0 (SNL/NM July 1994). All gamma spectroscopy data were reviewed by SNL/NM Department 7713 Radiation Protection Sample Diagnostic Laboratory to conform with "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 02 (SNL/NM July 1996). These reviews confirmed that the data are acceptable for use in the no further action (NFA) proposal for SWMU 81C. The data quality objectives (DQO) for SWMU 81C 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 81C 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, historical operating records, and radiological and explosives surveys. The DQOs contained in the work plan for OU 1333 (SNL/NM September 1995) and the VCM Plan for Excavation and Debris Removal at Environmental Restoration (ER) SWMU 81C Former Burial Location (SNL/NM August 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 81C that is presented in Section 3.5 of the associated NFA proposal. This section describes the quality of the data specifically used to determine the nature, rate, and extent of contamination.

III.2 Nature of Contamination

The nature of contamination at SWMU 81C was determined by a soil vapor survey (SVS), geophysical surveys, and analytical testing of soil media. The SVS and geophysical surveys were performed to pinpoint where possible contamination might exist and the analytical testing (volatile organic compounds [VOCs], semivolatile organic compounds [SVOCs], HE, and metals analyses) was performed to characterize potential releases of COCs. Gamma spectroscopy and gross alpha/gross beta were also performed to determine whether any radioactive materials were present at the site. These analytical methods are appropriate to characterize the COCs associated with the historical activities at SWMU 81C.

III.3 Rate of Contamination

Primary sources of COCs were removed from SWMU 81C during a VCM conducted in the fall of 1998. Currently, only minor amounts of metallic debris remain at the site. The rate of COC migration is dependent predominantly upon site meteorological and surface hydrologic processes as described in Section V. Data available from the Site-Wide Hydrogeologic Characterization Project Report (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 COC migration at SWMU 81C.

III.4 Extent of Contamination

Thirty-nine soil samples were collected at the bottom of the completed excavation at SWMU 81C. The sample collection points were selected based upon an evenly spaced grid on both the upper and lower sections of the site. The number of samples collected was deemed sufficient to establish the presence of detectable COCs from buried rocket motors and associated metal debris related to tests conducted at SWMU 81A. The sample density was 78 samples per acre, which is greater than comparable U.S. Environmental Protection Agency (EPA) remedial investigation/feasibility studies (Selman et al. 1994).

Because of the relatively low solubility of most metals and organic compounds, limited precipitation and high evapotranspiration, the vertical rate of contaminant migration is expected to be extremely low. Soil samples were collected from the surface of the bottom of the excavation of SWMU 81C. Approximately, 3 feet of soil was removed from the lower section of SWMU 81C before samples were taken, and approximately 12 feet of soil was removed from the upper section of SWMU 81C before samples were taken. Therefore, the sample collection depths are considered representative of the media potentially affected by burial activities and sufficient to determine the vertical extent of COC migration.

In summary, 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 identification of COCs and the sampling to determine the concentration levels of those COCs across the site are described in the SWMU 81C NFA proposal. Generally, all organics, radiologicals, and inorganic COCs that were detected through analysis were evaluated for this risk assessment. If the concentration represented by the analytical 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. Organic compounds that were determined to have sufficiently low detection limits to ensure protection of human health and the environment are not included in this assessment . In order to provide conservatism in this risk assessment, the calculation uses only the maximum concentration value of each COC determined for the entire site. The approved SNL/NM maximum background concentration (Dinwiddie September 1997, Zamorski December 1997) was selected to provide the background screen in Tables 3 and 4. If applicable, human health nonradiological COCs were also compared to SNL/NM Subparts S action levels (IT July 1994).

Nonradiological inorganics that are essential nutrients such as iron, magnesium, calcium, potassium, and sodium are not included in this risk assessment (EPA 1989). Both radiological and nonradiological COCs were evaluated. The nonradiological COCs evaluated include VOCs, SVOCs, explosives, and inorganics.

Table 3
Nonradiological COCs for Human Health and Ecological Risk Assessment at SWMU 81C 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}	Is COC a Bioaccumulator?[b] (BCF>40, Log K_{ow}>4)
Arsenic	13.5	9.8	**No**	44[c]	NA	**Yes**
Barium	496	246	**No**	170[d]	NA	**Yes**
Beryllium	1.07	0.75	**No**	19[c]	NA	No
Cadmium	1.67	0.64	**No**	64[c]	NA	**Yes**
Chromium, total[e]	37.7	18.8	**No**	16[c]	NA	No
Lead	176	18.9	**No**	49[c]	NA	**Yes**
Mercury	0.0842	0.055	**No**	5500[c]	NA	**Yes**
Selenium	1.3	2.7	Yes	800[f]	NA	**Yes**
Silver	0.518 J	<0.5	**No**	0.5[c]	NA	No
Chlorodibromomethane	0.00084 J	NA	NA	1.47[e]	2.24[e]	No
Chloroform	0.0074 J	NA	NA	10.35[e]	1.92[g]	No
Dichlorobromomethane	0.0021 J	NA	NA	1.37[e]	2.10[e]	No
Methylene chloride	0.0078 J	NA	NA	5[e]	1.25[e]	No
Bis(2-ethylhexyl)phthalate	1.5	NA	NA	851[h]	7.6[g]	**Yes**
Diethyl phthalate	13 J	NA	NA	117[h]	2.47[h]	**Yes**
m-dinitrobenzene	0.10	NA	NA	8.5[g]	1.49[g]	No
Phenol	0.24 J	NA	NA	277[h]	1.46[h]	**Yes**

Note: **Bold** indicates COCs that failed the background screening procedure and/or are bioaccumulators.
[a]From Zamorski (December 1997) Canyon Area Soils.
[b]From NMED (March 1998).
[c]BCF and/or Log K_{ow} from Yanicak (March 1998).
[d]BCF from Neumann (1976).
[e]BCF From Howard (1990).
[f]BCF from Callahan et al. (1979).
[g]Log K_{ow} from Micromedex (1998).
[h]BCF from Howard (1989).
BCF = Bioconcentration factor.
COC = Constituent of concern.
IT = IT Corporation.
J = Estimated concentration.
K_{ow} = Octanol-water partition coefficient.
Log = Logarithm (base 10).
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
NMED = New Mexico Environment Department.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

Table 4
Radiological COCs for Human Health and Ecological Risk Assessment at SWMU 81C with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC Name	Maximum Concentration (pCi/g)	SNL/NM Background Concentration (pCi/g)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Is COC a Bioaccumulator?[b] (BCF>40)
Th-232	0.89	1.03	Yes	3000[c]	No[d]
U-238	1.04	2.31	Yes	900[c]	**Yes**
U-235	0.252[g]	0.16	**No**	900[c]	**Yes**
U-234	0.13[e]	2.31	Yes	900[c]	**Yes**
Cs-137	0.575	0.515	**No**	3000[f]	**Yes**

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

[a]From Dinwiddie (September 1997), Canyons Area Soils.

[b]NMED (March 1998).

[c]Baker and Soldat (1992).

[d]Yanicak (March 1997).

[e]U-234 values were calculated using the U-238 concentration and assuming that the U-238 to U-234 ratio was equal to that detected during waste characterization of DU-contaminated soils generated during the radiological voluntary corrective measures project, where U-234=U-238/8 (Miller June 1998).

[f]BCF from Whicker and Schultz (1982).

[g]Gamma spectrometry results for this radionuclide was ND (not detected above MDA), but the MDA was higher than background and other reported concentrations. Therefore, the maximum MDA was used in the risk assessment calculations.

BCF = Bioconcentration factor.
COC = Constituents of concern.
DU = Depleted uranium.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

Table 3 lists nonradiological COCs for the human health and ecological risk assessment at SWMU 81C. Table 4 lists radiological COCs for human health and ecological risk assessment. All tables show the associated approved SNL/NM maximum background concentration values (Dinwiddie September 1997, Zamorski December 1997). Sections VI.4, VII.2, and VII.3 provide discussion of Tables 3 and 4.

V. Fate and Transport

The primary release of COCs at SWMU 81C was to the subsurface soil and resulted from the burial of waste materials. Excavation and removal of soil are potential human-caused mechanisms of transport. Wind, water, and biota are natural mechanisms of COC transport from the primary release point. Winds at this site, however, are moderated by the canyon topography and by the woodland vegetation on the nearby slopes. Therefore, wind erosion at this site is probably not significant as a transport mechanism.

Water at SWMU 81C is received as precipitation (rain and occasionally snow). Precipitation will either evaporate at or near the point of contact, infiltrate into the soil, or form runoff. The sloping terrain of the site may result in runoff during intense rainfall events and during extended rainfall periods when soils are near saturation from previous rainfall. However, infiltration at the site is enhanced by the coarse nature of the soil (the soil in the area of the site is primarily Tesajo-Millett stony sandy loam [USDA June 1977]). SWMU 81C occupies a site that had been part of a natural drainage channel that flowed into the main arroyo channel that drains the Sol se Mete Canyon, which discharges into Arroyo del Coyote in Lurance Canyon. Runoff may carry surface soil particles with adsorbed COCs. The distance of transport will depend upon the size of the particle and the velocity of the water. Particles within the drainage may be carried and deposited downstream during periods of surface-water flow.

Water that infiltrates into the soil will continue to percolate through the soil until field capacity is reached. COCs desorbed from the soil particles into the soil solution may be leached into the subsurface soil with this percolation. The effective rooting depths of the soil at SWMU 81C is about 60 inches (USDA June 1977). This indicates the depth of the system's transient water cycling zone (the dynamic balance between percolation/infiltration and evapotranspiration). Because groundwater at this site is approximately 222 feet bgs and is in a semiconfined or confined aquifer, the potential for COCs to reach groundwater through the unsaturated zone above the water table is very small. As water from the surface evaporates, the direction of COC movement may be reversed with capillary rise of the soil water.

Plant roots can take up COCs that are in the soil solution. This may be a passive process, but active uptake (i.e., that requires energy expenditure on the part of the plant) or exclusion of some constituents in the soil solution may also take place. COCs taken up by the roots may be transported to the above-ground tissues with the xylem stream. Above-ground tissues can take up adsorbed constituents directly from the air or by contact with dust particles. Organic constituents in plant tissues can be metabolized or released through volatilization. Those that remain in the tissue can be consumed by herbivores or eventually returned to the soil as litter. Above-ground litter is capable of transport by wind until consumed by decomposer organisms in the soil. COCs in plant tissues that are consumed by herbivores can pass through the gut and be returned to the soil in feces (at the site or transported from the site in the herbivore) or can be absorbed and held in tissues, metabolized, or excreted. The herbivore can be eaten by a

primary carnivore or scavenger, and the COCs still held in the consumed tissues will repeat the sequence of absorption, metabolization, excretion, and consumption by higher predators, scavengers, and decomposers. The potential for transport of the COCs within the food chain is dependent upon the mobility of the species that comprise the food chain and the potential for the COC to be transferred across the links in the food chain.

Degradation of COCs at SWMU 81C can result from biotic or abiotic processes. COCs at SWMU 81C that are inorganic and elemental in form are 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 (e.g., the conversion of selenite or selenate from soil to seleno-amino acids in plants). Degradation processes for organic COCs can include photolysis, hydrolysis, and biotransformation. Photolysis requires light and, therefore, takes place in the air, at the ground surface, or in surface water. Hydrolysis includes chemical transformations in water and can occur in the soil solution. Biotransformation (i.e., transformation caused by plants, animals, and microorganisms) can occur; however, biological activity may be limited by the aridity of the environment at this site.

Table 5 summarizes the fate and transport processes that can occur at SWMU 81C. COCs at this site include both inorganics (metals and radionuclides) and organics in surface and subsurface soil. Because of the local topography and woodland vegetation, the potential for transport of COCs by wind is low. The potential for transport by surface-water runoff is moderate for COCs currently at or near the soil surface because of the proximity to an ephemeral drainage channel. Significant leaching into the subsurface soil is unlikely for most inorganics and leaching to the groundwater at this site is highly unlikely. For inorganic COCs, the potential for degradation is low and the potential for uptake into the food chain is considered moderate to low because of the terrestrial nature of the habitat and the arid climate. Degradation and/or biotransformation of organics and their loss by volatilization can be significant. The potential for uptake into the food chain by most other organic COCs at SWMU 81C is considered moderate to low because of the terrestrial nature of the habitat and the arid climate. Decay of radiological COCs is insignificant because of their long half lives.

Table 5
Summary of Fate and Transport at SWMU 81C

Transport and Fate Mechanism	Existence at Site	Significance
Wind	Yes	Low
Surface runoff	Yes	Moderate
Migration to groundwater	No	None
Food chain uptake	Yes	Moderate to low
Transformation/degradation	Yes	Moderate to high (organics) Low (inorganics and radionuclides)

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 COCs 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 approved 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 may be calculated.
Step 7.	Uncertainties are discussed in the previous steps.

VI.2 Step 1. Site Data

Section I provides the description and history for SWMU 81C. Section II presents the DQOs. Section III discusses the nature, rate, and extent of contamination.

VI.3 Step 2. Pathway Identification

SWMU 81C 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 to inhale dust and volatiles (volatile inhalation is included for nonradiological constituents only). Soil ingestion is included for the radiological COCs as well. No water pathways to the groundwater are considered. Depth to groundwater at SWMU 81C 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 includes two screening procedures. The first compares the maximum COC concentration to the background screening level. The second compares maximum COC concentrations to SNL/NM proposed Subpart S action levels. This second procedure is applied only to COCs that are not eliminated during the first screening procedure.

VI.4.1 Background Screening Procedure

VI.4.1.1 Methodology

Maximum concentrations of nonradiological COCs are compared to the approved SNL/NM maximum screening level for this area. The approved SNL/NM maximum background concentrations were used to provide the background screen in Table 3 and to calculate risk attributable to background in Table 9. Only the COCs that are higher than their respective approved SNL/NM maximum background screening levels or do not have a quantifiable background screening level are considered in further risk assessment analyses.

For radiological COCs that exceed the approved SNL/NM background screening levels, background values are subtracted from the individual maximum radionuclide concentrations. Those that do not exceed these background levels are not carried any further in the risk assessment. This approach is consistent with DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE 1993). Radiological COCs that do not have a background value and are detected above the analytical minimum detectable activity are 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 Background Screening Procedure Results

Tables 3 and 4 show a comparison of SWMU 81C maximum COC concentrations to the approved SNL/NM maximum background values (Dinwiddie September 1997, Zamorski December 1997) for the human health risk assessment. Eight of the nonradiological COCs

exceeded their respective background screening levels. Eight nonradiological COCs are organic compounds and, therefore, do not have background concentrations.

The maximum concentration value for lead is 176 milligrams (mg) per kilogram (/kg). The EPA intentionally does not provide any human health toxicological data on lead and, therefore, no risk parameter values can be calculated. However, EPA Region 6 guidance for the screening value for lead for an industrial land-use scenario is 2,000 mg/kg (EPA 1996a); for a residential land-use scenario, the EPA screening guidance value is 400 mg/kg (EPA 1994). The maximum concentration value for lead at this site is less than both screening values and, therefore, lead is eliminated from further consideration in the human health risk assessment.

Of the radiological COCs, two (U-235 and Cs-137) had maximum measured activities or an MDA greater than their respective background activities.

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, this assumption is considered valid. If there were ten or fewer COCs and each had a maximum concentration less than 1/10 of the action level, then the site would be judged to pose no significant health hazard to humans. If there were more than ten COCs, the Subpart S screening procedure is not performed.

VI.4.2.2 Results

Because the SWMU 81C sample set has more than ten COCs that continue past the first screening level (including COCs that do not have background screening values), the proposed Subpart S screening process was not performed. All nonradiological COCs that are not eliminated during the background screening process for SWMU 81C have a calculated hazard quotient (HQ) and excess cancer risk value.

Radiological COCs have no predetermined action levels analogous to proposed Subpart S levels, and therefore this step in the screening process is not performed for radiological COCs.

VI.5 Step 4. Identification of Toxicological Parameters

Tables 6 (nonradiological) and 7 (radiological) show the COCs retained in the risk assessment and the values for the available toxicological information. The toxicological values used for nonradiological COCs in Table 6 are from the Integrated Risk Information System (IRIS)

Table 6
Toxicological Parameter Values for SWMU 81C Nonradiological COCs

COC Name	RfD_o (mg/kg-day)	Confidence[a]	RfD_{inh} (mg/kg-day)	Confidence[a]	SF_o $(mg/kg\text{-}day)^{-1}$	SF_{inh} $(mg/kg\text{-}day)^{-1}$	Cancer Class[b]
Arsenic	3E-4[c]	M	--	--	1.5E+0[c]	1.5E+1[c]	A
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
Cadmium	5E-4[c]	H	5.7E-5[d]	--	--	6.3E+0[c]	B1
Chromium III	1E+0[c]	L	5.7E-7[f]	--	--	--	--
Chromium VI	5E-3[c]	L	--	--	--	4.2E+1[c]	A
Mercury	3E-4[e]	--	8.6E-5[c]	M	--	--	D
Silver	5E-3[c]	L	--	--	--	--	D
Chlorodibromomethane	2E-2[c]	M	2E-2[d]	--	8.4E-2[c]	8.4E-2[d]	C
Chloroform	1E-2[c]	M	1E-2[d]	--	6.1E-3[c]	8.1E-2[c]	B2
Dichlorobromomethane	2E-2[c]	M	2E-2[d]	--	6.2E-2[c]	6.2E-2[d]	B2
Methylene chloride	6E-2[c]	M	8.6E-1[e]	--	7.5E-3[c]	1.7E-3[c]	B2
Bis(2-ethylhexyl) phthalate	2E-2[d]	--	2.2E-2[d]	--	1.4E-2[d]	1.4E-2[d]	--
Diethyl phthalate	8E-1[c]	L	8E-1[d]	--	--	--	D
m-dinitrobenzene	1E-4[c]	L	1E-4[d]	--	--	--	D
Phenol	6E-1[c]	L	6E-1[d]	--	--	--	D

[a]Confidence associated with IRIS (EPA 1998a) database values. Confidence—L = low, M = medium, H = high.

[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989) taken from IRIS (EPA 1998a):

- A = Human carcinogen.
- B1 = Probable human carcinogen. Indicates that limited human data are available.
- B2 = Probable human carcinogen. Indicates sufficient evidence in animals and inadequate or no evidence in humans.
- C = Possible human carcinogen.
- 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 1996b).

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

[f]Toxicological parameter values from EPA Region 3 electronic database (EPA 1997b).

COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
HEAST = Health Effects Assessment Summary Tables.
IRIS = Integrated Risk Information System.
mg/kg-day = Milligram(s) per kilogram day.
$(mg/kg\text{-}day)^{-1}$ = 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 7
Radiological Toxicological Parameter Values for SWMU 81C 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
Cs-137	3.20E-11	1.90E-11	2.10E-06	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 = Constituents 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.

(EPA 1998a), Health Effects Assessment Summary Tables (HEAST) (EPA 1997a), and the EPA Region 9 (EPA 1996b) and EPA Region 3 (EPA 1997b) electronic databases. 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 1988a).

- 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.

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*, Version 5.0 (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 8 shows an HI of 0.00 for the SWMU 81C nonradiological COCs and an excess cancer risk of 8E-7 for the designated recreational land-use scenario. The numbers presented included exposure from soil ingestion and dust and volatile inhalation for nonradiological COCs. Table 9 shows an HI of 0.00 and an excess cancer risk of 6E-7 assuming the maximum background concentrations of the SWMU 81C associated background COCs for the designated recreational land-use scenario.

For the radiological COCs, contribution from the direct gamma exposure pathway is included. For the recreational land-use scenario, a TEDE was calculated for an individual who spends 4 hours per week on the site. This resulted in an incremental TEDE of 5.6E-3 millirem per year (mrem/yr). In accordance with EPA guidance found in Office of Solid Waste and Emergency Response Directive No. 9200.4-18 (EPA 1997c), 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 81C for the recreational land use is well below this guideline. The estimated excess cancer risk is 7.0E-8.

For the residential land-use scenario nonradioactive COCs, the HI is 2, and the excess cancer risk is 2E-4 (Table 8). 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 9 shows that for the SWMU 81C associated background constituents, the HI is 1 and the excess cancer risk is 1E-4.

For the radiological COCs, the incremental TEDE for the residential land-use scenario is 1.1E-1 mrem/yr. The guideline being used is an excess TEDE of 75 mrem/yr (SNL/NM February 1998) for a complete loss of institutional controls (residential land use in this case);

Table 8
Risk Assessment Values for SWMU 81C 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
Arsenic	13.5	0.00	8E-7	0.77	2E-4
Barium	496	0.00	--	0.07	--
Beryllium	1.07	0.00	3E-11	0.00	8E-10
Cadmium	1.67	0.00	4E-11	1.37	9E-10
Chromium, total[b]	37.7	0.00	5E-9	0.03	1E-7
Mercury	0.0842	0.00	--	0.15	--
Silver	0.518 J	0.00	--	0.02	--
Chlorodibromomethane	0.00084	0.00	3E-11	0.00	3E-8
Chloroform	0.0074	0.00	1E-9	0.00	5E-8
Dichlorobromomethane	0.0021	0.00	7E-11	0.00	4E-8
Methylene chloride	0.0078	0.00	3E-11	0.00	6E-8
Bis(2-ethylhexyl) phthalate	1.5	0.00	8E-10	0.00	5E-8
Diethyl phthalate	13	0.00	--	0.01	--
m-dinitrobenzene	0.10	0.00	--	0.00	--
Phenol	0.24 J	0.00	--	0.00	--
Total		**0.00**	**8E-7**	**2**	**2E-4**

[a]EPA (1989).
[b]Chromium, total assumed to be chromium VI (most conservative).
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
J = Estimated concentration.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
-- = Information not available.

Table 9
Risk Assessment Values for SWMU 81C 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
Arsenic	9.8	0.00	6E-7	0.56	1E-4
Barium	246	0.00	--	0.04	--
Beryllium	0.75	0.00	2E-11	0.00	6E-10
Cadmium	0.64	0.00	1E-11	0.52	4E-10
Chromium, total[c]	18.8	0.00	--	0.01	--
Mercury	0.055	0.00	--	0.09	--
Silver	<0.5	--	--	--	--
Total		**0.00**	**6E-7**	**1**	**1E-4**

[a]From Zamorski (December 1997) Canyon Area Soils.
[b]EPA (1989).
[c]Chromium, total assumed to be chromium III.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
-- = Information not available.

the calculated dose value for SWMU 81C for the residential land-use scenario is well below this guideline. Consequently, SWMU 81C is eligible for unrestricted radiological release as the residential land-use scenario resulted in an incremental TEDE of less than 75 mrem/yr to the on-site receptor. The estimated excess cancer risk is 1.2E-6. 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 a recreational land-use scenario (the designated land-use scenario for this site) and a residential land-use scenario.

For the recreational land-use scenario nonradiological COCs, the HI calculated is 0.00 (less than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). Excess cancer risk is estimated at 8E-7. Guidance from the New Mexico Environment Department (NMED) indicates that excess lifetime risk of developing cancer by an individual must be less than 1E-6 for Class A and B2 carcinogens and less than 1E-5 for Class C carcinogens (NMED March 1998). The excess cancer risk is driven by arsenic which is a Class A carcinogen, 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. For nonradiological COCs,

assuming the recreational land-use scenario, the HI is 0.00 and the excess cancer risk is 6E-7. 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. Incremental HI is 0.00, and incremental cancer risk is 2.07E-7 for the recreational land-use scenario.

For radiological COCs of the recreational land-use scenario, incremental TEDE is 5.6E-3 mrem/yr, which is significantly less than EPA's numerical guideline of 15 mrem/yr. Incremental estimated excess cancer risk is 7.0E-8.

The calculated HI for the residential land-use scenario nonradiological COCs is 2, which is above the numerical guidance. Excess cancer risk is estimated at 2E-4. Excess cancer risk is driven by arsenic, thus the excess cancer risk for this site is above the suggested acceptable risk value (1E-6). The HI for associated background for the residential land-use scenario is 1 and the excess cancer risk is 1E-4. The incremental HI is 1.20, and the incremental cancer risk is 1E-4 for the residential land-use scenario. The incremental excess cancer risk calculation indicates a potentially significant contribution to human health risk from the COCs considering a residential land-use scenario.

The incremental TEDE for a residential land-use scenario from the radiological components is 1.1E-1 mrem/yr, which is significantly 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 1.2E-6.

VI.8 Step 7. Uncertainty Discussion

The data used to characterize SWMU 81C were provided by 39 surface soil samples and 5 duplicates. The samples were collected on a grid out in the bottom of the excavated area. The sampling grid encompassed 0.5 acre to account for uncertainty in the actual dimensions of SWMU 81C.

For this area, 39 surface samples were deemed sufficient to establish whether buried debris released COCs. The COCs for the SWMU are primarily HE residues, metals, VOCs, and SVOCs. The soil samples were analyzed for HE (EPA Method 8330); the RCRA metals, including beryllium (EPA Method 6010), and mercury (EPA Method 7471); for VOCs (EPA Method 8260); and for SVOCs (EPA Method 8270) (EPA November 1986). Radiological activity was measured using gamma spectroscopy and EPA Method 900.0 (EPA November 1986). Thirty-nine samples were sent off site to an EPA Contract Laboratory Program (CLP) laboratory and analyzed at Level III data quality. In addition, each of the 39 samples was analyzed on site for gamma spectroscopy. The data provided by the CLP laboratory and the on-site radiological laboratory are considered definitive data suitable for use in risk assessment analyses.

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 making the risk assessment analysis. Because the COCs are found in

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 IRIS (EPA 1998a), HEAST (EPA 1997a), and the EPA Region 9 (EPA 1996b) and EPA Region 3 (EPA 1997b) databases. Where values are not provided, information is not available from the HEAST (EPA 1997a), IRIS (EPA 1998a), or the EPA regions (EPA 1996b, 1997b). 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.

The total HI and excess cancer risk for the nonradiological COCs are below 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 81C has identified COCs consisting of some inorganic, organic, and radiological compounds. Because of the location of the site, the designated recreational land-use scenario, and the nature of contamination, potential exposure pathways identified for this site included soil ingestion and dust and volatile inhalation for chemical COCs and soil ingestion, dust inhalation, and direct gamma exposure for radionuclides. Plant uptake was included as an exposure pathway for the residential land-use scenario.

Using conservative assumptions and employing an RME approach to risk assessment, calculations for nonradiological COCs show that for the recreational land-use scenario the HI of 0.00 is significantly less than the accepted numerical guidance from the EPA. The excess cancer risk of 8E-7 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 2.07E-7.

Incremental TEDE and corresponding estimated cancer risk from radiological COCs are much less than EPA guidance values; the estimated TEDE is 5.6E-3 mrem/yr for the recreational land-use scenario. This value is much less than the EPA's numerical guidance of 15 mrem/yr (EPA 1997a). The corresponding incremental estimated cancer risk value is 7.0E-8 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 1.1E-1 mrem/yr with an associated risk of 1.2E-6. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, SWMU 81C is eligible for unrestricted radiological release.

Uncertainties associated with the calculations are considered small relative to the conservativism of risk assessment analysis. It is, therefore, concluded that this site does not have potential to adversely affect human health under a 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 81C. A component of the NMED Risk-Based Decision Tree is to conduct an ecological screening assessment that corresponds with that presented in EPA's Ecological Risk Assessment Guidance for Superfund (EPA 1997d). The current methodology is tiered and contains an initial scoping assessment followed by a more detailed screening assessment. Initial components of NMED's decision tree (a discussion of DQOs, a data assessment, and evaluations of bioaccumulation and fate-and-transport potential) are addressed in previous sections of this report. Following the 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 exposure of biota at/or adjacent to the site to be exposed to constituents associated with site activities. Included in this section are an evaluation of existing data and a comparison of maximum detected concentrations to background concentrations, examination of bioaccumulation potential, and fate and transport potential. A scoping risk management decision (Section VII.2.4) involves summarizing the scoping results and determining whether further examination of potential ecological impacts is necessary.

VII.2.1 Data Assessment

As indicated in Section IV (Tables 3 and 4), inorganic constituents in soil within the 0- to 5-foot depth interval that exceeded background concentrations were as follows:

- Arsenic
- Barium
- Beryllium
- Cadmium
- Chromium (total)
- Lead
- Mercury
- Silver
- U-235
- Cs-137.

Organic analytes detected in soil were as follows:

- m-dinitrobenzene
- Bis(2-ethylhexyl)phthalate
- Chlorodibromomethane
- Chloroform
- Dichlorobromomethane
- Diethyl phthalate
- Methylene chloride
- Phenol.

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 3 and 4):

- Arsenic
- Barium
- Cadmium
- Lead
- Mercury
- U-235
- Cs-137
- Bis(2-ethylhexyl)phthalate
- Diethyl phthalate
- Phenol.

It should be noted, however, that as directed by the NMED (NMED March 1998), bioaccumulation for inorganics is assessed exclusively based upon maximum reported bioconcentration factors (BCF) for aquatic species. Because only aquatic BCFs are used to evaluate the bioaccumulation potential for metals, bioaccumulation in terrestrial species is likely to be overpredicted.

VII.2.3 Fate and Transport Potential

The potential for the COPECs to move from the source of contamination to other media or biota is discussed in Section V. As noted in Table 5 (Section V), wind is expected to be of low significance as a transport mechanism for COPECs at this site, but surface-water runoff may be of moderate significance. Migration to groundwater is not anticipated. Food chain uptake is expected to be of moderate to low significance. Degradation/transformation for inorganic COPECs and radionuclides is expected to be of low significance. For the organic COPECs, the potential for biotransformation/ degradation is moderate to high, 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 may be associated with this SWMU and that COPECs also exist at the site. As a consequence, a screening assessment was deemed necessary to predict the potential level of ecological risk associated with the site.

VII.3 Screening Assessment

As concluded in Section VII.2.4, complete ecological pathways and COPECs are associated with this SWMU. The screening assessment performed for the site involves a quantitative estimate of current ecological risks using exposure models in association with exposure parameters and toxicity information obtained from the literature. The estimation of potential ecological risks is conservative to ensure that ecological risks are not underpredicted.

Components within the screening assessment include the following:

- Problem Formulation—sets the stage for the evaluation of potential exposure and risk.
- Exposure Estimation—provides a quantitative estimate of potential exposure.
- Ecological Effects Evaluation—presents benchmarks 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 for SNL/NM ER Program" (IT July 1998) and are not duplicated here.

VII.3.1.1 Ecological Pathways and Setting

SWMU 81C is approximately 0.5 acre in size. The site, located in Sol se Mete Canyon, is dominated by woodland habitat; however, much of the habitat at this site was disturbed during active use and during the recent VCM. Wildlife may use the area, but the small size of the site makes significant transfers of COPECs through the food chain pathway unlikely. A biological and sensitive species survey of the entire Aerial Cable Facility was conducted in 1991 (Sullivan 1994) and in 1993 and 1994, the area was included in a basewide threatened and endangered species survey conducted by the New Mexico Natural Heritage Program for the U.S. Air Force (NMNHP 1995). Although the gray vireo (*Vireo vicinior*), a New Mexico threatened species, was observed in the upper part of Sol se Mete Canyon in 1991 (probably a migrating individual) and three singing males were observed in Lurance Canyon near the mouth of Sol se Mete Canyon during the New Mexico Natural Heritage Program surveys, the species is not known to occur at SWMU 81C.

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

VII.3.1.2 COPECs

Waste materials that may have been buried at SWMU 81C include cables, wire, insulation material, wood, sandbags, weapon casings, camera stands, mirrors, and high explosive residue. Wire, cable, and metal debris have been observed protruding from the graded surface overlying the site. Excavation was performed at this site as part of the VCM. Soil samples were collected from between 3 to 12 feet bgs during excavation for confirmation purposes. In order to provide conservatism, this ecological risk assessment was based upon the maximum soil concentrations of the COPECs measured in at this site. Both radiological and nonradiological COPECs are evaluated. The nonradiological COPECs include both inorganic (i.e., metals) 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. All organic analytes detected are considered to be COPECs for the site. Tables 3 and 4 present maximum COPEC concentrations. 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

As described in detail in 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 associated with the site. The deer mouse (*Peromyscus maniculatus*) and the burrowing owl (*Speotyto cunicularia*) were used to represent wildlife use. Because of its opportunistic food habits, the deer mouse was used to represent a mammalian herbivore, omnivore, and insectivore. The burrowing owl was selected to represent a top predator at this site. Although burrowing owls are not expected to occur in the woodland habitat at SWMU 81C, it is used to conservatively represent exposure and risk to other small, predatory birds such as the western screech owl (*Otus kennicottii*) that may inhabit this site. The burrowing owl is present at SNL/NM and is designated a species of management concern by the U.S. Fish and Wildlife Service in Region 2, which includes the state of New Mexico (USFWS September 1995).

VII.3.2 Exposure Estimation

For nonradiological COPECs, direct uptake from the soil was considered the only significant route of exposure for terrestrial plants. Exposure modeling for the wildlife receptors was limited to food and soil ingestion pathways. Inhalation and dermal contact were considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Drinking water was also considered an insignificant pathway because of the lack of surface water at this site. The deer mouse was modeled under three dietary regimes: as an herbivore (100 percent of its diet as plant material), as an omnivore (50 percent of its diet as plants and 50 percent as soil invertebrates), and as an insectivore (100 percent of its diet as soil invertebrates). The burrowing owl was modeled as a strict predator on small mammals (100 percent of its diet as deer mice). Because the exposure in the burrowing owl from a diet consisting of equal parts of herbivorous, omnivorous, and insectivorous mice would be equivalent to the exposure consisting of only omnivorous mice, the diet of the burrowing owl was modeled with intake of omnivorous mice only. Both species were modeled with soil ingestion comprising 2 percent of the total dietary intake. Table 10 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 conservatively estimate potential exposures and risks to plants and wildlife at this site.

Table 10
Exposure Factors for Ecological Receptors at SWMU 81C

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

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

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 Cs-137 and U-235. Internal and external dose rates to the deer mouse and the burrowing owl are approximated using modified dose rate models from DOE (1995) as presented in the ecological risk assessment methodology document for the SNL/NM ER Project (IT July 1998). Radionuclide-dependent data for the dose rate calculations were obtained from Baker and Soldat (1992). The external-dose-rate model examines the total-body dose-rate to a receptor residing in soil exposed to radionuclides. The soil surrounding the receptor is assumed to be an infinite medium uniformly contaminated with gamma-emitting radionuclides. The external-dose-rate model is the same for both the deer mouse and the burrowing owl. The internal total-body dose-rate model assumes that a fraction of the radionuclide concentration ingested by a receptor is absorbed by the body and concentrated at the center of a spherical body shape. This provides 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 Cs-137 and U-235 in soil.

Table 11 presents the transfer factors used in modeling the concentrations of COPECs through the food chain. Table 12 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.

VII.3.3 Ecological Effects Evaluation

Table 13 shows benchmark toxicity values for the plant and wildlife receptors. For plants, the benchmark soil concentrations are based upon the lowest-observed-adverse-effect level (LOAEL). For wildlife, the toxicity benchmarks are based upon the no-observed-adverse-effect level (NOAEL) for chronic oral exposure in a taxonomically similar test species. Insufficient toxicity information was found to estimate the LOAELs or NOAELs for some COPECs for terrestrial plant life and for the burrowing owl, respectively.

The benchmark used for exposure of terrestrial receptors to radiation was 0.1 radiation absorbed dose 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 81C.

Table 11
Transfer Factors Used in Exposure Models for Constituents of Potential Ecological Concern at SWMU 81C

Constituent of Potential Ecological Concern	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Inorganic			
Arsenic	4.0E-2[a]	1.0E+0[b]	2.0E-3[a]
Barium	1.5E-1[a]	1.0E+0[b]	2.0E-4[c]
Beryllium	1.0E-2[a]	1.0E+0[b]	1.0E-3[a]
Cadmium	5.5E-1[a]	6.0E-1[d]	5.5E-4[a]
Chromium (total)	4.0E-2[c]	1.3E-1[e]	3.0E-2[c]
Lead	9.0E-2[c]	4.0E-2[d]	8.0E-4[c]
Mercury	1.0E+0[c]	1.0E+0[b]	2.5E-1[a]
Silver	1.0E+0[c]	2.5E-1[d]	5.0E-3[c]
Organic[f]			
m-dinitrobenzene	5.3E+0	1.6E+1	6.4E-7
Bis(2-ethylhexyl)phthalate	1.6E-3	3.2E+1	1.3E+0
Chlorodibromomethane	2.0E+0	1.7E+1	3.8E-6
Chloroform	3.0E+0	1.6E+1	1.8E-6
Dichlorobromomethane	2.4E+0	1.7E+1	2.7E-6
Diethyl phthalate	1.5E+0	1.8E+1	6.6E-6
Methylene chloride	7.3E+0	1.5E+1	3.6E-7
Phenol	5.5E+0	1.6E+1	5.9E-7

[a]From Baes et al. (1984).
[b]Default value.
[c]From NCRP (January 1989).
[d]From Stafford et al. (1991).
[e]From IAEA (1994).
[f]Soil-to-plant and food-to-muscle transfer factors from equations developed in Travis and Arms (1988). Soil-to-invertebrate transfer factors from equations developed in Connell and Markwell (1990). All three equations based upon relationship of the transfer factor to the log K_{ow} value of compound.

IAEA = International Atomic Energy Agency.
K_{ow} = Octanol-water partition coefficient.
Log = Logarithm (base 10).
NCRP = National Council on Radiation Protection and Measurements.
SWMU = Solid Waste Management Unit.

Table 12
Media Concentrations[a] for Constituents of Potential Ecological Concern at SWMU 81C

Constituent of Potential Ecological Concern	Soil (maximum)[a]	Plant Foliage[b]	Soil Invertebrate[b]	Deer Mouse Tissues[c]
Inorganic				
Arsenic	1.4E+1	5.4E-1	1.4E+1	4.6E-2
Barium	5.0E+2	7.4E+1	5.0E+2	1.8E-1
Beryllium	1.1E+0	1.1E-2	1.1E+0	1.8E-3
Cadmium	1.7E+0	9.2E-1	1.0E+0	1.7E-3
Chromium (total)	3.8E+1	1.5E+0	4.9E+0	3.7E-1
Lead	1.8E+2	1.6E+1	7.0E+0	3.7E-2
Mercury	8.4E-2	8.4E-2	8.4E-2	6.7E-2
Silver	5.2E-1[d]	5.2E-1	1.3E-1	5.2E-3
Organic				
m-dinitrobenzene	1.0E-1	5.3E-1	1.6E+0	2.1E-6
Bis(2-ethylhexyl)phthalate	1.5E+0	2.4E-3	4.7E+1	9.7E+1
Chlorodibromomethane	8.4E-4[d]	1.7E-3	1.4E-2	9.5E-8
Chloroform	7.4E-3[d]	2.2E-2	1.2E-1	4.0E-7
Dichlorobromomethane	2.1E-3[d]	5.0E-3	3.5E-2	1.7E-7
Diethyl phthalate	1.3E+1[d]	1.9E+1	2.3E+2	2.5E-3
Methylene chloride	7.8E-3[d]	5.7E-2	1.2E-1	9.9E-8
Phenol	2.4E-1[d]	1.3E+0	3.7E+0	4.7E-6

[a]In milligrams per kilogram. All biotic media are based upon dry weight of the media. Soil concentration measurements are assumed to have been based on dry weight. Values have been rounded to two significant digits after calculation.

[b]Product of the soil concentration and the corresponding transfer factor.

[c]Based upon the deer mouse with an omnivorous diet. Product of the average concentration ingested in food and soil times the food-to-muscle transfer factor times a wet weight-dry weight conversion factor of 3.125 (EPA 1993).

[d]Based on an estimated concentration.

EPA = U.S. Environmental Protection Agency.
SWMU = Solid Waste Management Unit.

Table 13
Toxicity Benchmarks for Ecological Receptors at SWMU 81C

Constituent of Potential Ecological Concern	Plant Benchmark[a,b]	Mammalian NOAELs			Avian NOAELs		
		Mammalian Test Species[c,d]	Test Species NOAEL[d,e]	Deer Mouse NOAEL[e,f]	Avian Test Species[d]	Test Species NOAEL[d,e]	Burrowing Owl NOAEL[e,g]
Inorganic							
Arsenic	10	Mouse	0.126	0.13	Mallard	5.14	5.14
Barium	500	Rat[h]	10.5	5.1	Chicken	20.8	20.8
Beryllium	10	Rat	0.66	1.29	---	---	---
Cadmium	3	Rat[i]	1.0	1.9	Mallard	1.45	1.45
Chromium (total)	1	Rat	2,737	5,354	Black duck	1.0	1.0
Lead	50	Rat	8.0	15.7	American kestrel	3.85	3.85
Mercury (inorganic)	0.3	Mouse	13.2	14.0	Japanese quail	0.45	0.45
Mercury (organic)	0.3	Rat	0.032	0.063	Mallard	0.0064	0.0064
Silver	2	Rat	17.8[j]	34.8	---	---	---
Organic							
m-dinitrobenzene	---	Rat[k]	0.113	0.221	---	---	---
Bis(2-ethylhexyl)phthalate	---	Mouse	19.4	18.3	---	---	---
Chlorodibromomethane	---	Rat	13.2[l]	25.8	---	---	---
Chloroform	---	Rat	15	29.3	---	---	---
Dichlorobromomethane	---	Rat	7.10[m]	13.9	---	---	---
Diethyl phthalate	---	Mouse[n]	75.3[n]	79.7	---	---	---
Methylene chloride	---	Rat	5.85	11.4	---	---	---
Phenol	70	Rat[o]	60[o]	117.4	---	---	---

[a]In milligrams per kilogram soil dry weight.
[b]From Efroymson et al. (1997).
[c]Body weights (in kilograms) for the no-observed-adverse-effect level (NOAEL) conversion are as follows: lab mouse, 0.030; lab rat, 0.350 (except where noted).
[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.

Table 13 (Concluded)
Toxicity Benchmarks for Ecological Receptors at SWMU 81C

[g]Based upon NOAEL conversion methodology presented in Sample et al. (1996). The avian scaling factor of 0.0 was used, making the NOAEL independent of body weight.
[h]Body weight: 0.435 kilogram.
[i]Body weight: 0.303 kilogram.
[j]Based upon a rat lowest-observed-adverse-effect level of 89 mg/kg/d (EPA 1998a) and an uncertainty factor of 0.2.
[k]Based on a subchronic (16-week) rat no-observed-adverse-effect level (NOAEL) of 1.13 mg/kg/d (Cody et al. 1981 as cited in Talmage and Opresko 1996) and an uncertainty factor of 0.1.
[l]Based upon the rat NOAEL for chloroform and the ratio of LD_{50} values for chlorodibromomethane and chloroform (Micromedex 1998).
[m]Based upon the rat NOAEL for chloroform and the ratio of LD_{50} values for dichlorobromomethane and chloroform (Micromedex 1998).
[n]Based upon a mouse NOAEL for bis(2-ethylhexyl)phthalate and the ratio of LD_{50} values for bis(2-ethylhexyl)phthalate and diethyl phthalate (Micromedex 1998).
[o]From NTP (1983) as cited in EPA (1998a).
SWMU = Solid waste management unit.
--- = insufficient toxicity data.

VII.3.4 Risk Characterization

Maximum concentrations in soil and estimated dietary exposures were compared to plant and wildlife benchmark values, respectively. Table 14 presents results of these comparisons. HQs are used to quantify the comparison with benchmarks for plants and wildlife exposure.

Analytes with HQs exceeding unity for plants were arsenic, chromium (total), and lead. HQs for plants could not be determined for any of the organic COPECs at this site with the exception of phenol. Arsenic and barium had HQs greater than unity for the deer mouse—the former for both the omnivorous and insectivorous dietary regimes, the latter for all three dietary regimes. Mercury, when assumed to be entirely in organic form, resulted in HQs greater than 1.0 for the burrowing owl. Exposure of the insectivorous deer mouse to m-dinitrobenzene resulted in an HQ of 1.1. Bis(2-ethylhexyl)phthalate resulted in an HQ greater than unity for the burrowing owl. HQs for the burrowing owl could not be determined for beryllium, silver, and organic COPECs other than 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). All receptors had total HIs greater than unity, with a maximum HI of 45 for plants (with chromium accounting for about 85 percent of the value). Bis(2-ethylhexyl)phthalate accounted for 89 percent of the HI for the burrowing owl. The HIs for the deer mice (all dietary regimes) were dominated by the HQs for arsenic and barium, with very little contribution from the organic COPECs.

Tables 15 and 16 summarize the internal and external dose rate model results for Cs-137 and U-235. The total radiation dose rate to the deer mouse was predicted to be 5.1E-5 rad/day. Total dose rate to the burrowing owl was predicted to be 4.3E-5 rad/day. The dose rates for the deer mouse and the burrowing owl are considerably less than the benchmark of 0.1 rad/day.

VII.3.5 Uncertainty Assessment

Many uncertainties are associated with the characterization of ecological risks at SWMU 81C. 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 are used to be more protective of the ecological resources potentially affected by the site. Conservatisms incorporated into this risk assessment include the use of maximum measured analyte concentrations in soil to evaluate risk, the use of wildlife toxicity benchmarks based upon NOAEL values, the incorporation of strict herbivorous and strict insectivorous diets for predicting the extreme HQ values for the deer mouse, and the use of 1.0 as the area use factor for wildlife receptors regardless of seasonal use or home range size. Each of these uncertainties, which are consistent among each of the SWMU-specific ecological risk assessments, is discussed in greater detail in the uncertainty section of the ecological risk assessment methodology document for the SNL/NM ER Project (IT July 1998).

Uncertainties associated with the estimation of risk to ecological receptors following exposure to U-235 and Cs-137 are primarily related to those inherent in the radionuclide-specific data. Radionuclide-dependent data are measured values that have their associated errors. The dose rate models used for these calculations are based upon conservative estimates on receptor

Table 14
Hazard Quotients for Ecological Receptors at SWMU 81C

Constituent of Potential Ecological Concern	Plant HQ[a]	Deer Mouse HQ (Herbivorous)[a]	Deer Mouse HQ (Omnivorous)[a]	Deer Mouse HQ (Insectivorous)[a]	Burrowing Owl HQ[a]
Inorganic					
Arsenic	**1.4E+0**	9.5E-1	**8.5E+0**	**1.6E+1**	6.8E-3
Barium	9.9E-1	**1.3E+0**	**4.4E+0**	**7.5E+0**	5.4E-2
Beryllium	1.1E-1	4.0E-3	7.0E-2	1.4E-1	---
Cadmium	5.6E-1	7.9E-2	8.2E-2	8.5E-2	2.7E-3
Chromium (total)	**3.8E+1**	6.6E-5	1.2E-4	1.6E-4	1.3E-1
Lead	**3.5E+0**	1.9E-1	1.5E-1	1.1E-1	1.0E-1
Mercury (inorganic)	2.8E-1	9.6E-4	9.6E-4	9.6E-4	1.7E-2
Mercury (organic)	2.8E-1	2.1E-1	2.1E-1	2.1E-1	**1.2E+0**
Silver	2.6E-1	2.4E-3	1.5E-3	6.3E-4	---
Organic					
m-dinitrobenzene	---	3.8E-1	7.4E-1	**1.1E+0**	---
Bis(2-ethylhexyl)phthalate	---	2.6E-4	1.9E-1	3.8E-1	**9.8E+0**
Chlorodibromomethane	---	1.0E-5	4.8E-5	8.6E-5	---
Chloroform	---	1.2E-4	3.8E-4	6.5E-4	---
Dichlorobromomethane	---	5.6E-5	2.3E-4	4.0E-4	---
Diethyl phthalate	---	3.7E-2	2.4E-1	4.4E-1	---
Methylene chloride	---	7.8E-4	1.2E-3	1.6E-3	---
Phenol	3.4E-3	1.8E-3	3.4E-3	5.0E-3	---
HI[b]	**4.5E+1**	**3.1E+0**	**1.5E+1**	**2.6E+1**	**1.1E+1**

[a]**Bold** text indicates HQ or HI exceeds unity.
[b]The HI is the sum of individual HQs using the value for organic mercury as a conservative estimate of the HI.
HI = Hazard index.
HQ = Hazard quotient.
SWMU = Solid Waste Management Unit.
--- = Insufficient toxicity data available for risk estimation purposes.

Table 15
Internal and External Dose Rates for
Deer Mice Exposed to Radionuclides at SWMU 81C

Radionuclide	Maximum Concentration (pCi/g)	Internal Dose (rad/day)	External Dose (rad/day)	Total Dose (rad/day)
Cs-137	0.575	1.79E-05	2.62E-05	4.41E-05
U-235[a]	0.252	2.64E-06	4.11E-06	6.74E-06
Total		2.06E-05	3.03E-05	5.09E-05

[a]Gamma spectrometry result for this radionuclide was ND (not detected above MDA), but the MDA was higher than background and other reported concentrations. Therefore, the maximum MDA was used in the risk assessment calculations.
pCi/g = Picocurie(s) per gram.
rad/day = Radiation absorbed dose per day.
SWMU = Solid Waste Management Unit.

Table 16
Internal and External Dose Rates for
Burrowing Owls Exposed to Radionuclides at SWMU 81C

Radionuclide	Maximum Concentration (pCi/g)	Internal Dose (rad/day)	External Dose (rad/day)	Total Dose (rad/day)
Cs-137	0.575	1.17E-05	2.62E-05	3.79E-05
U-235[a]	0.252	1.01E-06	4.11E-06	5.11E-06
Total		1.27E-05	3.03E-05	4.30E-05

[a]Gamma spectrometry result for this radionuclide was ND (not detected above MDA), but the MDA was higher than background and other reported concentrations. Therefore, the maximum MDA was used in the risk assessment calculations.
pCi/g = Picocurie(s) per gram.
rad/day = Radiation absorbed dose per day.
SWMU = Solid Waste Management Unit.

shape, radiation absorption by body tissues, and intake parameters. The goal is to provide a realistic but conservative estimate of a receptor's internal and external exposure to radionuclides in soil.

The assumption of an area use factor of 1.0 is a source of uncertainty for the burrowing owl. Because SWMU 81C is only about 0.5 acre in size, an area use factor of approximately 0.014 would be justified for this receptor. This is sufficient to reduce the HQs for organic mercury and bis(2-ethylhexyl)phthalate to values less than 0.15.

In the estimation of ecological risk, background concentrations are included as a component of maximum on-site concentrations. For several inorganic COPECs, conservatisms in the modeling of exposure and risk result in the prediction of risk to ecological receptors when exposed at background concentrations. As shown in Table 17, HQs associated with exposures to background are greater than 1.0 for arsenic, barium, and chromium. Background may account for as much as half of the HQs for barium and chromium and as much as 75 percent of the HQs for arsenic at this site. It is, therefore, likely that actual risk from arsenic, barium, and chromium at SWMU 81C is overestimated by the HQs calculated in this screening assessment because of conservatisms incorporated into the exposure assessment and in the toxicity benchmarks for these COPECs (e.g., the use of NOAELs for wildlife receptors).

A significant source of uncertainty associated with the prediction of ecological risks at this site is the use of the maximum measured concentrations or detection limits to evaluate risk. This results in a conservative exposure scenario that does not necessarily reflect actual site conditions. In the case of lead, only the maximum soil concentration value resulted in an HQ value greater than unity in plants. To assess the potential degree of overestimation caused by using the maximum measured soil concentrations in the exposure assessment, average soil concentrations were calculated for other COPECs with HQs greater than unity to determine whether these HQs can be accounted for by the magnitude of the extreme measurement. The mean concentrations of arsenic, barium, and total chromium were determined to be 5.2, 241 and 15.0 mg/kg, respectively. These means are less than their respective background values; therefore, their HQ values will be less than those shown in Table 17. All other mean soil concentrations resulted in HQs less than or equal to 1.0

Based upon this uncertainty analysis, ecological risks at SWMU 81C are expected to be very low. HQs greater than unity were initially predicted; however, closer examination of the exposure assumptions revealed an overestimation of risk primarily attributed to exposure concentration, background risk, and using conservatively estimated wildlife use factors in the exposure model.

VII.3.6 Risk Interpretation

Ecological risks associated with SWMU 81C were estimated through a screening assessment that incorporated site-specific information when available. Overall, risks to ecological receptors are expected to be low because predicted risks associated with exposure to COPECs are based upon calculations using maximum detected values. Predicted risks from exposure to arsenic, barium, chromium, and lead were attributed to using maximum detected values. The average arsenic, barium, and chromium concentrations at the site were within the range of background concentrations and that of lead was less than that required to indicate potential

Table 17
HQs for Ecological Receptors Exposed to Background Concentrations at SWMU 81C

Constituent of Potential Ecological Concern	Plant HQ[a]	Deer Mouse HQ (Herbivorous)[a]	Deer Mouse HQ (Omnivorous)[a]	Deer Mouse HQ (Insectivorous)[a]	Burrowing Owl HQ[a]
Inorganic					
Arsenic	9.8E-1	6.9E-1	**6.2E+0**	**1.2E+1**	5.0E-3
Barium	4.9E-1	6.2E-1	**2.2E+0**	**3.7E+0**	2.7E-2
Beryllium	7.5E-2	2.7E-3	4.8E-2	9.2E-2	---
Cadmium	2.1E-1	3.0E-2	3.1E-2	3.3E-2	1.0E-3
Chromium (total)	**1.9E+1**	3.3E-5	5.7E-5	8.2E-5	6.3E-2
Lead	3.8E-1	2.1E-2	1.6E-2	1.1E-2	1.1E-2
Mercury (inorganic)	1.8E-1	6.3E-4	6.3E-4	6.3E-4	1.1E-2
Mercury (organic)	1.8E-1	1.4E-1	1.4E-1	1.4E-1	7.8E-1
Silver	1.3E-1	1.1E-3	7.2E-4	3.0E-4	---
HI[b]	**2.1E+1**	**1.5E+0**	**8.6E+0**	**1.6E+1**	8.9E-1

[a]**Bold** text indicates HQ or HI exceeds unity.

[b]The HI is the sum of individual HQs using the value for organic mercury as a conservative estimate of the HI.

HI = Hazard index.
HQ = Hazard quotients.
SWMU = Solid Waste Management Unit.
--- = Insufficient toxicity data available for risk estimation purposes.

risk. Bis(2-ethylhexyl)phthalate was predicted to be hazardous to the burrowing owl; however, potential risks associated with this compound were evaluated using an area use factor for the owl of 1.0, which can account for the HQ exceeding unity. The same is true for mercury when it is assumed to be 100 percent in organic form, which in itself is an unlikely and highly conservative assumption. Based upon this final analysis, ecological risks associated with SWMU 81C are expected to be low.

VII.3.7 Screening Assessment Scientific/Management Decision Point

After potential ecological risks associated with the site have been assessed, a decision is made regarding whether the site should be recommended for NFA or whether additional data should be collected to assess actual ecological risk at the site more thoroughly. With respect to this site, ecological risks are predicted to be low. The scientific/management decision is to recommend this site for NFA.

VIII. References

Baes, III, C.F., R.D. Sharp, A.L. Sjoreen, and R.W. Shor, 1984. "A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides through Agriculture," ORNL-5786, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

Baker, D.A., and J.K. Soldat, 1992. *Methods for Estimating Doses to Organisms from Radioactive Materials Released into the Aquatic Environment*, PNL-8150, Pacific Northwest Laboratory, Richland, Washington, pp. 16–20.

Callahan, M.A., et al., 1979. "Water-Related Environmental Fate of 129 Priority Pollutants," EPA-440/4-79-029, Office of Water and Waste Management, Office of Water Planning and Standards, U.S. Environmental Protection Agency, Washington, D.C.

Cody, T.E., et al., 1981. "1,3-Dinitrobenzene: Toxic Effects in Vivo and in Vitro," Journal of Toxicology and Environmental Health, Vol. 7, pp. 829–848.

Connell, D.W., and R.D. Markwell, 1990. "Bioaccumulation in Soil to Earthworm System," *Chemosphere*, Vol. 20, pp. 91–100.

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

DOE, see U.S. Department of Energy.

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

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

EPA, see U.S. Environmental Protection Agency.

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

Howard, P.H., 1989. *Handbook of Environmental Fate and Exposure Data for Organic Chemicals: Volume 1 Large Production and Priority Pollutants*, Lewis Publishers, Inc., Chelsea, Michigan.

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

IAEA, see International Atomic Energy Agency.

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

International Atomic Energy Agency (IAEA), 1994. "Handbook of Parameter Values for the Prediction of Radionuclide Transfer in Temperate Environments," *Technical Reports Series No. 364*, International Atomic Energy Agency, Vienna, Austria.

IT, see IT Corporation.

IT Corporation (IT), July 1994. "Report of Generic Action Level Assistance for the Sandia National Laboratories/New Mexico Environmental Restoration Program," IT Corporation, Albuquerque, New Mexico.

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

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

Martz, M.K., September 1985a. Interview conducted for Environmental Restoration Project, Department 7585, Sandia National Laboratories, Personal Interview (unpublished), Albuquerque, ER/1333 081/INT/95-006.

Martz, M.K., September 1985b. Interview conducted for Environmental Restoration Project, Department 7585, Sandia National Laboratories, Personal Interview (unpublished), Albuquerque, ER/1333 081/INT/95-007.

Micromedex, Inc., 1998. "Registry of Toxic Effects of Chemical Substances (RTECS)," Hazardous Substances Databank.

Miller, M. (Sandia National Laboratories). Memo to Devon Jercinovic (IT Corporation), "Radiological Data Tables and DU Ratios Sandia National Laboratories," Memorandum (unpublished), Albuquerque, New Mexico. June 2, 1998.

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

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

National Council on Radiation Protection and Measurements (NCRP), January 1989. "Screening Techniques for Determining Compliance with Environmental Standards: Releases of Radionuclides to the Atmosphere," *NCRP Commentary No. 3*, Revision of January 1989, National Council on Radiation Protection and Measurements, Bethesda, Maryland.

National Toxicology Program (NTP), 1983. "Teratologic Evaluation of Phenol in CD Rats and Mice," Report prepared by Research Triangle Institute, Research Triangle Park, North Carolina.

NCRP, see National Council on Radiation Protection and Measurements.

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

New Mexico Environment Department (NMED), March 1998. "Risk-Based Decision Tree Description," in New Mexico Environment Department, "RPMP Document Requirement Guide," Hazardous and Radioactive Materials Bureau, RCRA Permits Management Program, New Mexico Environment Department, Santa Fe, New Mexico.

New Mexico Natural Heritage Program (NMNHP), 1995, "Threatened and Endangered Species Survey of Kirtland Air Force Base, New Mexico," New Mexico Natural Heritage Program, Albuquerque, New Mexico.

NMNHP, see New Mexico Natural Heritage Program.

NTP, see National Toxicology Program.

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

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

Sandia National Laboratories/New Mexico (SNL/NM), July 1994. "Verification and Validation of Chemical and Radiometric Data", TOP 94-03, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), August 1994. "Historical Aerial Photo Interpretation of the Canyons Test Area, OU 1333," Environmental Restoration Project, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), September 1995. "RCRA Facility Investigation Work Plan for Operable Unit 1333, Canyons Test Area," prepared for the U.S. Department of Energy by Sandia National Laboratories, Albuquerque, New Mexico.

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

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

Sandia National Laboratories/New Mexico (SNL/NM), August 1998. "Voluntary Corrective Measure Plan for Excavation and Debris Removal at Environmental Restoration SWMU 81C Former Burial Location, Operable Unit 1333, Canyons Test Area," Environmental Restoration Project, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

Selman, J.R., J.A. Celorie, and W.D. Featherman, 1994. "RI/FS Benchmarking Study: Process Analysis," EM-40 Technical Scope Analytical Team, U.S. Department of Energy, Washington D.C.

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

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

Stafford, E.A., J.W. Simmers, R.G. Rhett, and C.P. Brown, 1991. "Interim Report: Collation and Interpretation of Data for Times Beach Confined Disposal Facility, Buffalo, New York," Miscellaneous Paper D-91-17, U.S. Army Corps of Engineers, Buffalo, New York.

Sullivan, R.M., 1994. "Biological Investigations of the Sandia National Laboratories Sol se Mete Aerial Cable Facility," Contractor Report SAND93-7093, Sandia National Laboratories/New Mexico, Albuquerque, New Mexico.

Talmage, S.S. and D.M. Opresko, 1996. "Ecological Criteria Document for 1,3,5-Trinitrobenzene, CAS No. 99-35-4," Oak Ridge National Laboratory, Oak Ridge, Tennessee.

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

USDA, see U.S. Department of Agriculture.

U.S. Department of Agriculture (USDA), June 1977. "Soil Survey of Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico," Soil Conservation Service, U.S. Department

of the Interior Bureau of Indian Affairs and Bureau of Land Management, and New Mexico Agriculture Experiment Station, U.S. Government Printing Office, Washington, D.C.

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

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

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

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

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

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

U.S. Environmental Protection Agency (EPA), 1990. "Corrective Action for Solid Waste Management Units (SWMU) at Hazardous Waste Management Facilities, Proposed Rule," *Federal Register*, Vol. 55, Title 40, Code of Federal Regulations, Parts 264, 265, 270, and 271, U.S. Environmental Protection Agency, Washington, D.C.

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

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

U.S. Environmental Protection Agency (EPA). Memorandum from Elliott Laws, Assistant Administrator to Region Administrators I-X, "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Active Facilities," U.S. Environmental Protection Agency, Washington, D.C. July 14, 1994.

U.S. Environmental Protection Agency (EPA), 1996a. "Region 6 Superfund Guidance, Adult Lead Cleanup Level," Draft, U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1996b. "Region 9 Preliminary Remediation Goals (PRGs) 1996," electronic database maintained by Region 9, U.S. Environmental Protection Agency, San Francisco, California.

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

U.S. Environmental Protection Agency (EPA), 1997b. "Risk-Based Concentration Table," electronic database maintained by Region 3, U.S. Environmental Protection Agency, Philadelphia, Pennsylvania.

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

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

U.S. Environmental Protection Agency (EPA), 1998a. Integrated Risk Information System (IRIS) electronic database, maintained by the U.S. Environmental Protection Agency, Washington, D.C.

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

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

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

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

Yanicak, S. (Oversight Bureau, Department of Energy, New Mexico Environment Department). Letter to M. Johansen (DOE/AIP/POC Los Alamos National Laboratory), "(Tentative) list of constituents of potential ecological concern (COPECs) which are considered to be bioconcentrators and/or biomagnifiers." March 28, 1997.

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

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

Zamorski, M.J., December 1997. "Response to Request for Supplemental Information, Background Concentrations of Constituents of Concern to the Sandia National Laboratories/New Mexico Environmental Restoration Project and the Kirtland Air Force Base Installation Restoration Program," Sandia National Laboratories, Albuquerque, New Mexico.

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).

References

ANL, see Argonne National Laboratory.

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

DOE, see U.S. Department of Energy.

EPA, see U.S. Environmental Protection Agency.

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

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

U.S. Environmental Protection Agency (EPA), 1989b. *Exposure Factors Handbook*, EPA/600/8-89/043, U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Washington, D.C.

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

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

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