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Statement of Basis Approval of No Further Action  
Volume 24 of 30 January 2000, Solid Waste  
Management Unit 12B, Operable Unit 1333,  
Round 11

Sandia National Laboratories/NM

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**Statement of Basis  
Approval of No Further Action  
Volume 24 of 30**

**January 2000**

**Solid Waste Management Unit 12B  
Operable Unit 1333  
Round 11**

(RCRA Permit No. NM5890110518)

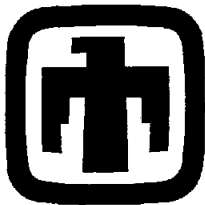
NFA Originally Submitted September 15, 1998 (Chapter 4)  
RSI Originally Submitted September 1999

**Environmental  
Restoration  
Project**



**United States Department of Energy  
Albuquerque Operations Office**

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**Sandia National Laboratories**

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## **4.0 SOLID WASTE MANAGEMENT UNIT 12B, BURIAL SITE**

### **4.1 Summary**

Solid Waste Management Unit (SWMU) 12, Burial Site/Open Dump (Lurance Canyon) (Active), Operable Unit (OU) 1333, is comprised of two subunits: SWMU 12A and SWMU 12B. SWMU 12 comprises approximately 0.6 acre. SWMU 12A (Open Arroyo), had been sampled previously and submitted for a no further action (NFA) during the 7<sup>th</sup> batch in May 1997. The other subunit, SWMU 12B (Buried Debris) is located within the graded portion of SWMU 65, Lurance Canyon Explosive Test Site, which is an inactive test site (Figure 4.1-1). SWMU 12B comprises approximately half of the SWMU 12 acreage.

SWMU 12B is being proposed for a risk-based NFA at this time. Review and analysis of all relevant data indicate that concentrations of constituents of concern (COC) at this site are (1) less than Sandia National Laboratories/New Mexico (SNL/NM) or other applicable background limits, (2) less than proposed Subpart S or other action levels, or (3) less than applicable risk assessment action levels. Thus, SWMU 12B is being proposed for a NFA decision based upon confirmatory sampling data demonstrating that COCs that may have been released from this SWMU into the environment pose an acceptable level of risk under current and projected future land use, per NFA Criterion 5, which states, "The SWMU has been fully characterized in accordance with current and 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" (NMED March 1998).

### **4.2 Description and Operational History**

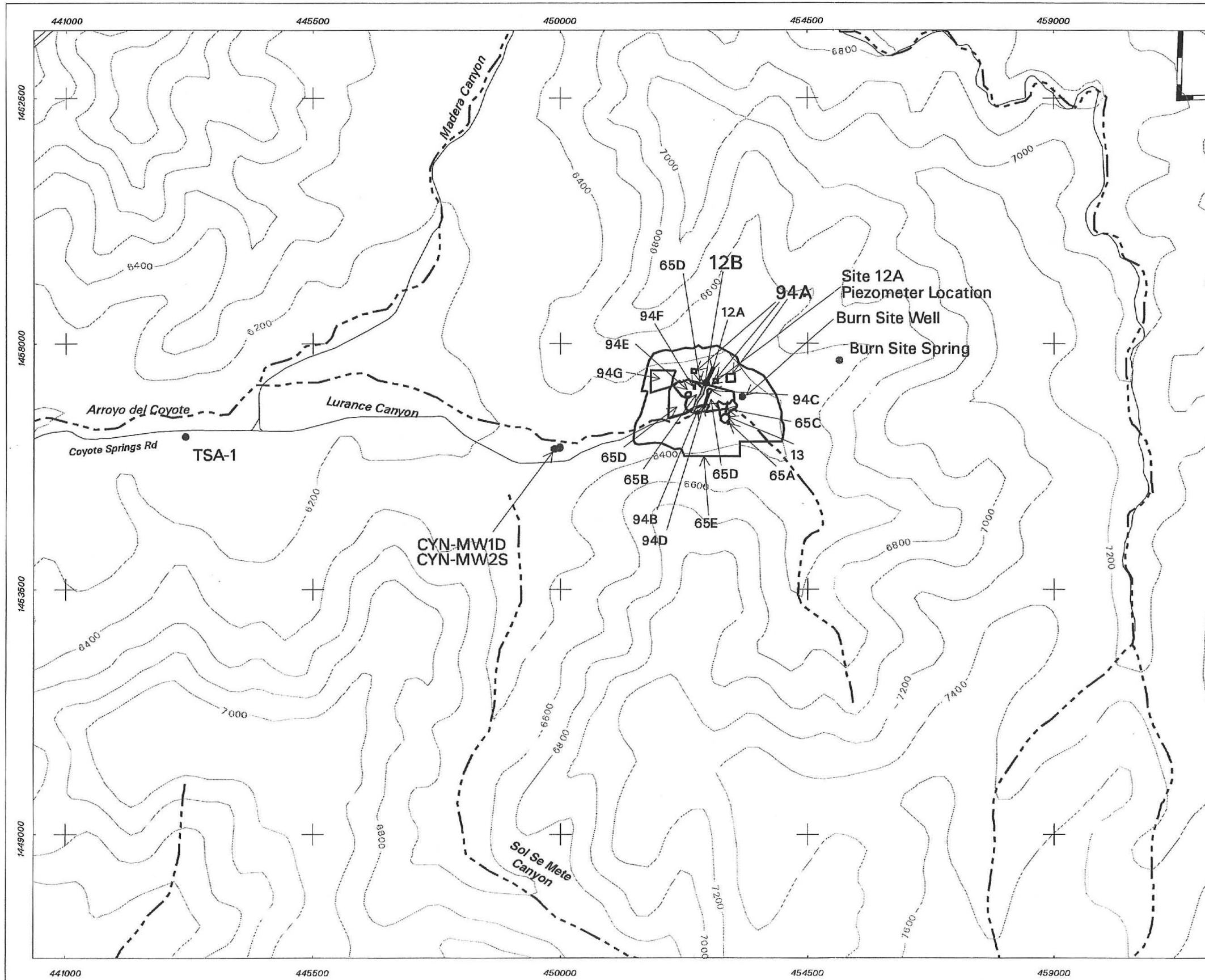
#### **4.2.1 Site Description**

SWMU 12B is approximately 550 feet long and 20 to 30 feet wide. It extends south from the Burn Site cable rack to the historic drainage confluence with the Lurance Canyon main arroyo channel (Figure 4.2.1-1). The site is within a former arroyo channel in the canyon floor alluvium in the closed upper reaches of the Lurance Canyon drainage in the Manzanita Mountains. Moderately steep canyon walls surround the site, and the immediate topographic relief is over 500 feet. The mean elevation of the site is 6,349 feet above sea level. The geology is characterized by complex faulting, which has exposed Precambrian metamorphic rock, which is capped by younger Paleozoic sedimentary rock. The canyon floor is covered in most places by 57- to 75-foot-thick, poorly sorted alluvium (SNL/NM September 1995).

#### **4.2.2 Operational History**

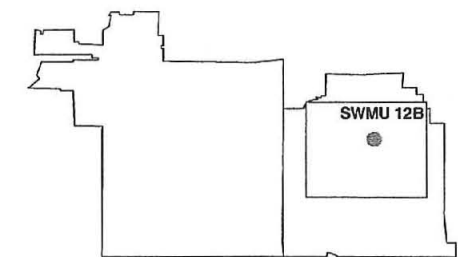
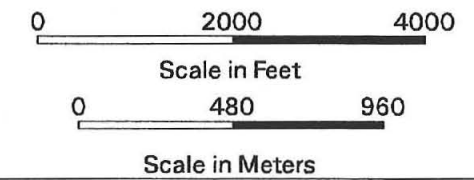
Activity at SWMU 12 is probably associated with the historical operation of SWMU 65, Lurance Canyon Explosives Test Site. The site is currently listed as a radioactive materials management area because of documented depleted uranium (DU) contamination from explosives testing at SWMU 65. A review of available historical aerial photographs verified that the site was undeveloped prior to 1971.

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### Legend

- Kirtland Air Force Base Boundary
- Surface-Water Features
- 200 Foot Contour Interval
- SWMU 12B
- OU 1333 SWMU Sites
- Well
- Piezometer Location



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**Figure 4.1-1**  
Location of SWMU 12B  
Burial Site-Open Dump;  
Buried Debris in Arroyo  
within Operable Unit 1333



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



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MAPID=980988

Unclassified

SNL GIS ORG. 6804

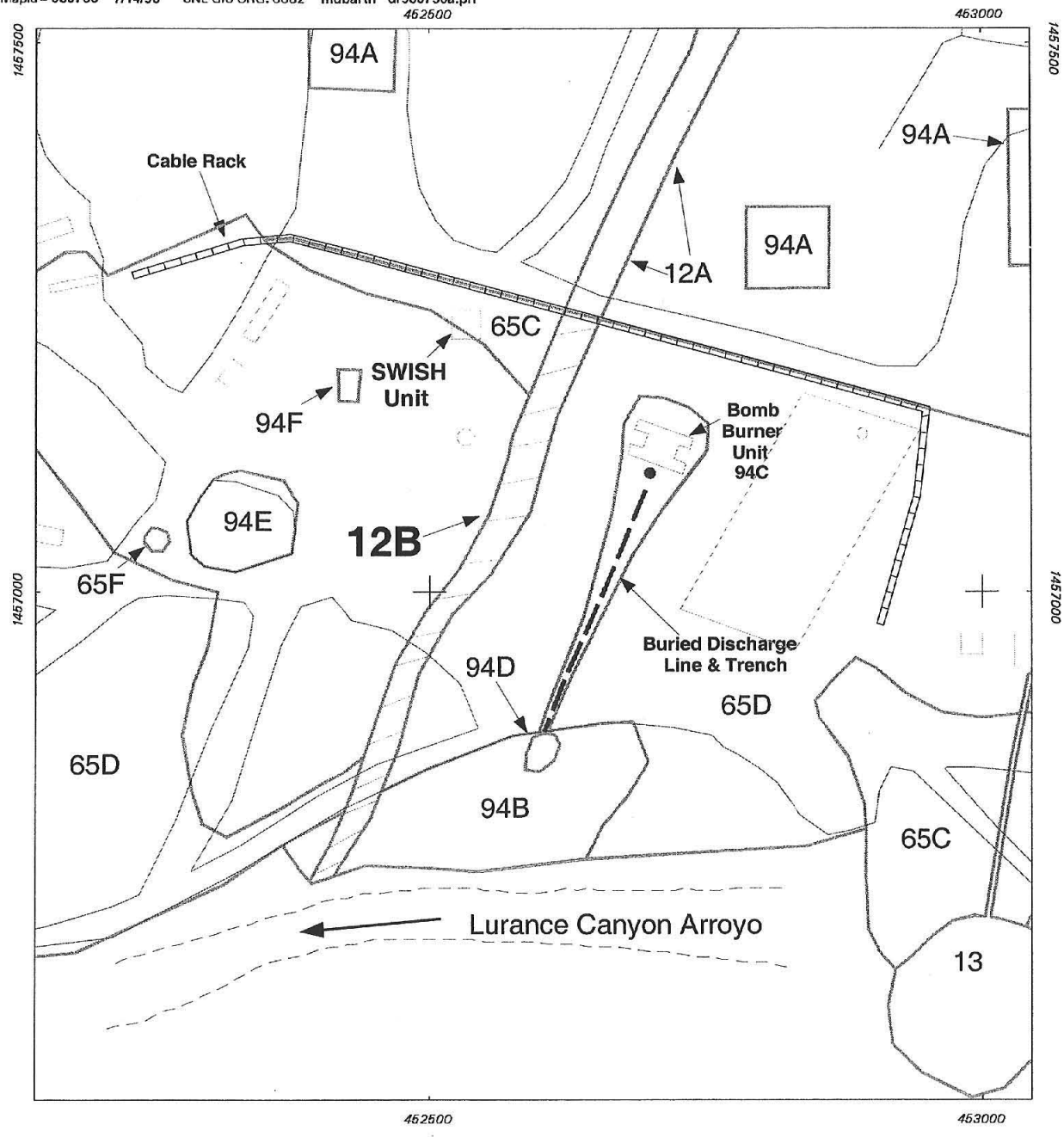
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




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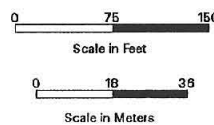




### Legend

-  Buried Discharge Line
-  Cable Conduit
-  Roads
-  Buildings/Structures
-  SWMU Boundary
-  SWMU 12B

**Figure 4.2.1-1  
SWMU 12B and  
the Burn Site Area**



Note: There are no occurrences of either endangered biota or archaeological sites within this area.

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By 1975, site-grading activities had buried a small portion of the arroyo. These activities continued until approximately 1983, when the central and southern portions of the graded area at SWMU 65 covered the arroyo. Various tests, including general explosives tests, fuel-fire burn tests of test units containing explosives, and rocket propellant burn tests, were conducted at SWMU 65 from 1967 to 1993.

Comprehensive records on the material buried at SWMU 12B were not located. Interview records state that solid debris such as cables, wire, and insulation material from past burn tests may be present in the buried portion of the arroyo channel. Additional debris may include wood, sandbags, weapons casings, camera stands, mirrors, and high explosive residue. Some interview records state that it is unlikely that material from testing activities at SWMU 65 would have been deposited in this arroyo channel, because of the small amounts of material involved. Interviews state that it was a common practice to shovel vegetation and soil into nearby arroyos when clearing areas for testing. The vegetation and soil may have been covered by soil fill that came from the grading operations in SWMU 65D. Wire, cable, and metal debris have been observed protruding from the graded surface overlying the buried channel. For a detailed discussion regarding the local setting at SWMU 12B, refer to the "RCRA [Resource Conservation and Recovery Act] Facility Investigation [RFI] Work Plan for OU 1333 Southwest Test Area" (SNL/NM March 1996).

## **4.3 Land Use**

### **4.3.1 Current**

SWMU 12B is part of U.S. Air Force land withdrawn from the Bureau of Land Management and permitted to the U.S. Department of Energy (DOE) (SNL/NM September 1995).

### **4.3.2 Future/Proposed**

SWMU 12B is located in the Cibola National Forest. SNL/NM's Future Use Logistics and Support Working Group recommends classifying the SWMU as recreational for planning purposes and for determining appropriate clean-up activities (DOE and USAF October 1995).

## **4.4 Investigatory Activities**

### **4.4.1 Summary**

Four investigations were conducted at SWMU 12B: the Comprehensive Environmental Assessment and Response Program (CEARP) investigation (DOE September 1987), SNL/NM Environmental Restoration (ER) preliminary investigations, the facility investigation (EPA April 1987), and the Voluntary Corrective Measure (VCM). The preliminary investigation included a

background review, an unexploded ordnance/high explosives (UXO/HE) survey, a radiological survey, a cultural-resources and sensitive-species survey, and a surface geophysics survey. A passive soil gas sampling program was conducted during the RFI. The VCM program was responsible for remediating SWMU 12B. This section presents a discussion of each investigation.

#### 4.4.2 Investigation # 1—Comprehensive Environmental Assessment and Response Program

##### 4.4.2.1 *Nonsampling Data Collection*

SWMU 12B was initially investigated under the CEARP (DOE September 1987) and the RCRA facility assessment (RFA) (EPA April 1987). The CEARP Phase I draft document reports that a portion of the arroyo now buried under the graded area had been used as a disposal site. RFA records indicate that disposal practices at this site included placing debris directly on the arroyo floor and covering the debris with soil, and that the site may have contained drums of trichloroethene (TCE) and other unlabeled drums containing liquids (EPA April 1987). In addition, information obtained from site personnel during the RFA interviews indicated that metal objects, wood, and full drums had been disposed of at the site. DU, lead, and beryllium may also have been disposed of at the site (EPA April 1987).

##### 4.4.2.2 *Sampling Data Collection*

No sampling activities were performed at SWMU 12B as part of the CEARP.

##### 4.4.2.3 *Data Gaps*

The proposed future action for the site was to conduct additional evaluations under CEARP Phase II to determine whether future action is warranted under CEARP Phase III (DOE September 1987).

##### 4.4.2.4 *Results and Conclusions*

The CERCLA finding under the CEARP was positive for Federal Facility Site Discovery and Identification Findings, Preliminary Assessment, and Preliminary Site Inspection. The Hazard Ranking System migration mode score was 8.1 (DOE September 1987).

#### 4.4.3 Investigation # 2—SNL/NM/ER Preliminary Investigations

##### 4.4.3.1 *Nonsampling Data Collection*

This section describes the nonsampling investigation data collected at SWMU 12B.

#### 4.4.3.1.1 *Background Review*

A background review was conducted in order to collect available and relevant information regarding SWMU 12B. Background information sources included interviewing SNL/NM staff and contractors familiar with the site's operational history and reviewing existing historical site records and reports. The study was documented completely and has provided traceable references that sustain the integrity of the NFA proposal. The following lists the information sources that were used to assist in evaluating SWMU 12B:

- Air and land photographs from three different sources reviewed by SNL/NM ER staff (Koogle and Pouls April 1992, USGS June 1971, June 1983)
- Seven interviews with current and retired facility personnel (SNL/NM September 1995) providing information on site history (e.g., debris deposited in the arroyo).

#### 4.4.3.1.2 *UXO/HE Survey*

Kirtland Air Force Base Explosive Ordnance Disposal personnel conducted a visual surface survey for HE at SWMUs 12, 13, 65, 94, and 219 in October 1993. No ordnance/HE or recognizable ordnance debris was found at SWMU 12 (Young September 1994).

#### 4.4.3.1.3 *Radiological Survey(s)*

Radiological surveys were conducted during November and December 1993 and January 1994. A total of 103.6 acres of brush-, cactus-, and grass-covered flat and rolling areas adjacent to fairly steep canyon hills covered with piñon and juniper trees were surveyed in SWMUs 12, 13, 65, and 94. A gamma scan survey was performed at 6-foot centers (100-percent coverage) over the exterior surface of the graded portion of the area (15.9 acres) that included all of SWMU 12B; the remainder of the survey area (87.7 acres) was surveyed at 10-foot centers (70-percent coverage). The radiological COC at SWMU 12B is DU (uranium-238, uranium-235, and uranium-234). Sixty-seven point sources and thirteen area sources of gamma activity 30-percent of or greater than the natural background were identified during the survey. Section 5.6.2 of the Surface Gamma Radiation Surveys Final Report (RUST Geotech December 1994) presents a detailed summary of the surface radiological survey and anomalies found within the area (see Annex 4-A).

Based upon the survey, VCM activities were conducted during March 1995 and May, June, and October 1996. Point sources and small area sources were cleaned up in March 1995. Larger area sources were remediated in May, June, and October 1996. Clean-up activities included radiation scanning to verify anomaly location, removing fragments and/or soil until readings were less than 1.3 times site-specific background levels, and postcleanup (verification) soil sampling for gamma spectroscopy analysis.

Fifty-two point sources and four small area sources were remediated during the cleanup. Two additional anomalies were detected during the cleanup and were remediated. After the remediation, 21 postcleanup (verification) samples were collected from areas exhibiting the

highest residual gamma radiation readings. All identified point and area sources of gamma activity 30-percent of or greater than natural background were removed from SWMU 12B. Based upon the results of the verification samples, the surface radiation VCM activities in the vicinity of SWMU 12B indicate that DU cleanup was successful. Section 5.6.2 of the Surface Radiation VCM Report (SNL/NM September 1997) presents a detailed summary of the VCM conducted within SWMU 12B (see Annex 4-B).

#### 4.4.3.1.4 *Cultural-Resources Survey*

A cultural-resources survey was conducted as part of the assessment of the Lurance Canyon Burn Site. No cultural resources were identified at or in the vicinity of SWMU 12B (IT February 1995a).

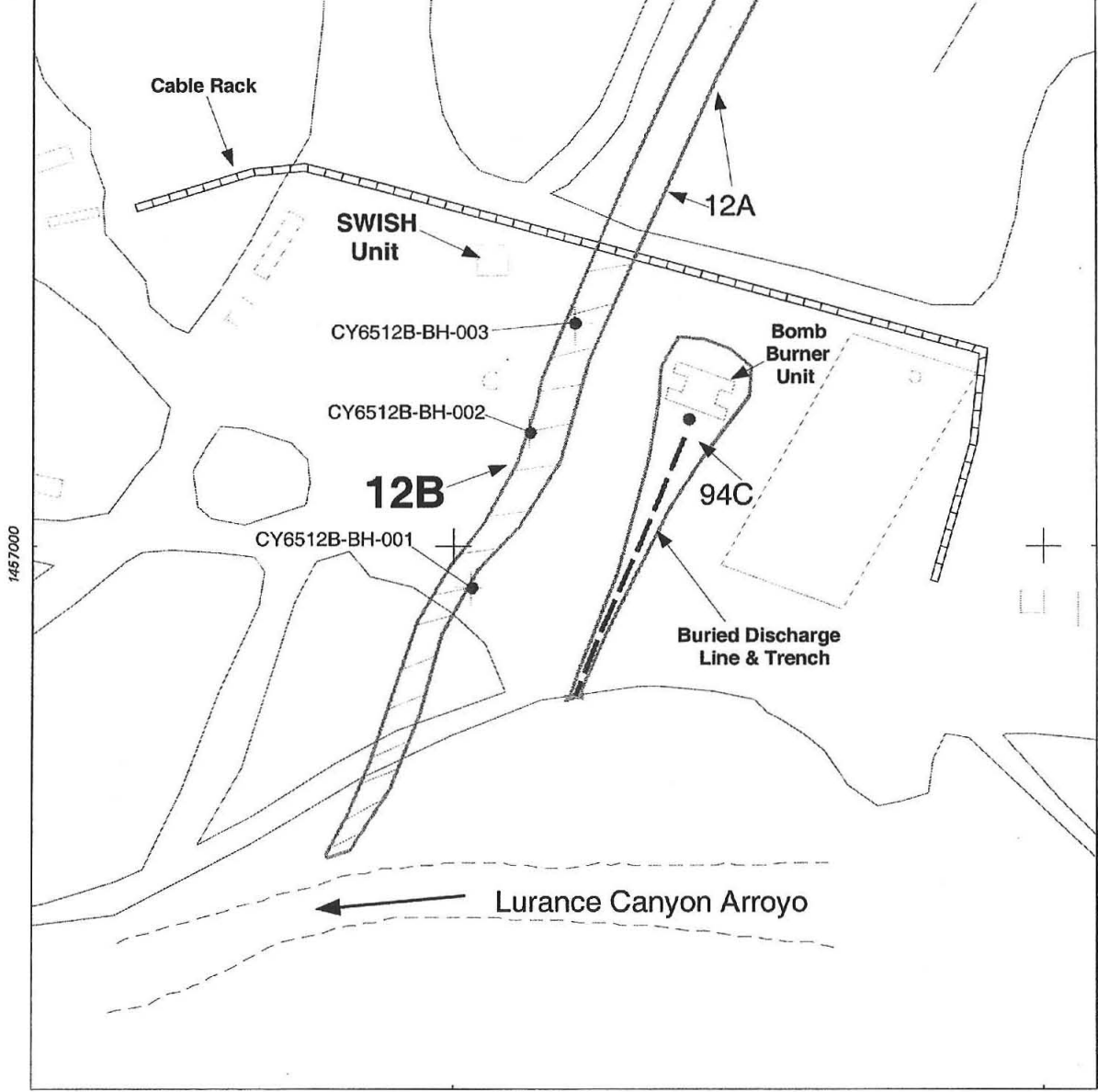
#### 4.4.3.1.5 *Sensitive-Species Survey*

A sensitive-species survey was conducted for the Lurance Canyon Burn Site. No sensitive species were found at SWMU 12B (DOE March 1996). Although searches for small cacti (grama grass cacti and Wright's pincushion cacti) were not conducted during this survey, the elevation of the site and the potential for cold-air drainage in this upper reach of the Lurance Canyon make the presence of these species unlikely (IT February 1995b).

#### 4.4.3.1.6 *Surface Geophysics Survey*

In November 1996, high-resolution magnetic and electromagnetic surface geophysical surveys were performed over the site. A 170-foot-wide by 500-foot-long grid (1.95 acres) was centered over the buried arroyo and marked in the field using a transit and a tape measure. The grid was marked with survey stakes and pin flags that delineated parallel northwest-southeast traverses separated by 5 feet. The boundary of the survey extended from the cable rack on the north side of SWMU 12B to the confluence with the main Lurance Canyon arroyo to the south (Figure 4.4.3-1). The irregularity in the northwestern corner of the grid is caused by the presence of a large metal test structure (the Small Wind-Shielded Unit). Another surface metal burn test structure fell within the boundaries; traverses were routed around this feature, which showed up on both survey maps as a large metallic anomalous area. Prior to the surveys, the site was cleared of all surface metal that could be removed without significant digging or heavy equipment. Vegetation in the southern area between the Burn Site access road and the Lurance Canyon arroyo (Figure 4.2.1-1) was removed or flattened so metal could be identified and removed.

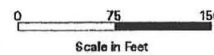
The measurements of the total magnetic field were made using a Geometrics G-858 cesium vapor magnetometer approximately 3 feet above the ground. The instrument detects only ferrous metal. Data were acquired approximately every 0.8 foot along each traverse, yielding about 19,500 measurements, which were transferred to a personal computer for processing using the Geosoft Inc. Mapping and Processing System. Two large concentrations of buried ferrous material were identified north of the access road, and a smaller area of scattered magnetic anomalies were identified roughly halfway between the main areas (Figure 4.4.3-1). Only a few scattered anomalies were observed south of the road. Time domain electromagnetic data were acquired using a Geonics EM-61 high precision metal locator, which detects any



**Legend**

- Scoping Sampling Borehole
- Roads
- ▭ Buildings/Structures
- ▭ SWMU Boundary
- ▭ Buried Discharge Line
- ▭ Cable Conduit
- ▭ SWMU 12B

**Figure 4.4.3-1**  
**SWMU 12B**  
**Scoping Sample Locations**



Note: There are no occurrences of either endangered biota or archaeological sites within this area.

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metal material. The lack of significant magnetic response in the extreme southern portion of the site led to the decision not to extend the EM-61 survey south of the road. This decision was also based upon the fact that the area south of the road is closer to natural grade and farther from the graded test areas; therefore, it is less likely to contain significant buried material. Data were acquired approximately every 0.6 foot along each traverse, yielding approximately 18,500 measurements, which were transferred to a personal computer for reduction and processing using the Geonics Ltd. DAT61 program. The data were then mapped using the Geosoft Inc. Mapping and Processing System. The EM-61 data are very consistent with the magneto reactor data with a few minor exceptions in the central area. This indicates that most of the buried metal is ferrous or is buried with ferrous metal.

Figure 4.4.3-1 shows the three areas of significant buried metal debris in the subsurface based upon both survey data sets. For both surveys the detection depth for significant buried metal (i.e., single 55-gallon drum) is 10 feet below the ground surface (bgs). Based upon the size of the arroyo channel just upstream from the buried segment, it is very unlikely that the buried portion beneath the graded area is deeper than 10 feet (it was estimated to be closer to 8 feet at its deepest point). Significant surface metal noted during site preparation for the surveys generally corresponded to the locations of buried metal. The approximate depth of burial for selected areas was calculated using the apparent depth routines in the DAT61. The calculated depth to the top of buried metal in the three anomalous areas shown in Figure 4.4.3-1 ranged from 0.9 to 2.9 feet bgs. Anomalies shown south of the road are defined by the magnetometer survey only. Annex 4-C includes the geophysical survey report and data maps.

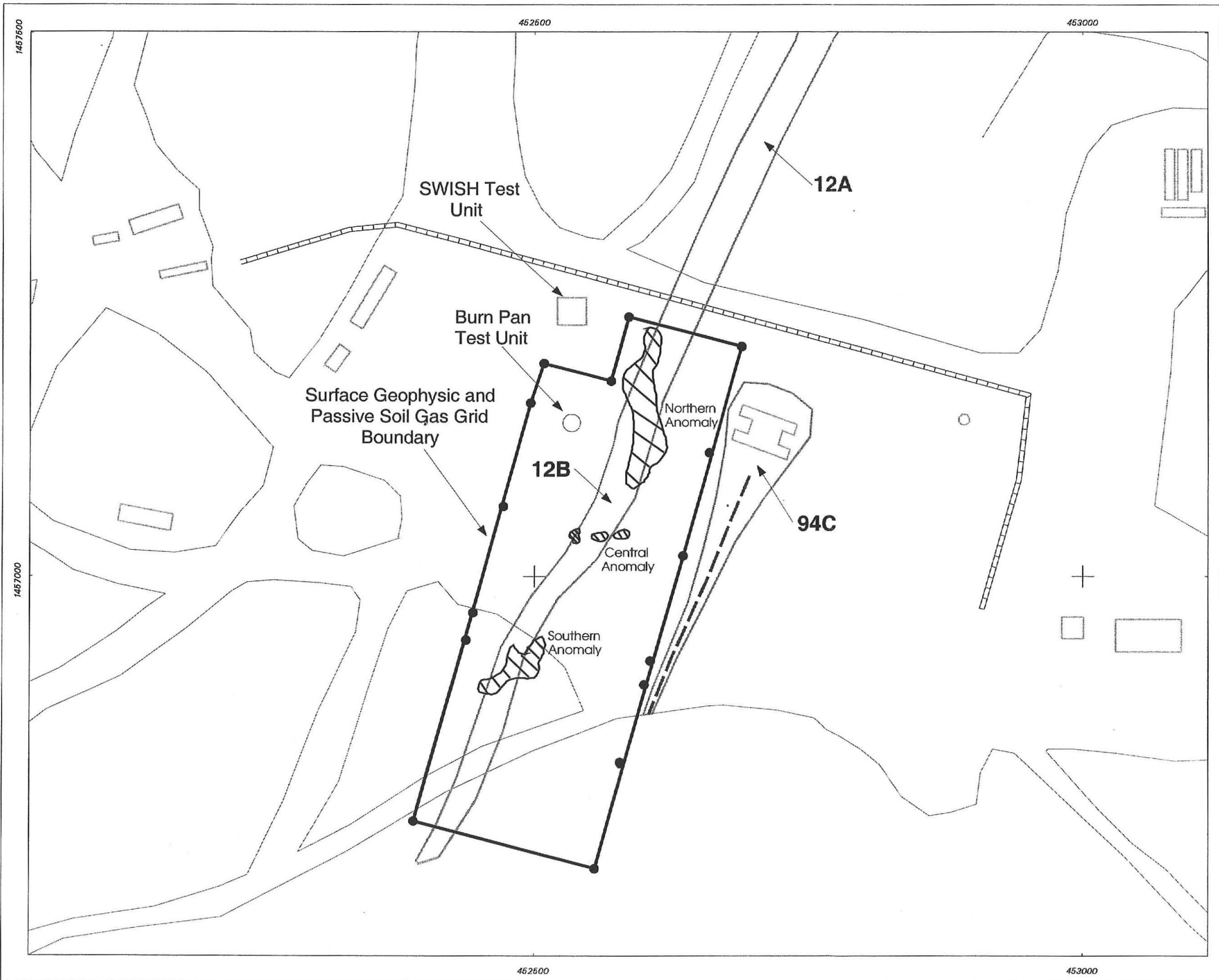
#### 4.4.3.1.7 RCRA Facility Investigation

A draft RFI work plan was developed for the OU 1333, Canyons Test Area (SNL/NM September 1995) that includes SWMU 12B. Because a VCM was approved for SWMU 12B, most of the work plan activities for this site were not completed except for a passive soil organic vapor survey. Annex 4-D provides a detailed report of the survey. This section summarizes the soil organic vapor survey results.

A passive soil organic vapor survey was conducted in December 1996 to evaluate the potential for significant organic contamination in the subsurface. The survey was performed over the same area as the surface geophysical surveys using the same grid system. Samplers consisted of glass vials approximately 6 centimeters (cm) long by 2 cm wide, each with activated charcoal to collect the organic vapors in the soil. The samplers were installed into holes approximately 8 inches deep by 1.5 inches wide that were made with a small hammer drill (a soil coring tool). Forty samplers were installed throughout the grid area (Figure 4.4.3-2). Locations were selected carefully to provide dense coverage of the buried arroyo area and the surrounding vicinity, which contains other possible areas of potential organic contamination (SWMU 94 subunits). Sample locations were measured off the already established geophysics grid along 11 parallel traverse lines spaced 50 feet apart. Samples were numbered according to the traverse line (1 through 11) and the distance west of the eastern grid boundary (e.g., Sample 1-105 was the sample taken from 105 feet west of the eastern grid boundary along traverse 1). Two background locations were selected north and south of the graded portion of the Burn Site area. Two additional trip blanks accompanied the samples in the field during installation and retrieval. When field work was not being conducted, the trip blanks were stored in the shipping box at the SNL/NM ER Field Office.

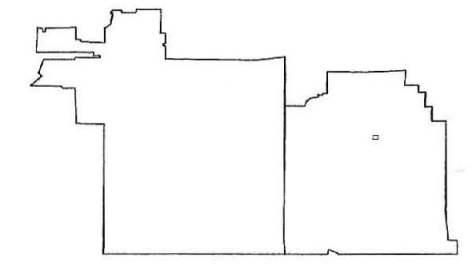
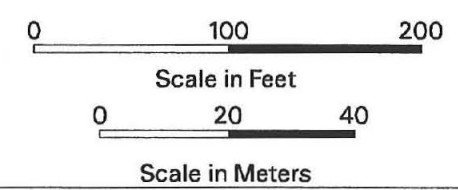
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### Legend

- SWMU Boundary
- Buried Discharge Line
- Cable Conduit
- Roads
- Building
- Areas of Subsurface Metal Burial
- Grid Boundary



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**Figure 4.4.3-2**  
**SWMU 12B**  
**Surface Geophysics Survey**



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



	MAPID= 980962
Unclassified	SNL GIS ORG. 6804
Rachel Loehman	r1980752.ps 08/18/98



On December 16, 1996, the samples were removed from the ground and shipped to Transglobal Environmental Geochemistry Rocky Mountain. All samples, including quality assurance/quality control (QA/QC) trip and method blanks, were analyzed for organic compounds using EPA methods modified for vapor analysis (EPA November 1986). EPA Method 8015 (gas chromatography [GC]) was used to analyze for total petroleum hydrocarbons (TPH) (diesel); and EPA Method 8021 (GC) was used to analyze for volatile organic compounds (VOC). Results for all compounds are in units of nanograms (ng, or  $10^{-9}$  grams) of vapor.

Results of the survey indicated that very low levels of organic vapor are present at discrete locations. Both fuel and chlorinated solvents compounds were detected but at levels that do not indicate significant soil contamination.

The following fuel compounds, ranging from 0.7 to 2.9 ng of vapor, were detected:

- Ethylbenzene (3 detections at from 0.8 to 1.0 ng)
- Toluene (3 detections at from 0.7 to 0.8 ng)
- Xylenes (4 detections at from 1.2 to 2.9 ng).

The following chlorinated compounds, ranging from 0.7 to 40 ng of vapor, were detected:

- Chlorobenzene (7 detections at from 1.0 to 33.0 ng) including both background locations
- Chloroform (3 detections at from 3.2 to 9.2 ng) including background north location
- 1,2-dichloroethane (1 detection at 6.2 ng)
- 1,1-dichloroethene (DCE) (2 detections at 0.9 and 3.0 ng)
- cis-1,2-DCE (2 detections at 2.4 and 40.0 ng)
- trans-1,2-DCE (2 detections at 0.7 and 0.8 ng)
- Freon 113 (1 detection at 0.9 ng)
- 1,1,1-trichloroethane (1 detection at 2.7 ng) at background north location
- TCE (2 detections at 4.6 and 25.0 ng) including background south location.

A total of 10 fuel compound and 21 chlorinated-compound detections were observed. The very low fuel compound detections are distributed toward the northern end of the site in the vicinity of the bomb burner unit, SWMU 94C (Figure 4.4.3-2). The distribution of these compound detections includes a slight co-location with the fuel compounds near the bomb burner unit at the northern end of the site (SWMU 94C), as well as the southern end near the retention pond for the bomb burner unit (the outfall from the buried discharge line) (Figure 4.2.1-1).

Chlorinated compounds were detected at both background locations at very low levels. The highest detection was TCE (25 ng) at the southern background location. Samples were collected during the VCM in order to investigate whether significant concentrations of VOCs exist in the subsurface soils at this location.

The objective of the soil gas survey at SWMU 12B was to determine whether gross organic compound contamination existed in the subsurface. Although several compounds were detected by the survey, the concentrations indicated no widespread or large-scale occurrence of chlorinated compounds in the soil.

#### 4.4.3.2 *Sampling Data Collection*

In July 1995 three locations within SWMU 12B were sampled (Figure 4.4.3-3). Subsurface soil samples were collected at depths of 2 and 4 feet from each location and were analyzed for VOCs (using EPA Methods 8240/8260 [EPA November 1986]); for TPHs (using immunoassay), for metals (using EPA Method 6010 [EPA November 1986] and x-ray fluorescence [XRF]), and radionuclides (using gamma spectroscopy). All analyses were performed at SNL/NM analytical laboratories. The sampling effort obtained preliminary analytical data to support ER Project site ranking and prioritization.

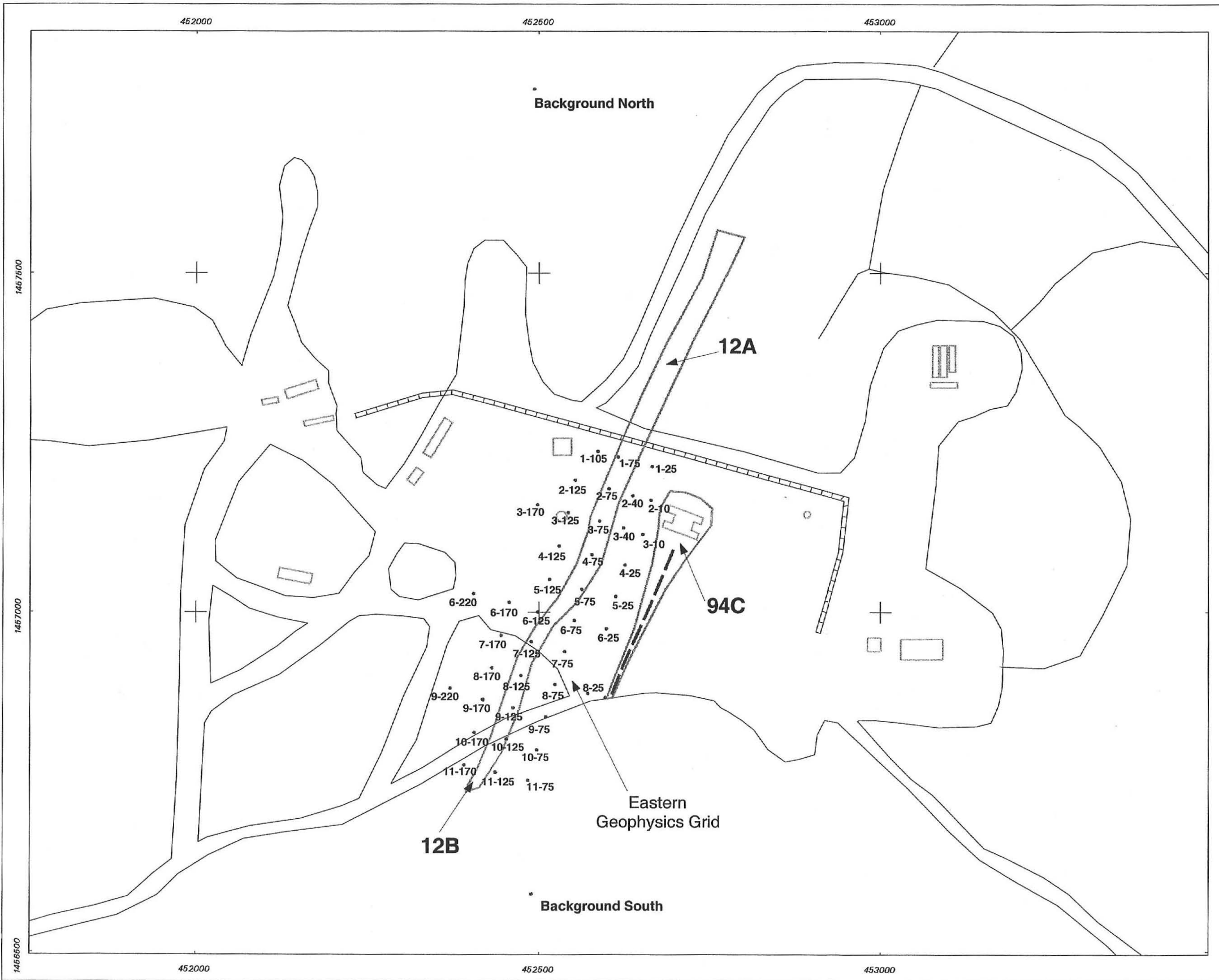
The VOC results indicated that no VOCs were present in any of the samples above the respective practical quantitation limits (PQL), which ranged from 2 to 20 parts per billion (minor detections [J values below the PQL] of acetone were present in each sample). No TPH was indicated by the immunoassay tests in any of the samples (detection limit of 10 parts per million [ppm]). The results of the semiquantitative XRF analyses (whole rock analyses) revealed no detectable arsenic, cadmium, or silver (with minimum detection limit [MDL] ranging from 10 to 30 ppm). Chromium concentrations ranged from no detections (with MDLs of from 25 ppm to 43 ppm). Concentrations of lead ranged from no detections (with MDLs of from 15 to 24 ppm). No RCRA metals or beryllium were detected above their respective PQLs using EPA Method 6010 (EPA November 1986), except for barium, which all samples contained at concentrations well below the background statistical upper tolerance limit of 246 milligrams (mg)/kilogram (kg). Most metals were below their MDLs (0.2 ppm for mercury, 3.4 ppm for beryllium, 50 ppm for selenium). The PQLs for the RCRA metals ranged from 0.8 ppm for mercury to 191 ppm for selenium; the PQL for beryllium was 13 ppm.

#### 4.4.3.3 *Data Gaps*

#### 4.4.3.4 *Results and Conclusions*

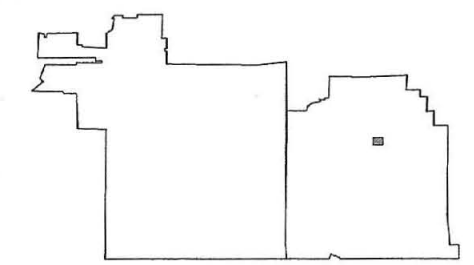
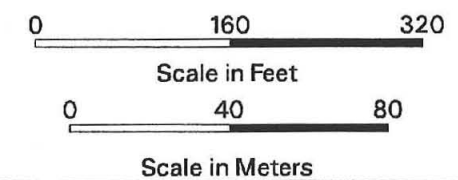
For this site an RFI was not completed except for the soil organic vapor study. The results of the scoping sampling effort conducted in July 1995 represent the only analytical data set that was available to provide direct information on the presence or absence of potential COCs and their relative concentrations. The results of the six subsurface samples collected from three boreholes do not indicate the presence of potential COCs; however, they are not sufficient to characterize the site adequately and were not intended for that purpose. Most preliminary field work consisted of nonintrusive surveys that provided critical data relative to focusing subsequent work such as the recent surface geophysics and soil organic vapor surveys. A notable exception to this was the surface radiation survey and VCM. Activities at SWMU 12B that were related to this VCM included identifying surface and shallow subsurface areas of elevated gamma radiation (DU), cleanup, and verification sampling.

Based upon the site characteristics and history, the most reliable and complete way to characterize the subsurface portion of the site adequately was to excavate the areas where material had been buried. The surface geophysics results defined these areas clearly, and the results of the soil organic vapor survey indicated that significant organic contamination was not present in the subsurface.



### Legend

- Soil Organic Vapor Sampling Location
- Roads
- Building
- SWMU Boundary
- Buried Discharge Line
- ▭ Cable Conduit



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**Figure 4.4.3-3**  
**SWMU 12B**  
**Soil Organic Vapor Survey**



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



MAPID = 980963
Unclassified
SNL GIS ORG. 6804
Rachel Loehman r1980753.ps 07/14/98





#### 4.4.4 Investigation #3—SNL/NM ER Project Voluntary Corrective Measure and Confirmatory Sampling

##### 4.4.4.1 *Nonsampling Data Collection*

Nonsampling data were not collected during the beginning of the VCM activities. Activities were centered on VCM work plan preparation and VCM field work plans.

##### 4.4.4.2 *Voluntary Corrective Measures Activities*

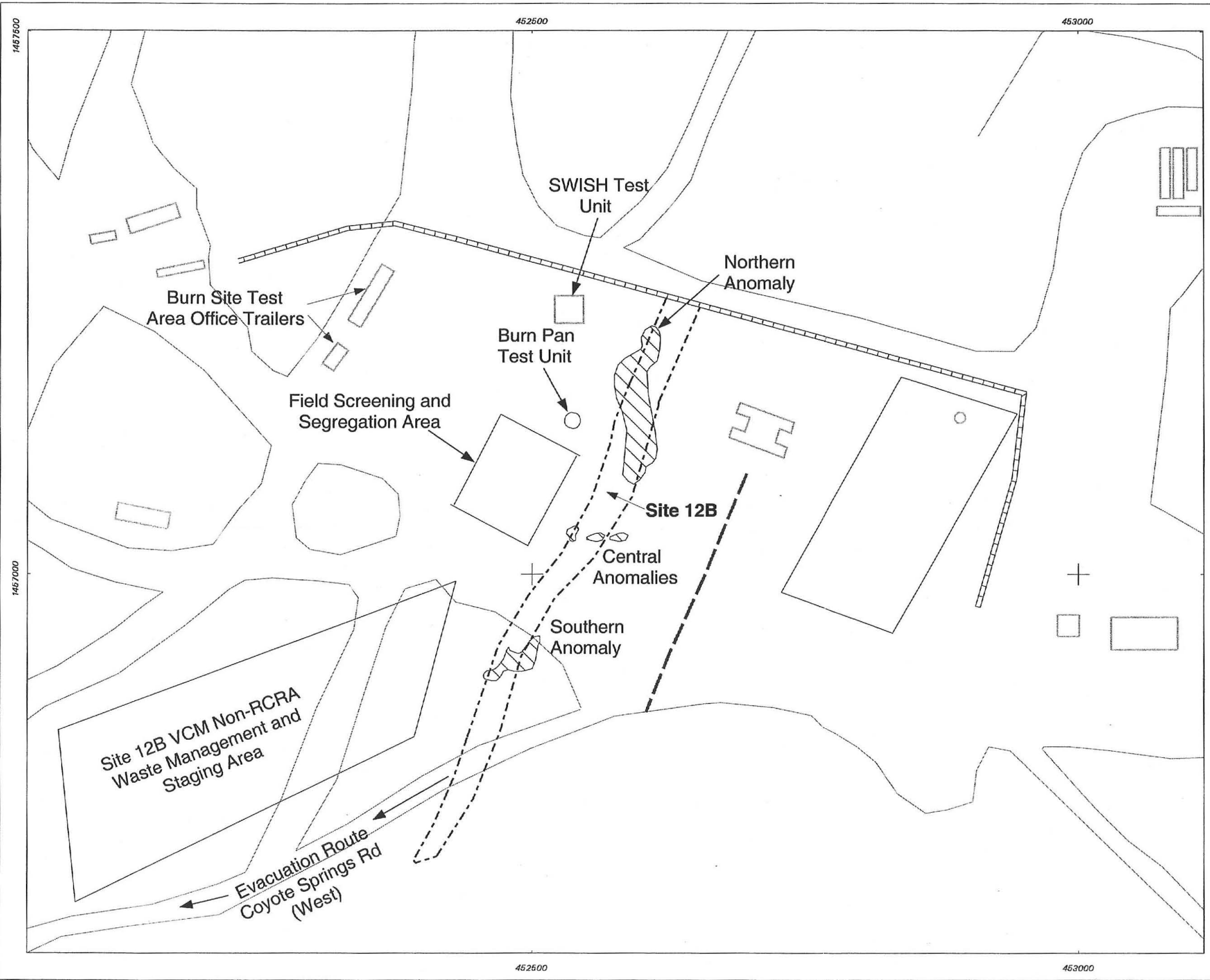
The SWMU 12B VCM field work was performed from June through September 1997. Site preparation and surface-water control measures were installed in late June, and excavation of the arroyo began at the northern end of the site in early July. A complete discussion of the VCM's scope of work is provided in the "Voluntary Corrective Measure Plan for Excavation and Debris Removal at Environmental Restoration Site 12B, Operable Unit 1333, Canyon Test Area, Revision 1" (SNL/NM July 1997).

Characterization, cleanup, and restoration of the SWMU 12B Buried Arroyo was accomplished through excavating soil and debris from three areas of subsurface burial defined by geophysical anomalies and by the estimated arroyo boundaries (Figure 4.4.4-1). A backhoe equipped with a front loader bucket and an articulated front loader with a 3-cubic-yard bucket were used. Excavation of the three areas and the former arroyo channel proceeded from north to south in sequentially numbered, 10- by 10-foot grid blocks (Figure 4.4.4-2). Lifts from each grid block were initially removed in 2-foot depths in the northern part of the site: lift 1 = 0- to 2-foot depth, lift 2 = 2- to 4-foot depth interval, etc. However, south of the large geophysical anomaly most grid blocks were excavated to the total depth in one continuous digging event. The depth of excavation varied from approximately 3 to 6 feet and was generally deeper at the northern end of the site. The average depth was approximately 4 to 5 feet, except at the southern end where the arroyo intersects the southernmost road. Here the excavation depth varied from 2 to 4 feet deep. Excavation continued both downward and laterally out until no sign of debris was visible and/or until the point of the original arroyo channel was encountered.

After excavated materials were visually examined and thoroughly field-screened and surveyed for contamination in the screening/segregation area, the material was segregated based upon field-screening results and material type (debris or soil). Final characterization was conducted using appropriate screening and/or analytical methods. The VCM Plan (SNL/NM July 1997) discusses the details of the screening and segregation procedures, which were ultimately documented in field logs (Mitchell June 1997) that tracked results by excavation block number.

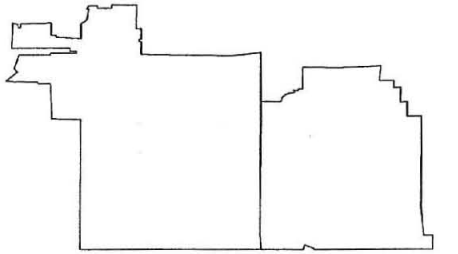
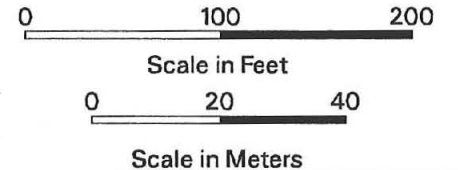
During the excavation of Block 88, a sample was collected because anomalous radioactivity was found in the soils. This screened segregated block of material was placed in soil pile SP-09. Because of the high values of radionuclides detected in the soil, SP-09 data are not included in the risk assessment portions of this NFA. Further characterization of SP-09 will be conducted in the near future.

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### Legend

- Buried Discharge Line
- Cable Conduit
- Roads
- Area to be excavated for SWMU 12B VCM
- Building
- Area to be excavated for SWMU 12B VCM (Anomaly)



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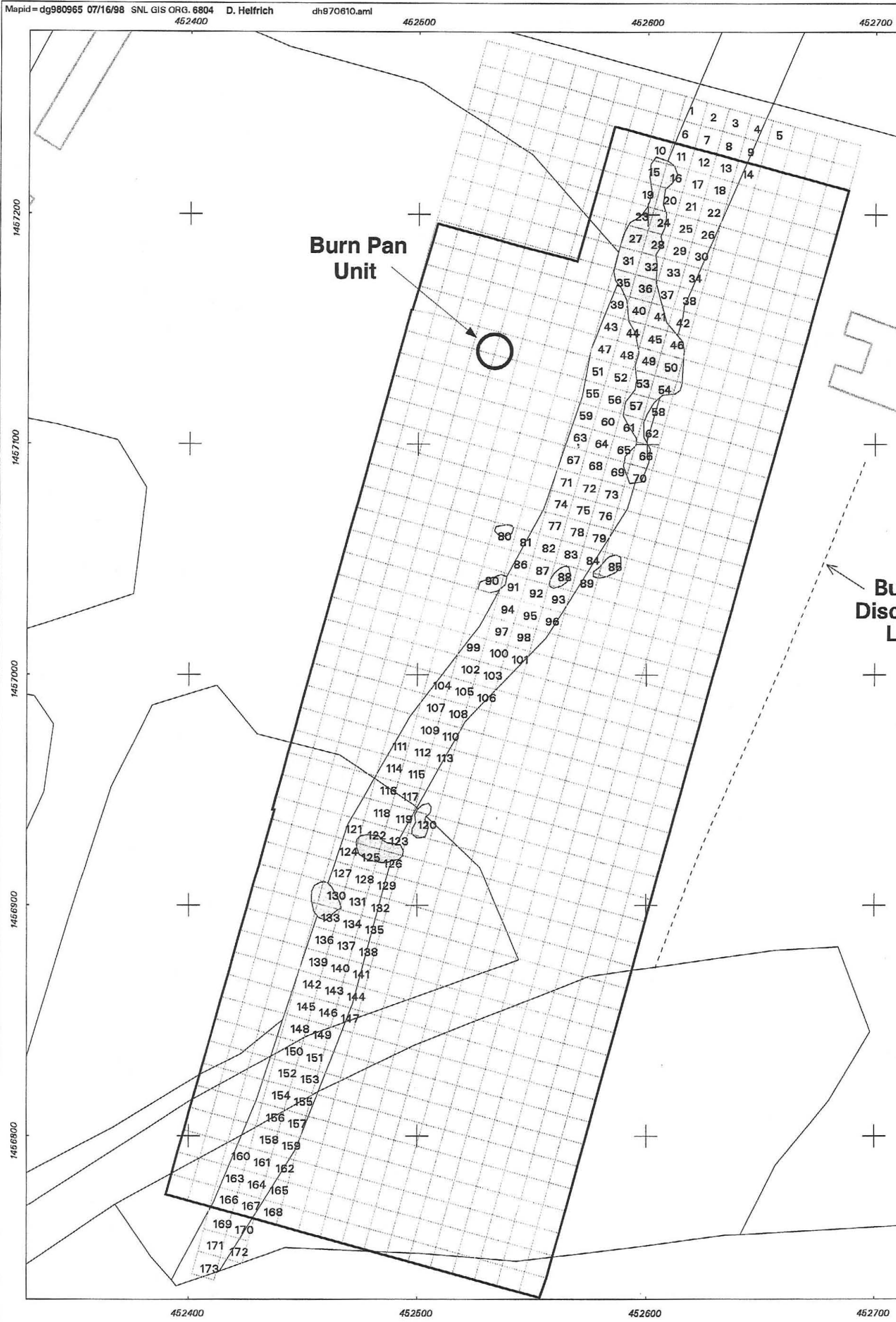
**Figure 4.4.4-1**  
**Site Layout for**  
**SWMU 12B VCM**









Transverse Mercator Projection, New Mexico State Plane Coordinate System, Central Zone, 1987 North American Horizontal Datum, 1929 North American Vertical Datum

	MAPID= 980964		
	Unclassified	SNL GIS ORG. 6804	
	Rachel Loehman	r1980754.pri	07/14/98

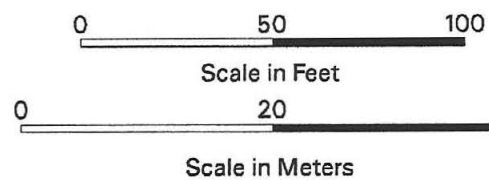




**Legend**

-  SWMU Boundary
-  Grid Line
-  Soil Gas Survey Boundary
-  Buried Discharge Line
-  Building/Structure
-  Subsurface Metal Anomaly

**Figure 4.4.4-2  
 SWMU 12B VCM  
 Arroyo Excavation Grid**





The following material was excavated, screened, and segregated (as set forth by the VCM work plan) during the VCM field effort:

- Approximately 3,300 cubic yards of soil, all field-screened clean except for
  - Approximately 2.5 cubic yards of potentially fuel-contaminated soil
  - Approximately 6 cubic yards of potentially radioactively contaminated soil
  - Approximately 75 cubic yards of debris and scrap metal, including 34 pallets of surveyed clean cable, metal scrap, and debris; 1 pallet of asbestos transite; 3 partially filled 55-gallon drums of lead metal; approximately 5 cubic yards of surveyed clean porous debris; and approximately 10 cubic yards of concrete blocks (surveyed clean)
- Two partially filled 55-gallon drums of batteries, one drum field-surveyed clean for radionuclides, and one drum with radioactive batteries.

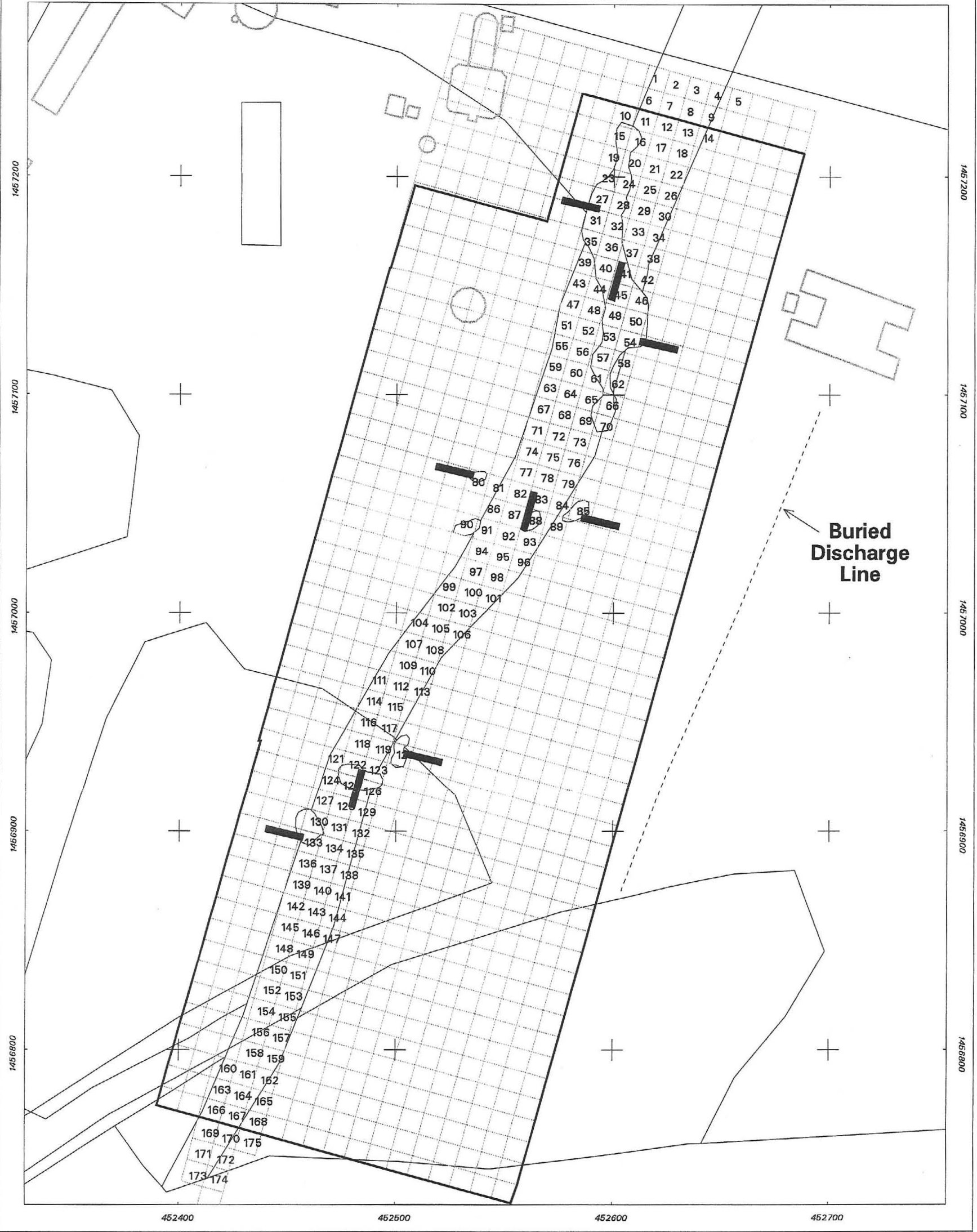
After the digging was completed north and south of the site's southern access road, a final magnetometer survey was performed over the excavated area to verify that all buried metal was removed. Six trenches (approximately 15 x 2 x 4 feet deep) at the edges of the excavation and three trenches (approximately 18 x 2 x 2 feet deep) in the arroyo channel were excavated into areas (Figure 4.4.4-3) where the most debris and contamination had been encountered during the digging to allow visual examination by the regulators during their site inspection. On September 5, 1997, representatives of the New Mexico Environment Department (NMED) Surface Water Quality Board, NMED Hazardous and Radioactive Materials Bureau, and DOE Oversight Bureau performed a site inspection and, in general, indicated that the scope of excavation was acceptable. Confirmation sample locations were marked in the field with pinflags so the regulators could inspect and provide input. The regulators indicated that the locations were acceptable and requested no changes or additional locations. On October 14, 1997, after the inspection, the excavation field work was completed: i.e., the nine trenches were filled in and the southern access road was excavated to a depth of approximately 2 feet, as requested by the regulators. The culvert and roadway across the arroyo were completed on October 17, 1997, and the southernmost access road was graded to form a low-water crossing at the request of the Burn Site manager.

During site preparation and throughout the project, surface-water control measures were installed and maintained. Diversion dams/berms were installed in the channel north of the excavation site and in the excavation areas as had been detailed in the project waste management plan (SNL/NM July 1997). Silt fences were installed in the work area and downgradient in road ditches to control runoff from the site and the soil pile management area. Also, a diversion berm was constructed around the soil pile management area (on the north side) to prevent run-on. Another diversion berm was constructed along the back side (north side) of the cable rack to divert run-on into the diversion ditch that parallels the excavated arroyo channel and discharges through a silt fence. Figure 4.4.4-4 shows the location of silt fences that continue to be maintained at the site.








Fifteen soil piles are stored in an area just outside the clean-up arroyo. The piles were sampled and analyzed to determine whether contamination is present. The analytical data (except those for soil pile SP-09) were included in the risk assessment calculations. SNL/NM plans to use the soil for backfill at the Bomb Burner site.



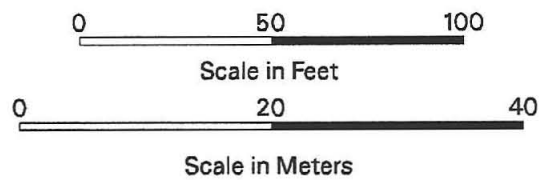
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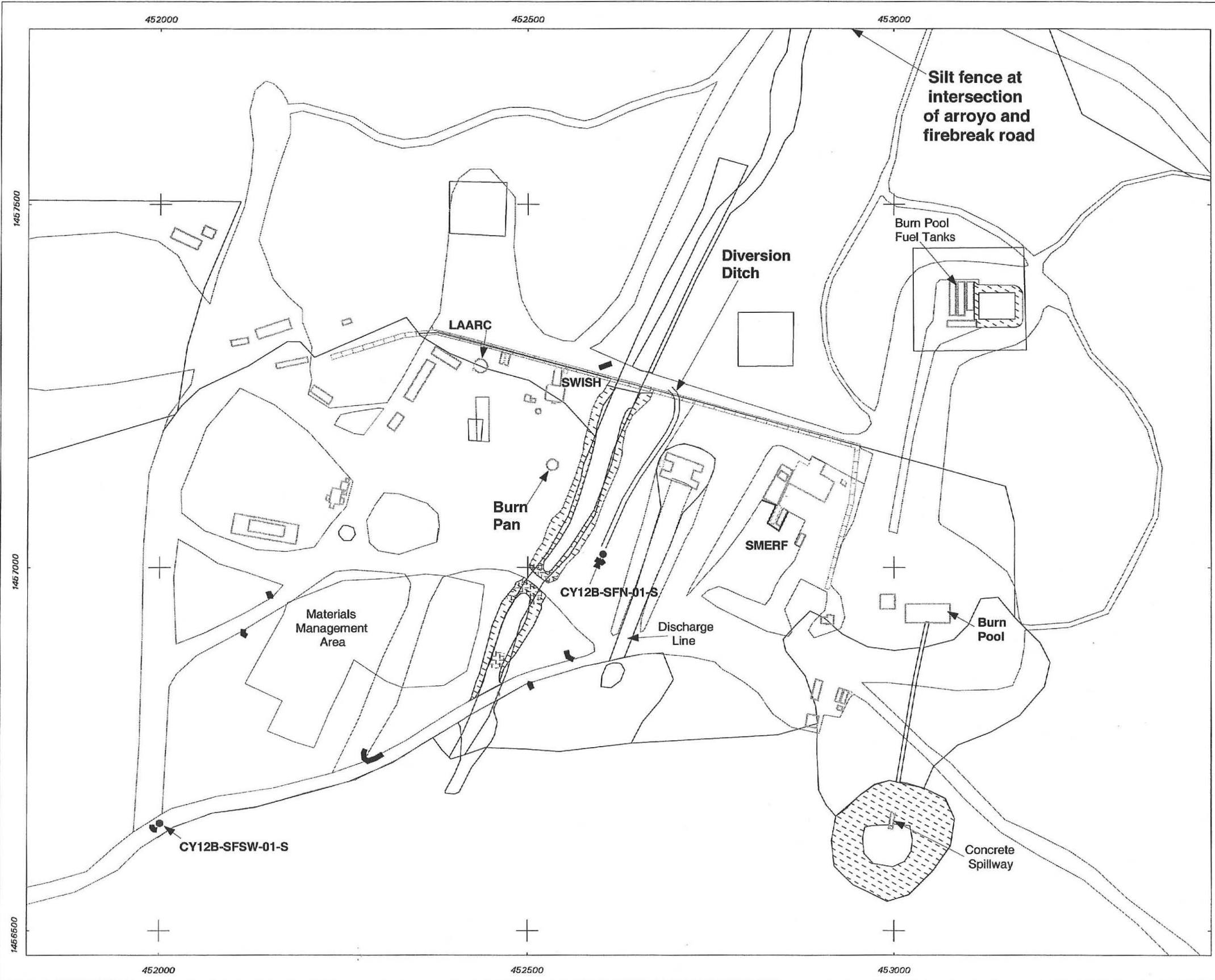
**Legend**

-  ER Site Boundary
-  Grid Line
-  Soil Gas Survey Boundary
-  Buried Discharge Line
-  Building/Structure
-  Subsurface Metal
-  Verification Trench





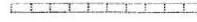


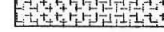
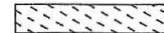


**Figure 4.4.4-3  
SWMU 12B VCM  
Verification Trench Locations**

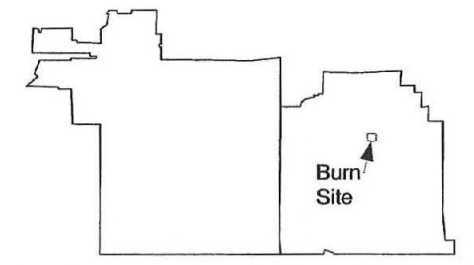
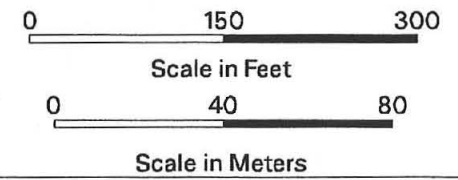






# Legend

-  Silt Sample Location
-  Silt Fence
-  Building / Structure
-  Road
-  Cable Conduit
-  SWMU Site
-  Trench
-  Rip-rap
-  Embankment / Depression
-  Arroyo Channel
-  Materials Management Area



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**Figure 4.4.4-4**  
**SWMU 12B**  
**Sediment Silt Fence**  
**and Sample Locations**



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



	MAPID= 980967
Unclassified	SNL GIS ORG. 6804
Debra Garcia	dg980967.pri 07/16/98



#### 4.4.4.2.1 *Verification Sampling*

Soil sampling was conducted as part of the VCM in order to characterize three different aspects of the site. All excavated and screened/segregated soil was placed into 15 discrete soil piles and was sampled and analyzed (based upon data evaluation/risk assessment) to determine whether it was clean enough to remain on site. Soil from the bottom of the excavated arroyo was sampled and analyzed to confirm that the VCM action was successful in removing enough contamination from the arroyo to allow for a risk-based NFA decision. Thirty-eight samples were collected from the arroyo and two samples were collected from behind silt fences outside the excavated area (all samples were collected at the 0- to 6-inch depth) (Figure 4.4.4-5). In addition, a geoprobe drilling system was used at five locations to collect soil samples (two samples per location at depths of from 2 to 4 feet bgs and 6 to 8 feet bgs) outside the excavated areas that had yielded detections of fuel or chlorinated compounds at very low levels in the soil organic vapor survey that had been conducted in December 1996 (Figure 4.4.4-6). Table 4.4.4-1 summarizes the main data sets and their purpose.

#### 4.4.4.2.2 *Verification Sample Analysis*

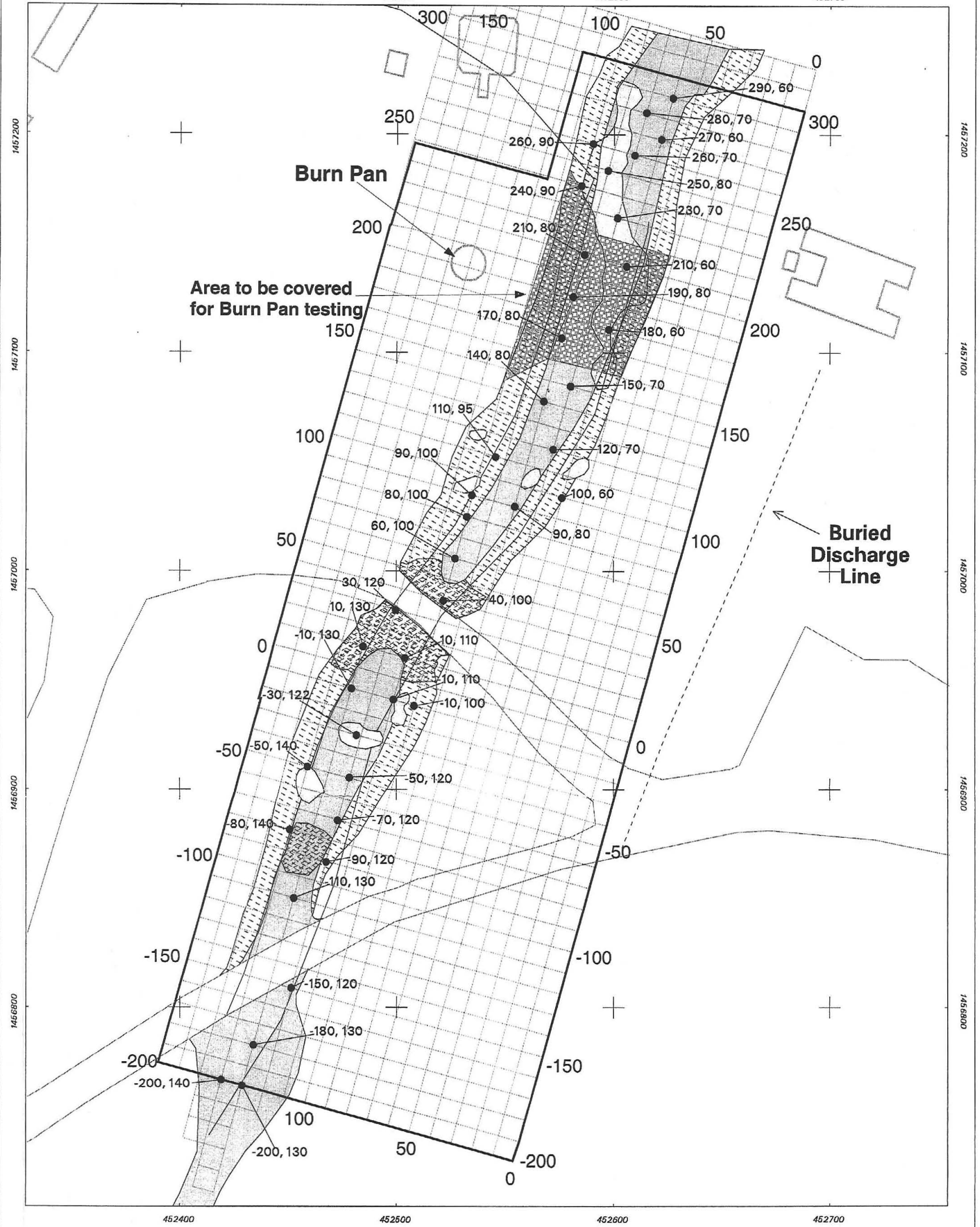
In order to confirm that the VCM activities had removed the contamination, a total of 40 soil samples (including two sediment samples) were collected on September 8, 1997, from within the arroyo. Figure 4.4.4-4 shows the sample locations for the two sediment samples, and Figure 4.4.4-5 shows the locations for the soil verification samples. The sample numbers are designated as follows:

- Soil verification sample number CY12B/260/90/01-US (example): CY = canyon, 12B = SWMU 12B, 260/90 = sample location by grid number, 01 = sample one, and US = soil sample.
- Sediment sample number CY12B-SFN-01-S: CY = canyon, 12B = SWMU 12B, SFN = silt fence (north), 01 = sample one, and S = sediment.
- Sediment sample number CY12B-SFSW-01-S: CY = canyon, 12B = SWMU 12B, SFSW = silt fence (southwest), 01 = sample one, and S = sediment.









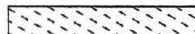
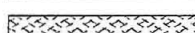
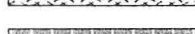
An off-site laboratory analyzed all samples for VOCs, semivolatile organic compounds (SVOC), HE, and RCRA metals plus beryllium and for radionuclides (using gamma spectroscopy). One sample only was analyzed for isotopic uranium. The results are as follows:

- Except for low levels of 4 compounds (chloroform, 2-butanone, methylene chloride, and vinyl chloride) and J values of 13 compounds (including TCE and perchloroethene), VOCs were not detected in any samples. Table 4.4.4-2 summarizes VOC results. Table 4.4.4-3 lists the MDLs for all analyzed VOCs.
- Chloroform levels ranged from 1.0 J to 8.1 micrograms ( $\mu\text{g}$ )/kg in 23 samples.

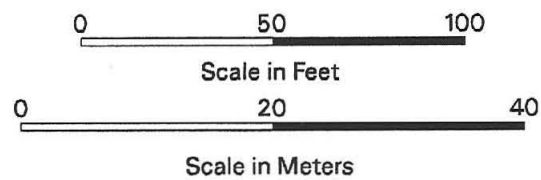
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**Legend**

-  -200, 130 Verification Sample Location with Grid Location Coordinates
-  Road
-  Grid Line
-  Soil Gas Survey Boundary
-  Buried Discharge Line
-  Building/Structure
-  Subsurface Metal
-  Channel Floor
-  Arroyo Bank
-  Riprap
-  Area to be covered for Burn Pan testing

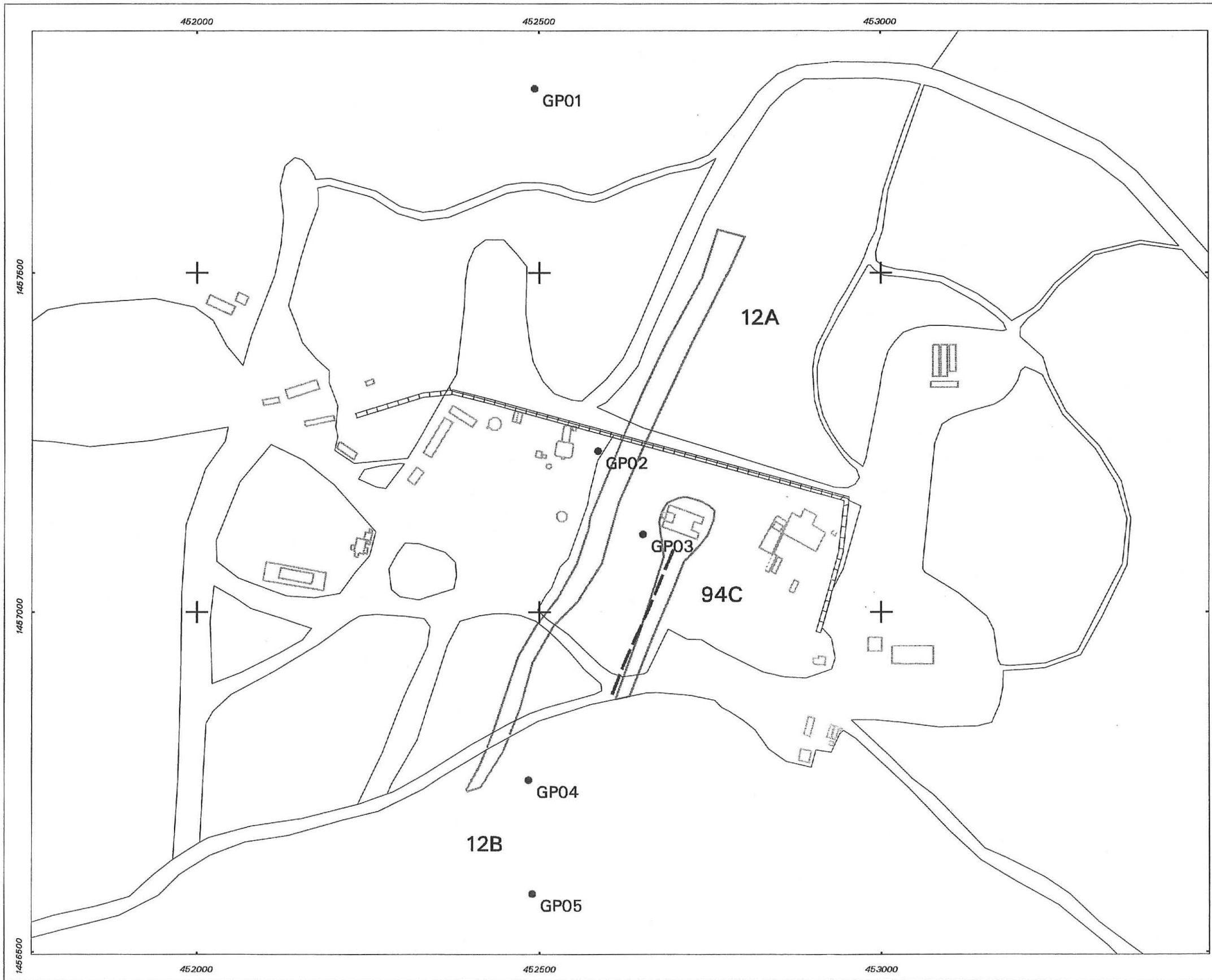
**Figure 4.4-5  
SWMU 12B  
Arroyo Verification  
Sample Locations**



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Environmental Geographic Information System

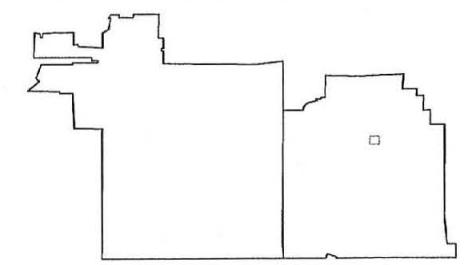
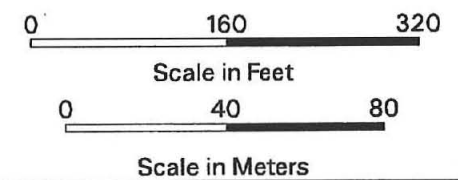






### Legend

- SWMU Site Boundary
- Buried Discharge Line
- Cable Conduit
- Roads
- Building
- Geoprobe Borehole & Sample Location



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Environmental Geographic Information System

**Figure 4.4.4-6**  
**SWMU 12B**  
**Geoprobe Borehole & Sample Location Map**



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



	MAPID=980969
Unclassified	SNL GIS ORG. 6804
raloehm	dr980969.aml 08/31/98



Table 4.4.4-1  
Data Sets for SWMU 12B

AR/COC No.	Data Purpose	Sampling Group	Analytical Type
06885	Characterize soil piles	Soil piles 1-10	VOC, SVOC, HE, RCRA metals
06895	Characterize soil piles	Soil piles 1-10	Gamma spectroscopy
06780	Determine isotopic ratios of U-238, U-235, U-234	Block 88	Isotopic uranium
06770	Determine isotopic ratios of U-238, U-235, U-234	Block 88	Gamma spectroscopy
06896	Characterize soil piles	Soil piles 11-15	VOC, SVOC, HE, RCRA metals
06897	Characterize soil piles	Soil piles 11-15	Gamma spectroscopy
510308	Characterize soil piles (resample)	Soil piles 1-15	VOC, SVOC
510471	Characterize soil piles (resample)	Soil piles 1-15	VOC
600317	Characterize soil piles (resample)	Soil piles 4, 5, 6, 8, 9	VOC
06899	Basis for determination that site is clean enough for NFA	Verification samples	VOC, SVOC, HE, RCRA metals
06898, 06900	Basis for determination that site is clean enough for NFA	Verification samples	Gamma spectroscopy
06954	Determine potential VOC and SVOC concentrations in soil where low detections were observed during SOV survey	Geoprobe samples	VOC, SVOC
06953	Characterize geoprobe soil samples	Geoprobe samples	Gamma spectroscopy

AR/COC = Analysis Request/Chain-of-Custody Record.

HE = High explosive(s).

NFA = No further action.

RCRA = Resource Conservation and Recovery Act.

SOV = Soil organic vapor.

SVOC = Semivolatile organic compound.

VOC = Volatile organic compound.

Table 4.4.4-2  
Summary of SWMU 12B Grid Sampling, VOC Analytical Results, September 1997  
(Off-site laboratory)

Sample Attributes			VOCs (EPA 8260) <sup>a</sup> (µg/kg)						
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Chloroform	Acetone	Trichloroethene	Tetrachloroethene	2-Butanone	2-Chloroethylvinylether	Methylene Chloride
6899	CY12B/260/90/01-US	0-0.5	2.6 (5.0) R	ND (5.0) R	ND (1.0) R	ND (1.0) R	ND (2.0) R	ND (1.0) R	ND (4.0) R
6899	CY12B/290/60/01-US	0-0.5	<b>2.1 J (5.0)<sup>c</sup></b>		ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/280/70/01-US	0-0.5	ND (1.0)	ND (5.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/270/60/01-US	0-0.5	<b>1.2 J (5.0)</b>	20 (10) U	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/260/70/01-US	0-0.5	ND (1.0)	ND (5.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/250/80/01-US	0-0.5	ND (1.0)	ND (5.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/240/90/01-US	0-0.5	2.0 (5.0) R	ND (5.0) R	ND (1.0) R	ND (1.0) R	ND (2.0) R	ND (1.0) R	ND (4.0) R
6899	CY12B/230/70/01-US	0-0.5	<b>1.4 J (5.0)</b>	ND (5.0)	<b>2.5 J (5.0)</b>	<b>1.4 J (5.0)</b>	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/210/80/01-US	0-0.5	<b>1.2 J (5.0)</b>	ND (5.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/210/60/01-US	0-0.5	<b>1.8 J (5.0)</b>	ND (5.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/190/80/01-US	0-0.5	ND (1.0)	ND (5.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/180/60/01-US	0-0.5	ND (1.0)	ND (5.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/170/80/01-US	0-0.5	<b>1.9 J (5.0)</b>	20 (10) U	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/150/70/01-US	0-0.5	<b>1.0 J (5.0)</b>	21 (10) U	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/140/80/01-US	0-0.5	ND (1.0)	ND (5.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/120/70/01-US	0-0.5	ND (1.0)	22 (10) U	ND (1.0)	<b>1.4 J (5.0)</b>	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/110/95/01-US	0-0.5	ND (1.0)	19 (10) U	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/100/60/01-US	0-0.5	ND (1.0) R	ND (5.0) R	2.4 (5.0) R	1.8 (5.0) R	ND (2.0) R	ND (1.0) R	ND (4.0) R
6899	CY12B/90/100/01-US	0-0.5	<b>1.0 J (5.0)</b>	19 (10) U	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/90/80/01-US	0-0.5	ND (1.0)	18 (10) U	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/80/100/01-US	0-0.5	ND (1.0)	ND (5.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/60/100/01-US	0-0.5	<b>1.8 J (5.0)</b>	ND (5.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/40/100/01-US	0-0.5	<b>6.1</b>	<b>27 (10) B</b>	<b>2.5 J (5.0)</b>	ND (1.0)	<b>16</b>	ND (1.0)	<b>4.3 J (5.0)</b>
6899	CY12B/30/120/01-US	0-0.5	<b>3.3 J (5.0)</b>	18 (10) U	<b>1.2 J (5.0)</b>	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/10/110/01-US	0-0.5	ND (1.0)	41 (10) U	ND (1.0)	<b>2.2 J (5.0)</b>	<b>17</b>	ND (1.0)	ND (4.0)
6899	CY12B/-10/130/01-US	0-0.5	<b>3.4 J (5.0)</b>	18 (10) U	<b>1.5 J (5.0)</b>	ND (1.0)	ND (2.0)	<b>1.0 J (20)</b>	ND (4.0)
6899	CY12B/-10/100/01-US	0-0.5	<b>4.7 J (5.0)</b>		<b>2.0 J (5.0)</b>	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)

Refer to footnotes at end of table.

Table 4.4.4-2 (Continued)  
 Summary of SWMU 12B Grid Sampling, VOC Analytical Results, September 1997  
 (Off-site laboratory)

Sample Attributes			VOCs (EPA 8260) <sup>a</sup> (µg/kg)						
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Chloroform	Acetone	Trichloroethene	Tetrachloroethene	2-Butanone	2- Chloroethylvinylether	Methylene Chloride
6899	CY12B/30/122/01-US	0-0.5	ND (1.0)	ND (5.0) B	1.9 J (5.0)	2.1 J (5.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/50/120/01-US	0-0.5	4.0 J (5.0)	20 (10) U	1.5 J (5.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/50/140/01-US	0-0.5	8.1	25 (10) U	2.8 J (5.0)	1.1 J (5.0)	ND (2.0)	ND (1.0)	5.1
6899	CY12B/70/120/01-US	0-0.5	2.0 J (5.0)	21 (10) U	1.5 J (5.0)	ND (1.0)	17	ND (1.0)	ND (4.0)
6899	CY12B/80/140/01-US	0-0.5	5.9	23 (10) U	1.5 J (5.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/90/120/01-US	0-0.5	ND (1.0)	24 (10) U	1.1 J (5.0)	2.0 J (5.0)	17	ND (1.0)	ND (4.0)
6899	CY12B/110/130/01-US	0-0.5	1.2 J (5.0)	19 (10) U	1.1 J (5.0)	ND (1.0)	16	ND (1.0)	ND (4.0)
6899	CY12B/150/120/01-US	0-0.5	ND (1.0)	18 (10) U	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/180/130/01-US	0-0.5	3.5 J (5.0)	24 (10) U	1.2 J (5.0)	ND (1.0)	16	ND (1.0)	ND (4.0)
6899	CY12B/200/130/01-US	0-0.5	2.3 J (5.0)	ND (5.0) B	ND (1.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B/200/140/01-US	0-0.5	2.6 J (5.0)	23 (10) U	ND (1.0)	ND (1.0)	15	ND (1.0)	ND (4.0)
6899	CY12B-SFN-01-S	0-0.5	4.0 J (5.0)	24 (10) U	1.1 J (5.0)	ND (1.0)	ND (2.0)	ND (1.0)	ND (4.0)
6899	CY12B-SFSW-01-S	0-0.5	4.4 J (5.0)	60 (10) U	1.2 J (5.0)	ND (1.0)	23	ND (1.0)	ND (4.0)
Quality Assurance/Quality Control Samples (µg/L)									
6899	CY12B-EB-02	NA	ND (2.0)	ND (3.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (3.0)	ND (4.0)
6899	CY12B-TB-03	NA	ND (2.0)	ND (3.0)	ND (1.0)	ND (1.0)	ND (2.0)	ND (3.0)	ND (4.0)

Refer to footnotes at end of table.

Table 4.4.4-2 (Continued)  
 Summary of SWMU 12B Grid Sampling, VOC Analytical Results, September 1997  
 (Off-site laboratory)

Sample Attributes			VOCs (EPA 8260)* (µg/kg)					
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	2-Hexanone	p,m-Xylene	1,4-Dichlorobenzene	Trichlorofluoromethane	1,1-Dichloroethene	Vinyl Chloride
6899	CY12B/260/90/01-US	0-0.5	ND (2.0) R	ND (1.0) R	ND (1.0) R	ND (1.0) R	ND (1.0) R	ND (1.0) R
6899	CY12B/290/60/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/280/70/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/270/60/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/260/70/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/250/80/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/240/90/01-US	0-0.5	ND (2.0) R	ND (1.0) R	ND (1.0) R	ND (1.0) R	ND (1.0) R	ND (1.0) R
6899	CY12B/230/70/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/210/80/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/210/60/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/190/80/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/180/60/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/170/80/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/150/70/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/140/80/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/120/70/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/110/95/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/100/60/01-US	0-0.5	ND (2.0) R	ND (1.0) R	ND (1.0) R	ND (1.0) R	ND (1.0) R	ND (1.0) R
6899	CY12B/90/100/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/90/80/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/80/100/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/60/100/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/40/100/01-US	0-0.5	ND (2.0)	1.1 J (5.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/30/120/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/10/110/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/10/130/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/10/100/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/30/122/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/50/120/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/50/140/01-US	0-0.5	2.5 J (10)	1.4 J (5.0)	1.2 J (5.0)	ND (1.0)	ND (1.0)	ND (1.0)

Refer to footnotes at end of table.

Table 4.4.4-2 (Concluded)  
 Summary of SWMU 12B Grid Sampling, VOC Analytical Results, September 1997  
 (Off-site laboratory)

Sample Attributes			VOCs (EPA 8260) <sup>a</sup> (µg/kg)					
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	2-Hexanone	p,m-Xylene	1,4-Dichlorobenzene	Trichlorofluoromethane	1,1-Dichloroethene	Vinyl Chloride
6899	CY12B/70/120/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/80/140/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/90/120/01-US	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/110/130/01-	0-0.5	ND (2.0)	<b>1.8 J (5.0)</b>	ND (1.0)	<b>1.5 J (5.0)</b>	<b>1.1 J (5.0)</b>	ND (1.0)
6899	CY12B/150/120/01-	0-0.5	ND (2.0)	<b>1.3 J (5.0)</b>	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/180/130/01-	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	<b>6.4</b>
6899	CY12B/200/130/01-	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B/200/140/01-	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B-SFN-01-S	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
6899	CY12B-SFSW-01-S	0-0.5	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (1.0)
Quality Assurance/Quality Control Samples (µg/L)								
6899	CY12B-EB-02	NA	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)
6899	CY12B-TB-03	NA	ND (1.0)	ND (2.0)	ND (1.0)	ND (1.0)	ND (1.0)	ND (2.0)

<sup>a</sup>EPA November 1986.

<sup>b</sup>Analysis Request/Chain-of-Custody.

<sup>c</sup>Numbers in bold represent detected values.

CY = Canyon.

B = Analyte detected in associated blank.

EB = Equipment blank.

EPA = U.S. Environmental Protection Agency.

ER = Environmental Restoration.

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.

NA = Not applicable.

ND ( ) = Not detected above the MDL, shown in parenthesis.

R = Analytical result was rejected during data validation.

S = Sediment sample.

SFN = Silt fence (north).

SFSW = Silt fence (southwest).

SWMU = Solid waste management unit.

TB = Trip blank.

U = Analytical result was qualified as not detected during data validation.

US = Soil sample.

VOC = Volatile organic compound.

µg/kg = Microgram(s) per kilogram.

µg/L = Microgram(s) per liter.



Table 4.4.4-3  
 Summary of VOC Analytical Detection Limits Used for SWMU 12B Soil Sampling,  
 September 1997 and January, March, and May 1998  
 (Off-site laboratory)

Analyte	MDL ( $\mu\text{g}/\text{kg}$ )
Acetone	2-5.0
Benzene	0.25-1.0
Bromodichloromethane	1.0
Bromoform	0.27-1.0
Bromomethane	2.0
2-Butanone	2.0-2.1
Carbon Disulfide	1.0-2.2
Carbon Tetrachloride	0.22-1.0
Chlorobenzene	0.25-1.0
Chloroethane	0.72-1.0
2-Chloroethylvinylether	1.0-3.0
Chloroform	0.24-2.0
Chloromethane	1.0
Dibromochloromethane	0.21-1.0
Dichlorobromomethane	0.24-2.0
1,2 -Dichlorobenzene	1.0
1,3 -Dichlorobenzene	1.0
1,4 -Dichlorobenzene	1.0
1,1 -Dichloroethane	0.2-1.0
1,2 -Dichloroethane	0.23-1.0
1,1 -Dichloroethene	0.25-1.0
Cis-1,2-Dichloroethene	0.25-1.0
Trans-1,2-Dichloroethene	0.19-1.0
1,2-Dichloropropane	0.23-1.0
Cis -1,3-Dichloropropene	0.25-1.0
Trans-1,3-Dichloropropene	0.22-1.0
Ethylbenzene	0.23-1.0
2-Hexanone	1.0-4.4
4-Methyl-2-pentanone	2.0-2.9
Methyl Bromide	0.67-1
Methyl Chloride	0.43-1
Methylene Chloride	0.25-4.0
Styrene	0.22-1.0
1,1,2,2-Tetrachloroethane	0.46-2.0
Tetrachloroethene	0.23-1.0
Toluene	0.22-1.0
Trichloroethylene	0.27-1.0
1,1,1-Trichloroethane	0.18-1.0
1,1,2-Trichloroethane	0.24-1.0
Trichlorofluoromethane	1.0
Vinyl Acetate	1.8-3.0
Vinyl Chloride	0.4-2.0
o-Xylene	1.0
m, p-Xylene	2.0
Xylenes (total)	0.62-2

$\mu\text{g}/\text{kg}$  = Microgram(s) per kilogram.  
 MDL = Method detection limit.  
 SWMU = Solid waste management unit.  
 VOC = Volatile organic compound.

- 2-butanone levels ranged from 15 to 23 µg/kg in eight samples.
- Methylene chloride levels were at 4.3 J and at 5.1 µg/kg in two samples.
- A level of vinyl chloride was detected at 6.4 µg/kg in one sample.
- Except for one compound—bis(2-ethylhexyl)phthalate, which was detected at a level of 170 J µg/kg in only one sample—SVOCs were not detected in any samples. Table 4.4.4-4 summarizes SVOC results. Table 4.4.4-5 lists the MDLs for all analyzed SVOCs.
- All samples were analyzed for RCRA metals plus beryllium. Table 4.4.4-6 summarizes the metal results, the MDLs, and the approved background levels.
- Arsenic levels ranged from 2.3 to 5.6 mg/kg in all samples, and all sample results were below the approved background level.
- Barium levels ranged from 71 J to 370 J mg/kg in all samples. All barium values were qualified with a J value during the data validation process (Annex 6). One sample result (at 370 J mg/kg) was above the approved background level.
- Beryllium levels were detected in two samples at 0.57 mg/kg and at 0.62 mg/kg. All remaining results were estimated at values ranging from 0.19 J to 0.52 J mg/kg. All sample results were below the approved background level.
- Cadmium was detected at a level of 0.60 mg/kg in one sample. All remaining results were either not detected or estimated at values ranging from 0.12 J to 0.36 J mg/kg. All sample results were below the approved background level.
- Lead levels ranged from 3.5 to 22 mg/kg in all samples. Two sample results (at 19 mg/kg and 22 mg/kg) were above the background level.
- Mercury was not detected in any samples. However, the MDLs for all of the samples that were analyzed were above the maximum background value (0.055 mg/kg) for mercury.
- A selenium level was detected at 0.67 mg/kg in one sample. In another sample a value of 0.43 J mg/kg was estimated. All remaining samples yielded nondetections. All sample results were below the background level.
- Silver was not detected in any samples.
- HE compounds were not detected in any samples. Table 4.4.4-7 lists the MDLs for all analyzed HE compounds.
- Gamma spectroscopy analysis yielded four isotopes: uranium-238, thorium-232, uranium-235, and cesium-137 (Table 4.4.4-8). Only two samples yielded levels above approved background: uranium-238 ( $9.25 \pm 3.37$  picocuries [pCi]/gram [g]) and uranium-235 ( $0.202 \pm 0.129$  pCi/g). Table 4.4.4-8 shows the MDAs for all nondetects. Annex 4-E provides a complete set of the gamma spectroscopy data.

Table 4.4.4-4  
Summary of SWMU 12B Grid Sampling, SVOC Analytical Results, September 1997  
(Off-site laboratory)

Sample Attributes			SVOCs (EPA 8270) <sup>a</sup> (µg/kg)
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	bis(2-ethylhexyl)phthalate
6899	CY12B/260/90/01-US	0-0.5	ND (140) J
6899	CY12B/290/60/01-US	0-0.5	ND (130) J
6899	CY12B/280/70/01-US	0-0.5	ND (130) J
6899	CY12B/270/60/01-US	0-0.5	ND (130) J
6899	CY12B/260/70/01-US	0-0.5	ND (130) J
6899	CY12B/250/80/01-US	0-0.5	ND (130) J
6899	CY12B/240/90/01-US	0-0.5	ND (140) J
6899	CY12B/230/70/01-US	0-0.5	ND (140) J
6899	CY12B/210/80/01-US	0-0.5	ND (140) J
6899	CY12B/210/60/01-US	0-0.5	ND (140) J
6899	CY12B/190/80/01-US	0-0.5	ND (140) J
6899	CY12B/180/60/01-US	0-0.5	ND (130) J
6899	CY12B/170/80/01-US	0-0.5	ND (130) J
6899	CY12B/150/70/01-US	0-0.5	ND (140) J
6899	CY12B/140/80/01-US	0-0.5	ND (130)
6899	CY12B/120/70/01-US	0-0.5	ND (130)
6899	CY12B/110/95/01-US	0-0.5	ND (130)
6899	CY12B/100/60/01-US	0-0.5	ND (130)
6899	CY12B/90/100/01-US	0-0.5	ND (130)
6899	CY12B/90/80/01-US	0-0.5	ND (130)
6899	CY12B/80/100/01-US	0-0.5	170 J (680) <sup>c</sup>
6899	CY12B/60/100/01-US	0-0.5	ND (130)
6899	CY12B/40/100/01-US	0-0.5	ND (130)
6899	CY12B/30/120/01-US	0-0.5	ND (130)
6899	CY12B/10/110/01-US	0-0.5	ND (130)
6899	CY12B/-10/130/01-US	0-0.5	ND (130)
6899	CY12B/-10/100/01-US	0-0.5	ND (130)
6899	CY12B/-30/122/01-US	0-0.5	ND (130)
6899	CY12B/-50/120/01-US	0-0.5	ND (130)
6899	CY12B/-50/140/01-US	0-0.5	ND (130)
6899	CY12B/-70/120/01-US	0-0.5	ND (130)
6899	CY12B/-80/140/01-US	0-0.5	ND (130)
6899	CY12B/-90/120/01-US	0-0.5	ND (130)
6899	CY12B/-110/130/01-US	0-0.5	ND (130)
6899	CY12B/-150/120/01-US	0-0.5	ND (130)
6899	CY12B/-180/130/01-US	0-0.5	ND (130)
6899	CY12B/-200/130/01-US	0-0.5	ND (130)
6899	CY12B/-200/140/01-US	0-0.5	ND (130)
6899	CY12B-SFN-01-S	0-0.5	ND (130)

Refer to footnotes at end of table.

Table 4.4.4-4 (Concluded)  
 Summary of SWMU 12B Grid Sampling, SVOC Analytical Results, September 1997  
 (Off-site laboratory)

Sample Attributes			SVOCs (EPA 8270) <sup>a</sup> (µg/kg)
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	
6899	CY12B-SFSW-01-S	0-0.5	bis(2-ethylhexyl)phthalate ND (130)
Quality Assurance/Quality Control Sample (µg/L)			
6899	CY12B-EB-02	NA	ND (7.0)

<sup>a</sup>EPA November 1986.

<sup>b</sup>Analysis Request/Chain-of-Custody.

<sup>c</sup>Numbers in bold represent detected values.

- CY = Canyon.
- EB = Equipment blank.
- EPA = U.S. Environmental Protection Agency.
- ER = Environmental Restoration.
- ID = Identification.
- J = Analytical result was qualified as an estimation during data validation.
- 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.
- NA = Not applicable.
- ND ( ) = Not detected above the MDL, shown in parenthesis.
- S = Sediment sample.
- SFN = Silt fence (north).
- SFSW = Silt fence (southwest).
- SVOC = Semivolatile organic compound.
- SWMU = Solid waste management unit.
- US = Soil sample.
- µg/kg = Microgram(s) per kilogram.
- µg/L = Microgram(s) per liter.

Table 4.4.4-5  
 Summary of SVOC Analytical Detection Limits  
 Used for SWMU 12B Soil Sampling, September 1997 and  
 January, March, and May 1998  
 (Off-site laboratory)

Analyte	MDL (µg/kg)
1,2,4-Trichlorobenzene	160-180
1,2-Dichlorobenzene	120-167
1,3-Dichlorobenzene	120-167
1,4-Dichlorobenzene	90-167
1,2-Diphenylhydrazine	167
2,4,5-Trichlorophenol	167-220
2,4,6-Trichlorophenol	167-200
2,4-Dichlorophenol	167-210
2,4-Dimethylphenol	100-167
2,4-Dinitrophenol	190-333
2,4-Dinitrotoluene	150-170
2,6-Dinitrotoluene	167-220
2-Chloronaphthalene	167-190
2-Chlorophenol	110-167
2-Methyl-4,6-dinitrophenol	167-270
2-Methylnaphthalene	160-180
2-Methylphenol (o-Cresol)	130-167
o-Nitroaniline (2)	167-220
2-Nitrophenol	150-170
3,3-Dichlorobenzidine	70-833
m-Nitroaniline (3)	167-210
4-Bromophenyl phenyl ether	130-167
4-Chloro-3-methylphenol	110-167
4-Chloroaniline	140-167
4-Chlorophenyl phenyl ether	167-230
4-Methylphenol (m,p-Cresol)	167-310
p-Nitroaniline (4)	167-300
4-Nitrophenol	167-210
Acenaphthene	167-210
Acenaphthylene	167-230
Anthracene	100-167
Benzo(a)anthracene	110-167
Benzo(a)pyrene	120-167
Benzo(b)fluoranthene	120-167
Benzo(g,h,i)perylene	167-270
Benzo(k)fluoranthene	167-320
Benzoic Acid	120-333
Benzyl Alcohol	167-210
Bis(2-chloroethoxy) methane	120-167
Bis(2-chloroethyl) ether	90-167
Bis(2-chloroisopropyl) ether	120-167

Refer to footnotes at end of table.

Table 4.4.4-5 (Continued)  
 Summary of SVOC Analytical Detection Limits  
 Used for SWMU 12B Soil Sampling, September 1997 and  
 January, March, and May 1998  
 (Off-site laboratory)

Analyte	MDL ( $\mu\text{g}/\text{kg}$ )
Bis(2-ethylhexyl)phthalate	130-167
Butylbenzylphthalate	110-167
Carbazole	100-110
Chrysene	140-167
Dibenzo(a,h)anthracene	167-230
Dibenzofuran	167-220
Diethylphthalate	100-167
Dimethylphthalate	167-280
Di-n-butylphthalate	90-167
Di-n-octylphthalate	160-180
Fluoranthene	167-260
Fluorene	160-180
Hexachlorobenzene	167-190
Hexachlorobutadiene	150-170
Hexachlorocyclopentadiene	90-167
Hexachloroethane	130-167
Indeno(1,2,3-cd)pyrene	150-170
Isophorone	167-200
Naphthalene	160-180
Nitrobenzene	167-190
N-Nitroso-di-n-propylamine	167-220
N-Nitrosodiphenylamine	140-167
Pentachlorophenol	130-167
Phenanthrene	90-167
Phenol	100-167
Pyrene	167-240

$\mu\text{g}/\text{kg}$  = Microgram(s) per kilogram.  
 MDL = Method detection limit.  
 SWMU = Solid waste management unit.  
 SVOC = Semivolatile organic compound.

Table 4.4.4-6  
Grid Sampling, Metals Analytical Results, September 1997  
(Off-site laboratory)

Sample Attributes			Metals (EPA 6010/7000) <sup>a</sup> (mg/kg)								
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
6899	CY12B/260/90/01-US	0-0.5	4.0	170 J	0.57	0.25 J (0.55)	11	8.0	ND (0.11)	ND (0.44)	ND (0.11)
6899	CY12B/290/60/01-US	0-0.5	4.5	110 J	0.32 J (0.51)	0.35 J (0.51)	9.1	10	ND (0.10)	0.43 J (0.51)	ND (0.10)
6899	CY12B/280/70/01-US	0-0.5	3.4	91 J	0.26 J (0.51)	0.30 J (0.51)	7.9	6.0	ND (0.10)	ND (0.41)	ND (0.10)
6899	CY12B/270/60/01-US	0-0.5	3.6	130 J	0.26 J (0.51)	0.31 J (0.51)	7.8	6.4	ND (0.094)	ND (0.41)	ND (0.10)
6899	CY12B/260/70/01-US	0-0.5	3.6	96 J	0.27 J (0.52)	0.26 J (0.52)	8.1	6.3	ND (0.094)	ND (0.41)	ND (0.10)
6899	CY12B/250/80/01-US	0-0.5	3.9	170 J	0.34 J (0.51)	0.34 J (0.51)	9.2	15	ND (0.10)	ND (0.41)	ND (0.10)
6899	CY12B/240/90/01-US	0-0.5	4.6	140 J	0.50 J (0.55)	0.34 J (0.55)	12	19 <sup>c</sup>	ND (0.11)	ND (0.44)	ND (0.11)
6899	CY12B/230/70/01-US	0-0.5	3.9	150 J	0.45 J (0.53)	0.30 J (0.53)	11	16	ND (0.10)	ND (0.42)	ND (0.11)
6899	CY12B/210/80/01-US	0-0.5	3.8	150 J	0.42 J (0.55)	0.31 J (0.55)	11	8.1	ND (0.11)	ND (0.44)	ND (0.11)
6899	CY12B/210/60/01-US	0-0.5	3.6	110 J	0.28 J (0.52)	0.34 J (0.52)	8.5	5.5	ND (0.095)	ND (0.41)	ND (0.10)
6899	CY12B/190/80/01-US	0-0.5	3.1	120 J	0.28 J (0.53)	0.29 J (0.53)	8.5	7.8	ND (0.11)	ND (0.42)	ND (0.11)
6899	CY12B/180/60/01-US	0-0.5	3.9	93 J	0.28 J (0.51)	0.36 J (0.51)	7.2	6.5	ND (0.098)	ND (0.41)	ND (0.10)
6899	CY12B/170/80/01-US	0-0.5	3.3	110 J	0.32 J (0.52)	0.33 J (0.52)	9.3	7.0	ND (0.099)	ND (0.42)	ND (0.10)
6899	CY12B/150/70/01-US	0-0.5	4.8	370 J	0.49 J (0.52)	0.33 J (0.52)	12	12	ND (0.10)	ND (0.41)	ND (0.10)
6899	CY12B/140/80/01-US	0-0.5	3.2	110 J	0.32 J (0.49)	0.27 J (0.49)	8.9	9.3	ND (0.096) J	ND (0.39)	ND (0.087) J
6899	CY12B/120/70/01-US	0-0.5	2.8	100 J	0.29 J (0.49)	0.21 J (0.49)	8.7	7.4	ND (0.098) J	ND (0.39)	ND (0.10) J
6899	CY12B/110/95/01-US	0-0.5	3.5	130 J	0.32 J (0.53)	0.35 J (0.53)	10	6.7	ND (0.11)	ND (0.42)	ND (0.11)
6899	CY12B/100/60/01-US	0-0.5	4.6	210 J	0.62	0.36 J (0.55)	15	12	ND (0.11)	ND (0.44)	ND (0.11)
6899	CY12B/90/100/01-US	0-0.5	4.0	140 J	0.44 J (0.51)	0.29 J (0.51)	12	9.3	ND (0.10)	0.67	ND (0.10)
6899	CY12B/90/80/01-US	0-0.5	3.1	110 J	0.33 J (0.51)	0.24 J (0.51)	8.9	6.8	ND (0.10)	ND (0.41)	ND (0.10)
6899	CY12B/80/100/01-US	0-0.5	4.0	140 J	0.45 J (0.52)	0.33 J (0.52)	13	8.7	ND (0.10)	ND (0.42)	ND (0.10)
6899	CY12B/60/100/01-US	0-0.5	4.06	139 J	0.454 J (0.53)	0.244 J (0.53)	11.4	10.2	ND (0.11)	ND (0.42)	ND (0.11)
6899	CY12B/40/100/01-US	0-0.5	2.69	90.1 J	0.302 J (0.53)	0.16 J (0.53)	7.99	8.35	ND (0.11) J	ND (0.42)	ND (0.10) J
6899	CY12B/30/120/01-US	0-0.5	3.4	110 J	0.31 J (0.53)	0.16 J (0.53)	9.1	6.6	ND (0.11) J	ND (0.42)	ND (0.10) J
6899	CY12B/10/110/01-US	0-0.5	3.5	140 J	0.45 J (0.53)	0.22 J (0.53)	11	14	ND (0.11) J	ND (0.42)	ND (0.096) J
6899	CY12B/-10/130/01-US	0-0.5	2.9	100 J	0.28 J (0.51)	0.22 J (0.51)	8.9	5.7	ND (0.10) J	ND (0.41)	ND (0.10) J
6899	CY12B/-10/100/01-US	0-0.5	3.3	120 J	0.47 J (0.54)	0.13 J (0.54)	11	17	ND (0.11) J	ND (0.43)	ND (0.11) J
6899	CY12B/-30/122/01-US	0-0.5	2.9	97 J	0.26 J (0.52)	0.16 J (0.52)	7.5	22	ND (0.087) J	ND (2.1)	ND (0.091) J
6899	CY12B/-50/120/01-US	0-0.5	2.3	71 J	0.23 J (0.50)	0.18 J (0.50)	7.0	4.6	ND (0.10) J	ND (0.40)	ND (0.10) J
6899	CY12B/-50/140/01-US	0-0.5	3.3	130 J	0.47 J (0.55)	0.19 J (0.55)	12	8.0	ND (0.096) J	ND (0.44)	ND (0.11) J
6899	CY12B/-70/120/01-US	0-0.5	2.8	83 J	0.23 J (0.51)	0.28 J (0.51)	7.4	4.1	ND (0.099) J	ND (2.0)	ND (0.10) J
6899	CY12B/-80/140/01-US	0-0.5	3.0	120 J	0.41 J (0.51)	0.14 J (0.51)	12	7.1	ND (0.10) J	ND (2.0)	ND (0.10) J
6899	CY12B/-90/120/01-US	0-0.5	2.7	82 J	0.24 J (0.50)	0.60	7.2	5.5	ND (0.092) J	ND (0.40)	ND (0.098) J
6899	CY12B/-110/130/01-US	0-0.5	2.6	130 J	0.21 J (0.51)	0.21 J (0.51)	7.1	4.1	ND (0.098) J	ND (0.41)	ND (0.093) J
6899	CY12B/-150/120/01-US	0-0.5	2.3	90 J	0.29 J (0.51)	ND (0.10)	7.3	5.2	ND (0.098) J	ND (0.41)	ND (0.095) J
6899	CY12B/-180/130/01-US	0-0.5	2.3	120 J	0.29 J (0.52)	0.25 J (0.52)	8.8	3.9	ND (0.094) J	ND (0.41)	ND (0.098) J
6899	CY12B/-200/130/01-US	0-0.5	5.6	77 J	0.19 J (0.50)	0.20 J (0.50)	6.4	3.5	ND (0.10) J	ND (0.40)	ND (0.10) J
6899	CY12B/-200/140/01-US	0-0.5	3.2	110 J	0.24 J (0.53)	0.33 J (0.53)	8.4	4.5	ND (0.10) J	ND (0.42)	ND (0.097) J

Refer to footnotes at end of table.

Table 4.4.4-6 (Concluded)  
 Summary of SWMU 12B Grid Sampling, Metals Analytical Results, September 1997  
 (Off-site laboratory)

Sample Attributes			Metals (EPA 6010/7000) <sup>a</sup> (mg/kg)								
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
6899	CY12B-SFN-01-S	0-0.5	3.8	150 J	0.52 J (0.54)	ND (0.11)	14	8.7	ND (0.11) J	ND (0.43)	ND (0.10) J
6899	CY12B-SFSW-01-S	0-0.5	2.8	110 J	0.38 J (0.51)	0.12 J (0.51)	10	5.3	ND (0.11) J	ND (0.41)	ND (0.10) J
Quality Assurance/Quality Control Sample (mg/L)											
6899	CY12B-EB-02	NA	ND (0.0030)	ND (0.0010)	ND (0.0010)	NC (0.0010)	ND (0.0010)	0.0026 J (0.0030)	ND (0.00020)	ND (0.0040)	ND (0.0010)
Background Soil Concentrations, Canyon Area <sup>c</sup>			9.8	246	0.75	0.64	18.8	18.9	0.055	3.0	<0.5

<sup>a</sup>EPA November 1986.

<sup>b</sup>Analysis Request/Chain-of-Custody.

<sup>c</sup>From Zamorski December 1997.

CY = Canyon.

EB = Equipment blank.

EPA = U.S. Environmental Protection Agency.

ER = Environmental Restoration.

ID = Identification.

J = The reported value was qualified as estimated during the data validation process.

J ( ) = The reported value is greater than or equal to the method detection limit (MDL) but is less than the practical reporting detection limit, shown in parenthesis.

mg/kg = Milligram(s) per kilogram.

mg/L = Milligram(s) per liter.

NA = Not applicable.

ND ( ) = Not detected above the MDL, shown in parenthesis.

S = Sediment sample.

SFN = Silt fence (north).

SFSW = Silt fence (southwest).

SWMU = Solid waste management unit.

US = Soil sample.



Table 4.4.4-7  
 Summary of HE Analytical Detection Limits  
 Used for SWMU 12B Grid Sampling,  
 September 1997  
 (Off-site laboratory)

Compounds	HE Detection Limits
	Off-Site Analyses by EPA Method 8330 <sup>a</sup> (µg/kg)
1,3,5-Trinitrobenzene	0.21-0.28
1,3-Dinitrobenzene	0.21-0.28
2,4,6-Trinitrotoluene	0.21-0.28
2,4-Dinitrotoluene	0.22-0.29
2,6-Dinitrotoluene	0.21-0.28
2-Amino-4,6-Dinitrotoluene	0.21-0.28
2-Nitrotoluene	0.21-0.28
3-Nitrotoluene	0.21-0.28
4-Amino-2,6-Dinitrotoluene	0.21-0.28
4-Nitrotoluene	0.21-0.28
HMX	1.9-2.4
Nitrobenzene	0.22-0.29
Pentaerythritol tetranitrate	NA
RDX	0.84-1.1
Tetryl	0.55-0.72

<sup>a</sup>EPA November 1986.

- EPA = U.S. Environmental Protection Agency.
- HE = High explosive(s).
- HMX = 1,3,5,7-tetranitro-1,3,5,7-tetrazacyclooctane.
- NA = Not applicable.
- RDX = 1,3,5-trinitro-1,3,5-triazacyclohexane.
- Tetryl = 2,4,6-trinitrophenylmethyl nitramine.
- SWMU = Solid waste management unit.
- µg/kg = Microgram(s) per kilogram.

Table 4.4.4-8  
Summary of SWMU 12B Grid Sampling, Gamma Spectroscopy Analytical Results, September 1997

Sample Attributes			Activity (pCi/g)							
Record Number <sup>a</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Uranium-238		Thorium-232		Uranium-235		Cesium-137	
			Result	Error <sup>b</sup>	Result	Error <sup>b</sup>	Result	Error <sup>b</sup>	Result	Error <sup>b</sup>
06900	CY12B/290/60/01-US	0-0.5	ND (2.29)	--	0.247	0.208	ND (0.174)	--	0.0426	0.0186
06900	CY12B/280/70/01-US	0-0.5	ND (2.37)	--	0.275	0.182	ND (0.169)	--	0.142	0.0306
06900	CY12B/270/60/01-US	0-0.5	ND (2.19)	--	0.220	0.162	ND (0.168)	--	ND (0.0130)	--
06900	CY12B/260/70/01-US	0-0.5	ND (2.31)	--	0.327	0.173	ND (0.176)	--	0.0639	0.0196
06900	CY12B/250/80/01-US	0-0.5	ND (2.59)	--	0.359	0.209	ND (0.0991)	--	0.0753	0.0281
06900	CY12B/240/90/01-US	0-0.5	ND (2.84)	--	0.432	0.260	ND (0.202)	--	0.0693	0.0267
06900	CY12B/230/70/01-US	0-0.5	ND (1.34)	--	0.598	0.312	ND (0.204)	--	0.0457	0.0198
06900	CY12B/210/80/01-US	0-0.5	ND (2.63)	--	0.417	0.237	ND (0.195)	--	ND (0.0257)	--
06898	CY12B/210/60/01-US (on-site laboratory)	0-0.5	ND (2.32E+00)	--	2.16E-01	1.48E-01	ND (1.68E-01)	--	8.98E-02	2.24E-02
06900	CY12B/190/80/01-US	0-0.5	ND (2.40)	--	0.326	0.201	ND (0.185)	--	0.0113	0.0223
06900	CY12B/180/60/01-US	0-0.5	ND (2.28)	--	0.178	0.126	ND (0.170)	--	0.0462	0.0209
06900	CY12B/170/80/01-US	0-0.5	ND (2.47)	--	0.278	0.162	0.0346	0.0551	0.0174	0.0139
06900	CY12B/150/70/01-US	0-0.5	ND (2.64)	--	0.513	0.275	0.0687	0.0713	0.0553	0.0198
06898	CY12B/260/90/01-US (on-site laboratory)	0-0.5	ND (3.01E+00)	--	5.37E-01	2.89E-01	ND (2.18E-01)	--	ND (2.92E-02)	--
06898	CY12B/140/80/01-US (on-site laboratory)	0-0.5	ND (2.88E+00)	--	5.87E-01	3.00E-01	ND (2.23E-01)	--	5.80E-02	2.96E-02
06900	CY12B/120/70/01-US	0-0.5	ND (2.50)	--	0.429	0.213	ND (0.186)	--	0.0937	0.0266
06900	CY12B/110/95/01-US	0-0.5	ND (2.78)	--	0.379	0.224	ND (0.203)	--	0.111	0.0749
06900	CY12B/100/60/01-US	0-0.5	ND (3.36)	--	0.685	0.350	ND (0.240)	--	0.426	0.193
06900	CY12B/100/60/01-USD	0-0.5	1.16	1.33	0.600	0.296	ND (0.212)	--	0.104	0.0266
06900	CY12B/90/80/01-US	0-0.5	ND (2.66)	--	0.354	0.223	ND (0.198)	--	0.101	0.0311
06898	CY12B/90/80/01-US (on-site laboratory)	0-0.5	ND (2.74E+00)	--	4.50E-01	2.62E-01	ND (2.02E-01)	--	ND (1.10E-01)	3.02E-02
06900	CY12B/80/100/01-US	0-0.5	ND (2.84)	--	0.501	0.270	ND (0.209)	--	0.0487	0.0335
06900	CY12B/60/100/01-US	0-0.5	ND (3.06)	--	0.597	0.302	ND (0.227)	--	0.105	0.0514
06900	CY12B/40/100/01-US	0-0.5	ND (3.01)	--	0.501	0.619	ND (0.209)	--	0.0444	0.0240
06900	CY12B/30/120/01-US	0-0.5	ND (2.67)	--	0.431	0.245	0.0500	0.0640	ND (0.0257)	--

Refer to footnotes at end of table.

Table 4.4.4-8 (Concluded)  
Summary of SWMU 12B Grid Sampling, Gamma Spectroscopy Analytical Results, September 1997

Sample Attributes			Activity (pCi/g)							
Record Number <sup>a</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Uranium-238		Thorium-232		Uranium-235		Cesium-137	
			Result	Error <sup>b</sup>	Result	Error <sup>b</sup>	Result	Error <sup>b</sup>	Result	Error <sup>b</sup>
06898	CY12B/10/110/01-US (on-site laboratory)	0-0.5	<b>4.28E+00<sup>c</sup></b>	2.04E+00	5.50E-01	2.76E-01	<b>1.64E-01</b>	1.73E-01	3.48E-02	2.30E-02
06900	CY12B/10/130/US	0-0.5	ND (2.70)	--	0.406	0.208	ND (0.196)	--	0.0470	0.0171
06900	CY12B/10/100/01-US	0-0.5	<b>9.25</b>	3.37	0.704	0.378	<b>0.202</b>	0.129	0.0324	0.0173
06900	CY12B/30/122/01-US	0-0.5	2.07	1.60	0.416	0.227	ND (0.196)	--	0.0751	0.0308
06898	CY12B/50/140/01-US (on-site laboratory)	0-0.5	ND (2.92E+00)	--	5.16E-01	2.60E-01	1.25E-01	4.98E-02	6.10E-02	2.01E-02
06900	CY12B/50/120/01-US	0-0.5	2.04	0.777	0.417	0.239	0.0714	0.0676	0.0743	0.0250
06900	CY12B/70/120/01-US	0-0.5	0.656	0.483	0.202	0.122	ND (0.134)	--	0.0299	0.0159
06900	CY12B/80/140/01-US	0-0.5	1.14	1.65	0.563	0.280	ND (0.164)	--	0.0426	0.0308
06900	CY12B/90/120/01-US	0-0.5	0.951	1.21	0.293	0.185	0.0661	0.102	0.0889	0.0331
06900	CY12B/110/130/01-US	0-0.5	0.698	0.650	0.300	0.174	ND (0.133)	--	0.0369	0.0204
06898	CY12B/150/120/01-US (on-site laboratory)	0-0.5	ND (2.85E+00)	--	ND (1.16E-01)	--	7.58E-02	6.84E-02	1.62E-02	1.28E-02
06900	CY12B/180/130/01-US	0-0.5	ND (0.931)	--	0.304	0.165	ND (0.142)	--	ND (0.0248)	--
06900	CY12B/200/130/01-US	0-0.5	ND (0.885)	--	0.291	0.171	0.0470	0.0468	ND (0.0247)	--
06900	CY12B/200/140/01-US	0-0.5	0.843	0.566	0.273	0.153	ND (0.137)	--	0.0669	0.0276
06900	CY12B/200/140/01-USD	0-0.5	ND (0.578)	--	0.165	0.0981	ND (0.133)	--	0.0470	0.0192
06900	CY12B-SFSW-01-S	0-0.5	0.636	0.564	0.562	0.294	ND (0.165)	--	ND (0.0292)	--
06898	CY12B-SFN-01-S (on-site laboratory)	0-0.5	ND (3.39E+00)	--	7.66E-01	4.13E-01	ND (2.42E-01)	--	5.30E-02	1.58E-02
Quality Assurance/Quality Control Sample (pCi/ml)										
06898	CY12B-EB-02 (on-site laboratory)	NA	ND (1.85E+00)	--	ND (1.63E-01)	--	ND (1.69E-01)	--	ND (2.46E-02)	--
Background Soil Activities, Upper Canyons <sup>d</sup>			2.31	NA	1.03	NA	0.16	NA	0.515	NA

<sup>a</sup> Analysis Request/Chain-of-Custody.

<sup>b</sup> Two standard deviations about the mean detected activity.

<sup>c</sup> Values in bold exceed background soil activities.

<sup>d</sup> From Dinwiddie September 1997.

CY = Canyon.

ER = Environmental Restoration.

ID = Identification.

NA = Not applicable.

ND ( ) = Not detected above the minimum detectable activity, shown in parenthesis.

pCi/g = Picocurie(s) per gram.

S = Sediment sample.

SFSW = Silt fence (southwest).

MU = Solid waste management unit.

US = Soil sample.

USD = Soil sample duplicate.

-- = Error not calculated for nondetectable results.

On December 8, 1997, six verification sample locations were resampled before a portion of the arroyo was filled in. A culvert was placed east of the Burn Pan at the request of the facility manager to cut down on air currents that could be created by the newly restored arroyo. These air currents could affect active testing conducted at the Burn Pan. The resampling was conducted at the following locations: CY12B-240/90-02-US, CY12B-210/80-02-US, CY12B-170/80-02-US, CY12B-210/60-02-US, CY12B-190/80-02-US, and CY12B-180/60-02-US. A total of seven soil samples (including one field duplicate) were collected next to the original grid location (i.e., 170/80) (Figure 4.4.4-5) and were analyzed for VOCs, SVOCs, and RCRA metals and beryllium.

- VOCs and SVOCs were not detected in any samples. Tables 4.4.4-3 and 4.4.4-5 list the MDLs for these two sets of compounds, respectively.
- All samples were analyzed for RCRA metals plus beryllium. Table 4.4.4-9 summarizes the metal results, the MDLs, and approved background values.
  - Arsenic levels ranged from 2.38 to 3.76 mg/kg in all samples. All sample results were below the approved background level.
  - Barium levels ranged from 88.8 J to 143 J mg/kg in all samples. All barium values were qualified with a J value. All sample results were below the approved background level.
  - Beryllium was detected at a level of 0.505 mg/kg in one sample. All remaining samples yielded estimated values ranging from 0.291 J to 0.458 J mg/kg. All sample results were below the background level.
  - Cadmium was detected in all samples at estimated values ranging from 0.165 J to 0.293 J mg/kg. All sample results were below the background level.
  - Chromium was detected in all samples at estimated values ranging from 8.39 J to 15.3 J mg/kg. All results were below the background level.
  - Lead levels ranged from 5.27 to 22.3 mg/kg in all samples. One sample result (at 22.3 mg/kg) was above the background level.
  - Mercury was not detected in any samples.
  - Selenium was detected at a level of 0.483 mg/kg in one sample. One sample result yielded no detection. The remaining results yielded estimated values ranging from 0.225 J to 0.388 J mg/kg. All sample results were below the approved background level.
  - Silver was not detected in any samples.

Table 4.4.4-9  
Summary of SWMU 12B Grid Resampling, Metals Analytical Results, December 1997  
(Off-site laboratory)

Sample Attributes			Metals (EPA 6010/7000) <sup>a</sup> (mg/kg)								
Record Number	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
510130	CY12B-240/90-02-US	0-0.5	3.13	136 J	0.458 J (0.476)	0.209 J (0.476)	11.5 J	<b>22.3<sup>c</sup></b>	ND (0.0173)	0.267 J (0.476)	ND (0.031)
510130	CY12B-210/80-02-US	0-0.5	3.14	143 J	0.416 J (0.481)	0.254 J (0.481)	13.9 J	9.16	ND (0.0173)	0.388 J (0.481)	ND (0.031)
510130	CY12B-210/60-02-US	0-0.5	3.42	125 J	0.505	0.245 J (0.455)	13.0 J	9.24	ND (0.0173)	0.225 J (0.455)	ND (0.031)
510130	CY12B-190/80-02-US	0-0.5	3.76	96.7 J	0.291 J (0.481)	0.261 J (0.481)	10.9 J	9.35	ND (0.0173)	ND (0.07)	ND (0.031)
510130	CY12B-170/80-02-US	0-0.5	2.38	88.8 J	0.298 J (0.481)	0.293 J (0.481)	15.3 J	5.27	ND (0.0173)	0.288 J (0.481)	ND (0.031)
510130	CY12B-180/60-02-US	0-0.5	2.49	117 J	0.391 J (0.459)	0.165 J (0.459)	8.39 J	10.4	ND (0.0173)	0.483	ND (0.031)
510130	CY12B-180/60-02-USD	0-0.5	3.05	135 J	0.438 J (0.459)	0.180 J (0.459)	11.2 J	11.2	ND (0.0173)	0.227 J (0.459)	ND (0.031)
Quality Assurance/Quality Control Sample (mg/L)											
510130	CY12B-EB-01	NA	ND (0.00293)	0.00177 J (0.00500)	ND (0.000223)	ND (0.000208)	0.00202 J (0.00500)	ND (0.000678)	ND (0.000104)	ND (0.0014)	ND (0.00062)
Background Soil Concentrations, Canyon Area <sup>d</sup>			9.8	246	0.75	0.64	18.8	18.9	0.055	3.0	<0.5

<sup>a</sup>EPA November 1986.

<sup>b</sup>Analysis Request/Chain-of-Custody.

<sup>c</sup>Value in bold exceed background soil concentrations.

<sup>d</sup>From Zamorski December 1997.

CY = Canyon.

EB = Equipment blank.

EPA = U.S. Environmental Protection Agency.

ER = Environmental Restoration.

ID = Identification.

J = Analytical result was qualified as an estimation during data validation.

J ( ) = The reported value is greater than or equal to the method detection limit (MDL) but is less than the project reporting limit, shown in parenthesis.

mg/kg = Milligram(s) per kilogram.

mg/L = Milligram(s) per liter.

NA = Not applicable.

ND ( ) = Not detected above the MDL, shown in parenthesis.

SWMU = Solid waste management unit.

US = Soil sample.

USD = Soil sample duplicate.

### Quality Assurance/Quality Control

Tables 4.4.4-2, 4.4.4-4, 4.4.4-6, 4.4.4-8, and 4.4.4-9 present the results of the QA/QC samples that were collected during the verification sampling. Those QA/QC samples consisted of three field duplicates, two equipment blanks, and one trip blank (CY12B-TB-02). The two field duplicate samples (from the original sampling) were sent to the off-site laboratory, but the samples were not analyzed (reason unknown). One field duplicate sample (from the resampling, CY-12B-180/60-02-USD and CY-12B-180/60-02-45) was analyzed (see Table 4.4.4-9). Table 4.4.4-10 presents the relative percent differences for this field duplicate sample. VOCs, SVOCs, and RCRA metals and beryllium either were not detected or were at low levels in this field duplicate sample, and they were not detected in the equipment blank samples. HE was not detected in the equipment blank sample, and VOCs were not detected in the trip blank sample.

### Data Validation

Data were validated for all the chemical analyses of samples collected at this site. Annex 4-F provides a letter summary report (AR/COC #06899).

### Geoprobe Sample Analysis

In order to confirm the possible presence of low levels of fuel or chlorinated compounds found during the soil organic vapor survey, a total of ten soil samples were collected from 5 geoprobe boreholes outside the arroyo. Figure 4.4.4-6 shows the sample locations. The sample numbers are designated as follows: For CY12B-GP01-05-01-S, CY = canyon, 12B = SWMU 12B, GP01 = Geoprobe location, 05 = sample depth in feet, 01 = sample one, and S = soil sample.

All samples were analyzed for VOCs and SVOCs, and one sample was analyzed for radionuclides.

- VOCs and SVOCs were not detected in any samples. Tables 4.4.4-3 and 4.4.4-5 show the MDLs.
- Table 4.4.4-11 summarizes gamma spectroscopy analytical results for four isotopes (uranium-238, thorium-232, uranium-235, and cesium-137). No isotope was detected above the approved background levels. Annex 4-E provides a complete set of the gamma spectroscopy data.

### Quality Assurance/Quality Control

QA/QC samples collected during the geoprobe sampling event consisted of one equipment blank (CY12B-EB-03) and two trip blanks (CY12B-TB-01 and CY12B-TB-04). VOCs and SVOCs were not detected in the equipment blank samples. VOCs were not detected in the trip blank samples.

Table 4.4.4-10  
Summary of SWMU 12B Field Duplicate Relative Percent Differences

Sample Attributes			Relative Percent Difference								
Record Number <sup>a</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
510130	CY12B-180/60-02-US CY12B-180/60-02-USD (off-site laboratory)	0-0.5	20.2	NC	NC	NC	NC	7.4	NC	NC	NC
06885	CY12B-SP01-01-S CY12B-SP01-01-SD (off-site laboratory)	0-0.5	2.4	NC	6.8	NC	8.0	NC	NC	NC	NC
06896	CY12B-SP11-01-S CY12B-SP11-01-SD (off-site laboratory)	0-0.5	9.8	19.4	1.7	NC	0.0	16.7	NC	NC	NC

<sup>a</sup>Analysis Request/Chain-of-Custody.

- CY = Canyon.
- ER = Environmental Restoration.
- ID = Identification.
- NC = Not calculated for estimated values or nondetected results.
- S = Soil sample.
- SD = Soil sample duplicate.
- SWMU = Solid waste management unit.
- US = Soil sample.
- USD = Soil sample duplicate.

Table 4.4.4-11  
Summary of SWMU 12B Geoprobe Sampling, Gamma Spectroscopy Analytical Results, September 1998

Sample Attributes			Activity (pCi/g)							
Record Number <sup>a</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Uranium-238		Thorium-232		Uranium-235		Cesium-137	
			Result	Error <sup>b</sup>	Result	Error <sup>b</sup>	Result	Error <sup>b</sup>	Result	Error <sup>b</sup>
06953	CY12B-GP01-05-01-S	0-0.5	ND (1.36)	--	0.621	0.321	0.0922	0.134	ND (0.0352)	--
Background Soil Activities, Upper Canyons <sup>c</sup>			2.31	NA	1.03	NA	0.16	NA	0.515	NA
Quality Assurance/Quality Control Sample (pCi/mL)										
06953	CY12B-EB-03	0-0.5	ND (0.770)	--	ND (0.147)	--	ND (0.142)	--	ND (0.0298)	--

<sup>a</sup>Analysis Request/Chain-of-Custody.

<sup>b</sup>Two standard deviations about the mean detected activity.

<sup>c</sup>From Dinwiddie September 1997.

- CY = Canyon.  
 EB = Equipment blank.  
 ER = Environmental Restoration.  
 GP = Geoprobe.  
 ID = Identification.  
 NA = Not applicable.  
 ND ( ) = Not detected above the minimum detectable activity, shown in parenthesis.  
 pCi/g = Picocurie(s) per gram.  
 pCi/mL = Picocurie(s) per milliliter.  
 S = Soil sample.  
 SWMU = Solid waste management unit.  
 -- = Error not calculated for nondetectable results.



## Data Validation

Data were validated for all the chemical analyses of samples collected at this site. Annex 4-F provides a letter summary report (AR/COC #06954).

### 4.4.4.2.3 *Soil Pile Analysis*

A total of 15 composite soil samples were collected from 15 soil piles (SP-01 through SP-15). The soil piles contain soil removed from the arroyo during the VCM. The sample numbers are designated as follows: For CY12B-SP01-01-S, CY = canyon, 12B = SWMU 12B, SP = Soil pile location, 01 = sample one, and S = soil sample.

The samples were analyzed for VOCs, SVOCs, RCRA metals plus beryllium, HE, and radionuclides. Because of problems associated with the off-site laboratory, the VOCs were collected and reanalyzed three times to obtain data acceptable under data validation criteria. Table 4.4.4-12 combines the acceptable VOC data from each data set with the three analytical data sets.

- Low levels of acetone were found in some samples ranging from 13 to 32  $\mu\text{g}/\text{kg}$ , and three compounds (2-butanone, methylene chloride, and toluene) were detected at J values. Table 4.4.4-3 lists the MDLs for analyzed VOCs.
- Except for two detections of bis(2-ethylhexyl)phthalate (at 210  $\mu\text{g}/\text{kg}$  and at 1,300  $\mu\text{g}/\text{kg}$ ), SVOCs were not detected in any samples. Table 4.4.4-13 summarizes the SVOC results. Table 4.4.4-5 lists the MDLs for all analyzed SVOCs.
- All samples were analyzed for RCRA metals and beryllium. The following summarizes the metal results (see also Table 4.4.4-14), the MDLs, and the background values.
  - Arsenic ranged from 3.4 to 4.8 mg/kg in all samples. All sample results were below the approved background level.
  - Barium ranged from 120 J to 290 mg/kg in all samples. One sample result (at 290 mg/kg) was above the approved background level.
  - Beryllium ranged from 0.47 J to 0.68 mg/kg in all samples. All sample results were below the approved background level.
  - Cadmium ranged from 0.19 J to 0.82 mg/kg in all samples. One sample result (at 0.82 mg/kg) was above the background level.
  - Chromium ranged from 12 to 15 mg/kg in all samples. All results were below the background level.
  - Lead ranged from 9.5 J to 190 J mg/kg in all samples. Six sample results (at levels ranging from 21 J to 190 J mg/kg) were above the background level.

Table 4.4-12  
Summary of SWMU 12B Soil Pile Sampling, VOC Analytical Results, January, March, and May 1998  
(Off-site laboratory)

Sample Attributes			VOCs (EPA 8260) <sup>a</sup> (µg/kg)				
Record Number <sup>b</sup>	ER Sample ID	Sample Depth (feet)	2-Butanone	2-Hexanone	Acetone	Methylene Chloride	Toluene
510471	CY12B-SP07-03-S	0.0	ND (5.00)	ND (5.00)	21 U	7.3 U	ND (2.00)
510471	CY12B-SP10-03-S	0.0	ND (5.00)	ND (5.00)	32 U	2.8 J (5.00) U	ND (2.00)
510471	CY12B-SP12-03-S	0.0	ND (5.00)	ND (5.00)	ND (10.0) U	1.9 J (5.00) U	ND (2.00)
510471	CY12B-SP13-03-S	0.0	ND (5.00)	ND (5.00)	30 U	2.6 J (5.00) U	ND (2.00)
510471	CY12B-SP14-03-S	0.0	ND (5.00)	ND (5.00)	12 U	4.6 J (5.00) U	ND (2.00)
510471	CY12B-SP15-03-S	0.0	ND (5.00)	ND (5.00)	12 U	4.8 J (5.00) U	ND (2.00)
510471	CY12B-SP15-03-SD	0.0	ND (5.00)	ND (5.00)	ND (10.0) U	3.2 J (5.00) U	ND (2.00)
510308	CY12B-SP01-02-S	0.0	ND (5.00)	ND (5.00)	13	2.4 J (5.00) U	1.1 J (2.00)
510308	CY12B-SP02-02-S	0.0	2.9 J (5.0) <sup>c</sup>	ND (5.00)	20	2.9 J (5.00) U	1.6 J (2.00)
510308	CY12B-SP03-02-S	0.0	3.6 J (5.0)	ND (5.00)	26	2.8 J (5.00) U	1.5 J (2.00)
510308	CY12B-SP05-02-S	0.0	ND (5.00)	ND (5.00)	13	1.7 J (5.00) U	ND (2.00)
600317	CY12B-SP04-04-S	0.0	ND (5.00)	ND (5.00)	ND (5.00)	3.2 U	ND (1.00)
600317	CY12B-SP06-04-S	0.0	ND (5.00)	ND (5.00)	ND (5.00)	1.7 U	ND (1.00)
600317	CY12B-SP08-04-S	0.0	ND (5.00)	ND (5.00)	2.7 J (5.00) B	2.3 U	ND (1.00)
600317	CY12B-SP09-04-S	0.0	ND (5.00)	ND (5.00)	ND (5.00)	1.5 U	ND (1.00)
600317	CY12B-SP09-04-SD	0.0	ND (5.00)	ND (5.00)	ND (5.00)	2.2 U	ND (1.00)
600317	CY12B-SP11-04-S	0.0	ND (5.00)	ND (5.00)	ND (5.00)	1.4 U	ND (1.00)
Quality Assurance/Quality Control Samples							
510471	CY12B-TB, (µg/kg)	NA	5.8	3.1 J (5.00)	38	6.1 B	ND (2.00)
510471	CY12B-EB, (µg/L)	NA	ND (5.00)	ND (5.00)	ND (10.0)	ND (5.00)	ND (2.00)
510308	CY12B-TB, (µg/L)	NA	ND (5.00)	ND (5.00)	ND (10.0)	2.1 J (5.00)	ND (2.00)
510308	CY12B-EB, (µg/L)	NA	ND (5.00)	ND (5.00)	ND (10.0)	1.5 J (5.00)	ND (2.00)
600317	CY12B-TB, (µg/L)	NA	4.6 J (5.00)	ND (5.00)	ND (5.00)	1.5 U	ND (1.00)
600317	CY12B-EB, (µg/L)	NA	ND (5.00)	ND (5.00)	ND (5.00)	1.6 U	ND (1.00)

<sup>a</sup>EPA November 1986.

<sup>b</sup>Analysis Request/Chain-of-Custody.

<sup>c</sup>Numbers in bold represent detected values.

B = Analyte detected in associated blank.

CY = Canyon.

EB = Equipment blank.

EPA = U.S. Environmental Protection Agency

ER = Environmental Restoration.

ID = Identification.

J ( ) = The reported value is greater than or equal to the detection limit but is less than the reporting limit, shown in parenthesis.

NA = Not applicable.

ND ( ) = Not detected above the reporting limit, shown in parenthesis.

S = Soil sample.

SD = Soil sample duplicate.

SP = Soil pile designation within SWMU 12B.

SWMU = Solid waste management unit.

TB = Trip blank.

U = Analytical result was qualified as not detected during data validation.

VOC = Volatile organic compound.

µg/kg = Microgram(s) per kilogram.

µg/L = Microgram(s) per liter.

Table 4.4.4-13  
 Summary of SWMU 12B Soil Pile Sampling,  
 SVOC Analytical Results, January 1998  
 (Off-site laboratory)

Sample Attributes			SVOCs (EPA 8270) <sup>a</sup> (µg/kg)
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Bis(2-ethylhexyl)phthalate
510308	CY12B-SP01-02-S	0	ND (167)
510308	CY12B-SP02-02-S	0	ND (167)
510308	CY12B-SP03-02-S	0	ND (167)
510308	CY12B-SP04-02-S	0	ND (167)
510308	CY12B-SP05-02-S	0	ND (167)
510308	CY12B-SP06-02-SD	0	ND (167)
510308	CY12B-SP06-02-S	0	ND (167)
510308	CY12B-SP07-02-S	0	ND (167)
510308	CY12B-SP08-02-S	0	ND (167)
510308	CY12B-SP09-02-S	0	ND (167)
510308	CY12B-SP10-02-S	0	ND (167)
510308	CY12B-SP11-02-S	0	ND (167)
510308	CY12B-SP12-02-S	0	ND (167)
510308	CY12B-SP13-02-S	0	<b>210</b> <sup>c</sup>
510308	CY12B-SP14-02-S	0	ND (167)
510308	CY12B-SP15-02-S	0	<b>1300</b>
Quality Assurance/Quality Control Sample (µg/L)			
510308	CY12B-EB	NA	ND (5)

<sup>a</sup>EPA November 1986.

<sup>b</sup>Analysis Request/Chain-of-Custody.

<sup>c</sup>Numbers in bold represent detected values.

- CY = Canyon.
- EB = Equipment blank.
- EPA = U.S. Environmental Protection Agency.
- ER = Environmental Restoration.
- ID = Identification.
- NA = Not applicable.
- ND ( ) = Not detected above the detection limit, shown in parenthesis.
- S = Soil sample.
- SD = Soil sample duplicate.
- SVOC = Semivolatile organic compound.
- SWMU = Solid waste management unit.
- µg/kg = Microgram(s) per kilogram.
- µg/L = Microgram(s) per liter.

Table 4.4.4-14  
Summary of SWMU 12B Soil Pile Sampling, Metals Analytical Results, August–September 1997  
(Off-site laboratory)

Sample Attributes			Metals (EPA 6010/7000) <sup>a</sup> (mg/kg)								
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
06885	CY12B-SP01-01-S	0–0.5	4.1	130 J	0.57	0.20 J (0.50)	12	12 J	ND (0.10) J	ND (0.30)	ND (0.099)
06885	CY12B-SP01-01-SD	0–0.5	4.2	150 J	0.61	0.19 J (0.50)	13	<b>46 J<sup>c</sup></b>	ND (0.10) J	ND (0.30)	ND (0.094)
06885	CY12B-SP02-01-S	0–0.5	4.2	170 J	0.64	0.23 J (0.49)	15	14 J	ND (0.10) J	ND (0.30)	ND (0.098)
06885	CY12B-SP03-01-S	0–0.5	4.8	140 J	0.60	0.33 J (0.50)	13	<b>22 J</b>	ND (0.10) J	ND (0.30)	ND (0.089)
06885	CY12B-SP04-01-S	0–0.5	3.9	130 J	0.54	0.22 J (0.50)	13	<b>34 J</b>	ND (0.095) J	ND (0.30)	ND (0.095)
06885	CY12B-SP05-01-S	0–0.5	4.2	170 J	0.60	0.33 J (0.49)	13	<b>21 J</b>	ND (0.10) J	ND (0.30)	ND (0.090)
06885	CY12B-SP06-01-S	0–0.5	3.5	120 J	0.51	0.21 J (0.50)	13	<b>26 J</b>	ND (0.10) J	ND (0.30)	ND (0.091)
06885	CY12B-SP07-01-S	0–0.5	3.6	140 J	0.51	0.23 J (0.50)	13	11 J	ND (0.10) J	ND (0.30)	ND (0.083)
06885	CY12B-SP08-01-S	0–0.5	3.4	120 J	0.47 J (0.50)	<b>0.82</b>	13	9.7 J	ND (0.10) J	ND (0.30)	ND (0.090)
06885	CY12B-SP09-01-S	0–0.5	3.9	130 J	0.53	0.28 J (0.49)	14	12 J	ND (0.10) J	ND (0.30)	ND (0.096)
06885	CY12B-SP10-01-S	0–0.5	3.8	170 J	0.55	0.24 J (0.49)	13	9.5 J	ND (0.10) J	ND (0.30)	ND (0.099)
06896	CY12B-SP11-01-S	0–0.5	4.3	170	0.60	0.31 J (0.54)	14	13	ND (0.11)	2.3 J (2.7)	ND (0.11)
06896	CY12B-SP11-01-SD	0–0.5	3.9	140	0.59	0.28 J (0.52)	14	11	ND (0.11)	ND (0.31)	ND (0.10)
06896	CY12B-SP12-01-S	0–0.5	4.6	150	0.59	0.30 J (0.56)	13	15	ND (0.11)	ND (0.34)	ND (0.11)
06896	CY12B-SP13-01-S	0–0.5	4.2	150	0.59	0.31 J (0.51)	13	<b>190 J</b>	ND (0.10)	ND (0.31)	ND (0.10)
06896	CY12B-SP14-01-S	0–0.5	3.9	<b>290</b>	0.68	0.23 J (0.53)	13	12	ND (0.11)	ND (0.32)	ND (0.11)
06896	CY12B-SP15-01-S	0–0.5	3.9	160	0.60	0.25 J (0.51)	13	11	ND (0.10)	ND (0.31)	ND (0.10)
Quality Assurance/Quality Control Sample (mg/L)											
06885	CY12B-EB	NA	ND	ND (0.0010)	ND (0.0010)	ND (0.0010)	ND (0.0010)	0.0036	ND (0.00020)	ND (0.0030)	ND (0.0010)
Background Soil Concentrations, Canyon Area <sup>d</sup>			9.8	246	0.75	0.64	18.8	18.9	0.055	3.0	<0.5

<sup>a</sup>EPA November 1986.

<sup>b</sup>Analysis Request/Chain-of-Custody.

<sup>c</sup>Values in bold exceed background soil concentrations.

<sup>d</sup>From Zamorski December 1997.

CY = Canyon.

EB = Equipment blank.

EPA = U.S. Environmental Protection Agency.

ER = Environmental Restoration.

ID = Identification.

J = Analytical result was qualified as an estimation during data validation.

J ( ) = The reported value is greater than or equal to the method detection limit (MDL) but is less than the reporting detection limit, shown in parenthesis.

mg/kg = Milligram(s) per kilogram.

mg/L = Milligram(s) per liter.

NA = Not applicable.

ND ( ) = Not detected above the MDL, shown in parenthesis.

S = Soil sample.

SD = Soil sample duplicate.

SP = Soil pile designation within SWMU 12B.

SWMU = Solid waste management unit.

- Mercury was not detected in any samples. However, the MDLs for all the samples that were analyzed were above the approved background level (0.055 mg/kg) for mercury.
- Selenium was detected in one sample at 2.3 J mg/kg. All remaining samples yielded no detections. All sample results were below the approved background level.
- Silver was not detected in any samples.
- Except for 2,4-dinitrotoluene (at 0.72 µg/kg in one sample) and 2,6-dinitrotoluene (at 0.84 µg/kg in another sample), HE were not detected in any samples. Table 4.4.4-15 summarizes the HE data and relevant MDLs.
- Table 4.4.4-16 summarizes the gamma spectroscopy analytical results for four isotopes (uranium-238, thorium-232, uranium-235, and cesium-137). Four samples were detected above the approved background levels for uranium-238 (at levels ranging from  $2.45 \pm 0.871$  to  $57.9 \pm 13.8$  pCi/g) and three samples for uranium-235 (at levels ranging from  $0.195 \pm 0.169$  to  $1.07 \pm 0.274$  pCi/g). The remaining two isotopes were below background values. Annex 4-E provides a complete set of the gamma spectroscopy data.
- Tables 4.4.4-17 and 4.4.4-18 provide Block 88 radionuclide data. The Block 88 data are presented for review only. These data were not included in the risk assessment (see Section 4.4.4.2).

#### Quality Assurance/Quality Control

Tables 4.4.4-10, 4.4.4-12, 4.4.4-13, 4.4.4-14, 4.4.4-15, and 4.4.4-16 present the results of the QA/QC samples collected during the soil pile sampling. These samples consisted of two field duplicate, three equipment blank, and three trip blank samples. VOCs, SVOCs, and RCRA metals and beryllium were not detected in the field duplicate samples, nor were they detected in the equipment blank samples. Table 4.4.4-10 presents the relative percent differences for the two field duplicate samples. HE were also not detected in the equipment blank samples, and VOCs were not detected in the trip blank sample.

#### Data Validation

Data were validated for all the chemical analyses of all samples that were collected from the soil piles. Annex 4-F provides letter summary reports (AR/COC #06885, #06896, #510308, and #600317).

## **4.5 Site Conceptual Model**

### **4.5.1 Nature and Extent of Contamination**

The contamination consisted of the buried debris (including cable, scrap metal, lead, batteries, asbestos transite, and concrete blocks) and soil in the arroyo. In addition, some of the soil in the arroyo was potentially contaminated with fuel and radioactive constituents. Drums of TCE or other

Table 4.4.4-15  
Summary of SWMU 12B Soil Pile Sampling, HE Analytical Results, August–September 1997  
(Off-site laboratory)

Sample Attributes			Explosives (EPA 8330) <sup>a</sup> (µg/kg)						
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	2,4,6-Trinitrotoluene	2,4-Dinitrotoluene	2,6-Dinitrotoluene	2 Amino, 4,6-Dinitrotoluene	4 Amino, 2,6-Dinitrotoluene	HMX	Nitrobenzene
06885	CY12B-SP01-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP01-01-SD	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP02-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP03-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP04-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP05-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP06-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP07-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP08-01-S	0–0.5	ND (0.11)	0.72 <sup>c</sup>	0.84	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP09-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP10-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06896	CY12B-SP11-01-S	0–0.5	ND (0.11) J	ND (0.16) J	ND (0.19) J	ND (0.13) J	ND (0.055) J	ND (0.42) J	ND (0.15)
06896	CY12B-SP11-01-SD	0–0.5	ND (0.11) J	ND (0.16) J	ND (0.19) J	ND (0.13) J	ND (0.055) J	ND (0.42) J	ND (0.15)
06896	CY12B-SP12-01-S	0–0.5	ND (0.11) J	ND (0.16) J	ND (0.19) J	ND (0.13) J	ND (0.055) J	ND (0.42) J	ND (0.15)
06896	CY12B-SP13-01-S	0–0.5	ND (0.11) J	ND (0.16) J	ND (0.19) J	ND (0.13) J	ND (0.055) J	ND (0.42) J	ND (0.15)
06896	CY12B-SP14-01-S	0–0.5	ND (0.11) J	ND (0.16) J	ND (0.19) J	ND (0.13) J	ND (0.055) J	ND (0.42) J	ND (0.15)
06896	CY12B-SP15-01-S	0–0.5	ND (0.11) J	ND (0.16) J	ND (0.19) J	ND (0.13) J	ND (0.055) J	ND (0.42) J	ND (0.15)
Quality Assurance/Quality Control Sample (µg/L)									
06885	CY12B-EB	NA	ND (0.030)	0.37 (0.26)	0.36 (0.25)	ND (0.040)	ND (0.050)	ND (0.080)	ND (0.040)

Refer to footnotes at end of table.

Table 4.4.4-15 (Concluded)  
 Summary of SWMU 12B Soil Pile Sampling, HE Analytical Results, August–September 1997  
 (Off-site laboratory)

Sample Attributes			Explosives (EPA 8330) <sup>a</sup> (µg/kg)						
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	RDX	Tetryl	1,3-Dinitrobenzene	2-Nitrotoluene	3-Nitrotoluene	4-Nitrotoluene	1,3,5-Trinitrobenzene
06885	CY12B-SP01-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP01-01-	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP02-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP03-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP04-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP05-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP06-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP07-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP08-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP09-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP10-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06896	CY12B-SP11-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070) J
06896	CY12B-SP11-01-	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070) J
06896	CY12B-SP12-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070) J
06896	CY12B-SP13-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070) J
06896	CY12B-SP14-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070) J
06896	CY12B-SP15-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070) J
Quality Assurance/Quality Control Sample (µg/L)									
06885	CY12B-EB	NA	ND (0.20)	ND (0.040)	ND (0.030)	ND (0.030)	ND (0.020)	0.31 (0.25)	ND (0.040)

<sup>a</sup>EPA November 1986.

<sup>b</sup>Analysis Request/Chain-of-Custody.

<sup>c</sup>Numbers in bold represent detected values.

CY = Canyon.

EB = Equipment blank.

EPA = U.S. Environmental Protection Agency.

ER = Environmental Restoration.

HE = High explosive.

HMX = 1,3,5,7-tetranitro-1,3,5,7-tetrazacyclooctane.

ID = Identification.

J = Analytical result was qualified as an estimation during data validation.

NA = Not applicable.

ND ( ) = Not detected above the method detection limit, shown in parenthesis.

RDX = 1,3,5-trinitro-1,3,5-triazacyclohexane.

Tetryl = 2,4,6-trinitrophenylmethylnitramine.

S = Soil sample.

SD = Soil sample duplicate.

SP = Soil pile designation within SWMU 12B.

SWMU = Solid waste management unit.

µg/kg = Microgram(s) per kilogram.

µg/L = Microgram(s) per liter.

Table 4.4.4-16  
Summary of SWMU 12B Soil Pile Sampling, Gamma Spectroscopy Analytical Results, August–September 1997  
(Off-site laboratory)

Sample Attributes			Activity (pCi/g)							
Record Number <sup>a</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Uranium-238		Thorium-232		Uranium-235		Cesium-137	
			Result	Error <sup>c</sup>	Result	Error <sup>c</sup>	Result	Error <sup>c</sup>	Result	Error <sup>c</sup>
06895	CY12B-SP01-01-S	0–0.5	ND (1.51)	--	0.862	0.421	0.0849	0.108	0.141	0.0522
06895	CY12B-SP01-01-SD	0–0.5	1.47	1.18	0.727	0.376	0.158	0.156	0.112	0.0354
06895	CY12B-SP02-01-S	0–0.5	1.82	1.14	0.582	0.330	ND (0.207)	--	0.0874	0.0422
06895	CY12B-SP03-01-S	0–0.5	ND (1.48)	--	0.579	0.332	ND (0.197)	--	0.127	0.146
06895	CY12B-SP04-01-S	0–0.5	<b>2.74<sup>b</sup></b>	1.35	0.618	0.336	<b>0.243</b>	0.149	0.101	0.0349
06895	CY12B-SP05-01-S	0–0.5	ND (1.73)	--	0.558	0.310	0.0740	0.0852	0.0879	0.0430
06895	CY12B-SP06-01-S	0–0.5	1.78	1.28	0.463	0.329	ND (0.194)	--	0.0680	0.0268
06895	CY12B-SP07-01-S	0–0.5	1.10	0.931	0.505	0.292	0.0893	0.0900	0.0536	0.0221
06895	CY12B-SP08-01-S	0–0.5	ND (1.36)	--	0.491	0.980	ND (0.186)	--	0.0494	0.0351
06895	CY12B-SP09-01-S	0–0.5	1.05	0.978	0.502	0.312	ND (0.191)	--	0.0677	0.0267
06895	CY12B-SP10-01-S	0–0.5	1.99	1.18	0.647	0.341	ND (0.206)	--	0.0585	0.0702
06897	CY12B-SP11-01-S	0–0.5	<b>2.45</b>	0.871	0.569	0.287	<b>0.195</b>	0.169	0.0528	0.0257
06897	CY12B-SP11-01-SD	0–0.5	2.26	1.58	0.562	0.293	0.129	0.155	0.0676	0.0219
06897	CY12B-SP12-01-S	0–0.5	<b>57.9</b>	13.8	0.603	0.650	<b>1.07</b>	0.274	0.0761	0.0380
06897	CY12B-SP13-01-S	0–0.5	<b>3.67</b>	1.22	0.605	0.297	0.0764	0.0677	0.0854	0.0235
06897	CY12B-SP14-01-S	0–0.5	ND (1.77)	--	0.773	0.373	ND (0.195)	--	0.0426	0.0196
06897	CY12B-SP15-01-S	0–0.5	1.45	0.831	0.601	0.288	ND (0.181)	--	0.133	0.0308
Background Soil Activities, Upper Canyons <sup>d</sup>			2.31	NA	1.03	NA	0.16	NA	0.515	NA
Quality Assurance/Quality Control Sample (pCi/mL)										
06895	CY12B-EB	0–0.5	ND (0.796)	--	ND (0.154)	--	ND (0.130)	--	ND (0.0238)	--

<sup>a</sup>Analysis Request/Chain-of-Custody.

<sup>b</sup>Values in bold exceed background soil activities.

<sup>c</sup>Two standard deviations about the mean detected activity.

<sup>d</sup>From Dinwiddie September 1997.

CY = Canyon.

EB = Equipment blank.

ER = Environmental Restoration.

ID = Identification.

NA = Not applicable.

ND ( ) = Not detected above the minimum detectable activity, shown in parenthesis.

pCi/g = Picocurie(s) per gram.

pCi/mL = Picocurie(s) per milliliter.

S = Soil sample.

SD = Soil sample duplicate.

SP = Soil pile designation within SWMU 12B.

SWMU = Solid waste management unit.

-- = Error not calculated for nondetectable results.



Table 4.4.4-17  
 Summary of SWMU 12B Block 88 Gamma Spectroscopy Analytical Results, August 1997  
 (On-Site Laboratory)

Sample Attributes			Gamma Spectroscopy Activity (pCi/g)							
Record Number <sup>a</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Uranium-238		Thorium-232		Uranium-235		Cesium-137	
			Results	Error <sup>b</sup>	Results	Error <sup>b</sup>	Results	Error <sup>b</sup>	Results	Error <sup>b</sup>
06770	CY12B-B88-L00-04-S	0-4.0	<b>3.12E+03<sup>c</sup></b>	7.12E+02	ND (2.63E+00)	--	<b>6.20E+01</b>	9.33E+00	ND (3.18E-01)	--
Background Soil Activities—Upper Canyons <sup>d</sup>			2.31	NA	1.03	NA	0.16	NA	0.515	NA

<sup>a</sup>Values in bold exceed background soil activity.

<sup>b</sup>Two standard deviations above the mean detected activity.

<sup>c</sup>Analysis Request/Chain-of-Custody.

<sup>d</sup>From Dinwiddie September 1997.

- CY = Canyons.
- ER = Environmental Restoration.
- ID = Identification.
- NA = Not applicable.
- ND = Not detected above the minimum detectable activity, shown in parenthesis.
- pCi/g = Picocurie(s) per gram.
- S = Soil sample.
- SWMU = Solid waste management unit.
- = Error not calculated for nondetectable results.

Table 4.4.4-18  
Summary of SWMU 12B Block 88 Isotopic Uranium Analytical Results, August 1997  
(Off-site laboratory)

Sample Attributes			Activity (pCi/g) <sup>a</sup>					
Record Number <sup>b</sup>	ER Sample ID	Sample Depth (feet)	Uranium-233/234		Uranium-235		Uranium-238	
			Result	Error <sup>c</sup>	Result	Error <sup>c</sup>	Result	Error <sup>c</sup>
06780	CY12B-B88-L00-04-S	0-4.0	<b>54.8</b>	5.8	<b>5.9</b>	1.7	<b>390</b>	24
Background Soil Activities—Upper Canyons <sup>d</sup>			2.31	NA	0.16	NA	2.31	NA

<sup>a</sup>Values in bold exceed background soil activity.

<sup>b</sup>Analysis Request/Chain-of-Custody.

<sup>c</sup>Two standard deviations above the mean detected activity.

<sup>d</sup>From Dinwiddie September 1997.

CY = Canyon.

ER = Environmental Restoration.

ID = Identification.

NA = Not applicable.

pCi/g = Picocurie(s) per gram.

S = Soil sample.

SWMU = Solid waste management unit.

liquids were not found in the arroyo (refer to Section 4.4.1). The VCM activities removed the debris and soil that would have been the sources for any contamination. Analysis of the verification, geoprobe, and soil pile samples yielded detections of VOCs, SVOCs, RCRA metals, beryllium, HE, isotopic uranium, and gamma spectroscopy radionuclides; only some of the COCs were slightly elevated above approved SNL/NM maximum background concentrations and/or above levels of detection (Dinwiddie September 1997, Zamorski December 1997).

Of the verification and soil pile samples collected for analysis, two samples exceeded the SNL/NM maximum background limit for barium, eight samples exceeded the limit for lead, one sample exceeded the limit for cadmium, and six samples exceeded the limit for uranium-238 and/or uranium-235. Mercury levels were not detected, but the MDLs were above the background levels. Mercury is discussed in the risk assessment. In addition, two HE compounds were analyzed at levels above the detection limit. Of the verification, geoprobe, and soil pile samples collected, 14 VOC compounds were analyzed above the detection limit and one SVOC was detected over the limit. All potential COCs are retained in the conceptual model and evaluated in the human health and ecological risk assessments.

The extent of the contamination (i.e., debris and soil) in the arroyo was defined vertically and horizontally by excavating the buried debris to the bottom and sides of the original arroyo configuration. When the excavation was completed, nine trenches were dug to verify the success of the VCM. Based upon the VCM excavation, verification trenches, and verification soil samples, all potential contaminated sources have been removed from the site, and if any COCs remain they are below any risk-based remediation goals and pose no hazard to human health or the environment.

#### **4.5.2 Environmental Fate**

The main potential sources of COCs were the debris and soil buried in the arroyo and any associated residues from these materials. All the debris and soil were removed from the arroyo during the VCM activities. The primary release mechanism of COCs to the surface and subsurface soils had resulted from the loss of containment of the debris and soils.

Upon removal of the debris/soil, the secondary sources are residual COCs in the surface and subsurface soil, air, and surface water. The secondary release mechanisms are surface-water runoff, percolation through the vadose zone, dust emissions, and uptake by biota (Figure 4.5.2-1). The pathways to receptors are surface water, air, soil, and biota. Groundwater is not considered a viable migration pathway because depth of groundwater is approximately 230 feet bgs (based upon the water level in the Burn Site piezometer, approximately 500 feet southwest of the site). In addition, during drilling of the piezometer borehole, moist soil was observed in the first 5 feet of the alluvium. The remaining 52 feet (to bedrock) was dry. Annex 4-G provides a complete discussion of the fate and transport of COCs.

### **4.6 Site Assessments**

#### **4.6.1 Summary**

The site assessment concludes that SWMU 12B does not have significant potential to affect human health under a recreational land-use scenario. After consideration of the uncertainties associated with the available data and modeling assumptions, ecological risks associated with

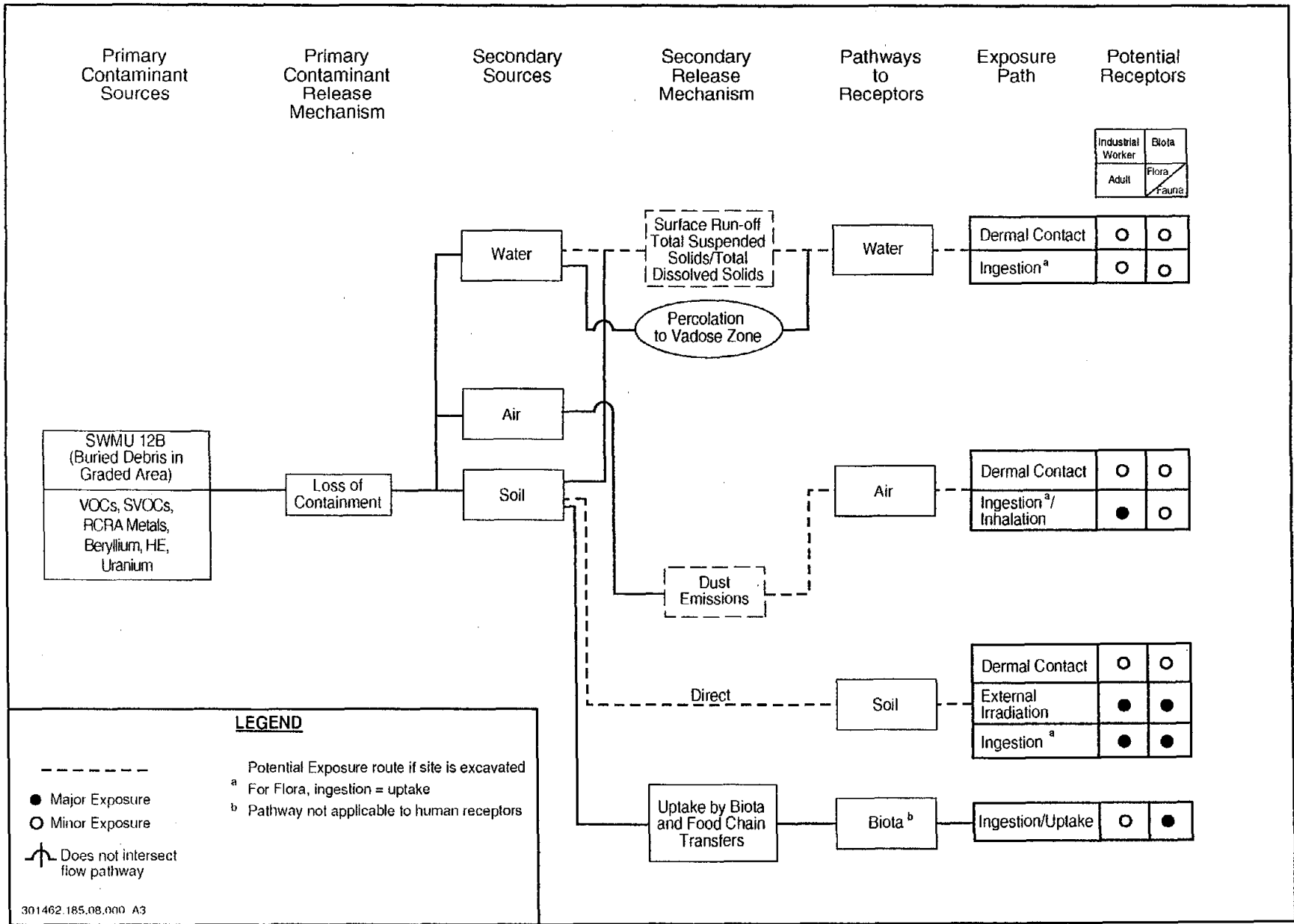


Figure 4.5.2-1

Conceptual Model Flow Diagram for SWMU 12B, Burial Site/Open Dump



SWMU 12B were found to be insignificant (or low). This section describes briefly and Annex 4-G contains details of the site assessments.

## 4.6.2 Screening Assessments

### 4.6.2.1 *Human Health*

SWMU 12B has been recommended for recreational land-use (DOE and USAF October 1995). Annex 4-G provides a complete discussion of the risk assessment process, results, and uncertainties. Because of the presence of COCs in concentrations or activities greater than background levels, it was necessary to perform a human health risk assessment analysis for this site. Besides COC metals, this assessment includes any VOCs, SVOCs, or HE detected above their reporting limits 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 both a recreational land-use and residential 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 12B 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 total excess cancer risk for SWMU 12B nonradiological COCs is  $2E-8$  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 total excess cancer risk for this site is below the suggested acceptable risk value ( $1E-6$ ). The incremental excess cancer risk for SWMU 12B is  $2.1E-8$ .

The incremental total effective dose equivalent for radionuclides for a recreational land-use setting is 0.19 millirem (mrem)/year (yr), which is well below the recommended dose limit of 15 mrem/yr found in EPA's OSWER Directive No. 9200.4-18 and reflected in a document entitled "Sandia National Laboratories/New Mexico Environmental Restoration Projects—RESRAD Input Parameter Assumptions and Justification" (SNL/NM February 1998). The incremental excess cancer risk for radionuclides is  $2.6E-6$  for a recreational land-use scenario, which is much less than risk values calculated from naturally occurring radiation and from intakes considered to be representative of background values.

The residential land-use scenarios for this site are provided only for comparison in the Risk Assessment Report (Annex 4-G). The report concludes that SWMU 12B does not have significant potential to affect human health under a recreational land-use scenario.

#### 4.6.2.2 *Ecological*

As set forth by the NMED Risk-Based Decision Tree (NMED March 1998), an ecological screening assessment that corresponds with the screening procedures in the EPA's Ecological Risk Assessment Guidance for Superfund (EPA 1997) was performed. This methodology requires a site conceptual model and a food web model be developed and that ecological receptors be identified. Each of these items is presented in the "Predictive Ecological Risk Assessment Methodology for the SNL/NM ER Program, SNL/NM (IT July 1998) and will not be duplicated in this document. The screening also includes the estimation of exposure and ecological risk.

Annex 4-G presents the results of the ecological risk assessment screening. The screening fails the chemical-specific hazard quotients exceeded unity. However, many of the assumptions associated with the screening assessment are based upon conservatism, and some are not technically justified. As an example, it is not scientifically defensible to assume minimum body weight and maximum ingestion rate. With the deer mouse, this would require using a body weight that corresponds to a juvenile and an ingestion rate that corresponds to a lactating female. In addition, an assumption that an animal only ingests soil is not based upon any known life history information. For modeling purposes, it reflects a one-to-one correspondence between soil and food item concentrations, which would negate the use of maximum bioaccumulation and biomagnification information from the literature. Furthermore, use of the lowest chronic no-observed-adverse-effect level for the most toxicologically sensitive species may not be relevant to the site-specific risk assessment. For these reasons, a more realistic predictive estimation of exposure and risk was conducted (Annex 4-G).

#### 4.6.3 Risk Assessments

##### 4.6.3.1 *Human Health*

Based upon the screening assessment summarized in Section 4.6.2.1, a baseline human health risk assessment is not required for SWMU 12B.

##### 4.6.3.2 *Ecological*

Based upon the screening assessment summarized in Section 4.6.2.2, a baseline ecological risk assessment is not required for SWMU 12B.

#### 4.6.4 Surface Water

Samples taken from surface-water runoff during storms at the Burn Site area characterize the water quality. Samples of runoff will be taken from two locations at the site at the ground surface in order to determine background data, and samples of runoff will be taken from one location bgs at the site for comparison purposes. The project is ongoing during the writing of this NFA. The data will be reported at a future date.

## **4.7 No Further Action Proposal**

### **4.7.1 Rationale**

Based upon the VCM actions, verification sampling data, and the human health and ecological risk assessment analyses, an NFA is being recommended for the following reasons:

- The potentially contaminated debris and soil were completely removed from the site, as indicated by the verification sampling and trenching.
- With few exceptions, the gamma spectroscopy results for radionuclides were within background levels.
- No significant VOC, SVOC, or HE concentrations were detected above reporting limits.
- With few exceptions (barium, cadmium, and lead), the RCRA metals and beryllium concentrations were either not detected and/or were below SNL/NM approved background levels.
- The risk assessment shows that no COCs were present in concentrations considered hazardous to human health or the environment for a recreational land-use scenario.

### **4.7.2 Criterion**

Based upon the evidence provide above, SWMU 12B is proposed for an NFA decision in conformance with Criterion 5 (NMED March 1998), which states that "the SWMU has been fully characterized and remediated in accordance with current and applicable state or federal regulations and that available data indicate that contaminants pose an acceptable level of risk under current and projected future land-use."

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**ANNEX 4-A**  
**Final Report Gamma Radiation Surveys (RUST Geotech)**



**Final Report, Surface Gamma Radiation Surveys  
for Sandia National Laboratories/New Mexico  
Environmental Restoration Project**

**Volume 1 of 4**

**December 1994**

***U.S. Department of Energy  
Grand Junction Projects Office***

*Approved for public release; distribution is unlimited.*

*Work Performed Under DOE Contract No. DE-AC04-86ID12584 for U.S. Department of Energy*





## **5.6.2 Burial Site and Open Dump, Oil Surface Impoundment, Lurance Canyon Explosive Test Site, and Lurance Canyon Burn Site (SWMUs 12, 13, 65, and 94)**

The radiological surveys at these ER sites, designated as SWMUs 12, 13, 65, and 94 consist of 103.6 acres of brush-, cactus-, and grass-covered flat and rolling areas adjacent to fairly steep canyon hills covered with pinyon and juniper trees. The hilly areas are underlain by metarhyolites and somewhat resemble talus slopes in areas. In the center of the survey boundary is a flat graded area where five large burn units and various office and shop facilities are located. Radiological and land surveys were conducted at SWMU 94 during November and December 1993 and January 1994.

SWMUs 12, 13, 65, and 94 are in ADS 1333. Because survey boundaries for these areas have not been defined, all anomalies were given a "94" designation.

### **5.6.2.1 Physical Survey**

Control station data provided by SNL/NM for two control points were used to establish the starting x, y, and z coordinates for the physical survey. Geotech established one additional control point for land survey control of the survey boundaries, gamma anomalies, and cultural features.

Figure 5.6.2-1 (Appendix I-4) shows the boundaries established for the radiological survey and control point descriptions, coordinates, elevations, and relevant site features.

### **5.6.2.2 Gamma Exposure-Rate Survey**

A gamma scan survey was performed at 6-foot centers over the exterior surface area of the graded portion of the area (approximately 16 acres); the remainder of the survey area had a gamma scan survey performed at 10-foot centers over the exterior surface area (approximately 88 acres), within the survey boundaries shown in Figure 5.6.2-1 (Appendix I-4). Areas excluded from the survey include the interiors of the permanent and mobile structures and inaccessible areas beneath moveable objects and stockpiled items.

The background gamma exposure rates range from 10 to 13  $\mu\text{R}/\text{h}$ . Areas of gamma activity that were 30 percent or greater than the natural background are shown in Figure 5.6.2-2 (Appendix I-4) and are summarized in Table 5-35. Anomalies with values near the upper range of background are associated with area sources in which the gamma radiation values varied.

**Table 5-35. Areas of Gamma Activity 30 Percent or Greater Than Natural Background at SWMUs 12, 13, 65, and 94**

<b>Anomaly Type</b>	<b>Total</b>	<b><math>\mu</math>R/h Range</b>	<b>Comments</b>
Soil Point Source	54	14-149	All soil point sources are an average survey area equivalent of a 1- to 2-foot-diameter circle for anomalous gamma activity
Soil Area Source	13	11-42	All of the area sources were located on the graded area or the west graded storage area; visible yellow schoepite (uranium oxide) was present on the surface of the soil at most locations
Fragment Point Source	13	22-664	Identified DU fragments range in size from 3/4 inch square to 6 by 3 inches; most were thin black metal; one fragment was purple

**5.6.2.3 Findings and Observations**

A detailed summary of the anomalies found within the survey boundaries of SWMU 94 is presented in Table 5-36. The area background values presented in this table are representative of the localized area in which the anomaly was detected. Anomaly locations and gamma exposure rates are shown in Figure 5.6.2-2 (Appendix I-4).

The majority of the anomalies located in SWMU 94 were soil point sources, which were identified throughout the survey area. Because of the nature of the response of the radiological survey instruments, the anomalous readings are probably the result of buried DU fragments. Visible yellow schoepite was present at most of the soil area source locations. These locations were situated exclusively on the graded area of the survey area. Identified area locations could be moved with additional grading operations or new locations could be uncovered as a result of grading. Numerous DU fragments were also identified, mainly in the outlying hilly areas, in all directions from the graded area. The fragments appeared to be thin black metal ranging in size from approximately 3/4 inch square to a single fragment 6 by 3 inches in size. No gamma anomalies were identified in the north arroyo drainage (SWMU 12).

**Table 5-36. Detailed Summary of Anomalies Found at  
SWMUs 12, 13, 65, and 94**

Anomaly					Area Background		Description/Comments
ID	Type Code*	Area (ft <sup>2</sup> )	cps	μR/h	cps	μR/h	
94E1	SA	1946.2	130-250	13-20	110	12	Concrete pit with wind screens; concrete open pit has elevated readings on concrete; Burn Pit No. 3
94E2	SP	7.1	1500	88	100	11	
94E3	SP	3.1	1200	72	90	11	
94E4	SP	3.1	200	17	90	11	
94E5	SA	3.1	110-200	12-17	100	11	Yellow discoloration on soil surface
94E6	SP	3.1	250	20	100	11	
94E7	SA	3.1	100-180	11-16	90	11	Yellow discoloration on soil surface
94E8	SA	7.1	110-1200	12-72	100	11	Yellow discoloration on soil surface
94E9	SA	362.1	120-325	13-24	110	12	
94E10	SA	12.6	100-700	11-44	90	11	
94E11	SP	0.8	450	31	90	11	
94E12	SP	3.1	800	50	100	11	
94E13	FP	28.3	12000	664	90	11	6- by 3- inch, thin black piece of metal
94E14	SP	3.1	170	15	120	13	Small, round, black material
94E15	SP	3.1	180	16	120	13	
94E16	SP	3.1	180	16	120	13	
94E17	FP	7.1	3000	171	110	12	2- inch fragment; thin black metal
94E18	SP	3.1	1000	61	100	11	
94E19	SP	3.1	1000	61	110	12	
94E20	SP	3.1	1500	88	120	13	
94E21	SP	3.1	450	31	100	11	
94E22	SP	3.1	900	55	90	11	Northwest graded area
94E23	FP	0.8	950	58	80	10	~ 3/4-inch-diameter fragment; thin black metal

Table 5-36 (continued). Detailed Summary of Anomalies Found at SWMUs 12, 13, 65, and 94

Anomaly					Area Background		Description/Comments
ID	Type Code*	Area (ft <sup>2</sup> )	cps	μR/h	cps	μR/h	
94E24	SP	3.1	1400	83	90	11	
94E25	FP	0.8	1200	72	90	11	
94E26	SP	3.1	600	39	80	10	
94E27	SP	3.1	180	16	90	11	
94E28	SP	3.1	700	44	90	11	
94E29	SP	3.1	200	17	100	11	
94E30	FP	3.1	1400	83	100	11	1- by 2-inch fragment; thin black metal
94E31	SP	3.1	300	22	90	11	
94E32	SP	3.1	400	28	90	11	
94E33	SP	7.1	140	14	90	11	
94E34	FP	3.1	900	55	100	11	~1-inch-diameter fragment; thin purple metal
94E35	SP	3.1	300	22	110	12	
94E36	FP	0.8	2250	129	70	10	~2- by 4-inch fragment; thin black metal
94E37	FP	0.8	750	47	90	11	~3/4-inch-diameter fragment; thin black metal; fragment is sticking out of the ground
94E38	FP	0.8	300	22	90	11	
94E39	FP	0.8	2500	143	100	11	~6- by 1-1/2-inch fragment; curled up thin dark metal
94E40	SP	0.8	350	25	90	11	
94E41	SP	0.8	300	22	100	1	
94E42	SP	0.8	400	28	100	11	
94E43	SP	7.1	500	33	100	11	94E43 through 94E48 are clustered in an area that has been pushed into a pile with a few of them in a flat adjacent area
94E44	SP	3.1	600	39			
94E45	SP	7.1	700	44			

**Table 5-36 (continued). Detailed Summary of Anomalies Found at  
SWMUs 12, 13, 65, and 94**

Anomaly					Area Background		Description/Comments
ID	Type Code <sup>a</sup>	Area (ft <sup>2</sup> )	cps	μR/h	cps	μR/h	
94E46	SP	7.1	225	18	100	11	94E43 through 94E48 are clustered in an area that has been pushed into a pile with a few of them in a flat adjacent area
94E47	SP	0.8	150	14			
94E48	SP	0.8	150	14			
94E49	SA	7.1	110-650	12-42	100	11	
94E50	SP	3.1	900	55	110	12	
94E51	FP	0.8	2500	143	90	11	
94E52	FP	0.8	1700	99	110	12	
94E53	SP	0.8	1100	66	90	11	
94E54	FP	0.8	3000	171	110	12	1-inch-diameter
94E55	SP	0.8	350	25	80	10	
94E56	SA	3.1	110-170	12-15	100	11	Yellow discoloration on soil
94E57	SA	7.1	110-250	12-20	100	11	Yellow discoloration on soil
94E58	SP	3.1	200	17	100	11	
94E59	SP	3.1	300	22	100	11	
94E60	SP	3.1	225	18	100	11	
94E61	SP	3.1	160	15	100	11	
94E62	SP	3.1	300	22	100	11	
94E63	SP	3.1	160	15	100	11	
94E64	SP	3.1	900	55	100	11	
94E65	SP	7.1	300	22	100	11	
94E66	SP	7.1	250	20	90	11	
94E67	SA	21.9	110-550	12-36	90	11	
94E68	SA	16.0	130-170	13-15	110	12	
94E69	SA	19.2	110-400	12-28	110	12	
94E70	SP	3.1	170	15	100	11	

**Table 5-36 (continued). Detailed Summary of Anomalies Found at  
SWMUs 12, 13, 65, and 94**

Anomaly					Area Background		Description/Comments
ID	Type Code <sup>a</sup>	Area (ft <sup>2</sup> )	cps	μR/h	cps	μR/h	
94E71	SA	28.3	120-200	13-17	100	11	
94E72	SP	3.1	200	17	80	10	
94E73	SP	12.6	1200	72	100	11	
94E74	SP	3.1	650	42	90	11	
94E75	SP	7.1	2500	143	110	12	
94E76	SP	7.1	2600	149	90	11	
94E77	SP	7.1	325	24	100	11	
94E78	SP	3.1	450	31	100	11	
94E79	SP	7.1	1300	77	100	11	
94E80	SP	3.1	180	16	100	11	
94E81	OC	400.0	170-250	15-20	100	11	Fragile, yellowish rock/soil

<sup>a</sup> Type Codes: SA = Soil Area Source, SP = Soil Point Source, FP = Fragment Point Source, OC = Outcrop

### 5.6.3 Balloon Test Area (SWMU 63)

The radiological survey at this ER site, designated as SWMU 63, consisted of 19.8 acres of flat alluvial terrain covered with wild grasses and cacti. The majority of the survey area appears to have been graded at one time. The southwest portion of the area contains a fairly steep arroyo drainage running southeast through the survey area. This area contains large cacti and brush with scattered trees.

Radiological and land surveys were conducted over 8.9 acres at SWMU 63 during December 1993. In October 1994, an additional radiological survey was conducted over 10.9 acres located to the north, east and southeast of the area initially surveyed in December 1993.



**ANNEX 4-B**  
**Final Report Survey and Removal of Radioactive**  
**Surface Contamination at ER Sites (SNL/NM)**





# SANDIA REPORT

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## Final Report, Survey and Removal of Radioactive Surface Contamination at Environmental Restoration Sites Sandia National Laboratories/New Mexico Volume 1

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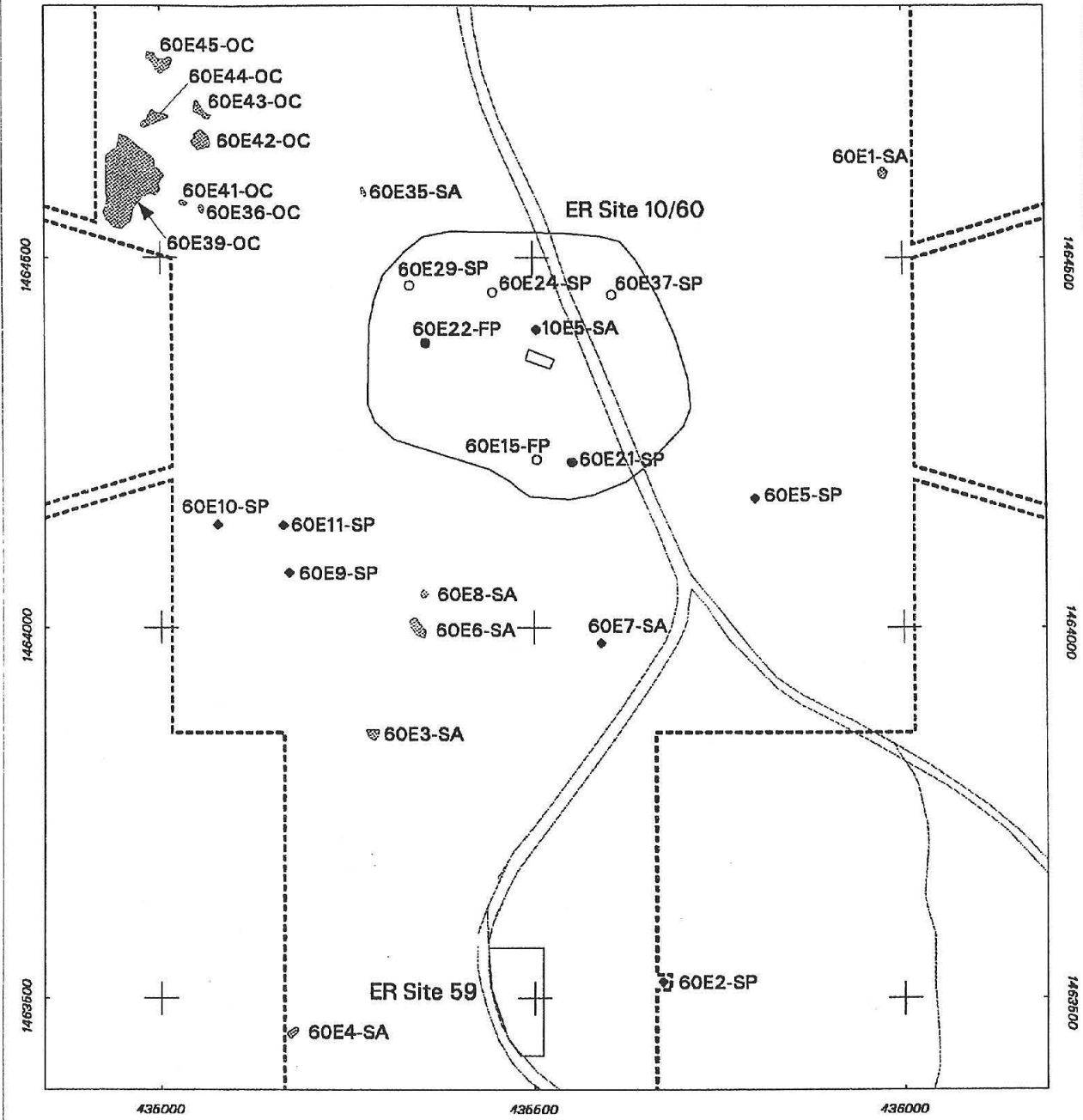
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### Legend

- |   |   |         |   |
|---|---|---------|---|
| ● | Point Source Gamma Radiation Anomaly, No cleanup Attempted (SP = Soil Point, FP = Fragment Point)               | —       | Road  |
| ◆ | Point Source Gamma Radiation Anomaly from Naturally Occurring Geologic Material (OC = Outcrop, SP = Soil Point) | - - - - | Rad Survey Boundary   |
| ○ | Point Source Gamma Radiation Anomaly Not Relocated  | □       | ER Sites 10, 60, & 59 Burial Mounds/Bunker Area   |
|   |   | ▨       | Area Source Gamma Radiation Anomaly from Naturally Occurring Geologic Material (SA = Soil Area, FA = Fragment Area) |

0 112.5 225  
Scale in Feet

0 27 54  
Scale in Meters

1:900  
1 in = 75'



Sandia National Laboratories, New Mexico  
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**Figure 5.6.3 Radiation Anomalies Remaining After Completion of the VCM at ER Sites 10, 60, & 59**

**Table 5.6.8 Summary of Point and Area Source Removal at ER Sites 10 and 60**

Anomaly Type	Total Identified	Total Removed	Comments
Point Sources	39	25	Four sources could not be relocated. Five sources are related to underlying, naturally-occurring geologic material. Five sources are associated with a telephone pole, metal debris pile, and bunker.
Area Sources	21	6	Fifteen sources are related to underlying, naturally-occurring geologic material.

No additional cleanup activities were performed during this VCM. The status of other possible COCs is not addressed in this report.

All waste was characterized as "Radioactive-Low Level Only" and managed in accordance with SNL/NM Department 7572 (Waste Management) procedures.

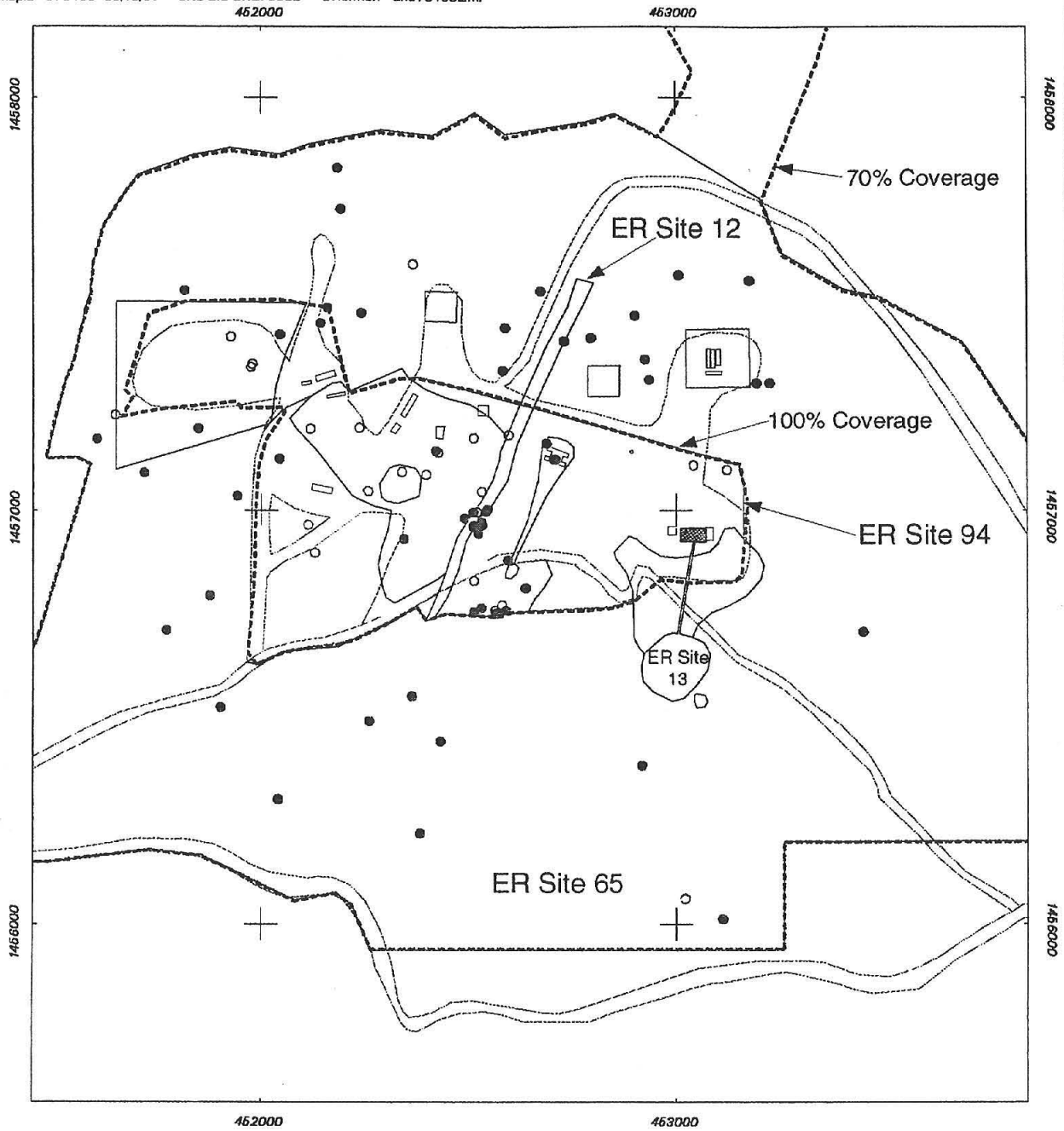
### **5.6.2. Burn Site Area (ER Sites 12, 13, 65 and 94)**

#### **Overview**

The Phase I survey at ER Sites 12, 13, 65, and 94 was conducted during November and December 1993 and January 1994. This survey covered a total of 103.6 acres of brush-, cactus-, and grass-covered, flat and rolling areas adjacent to fairly steep canyon hills covered with piñon and juniper trees. ER Site 94 was surveyed with ER Sites 12, 13, and 65 and, since survey boundaries for these areas had not been defined, all anomalies were given a "94E" designation. A gamma scan survey was performed at 6-foot centers (100 percent coverage) over the surface of the graded portion of the site (15.9 acres); the remainder of the survey area (87.7 acres) was surveyed at 10-foot centers (70 percent coverage). Sixty-seven point sources and thirteen area sources of gamma activity 30 percent or greater than the natural background were identified during this survey. At ER Site 13, only the exterior of the surface impoundment was surveyed; the interior was excluded. In June 1997, the surface impoundment interior was surveyed on 6-foot centers (100 percent coverage) by RPO, and no anomalies were identified. A detailed summary of the surface radiological survey and anomalies found at the site is presented in Section 5.6.2 of the Surface Gamma Radiation Surveys Final Report (Geotech 1994b).

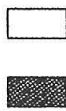
Figure 5.6.4 shows the site, surface radiological survey boundaries, and anomalies found during the Phase I survey.

VCM activities were conducted during March 1995 and May, June, and October 1996. Resurveying (scanning) was not performed at these sites. Point sources and small area sources were removed in March 1995. Larger area sources were remediated in May, June, and October 1996. Heavy equipment (backhoe) was used on one area source (94E63) since the lateral and vertical extent of elevated radiation exceeded the capabilities of manual cleanup procedures.



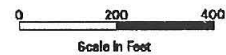
### Legend

- Point Source Gamma Radiation Anomaly (Elevated relative to site specific background)
- Road
- Building/Structure
- Rad Survey Boundary (100% Coverage)
- Rad Survey Boundary (70% Coverage)



ER Sites 12, 13, 65 & 94 Burn Site Area

Area Source Gamma Radiation Anomaly (Elevated relative to site specific background)  
(○ = Area Source < 400 sq. ft.)



1:4800

1 in = 400'



Sandia National Laboratories, New Mexico  
Environmental Geographic Information System

Figure 5.6.4 Phase I Survey Radiation Anomalies at ER Sites 12, 13, 65, & 94

Cleanup activities included radiation scanning to verify anomaly location, removal of fragment and/or soil until readings were less than 1.3 times site-specific background levels, and post-cleanup (verification) soil sampling for gamma spectroscopy analysis (see Section 3.1). Table 5.6.9 summarizes field activities during the VCM.

**Table 5.6.9 Summary of Field Activities at ER Sites 12, 13, 65, and 94  
Removal Action Procedures**

Actual Acreage Surveyed	Duration of Cleanup (days)	Verify Anomaly Location	Rad Removal <sup>a</sup>	Post-Cleanup Sampling	Heavy Equipment Support	Comments
103.60	14.00	X	X	X	X	Backhoe used on large area sources.

<sup>a</sup> Removal of fragment and/or soil until readings are less than 1.3 times site-specific background

## Findings and Observations

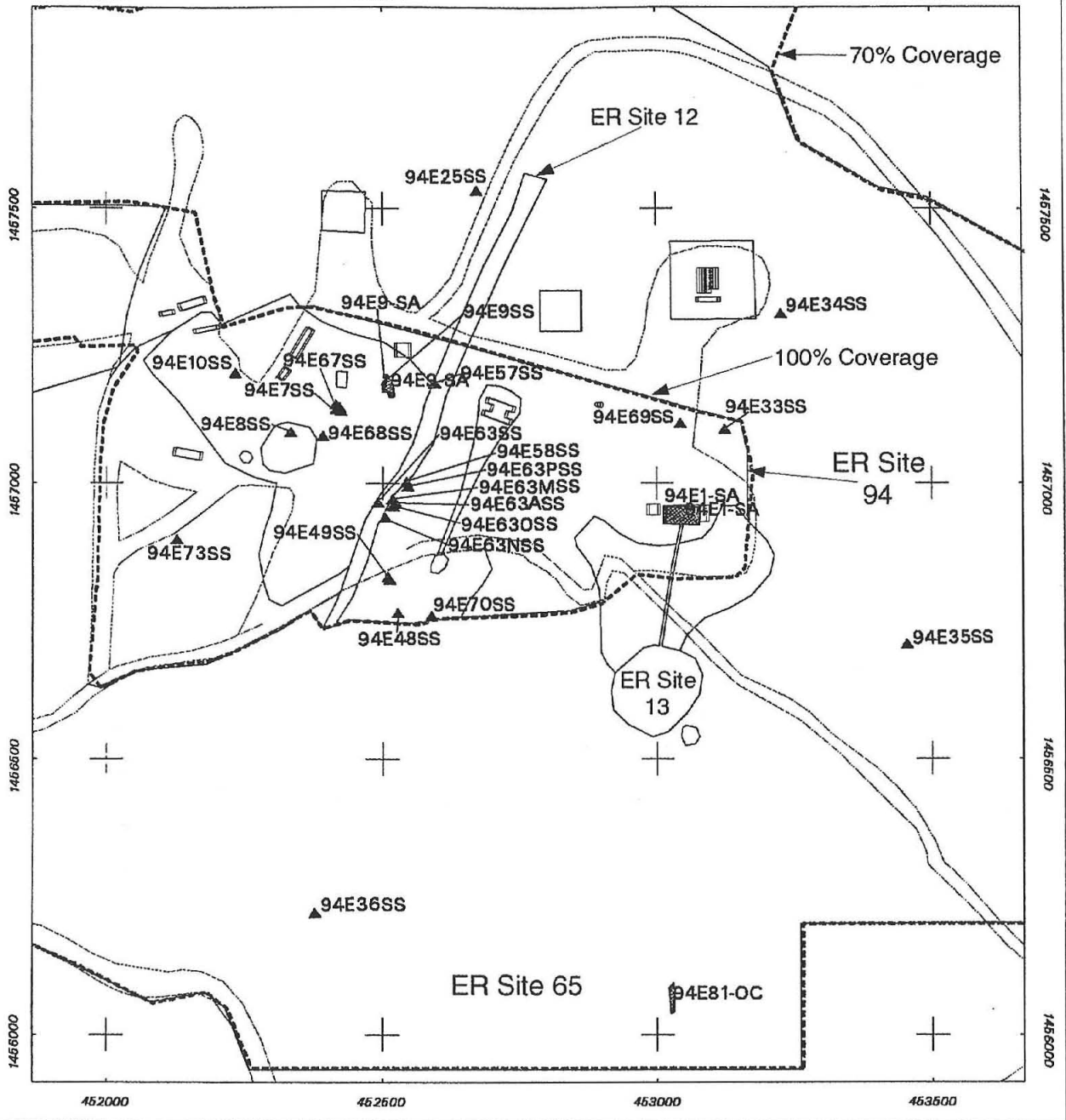
### Point and Area Source Status

During the initial cleanup, 52 point sources and 4 small area sources were remediated. Excavation of two closely-spaced sources (94E14 and 94E15) showed them to be linked to one large area source. This area source and nine other large area sources were remediated during subsequent cleanup activities. Cleanup was initiated on one area source (94E63) but was stopped since the lateral and vertical extent of elevated radiation exceeded the capabilities of manual cleanup procedures. Remediation on this area source was completed in October 1996 using a backhoe. Figure 5.6.5 shows VCM verification sampling locations (post-cleanup), and Figure 5.6.6 shows verification sampling locations (post-cleanup) for the graded portion of the site.

Two new sources were detected and remediated during the initial cleanup. The new sources were in the graded portion of the site. These gamma anomalies were at a depth beyond the detection capabilities of the gamma scintillometers during the initial survey and have become exposed over time by weathering events. Cleanup was completed on all sources and no additional point or area sources were identified during this VCM. However, the majority of ER Site 65 was surveyed at only 70 percent coverage, and additional anomalies may remain. New sources are summarized in Table 5.6.10.

**Table 5.6.10 Radiation Anomalies 30 Percent or Greater Than Natural Background Identified During the VCM at ER Sites 12, 13, 65, and 94**

Anomaly Type	Total	Comments
Point Sources	2	Two gray, black fragments with yellow uranium oxide (DU) in soil.



### Legend

- ▲ Post-cleanup (Verification) Soil Sample Location (SS = Soil Sample)
- Road
- Building/Structure
- - - Rad Survey Boundary (100% Coverage)
- - - Rad Survey Boundary (70% Coverage)

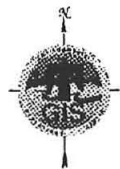
□ ER Sites 12, 13, 65 & 94 Burn Site Area

■ Area Source Gamma Radiation Anomaly (Elevated relative to site specific background)

0 150 300  
Scale In Feet

0 36 72  
Scale In Meters

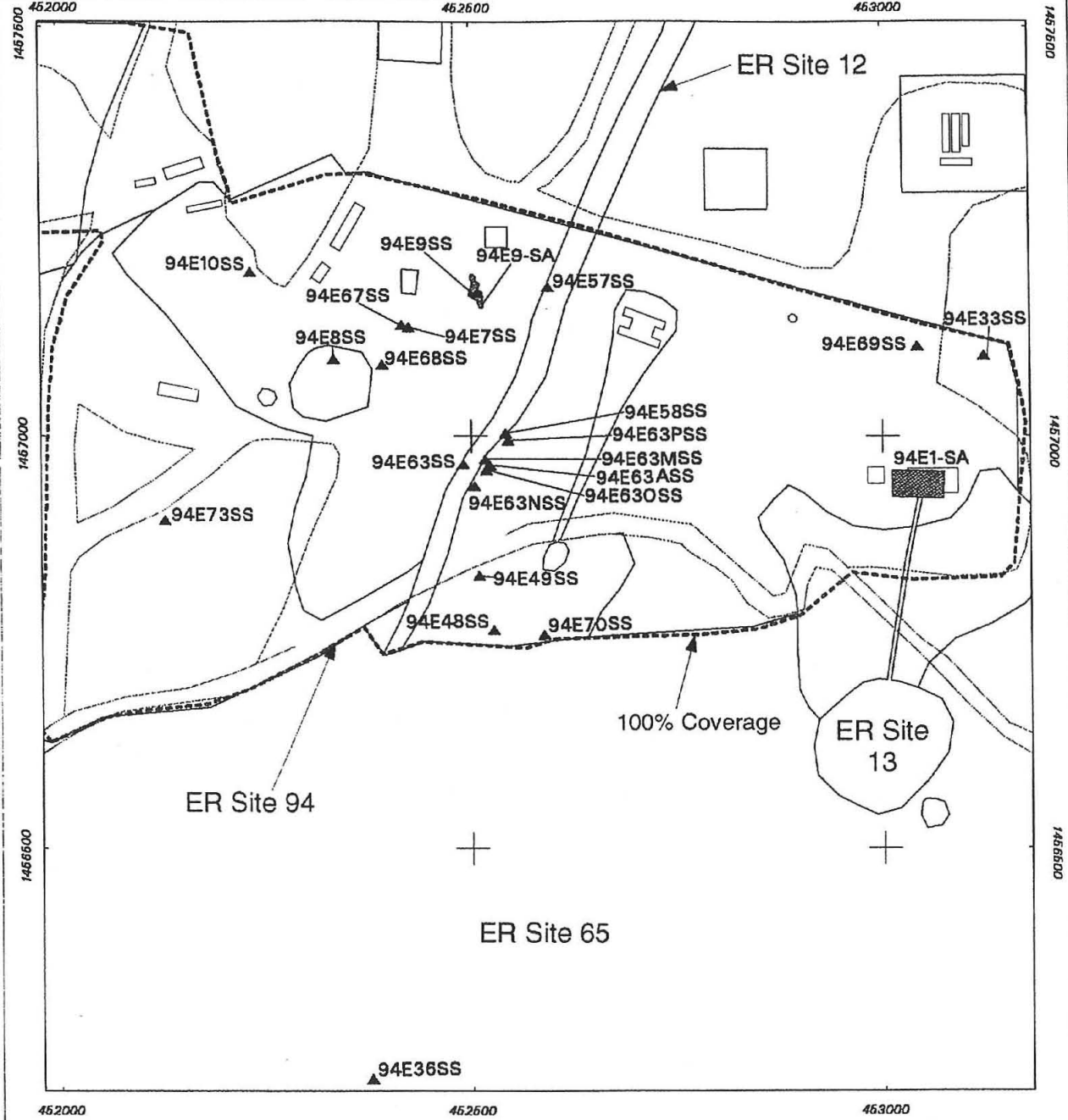
1:3600  
1 in = 300'



Sandia National Laboratories, New Mexico  
 Environmental Geographic Information System

Figure 5.6.5 VCM Surface Soil Sampling Locations at ER Sites 12, 13, 65, & 94





**Legend**

- ▲ Post-cleanup (Verification) Soil Sample Location (SS = Soil Sample)
- Road
- Building/Structure
- Rad Survey Boundary (100% Coverage)

□ ER Sites 12, 13, 65 & 94 Burn Site Area

■ Area Source Gamma Radiation Anomaly (Elevated relative to site specific background SA = Soil Area)

0 100 200  
Scale in Feet

0 24 48  
Scale in Meters

1:2400  
1 in=200'



Sandia National Laboratories, New Mexico  
Environmental Geographic Information System

**Figure 5.6.6 VCM Surface Soil Sampling Locations in the Graded Area at ER Sites 12, 13, 65, & 94**

## Post-Cleanup (Verification) Sample Results

After the removal of radiologically contaminated soils, 21 post-cleanup (verification) samples were collected from areas exhibiting the highest residual gamma radiation readings. Gamma spectroscopy analysis was performed on these samples to characterize the residual radioactivity remaining in the soil. The radiological COC was DU (U-238, U-235, and U-234). Table 5.6.11 summarizes the post-cleanup (verification) samples collected at the site, and the maximum level of residual radiological COCs in soils is presented in Table 5.6.12.

**Table 5.6.11 Post-Cleanup (Verification) Samples Collected at ER Sites 12, 13, 65, and 94**

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

<sup>a</sup> Sample duplicate

<sup>b</sup> Anomaly location sampled on two separate dates (see Appendix E for dates).

**Table 5.6.12 Maximum Residual Radionuclide Levels in ER Sites 12, 13, 65, and 94 Soils**

Radionuclide	Maximum Activity (pCi/g)	Background Activity (pCi/g)
U-238	35.8	2.3
U-235	0.55	0.16
U-234	4.5	2.3

## Risk Assessment Results

Further work is planned at these sites and, therefore, risk assessment has been postponed pending additional characterization and remediation. After future cleanup and characterization activities are complete, it is anticipated that the potential effects on human health due to exposure to radionuclides at the sites will be within proposed standards. This is based on preliminary review of site-specific input parameters and land-use scenarios for the risk assessment to be performed using the RESRAD code.

## Waste Management

The cleanup activities produced soil, metal fragment, and PPE wastes. All waste was containerized in either 30- or 55-gallon drums. A total of 202 waste drums were generated during cleanup activities: 198 soil drums, 1 metal fragment drum, and 3 PPE drums. Waste

consolidation was performed to minimize the number of drums produced for each waste stream. One metal fragment drum was consolidated, and one PPE drum was consolidated. Table 5.6.13 shows the number of waste drums after waste minimization/consolidation was performed, and Appendix J summarizes the waste minimization/consolidation effort.

**Table 5.6.13 Summary of Waste Drums for ER Sites 12, 13, 65, and 94 (Post Minimization/Consolidation Effort)**

Soil Waste		Metal Fragment Waste		PPE Waste		TCLP/ Gamma Spec Samples	Comments
30 Gallon Drums	55 Gallon Drums	30 Gallon Drums	55 Gallon Drums	30 Gallon Drums	55 Gallon Drums		
0	198	0	0	0	2	5 Soil 1 Frag	Waste Minimization/ Consolidation was performed. <sup>a</sup>

<sup>a</sup> See Appendix J

Five composite soil samples and one metal fragment sample were collected from the waste drums and analyzed for gamma emitters using standard laboratory gamma spectroscopy methods and for leachable RCRA metals using TCLP analytical procedures. Mercury was not identified as a COC and was not included in the TCLP analysis. All samples passed the TCLP tests, and all waste was characterized as “Radioactive-Low Level Only.” A summary of radiological activity for the waste is presented in Appendix G.

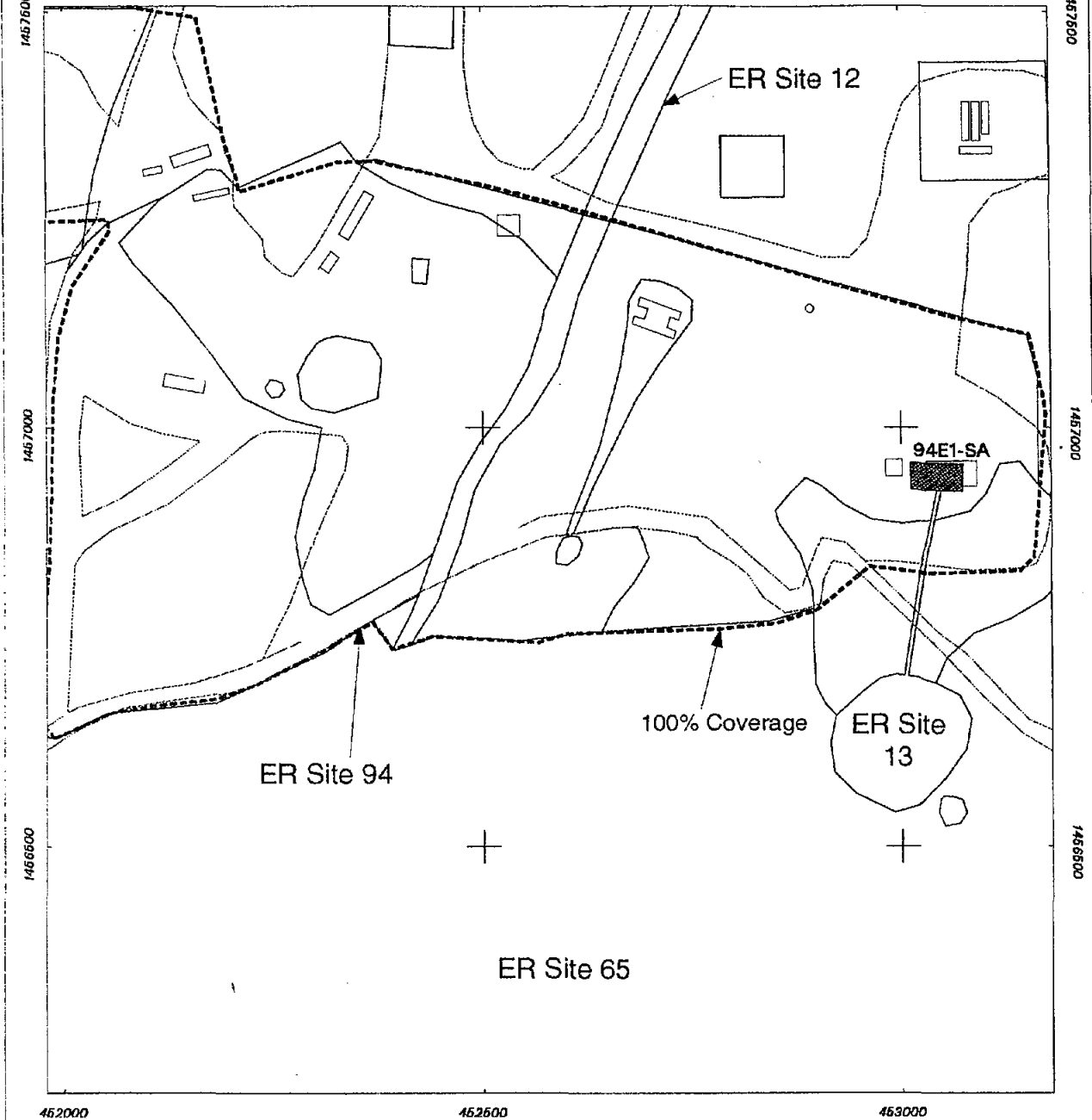
Disposal of regulated VCM waste was handled by SNL/NM Department 7577 (Waste Operations), which packaged and secured waste drums for transfer to Envirocare of Utah. Nonregulated waste was disposed of using standard SNL/NM-approved waste disposal methods.

## Conclusions

All identified point and area sources of gamma activity 30 percent or greater than the natural background were removed from the site with the exception of one area source associated with the large open burn pool. This source was not cleaned up because it is embedded within concrete at an active test structure. Further radiological characterization is planned for the graded portion and oil surface impoundment area at the site. A risk assessment will be conducted after all characterization and source removal is performed. No radiological anomalies were identified at ER Site 13.

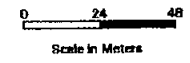
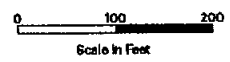
Source removal is summarized in Table 5.6.14, and sources remaining after completion of the VCM are shown in Figure 5.6.7.

No additional cleanup activities were performed during this VCM. The status of other possible COCs is not addressed in this report.



**Legend**

- Road
- Building/Structure
- Rad Survey Boundary (100% Coverage)
- ER Sites 12, 13, 65 & 94 Burn Site Area
- Area Source Gamma Radiation Anomaly, No Cleanup Attempted (SA = Soil Area)



1:2400

1 in = 200'



Sandia National Laboratories, New Mexico  
 Environmental Geographic Information System

**Figure 5.6.7 Radiation Anomalies Remaining After Completion of the VCM at ER Sites 12, 13, 65, & 94**

**Table 5.6.14 Summary of Point and Area Source Removal at ER Sites 12, 13, 65, and 94**

Anomaly Type	Total Identified	Total Removed	Comments
Point Sources	69	69	Cleanup complete and no further action is required.
Area Sources	13	12	One source is associated with concrete in the large open burn pool.

All waste was characterized as "Radioactive-Low Level Only" and managed in accordance with SNL/NM Department 7572 (Waste Management) procedures.

### 5.6.3. New Aerial Cable Site, Burial Site, Dump, Test Area (ER Site 81)

#### Overview

The Phase I survey at ER Site 81 was conducted during March 1994 and covered a total of 31.2 acres of uneven terrain nestled within a narrow valley. A gamma scan survey was performed at 6-foot centers (100 percent coverage) over the surface of the site. Four area sources of gamma activity 30 percent or greater than the natural background were identified during this survey. The elevated radiation at these area sources is suspected to be related to the underlying, naturally-occurring geological material. A detailed summary of the surface radiological survey and anomalies found at the site is presented in Section 5.6.5 of the Surface Gamma Radiation Surveys Final Report (Geotech 1994b).

Figure 5.6.8 shows the site, surface radiological survey boundaries, and anomalies found during the Phase I survey, and VCM pre-cleanup (confirmatory) sampling locations.

During July 1996, pre-cleanup (confirmatory) soil sampling for gamma spectroscopy analysis was conducted on the four area sources to assess the need for remediation. Table 5.6.15 summarizes field activities during the VCM.

**Table 5.6.15 Summary of Field Activities at ER Site 81**

Actual Acreage Surveyed	Duration of Cleanup (days)	Verify Anomaly Location	Pre-Cleanup Sampling (area sources)	Comments
31.20	< 0.25	X	X	Pre-cleanup sampling of natural outcrops.

<sup>a</sup> Removal of fragment and/or soil until readings are less than 1.3 times site-specific background

**ANNEX 4-D**  
**Vaportec Passive Soil gas Survey Results**  
**Sandia National Laboratories, New Mexico, ER Site 12B**



## **7.2 December 1996 Soil Organic Vapor Survey Report**



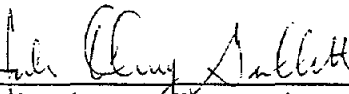


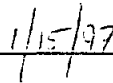


VAPORTEC PASSIVE SOIL GAS SURVEY RESULTS  
SNL ER SITE 12B  
SANDIA NATIONAL LABORATORIES  
ALBUQUERQUE, NEW MEXICO

PREPARED BY:

DATE:

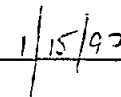
  
\_\_\_\_\_  
Julia Olney Gullett, Senior Geologist

  
\_\_\_\_\_  
1/15/97

APPROVED BY:

DATE:

  
\_\_\_\_\_  
James H. Viellenave, Director

  
\_\_\_\_\_  
1/15/97

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Fax: (303) 670-1792



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## 4.0 OBJECTIVES

The purposes of the soil gas survey were to:

1. Identify and report VOCs and SVOCs as detected in soil gas;
2. Map the distribution of the most prevalent compound occurrences to aid in defining potential source areas and the areal limits of potential compound occurrences; and
3. Provide data to aid in developing strategies for monitoring groundwater quality, and developing future investigative studies (as applicable).

## 5.0 SCOPE OF WORK

teg provided forty-two (42) VaporTec samplers for this investigation. Sampler installation and retrieval was performed by SNL Personnel. Samplers were returned from the field and submitted to teg's laboratory for analysis by EPA Methods 8021 and 8015 modified for soil gas. The analytical results were compiled onto compound distribution maps and this interpretive report.

## 6.0 FIELD ACTIVITIES

### 6.1 Sampler installation and Retrieval

Samplers were installed on December 4, 1996 and retrieved on December 16, 1996. Samplers were placed at 50 foot intervals on a regular grid (where applicable) throughout the area of investigation. All sample locations are shown on Plate 1, Appendix C.

Samplers were installed in a shallow hole in native soils according to the field methods specified and provided by teg. Samplers were retrieved, numbered and placed back into the separated boxes for shipment. The boreholes were abandoned.

### 6.2 Sampler Exposure Time

The soil gas samplers are retrieved following a time period that has allowed for the soil gas emanating from the subsurface environment of a survey area to equilibrate with the installed samplers. This time integration period is determined for each soil gas survey based on time calibration data or site conditions. Samplers reach equilibrium with soil gas during the exposure period so that there are minimal variances in response between samples. Samplers are retrieved in the same order in which they were installed to minimize any variations based upon sample exposure time.

Sample exposure time for this investigation was determined by the nature of the target compounds and site conditions, and was determined to be 12 days.

## 7.0 ANALYTICAL METHODS

VaporTec passive soil gas samplers are analyzed by EPA methods modified for soil gas by either Gas Chromatograph (GC) or Gas Chromatograph/Mass Spectrometer (GC/MS). Samplers for this investigation were analyzed for the presence/absence of Total Petroleum Hydrocarbons and Volatile Organics. To optimize these analyses, teg selected EPA methods 8015 and 8020 (modified) for analysis.

The sample is prepared by heating it to approximately 150°C for approximately 45 minutes. A three cc aliquot of sample is extracted using an air tight, lockable syringe and injected directly onto the column for analysis. The syringe is cleaned after every sample and again at the end of each day of analysis. Calibration allows the calculation of nanograms or micrograms of analyte. A summary of the methods QA/QC methods is shown below.

### Modified EPA Method 8015 for TPH (diesel) by GC

Instrument: Shimadzu GC-14 Gas Chromatograph  
Column: 30 meter Rtx-5, thick film, 0.53 mm megabore capillary  
Carrier flow: Helium at 12 mL/min  
Detectors: Flame Ionization Detector (FID)  
Column Oven: 75° C for 1 min, 75° C to 225° at 25°C/min; hold at 225°C for 1 min

### Modified EPA Method 8021 for Volatile Organics by GC

Instrument: Shimadzu GC-14 Gas Chromatograph  
Column: 30 meter Rtx-5, thick film, 0.53 mm megabore capillary  
Carrier flow: Helium at 12 mL/min  
Detectors: Photo Ionization Detector (PID)  
Column Oven: 75° C for 1 min, 75° C to 225° at 25°C/min; hold at 225°C for 1 min

Standard Preparation Neat (pure) Standard of diesel fuel is used by the laboratory to enable both identification and quantitation. Standards are prepared in reagent grade trichlorotrifluoroethane (Freon 113).

### Instrument Calibration

A calibration curve for each target component or mixture are prepared and analyzed during the run to afford maximum correlation.

teg uses 3 and 5 point calibrations across a range of concentrations expected to be encountered to open a run, and continuing calibrations during and after the run. Linearity of the opening calibration must meet or exceed  $R=0.99$  or a Relative Standard Deviation of less than 20%. Continuing calibrations must fall within a window of 15%. teg is careful to assure that the majority of results that are reported fall into the actual range of calibrations so that the data will be legally defensible. Blanks are used according to regulation.

## 8.0 METHOD QA/QC

### 8.1 Lot Control

Before shipment to the field, the samplers are heated in an evacuated container to remove and residual volatile organic materials that may have adhered to the charcoal during manufacturing. Approximately 1 of every 25 samplers is tested to assure that the batch is clean prior to use in the field.

### 8.2 Travel Blanks

Two samplers were provided as travel blanks. The travel blanks remained sealed and traveled with the survey samplers from the laboratory to the field and back to the laboratory. The travel blank samples were analyzed under the same instrument conditions as the survey collectors. The results of the travel blank analysis is provided on Table A1, Appendix A, and indicate that no compounds were detected on the travel blank samples.

### 8.3 Method Blanks

Method Blanks are analyzed at the start of each day and more as appropriate depending on the measured concentrations. Typically when values exceeding the quantitation limit of any targeted compound are encountered, additional blanks are analyzed. No values were detected in the method blanks.

### 8.4 Duplicates

Duplicate samples are analyzed when inconsistent data are observed or as requested by the client or regulatory agency. Because soil vapor duplicates can vary, teg's nominal RPD acceptance factor is +/- a factor of 2.

## 9.0 RESULTS

Analytical results are reported as nanograms (ng) of vapor ( $10^{-9}$  grams ) for every compound.

Trace levels of petroleum hydrocarbons were detected in soil gas. The petroleum hydrocarbons ethylbenzene and toluene were detected at or below the quantitation limits; xylene(s) were reported at or slightly above the quantitation limits. The values detected ranged from ND (not detected) to 2.9 ng, benzene and diesel range organics were not detected.

The chlorinated hydrocarbons detected include chlorobenzene, chloroform, 1,2 dichloroethane (1,2 DCA), 1,1 dichloroethene (1,1 DCE) cis-1,2 dichloroethene (cis-1,2 DCE) trans-1,2 dichloroethene (trans-1,2 DCE), and trichloroethene (TCE). The values detected ranged from ND (not detected) to 40 ng.



## 9.1 Presentation

The levels of soil gas response for all reported compounds are shown on Table A1, Appendix A. The distributions of Total Volatile Petroleum Hydrocarbons (TPH-V) and Total Chlorinated VOCs have been mapped and are shown as Plates 2 and 3, Appendix C. In order to report the compounds detected the mass of the compounds identified, reported as nanograms (ng), were plotted.

## 10.0 DISCUSSION

### 10.1 Use of Soil Gas Data

The passive soil gas data reflect volatile and semivolatile organics collected at a point in the near surface. The sources of these volatile organics may be in the stratigraphic column and/or in groundwater below the collection point. Thus, the organics can be derived from surface spills, deposition, or migration into the deeper vadose zone, and groundwater. The soil gas survey reveals the areal extent of contamination and is the optimum guide in identifying areas in order to develop a vertical profile, including the probing of soil borings and monitoring wells. Soil gas data are always semi-quantitative in that multiple sources in soil and/or groundwater cannot be readily differentiated without supporting soil and groundwater data. The higher soil gas responses are representative of higher concentrations in the subsurface, given that geologic conditions are relatively consistent.

### 10.2 Evaluation of Soil Gas Response

Generally soil gas response levels are described as high, elevated or low relative to the entire data set. In this investigation all response levels detected were low. Low levels are considered by teg as unlikely to be detected in subsurface soils and/or groundwater. The soil gas response levels detected more likely are related to vapor transport of the compounds detected. In teg's experience, levels below 10 ng for a single compound, and levels below 100 ngs for mixtures i.e. BTEX) do not typically represent detectable subsurface concentration levels under normal site conditions. Normal site conditions are considered to be sites in which soil matrices are somewhat uniform, the depth to groundwater is less than 100 feet below the surface, groundwater flow rates are undisturbed, and normal precipitation and temperatures occur during sampler exposure.

### 10.3 Map Evaluation

#### 10.3.1 The Distribution of Total Volatile Petroleum Hydrocarbons (TPH-V)

Only low levels of TPH-V were detected in soil gas. By mapping the compound occurrences, a potential migration pathway may have been identified in the north central portion of the site adjacent to the building and buried discharge line. Though the levels detected do not indicate the presence of detectable concentrations in subsurface soils, the migration of vapors in this area may illustrate a potential migration pathway. The distribution of TPH-V is shown on Plate 2, Appendix C.

### 10.3.2 The Distribution of Total Chlorinated VOCs

The distribution of Total Chlorinated VOCs as detected in soil gas is shown on Plate 2, Appendix C. Only three discrete sample locations indicated the presence of chlorinated compounds which may be at levels indicative of detectable concentrations in subsurface soils. These samples are located in the northern portion of the survey area, and at the Background South location. Soil gas conditions indicative of widespread subsurface contamination were not observed, however many spatially contiguous samples indicated the presence of low levels of chlorinated compounds. Due to the potential significance of these occurrences along the Site boundaries, levels not normally considered to be significant were contoured. The levels depicted by the lowest contour intervals are most likely related to a vapor plume rather than detectable levels in subsurface soils and/or groundwater, but may be indicative of subsurface conditions at an adjacent site.

## 11.0 CONCLUSIONS

Low levels of the petroleum hydrocarbons ethylbenzene, toluene and xylene(s) were detected in soil gas., benzene was not detected. Low levels of the chlorinated hydrocarbons chlorobenzene, chloroform, 1,2 DCA, 1,1 DCE, cis-1,2 DCE, trans-1,2 DCE, and TCE. The chlorinated compound occurrences detected at Site 12B appear to be discrete and do not indicate the presence of widespread subsurface contamination by these compounds.

The results of the soil gas investigation indicate that only limited, discrete occurrences of potential contaminants are present in the subsurface at ER Site 12B.

Because soil gas emanation rates are site and chemical specific, the environmental significance of the soil gas response values must be determined relative to compound concentrations in subsurface soil and/or groundwater. Changes in soil gas response in orders of magnitude may be used to plan future investigative studies, and to aid in characterizing the behavior (migration, attenuation) of the chemicals in the subsurface. Passive soil gas methods by their very nature collect a cumulative sample and are therefore extremely sensitive and often detect compounds in the low part per billion (ppb) range; therefore areas depicted as background by the VaporTec passive soil gas method generally do not represent environmentally significant contaminant levels in the subsurface.

030rjg/01.15.97



**APPENDIX A**  
**Tabulated Data**



**Table A1**  
**VaporTec Passive Soil Gas Results**  
**TEG Rocky Mountain**  
**Sandia National Laboratories - VaporTec Soil Vapor Survey**  
**Sandia National Laboratories - ER Site 12B**  
**Albuquerque, New Mexico 87085-5800**  
**Date: January 3, 1997**  
**TEG Project # 1196-030**

**Total Petroleum Hydrocarbons (EPA Method 8015 Modified)**  
**& Volatile Organic Analyses (EPA Method 8021 Modified) SOIL VAPOR - Passive Sampler**

Sample ID	Benzene	Carbon Tetrachloride	Chlorobenzene	Chloroform	1,1 Dichloroethane	1,2 Dichloroethane	1,1 Dichloroethene	cis 1,2 Dichloroethene	trans 1,2 Dichloroethene	Ethylbenzene	Freon 113	Methylene Chloride	1,1,1,2 Tetrachloroethane	1,1,2,2 Tetrachloroethane	Tetrachloroethene (PCE)	Toluene	1,1,1 Trichloroethane	1,1,2 Trichloroethane	Trichloroethene (TCE)	m-,p Xylene	o-Xylene	Total Petroleum Hydrocarbon
Syringe Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Background South	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	25.0	ND	ND	ND
Trip Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-1-25	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8	ND	ND	ND	ND	ND	ND
12BSGS-1-75	ND	ND	ND	9.2	ND	ND	ND	ND	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-1-105	ND	ND	ND	ND	ND	ND	ND	40.0	ND	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-2-10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.7	ND	ND	ND	2.3	ND	ND
12BSGS-2-40	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-2-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-2-125	ND	ND	6.6	ND	ND	ND	ND	ND	0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.6	ND
12BSGS-3-10	ND	ND	33.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.7	ND	ND	ND	ND	ND	ND

Sample ID	Benzene	Carbon Tetrachloride	Chlorobenzene	Chloroform	1,1 Dichloroethane	1,2 Dichloroethane	1,1 Dichloroethene	cis 1,2 Dichloroethene	trans 1,2 Dichloroethene	Ethylbenzene	Freon 113	Methylene Chloride	1,1,1,2 Tetrachloroethane	1,1,2,2 Tetrachloroethane	Tetrachloroethene (PCE)	Toluene	1,1,1 Trichloroethane	1,1,2 Trichloroethane	Trichloroethene (TCE)	m-,p Xylene	o-Xylene	Total Petroleum Hydrocarbon
12BSGS-3-40	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.9	ND	ND
12BSGS-3-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-3-125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Syringe Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-3-170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-4-25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	ND
12BSGS-4-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-4-125	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-5-25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-5-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-5-125	ND	ND	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-6-25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-6-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.6	ND	ND
12BSGS-6-125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-6-170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-6-220	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-7-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-7-125	ND	ND	ND	ND	ND	ND	0.9	ND	ND	ND	0.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-7-170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-8-25	ND	ND	ND	ND	ND	ND	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-8-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-8-125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

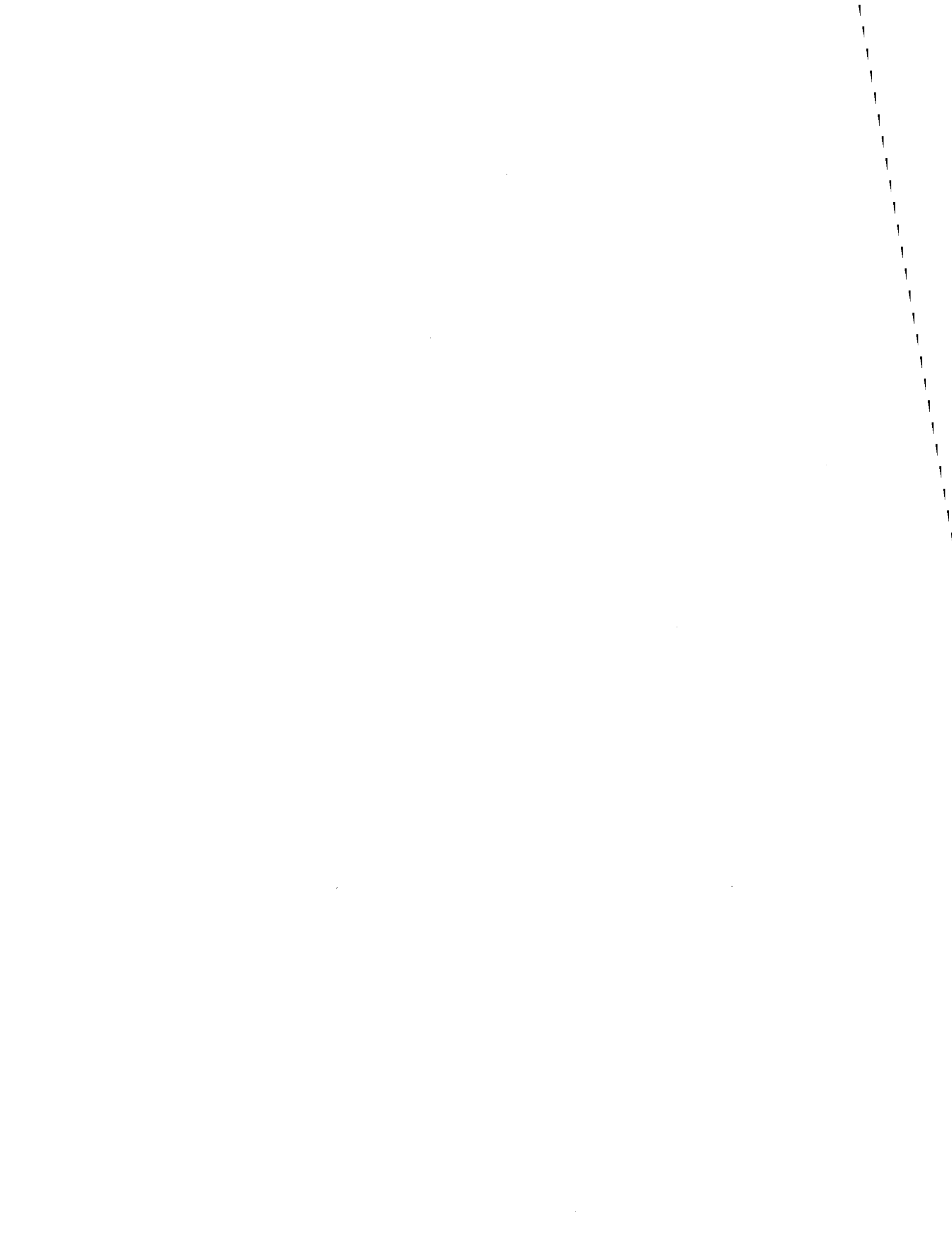
Sample ID	Benzene	Carbon Tetrachloride	Chlorobenzene	Chloroform	1,1 Dichloroethane	1,2 Dichloroethane	1,1 Dichloroethene	cis 1,2 Dichloroethene	trans 1,2 Dichloroethene	Ethylbenzene	Freon 113	Methylene Chloride	1,1,1,2 Tetrachloroethane	1,1,1,2,2 Tetrachloroethane	Tetrachloroethene (PCE)	Toluene	1,1,1 Trichloroethane	1,1,2 Trichloroethane	Trichloroethene (TCE)	m-,+p Xylene	o-Xylene	Total Petroleum Hydrocarbon
12BSGS-8-170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Syringe Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-9-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-9-125	ND	ND	ND	ND	ND	ND	ND	2.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-9-170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-9-220	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-10-75	ND	ND	3.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-10-125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-10-170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-11-75	ND	ND	ND	7.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-11-125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-11-170	ND	ND	ND	ND	ND	6.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Background North	ND	ND	3.2	2.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.7	ND	ND	ND	ND	ND
Trip Blank #2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Quantitation Limits	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	10.0
All results in ng/sampler ND indicates Not detected																						

Analyses performed in TEG's Mobile Laboratory

Analyses performed by: Micheal P. Charney

Data Reviewed by:





**APPENDIX B**  
**Chain of Custody Documents**



# ANALYSIS REQUEST AND CHAIN OF CUSTODY

Internal Lab  
Batch No. \_\_\_\_\_

Purchase Order  
**AR/COC- 06109**

SE 2001 ECH 06/99

Dept. No./Mail Stop: <b>6685 / 1148</b> Project/Task Manager: <b>Mike Mitchell / Lori Dawson</b> Project Name: <b>Site 12B UCM</b> Record Center Code: Logbook Ref No: <b># 105</b> Service Order No.: <b>NA</b>	Date Samples Shipped: <b>12/16/96</b> Carrier/Waybill No.: <b>Fed Ex</b> Lab Contact: <b>Julie Gullette</b> Lab Destination: <b>TEG in Denver, CO</b> SMO Contact/Phone: <b>Mike Mitchell 505 284-2575</b> Send Report to SMO	Contract No.: <b>AS-0367</b> Case No.: <b>8821 2d2BO</b> SMO Authorized: Bill to: <b>Santa National Laboratories</b> Supplier Services Department P.O. Box 5800 MS 0154 Albuquerque, NM 87185 0154	Parameter & Method Requested <b>VOCs 8021</b> <b>TPH/Fuel Fingerprint</b>
---	--	--	---

Location		Beginning Depth in Feet	ER Site No.	Date/Time Collected	Reference LOV (available at SMO)						Lab Samp ID
Tech Area <u>NA</u>					Sample Matrix	Container		Preser- vative	Sample Collection Method	Sample Type	
Building <u>NA</u>	Room <u>NA</u>					Type	Volume				
Sample No. - Fraction	ER Sample ID or Sample Location Detail										
	12B565-1-25	4	12B	12/16/96 0838	SG	Glass	40ml	NA	Grab	SA	X X
	-1-75			12/16/96 0846							
	-1-105			12/16/96 0853							
	-2-10			12/16/96 0916							
	-2-40			12/16/96 0904							
	-2-75			12/16/96 0902							
	-2-125			12/16/96 0858							
	-3-10			12/16/96 0917							
	-3-40			12/16/96 0915							
	-3-75			12/16/96 0924							

RMMA <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Ref. No. _____	<b>Sample Tracking</b> Date Entered (mm/dd/yy) _____ Entered by: _____	Special Instructions/QC Requirements	Abnormal Conditions on Receipt
---	--	--------------------------------------	--------------------------------------

Turnaround Time  Normal  Rush Required Report Date \_\_\_\_\_ QC Inits. \_\_\_\_\_

Sample Team Members	Name	Signature	Init	Company/Organization/Phone
	Mike Mitchell	<i>Mike Mitchell</i>	MM	BARE / 6685 / 284-2575
	Gilbert Quintana	<i>Gilbert Quintana</i>	GQ	IT / 6684 284-3308

1. Relinquished by <i>Michael Quintana</i> Org. <b>6684</b> Date <b>12-16-96</b> Time <b>1345</b>	4. Relinquished by	Org.	Date	Time
1. Received by <i>Michael Charney</i> Org. <b>TEG - Rony</b> Date <b>12/17/96</b> Time <b>1100</b>	4. Received by	Org.	Date	Time
2. Relinquished by	5. Relinquished by	Org.	Date	Time
2. Received by	5. Received by	Org.	Date	Time
3. Relinquished by	6. Relinquished by	Org.	Date	Time
3. Received by	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

# ANALYSIS REQUEST AND CHAIN OF CUSTODY

SF 2001 (XJ) (9/94)

AR/COC-1 06109

Project Name: <u>Site 12B VCM</u>		Project/Task Manager: <u>Mike Mitchell Lon Dawson</u>		Case No.: <u>NA</u>															
<b>Location</b>		Tech Area: <u>NA</u>		<b>Reference LOV (available at SMO)</b>															
Building: <u>NA</u> Room: <u>NA</u>		Beginning Depth in Feet: <u>  </u>						ER Site No.: <u>  </u>											
Sample No. - Fraction		ER Sample ID or Sample Location Detail		Date/Time Collected		Sample Matrix		Container		Preservative		Sample Collection Method		Sample Type		VOCs 8021 TPH/Fuel Fingerprint		Lab Sample ID	
		<u>12B565-3-125</u>		<u>12/16/96 0926</u>		<u>SG</u>		<u>G</u>		<u>40ml</u>		<u>NA</u>		<u>G</u>		<u>SA</u>		<u>X X</u>	
		<u>3-170</u>		<u>12/16/96 0928</u>															
		<u>4-25</u>		<u>12/16/96 0944</u>															
		<u>4-75</u>		<u>12/16/96 0942</u>															
		<u>4-125</u>		<u>12/16/96 0932</u>															
		<u>5-25</u>		<u>12/16/96 0946</u>															
		<u>5-75</u>		<u>12/16/96 0951</u>															
		<u>5-125</u>		<u>12/16/96 1009</u>															
		<u>6-25</u>		<u>12/16/96 1018</u>															
		<u>6-75</u>		<u>12/16/96 1016</u>															
		<u>6-125</u>		<u>12/16/96 1013</u>															
		<u>6-170</u>		<u>12/16/96 1011</u>															
		<u>6-220</u>		<u>12/16/96 1006</u>															
		<u>7-75</u>		<u>12/16/96 1021</u>															
		<u>7-125</u>		<u>12/16/96 1025</u>															
		<u>7-170</u>		<u>12/16/96 1026</u>															
		<u>8-25</u>		<u>12/16/96 1037</u>															
		<u>8-75</u>		<u>12/16/96 1034</u>															

Abnormal Conditions on Receipt

# ANALYSIS REQUEST AND CHAIN OF CUSTODY

SF 2001 CUD (9/94)

AR/COC- 06109

Parameter & Method Requested														
Location		Tech Area		Beginning Depth in Feet	ER Site No.	Date/Time Collected	Reference LOV (available at SMO)				VOCs 8021 TPH/Fuel Fingerprint		La San II	
Building	Room						Sample Matrix	Container Type	Volume	Preservative				Sample Collection Method
Sample No. - Fraction		ER Sample ID or Sample Location Detail												
		12B565-8-125		4	12B	12/16/96 1031	SG	G	40ml	NA	G	SA	X	X
		8-170				12/16/96 1030								
		9-75				12/16/96 1041								
		9-125				12/16/96 1044								
		9-170				12/16/96 1047								
		9-220				12/16/96 1049								
		10-75				12/16/96 1055								
		10-125				12/16/96 1102								
		10-170				12/16/96 1052								
		11-75				12/16/96 1130								
		11-125				12/16/96 1120								
		↓ 11-170				12/16/96 1110								
		12B565-BK6-North				12/16/96 1152								
		↓ South				12/16/96 1135								
		Trip Blank		Both			Air				Blank	TB		
		Trip Blank		with other samplers, transported to site during installation and removal, and kept in shipping box while other samplers in the ground.			Air				Blank	TB		
						12/16/96								

**Abnormal Conditions on Receipt**

Recipient Initials: TPP

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



**APPENDIX C**  
**Plates 1-3**

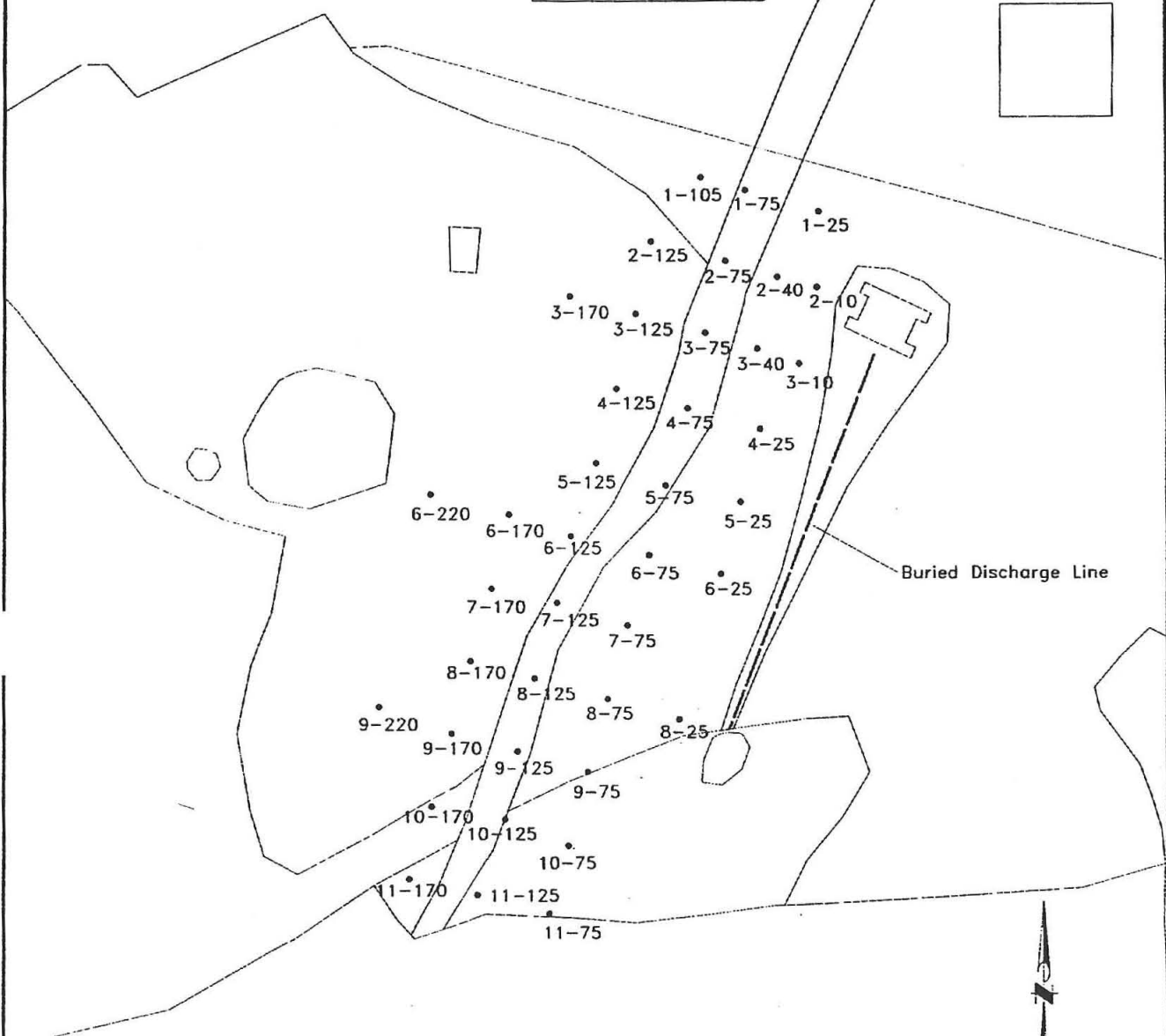


11

12

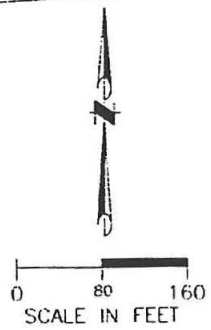
13

**INSET**  
 • Background North  
 Sample Location  
 not to Scale  
 Location approximately  
 320 feet north of  
 location shown



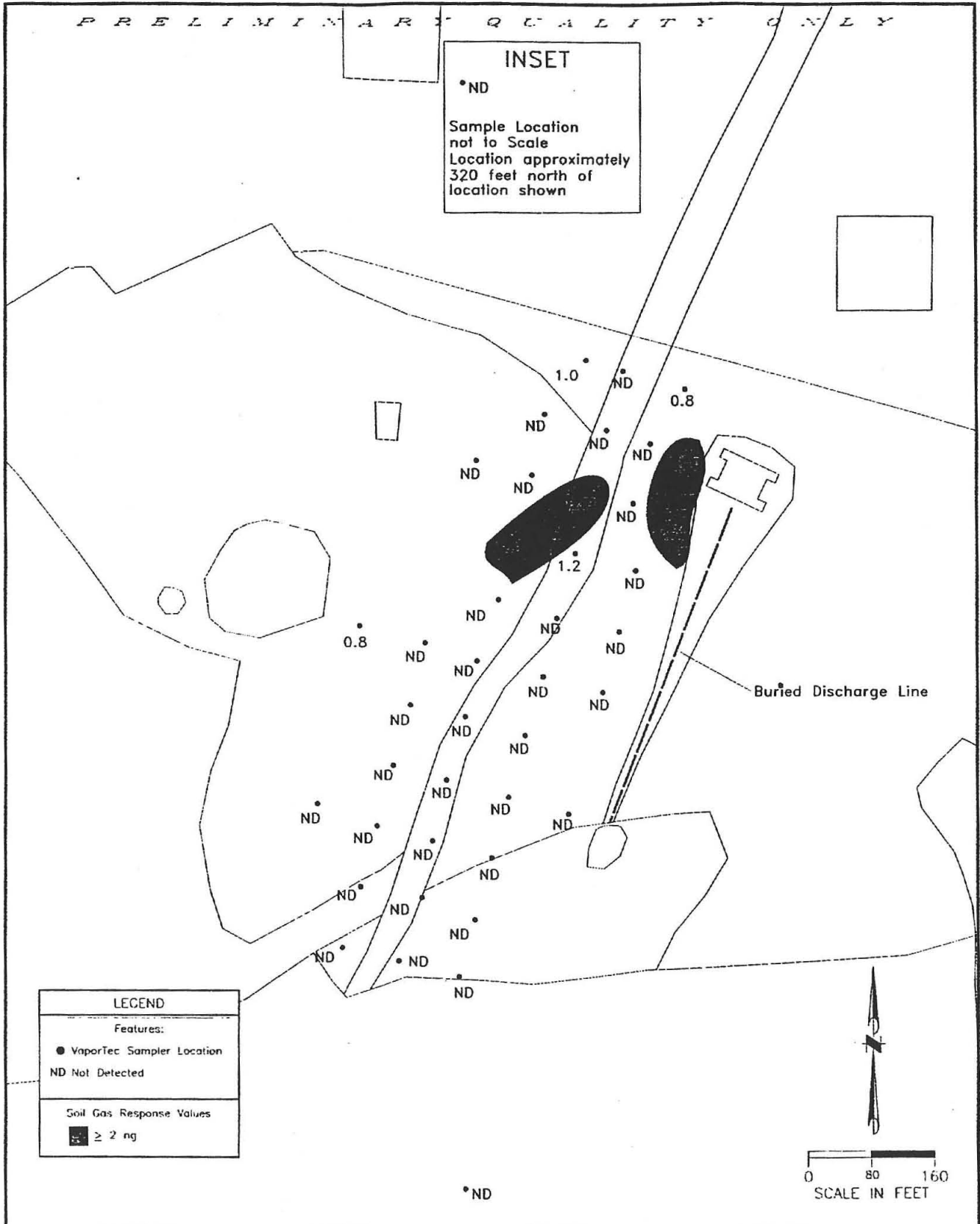
**LEGEND**  
 Features:  
 ● VaporTec Sampler Location  
 ⊕ Monitoring Well Location

• Background South



	Drawn By: JOG	Project #: 1196-030	Sandia National Laboratories
	Checked By: <i>JMS</i>	Date: 12/30/1996	ER Site 12B
	Project Mgr: JOG	File Name: 030-1.dwg	SNL, New Mexico
			Sampler Locations
			Plate 1

**INSET**  
 \*ND  
 Sample Location  
 not to Scale  
 Location approximately  
 320 feet north of  
 location shown



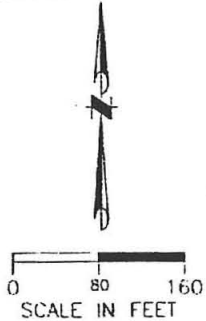
**LEGEND**

**Features:**

- VaporTec Sampler Location
- ND Not Detected

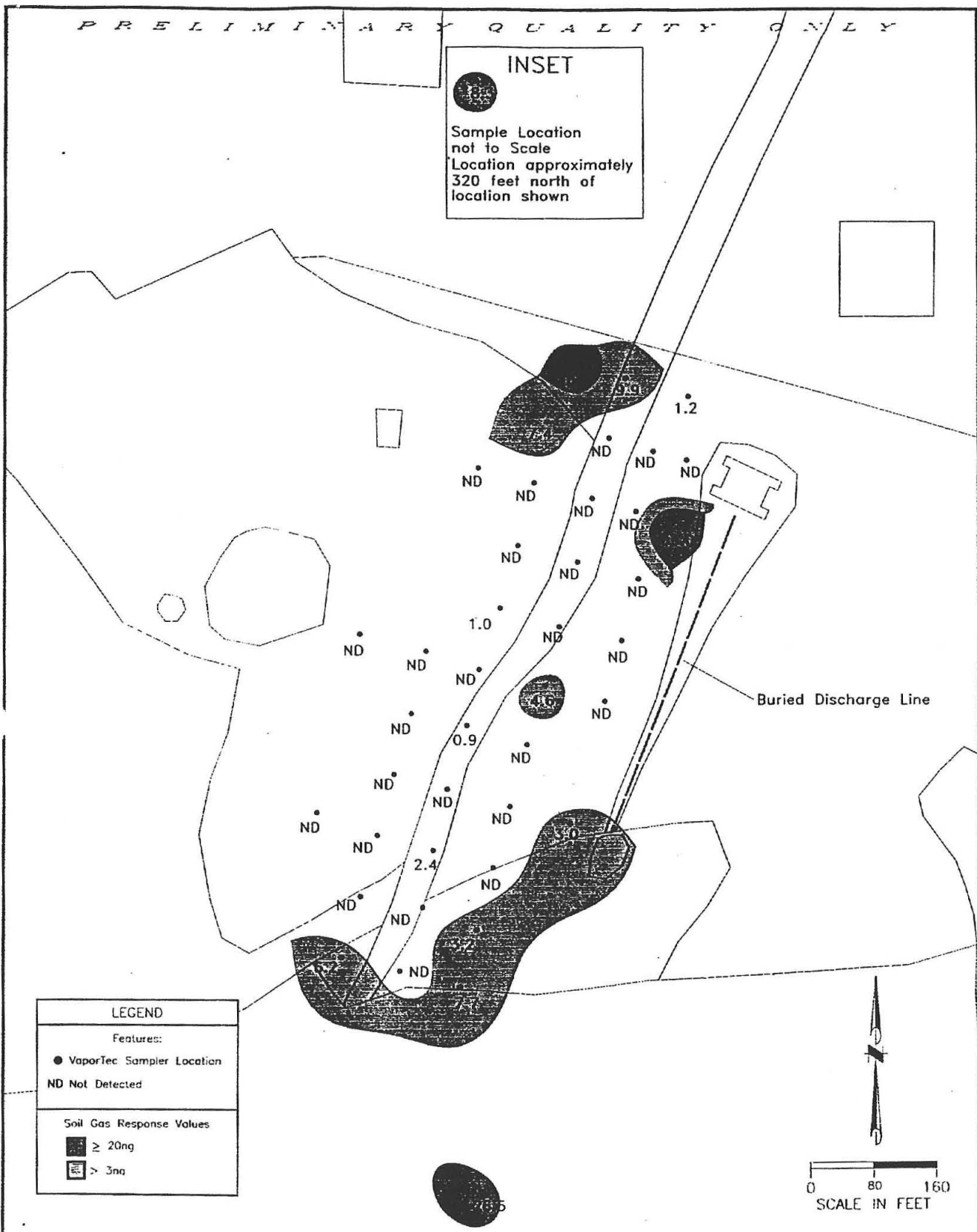
**Soil Gas Response Values**

- ≥ 2 ng

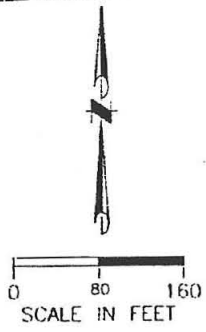


	Drawn By: JOG	Project #: 1196-030	Sandia National Laboratories	<b>SOIL GAS RESPONSE</b>
	Checked By:	Date: 12/30/1995	ER Site 12B	Total Volatile Petroleum Hydrocarbons (TPH-V)
	Project Mgr: JOG	File Name: 030-2.dwg	SNL, New Mexico	Plate 2

**INSET**  
 Sample Location  
 not to Scale  
 Location approximately  
 320 feet north of  
 location shown



LEGEND	
Features:	
●	VaporTec Sampler Location
ND	Not Detected
Soil Gas Response Values	
■	≥ 20ng
■	> 3ng



	Drawn By: JOC	Project #: 1196-030	Sandia National Laboratories	SOIL GAS RESPONSE
	Checked By: JOC	Date: 12/30/1996	ER Site 12B	Total Chlorinated VOCs
	Project Mgr: JOC	File Name: 030-3.dwg	SNL, New Mexico	Plate 3



**ANNEX 4-F**  
**Data Validation Summary Letter Reports**



**SAMPLE FINDINGS SUMMARY**

Site: ER Site 12-B

AR/COG: 600317

Data Classification:

Sample/ Fraction No.	Analysis	DV Qualifiers	Comments
SP04-04-S	75-09-2	U	Methylene Chloride 3.2 u
	75-35-4	UJ	1,1-DCE
	71-43-2	UJ	Benzene
	108-90-7	UJ	Chlorobenzene
	108-88-3	UJ	Toluene
	79-01-6	UJ	TCE
SP05-04-S	75-09-2	U	Methylene chloride 1.7u
	67-64-1	U	Acetone 2.9u
SP06-04-S	75-09-2	U	Methylene chloride 1.7u
SP08-04-S	75-09-2	U	Methylene chloride 2.3u
	67-64-1	U	Acetone 2.7u
SP09-04-S	75-09-2	U	Methylene chloride 1.5u
SP09-04-SD	75-09-2	U	Methylene chloride 2.2u
CY12B-TB	75-09-2	U	Methylene chloride 1.5u
CY12B-EB	75-09-2	U	Methylene chloride 1.6u
SP11-04-S	75-09-2	U	Methylene chloride 1.4u

**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: A Sealey

Date: 7-13-98







May 14, 1998

Project No. 301462.196.02.000

Sandia National Laboratories/New Mexico  
 Attn: Mr. Paul Freshour  
 Department 6133  
 P.O. Box 5800, M/S 1147  
 Albuquerque, New Mexico 87185-1147

Data Validation Results For Sample Locations at ER Site 12B, ARCOG 510308

Dear Mr. Freshour:

Data validation review of analysis results for soil sample locations at ER Site 12B (Burn Site), recorded on Analysis Request and Chain of Custody (ARCOG) 510308, was completed by IT Corporation (IT) on May 12, 1998. The samples of interest were collected on January 14, 1998. This letter and the attached forms transmit the results from that review. The samples included in this validation transmittal are identified as follows:

033260-001	CY12B-SP01-02-S	033260-002	CY12B-SP01-02-S
033261-001	CY12B-SP02-02-S	033261-002	CY12B-SP02-02-S
033262-001	CY12B-SP03-02-S	033262-002	CY12B-SP03-02-S
033263-001	CY12B-SP04-02-S	033263-002	CY12B-SP04-02-S
033264-001	CY12B-SP05-02-S	033264-002	CY12B-SP05-02-S
033265-001	CY12B-SP06-02-SD	033265-002	CY12B-SP06-02-SD
033266-001	CY12B-SP06-02-S	033266-002	CY12B-SP06-02-S
033267-001	CY12B-SP07-02-S	033267-002	CY12B-SP07-02-S
033269-001	CY12B-SP08-02-S	033269-002	CY12B-SP08-02-S
033270-001	CY12B-SP09-02-S	033270-002	CY12B-SP09-02-S
033271-001	CY12B-SP10-02-S	033271-002	CY12B-SP10-02-S
033272-001	CY12B-SP11-02-S	033272-002	CY12B-SP11-02-S
033273-001	CY12B-SP12-02-S	033273-002	CY12B-SP12-02-S
033275-001	CY12B-SP13-02-S	033275-002	CY12B-SP13-02-S
033276-001	CY12B-SP14-02-S	033276-002	CY12B-SP14-02-S
033277-001	CY12B-SP15-02-S	033277-002	CY12B-SP15-02-S
033278-003	CY12B-TB	033279-004	CY12B-EB
033280-005	CY12B-EB		

Volatile and semi-volatile organic compound analyses (VOC and SVOC) (EPA Methods 8260 and 8270) were requested on all samples from General Engineering Laboratories (GEL) in Charleston, South Carolina. Analytical results were reported by GEL in the document numbered 9801359.

Mr. Paul Freshour

2

May 14, 1998

Data review and validation are documented on *Data Verification/Validation Level 3 - DV3*, following the Sandia procedures, *Verification and Validation of Chemical and Radiochemical Data, TOP 94-03, rev.0, July 1994*.

Volatile Organic Compounds, Method 8260

Analysis results for samples 033266-001, 033267-001, 033269-001, 033270-001, 033271-001, 033272-001, 033273-001, 033275-001, 033276-001, and 033277-001 are rejected as unusable, qualified "R," because they were re-analyzed outside of holding time. The original analyses, which were performed within holding time, occurred following contamination of the instrument and were rejected by the laboratory because a blank sample failed quality control (QC) criteria.

Methylene chloride concentrations reported in samples 033260-001, 033261-001, 033262-001, and 033264-001 are qualified "U" undetected because of blank contamination. Similarly, concentrations of 1,1,1-trichloroethane, 1,1-dichloroethane, carbon tetrachloride, and methylene chloride reported in sample 033265-001 are qualified "U" undetected due to blank contamination.

Semi-Volatile Organic Compounds, Method 8270

The qualifier "P" is assigned to 4-Nitrophenol and pentachlorophenol in samples 033260-002, 033261-002, and 033262-002 because precision measurements of relative percent difference from the laboratory control sample duplicate exceeded laboratory-established control limits. Accuracy, measured as percent recovery, was acceptable in both laboratory control samples.

Thank you for the opportunity to be of service in this matter. Please contact me by telephone at 262-8920 with any questions.

Respectfully submitted,

IT CORPORATION



Mark Lyon  
Project Chemist

ML: ml  
Attachments

cc: P. Puissant, SNL 7578  
H. Fleck, IT Corp.  
Project File



May 13, 1998

Project No. 301462.196.02.000

Sandia National Laboratories/New Mexico  
 Attn: Mr. Paul Freshour  
 Department 6133  
 P.O. Box 5800, M/S 1147  
 Albuquerque, New Mexico 87185-1147

Data Validation Results For Sample Locations at ER Site 12B, ARCOG 510471

Dear Mr Freshour:

Data validation review of analysis results for soil sample locations at ER Site 12B (Burn Site), recorded on Analysis Request and Chain of Custody (ARCOG) 510471, was completed by IT Corporation (IT) on May 13, 1998. The samples of interest were collected on March 4, 1998. This letter and the attached forms transmit the results from that review. The samples included in this validation transmittal are identified as follows:

037327-001	CY12B-SP01-03-S	037328-001	CY12B-SP02-03-S
037329-001	CY12B-SP03-03-S	037330-001	CY12B-SP04-03-S
037331-001	CY12B-SP05-03-S	037332-001	CY12B-SP06-03-S
037333-001	CY12B-SP07-03-S	037334-001	CY12B-SP08-03-S
037335-001	CY12B-SP09-03-S	037336-001	CY12B-SP10-03-S
037337-001	CY12B-SP11-03-S	037338-001	CY12B-SP12-03-S
037339-001	CY12B-SP13-03-S	037340-001	CY12B-SP14-03-S
037341-001	CY12B-SP15-03-S	037342-001	CY12B-SP15-03-SD
037343-001	CY12B-TB	037344-001	CY12B-EB

Volatile organic compound analysis (VOC) following EPA Method 8260 was requested on all samples from General Engineering Laboratories (GEL) in Charleston, South Carolina. Analytical results were reported by GEL in the document numbered 9803167.

Data review and validation are documented on *Data Verification/Validation Level 3 - DV3*, following Sandia procedures, *Verification and Validation of Chemical and Radiochemical Data, TOP 94-03, rev. 0*, July 1994.

Volatile Organic Compounds, Method 8260

Analysis results for samples 037327-001, 037328-001, 037329-001, 037330-001, 037332-001, 037334-001, and 037335-001 are rejected as unusable, qualified "R," because one or more internal standards areas failed to meet quality control (QC) acceptance limits. Re-analysis results confirmed the original QC

Mr. Paul Freshour

2

May 13, 1998

failures. We suggest GEL be contacted with the request to provide a root-cause explanation for these repeated analysis failures.

Analysis results for samples 037331-001 and 037337-001 are qualified as unusable, "R." because the reported re-analyses occurred after the holding time had expired. The original analyses occurred within holding times, however internal standards areas or purge failures led the laboratory to perform re-analyses.

Other laboratory batch or sample specific QC measures, i.e., matrix spike and duplicate, laboratory control samples, and method blank sample results, which may have been reported with deficiencies and are only applicable to the sample analyses previously rejected, warrant no further discussion here.

The remaining sample analysis results are acceptable with minor qualifications. Methylene chloride and acetone results in samples 037333-001, 037336-001, 037338-001, 037339-001, 037340-001, 037341-001, and 037342-001 are qualified "U" for undetected because contamination by these compounds was observed in appropriate laboratory method blanks and the soil trip blank sample 037343-001. Other laboratory batch and sample specific quality control measures for these samples met all acceptance criteria.

Thank you for the opportunity to be of service in this matter. Please contact me by telephone at 262-8920 with any questions.

Respectfully submitted,

IT CORPORATION



Mark Lyon  
Project Chemist

ML: ml  
Attachments

cc: P. Puissant, SNL 7578  
H. Fleck, IT Corp.  
Project File



January 23, 1998

Project No. 301462.170.02.000

Sandia National Laboratories/New Mexico  
 Attn: Ms. Sharissa Young  
 Department 6133  
 P.O. Box 5800, M/S 1147  
 Albuquerque, New Mexico 87185-1147

Data Validation Results for Samples from ER Site 12B, ARCOG 06899

Dear Ms. Young:

Data validation review of analysis results for samples from ER Site 12B (Burn Site) recorded on Analysis Request and Chain of Custody (ARCOG) 06899 was completed by IT Corporation (IT) on January 22, 1998. The samples of interest were collected on September 8, 1997. This letter transmits results from that review except for the data validation results expedited for five selected soil samples and transmitted on November 25, 1997. The samples **NOT** included in this validation transmittal are identified as follows:

<u>Sample No. - Fractions</u>	<u>Sample Location Detail</u>
034062-001, -002	CY12B/210/80/01-US
034061-001, -002	CY12B/210/60/01-US
034063-001, -002	CY12B/190/80/01-US
034064-001, -002	CY12B/180/60/01-US
034065-001, -002	CY12B/170/80/01-US

Analytical results for volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), explosives residues, and Resource Conservation and Recovery Act (RCRA) list metals plus beryllium were reported by LAS Laboratories, Las Vegas, Nevada, in the document numbered L10490.

Data review and validation are documented in this letter and on *Data Verification/Validation Level 3 - DV3*, forms which are attached. Data validation followed Sandia procedures outlined in *Verification and Validation of Chemical and Radiochemical Data, TOP 94-03, rev.0*, July 1994.

General Review Comments

The analytical report reviewed was not a raw data package but a comprehensive summary report including analytical batch, instrument, and sample specific quality control data. The report had been taken apart and reassembled in binders by the project staff prior to this review.

Duplicate sample pairs identified on the ARCOG included 034154 / 034173, and 034172 / 034174. Data for the duplicate samples 034173 and 034174 did not appear in the analytical report. Consequently, this review was unable to evaluate overall sampling and analysis precision. Additionally, samples appearing in the report identified as 035001 and 035002 were not recorded on the ARCOG, but may have been the misidentified samples 034156-002 and 034157-002

#### Volatile Organic Compounds, Method 8260

Results for the following samples are qualified "R" meaning rejected and not usable because of continuing failure to meet internal standard area acceptance criteria, for one or more internal standards, in both the initial and re-analyses: 034057-001, 034059-001, and 034152-001.

Numerous samples appearing in the laboratory's exception reports are noted as failing internal standard area acceptance criteria for 1,4-dichlorobenzene-d4. However, after attempting to verify those occurrences in the quality control sections of the report it was discovered that some of the values reported as internal standard area failures were in fact within acceptance criteria. Apparently, these discrepancies are laboratory reporting errors.

Acetone concentrations are qualified with "U" meaning undetected in samples 034158-001, 034160-001, 034161-001, 034163-001, 034165-001, 034166-001, 034168-001, 034169-001, 034150-001, 034159-001, 034164-001, 034167-001, 034170-001, 034172-001, 034178-001, and 034179-001 because of acetone contamination in laboratory method blanks 53784MB (September 21, 1997) and 53787MB (September 22, 1997).

A discrepancy in the laboratory's volatile organics compounds exception report was noted relative to the laboratory method blank samples 53723MB and 54589MB analyzed on September 19, 1997. On the exception report, both method blanks are shown analyzed at identical times of 12:48 hours, however only 53723MB is shown on the run log and only 53723MB is reported in the quality control section of the report. The 53723MB shows no contamination and no samples ran this day were so flagged. To the contrary, the exception report notes that the 54589MB contained 5.4 acetone concentration and associated samples were flagged by the lab. But, if not for the exception report, there would be no indication of 54589MB in this report. Soil samples analyzed this day, September 19, 1997, show acetone contamination consistent with the analytical batches analyzed September 21 and 22, 1997 for which all acetone results were qualified "U" because of method blank contamination. Consequently, this review suspects a laboratory reporting error in the exception report for the September 19, 1997 samples and suggest that all samples analyzed that day be qualified "U" for acetone. These include 034065-001, 034148-001, 034151-001, 034153-001, 034154-001, and 034055-001.

Sample results are reported for two samples, 035001-001 and 035002-001, which are not recorded on ARCOG 06899. Additionally, the location detail attached to sample number 034158-001 on the volatile analysis report does not match sample location detail on the ARCOG. Sample 035002-001 has the correct

location detail for 034158-001 on the volatile analysis report, but sample 035002-001 is not even recorded on the ARCOG.

#### Semi-Volatile Organic Compounds. Method 8270

Forty soil samples and one aqueous equipment blank sample were analyzed for semi-volatile organic compounds. Quality control data available for review in the comprehensive summary report included surrogate recoveries, internal standard area and retention time reports, method blanks, laboratory control samples, matrix spike, and matrix spike duplicate. Instrument initial and continuing calibration response factor reports and summaries, analysis run log, sample analysis response factor reports and extracted ion profiles, and tentatively identified compound (TIC) library search reports were not included in the documentation and could not be verified. However, there were only two target compounds detected, one in each of two different soil samples, 034155-002 and 034176-005 (equipment blank). The QC data provided was sufficient to assign any results qualifications as discussed below. The data validation qualifiers assigned are based upon the analytical batch and sample specific QC results reported by the lab.

LAS laboratory failed to comply with requirements of their contract with Sandia. The laboratory failed to analyze duplicate laboratory control samples in the soil matrix. And, soil semi-volatile organic compound analysis results were reported on a dry-weight basis with percent moisture values.

Analysis results for two field duplicate samples, 034173-002 and 034174-002, were not reported and staff notation on the ARCOG indicated that the analyses were not performed. Samples 034156-002 and 034157-002 on the ARCOG were apparently mislabeled as 035001-002 and 035002-002 when submitted to the lab. Results are reported for the latter but not the former.

Sample analyses dates exceeded the 40-day extraction-to-analysis holding time in 14 soil samples. All target analyte results were non-detected and all associated batch QC was acceptable. Consequently, all target compound results for samples 034046-002, 034054-002 through 034065-002 consecutively, and 034148-002 are qualified "UJ" as undetected with the quantitation limit estimated.

A low internal standard area count for perylene-d12 was reported in both analysis and reanalysis of sample 034178-002. Consequently, the compounds benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, dibenz(a,j)acridine, dibenz(a,h)anthracene, di-n-octylphthalate, and indeno(1,2,3-cd)pyrene are qualified "UJ" as not detected with uncertainty concerning the actual quantitation limit.

Isolated occurrences of poor matrix spike duplicate precision (low RPD for two compounds in one MSD) and low surrogate recoveries (two of six surrogates recoveries in equipment blank sample 034176-005) are noted in the attached review forms. No results qualifications were made.

Tentatively identified compounds (TIC) reported as a result of the mass spectral library search showed concentrations of acetone, hydrocarbons, and other unidentified, but late eluting, compounds. All TIC



concentrations for acetone are qualified "U" for undetected because of similar acetone concentrations reported in all laboratory method blank samples. The source for acetone contamination in the samples likely originated in the laboratory.

Additional TICs reported as unknowns and unknown hydrocarbons may be indicative of petroleum-source contamination and a concern of the project staff. Re-sampling at the indicated locations and analysis for extractable total petroleum hydrocarbons may be recommended depending on project requirements.

#### Explosives Residues: Method 8330

Forty soil samples and one aqueous equipment blank sample were analyzed for explosives residue analysis. All explosives residues analysis results were reported as not detected. Information available for review included laboratory batch and sample specific quality control measures and continuing calibration check results. Based upon analytical QC batch measures the following qualifications to analytical results are made.

Analytical bias was generally low, but acceptable, in the laboratory control sample for LAS QC batch no. 53541, except for 2,4-dinitrotoluene, which failed percent recovery criteria at 64 percent. Because only one compound failed recovery criteria, the only samples qualified in this batch also failed surrogate recovery. Sample 034149-002 results is qualified "UJ" as undetected with detection limit uncertainty because the surrogate spike recovery at 41 percent failed acceptance criteria. Extraction or spiking problems are suspected.

The matrix spike on sample 034172-002 run for QC in laboratory batch no. 53664 failed low for all but two compounds. Surrogate recovery was also below acceptance criteria. The matrix spike duplicate showed acceptable percent recoveries, however this led to precision values, calculated as relative percent differences, failing acceptance criteria. The laboratory reran the associated project samples (outside of holding time) and confirmed the not detected analysis results. Even though the problem may have been isolated to poor spiking or extraction procedure in the matrix spike sample only, all sample analysis results in this lab QC batch are qualified "UJ" for undetected with uncertainty concerning the detection limit because of poor MSD precision. Affected samples are: 034172-002, 034178-002, and 034179-002.

LAS laboratory failed to perform up to requirements of their Sandia contract. Laboratory control duplicate samples were not analyzed in the soil matrix and soil results were reported on a dry weight basis that included percent moisture values. Samples identified as field duplicates on the ARCO were apparently not analyzed because no results were reported.

#### RCRA List Metals + Beryllium. Methods 6010 and 7471.

Soil samples were analyzed for ICP metals in two analytical batches. Barium results for 20 samples (inclusive of the five previously reviewed) in batch no. 53738 are qualified with "J" as estimated values, bias low, because of slightly low recovery, less than acceptance criteria of barium in the matrix spike and

matrix spike duplicate sample. These samples are 034046-002, 034054-002 consecutively through 034065-002, 034148-002, 034151-002 consecutively through 034155-002, and the misidentified sample 035001-002 (034156-002 ??). Relative percent difference precision measurement for silver in the laboratory control duplicate sample exceeded acceptance criteria of 20 RPD, however percent recoveries were 81 and 104 percent and consequently no qualifiers are assigned.

In analytical batch no. 53739 all sample results are qualified "J" (or "UJ" for any nondetects) for barium and beryllium, bias low, because of matrix spike and matrix spike duplicate recovery slightly less than 75 percent. Affected samples are; the mislabeled sample 035002-002 (034157-002 ?), 034149-002, 034150-002, 034158-002 consecutively through 034172-002, 034178-002, and 034179-002. Chromium and lead also recovered less than 75 percent in the matrix spike duplicate sample but are not qualified because the matrix spike and laboratory control sample recoveries were acceptable. Mercury results for all the above samples in laboratory batch 53739 are qualified "J" for detects and "UJ" for nondetects because RPD precision for the MSD exceeded 20. Similarly, silver results for all the above samples are qualified "J" for detects and "UJ" for nondetects because RPD precision in the laboratory control sample duplicates exceeded 20.

Thank you for the opportunity to be of service in this matter. Please contact me by telephone at 262-8920 with any questions.

Respectfully submitted,

IT CORPORATION



Mark Lyon  
Project Chemist

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cc: P. Puissant, SNL 7578  
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December 31, 1997

Project No. 301462.170.02.000

Sandia National Laboratories/New Mexico  
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Department 6133  
P.O. Box 5800, M/S 1147  
Albuquerque, New Mexico 87185-1147

Data Validation Results for Environmental Restoration (ER) Site 12B Samples, ARCOG 06885

Dear Ms. Young:

Data validation review of analysis results for soil samples from ER Site 12B (Burn Site) recorded on Analysis Request and Chain of Custody (ARCOG) 06885 was completed by IT Corporation (IT) on December 31, 1997. This letter transmits results from that review.

Eleven investigatory soil samples recorded on ARCOG 06885 were collected on August 19, 1997. Quality control samples also recorded included one soil field duplicate sample, one aqueous trip blank sample, and an aqueous equipment blank sample. The samples were shipped to LAS Laboratories, Las Vegas, Nevada, where analyses for volatile organic compounds (EPA Method 8260), semi-volatile organic compounds (EPA Method 8270), Resource Conservation and Recovery Act (RCRA) metals plus beryllium, and high explosives residues (EPA Method 8330) were requested. Laboratory results were reported in the comprehensive laboratory summary data package numbered L10349. The raw data backup documentation was not available during this review.

The aqueous equipment blank sample fraction 033678-004 for volatile organic compound analysis was broken in transit and unrecoverable. There were no volatile organic compound analyses on the equipment blank sample.

Data review and validation are documented in this letter and on *Data Verification/Validation Level 3 - DV3* forms which are attached. Data validation followed Sandia procedures outlined in *Verification and Validation of Chemical and Radiochemical Data, TOP 94-03, rev.0*, July 1994. Data review observations and any data validation qualifiers assigned are discussed by test method below.

***Volatile Organic Compounds EPA Method 8260***

Samples 033668-001 (field duplicate) and 033669-001 are qualified "R" as rejected because of multiple quality control failures. Failures include surrogate recovery, internal standards areas, and holding times in either or both initially reported run data and re-analysis data. Samples 033673-001 and 033675-001 are qualified "J" for detects and "UJ" for non-detects because of missed holding times. Tentatively identified compounds (TIC) in 033673-001 and 033675-001 are qualified "U" for undetected because of a similar,

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unknown TIC reported at the same elution time in the September 3, 1997, laboratory method blank sample, 53033MB.

LAS laboratory did not perform in accordance with Sandia contract requirements while analyzing the samples on this ARCO. LAS failed to analyze a laboratory control sample duplicate with the volatile samples, and failed to analyze a matrix spike (MS) and matrix spike duplicate (MSD) on the Sandia sample so designated on the ARCO. The non-Sandia samples reported for MS/MSD were not even in the same analytical batches as the samples on this ARCO. Also evidenced on the LAS volatile sample run logs, LAS had difficulties getting valid analyses on numerous samples run on September 2, 1997, because of internal standards failures. Consequently, resampling and analysis for volatile organic compounds are recommended depending on requirements of the project.

### ***Semi-Volatile Organic Compounds EPA Method 8270***

Diethylphthalate results in samples 033668-002, 033669-002, and 033670-002 are qualified "J" as estimated values because of poor precision in the field duplicate pair (033667-002 and 033668-002). Diethylphthalate was not detected in sample 0033667-002 above a practical quantitation limit of 100 µg/kg but reported at 450 µg/kg in the field duplicate 0033668-002. All TIC reports of substitute phenols and aldol condensation products in all soil samples are qualified "U" for undetected because of similar contamination in the laboratory method blank. As narrated in the report, LAS determined that laboratory vial caps were the source of contamination introduced into the samples. Numerous TICs identified as unknown hydrocarbons were reported in the soil samples as well as infrequent low level concentrations of target compounds. Resampling and analysis is recommended to confirm these compound identifications depending on requirements for the project.

LAS laboratory apparently ran semi-volatile organic compound analyses using EPA Contract Laboratory Program (CLP) GC/MS calibration criteria which is less stringent than the requested EPA SW-846 Method 8270 criteria. While all calibration requirements for Method 8270 were met in terms of system performance and continuing calibration check compounds, some percent deviation in response factors compared to initial calibration average response factors were observed greater than Method 8270 criteria but less than CLP acceptance criteria. No action was taken during review and no sample results were qualified because of this.

LAS failed to perform up to analytical method and Sandia contract requirements in analysis of the semi-volatile organic compounds. MS/MSD was not performed in the analytical batch containing the aqueous equipment blank sample and there was no laboratory control sample duplicate sample analyzed in the analytical batch with the soil samples.

### ***RCRA Metals plus Beryllium***

Metals analyses were performed following EPA Methods 6010 and 7471 (mercury). Lead result in all soil samples, 033667-002 consecutively through 033677-002 are qualified "J" as estimated values. Lead quality control checks showed positive interference in the ICP-Trace interference check sample analysis, lead recovery failed criteria in the sample dilution test, and field duplicate precision for lead was calculated at 117 relative percent difference (RPD). Barium results in all soil samples are qualified "J" as estimated values with a slightly low bias because of low recoveries less than acceptance limits in the matrix spike and matrix spike duplicate samples. Barium recovered at 68 and 73 percent. Mercury analysis results in all soil samples are qualified "UJ" meaning undetected with uncertainty concerning the

Ms. Sharissa Young

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January 2, 1998

reported limit of detection because mercury recovered slightly low in the matrix spike and matrix spike duplicate at 71 and 79 percent.

**High Explosives Residues EPA Method 8330**

Data reported by the laboratory are acceptable without additional qualification. LAS failed to run a laboratory control sample duplicate in the soil sample analysis batch. Poor laboratory control sample results in the water matrix were isolated and narrated by the laboratory and did not impact analysis of the equipment blank sample.

Thank you for the opportunity to be of service in this matter. Please contact me by telephone at 262-8920 with any questions.

Respectfully submitted,

IT CORPORATION

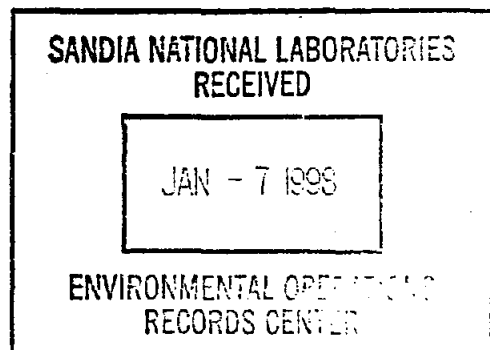


Mark Lyon  
Project Chemist

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*EORC ER / 1333 / 12B / DAT*







December 22, 1997

Project No. 301462.170.02.000

Sandia National Laboratories/New Mexico  
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Department 6133  
P.O. Box 5800, M/S 1147  
Albuquerque, New Mexico 87185-1147

Data Validation Results for Environmental Restoration (ER) Site 12B Samples, ARCOC 06896

Dear Ms. Young:

Data validation review of analysis results for soil samples from ER Site 12B (Burn Site) recorded on Analysis Request and Chain of Custody (ARCOC) 06896 was completed by IT Corporation (IT) on December 18, 1997. This letter transmits results from that review.

Six investigatory soil samples recorded on ARCOC 06896 were collected on September 2, 1997. Quality control samples also recorded included one soil trip blank sample. The samples were shipped to LAS Laboratories, Las Vegas, Nevada, where analyses for volatile organic compounds (EPA Method 8260), semi-volatile organic compounds (EPA Method 8270), Resource Conservation and Recovery Act (RCRA) metals plus beryllium, and high explosives residues (EPA Method 8330) were requested. Laboratory results were reported in the laboratory summary data package with raw data backup numbered L10445.

Data review and validation are documented in this letter and on *Data Verification/Validation Level 3 - DV3* forms which are attached. Data validation followed Sandia procedures outlined in *Verification and Validation of Chemical and Radiochemical Data, TOP 94-03, rev.0*, July 1994. Data review observations and any data validation qualifiers assigned are discussed by test method below.

***Volatile Organic Compounds EPA Method 8260***

Concentrations of 1,1,1-trichloroethane, tetrachloroethene, and toluene were detected in all of the samples at levels slightly above or below the practical quantitation limits (PQL). The common lab contaminant acetone was also detected in one sample. The soil trip blank (034053-004) submitted contained these same contaminants at greater concentrations as well as eight other target compounds above and below the PQL's. Consequently, the samples 034048-001, 034049-001, 034050-001, 034051-001, and 034052-001 are qualified "U" undetected for 1,1,1-trichloroethane, tetrachloroethene, and toluene. Acetone is qualified "U" in sample 034050-001. ER staff are cautioned however, that the source(s) for these compounds in the investigatory samples and the contamination in the soil trip blank are unknown, and confirmation re-sampling may be desirable depending on the usage requirements for the data and the known site history.

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**Semi-Volatile Organic Compounds EPA Method 8270**

Sample extraction was performed within the EPA recommended holding time, however, analysis of the extracts occurred several days past the analysis holding time. Laboratory batch quality control samples were prepared at the same time as sample extraction and those quality control results met all acceptance criteria. Consequently, the data are not rejected because of the holding time violations, but, with one exception, all compound analysis results in all samples are qualified "UJ" meaning undetected with uncertainty about the level of detection. The exception being one identification of bis(2-ethyl hexyl) phthalate in sample 034052-002 qualified by the laboratory as estimated below the PQL with the "J" flag.

Tentatively identified compounds (TIC) reported as a result of the mass spectral library search showed concentrations of acetone, hydrocarbons, and other unidentified, but late eluting, compounds. All soil sample TIC concentrations for acetone are qualified "U" for undetected because of similar acetone concentrations reported in the laboratory method blank sample. The source for acetone contamination in the samples likely originated in the laboratory.

**RCRA Metals plus Beryllium**

Metals analyses were performed following EPA Methods 6010 and 7471 (mercury). The lead result in sample 034050-002 is qualified "J" as an estimated value because the result of the serial dilution test performed by the laboratory on sample 034047-002 in accordance with Method 6010 requirements exceeded 10 percent difference. Sample 034050-002 was the only lead result so qualified because that was the only lead result greater than 50 times the instrument detection limit. All other metals results are usable without qualification.

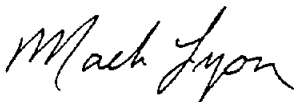
**High Explosives Residues EPA Method 8330**

Analysis results for HMX, 1,3,5-trinitrobenzene, 2,4,6-trinitrotoluene, 2-Am-4,6-DNT, 4-Am-2,6-DNT, 2,6-dinitrotoluene, and 2,4-dinitrotoluene are qualified "UJ" in all samples because of percent recoveries slightly less than acceptance limits in the laboratory control sample. Analysis results are not rejected because sample surrogate percent recoveries were acceptable in all samples and results for the sample matrix spike and matrix spike duplicate met quality control criteria. All other explosives results are usable without qualification.

Thank you for the opportunity to be of service in this matter. Please contact me by telephone at 262-8920 with any questions.

Respectfully submitted,

IT CORPORATION



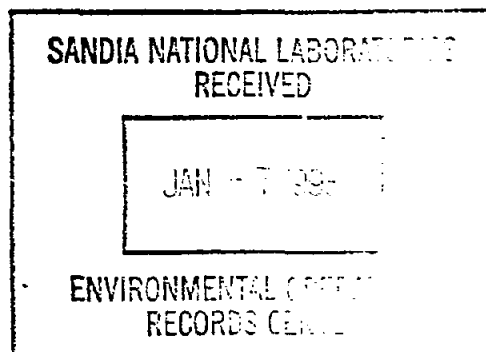
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cc: P. Puissant, SNL 7578  
Project File

*EORC 7333* *ER/1333/12B/DAT*

AL12-97/WP/ISNL-YU'NG6896.DOC





December 18, 1997

Project No. 301462.170.02.000

Sandia National Laboratories/New Mexico  
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Albuquerque, New Mexico 87185-1147

Data Validation Results for Environmental Restoration (ER) Site 12B Samples, ARCOG 06954

Dear Ms. Young:

Data validation review of analysis results for soil samples from ER Site 12B (Burn Site) recorded on Analysis Request and Chain of Custody (ARCOG) was completed by IT Corporation (IT) on December 16, 1997. This letter transmits results from that review.

Ten investigatory soil samples recorded on ARCOG 06954 were collected on September 10, 1997. Quality control samples also recorded include one aqueous equipment blank sample, one aqueous trip blank, and one soil trip blank sample. The samples were shipped to LAS Laboratories, Las Vegas, Nevada, where analyses for volatile organic compounds (EPA Method 8260) and semi-volatile organic compounds (EPA Method 8270) were requested. Laboratory results were reported in the laboratory summary data package with raw data backup numbered L10504.

Data review and validation are documented in this letter and on *Data Verification/Validation Level 3 - DV3* forms which are attached. Data validation followed Sandia procedures outlined in *Verification and Validation of Chemical and Radiochemical Data, TOP 94-03, rev.0*, July 1994.

Data review observations and any data validation qualifiers assigned are discussed by test method below.

***Volatile Organic Compounds EPA Method 8260***

The common laboratory contaminants of acetone and 2-butanone were consistently detected in the investigatory soil samples at low concentrations greater than the practical quantitation limit (PQL) (e.g., 10 to 30 micrograms per kilogram [ $\mu\text{g}/\text{kg}$ ]). These same compounds were not detected in the aqueous trip blank nor the laboratory method blank samples. However, the soil trip blank submitted did contain these common laboratory contaminants at similar quantifiable concentrations, 15 other identified target compounds at estimated concentrations less than the PQL's, and eight unknown hydrocarbons reported as tentatively identified compounds (TIC). Based upon the soil trip blank data, acetone, 2-butanone, m,p-xylene, and trichloroethene concentrations in several investigatory soil samples are qualified "U" for

undetected as listed below. However, ER staff are cautioned that the source(s) for acetone and 2-butanone in the investigatory samples, as well as other contamination in the soil trip blank are unknown, and confirmation re-sampling may be desirable depending on the usage requirements for the data and the known site history. The following results qualifications were made.

Sample ID	Acetone	2-Butanone	m,p-Xylene	Trichloroethene
034181-001	U			
034182-001	U			
034183-001	U	U		
034184-001	U			
034185-001	U	U		
034186-001	U	U	U	
034187-001	U	U		
034214-001	U			
034216-001	U			U

The qualifier "U" indicates that the result is qualified undetected because the compound concentration is less than 5 times (10 times in the case of common laboratory contaminants of acetone and 2-butanone) that compounds concentration in an associated blank sample.

#### ***Semi-Volatile Organic Compounds EPA Method 8270***

Review of the instrument initial and continuing calibration indicated that the laboratory is using EPA Contract Laboratory Program (CLP) acceptance criteria for the percent relative standard deviation of calibration compound response factors and percent difference between continuing calibration response factors versus the initial calibration average response factors. More stringent acceptance criteria for these quality measures are found in EPA Method 8270 than EPA CLP. Consequently, the following samples are qualified "UJ" for several compounds meaning undetected and there is uncertainty concerning the lower limit of detection because calibration criteria failed Method 8270 criteria. Analysis results are not rejected because CLP method criteria were met. Sample results all showed undetected. Samples 034181-002, 034182-002, 034183-002, 034184-002, 034185-002, 034186-002, 034187-002, 034214-002, 034215-002, and 034216-002 are qualified "UJ" for 4,6-dinitro-2-methylphenol, 2,4-dinitrophenol, 4-nitrophenol, 2,4-dinitrotoluene, 4-nitroaniline, and 3,3'-dichlorobenzidene. Sample 034218-002 is qualified "UJ" for bis(2-chloroethyl)ether.

Tentatively identified compounds (TIC) reported as a result of the mass spectral library search showed concentrations of acetone, hydrocarbons, and other unidentified, but late eluting, compounds. All soil sample TIC concentrations for acetone are qualified "U" for undetected because of similar acetone concentrations reported in the laboratory method blank sample. The source for acetone contamination in the samples likely originated in the laboratory.

Ms. Sharissa Young

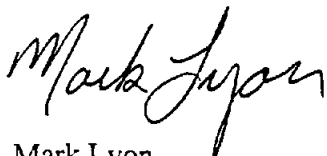
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December 18, 1997

Thank you for the opportunity to be of service in this matter. Please contact me by telephone at 262-8920 with any questions.

Respectfully submitted,

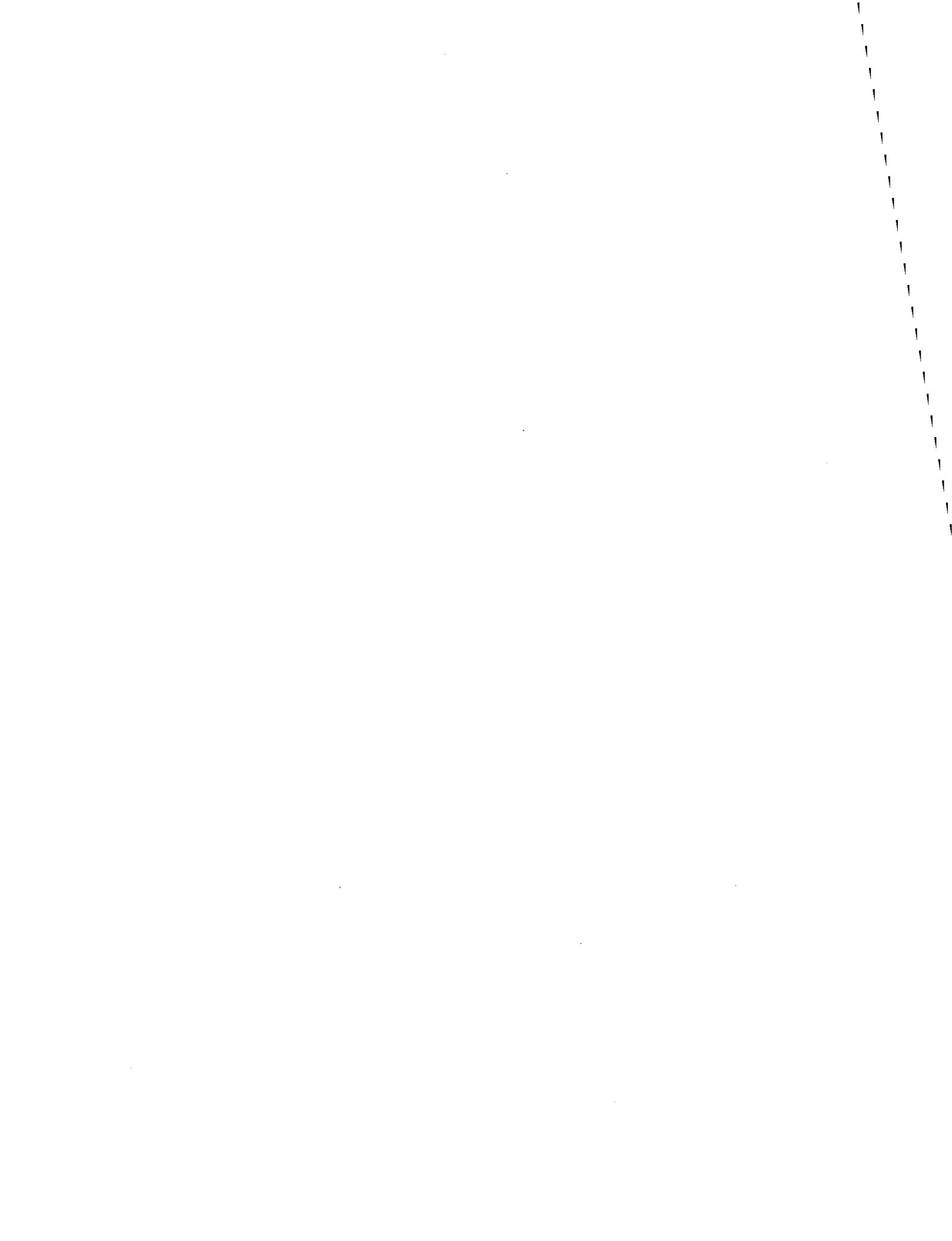
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November 26, 1997

Project No. 301462.170.02.000

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Sandia National Laboratories/New Mexico  
Department 6133  
P.O. Box 5800, M/S 1147  
Albuquerque, New Mexico 87185-1147

Data Validation Results for Five Samples from ER Site 12B, ARCOG 06899

Dear Ms. Young:

Expedited data validation review of analysis results for five soil samples from ER Site 12B (Burn Site) was completed by IT Corporation (IT) on Monday, November 24, 1997. This letter transmits results from that review.

The samples of interest were collected on September 8, 1997, and identified on Analysis Request and Chain of Custody (ARCOG) 06899 as follows:

<u>Sample No. - Fractions</u>	<u>Sample Location Detail</u>
034062-001, -002	CY12B/210/80/01-US
034061-001, -002	CY12B/210/60/01-US
034063-001, -002	CY12B/190/80/01-US
034064-001, -002	CY12B/180/60/01-US
034065-001, -002	CY12B/170/80/01-US

Analytical results for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), explosives residues, and Resource Conservation and Recovery Act (RCRA) list metals plus beryllium were reported by LAS Laboratories, Las Vegas, Nevada, in the document numbered L10490. The five samples of interest are a small excerpt of those recorded on ARCOG 06899 and reported by the lab in document L10490.

Data review and validation are documented in this letter and on *Data Verification/Validation Level 3 - DV3* forms, which are attached. Data validation followed Sandia procedures outlined in *Verification and Validation of Chemical and Radiochemical Data, TOP 94-03, rev.0*, July 1994.

General Review Comments

Laboratory report L10490 had been taken apart and placed in 3-ring binders or loose-leaf binder-clipped stacks prior to receipt at IT. The review could not determine whether the report was complete or whether it was intended to be a summary data package or a raw data package. Sample results certificates, exception

reports, and quality control summaries of analytical batch, and instrument-level monitoring measures were located, but there was very little raw or bench-level documentation in the package. Consequently, numerous review items could not be verified against, or traced back to, original documentation.

#### Volatile Organic Compounds. Method 8260

Volatile organic compound analysis results are acceptable and usable as reported without qualification. Quality control items reviewed included holding times, instrument tuning, initial and continuing calibration verification, initial and continuing calibration blanks, method blanks, surrogate compound recoveries, matrix spike/matrix spike duplicate, laboratory control samples, and internal standards. The report package did not contain response factor reports nor extracted ion chromatograms for the samples. Consequently, estimated, low-level, chloroform concentrations in the samples could not be evaluated as possible false positives.

#### Semivolatile Organic Compounds. Method 8270

Verification of the reported semivolatile organic compound analysis results could not be made. Instrument initial and continuing calibration response factor reports and summaries, extraction log, analysis run log, sample analysis response factor reports and extracted ion profiles, and tentatively identified compound (TIC) library search reports were not included in the documentation. Data validation qualifiers assigned below are based upon the batch quality control measures and sample-specific surrogate compound recoveries reported by the lab.

Sample analyses were completed outside of the 40-day extraction-to-analysis holding time and all target analyte results were nondetected in all five samples. However, all batch quality control measures including laboratory control sample, matrix spike and matrix spike duplicate, method blank, and surrogates spikes set up at the time of sample extraction met acceptance criteria. Consequently, these data are usable and qualified "UJ" as undetected with the quantitation limit estimated. Resampling of the locations for semivolatile analyses may be recommended if the data will be subject to regulatory scrutiny.

Tentatively identified compounds (TIC) reported as a result of the mass spectral library search showed concentrations of acetone, hydrocarbons, and other unidentified, but late eluting, compounds. All TIC concentrations for acetone are qualified "U" for undetected because of similar acetone concentrations reported in the laboratory method blank sample, and the absence of any acetone reported in the volatile compound sample analysis fractions. The source for acetone contamination in the samples likely originated in the laboratory.

Additional TICs reported as unknowns and unknown hydrocarbons may be indicative of petroleum-source contamination and a concern of the project staff. Re-sampling at the indicated locations and analysis for extractable total petroleum hydrocarbons may be recommended depending on project requirements.

#### Explosives Residues. Method 8330

All analysis results are usable as reported without qualification (all results were nondetects) with the understanding that the review process was essentially a Level II review of summary data forms. Explosives residue analysis data could not be verified back to the laboratory bench level. The

documentation provided for review included analysis results and surrogate compound recoveries, routine batch quality control summaries, exception reports, and continuing calibration summary reports. There was no documentation of initial calibration, preparation logs, analysis run logs, or sample chromatograms provided. Precision was measured from the matrix spike duplicate analysis because the laboratory neglected to run a duplicate control sample with the analytical batches.

RCRA List Metals + Beryllium. Methods 6010 and 7471.

Again, analysis results could not be verified back to the lab-bench level because the appropriate documentation was not provided. Given that, the results are usable as reported without qualification except for barium. Barium results in all five samples are qualified with "J" as estimated values, bias low, because of slightly low recovery, less than acceptance criteria of barium in the matrix spike and matrix spike duplicate sample.

Documentation that was not provided includes calibration summaries for both methods and instrument-run printouts. The preparation logs and analysis run logs provided were retyped versions of the handwritten originals and not signed by the originating laboratory staff. Initial and continuing calibration and blank verifications were reported as summary tables that could not be verified because there were no instrument printouts.

Thank you for the opportunity to be of service in this matter. Please contact me by telephone at 262-8920 with any questions.

Respectfully submitted,

IT CORPORATION



Mark Lyon  
Project Chemist

ML:dlr  
Attachments

cc: G. Haggerty, Gram, Inc.  
P. Puissant, SNL 7578  
E. Morse, IT-Albuquerque  
Project File



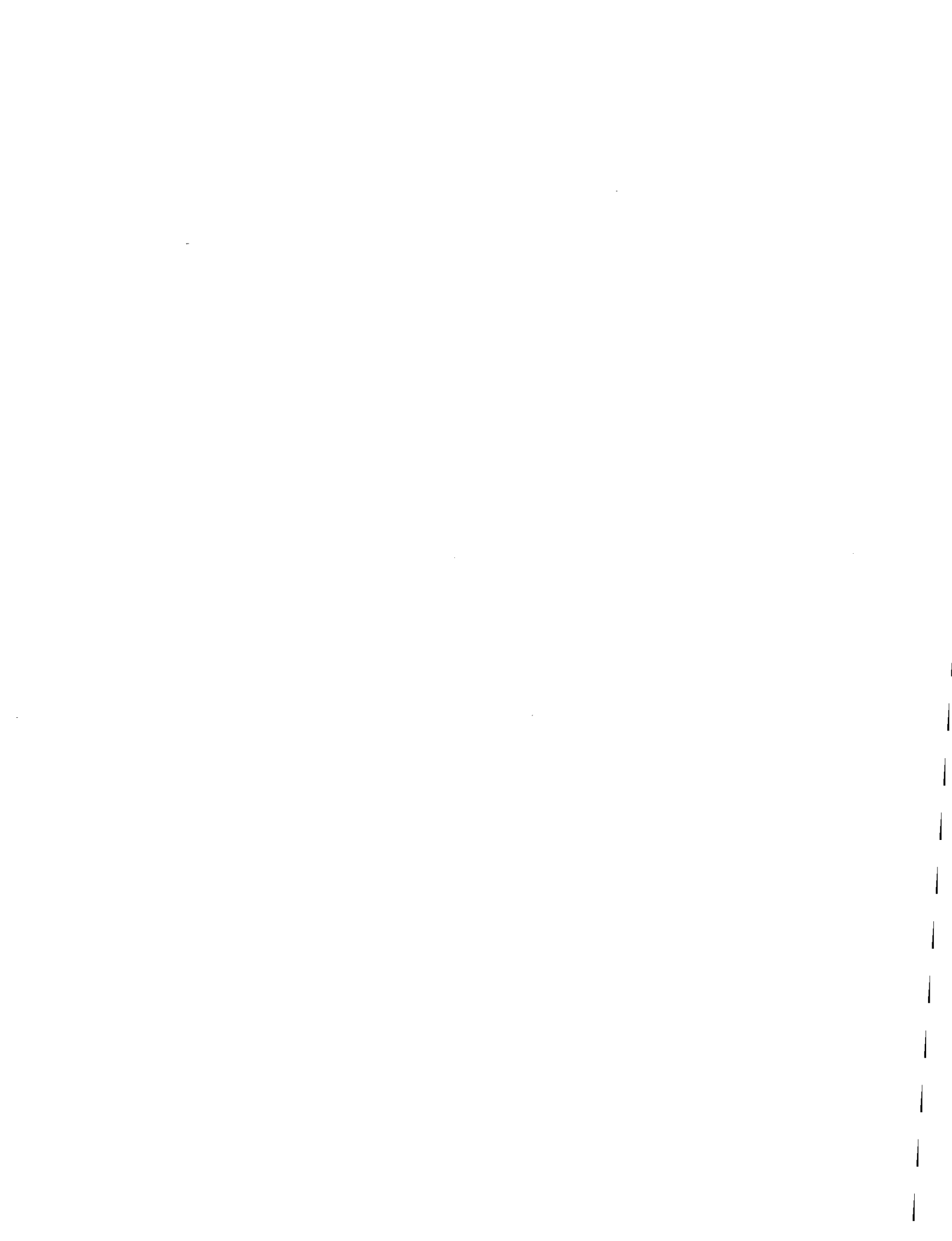




**ANNEX 4-C**  
**Geophysical Investigation of ER Site 12B**



## **7.1 November 1996 Surface Geophysical Surveys Report**



## 1.0 EXECUTIVE SUMMARY

Transglobal Environmental Geochemistry (**teg**) and Sandia National Laboratories (SNL) recently performed a VaporTec passive soil gas survey at Environmental Restoration (ER) Site 12B of Sandia National Laboratories, Albuquerque, New Mexico. The purpose of the soil gas investigation was to screen site soil gas for volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) to determine the presence/absence of contaminant occurrence in subsurface soils at this site.

Trace levels of petroleum hydrocarbons and chlorinated hydrocarbons were detected in soil gas. The petroleum hydrocarbons ethylbenzene and toluene were detected at or below the normal quantitation limits; xylene(s) were reported at or slightly above the quantitation limits, benzene was not detected. No diesel range hydrocarbons were detected.

The chlorinated hydrocarbons detected include chlorobenzene, chloroform, 1,2 dichloroethane (1,2 DCA), 1,1 dichloroethene (1,1 DCE) cis-1,2 dichloroethene (cis-1,2 DCE) trans-1,2 dichloroethene (trans-1,2 DCE), and trichloroethene (TCE). No single chlorinated species was found at all sites where chlorinated compounds were detected nor was there a predominant compound detected.

The locations and levels of soil gas response for the reported compounds are shown on Table A1, Appendix A. The distributions of Total Volatile Petroleum Hydrocarbons (TPH-V) and Total Chlorinated VOCs have been mapped. Due to the spatial continuity of detections in soil gas, and the potential significance of the chlorinated compound occurrences along the survey boundaries, extremely low levels of the compound occurrences were contoured. The levels depicted by the lowest contour intervals are most likely related to a vapor plume rather than detectable levels in subsurface soils and/or groundwater, but may be indicative of subsurface conditions at an adjacent site. There is no evidence to indicate the presence of widespread subsurface contamination at ER Site 12B.







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# GEOPHYSICAL INVESTIGATION OF ENVIRONMENTAL SITE 12B

Prepared for:

Department 6682  
Sandia National Laboratories  
Albuquerque, New Mexico

Task Order:  
12-0939-B.0348

David A. Hyndman

December 1996



## **Introduction**

A geophysical investigation has been conducted at Environmental Restoration (ER) Site 12B located within the Burn Site experimental facilities at Sandia National Laboratories (SNL), New Mexico. The investigation included high resolution magnetic and electromagnetic surveys. The investigation was designed to determine the location of any burial trenches, and provide any possible characterization of the buried waste within the trenches.

Survey activities were performed between 12 November and 22 November, 1996. The survey was successful in delineating a burial trench at ER Site 12B. This report documents the survey activities and presents the results.

## **Site Description**

ER Site 12B covers approximately 2 acres located within the SNL Burn Site facilities. ER Site 12B is centered on an arroyo which has been filled with both waste and soil. It is bounded to the east by a post and cable fence and to the north by experimental facilities and a cable tray.

The northern half of the site was clear of vegetation and contained partially buried metallic litter. The southern half of the site contained broken terrain and was covered with vegetation. A road traverses the southern portion of the site. The area to the south of the road contained tall vegetation, a few pieces of metallic litter, and mechanically worked piles of soil, presumably spoil from past construction activities.

Site preparation was provided by SNL personnel prior to geophysical surveying. The land surface to the north of the road was cleared of vegetation and the metallic debris that could be removed by hand. The vegetation to the south of the road was partially cleared.

## **Reference Grid**

A reference grid for the geophysical surveys was placed utilizing a transit and tape. The origin for the grid (0,0) was positioned at the southern extreme of the clear area of the site, approximately 5 ft from the post and cable fence bounding the eastern edge. The grid was marked with wooden stakes and plastic stemmed pin flags delineating parallel northwest-southeast traverses separated by 5 ft. The survey grid covered an area of 1.95 acres (170 ft by 500 ft).

## Geophysical Investigation

### Magnetic Survey

Measurements of the total magnetic field strength were made utilizing a Geometrics G-858 cesium vapor magnetometer. The magnetometer sensor was deployed approximately 3 ft above the ground surface. Data were acquired approximately every .8 ft along each traverse, yielding approximately 19,500 data measurements.

The magnetometer data were transferred to a personal computer for reduction and processing. The data were reduced using the MagMapper program (Geometrics, Inc.), and imaged using the Geosoft Mapping and Processing System (Geosoft Inc.). No special processing enhancements or filters were applied to the data other than the filtering inherent to creating a gridded image from discrete data.

The total magnetic field data are provided in Figure 1. The position of the road and several experimental fixtures are noted on the figure. Two large concentrations of buried ferrous material are observed on Figure 1. Only a few scattered magnetic features are observed to the south of the road.

### Electromagnetic Survey

Time domain electromagnetic data were acquired utilizing a Geonics EM-61 high precision metal locator. The lack of significant magnetic response in the extreme southern portion of the site (south of the road) indicated that EM-61 data need be acquired only to the north of the road. Data were acquired approximately every .6 ft along each traverse, yielding approximately 18,500 measurements.

The EM-61 data were transferred to a personal computer for reduction and processing. The data were reduced using the DAT61 program (Geonics Ltd.), and then imaged using the Geosoft Mapping and Processing System (Geosoft Inc.). No special processing enhancements or filters were applied to the data other than the filtering inherent to creating a gridded image from discrete data.

The EM-61 primary channel data are presented in Figure 2, together with the position of the road and the experimental fixtures. The EM-61 data mirror the magnetic data, revealing two large concentrations of buried metal connected by scattered buried objects.

## Analysis

Both the magnetic and electromagnetic surveys revealed a burial trench coincident with the drainage arroyo, with waste buried over a length of approximately 375 ft. The major concentrations of buried metal are found in the northern and southern extremes of the trench, with scattered buried objects along the entire length.

The approximate depth of burial for selected areas and objects (denoted as A, B, ..., Figure 2), calculated using the apparent depth routines in DAT61 (Geonics Ltd.), are given below:

Area/Object	Depth (ft)
A	2.4
B	.9
C	1.3
D	1.6
E	1.4
F	2.9
G	1.5
H	2.9

A close comparison of the EM-61 to the magnetometer data provides some further characterization of the buried waste. The EM-61 detects all metal. The magnetic data reveals only ferrous objects. Any area displaying a strong EM-61 response without a comparable magnetic response can be deduced to be non-ferrous, either aluminum, copper, lead, or possibly depleted uranium (DU).

Several areas displaying a strong EM-61 response but with no comparable magnetic anomaly are noted in Figure 3, which presents contours of the EM-61 data superposed on the gridded magnetic data. Most likely these features (marked "?", Figure 3) are due to aluminum or other innocuous scrap, but the possibility for DU can not be discounted.

Both the magnetic and electromagnetic display anomalies at the southwestern edge of the survey. The area beyond this edge of the survey was screened with a Schonstedt magnetic locator, revealing only a few, scattered magnetic features.

## Conclusions

The geophysical investigation at ER Site 12B was successful in delineating a 375 ft long burial trench with two major concentrations of buried metal. Scattered buried objects have been detected connecting these two concentrations. The approximate depth of burial of selected areas/objects has been determined. Several of the buried objects have been determined to be non-ferrous.

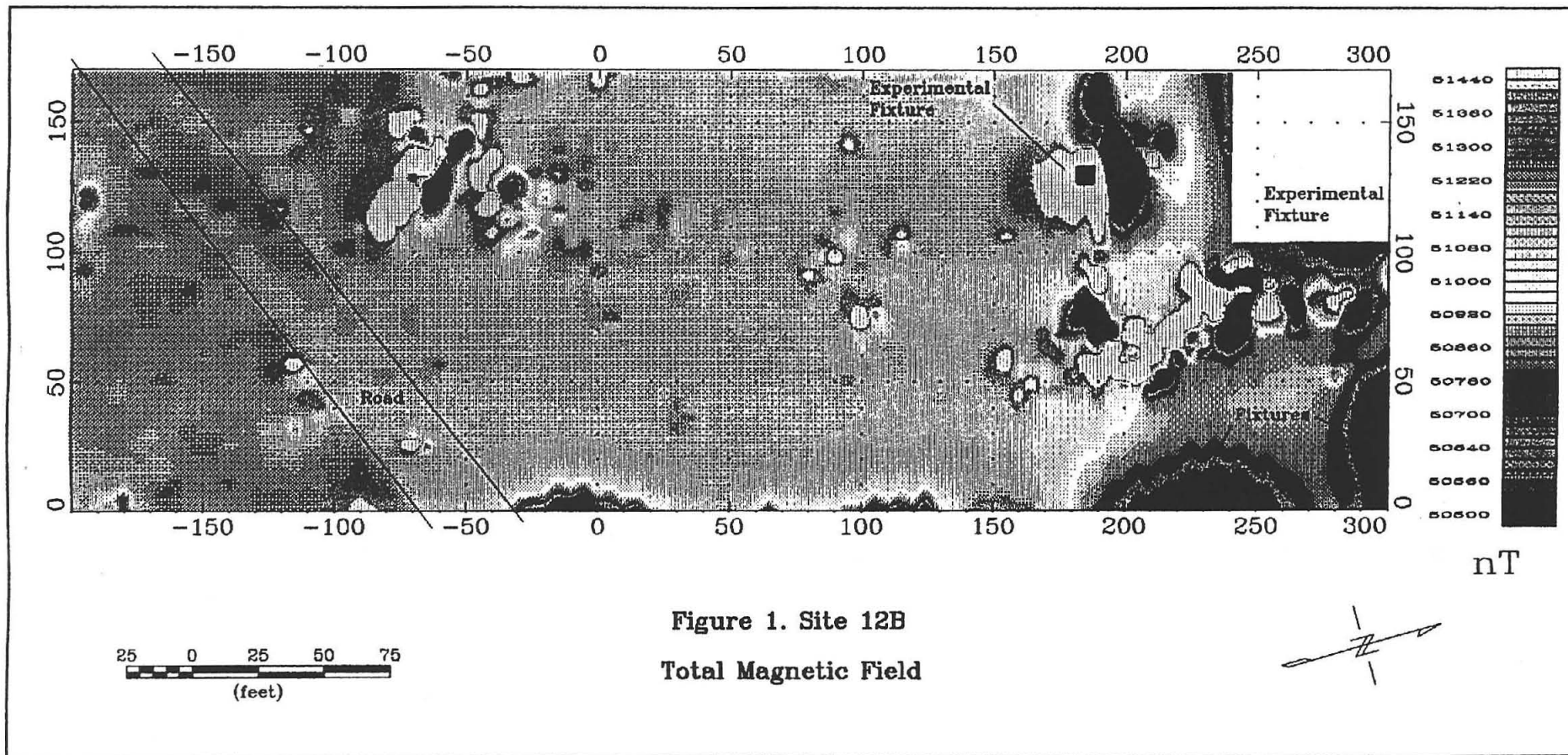
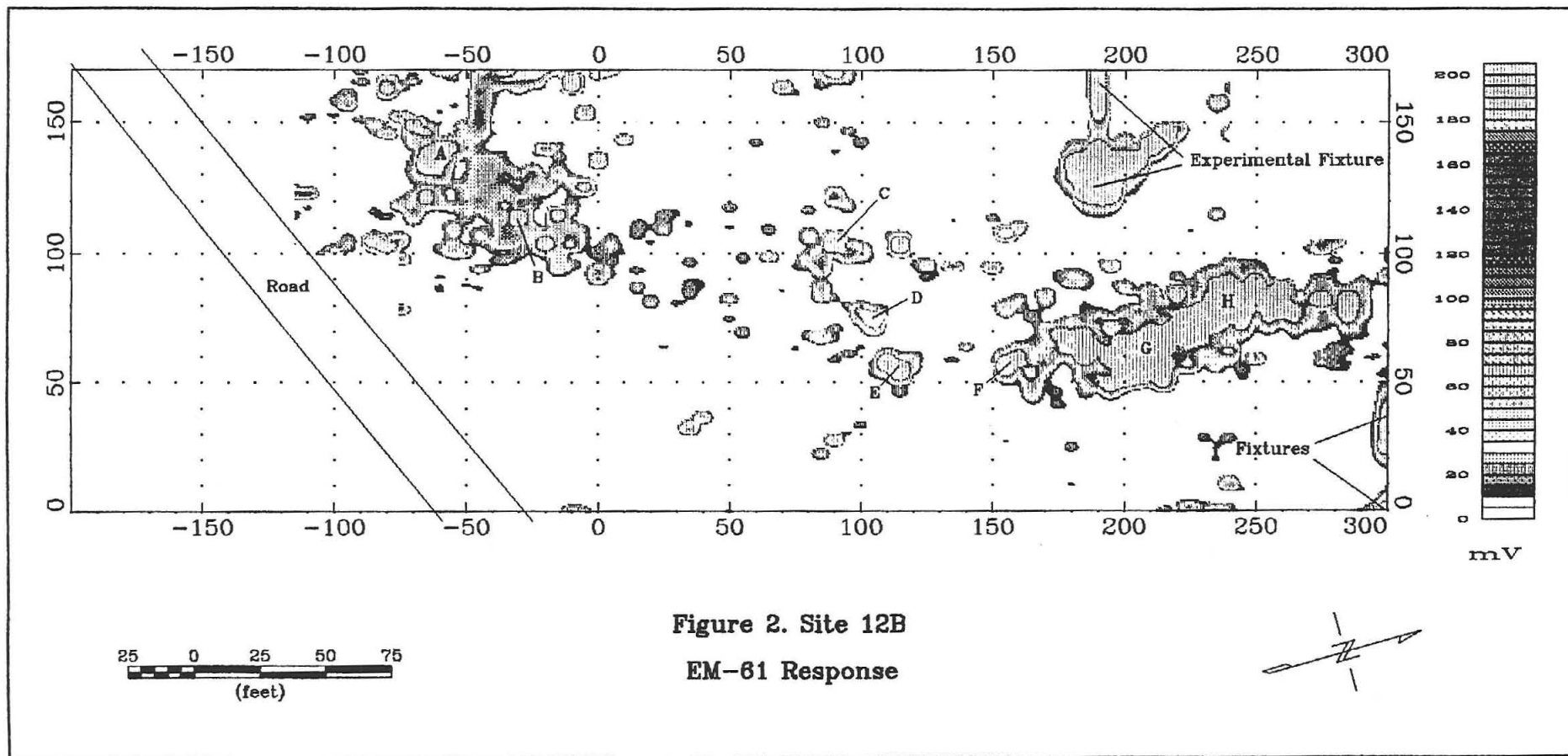


Figure 1. Site 12B  
Total Magnetic Field



**Figure 2. Site 12B**  
**EM-61 Response**







**ANNEX 4-D**  
**Vaportec Passive Soil gas Survey Results**  
**Sandia National Laboratories, New Mexico, ER Site 12B**



## **7.2 December 1996 Soil Organic Vapor Survey Report**

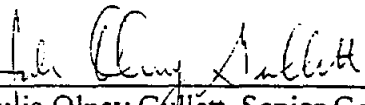


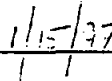


VAPORTEC PASSIVE SOIL GAS SURVEY RESULTS  
SNL ER SITE 12B  
SANDIA NATIONAL LABORATORIES  
ALBUQUERQUE, NEW MEXICO

PREPARED BY:

DATE:

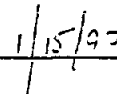
  
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Julia Olney Gullett, Senior Geologist

  
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1/15/97

APPROVED BY:

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## 4.0 OBJECTIVES

The purposes of the soil gas survey were to:

1. Identify and report VOCs and SVOCs as detected in soil gas;
2. Map the distribution of the most prevalent compound occurrences to aid in defining potential source areas and the areal limits of potential compound occurrences; and
3. Provide data to aid in developing strategies for monitoring groundwater quality, and developing future investigative studies (as applicable).

## 5.0 SCOPE OF WORK

teg provided forty-two (42) VaporTec samplers for this investigation. Sampler installation and retrieval was performed by SNL Personnel. Samplers were returned from the field and submitted to teg's laboratory for analysis by EPA Methods 8021 and 8015 modified for soil gas. The analytical results were compiled onto compound distribution maps and this interpretive report.

## 6.0 FIELD ACTIVITIES

### 6.1 Sampler installation and Retrieval

Samplers were installed on December 4, 1996 and retrieved on December 16, 1996. Samplers were placed at 50 foot intervals on a regular grid (where applicable) throughout the area of investigation. All sample locations are shown on Plate 1, Appendix C.

Samplers were installed in a shallow hole in native soils according to the field methods specified and provided by teg. Samplers were retrieved, numbered and placed back into the separated boxes for shipment. The boreholes were abandoned.

### 6.2 Sampler Exposure Time

The soil gas samplers are retrieved following a time period that has allowed for the soil gas emanating from the subsurface environment of a survey area to equilibrate with the installed samplers. This time integration period is determined for each soil gas survey based on time calibration data or site conditions. Samplers reach equilibrium with soil gas during the exposure period so that there are minimal variances in response between samples. Samplers are retrieved in the same order in which they were installed to minimize any variations based upon sample exposure time.

Sample exposure time for this investigation was determined by the nature of the target compounds and site conditions, and was determined to be 12 days.

## 7.0 ANALYTICAL METHODS

VaporTec passive soil gas samplers are analyzed by EPA methods modified for soil gas by either Gas Chromatograph (GC) or Gas Chromatograph/Mass Spectrometer (GC/MS). Samplers for this investigation were analyzed for the presence/absence of Total Petroleum Hydrocarbons and Volatile Organics. To optimize these analyses, teg selected EPA methods 8015 and 8020 (modified) for analysis.

The sample is prepared by heating it to approximately 150°C for approximately 45 minutes. A three cc aliquot of sample is extracted using an air tight, lockable syringe and injected directly onto the column for analysis. The syringe is cleaned after every sample and again at the end of each day of analysis. Calibration allows the calculation of nanograms or micrograms of analyte. A summary of the methods QA/QC methods is shown below.

### Modified EPA Method 8015 for TPH (diesel) by GC

Instrument: Shimadzu GC-14 Gas Chromatograph  
Column: 30 meter Rtx-5, thick film, 0.53 mm megabore capillary  
Carrier flow: Helium at 12 mL/min  
Detectors: Flame Ionization Detector (FID)  
Column Oven: 75° C for 1 min, 75° C to 225° at 25°C/min; hold at 225°C for 1 min

### Modified EPA Method 8021 for Volatile Organics by GC

Instrument: Shimadzu GC-14 Gas Chromatograph  
Column: 30 meter Rtx-5, thick film, 0.53 mm megabore capillary  
Carrier flow: Helium at 12 mL/min  
Detectors: Photo Ionization Detector (PID)  
Column Oven: 75° C for 1 min, 75° C to 225° at 25°C/min; hold at 225°C for 1 min

Standard Preparation Neat (pure) Standard of diesel fuel is used by the laboratory to enable both identification and quantitation. Standards are prepared in reagent grade trichlorotrifluoroethane (Freon 113).

### Instrument Calibration

A calibration curve for each target component or mixture are prepared and analyzed during the run to afford maximum correlation.

teg uses 3 and 5 point calibrations across a range of concentrations expected to be encountered to open a run, and continuing calibrations during and after the run. Linearity of the opening calibration must meet or exceed  $R=0.99$  or a Relative Standard Deviation of less than 20%. Continuing calibrations must fall within a window of 15%. teg is careful to assure that the majority of results that are reported fall into the actual range of calibrations so that the data will be legally defensible. Blanks are used according to regulation.

## 8.0 METHOD QA/QC

### 8.1 Lot Control

Before shipment to the field, the samplers are heated in an evacuated container to remove and residual volatile organic materials that may have adhered to the charcoal during manufacturing. Approximately 1 of every 25 samplers is tested to assure that the batch is clean prior to use in the field.

### 8.2 Travel Blanks

Two samplers were provided as travel blanks. The travel blanks remained sealed and traveled with the survey samplers from the laboratory to the field and back to the laboratory. The travel blank samples were analyzed under the same instrument conditions as the survey collectors. The results of the travel blank analysis is provided on Table A1, Appendix A, and indicate that no compounds were detected on the travel blank samples.

### 8.3 Method Blanks

Method Blanks are analyzed at the start of each day and more as appropriate depending on the measured concentrations. Typically when values exceeding the quantitation limit of any targeted compound are encountered, additional blanks are analyzed. No values were detected in the method blanks.

### 8.4 Duplicates

Duplicate samples are analyzed when inconsistent data are observed or as requested by the client or regulatory agency. Because soil vapor duplicates can vary, teg's nominal RPD acceptance factor is +/- a factor of 2.

## 9.0 RESULTS

Analytical results are reported as nanograms (ng) of vapor ( $10^{-9}$  grams) for every compound.

Trace levels of petroleum hydrocarbons were detected in soil gas. The petroleum hydrocarbons ethylbenzene and toluene were detected at or below the quantitation limits; xylene(s) were reported at or slightly above the quantitation limits. The values detected ranged from ND (not detected) to 2.9 ng, benzene and diesel range organics were not detected.

The chlorinated hydrocarbons detected include chlorobenzene, chloroform, 1,2 dichloroethane (1,2 DCA), 1,1 dichloroethene (1,1 DCE) cis-1,2 dichloroethene (cis-1,2 DCE) trans-1,2 dichloroethene (trans-1,2 DCE), and trichloroethene (TCE). The values detected ranged from ND (not detected) to 40 ng.

## 9.1 Presentation

The levels of soil gas response for all reported compounds are shown on Table A1, Appendix A. The distributions of Total Volatile Petroleum Hydrocarbons (TPH-V) and Total Chlorinated VOCs have been mapped and are shown as Plates 2 and 3, Appendix C. In order to report the compounds detected the mass of the compounds identified, reported as nanograms (ng), were plotted.

## 10.0 DISCUSSION

### 10.1 Use of Soil Gas Data

The passive soil gas data reflect volatile and semivolatile organics collected at a point in the near surface. The sources of these volatile organics may be in the stratigraphic column and/or in groundwater below the collection point. Thus, the organics can be derived from surface spills, deposition, or migration into the deeper vadose zone, and groundwater. The soil gas survey reveals the areal extent of contamination and is the optimum guide in identifying areas in order to develop a vertical profile, including the probing of soil borings and monitoring wells. Soil gas data are always semi-quantitative in that multiple sources in soil and/or groundwater cannot be readily differentiated without supporting soil and groundwater data. The higher soil gas responses are representative of higher concentrations in the subsurface, given that geologic conditions are relatively consistent.

### 10.2 Evaluation of Soil Gas Response

Generally soil gas response levels are described as high, elevated or low relative to the entire data set. In this investigation all response levels detected were low. Low levels are considered by teg as unlikely to be detected in subsurface soils and/or groundwater. The soil gas response levels detected more likely are related to vapor transport of the compounds detected. In teg's experience, levels below 10 ng for a single compound, and levels below 100 ngs for mixtures i.e. BTEX) do not typically represent detectable subsurface concentration levels under normal site conditions. Normal site conditions are considered to be sites in which soil matrices are somewhat uniform, the depth to groundwater is less than 100 feet below the surface, groundwater flow rates are undisturbed, and normal precipitation and temperatures occur during sampler exposure.

### 10.3 Map Evaluation

#### 10.3.1 The Distribution of Total Volatile Petroleum Hydrocarbons (TPH-V)

Only low levels of TPH-V were detected in soil gas. By mapping the compound occurrences, a potential migration pathway may have been identified in the north central portion of the site adjacent to the building and buried discharge line. Though the levels detected do not indicate the presence of detectable concentrations in subsurface soils, the migration of vapors in this area may illustrate a potential migration pathway. The distribution of TPH-V is shown on Plate 2, Appendix C.

### 10.3.2 The Distribution of Total Chlorinated VOCs

The distribution of Total Chlorinated VOCs as detected in soil gas is shown on Plate 2, Appendix C. Only three discrete sample locations indicated the presence of chlorinated compounds which may be at levels indicative of detectable concentrations in subsurface soils. These samples are located in the northern portion of the survey area, and at the Background South location. Soil gas conditions indicative of widespread subsurface contamination were not observed, however many spatially contiguous samples indicated the presence of low levels of chlorinated compounds. Due to the potential significance of these occurrences along the Site boundaries, levels not normally considered to be significant were contoured. The levels depicted by the lowest contour intervals are most likely related to a vapor plume rather than detectable levels in subsurface soils and/or groundwater, but may be indicative of subsurface conditions at an adjacent site.

## 11.0 CONCLUSIONS

Low levels of the petroleum hydrocarbons ethylbenzene, toluene and xylene(s) were detected in soil gas, benzene was not detected. Low levels of the chlorinated hydrocarbons chlorobenzene, chloroform, 1,2 DCA, 1,1 DCE, cis-1,2 DCE, trans-1,2 DCE, and TCE. The chlorinated compound occurrences detected at Site 12B appear to be discrete and do not indicate the presence of widespread subsurface contamination by these compounds.

The results of the soil gas investigation indicate that only limited, discrete occurrences of potential contaminants are present in the subsurface at ER Site 12B.

Because soil gas emanation rates are site and chemical specific, the environmental significance of the soil gas response values must be determined relative to compound concentrations in subsurface soil and/or groundwater. Changes in soil gas response in orders of magnitude may be used to plan future investigative studies, and to aid in characterizing the behavior (migration, attenuation) of the chemicals in the subsurface. Passive soil gas methods by their very nature collect a cumulative sample and are therefore extremely sensitive and often detect compounds in the low part per billion (ppb) range; therefore areas depicted as background by the VaporTec passive soil gas method generally do not represent environmentally significant contaminant levels in the subsurface.

030rjg/01.15.97



**APPENDIX A**  
**Tabulated Data**





Table A1  
 VaporTec Passive Soil Gas Results  
 TEG Rocky Mountain  
 Sandia National Laboratories - VaporTec Soil Vapor Survey  
 Sandia National Laboratories - ER Site 12B  
 Albuquerque, New Mexico 87085-5800  
 Date: January 3, 1997  
 TEG Project # 1196-030

Total Petroleum Hydrocarbons (EPA Method 8015 Modified)  
 & Volatile Organic Analyses (EPA Method 8021 Modified) SOIL VAPOR - Passive Sampler

Sample ID	Benzene	Carbon Tetrachloride	Chlorobenzene	Chloroform	1,1 Dichloroethane	1,2 Dichloroethane	1,1 Dichloroethene	cis 1,2 Dichloroethene	trans 1,2 Dichloroethene	Ethylbenzene	Freon 113	Methylene Chloride	1,1,1,2 Tetrachloroethane	1,1,1,2,2 Tetrachloroethane	Tetrachloroethene (PCE)	Toluene	1,1,1 Trichloroethane	1,1,2 Trichloroethane	Trichloroethene (TCE)	m-,p Xylene	o-Xylene	Total Petroleum Hydrocarbon	
Syringe Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Background South	ND	ND	1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	25.0	ND	ND	ND	ND
Trip Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-1-25	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8	ND	ND	ND	ND	ND	ND	ND
12BSGS-1-75	ND	ND	ND	9.2	ND	ND	ND	ND	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-1-105	ND	ND	ND	ND	ND	ND	ND	40.0	ND	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-2-10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.7	ND	ND	ND	2.3	ND	ND	ND
12BSGS-2-40	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-2-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-2-125	ND	ND	6.6	ND	ND	ND	ND	ND	0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.6	ND
12BSGS-3-10	ND	ND	33.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.7	ND	ND	ND	ND	ND	ND	ND

Sample ID	Benzene	Carbon Tetrachloride	Chlorobenzene	Chloroform	1,1 Dichloroethane	1,2 Dichloroethane	1,1 Dichloroethene	cis 1,2 Dichloroethene	trans 1,2 Dichloroethene	Ethylbenzene	Freon 113	Methylene Chloride	1,1,1,2 Tetrachloroethane	1,1,1,2,2 Tetrachloroethane	Tetrachloroethene (PCE)	Toluene	1,1,1 Trichloroethane	1,1,2 Trichloroethane	Trichloroethene (TCE)	m-,p Xylene	o-Xylene	Total Petroleum Hydrocarbon
12BSGS-3-40	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.9	ND	ND
12BSGS-3-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-3-125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Syringe Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-3-170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-4-25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2	ND
12BSGS-4-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-4-125	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-5-25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-5-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-5-125	ND	ND	1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-6-25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-6-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.6	ND	ND
12BSGS-6-125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-6-170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-6-220	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-7-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-7-125	ND	ND	ND	ND	ND	ND	0.9	ND	ND	ND	0.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-7-170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-8-25	ND	ND	ND	ND	ND	ND	3.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-8-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-8-125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Sample ID	Benzene	Carbon Tetrachloride	Chlorobenzene	Chloroform	1,1 Dichloroethane	1,2 Dichloroethane	1,1 Dichloroethene	cis 1,2 Dichloroethene	trans 1,2 Dichloroethene	Ethylbenzene	Freon 113	Methylene Chloride	1,1,1,2 Tetrachloroethane	1,1,1,2,2 Tetrachloroethane	Tetrachloroethene (PCE)	Toluene	1,1,1 Trichloroethane	1,1,2 Trichloroethane	Trichloroethene (TCE)	m-,+p Xylene	o-Xylene	Total Petroleum Hydrocarbon
12BSGS-8-170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Syringe Blank	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-9-75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-9-125	ND	ND	ND	ND	ND	ND	ND	2.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-9-170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-9-220	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-10-75	ND	ND	3.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-10-125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-10-170	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-11-75	ND	ND	ND	7.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-11-125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
12BSGS-11-170	ND	ND	ND	ND	ND	6.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Background North	ND	ND	3.2	2.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.7	ND	ND	ND	ND	ND
Trip Blank #2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Quantitation Limits	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	10.0
All results in ng/sampler ND indicates Not detected																						

Analyses performed in TEG's Mobile Laboratory

Analyses performed by: Micheal P. Charney

Data Reviewed by:



**APPENDIX B**  
**Chain of Custody Documents**



Internal Lab  
Batch No.

# ANALYSIS REQUEST AND CHAIN OF CUSTODY

AR/COC- 06109

Dept. No / Mail Stop: <u>6685 / 1148</u> Project/Task Manager: <u>Mike Mitchell / Lori Dawson</u> Project Name: <u>Site 123 UCM</u> Record Center Code: Logbook Ref No: <u># 165</u> Service Order No.: <u>NA</u>	Date Samples Shipped: <u>12/16/96</u> Carrier/Waybill No.: <u>Fed Ex</u> Lab Contact: <u>Julie Gullette</u> Lab Destination: <u>TEG in Denver, CO</u> SMO Contact/Phone: <u>Mike Mitchell</u> <u>ER</u> Send Report to SMO	Purchase Order Contract No: <u>AS-0362</u> Case No: <u>8821-20x280</u> SMO Authorized: Bill to: <u>Canada National Laboratories</u> <u>Supplier Services Department</u> <u>P.O. Box 5800 MS 0154</u> <u>Albuquerque, NM 87105 0154</u>	<b>Parameter &amp; Method Requested</b> VOCs 3021 TPH / Fuel Fingerprint
--	--	---	--

Location		Tech Area		Beginning Depth in Feet	ER Site No.	Date/Time Collected	Reference LOV (available at SMO)					Lab Sampl ID			
Building	Floor	NA	NA				Sample Matrix	Container Type	Volume	Preser- vative	Sample Collection Method		Sample Type		
				4	128	12/16/96 0838	SG	Glass	40ml	NA	Grab	SA	X	X	
						12/16/96 0846									
						12/16/96 0853									
						12/16/96 0916									
						12/16/96 0906									
						12/16/96 0902									
						12/16/96 0858									
						12/16/96 0917									
						12/16/96 0915									
						12/16/96 0924									

RMMA <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Ref. No. _____	<b>Sample Tracking</b> Date Entered (mm/dd/yy) _____ Entered by: _____	<b>Special Instructions/QC Requirements</b> _____	<b>Abnormal Conditions on Receipt</b> _____
Sample Disposal <input type="checkbox"/> Return to Client <input checked="" type="checkbox"/> Disposal by lab		Turnaround Time <input checked="" type="checkbox"/> Normal <input type="checkbox"/> Rush Required Report Date _____ QC Inits. _____	
<b>Sample Team Members</b> Name: <u>Mike Mitchell</u> <u>Gilbert Quintana</u>	Signature: <u>[Signature]</u> <u>[Signature]</u>	Init: <u>mm</u> <u>PK</u>	Company/Organization/Phone: <u>BRE / 6685 / 284-250</u> <u>IT / 6684 / 284-3308</u>

1. Relinquished by <u>Robert Quintana</u> Org. <u>6684</u> Date <u>12-16-96</u> Time <u>1345</u> 1. Received by <u>Michael Charney</u> Org. <u>TEG - Rocky</u> Date <u>12/17/96</u> Time <u>1100</u> 2. Relinquished by _____ Org. _____ Date _____ Time _____ 2. Received by _____ Org. _____ Date _____ Time _____ 3. Relinquished by _____ Org. _____ Date _____ Time _____ 3. Received by _____ Org. _____ Date _____ Time _____	4. Relinquished by _____ Org. _____ Date _____ Time _____ 4. Received by _____ Org. _____ Date _____ Time _____ 5. Relinquished by _____ Org. _____ Date _____ Time _____ 5. Received by _____ Org. _____ Date _____ Time _____ 6. Relinquished by _____ Org. _____ Date _____ Time _____ 6. Received by _____ Org. _____ Date _____ Time _____
---	--

# ANALYSIS REQUEST AND CHAIN OF CUSTODY

SF 2001 (2) (9 94)

AR/COC-1 06109

Location										Reference LOV (available at SMO)										Parameter & Method Requested	
Project Name: <u>Site 12B VCM</u>					Project/Task Manager: <u>Mike Mitchell Lon Dawson</u>					Case No.: <u>NA</u>											
Tech Area: <u>NA</u>		Building: <u>NA</u>		Room: <u>NA</u>		Beginning Depth in Feet	ER Site No.	Date/Time Collected	Sample Matrix		Container		Preservative	Sample Collection Method	Sample Type			Lab Sam ID			
Sample No. - Fraction		ER Sample ID or Sample Location Detail		Type	Volume				Type	Volume											
						4	12B	12/16/96 0926	SG	G	40ml	NA	G	SA	X	X					
								12/16/96 0928													
								12/16/96 0944													
								12/16/96 0942													
								12/16/96 0932													
								12/16/96 0946													
								12/16/96 0951													
								12/16/96 1009													
								12/16/96 1018													
								12/16/96 1016													
								12/16/96 1013													
								12/16/96 1011													
								12/16/96 1006													
								12/16/96 1021													
								12/16/96 1025													
								12/16/96 1026													
								12/16/96 1037													
								12/16/96 1034													

VOCs 8021  
TPH/Fuel Fingerprint

Abnormal Conditions on Receipt

Recipient Init:

WHITE - To Laboratory Copy

BLUE - To Accompany Samples, Return to SMO

YELLOW - S. Response Copy

PINK - Field Copy



# ANALYSIS REQUEST AND CHAIN OF CUSTODY

SF 2001 (C01) (9 94)

AR/COC-1 06109

Project Name: <u>Site 12B VCM</u>										Project/Task Manager: <u>M. Rec Mitchell Lori Dawson</u>										Case No.: <u>NA</u>									
Location		Tech Area: <u>NA</u>		Beginning Date Depth in Feet <small>(12/16/96)</small>	ER Site No.	Date/Time Collected	Reference LOV (available at SMO)					Parameter & Method Requested																	
Building: <u>NA</u>	Room: <u>NA</u>	Sample No. - Fraction	ER Sample ID or Sample Location Detail				Sample Matrix	Container Type	Volume	Preservative	Sample Collection Method	Sample Type																	
			12B565-8-125	4	12B	12/16/96 1031	SG	G	40ml	NA	G	SA	X	X															
			8-170			12/16/96 1030																							
			9-75			12/16/96 1041																							
			9-125			12/16/96 1044																							
			9-170			12/16/96 1047																							
			9-220			12/16/96 1049																							
			10-75			12/16/96 1055																							
			10-125			12/16/96 1102																							
			10-170			12/16/96 1052																							
			11-75			12/16/96 1130																							
			11-125			12/16/96 1120																							
			11-170			12/16/96 1110																							
			12B565-BK6-North			12/16/96 1152																							
			↓ South			12/16/96 1135																							
			Top Blank				Air					Blank	TB																
			Top Blank				Air					Blank	TB																

VOCs 8021  
TPH/Fed fingerprint

Both Top Blanks received with other samples, transported to site during installation and retrieval, and kept in shipping box while other samples in the ground. January 12/16/96

**Abnormal Conditions on Receipt**

Recipient Initials: [Signature]

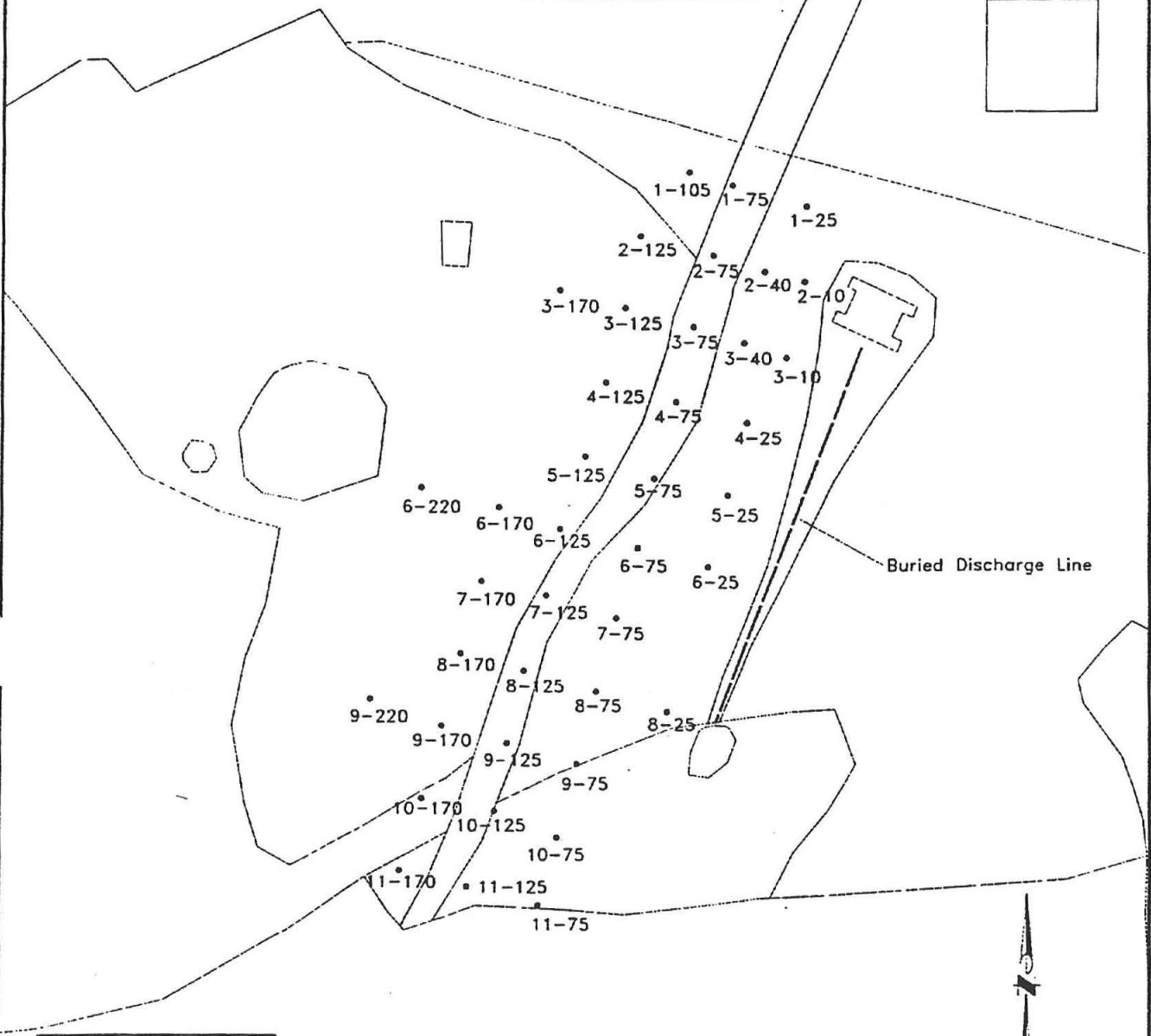
WHITE - To Accompany Samples, Laboratory Copy    BLUE - To Accompany Samples, Return to SMO    YELLOW - SMO Suspense Copy    PINK - Field Copy



**APPENDIX C**  
**Plates 1-3**



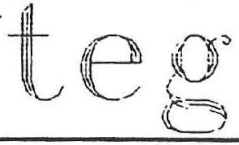
**INSET**  
 \*Background North  
 Sample Location  
 not to Scale  
 Location approximately  
 320 feet north of  
 location shown



**LEGEND**  
 Features:  
 ● VaporTec Sampler Location  
 ⊕ Monitoring Well Location

\*Background South

0 80 160  
 SCALE IN FEET

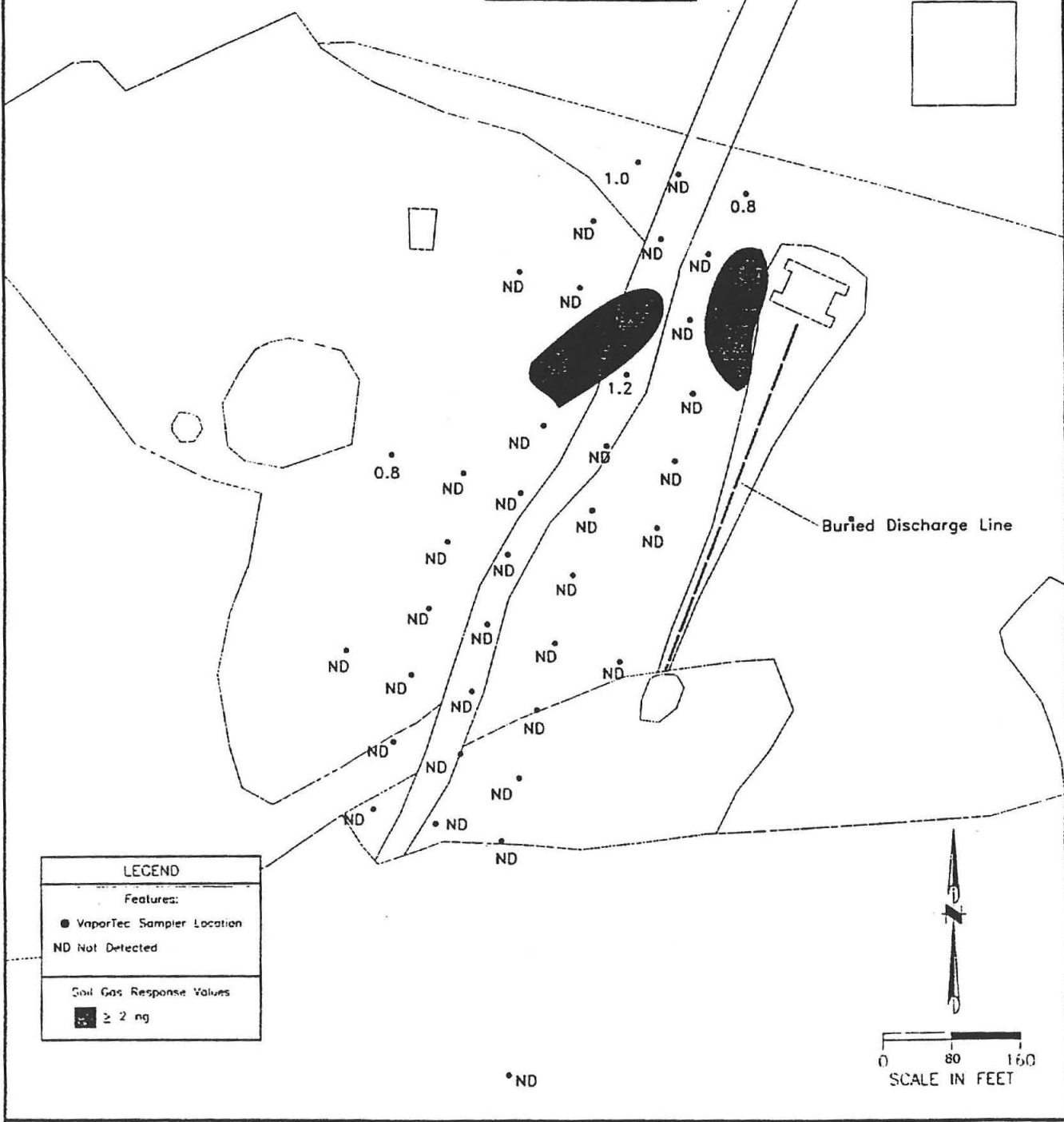


Drawn By: JOC	Project #: 1196-030	Sandia National Laboratories
Checked by: JOC	Date: 12/30/1996	ER Site 12B
Project Mgr: JOC	File Name: 030-1.dwg	SNL, New Mexico

Sampler Locations

Plate 1

**INSET**  
 \*ND  
 Sample Location  
 not to Scale  
 Location approximately  
 320 feet north of  
 location shown



**LEGEND**


Features:

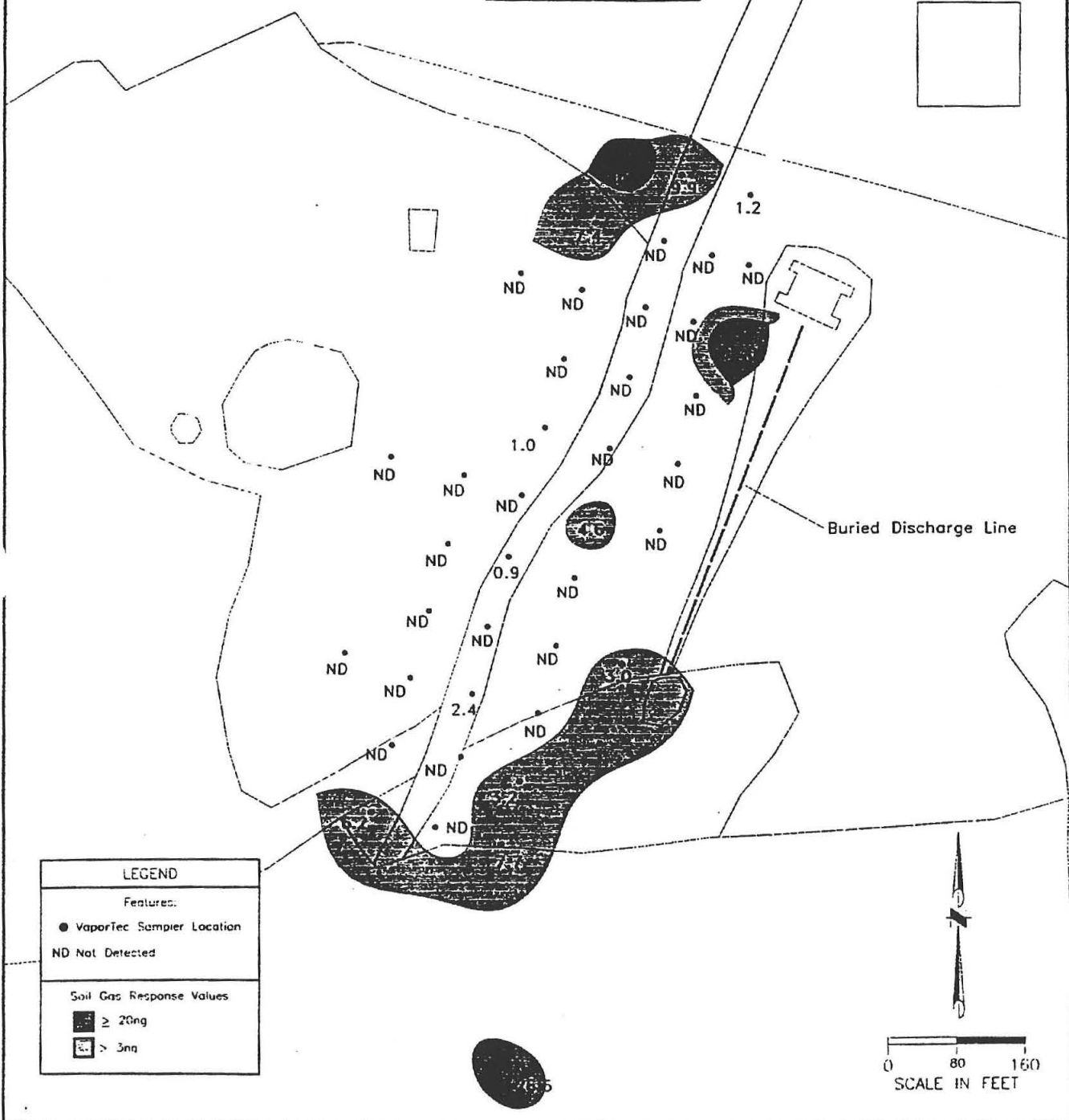
- VaporTec Sampler Location
- ND Not Detected

Soil Gas Response Values

- $\geq 2$  ng

	Drawn By: JOC	Project #: 1196-030	Sandia National Laboratories	<b>SOIL GAS RESPONSE</b>
	Checked By: <i>[Signature]</i>	Date: 12/30/1996	ER Site 12B	Total Volatile Petroleum Hydrocarbons (TPH-V)
	Project Mgr: JOC	File Name: 030-2.dwg	SNL, New Mexico	Plate 2

**INSET**  
  
 Sample Location  
 not to Scale  
 Location approximately  
 320 feet north of  
 location shown



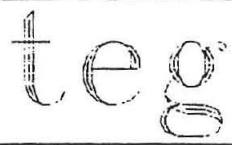
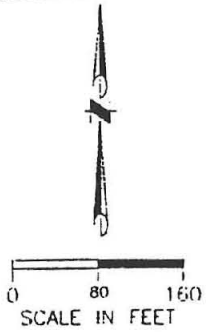
**LEGEND**

Features:

- VaporTec Sampler Location
- ND Not Detected

Soil Gas Response Values

- ≥ 20ng
- > 3ng



Drawn By: JOC	Project #: 1196-030	Sandia National Laboratories	SOIL GAS RESPONSE
Checked By: JOC	Date: 12/30/1996	ER Site 12B	Total Chlorinated VOCs
Project Mgr: JOC	File Name: 030-3.dwg	SNL, New Mexico	
			Plate 3







**ANNEX 4-E**  
**Gamma Spectroscopy Results**



**ANALYSIS REQUEST AND CHAIN OF CUSTODY**

Internal Lab Batch No. 701465

AR/COC- | **06895**

Dept. No./Mail Stop: 6685/705 1168  
 Project/Task Manager: Mike Mitchell  
 Project Name: ER Site 12B WCAI  
 Record Center Code: ER/1333/12B/DAT  
 Logbook Ref No.: ER-013  
 Service Order No.: CF-0404

Date Samples Shipped: 8/20/97  
 Carrier/Waybill No.: HC  
 Lab Contact: Fernando Dominguez  
 Lab Destination: RPSD Bldg  
 SMO Contact/Phone: Pam Poirson 7/841-315  
 Send Report to SMO Pam Poirson

Contract No.: NA  
 Case No.: 892120136  
 SMO Authorization: SMO  
 Bill to: Sandia National Laboratories  
Supplier Services Department  
P.O. Box 5800 MS 0154  
Albuquerque, NM 87185-0154

**Parameter & Method Requested**

Location		ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO)					Sample Collection Method	Sample Type	Lab Sample ID
Building	Tech Area					Room	Sample No. - Fraction	Sample Matrix	Container Type	Volume			
✓	033667	003	0	12B	8/20/97	Soil	P	500ml	None	C	SA	033667-003	
✓	033668	003	0	12B	8/20/97	Soil	P	500ml	None		DU	033668-003	
✓	033669	003	0	12B	8/20/97	Soil	P	500ml	None		SA	033669-003	
✓	033670	003	0	12B	8/20/97	Soil	P	500ml	None		SA	033670-003	
✓	033671	003	0	12B	8/20/97	Soil	P	500ml	None		SA	033671-003	
✓	033672	003	0	12B	8/20/97	Soil	P	500ml	None		SA	033672-003	
✓	033673	003	0	12B	8/20/97	Soil	P	500ml	None		SA	033673-003	
✓	033674	003	0	12B	8/20/97	Soil	P	500ml	None		SA	033674-003	
✓	033675	003	0	12B	8/20/97	Soil	P	500ml	None		SA	033675-003	
✓	033676	003	0	12B	8/20/97	Soil	P	500ml	None	V	SA	033676-003	

RMMA  Yes  No Ref. No. \_\_\_\_\_  
 Sample Disposal  Return to Client  Disposal by lab

Sample Tracking  
 Date Entered (m/d/y): 8/26/97  
 Entered by: [Signature]

Special Instructions/QC Requirements  
 • AR-COC 06895, 1414-585  
 AR-COC 06895 to LAS

Abnormal Conditions on Receipt  
 Initials: \_\_\_\_\_  
 Date: \_\_\_\_\_

Turnaround Time  Normal  Rush Required Report Date 8/21/97  
 QC Initials: [Signature]  
 Sample Team Name: Gilbert L. [Signature]  
 Signature: [Signature]  
 Init: [Signature] Company/Organization/Phone: 17/6694 739-7417

**RUSH**

1. Relinquished by <u>[Signature]</u> Org. <u>6684</u> Date <u>8/20/97</u> Time <u>1010</u>	4. Relinquished by _____ Org. _____ Date _____ Time _____
1. Received by <u>[Signature]</u> Org. <u>SMU7578</u> Date <u>8/20/97</u> Time <u>1010</u>	4. Received by _____ Org. _____ Date _____ Time _____
2. Relinquished by <u>[Signature]</u> Org. <u>SMU7578</u> Date <u>8/20/97</u> Time <u>1043</u>	5. Relinquished by _____ Org. _____ Date _____ Time _____
2. Received by <u>[Signature]</u> Org. <u>SMU7578</u> Date <u>8/20/97</u> Time <u>1043</u>	5. Received by _____ Org. _____ Date _____ Time _____
3. Relinquished by <u>[Signature]</u> Org. <u>758</u> Date <u>8/21/97</u> Time <u>1110</u>	6. Relinquished by _____ Org. _____ Date _____ Time _____
3. Received by <u>[Signature]</u> Org. <u>SMU7578</u> Date <u>8/21/97</u> Time <u>1110</u>	6. Received by _____ Org. _____ Date _____ Time _____



Sandia National Laboratories  
 Radiation Protection Sample Diagnostics Program [881 Laboratory]  
 8-20-97 11:12:28 PM

Analyzed by: *J* 8/21/97 Reviewed by: *K 8/21/97*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 033667-003  
 Lab Sample ID : 70146501

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 839.000 gram  
 Sample Date/Time : 8-19-97 8:28:00 AM  
 Acquire Start Date/Time : 8-20-97 11:29:41 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	-----	1.51E+00
TH-234	1.90E+00	5.33E-01	4.81E-01
RA-226	Not Detected	-----	5.58E-01
PB-214	7.74E-01	1.33E-01	4.81E-02
BI-214	7.62E-01	1.82E-01	4.83E-02
TH-232	8.62E-01	4.21E-01	1.98E-01
RA-228	8.62E-01	1.09E+00	1.42E-01
AC-228	7.91E-01	1.93E-01	8.57E-02
TH-228	7.97E-01	4.81E-01	4.30E-01
RA-224	7.39E-01	2.83E-01	7.01E-02
PB-212	7.20E-01	1.20E-01	3.55E-02
BI-212	9.27E-01	4.86E-01	3.31E-01
TL-208	6.09E-01	1.39E-01	6.97E-02
U-235	8.49E-02	1.08E-01	1.38E-01
TH-231	Not Detected	-----	8.24E+00
PA-231	Not Detected	-----	1.35E+00
TH-227	Not Detected	-----	3.44E-01
RA-223	Not Detected	-----	1.40E-01
PN-219	Not Detected	-----	4.03E-01
PB-211	Not Detected	-----	9.21E-01
TL-207	Not Detected	-----	1.46E+01
AM-241	Not Detected	-----	1.84E-01
PU-239	Not Detected	-----	3.43E+02
NP-237	<del>1.04E-01</del>	<del>1.25E-01</del>	2.07E-01
PA-233	Not Detected	-----	5.49E-02
TH-229	Not Detected	-----	1.98E-01

*Uncert.*

*Not detected J 8/21/97*

Isotope Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	4.26E-02
AG-110m	Not Detected	-----	4.47E-02
BA-133	Not Detected	-----	5.46E-02
BE-7	Not Detected	-----	2.47E-01
BI-207	Not Detected	-----	3.01E-02
BD-109	Not Detected	-----	9.37E-01
BD-115	Not Detected	-----	9.26E-02
BE-139	Not Detected	-----	2.57E-02
BE-141	Not Detected	-----	4.52E-02
BE-144	Not Detected	-----	1.83E-01
BO-56	Not Detected	-----	3.69E-02
BO-57	Not Detected	-----	2.36E-02
BO-58	Not Detected	-----	3.27E-02
BO-60	Not Detected	-----	3.73E-02
BR-51	Not Detected	-----	2.24E-01
BS-134	Not Detected	-----	4.65E-02
BS-137	1.41E-01	5.22E-02	2.47E-02
EU-152	Not Detected	-----	7.09E-02
EU-154	Not Detected	-----	1.98E-01
EU-155	Not Detected	-----	1.09E-01
FE-59	Not Detected	-----	7.15E-02
GD-153	Not Detected	-----	8.09E-02
HG-203	Not Detected	-----	3.01E-02
I-131	Not Detected	-----	3.14E-02
IR-192	Not Detected	-----	2.65E-02
K-40	1.26E+01	2.11E+00	3.08E-01
KN-52	Not Detected	-----	3.75E-02
KN-54	Not Detected	-----	3.69E-02
MO-99	Not Detected	-----	3.22E-01
NA-22	Not Detected	-----	4.24E-02
NA-24	Not Detected	-----	1.22E-01
NB-95	Not Detected	-----	1.82E-01
ND-147	Not Detected	-----	2.16E-01
NI-57	Not Detected	-----	9.12E-02
PB-210	Not Detected	-----	7.55E+00
RU-103	Not Detected	-----	2.98E-02
RU-106	Not Detected	-----	2.75E-01
SB-122	Not Detected	-----	5.31E-02
SB-124	Not Detected	-----	3.16E-02
SB-125	Not Detected	-----	8.89E-02
SN-113	Not Detected	-----	3.77E-02
SR-85	Not Detected	-----	3.79E-02
TA-182	Not Detected	-----	1.74E-01
TA-183	Not Detected	-----	1.83E-01
TC-99m	Not Detected	-----	5.41E-01
TL-201	Not Detected	-----	1.35E-01
XE-133	Not Detected	-----	5.53E-02
Y-88	Not Detected	-----	2.48E-02
ZN-65	Not Detected	-----	1.17E-01
ZR-95	Not Detected	-----	6.04E-02

Analyzed by: *J* 8/21/97 Reviewed by: *KSP/ax*

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 Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 033668-003  
 Lab Sample ID : 70146502

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 780.000 gram  
 Sample Date/Time : 8-19-97 8:30:00 AM  
 Acquire Start Date/Time : 8-20-97 1:15:00 PM  
 Detector Name : LAB01  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	1.47E+00	1.18E+00	1.74E+00
TH-234	1.74E+00	5.59E-01	4.66E-01
RA-226	2.37E+00	7.78E-01	6.13E-01
PB-214	9.03E-01	1.63E-01	5.01E-02
BI-214	8.42E-01	1.71E-01	4.83E-02
TH-232	7.27E-01	3.76E-01	2.07E-01
RA-228	6.38E-01	2.11E-01	1.64E-01
AC-228	7.23E-01	1.89E-01	8.86E-02
TH-228	5.18E-01	3.30E-01	4.45E-01
RA-224	6.97E-01	2.98E-01	6.45E-02
PB-212	7.43E-01	1.27E-01	3.86E-02
BI-212	7.67E-01	3.53E-01	3.01E-01
TL-208	7.04E-01	1.80E-01	7.30E-02
U-235	1.58E-01	1.56E-01	2.18E-01
TH-231	Not Detected	-----	8.99E+00
PA-231	Not Detected	-----	1.40E+00
TH-227	Not Detected	-----	3.65E-01
RA-223	Not Detected	-----	1.53E-01
RN-219	Not Detected	-----	4.19E-01
PB-211	Not Detected	-----	9.41E-01
TL-207	Not Detected	-----	1.58E+01
AM-241	Not Detected	-----	1.94E-01
PU-239	Not Detected	-----	3.63E+02
NP-237	<del>2.91E-01</del>	<del>1.25E-01</del>	2.37E-01
PA-233	Not Detected	-----	5.95E-02
TH-229	Not Detected	-----	2.03E-01

*not detected J 8/21/97*



Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	4.50E-02
AG-110m	Not Detected	-----	4.42E-02
EA-133	Not Detected	-----	5.82E-02
EE-7	Not Detected	-----	2.63E-01
BI-207	Not Detected	-----	3.07E-02
CD-109	Not Detected	-----	9.76E-01
CD-115	Not Detected	-----	9.66E-02
CE-139	Not Detected	-----	2.64E-02
CE-141	Not Detected	-----	4.76E-02
CE-144	Not Detected	-----	1.92E-01
CO-56	Not Detected	-----	3.85E-02
CO-57	Not Detected	-----	2.50E-02
CO-58	Not Detected	-----	3.58E-02
CO-60	Not Detected	-----	4.02E-02
CR-51	<del>5.11E-02</del>	<del>7.14E-02</del>	<del>1.24E-01</del>
CS-134	Not Detected	-----	4.83E-02
CS-137	1.12E-01	3.54E-02	2.70E-02
EU-152	Not Detected	-----	7.46E-02
EU-154	Not Detected	-----	2.05E-01
EU-155	Not Detected	-----	1.14E-01
FE-59	Not Detected	-----	7.84E-02
GD-153	Not Detected	-----	8.34E-02
HG-203	Not Detected	-----	3.16E-02
I-131	Not Detected	-----	3.20E-02
IR-192	Not Detected	-----	2.71E-02
K-40	1.28E+01	2.50E+00	3.49E-01
MN-52	Not Detected	-----	4.17E-02
MN-54	Not Detected	-----	3.89E-02
MO-99	Not Detected	-----	3.56E-01
NA-22	Not Detected	-----	4.68E-02
NA-24	Not Detected	-----	1.42E-01
NE-95	Not Detected	-----	1.96E-01
ND-147	Not Detected	-----	2.22E-01
NI-57	Not Detected	-----	9.69E-02
PB-210	Not Detected	-----	8.02E+00
RU-103	Not Detected	-----	3.10E-02
RU-106	Not Detected	-----	2.96E-01
SB-122	Not Detected	-----	5.69E-02
SB-124	Not Detected	-----	3.08E-02
SB-125	Not Detected	-----	8.79E-02
SN-113	Not Detected	-----	4.01E-02
SR-85	Not Detected	-----	3.92E-02
TA-182	Not Detected	-----	1.68E-01
TA-183	Not Detected	-----	1.94E-01
TC-99m	Not Detected	-----	6.82E-01
TL-201	Not Detected	-----	1.44E-01
XE-133	Not Detected	-----	1.43E-01
Y-88	Not Detected	-----	3.40E-02
ZN-65	Not Detected	-----	1.18E-01
ZR-95	Not Detected	-----	6.09E-02

*not detected 8/21/57*

Sandia National Laboratories  
 Radiation Protection Sample Diagnostics Program [881 Laboratory]  
 8-20-97 4:48:57 PM

Analyzed by: *J* 8/21/97 Reviewed by: *K 8/21/97*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 033669-003  
 Lab Sample ID : 70146503

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 790.000 gram  
 Sample Date/Time : 8-19-97 8:40:00 AM  
 Acquire Start Date/Time : 8-20-97 3:00:09 PM  
 Detector Name : LAB01  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	1.82E+00	1.14E+00	1.61E+00
TH-234	2.36E+00	5.86E-01	4.56E-01
RA-226	2.32E+00	6.21E-01	5.29E-01
PE-214	8.38E-01	1.42E-01	4.64E-02
BI-214	7.60E-01	1.42E-01	5.24E-02
TH-232	5.82E-01	3.30E-01	2.06E-01
RA-228	5.54E-01	1.81E-01	1.70E-01
AC-228	6.15E-01	1.69E-01	9.86E-02
TH-228	3.69E-01	6.10E-01	3.25E-01
RA-224	6.83E-01	3.13E-01	8.37E-02
PE-212	6.67E-01	1.13E-01	3.70E-02
BI-212	6.52E-01	3.55E-01	3.17E-01
TL-208	5.93E-01	1.39E-01	7.39E-02
U-235	Not Detected	-----	2.07E-01
TH-231	Not Detected	-----	8.60E+00
PA-231	Not Detected	-----	1.35E+00
TH-227	Not Detected	-----	3.43E-01
FA-223	Not Detected	-----	1.45E-01
RN-219	Not Detected	-----	4.16E-01
PE-211	Not Detected	-----	9.39E-01
TL-207	Not Detected	-----	1.51E+01
AM-241	Not Detected	-----	1.90E-01
PU-239	Not Detected	-----	3.49E+02
NP-237	<del>3.65E-01</del>	<del>1.22E-01</del>	2.33E-01
PA-233	Not Detected	-----	5.79E-02
TH-229	Not Detected	-----	1.93E-01

*not detected J 8/21/97*

[Summary Report] - Sample ID: : 70146503

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	4.19E-02
AG-110m	Not Detected	-----	4.06E-02
BA-133	Not Detected	-----	5.48E-02
BE-7	Not Detected	-----	2.41E-01
BI-207	Not Detected	-----	3.07E-02
CD-109	Not Detected	-----	9.54E-01
CD-115	Not Detected	-----	9.33E-02
CE-139	Not Detected	-----	2.63E-02
CE-141	Not Detected	-----	4.55E-02
CE-144	Not Detected	-----	1.90E-01
CO-56	Not Detected	-----	3.60E-02
CO-57	Not Detected	-----	2.40E-02
CO-58	Not Detected	-----	3.44E-02
CO-60	Not Detected	-----	3.79E-02
CR-51	Not Detected	-----	2.23E-01
CS-134	Not Detected	-----	4.71E-02
CS-137	8.74E-02	4.22E-02	2.19E-02
EU-152	Not Detected	-----	7.15E-02
EU-154	Not Detected	-----	1.92E-01
EU-155	Not Detected	-----	1.09E-01
FE-59	Not Detected	-----	7.70E-02
GD-153	Not Detected	-----	7.88E-02
HG-203	Not Detected	-----	3.03E-02
I-131	Not Detected	-----	3.07E-02
IR-192	Not Detected	-----	2.66E-02
K-40	1.19E+01	2.00E+00	2.76E-01
MN-52	Not Detected	-----	4.03E-02
MN-54	Not Detected	-----	3.38E-02
MO-99	Not Detected	-----	3.54E-01
NA-22	Not Detected	-----	4.37E-02
NA-24	Not Detected	-----	1.36E-01
NB-95	Not Detected	-----	1.88E-01
ND-147	Not Detected	-----	2.16E-01
NI-57	Not Detected	-----	1.03E-01
PB-210	Not Detected	-----	7.86E+00
RJ-103	Not Detected	-----	2.99E-02
RU-106	Not Detected	-----	2.94E-01
SB-122	Not Detected	-----	5.61E-02
SB-124	Not Detected	-----	3.08E-02
SB-125	Not Detected	-----	8.80E-02
SN-113	Not Detected	-----	3.60E-02
SR-85	Not Detected	-----	3.71E-02
TA-182	Not Detected	-----	1.73E-01
TA-183	Not Detected	-----	1.91E-01
TC-99m	Not Detected	-----	7.87E-01
TL-201	Not Detected	-----	1.42E-01
XE-133	Not Detected	-----	1.41E-01
Y-88	Not Detected	-----	2.96E-02
ZN-65	Not Detected	-----	1.17E-01
ZR-95	Not Detected	-----	5.94E-02

Analyzed by: *J 8/21/97* Reviewed by: *K 8/21/97*  
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Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 033670-003  
 Lab Sample ID : 70146504

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 843.000 gram  
 Sample Date/Time : 8-19-97 8:50:00 AM  
 Acquire Start Date/Time : 8-20-97 4:51:57 PM  
 Detector Name : LAB01  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	1.48E+00
TH-234	1.79E+00	4.77E-01	4.41E-01
RA-226	2.30E+00	9.02E-01	5.43E-01
PB-214	8.35E-01	1.40E-01	4.64E-02
BI-214	7.63E-01	1.43E-01	4.45E-02
TH-232	5.79E-01	3.32E-01	1.88E-01
RA-228	5.21E-01	2.06E-01	1.47E-01
AC-228	6.52E-01	2.04E-01	9.33E-02
TH-228	5.76E-01	3.24E-01	4.27E-01
PA-224	5.49E-01	3.50E-01	8.17E-02
PB-212	6.00E-01	1.10E-01	3.68E-02
BI-212	5.95E-01	4.48E-01	3.26E-01
TL-208	5.60E-01	1.36E-01	6.65E-02
U-235	Not Detected	-----	1.97E-01
TH-231	Not Detected	-----	8.40E+00
PA-231	Not Detected	-----	1.31E+00
TH-227	Not Detected	-----	3.18E-01
RA-223	Not Detected	-----	1.42E-01
RN-219	Not Detected	-----	3.99E-01
PB-211	Not Detected	-----	8.88E-01
TL-207	Not Detected	-----	1.37E+01
AM-241	Not Detected	-----	1.73E-01
PU-239	Not Detected	-----	3.28E+02
<del>NP-237</del>	<del>3.50E-01</del>	<del>1.10E-01</del>	<del>2.03E-01</del>
PA-233	Not Detected	-----	5.36E-02
TH-229	Not Detected	-----	1.86E-01

*Not detected J 8/21/97*

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.92E-02
AG-110m	Not Detected	-----	4.18E-02
BA-133	Not Detected	-----	5.26E-02
BE-7	Not Detected	-----	2.39E-01
BI-207	Not Detected	-----	2.90E-02
CD-109	Not Detected	-----	8.90E-01
CD-115	Not Detected	-----	8.98E-02
CE-139	Not Detected	-----	2.43E-02
CE-141	Not Detected	-----	4.40E-02
CE-144	Not Detected	-----	1.83E-01
CO-56	Not Detected	-----	3.41E-02
CO-57	Not Detected	-----	2.28E-02
CO-58	Not Detected	-----	3.23E-02
CO-60	Not Detected	-----	3.59E-02
CR-51	Not Detected	-----	2.22E-01
CS-134	Not Detected	-----	4.44E-02
CS-137	1.27E-01	1.46E-01	2.09E-02
EU-152	Not Detected	-----	6.91E-02
EU-154	Not Detected	-----	1.80E-01
EU-155	Not Detected	-----	1.04E-01
FE-59	Not Detected	-----	6.83E-02
FD-153	Not Detected	-----	7.75E-02
HG-203	Not Detected	-----	2.84E-02
I-131	Not Detected	-----	3.01E-02
IR-192	Not Detected	-----	2.59E-02
K-40	1.10E+01	1.78E+00	3.28E-01
MN-52	Not Detected	-----	3.70E-02
MN-54	Not Detected	-----	3.31E-02
MO-99	Not Detected	-----	3.27E-01
NA-22	Not Detected	-----	4.13E-02
NA-24	Not Detected	-----	1.47E-01
NB-95	Not Detected	-----	1.75E-01
ND-147	Not Detected	-----	2.02E-01
NI-57	Not Detected	-----	9.39E-02
PB-210	Not Detected	-----	7.14E+00
PU-103	Not Detected	-----	2.99E-02
PU-106	Not Detected	-----	2.55E-01
SB-122	Not Detected	-----	5.13E-02
SB-124	Not Detected	-----	2.89E-02
SB-125	Not Detected	-----	8.34E-02
SN-113	Not Detected	-----	3.69E-02
SR-85	Not Detected	-----	3.63E-02
TA-182	Not Detected	-----	1.60E-01
TA-183	Not Detected	-----	1.76E-01
TC-99m	Not Detected	-----	9.15E-01
TL-201	Not Detected	-----	1.39E-01
TE-133	Not Detected	-----	1.40E-01
Tl-88	Not Detected	-----	2.95E-02
TN-65	Not Detected	-----	1.08E-01
TR-95	Not Detected	-----	5.52E-02

Analyzed by: *J* 8/21/97 Reviewed by: *K 8/21/97*  
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Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 033671-003  
 Lab Sample ID : 70146505

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 773.000 gram  
 Sample Date/Time : 8-19-97 8:55:00 AM  
 Acquire Start Date/Time : 8-20-97 6:38:44 PM  
 Detector Name : LAB01  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	2.74E+00	1.35E+00	1.68E+00
TH-234	2.91E+00	6.85E-01	4.56E-01
RA-226	2.15E+00	6.10E-01	5.45E-01
PB-214	7.36E-01	1.36E-01	4.72E-02
BI-214	7.38E-01	1.42E-01	5.17E-02
TH-232	6.18E-01	3.36E-01	2.03E-01
RA-228	5.93E-01	2.39E-01	1.60E-01
AC-228	5.39E-01	1.64E-01	9.60E-02
TH-228	5.22E-01	5.05E-01	4.97E-01
RA-224	6.07E-01	2.59E-01	7.59E-02
PB-212	5.47E-01	9.73E-02	3.58E-02
BI-212	6.13E-01	3.93E-01	3.21E-01
TL-208	4.77E-01	2.94E-01	6.76E-02
U-235	2.43E-01	1.49E-01	2.08E-01
TH-231	Not Detected	-----	8.41E+00
PA-231	Not Detected	-----	1.34E+00
TH-227	Not Detected	-----	3.24E-01
RA-223	Not Detected	-----	1.44E-01
RN-219	Not Detected	-----	3.80E-01
PB-211	Not Detected	-----	8.86E-01
TL-207	Not Detected	-----	1.33E+01
AM-241	Not Detected	-----	1.88E-01
PU-239	Not Detected	-----	3.34E+02
<del>NP-237</del>	<del>3.44E-01</del>	<del>1.66E-01</del>	<del>2.13E-01</del>
PA-233	Not Detected	-----	5.50E-02
TH-229	Not Detected	-----	1.94E-01

*not detected J 8/21/97*

[Summary Report] - Sample ID: : 70146505

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	4.03E-02
AG-110m	Not Detected	-----	4.09E-02
EA-133	Not Detected	-----	5.28E-02
EE-7	Not Detected	-----	2.54E-01
BI-207	Not Detected	-----	2.99E-02
CD-109	Not Detected	-----	9.25E-01
CD-115	Not Detected	-----	9.65E-02
CE-139	Not Detected	-----	2.52E-02
CE-141	Not Detected	-----	4.57E-02
CE-144	Not Detected	-----	1.85E-01
CO-56	Not Detected	-----	3.75E-02
CO-57	Not Detected	-----	2.30E-02
CO-58	Not Detected	-----	3.30E-02
CO-60	Not Detected	-----	3.77E-02
CR-51	Not Detected	-----	2.25E-01
CS-134	Not Detected	-----	4.63E-02
CS-137	1.01E-01	3.49E-02	2.46E-02
EU-152	Not Detected	-----	6.89E-02
EU-154	Not Detected	-----	1.87E-01
EU-155	Not Detected	-----	1.09E-01
FE-59	Not Detected	-----	7.35E-02
GD-153	Not Detected	-----	7.84E-02
HG-203	Not Detected	-----	3.03E-02
I-131	Not Detected	-----	3.19E-02
IR-192	Not Detected	-----	2.57E-02
K-40	9.98E+00	1.64E+00	3.10E-01
MN-52	Not Detected	-----	3.82E-02
MN-54	Not Detected	-----	3.48E-02
MO-99	Not Detected	-----	3.48E-01
NA-22	Not Detected	-----	4.11E-02
NA-24	Not Detected	-----	1.63E-01
NB-95	Not Detected	-----	1.81E-01
ND-147	Not Detected	-----	2.33E-01
NI-57	Not Detected	-----	1.04E-01
PB-210	Not Detected	-----	7.47E+00
RU-103	Not Detected	-----	2.95E-02
RU-106	Not Detected	-----	2.91E-01
SB-122	Not Detected	-----	5.87E-02
SB-124	Not Detected	-----	3.03E-02
SB-125	Not Detected	-----	8.21E-02
SN-113	Not Detected	-----	3.59E-02
SR-85	Not Detected	-----	3.74E-02
TA-182	Not Detected	-----	1.67E-01
TA-183	Not Detected	-----	1.94E-01
TC-99m	Not Detected	-----	1.16E+00
TL-201	Not Detected	-----	1.43E-01
XE-133	Not Detected	-----	1.44E-01
Y-88	Not Detected	-----	3.07E-02
ZN-65	Not Detected	-----	1.12E-01
ZR-95	Not Detected	-----	5.80E-02

Analyzed by: *[Signature]* 8/21/97 Reviewed by: *[Signature]* 8/21/97  
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Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 033672-003  
 Lab Sample ID : 70146506

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 882.000 gram  
 Sample Date/Time : 8-19-97 9:05:00 AM  
 Acquire Start Date/Time : 8-20-97 8:25:25 PM  
 Detector Name : LAB01  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	1.73E+00
TH-234	2.11E+00	5.36E-01	4.35E-01
RA-226	7.29E-01	7.49E-01	5.17E-01
PB-214	8.24E-01	1.37E-01	4.59E-02
BI-214	7.20E-01	1.45E-01	4.13E-02
TH-232	5.58E-01	3.10E-01	1.80E-01
RA-228	6.58E-01	2.23E-01	1.40E-01
AC-228	6.35E-01	1.96E-01	8.35E-02
TH-228	3.62E-01	2.98E-01	4.62E-01
RA-224	6.50E-01	2.89E-01	7.38E-02
PB-212	5.69E-01	1.03E-01	3.46E-02
BI-212	6.66E-01	3.02E-01	2.91E-01
TL-208	5.45E-01	1.43E-01	6.46E-02
U-235	7.40E-02	8.52E-02	1.11E-01
TH-231	Not Detected	-----	8.30E+00
PA-231	Not Detected	-----	1.30E+00
TH-227	Not Detected	-----	3.12E-01
RA-223	Not Detected	-----	1.40E-01
RN-219	Not Detected	-----	3.69E-01
PB-211	Not Detected	-----	8.48E-01
TL-207	Not Detected	-----	1.35E+01
AM-241	Not Detected	-----	1.74E-01
PU-239	Not Detected	-----	3.20E+02
<del>PF-237</del>	<del>3.91E-01</del>	<del>1.15E-01</del>	<del>1.98E-01</del>
PA-233	Not Detected	-----	5.23E-02
TH-229	Not Detected	-----	1.83E-01

*not detected* *[Signature]* 8/21/97



[Summary Report] - Sample ID: : 70146506

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.74E-02
AG-110m	Not Detected	-----	3.80E-02
BA-133	Not Detected	-----	5.20E-02
BE-7	Not Detected	-----	2.41E-01
BI-207	Not Detected	-----	2.63E-02
CD-109	Not Detected	-----	8.74E-01
CD-115	Not Detected	-----	9.09E-02
CE-139	Not Detected	-----	2.43E-02
CE-141	Not Detected	-----	4.30E-02
CE-144	<del>2.69E-02</del>	<del>3.51E-02</del>	6.81E-02
CO-56	Not Detected	-----	3.29E-02
CO-57	Not Detected	-----	2.16E-02
CO-58	Not Detected	-----	3.14E-02
CO-60	Not Detected	-----	3.38E-02
CR-51	Not Detected	-----	2.15E-01
CS-134	Not Detected	-----	4.35E-02
CS-137	8.79E-02	4.30E-02	2.47E-02
EU-152	Not Detected	-----	6.51E-02
EU-154	Not Detected	-----	1.74E-01
EU-155	Not Detected	-----	1.01E-01
FE-59	Not Detected	-----	7.03E-02
GD-153	Not Detected	-----	7.51E-02
HG-203	Not Detected	-----	2.76E-02
I-131	Not Detected	-----	3.02E-02
IR-192	Not Detected	-----	2.45E-02
K-40	1.07E+01	1.71E+00	2.79E-01
KN-52	Not Detected	-----	3.62E-02
KN-54	Not Detected	-----	3.39E-02
MO-99	Not Detected	-----	3.31E-01
NA-22	Not Detected	-----	3.93E-02
NA-24	Not Detected	-----	1.68E-01
NE-95	Not Detected	-----	1.79E-01
ND-147	Not Detected	-----	2.14E-01
NI-57	Not Detected	-----	1.00E-01
FE-210	Not Detected	-----	6.84E+00
RU-103	Not Detected	-----	2.80E-02
RU-106	Not Detected	-----	2.60E-01
SB-122	Not Detected	-----	5.01E-02
SB-124	Not Detected	-----	2.84E-02
SB-125	Not Detected	-----	8.12E-02
SN-113	Not Detected	-----	3.49E-02
SR-85	Not Detected	-----	3.46E-02
TA-182	Not Detected	-----	1.60E-01
TA-183	Not Detected	-----	1.81E-01
TC-99m	Not Detected	-----	1.35E+00
TL-201	Not Detected	-----	1.35E-01
XE-133	Not Detected	-----	1.44E-01
Y-88	Not Detected	-----	3.01E-02
ZN-65	Not Detected	-----	1.10E-01
ZR-95	Not Detected	-----	5.28E-02

*Not detected 7/8/21/82*

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 8-21-97 8:17:31 AM \*  
 \*\*\*\*\*

\* Analyzed by: *J* 8/21/97 Reviewed by: *KH 8/21/97* \*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 033673-003  
 Lab Sample ID : 70146507

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 803.000 gram  
 Sample Date/Time : 8-19-97 9:20:00 AM  
 Acquire Start Date/Time : 8-20-97 10:12:08 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	1.78E+00	1.28E+00	1.79E+00
TH-234	1.78E+00	5.72E-01	4.59E-01
RA-226	1.72E+00	5.15E-01	4.89E-01
PB-214	7.23E-01	1.40E-01	4.94E-02
BI-214	6.88E-01	1.95E-01	4.84E-02
TH-232	4.63E-01	3.29E-01	2.00E-01
RA-228	5.79E-01	2.19E-01	1.53E-01
AC-228	5.30E-01	2.09E-01	8.96E-02
TH-228	5.38E-01	2.03E-01	4.09E-01
RA-224	5.55E-01	2.21E-01	7.19E-02
PB-212	5.73E-01	1.03E-01	3.47E-02
BI-212	6.40E-01	3.41E-01	3.03E-01
TL-208	5.64E-01	1.13E-01	6.50E-02
U-235	Not Detected	-----	1.94E-01
TH-231	Not Detected	-----	8.21E+00
PA-231	Not Detected	-----	1.30E+00
TH-227	Not Detected	-----	3.20E-01
RA-223	Not Detected	-----	1.40E-01
RN-219	Not Detected	-----	3.95E-01
PB-211	Not Detected	-----	8.80E-01
TL-207	Not Detected	-----	1.27E+01
AM-241	Not Detected	-----	1.72E-01
PU-239	Not Detected	-----	3.21E+02
NP-237	<del>4.67E-01</del>	<del>1.34E-01</del>	2.20E-01
FA-233	Not Detected	-----	5.43E-02
TH-229	Not Detected	-----	1.82E-01

*not detected J 8/21/97*

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	4.14E-02
AG-110m	Not Detected	-----	3.76E-02
BA-133	Not Detected	-----	5.26E-02
BE-7	Not Detected	-----	2.46E-01
BI-207	Not Detected	-----	2.84E-02
CD-109	Not Detected	-----	8.75E-01
CD-115	Not Detected	-----	9.52E-02
CE-139	Not Detected	-----	2.43E-02
CE-141	Not Detected	-----	4.33E-02
CE-144	Not Detected	-----	1.78E-01
CO-56	Not Detected	-----	3.54E-02
CO-57	Not Detected	-----	2.27E-02
CO-58	Not Detected	-----	3.10E-02
CO-60	Not Detected	-----	3.41E-02
CR-51	Not Detected	-----	2.20E-01
CS-134	Not Detected	-----	4.65E-02
CS-137	6.80E-02	2.68E-02	2.30E-02
EU-152	Not Detected	-----	6.82E-02
EU-154	Not Detected	-----	1.93E-01
EU-155	Not Detected	-----	1.03E-01
FE-59	Not Detected	-----	7.23E-02
ED-153	Not Detected	-----	7.42E-02
EG-203	Not Detected	-----	2.91E-02
F-131	Not Detected	-----	3.14E-02
FR-192	Not Detected	-----	2.55E-02
K-40	1.07E+01	2.24E+00	3.41E-01
KN-52	Not Detected	-----	4.06E-02
KN-54	Not Detected	-----	3.40E-02
KO-99	Not Detected	-----	3.55E-01
KA-22	Not Detected	-----	4.27E-02
KA-24	Not Detected	-----	1.67E-01
KB-95	Not Detected	-----	1.84E-01
KB-147	Not Detected	-----	2.18E-01
KI-57	Not Detected	-----	9.91E-02
KB-210	Not Detected	-----	7.18E+00
KU-103	Not Detected	-----	2.91E-02
KU-106	Not Detected	-----	2.77E-01
SB-122	Not Detected	-----	5.51E-02
SB-124	Not Detected	-----	2.90E-02
SB-125	Not Detected	-----	8.29E-02
SN-113	Not Detected	-----	3.59E-02
SR-85	Not Detected	-----	3.72E-02
TA-182	Not Detected	-----	1.61E-01
TA-183	Not Detected	-----	1.80E-01
TC-99m	Not Detected	-----	1.60E+00
TL-201	Not Detected	-----	1.40E-01
TE-133	Not Detected	-----	1.44E-01
Y-88	Not Detected	-----	2.84E-02
ZN-65	Not Detected	-----	1.10E-01
ZR-95	Not Detected	-----	5.68E-02

Analyzed by: *J* *8/21/97* Reviewed by: *K* *8/21/97*  
 \*\*\*\*\*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 033674-003  
 Lab Sample ID : 70146508

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 809.000 gram  
 Sample Date/Time : 8-19-97 9:30:00 AM  
 Acquire Start Date/Time : 8-20-97 11:58:55 PM  
 Detector Name : LAB01  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	1.10E+00	9.31E-01	1.52E+00
TH-234	1.42E+00	4.52E-01	4.40E-01
RA-226	3.57E-01	5.29E-01	5.16E-01
PB-214	7.90E-01	1.33E-01	4.19E-02
BI-214	6.79E-01	1.32E-01	4.72E-02
TH-232	5.05E-01	2.92E-01	1.94E-01
RA-228	5.06E-01	1.74E-01	1.46E-01
AC-228	5.60E-01	2.08E-01	8.28E-02
TH-228	3.05E-01	1.76E-01	4.65E-01
RA-224	4.66E-01	4.23E-01	9.33E-02
PB-212	5.30E-01	1.02E-01	3.64E-02
BI-212	5.83E-01	4.37E-01	3.09E-01
TL-208	4.69E-01	1.34E-01	6.51E-02
U-235	8.93E-02	9.00E-02	1.27E-01
TH-231	Not Detected	-----	7.85E+00
PA-231	Not Detected	-----	1.21E+00
TR-227	Not Detected	-----	3.10E-01
RA-223	Not Detected	-----	1.33E-01
RN-219	Not Detected	-----	3.63E-01
PB-211	Not Detected	-----	8.30E-01
TL-207	Not Detected	-----	1.32E+01
AM-241	Not Detected	-----	1.71E-01
PU-239	Not Detected	-----	3.10E+02
NE-237	<del>4.75E-02</del>	<del>2.48E-02</del>	2.02E-01
PA-233	Not Detected	-----	5.12E-02
TH-229	Not Detected	-----	1.77E-01

*Not detected J 8/21/97*

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected		3.87E-02
AG-110m	Not Detected		3.40E-02
BA-133	Not Detected		5.28E-02
BE-7	Not Detected		2.37E-01
BI-207	Not Detected		2.97E-02
CD-109	Not Detected		8.60E-01
CD-115	Not Detected		9.64E-02
CE-139	Not Detected		2.37E-02
CE-141	Not Detected		4.31E-02
CE-144	Not Detected		1.74E-01
CO-56	Not Detected		3.33E-02
CO-57	Not Detected		2.24E-02
CO-58	Not Detected		2.95E-02
CO-60	Not Detected		3.46E-02
CR-51	Not Detected		2.16E-01
CS-134	Not Detected		4.41E-02
CS-137	5.36E-02	2.21E-02	1.96E-02
EU-152	Not Detected		6.73E-02
EU-154	Not Detected		1.79E-01
EU-155	Not Detected		9.93E-02
FE-59	Not Detected		7.37E-02
GD-153	Not Detected		7.22E-02
HG-203	Not Detected		2.85E-02
I-131	Not Detected		2.91E-02
IR-192	Not Detected		2.43E-02
K-40	9.06E+00	1.57E+00	3.19E-01
MA-52	Not Detected		3.82E-02
MA-54	<del>2.35E-02</del>	<del>1.45E-02</del>	2.04E-02
MO-99	Not Detected		3.48E-01
NA-22	Not Detected		4.15E-02
NA-24	Not Detected		1.75E-01
NB-95	Not Detected		1.79E-01
ND-147	Not Detected		2.17E-01
NI-57	Not Detected		1.06E-01
PB-210	Not Detected		7.05E+00
RU-103	Not Detected		2.75E-02
RU-106	Not Detected		2.67E-01
SB-122	Not Detected		5.61E-02
SB-124	Not Detected		2.84E-02
SB-125	Not Detected		8.02E-02
SN-113	Not Detected		3.39E-02
SR-85	Not Detected		3.49E-02
TA-182	Not Detected		1.56E-01
TA-183	Not Detected		1.81E-01
TC-99m	Not Detected		1.84E+00
TL-201	Not Detected		1.38E-01
XE-133	Not Detected		1.43E-01
Y-88	Not Detected		3.05E-02
ZN-65	Not Detected		1.06E-01
ZR-95	Not Detected		5.43E-02

*not detected* *J 8/21/97*

Sandia National Laboratories  
 Radiation Protection Sample Diagnostics Program [881 Laboratory]  
 8-21-97 3:30:00 AM

Analyzed by: *J*

*8/21/97*

Reviewed by: *K*

*8/21/97*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 033675-003  
 Lab Sample ID : 70146509

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 793.000 gram  
 Sample Date/Time : 8-19-97 9:40:00 AM  
 Acquire Start Date/Time : 8-21-97 1:45:49 AM  
 Detector Name : LAB01  
 Lapsed Live/Real Time : 6000 / 6002 seconds

Comments:

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	1.36E+00
TH-234	1.10E+00	3.95E-01	4.18E-01
RA-226	1.87E+00	5.28E-01	5.03E-01
PB-214	7.52E-01	2.59E-01	4.27E-02
BI-214	7.34E-01	1.58E-01	4.42E-02
TH-232	4.91E-01	9.80E-01	1.97E-01
RA-228	3.72E-01	1.60E-01	1.55E-01
AC-228	4.68E-01	1.71E-01	8.62E-02
TH-228	1.99E-01	1.98E-01	3.89E-01
RA-224	4.33E-01	3.01E-01	6.34E-02
PB-212	4.62E-01	9.36E-02	3.51E-02
BI-212	5.76E-01	7.29E-01	2.95E-01
TL-208	4.13E-01	1.02E-01	6.73E-02
U-235	Not Detected	-----	1.86E-01
TH-231	Not Detected	-----	7.90E+00
PA-231	Not Detected	-----	1.28E+00
TH-227	Not Detected	-----	2.95E-01
RA-223	Not Detected	-----	1.35E-01
RN-219	Not Detected	-----	3.77E-01
PB-211	Not Detected	-----	8.40E-01
TL-207	Not Detected	-----	1.30E+01
AM-241	Not Detected	-----	1.69E-01
PU-239	Not Detected	-----	3.12E+02
NP-237	Not Detected	-----	2.48E-01
PA-233	Not Detected	-----	5.18E-02
TH-229	Not Detected	-----	1.76E-01

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.91E-02
AG-110m	Not Detected	-----	3.39E-02
EA-133	Not Detected	-----	5.21E-02
EE-7	Not Detected	-----	2.24E-01
EI-207	Not Detected	-----	2.93E-02
CD-109	<del>2.06E+00</del>	<del>3.75E-01</del>	6.50E-01
CD-115	Not Detected	-----	9.61E-02
CE-139	Not Detected	-----	2.38E-02
CE-141	Not Detected	-----	4.16E-02
CE-144	Not Detected	-----	1.73E-01
CO-56	Not Detected	-----	3.24E-02
CO-57	Not Detected	-----	2.19E-02
CO-58	Not Detected	-----	3.20E-02
CO-60	Not Detected	-----	3.82E-02
CR-51	Not Detected	-----	2.21E-01
CS-134	Not Detected	-----	4.48E-02
CS-137	4.94E-02	3.51E-02	2.07E-02
EU-152	Not Detected	-----	6.49E-02
EU-154	Not Detected	-----	1.81E-01
EU-155	Not Detected	-----	9.73E-02
FE-59	Not Detected	-----	6.53E-02
GD-153	Not Detected	-----	7.32E-02
HG-203	Not Detected	-----	2.78E-02
I-131	Not Detected	-----	3.02E-02
IR-192	Not Detected	-----	2.48E-02
K-40	7.93E+00	1.36E+00	3.14E-01
KN-52	Not Detected	-----	3.77E-02
KN-54	Not Detected	-----	3.12E-02
MO-99	Not Detected	-----	3.55E-01
NA-22	Not Detected	-----	3.69E-02
NA-24	Not Detected	-----	2.19E-01
NB-95	Not Detected	-----	1.75E-01
ND-147	Not Detected	-----	2.12E-01
NI-57	Not Detected	-----	1.04E-01
FB-210	Not Detected	-----	6.65E+00
RU-103	Not Detected	-----	2.81E-02
RU-106	Not Detected	-----	2.64E-01
SB-122	Not Detected	-----	5.51E-02
SB-124	Not Detected	-----	2.87E-02
SB-125	Not Detected	-----	8.16E-02
SN-113	Not Detected	-----	3.35E-02
SR-85	Not Detected	-----	3.29E-02
TA-182	Not Detected	-----	1.54E-01
TA-183	Not Detected	-----	1.80E-01
TC-99m	Not Detected	-----	2.23E+00
TL-201	Not Detected	-----	1.37E-01
TE-133	Not Detected	-----	1.48E-01
Y-88	Not Detected	-----	2.80E-02
ZN-65	Not Detected	-----	1.07E-01
ZR-95	Not Detected	-----	5.22E-02

*not detected J 8/21/57*

Sandia National Laboratories  
Radiation Protection Sample Diagnostics Program [881 Laboratory]  
8-21-97 5:16:57 AM

Analyzed by: *J* 8/21/97 Reviewed by: *K* 8/21/97

Customer : M. MITCHELL/MAC (6685/SMO)  
Customer Sample ID : 033676-003  
Lab Sample ID : 70146510

Sample Description : MARINELLI SOLID SAMPLE  
Sample Quantity : 798.000 gram  
Sample Date/Time : 8-19-97 9:50:00 AM  
Acquire Start Date/Time : 8-21-97 3:32:34 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	1.05E+00	9.78E-01	1.56E+00
TH-234	1.57E+00	4.41E-01	4.60E-01
RA-226	1.73E+00	5.07E-01	5.09E-01
PB-214	7.13E-01	1.35E-01	4.89E-02
BI-214	7.47E-01	1.56E-01	4.81E-02
TH-232	5.02E-01	3.12E-01	2.02E-01
RA-228	5.03E-01	3.13E-01	1.33E-01
AC-228	5.65E-01	1.66E-01	9.38E-02
TH-228	3.74E-01	2.92E-01	4.29E-01
RA-224	5.95E-01	2.70E-01	8.32E-02
PB-212	5.86E-01	1.04E-01	3.49E-02
BI-212	4.82E-01	2.66E-01	2.87E-01
TL-208	5.12E-01	1.49E-01	6.50E-02
U-235	Not Detected	-----	1.91E-01
TH-231	Not Detected	-----	8.14E+00
PA-231	Not Detected	-----	1.29E+00
TH-227	Not Detected	-----	3.23E-01
RA-223	Not Detected	-----	1.41E-01
RN-219	Not Detected	-----	3.78E-01
PB-211	Not Detected	-----	8.36E-01
TL-207	<del>3.35E-00</del>	<del>3.73E-00</del>	7.10E+00
AM-241	Not Detected	-----	1.74E-01
PU-239	Not Detected	-----	3.16E+02
NP-237	Not Detected	-----	2.61E-01
PA-233	Not Detected	-----	5.46E-02
TH-229	Not Detected	-----	1.83E-01

*not detected J 8/21/97*



Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	4.02E-02
AG-110m	Not Detected	-----	3.84E-02
BA-133	Not Detected	-----	5.42E-02
BE-7	Not Detected	-----	2.45E-01
BI-207	Not Detected	-----	2.94E-02
CD-109	<del>1.12E+00</del>	<del>2.77E-01</del>	7.65E-01
CD-115	Not Detected	-----	1.01E-01
CE-139	Not Detected	-----	2.48E-02
CE-141	Not Detected	-----	4.24E-02
CE-144	Not Detected	-----	1.77E-01
CO-56	Not Detected	-----	2.49E-02
GO-57	Not Detected	-----	2.21E-02
CO-58	Not Detected	-----	3.14E-02
CO-60	Not Detected	-----	3.67E-02
CR-51	Not Detected	-----	2.27E-01
CS-134	Not Detected	-----	4.58E-02
CS-137	6.77E-02	2.67E-02	2.21E-02
EU-152	Not Detected	-----	6.62E-02
EU-154	Not Detected	-----	1.86E-01
EU-155	Not Detected	-----	1.01E-01
FE-59	Not Detected	-----	6.76E-02
GD-153	Not Detected	-----	7.48E-02
HG-203	Not Detected	-----	2.87E-02
I-131	Not Detected	-----	3.08E-02
IR-192	Not Detected	-----	2.61E-02
K-40	1.03E+01	1.77E+00	3.39E-01
MN-52	Not Detected	-----	3.99E-02
MN-54	Not Detected	-----	3.34E-02
MO-99	Not Detected	-----	3.69E-01
NA-22	Not Detected	-----	4.27E-02
NA-24	Not Detected	-----	2.24E-01
NB-95	Not Detected	-----	1.90E-01
ND-147	Not Detected	-----	2.14E-01
NI-57	Not Detected	-----	1.20E-01
PB-210	Not Detected	-----	7.20E+00
RU-103	Not Detected	-----	2.87E-02
RU-106	Not Detected	-----	2.78E-01
SB-122	Not Detected	-----	5.85E-02
SB-124	Not Detected	-----	2.86E-02
SB-125	Not Detected	-----	8.38E-02
SN-113	Not Detected	-----	3.68E-02
SR-85	Not Detected	-----	3.58E-02
TA-182	Not Detected	-----	1.60E-01
TA-183	Not Detected	-----	1.87E-01
TC-99m	Not Detected	-----	2.80E+00
TL-201	Not Detected	-----	1.48E-01
XE-133	Not Detected	-----	1.53E-01
Y-88	Not Detected	-----	2.70E-02
ZN-65	Not Detected	-----	1.09E-01
ZR-95	Not Detected	-----	6.05E-02

*not detected J 8/21/81*

\*\*\*\*\*  
 Sandia National Laboratories \*  
 Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 8-21-97 7:03:55 AM \*  
 \*\*\*\*\*  
 Analyzed by: *[Signature]* 8/21/97 Reviewed by: *[Signature]* 8/21/97 \*  
 \*\*\*\*\*  
 Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 033677-003  
 Lab Sample ID : 70146511  
  
 Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 752.000 gram  
 Sample Date/Time : 8-19-97 10:00:00 AM  
 Acquire Start Date/Time : 8-21-97 5:19:35 AM  
 Detector Name : LAB01  
 Lapsed Live/Real Time : 6000 / 6002 seconds  
  
 Comments:  
 \*\*\*\*\*

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	1.99E+00	1.18E+00	1.66E+00
TH-234	2.35E+00	6.37E-01	4.46E-01
RA-226	1.75E+00	1.28E+00	5.63E-01
FE-214	7.87E-01	1.54E-01	4.93E-02
BI-214	7.06E-01	1.52E-01	5.06E-02
TH-232	6.47E-01	3.41E-01	2.08E-01
RA-228	6.01E-01	2.95E-01	1.63E-01
AC-228	6.34E-01	2.24E-01	9.60E-02
TH-228	6.05E-01	5.76E-01	4.31E-01
RA-224	6.48E-01	2.44E-01	7.73E-02
FE-212	6.36E-01	1.20E-01	3.92E-02
BI-212	4.72E-01	3.98E-01	3.52E-01
TL-208	6.34E-01	1.63E-01	7.07E-02
U-235	Not Detected	-----	2.06E-01
TH-231	Not Detected	-----	8.62E+00
PA-231	Not Detected	-----	1.31E+00
TH-227	Not Detected	-----	3.47E-01
RA-223	Not Detected	-----	1.51E-01
RN-219	Not Detected	-----	4.00E-01
FE-211	Not Detected	-----	8.92E-01
TL-207	Not Detected	-----	1.45E+01
AM-241	Not Detected	-----	1.89E-01
PU-239	Not Detected	-----	3.44E+02
NP-237	<del>2.26E-01</del>	<del>1.33E-01</del>	2.12E-01
PA-233	Not Detected	-----	5.75E-02
TH-229	Not Detected	-----	1.99E-01

*Not detected 8/21/97*

[Summary Report] - Sample ID: : 70146511

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected		4.21E-02
AG-110m	Not Detected		3.86E-02
BA-133	Not Detected		5.63E-02
BE-7	Not Detected		2.54E-01
EI-207	Not Detected		2.94E-02
CD-109	Not Detected		9.36E-01
CD-115	Not Detected		1.14E-01
CE-139	Not Detected		2.62E-02
CE-141	Not Detected		4.57E-02
CE-144	Not Detected		1.90E-01
CO-56	Not Detected		3.80E-02
CO-57	Not Detected		2.37E-02
CO-58	Not Detected		3.42E-02
CO-60	Not Detected		3.83E-02
CR-51	Not Detected		2.32E-01
CS-134	Not Detected		4.55E-02
CS-137	5.85E-02	7.02E-02	3.17E-02
EU-152	Not Detected		7.16E-02
EU-154	Not Detected		1.95E-01
EU-155	Not Detected		1.15E-01
FE-59	Not Detected		7.74E-02
GD-153	Not Detected		8.07E-02
HG-203	Not Detected		2.93E-02
I-131	Not Detected		3.25E-02
IR-192	Not Detected		2.69E-02
K-40	1.09E+01	1.92E+00	3.22E-01
MN-52	Not Detected		4.07E-02
MN-54	Not Detected		3.46E-02
MO-99	Not Detected		3.95E-01
NA-22	Not Detected		4.22E-02
NA-24	Not Detected		2.64E-01
NE-95	Not Detected		2.08E-01
ND-147	Not Detected		2.33E-01
NI-67	Not Detected		1.24E-01
PB-210	Not Detected		7.77E-00
RU-103	Not Detected		3.04E-02
RU-106	Not Detected		2.98E-01
SB-122	Not Detected		6.40E-02
SB-124	Not Detected		3.06E-02
SB-125	Not Detected		8.91E-02
SN-113	Not Detected		3.74E-02
SR-85	Not Detected		3.74E-02
TA-182	Not Detected		1.74E-01
TA-183	Not Detected		2.06E-01
TC-99m	Not Detected		3.62E-00
TL-201	Not Detected		1.61E-01
XE-133	Not Detected		1.65E-01
Y-88	Not Detected		3.20E-02
ZN-65	Not Detected		1.19E-01
IR-95	Not Detected		5.88E-02

Sandia National Laboratories  
 Radiation Protection Sample Diagnostics Program [881 Laboratory]  
 8-21-97 8:48:15 AM

Analyzed by: *[Signature]* 8/21/97 Reviewed by: *[Signature]* 8/21/97  
 Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 033678-003  
 Lab Sample ID : 70146512

Sample Description : MARINELLI LIQUID SAMPLE  
 Sample Quantity : 500.000 mL  
 Sample Date/Time : 8-19-97 11:30:00 AM  
 Acquire Start Date/Time : 8-21-97 7:06:29 AM  
 Detector Name : LAB01  
 Elapsed Live/Real Time : 6000 / 6001 seconds

Comments:

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Nuclide Name	Activity (pCi/mL)	2-sigma Error	MDA (pCi/mL)
U-238	Not Detected	-----	7.96E-01
TH-234	Not Detected	-----	3.19E-01
RA-226	Not Detected	-----	4.78E-01
PB-214	Not Detected	-----	5.43E-02
BI-214	Not Detected	-----	5.15E-02
TH-232	Not Detected	-----	1.54E-01
RA-228	Not Detected	-----	1.61E-01
AC-228	Not Detected	-----	1.06E-01
TH-228	Not Detected	-----	5.36E-01
RA-224	Not Detected	-----	1.68E-01
PB-212	Not Detected	-----	4.01E-02
BI-212	Not Detected	-----	3.90E-01
TL-208	Not Detected	-----	7.72E-02
U-235	Not Detected	-----	1.30E-01
TH-231	Not Detected	-----	4.46E+00
PA-231	Not Detected	-----	1.00E+00
TH-227	Not Detected	-----	1.51E-01
RA-223	Not Detected	-----	7.81E-02
RN-219	Not Detected	-----	2.88E-01
PB-211	Not Detected	-----	6.85E-01
TL-207	Not Detected	-----	1.17E+01
AM-241	Not Detected	-----	1.00E-01
PU-239	Not Detected	-----	2.11E+02
NP-237	Not Detected	-----	1.39E-01
PA-233	Not Detected	-----	4.27E-02
TH-229	Not Detected	-----	1.22E-01

Nuclide Name	Activity (pCi/mL )	2-sigma Error	MDA (pCi/mL )
AG-108m	Not Detected	-----	2.64E-02
AG-110m	Not Detected	-----	2.23E-02
BA-133	Not Detected	-----	3.23E-02
BE-7	Not Detected	-----	2.15E-01
BE-207	Not Detected	-----	2.76E-02
BD-109	Not Detected	-----	4.74E-01
BD-115	Not Detected	-----	6.55E-02
BE-139	Not Detected	-----	1.86E-02
BE-141	Not Detected	-----	3.00E-02
BE-144	Not Detected	-----	1.26E-01
BO-56	Not Detected	-----	3.81E-02
BO-57	Not Detected	-----	1.56E-02
BO-58	Not Detected	-----	2.27E-02
BO-60	Not Detected	-----	3.02E-02
BR-51	Not Detected	-----	1.90E-01
BS-134	Not Detected	-----	2.30E-02
BS-137	Not Detected	-----	2.38E-02
BU-152	Not Detected	-----	4.67E-02
BU-154	Not Detected	-----	1.20E-01
BU-155	Not Detected	-----	6.76E-02
BE-59	Not Detected	-----	4.98E-02
BD-153	Not Detected	-----	4.71E-02
BG-203	Not Detected	-----	2.12E-02
I-131	Not Detected	-----	2.68E-02
IR-192	Not Detected	-----	2.11E-02
K-40	Not Detected	-----	3.67E-01
DN-52	Not Detected	-----	3.52E-02
DN-54	Not Detected	-----	2.48E-02
KO-99	Not Detected	-----	2.76E-01
JA-22	Not Detected	-----	2.78E-02
JA-24	Not Detected	-----	2.06E-01
VB-95	Not Detected	-----	9.75E-02
JD-147	Not Detected	-----	1.90E-01
JE-57	Not Detected	-----	7.79E-02
BB-210	Not Detected	-----	3.57E+00
BU-103	Not Detected	-----	2.65E-02
BU-106	Not Detected	-----	2.40E-01
BE-122	Not Detected	-----	5.00E-02
BE-124	Not Detected	-----	2.21E-02
BE-125	Not Detected	-----	6.41E-02
BN-113	Not Detected	-----	2.95E-02
BR-85	Not Detected	-----	3.19E-02
BA-162	Not Detected	-----	7.94E-02
BA-163	Not Detected	-----	1.09E-01
BO-99m	Not Detected	-----	2.47E+00
BL-201	Not Detected	-----	8.35E-02
BE-133	Not Detected	-----	8.94E-02
K-88	Not Detected	-----	2.88E-02
BN-65	Not Detected	-----	5.70E-02
IR-95	Not Detected	-----	4.19E-02

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 8-21-97 9:02:56 AM \*  
 \*\*\*\*\*

\* Analyzed by: *[Signature]* 8/21/97 Reviewed by: *[Signature]* 8/21/97 \*  
 \*\*\*\*\*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : LAB CONTROL SAMPLE USING CG134  
 Lab Sample ID : 70146513

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 : 8-21-97 8:50:55 AM  
 Detector Name : LAB01  
 Elapsed Live/Real Time : 600 / 605 seconds

Comments:  
 \*\*\*\*\*

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
U-238	Not Detected	-----	8.89E+03
TH-234	Not Detected	-----	3.45E+03
RA-226	Not Detected	-----	5.96E+03
PB-214	Not Detected	-----	8.00E+02
EI-214	Not Detected	-----	6.96E+02
TH-232	Not Detected	-----	2.35E+03
RA-228	Not Detected	-----	3.38E+03
AC-228	Not Detected	-----	1.98E+03
TH-228	Not Detected	-----	8.63E+04
RA-224	Not Detected	-----	9.77E+02
PB-212	Not Detected	-----	6.42E+03
EI-212	Not Detected	-----	6.39E+04
TL-208	Not Detected	-----	1.32E+04
U-235	Not Detected	-----	1.58E+03
TH-231	Not Detected	-----	5.47E+04
PA-231	Not Detected	-----	1.53E+04
TH-227	Not Detected	-----	2.60E+03
RA-223	Not Detected	-----	1.00E+26
RN-219	Not Detected	-----	6.67E+03
PB-211	Not Detected	-----	1.51E+04
TL-207	Not Detected	-----	2.75E+05
AM-241	8.43E+04	1.44E+04	1.49E+03
FU-239	Not Detected	-----	2.54E+06
NP-237	Not Detected	-----	1.73E+03
PA-233	Not Detected	-----	6.61E+02
TH-229	Not Detected	-----	1.40E+03

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
AG-108m	Not Detected	-----	4.06E+02
AG-110m	Not Detected	-----	1.84E+06
BA-133	Not Detected	-----	7.67E+02
BE-7	Not Detected	-----	4.22E+17
BI-207	Not Detected	-----	3.84E+02
CD-109	2.95E+05	1.22E+05	1.49E+05
CD-115	Not Detected	-----	1.00E+26
CE-139	Not Detected	-----	5.71E+07
CE-141	Not Detected	-----	1.00E+26
CE-144	Not Detected	-----	6.14E+05
CO-56	Not Detected	-----	2.32E+12
CO-57	Not Detected	-----	1.02E+05
CO-58	Not Detected	-----	1.48E+13
CO-60	7.59E+04	1.05E+04	4.90E+02
CR-51	Not Detected	-----	1.00E+26
CS-134	Not Detected	-----	3.37E+03
CS-137	6.87E+04	9.22E+03	3.58E+02
EU-152	Not Detected	-----	7.68E+02
EU-154	Not Detected	-----	3.12E+03
EU-155	Not Detected	-----	2.27E+03
FE-59	Not Detected	-----	6.96E+19
GD-153	Not Detected	-----	6.96E+05
HG-203	Not Detected	-----	3.51E+18
I-131	Not Detected	-----	1.00E+26
IR-192	Not Detected	-----	4.15E+12
K-40	Not Detected	-----	1.83E+03
MN-52	Not Detected	-----	1.00E+26
MN-54	Not Detected	-----	1.12E+05
MO-99	Not Detected	-----	1.00E+26
NA-22	Not Detected	-----	1.40E+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
PB-210	Not Detected	-----	6.87E+04
RU-103	Not Detected	-----	4.78E+21
RU-106	Not Detected	-----	3.69E+05
SB-122	Not Detected	-----	1.00E+26
SB-124	Not Detected	-----	9.13E+14
SB-125	Not Detected	-----	7.28E+03
SN-113	Not Detected	-----	1.56E+09
SR-85	Not Detected	-----	1.42E+14
TA-182	Not Detected	-----	4.90E+09
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	-----	1.77E+09
ZN-65	Not Detected	-----	1.33E+06
ZR-95	Not Detected	-----	3.35E+14

Internal Lab Batch No. 1144

ANALYSIS REQUEST AND CHAIN OF CUSTODY

AR/COC- 06897

Dept. No./Mail Stop: 6087 / MS 1144  
 Project/Task Manager: John W. White  
 Project Name: ER 3.18 12B/10A  
 Record Center Code: ER 1133/12B/10A  
 Logbook Ref No.: ER-513  
 Service Order No.: CF-0403

Date Samples Shipped: 7/14/97  
 Carrier/Waybill No.: 10  
 Lab Contact: John W. White  
 Lab Destination: RMSD Bldg  
 SMO Contact/Phone: 703-591-1107  
 Send Report to SMO Per. 1133-7

Contract No.: NA  
 Case No.: 1144-1144  
 SMO Authorization: SMO  
 Bill to: Sandia National Laboratories  
 Supplier Services Department  
 P.O. Box 5800 MS 0154  
 Albuquerque, NM 87185-0154

Parameter & Method Requested

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)					Lab Sample ID	
									Sample Matrix	Type	Volume	Preservative	Sample Collection Method		Sample Type
	<u>NA</u>		<u>NA</u>	<u>3 4 5 7 - 0 3</u>	<u>CY118-SP11-01-5</u>	<u>0</u>	<u>121</u>	<u>07-12-97 1020</u>	<u>S</u>	<u>P</u>	<u>50ml</u>	<u>None</u>	<u>C</u>	<u>SA</u>	<u>X</u>
				<u>3 4 5 8 - 0 3</u>	<u>CY118-SP11-01-5D</u>			<u>1035</u>						<u>DU</u>	<u>X</u>
				<u>3 4 5 9 - 0 3</u>	<u>CY118-SP12-01-5</u>			<u>1030</u>						<u>SA</u>	<u>X</u>
				<u>3 4 5 10 - 0 3</u>	<u>CY118-SP13-01-5</u>			<u>1035</u>							<u>X</u>
				<u>3 4 5 11 - 0 3</u>	<u>CY118-SP14-01-5</u>			<u>1040</u>							<u>X</u>
				<u>3 4 5 12 - 0 3</u>	<u>CY118-SP15-01-5</u>			<u>1050</u>							<u>X</u>

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) 9/14/97  
 Entered by: [Signature]

Special Instructions/QC Requirements  
 • AR-COC 06897 release  
 AR-COC 06897 to LAS

Abnormal Conditions on Receipt

Sample Team Members	Name	Signature	Init.	Company/Organization/Phone
	<u>Gilbert L. [Name]</u>	<u>[Signature]</u>	<u>GL</u>	<u>IT Corp / 604 1234567</u>

1. Relinquished by <u>[Signature]</u> Org. <u>6084</u> Date <u>07/14/97</u> Time <u>1000</u>	4. Relinquished by _____ Org. _____ Date _____ Time _____
1. Received by <u>[Signature]</u> Org. <u>SAN 7578</u> Date <u>7/31/97</u> Time <u>1000</u>	4. Received by _____ Org. _____ Date _____ Time _____
2. Relinquished by <u>[Signature]</u> Org. <u>7578</u> Date <u>7/31/97</u> Time <u>1035</u>	5. Relinquished by _____ Org. _____ Date _____ Time _____
2. Received by <u>[Signature]</u> Org. <u>7578</u> Date <u>7/31/97</u> Time <u>1035</u>	5. Received by _____ Org. _____ Date _____ Time _____
3. Relinquished by <u>[Signature]</u> Org. <u>SAN 7578</u> Date <u>7/14/97</u> Time <u>0945</u>	6. Relinquished by _____ Org. _____ Date _____ Time _____
3. Received by <u>[Signature]</u> Org. <u>7578</u> Date <u>7/14/97</u> Time <u>0945</u>	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





\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 11-03-97 4:51:47 PM \*  
 \*\*\*\*\*  
 \* Analyzed by: *[Signature]* 11/11/97. Reviewed by: *[Signature]* \*

Customer : M. MITCHELL/D. BISWELL 6685/SMO  
 Customer Sample ID : 034047-003  
 Lab Sample ID : 70153401

Sample Description : SOIL MARINELLI SAMPLE  
 Sample Quantity : 783.000 gram  
 Sample Date/Time : 9-02-97 10:00:00 AM  
 Acquire Start Date/Time : 9-03-97 10:43:12 AM  
 Detector Name : LAB04  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	2.45E+00	8.71E-01	1.44E+00
TH-234	2.78E+00	6.50E-01	4.04E-01
RA-226	2.10E+00	7.42E-01	4.09E-01
PB-214	7.98E-01	1.29E-01	3.45E-02
BI-214	6.93E-01	1.29E-01	3.60E-02
PB-210	Not Detected	-----	8.56E+00
TH-232	5.69E-01	2.87E-01	1.24E-01
RA-228	5.57E-01	1.91E-01	1.08E-01
AC-228	5.76E-01	1.38E-01	5.91E-02
TH-228	5.31E-01	1.85E-01	4.00E-01
RA-224	6.52E-01	2.24E-01	7.34E-02
PB-212	6.21E-01	1.06E-01	3.30E-02
BI-212	6.53E-01	3.54E-01	2.43E-01
TL-208	5.46E-01	1.26E-01	6.04E-02
U-235	1.95E-01	1.69E-01	1.90E-01
TH-231	Not Detected	-----	1.92E+00
PA-231	Not Detected	-----	3.25E+00
TH-227	Not Detected	-----	2.85E-01
RA-223	Not Detected	-----	1.09E-01
RN-219	Not Detected	-----	3.17E-01
PB-211	Not Detected	-----	7.07E-01
TL-207	Not Detected	-----	1.05E+01
AM-241	Not Detected	-----	2.16E-01
PU-239	Not Detected	-----	3.13E+02
NP-237	Not Detected	-----	1.83E-01
PA-233	Not Detected	-----	4.90E-02
TH-229	Not Detected	-----	1.86E-01

[Summary Report] - Sample ID: : 70153401

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.32E-02
AG-110m	Not Detected	-----	2.98E-02
BA-133	Not Detected	-----	6.13E-02
BE-7	Not Detected	-----	2.05E-01
CD-109	<del>1.78E+00</del>	<del>4.20E-01</del>	6.22E-01
CD-115	Not Detected	-----	7.30E-02
CE-139	Not Detected	-----	2.37E-02
CE-141	Not Detected	-----	4.19E-02
CE-144	Not Detected	-----	1.72E-01
CO-56	Not Detected	-----	2.48E-02
CO-57	Not Detected	-----	2.25E-02
CO-58	Not Detected	-----	2.58E-02
CO-60	Not Detected	-----	2.91E-02
CR-51	Not Detected	-----	1.98E-01
CS-134	Not Detected	-----	4.30E-02
CS-137	5.28E-02	2.57E-02	1.88E-02
EU-152	Not Detected	-----	6.75E-02
EU-154	Not Detected	-----	1.52E-01
EU-155	Not Detected	-----	1.03E-01
FE-59	Not Detected	-----	5.47E-02
GD-153	Not Detected	-----	8.06E-02
HG-203	Not Detected	-----	2.62E-02
I-131	Not Detected	-----	2.52E-02
IR-192	Not Detected	-----	2.30E-02
K-40	1.02E+01	1.59E+00	2.11E-01
MN-52	Not Detected	-----	2.64E-02
MN-54	Not Detected	-----	2.70E-02
MO-99	Not Detected	-----	2.32E-01
NA-22	Not Detected	-----	3.12E-02
NA-24	Not Detected	-----	8.19E-02
NB-95	Not Detected	-----	1.60E-01
ND-147	Not Detected	-----	1.73E-01
NI-57	Not Detected	-----	6.78E-02
RU-103	Not Detected	-----	2.48E-02
RU-106	Not Detected	-----	2.31E-01
SB-122	Not Detected	-----	4.12E-02
SB-124	Not Detected	-----	2.49E-02
SB-125	Not Detected	-----	6.61E-02
SN-113	Not Detected	-----	3.07E-02
SR-85	Not Detected	-----	3.02E-02
TA-182	Not Detected	-----	1.29E-01
TA-183	Not Detected	-----	2.10E-01
TC-99m	Not Detected	-----	4.03E-01
TL-201	Not Detected	-----	1.29E-01
XE-133	<del>5.53E-02</del>	<del>3.32E-02</del>	1.04E-01
Y-88	Not Detected	-----	2.04E-02
ZN-65	Not Detected	-----	8.75E-02
ZR-95	Not Detected	-----	4.32E-02

*Not detected*  
*7/11/57*

*Not detected*  
*7/11/57*

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-03-97 2:12:30 PM \*  
 \*\*\*\*\*  
 \* Analyzed by: *[Signature]* 9/3/97 Reviewed by: *[Signature]* 9/4/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/D.BISWELL 6685/SMO  
 Customer Sample ID : 034048-003  
 Lab Sample ID : 70153402

Sample Description : SOIL MARINELLI SAMPLE  
 Sample Quantity : 751.000 gram  
 Sample Date/Time : 9-02-97 10:05:00 AM  
 Acquire Start Date/Time : 9-03-97 12:26:38 PM  
 Detector Name : LAB04  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	2.26E+00	1.58E+00	1.21E+00
TH-234	2.44E+00	6.60E-01	4.13E-01
RA-226	2.26E+00	5.45E-01	4.36E-01
PB-214	7.84E-01	1.25E-01	3.82E-02
BI-214	7.08E-01	1.52E-01	3.56E-02
TH-232	5.62E-01	2.93E-01	1.20E-01
RA-228	6.82E-01	5.77E-01	1.04E-01
AC-228	5.57E-01	1.65E-01	7.04E-02
TH-228	3.83E-01	1.75E-01	4.19E-01
RA-224	6.07E-01	2.68E-01	7.68E-02
PB-212	6.09E-01	1.03E-01	3.41E-02
BI-212	6.86E-01	4.27E-01	2.44E-01
TL-208	5.18E-01	1.11E-01	5.67E-02
U-235	1.29E-01	1.55E-01	1.93E-01
TH-231	Not Detected	-----	8.66E+00
PA-231	Not Detected	-----	1.21E+00
TH-227	Not Detected	-----	2.93E-01
RA-223	Not Detected	-----	1.45E-01
RN-219	Not Detected	-----	3.17E-01
PB-211	Not Detected	-----	7.32E-01
TL-207	Not Detected	-----	1.13E+01
AM-241	Not Detected	-----	2.20E-01
PU-239	Not Detected	-----	3.25E+02
NP-237	Not Detected	-----	2.71E-01
PA-233	Not Detected	-----	5.05E-02
TH-229	Not Detected	-----	1.86E-01

[Summary Report] - Sample ID: : 70153402

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.33E-02
AG-110m	Not Detected	-----	3.16E-02
BA-133	Not Detected	-----	6.32E-02
BE-7	Not Detected	-----	2.20E-01
BI-207	Not Detected	-----	2.36E-02
CD-109	<del>1.32E+00</del>	<del>3.80E-01</del>	6.25E-01
CD-115	Not Detected	-----	7.53E-02
CE-139	Not Detected	-----	2.40E-02
CE-141	Not Detected	-----	4.22E-02
CE-144	Not Detected	-----	1.81E-01
CO-56	Not Detected	-----	2.50E-02
CO-57	Not Detected	-----	2.31E-02
CO-58	Not Detected	-----	2.40E-02
CO-60	Not Detected	-----	2.73E-02
CR-51	Not Detected	-----	2.05E-01
CS-134	Not Detected	-----	4.46E-02
CS-137	6.76E-02	2.19E-02	1.66E-02
EU-152	Not Detected	-----	6.96E-02
EU-154	Not Detected	-----	1.54E-01
EU-155	Not Detected	-----	1.07E-01
FE-59	Not Detected	-----	5.65E-02
GD-153	Not Detected	-----	8.21E-02
HG-203	Not Detected	-----	2.60E-02
I-131	Not Detected	-----	2.58E-02
IR-192	Not Detected	-----	2.39E-02
K-40	1.06E+01	1.66E+00	2.06E-01
MN-52	Not Detected	-----	2.98E-02
MN-54	Not Detected	-----	1.40E-02
MO-99	Not Detected	-----	2.59E-01
NA-22	Not Detected	-----	3.37E-02
NA-24	Not Detected	-----	8.69E-02
NB-95	Not Detected	-----	1.66E-01
ND-147	Not Detected	-----	1.80E-01
NI-57	Not Detected	-----	3.92E-02
PB-210	Not Detected	-----	8.58E+00
RU-103	Not Detected	-----	2.49E-02
RU-106	Not Detected	-----	2.34E-01
SB-122	Not Detected	-----	4.52E-02
SB-124	Not Detected	-----	2.63E-02
SB-125	Not Detected	-----	6.98E-02
SN-113	Not Detected	-----	3.05E-02
SR-85	Not Detected	-----	3.14E-02
TA-182	Not Detected	-----	1.33E-01
TA-183	Not Detected	-----	2.15E-01
TC-99m	Not Detected	-----	4.48E-01
TL-201	Not Detected	-----	1.35E-01
XE-133	Not Detected	-----	1.56E-01
Y-88	Not Detected	-----	2.01E-02
ZN-65	Not Detected	-----	9.09E-02
ZR-95	Not Detected	-----	4.46E-02

*not detected J 9/3/57*

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-03-97 4:00:02 PM \*  
 \*\*\*\*\*  
 \* Analyzed by: *J 9/3/97* Reviewed by: *J 9/4/97* \*

Customer : M.MITCHELL/D.BISWELL 6685/SMO  
 Customer Sample ID : 034049-003  
 Lab Sample ID : 70153403

Sample Description : SOIL MARINELLI SAMPLE  
 Sample Quantity : 739.000 gram  
 Sample Date/Time : 9-02-97 10:20:00 AM  
 Acquire Start Date/Time : 9-03-97 2:09:42 PM  
 Detector Name : LAB04  
 Elapsed Live/Real Time : 6000 / 6009 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	5.79E+01	1.38E+01	3.72E+00
TH-234	8.35E+01	1.59E+01	1.34E+00
RA-226	5.79E+00	3.65E+00	9.32E-01
PB-214	7.93E-01	1.44E-01	7.67E-02
BI-214	7.00E-01	1.32E-01	6.17E-02
TH-232	6.03E-01	6.50E-01	2.97E-01
RA-228	6.29E-01	2.66E-01	1.52E-01
AC-228	Not Detected	-----	1.81E-01
TH-228	Not Detected	-----	1.37E+00
RA-224	5.53E-01	2.15E-01	7.17E-02
PB-212	6.05E-01	1.14E-01	7.17E-02
BI-212	9.15E-01	6.00E-01	4.27E-01
TL-208	5.29E-01	1.66E-01	1.07E-01
U-235	1.07E+00	2.74E-01	3.00E-01
TH-231	Not Detected	-----	2.91E+01
PA-231	Not Detected	-----	2.63E+00
TH-227	Not Detected	-----	4.46E-01
RA-223	Not Detected	-----	4.88E-01
RN-219	Not Detected	-----	6.11E-01
PB-211	Not Detected	-----	1.38E+00
TL-207	<del>5.69E+00</del>	<del>7.12E+00</del>	9.86E+00
AM-241	Not Detected	-----	6.44E-01
PU-239	Not Detected	-----	7.85E+02
NP-237	Not Detected	-----	8.55E-01
PA-233	Not Detected	-----	1.09E-01
TH-229	Not Detected	-----	7.74E-01

*not detected J 9/3/97*

[Summary Report] - Sample ID: : 70153403

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	5.15E-02
AG-110m	Not Detected	-----	4.92E-02
BA-133	Not Detected	-----	8.71E-02
BE-7	Not Detected	-----	4.20E-01
BI-207	<del>1.72E-02</del>	<del>1.53E-02</del>	2.33E-02
CD-109	Not Detected	-----	2.83E+00
CD-115	Not Detected	-----	1.35E-01
CE-139	Not Detected	-----	5.91E-02
CE-141	Not Detected	-----	1.07E-01
CE-144	Not Detected	-----	4.43E-01
CO-56	Not Detected	-----	4.08E-02
CO-57	Not Detected	-----	5.79E-02
CO-58	Not Detected	-----	4.30E-02
CO-60	Not Detected	-----	3.05E-02
CR-51	Not Detected	-----	4.34E-01
CS-134	Not Detected	-----	5.74E-02
CS-137	7.61E-02	3.80E-02	3.13E-02
EU-152	Not Detected	-----	1.74E-01
EU-154	Not Detected	-----	2.37E-01
EU-155	Not Detected	-----	3.21E-01
FE-59	Not Detected	-----	6.61E-02
GD-153	Not Detected	-----	3.66E-01
HG-203	Not Detected	-----	5.43E-02
I-131	Not Detected	-----	5.47E-02
IR-192	Not Detected	-----	5.08E-02
K-40	1.02E+01	1.64E+00	2.27E-01
MN-52	Not Detected	-----	3.73E-02
MN-54	Not Detected	-----	4.32E-02
MO-99	Not Detected	-----	5.89E-01
NA-22	Not Detected	-----	3.61E-02
NA-24	Not Detected	-----	1.08E-01
NB-95	Not Detected	-----	2.56E-01
ND-147	Not Detected	-----	3.50E-01
NI-57	<del>7.15E-02</del>	<del>3.95E-02</del>	4.27E-02
PB-210	Not Detected	-----	2.35E+01
RU-103	Not Detected	-----	4.80E-02
RU-106	Not Detected	-----	4.14E-01
SB-122	Not Detected	-----	8.44E-02
SB-124	Not Detected	-----	4.39E-02
SB-125	Not Detected	-----	1.37E-01
SN-113	Not Detected	-----	6.21E-02
SR-85	Not Detected	-----	4.95E-02
TA-182	Not Detected	-----	1.39E-01
TA-183	Not Detected	-----	6.27E-01
TC-99m	Not Detected	-----	1.31E+00
TL-201	Not Detected	-----	4.11E-01
XE-133	Not Detected	-----	4.73E-01
Y-88	Not Detected	-----	3.39E-02
ZN-65	Not Detected	-----	9.27E-02
ZR-95	Not Detected	-----	8.43E-02

Not detected J 9/3/97

Not detected J 9/3/97

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Sandia National Laboratories  
Radiation Protection Sample Diagnostics Program [881 Laboratory]  
9-03-97 5:39:24 PM

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Analyzed by: *J* 9/3/97 Reviewed by: *Ka 9/4/97*  
\*\*\*\*\*

Customer : M. MITCHELL/D. BISWELL 6685/SMO  
Customer Sample ID : 034050-003  
Lab Sample ID : 70153404

Sample Description : SOIL MARINELLI SAMPLE  
Sample Quantity : 873.000 gram  
Sample Date/Time : 9-02-97 10:30:00 AM  
Acquire Start Date/Time : 9-03-97 3:51:13 PM  
Detector Name : LAB04  
Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	3.67E+00	1.22E+00	1.17E+00
TH-234	3.75E+00	9.39E-01	4.09E-01
RA-226	1.01E+00	6.20E-01	4.44E-01
PB-214	7.87E-01	1.14E-01	3.52E-02
BI-214	7.36E-01	1.25E-01	3.32E-02
TH-232	6.05E-01	2.97E-01	1.25E-01
RA-228	5.59E-01	1.91E-01	1.18E-01
AC-228	5.93E-01	1.48E-01	6.53E-02
TH-228	6.25E-01	1.86E-01	3.62E-01
RA-224	5.89E-01	3.40E-01	6.71E-02
PB-212	6.08E-01	1.04E-01	3.26E-02
BI-212	6.77E-01	3.75E-01	2.27E-01
TL-208	5.34E-01	1.05E-01	5.00E-02
U-235	7.64E-02	6.77E-02	1.03E-01
TH-231	Not Detected	-----	8.55E+00
PA-231	Not Detected	-----	1.18E+00
TH-227	Not Detected	-----	2.70E-01
RA-223	Not Detected	-----	1.46E-01
RN-219	Not Detected	-----	2.97E-01
PB-211	Not Detected	-----	6.75E-01
TL-207	Not Detected	-----	1.01E+01
AM-241	Not Detected	-----	2.13E-01
PU-239	Not Detected	-----	3.11E+02
NP-237	<del>4.30E-01</del>	<del>1.13E-01</del>	1.84E-01
PA-233	Not Detected	-----	4.61E-02
TH-229	Not Detected	-----	1.80E-01

*Not detected J 9/3/97*



Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected		3.09E-02
AG-110m	Not Detected		3.09E-02
BA-133	Not Detected		5.87E-02
BE-7	Not Detected		2.04E-01
BI-207	Not Detected		2.19E-02
CD-109	Not Detected		6.23E-01
CD-115	Not Detected		7.64E-02
CE-139	Not Detected		2.27E-02
CE-141	Not Detected		4.01E-02
CE-144	Not Detected		1.69E-01
CO-56	Not Detected		2.39E-02
CO-57	Not Detected		2.18E-02
CO-58	Not Detected		2.37E-02
CO-60	Not Detected		2.61E-02
CR-51	Not Detected		1.92E-01
CS-134	Not Detected		4.12E-02
CS-137	8.54E-02	2.35E-02	1.78E-02
EU-152	Not Detected		6.57E-02
EU-154	Not Detected		1.43E-01
EU-155	Not Detected		1.00E-01
FE-59	Not Detected		5.23E-02
GD-153	Not Detected		8.00E-02
HG-203	Not Detected		2.50E-02
I-131	Not Detected		2.55E-02
IR-192	Not Detected		2.22E-02
K-40	1.10E+01	1.67E+00	1.94E-01
MN-52	Not Detected		2.77E-02
MN-54	Not Detected		2.50E-02
MO-99	Not Detected		2.46E-01
NA-22	Not Detected		2.88E-02
NA-24	Not Detected		8.95E-02
NB-95	Not Detected		1.57E-01
ND-147	Not Detected		1.64E-01
NI-57	<del>8.68E-02</del>	<del>5.98E-02</del>	3.75E-02
PB-210	Not Detected		8.35E+00
PU-103	Not Detected		2.24E-02
PU-106	Not Detected		2.20E-01
SE-122	Not Detected		4.01E-02
SE-124	Not Detected		2.36E-02
SE-125	Not Detected		6.64E-02
SN-113	Not Detected		2.90E-02
SR-85	Not Detected		2.82E-02
TA-182	Not Detected		1.18E-01
TA-183	Not Detected		2.11E-01
TC-99m	Not Detected		6.06E-01
TL-201	Not Detected		1.34E-01
XE-133	Not Detected		1.56E-01
Y-88	Not Detected		2.00E-02
ZN-65	Not Detected		8.17E-02
ZR-95	Not Detected		4.25E-02

*Not detected 7/9/3/97*

Sandia National Laboratories  
 Radiation Protection Sample Diagnostics Program [881 Laboratory]  
 9-03-97 7:22:03 PM

Analyzed by: *[Signature]* 9/4/97 Reviewed by: *[Signature]* 9/4/97  
 Customer : M. MITCHELL/D. BISWELL 6685/SMO  
 Customer Sample ID : 034051-003  
 Lab Sample ID : 70153405

Sample Description : SOIL MARINELLI SAMPLE  
 Sample Quantity : 746.000 gram  
 Sample Date/Time : 9-02-97 10:40:00 AM  
 Acquire Start Date/Time : 9-03-97 5:33:48 PM  
 Detector Name : LAB04  
 Elapsed Live/Real Time : 6000 / 6003 seconds

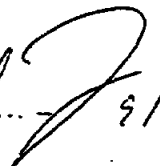
Comments:

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	1.77E+00
TH-234	1.39E+00	3.86E-01	4.26E-01
RA-226	2.03E+00	5.04E-01	4.50E-01
PB-214	7.95E-01	1.28E-01	3.83E-02
BI-214	7.35E-01	1.39E-01	3.95E-02
TH-232	7.73E-01	3.73E-01	1.24E-01
RA-228	7.73E-01	2.99E-01	1.29E-01
AC-228	7.72E-01	1.71E-01	6.69E-02
TH-228	7.30E-01	1.70E-01	4.67E-01
RA-224	7.82E-01	2.71E-01	6.87E-02
PB-212	7.60E-01	1.25E-01	3.51E-02
BI-212	6.88E-01	6.15E-01	2.48E-01
TL-208	6.67E-01	1.30E-01	5.29E-02
U-235	<del>1.95E-01</del>	<del>1.57E-01</del>	1.95E-01
TH-231	<del>7.84E-01</del>	<del>1.37E-01</del>	8.82E+00
PA-231	Not Detected	-----	1.25E+00
TH-227	Not Detected	-----	3.13E-01
RA-223	Not Detected	-----	1.47E-01
RN-219	Not Detected	-----	3.30E-01
PB-211	Not Detected	-----	7.55E-01
TL-207	Not Detected	-----	1.16E+01
AM-241	Not Detected	-----	2.16E-01
PU-239	Not Detected	-----	3.32E+02
NP-237	Not Detected	-----	2.80E-01
PA-233	Not Detected	-----	5.14E-02
TH-229	Not Detected	-----	1.90E-01

*not detected*  
*[Signature]* 9/4/97

[Summary Report] - Sample ID: : 70153405

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.45E-02
AG-110m	Not Detected	-----	3.16E-02
BA-133	Not Detected	-----	6.42E-02
BE-7	Not Detected	-----	2.25E-01
BI-207	Not Detected	-----	2.55E-02
CD-109	<del>1.86E+00</del>	<del>5.00E-01</del>	<del>6.26E-01</del>
CD-115	Not Detected	-----	8.70E-02
CE-139	Not Detected	-----	2.44E-02
CE-141	Not Detected	-----	4.28E-02
CE-144	Not Detected	-----	1.81E-01
CO-56	Not Detected	-----	2.60E-02
CO-57	Not Detected	-----	2.35E-02
CO-58	Not Detected	-----	2.63E-02
CO-60	Not Detected	-----	2.70E-02
CR-51	Not Detected	-----	2.07E-01
CS-134	Not Detected	-----	4.59E-02
CS-137	4.26E-02	1.96E-02	1.78E-02
EU-152	Not Detected	-----	7.06E-02
EU-154	Not Detected	-----	1.60E-01
EU-155	Not Detected	-----	1.09E-01
FE-59	Not Detected	-----	6.18E-02
GD-153	Not Detected	-----	8.30E-02
HG-203	Not Detected	-----	2.66E-02
I-131	Not Detected	-----	2.74E-02
IR-192	Not Detected	-----	2.43E-02
K-40	1.20E+01	1.86E+00	1.95E-01
MN-52	Not Detected	-----	2.93E-02
MN-54	Not Detected	-----	2.89E-02
MO-99	Not Detected	-----	2.74E-01
NA-22	Not Detected	-----	3.13E-02
NA-24	Not Detected	-----	1.08E-01
NB-95	Not Detected	-----	1.84E-01
ND-147	Not Detected	-----	1.89E-01
NI-57	Not Detected	-----	7.19E-02
PB-210	Not Detected	-----	8.87E+00
RU-103	Not Detected	-----	2.52E-02
RU-106	Not Detected	-----	2.50E-01
SB-122	Not Detected	-----	4.79E-02
SB-124	Not Detected	-----	2.65E-02
SB-125	Not Detected	-----	7.04E-02
SN-113	Not Detected	-----	3.22E-02
SR-85	Not Detected	-----	3.27E-02
TA-182	Not Detected	-----	1.34E-01
TA-183	Not Detected	-----	2.17E-01
TC-99m	Not Detected	-----	7.76E-01
TL-201	Not Detected	-----	1.44E-01
XE-133	Not Detected	-----	1.72E-01
Y-88	Not Detected	-----	2.34E-02
ZN-65	Not Detected	-----	9.06E-02
ZR-95	Not Detected	-----	4.78E-02

*not detected*  9/4/97

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-04-97 8:54:44 AM \*  
 \*\*\*\*\*

\* Analyzed by: *[Signature]* 9/4/97 Reviewed by: *[Signature]* 9/4/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/D.BISWELL (6685/SMO)  
 Customer Sample ID : 034052-003  
 Lab Sample ID : 70153406

Sample Description : MARINELLI SOIL SAMPLE  
 Sample Quantity : 853.000 gram  
 Sample Date/Time : 9-02-97 10:50:00 AM  
 Acquire Start Date/Time : 9-04-97 7:10:22 AM  
 Detector Name : LAB04  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	1.45E+00	8.31E-01	1.10E+00
TH-234	1.31E+00	3.86E-01	3.82E-01
RA-226	1.74E+00	4.48E-01	4.35E-01
PB-214	8.03E-01	1.25E-01	3.53E-02
BI-214	7.13E-01	1.41E-01	3.58E-02
TH-232	6.01E-01	2.88E-01	1.05E-01
RA-228	6.22E-01	1.94E-01	1.03E-01
AC-228	6.37E-01	1.43E-01	6.45E-02
TH-228	5.41E-01	1.94E-01	3.67E-01
RA-224	7.05E-01	2.15E-01	5.99E-02
PB-212	6.22E-01	1.02E-01	3.18E-02
BI-212	7.02E-01	3.30E-01	2.32E-01
TL-208	6.14E-01	1.16E-01	5.15E-02
U-235	Not Detected	-----	1.81E-01
TH-231	Not Detected	-----	8.20E+00
PA-231	Not Detected	-----	1.18E+00
TH-227	Not Detected	-----	2.74E-01
RA-223	Not Detected	-----	1.43E-01
RN-219	Not Detected	-----	2.91E-01
PB-211	Not Detected	-----	6.72E-01
TL-207	Not Detected	-----	1.06E+01
AM-241	Not Detected	-----	2.02E-01
PU-239	Not Detected	-----	3.11E+02
NP-237	Not Detected	-----	2.56E-01
PA-233	Not Detected	-----	4.94E-02
TH-229	Not Detected	-----	1.77E-01

[Summary Report] - Sample ID: : 70153406

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.06E-02
AG-110m	Not Detected	-----	3.51E-02
BA-133	Not Detected	-----	5.99E-02
BE-7	Not Detected	-----	2.06E-01
BI-207	Not Detected	-----	2.30E-02
CD-109	<del>1.66E+00</del>	<del>4.73E-01</del>	5.68E-01
CD-115	Not Detected	-----	9.31E-02
CE-139	Not Detected	-----	2.25E-02
CE-141	Not Detected	-----	4.11E-02
CE-144	Not Detected	-----	1.70E-01
CO-56	Not Detected	-----	2.39E-02
CO-57	Not Detected	-----	2.20E-02
CO-58	Not Detected	-----	2.33E-02
CO-60	Not Detected	-----	2.73E-02
CR-51	Not Detected	-----	1.99E-01
CS-134	Not Detected	-----	4.24E-02
CS-137	1.33E-01	3.08E-02	1.68E-02
EU-152	Not Detected	-----	6.59E-02
EU-154	Not Detected	-----	1.41E-01
EU-155	Not Detected	-----	9.82E-02
FE-59	Not Detected	-----	5.64E-02
GD-153	Not Detected	-----	7.66E-02
HG-203	Not Detected	-----	2.53E-02
I-131	Not Detected	-----	2.62E-02
IR-192	Not Detected	-----	2.33E-02
K-40	1.14E+01	1.76E+00	2.06E-01
MN-52	Not Detected	-----	2.87E-02
MN-54	Not Detected	-----	2.59E-02
MO-99	Not Detected	-----	2.91E-01
NA-22	Not Detected	-----	3.00E-02
NA-24	Not Detected	-----	1.92E-01
NB-95	Not Detected	-----	1.80E-01
ND-147	Not Detected	-----	1.75E-01
NI-57	Not Detected	-----	9.77E-02
PB-210	Not Detected	-----	8.27E+00
RU-103	Not Detected	-----	2.43E-02
RU-106	Not Detected	-----	2.24E-01
SB-122	Not Detected	-----	4.99E-02
SB-124	Not Detected	-----	2.49E-02
SB-125	Not Detected	-----	6.95E-02
SN-113	Not Detected	-----	2.97E-02
SR-85	Not Detected	-----	3.00E-02
TA-182	Not Detected	-----	1.24E-01
TA-183	Not Detected	-----	2.20E-01
TC-99m	Not Detected	-----	3.35E+00
TL-201	Not Detected	-----	1.50E-01
XE-133	Not Detected	-----	1.88E-01
Y-88	Not Detected	-----	2.16E-02
ZN-65	Not Detected	-----	8.37E-02
ZR-95	Not Detected	-----	4.36E-02

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-04-97 9:09:00 AM \*  
 \*\*\*\*\*  
 \* Analyzed by: *[Signature]* 9/4/97 Reviewed by: *[Signature]* 9/4/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/D.BISWELL (6685/SMO)  
 Customer Sample ID : LAB CONTROL SAMPLE USING CG134  
 Lab Sample ID : 70153407

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 : 9-04-97 8:55:58 AM  
 Detector Name : LAB04  
 Elapsed Live/Real Time : 600 / 606 seconds

Comments:

\*\*\*\*\*

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
U-238	Not Detected	-----	2.37E+04
TH-234	Not Detected	-----	3.33E+03
RA-226	Not Detected	-----	5.57E+03
PB-214	Not Detected	-----	6.61E+02
BI-214	Not Detected	-----	6.08E+02
TH-232	Not Detected	-----	2.11E+03
RA-228	Not Detected	-----	2.65E+03
AC-228	Not Detected	-----	1.48E+03
TH-228	Not Detected	-----	7.92E+04
RA-224	Not Detected	-----	3.09E+03
PB-212	Not Detected	-----	5.50E+03
BI-212	Not Detected	-----	4.91E+04
TL-208	Not Detected	-----	1.05E+04
U-235	Not Detected	-----	1.46E+03
TH-231	Not Detected	-----	5.41E+04
PA-231	Not Detected	-----	1.35E+04
TH-227	Not Detected	-----	2.22E+03
RA-223	Not Detected	-----	1.00E+26
RN-219	Not Detected	-----	5.33E+03
PB-211	Not Detected	-----	1.21E+04
TL-207	4.69E+04	4.68E+04	8.65E+04
AM-241	8.57E+04	1.43E+04	1.42E+03
PU-239	Not Detected	-----	2.38E+06
NP-237	Not Detected	-----	1.71E+03
FA-233	Not Detected	-----	5.98E+02
TH-229	Not Detected	-----	1.34E+03

[Summary Report] - Sample ID: : 70153407

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
AG-108m	Not Detected	-----	3.18E+02
AG-110m	Not Detected	-----	1.63E+06
BA-133	Not Detected	-----	6.53E+02
BE-7	Not Detected	-----	4.34E+17
BI-207	Not Detected	-----	3.16E+02
CD-109	3.29E+05	2.54E+05	1.53E+05
CD-115	Not Detected	-----	1.00E+26
CE-139	Not Detected	-----	5.65E+07
CE-141	Not Detected	-----	1.00E+26
CE-144	Not Detected	-----	5.95E+05
CO-56	Not Detected	-----	1.97E+12
CO-57	Not Detected	-----	1.02E+05
CO-58	Not Detected	-----	1.39E+13
CO-60	8.07E+04	1.09E+04	3.94E+02
CR-51	Not Detected	-----	1.00E+26
CS-134	Not Detected	-----	2.78E+03
CS-137	7.26E+04	1.02E+04	2.66E+02
EU-152	Not Detected	-----	7.48E+02
EU-154	Not Detected	-----	2.44E+03
EU-155	Not Detected	-----	2.12E+03
FE-59	Not Detected	-----	6.16E+19
GD-153	Not Detected	-----	7.00E+05
HG-203	Not Detected	-----	3.75E+18
I-131	Not Detected	-----	1.00E+26
IR-192	Not Detected	-----	4.30E+12
K-40	Not Detected	-----	1.49E+03
MN-52	Not Detected	-----	1.00E+26
MN-54	Not Detected	-----	8.51E+04
MO-99	Not Detected	-----	1.00E+26
NA-22	Not Detected	-----	1.21E+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
PB-210	Not Detected	-----	8.23E+04
RU-103	Not Detected	-----	5.05E+21
RU-106	Not Detected	-----	3.12E+05
SB-122	Not Detected	-----	1.00E+26
SB-124	Not Detected	-----	8.89E+14
SB-125	Not Detected	-----	5.83E+03
SN-113	Not Detected	-----	1.45E+09
SR-85	Not Detected	-----	1.37E+14
TA-182	Not Detected	-----	3.90E+09
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	-----	1.99E+09
ZN-65	Not Detected	-----	1.01E+06
ZR-95	Not Detected	-----	2.98E+14

# Sandia National Laboratories

Albuquerque, New Mexico 87185-0854

Date: August 21, 1997

To: Whom it May Concern

From:   
D. L. McLaughlin, MS-0854 (7578)

Subject: Samples 06895 to release samples on COC 06885 to LVAS.

Per the license agreement of Las Vegas Analytical Services (Formerly Lockheed Analytical Services) and the State of Nevada, License Number 03-11-0269-03, the aforementioned samples on COC 06885 which are represented by the sample splits on COC 06895 may be sent to Las Vegas Analytical Services without violating their license agreements.

If you have any questions, please contact me at 844-0941.

DLM:7578:dln

Copy to SMO data pack

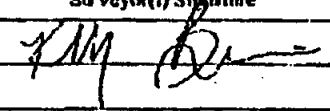




# RADIOLOGICAL SURVEY FORM

Survey Number. **6-97-0471**

Page **1** of **3**

Location <b>ER12B</b>	Requester/Dept <b>M MITCHELL/6564</b>	Date <b>081997</b>	Time <b>1500</b>	Duration <b>NA</b>
Purpose <b>RELEASE OF SAMPLES TO SMO</b>		Request # <b>NA</b>	EWP # <b>RE-97-0043</b>	RPIR # <b>NA</b>
Instrument and Probe Type and Serial Number <b>ASP1-HO260-2883</b>		Surveyor(s) Printed Name <b>KM BABILON</b>		Surveyor(s) Signature 

#	Item Description	BETA-GAMMA CONTAMINATION Counting Data Attached <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				ALPHA CONTAMINATION Counting Data Attached <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				RADIATION SURVEY	
		%EFF	20	/Isotope	DU	%EFF	0	/Isotope	NA	Ekg.	NA
		cpm	Bkg. cpm	dpm / 100 cm <sup>2</sup> (1)	(2) T/R/F	cpm	Bkg. cpm	dpm / 100 cm <sup>2</sup> (1)	(2) T/R/F	meter (3)	Distance
1,2	Sample #33667	80	80	ND	T						
3,4	Sample #33668	80	80	ND	T						
5,6	Sample #33669	80	80	ND	T						
7,8	Sample #33670	80	80	ND	T						
9,10	Sample #33671	80	80	ND	T						
11,12	Sample #33672	80	80	ND	T						
13,14	Sample #33673	80	80	ND	T						
15,16	Sample #33674	80	80	ND	T						
17,18	Sample #33675	80	80	ND	T						
19,20	Sample #33676	80	80	ND	T						
21,22	Sample #33677	80	80	ND	T						
23-26	Sample #33678	80	80	ND	T						
27	Sample #33679	80	80	ND	T						

Notes (1): If area other than 100 cm<sup>2</sup>, record as cpm/probe, or dpm/LAW. Note (2): Total/Removable/Total. Note (3): Indicate type, of other than gamma (i.e., n or p).

Remarks: **The samples were containerized in plastic marinellies or in glass jars. They was a direct frisk taken on each one containing the sample. The smears showed there to not be any detectable contamination.**

Reviewed by \_\_\_\_\_

**Radiation Protection Sample Diagnostics (7578) TA-III 8921  
Smear Analysis**

Date: 8/20/97  
 Counting Unit Id: 1 (SNL# 5674584)  
 Data file name: C:\LBXL\UNIT1\73516002.XLD  
 Batch Ended: 8/19/97 16:28  
 Crossstalk Correction: Applied  
 ANALYZED BY REESE  
 REVIEWED BY: *[Signature]* 8/20/97  
 Batch ID: SAMPLES 8/19/88BILON

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

Alpha efficiency log file: pu238ab  
 Alpha Efficiency: 43.14%  
 Alpha to Beta Crosstalk: 10.10%  
 Alpha Background (CPM): 0.4  
 Alpha Correction Factor: 1.000  
 Beta efficiency log file: d38ab  
 Beta Efficiency: 54.86%  
 Beta into Alpha Crosstalk: 1.36%  
 Beta Background (CPM): 2.0  
 Beta Correction Factor: 1.000

ID	Alpha Activity				Beta Activity				count Time	Alpha CPM	Beta CPM	Time Comp.
	DPM	$\sigma$	flags	MDA	DPM	$\sigma$	flags	MDA				
1	1.62	2.63	<MDA	11.68	-3.63	1.98	<MDA	15.65	1.00	0.60	-1.90	15:58
2	1.65	2.63	<MDA	11.51	-5.48	1.98	<MDA	15.65	1.00	0.60	-2.90	15:59
3	-1.04	2.65	<MDA	12.01	0.27	3.28	<MDA	15.45	1.00	-0.40	0.10	16:00
4	-1.07	2.67	<MDA	12.16	2.11	3.76	<MDA	15.44	1.00	-0.40	1.10	16:02
5	-1.04	2.65	<MDA	12.31	0.27	3.28	<MDA	15.45	1.00	-0.40	0.10	16:03
6	1.62	2.63	<MDA	11.68	-3.63	1.98	<MDA	15.65	1.00	0.60	-1.90	16:04
7	-1.11	2.68	<MDA	12.31	3.06	4.19	<MDA	15.44	1.00	-0.40	2.10	16:05
8	-1.00	2.64	<MDA	11.86	-1.58	2.71	<MDA	15.45	1.00	-0.40	-0.90	16:06
9	4.02	3.73	<AL	12.42	5.39	4.53	<MDA	15.33	1.00	1.60	3.10	16:07
10	1.58	2.64	<MDA	11.84	-1.79	2.71	<MDA	15.35	1.00	0.60	-0.90	16:08
11	-1.11	2.68	<MDA	12.31	3.96	4.13	<MDA	15.44	1.00	-0.40	2.10	16:10
12	-1.07	2.67	<MDA	12.16	2.11	3.75	<MDA	16.44	1.00	-0.40	1.10	16:11
13	-1.07	2.67	<MDA	12.16	2.11	3.75	<MDA	15.44	1.00	-0.40	1.10	16:12
14	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	16:13
15	-1.07	2.67	<MDA	12.16	2.11	3.78	<MDA	15.44	1.00	-0.40	1.10	16:14
16	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	16:16
17	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	16:17
18	-1.14	2.68	<MDA	12.46	5.81	4.58	<AL	15.44	1.00	-0.40	3.10	16:18
19	4.20	3.68	<AL	11.68	-3.84	1.98	<MDA	15.84	1.00	1.60	-1.90	16:19
20	4.13	3.70	<AL	11.90	-0.15	3.28	<MDA	15.84	1.00	1.60	0.10	16:20
21	-1.14	2.66	<MDA	12.48	5.81	4.58	<AL	15.44	1.00	-0.40	3.10	16:21
22	-1.00	2.64	<MDA	11.86	-1.58	2.71	<MDA	15.45	1.00	-0.40	-0.90	16:22

**Radiation Protection Sample Diagnostics (7578) TA-III 8921**

**Smear Analysis**

Date: 8/20/97

Alpha activity action level (DPM): 20.00

Counting Unit ID: 1 (SNL# 8874564)

Beta activity action level (DPM): 1000.00

Data file name: C:\BXL\UNIT1\73518032.XLD

Certainty level for MDA and flags: 95.00%

Batch Ended: 8/19/97 1628

High Voltage Setting: 1380

Crosstalk Correction: Applied

ANALYZED BY REESE

Application Revision: 3

REVIEWED BY: *[Signature]* 8/20/97

Application Version: Standard

Batch ID: SAMPLES 8/19 BABILON

Alpha efficiency log file: pu238ab
Alpha Efficiency: 43.14%
Alpha to Beta Crosstalk: 10.18%
Alpha Background (CPM): 0.4
Alpha Correction Factor: 1.000
Beta efficiency log file: cf38ab
Beta Efficiency: 54.88%
Beta into Alpha Crosstalk: 1.36%
Beta Background (CPM): 2.9
Beta Correction Factor: 1.000

ID	Alpha Activity				Beta Activity				count Time	Alpha CPM	Beta CPM	Time Compl
	DPM	$\sigma$	flags	MDA	DPM	$\sigma$	flags	MDA				
23	-0.97	2.63	<MDA	11.70	-3.43	1.98	<MDA	15.45	1.00	-0.40	-1.90	16:24
24	-1.00	2.64	<MDA	11.86	-1.53	2.71	<MDA	15.45	1.00	-0.40	-0.90	16:25
25	-1.00	2.64	<MDA	11.86	-1.53	2.71	<MDA	15.45	1.00	-0.40	-0.90	16:26
26	-1.07	2.67	<MDA	12.18	2.11	3.76	<MDA	15.44	1.00	-0.40	1.10	16:27
27	-1.18	2.71	<MDA	12.80	7.85	4.94	<AL	15.43	1.00	-0.40	4.10	16:28





Amir Please Rush

To be completed by Customer

Shaded areas are for RPSD use only

Customer: <u>Mike M. TeLall</u>	Hazards/Special Instructions: • This Analysis Request goes with AR/COC 06895 • Rush; these are screening samples for offsite lab <b>RUSH</b>	Batch Log Number: <u>701465</u>
Organization: <u>6685</u>		Logged By: <u>Jim</u>
Project Location: <u>12B-UCM (Dunesite)</u>		Analysis Type: <input type="checkbox"/> Gamma Spec <input type="checkbox"/> H-3 <input type="checkbox"/> Alpha/Beta <input type="checkbox"/> Alpha Spec <input type="checkbox"/> Total U <input type="checkbox"/> Other
Phone: <u>284-2575</u>		
Date Results Needed: <u>ASAP 8/20/97</u>		
Suspect Isotopes: <u>None</u>	Case Number: <u>8821.2012 80</u>	

124  
1367  
1368  
1369  
1370  
1371  
1372  
1373  
1374  
1375  
1376  
1377  
1378

Customer Sample ID	Sample Type	Date/Time Collected	Sample Quantity	Requested Analysis	RPSD Sample ID	Screen. cpm	Sample Mass	Remarks / Aliquot Amount
CY12B-S001 01-S	Soil	08-19-97 0828	500 ml	Gamma Spec	01	<300	839g	
CY12B-S002 01-S		08-19-97 0830	500 ml		02	<300	780g	
CY12B-S003 01-S		08-19-97 0840			03	<300	790g	
CY12B-S004 01-S		08-19-97 0850			04	<300	843g	
CY12B-S005 01-S		08-19-97 0855			05	<300	773g	
CY12B-S006 01-S		08-19-97 0905			06	<300	882g	
CY12B-S007 01-S		08-19-97 0920			07	<300	803g	
CY12B-S008 01-S		08-19-97 0930			08	<300	809g	
CY12B-S009 01-S		08-19-97 0940			09	<300	793g	
CY12B-S010 01-S		08-19-97 0950			10	<300	798g	
CY12B-S011 01-S		08-19-97 1000			11	<300	752g	
CY12B-EB		Water	08-19-97 1130				12	<300

Relinquished by: <u>[Signature]</u>	Date: <u>08-20-97</u>	Received by: <u>[Signature]</u>	Date: <u>8/20/97</u>
Relinquished by: <u>[Signature]</u>	Date: <u>8/20/97</u>	Received by: <u>[Signature]</u>	Date: <u>8/20/97</u>
Relinquished by: <u>[Signature]</u>	Date: <u>8/21/97</u>	Received by: <u>[Signature]</u>	Date: <u>8/21/97</u>
Relinquished by: _____	Date: _____	Received by: _____	Date: _____



**ANALYSIS REQUEST AND CHAIN OF CUSTODY**

AR/COC- **06898**

Int of Lab  
Batch No. **701572**

Dept. No./Mail Stop: **CG 45 / MS 11049**  
Project/Task Manager: **Mike White**  
Project Name: **ER 512 - IIR VCM**  
Record Center Code: **ER/1332/12B/DAT**  
Logbook Ref No.: **ER-013**  
Service Order No.: **CF-0408**

Date Samples Shipped: **9/9/97**  
Carrier/Waybill No.: **HC**  
Lab Contact: **Fernando Dominguez**  
Lab Destination: **RPSD BIL**  
SMO Contact/Phone: **Rita Puissant / 249-3155**  
Send Report to SMO: **Rita Puissant**

Contract No.: **NA**  
Case No.: **9921-2017**  
SMO Authorization: **[Signature]**  
Bill to: Sandia National Laboratories  
Supplier Services Department  
P.O. Box 5800 MS 0154  
Albuquerque, NM 87185-0154

**Parameter & Method Requested**


**Location** Tech Area **NA**

Building **NA** Room **NA**

Beginning Depth in Ft.  
ER Site No.

**Reference LOV (available at SMO)**

Sample No. - Fraction	ER Sample ID or Sample Location Detail	Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Sample Matrix	Container		Preservative	Sample Collection Method	Sample Type	Lab Sample ID
						Type	Volume				
34057-003	CY12B/260/90/01-US	0-6"	12B	09-09-97 0755	S	P	5.0 ml	None	G	SA	
34061-003	CY12B/210/80/01-US			1045							
34154-003	CY12B/90/80/01-US			1225							
34149-003	CY12B/140/80/01-US			1155							
34159-003	CY12B/110/110/01-US			1430							
34164-003	CY12B/50/140/01-US			1450							
34169-003	CY12B/150/120/01-US			1510							
34178-003	CY12B-SFN-01-S			1110							
34180-003	CY12B-ER-02			1645	DIW					ER	
<b>LAST ITEM</b>											

RMA  Yes  No Ref. No. \_\_\_\_\_

**Sample Tracking**  
Date Entered (mm/dd/yyyy) **9/10/97**  
Entered by: **[Signature]**

**Special Instructions/QC Requirements**

**Abnormal Conditions on Receipt**

Sample Disposal  Return to Client  Disposal by lab

Turnaround Time  Normal  Rush Required Report Date \_\_\_\_\_

**AR/COC 06898 releases**  
**AR/COC 06899 to LAS**

Sample Team Members	Name	Signature	Init	Company/Organization/Phone
	Garbort L. Quintanilla	[Signature]	GL	IT 1604 / 238-9417
	C. Cacciato	[Signature]	CC	MDM/1602 / 229-5710

1. Relinquished by	[Signature]	Org. 6684	Date 09-09-97	Time 1400
1. Received by	[Signature]	Org. SNL7578	Date 09/09/97	Time 1400
2. Relinquished by	[Signature]	Org. SNL7578	Date 09/09/97	Time 1402
2. Received by	[Signature]	Org. ERFD 6621	Date 09/09/97	Time 1402
3. Relinquished by	[Signature]	Org. ERFD 6621	Date 09/09/97	Time 1412
3. Received by	[Signature]	Org. SNL7578	Date 9/9/97	Time 1412

4. Relinquished by	[Signature]	Org. SNL7578	Date 9/10/97	Time 1107
4. Received by	[Signature]	Org. SNL7578	Date 9/10/97	Time 1107
5. Relinquished by		Org.	Date	Time
5. Received by		Org.	Date	Time
6. Relinquished by		Org.	Date	Time
6. Received by		Org.	Date	Time

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

12/09/91 12:13 5058443128 SNL SMO SMO SHIPPING 002/013





**RUSH**

*Amin Please Rush*

To be completed by Customer

Shaded areas are for RPSD use only

Customer: Mike Mitchell  
Organization: 2685  
Project Location: 128 UCM (Bunast)  
Phone: 284-2575  
Date Results Needed: ASAP 9/10/97 (AM)  
Suspect Isotopes: None  
Case Number: 8821.2012 BO

Hazards/Special Instructions:  
• This Analysis Request goes with AR/COC 06898  
• Please Rush. These are screening samples for off site Lab.  
Call SMO@ 844 0741 upon completion

**RUSH**

Batch Log Number: 701572  
Logged By: Jus  
Analysis Type:  Gamma Spec  
 H-3  
 Alpha/Beta  
 Alpha Spec  
 Total U  
 Other

Customer Sample ID	Sample Type	Date/Time Collected	Sample Quantity	Requested Analysis	RPSD Sample ID	Screen cpm	Sample Mass	Remarks / Aliquot Amount
234057-003	Soil	09-08-97 0950	500 ml	Gamma Spec	01	< 300	798g	
234061-003		1045			02		973g	
234154-003		1320			03		844g	
234149-003		1155			04		781g	
234159-003		1400			05		862g	
234164-003		1450			06		801g	
234169-003		1570			07		918g	
234178-003	↓	1610			08	↓	773g	
234180-003	D/W	↓ 1645	↓	↓	09	< 300	450ml	
		— Last		1 Tem				
LCS		11/20/90		8 spec	10	N/A	N/A	

Relinquished by [Signature] Date 09-09/97 Received by [Signature] Date 9/9/97  
 Relinquished by [Signature] Date 9/10/97 Received by [Signature] Date 9/10/97  
 Relinquished by \_\_\_\_\_ Date \_\_\_\_\_ Received by \_\_\_\_\_ Date \_\_\_\_\_  
 Relinquished by \_\_\_\_\_ Date \_\_\_\_\_ Received by \_\_\_\_\_ Date \_\_\_\_\_

**RUSH**

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-09-97 4:17:28 PM \*  
 \* \*\*\*\*\*

\* Analyzed by: *[Signature]* 9/8/97 Reviewed by: *[Signature]* 9/10/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/C.C. (6685/IT)  
 Customer Sample ID : 034057-003  
 Lab Sample ID : 70157201

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 798.000 gram  
 Sample Date/Time : 9-08-97 9:50:00 AM  
 Acquire Start Date/Time : 9-09-97 2:28:36 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

\*\*\*\*\*

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	3.01E+00
TH-234	5.25E-01	5.48E-01	4.91E-01
RA-226	1.75E+00	5.35E-01	4.84E-01
PB-214	7.49E-01	3.77E-01	4.28E-02
BI-214	6.48E-01	4.56E-01	4.11E-02
-232	5.37E-01	2.89E-01	1.33E-01
RA-228	7.10E-01	3.28E-01	1.34E-01
AC-228	6.22E-01	1.58E-01	7.45E-02
TH-228	6.67E-01	2.19E-01	4.36E-01
RA-224	7.38E-01	2.27E-01	5.21E-02
PB-212	6.01E-01	1.04E-01	3.78E-02
BI-212	7.16E-01	3.83E-01	2.63E-01
TL-208	5.51E-01	3.23E-01	5.93E-02
U-235	Not Detected	-----	2.18E-01
TH-231	Not Detected	-----	1.16E+01
PA-231	Not Detected	-----	1.26E+00
TH-227	Not Detected	-----	2.99E-01
RA-223	Not Detected	-----	1.93E-01
RN-219	Not Detected	-----	3.34E-01
PB-211	Not Detected	-----	7.56E-01
TL-207	Not Detected	-----	1.18E+01
AM-241	Not Detected	-----	4.31E-01
PU-239	Not Detected	-----	4.04E+02
NP-237	Not Detected	-----	2.48E-01
PA-233	Not Detected	-----	5.11E-02
TH-229	Not Detected	-----	2.21E-01

[Summary Report] - Sample ID: : 70157201

Slide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.44E-02
AG-110m	Not Detected	-----	2.67E-02
BA-133	Not Detected	-----	6.37E-02
BE-7	Not Detected	-----	2.16E-01
CD-109	Not Detected	-----	8.43E-01
CD-115	Not Detected	-----	8.30E-02
CE-139	Not Detected	-----	2.64E-02
CE-141	Not Detected	-----	4.78E-02
CE-144	Not Detected	-----	2.21E-01
CO-56	Not Detected	-----	2.26E-02
CO-57	Not Detected	-----	2.71E-02
CO-58	Not Detected	-----	2.65E-02
CO-60	Not Detected	-----	3.02E-02
CR-51	Not Detected	-----	2.09E-01
CS-134	Not Detected	-----	4.49E-02
CS-137	Not Detected	-----	2.92E-02
EU-152	Not Detected	-----	8.14E-02
EU-154	Not Detected	-----	1.59E-01
EU-155	Not Detected	-----	1.37E-01
FE-59	Not Detected	-----	6.12E-02
GD-153	Not Detected	-----	9.54E-02
HG-203	Not Detected	-----	2.84E-02
I-131	Not Detected	-----	2.74E-02
IR-192	Not Detected	-----	2.43E-02
J-40	1.10E+01	1.70E+00	2.38E-01
J-52	Not Detected	-----	2.97E-02
MN-54	Not Detected	-----	3.14E-02
MO-99	Not Detected	-----	2.64E-01
NA-22	Not Detected	-----	3.45E-02
NA-24	Not Detected	-----	1.11E-01
NB-95	Not Detected	-----	1.73E-01
ND-147	Not Detected	-----	1.80E-01
NI-57	<del>7.11E-02</del>	<del>4.06E-02</del>	3.95E-02
PB-210	Not Detected	-----	3.11E+01
RU-103	Not Detected	-----	2.52E-02
RU-106	Not Detected	-----	2.54E-01
SB-122	Not Detected	-----	4.72E-02
SB-124	Not Detected	-----	2.74E-02
SB-125	Not Detected	-----	7.18E-02
SN-113	Not Detected	-----	3.25E-02
SR-85	Not Detected	-----	3.38E-02
TA-182	Not Detected	-----	1.27E-01
TA-183	Not Detected	-----	4.32E-01
TC-99m	Not Detected	-----	7.03E-01
TL-201	Not Detected	-----	2.18E-01
XE-133	Not Detected	-----	1.92E-01
Y-88	Not Detected	-----	2.26E-02
ZN-65	Not Detected	-----	8.85E-02
ZR-95	Not Detected	-----	4.95E-02

*not detected J 8/9/97*

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-09-97 6:08:51 PM \*  
 \* \*\*\*\*\*

\* Analyzed by: *[Signature]* 9/9/97 Reviewed by: *[Signature]* 9/10/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/C.C. (6685/IT)  
 Customer Sample ID : 034061-003  
 Lab Sample ID : 70157202

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 973.000 gram  
 Sample Date/Time : 9-08-97 10:45:00 AM  
 Acquire Start Date/Time : 9-09-97 4:20:08 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.32E+00
TH-234	7.41E-01	2.92E-01	3.86E-01
RA-226	1.39E+00	5.30E-01	3.74E-01
PB-214	6.00E-01	1.02E-01	3.16E-02
BI-214	5.80E-01	1.47E-01	3.14E-02
I-232	2.16E-01	1.48E-01	9.01E-02
SA-228	2.38E-01	1.28E-01	8.38E-02
AC-228	Not Detected	-----	1.11E-01
TH-228	3.65E-01	5.46E-01	3.32E-01
RA-224	2.55E-01	1.17E-01	4.34E-02
PB-212	2.49E-01	2.62E-01	2.74E-02
BI-212	Not Detected	-----	2.11E-01
TL-208	2.14E-01	3.49E-01	4.14E-02
U-235	Not Detected	-----	1.68E-01
TH-231	Not Detected	-----	8.77E+00
PA-231	Not Detected	-----	9.49E-01
TH-227	Not Detected	-----	1.94E-01
RA-223	Not Detected	-----	1.49E-01
RN-219	Not Detected	-----	2.56E-01
PB-211	Not Detected	-----	5.77E-01
TL-207	Not Detected	-----	8.60E+00
AM-241	Not Detected	-----	3.24E-01
PU-239	Not Detected	-----	3.05E+02
NP-237	Not Detected	-----	1.84E-01
PA-233	Not Detected	-----	4.13E-02
TH-229	Not Detected	-----	1.69E-01

[Summary Report] - Sample ID: : 70157202

Nuclide ume	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.41E-02
AG-110m	Not Detected	-----	2.88E-02
BA-133	Not Detected	-----	5.04E-02
BE-7	Not Detected	-----	1.76E-01
CD-109	Not Detected	-----	6.24E-01
CD-115	Not Detected	-----	5.86E-02
CE-139	<del>4.86E-03</del>	<del>6.91E-03</del>	1.19E-02
CE-141	Not Detected	-----	3.74E-02
CE-144	Not Detected	-----	1.72E-01
CO-56	Not Detected	-----	1.61E-02
CO-57	Not Detected	-----	2.12E-02
CO-58	Not Detected	-----	2.05E-02
CO-60	Not Detected	-----	2.11E-02
CR-51	Not Detected	-----	1.60E-01
CS-134	Not Detected	-----	3.71E-02
CS-137	8.98E-02	2.24E-02	1.44E-02
EU-152	Not Detected	-----	6.37E-02
EU-154	Not Detected	-----	1.11E-01
EU-155	Not Detected	-----	1.03E-01
FE-59	Not Detected	-----	4.27E-02
GD-153	Not Detected	-----	7.21E-02
HG-203	Not Detected	-----	2.07E-02
I-131	Not Detected	-----	2.13E-02
IR-192	Not Detected	-----	1.88E-02
K-40	5.06E+00	8.42E-01	1.76E-01
MA-52	Not Detected	-----	2.28E-02
-54	Not Detected	-----	2.26E-02
MO-99	Not Detected	-----	2.06E-01
NA-22	Not Detected	-----	2.39E-02
NA-24	Not Detected	-----	8.40E-02
NB-95	Not Detected	-----	1.13E-01
ND-147	Not Detected	-----	1.37E-01
NI-57	<del>6.64E-02</del>	<del>7.75E-02</del>	2.61E-02
PB-210	Not Detected	-----	2.43E+01
RU-103	Not Detected	-----	1.89E-02
RU-106	Not Detected	-----	1.90E-01
SB-122	Not Detected	-----	3.25E-02
SB-124	Not Detected	-----	2.15E-02
SB-125	Not Detected	-----	5.70E-02
SN-113	Not Detected	-----	2.58E-02
SR-85	Not Detected	-----	2.41E-02
TA-182	Not Detected	-----	1.03E-01
TA-183	Not Detected	-----	3.27E-01
TC-99m	Not Detected	-----	5.95E-01
TL-201	Not Detected	-----	1.64E-01
XE-133	Not Detected	-----	1.48E-01
Y-88	Not Detected	-----	1.73E-02
ZN-65	Not Detected	-----	7.18E-02
ZR-95	Not Detected	-----	3.49E-02

*not detected - 7/9/97*

*not detected - 7/9/97*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-09-97 8:00:17 PM \*  
 \* \*\*\*\*\*  
 \* Analyzed by: *[Signature]* 9/9/97 Reviewed by: *[Signature]* 9/10/97 \*  
 \* \*\*\*\*\*

Customer : M.MITCHELL/C.C. (6685/IT)  
 Customer Sample ID : 034154-003  
 Lab Sample ID : 70157203

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 844.000 gram  
 Sample Date/Time : 9-08-97 1:20:00 PM  
 Acquire Start Date/Time : 9-09-97 6:11:26 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.74E+00
TH-234	8.68E-01	3.38E-01	4.97E-01
RA-226	1.60E+00	5.46E-01	4.97E-01
PB-214	7.47E-01	2.45E-01	3.64E-02
BI-214	6.78E-01	1.60E-01	3.99E-02
TH-232	4.50E-01	2.62E-01	1.16E-01
PA-228	3.97E-01	2.96E-01	1.14E-01
AC-228	3.95E-01	4.50E-01	6.13E-02
TH-228	5.34E-01	1.82E-01	4.23E-01
RA-224	4.31E-01	1.88E-01	4.39E-02
PB-212	3.98E-01	5.72E-01	3.34E-02
BI-212	4.68E-01	2.17E-01	2.30E-01
TL-208	3.80E-01	1.13E-01	5.39E-02
U-235	Not Detected	-----	2.02E-01
TH-231	Not Detected	-----	1.04E+01
PA-231	Not Detected	-----	1.12E+00
TH-227	Not Detected	-----	2.53E-01
RA-223	Not Detected	-----	1.69E-01
RN-219	Not Detected	-----	3.02E-01
PB-211	Not Detected	-----	6.75E-01
TL-207	Not Detected	-----	1.06E+01
AM-241	Not Detected	-----	3.86E-01
PU-239	Not Detected	-----	3.58E+02
NP-237	Not Detected	-----	3.06E-01
PA-233	Not Detected	-----	4.70E-02
TH-229	Not Detected	-----	2.03E-01

[Summary Report] - Sample ID: : 70157203

Isotope Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.91E-02
AG-110m	Not Detected	-----	3.50E-02
BA-133	Not Detected	-----	6.11E-02
BE-7	Not Detected	-----	2.06E-01
CD-109	Not Detected	-----	8.20E-01
CD-115	Not Detected	-----	7.22E-02
CE-139	Not Detected	-----	2.48E-02
CE-141	Not Detected	-----	4.48E-02
CE-144	Not Detected	-----	1.98E-01
CO-56	Not Detected	-----	2.15E-02
CO-57	Not Detected	-----	2.47E-02
CO-58	Not Detected	-----	2.46E-02
CO-60	Not Detected	-----	2.76E-02
CR-51	Not Detected	-----	1.87E-01
CS-134	Not Detected	-----	4.16E-02
CS-137	1.10E-01	3.02E-02	1.85E-02
EU-152	Not Detected	-----	7.44E-02
EU-154	Not Detected	-----	1.35E-01
EU-155	Not Detected	-----	1.20E-01
FE-59	Not Detected	-----	5.03E-02
GD-153	Not Detected	-----	8.67E-02
HG-203	Not Detected	-----	2.55E-02
I-131	Not Detected	-----	2.55E-02
IR-192	Not Detected	-----	2.16E-02
K-40	7.52E+00	1.24E+00	2.28E-01
N-52	Not Detected	-----	2.77E-02
AN-54	Not Detected	-----	2.67E-02
MO-99	Not Detected	-----	2.37E-01
NA-22	Not Detected	-----	2.93E-02
NA-24	Not Detected	-----	9.44E-02
NB-95	Not Detected	-----	1.47E-01
ND-147	Not Detected	-----	1.66E-01
NI-57	Not Detected	-----	6.96E-02
PB-210	Not Detected	-----	2.83E+01
RU-103	Not Detected	-----	2.37E-02
RU-106	Not Detected	-----	2.18E-01
SB-122	Not Detected	-----	4.26E-02
SB-124	Not Detected	-----	2.44E-02
SB-125	Not Detected	-----	6.44E-02
SN-113	Not Detected	-----	3.04E-02
SR-85	Not Detected	-----	2.87E-02
TA-182	Not Detected	-----	1.22E-01
TA-183	Not Detected	-----	3.87E-01
TC-99m	Not Detected	-----	6.73E-01
TL-201	Not Detected	-----	1.93E-01
XE-133	Not Detected	-----	1.72E-01
Y-88	Not Detected	-----	2.29E-02
ZN-65	Not Detected	-----	8.38E-02
ZR-95	Not Detected	-----	4.00E-02

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-09-97 9:52:27 PM \*  
 \*\*\*\*\*

\* Analyzed by: *J 9/10/97* Reviewed by: *W 9/10/97* \*

Customer : M.MITCHELL/C.C. (6685/IT)  
 Customer Sample ID : 034149-003  
 Lab Sample ID : 70157204

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 781.000 gram  
 Sample Date/Time : 9-08-97 11:55:00 AM  
 Acquire Start Date/Time : 9-09-97 8:02:52 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.88E+00
TH-234	1.19E+00	4.81E-01	5.59E-01
RA-226	2.05E+00	7.75E-01	4.94E-01
PB-214	7.97E-01	2.70E-01	4.44E-02
BI-214	7.20E-01	1.45E-01	4.08E-02
TH-232	5.87E-01	3.00E-01	1.31E-01
LA-228	5.88E-01	2.38E-01	1.29E-01
AC-228	5.69E-01	3.43E-01	7.01E-02
TH-228	5.79E-01	2.01E-01	4.41E-01
RA-224	5.09E-01	1.98E-01	6.38E-02
PB-212	5.42E-01	9.96E-02	3.63E-02
BI-212	4.57E-01	2.74E-01	2.46E-01
TL-208	4.51E-01	1.15E-01	5.94E-02
U-235	Not Detected	-----	2.23E-01
TH-231	Not Detected	-----	1.16E+01
PA-231	Not Detected	-----	1.29E+00
TH-227	Not Detected	-----	2.92E-01
RA-223	Not Detected	-----	1.90E-01
RN-219	Not Detected	-----	3.25E-01
PB-211	Not Detected	-----	7.29E-01
TL-207	Not Detected	-----	1.12E+01
AM-241	Not Detected	-----	4.18E-01
PU-239	Not Detected	-----	3.89E+02
NP-237	<del>4.50E-01</del>	<del>1.52E-01</del>	2.75E-01
PA-233	Not Detected	-----	5.01E-02
TH-229	Not Detected	-----	2.28E-01

*Not detected J 9/10/97*



[Summary Report] - Sample ID: : 70157204

Slide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.34E-02
AG-110m	Not Detected	-----	3.26E-02
BA-133	Not Detected	-----	6.66E-02
BE-7	1.29E-01	1.47E-01	1.38E-01
CD-109	Not Detected	-----	9.34E-01
CD-115	Not Detected	-----	8.54E-02
CE-139	Not Detected	-----	2.68E-02
CE-141	Not Detected	-----	4.94E-02
CE-144	Not Detected	-----	2.19E-01
CO-56	Not Detected	-----	2.24E-02
CO-57	Not Detected	-----	2.74E-02
CO-58	Not Detected	-----	2.45E-02
CO-60	Not Detected	-----	2.95E-02
CR-51	Not Detected	-----	2.15E-01
CS-134	Not Detected	-----	4.62E-02
CS-137	5.80E-02	2.96E-02	2.08E-02
EU-152	Not Detected	-----	8.24E-02
EU-154	Not Detected	-----	1.53E-01
EU-155	Not Detected	-----	1.35E-01
FE-59	Not Detected	-----	5.57E-02
GD-153	Not Detected	-----	9.60E-02
HG-203	Not Detected	-----	2.79E-02
I-131	Not Detected	-----	2.76E-02
IR-192	Not Detected	-----	2.45E-02
K-40	1.02E+01	1.63E+00	2.01E-01
-52	Not Detected	-----	3.22E-02
MN-54	Not Detected	-----	2.98E-02
MO-99	Not Detected	-----	2.91E-01
NA-22	Not Detected	-----	3.16E-02
NA-24	Not Detected	-----	1.24E-01
NB-95	Not Detected	-----	1.73E-01
ND-147	Not Detected	-----	1.83E-01
NI-57	<del>1.02E-01</del>	<del>3.76E-02</del>	3.96E-02
PB-210	Not Detected	-----	3.11E+01
RU-103	Not Detected	-----	2.58E-02
RU-106	Not Detected	-----	2.59E-01
SB-122	Not Detected	-----	4.85E-02
SB-124	Not Detected	-----	2.70E-02
SB-125	Not Detected	-----	7.36E-02
SN-113	Not Detected	-----	3.31E-02
SR-85	Not Detected	-----	3.23E-02
TA-182	Not Detected	-----	1.38E-01
TA-183	Not Detected	-----	4.30E-01
TC-99m	Not Detected	-----	1.07E+00
TL-201	Not Detected	-----	2.19E-01
XE-133	Not Detected	-----	1.96E-01
Y-88	Not Detected	-----	2.35E-02
ZN-65	Not Detected	-----	9.38E-02
ZR-95	Not Detected	-----	4.99E-02

not detected 7/6/77

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-09-97 11:38:01 PM \*  
 \*\*\*\*\*

\* Analyzed by: *[Signature]* 9/10/97 Reviewed by: *[Signature]* 9/10/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/C.C. (6685/IT)  
 Customer Sample ID : 034159-003  
 Lab Sample ID : 70157205

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 862.000 gram  
 Sample Date/Time : 9-08-97 2:00:00 PM  
 Acquire Start Date/Time : 9-09-97 9:55:11 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	4.28E+00	2.04E+00	2.84E+00
TH-234	4.97E+00	1.61E+00	5.96E-01
RA-226	2.47E+00	6.56E-01	4.37E-01
PB-214	7.59E-01	1.27E-01	4.02E-02
BI-214	6.51E-01	1.93E-01	3.79E-02
W-232	5.50E-01	2.76E-01	1.26E-01
LA-228	5.88E-01	1.85E-01	1.12E-01
AC-228	6.62E-01	2.71E-01	6.82E-02
TH-228	6.09E-01	1.96E-01	3.98E-01
RA-224	5.94E-01	1.91E-01	5.77E-02
PB-212	5.94E-01	1.12E-01	3.61E-02
BI-212	5.19E-01	2.75E-01	2.24E-01
TL-208	5.36E-01	2.72E-01	5.66E-02
U-235	1.64E-01	1.73E-01	2.22E-01
TH-231	Not Detected	-----	1.21E+01
PA-231	Not Detected	-----	1.21E+00
TH-227	Not Detected	-----	2.88E-01
RA-223	Not Detected	-----	2.03E-01
RN-219	Not Detected	-----	3.23E-01
PB-211	Not Detected	-----	7.23E-01
TL-207	Not Detected	-----	1.08E+01
AM-241	Not Detected	-----	4.55E-01
PU-239	Not Detected	-----	4.02E+02
NP-237	Not Detected	-----	2.57E-01
PA-233	Not Detected	-----	4.93E-02
TH-229	Not Detected	-----	2.33E-01

[Summary Report] - Sample ID: : 70157205

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.22E-02
AG-110m	Not Detected	-----	2.87E-02
BA-133	Not Detected	-----	6.20E-02
BE-7	Not Detected	-----	2.15E-01
CD-109	<del>1.03E+00</del>	<del>3.99E-01</del>	8.71E-01
CD-115	Not Detected	-----	8.25E-02
CE-139	Not Detected	-----	2.63E-02
CE-141	Not Detected	-----	4.89E-02
CE-144	Not Detected	-----	2.17E-01
CO-56	Not Detected	-----	2.06E-02
CO-57	Not Detected	-----	2.78E-02
CO-58	Not Detected	-----	2.63E-02
CO-60	Not Detected	-----	2.75E-02
CR-51	Not Detected	-----	2.06E-01
CS-134	Not Detected	-----	4.29E-02
CS-137	3.48E-02	2.30E-02	1.76E-02
EU-152	Not Detected	-----	8.37E-02
EU-154	Not Detected	-----	1.48E-01
EU-155	Not Detected	-----	1.35E-01
FE-59	Not Detected	-----	5.60E-02
GD-153	Not Detected	-----	1.01E-01
HG-203	Not Detected	-----	2.75E-02
I-131	Not Detected	-----	2.76E-02
IR-192	Not Detected	-----	2.37E-02
K-40	1.05E+01	1.67E+00	2.02E-01
MN-52	Not Detected	-----	3.07E-02
MN-54	Not Detected	-----	2.86E-02
MO-99	Not Detected	-----	2.85E-01
NA-22	Not Detected	-----	3.41E-02
NA-24	Not Detected	-----	1.12E-01
NB-95	Not Detected	-----	1.71E-01
ND-147	Not Detected	-----	1.77E-01
NI-57	<del>7.54E-02</del>	<del>5.88E-02</del>	4.35E-02
PB-210	Not Detected	-----	3.16E+01
RU-103	Not Detected	-----	2.55E-02
RU-106	Not Detected	-----	2.49E-01
SB-122	Not Detected	-----	4.61E-02
SB-124	Not Detected	-----	2.65E-02
SB-125	Not Detected	-----	7.05E-02
SN-113	Not Detected	-----	3.16E-02
SR-85	Not Detected	-----	3.12E-02
TA-182	Not Detected	-----	1.29E-01
TA-183	Not Detected	-----	4.61E-01
TC-99m	Not Detected	-----	1.03E+00
TL-201	Not Detected	-----	2.33E-01
XE-133	Not Detected	-----	2.10E-01
Y-88	Not Detected	-----	2.19E-02
ZN-65	Not Detected	-----	8.79E-02
ZR-95	Not Detected	-----	4.73E-02

*Not detected 9/10/97*

*Not detected 9/10/97*

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-10-97 1:23:02 AM \*  
 \*\*\*\*\*

\* Analyzed by: *[Signature]* 9/10/97 Reviewed by: *[Signature]* 9/10/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/C.C. (6685/IT)  
 Customer Sample ID : 034164-003  
 Lab Sample ID : 70157206

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 801.000 gram  
 Sample Date/Time : 9-08-97 2:50:00 PM  
 Acquire Start Date/Time : 9-09-97 11:40:15 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.92E+00
TH-234	1.17E+00	4.78E-01	5.20E-01
RA-226	Not Detected	-----	5.09E-01
PB-214	7.14E-01	1.38E-01	4.32E-02
BI-214	6.25E-01	1.17E-01	4.03E-02
Y-232	5.16E-01	2.60E-01	1.37E-01
LA-228	6.02E-01	1.49E-01	1.26E-01
AC-228	5.71E-01	3.72E-01	7.05E-02
TH-228	5.78E-01	1.97E-01	4.19E-01
RA-224	5.97E-01	2.16E-01	6.16E-02
PB-212	5.65E-01	9.94E-02	3.64E-02
BI-212	5.63E-01	3.79E-01	2.66E-01
TL-208	5.10E-01	1.05E-01	5.23E-02
U-235	1.25E-01	4.98E-02	1.43E-01
TH-231	Not Detected	-----	1.15E+01
PA-231	Not Detected	-----	1.26E+00
TH-227	Not Detected	-----	2.93E-01
RA-223	Not Detected	-----	1.92E-01
RN-219	Not Detected	-----	3.42E-01
PB-211	Not Detected	-----	7.95E-01
TL-207	Not Detected	-----	1.12E+01
AM-241	Not Detected	-----	4.23E-01
PU-239	Not Detected	-----	3.90E+02
NP-237	Not Detected	-----	2.47E-01
PA-233	Not Detected	-----	5.17E-02
TH-229	Not Detected	-----	2.28E-01

[Summary Report] - Sample ID: : 70157206

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.32E-02
AG-110m	Not Detected	-----	3.17E-02
BA-133	Not Detected	-----	6.29E-02
BE-7	6.71E-02	7.38E-02	1.07E-01
CD-109	Not Detected	-----	8.38E-01
CD-115	Not Detected	-----	8.59E-02
CE-139	Not Detected	-----	2.68E-02
CE-141	<del>2.49E-02</del>	<del>7.85E-03</del>	<del>3.95E-02</del>
CE-144	Not Detected	-----	2.17E-01
CO-56	Not Detected	-----	2.14E-02
CO-57	Not Detected	-----	2.65E-02
CO-58	Not Detected	-----	2.77E-02
CO-60	Not Detected	-----	2.96E-02
CR-51	Not Detected	-----	2.06E-01
CS-134	Not Detected	-----	4.34E-02
CS-137	6.10E-02	2.01E-02	1.73E-02
EU-152	Not Detected	-----	7.96E-02
EU-154	Not Detected	-----	1.54E-01
EU-155	Not Detected	-----	1.31E-01
FE-59	Not Detected	-----	5.77E-02
GD-153	Not Detected	-----	9.47E-02
HG-203	Not Detected	-----	2.79E-02
I-131	Not Detected	-----	2.76E-02
IR-192	Not Detected	-----	2.37E-02
K-40	1.06E+01	2.02E+00	2.47E-01
V-52	Not Detected	-----	3.11E-02
AN-54	Not Detected	-----	3.02E-02
MO-99	Not Detected	-----	2.92E-01
NA-22	Not Detected	-----	3.65E-02
NA-24	Not Detected	-----	1.17E-01
NB-95	Not Detected	-----	1.75E-01
ND-147	Not Detected	-----	1.92E-01
NI-57	Not Detected	-----	4.22E-02
PB-210	Not Detected	-----	3.11E+01
RU-103	Not Detected	-----	2.46E-02
RU-106	Not Detected	-----	2.54E-01
SB-122	Not Detected	-----	4.42E-02
SB-124	Not Detected	-----	2.59E-02
SB-125	Not Detected	-----	6.95E-02
SN-113	Not Detected	-----	3.30E-02
SR-85	Not Detected	-----	3.11E-02
TA-182	Not Detected	-----	1.30E-01
TA-183	Not Detected	-----	4.36E-01
TC-99m	Not Detected	-----	1.13E+00
TL-201	Not Detected	-----	2.18E-01
XE-133	Not Detected	-----	1.96E-01
Y-88	Not Detected	-----	2.03E-02
ZN-65	Not Detected	-----	9.07E-02
ZR-95	Not Detected	-----	5.00E-02

*not detected 7/10/97*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-10-97 3:08:05 AM \*  
 \*\*\*\*\*

\* Analyzed by: *J s/co/97* Reviewed by: *MS 9/10/97* \*

Customer : M. MITCHELL/C.C. (6685/IT)  
 Customer Sample ID : 034169-003  
 Lab Sample ID : 70157207

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 918.000 gram  
 Sample Date/Time : 9-08-97 3:10:00 PM  
 Acquire Start Date/Time : 9-10-97 1:25:17 AM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.85E+00
TH-234	1.35E+00	4.30E-01	5.17E-01
RA-226	5.00E-01	5.62E-01	4.46E-01
PB-214	7.39E-01	2.40E-01	4.10E-02
BI-214	6.55E-01	1.20E-01	3.99E-02
Th-232	Not Detected	-----	1.16E-01
-228	7.20E-01	2.21E-01	1.17E-01
AC-228	6.94E-01	1.63E-01	6.56E-02
TH-228	3.60E-01	1.67E-01	4.38E-01
RA-224	6.53E-01	2.01E-01	6.05E-02
PB-212	6.60E-01	1.15E-01	3.46E-02
BI-212	8.60E-01	4.47E-01	2.28E-01
TL-208	5.72E-01	1.13E-01	5.51E-02
U-235	7.58E-02	6.84E-02	1.17E-01
TH-231	Not Detected	-----	1.13E+01
PA-231	Not Detected	-----	1.19E+00
TH-227	Not Detected	-----	2.89E-01
RA-223	Not Detected	-----	1.89E-01
RN-219	<del>1.39E-01</del>	<del>2.67E-01</del>	3.17E-01
PB-211	Not Detected	-----	7.11E-01
TL-207	Not Detected	-----	1.08E+01
AM-241	Not Detected	-----	3.93E-01
PU-239	Not Detected	-----	3.87E+02
NP-237	Not Detected	-----	2.43E-01
PA-233	Not Detected	-----	4.97E-02
TH-229	Not Detected	-----	2.21E-01

*not detected J s/co/97*

[Summary Report] - Sample ID: : 70157207

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.31E-02
AG-110m	Not Detected	-----	2.76E-02
BA-133	Not Detected	-----	5.93E-02
BE-7	Not Detected	-----	2.07E-01
CD-109	<del>1.09E+00</del>	<del>4.30E-01</del>	8.26E-01
CD-115	Not Detected	-----	8.56E-02
CE-139	Not Detected	-----	2.62E-02
CE-141	Not Detected	-----	4.71E-02
CE-144	Not Detected	-----	2.10E-01
CO-56	Not Detected	-----	2.96E-02
CO-57	Not Detected	-----	2.61E-02
CO-58	Not Detected	-----	2.64E-02
CO-60	Not Detected	-----	3.07E-02
CR-51	Not Detected	-----	2.02E-01
CS-134	Not Detected	-----	4.20E-02
CS-137	1.62E-02	1.28E-02	1.70E-02
EU-152	Not Detected	-----	7.86E-02
EU-154	Not Detected	-----	1.53E-01
EU-155	Not Detected	-----	1.31E-01
FE-59	Not Detected	-----	6.11E-02
GD-153	Not Detected	-----	9.17E-02
HG-203	Not Detected	-----	2.72E-02
I-131	Not Detected	-----	2.70E-02
IR-192	Not Detected	-----	2.38E-02
K-40	1.44E+01	2.15E+00	2.30E-01
I-52	Not Detected	-----	2.86E-02
LA-54	Not Detected	-----	2.90E-02
MO-99	Not Detected	-----	2.87E-01
NA-22	Not Detected	-----	3.63E-02
NA-24	Not Detected	-----	1.25E-01
NB-95	Not Detected	-----	1.75E-01
ND-147	Not Detected	-----	1.82E-01
NI-57	Not Detected	-----	4.62E-02
PB-210	Not Detected	-----	2.98E+01
RU-103	Not Detected	-----	2.54E-02
RU-106	Not Detected	-----	2.34E-01
SB-122	Not Detected	-----	4.75E-02
SB-124	Not Detected	-----	2.57E-02
SB-125	Not Detected	-----	6.85E-02
SN-113	Not Detected	-----	3.15E-02
SR-85	Not Detected	-----	3.10E-02
TA-182	Not Detected	-----	1.31E-01
TA-183	Not Detected	-----	4.11E-01
TC-99m	Not Detected	-----	1.30E+00
TL-201	Not Detected	-----	2.17E-01
XE-133	Not Detected	-----	1.97E-01
Y-88	Not Detected	-----	2.04E-02
ZN-65	Not Detected	-----	8.90E-02
ZR-95	Not Detected	-----	4.87E-02

not detected  
*J 9/10/97*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-10-97 4:53:06 AM \*  
 \* \*\*\*\*\*  
 \* Analyzed by: *J 9/10/97* Reviewed by: *W 9/10/97* \*  
 \* \*\*\*\*\*

Customer : M.MITCHELL/C.C. (6685/IT)  
 Customer Sample ID : 034178-003  
 Lab Sample ID : 70157208

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 773.000 gram  
 Sample Date/Time : 9-08-97 4:10:00 PM  
 Acquire Start Date/Time : 9-10-97 3:10:16 AM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	3.39E+00
TH-234	Not Detected	-----	6.78E-01
RA-226	1.74E+00	1.55E+00	5.47E-01
PB-214	7.48E-01	1.27E-01	4.61E-02
BI-214	6.88E-01	1.35E-01	4.06E-02
U-232	7.66E-01	4.13E-01	1.56E-01
TH-228	7.68E-01	2.06E-01	1.32E-01
AC-228	8.14E-01	1.78E-01	7.59E-02
TH-228	1.15E+00	2.93E-01	4.47E-01
RA-224	8.57E-01	2.98E-01	6.51E-02
PB-212	7.83E-01	1.34E-01	3.88E-02
BI-212	8.82E-01	1.55E+00	3.06E-01
TL-208	8.20E-01	1.65E-01	6.53E-02
U-235	Not Detected	-----	2.42E-01
TH-231	Not Detected	-----	1.26E+01
PA-231	Not Detected	-----	1.40E+00
TH-227	Not Detected	-----	3.42E-01
RA-223	Not Detected	-----	2.15E-01
RN-219	<del>3.99E-01</del>	<del>2.99E-01</del>	3.62E-01
PB-211	Not Detected	-----	8.03E-01
TL-207	Not Detected	-----	1.29E+01
AM-241	Not Detected	-----	4.72E-01
PU-239	Not Detected	-----	4.40E+02
NP-237	Not Detected	-----	3.86E-01
PA-233	Not Detected	-----	5.62E-02
TH-229	Not Detected	-----	2.56E-01

*not detected J 9/10/97*



[Summary Report] - Sample ID: : 70157208

Nuclide me	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.87E-02
AG-110m	Not Detected	-----	3.54E-02
BA-133	Not Detected	-----	6.70E-02
BE-7	4.00E-01	1.65E-01	1.66E-01
CD-109	<del>1.19E+00</del>	<del>1.24E+00</del>	1.03E+00
CD-115	Not Detected	-----	1.02E-01
CE-139	Not Detected	-----	2.93E-02
CE-141	Not Detected	-----	5.36E-02
CE-144	Not Detected	-----	2.43E-01
CO-56	Not Detected	-----	2.24E-02
GO-57	Not Detected	-----	3.02E-02
CO-58	Not Detected	-----	3.15E-02
CO-60	Not Detected	-----	3.30E-02
CR-51	Not Detected	-----	2.30E-01
CS-134	Not Detected	-----	4.67E-02
CS-137	5.30E-02	1.58E-02	2.12E-02
EU-152	Not Detected	-----	9.08E-02
EU-154	Not Detected	-----	1.78E-01
EU-155	Not Detected	-----	1.47E-01
FE-59	Not Detected	-----	6.56E-02
GD-153	Not Detected	-----	1.06E-01
HG-203	Not Detected	-----	3.08E-02
I-131	Not Detected	-----	3.20E-02
IR-192	Not Detected	-----	2.69E-02
K-40	1.58E+01	2.35E+00	2.33E-01
Na-52	Not Detected	-----	3.41E-02
J-54	<del>1.50E-02</del>	<del>1.57E-02</del>	1.86E-02
MO-99	Not Detected	-----	3.28E-01
NA-22	Not Detected	-----	3.87E-02
NA-24	Not Detected	-----	1.62E-01
NB-95	Not Detected	-----	2.08E-01
ND-147	Not Detected	-----	2.17E-01
NI-57	Not Detected	-----	4.26E-02
PB-210	Not Detected	-----	3.46E+01
RU-103	Not Detected	-----	2.96E-02
RU-106	Not Detected	-----	2.89E-01
SB-122	Not Detected	-----	5.41E-02
SB-124	Not Detected	-----	2.92E-02
SB-125	Not Detected	-----	7.97E-02
SN-113	Not Detected	-----	3.64E-02
SR-85	Not Detected	-----	3.56E-02
TA-182	Not Detected	-----	1.44E-01
TA-183	Not Detected	-----	4.88E-01
TC-99m	Not Detected	-----	1.62E+00
TL-201	Not Detected	-----	2.54E-01
XE-133	Not Detected	-----	2.25E-01
Y-88	Not Detected	-----	2.79E-02
ZN-65	Not Detected	-----	9.89E-02
ZR-95	Not Detected	-----	5.62E-02

*Not detected 7/9/10/97*

*Not detected 7/9/10/00*

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-10-97 6:37:12 AM \*  
 \*/ \*\*\*\*\*

\* Analyzed by: *J 9/10/97* Reviewed by: *W 9/10/97* \*  
 \*\*\*\*\*

Customer : M.MITCHELL/C.C. (6685/IT)  
 Customer Sample ID : 034180-003  
 Lab Sample ID : 70157209

Sample Description : MARINELLI LIQUID SAMPLE  
 Sample Quantity : 450.000 mL  
 Sample Date/Time : 9-08-97 4:45:00 PM  
 Acquire Start Date/Time : 9-10-97 4:55:20 AM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6001 seconds

Comments:

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Nuclide Name	Activity (pCi/mL)	2-sigma Error	MDA (pCi/mL)
U-238	Not Detected	-----	1.85E+00
TH-234	Not Detected	-----	4.37E-01
RA-226	Not Detected	-----	5.33E-01
PB-214	Not Detected	-----	5.20E-02
BI-214	Not Detected	-----	5.69E-02
TH-232	Not Detected	-----	1.63E-01
-228	Not Detected	-----	1.59E-01
AC-228	Not Detected	-----	8.94E-02
TH-228	Not Detected	-----	5.47E-01
RA-224	Not Detected	-----	1.34E-01
PB-212	Not Detected	-----	4.21E-02
BI-212	Not Detected	-----	3.28E-01
TL-208	Not Detected	-----	7.80E-02
U-235	Not Detected	-----	1.69E-01
TH-231	Not Detected	-----	7.23E+00
PA-231	Not Detected	-----	1.10E+00
TH-227	Not Detected	-----	1.65E-01
RA-223	Not Detected	-----	1.19E-01
RN-219	Not Detected	-----	2.84E-01
PB-211	Not Detected	-----	6.22E-01
TL-207	Not Detected	-----	9.94E+00
AM-241	Not Detected	-----	2.54E-01
PU-239	Not Detected	-----	3.13E+02
NP-237	Not Detected	-----	1.94E-01
PA-233	Not Detected	-----	4.45E-02
TH-229	Not Detected	-----	1.56E-01

[Summary Report] - Sample ID: : 70157209

Nuclide ne	Activity (pCi/mL )	2-sigma Error	MDA (pCi/mL )
AG-108m	Not Detected	-----	2.54E-02
AG-110m	Not Detected	-----	2.42E-02
BA-133	Not Detected	-----	3.29E-02
BE-7	Not Detected	-----	1.96E-01
CD-109	Not Detected	-----	6.38E-01
CD-115	Not Detected	-----	6.51E-02
CE-139	Not Detected	-----	2.10E-02
CE-141	Not Detected	-----	3.69E-02
CE-144	Not Detected	-----	1.78E-01
CO-56	Not Detected	-----	3.52E-02
CO-57	Not Detected	-----	2.15E-02
CO-58	Not Detected	-----	2.41E-02
CO-60	Not Detected	-----	2.58E-02
CR-51	Not Detected	-----	1.95E-01
CS-134	Not Detected	-----	2.61E-02
CS-137	Not Detected	-----	2.46E-02
EU-152	Not Detected	-----	6.47E-02
EU-154	Not Detected	-----	1.16E-01
EU-155	Not Detected	-----	9.70E-02
FE-59	Not Detected	-----	4.62E-02
GD-153	Not Detected	-----	6.91E-02
HG-203	Not Detected	-----	2.50E-02
I-131	Not Detected	-----	2.53E-02
IR-192	Not Detected	-----	2.12E-02
K-40	Not Detected	-----	3.90E-01
La-52	Not Detected	-----	3.04E-02
La-54	Not Detected	-----	2.71E-02
MO-99	Not Detected	-----	2.66E-01
NA-22	Not Detected	-----	2.75E-02
NA-24	Not Detected	-----	1.32E-01
NB-95	Not Detected	-----	1.01E-01
ND-147	Not Detected	-----	1.72E-01
NI-57	Not Detected	-----	7.11E-02
PB-210	Not Detected	-----	1.60E+01
RU-103	Not Detected	-----	2.41E-02
RU-106	Not Detected	-----	2.58E-01
SB-122	Not Detected	-----	4.75E-02
SB-124	Not Detected	-----	2.52E-02
SB-125	Not Detected	-----	6.52E-02
SN-113	Not Detected	-----	2.97E-02
SR-85	Not Detected	-----	3.62E-02
TA-182	Not Detected	-----	8.49E-02
TA-183	Not Detected	-----	2.69E-01
<del>TC-99m</del>	<del>7.79E-01</del>	<del>1.06E+00</del>	<del>1.09E+00</del>
TL-201	Not Detected	-----	1.45E-01
XE-133	Not Detected	-----	1.37E-01
Y-88	Not Detected	-----	2.69E-02
ZN-65	Not Detected	-----	6.02E-02
ZR-95	Not Detected	-----	4.15E-02

*not detected 5/10/97*

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-10-97 7:56:46 AM \*  
 \* \*\*\*\*\*  
 \* Analyzed by: *J 9/10/97* Reviewed by: *WJ 9/10/97* \*  
 \* \*\*\*\*\*

Customer : M.MITCHELL/C.C. (6685/IT)  
 Customer Sample ID : LAB CONTROL SAMPLE USING CG134  
 Lab Sample ID : 70157210

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 : 9-10-97 7:44:40 AM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 600 / 605 seconds

Comments:

\*\*\*\*\*

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
U-238	Not Detected	-----	2.13E+04
TH-234	Not Detected	-----	4.72E+03
RA-226	Not Detected	-----	6.33E+03
PB-214	Not Detected	-----	7.31E+02
BI-214	Not Detected	-----	6.62E+02
TH-232	Not Detected	-----	2.29E+03
U-228	Not Detected	-----	2.67E+03
AC-228	Not Detected	-----	1.61E+03
TH-228	Not Detected	-----	8.71E+04
RA-224	Not Detected	-----	3.24E+03
PB-212	Not Detected	-----	6.34E+03
BI-212	Not Detected	-----	5.64E+04
TL-208	Not Detected	-----	1.15E+04
U-235	Not Detected	-----	1.84E+03
TH-231	Not Detected	-----	8.46E+04
PA-231	Not Detected	-----	1.51E+04
TH-227	Not Detected	-----	2.55E+03
RA-223	Not Detected	-----	1.00E+26
RN-219	Not Detected	-----	5.68E+03
PB-211	Not Detected	-----	1.29E+04
TL-207	Not Detected	-----	2.21E+05
AM-241	8.09E+04	1.43E+04	3.28E+03
PU-239	Not Detected	-----	3.25E+06
NP-237	Not Detected	-----	2.49E+03
PA-233	Not Detected	-----	6.27E+02
TH-229	Not Detected	-----	1.81E+03

[Summary Report] - Sample ID: : 70157210

Slide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
AG-108m	Not Detected	-----	3.49E+02
AG-110m	Not Detected	-----	1.75E+06
BA-133	Not Detected	-----	7.18E+02
BE-7	Not Detected	-----	5.11E+17
CD-109	2.97E+05	1.82E+05	2.56E+05
CD-115	Not Detected	-----	1.00E+26
CE-139	Not Detected	-----	7.12E+07
CE-141	Not Detected	-----	1.00E+26
CE-144	Not Detected	-----	8.22E+05
CO-56	Not Detected	-----	2.31E+12
CO-57	Not Detected	-----	1.38E+05
CO-58	Not Detected	-----	1.48E+13
CO-60	7.98E+04	1.08E+04	4.32E+02
CR-51	Not Detected	-----	1.00E+26
CS-134	Not Detected	-----	3.03E+03
CS-137	7.14E+04	9.51E+03	2.74E+02
EU-152	Not Detected	-----	9.93E+02
EU-154	Not Detected	-----	2.70E+03
EU-155	Not Detected	-----	2.97E+03
FE-59	Not Detected	-----	7.45E+19
GD-153	Not Detected	-----	9.83E+05
HG-203	Not Detected	-----	4.65E+18
I-131	Not Detected	-----	1.00E+26
IR-192	Not Detected	-----	4.81E+12
K-40	Not Detected	-----	1.62E+03
-52	Not Detected	-----	1.00E+26
-54	Not Detected	-----	9.70E+04
MO-99	Not Detected	-----	1.00E+26
NA-22	Not Detected	-----	1.37E+03
NA-24	Not Detected	-----	1.00E+26
NE-95	Not Detected	-----	1.00E+26
ND-147	Not Detected	-----	1.00E+26
NI-57	Not Detected	-----	1.00E+26
PB-210	Not Detected	-----	2.64E+05
RU-103	Not Detected	-----	5.93E+21
RU-106	Not Detected	-----	3.54E+05
SB-122	Not Detected	-----	1.00E+26
SB-124	Not Detected	-----	1.00E+15
SB-125	Not Detected	-----	6.29E+03
SN-113	Not Detected	-----	1.59E+09
SR-85	Not Detected	-----	1.59E+14
TA-182	Not Detected	-----	4.42E+09
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	-----	1.91E+09
ZN-65	Not Detected	-----	1.14E+06
ZR-95	Not Detected	-----	3.41E+14

# RESULTS FROM RPSD LAB

<b>Project Name:</b> <u>SITE 12B VCM</u>	<b>Case No./Service Order:</b> <u>8821.2012B0/ CF0408</u>
<b>SNL Task Leader:</b> <u>YOUNG, S.</u>	<b>Org/Mail Stop:</b> <u>6682/1147</u>
<b>Final Transmittal To:</b> <u>MITCHELL</u>	<b>Date Transmitted:</b> <u>10/01/97</u>
<b>SMO Project Coordinator:</b> <u>PUISSANT</u>	<b>Sample Ship Date:</b> <u>09/09/97</u>

<b>ARCOC</b>	<b>Lab</b>	<b>Lab ID</b>
<u>06900</u>	<u>RPSD</u>	<u>701576</u>
<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>

**Date**

**Filed in Records Center:** 10/14/97 **Transmitted By:** *L. Scarborough*

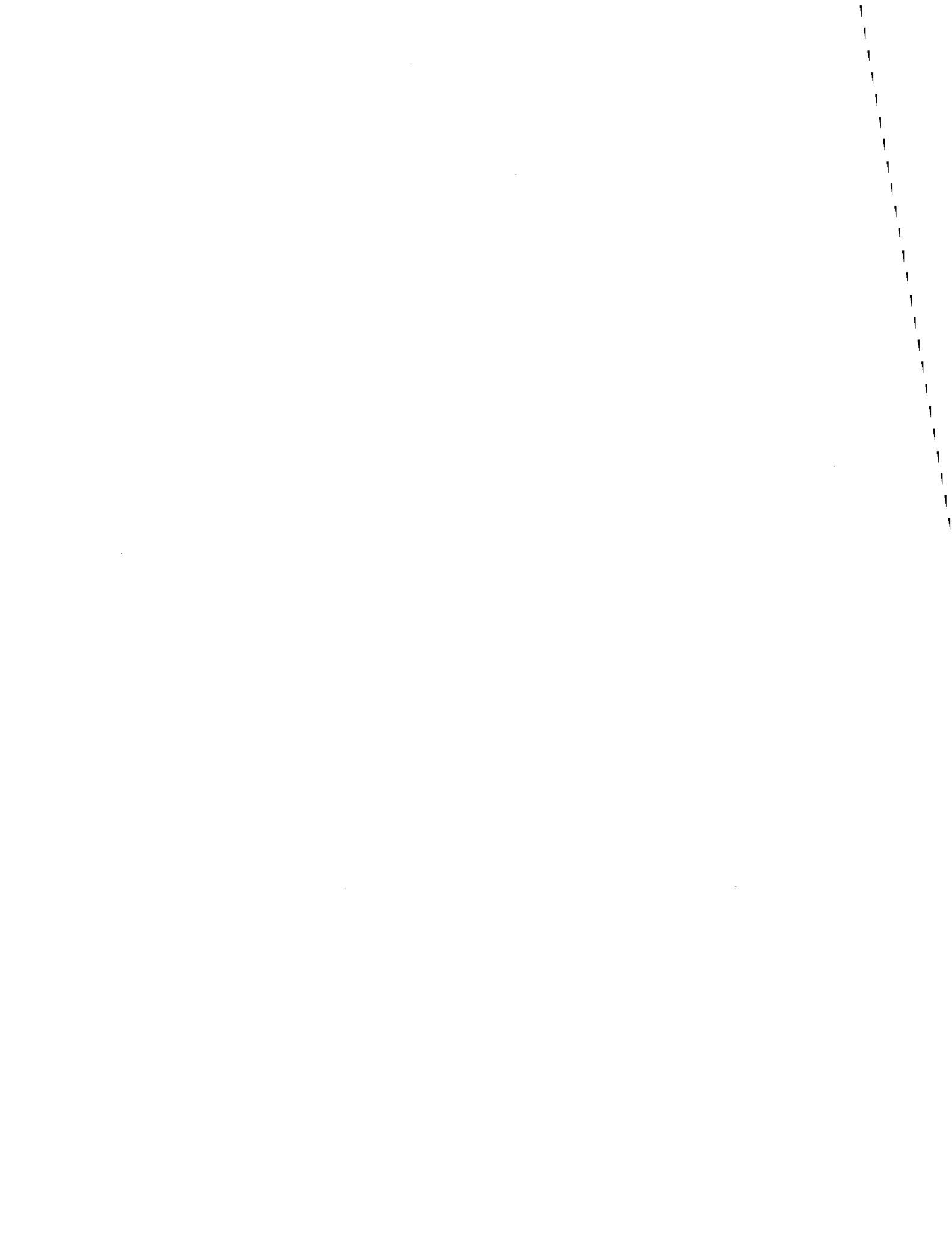
**Comments:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_





*Amir*

To be completed by Customer

Shaded areas are for RPSD use only

Customer: <u>Miche Mitchell</u>	Hazards/Special Instructions: <i>• This sheet refers to AR/COC 06900</i>	Batch Log Number: <u>701516</u>
Organization: <u>6685</u>		Logged By: <u>MAS</u>
Project Location: <u>12B UCM (Garrett)</u>		Analysis Type: <input checked="" type="checkbox"/> Gamma Spec <input type="checkbox"/> H-3 <input type="checkbox"/> Alpha/Beta <input type="checkbox"/> Alpha Spec <input type="checkbox"/> Total U <input type="checkbox"/> Other
Phone: <u>284-2575</u>		
Date Results Needed: <u>09-22-97</u>		
Suspect Isotopes: <u>None</u>		
Case Number: <u>8821.2012 80</u>		

Customer Sample ID	Sample Type	Date/Time Collected	Sample Quantity	Requested Analysis	RPSD Sample ID	Screen cpm	Sample Mass	Remarks / Aliquot Amount
034046-003	S	09-08-97	500 ml	Gamma Spec	01	4300	996	
034054-003		0910			02		985	
034055-003		0918			03		1016	
034056-003		0945			04		925	
034058-003		0955			05		920	
034059-003		1000			06		831	
034060-003		1010			07		894	
034062-003		1030			08		855	
034063-003		1050			09		897	
034064-003		1105			10		1020	
034065-003		1110			11		871	
034148-003		1145			12		946	
034150-003		1150			13		974	

Relinquished by <u>[Signature]</u>	Date <u>9/9/97</u>	Received by <u>Michael D [Signature]</u>	Date <u>9/9/97</u>
Relinquished by <u>[Signature]</u>	Date <u>9/17/97</u>	Received by <u>[Signature]</u>	Date <u>9/17/97</u>
Relinquished by _____	Date _____	Received by _____	Date _____
Relinquished by _____	Date _____	Received by _____	Date _____





*Amir*

To be completed by Customer

Shaded areas are for RPSD use only

Customer: <u>Miche Mitchell</u>	Hazards/Special Instructions:	Batch Log Number: <u>701576</u>
Organization: <u>6685</u>		Logged By: <u>MDS</u>
Project Location: <u>120 UCM (garage)</u>		Analysis Type: <input checked="" type="checkbox"/> Gamma Spec <input type="checkbox"/> H-3 <input type="checkbox"/> Alpha/Beta <input type="checkbox"/> Alpha Spec <input type="checkbox"/> Total U <input type="checkbox"/> Other
Phone: <u>284-2575</u>		
Date Results Needed: <u>09-22-97</u>		
Suspect Isotopes: <u>None</u>		
Case Number: <u>8821.2012 BD</u>		

Customer Sample ID	Sample Type	Date/Time Collected	Sample Quantity	Requested Analysis	RPSD Sample ID	Screen cpm	Sample Mass	Remarks / Aliquot Amount
034151-003	S	09-08-97 1205	500ml	Gamma Spec	14	4300	802	
034152-003		1155			15		740	
034153-003		1330			16		820	
034173-003		1325			17		847	
034155-003		1332			18		848	
034156-003		1405			19		777	
034157-003		1335			20		854	
034158-003		1350			21		870	
034160-003		1407			22		870	
034161-003		1410			23		825	
034162-003		1420			24		866	
034163-003		1445			25		876	
034165-003	↓	↓ 1500	↓	↓	26	↓	1004	

Relinquished by _____	Date _____	Received by <u>Michael D. Stan</u>	Date <u>9/9/97</u>
Relinquished by _____	Date _____	Received by _____	Date _____
Relinquished by _____	Date _____	Received by _____	Date _____
Relinquished by _____	Date _____	Received by _____	Date _____



*Amir*

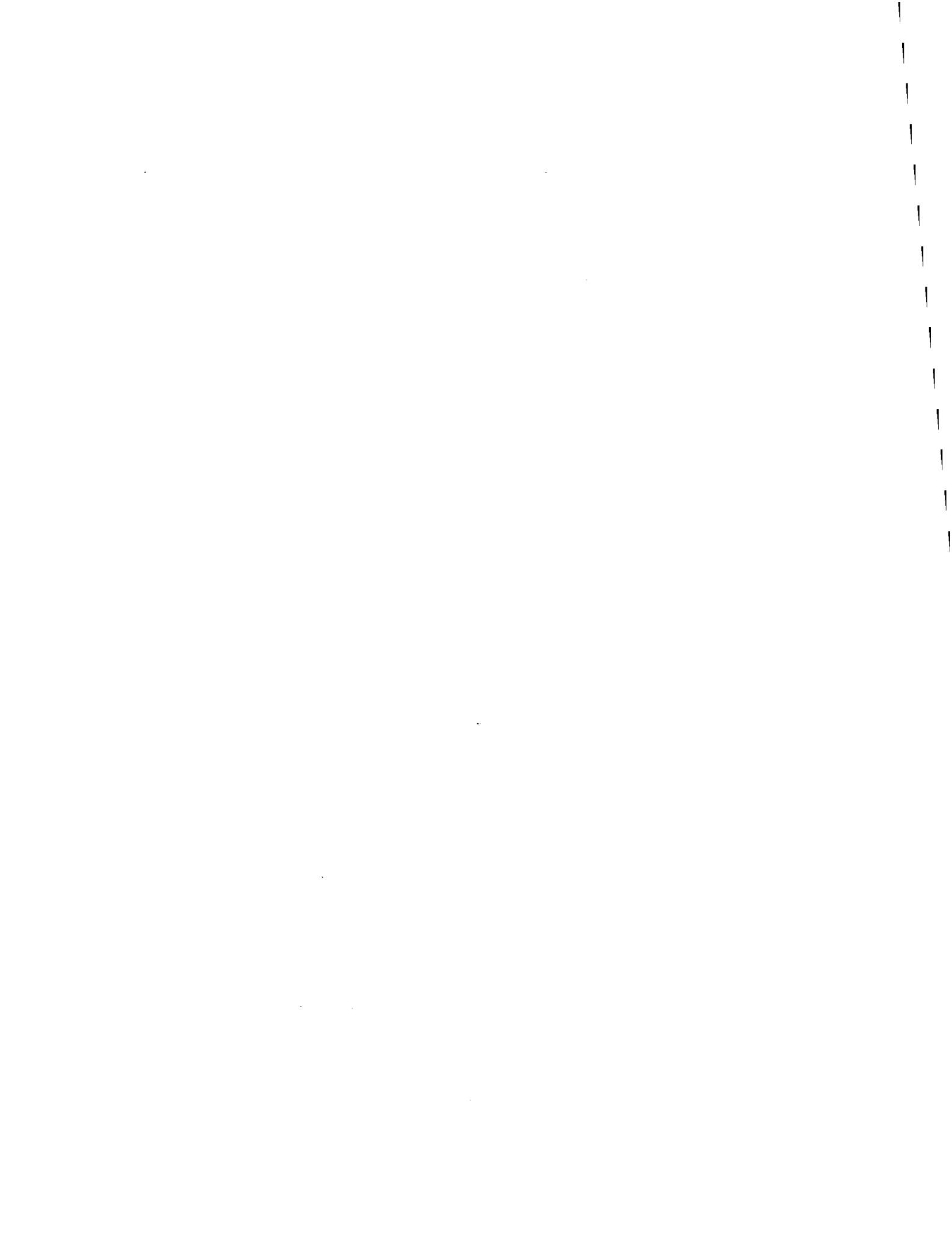
To be completed by Customer

Shaded areas are for RPSD use only

Customer: <u>Miche Mitchell</u>	Hazards/Special Instructions:	Batch Log Number: <u>201576</u>
Organization: <u>6685</u>		Logged By: <u>MDJ</u>
Project Location: <u>12B UCM (Barista)</u>		Analysis Type: <input checked="" type="checkbox"/> Gamma Spec <input type="checkbox"/> H-3 <input type="checkbox"/> Alpha/Beta <input type="checkbox"/> Alpha Spec <input type="checkbox"/> Total U <input type="checkbox"/> Other
Phone: <u>284-2575</u>		
Date Results Needed: <u>09-22-97</u>		
Suspect Isotopes: <u>None</u>		
Case Number: <u>2821.2012 BD</u>		

Customer Sample ID	Sample Type	Date/Time Collected	Sample Quantity	Requested Analysis	RPSD Sample ID	Screen cpm	Sample Mass	Remarks / Aliquot Amount
034166-003	5	09-08-97 1455	500 ml	Gamma Spec	27	4300	922	
034167-003		1505			28		980	
034168-003		1505			29		1030	
034170-003		1535			30		999	
034171-003		1540			31		1026	
034172-003		1600			32		942	
034174-003		1603			33		1013	
034179-003	✓	✓ 1620	✓	✓	34		878	
		last		1 Tem				
LCS		1 NOV 97		8 spec	35, 36	N/A	N/A	

Relinquished by _____	Date _____	Received by <u>Michael D Stan</u>	Date <u>9/19/97</u>
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 [881 Laboratory] \*  
 \* 9-10-97 10:38:50 AM \*  
 \*\*\*\*\*

\* Analyzed by: *[Signature]* 9/15/97 Reviewed by: *[Signature]* 9/16/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034046-003  
 Lab Sample ID : 70157601

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 996.000 gram  
 Sample Date/Time : 9-08-97 9:00:00 AM  
 Acquire Start Date/Time : 9-10-97 8:56:08 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	Not Detected	-----	2.29E+00
TH-234	5.71E-01	3.12E-01	4.16E-01
RA-226	1.46E+00	8.51E-01	3.70E-01
PB-214	7.82E-01	2.05E-01	3.19E-02
BI-214	7.30E-01	1.73E-01	2.76E-02
TH-232	2.47E-01	2.08E-01	8.96E-02
PA-228	2.00E-01	1.01E-01	9.04E-02
AC-228	Not Detected	-----	1.05E-01
TH-228	3.39E-01	1.40E-01	3.33E-01
RA-224	2.99E-01	1.42E-01	4.20E-02
PB-212	2.23E-01	1.37E-01	2.75E-02
BI-212	2.48E-01	1.69E-01	1.81E-01
TL-208	2.19E-01	8.41E-02	4.90E-02
U-235	Not Detected	-----	1.74E-01
TH-231	Not Detected	-----	8.93E+00
PA-231	Not Detected	-----	9.80E-01
TH-227	Not Detected	-----	1.97E-01
RA-223	Not Detected	-----	1.55E-01
RN-219	Not Detected	-----	2.51E-01
PB-211	Not Detected	-----	5.74E-01
TL-207	Not Detected	-----	8.80E+00
AM-241	Not Detected	-----	3.34E-01
PU-239	Not Detected	-----	3.05E+02
NP-237	Not Detected	-----	2.66E-01
PA-233	Not Detected	-----	4.10E-02
TH-229	Not Detected	-----	1.70E-01

[Summary Report] - Sample ID: : 70157601

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.37E-02
AG-110m	Not Detected	-----	2.45E-02
BA-133	Not Detected	-----	5.55E-02
BE-7	Not Detected	-----	1.74E-01
CD-109	Not Detected	-----	5.75E-01
CD-115	Not Detected	-----	7.37E-02
CE-139	Not Detected	-----	2.08E-02
CE-141	Not Detected	-----	3.91E-02
CE-144	Not Detected	-----	1.66E-01
CO-56	Not Detected	-----	1.68E-02
CO-57	Not Detected	-----	2.16E-02
CO-58	Not Detected	-----	2.09E-02
CO-60	Not Detected	-----	2.14E-02
CR-51	Not Detected	-----	1.68E-01
CS-134	Not Detected	-----	3.89E-02
CS-137	4.26E-02	1.86E-02	1.45E-02
EU-152	Not Detected	-----	6.47E-02
EU-154	Not Detected	-----	1.09E-01
EU-155	Not Detected	-----	1.03E-01
FE-59	Not Detected	-----	4.04E-02
GD-153	Not Detected	-----	7.35E-02
HG-203	Not Detected	-----	2.17E-02
I-131	Not Detected	-----	2.20E-02
IR-192	Not Detected	-----	1.95E-02
K-40	3.92E+00	7.38E-01	1.94E-01
MN-52	Not Detected	-----	2.49E-02
N-54	Not Detected	-----	2.30E-02
MO-99	Not Detected	-----	2.32E-01
NA-22	Not Detected	-----	2.43E-02
NA-24	Not Detected	-----	1.88E-01
NB-95	Not Detected	-----	1.33E-01
ND-147	Not Detected	-----	1.40E-01
NI-57	Not Detected	-----	4.42E-02
PB-210	Not Detected	-----	2.40E+01
RU-103	Not Detected	-----	1.96E-02
RU-106	Not Detected	-----	1.89E-01
SB-122	Not Detected	-----	4.45E-02
SB-124	Not Detected	-----	2.05E-02
SB-125	Not Detected	-----	5.23E-02
SN-113	Not Detected	-----	2.55E-02
SR-85	Not Detected	-----	2.37E-02
TA-182	Not Detected	-----	1.06E-01
TA-183	Not Detected	-----	3.74E-01
TC-99m	Not Detected	-----	5.19E+00
TL-201	Not Detected	-----	1.96E-01
XE-133	Not Detected	-----	1.89E-01
Y-88	Not Detected	-----	1.66E-02
ZN-65	Not Detected	-----	7.28E-02
ZR-95	Not Detected	-----	3.59E-02

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-10-97 12:29:23 PM \*  
 \*\*\*\*\*

Analyzed by: *[Signature]* 9/15/97 Reviewed by: *[Signature]* 9/16/97  
 \*\*\*\*\*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034054-003  
 Lab Sample ID : 70157602

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 985.000 gram  
 Sample Date/Time : 9-08-97 9:10:00 AM  
 Acquire Start Date/Time : 9-10-97 10:40:58 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	-----	2.37E+00
TH-234	6.23E-01	3.48E-01	4.00E-01
RA-226	1.30E+00	3.96E-01	3.86E-01
PB-214	6.41E-01	7.18E-01	3.29E-02
BI-214	5.69E-01	1.38E-01	3.16E-02
TH-232	2.75E-01	1.82E-01	1.02E-01
RA-228	2.84E-01	1.19E-01	8.99E-02
C-228	Not Detected	-----	1.08E-01
Th-228	1.56E-01	1.21E-01	3.35E-01
RA-224	3.33E-01	1.30E-01	4.96E-02
PB-212	2.55E-01	5.00E-02	2.86E-02
BI-212	2.52E-01	4.25E-01	1.75E-01
TL-208	2.48E-01	6.73E-02	3.82E-02
U-235	Not Detected	-----	1.69E-01
TH-231	Not Detected	-----	9.07E+00
PA-231	Not Detected	-----	9.81E-01
TH-227	Not Detected	-----	1.98E-01
RA-223	Not Detected	-----	1.59E-01
RN-219	Not Detected	-----	2.58E-01
PB-211	Not Detected	-----	5.87E-01
TL-207	Not Detected	-----	9.00E+00
AM-241	Not Detected	-----	3.17E-01
PU-239	Not Detected	-----	2.99E+02
NP-237	Not Detected	-----	1.89E-01
PA-233	Not Detected	-----	4.06E-02
TH-229	Not Detected	-----	1.74E-01

[Summary Report] - Sample ID: : 70157602

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.46E-02
AG-110m	Not Detected	-----	3.30E-02
BA-133	Not Detected	-----	5.27E-02
BE-7	6.61E-02	2.99E-02	1.03E-01
CD-109	Not Detected	-----	6.44E-01
CD-115	Not Detected	-----	7.68E-02
CE-139	Not Detected	-----	2.10E-02
CE-141	Not Detected	-----	3.78E-02
CE-144	Not Detected	-----	1.64E-01
CO-56	Not Detected	-----	1.64E-02
CO-57	Not Detected	-----	2.16E-02
CO-58	Not Detected	-----	1.99E-02
CO-60	Not Detected	-----	2.22E-02
CR-51	Not Detected	-----	1.65E-01
CS-134	Not Detected	-----	3.57E-02
CS-137	1.42E-01	3.06E-02	1.39E-02
EU-152	Not Detected	-----	6.47E-02
EU-154	Not Detected	-----	1.13E-01
EU-155	Not Detected	-----	1.02E-01
FE-59	Not Detected	-----	4.20E-02
GD-153	Not Detected	-----	7.30E-02
HG-203	Not Detected	-----	2.19E-02
I-131	Not Detected	-----	2.25E-02
IR-192	Not Detected	-----	1.92E-02
K-40	5.48E+00	9.52E-01	1.83E-01
MN-52	Not Detected	-----	2.73E-02
MN-54	Not Detected	-----	2.26E-02
IO-99	Not Detected	-----	2.54E-01
JA-22	Not Detected	-----	2.41E-02
NA-24	Not Detected	-----	1.88E-01
NE-95	Not Detected	-----	1.35E-01
ND-147	Not Detected	-----	1.50E-01
NI-57	1.11E-01	7.47E-02	4.40E-02
PB-210	Not Detected	-----	2.46E+01
RU-103	Not Detected	-----	2.00E-02
RU-106	Not Detected	-----	1.88E-01
SB-122	Not Detected	-----	4.35E-02
SB-124	Not Detected	-----	2.07E-02
SB-125	Not Detected	-----	5.54E-02
SN-113	Not Detected	-----	2.51E-02
SR-85	Not Detected	-----	2.44E-02
TA-182	Not Detected	-----	1.01E-01
TA-183	Not Detected	-----	3.60E-01
TC-99m	Not Detected	-----	6.19E+00
TL-201	Not Detected	-----	1.99E-01
XE-133	Not Detected	-----	1.92E-01
Y-88	Not Detected	-----	1.82E-02
ZN-65	Not Detected	-----	7.01E-02
ZR-95	Not Detected	-----	3.48E-02

*not detected 7/5/97*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-10-97 2:20:21 PM \*  
 \*\*\*\*\*

Analyzed by: *J* 9/15/97 Reviewed by: *WJ* 9/16/97  
 \*\*\*\*\*  
 Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034055-003  
 Lab Sample ID : 70157603

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 1016.000 gram  
 Sample Date/Time : 9-08-97 9:18:00 AM  
 Acquire Start Date/Time : 9-10-97 12:31:57 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.19E+00
TH-234	9.04E-01	3.65E-01	4.05E-01
RA-226	1.43E+00	4.21E-01	3.67E-01
PB-214	7.24E-01	1.18E-01	3.24E-02
BI-214	6.67E-01	1.64E-01	3.09E-02
TH-232	2.20E-01	1.62E-01	9.86E-02
RA-228	2.23E-01	9.10E-02	8.53E-02
C-228	Not Detected	-----	1.07E-01
H-228	2.75E-01	2.23E-01	3.32E-01
RA-224	2.23E-01	1.02E-01	4.98E-02
PB-212	2.13E-01	4.45E-02	2.72E-02
BI-212	2.89E-01	1.91E-01	1.79E-01
TL-208	1.86E-01	5.30E-02	4.19E-02
U-235	<del>1.00E-01</del>	<del>1.30E-01</del>	1.68E-01
TH-231	Not Detected	-----	8.60E+00
PA-231	Not Detected	-----	9.83E-01
TH-227	Not Detected	-----	1.92E-01
RA-223	Not Detected	-----	1.50E-01
RN-219	Not Detected	-----	2.57E-01
PB-211	Not Detected	-----	5.90E-01
TL-207	Not Detected	-----	8.39E+00
AM-241	Not Detected	-----	3.16E-01
PU-239	Not Detected	-----	3.01E+02
NP-237	Not Detected	-----	1.78E-01
PA-233	Not Detected	-----	3.91E-02
TH-229	Not Detected	-----	1.72E-01

*Not detected J 9/15/97*



[Summary Report] - Sample ID: : 70157603

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
. 108m	Not Detected	-----	2.40E-02
AG-110m	Not Detected	-----	2.24E-02
BA-133	Not Detected	-----	5.38E-02
BE-7	Not Detected	-----	1.68E-01
CD-109	Not Detected	-----	6.04E-01
CD-115	Not Detected	-----	7.73E-02
CE-139	Not Detected	-----	2.07E-02
CE-141	Not Detected	-----	3.76E-02
CE-144	Not Detected	-----	1.69E-01
CO-56	Not Detected	-----	2.28E-02
CO-57	Not Detected	-----	2.08E-02
CO-58	Not Detected	-----	2.01E-02
CO-60	Not Detected	-----	2.11E-02
CR-51	Not Detected	-----	1.66E-01
CS-134	Not Detected	-----	3.73E-02
CS-137	Not Detected	-----	1.30E-02
EU-152	Not Detected	-----	6.24E-02
EU-154	Not Detected	-----	1.10E-01
EU-155	Not Detected	-----	1.00E-01
FE-59	Not Detected	-----	3.97E-02
GD-153	Not Detected	-----	7.30E-02
HG-203	Not Detected	-----	2.13E-02
I-131	Not Detected	-----	2.35E-02
IR-192	Not Detected	-----	1.88E-02
K-40	4.47E+00	1.83E+00	1.79E-01
MN-52	Not Detected	-----	2.46E-02
MN-54	Not Detected	-----	2.21E-02
99	Not Detected	-----	2.57E-01
22	Not Detected	-----	2.38E-02
NA-24	Not Detected	-----	2.03E-01
NB-95	Not Detected	-----	1.33E-01
ND-147	Not Detected	-----	1.39E-01
NI-57	<del>1.20E-01</del>	<del>6.55E-02</del>	4.97E-02
PB-210	Not Detected	-----	2.39E+01
RU-103	Not Detected	-----	1.88E-02
RU-106	Not Detected	-----	1.79E-01
SB-122	Not Detected	-----	4.13E-02
SB-124	Not Detected	-----	2.07E-02
SB-125	Not Detected	-----	5.25E-02
SN-113	Not Detected	-----	2.46E-02
SR-85	Not Detected	-----	2.20E-02
TA-182	Not Detected	-----	1.04E-01
TA-183	Not Detected	-----	3.58E-01
TC-99m	Not Detected	-----	7.26E+00
TL-201	Not Detected	-----	1.93E-01
XE-133	Not Detected	-----	1.86E-01
Y-88	Not Detected	-----	1.68E-02
ZN-65	Not Detected	-----	7.06E-02
ZR-95	Not Detected	-----	3.40E-02

*Not Detected 9/15/97*

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-10-97 4:11:31 PM \*  
 \*\*\*\*\*

\* Analyzed by: *J* 9/15/97 Reviewed by: *W* 9/16/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034056-003  
 Lab Sample ID : 70157604

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 925.000 gram  
 Sample Date/Time : 9-08-97 9:45:00 AM  
 Acquire Start Date/Time : 9-10-97 2:22:54 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.31E+00
TH-234	5.74E-01	3.56E-01	4.35E-01
RA-226	1.59E+00	4.40E-01	4.04E-01
PB-214	6.70E-01	8.35E-01	3.28E-02
BI-214	6.24E-01	5.54E-01	3.12E-02
TH-232	3.27E-01	1.73E-01	9.86E-02
RA-228	3.07E-01	1.09E-01	9.11E-02
-228	Not Detected	-----	1.10E-01
-228	Not Detected	-----	6.24E-01
RA-224	2.87E-01	1.19E-01	4.42E-02
PB-212	2.52E-01	4.94E-02	2.81E-02
BI-212	2.56E-01	3.86E-01	2.12E-01
TL-208	Not Detected	-----	4.39E-02
U-235	Not Detected	-----	1.76E-01
TH-231	Not Detected	-----	9.07E+00
PA-231	Not Detected	-----	1.05E+00
TH-227	Not Detected	-----	2.07E-01
RA-223	Not Detected	-----	1.59E-01
RN-219	Not Detected	-----	2.65E-01
PB-211	Not Detected	-----	5.94E-01
TL-207	Not Detected	-----	9.06E+00
AM-241	Not Detected	-----	3.38E-01
PU-239	Not Detected	-----	3.14E+02
NP-237	Not Detected	-----	1.70E-01
PA-233	Not Detected	-----	4.12E-02
TH-229	Not Detected	-----	1.80E-01

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
108m	Not Detected		2.44E-02
AG-110m	Not Detected		2.87E-02
BA-133	Not Detected		5.49E-02
BE-7	Not Detected		1.76E-01
CD-109	Not Detected		5.79E-01
CD-115	Not Detected		8.29E-02
CE-139	Not Detected		2.14E-02
CE-141	Not Detected		3.91E-02
CE-144	Not Detected		1.75E-01
CO-56	Not Detected		1.73E-02
CO-57	Not Detected		2.22E-02
CO-58	Not Detected		2.16E-02
CO-60	Not Detected		2.43E-02
CR-51	Not Detected		1.74E-01
CS-134	Not Detected		3.78E-02
CS-137	6.39E-02	1.96E-02	1.45E-02
EU-152	Not Detected		6.66E-02
EU-154	Not Detected		1.13E-01
EU-155	Not Detected		1.06E-01
FE-59	Not Detected		4.48E-02
GD-153	Not Detected		7.64E-02
HG-203	Not Detected		2.29E-02
I-131	Not Detected		2.46E-02
IR-192	Not Detected		1.98E-02
K-40	5.06E+00	9.13E-01	2.00E-01
MN-52	Not Detected		2.67E-02
MN-54	Not Detected		2.35E-02
MO-99	Not Detected		2.71E-01
-22	Not Detected		2.46E-02
NA-24	Not Detected		2.54E-01
NB-95	Not Detected		1.45E-01
ND-147	Not Detected		1.54E-01
NI-57	<del>9.82E-02</del>	<del>5.78E-02</del>	5.35E-02
PB-210	Not Detected		2.56E+01
RU-103	Not Detected		2.10E-02
RU-106	Not Detected		1.98E-01
SB-122	Not Detected		4.60E-02
SB-124	Not Detected		2.12E-02
SB-125	Not Detected		5.96E-02
SN-113	Not Detected		2.68E-02
SR-85	Not Detected		2.53E-02
TA-182	Not Detected		1.08E-01
TA-183	Not Detected		3.87E-01
TC-99m	Not Detected		9.17E+00
TL-201	Not Detected		2.08E-01
XE-133	Not Detected		2.06E-01
Y-88	Not Detected		1.67E-02
ZN-65	Not Detected		7.35E-02
ZR-95	Not Detected		3.63E-02

*not detected 7/9/15/97*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-10-97 6:10:04 PM \*  
 \*\*\*\*\*

\* Analyzed by: *J 9/15/97* Reviewed by: *W 9/16/97* \*  
 \*\*\*\*\*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034058-003  
 Lab Sample ID : 70157605

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 920.000 gram  
 Sample Date/Time : 9-08-97 9:55:00 AM  
 Acquire Start Date/Time : 9-10-97 4:21:17 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.59E+00
TH-234	1.57E+00	4.52E-01	4.63E-01
RA-226	9.10E-01	7.94E-01	4.54E-01
PB-214	7.57E-01	1.58E-01	3.71E-02
BI-214	6.89E-01	6.16E-01	3.49E-02
TH-232	3.59E-01	2.09E-01	1.05E-01
A-228	2.67E-01	1.04E-01	1.01E-01
AC-228	Not Detected	-----	1.22E-01
TH-228	Not Detected	-----	3.69E-01
RA-224	3.44E-01	1.37E-01	5.53E-02
PB-212	3.70E-01	6.82E-02	3.21E-02
BI-212	3.98E-01	1.98E-01	1.95E-01
TL-208	Not Detected	-----	4.65E-02
<del>U-235</del>	<del>4.81E-02</del>	<del>4.79E-02</del>	9.91E-02
TH-231	Not Detected	-----	9.82E+00
PA-231	Not Detected	-----	1.07E+00
TH-227	Not Detected	-----	2.35E-01
RA-223	Not Detected	-----	1.73E-01
RN-219	Not Detected	-----	2.79E-01
PB-211	Not Detected	-----	6.32E-01
TL-207	Not Detected	-----	9.46E+00
AM-241	Not Detected	-----	3.58E-01
PU-239	Not Detected	-----	3.32E+02
<del>NP-237</del>	<del>4.01E-01</del>	<del>1.26E-01</del>	2.35E-01
PA-233	Not Detected	-----	4.42E-02
TH-229	Not Detected	-----	1.87E-01

*not detected J 9/15/97*

*not detected J 9/15/97*

[Summary Report] - Sample ID: : 70157605

Slide name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected		2.76E-02
AG-110m	Not Detected		3.06E-02
BA-133	Not Detected		5.89E-02
BE-7	Not Detected		1.91E-01
CD-109	Not Detected		7.99E-01
CD-115	Not Detected		9.12E-02
CE-139	Not Detected		2.28E-02
CE-141	Not Detected		2.26E-02
CE-144	Not Detected		1.87E-01
CO-56	Not Detected		1.77E-02
CO-57	Not Detected		2.36E-02
CO-58	Not Detected		2.35E-02
CO-60	Not Detected		2.38E-02
CR-51	Not Detected		1.83E-01
CS-134	Not Detected		3.93E-02
CS-137	7.53E-02	2.81E-02	1.60E-02
EU-152	Not Detected		7.08E-02
EU-154	Not Detected		1.28E-01
EU-155	Not Detected		1.14E-01
FE-59	Not Detected		4.77E-02
GD-153	Not Detected		8.06E-02
HG-203	Not Detected		2.41E-02
I-131	Not Detected		2.47E-02
IR-192	Not Detected		2.11E-02
K-40	6.67E+00	1.90E+00	1.89E-01
LN-52	Not Detected		2.98E-02
LN-54	Not Detected		2.48E-02
MO-99	Not Detected		2.91E-01
NA-22	Not Detected		2.81E-02
NA-24	Not Detected		2.89E-01
NB-95	Not Detected		1.67E-01
ND-147	Not Detected		1.61E-01
NI-57	Not Detected		6.06E-02
PB-210	Not Detected		2.61E+01
RU-103	Not Detected		2.18E-02
RU-106	Not Detected		2.18E-01
SB-122	Not Detected		5.06E-02
SB-124	Not Detected		2.18E-02
SB-125	Not Detected		6.11E-02
SN-113	Not Detected		2.95E-02
SR-85	Not Detected		2.67E-02
TA-182	Not Detected		1.15E-01
TA-183	Not Detected		4.15E-01
TC-99m	Not Detected		1.21E+01
TL-201	Not Detected		2.35E-01
XE-133	Not Detected		2.26E-01
Y-88	Not Detected		2.08E-02
ZN-65	Not Detected		7.82E-02
ZR-95	Not Detected		4.15E-02

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-10-97 7:55:18 PM \*  
 \*\*\*\*\*

\* Analyzed by: *J 9/15/97* Reviewed by: *AY 9/16/97* \*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034059-003  
 Lab Sample ID : 70157606

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 831.000 gram  
 Sample Date/Time : 9-08-97 10:00:00 AM  
 Acquire Start Date/Time : 9-10-97 6:12:38 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.84E+00
TH-234	1.16E+00	5.51E-01	4.86E-01
RA-226	1.61E+00	4.96E-01	4.85E-01
PB-214	6.79E-01	1.23E-01	3.86E-02
BI-214	6.30E-01	1.61E-01	3.65E-02
TH-232	4.32E-01	2.60E-01	1.25E-01
A-228	4.15E-01	2.07E-01	1.27E-01
AC-228	5.22E-01	5.93E-01	6.35E-02
TH-228	5.31E-01	4.03E-01	4.08E-01
RA-224	4.67E-01	1.73E-01	6.18E-02
PB-212	4.97E-01	9.12E-02	3.28E-02
BI-212	5.75E-01	4.01E-01	2.45E-01
TL-208	4.22E-01	1.04E-01	5.40E-02
U-235	Not Detected	-----	2.02E-01
TH-231	Not Detected	-----	1.09E+01
PA-231	Not Detected	-----	1.16E+00
TH-227	Not Detected	-----	2.68E-01
RA-223	Not Detected	-----	1.94E-01
RN-219	Not Detected	-----	3.06E-01
PB-211	Not Detected	-----	6.85E-01
TL-207	Not Detected	-----	1.05E+01
AM-241	Not Detected	-----	4.12E-01
PU-239	Not Detected	-----	3.67E+02
NP-237	<del>2.47E-01</del>	<del>1.16E-01</del>	<del>2.55E-01</del>
PA-233	Not Detected	-----	4.62E-02
TH-229	Not Detected	-----	2.15E-01

*not detected J 9/15/97*

[Summary Report] - Sample ID: : 70157606

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.10E-02
AG-110m	Not Detected	-----	3.09E-02
BA-133	Not Detected	-----	5.98E-02
BE-7	Not Detected	-----	2.10E-01
CD-109	Not Detected	-----	8.68E-01
CD-115	Not Detected	-----	1.08E-01
CE-139	Not Detected	-----	2.47E-02
CE-141	Not Detected	-----	4.55E-02
CE-144	Not Detected	-----	2.02E-01
CO-56	Not Detected	-----	1.98E-02
CO-57	Not Detected	-----	2.55E-02
CO-58	Not Detected	-----	2.64E-02
CO-60	Not Detected	-----	2.62E-02
CR-51	Not Detected	-----	1.96E-01
CS-134	Not Detected	-----	4.14E-02
CS-137	6.93E-02	2.67E-02	1.73E-02
EU-152	Not Detected	-----	7.65E-02
EU-154	Not Detected	-----	1.45E-01
EU-155	Not Detected	-----	1.22E-01
FE-59	Not Detected	-----	5.20E-02
GD-153	Not Detected	-----	8.96E-02
HG-203	Not Detected	-----	2.61E-02
I-131	Not Detected	-----	2.77E-02
IR-192	Not Detected	-----	2.22E-02
K-40	8.17E+00	1.35E+00	1.95E-01
MN-52	Not Detected	-----	3.50E-02
N-54	Not Detected	-----	2.81E-02
MO-99	Not Detected	-----	3.38E-01
NA-22	Not Detected	-----	3.05E-02
NA-24	Not Detected	-----	3.48E-01
NB-95	Not Detected	-----	1.93E-01
ND-147	Not Detected	-----	1.89E-01
NI-57	<del>1.33E-01</del>	<del>9.04E-02</del>	7.03E-02
PB-210	Not Detected	-----	2.96E+01
RU-103	Not Detected	-----	2.51E-02
RU-106	Not Detected	-----	2.32E-01
SB-122	Not Detected	-----	5.59E-02
SB-124	Not Detected	-----	2.42E-02
SB-125	Not Detected	-----	6.53E-02
SN-113	Not Detected	-----	3.14E-02
SR-85	Not Detected	-----	2.91E-02
TA-182	Not Detected	-----	1.22E-01
TA-183	Not Detected	-----	4.77E-01
TC-99m	Not Detected	-----	1.59E+01
TL-201	Not Detected	-----	2.53E-01
XE-133	Not Detected	-----	2.55E-01
Y-88	Not Detected	-----	2.34E-02
ZN-65	Not Detected	-----	8.27E-02
ZR-95	Not Detected	-----	4.60E-02

*not detected 7/9/15/197*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-10-97 9:40:17 PM \*  
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\* Analyzed by: *J 9/15/97* Reviewed by: *SM 9/16/97* \*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034060-003  
 Lab Sample ID : 70157607

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 894.000 gram  
 Sample Date/Time : 9-08-97 10:10:00 AM  
 Acquire Start Date/Time : 9-10-97 7:57:25 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	1.34E+00
TH-234	1.33E+00	4.72E-01	5.16E-01
RA-226	Not Detected	-----	3.99E-01
PB-214	7.66E-01	1.31E-01	3.91E-02
BI-214	7.15E-01	1.28E-01	3.63E-02
TH-232	5.98E-01	3.12E-01	1.22E-01
A-228	5.64E-01	1.91E-01	1.06E-01
AC-228	5.31E-01	1.40E-01	6.28E-02
TH-228	3.04E-01	1.60E-01	4.23E-01
RA-224	5.50E-01	2.26E-01	5.85E-02
PB-212	5.19E-01	9.18E-02	3.23E-02
BI-212	5.13E-01	2.39E-01	2.46E-01
TL-208	4.72E-01	1.05E-01	5.27E-02
U-235	Not Detected	-----	2.04E-01
TH-231	Not Detected	-----	1.07E+01
PA-231	Not Detected	-----	1.16E+00
TH-227	Not Detected	-----	2.63E-01
RA-223	Not Detected	-----	1.92E-01
RN-219	Not Detected	-----	2.97E-01
PB-211	Not Detected	-----	6.69E-01
TL-207	Not Detected	-----	1.03E+01
AM-241	Not Detected	-----	4.03E-01
PU-239	Not Detected	-----	3.70E+02
NP-237	<del>3.63E-01</del>	<del>1.26E-01</del>	2.55E-01
PA-233	Not Detected	-----	4.62E-02
TH-229	Not Detected	-----	2.07E-01

*Not detected J 9/15/97*



[Summary Report] - Sample ID: : 70157607

Slide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.01E-02
AG-110m	Not Detected	-----	2.97E-02
BA-133	Not Detected	-----	6.09E-02
BE-7	Not Detected	-----	2.10E-01
CD-109	Not Detected	-----	8.67E-01
CD-115	Not Detected	-----	1.07E-01
CE-139	Not Detected	-----	2.48E-02
CE-141	Not Detected	-----	4.63E-02
CE-144	Not Detected	-----	1.98E-01
CO-56	Not Detected	-----	2.14E-02
CO-57	Not Detected	-----	2.50E-02
CO-58	Not Detected	-----	2.59E-02
CO-60	Not Detected	-----	2.80E-02
CR-51	Not Detected	-----	1.94E-01
CS-134	Not Detected	-----	4.18E-02
CS-137	4.57E-02	1.98E-02	1.87E-02
EU-152	Not Detected	-----	7.50E-02
EU-154	Not Detected	-----	1.38E-01
EU-155	Not Detected	-----	1.22E-01
FE-59	Not Detected	-----	5.23E-02
GD-153	Not Detected	-----	8.76E-02
HG-203	Not Detected	-----	2.62E-02
I-131	Not Detected	-----	2.80E-02
IR-192	Not Detected	-----	2.21E-02
K-40	9.22E+00	1.46E+00	1.97E-01
LV-52	Not Detected	-----	3.12E-02
L-54	Not Detected	-----	2.65E-02
MO-99	Not Detected	-----	3.46E-01
NA-22	Not Detected	-----	2.98E-02
NA-24	Not Detected	-----	3.84E-01
NB-95	Not Detected	-----	1.92E-01
ND-147	Not Detected	-----	1.85E-01
NI-57	<del>1.20E-01</del>	<del>9.00E-02</del>	7.16E-02
PB-210	Not Detected	-----	2.95E+01
RU-103	Not Detected	-----	2.28E-02
RU-106	Not Detected	-----	2.26E-01
SB-122	Not Detected	-----	5.84E-02
SB-124	Not Detected	-----	2.43E-02
SB-125	Not Detected	-----	6.54E-02
SN-113	Not Detected	-----	3.02E-02
SR-85	Not Detected	-----	2.93E-02
TA-182	Not Detected	-----	1.23E-01
TA-183	Not Detected	-----	4.80E-01
TC-99m	Not Detected	-----	1.89E+01
TL-201	Not Detected	-----	2.59E-01
XE-133	Not Detected	-----	2.55E-01
Y-88	Not Detected	-----	2.38E-02
ZN-65	Not Detected	-----	8.32E-02
ZR-95	Not Detected	-----	4.42E-02

*Not detected 7/15/57*

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-10-97 11:25:15 PM \*  
 \*\*\*\*\*

\* Analyzed by: *[Signature]* 9/15/97 Reviewed by: *[Signature]* 9/16/97 \*  
 \*\*\*\*\*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034062-003  
 Lab Sample ID : 70157608

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 855.000 gram  
 Sample Date/Time : 9-08-97 10:30:00 AM  
 Acquire Start Date/Time : 9-10-97 9:42:34 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.63E+00
TH-234	7.21E-01	4.13E-01	4.50E-01
RA-226	1.78E+00	5.35E-01	4.59E-01
PB-214	6.71E-01	1.10E-01	3.66E-02
BI-214	6.33E-01	1.22E-01	3.77E-02
Th-232	4.17E-01	2.37E-01	1.09E-01
A-228	4.46E-01	1.49E-01	1.06E-01
AC-228	4.63E-01	1.27E-01	5.87E-02
TH-228	5.29E-01	1.78E-01	3.55E-01
RA-224	3.77E-01	1.52E-01	4.97E-02
PB-212	4.26E-01	1.87E-01	3.15E-02
BI-212	5.69E-01	2.55E-01	2.42E-01
TL-208	3.94E-01	3.76E-01	5.13E-02
U-235	Not Detected	-----	1.95E-01
TH-231	Not Detected	-----	9.89E+00
PA-231	Not Detected	-----	1.14E+00
TH-227	Not Detected	-----	2.50E-01
RA-223	Not Detected	-----	1.81E-01
RN-219	<del>2.23E-01</del>	<del>2.45E-01</del>	2.99E-01
PB-211	Not Detected	-----	6.53E-01
TL-207	Not Detected	-----	1.05E+01
AM-241	Not Detected	-----	3.82E-01
PU-239	Not Detected	-----	3.49E+02
NP-237	Not Detected	-----	2.04E-01
PA-233	Not Detected	-----	4.62E-02
TH-229	Not Detected	-----	1.99E-01

*Not Detected 9/15/97*

[Summary Report] - Sample ID: : 70157608

Isotope Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.02E-02
AG-110m	Not Detected	-----	2.33E-02
BA-133	Not Detected	-----	5.81E-02
BE-7	Not Detected	-----	1.95E-01
CD-109	Not Detected	-----	6.93E-01
CD-115	Not Detected	-----	1.06E-01
CE-139	Not Detected	-----	2.42E-02
CE-141	Not Detected	-----	4.45E-02
CE-144	Not Detected	-----	1.96E-01
CO-56	Not Detected	-----	1.92E-02
CO-57	Not Detected	-----	2.43E-02
CO-58	Not Detected	-----	2.47E-02
CO-60	Not Detected	-----	2.68E-02
CR-51	Not Detected	-----	1.90E-01
CS-134	Not Detected	-----	4.12E-02
CS-137	Not Detected	-----	2.57E-02
EU-152	Not Detected	-----	7.28E-02
EU-154	Not Detected	-----	1.41E-01
EU-155	Not Detected	-----	1.15E-01
FE-59	Not Detected	-----	5.19E-02
GD-153	Not Detected	-----	8.60E-02
HG-203	Not Detected	-----	2.56E-02
I-131	Not Detected	-----	2.75E-02
IR-192	Not Detected	-----	2.19E-02
K-40	7.40E+00	1.19E+00	2.02E-01
N-52	Not Detected	-----	3.20E-02
N-54	Not Detected	-----	2.58E-02
MO-99	Not Detected	-----	3.22E-01
NA-22	Not Detected	-----	3.25E-02
NA-24	Not Detected	-----	3.75E-01
NB-95	Not Detected	-----	1.85E-01
ND-147	Not Detected	-----	1.75E-01
NI-57	Not Detected	-----	1.21E-01
PB-210	Not Detected	-----	2.81E+01
RU-103	Not Detected	-----	2.30E-02
RU-106	Not Detected	-----	2.21E-01
SB-122	Not Detected	-----	5.48E-02
SB-124	Not Detected	-----	2.48E-02
SB-125	Not Detected	-----	6.29E-02
SN-113	Not Detected	-----	2.99E-02
SR-85	Not Detected	-----	2.90E-02
TA-182	Not Detected	-----	1.19E-01
TA-183	Not Detected	-----	4.54E-01
TC-99m	Not Detected	-----	2.13E+01
TL-201	Not Detected	-----	2.54E-01
XE-133	Not Detected	-----	2.45E-01
Y-88	Not Detected	-----	1.90E-02
ZN-65	Not Detected	-----	7.95E-02
ZR-95	Not Detected	-----	4.19E-02



[Summary Report] - Sample ID: : 70157609

Isotope Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.75E-02
AG-110m	Not Detected	-----	2.23E-02
BA-133	Not Detected	-----	5.52E-02
BE-7	Not Detected	-----	1.10E-01
CD-109	Not Detected	-----	7.00E-01
CD-115	Not Detected	-----	9.68E-02
CE-139	Not Detected	-----	2.23E-02
CE-141	Not Detected	-----	4.16E-02
CE-144	Not Detected	-----	1.81E-01
CO-56	Not Detected	-----	1.79E-02
CO-57	Not Detected	-----	2.31E-02
CO-58	Not Detected	-----	2.23E-02
CO-60	Not Detected	-----	2.43E-02
CR-51	Not Detected	-----	1.77E-01
CS-134	Not Detected	-----	3.87E-02
CS-137	1.13E-02	2.23E-02	1.48E-02
EU-152	Not Detected	-----	6.93E-02
EU-154	Not Detected	-----	1.28E-01
EU-155	Not Detected	-----	1.08E-01
FE-59	Not Detected	-----	4.53E-02
GD-153	Not Detected	-----	7.76E-02
HG-203	Not Detected	-----	2.32E-02
I-131	Not Detected	-----	2.45E-02
IR-192	Not Detected	-----	2.03E-02
K-40	5.97E+00	1.03E+00	1.71E-01
W-52	Not Detected	-----	2.79E-02
N-54	Not Detected	-----	2.50E-02
MO-99	Not Detected	-----	3.06E-01
NA-22	Not Detected	-----	2.70E-02
NA-24	Not Detected	-----	3.50E-01
NB-95	Not Detected	-----	1.64E-01
ND-147	Not Detected	-----	1.49E-01
NI-57	Not Detected	-----	5.82E-02
PB-210	Not Detected	-----	2.56E+01
RU-103	Not Detected	-----	2.09E-02
RU-106	Not Detected	-----	2.09E-01
SB-122	Not Detected	-----	5.11E-02
SB-124	Not Detected	-----	2.27E-02
SB-125	Not Detected	-----	5.58E-02
SN-113	Not Detected	-----	2.78E-02
SR-85	Not Detected	-----	2.66E-02
TA-182	Not Detected	-----	1.09E-01
TA-183	Not Detected	-----	4.11E-01
TC-99m	Not Detected	-----	2.36E+01
TL-201	Not Detected	-----	2.35E-01
XE-133	Not Detected	-----	2.38E-01
Y-88	Not Detected	-----	1.79E-02
ZN-65	Not Detected	-----	7.53E-02
ZR-95	Not Detected	-----	3.83E-02

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-11-97 2:54:41 AM \*  
 \*\*\*\*\*

\* Analyzed by: *J* 9/15/97 Reviewed by: *WJ* 9/16/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034064-003  
 Lab Sample ID : 70157610

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 1020.000 gram  
 Sample Date/Time : 9-08-97 11:05:00 AM  
 Acquire Start Date/Time : 9-11-97 1:12:07 AM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.28E+00
TH-234	7.00E-01	4.02E-01	4.28E-01
RA-226	1.35E+00	1.69E+00	4.13E-01
PB-214	7.23E-01	4.63E-01	3.07E-02
BI-214	6.49E-01	5.35E-01	2.93E-02
TH-232	1.78E-01	1.26E-01	9.00E-02
A-228	2.30E-01	9.60E-02	9.39E-02
AC-228	Not Detected	-----	1.05E-01
TH-228	3.04E-01	1.29E-01	3.05E-01
RA-224	2.19E-01	1.14E-01	4.51E-02
PB-212	2.41E-01	4.67E-02	2.71E-02
BI-212	2.27E-01	1.41E-01	1.61E-01
TL-208	2.61E-01	9.66E-02	4.48E-02
U-235	Not Detected	-----	1.70E-01
TH-231	Not Detected	-----	8.40E+00
PA-231	Not Detected	-----	9.50E-01
TH-227	Not Detected	-----	1.90E-01
RA-223	Not Detected	-----	1.52E-01
RN-219	Not Detected	-----	2.51E-01
PB-211	Not Detected	-----	5.62E-01
TL-207	Not Detected	-----	8.43E+00
AM-241	Not Detected	-----	3.26E-01
PU-239	Not Detected	-----	2.95E+02
NP-237	Not Detected	-----	2.04E-01
PA-233	Not Detected	-----	3.74E-02
TH-229	Not Detected	-----	1.72E-01

[Summary Report] - Sample ID: : 70157610

Nuclide name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.37E-02
AG-110m	Not Detected	-----	2.50E-02
BA-133	Not Detected	-----	5.32E-02
BE-7	Not Detected	-----	1.76E-01
CD-109	Not Detected	-----	6.92E-01
CD-115	Not Detected	-----	8.73E-02
CE-139	<del>3.44E-03</del>	<del>5.49E-03</del>	<del>9.58E-03</del>
CE-141	Not Detected	-----	3.86E-02
CE-144	Not Detected	-----	1.65E-01
CO-56	Not Detected	-----	2.25E-02
CO-57	Not Detected	-----	2.05E-02
CO-58	Not Detected	-----	2.17E-02
CO-60	Not Detected	-----	2.14E-02
CR-51	Not Detected	-----	1.64E-01
CS-134	Not Detected	-----	3.80E-02
CS-137	4.62E-02	2.09E-02	1.45E-02
EU-152	Not Detected	-----	6.16E-02
EU-154	Not Detected	-----	1.09E-01
EU-155	Not Detected	-----	9.77E-02
FE-59	Not Detected	-----	4.07E-02
GD-153	Not Detected	-----	7.25E-02
HG-203	Not Detected	-----	2.15E-02
I-131	Not Detected	-----	2.34E-02
IR-192	Not Detected	-----	1.85E-02
K-40	4.76E+00	1.35E+00	1.82E-01
MN-52	Not Detected	-----	2.53E-02
I-54	Not Detected	-----	2.16E-02
MO-99	Not Detected	-----	2.74E-01
NA-22	Not Detected	-----	2.48E-02
NA-24	Not Detected	-----	3.86E-01
NB-95	Not Detected	-----	1.43E-01
ND-147	Not Detected	-----	1.51E-01
NI-57	<del>1.27E-01</del>	<del>9.33E-02</del>	<del>5.78E-02</del>
PB-210	Not Detected	-----	2.41E+01
RU-103	Not Detected	-----	1.91E-02
RU-106	Not Detected	-----	1.76E-01
SB-122	Not Detected	-----	4.65E-02
SB-124	Not Detected	-----	2.05E-02
SB-125	Not Detected	-----	5.32E-02
SN-113	Not Detected	-----	2.47E-02
SR-85	Not Detected	-----	2.32E-02
TA-182	Not Detected	-----	1.03E-01
TA-183	Not Detected	-----	3.95E-01
TC-99m	Not Detected	-----	2.56E+01
TL-201	Not Detected	-----	2.14E-01
XE-133	Not Detected	-----	2.17E-01
Y-88	Not Detected	-----	1.68E-02
ZN-65	Not Detected	-----	6.98E-02
ZR-95	Not Detected	-----	3.43E-02

*not detected 7/15/57*

*not detected 7/15/57*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-11-97 4:39:31 AM \*  
 \*\*\*\*\*

\* Analyzed by: *J 9/15/97* Reviewed by: *MS 9/16/97* \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034065-003  
 Lab Sample ID : 70157611

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 891.000 gram  
 Sample Date/Time : 9-08-97 11:10:00 AM  
 Acquire Start Date/Time : 9-11-97 2:56:46 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	-----	2.47E+00
TH-234	1.03E+00	3.45E-01	4.31E-01
RA-226	1.07E+00	4.55E-01	4.45E-01
PB-214	7.11E-01	1.14E+00	3.55E-02
BI-214	6.45E-01	1.23E-01	3.44E-02
TH-232	2.78E-01	1.62E-01	1.03E-01
A-228	3.80E-01	1.59E-01	1.03E-01
AC-228	2.49E-01	4.69E-01	5.65E-02
TH-228	Not Detected	-----	6.41E-01
RA-224	3.80E-01	1.62E-01	5.52E-02
PB-212	3.05E-01	6.79E-02	3.11E-02
BI-212	3.34E-01	2.53E-01	2.04E-01
TL-208	2.68E-01	2.68E-01	4.71E-02
U-235	3.46E-02	5.51E-02	1.04E-01
TH-231	Not Detected	-----	9.82E+00
PA-231	Not Detected	-----	1.09E+00
TH-227	Not Detected	-----	2.26E-01
RA-223	Not Detected	-----	1.77E-01
RN-219	Not Detected	-----	2.80E-01
PB-211	Not Detected	-----	6.51E-01
TL-207	Not Detected	-----	9.59E+00
AM-241	Not Detected	-----	3.57E-01
PU-239	Not Detected	-----	3.32E+02
NP-237	Not Detected	-----	2.87E-01
PA-233	Not Detected	-----	4.20E-02
TH-229	Not Detected	-----	1.92E-01



[Summary Report] - Sample ID: : 70157611

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.70E-02
AG-110m	Not Detected	-----	2.38E-02
BA-133	Not Detected	-----	5.79E-02
BE-7	Not Detected	-----	1.88E-01
CD-109	<del>8.01E-01</del>	<del>3.77E-01</del>	7.38E-01
CD-115	Not Detected	-----	1.03E-01
CE-139	Not Detected	-----	2.30E-02
CE-141	Not Detected	-----	2.39E-02
CE-144	Not Detected	-----	1.80E-01
CO-56	Not Detected	-----	1.78E-02
CO-57	Not Detected	-----	2.31E-02
CO-58	Not Detected	-----	2.39E-02
CO-60	Not Detected	-----	2.27E-02
CR-51	Not Detected	-----	1.89E-01
CS-134	Not Detected	-----	4.12E-02
CS-137	1.74E-02	1.39E-02	1.43E-02
EU-152	Not Detected	-----	6.92E-02
EU-154	Not Detected	-----	1.24E-01
EU-155	Not Detected	-----	1.11E-01
FE-59	Not Detected	-----	4.66E-02
GD-153	Not Detected	-----	8.00E-02
HG-203	Not Detected	-----	2.41E-02
I-131	Not Detected	-----	2.60E-02
IR-192	Not Detected	-----	2.02E-02
K-40	5.73E+00	9.66E-01	1.92E-01
MN-52	Not Detected	-----	2.87E-02
-54	Not Detected	-----	2.51E-02
MO-99	Not Detected	-----	3.31E-01
NA-22	Not Detected	-----	2.96E-02
NA-24	Not Detected	-----	4.44E-01
NB-95	Not Detected	-----	1.73E-01
ND-147	Not Detected	-----	1.74E-01
NI-57	<del>1.76E-01</del>	<del>1.31E-01</del>	6.78E-02
PB-210	Not Detected	-----	2.62E+01
RU-103	Not Detected	-----	2.15E-02
RU-106	Not Detected	-----	2.01E-01
SB-122	Not Detected	-----	5.54E-02
SB-124	Not Detected	-----	2.24E-02
SB-125	Not Detected	-----	5.97E-02
SN-113	Not Detected	-----	2.91E-02
SR-85	Not Detected	-----	2.65E-02
TA-182	Not Detected	-----	1.13E-01
TA-183	Not Detected	-----	4.35E-01
TC-99m	Not Detected	-----	3.42E+01
TL-201	Not Detected	-----	2.48E-01
XE-133	Not Detected	-----	2.51E-01
Y-88	Not Detected	-----	1.95E-02
ZN-65	Not Detected	-----	7.74E-02
ZR-95	Not Detected	-----	3.80E-02

*not detected 7/15/57*

*not detected 7/15/57*

\*\*\*\*\*  
 Sandia National Laboratories \*  
 Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 9-11-97 6:24:29 AM \*  
 \*\*\*\*\*

Analyzed by: *J* 9/15/97 Reviewed by: *W* 9/16/97 \*  
 \*\*\*\*\*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034148-003  
 Lab Sample ID : 70157612

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 946.000 gram  
 Sample Date/Time : 9-08-97 11:45:00 AM  
 Acquire Start Date/Time : 9-11-97 4:41:41 AM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:  
 \*\*\*\*\*

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.64E+00
TH-234	1.01E+00	4.00E-01	4.78E-01
RA-226	7.38E-01	5.35E-01	4.34E-01
PB-214	7.14E-01	1.24E-01	3.34E-02
BI-214	6.52E-01	5.57E-01	3.53E-02
TH-232	5.13E-01	2.75E-01	1.16E-01
-228	4.96E-01	1.87E-01	9.61E-02
AC-228	5.81E-01	1.46E-01	5.53E-02
TH-228	4.74E-01	1.70E-01	3.90E-01
RA-224	4.81E-01	1.75E-01	5.32E-02
PB-212	4.88E-01	3.41E-01	3.16E-02
BI-212	5.71E-01	2.73E-01	2.11E-01
TL-208	4.65E-01	9.56E-02	5.17E-02
U-235	6.87E-02	7.13E-02	1.25E-01
TH-231	Not Detected	-----	1.01E+01
PA-231	Not Detected	-----	1.13E+00
TH-227	Not Detected	-----	2.50E-01
RA-223	Not Detected	-----	1.84E-01
RN-219	Not Detected	-----	2.83E-01
PB-211	Not Detected	-----	6.40E-01
TL-207	Not Detected	-----	9.63E+00
AM-241	Not Detected	-----	3.86E-01
PU-239	Not Detected	-----	3.52E+02
NP-237	Not Detected	-----	2.17E-01
PA-233	Not Detected	-----	4.43E-02
TH-229	Not Detected	-----	1.96E-01

[Summary Report] - Sample ID: : 70157612

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.96E-02
AG-110m	Not Detected	-----	2.92E-02
BA-133	Not Detected	-----	5.62E-02
BE-7	Not Detected	-----	1.99E-01
CD-109	<del>1.21E+00</del>	<del>4.34E-01</del>	7.38E-01
CD-115	Not Detected	-----	1.14E-01
CE-139	Not Detected	-----	2.37E-02
CE-141	Not Detected	-----	4.47E-02
CE-144	Not Detected	-----	1.94E-01
CO-56	Not Detected	-----	1.89E-02
CO-57	Not Detected	-----	2.36E-02
CO-58	Not Detected	-----	2.50E-02
CO-60	Not Detected	-----	2.61E-02
CR-51	Not Detected	-----	1.92E-01
CS-134	Not Detected	-----	4.06E-02
CS-137	5.53E-02	1.98E-02	1.83E-02
EU-152	Not Detected	-----	7.07E-02
EU-154	Not Detected	-----	1.37E-01
EU-155	Not Detected	-----	1.21E-01
FE-59	Not Detected	-----	5.10E-02
GD-153	Not Detected	-----	8.17E-02
HG-203	Not Detected	-----	2.50E-02
I-131	Not Detected	-----	2.63E-02
IR-192	Not Detected	-----	2.18E-02
K-40	8.60E+00	1.33E+00	1.93E-01
MN-52	Not Detected	-----	3.13E-02
N-54	Not Detected	-----	2.57E-02
MO-99	Not Detected	-----	3.51E-01
NA-22	Not Detected	-----	2.99E-02
NA-24	Not Detected	-----	4.80E-01
NB-95	Not Detected	-----	1.93E-01
ND-147	Not Detected	-----	1.78E-01
NI-57	<del>1.72E-01</del>	<del>8.47E-02</del>	7.75E-02
PB-210	Not Detected	-----	2.81E+01
RU-103	Not Detected	-----	2.27E-02
RU-106	Not Detected	-----	2.07E-01
SB-122	Not Detected	-----	5.80E-02
SB-124	Not Detected	-----	2.45E-02
SB-125	Not Detected	-----	6.57E-02
SN-113	Not Detected	-----	2.93E-02
SR-85	Not Detected	-----	2.84E-02
TA-182	Not Detected	-----	1.18E-01
TA-183	Not Detected	-----	4.78E-01
TC-99m	Not Detected	-----	4.08E+01
TL-201	Not Detected	-----	2.60E-01
XE-133	Not Detected	-----	2.66E-01
Y-88	Not Detected	-----	2.03E-02
ZN-65	Not Detected	-----	7.87E-02
ZR-95	Not Detected	-----	4.04E-02

*not detected 7/9/15/97*

*not detected 7/9/15/97*

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-11-97 9:57:31 AM \*  
 \*\*\*\*\*

\* Analyzed by: *[Signature]* 9/15/97 Reviewed by: *[Signature]* 9/16/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034150-003  
 Lab Sample ID : 70157613

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 994.000 gram  
 Sample Date/Time : 9-08-97 11:50:00 AM  
 Acquire Start Date/Time : 9-11-97 8:07:57 AM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.50E+00
TH-234	1.12E+00	3.71E-01	4.60E-01
RA-226	1.53E+00	4.31E-01	4.12E-01
PB-214	7.10E-01	2.38E-01	3.34E-02
BI-214	6.72E-01	1.08E-01	3.17E-02
TH-232	4.29E-01	2.13E-01	1.01E-01
A-228	3.43E-01	1.24E-01	1.17E-01
AC-228	Not Detected	-----	5.99E-02
TH-228	5.67E-01	4.25E-01	3.53E-01
RA-224	4.19E-01	1.40E-01	5.38E-02
PB-212	4.09E-01	2.71E-01	2.93E-02
BI-212	Not Detected	-----	2.24E-01
TL-208	3.95E-01	9.09E-02	4.73E-02
U-235	Not Detected	-----	1.86E-01
TH-231	Not Detected	-----	9.77E+00
PA-231	Not Detected	-----	1.09E+00
TH-227	Not Detected	-----	2.36E-01
RA-223	Not Detected	-----	1.78E-01
RN-219	Not Detected	-----	2.72E-01
PB-211	Not Detected	-----	6.12E-01
TL-207	Not Detected	-----	1.00E+01
AM-241	Not Detected	-----	3.59E-01
PU-239	Not Detected	-----	3.41E+02
NP-237	Not Detected	-----	2.92E-01
PA-233	Not Detected	-----	4.37E-02
TH-229	Not Detected	-----	1.95E-01

[Summary Report] - Sample ID: : 70157613

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.69E-02
AG-110m	Not Detected	-----	3.05E-02
BA-133	Not Detected	-----	5.54E-02
BE-7	Not Detected	-----	1.91E-01
CD-109	<del>8.63E-01</del>	<del>3.87E-01</del>	7.64E-01
CD-115	Not Detected	-----	1.11E-01
CE-139	Not Detected	-----	2.22E-02
CE-141	Not Detected	-----	4.25E-02
CE-144	Not Detected	-----	1.87E-01
CO-56	Not Detected	-----	1.84E-02
GO-57	Not Detected	-----	2.34E-02
CO-58	Not Detected	-----	2.22E-02
CO-60	Not Detected	-----	2.44E-02
CR-51	Not Detected	-----	1.83E-01
CS-134	Not Detected	-----	3.89E-02
CS-137	9.37E-02	2.66E-02	1.58E-02
EU-152	Not Detected	-----	7.01E-02
EU-154	Not Detected	-----	1.25E-01
EU-155	Not Detected	-----	1.15E-01
FE-59	Not Detected	-----	4.91E-02
GD-153	Not Detected	-----	8.23E-02
HG-203	Not Detected	-----	2.41E-02
I-131	Not Detected	-----	2.74E-02
IR-192	Not Detected	-----	2.07E-02
K-40	8.12E+00	1.26E+00	1.79E-01
MN-52	Not Detected	-----	3.10E-02
N-54	Not Detected	-----	2.39E-02
O-99	Not Detected	-----	3.41E-01
NA-22	Not Detected	-----	2.76E-02
NA-24	Not Detected	-----	5.23E-01
NB-95	Not Detected	-----	1.88E-01
ND-147	Not Detected	-----	1.63E-01
NI-57	<del>2.15E-01</del>	<del>8.26E-02</del>	5.34E-02
PB-210	Not Detected	-----	2.67E+01
RU-103	Not Detected	-----	2.11E-02
RU-106	Not Detected	-----	2.06E-01
SB-122	Not Detected	-----	5.87E-02
SB-124	Not Detected	-----	2.21E-02
SB-125	Not Detected	-----	6.06E-02
SN-113	Not Detected	-----	2.75E-02
SR-85	Not Detected	-----	2.62E-02
TA-182	Not Detected	-----	1.10E-01
TA-183	Not Detected	-----	4.46E-01
TC-99m	Not Detected	-----	5.87E+01
TL-201	Not Detected	-----	2.59E-01
XE-133	Not Detected	-----	2.69E-01
Y-88	Not Detected	-----	1.90E-02
ZN-65	Not Detected	-----	7.57E-02
ZR-95	Not Detected	-----	4.01E-02

*not detected 7/9/15/97*

*not detected 7/9/15/97*

\* Analyzed by: *J 9/15/97* Reviewed by: *XW 9/16/97* \*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034151-003  
 Lab Sample ID : 70157614

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 802.000 gram  
 Sample Date/Time : 9-08-97 12:05:00 PM  
 Acquire Start Date/Time : 9-11-97 10:00:15 AM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.78E+00
TH-234	1.02E+00	3.68E-01	4.72E-01
RA-226	1.26E+00	3.86E-01	3.80E-01
PB-214	7.01E-01	1.22E-01	3.91E-02
BI-214	6.18E-01	1.28E-01	3.71E-02
TH-232	3.79E-01	2.24E-01	1.27E-01
U-228	3.47E-01	1.53E-01	1.22E-01
U-228	Not Detected	-----	1.41E-01
TH-228	4.54E-01	1.78E-01	3.77E-01
RA-224	4.35E-01	2.02E-01	6.48E-02
PB-212	3.63E-01	7.22E-02	3.05E-02
BI-212	3.59E-01	2.27E-01	2.28E-01
TL-208	3.74E-01	9.91E-02	5.25E-02
U-235	Not Detected	-----	2.03E-01
TH-231	Not Detected	-----	1.04E+01
PA-231	Not Detected	-----	1.17E+00
TH-227	Not Detected	-----	2.51E-01
RA-223	Not Detected	-----	1.94E-01
RN-219	<del>2.67E-01</del>	<del>2.62E-01</del>	3.20E-01
PB-211	Not Detected	-----	7.22E-01
TL-207	Not Detected	-----	1.05E+01
AM-241	Not Detected	-----	3.91E-01
PU-239	Not Detected	-----	3.57E+02
NP-237	Not Detected	-----	2.42E-01
PA-233	Not Detected	-----	4.71E-02
TH-229	Not Detected	-----	2.07E-01

*not detected J 9/15/97*

[Summary Report] - Sample ID: : 70157614

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.10E-02
AG-110m	Not Detected	-----	3.53E-02
BA-133	Not Detected	-----	6.12E-02
BE-7	Not Detected	-----	2.14E-01
CD-109	Not Detected	-----	8.22E-01
CD-115	Not Detected	-----	1.25E-01
CE-139	Not Detected	-----	2.45E-02
CE-141	Not Detected	-----	4.68E-02
CE-144	Not Detected	-----	1.98E-01
CO-56	Not Detected	-----	2.23E-02
CO-57	Not Detected	-----	2.47E-02
CO-58	Not Detected	-----	2.48E-02
CO-60	Not Detected	-----	2.63E-02
CR-51	Not Detected	-----	2.08E-01
CS-134	Not Detected	-----	4.19E-02
CS-137	1.11E-01	7.49E-02	1.72E-02
EU-152	Not Detected	-----	7.40E-02
EU-154	Not Detected	-----	1.43E-01
EU-155	Not Detected	-----	1.21E-01
FE-59	Not Detected	-----	5.39E-02
GD-153	Not Detected	-----	8.83E-02
HG-203	Not Detected	-----	2.67E-02
I-131	Not Detected	-----	3.05E-02
IR-192	Not Detected	-----	2.38E-02
K-40	7.71E+00	1.25E+00	2.28E-01
MN-52	Not Detected	-----	3.22E-02
MN-54	Not Detected	-----	2.71E-02
MO-99	Not Detected	-----	3.68E-01
NA-22	Not Detected	-----	3.10E-02
NA-24	Not Detected	-----	6.45E-01
NB-95	Not Detected	-----	2.02E-01
ND-147	Not Detected	-----	1.92E-01
NI-57	<del>1.39E-01</del>	<del>9.58E-02</del>	8.63E-02
PB-210	9.02E+00	9.64E+00	1.66E+01
RU-103	Not Detected	-----	2.48E-02
RU-106	Not Detected	-----	2.37E-01
SB-122	Not Detected	-----	6.42E-02
SB-124	Not Detected	-----	2.60E-02
SB-125	Not Detected	-----	6.99E-02
SN-113	Not Detected	-----	3.13E-02
SR-85	Not Detected	-----	2.99E-02
TA-182	Not Detected	-----	1.30E-01
TA-183	Not Detected	-----	5.00E-01
TC-99m	Not Detected	-----	7.62E+01
TL-201	Not Detected	-----	2.79E-01
XE-133	Not Detected	-----	2.90E-01
Y-88	Not Detected	-----	2.43E-02
ZN-65	Not Detected	-----	8.93E-02
ZR-95	Not Detected	-----	4.64E-02

*not detected 7/15/9*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-11-97 1:34:18 PM \*  
 \*\*\*\*\*

\* Analyzed by: *J* 9/15/97 Reviewed by: *WJ* 9/16/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034152-003  
 Lab Sample ID : 70157615

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 740.000 gram  
 Sample Date/Time : 9-08-97 11:55:00 AM  
 Acquire Start Date/Time : 9-11-97 11:45:10 AM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	3.36E+00
TH-234	Not Detected	-----	7.75E-01
RA-226	1.62E+00	3.12E-01	5.69E-01
PB-214	7.19E-01	1.85E-01	4.64E-02
BI-214	6.73E-01	1.28E-01	4.84E-02
TH-232	6.85E-01	3.50E-01	1.35E-01
A-228	7.71E-01	2.49E-01	1.38E-01
AC-228	7.17E-01	3.56E-01	7.64E-02
TH-228	Not Detected	-----	4.89E-01
RA-224	6.45E-01	2.35E-01	6.17E-02
PB-212	6.96E-01	1.22E-01	3.60E-02
BI-212	Not Detected	-----	3.05E-01
TL-208	6.93E-01	1.68E-01	6.47E-02
U-235	Not Detected	-----	2.40E-01
TH-231	Not Detected	-----	1.27E+01
PA-231	Not Detected	-----	1.43E+00
TH-227	Not Detected	-----	3.34E-01
RA-223	Not Detected	-----	2.33E-01
RN-219	Not Detected	-----	3.73E-01
PB-211	Not Detected	-----	8.56E-01
TL-207	Not Detected	-----	1.30E+01
AM-241	Not Detected	-----	4.58E-01
PU-239	Not Detected	-----	4.31E+02
NP-237	<del>3.45E-01</del>	<del>1.06E-01</del>	<del>2.63E-01</del>
PA-233	Not Detected	-----	5.83E-02
TH-229	Not Detected	-----	2.50E-01

*not detected J 9/15/97*



[Summary Report] - Sample ID: : 70157615

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.86E-02
AG-110m	Not Detected	-----	6.14E-02
BA-133	Not Detected	-----	6.75E-02
BE-7	Not Detected	-----	2.60E-01
CD-109	Not Detected	-----	8.96E-01
CD-115	Not Detected	-----	1.61E-01
CE-139	Not Detected	-----	2.87E-02
CE-141	Not Detected	-----	5.44E-02
CE-144	Not Detected	-----	2.39E-01
CO-56	Not Detected	-----	3.54E-02
CO-57	Not Detected	-----	2.99E-02
CO-58	Not Detected	-----	3.10E-02
CO-60	Not Detected	-----	3.24E-02
CR-51	Not Detected	-----	2.41E-01
CS-134	Not Detected	-----	4.78E-02
CS-137	4.26E-01	1.93E-01	2.33E-02
EU-152	Not Detected	-----	8.94E-02
EU-154	Not Detected	-----	1.76E-01
EU-155	Not Detected	-----	1.48E-01
FE-59	Not Detected	-----	6.58E-02
GD-153	Not Detected	-----	1.06E-01
HG-203	Not Detected	-----	3.26E-02
I-131	Not Detected	-----	3.66E-02
IR-192	Not Detected	-----	2.81E-02
K-40	1.22E+01	1.86E+00	2.33E-01
MN-52	Not Detected	-----	3.97E-02
N-54	Not Detected	-----	3.17E-02
O-99	Not Detected	-----	4.72E-01
NA-22	Not Detected	-----	4.03E-02
NA-24	Not Detected	-----	8.49E-01
NB-95	Not Detected	-----	2.73E-01
ND-147	Not Detected	-----	2.43E-01
NI-57	<del>2.02E-01</del>	<del>1.68E-01</del>	1.08E-01
PB-210	Not Detected	-----	3.47E+01
RU-103	Not Detected	-----	3.04E-02
RU-106	Not Detected	-----	2.71E-01
SB-122	Not Detected	-----	8.29E-02
SB-124	Not Detected	-----	3.08E-02
SB-125	Not Detected	-----	8.10E-02
SN-113	Not Detected	-----	3.92E-02
SR-85	Not Detected	-----	3.72E-02
TA-182	Not Detected	-----	1.44E-01
TA-183	Not Detected	-----	5.85E-01
TC-99m	Not Detected	-----	1.14E+02
TL-201	Not Detected	-----	3.59E-01
XE-133	Not Detected	-----	3.62E-01
Y-88	Not Detected	-----	2.40E-02
ZN-65	Not Detected	-----	9.71E-02
ZR-95	Not Detected	-----	5.43E-02

*not detected 7/5/5/77*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-11-97 3:26:00 PM \*  
 \*\*\*\*\*

\* Analyzed by: *J 9/15/97* Reviewed by: *W 9/16/97* \*  
 \*\*\*\*\*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034153-003  
 Lab Sample ID : 70157616

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 820.000 gram  
 Sample Date/Time : 9-08-97 1:30:00 PM  
 Acquire Start Date/Time : 9-11-97 1:36:53 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	1.16E+00	1.33E+00	2.06E+00
TH-234	2.15E+00	5.90E-01	5.54E-01
RA-226	2.06E+00	5.84E-01	5.01E-01
PB-214	8.21E-01	1.36E-01	3.96E-02
BI-214	Not Detected	-----	4.19E-02
TH-232	6.00E-01	2.96E-01	1.30E-01
A-228	5.35E-01	2.02E-01	1.37E-01
C-228	5.71E-01	1.85E-01	7.11E-02
TH-228	3.76E-01	1.72E-01	4.27E-01
RA-224	5.04E-01	1.75E-01	6.72E-02
PB-212	5.71E-01	1.08E-01	3.56E-02
BI-212	6.77E-01	4.04E-01	2.35E-01
TL-208	5.10E-01	1.28E-01	5.41E-02
U-235	Not Detected	-----	2.12E-01
TH-231	Not Detected	-----	1.15E+01
PA-231	Not Detected	-----	1.24E+00
TH-227	Not Detected	-----	2.90E-01
RA-223	Not Detected	-----	2.12E-01
RN-219	Not Detected	-----	3.38E-01
PB-211	Not Detected	-----	7.74E-01
TL-207	Not Detected	-----	1.13E+01
AM-241	Not Detected	-----	4.30E-01
PU-239	Not Detected	-----	3.99E+02
NP-237	<del>3.20E-01</del>	<del>1.23E-01</del>	2.50E-01
PA-233	Not Detected	-----	5.11E-02
TH-229	Not Detected	-----	2.25E-01

*Not detected J 9/15/97*

[Summary Report] - Sample ID: : 70157616

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.38E-02
AG-110m	Not Detected	-----	3.68E-02
BA-133	Not Detected	-----	6.47E-02
BE-7	Not Detected	-----	2.26E-01
CD-109	Not Detected	-----	8.50E-01
CD-115	Not Detected	-----	1.44E-01
CE-139	Not Detected	-----	2.61E-02
CE-141	Not Detected	-----	4.86E-02
CE-144	Not Detected	-----	2.14E-01
CO-56	Not Detected	-----	2.12E-02
CO-57	Not Detected	-----	2.71E-02
CO-58	Not Detected	-----	2.90E-02
CO-60	Not Detected	-----	2.73E-02
CR-51	Not Detected	-----	2.17E-01
CS-134	Not Detected	-----	4.55E-02
CS-137	1.04E-01	2.66E-02	1.91E-02
EU-152	Not Detected	-----	8.13E-02
EU-154	Not Detected	-----	1.56E-01
EU-155	Not Detected	-----	1.35E-01
FE-59	Not Detected	-----	6.08E-02
GD-153	Not Detected	-----	9.56E-02
HG-203	Not Detected	-----	2.91E-02
I-131	Not Detected	-----	3.31E-02
IR-192	Not Detected	-----	2.44E-02
K-40	1.01E+01	1.58E+00	2.34E-01
MN-52	Not Detected	-----	3.84E-02
I-54	Not Detected	-----	2.85E-02
O-99	Not Detected	-----	4.24E-01
NA-22	Not Detected	-----	3.32E-02
NA-24	Not Detected	-----	7.61E-01
NB-95	Not Detected	-----	2.37E-01
ND-147	Not Detected	-----	2.09E-01
NI-57	Not Detected	-----	8.92E-02
PB-210	Not Detected	-----	3.16E+01
RU-103	Not Detected	-----	2.59E-02
RU-106	Not Detected	-----	2.55E-01
SB-122	Not Detected	-----	7.38E-02
SB-124	Not Detected	-----	2.76E-02
SB-125	Not Detected	-----	7.10E-02
SN-113	Not Detected	-----	3.36E-02
SR-85	Not Detected	-----	3.29E-02
TA-182	Not Detected	-----	1.29E-01
TA-183	Not Detected	-----	5.47E-01
TC-99m	Not Detected	-----	1.04E+02
TL-201	Not Detected	-----	3.16E-01
XE-133	Not Detected	-----	3.31E-01
Y-88	Not Detected	-----	2.32E-02
ZN-65	Not Detected	-----	8.67E-02
ZR-95	Not Detected	-----	4.88E-02

\*\*\*\*\*  
 Sandia National Laboratories \*  
 Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 9-11-97 5:42:31 PM \*  
 \*\*\*\*\*

Analyzed by: *[Signature]* 9/15/97 Reviewed by: *[Signature]* 9/16/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034173-003  
 Lab Sample ID : 70157617

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 847.000 gram  
 Sample Date/Time : 9-08-97 1:25:00 PM  
 Acquire Start Date/Time : 9-11-97 3:55:38 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.66E+00
TH-234	9.59E-01	3.63E-01	5.44E-01
RA-226	1.49E+00	5.42E-01	4.66E-01
PB-214	7.63E-01	1.34E-01	3.80E-02
BI-214	7.05E-01	1.27E-01	3.48E-02
TH-232	3.54E-01	2.23E-01	1.12E-01
-228	3.26E-01	1.18E-01	9.88E-02
AC-228	Not Detected	-----	1.33E-01
TH-228	3.38E-01	1.58E-01	4.17E-01
RA-224	4.14E-01	1.81E-01	5.10E-02
PB-212	3.67E-01	6.70E-02	3.40E-02
BI-212	Not Detected	-----	3.76E-01
TL-208	Not Detected	-----	5.28E-02
U-235	Not Detected	-----	1.98E-01
TH-231	Not Detected	-----	1.00E+01
PA-231	Not Detected	-----	1.12E+00
TH-227	Not Detected	-----	2.40E-01
RA-223	Not Detected	-----	1.88E-01
RN-219	Not Detected	-----	3.03E-01
PB-211	Not Detected	-----	6.79E-01
TL-207	Not Detected	-----	1.00E+01
AM-241	Not Detected	-----	3.72E-01
PU-239	Not Detected	-----	3.53E+02
NP-237	Not Detected	-----	3.13E-01
PA-233	Not Detected	-----	4.75E-02
TH-229	Not Detected	-----	2.04E-01

[Summary Report] - Sample ID: : 70157617

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.84E-02
AG-110m	Not Detected	-----	3.32E-02
BA-133	Not Detected	-----	6.11E-02
BE-7	Not Detected	-----	1.98E-01
CD-109	Not Detected	-----	1.02E+00
CD-115	Not Detected	-----	1.28E-01
CE-139	Not Detected	-----	2.47E-02
CE-141	Not Detected	-----	4.63E-02
CE-144	<del>2.86E-02</del>	<del>1.48E-02</del>	8.06E-02
CO-56	Not Detected	-----	2.82E-02
CO-57	Not Detected	-----	2.47E-02
CO-58	Not Detected	-----	2.45E-02
CO-60	Not Detected	-----	2.73E-02
CR-51	Not Detected	-----	1.97E-01
CS-134	Not Detected	-----	4.20E-02
CS-137	1.01E-01	3.11E-02	1.73E-02
EU-152	Not Detected	-----	7.41E-02
EU-154	Not Detected	-----	1.30E-01
EU-155	Not Detected	-----	1.16E-01
FE-59	Not Detected	-----	4.92E-02
GD-153	Not Detected	-----	8.54E-02
HG-203	Not Detected	-----	2.58E-02
I-131	Not Detected	-----	3.02E-02
IR-192	Not Detected	-----	2.21E-02
K-40	6.57E+00	1.09E+00	2.01E-01
MN-52	Not Detected	-----	3.21E-02
N-54	Not Detected	-----	2.65E-02
NO-99	Not Detected	-----	3.80E-01
NA-22	Not Detected	-----	3.06E-02
NA-24	Not Detected	-----	7.00E-01
NB-95	Not Detected	-----	2.00E-01
ND-147	Not Detected	-----	1.84E-01
NI-57	Not Detected	-----	8.32E-02
PB-210	Not Detected	-----	2.85E+01
RU-103	Not Detected	-----	2.46E-02
RU-106	Not Detected	-----	2.19E-01
SB-122	Not Detected	-----	6.29E-02
SB-124	Not Detected	-----	2.46E-02
SB-125	Not Detected	-----	6.57E-02
SN-113	Not Detected	-----	2.91E-02
SR-85	Not Detected	-----	2.90E-02
TA-182	Not Detected	-----	1.22E-01
TA-183	Not Detected	-----	4.83E-01
TC-99m	Not Detected	-----	1.25E+02
TL-201	Not Detected	-----	2.88E-01
XE-133	Not Detected	-----	3.01E-01
Y-88	Not Detected	-----	2.09E-02
ZN-65	Not Detected	-----	8.26E-02
ZR-95	Not Detected	-----	4.20E-02

*not detected 9/15/77*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-11-97 7:27:45 PM \*  
 \*\*\*\*\*

\* Analyzed by: *J 9/15/97* Reviewed by: *9/16/97* \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034155-003  
 Lab Sample ID : 70157618

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 848.000 gram  
 Sample Date/Time : 9-08-97 1:32:00 PM  
 Acquire Start Date/Time : 9-11-97 5:45:04 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.84E+00
TH-234	1.43E+00	6.51E-01	5.05E-01
RA-226	1.96E+00	5.58E-01	5.07E-01
PB-214	7.34E-01	1.24E-01	3.90E-02
BI-214	7.07E-01	1.10E+00	3.82E-02
TH-232	5.01E-01	2.70E-01	1.30E-01
A-228	4.55E-01	1.67E-01	1.14E-01
..C-228	4.47E-01	1.14E-01	6.53E-02
TH-228	4.98E-01	5.49E-01	3.91E-01
RA-224	5.53E-01	2.01E-01	5.88E-02
PB-212	4.73E-01	5.39E-01	3.24E-02
BI-212	5.43E-01	3.08E-01	2.32E-01
TL-208	4.70E-01	8.27E-02	4.94E-02
<del>U-235</del>	<del>1.11E-01</del>	<del>1.62E-01</del>	<del>2.09E-01</del>
TH-231	Not Detected	-----	1.09E+01
PA-231	Not Detected	-----	1.16E+00
TH-227	Not Detected	-----	2.66E-01
RA-223	Not Detected	-----	2.02E-01
RN-219	Not Detected	-----	3.18E-01
PB-211	Not Detected	-----	7.06E-01
TL-207	Not Detected	-----	1.08E+01
AM-241	Not Detected	-----	4.04E-01
PU-239	Not Detected	-----	3.75E+02
NP-237	Not Detected	-----	2.16E-01
PA-233	Not Detected	-----	4.81E-02
TH-229	Not Detected	-----	2.15E-01

*not detected J 9/15/97*

[Summary Report] - Sample ID: : 70157618

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.99E-02
AG-110m	Not Detected	-----	3.00E-02
BA-133	Not Detected	-----	6.07E-02
BE-7	Not Detected	-----	2.20E-01
CD-109	Not Detected	-----	7.37E-01
CD-115	Not Detected	-----	1.40E-01
CE-139	Not Detected	-----	2.48E-02
CE-141	Not Detected	-----	4.77E-02
CE-144	Not Detected	-----	2.05E-01
CO-56	Not Detected	-----	2.96E-02
CO-57	Not Detected	-----	2.59E-02
CO-58	Not Detected	-----	2.66E-02
CO-60	Not Detected	-----	2.92E-02
CR-51	Not Detected	-----	2.11E-01
CS-134	Not Detected	-----	4.28E-02
CS-137	4.87E-02	3.35E-02	1.96E-02
EU-152	Not Detected	-----	7.76E-02
EU-154	Not Detected	-----	1.37E-01
EU-155	Not Detected	-----	1.26E-01
FE-59	Not Detected	-----	5.54E-02
GD-153	Not Detected	-----	9.12E-02
HG-203	Not Detected	-----	2.70E-02
I-131	Not Detected	-----	2.97E-02
IR-192	Not Detected	-----	2.40E-02
K-40	8.88E+00	1.40E+00	2.06E-01
MN-52	Not Detected	-----	3.62E-02
N-54	Not Detected	-----	2.68E-02
NO-99	Not Detected	-----	4.13E-01
NA-22	Not Detected	-----	3.03E-02
NA-24	Not Detected	-----	8.29E-01
NB-95	Not Detected	-----	2.25E-01
ND-147	Not Detected	-----	1.91E-01
NI-57	Not Detected	-----	1.82E-01
PB-210	Not Detected	-----	2.89E+01
RU-103	Not Detected	-----	2.40E-02
RU-106	Not Detected	-----	2.39E-01
SB-122	Not Detected	-----	7.03E-02
SB-124	Not Detected	-----	2.56E-02
SB-125	Not Detected	-----	6.90E-02
SN-113	Not Detected	-----	3.15E-02
SR-85	Not Detected	-----	3.10E-02
TA-182	Not Detected	-----	1.23E-01
TA-183	Not Detected	-----	5.28E-01
TC-99m	Not Detected	-----	1.62E+02
TL-201	Not Detected	-----	3.09E-01
XE-133	Not Detected	-----	3.34E-01
Y-88	Not Detected	-----	2.13E-02
ZN-65	Not Detected	-----	8.33E-02
ZR-95	Not Detected	-----	4.52E-02

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-11-97 9:12:38 PM \*  
 \*\*\*\*\*

\* Analyzed by: *J* 9/15/97 Reviewed by: *W* 9/16/97 \*  
 \*\*\*\*\*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034156-003  
 Lab Sample ID : 70157619

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 777.000 gram  
 Sample Date/Time : 9-08-97 2:05:00 PM  
 Acquire Start Date/Time : 9-11-97 7:29:54 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	3.06E+00
TH-234	1.74E+00	5.31E-01	5.95E-01
RA-226	1.75E+00	7.86E-01	5.02E-01
PB-214	7.64E-01	1.34E-01	4.16E-02
BI-214	6.63E-01	1.87E-01	4.06E-02
TH-232	5.97E-01	3.02E-01	1.31E-01
RA-228	5.77E-01	2.76E-01	1.29E-01
-228	5.68E-01	1.61E-01	7.93E-02
H-228	5.27E-01	1.59E-01	4.57E-01
RA-224	7.01E-01	2.18E-01	6.76E-02
PB-212	5.44E-01	1.35E-01	3.77E-02
BI-212	7.85E-01	2.82E-01	2.37E-01
TL-208	4.79E-01	8.58E-02	6.13E-02
U-235	<del>9.67E-02</del>	<del>1.76E-01</del>	2.27E-01
TH-231	Not Detected	-----	1.18E+01
PA-231	Not Detected	-----	1.30E+00
TH-227	Not Detected	-----	2.90E-01
RA-223	Not Detected	-----	2.19E-01
RN-219	<del>2.11E-01</del>	<del>2.85E-01</del>	3.44E-01
PB-211	Not Detected	-----	7.85E-01
TL-207	Not Detected	-----	1.21E+01
AM-241	Not Detected	-----	4.43E-01
PU-239	Not Detected	-----	4.23E+02
NP-237	Not Detected	-----	3.50E-01
PA-233	Not Detected	-----	5.46E-02
TH-229	Not Detected	-----	2.38E-01

*not detected J 9/15/97*

*not detected J 9/15/97*



[Summary Report] - Sample ID: : 70157619

Nuclide name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected		3.52E-02
AG-110m	Not Detected		3.83E-02
BA-133	Not Detected		6.50E-02
BE-7	Not Detected		2.45E-01
CD-109	Not Detected		9.18E-01
CD-115	Not Detected		1.61E-01
CE-139	Not Detected		2.84E-02
CE-141	Not Detected		5.27E-02
CE-144	Not Detected		2.24E-01
CO-56	Not Detected		2.34E-02
GO-57	Not Detected		2.84E-02
CO-58	Not Detected		2.99E-02
CO-60	Not Detected		3.12E-02
CR-51	Not Detected		2.32E-01
CS-134	Not Detected		4.56E-02
CS-137	1.05E-01	5.14E-02	2.04E-02
EU-152	Not Detected		8.51E-02
EU-154	Not Detected		1.62E-01
EU-155	Not Detected		1.34E-01
FE-59	Not Detected		6.30E-02
GD-153	Not Detected		9.94E-02
HG-203	Not Detected		2.95E-02
I-131	Not Detected		3.42E-02
IR-192	Not Detected		2.61E-02
K-40	1.03E+01	1.64E+00	2.26E-01
MN-52	Not Detected		4.21E-02
I-54	Not Detected		3.08E-02
MO-99	Not Detected		4.68E-01
NA-22	Not Detected		3.59E-02
NA-24	Not Detected		9.97E-01
NB-95	Not Detected		2.48E-01
ND-147	Not Detected		2.11E-01
NI-57	<del>2.23E-01</del>	<del>1.23E-01</del>	1.14E-01
PB-210	Not Detected		3.23E+01
RU-103	Not Detected		2.74E-02
RU-106	Not Detected		2.68E-01
SB-122	Not Detected		7.60E-02
SB-124	Not Detected		2.84E-02
SB-125	Not Detected		7.35E-02
SN-113	Not Detected		3.39E-02
SR-85	Not Detected		3.26E-02
TA-182	Not Detected		1.38E-01
TA-183	Not Detected		5.86E-01
TC-99m	Not Detected		1.97E+02
TL-201	Not Detected		3.60E-01
XE-133	Not Detected		3.70E-01
Y-88	Not Detected		2.52E-02
ZN-65	Not Detected		9.44E-02
ZR-95	Not Detected		5.13E-02

*not detected 7/9/15/17*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-11-97 10:57:30 PM \*  
 \* \*\*\*\*\*

\* Analyzed by: *[Signature]* 9/15/97 . Reviewed by: *[Signature]* 9/16/97 \*  
 \*\*\*\*\*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034157-003  
 Lab Sample ID : 70157620

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 854.000 gram  
 Sample Date/Time : 9-08-97 1:35:00 PM  
 Acquire Start Date/Time : 9-11-97 9:14:46 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	3.01E+00
TH-234	2.21E+00	6.55E-01	5.31E-01
RA-226	1.81E+00	1.54E+00	4.54E-01
PB-214	6.99E-01	1.18E-01	3.87E-02
BI-214	6.53E-01	2.61E-01	3.89E-02
TH-232	5.01E-01	6.19E-01	1.11E-01
PA-228	4.74E-01	1.66E-01	1.26E-01
U-228	5.52E-01	1.31E-01	6.87E-02
TH-228	5.30E-01	5.52E-01	3.99E-01
RA-224	5.37E-01	1.69E-01	5.56E-02
PB-212	5.09E-01	9.14E-02	3.46E-02
BI-212	5.20E-01	2.34E-01	2.27E-01
TL-208	5.34E-01	4.77E-01	5.30E-02
U-235	Not Detected	-----	2.09E-01
TH-231	Not Detected	-----	1.14E+01
PA-231	Not Detected	-----	1.20E+00
TH-227	Not Detected	-----	2.70E-01
RA-223	Not Detected	-----	2.18E-01
RN-219	Not Detected	-----	3.00E-01
PB-211	Not Detected	-----	6.96E-01
TL-207	Not Detected	-----	1.07E+01
AM-241	Not Detected	-----	4.12E-01
PU-239	Not Detected	-----	3.78E+02
NP-237	Not Detected	-----	3.46E-01
PA-233	Not Detected	-----	4.85E-02
TH-229	Not Detected	-----	2.18E-01

[Summary Report] - Sample ID: : 70157620

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.16E-02
AG-110m	Not Detected	-----	3.04E-02
BA-133	Not Detected	-----	5.95E-02
BE-7	Not Detected	-----	2.18E-01
CD-109	Not Detected	-----	1.14E+00
CD-115	Not Detected	-----	1.49E-01
CE-139	Not Detected	-----	2.60E-02
CE-141	Not Detected	-----	4.79E-02
CE-144	Not Detected	-----	2.09E-01
CO-56	Not Detected	-----	2.01E-02
CO-57	Not Detected	-----	2.58E-02
CO-58	Not Detected	-----	2.57E-02
CO-60	Not Detected	-----	2.83E-02
CR-51	Not Detected	-----	2.09E-01
CS-134	Not Detected	-----	4.19E-02
CS-137	4.44E-02	2.40E-02	1.87E-02
EU-152	Not Detected	-----	7.73E-02
EU-154	Not Detected	-----	1.47E-01
EU-155	Not Detected	-----	1.32E-01
FE-59	Not Detected	-----	5.64E-02
GD-153	Not Detected	-----	9.17E-02
HG-203	Not Detected	-----	2.72E-02
I-131	Not Detected	-----	3.34E-02
IR-192	Not Detected	-----	2.27E-02
K-40	9.33E+00	1.46E+00	2.22E-01
MN-52	Not Detected	-----	3.56E-02
MN-54	Not Detected	-----	2.90E-02
)-99	Not Detected	-----	4.36E-01
NA-22	Not Detected	-----	3.11E-02
NA-24	Not Detected	-----	1.12E+00
NB-95	Not Detected	-----	2.34E-01
ND-147	Not Detected	-----	1.92E-01
NI-57	<del>1.84E-01</del>	<del>1.40E-01</del>	1.02E-01
PB-210	Not Detected	-----	2.92E+01
RU-103	Not Detected	-----	2.47E-02
RU-106	Not Detected	-----	2.47E-01
SB-122	Not Detected	-----	7.25E-02
SB-124	Not Detected	-----	2.54E-02
SB-125	Not Detected	-----	7.10E-02
SN-113	Not Detected	-----	3.20E-02
SR-85	Not Detected	-----	3.11E-02
TA-182	Not Detected	-----	1.30E-01
TA-183	Not Detected	-----	5.51E-01
TC-99m	Not Detected	-----	2.46E+02
TL-201	Not Detected	-----	3.41E-01
XE-133	Not Detected	-----	3.69E-01
Y-88	Not Detected	-----	2.45E-02
ZN-65	Not Detected	-----	8.73E-02
ZR-95	Not Detected	-----	4.54E-02

*not detected 3/15/77*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-12-97 12:42:20 AM \*  
 \*\*\*\*\*

\* Analyzed by: *J* 9/15/97. Reviewed by: *YJ* 9/16/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034158-003  
 Lab Sample ID : 70157621

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 890.000 gram  
 Sample Date/Time : 9-08-97 1:50:00 PM  
 Acquire Start Date/Time : 9-11-97 10:59:41 PM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	2.67E+00
TH-234	1.31E+00	6.15E-01	4.79E-01
RA-226	1.17E+00	5.49E-01	4.63E-01
PB-214	7.53E-01	1.25E-01	3.83E-02
BI-214	6.70E-01	1.67E-01	3.76E-02
TH-232	4.31E-01	2.45E-01	1.15E-01
PA-228	4.42E-01	1.94E-01	1.10E-01
C-228	4.35E-01	1.44E-01	6.42E-02
TH-228	4.68E-01	1.68E-01	3.90E-01
RA-224	3.91E-01	1.58E-01	5.86E-02
PB-212	3.97E-01	7.99E-02	3.17E-02
BI-212	4.78E-01	2.07E-01	2.06E-01
TL-208	3.77E-01	1.12E-01	5.29E-02
U-235	5.00E-02	6.40E-02	1.13E-01
TH-231	Not Detected	-----	1.03E+01
PA-231	Not Detected	-----	1.10E+00
TH-227	Not Detected	-----	2.42E-01
RA-223	Not Detected	-----	1.91E-01
RN-219	Not Detected	-----	2.85E-01
PB-211	Not Detected	-----	6.46E-01
TL-207	Not Detected	-----	9.92E+00
AM-241	Not Detected	-----	3.79E-01
PU-239	Not Detected	-----	3.45E+02
NP-237	<del>3.22E-01</del>	<del>1.24E-01</del>	2.14E-01
PA-233	Not Detected	-----	4.59E-02
TH-229	Not Detected	-----	2.05E-01

*not detected J 9/15/97*

[Summary Report] - Sample ID: : 70157621

Nuclide ame	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.94E-02
AG-110m	Not Detected	-----	2.40E-02
BA-133	Not Detected	-----	5.95E-02
BE-7	Not Detected	-----	2.10E-01
CD-109	Not Detected	-----	7.28E-01
CD-115	Not Detected	-----	1.39E-01
CE-139	Not Detected	-----	2.41E-02
CE-141	Not Detected	-----	4.53E-02
CE-144	Not Detected	-----	1.96E-01
CO-56	Not Detected	-----	1.90E-02
GO-57	Not Detected	-----	2.46E-02
CO-58	Not Detected	-----	2.42E-02
CO-60	Not Detected	-----	2.49E-02
CR-51	Not Detected	-----	1.95E-01
CS-134	Not Detected	-----	4.14E-02
CS-137	Not Detected	-----	2.57E-02
EU-152	Not Detected	-----	7.35E-02
EU-154	Not Detected	-----	1.36E-01
EU-155	Not Detected	-----	1.17E-01
FE-59	Not Detected	-----	5.20E-02
GD-153	Not Detected	-----	8.55E-02
HG-203	Not Detected	-----	2.55E-02
I-131	Not Detected	-----	2.96E-02
IR-192	Not Detected	-----	2.22E-02
K-40	6.76E+00	1.10E+00	2.13E-01
MN-52	Not Detected	-----	3.57E-02
I-54	Not Detected	-----	2.58E-02
MO-99	Not Detected	-----	4.00E-01
NA-22	Not Detected	-----	2.95E-02
NA-24	Not Detected	-----	9.76E-01
NB-95	Not Detected	-----	2.13E-01
ND-147	Not Detected	-----	1.79E-01
NI-57	Not Detected	-----	8.67E-02
PB-210	Not Detected	-----	2.69E+01
RU-103	Not Detected	-----	2.26E-02
RU-106	Not Detected	-----	2.15E-01
SB-122	Not Detected	-----	7.22E-02
SB-124	Not Detected	-----	2.44E-02
SB-125	Not Detected	-----	6.42E-02
SN-113	Not Detected	-----	3.04E-02
SR-85	Not Detected	-----	2.78E-02
TA-182	Not Detected	-----	1.19E-01
TA-183	Not Detected	-----	5.12E-01
TC-99m	Not Detected	-----	2.70E+02
TL-201	Not Detected	-----	3.00E-01
XE-133	Not Detected	-----	3.39E-01
Y-88	Not Detected	-----	2.29E-02
ZN-65	Not Detected	-----	8.09E-02
ZR-95	Not Detected	-----	4.39E-02

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-12-97 2:27:06 AM \*  
 \*\*\*\*\*

\* Analyzed by: *J* 9/15/97 Reviewed by: *W* 9/16/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034160-003  
 Lab Sample ID : 70157622

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 870.000 gram  
 Sample Date/Time : 9-08-97 2:07:00 PM  
 Acquire Start Date/Time : 9-12-97 12:44:28 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	-----	2.70E+00
TH-234	1.80E+00	1.03E+00	5.17E-01
RA-226	1.68E+00	6.64E-01	4.82E-01
PB-214	6.97E-01	1.17E-01	3.67E-02
BI-214	6.57E-01	1.32E-01	3.65E-02
TH-232	4.06E-01	2.08E-01	1.12E-01
A-228	3.40E-01	2.26E-01	1.21E-01
AC-228	Not Detected	-----	1.35E-01
TH-228	3.20E-01	1.52E-01	4.02E-01
RA-224	4.26E-01	1.47E-01	5.62E-02
PB-212	3.93E-01	8.10E-02	3.29E-02
BI-212	4.72E-01	2.53E-01	2.17E-01
TL-208	3.83E-01	8.52E-02	5.18E-02
U-235	Not Detected	-----	1.96E-01
TH-231	Not Detected	-----	1.01E+01
PA-231	Not Detected	-----	1.14E+00
TH-227	Not Detected	-----	2.42E-01
RA-223	Not Detected	-----	1.94E-01
RN-219	Not Detected	-----	2.88E-01
PB-211	Not Detected	-----	6.51E-01
TL-207	Not Detected	-----	1.01E+01
AM-241	Not Detected	-----	3.88E-01
PU-239	Not Detected	-----	3.54E+02
NP-237	<del>4.75E-01</del>	<del>1.88E-01</del>	<del>2.60E-01</del>
PA-233	Not Detected	-----	4.71E-02
TH-229	Not Detected	-----	1.98E-01

*not detected J 9/15/97*

[Summary Report] - Sample ID: : 70157622

Slide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected		2.96E-02
AG-110m	Not Detected		2.90E-02
BA-133	Not Detected		5.86E-02
BE-7	Not Detected		1.97E-01
CD-109	Not Detected		8.84E-01
CD-115	Not Detected		1.42E-01
CE-139	Not Detected		2.41E-02
CE-141	Not Detected		4.56E-02
CE-144	Not Detected		1.94E-01
CO-56	Not Detected		1.94E-02
CO-57	Not Detected		2.43E-02
CO-58	Not Detected		2.46E-02
CO-60	Not Detected		2.70E-02
CR-51	Not Detected		2.00E-01
CS-134	Not Detected		4.13E-02
CS-137	4.70E-02	1.71E-02	1.67E-02
EU-152	Not Detected		7.28E-02
EU-154	Not Detected		1.37E-01
EU-155	Not Detected		1.20E-01
FE-59	Not Detected		5.36E-02
GD-153	Not Detected		8.20E-02
HG-203	Not Detected		2.55E-02
I-131	Not Detected		2.97E-02
IR-192	Not Detected		2.33E-02
K-40	6.97E+00	1.15E+00	2.00E-01
MI-52	Not Detected		3.50E-02
MI-54	Not Detected		2.41E-02
MO-99	Not Detected		4.24E-01
NA-22	Not Detected		3.00E-02
NA-24	Not Detected		1.11E+00
NB-95	Not Detected		2.15E-01
ND-147	Not Detected		1.79E-01
NI-57	<del>3.11E-01</del>	<del>1.55E-01</del>	1.00E-01
PB-210	Not Detected		2.79E+01
RU-103	Not Detected		2.32E-02
RU-106	Not Detected		2.20E-01
SB-122	Not Detected		7.05E-02
SB-124	Not Detected		2.44E-02
SB-125	Not Detected		6.72E-02
SN-113	Not Detected		2.98E-02
SR-85	Not Detected		2.91E-02
TA-182	Not Detected		1.17E-01
TA-183	Not Detected		5.29E-01
TC-99m	Not Detected		3.16E+02
TL-201	Not Detected		3.19E-01
XE-133	Not Detected		3.32E-01
Y-88	Not Detected		2.02E-02
ZN-65	Not Detected		8.25E-02
ZR-95	Not Detected		4.29E-02

*Not detected 7/3/15/17*

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-12-97 4:11:59 AM \*  
 \*\*\*\*\*

\* Analyzed by: *[Signature]* 9/15/97 Reviewed by: *[Signature]* 9/16/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034161-003  
 Lab Sample ID : 70157623

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 825.000 gram  
 Sample Date/Time : 9-08-97 2:10:00 PM  
 Acquire Start Date/Time : 9-12-97 2:29:10 AM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	9.25E+00	3.37E+00	2.80E+00
TH-234	8.65E+00	2.47E+00	6.39E-01
RA-226	Not Detected	-----	5.17E-01
PB-214	6.67E-01	3.01E-01	4.05E-02
BI-214	6.70E-01	1.30E-01	3.99E-02
I-232	7.04E-01	3.78E-01	1.32E-01
LA-228	6.80E-01	1.41E-01	1.25E-01
AC-228	5.90E-01	5.14E-01	7.08E-02
TH-228	5.39E-01	2.12E-01	4.53E-01
RA-224	6.94E-01	2.01E-01	6.36E-02
PB-212	6.63E-01	2.16E-01	3.57E-02
BI-212	8.03E-01	3.39E-01	2.62E-01
TL-208	6.41E-01	1.41E-01	5.72E-02
U-235	2.02E-01	1.29E-01	1.57E-01
TH-231	Not Detected	-----	1.34E+01
PA-231	Not Detected	-----	1.30E+00
TH-227	Not Detected	-----	3.11E-01
RA-223	Not Detected	-----	2.59E-01
RN-219	Not Detected	-----	3.29E-01
PB-211	Not Detected	-----	7.60E-01
TL-207	Not Detected	-----	1.18E+01
AM-241	Not Detected	-----	4.74E-01
PU-239	Not Detected	-----	4.26E+02
NP-237	Not Detected	-----	4.05E-01
PA-233	Not Detected	-----	5.39E-02
TH-229	Not Detected	-----	2.54E-01



[Summary Report] - Sample ID: : 70157623

Slide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.58E-02
AG-110m	Not Detected	-----	3.10E-02
BA-133	Not Detected	-----	6.19E-02
BE-7	5.75E-02	1.08E-01	1.02E-01
CD-109	<del>1.06E+00</del>	<del>4.38E-01</del>	1.05E+00
CD-115	Not Detected	-----	1.74E-01
CE-139	Not Detected	-----	2.78E-02
CE-141	Not Detected	-----	5.51E-02
CE-144	Not Detected	-----	2.33E-01
CO-56	Not Detected	-----	2.09E-02
CO-57	Not Detected	-----	2.89E-02
CO-58	Not Detected	-----	2.89E-02
CO-60	Not Detected	-----	2.99E-02
CR-51	Not Detected	-----	2.29E-01
CS-134	Not Detected	-----	4.46E-02
CS-137	3.24E-02	1.73E-02	1.85E-02
EU-152	Not Detected	-----	8.65E-02
EU-154	Not Detected	-----	1.65E-01
EU-155	Not Detected	-----	1.44E-01
FE-59	Not Detected	-----	6.38E-02
GD-153	Not Detected	-----	1.12E-01
HG-203	Not Detected	-----	2.90E-02
I-131	Not Detected	-----	3.47E-02
IR-192	Not Detected	-----	2.56E-02
K-40	1.26E+01	3.19E+00	2.23E-01
N-52	Not Detected	-----	4.11E-02
LN-54	Not Detected	-----	3.01E-02
MO-99	Not Detected	-----	5.13E-01
NA-22	Not Detected	-----	3.49E-02
NA-24	Not Detected	-----	1.32E+00
NB-95	Not Detected	-----	2.81E-01
ND-147	Not Detected	-----	2.19E-01
NI-57	Not Detected	-----	1.23E-01
PB-210	Not Detected	-----	3.29E+01
RU-103	Not Detected	-----	2.73E-02
RU-106	Not Detected	-----	2.64E-01
SB-122	Not Detected	-----	8.57E-02
SB-124	Not Detected	-----	2.72E-02
SB-125	Not Detected	-----	7.14E-02
SN-113	Not Detected	-----	3.48E-02
SR-85	Not Detected	-----	3.33E-02
TA-182	Not Detected	-----	1.32E-01
TA-183	Not Detected	-----	6.51E-01
TC-99m	Not Detected	-----	4.68E+02
TL-201	Not Detected	-----	4.07E-01
XE-133	Not Detected	-----	4.56E-01
Y-88	Not Detected	-----	2.43E-02
ZN-65	Not Detected	-----	8.82E-02
ZR-95	Not Detected	-----	5.13E-02

*not detected 7/15/77*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-12-97 5:57:03 AM \*  
 \*\*\*\*\*

\* Analyzed by: *[Signature]* 9/15/97 Reviewed by: *[Signature]* 9/16/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034162-003  
 Lab Sample ID : 70157624

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 866.000 gram  
 Sample Date/Time : 9-08-97 2:20:00 PM  
 Acquire Start Date/Time : 9-12-97 4:14:13 AM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	2.07E+00	1.60E+00	2.09E+00
TH-234	2.37E+00	7.49E-01	4.98E-01
RA-226	1.89E+00	5.20E-01	4.40E-01
PB-214	7.40E-01	1.25E-01	3.87E-02
BI-214	6.54E-01	1.26E-01	3.45E-02
TH-232	4.16E-01	2.27E-01	1.15E-01
A-228	3.50E-01	1.30E-01	1.12E-01
AC-228	4.10E-01	1.37E-01	6.51E-02
TH-228	3.52E-01	3.53E-01	3.91E-01
RA-224	3.88E-01	1.79E-01	5.23E-02
PB-212	4.26E-01	7.90E-02	3.32E-02
BI-212	5.02E-01	2.99E-01	2.40E-01
TL-208	3.86E-01	8.77E-02	5.28E-02
U-235	Not Detected	-----	1.96E-01
TH-231	Not Detected	-----	1.06E+01
PA-231	Not Detected	-----	1.12E+00
TH-227	Not Detected	-----	2.49E-01
RA-223	Not Detected	-----	2.05E-01
RN-219	Not Detected	-----	3.02E-01
PB-211	Not Detected	-----	6.96E-01
TL-207	Not Detected	-----	9.91E+00
AM-241	Not Detected	-----	3.87E-01
PU-239	Not Detected	-----	3.56E+02
NP-237	Not Detected	-----	2.23E-01
PA-233	Not Detected	-----	4.65E-02
TH-229	Not Detected	-----	2.05E-01

[Summary Report] - Sample ID: : 70157624

Slide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.92E-02
AG-110m	Not Detected	-----	3.06E-02
BA-133	Not Detected	-----	6.03E-02
BE-7	Not Detected	-----	1.99E-01
CD-109	<del>1.05E+00</del>	<del>3.95E-01</del>	<del>7.60E-01</del>
CD-115	Not Detected	-----	1.50E-01
CE-139	Not Detected	-----	2.50E-02
CE-141	Not Detected	-----	4.61E-02
CE-144	Not Detected	-----	1.98E-01
CO-56	Not Detected	-----	1.93E-02
CO-57	Not Detected	-----	2.47E-02
CO-58	Not Detected	-----	2.54E-02
CO-60	Not Detected	-----	2.71E-02
CR-51	Not Detected	-----	2.02E-01
CS-134	Not Detected	-----	4.16E-02
CS-137	7.51E-02	3.08E-02	1.72E-02
EU-152	Not Detected	-----	7.40E-02
EU-154	Not Detected	-----	1.35E-01
EU-155	Not Detected	-----	1.19E-01
FE-59	Not Detected	-----	5.35E-02
GD-153	Not Detected	-----	8.76E-02
HG-203	Not Detected	-----	2.53E-02
I-131	Not Detected	-----	3.04E-02
IR-192	Not Detected	-----	2.25E-02
K-40	7.42E+00	1.18E+00	1.87E-01
N-52	Not Detected	-----	3.71E-02
N-54	Not Detected	-----	2.66E-02
MO-99	Not Detected	-----	4.34E-01
NA-22	Not Detected	-----	3.08E-02
NA-24	Not Detected	-----	1.21E+00
NB-95	Not Detected	-----	2.27E-01
ND-147	Not Detected	-----	1.89E-01
NI-57	<del>2.01E-01</del>	<del>1.52E-01</del>	<del>9.89E-02</del>
PB-210	Not Detected	-----	2.85E+01
RU-103	Not Detected	-----	2.29E-02
RU-106	Not Detected	-----	2.20E-01
SB-122	Not Detected	-----	7.57E-02
SB-124	Not Detected	-----	2.44E-02
SB-125	Not Detected	-----	6.62E-02
SN-113	Not Detected	-----	3.03E-02
SR-85	Not Detected	-----	2.90E-02
TA-182	Not Detected	-----	1.18E-01
TA-183	Not Detected	-----	5.36E-01
TC-99m	Not Detected	-----	4.66E+02
TL-201	Not Detected	-----	3.40E-01
XE-133	Not Detected	-----	3.70E-01
Y-88	Not Detected	-----	2.28E-02
ZN-65	Not Detected	-----	8.20E-02
ZR-95	Not Detected	-----	4.43E-02

*not detected 7/15/57*

*not detected 7/15/57*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-11-97 7:19:57 PM \*  
 \*\*\*\*\*

\* Analyzed by: *J 9/15/97* Reviewed by: *WJ 9/16/97* \*  
 \*\*\*\*\*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034163-003  
 Lab Sample ID : 70157625

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 896.000 gram  
 Sample Date/Time : 9-08-97 2:45:00 PM  
 Acquire Start Date/Time : 9-11-97 5:36:33 PM  
 Detector Name : LAB03  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:  
 \*\*\*\*\*

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	2.04E+00	7.77E-01	8.05E-01
TH-234	2.23E+00	6.15E-01	3.58E-01
RA-226	7.64E-01	7.53E-01	4.50E-01
PB-214	7.78E-01	1.37E-01	3.87E-02
BI-214	7.19E-01	1.32E-01	4.13E-02
TH-232	4.17E-01	2.39E-01	1.26E-01
AC-228	4.82E-01	1.61E-01	1.38E-01
AC-228	4.57E-01	1.45E-01	7.65E-02
TH-228	4.31E-01	2.73E-01	4.04E-01
RA-224	5.03E-01	2.03E-01	7.75E-02
PB-212	4.52E-01	8.10E-02	3.41E-02
BI-212	6.01E-01	3.66E-01	2.84E-01
TL-208	4.37E-01	1.22E-01	6.27E-02
U-235	7.14E-02	6.76E-02	1.08E-01
TH-231	Not Detected	-----	6.44E+00
PA-231	Not Detected	-----	1.14E+00
TH-227	Not Detected	-----	2.71E-01
RA-223	Not Detected	-----	1.23E-01
RN-219	Not Detected	-----	3.26E-01
PB-211	Not Detected	-----	7.30E-01
TL-207	Not Detected	-----	1.20E+01
AM-241	Not Detected	-----	1.29E-01
PU-239	Not Detected	-----	2.84E+02
NP-237	<del>3.24E-01</del>	<del>1.01E-01</del>	1.72E-01
PA-233	Not Detected	-----	4.89E-02
TH-229	Not Detected	-----	1.55E-01

*not detected J 9/15/97*

[Summary Report] - Sample ID: : 70157625

Slide name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.43E-02
AG-110m	Not Detected	-----	3.66E-02
BA-133	Not Detected	-----	4.67E-02
BE-7	Not Detected	-----	2.27E-01
CD-109	Not Detected	-----	7.22E-01
CD-115	Not Detected	-----	1.34E-01
CE-139	Not Detected	-----	2.15E-02
CE-141	Not Detected	-----	3.70E-02
CE-144	Not Detected	-----	1.57E-01
CO-56	Not Detected	-----	2.95E-02
CO-57	Not Detected	-----	1.93E-02
CO-58	Not Detected	-----	2.88E-02
CO-60	Not Detected	-----	3.08E-02
CR-51	Not Detected	-----	2.08E-01
CS-134	Not Detected	-----	4.67E-02
CS-137	7.43E-02	2.50E-02	2.16E-02
EU-152	Not Detected	-----	5.79E-02
EU-154	Not Detected	-----	1.58E-01
EU-155	Not Detected	-----	8.98E-02
FE-59	Not Detected	-----	6.26E-02
GD-153	Not Detected	-----	6.45E-02
HG-203	Not Detected	-----	2.53E-02
I-131	Not Detected	-----	3.20E-02
IR-192	Not Detected	-----	2.35E-02
K-40	8.13E+00	1.42E+00	2.65E-01
L-52	Not Detected	-----	4.10E-02
L-54	Not Detected	-----	2.82E-02
MO-99	Not Detected	-----	4.59E-01
NA-22	Not Detected	-----	3.74E-02
NA-24	Not Detected	-----	9.17E-01
NB-95	Not Detected	-----	2.26E-01
ND-147	Not Detected	-----	2.10E-01
NI-57	Not Detected	-----	2.00E-01
PB-210	Not Detected	-----	3.70E+00
RU-103	Not Detected	-----	2.49E-02
RU-106	Not Detected	-----	2.47E-01
SB-122	Not Detected	-----	7.42E-02
SB-124	Not Detected	-----	2.64E-02
SB-125	Not Detected	-----	7.19E-02
SN-113	Not Detected	-----	3.39E-02
SR-85	Not Detected	-----	3.07E-02
TA-182	Not Detected	-----	1.50E-01
TA-183	Not Detected	-----	1.67E-01
TC-99m	Not Detected	-----	1.05E+02
TL-201	Not Detected	-----	1.48E-01
XE-133	Not Detected	-----	1.88E-01
Y-88	Not Detected	-----	2.48E-02
ZN-65	Not Detected	-----	1.01E-01
ZR-95	Not Detected	-----	4.99E-02

\*\*\*\*\*  
 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-11-97 5:33:21 PM \*  
 \* \*\*\*\*\*

\* Analyzed by: *J 9/15/97* Reviewed by: *WJA/16/97* \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034165-003  
 Lab Sample ID : 70157626

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 1004.000 gram  
 Sample Date/Time : 9-08-97 3:00:00 PM  
 Acquire Start Date/Time : 9-11-97 3:44:38 PM  
 Detector Name : LAB03  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	6.56E-01	4.83E-01	6.44E-01
TH-234	7.73E-01	1.99E-01	2.61E-01
RA-226	1.35E+00	3.98E-01	3.52E-01
PB-214	7.25E-01	1.26E-01	3.26E-02
BI-214	6.93E-01	1.28E-01	3.50E-02
Tl-232	2.02E-01	1.22E-01	1.00E-01
Ac-228	2.07E-01	9.50E-02	8.38E-02
AC-228	Not Detected	-----	1.12E-01
TH-228	Not Detected	-----	4.83E-01
RA-224	2.15E-01	1.98E-01	5.56E-02
PB-212	2.04E-01	4.97E-02	2.75E-02
BI-212	2.06E-01	1.87E-01	1.93E-01
TL-208	1.41E-01	5.36E-02	4.86E-02
U-235	Not Detected	-----	1.34E-01
TH-231	<del>6.67E+00</del>	<del>3.97E+00</del>	5.20E+00
PA-231	Not Detected	-----	9.57E-01
TH-227	Not Detected	-----	1.91E-01
RA-223	Not Detected	-----	9.53E-02
RN-219	Not Detected	-----	2.63E-01
PB-211	Not Detected	-----	6.06E-01
TL-207	Not Detected	-----	9.99E+00
AM-241	Not Detected	-----	1.02E-01
PU-239	Not Detected	-----	2.28E+02
NP-237	Not Detected	-----	1.24E-01
PA-233	Not Detected	-----	4.13E-02
TH-229	Not Detected	-----	1.29E-01

*not detected J 9/15/97*

[Summary Report] - Sample ID: : 70157626

Slide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.58E-02
AG-110m	Not Detected	-----	2.58E-02
BA-133	Not Detected	-----	3.78E-02
BE-7	Not Detected	-----	1.65E-01
CD-109	Not Detected	-----	5.45E-01
CD-115	Not Detected	-----	9.81E-02
CE-139	Not Detected	-----	1.83E-02
CE-141	Not Detected	-----	3.17E-02
CE-144	Not Detected	-----	1.23E-01
CO-56	<del>5.95E-03</del>	<del>6.50E-03</del>	1.29E-02
CO-57	Not Detected	-----	1.63E-02
CO-58	Not Detected	-----	2.37E-02
CO-60	Not Detected	-----	2.39E-02
CR-51	Not Detected	-----	1.57E-01
CS-134	Not Detected	-----	4.22E-02
CS-137	2.99E-02	1.59E-02	1.53E-02
EU-152	Not Detected	-----	4.86E-02
EU-154	Not Detected	-----	1.18E-01
EU-155	Not Detected	-----	7.10E-02
FE-59	Not Detected	-----	4.31E-02
GD-153	Not Detected	-----	5.21E-02
HG-203	Not Detected	-----	2.10E-02
I-131	Not Detected	-----	2.53E-02
IR-192	Not Detected	-----	1.92E-02
K-40	3.25E+00	7.76E-01	2.26E-01
LN-52	Not Detected	-----	3.62E-02
N-54	Not Detected	-----	2.55E-02
MO-99	Not Detected	-----	3.59E-01
NA-22	Not Detected	-----	2.69E-02
NA-24	Not Detected	-----	7.12E-01
NB-95	Not Detected	-----	1.56E-01
ND-147	Not Detected	-----	1.55E-01
NI-57	Not Detected	-----	1.78E-01
PB-210	Not Detected	-----	2.85E+00
RU-103	Not Detected	-----	2.08E-02
RU-106	Not Detected	-----	1.94E-01
SB-122	Not Detected	-----	5.31E-02
SB-124	Not Detected	-----	2.21E-02
SB-125	Not Detected	-----	5.80E-02
SN-113	Not Detected	-----	2.70E-02
SR-85	Not Detected	-----	2.49E-02
TA-182	Not Detected	-----	1.23E-01
TA-183	Not Detected	-----	1.30E-01
TC-99m	Not Detected	-----	6.73E+01
TL-201	Not Detected	-----	1.13E-01
XE-133	<del>1.84E-02</del>	<del>2.81E-02</del>	1.25E-01
Y-88	Not Detected	-----	2.10E-02
ZN-65	Not Detected	-----	8.25E-02
ZR-95	Not Detected	-----	4.07E-02

*not detected 7/9/15/97*

*not detected 7/9/15/97*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-11-97 3:31:56 PM \*  
 \*\*\*\*\*

\* Analyzed by: *J* 9/15/97 Reviewed by: *YS* 9/16/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034166-003  
 Lab Sample ID : 70157627

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 922.000 gram  
 Sample Date/Time : 9-08-97 2:55:00 PM  
 Acquire Start Date/Time : 9-11-97 1:49:02 PM  
 Detector Name : LAB03  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	1.14E+00	1.65E+00	9.16E-01
TH-234	1.23E+00	4.13E-01	3.44E-01
RA-226	1.60E+00	4.62E-01	4.11E-01
PB-214	8.18E-01	1.45E-01	4.11E-02
BI-214	7.54E-01	2.39E-01	3.98E-02
TH-232	5.63E-01	2.80E-01	1.28E-01
A-228	5.86E-01	2.62E-01	1.38E-01
AC-228	6.54E-01	1.74E-01	7.50E-02
TH-228	2.18E-01	9.58E-02	2.58E-01
RA-224	6.14E-01	2.67E-01	7.20E-02
PB-212	6.05E-01	1.12E-01	3.15E-02
BI-212	6.19E-01	3.13E-01	2.49E-01
TL-208	5.28E-01	1.25E-01	5.89E-02
U-235	Not Detected	-----	1.64E-01
TH-231	Not Detected	-----	6.57E+00
PA-231	Not Detected	-----	1.16E+00
TH-227	Not Detected	-----	2.95E-01
RA-223	Not Detected	-----	1.22E-01
RN-219	Not Detected	-----	3.32E-01
PB-211	Not Detected	-----	7.56E-01
TL-207	Not Detected	-----	1.20E+01
AM-241	Not Detected	-----	1.34E-01
PU-239	Not Detected	-----	2.95E+02
NP-237	<del>4.59E-01</del>	<del>1.22E-01</del>	1.71E-01
PA-233	Not Detected	-----	5.06E-02
TH-229	Not Detected	-----	1.55E-01

*Not detected J 9/15/97*



[Summary Report] - Sample ID: : 70157627

Slide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected		3.61E-02
AG-110m	Not Detected		3.29E-02
BA-133	Not Detected		4.42E-02
BE-7	Not Detected		2.33E-01
CD-109	Not Detected		7.32E-01
CD-115	Not Detected		1.39E-01
CE-139	Not Detected		2.28E-02
CE-141	Not Detected		3.82E-02
CE-144	Not Detected		1.60E-01
CO-56	Not Detected		3.09E-02
CO-57	Not Detected		1.99E-02
CO-58	Not Detected		2.84E-02
CO-60	Not Detected		3.10E-02
CR-51	Not Detected		2.21E-01
CS-134	Not Detected		4.77E-02
CS-137	4.26E-02	3.08E-02	1.98E-02
EU-152	Not Detected		5.91E-02
EU-154	Not Detected		1.66E-01
EU-155	Not Detected		9.12E-02
FE-59	Not Detected		6.79E-02
GD-153	Not Detected		6.51E-02
HG-203	Not Detected		2.66E-02
I-131	Not Detected		3.21E-02
IR-192	Not Detected		2.51E-02
K-40	9.92E+00	1.67E+00	2.65E-01
LN-52	Not Detected		4.04E-02
J-54	Not Detected		2.96E-02
MO-99	Not Detected		4.41E-01
NA-22	Not Detected		3.40E-02
NA-24	Not Detected		8.06E-01
NB-95	Not Detected		2.38E-01
ND-147	Not Detected		2.10E-01
NI-57	Not Detected		1.86E-01
PB-210	Not Detected		1.93E+00
RU-103	Not Detected		2.54E-02
RU-106	Not Detected		2.55E-01
SB-122	Not Detected		7.32E-02
SB-124	Not Detected		2.59E-02
SB-125	Not Detected		7.21E-02
SN-113	Not Detected		3.32E-02
SR-85	Not Detected		3.27E-02
TA-182	Not Detected		1.52E-01
TA-183	Not Detected		1.70E-01
TC-99m	Not Detected		6.96E+01
TL-201	Not Detected		1.46E-01
XE-133	Not Detected		1.80E-01
Y-88	Not Detected		2.53E-02
ZN-65	Not Detected		1.03E-01
ZR-95	Not Detected		5.39E-02

\*\*\*\*\*  
 Sandia National Laboratories  
 Radiation Protection Sample Diagnostics Program [881 Laboratory]  
 9-11-97 1:52:51 PM  
 \*\*\*\*\*

Analyzed by: *J* 9/15/97 Reviewed by: *WJ* 9/16/97  
 \*\*\*\*\*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034167-003  
 Lab Sample ID : 70157628

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 980.000 gram  
 Sample Date/Time : 9-08-97 3:05:00 PM  
 Acquire Start Date/Time : 9-11-97 12:06:56 PM  
 Detector Name : LAB03  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	9.51E-01	1.21E+00	6.73E-01
TH-234	9.13E-01	2.80E-01	2.99E-01
RA-226	1.46E+00	4.59E-01	4.06E-01
PB-214	7.22E-01	1.26E-01	3.74E-02
BI-214	6.49E-01	2.22E-01	3.25E-02
TH-232	2.93E-01	1.85E-01	1.02E-01
U-228	3.66E-01	2.16E-01	1.04E-01
AC-228	Not Detected	-----	1.36E-01
TH-228	2.83E-01	2.62E-01	3.63E-01
RA-224	3.16E-01	1.53E-01	6.30E-02
PB-212	3.11E-01	6.08E-02	3.01E-02
BI-212	3.69E-01	2.87E-01	2.24E-01
TL-208	2.86E-01	8.07E-02	5.08E-02
U-235	6.61E-02	1.02E-01	1.43E-01
TH-231	Not Detected	-----	5.52E+00
PA-231	Not Detected	-----	9.85E-01
TH-227	Not Detected	-----	2.26E-01
RA-223	Not Detected	-----	1.04E-01
RN-219	Not Detected	-----	2.90E-01
PB-211	Not Detected	-----	6.53E-01
TL-207	Not Detected	-----	1.04E+01
AM-241	Not Detected	-----	1.11E-01
PU-239	Not Detected	-----	2.44E+02
NP-237	<del>2.76E-01</del>	<del>8.56E-02</del>	1.40E-01
PA-233	Not Detected	-----	4.08E-02
TH-229	Not Detected	-----	1.36E-01

*not detected J 9/15/97*

[Summary Report] - Sample ID: : 70157628

Isotope Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.88E-02
AG-110m	Not Detected	-----	3.50E-02
BA-133	Not Detected	-----	3.82E-02
BE-7	Not Detected	-----	1.90E-01
CD-109	Not Detected	-----	6.10E-01
CD-115	Not Detected	-----	1.08E-01
CE-139	Not Detected	-----	1.89E-02
CE-141	Not Detected	-----	3.31E-02
CE-144	Not Detected	-----	1.40E-01
CO-56	Not Detected	-----	2.45E-02
CO-57	Not Detected	-----	1.81E-02
CO-58	Not Detected	-----	2.55E-02
CO-60	Not Detected	-----	2.84E-02
CR-51	Not Detected	-----	1.84E-01
CS-134	Not Detected	-----	4.39E-02
CS-137	8.89E-02	3.31E-02	2.02E-02
EU-152	Not Detected	-----	5.38E-02
EU-154	Not Detected	-----	1.35E-01
EU-155	Not Detected	-----	7.85E-02
FE-59	Not Detected	-----	5.21E-02
GD-153	Not Detected	-----	5.56E-02
HG-203	Not Detected	-----	2.23E-02
I-131	Not Detected	-----	2.81E-02
IR-192	Not Detected	-----	1.98E-02
K-40	5.89E+00	1.10E+00	2.04E-01
La-138	Not Detected	-----	3.59E-02
La-152	Not Detected	-----	2.64E-02
MO-99	Not Detected	-----	3.72E-01
NA-22	Not Detected	-----	2.74E-02
NA-24	Not Detected	-----	6.72E-01
NB-95	Not Detected	-----	1.79E-01
ND-147	Not Detected	-----	1.78E-01
NI-57	Not Detected	-----	1.64E-01
PB-210	1.15E+00	1.20E+00	2.15E+00
RU-103	Not Detected	-----	2.23E-02
RU-106	Not Detected	-----	2.17E-01
SB-122	Not Detected	-----	5.67E-02
SB-124	Not Detected	-----	2.39E-02
SB-125	Not Detected	-----	6.38E-02
SN-113	Not Detected	-----	2.89E-02
SR-85	Not Detected	-----	2.65E-02
TA-182	Not Detected	-----	1.29E-01
TA-183	Not Detected	-----	1.39E-01
TC-99m	Not Detected	-----	4.63E+01
TL-201	Not Detected	-----	1.20E-01
XE-133	Not Detected	-----	1.50E-01
Y-88	Not Detected	-----	2.08E-02
ZN-65	Not Detected	-----	8.82E-02
ZR-95	Not Detected	-----	4.20E-02

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 Sandia National Laboratories \*  
 Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 9-11-97 11:00:51 AM \*  
 \*\*\*\*\*

\* Analyzed by: *[Signature]* 9/15/97 Reviewed by: *[Signature]* 9/16/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034168-003  
 Lab Sample ID : 70157629

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 1030.000 gram  
 Sample Date/Time : 9-08-97 3:05:00 PM  
 Acquire Start Date/Time : 9-11-97 9:17:45 AM  
 Detector Name : LAB03  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	6.98E-01	6.50E-01	6.63E-01
TH-234	7.96E-01	2.72E-01	2.79E-01
RA-226	1.17E+00	3.97E-01	3.57E-01
PB-214	6.28E-01	1.09E-01	3.19E-02
BI-214	5.81E-01	1.07E-01	3.00E-02
TH-232	3.00E-01	1.74E-01	1.12E-01
AC-228	2.71E-01	1.19E-01	9.44E-02
AC-228	Not Detected	-----	1.22E-01
TH-228	2.08E-01	2.12E-01	2.89E-01
RA-224	3.05E-01	3.82E-01	4.90E-02
PB-212	2.84E-01	5.60E-02	2.62E-02
BI-212	2.42E-01	3.31E-01	2.37E-01
TL-208	2.45E-01	9.53E-02	4.99E-02
U-235	Not Detected	-----	1.33E-01
TH-231	Not Detected	-----	5.25E+00
PA-231	Not Detected	-----	9.37E-01
TH-227	Not Detected	-----	2.07E-01
RA-223	Not Detected	-----	9.63E-02
RN-219	Not Detected	-----	2.54E-01
PB-211	Not Detected	-----	5.92E-01
TL-207	Not Detected	-----	9.71E+00
AM-241	Not Detected	-----	1.06E-01
PU-239	Not Detected	-----	2.36E+02
NP-237	Not Detected	-----	1.20E-01
PA-233	Not Detected	-----	3.89E-02
TH-229	Not Detected	-----	1.30E-01

[Summary Report] - Sample ID: : 70157629

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.78E-02
AG-110m	Not Detected	-----	2.64E-02
BA-133	Not Detected	-----	3.65E-02
BE-7	Not Detected	-----	1.87E-01
CD-109	Not Detected	-----	5.77E-01
CD-115	Not Detected	-----	9.94E-02
CE-139	Not Detected	-----	1.80E-02
CE-141	Not Detected	-----	3.08E-02
CE-144	Not Detected	-----	1.31E-01
CO-56	Not Detected	-----	2.27E-02
CO-57	Not Detected	-----	1.65E-02
CO-58	Not Detected	-----	2.21E-02
CO-60	Not Detected	-----	2.39E-02
CR-51	Not Detected	-----	1.71E-01
CS-134	Not Detected	-----	3.85E-02
CS-137	3.69E-02	2.04E-02	1.62E-02
EU-152	Not Detected	-----	4.96E-02
EU-154	Not Detected	-----	1.27E-01
EU-155	Not Detected	-----	7.33E-02
FE-59	Not Detected	-----	5.08E-02
GD-153	Not Detected	-----	5.27E-02
HG-203	Not Detected	-----	1.97E-02
I-131	Not Detected	-----	2.46E-02
IR-192	Not Detected	-----	1.88E-02
K-40	5.43E+00	1.05E+00	2.11E-01
MN-52	Not Detected	-----	3.41E-02
J-54	Not Detected	-----	2.36E-02
MO-99	Not Detected	-----	3.36E-01
NA-22	Not Detected	-----	2.83E-02
NA-24	Not Detected	-----	5.43E-01
NB-95	Not Detected	-----	1.61E-01
ND-147	Not Detected	-----	1.63E-01
NI-57	Not Detected	-----	1.41E-01
PB-210	Not Detected	-----	2.95E+00
RU-103	Not Detected	-----	2.02E-02
RU-106	Not Detected	-----	2.11E-01
SB-122	Not Detected	-----	5.14E-02
SB-124	Not Detected	-----	2.11E-02
SB-125	Not Detected	-----	5.57E-02
SN-113	Not Detected	-----	2.63E-02
SR-85	Not Detected	-----	2.52E-02
TA-182	Not Detected	-----	1.22E-01
TA-183	Not Detected	-----	1.30E-01
TC-99m	Not Detected	-----	3.20E+01
TL-201	Not Detected	-----	1.06E-01
XE-133	<del>2.75E-02</del>	<del>4.55E-02</del>	8.07E-02
Y-88	Not Detected	-----	2.23E-02
ZN-65	Not Detected	-----	8.25E-02
ZR-95	Not Detected	-----	3.76E-02

*not detected 9/15/27*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-11-97 9:11:46 AM \*  
 \*\*\*\*\*

\* Analyzed by: *J* 9/15/97 . Reviewed by: *YJ* 9/16/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034170-003  
 Lab Sample ID : 70157630

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 999.000 gram  
 Sample Date/Time : 9-08-97 3:35:00 PM  
 Acquire Start Date/Time : 9-11-97 7:23:16 AM  
 Detector Name : LAB03  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	9.31E-01
TH-234	1.04E+00	3.01E-01	3.07E-01
RA-226	1.66E+00	4.89E-01	4.10E-01
PB-214	7.12E-01	1.58E-01	3.20E-02
BI-214	6.44E-01	1.53E-01	3.40E-02
TH-232	3.04E-01	1.65E-01	9.80E-02
U-228	2.56E-01	1.22E-01	1.21E-01
Ac-228	Not Detected	-----	1.29E-01
TH-228	1.99E-01	3.63E-01	2.92E-01
RA-224	3.28E-01	1.63E-01	6.85E-02
PB-212	3.11E-01	1.16E-01	2.81E-02
BI-212	4.15E-01	2.39E-01	2.10E-01
TL-208	2.94E-01	9.34E-02	4.78E-02
U-235	Not Detected	-----	1.42E-01
TH-231	Not Detected	-----	5.26E+00
PA-231	Not Detected	-----	9.40E-01
TH-227	Not Detected	-----	2.22E-01
RA-223	Not Detected	-----	9.89E-02
RN-219	Not Detected	-----	2.83E-01
PB-211	Not Detected	-----	6.58E-01
TL-207	Not Detected	-----	9.63E+00
AM-241	Not Detected	-----	1.11E-01
PU-239	Not Detected	-----	2.39E+02
NP-237	<del>3.98E-01</del>	<del>1.09E-01</del>	1.42E-01
PA-233	Not Detected	-----	3.99E-02
TH-229	Not Detected	-----	1.31E-01

*not detected J 9/15/97*

[Summary Report] - Sample ID: : 70157630

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.85E-02
AG-110m	Not Detected	-----	2.17E-02
BA-133	Not Detected	-----	3.72E-02
BE-7	Not Detected	-----	1.79E-01
CD-109	Not Detected	-----	6.01E-01
CD-115	Not Detected	-----	9.73E-02
CE-139	Not Detected	-----	1.90E-02
CE-141	Not Detected	-----	3.20E-02
CE-144	Not Detected	-----	1.31E-01
CO-56	Not Detected	-----	2.53E-02
CO-57	Not Detected	-----	1.70E-02
CO-58	Not Detected	-----	2.42E-02
CO-60	Not Detected	-----	2.68E-02
CR-51	Not Detected	-----	1.77E-01
CS-134	Not Detected	-----	4.19E-02
CS-137	Not Detected	-----	2.48E-02
EU-152	Not Detected	-----	5.08E-02
EU-154	Not Detected	-----	1.32E-01
EU-155	Not Detected	-----	7.46E-02
FE-59	Not Detected	-----	5.20E-02
GD-153	Not Detected	-----	5.40E-02
HG-203	Not Detected	-----	2.11E-02
I-131	Not Detected	-----	2.56E-02
IR-192	Not Detected	-----	2.01E-02
K-40	6.01E+00	1.06E+00	2.27E-01
MN-52	Not Detected	-----	3.49E-02
N-54	Not Detected	-----	2.62E-02
O-99	Not Detected	-----	3.25E-01
NA-22	Not Detected	-----	2.97E-02
NA-24	Not Detected	-----	4.25E-01
NB-95	Not Detected	-----	1.70E-01
ND-147	Not Detected	-----	1.71E-01
NI-57	Not Detected	-----	1.36E-01
PB-210	Not Detected	-----	3.17E+00
RU-103	Not Detected	-----	2.08E-02
RU-106	Not Detected	-----	2.16E-01
SB-122	Not Detected	-----	5.35E-02
SB-124	Not Detected	-----	2.32E-02
SB-125	Not Detected	-----	6.14E-02
SN-113	Not Detected	-----	2.67E-02
SR-85	Not Detected	-----	2.70E-02
TA-182	Not Detected	-----	1.25E-01
TA-183	Not Detected	-----	1.35E-01
TC-99m	Not Detected	-----	2.62E+01
TL-201	Not Detected	-----	1.11E-01
XE-133	Not Detected	-----	1.32E-01
Y-88	Not Detected	-----	2.10E-02
ZN-65	Not Detected	-----	8.54E-02
ZR-95	Not Detected	-----	4.14E-02

\*\*\*\*\*  
 Sandia National Laboratories \*  
 Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 9-10-97 6:27:53 PM \*  
 \*\*\*\*\*

Analyzed by: *[Signature]* 9/15/97 Reviewed by: *[Signature]* 9/16/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034171-003  
 Lab Sample ID : 70157631

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 1026.000 gram  
 Sample Date/Time : 9-08-97 3:40:00 PM  
 Acquire Start Date/Time : 9-10-97 4:44:39 PM  
 Detector Name : LAB03  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	8.85E-01
TH-234	7.05E-01	2.67E-01	2.73E-01
RA-226	4.68E-01	4.89E-01	3.64E-01
PB-214	6.61E-01	1.10E-01	3.23E-02
BI-214	6.00E-01	1.18E-01	3.13E-02
TH-232	2.91E-01	1.71E-01	9.72E-02
-228	2.53E-01	1.36E-01	9.72E-02
AC-228	Not Detected	-----	1.29E-01
TH-228	1.87E-01	1.89E-01	2.96E-01
RA-224	3.17E-01	2.36E-01	6.45E-02
PB-212	2.72E-01	5.12E-02	2.77E-02
BI-212	1.98E-01	2.23E-01	2.22E-01
TL-208	2.45E-01	6.80E-02	4.59E-02
U-235	4.70E-02	4.68E-02	8.01E-02
TH-231	Not Detected	-----	5.14E+00
PA-231	Not Detected	-----	9.07E-01
TH-227	Not Detected	-----	2.10E-01
RA-223	Not Detected	-----	9.15E-02
RN-219	Not Detected	-----	2.65E-01
PB-211	Not Detected	-----	5.95E-01
TL-207	Not Detected	-----	9.55E+00
AM-241	Not Detected	-----	1.04E-01
PU-239	Not Detected	-----	2.24E+02
NP-237	Not Detected	-----	1.39E-01
PA-233	Not Detected	-----	3.87E-02
TH-229	Not Detected	-----	1.22E-01



[Summary Report] - Sample ID: : 70157631

Isotope Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.75E-02
AG-110m	Not Detected	-----	2.12E-02
BA-133	Not Detected	-----	3.57E-02
BE-7	Not Detected	-----	1.71E-01
CD-109	Not Detected	-----	5.65E-01
CD-115	Not Detected	-----	7.71E-02
CE-139	Not Detected	-----	1.75E-02
CE-141	Not Detected	-----	2.94E-02
CE-144	<del>2.38E-02</del>	<del>2.74E-02</del>	7.39E-02
CO-56	Not Detected	-----	2.35E-02
CO-57	Not Detected	-----	1.57E-02
CO-58	Not Detected	-----	2.43E-02
CO-60	Not Detected	-----	2.54E-02
CR-51	Not Detected	-----	1.64E-01
CS-134	Not Detected	-----	4.09E-02
CS-137	Not Detected	-----	2.47E-02
EU-152	Not Detected	-----	4.71E-02
EU-154	Not Detected	-----	1.26E-01
EU-155	Not Detected	-----	7.29E-02
FE-59	Not Detected	-----	5.06E-02
GD-153	Not Detected	-----	5.02E-02
HG-203	Not Detected	-----	2.03E-02
I-131	Not Detected	-----	2.36E-02
IR-192	Not Detected	-----	1.89E-02
K-40	5.61E+00	1.02E+00	1.98E-01
MN-52	Not Detected	-----	2.82E-02
-54	Not Detected	-----	2.46E-02
MO-99	Not Detected	-----	2.70E-01
NA-22	Not Detected	-----	2.78E-02
NA-24	Not Detected	-----	2.19E-01
NB-95	Not Detected	-----	1.42E-01
ND-147	Not Detected	-----	1.53E-01
NI-57	Not Detected	-----	1.02E-01
PB-210	9.54E-01	1.14E+00	2.03E+00
RU-103	Not Detected	-----	2.10E-02
RU-106	Not Detected	-----	2.06E-01
SB-122	Not Detected	-----	4.14E-02
SB-124	Not Detected	-----	2.21E-02
SB-125	Not Detected	-----	5.57E-02
SN-113	Not Detected	-----	2.65E-02
SR-85	Not Detected	-----	2.35E-02
TA-182	Not Detected	-----	1.20E-01
TA-183	Not Detected	-----	1.16E-01
TC-99m	Not Detected	-----	4.36E+00
TL-201	Not Detected	-----	9.15E-02
XE-133	Not Detected	-----	1.08E-01
Y-88	Not Detected	-----	1.95E-02
ZN-65	Not Detected	-----	8.34E-02
ZR-95	Not Detected	-----	3.94E-02

not detected 9/15/97

\*\*\*\*\*  
 Sandia National Laboratories  
 Radiation Protection Sample Diagnostics Program [881 Laboratory]  
 9-10-97 4:36:13 PM  
 \*\*\*\*\*

\* Analyzed by: *J* 9/15/97 . Reviewed by: *WS* 9/16/97  
 \*\*\*\*\*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034172-003  
 Lab Sample ID : 70157632

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 942.000 gram  
 Sample Date/Time : 9-08-97 4:00:00 PM  
 Acquire Start Date/Time : 9-10-97 2:53:01 PM  
 Detector Name : LAB03  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	8.43E-01	5.66E-01	7.79E-01
TH-234	1.00E+00	2.86E-01	3.07E-01
RA-226	1.79E+00	8.05E-01	3.84E-01
PB-214	7.04E-01	1.31E-01	3.57E-02
BI-214	6.80E-01	1.40E-01	3.71E-02
TH-232	2.73E-01	1.53E-01	1.01E-01
-228	3.44E-01	2.29E-01	1.13E-01
AC-228	Not Detected	-----	1.32E-01
TH-228	2.41E-01	3.46E-01	3.09E-01
RA-224	2.38E-01	1.68E-01	5.35E-02
PB-212	2.58E-01	4.96E-02	2.76E-02
BI-212	2.99E-01	1.95E-01	2.11E-01
TL-208	2.22E-01	8.08E-02	5.11E-02
U-235	Not Detected	-----	1.37E-01
TH-231	Not Detected	-----	5.40E+00
PA-231	Not Detected	-----	9.42E-01
TH-227	Not Detected	-----	2.16E-01
RA-223	Not Detected	-----	9.66E-02
RN-219	Not Detected	-----	2.89E-01
PB-211	Not Detected	-----	6.63E-01
TL-207	Not Detected	-----	1.09E+01
AM-241	Not Detected	-----	1.08E-01
PU-239	Not Detected	-----	2.40E+02
NP-237	<del>2.98E-01</del>	<del>9.02E-02</del>	1.39E-01
PA-233	Not Detected	-----	4.11E-02
TH-229	Not Detected	-----	1.31E-01

*not detected J 9/15/97*

[Summary Report] - Sample ID: : 70157632

Slide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.72E-02
AG-110m	Not Detected	-----	3.18E-02
BA-133	Not Detected	-----	3.87E-02
BE-7	Not Detected	-----	1.89E-01
CD-109	Not Detected	-----	6.04E-01
CD-115	Not Detected	-----	7.90E-02
CE-139	Not Detected	-----	1.96E-02
CE-141	Not Detected	-----	3.06E-02
CE-144	Not Detected	-----	1.35E-01
CO-56	Not Detected	-----	2.31E-02
CO-57	Not Detected	-----	1.73E-02
CO-58	Not Detected	-----	2.50E-02
CO-60	Not Detected	-----	2.57E-02
CR-51	Not Detected	-----	1.82E-01
CS-134	Not Detected	-----	4.41E-02
CS-137	6.69E-02	2.76E-02	1.51E-02
EU-152	Not Detected	-----	5.17E-02
EU-154	Not Detected	-----	1.26E-01
EU-155	Not Detected	-----	7.44E-02
FE-59	Not Detected	-----	5.15E-02
GD-153	Not Detected	-----	5.30E-02
HG-203	Not Detected	-----	2.07E-02
I-131	Not Detected	-----	2.35E-02
IR-192	Not Detected	-----	2.00E-02
K-40	5.14E+00	1.01E+00	2.46E-01
N-52	Not Detected	-----	3.08E-02
N-54	Not Detected	-----	2.57E-02
MO-99	Not Detected	-----	2.93E-01
NA-22	Not Detected	-----	2.87E-02
NA-24	Not Detected	-----	2.39E-01
NB-95	Not Detected	-----	1.44E-01
ND-147	Not Detected	-----	1.65E-01
NI-57	Not Detected	-----	1.07E-01
PB-210	Not Detected	-----	3.18E+00
RU-103	Not Detected	-----	2.16E-02
RU-106	Not Detected	-----	2.23E-01
SB-122	Not Detected	-----	4.50E-02
SB-124	Not Detected	-----	2.20E-02
SB-125	Not Detected	-----	6.14E-02
SN-113	Not Detected	-----	2.78E-02
SR-85	Not Detected	-----	2.59E-02
TA-182	Not Detected	-----	1.32E-01
TA-183	Not Detected	-----	1.20E-01
TC-99m	Not Detected	-----	3.71E+00
TL-201	Not Detected	-----	9.52E-02
XE-133	Not Detected	-----	1.09E-01
Y-88	Not Detected	-----	2.34E-02
ZN-65	Not Detected	-----	8.94E-02
ZR-95	Not Detected	-----	3.97E-02

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-10-97 2:49:48 PM \*  
 \*\*\*\*\*

\* Analyzed by: *J* 9/15/97 Reviewed by: *WJ 9/16/97*  
 \*\*\*\*\*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034174-003  
 Lab Sample ID : 70157633

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 1013.000 gram  
 Sample Date/Time : 9-08-97 4:03:00 PM  
 Acquire Start Date/Time : 9-10-97 1:06:33 PM  
 Detector Name : LAB03  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	5.78E-01
TH-234	9.53E-01	2.86E-01	2.91E-01
RA-226	1.58E+00	4.24E-01	3.42E-01
PB-214	7.08E-01	1.28E-01	3.25E-02
BI-214	6.71E-01	1.33E-01	3.23E-02
TH-232	1.65E-01	9.81E-02	8.50E-02
A-228	2.16E-01	1.07E-01	1.01E-01
AC-228	Not Detected	-----	1.18E-01
TH-228	1.39E-01	2.03E-01	2.05E-01
RA-224	2.24E-01	1.54E-01	6.08E-02
PB-212	2.15E-01	4.94E-02	2.71E-02
BI-212	Not Detected	-----	2.25E-01
TL-208	1.97E-01	6.03E-02	4.95E-02
<del>U-235</del>	<del>5.82E-02</del>	<del>9.49E-02</del>	<del>1.33E-01</del>
TH-231	Not Detected	-----	5.13E+00
PA-231	Not Detected	-----	9.10E-01
TH-227	Not Detected	-----	1.96E-01
RA-223	Not Detected	-----	8.89E-02
RN-219	Not Detected	-----	2.67E-01
PB-211	Not Detected	-----	5.79E-01
TL-207	Not Detected	-----	9.53E+00
AM-241	Not Detected	-----	1.00E-01
PU-239	Not Detected	-----	2.25E+02
NP-237	Not Detected	-----	1.44E-01
PA-233	Not Detected	-----	3.91E-02
TH-229	Not Detected	-----	1.32E-01

*not detected J 9/15/97*

[Summary Report] - Sample ID: : 70157633

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	2.58E-02
AG-110m	Not Detected	-----	2.76E-02
BA-133	Not Detected	-----	3.90E-02
BE-7	Not Detected	-----	1.79E-01
CD-109	Not Detected	-----	5.71E-01
CD-115	Not Detected	-----	6.99E-02
CE-139	Not Detected	-----	1.82E-02
CE-141	Not Detected	-----	3.01E-02
CE-144	Not Detected	-----	1.26E-01
CO-56	Not Detected	-----	2.27E-02
GO-57	Not Detected	-----	1.59E-02
CO-58	Not Detected	-----	2.38E-02
CO-60	Not Detected	-----	2.39E-02
CR-51	Not Detected	-----	1.67E-01
CS-134	Not Detected	-----	4.13E-02
CS-137	4.70E-02	1.92E-02	1.61E-02
EU-152	Not Detected	-----	4.76E-02
EU-154	Not Detected	-----	1.20E-01
EU-155	Not Detected	-----	7.20E-02
FE-59	Not Detected	-----	4.95E-02
GD-153	Not Detected	-----	5.26E-02
HG-203	Not Detected	-----	2.00E-02
I-131	Not Detected	-----	2.41E-02
IR-192	Not Detected	-----	1.85E-02
K-40	4.43E+00	9.16E-01	2.20E-01
MN-52	Not Detected	-----	2.78E-02
N-54	Not Detected	-----	2.35E-02
O-99	Not Detected	-----	2.61E-01
NA-22	Not Detected	-----	2.73E-02
NA-24	Not Detected	-----	1.88E-01
NB-95	Not Detected	-----	1.28E-01
ND-147	Not Detected	-----	1.56E-01
NI-57	Not Detected	-----	9.02E-02
PB-210	Not Detected	-----	3.04E+00
RU-103	Not Detected	-----	1.96E-02
RU-106	Not Detected	-----	2.03E-01
SB-122	Not Detected	-----	4.14E-02
SB-124	Not Detected	-----	2.07E-02
SB-125	Not Detected	-----	5.68E-02
SN-113	Not Detected	-----	2.56E-02
SR-85	Not Detected	-----	2.54E-02
TA-182	Not Detected	-----	1.25E-01
TA-183	Not Detected	-----	1.09E-01
TC-99m	Not Detected	-----	2.79E+00
TL-201	Not Detected	-----	8.63E-02
XE-133	Not Detected	-----	1.01E-01
Y-88	Not Detected	-----	2.03E-02
ZN-65	Not Detected	-----	8.36E-02
ZR-95	Not Detected	-----	3.99E-02

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 Sandia National Laboratories \*  
 Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 9-10-97 12:53:18 PM \*  
 \*\*\*\*\*

Analyzed by: *J 9/15/97* Reviewed by: *J 9/16/97* \*  
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Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : 034149-003  
 Lab Sample ID : 70157634

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 878.000 gram  
 Sample Date/Time : 9-08-97 4:20:00 PM  
 Acquire Start Date/Time : 9-10-97 11:09:50 AM  
 Detector Name : LAB03  
 Elapsed Live/Real Time : 6000 / 6003 seconds

Comments:

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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	6.36E-01	5.64E-01	8.48E-01
TH-234	1.09E+00	4.51E-01	3.52E-01
RA-226	1.53E+00	7.54E-01	4.73E-01
PB-214	7.23E-01	1.51E-01	4.07E-02
BI-214	6.20E-01	1.21E-01	4.37E-02
U-232	5.62E-01	2.94E-01	1.49E-01
U-228	5.81E-01	2.16E-01	1.46E-01
AC-228	5.90E-01	1.66E-01	8.42E-02
TH-228	7.02E-01	3.25E-01	3.73E-01
RA-224	6.89E-01	2.74E-01	6.30E-02
PB-212	6.16E-01	9.27E-02	3.40E-02
BI-212	6.45E-01	1.22E+00	2.91E-01
TL-208	5.28E-01	6.70E-01	6.33E-02
U-235	Not Detected	-----	1.65E-01
TH-231	<del>1.45E+00</del>	<del>2.23E+00</del>	6.63E+00
PA-231	Not Detected	-----	1.13E+00
TH-227	Not Detected	-----	3.07E-01
RA-223	Not Detected	-----	1.16E-01
RN-219	Not Detected	-----	3.30E-01
PB-211	Not Detected	-----	7.78E-01
TL-207	Not Detected	-----	1.29E+01
AM-241	Not Detected	-----	1.30E-01
PU-239	Not Detected	-----	2.96E+02
NP-237	<del>4.14E-01</del>	<del>1.14E-01</del>	1.68E-01
PA-233	Not Detected	-----	4.88E-02
TH-229	Not Detected	-----	1.61E-01

*not detected J 9/15/97*

*not detected J 9/15/97*

[Summary Report] - Sample ID: : 70157634

Slide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	3.81E-02
AG-110m	Not Detected	-----	2.75E-02
BA-133	Not Detected	-----	4.38E-02
BE-7	Not Detected	-----	2.23E-01
CD-109	Not Detected	-----	7.35E-01
CD-115	Not Detected	-----	9.76E-02
CE-139	Not Detected	-----	2.19E-02
CE-141	Not Detected	-----	3.73E-02
CE-144	Not Detected	-----	1.62E-01
CO-56	Not Detected	-----	2.94E-02
CO-57	Not Detected	-----	2.01E-02
CO-58	Not Detected	-----	3.06E-02
CO-60	Not Detected	-----	3.36E-02
CR-51	Not Detected	-----	2.17E-01
CS-134	Not Detected	-----	4.51E-02
CS-137	Not Detected	-----	2.92E-02
EU-152	Not Detected	-----	6.01E-02
EU-154	Not Detected	-----	1.75E-01
EU-155	Not Detected	-----	9.26E-02
FE-59	Not Detected	-----	6.66E-02
GD-153	Not Detected	-----	6.59E-02
HG-203	Not Detected	-----	2.53E-02
I-131	Not Detected	-----	2.91E-02
IR-192	Not Detected	-----	2.41E-02
K-40	1.14E+01	1.85E+00	2.69E-01
LN-52	Not Detected	-----	3.69E-02
LI-54	Not Detected	-----	2.99E-02
MO-99	Not Detected	-----	3.65E-01
NA-22	Not Detected	-----	4.04E-02
NA-24	Not Detected	-----	2.20E-01
NB-95	<del>2.80E-02</del>	<del>1.56E-02</del>	7.84E-02
ND-147	Not Detected	-----	1.96E-01
NI-57	Not Detected	-----	1.04E-01
PB-210	Not Detected	-----	3.76E+00
RU-103	Not Detected	-----	2.58E-02
RU-106	Not Detected	-----	2.72E-01
SB-122	Not Detected	-----	5.25E-02
SB-124	Not Detected	-----	2.72E-02
SB-125	Not Detected	-----	6.98E-02
SN-113	Not Detected	-----	3.30E-02
SR-85	Not Detected	-----	3.34E-02
TA-182	Not Detected	-----	1.53E-01
TA-183	Not Detected	-----	1.40E-01
TC-99m	Not Detected	-----	2.80E+00
TL-201	Not Detected	-----	1.13E-01
XE-133	Not Detected	-----	1.25E-01
Y-88	Not Detected	-----	2.66E-02
ZN-65	Not Detected	-----	1.05E-01
ZR-95	Not Detected	-----	5.23E-02

not detected 7/15/97

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 Sandia National Laboratories \*  
 Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 9-11-97 7:41:08 PM \*  
 \*\*\*\*\*

Analyzed by: *J 9/15/97* Reviewed by: *WJ 9/16/97* \*

\*\*\*\*\*  
 Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : LAB CONTROL SAMPLE USING CG134  
 Lab Sample ID : 70157635  
 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 : 9-11-97 7:28:50 PM  
 Detector Name : LAB03  
 Elapsed Live/Real Time : 600 / 607 seconds

Comments:  
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Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
U-238	Not Detected	-----	7.02E+03
TH-234	Not Detected	-----	2.90E+03
RA-226	Not Detected	-----	6.20E+03
PB-214	Not Detected	-----	8.06E+02
BI-214	Not Detected	-----	7.57E+02
TH-232	Not Detected	-----	2.36E+03
Pa-228	Not Detected	-----	3.27E+03
AC-228	Not Detected	-----	1.84E+03
TH-228	Not Detected	-----	8.94E+04
RA-224	Not Detected	-----	3.64E+03
PB-212	Not Detected	-----	6.07E+03
BI-212	Not Detected	-----	6.36E+04
TL-208	Not Detected	-----	1.24E+04
U-235	Not Detected	-----	1.44E+03
TH-231	Not Detected	-----	4.40E+04
PA-231	Not Detected	-----	1.51E+04
TH-227	Not Detected	-----	2.43E+03
RA-223	Not Detected	-----	1.00E+26
RN-219	Not Detected	-----	6.38E+03
PB-211	Not Detected	-----	1.44E+04
TL-207	Not Detected	-----	2.62E+05
AM-241	8.82E+04	1.48E+04	1.23E+03
PU-239	Not Detected	-----	2.44E+06
NP-237	Not Detected	-----	1.51E+03
PA-233	Not Detected	-----	6.78E+02
TH-229	Not Detected	-----	1.30E+03



[Summary Report] - Sample ID: : 70157635

Isotope Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
AG-108m	Not Detected	-----	3.98E+02
AG-110m	Not Detected	-----	2.04E+06
BA-133	Not Detected	-----	7.87E+02
BE-7	Not Detected	-----	5.68E+17
CD-109	3.80E+05	1.62E+05	1.64E+05
CD-115	Not Detected	-----	1.00E+26
CE-139	Not Detected	-----	6.39E+07
CE-141	Not Detected	-----	1.00E+26
CE-144	Not Detected	-----	6.26E+05
CO-56	Not Detected	-----	2.77E+12
CO-57	Not Detected	-----	1.06E+05
CO-58	Not Detected	-----	1.79E+13
CO-60	8.10E+04	1.14E+04	4.78E+02
CR-51	Not Detected	-----	1.00E+26
CS-134	Not Detected	-----	3.35E+03
CS-137	7.14E+04	9.55E+03	3.37E+02
EU-152	Not Detected	-----	7.57E+02
EU-154	Not Detected	-----	3.08E+03
EU-155	Not Detected	-----	2.11E+03
FE-59	Not Detected	-----	8.81E+19
GD-153	Not Detected	-----	6.88E+05
HG-203	Not Detected	-----	4.72E+18
I-131	Not Detected	-----	1.00E+26
IR-192	Not Detected	-----	5.30E+12
K-40	Not Detected	-----	1.86E+03
LN-52	Not Detected	-----	1.00E+26
LN-54	Not Detected	-----	1.17E+05
MO-99	Not Detected	-----	1.00E+26
NA-22	Not Detected	-----	1.54E+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
PB-210	Not Detected	-----	4.53E+04
RU-103	Not Detected	-----	6.67E+21
RU-106	Not Detected	-----	3.98E+05
SB-122	Not Detected	-----	1.00E+26
SB-124	Not Detected	-----	1.10E+15
SB-125	Not Detected	-----	7.10E+03
SN-113	Not Detected	-----	1.76E+09
SR-85	Not Detected	-----	1.74E+14
TA-182	Not Detected	-----	5.34E+09
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	-----	2.32E+09
ZN-65	Not Detected	-----	1.34E+06
ZR-95	Not Detected	-----	4.08E+14

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

Report Date : 9-11-97 7:41:48 PM  
 QA File : C:\GENIEPC\CAMFILES\LCS3.QAF  
 Analyst : FCD  
 Sample ID : 70157635  
 Sample Quantity : 1.00 Each  
 Sample Date : 11-01-90 12:00:00 PM  
 Measurement Date : 9-11-97 7:28:50 PM  
 Elapsed Live Time : 600 seconds  
 Elapsed Real Time : 607 seconds

Parameter	Mean	1S Error	New Value	< LU	: SD	: UD	: BS >
AM-241 Activity	8.705E-02	2.117E-03	8.824E-02	<	:	:	>
CS-137 Activity	6.802E-02	1.705E-03	7.138E-02	<	:In	:	>
CO-60 Activity	7.788E-02	2.708E-03	8.065E-02	<	In	:	>

*OK*  
*9/15/97*

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: *J 9/15/97*



\*\*\*\*\*  
 Sandia National Laboratories \*  
 Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 9-12-97 7:18:35 AM \*  
 \*\*\*\*\*

Analyzed by: *J* 9/15/97 Reviewed by: *W* 9/16/97 \*  
 \*\*\*\*\*

Customer : M. MITCHELL/MAC (6685/SMO)  
 Customer Sample ID : LAB CONTROL SAMPLE USING CG134  
 Lab Sample ID : 70157636

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 : 9-12-97 7:06:31 AM  
 Detector Name : LAB02  
 Elapsed Live/Real Time : 600 / 605 seconds

Comments:  
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Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
U-238	Not Detected	-----	2.11E+04
TH-234	Not Detected	-----	4.76E+03
RA-226	Not Detected	-----	6.43E+03
PB-214	Not Detected	-----	7.21E+02
BI-214	Not Detected	-----	6.55E+02
Y-232	Not Detected	-----	2.31E+03
A-228	Not Detected	-----	2.69E+03
AC-228	Not Detected	-----	1.60E+03
TH-228	Not Detected	-----	8.42E+04
RA-224	Not Detected	-----	2.48E+03
PB-212	Not Detected	-----	6.33E+03
BI-212	Not Detected	-----	5.27E+04
TL-208	Not Detected	-----	1.15E+04
U-235	Not Detected	-----	1.81E+03
TH-231	Not Detected	-----	8.43E+04
PA-231	Not Detected	-----	1.50E+04
TH-227	Not Detected	-----	2.52E+03
RA-223	Not Detected	-----	1.00E+26
RN-219	Not Detected	-----	5.77E+03
PB-211	Not Detected	-----	1.31E+04
TL-207	Not Detected	-----	2.23E+05
AM-241	7.80E+04	1.39E+04	3.17E+03
PU-239	Not Detected	-----	3.33E+06
NP-237	Not Detected	-----	2.49E+03
PA-233	Not Detected	-----	6.34E+02
TH-229	Not Detected	-----	1.79E+03

[Summary Report] - Sample ID: : 70157636

Isotope Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
AG-108m	Not Detected	-----	3.36E+02
AG-110m	Not Detected	-----	1.75E+06
BA-133	Not Detected	-----	7.02E+02
BE-7	Not Detected	-----	5.11E+17
CD-109	3.59E+05	3.32E+05	2.90E+05
CD-115	Not Detected	-----	1.00E+26
CE-139	Not Detected	-----	7.15E+07
CE-141	Not Detected	-----	1.00E+26
CE-144	Not Detected	-----	8.23E+05
CO-56	Not Detected	-----	2.31E+12
CO-57	Not Detected	-----	1.38E+05
CO-58	Not Detected	-----	1.60E+13
CO-60	8.02E+04	1.09E+04	4.03E+02
CR-51	Not Detected	-----	1.00E+26
CS-134	Not Detected	-----	2.95E+03
CS-137	7.10E+04	9.45E+03	2.54E+02
EU-152	Not Detected	-----	9.90E+02
EU-154	Not Detected	-----	2.60E+03
EU-155	Not Detected	-----	3.01E+03
FE-59	Not Detected	-----	7.68E+19
GD-153	Not Detected	-----	9.91E+05
HG-203	Not Detected	-----	4.78E+18
I-131	Not Detected	-----	1.00E+26
IR-192	Not Detected	-----	4.93E+12
K-40	Not Detected	-----	1.70E+03
La-52	Not Detected	-----	1.00E+26
La-54	Not Detected	-----	1.01E+05
MO-99	Not Detected	-----	1.00E+26
NA-22	Not Detected	-----	1.35E+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
PB-210	Not Detected	-----	2.69E+05
RU-103	Not Detected	-----	6.23E+21
RU-106	Not Detected	-----	3.40E+05
SB-122	Not Detected	-----	1.00E+26
SB-124	Not Detected	-----	1.01E+15
SB-125	Not Detected	-----	6.31E+03
SN-113	Not Detected	-----	1.63E+09
SR-85	Not Detected	-----	1.65E+14
TA-182	Not Detected	-----	4.43E+09
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	-----	1.90E+09
ZN-65	Not Detected	-----	1.12E+06
ZR-95	Not Detected	-----	3.57E+14

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

Report Date : 9-12-97 7:19:12 AM  
 QA File : C:\GENIEPC\CAMFILES\LCS2.QAF  
 Analyst : GLS  
 Sample ID : 70157636  
 Sample Quantity : 1.00 Each  
 Sample Date : 11-01-90 12:00:00 PM  
 Measurement Date : 9-12-97 7:06:31 AM  
 Elapsed Live Time : 600 seconds  
 Elapsed Real Time : 605 seconds

Parameter	Mean	1S Error	New Value	< LU	: SD	: UD	: BS	>
AM-241 Activity	8.503E-02	3.997E-03	7.803E-02	<	:In	:In	:	>
CS-137 Activity	6.978E-02	1.925E-03	7.098E-02	<	:	:	:	>
CO-60 Activity	7.744E-02	2.055E-03	8.024E-02	<	:In	:	:	>

*OK 9/15/97*

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: *J 9/15/97*



# ANALYSIS REQUEST AND CHAIN OF CUSTODY

Internal Lab

Batch No. 11/11/97 ER SITE 12B VCM (GEOPROBE)

AR/COC- 06953

Dept. No./Mail Stop: 66085 / ms 1148  
 Project/Task Manager: Mike Mitchell  
 Project Name: ER12B VCM  
 Record Center Code: ER/1333/12B/DAT  
 Logbook Ref No: ER-013  
 Service Order No.: CF-0408

Date Samples Shipped: 9/11/97  
 Carrier/Waybill No.: HC  
 Lab Contact: Fernando Dominguez  
 Lab Destination: RPSD Bldg 801  
 SMO Contact/Phone: Pam Pissicat / 844-3185  
 Send Report to SMO Pam Pissicat

Contract No.: NA  
 Case No.: 18712073  
 SMO Authorization: [Signature]  
 Bill to: Sandia National Laboratories  
 Supplier Services Department  
 P.O. Box 5800 MS 0154  
 Albuquerque, NM 87185-0154

### Parameter & Method Requested

Location		Tech Area		Beginning Depth in Ft.	ER Site No.	Date/Time Collected	Reference LOV (available at SMO)					Sample Matrix	Type	Volume	Preservative	Sample Collection Method	Sample Type	GAMMA SPEC.	Lab Sample ID
Building		Room					Type	Volume	Preservative	Sample Collection Method	Sample Type								
Sample No. - Fraction		ER Sample ID or Sample Location Detail																	
✓	034217-003	CY12B-GR-05-01-5		2'-0"	12B	9-10-97 1530	Soil	P	500ml	-	C	SA	✗						
✓	034218-003	CY12B-EB-03		-	12B	9-10-97 1545	DIW	P	500ml	-	G	EB	✗						

RMMA  Yes  No Ref. No. \_\_\_\_\_

Sample Tracking Date Entered (m/d/yyyy) 9/15/97

Special Instructions/QC Requirements

Abnormal Conditions on Receipt

Sample Disposal  Return to Client  Disposal by lab

Entered by: [Signature]

• Please send test results to Mike Mitchell

• This AR-COC # 06953 will release AR-COC # 06954 to OFF SITE LAs L43.

Turnaround Time  Normal  Rush Required Report Date \_\_\_\_\_

QC Initia. LANC

• 034217-003 is a composite of Geoprobe holes 01, 02, 03, 04, 05

Sample Team Members	Name	Signature	Init	Company/Organization/Phone
	<u>Conchetta Carristo</u>	<u>[Signature]</u>	<u>CC</u>	<u>MDM / 6621 / 221-5778</u>
	<u>GILBERT QUINTANA</u>	<u>[Signature]</u>	<u>17</u>	<u>6621 / 221-9410</u>

1. Relinquished by <u>[Signature]</u>	Org. <u>6621</u>	Date <u>9-11-97</u>	Time <u>1500</u>
1. Received by <u>[Signature]</u>	Org. <u>5107578</u>	Date <u>9/11/97</u>	Time <u>1500</u>
2. Relinquished by <u>[Signature]</u>	Org. <u>5107578</u>	Date <u>9/11/97</u>	Time <u>1515</u>
2. Received by <u>[Signature]</u>	Org. <u>7211</u>	Date <u>9/11/97</u>	Time <u>1512</u>
3. Relinquished by <u>[Signature]</u>	Org. <u>5107578</u>	Date <u>9/12/97</u>	Time <u>1500</u>
3. Received by <u>[Signature]</u>	Org. <u>5107578</u>	Date <u>9/12/97</u>	Time <u>0838</u>

4. Relinquished by _____	Org. _____	Date _____	Time _____
4. Received by _____	Org. _____	Date _____	Time _____
5. Relinquished by _____	Org. _____	Date _____	Time _____
5. Received by _____	Org. _____	Date _____	Time _____
6. Relinquished by _____	Org. _____	Date _____	Time _____
6. Received by _____	Org. _____	Date _____	Time _____





\*\*\*\*\*  
 Sandia National Laboratories \*  
 Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 9-11-97 7:13:19 PM \*  
 \*\*\*\*\*

Analyzed by: *[Signature]* 9/11/97 Reviewed by: *[Signature]* 9/12/97 \*  
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Customer : M. MITCHELL/McLAUGHLIN (6685/SMO)  
 Customer Sample ID : 034217-003  
 Lab Sample ID : 70159801

Sample Description : MARINELLI SOLID SAMPLE  
 Sample Quantity : 837.000 gram  
 Sample Date/Time : 9-10-97 3:30:00 PM  
 Acquire Start Date/Time : 9-11-97 5:25:13 PM  
 Detector Name : LAB01  
 Elapsed Live/Real Time : 6000 / 6002 seconds

Comments:  
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Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	-----	1.36E+00
TH-234	1.08E+00	3.95E-01	4.28E-01
RA-226	Not Detected	-----	4.87E-01
PB-214	7.59E-01	3.60E-01	4.65E-02
BI-214	6.95E-01	1.34E-01	4.49E-02
TH-232	6.21E-01	3.21E-01	1.37E-01
PA-228	6.10E-01	2.14E-01	1.54E-01
-228	5.92E-01	1.77E-01	1.01E-01
TH-228	6.01E-02	4.13E-02	4.34E-01
RA-224	5.66E-01	2.49E-01	8.50E-02
PB-212	5.72E-01	1.05E-01	3.35E-02
BI-212	8.01E-01	4.80E-01	3.04E-01
TL-208	5.46E-01	2.45E-01	6.35E-02
U-235	9.22E-02	1.34E-01	1.89E-01
TH-231	Not Detected	-----	7.99E+00
PA-231	Not Detected	-----	1.26E+00
TH-227	Not Detected	-----	3.14E-01
RA-223	Not Detected	-----	1.33E-01
RN-219	Not Detected	-----	3.66E-01
PB-211	Not Detected	-----	8.32E-01
TL-207	Not Detected	-----	1.28E+01
AM-241	Not Detected	-----	1.61E-01
PU-239	Not Detected	-----	3.10E+02
NP-237	Not Detected	-----	1.85E-01
PA-233	Not Detected	-----	5.18E-02
TH-229	Not Detected	-----	1.78E-01

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	-----	4.00E-02
AG-110m	Not Detected	-----	2.98E-02
BA-133	Not Detected	-----	5.24E-02
BE-7	Not Detected	-----	2.37E-01
BI-207	Not Detected	-----	2.82E-02
CD-109	<del>1.51E+00</del>	<del>5.09E-01</del>	<del>6.27E-01</del>
CD-115	Not Detected	-----	8.25E-02
CE-139	Not Detected	-----	2.40E-02
CE-141	Not Detected	-----	4.12E-02
CE-144	Not Detected	-----	1.71E-01
CO-56	Not Detected	-----	2.43E-02
CO-57	Not Detected	-----	2.23E-02
CO-58	Not Detected	-----	3.19E-02
CO-60	Not Detected	-----	3.36E-02
CR-51	Not Detected	-----	2.07E-01
CS-134	Not Detected	-----	4.22E-02
CS-137	Not Detected	-----	3.52E-02
EU-152	Not Detected	-----	6.72E-02
EU-154	Not Detected	-----	1.86E-01
EU-155	Not Detected	-----	9.94E-02
FE-59	Not Detected	-----	7.03E-02
GD-153	Not Detected	-----	7.10E-02
HG-203	Not Detected	-----	2.85E-02
I-131	Not Detected	-----	2.94E-02
IR-192	Not Detected	-----	2.31E-02
K-40	9.67E+00	1.61E+00	2.32E-01
MN-52	Not Detected	-----	3.32E-02
I-54	Not Detected	-----	2.01E-02
MO-99	Not Detected	-----	2.92E-01
NA-22	Not Detected	-----	4.09E-02
NA-24	Not Detected	-----	1.09E-01
NB-95	Not Detected	-----	1.64E-01
ND-147	Not Detected	-----	2.04E-01
NI-57	Not Detected	-----	8.28E-02
PB-210	Not Detected	-----	6.75E+00
RU-103	Not Detected	-----	2.68E-02
RU-106	Not Detected	-----	2.55E-01
SB-122	Not Detected	-----	4.86E-02
SB-124	Not Detected	-----	2.76E-02
SB-125	Not Detected	-----	8.21E-02
SN-113	Not Detected	-----	3.49E-02
SR-85	Not Detected	-----	3.70E-02
TA-182	Not Detected	-----	1.54E-01
TA-183	Not Detected	-----	1.58E-01
TC-99m	Not Detected	-----	4.32E-01
TL-201	Not Detected	-----	1.22E-01
XE-133	Not Detected	-----	1.21E-01
Y-88	Not Detected	-----	2.64E-02
ZN-65	Not Detected	-----	1.02E-01
ZR-95	Not Detected	-----	5.15E-02

*not detected 7/9/11/97*

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 \* Sandia National Laboratories \*  
 \* Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 \* 9-11-97 7:27:15 PM \*  
 \*\*\*\*\*

\* Analyzed by: *J 9/11/97* Reviewed by: *AS 9/12/97* \*  
 \*\*\*\*\*

Customer : M.MITCHELL/McLAUGHLIN (6685/SMO)  
 Customer Sample ID : 034218-003  
 Lab Sample ID : 70159802

Sample Description : WATER IN A MARINELLI  
 Sample Quantity : 500.000 mL  
 Sample Date/Time : 9-10-97 3:45:00 PM  
 Acquire Start Date/Time : 9-11-97 3:22:56 PM  
 Detector Name : LAB01  
 Elapsed Live/Real Time : 6000 / 6001 seconds

Comments:

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Nuclide Name	Activity (pCi/mL)	2-sigma Error	MDA (pCi/mL)
U-238	Not Detected	-----	7.70E-01
TH-234	Not Detected	-----	2.58E-01
RA-226	1.16E-01	2.16E-01	3.56E-01
PB-214	Not Detected	-----	5.26E-02
BI-214	Not Detected	-----	6.01E-02
TH-232	Not Detected	-----	1.47E-01
PA-228	Not Detected	-----	1.68E-01
-228	Not Detected	-----	1.04E-01
TH-228	Not Detected	-----	5.00E-01
RA-224	Not Detected	-----	1.71E-01
PB-212	1.41E-02	2.09E-02	3.40E-02
BI-212	Not Detected	-----	4.21E-01
TL-208	Not Detected	-----	8.60E-02
U-235	Not Detected	-----	1.42E-01
TH-231	Not Detected	-----	4.89E+00
PA-231	Not Detected	-----	1.13E+00
TH-227	Not Detected	-----	1.53E-01
RA-223	Not Detected	-----	7.77E-02
RN-219	Not Detected	-----	2.87E-01
PB-211	Not Detected	-----	6.41E-01
TL-207	Not Detected	-----	1.06E+01
AM-241	Not Detected	-----	9.41E-02
PU-239	Not Detected	-----	2.08E+02
NP-237	Not Detected	-----	1.37E-01
PA-233	Not Detected	-----	4.51E-02
TH-229	Not Detected	-----	1.20E-01

[Summary Report] - Sample ID: : 70159802

Nuclide Name	Activity (pCi/mL )	2-sigma Error	MDA (pCi/mL )
AG-108m	Not Detected	-----	3.04E-02
AG-110m	Not Detected	-----	2.63E-02
BA-133	Not Detected	-----	3.34E-02
BE-7	Not Detected	-----	2.05E-01
BI-207	Not Detected	-----	2.17E-02
CD-109	Not Detected	-----	4.61E-01
CD-115	Not Detected	-----	4.92E-02
CE-139	Not Detected	-----	1.82E-02
CE-141	Not Detected	-----	3.10E-02
CE-144	Not Detected	-----	1.28E-01
CO-56	Not Detected	-----	3.58E-02
CO-57	Not Detected	-----	1.67E-02
CO-58	Not Detected	-----	2.47E-02
CO-60	Not Detected	-----	2.93E-02
CR-51	Not Detected	-----	1.81E-01
CS-134	Not Detected	-----	2.72E-02
CS-137	Not Detected	-----	2.98E-02
EU-152	Not Detected	-----	4.96E-02
EU-154	Not Detected	-----	1.43E-01
EU-155	Not Detected	-----	6.85E-02
FE-59	Not Detected	-----	4.72E-02
GD-153	Not Detected	-----	4.64E-02
HG-203	Not Detected	-----	2.23E-02
I-131	Not Detected	-----	2.49E-02
IR-192	Not Detected	-----	2.03E-02
K-40	Not Detected	-----	3.07E-01
N-52	Not Detected	-----	2.83E-02
N-54	Not Detected	-----	2.62E-02
MO-99	Not Detected	-----	2.72E-01
NA-22	Not Detected	-----	3.35E-02
NA-24	Not Detected	-----	7.85E-02
NB-95	Not Detected	-----	8.38E-02
ND-147	Not Detected	-----	1.77E-01
NI-57	Not Detected	-----	6.42E-02
PB-210	Not Detected	-----	3.66E+00
RU-103	Not Detected	-----	2.56E-02
RU-106	Not Detected	-----	2.34E-01
SB-122	Not Detected	-----	4.11E-02
SB-124	Not Detected	-----	2.73E-02
SB-125	Not Detected	-----	7.06E-02
SN-113	Not Detected	-----	2.99E-02
SR-85	Not Detected	-----	3.21E-02
TA-182	Not Detected	-----	8.60E-02
TA-183	Not Detected	-----	9.13E-02
TC-99m	Not Detected	-----	2.64E-01
TL-201	Not Detected	-----	7.19E-02
XE-133	Not Detected	-----	7.29E-02
Y-88	Not Detected	-----	3.22E-02
ZN-65	Not Detected	-----	5.26E-02
ZR-95	Not Detected	-----	4.51E-02

\*\*\*\*\*  
 Sandia National Laboratories \*  
 Radiation Protection Sample Diagnostics Program [881 Laboratory] \*  
 9-11-97 7:25:05 PM \*  
 \*\*\*\*\*

Analyzed by: *[Signature]* 9/16/97 Reviewed by: *[Signature]* 9/12/97 \*  
 \*\*\*\*\*

Customer : M.MITCHELL/McLAUGHLIN (6685/SMO)  
 Customer Sample ID : LAB CONTROL SAMPLE USING CG134  
 Lab Sample ID : 70159803

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 : 9-11-97 7:11:38 PM  
 Detector Name : LAB01  
 Elapsed Live/Real Time : 600 / 605 seconds

Comments:  
 \*\*\*\*\*

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
U-238	Not Detected	-----	8.73E+03
TH-234	Not Detected	-----	3.45E+03
RA-226	Not Detected	-----	5.95E+03
PB-214	Not Detected	-----	7.82E+02
BI-214	Not Detected	-----	7.32E+02
TH-232	Not Detected	-----	2.35E+03
PA-228	Not Detected	-----	3.32E+03
U-228	Not Detected	-----	1.96E+03
TH-228	Not Detected	-----	8.50E+04
RA-224	Not Detected	-----	3.43E+03
PB-212	Not Detected	-----	6.39E+03
BI-212	Not Detected	-----	6.84E+04
TL-208	Not Detected	-----	1.30E+04
U-235	Not Detected	-----	1.58E+03
TH-231	Not Detected	-----	5.43E+04
PA-231	Not Detected	-----	1.51E+04
TH-227	Not Detected	-----	2.58E+03
RA-223	Not Detected	-----	1.00E+26
RN-219	Not Detected	-----	6.77E+03
PB-211	Not Detected	-----	1.53E+04
TL-207	Not Detected	-----	2.70E+05
AM-241	8.60E+04	1.46E+04	1.46E+03
PU-239	Not Detected	-----	2.55E+06
NP-237	Not Detected	-----	1.76E+03
PA-233	Not Detected	-----	6.69E+02
TH-229	Not Detected	-----	1.39E+03

[Summary Report] - Sample ID: : 70159803

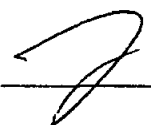
Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
AG-108m	Not Detected		4.22E+02
AG-110m	Not Detected		1.95E+06
BA-133	Not Detected		7.56E+02
BE-7	Not Detected		5.59E+17
BI-207	Not Detected		3.88E+02
CD-109	3.91E+05	2.19E+05	2.16E+05
CD-115	Not Detected		1.00E+26
CE-139	Not Detected		6.35E+07
CE-141	Not Detected		1.00E+26
CE-144	Not Detected		6.54E+05
CO-56	Not Detected		2.83E+12
CO-57	Not Detected		1.07E+05
CO-58	Not Detected		1.83E+13
CO-60	7.78E+04	1.09E+04	4.78E+02
CR-51	Not Detected		1.00E+26
CS-134	Not Detected		3.48E+03
CS-137	6.95E+04	9.33E+03	3.25E+02
EU-152	Not Detected		7.78E+02
EU-154	Not Detected		3.25E+03
EU-155	Not Detected		2.12E+03
FE-59	Not Detected		9.50E+19
GD-153	Not Detected		7.66E+05
HG-203	Not Detected		4.89E+18
I-131	Not Detected		1.00E+26
IR-192	Not Detected		5.11E+12
K-40	Not Detected		1.65E+03
LN-52	Not Detected		1.00E+26
L-54	Not Detected		1.17E+05
MO-99	Not Detected		1.00E+26
NA-22	Not Detected		1.53E+03
NA-24	Not Detected		1.00E+26
NB-95	Not Detected		1.00E+26
ND-147	Not Detected		1.00E+26
NI-57	Not Detected		1.00E+26
PB-210	Not Detected		6.97E+04
RU-103	Not Detected		6.86E+21
RU-106	Not Detected		3.68E+05
SB-122	Not Detected		1.00E+26
SB-124	Not Detected		1.17E+15
SB-125	Not Detected		7.19E+03
SN-113	Not Detected		1.77E+09
SR-85	Not Detected		1.80E+14
TA-182	Not Detected		5.52E+09
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		2.33E+09
ZN-65	Not Detected		1.44E+06
ZR-95	Not Detected		4.22E+14

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

Report Date : 9-11-97 7:25:55 PM  
 QA File : C:\GENIEPC\CAMFILES\LCS1.QAF  
 Analyst : FCD  
 Sample ID : 70159803  
 Sample Quantity : 1.00 Each  
 Sample Date : 11-01-90 12:00:00 PM  
 Measurement Date : 9-11-97 7:11:38 PM  
 Elapsed Live Time : 600 seconds  
 Elapsed Real Time : 605 seconds

Parameter	Mean	1S Error	New Value	< LU	: SD	: UD	: BS	>
AM-241 Activity	8.736E-02	2.733E-03	8.598E-02	<	:	:	:	>
CS-137 Activity	6.888E-02	1.637E-03	6.953E-02	<	:	:	:	>
CO-60 Activity	7.595E-02	2.962E-03	7.823E-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:  9/11/97







**ANNEX 4-F**  
**Data Validation Summary Letter Reports**



**SAMPLE FINDINGS SUMMARY**

Site: ER Site 12-B

AR/COC: 600317

Data Classification:

Sample/ Fraction No.	Analysis	DV Qualifiers	Comments
SP04-04-S	75-09-2	U	Methylene Chloride 3.2 u
	75-35-4	UJ	1,1-DCE
	71-43-2	UJ	Benzene
	108-90-7	UJ	Chlorobenzene
	108-88-3	UJ	Toluene
	79-01-6	UJ	TCE
SP05-04-S	75-09-2	U	Methylene chloride 1.7u
	67-64-1	U	Acetone 2.9u
SP06-04-S	75-09-2	U	Methylene chloride 1.7u
SP08-04-S	75-09-2	U	Methylene chloride 2.3u
	67-64-1	U	Acetone 2.7u
SP09-04-S	75-09-2	U	Methylene chloride 1.5u
SP09-04-50	75-09-2	U	Methylene chloride 2.2u
CY12B-TB	75-09-2	U	Methylene chloride 1.5u
CY12B-EB	75-09-2	U	Methylene chloride 1.6u
SP11-04-S	75-09-2	U	Methylene chloride 1.4u

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

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

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

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

Test Methods - Anions\_CE, EPA6010, EPA6020, EPA7470/1, EPA8015B, EPA8081, EPA8260, EPA8260-M3, EPA8270, HACH\_ALK, HACH\_NO2, HACH\_NO3, MEKC\_HE, PCBRISC

Reviewed by: H. Sealey Date: 7-13-98





May 14, 1998

Project No. 301462.196.02.000

Sandia National Laboratories/New Mexico  
 Attn: Mr. Paul Freshour  
 Department 6133  
 P.O. Box 5800, M/S 1147  
 Albuquerque, New Mexico 87185-1147

Data Validation Results For Sample Locations at ER Site 12B. ARCOG 510308

Dear Mr. Freshour:

Data validation review of analysis results for soil sample locations at ER Site 12B (Burn Site), recorded on Analysis Request and Chain of Custody (ARCOG) 510308, was completed by IT Corporation (IT) on May 12, 1998. The samples of interest were collected on January 14, 1998. This letter and the attached forms transmit the results from that review. The samples included in this validation transmittal are identified as follows:

033260-001	CY12B-SP01-02-S	033260-002	CY12B-SP01-02-S
033261-001	CY12B-SP02-02-S	033261-002	CY12B-SP02-02-S
033262-001	CY12B-SP03-02-S	033262-002	CY12B-SP03-02-S
033263-001	CY12B-SP04-02-S	033263-002	CY12B-SP04-02-S
033264-001	CY12B-SP05-02-S	033264-002	CY12B-SP05-02-S
033265-001	CY12B-SP06-02-SD	033265-002	CY12B-SP06-02-SD
033266-001	CY12B-SP06-02-S	033266-002	CY12B-SP06-02-S
033267-001	CY12B-SP07-02-S	033267-002	CY12B-SP07-02-S
033269-001	CY12B-SP08-02-S	033269-002	CY12B-SP08-02-S
033270-001	CY12B-SP09-02-S	033270-002	CY12B-SP09-02-S
033271-001	CY12B-SP10-02-S	033271-002	CY12B-SP10-02-S
033272-001	CY12B-SP11-02-S	033272-002	CY12B-SP11-02-S
033273-001	CY12B-SP12-02-S	033273-002	CY12B-SP12-02-S
033275-001	CY12B-SP13-02-S	033275-002	CY12B-SP13-02-S
033276-001	CY12B-SP14-02-S	033276-002	CY12B-SP14-02-S
033277-001	CY12B-SP15-02-S	033277-002	CY12B-SP15-02-S
033278-003	CY12B-TB	033279-004	CY12B-EB
033280-005	CY12B-EB		

Volatile and semi-volatile organic compound analyses (VOC and SVOC) (EPA Methods 8260 and 8270) were requested on all samples from General Engineering Laboratories (GEL) in Charleston, South Carolina. Analytical results were reported by GEL in the document numbered 9801359.

Mr. Paul Freshour

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May 14, 1998

Data review and validation are documented on *Data Verification/Validation Level 3 - DV3*, following the Sandia procedures, *Verification and Validation of Chemical and Radiochemical Data, TOP 94-03, rev. 0*, July 1994.

Volatile Organic Compounds, Method 8260

Analysis results for samples 033266-001, 033267-001, 033269-001, 033270-001, 033271-001, 033272-001, 033273-001, 033275-001, 033276-001, and 033277-001 are rejected as unusable, qualified "R," because they were re-analyzed outside of holding time. The original analyses, which were performed within holding time, occurred following contamination of the instrument and were rejected by the laboratory because a blank sample failed quality control (QC) criteria.

Methylene chloride concentrations reported in samples 033260-001, 033261-001, 033262-001, and 033264-001 are qualified "U" undetected because of blank contamination. Similarly, concentrations of 1,1,1-trichloroethane, 1,1-dichloroethane, carbon tetrachloride, and methylene chloride reported in sample 033265-001 are qualified "U" undetected due to blank contamination.

Semi-Volatile Organic Compounds, Method 8270

The qualifier "P" is assigned to 4-Nitrophenol and pentachlorophenol in samples 033260-002, 033261-002, and 033262-002 because precision measurements of relative percent difference from the laboratory control sample duplicate exceeded laboratory-established control limits. Accuracy, measured as percent recovery, was acceptable in both laboratory control samples.

Thank you for the opportunity to be of service in this matter. Please contact me by telephone at 262-8920 with any questions.

Respectfully submitted,

IT CORPORATION



Mark Lyon  
Project Chemist

ML: ml  
Attachments

cc: P. Puissant, SNL 7578  
H. Fleck, IT Corp.  
Project File





May 13, 1998

Project No. 301462.196.02.000

Sandia National Laboratories/New Mexico  
 Attn: Mr. Paul Freshour  
 Department 6133  
 P.O. Box 5800, M/S 1147  
 Albuquerque, New Mexico 87185-1147

Data Validation Results For Sample Locations at ER Site 12B. ARCOG 510471

Dear Mr Freshour:

Data validation review of analysis results for soil sample locations at ER Site 12B (Burn Site), recorded on Analysis Request and Chain of Custody (ARCOG) 510471, was completed by IT Corporation (IT) on May 13, 1998. The samples of interest were collected on March 4, 1998. This letter and the attached forms transmit the results from that review. The samples included in this validation transmittal are identified as follows:

037327-001	CY12B-SP01-03-S	037328-001	CY12B-SP02-03-S
037329-001	CY12B-SP03-03-S	037330-001	CY12B-SP04-03-S
037331-001	CY12B-SP05-03-S	037332-001	CY12B-SP06-03-S
037333-001	CY12B-SP07-03-S	037334-001	CY12B-SP08-03-S
037335-001	CY12B-SP09-03-S	037336-001	CY12B-SP10-03-S
037337-001	CY12B-SP11-03-S	037338-001	CY12B-SP12-03-S
037339-001	CY12B-SP13-03-S	037340-001	CY12B-SP14-03-S
037341-001	CY12B-SP15-03-S	037342-001	CY12B-SP15-03-SD
037343-001	CY12B-TB	037344-001	CY12B-EB

Volatile organic compound analysis (VOC) following EPA Method 8260 was requested on all samples from General Engineering Laboratories (GEL) in Charleston, South Carolina. Analytical results were reported by GEL in the document numbered 9803167.

Data review and validation are documented on *Data Verification/Validation Level 3 - DV3*, following Sandia procedures, *Verification and Validation of Chemical and Radiochemical Data, TOP 94-03, rev. 0*, July 1994.

Volatile Organic Compounds, Method 8260

Analysis results for samples 037327-001, 037328-001, 037329-001, 037330-001, 037332-001, 037334-001, and 037335-001 are rejected as unusable, qualified "R," because one or more internal standards areas failed to meet quality control (QC) acceptance limits. Re-analysis results confirmed the original QC

Mr. Paul Freshour

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May 13, 1998

failures. We suggest GEL be contacted with the request to provide a root-cause explanation for these repeated analysis failures.

Analysis results for samples 037331-001 and 037337-001 are qualified as unusable. "R." because the reported re-analyses occurred after the holding time had expired. The original analyses occurred within holding times, however internal standards areas or purge failures led the laboratory to perform re-analyses.

Other laboratory batch or sample specific QC measures, i.e., matrix spike and duplicate, laboratory control samples, and method blank sample results, which may have been reported with deficiencies and are only applicable to the sample analyses previously rejected, warrant no further discussion here.

The remaining sample analysis results are acceptable with minor qualifications. Methylene chloride and acetone results in samples 037333-001, 037336-001, 037338-001, 037339-001, 037340-001, 037341-001, and 037342-001 are qualified "U" for undetected because contamination by these compounds was observed in appropriate laboratory method blanks and the soil trip blank sample 037343-001. Other laboratory batch and sample specific quality control measures for these samples met all acceptance criteria.

Thank you for the opportunity to be of service in this matter. Please contact me by telephone at 262-8920 with any questions.

Respectfully submitted,

IT CORPORATION



Mark Lyon  
Project Chemist

ML: ml  
Attachments

cc: P. Puissant, SNL 7578  
H. Fleck, IT Corp.  
Project File



January 23, 1998

Project No. 301462.170.02.000

Sandia National Laboratories/New Mexico  
 Attn: Ms. Sharissa Young  
 Department 6133  
 P.O. Box 5800, M/S 1147  
 Albuquerque, New Mexico 87185-1147

Data Validation Results for Samples from ER Site 12B, ARCOG 06899

Dear Ms. Young:

Data validation review of analysis results for samples from ER Site 12B (Burn Site) recorded on Analysis Request and Chain of Custody (ARCOG) 06899 was completed by IT Corporation (IT) on January 22, 1998. The samples of interest were collected on September 8, 1997. This letter transmits results from that review except for the data validation results expedited for five selected soil samples and transmitted on November 25, 1997. The samples **NOT** included in this validation transmittal are identified as follows:

<u>Sample No. - Fractions</u>	<u>Sample Location Detail</u>
034062-001, -002	CY12B/210/80/01-US
034061-001, -002	CY12B/210/60/01-US
034063-001, -002	CY12B/190/80/01-US
034064-001, -002	CY12B/180/60/01-US
034065-001, -002	CY12B/170/80/01-US

Analytical results for volatile organic compounds (VOC), semi-volatile organic compounds (SVOC), explosives residues, and Resource Conservation and Recovery Act (RCRA) list metals plus beryllium were reported by LAS Laboratories, Las Vegas, Nevada, in the document numbered L10490.

Data review and validation are documented in this letter and on *Data Verification/Validation Level 3 - DV3*, forms which are attached. Data validation followed Sandia procedures outlined in *Verification and Validation of Chemical and Radiochemical Data, TOP 94-03, rev.0*, July 1994.

General Review Comments

The analytical report reviewed was not a raw data package but a comprehensive summary report including analytical batch, instrument, and sample specific quality control data. The report had been taken apart and reassembled in binders by the project staff prior to this review.

Duplicate sample pairs identified on the ARCOG included 034154 / 034173, and 034172 / 034174. Data for the duplicate samples 034173 and 034174 did not appear in the analytical report. Consequently, this review was unable to evaluate overall sampling and analysis precision. Additionally, samples appearing in the report identified as 035001 and 035002 were not recorded on the ARCOG, but may have been the misidentified samples 034156-002 and 034157-002

#### Volatile Organic Compounds, Method 8260

Results for the following samples are qualified "R" meaning rejected and not usable because of continuing failure to meet internal standard area acceptance criteria, for one or more internal standards, in both the initial and re-analyses: 034057-001, 034059-001, and 034152-001.

Numerous samples appearing in the laboratory's exception reports are noted as failing internal standard area acceptance criteria for 1,4-dichlorobenzene-d4. However, after attempting to verify those occurrences in the quality control sections of the report it was discovered that some of the values reported as internal standard area failures were in fact within acceptance criteria. Apparently, these discrepancies are laboratory reporting errors.

Acetone concentrations are qualified with "U" meaning undetected in samples 034158-001, 034160-001, 034161-001, 034163-001, 034165-001, 034166-001, 034168-001, 034169-001, 034150-001, 034159-001, 034164-001, 034167-001, 034170-001, 034172-001, 034178-001, and 034179-001 because of acetone contamination in laboratory method blanks 53784MB (September 21, 1997) and 53787MB (September 22, 1997).

A discrepancy in the laboratory's volatile organics compounds exception report was noted relative to the laboratory method blank samples 53723MB and 54589MB analyzed on September 19, 1997. On the exception report, both method blanks are shown analyzed at identical times of 12:48 hours, however only 53723MB is shown on the run log and only 53723MB is reported in the quality control section of the report. The 53723MB shows no contamination and no samples ran this day were so flagged. To the contrary, the exception report notes that the 54589MB contained 5.4 acetone concentration and associated samples were flagged by the lab. But, if not for the exception report, there would be no indication of 54589MB in this report. Soil samples analyzed this day, September 19, 1997, show acetone contamination consistent with the analytical batches analyzed September 21 and 22, 1997 for which all acetone results were qualified "U" because of method blank contamination. Consequently, this review suspects a laboratory reporting error in the exception report for the September 19, 1997 samples and suggest that all samples analyzed that day be qualified "U" for acetone. These include 034065-001, 034148-001, 034151-001, 034153-001, 034154-001, and 034055-001.

Sample results are reported for two samples, 035001-001 and 035002-001, which are not recorded on ARCOG 06899. Additionally, the location detail attached to sample number 034158-001 on the volatile analysis report does not match sample location detail on the ARCOG. Sample 035002-001 has the correct

location detail for 034158-001 on the volatile analysis report, but sample 035002-001 is not even recorded on the ARCOG.

#### Semi-Volatile Organic Compounds. Method 8270

Forty soil samples and one aqueous equipment blank sample were analyzed for semi-volatile organic compounds. Quality control data available for review in the comprehensive summary report included surrogate recoveries, internal standard area and retention time reports, method blanks, laboratory control samples, matrix spike, and matrix spike duplicate. Instrument initial and continuing calibration response factor reports and summaries, analysis run log, sample analysis response factor reports and extracted ion profiles, and tentatively identified compound (TIC) library search reports were not included in the documentation and could not be verified. However, there were only two target compounds detected, one in each of two different soil samples, 034155-002 and 034176-005 (equipment blank). The QC data provided was sufficient to assign any results qualifications as discussed below. The data validation qualifiers assigned are based upon the analytical batch and sample specific QC results reported by the lab.

LAS laboratory failed to comply with requirements of their contract with Sandia. The laboratory failed to analyze duplicate laboratory control samples in the soil matrix. And, soil semi-volatile organic compound analysis results were reported on a dry-weight basis with percent moisture values.

Analysis results for two field duplicate samples, 034173-002 and 034174-002, were not reported and staff notation on the ARCOG indicated that the analyses were not performed. Samples 034156-002 and 034157-002 on the ARCOG were apparently mislabeled as 035001-002 and 035002-002 when submitted to the lab. Results are reported for the latter but not the former.

Sample analyses dates exceeded the 40-day extraction-to-analysis holding time in 14 soil samples. All target analyte results were non-detected and all associated batch QC was acceptable. Consequently, all target compound results for samples 034046-002, 034054-002 through 034065-002 consecutively, and 034148-002 are qualified "UJ" as undetected with the quantitation limit estimated.

A low internal standard area count for perylene-d12 was reported in both analysis and reanalysis of sample 034178-002. Consequently, the compounds benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, benzo(a)pyrene, dibenz(a,j)acridine, dibenz(a,h)anthracene, di-n-octylphthalate, and indeno(1,2,3-cd)pyrene are qualified "UJ" as not detected with uncertainty concerning the actual quantitation limit.

Isolated occurrences of poor matrix spike duplicate precision (low RPD for two compounds in one MSD) and low surrogate recoveries (two of six surrogates recoveries in equipment blank sample 034176-005) are noted in the attached review forms. No results qualifications were made.

Tentatively identified compounds (TIC) reported as a result of the mass spectral library search showed concentrations of acetone, hydrocarbons, and other unidentified, but late eluting, compounds. All TIC

concentrations for acetone are qualified "U" for undetected because of similar acetone concentrations reported in all laboratory method blank samples. The source for acetone contamination in the samples likely originated in the laboratory.

Additional TICs reported as unknowns and unknown hydrocarbons may be indicative of petroleum-source contamination and a concern of the project staff. Re-sampling at the indicated locations and analysis for extractable total petroleum hydrocarbons may be recommended depending on project requirements.

#### Explosives Residues, Method 8330

Forty soil samples and one aqueous equipment blank sample were analyzed for explosives residue analysis. All explosives residues analysis results were reported as not detected. Information available for review included laboratory batch and sample specific quality control measures and continuing calibration check results. Based upon analytical QC batch measures the following qualifications to analytical results are made.

Analytical bias was generally low, but acceptable, in the laboratory control sample for LAS QC batch no. 53541, except for 2,4-dinitrotoluene, which failed percent recovery criteria at 64 percent. Because only one compound failed recovery criteria, the only samples qualified in this batch also failed surrogate recovery. Sample 034149-002 results is qualified "UJ" as undetected with detection limit uncertainty because the surrogate spike recovery at 41 percent failed acceptance criteria. Extraction or spiking problems are suspected.

The matrix spike on sample 034172-002 run for QC in laboratory batch no. 53664 failed low for all but two compounds. Surrogate recovery was also below acceptance criteria. The matrix spike duplicate showed acceptable percent recoveries, however this led to precision values, calculated as relative percent differences, failing acceptance criteria. The laboratory reran the associated project samples (outside of holding time) and confirmed the not detected analysis results. Even though the problem may have been isolated to poor spiking or extraction procedure in the matrix spike sample only, all sample analysis results in this lab QC batch are qualified "UJ" for undetected with uncertainty concerning the detection limit because of poor MSD precision. Affected samples are: 034172-002, 034178-002, and 034179-002.

LAS laboratory failed to perform up to requirements of their Sandia contract. Laboratory control duplicate samples were not analyzed in the soil matrix and soil results were reported on a dry weight basis that included percent moisture values. Samples identified as field duplicates on the ARCO were apparently not analyzed because no results were reported.

#### RCRA List Metals + Beryllium, Methods 6010 and 7471.

Soil samples were analyzed for ICP metals in two analytical batches. Barium results for 20 samples (inclusive of the five previously reviewed) in batch no. 53738 are qualified with "J" as estimated values, bias low, because of slightly low recovery, less than acceptance criteria of barium in the matrix spike and

matrix spike duplicate sample. These samples are 034046-002, 034054-002 consecutively through 034065-002, 034148-002, 034151-002 consecutively through 034155-002, and the misidentified sample 035001-002 (034156-002 ??). Relative percent difference precision measurement for silver in the laboratory control duplicate sample exceeded acceptance criteria of 20 RPD, however percent recoveries were 81 and 104 percent and consequently no qualifiers are assigned.

In analytical batch no. 53739 all sample results are qualified "J" (or "UJ" for any nondetects) for barium and beryllium, bias low, because of matrix spike and matrix spike duplicate recovery slightly less than 75 percent. Affected samples are; the mislabeled sample 035002-002 (034157-002 ?), 034149-002, 034150-002, 034158-002 consecutively through 034172-002, 034178-002, and 034179-002. Chromium and lead also recovered less than 75 percent in the matrix spike duplicate sample but are not qualified because the matrix spike and laboratory control sample recoveries were acceptable. Mercury results for all the above samples in laboratory batch 53739 are qualified "J" for detects and "UJ" for nondetects because RPD precision for the MSD exceeded 20. Similarly, silver results for all the above samples are qualified "J" for detects and "UJ" for nondetects because RPD precision in the laboratory control sample duplicates exceeded 20.

Thank you for the opportunity to be of service in this matter. Please contact me by telephone at 262-8920 with any questions.

Respectfully submitted,

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December 31, 1997

Project No. 301462.170.02.000

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Data Validation Results for Environmental Restoration (ER) Site 12B Samples. ARCOG 06885

Dear Ms. Young:

Data validation review of analysis results for soil samples from ER Site 12B (Burn Site) recorded on Analysis Request and Chain of Custody (ARCOG) 06885 was completed by IT Corporation (IT) on December 31, 1997. This letter transmits results from that review.

Eleven investigatory soil samples recorded on ARCOG 06885 were collected on August 19, 1997. Quality control samples also recorded included one soil field duplicate sample, one aqueous trip blank sample, and an aqueous equipment blank sample. The samples were shipped to LAS Laboratories, Las Vegas, Nevada, where analyses for volatile organic compounds (EPA Method 8260), semi-volatile organic compounds (EPA Method 8270), Resource Conservation and Recovery Act (RCRA) metals plus beryllium, and high explosives residues (EPA Method 8330) were requested. Laboratory results were reported in the comprehensive laboratory summary data package numbered L10349. The raw data backup documentation was not available during this review.

The aqueous equipment blank sample fraction 033678-004 for volatile organic compound analysis was broken in transit and unrecoverable. There were no volatile organic compound analyses on the equipment blank sample.

Data review and validation are documented in this letter and on *Data Verification/Validation Level 3 - DV3* forms which are attached. Data validation followed Sandia procedures outlined in *Verification and Validation of Chemical and Radiochemical Data, TOP 94-03, rev.0*, July 1994. Data review observations and any data validation qualifiers assigned are discussed by test method below.

***Volatile Organic Compounds EPA Method 8260***

Samples 033668-001 (field duplicate) and 033669-001 are qualified "R" as rejected because of multiple quality control failures. Failures include surrogate recovery, internal standards areas, and holding times in either or both initially reported run data and re-analysis data. Samples 033673-001 and 033675-001 are qualified "J" for detects and "UJ" for non-detects because of missed holding times. Tentatively identified compounds (TIC) in 033673-001 and 033675-001 are qualified "U" for undetected because of a similar,

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unknown TIC reported at the same elution time in the September 3, 1997, laboratory method blank sample, 53033MB.

LAS laboratory did not perform in accordance with Sandia contract requirements while analyzing the samples on this ARCO. LAS failed to analyze a laboratory control sample duplicate with the volatile samples, and failed to analyze a matrix spike (MS) and matrix spike duplicate (MSD) on the Sandia sample so designated on the ARCO. The non-Sandia samples reported for MS/MSD were not even in the same analytical batches as the samples on this ARCO. Also evidenced on the LAS volatile sample run logs, LAS had difficulties getting valid analyses on numerous samples run on September 2, 1997, because of internal standards failures. Consequently, resampling and analysis for volatile organic compounds are recommended depending on requirements of the project.

### ***Semi-Volatile Organic Compounds EPA Method 8270***

Diethylphthalate results in samples 033668-002, 033669-002, and 033670-002 are qualified "J" as estimated values because of poor precision in the field duplicate pair (033667-002 and 033668-002). Diethylphthalate was not detected in sample 0033667-002 above a practical quantitation limit of 100 µg/kg but reported at 450 µg/kg in the field duplicate 0033668-002. All TIC reports of substitute phenols and aldol condensation products in all soil samples are qualified "U" for undetected because of similar contamination in the laboratory method blank. As narrated in the report, LAS determined that laboratory vial caps were the source of contamination introduced into the samples. Numerous TICs identified as unknown hydrocarbons were reported in the soil samples as well as infrequent low level concentrations of target compounds. Resampling and analysis is recommended to confirm these compound identifications depending on requirements for the project.

LAS laboratory apparently ran semi-volatile organic compound analyses using EPA Contract Laboratory Program (CLP) GC/MS calibration criteria which is less stringent than the requested EPA SW-846 Method 8270 criteria. While all calibration requirements for Method 8270 were met in terms of system performance and continuing calibration check compounds, some percent deviation in response factors compared to initial calibration average response factors were observed greater than Method 8270 criteria but less than CLP acceptance criteria. No action was taken during review and no sample results were qualified because of this.

LAS failed to perform up to analytical method and Sandia contract requirements in analysis of the semi-volatile organic compounds. MS/MSD was not performed in the analytical batch containing the aqueous equipment blank sample and there was no laboratory control sample duplicate sample analyzed in the analytical batch with the soil samples.

### ***RCRA Metals plus Beryllium***

Metals analyses were performed following EPA Methods 6010 and 7471 (mercury). Lead result in all soil samples, 033667-002 consecutively through 033677-002 are qualified "J" as estimated values. Lead quality control checks showed positive interference in the ICP-Trace interference check sample analysis, lead recovery failed criteria in the sample dilution test, and field duplicate precision for lead was calculated at 117 relative percent difference (RPD). Barium results in all soil samples are qualified "J" as estimated values with a slightly low bias because of low recoveries less than acceptance limits in the matrix spike and matrix spike duplicate samples. Barium recovered at 68 and 73 percent. Mercury analysis results in all soil samples are qualified "UJ" meaning undetected with uncertainty concerning the

Ms. Sharissa Young

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January 2, 1998

reported limit of detection because mercury recovered slightly low in the matrix spike and matrix spike duplicate at 71 and 79 percent.

**High Explosives Residues EPA Method 8330**

Data reported by the laboratory are acceptable without additional qualification. LAS failed to run a laboratory control sample duplicate in the soil sample analysis batch. Poor laboratory control sample results in the water matrix were isolated and narrated by the laboratory and did not impact analysis of the equipment blank sample.

Thank you for the opportunity to be of service in this matter. Please contact me by telephone at 262-8920 with any questions.

Respectfully submitted,

IT CORPORATION

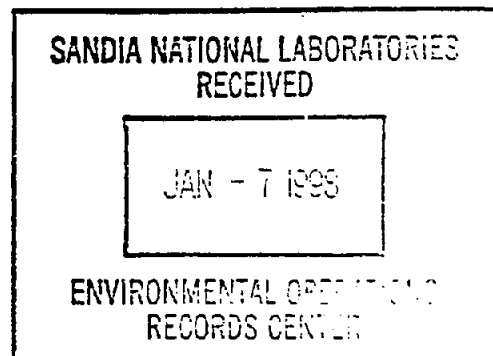


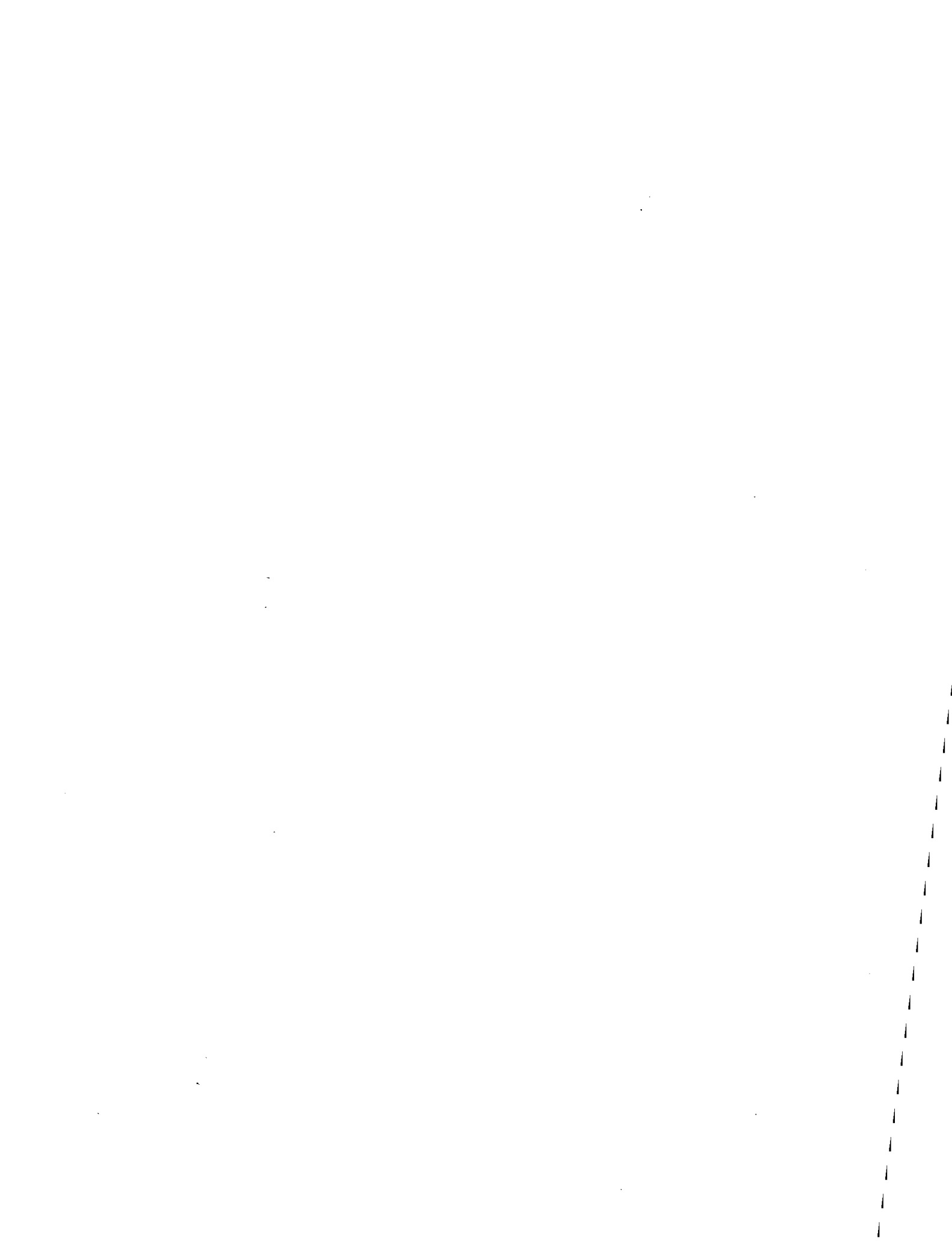
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*EORC ER / 1333 / 12B / DAT*







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Data Validation Results for Environmental Restoration (ER) Site 12B Samples, ARCOG 06896

Dear Ms. Young:

Data validation review of analysis results for soil samples from ER Site 12B (Burn Site) recorded on Analysis Request and Chain of Custody (ARCOG) 06896 was completed by IT Corporation (IT) on December 18, 1997. This letter transmits results from that review.

Six investigatory soil samples recorded on ARCOG 06896 were collected on September 2, 1997. Quality control samples also recorded included one soil trip blank sample. The samples were shipped to LAS Laboratories, Las Vegas, Nevada, where analyses for volatile organic compounds (EPA Method 8260), semi-volatile organic compounds (EPA Method 8270), Resource Conservation and Recovery Act (RCRA) metals plus beryllium, and high explosives residues (EPA Method 8330) were requested. Laboratory results were reported in the laboratory summary data package with raw data backup numbered L10445.

Data review and validation are documented in this letter and on *Data Verification/Validation Level 3 - DV3* forms which are attached. Data validation followed Sandia procedures outlined in *Verification and Validation of Chemical and Radiochemical Data, TOP 94-03, rev.0*, July 1994. Data review observations and any data validation qualifiers assigned are discussed by test method below.

***Volatile Organic Compounds EPA Method 8260***

Concentrations of 1,1,1-trichloroethane, tetrachloroethene, and toluene were detected in all of the samples at levels slightly above or below the practical quantitation limits (PQL). The common lab contaminant acetone was also detected in one sample. The soil trip blank (034053-004) submitted contained these same contaminants at greater concentrations as well as eight other target compounds above and below the PQL's. Consequently, the samples 034048-001, 034049-001, 034050-001, 034051-001, and 034052-001 are qualified "U" undetected for 1,1,1-trichloroethane, tetrachloroethene, and toluene. Acetone is qualified "U" in sample 034050-001. ER staff are cautioned however, that the source(s) for these compounds in the investigatory samples and the contamination in the soil trip blank are unknown, and confirmation re-sampling may be desirable depending on the usage requirements for the data and the known site history.

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**Semi-Volatile Organic Compounds EPA Method 8270**

Sample extraction was performed within the EPA recommended holding time, however, analysis of the extracts occurred several days past the analysis holding time. Laboratory batch quality control samples were prepared at the same time as sample extraction and those quality control results met all acceptance criteria. Consequently, the data are not rejected because of the holding time violations, but, with one exception, all compound analysis results in all samples are qualified "UJ" meaning undetected with uncertainty about the level of detection. The exception being one identification of bis(2-ethyl hexyl) phthalate in sample 034052-002 qualified by the laboratory as estimated below the PQL with the "J" flag.

Tentatively identified compounds (TIC) reported as a result of the mass spectral library search showed concentrations of acetone, hydrocarbons, and other unidentified, but late eluting, compounds. All soil sample TIC concentrations for acetone are qualified "U" for undetected because of similar acetone concentrations reported in the laboratory method blank sample. The source for acetone contamination in the samples likely originated in the laboratory.

**RCRA Metals plus Beryllium**

Metals analyses were performed following EPA Methods 6010 and 7471 (mercury). The lead result in sample 034050-002 is qualified "J" as an estimated value because the result of the serial dilution test performed by the laboratory on sample 034047-002 in accordance with Method 6010 requirements exceeded 10 percent difference. Sample 034050-002 was the only lead result so qualified because that was the only lead result greater than 50 times the instrument detection limit. All other metals results are usable without qualification.

**High Explosives Residues EPA Method 8330**

Analysis results for HMX, 1,3,5-trinitrobenzene, 2,4,6-trinitrotoluene, 2-Am-4,6-DNT, 4-Am-2,6-DNT, 2,6-dinitrotoluene, and 2,4-dinitrotoluene are qualified "UJ" in all samples because of percent recoveries slightly less than acceptance limits in the laboratory control sample. Analysis results are not rejected because sample surrogate percent recoveries were acceptable in all samples and results for the sample matrix spike and matrix spike duplicate met quality control criteria. All other explosives results are usable without qualification.

Thank you for the opportunity to be of service in this matter. Please contact me by telephone at 262-8920 with any questions.

Respectfully submitted,

IT CORPORATION



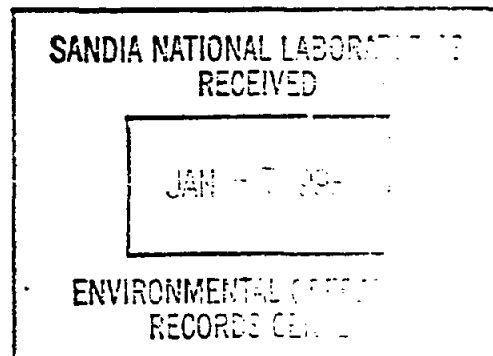
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December 18, 1997

Project No. 301462.170.02.000

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Data Validation Results for Environmental Restoration (ER) Site 12B Samples, ARCOG 06954

Dear Ms. Young:

Data validation review of analysis results for soil samples from ER Site 12B (Burn Site) recorded on Analysis Request and Chain of Custody (ARCOG) was completed by IT Corporation (IT) on December 16, 1997. This letter transmits results from that review.

Ten investigatory soil samples recorded on ARCOG 06954 were collected on September 10, 1997. Quality control samples also recorded include one aqueous equipment blank sample, one aqueous trip blank, and one soil trip blank sample. The samples were shipped to LAS Laboratories, Las Vegas, Nevada, where analyses for volatile organic compounds (EPA Method 8260) and semi-volatile organic compounds (EPA Method 8270) were requested. Laboratory results were reported in the laboratory summary data package with raw data backup numbered L10504.

Data review and validation are documented in this letter and on *Data Verification/Validation Level 3 - DV3* forms which are attached. Data validation followed Sandia procedures outlined in *Verification and Validation of Chemical and Radiochemical Data, TOP 94-03, rev.0, July 1994*.

Data review observations and any data validation qualifiers assigned are discussed by test method below.

***Volatile Organic Compounds EPA Method 8260***

The common laboratory contaminants of acetone and 2-butanone were consistently detected in the investigatory soil samples at low concentrations greater than the practical quantitation limit (PQL) (e.g., 10 to 30 micrograms per kilogram [ $\mu\text{g}/\text{kg}$ ]). These same compounds were not detected in the aqueous trip blank nor the laboratory method blank samples. However, the soil trip blank submitted did contain these common laboratory contaminants at similar quantifiable concentrations, 15 other identified target compounds at estimated concentrations less than the PQL's, and eight unknown hydrocarbons reported as tentatively identified compounds (TIC). Based upon the soil trip blank data, acetone, 2-butanone, m,p-xylene, and trichloroethene concentrations in several investigatory soil samples are qualified "U" for

undetected as listed below. However, ER staff are cautioned that the source(s) for acetone and 2-butanone in the investigatory samples, as well as other contamination in the soil trip blank are unknown, and confirmation re-sampling may be desirable depending on the usage requirements for the data and the known site history. The following results qualifications were made.

Sample ID	Acetone	2-Butanone	m,p-Xylene	Trichloroethene
034181-001	U			
034182-001	U			
034183-001	U	U		
034184-001	U			
034185-001	U	U		
034186-001	U	U	U	
034187-001	U	U		
034214-001	U			
034216-001	U			U

The qualifier "U" indicates that the result is qualified undetected because the compound concentration is less than 5 times (10 times in the case of common laboratory contaminants of acetone and 2-butanone) that compounds concentration in an associated blank sample.

#### ***Semi-Volatile Organic Compounds EPA Method 8270***

Review of the instrument initial and continuing calibration indicated that the laboratory is using EPA Contract Laboratory Program (CLP) acceptance criteria for the percent relative standard deviation of calibration compound response factors and percent difference between continuing calibration response factors versus the initial calibration average response factors. More stringent acceptance criteria for these quality measures are found in EPA Method 8270 than EPA CLP. Consequently, the following samples are qualified "UJ" for several compounds meaning undetected and there is uncertainty concerning the lower limit of detection because calibration criteria failed Method 8270 criteria. Analysis results are not rejected because CLP method criteria were met. Sample results all showed undetected. Samples 034181-002, 034182-002, 034183-002, 034184-002, 034185-002, 034186-002, 034187-002, 034214-002, 034215-002, and 034216-002 are qualified "UJ" for 4,6-dinitro-2-methylphenol, 2,4-dinitrophenol, 4-nitrophenol, 2,4-dinitrotoluene, 4-nitroaniline, and 3,3'-dichlorobenzidene. Sample 034218-002 is qualified "UJ" for bis(2-chloroethyl)ether.

Tentatively identified compounds (TIC) reported as a result of the mass spectral library search showed concentrations of acetone, hydrocarbons, and other unidentified, but late eluting, compounds. All soil sample TIC concentrations for acetone are qualified "U" for undetected because of similar acetone concentrations reported in the laboratory method blank sample. The source for acetone contamination in the samples likely originated in the laboratory.



Ms. Sharissa Young

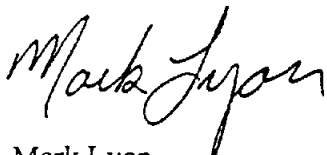
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December 18, 1997

Thank you for the opportunity to be of service in this matter. Please contact me by telephone at 262-8920 with any questions.

Respectfully submitted,

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November 26, 1997

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Data Validation Results for Five Samples from ER Site 12B, ARCOC 06899

Dear Ms. Young:

Expedited data validation review of analysis results for five soil samples from ER Site 12B (Burn Site) was completed by IT Corporation (IT) on Monday, November 24, 1997. This letter transmits results from that review.

The samples of interest were collected on September 8, 1997, and identified on Analysis Request and Chain of Custody (ARCOC) 06899 as follows:

<u>Sample No. - Fractions</u>	<u>Sample Location Detail</u>
034062-001, -002	CY12B/210/80/01-US
034061-001, -002	CY12B/210/60/01-US
034063-001, -002	CY12B/190/80/01-US
034064-001, -002	CY12B/180/60/01-US
034065-001, -002	CY12B/170/80/01-US

Analytical results for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), explosives residues, and Resource Conservation and Recovery Act (RCRA) list metals plus beryllium were reported by LAS Laboratories, Las Vegas, Nevada, in the document numbered L10490. The five samples of interest are a small excerpt of those recorded on ARCOC 06899 and reported by the lab in document L10490.

Data review and validation are documented in this letter and on *Data Verification/Validation Level 3 - DV3* forms, which are attached. Data validation followed Sandia procedures outlined in *Verification and Validation of Chemical and Radiochemical Data. TOP 94-03, rev.0, July 1994.*

General Review Comments

Laboratory report L10490 had been taken apart and placed in 3-ring binders or loose-leaf binder-clipped stacks prior to receipt at IT. The review could not determine whether the report was complete or whether it was intended to be a summary data package or a raw data package. Sample results certificates, exception

reports, and quality control summaries of analytical batch, and instrument-level monitoring measures were located, but there was very little raw or bench-level documentation in the package. Consequently, numerous review items could not be verified against, or traced back to, original documentation.

#### Volatile Organic Compounds. Method 8260

Volatile organic compound analysis results are acceptable and usable as reported without qualification. Quality control items reviewed included holding times, instrument tuning, initial and continuing calibration verification, initial and continuing calibration blanks, method blanks, surrogate compound recoveries, matrix spike/matrix spike duplicate, laboratory control samples, and internal standards. The report package did not contain response factor reports nor extracted ion chromatograms for the samples. Consequently, estimated, low-level, chloroform concentrations in the samples could not be evaluated as possible false positives.

#### Semivolatile Organic Compounds. Method 8270

Verification of the reported semivolatile organic compound analysis results could not be made. Instrument initial and continuing calibration response factor reports and summaries, extraction log, analysis run log, sample analysis response factor reports and extracted ion profiles, and tentatively identified compound (TIC) library search reports were not included in the documentation. Data validation qualifiers assigned below are based upon the batch quality control measures and sample-specific surrogate compound recoveries reported by the lab.

Sample analyses were completed outside of the 40-day extraction-to-analysis holding time and all target analyte results were nondetected in all five samples. However, all batch quality control measures including laboratory control sample, matrix spike and matrix spike duplicate, method blank, and surrogates spikes set up at the time of sample extraction met acceptance criteria. Consequently, these data are usable and qualified "UJ" as undetected with the quantitation limit estimated. Resampling of the locations for semivolatile analyses may be recommended if the data will be subject to regulatory scrutiny.

Tentatively identified compounds (TIC) reported as a result of the mass spectral library search showed concentrations of acetone, hydrocarbons, and other unidentified, but late eluting, compounds. All TIC concentrations for acetone are qualified "U" for undetected because of similar acetone concentrations reported in the laboratory method blank sample, and the absence of any acetone reported in the volatile compound sample analysis fractions. The source for acetone contamination in the samples likely originated in the laboratory.

Additional TICs reported as unknowns and unknown hydrocarbons may be indicative of petroleum-source contamination and a concern of the project staff. Re-sampling at the indicated locations and analysis for extractable total petroleum hydrocarbons may be recommended depending on project requirements.

#### Explosives Residues. Method 8330

All analysis results are usable as reported without qualification (all results were nondetects) with the understanding that the review process was essentially a Level II review of summary data forms. Explosives residue analysis data could not be verified back to the laboratory bench level. The

documentation provided for review included analysis results and surrogate compound recoveries, routine batch quality control summaries, exception reports, and continuing calibration summary reports. There was no documentation of initial calibration, preparation logs, analysis run logs, or sample chromatograms provided. Precision was measured from the matrix spike duplicate analysis because the laboratory neglected to run a duplicate control sample with the analytical batches.

RCRA List Metals + Beryllium. Methods 6010 and 7471.

Again, analysis results could not be verified back to the lab-bench level because the appropriate documentation was not provided. Given that, the results are usable as reported without qualification except for barium. Barium results in all five samples are qualified with "J" as estimated values, bias low, because of slightly low recovery, less than acceptance criteria of barium in the matrix spike and matrix spike duplicate sample.

Documentation that was not provided includes calibration summaries for both methods and instrument-run printouts. The preparation logs and analysis run logs provided were retyped versions of the handwritten originals and not signed by the originating laboratory staff. Initial and continuing calibration and blank verifications were reported as summary tables that could not be verified because there were no instrument printouts.

Thank you for the opportunity to be of service in this matter. Please contact me by telephone at 262-8920 with any questions.

Respectfully submitted,

IT CORPORATION



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Project Chemist

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Attachments

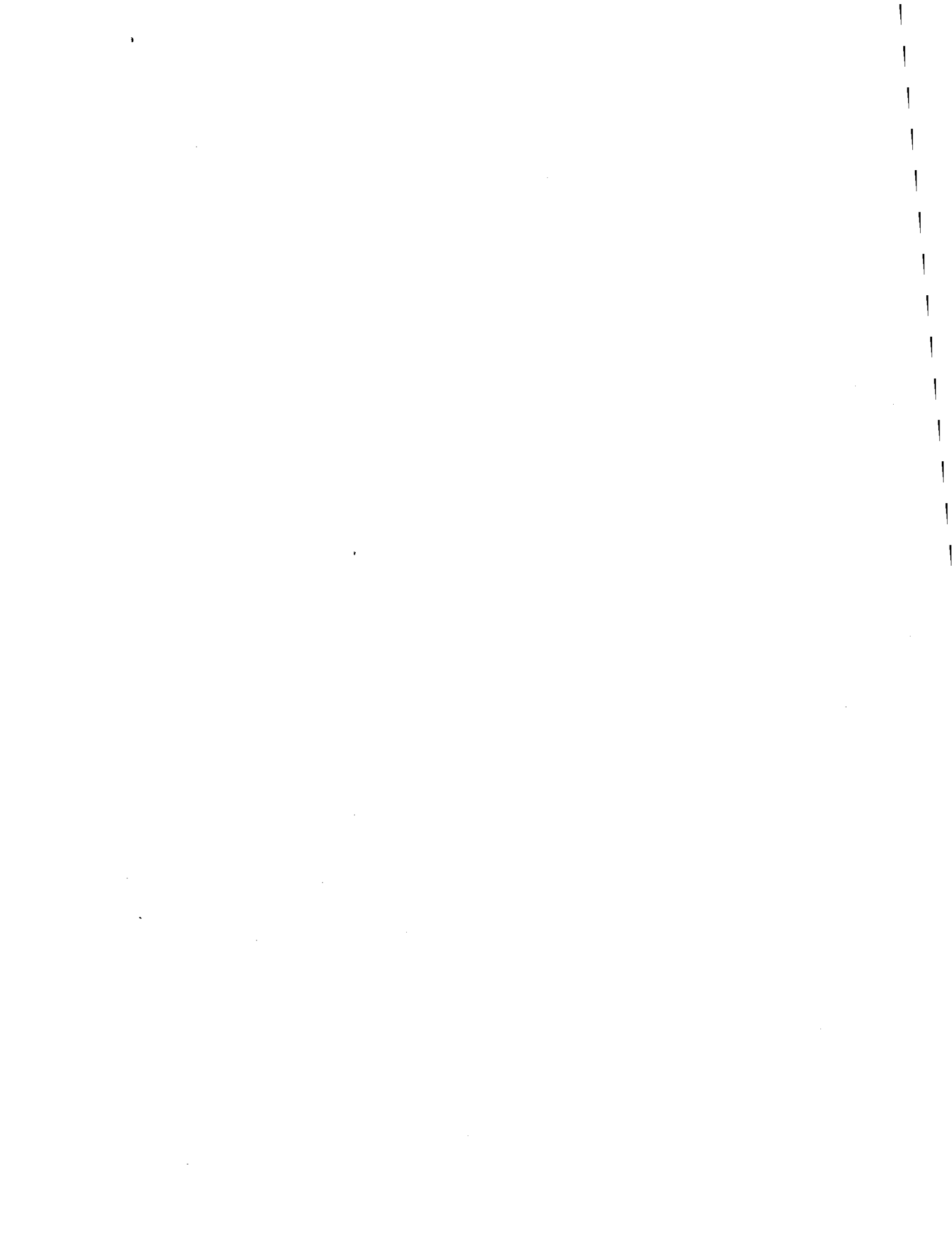
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**ANNEX 4-G**  
**Risk Screening Assessment**





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## **SWMU 12B: RISK SCREENING ASSESSMENT REPORT**

### **I. Site Description and History**

Solid waste management unit (SWMU) 12B, Buried Site, Operable Unit 1333, comprises approximately 0.3 acres of U.S. Air Force land withdrawn from the Forest Service and permitted to the U.S. Department of Energy (DOE). SWMU 12B is located within the graded portion of SWMU 94, Lurance Canyon Burn Site, which is an active site. SWMU 12B is approximately 500 feet long and 20 to 30 feet wide. It extends south from the Burn Site cable rack to the historical drainage confluence with the Lurance Canyon main arroyo channel.

Activity at the site is probably associated with the operations of SWMU 65, Lurance Canyon Explosives Test Site, and the construction activities associated with SWMU 94. The site is listed as a radiological materials management area. Various tests, including general explosive tests, fuel-fire burn tests, and rocket propellant burn tests were conducted at SWMU 65 located near SWMU 12B. Debris found in the arroyo includes wire, cable, metal scrap, lead, batteries, asbestos transite, and concrete blocks.

### **II. Comparison of Results to Data Quality Objectives**

The key assumptions on which the voluntary corrective measures (VCM) activities conducted at SWMU 12B were designed include the following:

- Thorough characterization and remediation can be accomplished in one field effort.
- All refuse can be removed from the water course.
- The remedy will probably be a final solution and will prevent any potential releases or migration of hazardous or radioactive material in the future.
- Adequate treatment, storage, and disposal capacity is available for all expected waste types.
- Protection of the complex hydrogeologic setting of the Burn Site area from SWMU 12B will be achieved.

Table 1 summarizes the sample location design for SWMU 12B.

The number and location of the samples collected was dependent upon the amount of soil removed from the arroyo and the size of area in which the VCM activities were performed.

**Table 1  
Summary of Sampling Performed to Meet Data Quality Objectives**

Area Under Investigation	Potential COC Source	Number of Sampling Locations	Sampling Location Rationale and Analytical Parameters
SWMU 12B	Explosive and/or fuel-fire burn tests containing DU, HE, fuel, and metals. Debris including wood, sandbags, weapon casings, cable/wire, and explosive residue.	65	Sample locations distributed around the arroyo and collected from soil piles to confirm the VCM clean up activities. Analysis for VOCs, SVOCs, metals, HE, and radionuclides.

COC = Constituent of concern.

DU = Depleted uranium.

HE = High explosive(s).

SVOC = Semivolatile organic compound.

SWMU = Solid waste management unit.

VCM = Voluntary corrective measure.

VOC = Volatile organic compound.

Table 2 summarizes the analytical methods and data quality requirements necessary (1) to adequately characterize hazardous waste or hazardous constituents associated with the burial material in the arroyo, (2) to adequately characterize radioactive waste or radioactive constituents associated with the burial material in the arroyo, and (3) to support screening risk assessments.

A total of 40 arroyo verification locations, five geoprobe locations, and 15 soil pile locations were sampled at the SWMU 12B site. The samples were sent to the on-site laboratory for volatile organic compounds (VOC), semivolatile organic compounds (SVOC), Resource Conservation and Recovery Act (RCRA) metals, high explosives (HE), and gamma spectroscopy analyses. The samples were sent to the off-site laboratory for VOC, SVOC, RCRA metals, HE, and isotropic uranium analyses. The off-site laboratory's MDLs for all RCRA metals (except mercury) were lower than the approved background concentration limits.

The Sandia National Laboratories/New Mexico (SNL/NM) Sample Management Office conducted Data Validation I, II, and III reviews in accordance with Technical Operating Procedure 94-03, Rev. 0 (SNL/NM July 1994). The data quality objectives (DQOs) for SWMU 12B 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 12B was based upon an initial conceptual model validated with some initial sampling and the VCM clean-up effort at the site. The initial conceptual model was developed from historical background information including numerous site inspections, personal interviews, historical photographs, and fieldwork associated with the site investigation and the VCM clean-up of the site. The DQOs contained in the VCM Plan (SNL/NM July 1997) identified the removal action for the

**Table 2**  
**Summary of Data Quality Requirements**

<b>Analytical Requirements</b>	<b>Data Quality Level</b>	<b>SNL/NM Laboratories</b>	<b>GEL/LAS Laboratories</b>
VOCs EPA Method 8260 <sup>a</sup>	Level 3	Not applicable	78 samples 8 samples (QA/QC)
SVOCs EPA Method 8270 <sup>a</sup>	Level 3	Not applicable	78 samples 8 samples (QA/QC)
RCRA metals + Be EPA Method 6010/7471 <sup>a</sup>	Level 3	Not applicable	63 samples 8 samples (QA/QC)
High explosives EPA Method 8330 <sup>a</sup>	Level 3	Not applicable	63 samples 8 samples (QA/QC)
Gamma Spec	Level 2	117 samples 4 samples (QA/QC)	Not applicable
Isotopic uranium Method LAL-91-SOP 0108	Level 2	Not applicable	1 sample
VOCs EPA Method 8260 <sup>a</sup>	Level 1	9 samples	Not applicable
SVOCs EPA Method 8270 <sup>a</sup>	Level 1	8 samples	Not applicable
RCRA metals + Be EPA Method 6010/7471 <sup>a</sup>	Level 1	7 samples	Not applicable
High explosives EPA Method 8330 <sup>a</sup>	Level 1	7 samples	Not applicable

<sup>a</sup>EPA (November 1986).

EPA = U.S. Environmental Protection Agency.

GEL = General Engineering Laboratories, Charleston, South Carolina.

LAS = Lockheed Analytical Services, Las Vegas, Nevada.

QA = Quality assurance.

QC = Quality control.

RCRA = Resource Conservation and Recovery Act.

SNL/NM = Sandia National Laboratories/New Mexico.

SVOC = Semivolatile organic compound.

VOC = Volatile organic compound.

arroyo, the sample locations, sample depth, analytical requirements, and the waste management plan. The removal action and sampling data for the VCM action at SWMU 12B were completed in accordance with the rationale and procedures described in the VCM Plan (SNL/NM July 1997). The data collected were subsequently used to develop the final conceptual model for SWMU 12B, which is presented in Section 4.5 of the associated no further action (NFA) proposal. The quality of the data specifically used to determine the nature, rate, and extent of contamination are described below.

### III.2 Nature of Contamination

The nature (and/or lack) of contamination at SWMU 12B was determined with the VCM removal action and analytical testing of the debris and soil. The analytical requirements included VOCs, SVOCs, RCRA metals, Be, HE, radionuclides, and isotopic uranium to characterize the site. The analytical methods were appropriate to characterize the constituents of concern (COC) and potential degradation products associated with the historical activities at SWMU 12B.

### III.3 Rate of Contamination

All primary sources of COCs were removed from the SWMU 12B investigative area during the VCM action. Secondary sources of possible COCs are adsorbed metals and adsorbed, dissolved, or volatilized organic compounds in the soils. The rate of possible COC migration is dependent predominantly upon surface hydrologic processes, as described in Section V. SWMU 12B is an open arroyo (drainage) that is subjected to intermittent flow through this site. The surface hydrologic processes have the ability to effect possible contaminant migration.

### III.4 Extent of Contamination

Approximately 3,300 cubic yards of soil and 75 cubic yards of debris and scrap metal were removed from the arroyo. Forty surface soil samples (all at the 0- to 6-inch depth) were collected from the bottom of the excavated arroyo to determine that the VCM was successful in removing contamination from the arroyo. In addition, two sediment samples were collected behind silt fences outside the excavated area. Five geoprobe locations were sampled (two soil samples per location depth of 2 to 4 feet below ground surface [bgs] and 6 to 8 feet bgs) outside the excavated area. Fifteen composite soil samples were collected from the excavated soil piles.

Because of the relatively low solubility of most metals and organic compounds, limited precipitation, high evapotranspiration, and intermittent surface-water flow conditions, the vertical and horizontal rate of contamination migration is expected to be extremely low.

In summary, the design of the VCM removal action and 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 12B NFA proposal. Generally, COCs evaluated in this risk assessment include all detected organics and radionuclides and all inorganic COCs that were analyzed for. If the detection limit of an organic compound was too high (could possibly cause an adverse effect to human health or the environment), the compound was retained. Nondetect organics not included in this assessment were determined to have sufficiently low detection limits to ensure protection of human health and the environment. In order to provide conservatism in this risk assessment, the calculation uses only the maximum concentration value of each COC determined for the entire site. The 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 proposed RCRA Subpart S action levels (IT July 1994).

This risk assessment does not include nonradiological inorganics that are essential nutrients such as iron, magnesium, calcium, potassium, and sodium (EPA 1989). Both radiological and nonradiological COCs are evaluated. The nonradiological COCs evaluated include HEs, VOCs, SVOCs, and inorganics.

Table 3 lists nonradiological COCs for the human health and ecological risk assessment at SWMU 12B. Table 4 lists radiological COCs for human health and ecological risk assessment. All tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997, Zamorski December 1997). Sections VI.4, VII.2 and VII.3 discuss Tables 3 and 4.

#### **V. Fate and Transport**

The primary releases of COCs at SWMU 12B were to surface and subsurface soils associated with a buried debris site. Wind, water, and biota are natural mechanisms of COC transport from the primary release point. Because the site is situated within Lurance Canyon in the Manzanita Mountains and is surrounded by woodland vegetation, it is protected from strong winds at the ground surface. Therefore, wind is probably not a significant transport mechanism for COCs adsorbed to soil particles. However, because the COCs at this site may include VOCs and SVOCs, moderate and light wind will be important in transporting COCs that volatilize at the soil surface.

Surface water runoff at this site can transport COCs, either directly in solution or adsorbed to surface soil particles being transported. The SWMU 12B debris burial site had been an arroyo bed before being graded over. Site remediation has restored the channel of this drainage, connecting the natural channel above the site with the main arroyo channel of Lurance Canyon below the site (a tributary to Arroyo del Coyote in the lower part of the canyon). Water at SWMU 12B is therefore received both as precipitation (rain or occasionally snow) and as periodic, ephemeral surface flow in this channel from the upper part of the drainage. The slopes of this drainage are expected to produce runoff during intense rainfall events and during extended rainfall periods when soils are near saturation from previous rainfall. Runoff produced on the site from local precipitation will also flow into this channel.



**Table 3**  
**Nonradiological COCs for Human Health and Ecological Risk Assessment at SWMU 12B with**  
**Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K<sub>ow</sub>**  
 (Note: Several samples were collected from 0–8 feet; however, all maximums were found at 0–5 feet)

COC Name	Maximum Concentration (mg/kg)	SNL/NM Background Concentration (mg/kg) <sup>a</sup>	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Log K <sub>ow</sub> (for organic COCs)	Is COC a Bioaccumulator? (BCF>40, Log K <sub>ow</sub> >4) <sup>b</sup>
Arsenic	5.6	9.8	Yes	44 <sup>c</sup>	NA	Yes
Barium	370 J	246	No	170 <sup>d</sup>	NA	Yes
Beryllium	0.68	0.75	Yes	19 <sup>c</sup>	NA	No
Cadmium	0.82	0.64	No	64 <sup>c</sup>	NA	Yes
Chromium, total	15.3 J	18.8	Yes	16 <sup>c</sup>	NA	No
Lead	190 J	18.9	No	49 <sup>c</sup>	NA	Yes
Mercury	0.06 <sup>e</sup>	0.055	No	5500 <sup>c</sup>	NA	Yes
Selenium	2.3 J	3	Yes	800 <sup>f</sup>	NA	Yes
Silver	0.06 <sup>e</sup>	<0.5	Unknown	0.5 <sup>c</sup>	NA	No
1,1-Dichloroethene	0.0011 J	NA	NA	--	2.13 <sup>g</sup>	No
1,4-Dichlorobenzene	0.0012 J	NA	NA	55.6 <sup>c</sup>	3.52 <sup>o</sup>	Yes
2-Butanone	0.023	NA	NA	1 <sup>i</sup>	0.29 <sup>j</sup>	No
2-Hexanone	0.0025 J	NA	NA	6 <sup>j</sup>	1.38 <sup>j</sup>	No
2-Chloroethylvinyl ether	0.001 J	NA	NA	5 <sup>j</sup>	0.99 <sup>j</sup>	No
Acetone	0.027 B	NA	NA	0.69 <sup>j</sup>	-0.24 <sup>j</sup>	No
Chloroform	0.0081	NA	NA	10.35 <sup>j</sup>	1.92 <sup>g</sup>	No
Methylene chloride	0.0051	NA	NA	5 <sup>j</sup>	1.25 <sup>j</sup>	No
Tetrachloroethene	0.0022 J	NA	NA	49 <sup>j</sup>	2.67 <sup>g</sup>	Yes
Toluene	0.0016 J	NA	NA	10.7 <sup>c</sup>	2.69 <sup>c</sup>	No
Trichloroethene	0.0028 J	NA	NA	10.6 <sup>c</sup>	2.29 <sup>c</sup>	No
Trichlorofluoromethane	0.0015 J	NA	NA	25 <sup>j</sup>	2.53 <sup>j</sup>	No
Vinyl Chloride	0.0064	NA	NA	7 <sup>k</sup>	1.38 <sup>k</sup>	No
p,m-Xylene	0.0018 J	NA	NA	23.4 <sup>h</sup>	1.5 <sup>g</sup>	No
bis (2-Ethylhexyl) phthalate	1.3	NA	NA	851 <sup>k</sup>	7.6 <sup>g</sup>	Yes

Refer to footnotes at end of table.

**Table 3 (Concluded)**  
**Nonradiological COCs for Human Health and Ecological Risk Assessment at SWMU 12B with**  
**Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log  $K_{ow}$**   
 (Note: Several samples were collected from 0–8 feet; however, all maximums were found at 0–5 feet)

COC Name	Maximum Concentration (mg/kg)	SNL/NM Background Concentration (mg/kg) <sup>a</sup>	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Log $K_{ow}$ (for organic COCs)	Is COC a Bioaccumulator? (BCF>40, Log $K_{ow}$ >4) <sup>b</sup>
2,4-Dinitrotoluene	0.00072	NA	NA	204 <sup>g</sup>	1.98 <sup>g</sup>	Yes
2,6-Dinitrotoluene	0.00084	NA	NA	5,225 <sup>g</sup>	1.72 <sup>g</sup>	Yes

<sup>a</sup>From Zamorski (December 1997).

<sup>b</sup>From NMED (March 1998).

<sup>c</sup>BCF and/or Log  $K_{ow}$  from Yanicak (March 1997).

<sup>d</sup>BCF from Neumann (1976).

<sup>e</sup>Parameter nondetect, concentration assumed to be one-half of detection limit.

<sup>f</sup>BCF from Callahan et al. (1979).

<sup>g</sup>BCF and/or Log  $K_{ow}$  from Micromedex (1998).

<sup>h</sup>From NMED (May 1998).

<sup>i</sup>BCF and/or Log  $K_{ow}$  from Howard (1990).

<sup>j</sup>BCF and/or Log  $K_{ow}$  from Howard (1993).

<sup>k</sup>BCF and/or Log  $K_{ow}$  from Howard (1989).

B = Analyte detected in associated blank.

BCF = Bioconcentration factor.

COC = Constituent of concern.

J = Estimated concentration.

$K_{ow}$  = Octanol-water partition coefficient.

Log = Logarithm (base 10).

mg/kg = Milligram(s) per kilogram.

NA = Not applicable (organic COCs do not have accepted background concentrations).

NMED = New Mexico Environment Department.

SNL/NM = Sandia National Laboratories/New Mexico

SWMU = Solid waste management unit.

-- = Information not available.

**Table 4**  
**Radiological COCs for Human Health and Ecological Risk Assessment at SWMU 12B with**  
**Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K<sub>ow</sub>**

<b>COC Name</b>	<b>Maximum Concentration (pCi/g)</b>	<b>SNL/NM Background Concentration (pCi/g)<sup>a</sup></b>	<b>Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?</b>	<b>BCF (maximum aquatic)</b>	<b>Is COC a Bioaccumulator?<sup>b</sup> (BCF&gt;40, Log K<sub>ow</sub>&gt;4)</b>
Cs-137	0.43	0.52	Yes	3000 <sup>c</sup>	Yes
Th-232	0.86	1.03	Yes	3000 <sup>d</sup>	No <sup>b</sup>
U-235	1.07	0.16	No	900 <sup>d</sup>	Yes <sup>d</sup>
U-238	57.9	2.31	No	900 <sup>d</sup>	Yes <sup>d</sup>

<sup>a</sup>From Dinwiddie (September 1997).

<sup>b</sup>From NMED (March 1998).

<sup>c</sup>BCF from Yanicak (March 1997).

<sup>d</sup>From Baker and Soldat (1992).

BCF = Bioconcentration factor.

COC = Constituent of concern.

K<sub>ow</sub> = Octanol-water partition coefficient.

Log = Logarithm (base 10).

NMED = New Mexico Environment Department.

pCi/g = Picocurie(s) per gram.

SNL/NM = Sandia National Laboratories/New Mexico.

SWMU = Solid waste management unit.

Infiltration at the site is enhanced by the coarse texture of the canyon soils (Tesajo-Millett stony sandy loam [USDA June 1977]). Water that infiltrates into the soil will continue to percolate through the soil until field capacity is reached. Based upon observations made during the installation of a piezometer in the arroyo channel immediately above SWMU 12B, the alluvium above the bedrock is 57 feet in thickness. Moist soil was observed in the first 5 feet of alluvium, and the remaining 52 feet (to bedrock) were dry. The Burn Site Well, about 500 feet southeast of the site, did not encounter groundwater until 230 feet below ground surface. Therefore, infiltration from the arroyo does not appear to be sufficient to contact groundwater in the area of the Lurance Canyon Burn Site.

Plant roots can take up COCs that are in the soil. These COCs may be transported to the aboveground tissues with the xylem stream and may then be consumed by herbivores or returned to the soil as litter. Aboveground litter is capable of transport by wind until consumed by decomposer organisms in the soil. Constituents in plant tissues that are consumed by herbivores may pass through the gut and be returned to the soil (at the site or transported from the site in the herbivore) in feces, or be absorbed into tissues and held, metabolized, or later excreted. The herbivore may be eaten by a primary carnivore or scavenger and the constituents still held in the consumed tissues will repeat the sequence of absorption, metabolism, excretion, and consumption by higher predators, scavengers, and decomposers. The potential for transport of the constituents within the food chain is dependent upon the mobility of the species that comprise the food chain and the potential for the constituent to be transferred across the links in the food chain. Although SWMU 12B has been highly disturbed and is essentially bare of vegetation, downstream areas are vegetated and some recovery of vegetation along the channel is expected to occur. Therefore, food chain uptake is a potential transport mechanism at this site.

Degradation of COCs at SWMU 12B may result from biotic or abiotic processes. Inorganic COCs at this site are elemental in form and are therefore not considered to be degradable. Radiological COCs, however, undergo decay to stable isotopes or radioactive daughter elements. Other transformations of inorganics may 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 organics (HE, VOCs, and SVOCs) may 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 may occur in the soil solution. Biotransformation is the result of metabolic breakdown of the compound by plants, animals, and microorganisms.

Table 5 summarizes the fate and transport processes that may occur at SWMU 12B. Because the site is situated within the Lurance Canyon, and is therefore sheltered by surrounding slopes and woodland vegetation, significant transport of soil particles by wind is unlikely. The loss of organic COCs at the soil surface through volatilization and photolysis may be significant. Transport of COCs in the surface soil by surface water runoff may also be significant due to the restored drainage channel on the site. Subsurface migration of COCs from this channel bed,

**Table 5**  
**Summary of Fate and Transport at SWMU 12B**

<b>Transport and Fate Mechanism</b>	<b>Existence at Site</b>	<b>Significance</b>
Wind	Yes	Low
Surface runoff	Yes	Moderate
Migration to groundwater	No	None
Food chain uptake	Yes	Low
Transformation/degradation	Yes	Low (inorganics and radionuclides) Moderate to high (organics)

SWMU = Solid waste management unit.

however, is not significant and is highly unlikely to contact groundwater. For inorganic COCs, the potential for degradation and/or transformation is very low and decay of radiological COCs is insignificant due to their long half lives. The potential for degradation and/or biotransformation of the VOCs and SVOCs is moderate to high. Food chain transfers are not expected to be significant for the COCs because of the lack of ecological receptors at this site.

## **VI. Human Health Risk Screening Assessment**

### **VI.1 Introduction**

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

Step 1.	Site data are described that provide information on the potential COCs, as well as the relevant physical characteristics and properties of the site.
Step 2.	Potential pathways are identified by which a representative population might be exposed to the COCs.
Step 3.	The potential intake of these COCs by the representative population is calculated using a tiered approach. The first component of the tiered approach includes two screening procedures. One screening procedure compares the maximum concentration of the COC to an SNL/NM maximum background screening value. COCs that are not eliminated during the first screening procedure are subjected to a second screening procedure that compares the maximum concentration of the COC to the SNL/NM proposed Subpart S action level.
Step 4.	Toxicological parameters are identified and referenced for COCs that were not eliminated during the screening steps.
Step 5.	Potential toxicity effects (specified as a hazard index [HI]) and excess cancer risks are calculated for nonradiological COCs and background. For radiological COCs, the incremental total effective dose equivalent (TEDE) and incremental estimated cancer risk are calculated by subtracting applicable background concentrations directly from maximum on-site contaminant values. This background subtraction only occurs when a radiological COC occurs as contamination and exists as a natural background radionuclide.

Step 6.	These values are compared with guidelines established by the U.S. Environmental Protection Agency (EPA) and DOE to determine whether further evaluation, and potential site clean-up, 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 12B. Section II presents the comparison of results to DQOs. Section III describes the determination of the nature, rate, and extent of contamination.

VI.3 Step 2. Pathway Identification

SWMU 12B 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 pathway for nonradiologicals only). Soil ingestion is included for the radiological COCs as well. No water pathways to the groundwater are considered. Depth to groundwater at SWMU 12B is approximately 230 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, discussed in this section, includes two screening procedures. The first screening procedure is a comparison of the maximum COC concentration to the background screening level. The second screening procedure compares maximum COC concentrations to SNL/NM proposed Subpart S action levels. This second procedure 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 SNL/NM maximum screening level for this area. SNL/NM has been verbally informed that all the metals background values from the Canyons Study, with the exception of selenium, will be approved (NMED May 1998). Samples have been collected to resolve the selenium issue. The SNL/NM maximum background concentration is selected to provide the background screen in Table 3 and used to calculate risk attributable to background in Table 9. Only the COCs that are above their respective 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 SNL/NM background screening levels, background values are subtracted from the individual maximum radionuclide concentrations. Those that do not exceed these background levels are carried no 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 Results

Tables 3 and 4 present a comparison of SWMU 12B maximum COC concentrations to the SNL/NM maximum background values (Dinwiddie September 1997, Zamorski December 1997) for the human health risk assessment. For the nonradiological COCs, four COCs exceeded their respective background screening levels. One nonradiological COC has no quantifiable background concentration, so it is not known whether that COC exceeded background. Seventeen of the COCs are organic compounds and do not have background screening levels.

The maximum concentration value for lead is 190 J milligrams per kilogram (mg/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.

For the radiological COCs, two constituents had maximum measured activities greater than their respective background (U-235 and U-238). Each was only slightly above its respective background comparison value.

## 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 July 1990) and Risk Assessment Guidance for Superfund (RAGS) (EPA 1989) documentation. Accordingly, all calculations were based upon the assumption that receptor doses from both toxic and potentially carcinogenic compounds result most significantly from ingestion of contaminated soil. Because the samples were all taken from the surface and near-surface, this assumption is considered valid. If there were ten or fewer COCs and each had a maximum concentration 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 12B 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 12B 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) (EPA 1998a), Health Effects Assessment Summary Tables (HEAST) (EPA 1997a), and EPA Region 9 (EPA 1996b) and EPA Region 3 (EPA 1997c) 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 1988).



**Table 6**  
**Toxicological Parameter Values for SWMU 12B Nonradiological COCs**

COC Name	RfD <sub>o</sub> (mg/kg-day)	Confidence <sup>a</sup>	RfD <sub>inh</sub> (mg/kg-day)	Confidence <sup>a</sup>	SF <sub>o</sub> (mg/kg-day) <sup>-1</sup>	Sf <sub>inh</sub> (mg/kg-day) <sup>-1</sup>	Cancer Class <sup>b</sup>
Barium	7E-2 <sup>c</sup>	M	1.4E-4 <sup>e</sup>	--	--	--	--
Cadmium	5E-4 <sup>c</sup>	H	5.7E-5 <sup>e</sup>	--	--	6.3E+0 <sup>c</sup>	B1
Mercury	3E-4 <sup>d</sup>	--	8.6E-5 <sup>c</sup>	M	--	--	D
Silver	5E-3 <sup>c</sup>	L	--	--	--	--	D
1,1-Dichloroethene	9E-3 <sup>c</sup>	M	9E-3 <sup>e</sup>	--	6E-1 <sup>c</sup>	1.8E-1 <sup>c</sup>	C
1,4-Dichlorobenzene	2.3E-1 <sup>e</sup>	--	2.3E-1 <sup>c</sup>	M	2.4E-2 <sup>d</sup>	2.4E-2 <sup>e</sup>	--
2-Butanone	6E-1 <sup>c</sup>	L	2.9E-1 <sup>c</sup>	L	--	--	D
2-Hexanone	4E-2 <sup>f</sup>	--	--	--	--	--	--
2-Chloroethyl-vinylether	2.5E-2 <sup>f</sup>	--	--	--	--	--	--
Acetone	1E-1 <sup>c</sup>	L	1E-1 <sup>e</sup>	--	--	--	D
Chloroform	1E-2 <sup>c</sup>	M	1E-2 <sup>e</sup>	--	6.1E-3 <sup>c</sup>	8.1E-2 <sup>c</sup>	B2
Methylene chloride	6E-2 <sup>c</sup>	M	8.6E-1 <sup>d</sup>	--	7.5E-3 <sup>c</sup>	1.7E-3 <sup>c</sup>	B2
Tetrachloroethene	1E-2 <sup>c</sup>	M	1E-2 <sup>e</sup>	--	5.2E-2 <sup>e</sup>	2E-3 <sup>e</sup>	--
Toluene	2E-1 <sup>c</sup>	M	1.1E-1 <sup>c</sup>	M	--	--	D
Trichloroethene	6E-3 <sup>e</sup>	--	6E-3 <sup>e</sup>	--	1.1E-2 <sup>e</sup>	6E-3 <sup>e</sup>	--
Trichlorofluoromethane	3E-1 <sup>c</sup>	M	2E-1 <sup>e</sup>	--	--	--	--
Vinyl Chloride	--	--	--	--	1.9E+0 <sup>d</sup>	3E-1 <sup>d</sup>	--
p,m-Xylene <sup>g</sup>	2E+0 <sup>c</sup>	M	2E-1 <sup>e</sup>	--	--	--	D
bis (2-Ethylhexyl) phthalate	2E-2 <sup>e</sup>	--	2.2E-2 <sup>e</sup>	--	1.4E-2 <sup>e</sup>	1.4E-2 <sup>e</sup>	--
2,4-Dinitrotoluene	2E-3 <sup>c</sup>	H	2E-3 <sup>e</sup>	--	6.8E-1 <sup>c</sup>	6.8E-1 <sup>e</sup>	B2
2,6-Dinitrotoluene	1E-3 <sup>d</sup>	--	1E-3 <sup>e</sup>	--	6.8E-1 <sup>c</sup>	6.8E-1 <sup>e</sup>	B2

<sup>a</sup>Confidence associated with IRIS (EPA 1998) database values. Confidence: L = low, M = medium, H = high.

<sup>b</sup>EPA weight-of-evidence classification system for carcinogenicity (EPA 1989) taken from IRIS (EPA 1998):

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.

<sup>c</sup>Toxicological parameter values from IRIS electronic database (EPA 1998a).

<sup>d</sup>Toxicological parameter values from HEAST database (EPA 1997a).

<sup>e</sup>Toxicological parameter values from EPA Region 9 electronic database (EPA 1996b).

<sup>f</sup>Toxicological parameter values from EPA Region 3 electronic database (EPA 1997c).

<sup>g</sup>Toxicological values are for xylene, mixture.

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-day)<sup>-1</sup> = Per milligram per kilogram day.

RfD<sub>inh</sub> = Inhalation chronic reference dose.

RfD<sub>o</sub> = Oral chronic reference dose.

SF<sub>inh</sub> = Inhalation slope factor.

SF<sub>o</sub> = Oral slope factor.

SWMU = Solid waste management unit.

-- = Information not available.

**Table 7**  
**Radiological Toxicological Parameter Values for SWMU 12B COCs Obtained from**  
**RESRAD Risk Coefficients<sup>a</sup>**

<b>COC Name</b>	<b>SF<sub>o</sub></b> <b>(1/pCi)</b>	<b>Sf<sub>inh</sub></b> <b>(1/pCi)</b>	<b>Sf<sub>ev</sub></b> <b>(g/pCi-yr)</b>	<b>Cancer Class<sup>b</sup></b>
U-238	6.20E-11	1.20E-08	6.60E-08	<b>A</b>
U-235	4.70E-11	1.30E-08	2.70E-07	<b>A</b>

<sup>a</sup>From Yu et al. (1993a).

<sup>b</sup>EPA weight-of-evidence classification system for carcinogenicity (EPA 1989): A - human carcinogen.

1/pCi = One per picocurie

COC = Constituent of concern.

EPA = U.S. Environmental Protection Agency.

g/pCi-yr = Gram(s) per picocurie-year

SF<sub>ev</sub> = External volume exposure slope factor.

SF<sub>inh</sub> = Inhalation slope factor.

SF<sub>o</sub> = Oral (ingestion) slope factor

SWMU = Solid waste management unit.

- 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" (*Health Physics* 28:193-205 [Kocher 1983]) and in ANL/EAIS-8, "Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil" (Yu et al. 1993a).

## 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. 1993b).

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 12B nonradiological COCs and an excess cancer risk of  $2E-8$  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  $1E-11$  assuming the maximum background concentrations of the SWMU 12B associated background constituents for the designated recreational land-use scenario.

For the radiological COCs, contribution from the direct gamma exposure pathway is included. For the recreational land-use scenario, a TEDE was calculated for an individual who spends 4 hours per week on the site. This resulted in an incremental TEDE of 0.19 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 1997b), an incremental TEDE of 15 mrem/yr is used for the probable land-use scenario (recreational in this case); the calculated dose value for SWMU 12B for the recreational land use is well below this guideline. The estimated excess cancer risk is  $2.6E-6$ . The estimated excess cancer risk is  $5.6E-5$ . The excess cancer risk from the nonradiological COCs and the radiological COCs is not additive, as noted in the RAGS (EPA 1989).

For the residential land-use scenario nonradioactive COCs, the HI is 0.8, and the excess cancer risk is  $1E-5$  (Table 8). The numbers in the table included exposure from soil ingestion, dust and volatile inhalation, and plant uptake. Although the EPA (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 12B associated background constituents, the HI is 0.7 and the excess cancer risk is  $4E-10$ .

For the radiological COCs, the incremental TEDE for the residential land-use scenario is 4.49 mrem/yr. The guideline being used is an excess TEDE of 75 mrem/yr (SNL/NM February 1998) for a complete loss of institutional controls (residential land use in this case); the calculated dose value for SWMU 12B for the residential land-use scenario is well below this guideline. Consequently, SWMU 12B 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.

**Table 8**  
**Risk Assessment Values for SWMU 12B Nonradiological COCs**

COC Name	Maximum Concentration (mg/kg)	Recreational Land-Use Scenario <sup>a</sup>		Residential Land-Use Scenario <sup>a</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Barium	370 J	0.00	--	0.06	--
Cadmium	0.82	0.00	2E-11	0.67	5E-10
Mercury	0.06 <sup>b</sup>	0.00	--	0.10	--
Silver	0.06 <sup>b</sup>	0.00	--	0.00	--
1,1-Dichloroethene	0.0011 J	0.00	7E-10	0.00	3E-7
1,4-Dichlorobenzene	0.0012 J	0.00	9E-12	0.00	2E-9
2-Butanone	0.023	0.00	--	0.00	--
2-Hexanone	0.0025 J	0.00	--	0.00	--
2-Chloroethyl-vinylether	0.001 J	0.00	--	0.00	--
Acetone	0.027 B	0.00	--	0.00	--
Chloroform	0.0081	0.00	1E-9	0.00	5E-8
Methylene chloride	0.0051	0.00	2E-11	0.00	4E-8
Tetrachloroethene	0.0022 J	0.00	1E-11	0.00	2E-8
Toluene	0.0016 J	0.00	--	0.00	--
Trichloroethene	0.0028 J	0.00	2E-11	0.00	8E-9
Trichlorofluoro-methane	0.0015 J	0.00	--	0.00	--
Vinyl chloride	0.0064	0.00	2E-8	0.00	1E-5
p,m-Xylene <sup>c</sup>	0.0018 J	0.00	--	0.00	--
bis (2-Ethylhexyl) phthalate	1.3	0.00	7E-10	0.00	3E-8
2,4-Dinitrotoluene	0.00072	0.00	2E-11	0.00	9E-10
2,6-Dinitrotoluene	0.00084	0.00	3E-11	0.00	1E-9
<b>Total</b>		<b>0.00</b>	<b>2E-8</b>	<b>0.8</b>	<b>1E-5</b>

<sup>a</sup>From EPA (1989).

<sup>b</sup>Parameter nondetect, concentration assumed to be 0.5 of detection limit.

<sup>c</sup>Toxicological values used in calculations are for xylene, mixture.

- B = Analyte detected in associated blank.  
 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 12B Nonradiological Background Constituents**

COC Name	Background Concentration <sup>a</sup> (mg/kg)	Recreational Land-Use Scenario <sup>b</sup>		Residential Land-Use Scenario <sup>b</sup>	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Barium	246	0.00	--	0.04	--
Cadmium	0.64	0.00	1E-11	0.52	4E-10
Mercury	0.055	0.00	--	0.09	--
Silver	<0.5	--	--	--	--
<b>Total</b>		<b>0.00</b>	<b>1E-11</b>	<b>0.7</b>	<b>4E-10</b>

<sup>a</sup>From Zamorski (December 1997).

<sup>b</sup>From EPA (1989).

COC = Constituent of concern.

EPA = U.S. Environmental Protection Agency

SWMU = Solid waste management unit.

-- = Information not available.

#### 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 2E-8. 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 B carcinogens and less than 1E-5 for Class C carcinogens (NMED March 1998). The excess cancer risk is driven by vinyl chloride, which is not currently classified. However, assuming the most stringent classification (A), the excess cancer risk for this site is below the suggested acceptable risk value of 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 1E-11. Incremental risk is determined by subtracting risk associated with background from potential COC risk. These numbers are not rounded before the difference is determined and, therefore, may appear to be inconsistent with numbers presented in tables and within the text. Incremental HI is 0.00, and the incremental cancer risk is 2.1E-8 for the recreational land-use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs considering a recreational land-use scenario.

For radiological COCs of the recreational land-use scenario, incremental TEDE is 0.19 mrem/yr, which is significantly less than the EPA's numerical guideline of 15 mrem/yr. Incremental estimated excess cancer risk is 2.6E-6.

The calculated HI for the residential land-use scenario nonradiological COCs is 0.8, which is also below the numerical guidance. Excess cancer risk is estimated at  $1E-5$ . Excess cancer risk is driven by vinyl chloride which is currently not classified. Assuming the most restrictive class (A), 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 0.7 and the excess cancer risk is  $4E-10$ . The incremental HI is 0.18, and the incremental cancer risk is  $1E-5$  for the residential land-use scenario. The incremental excess cancer risk calculation indicates 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 4.49 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  $5.6E-5$ .

## VI.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at SWMU 12B was based upon an initial conceptual model validated with the VCM activities at the site. The confirmatory sampling was implemented after the VCM action in accordance with the VCM Plan (SNL/NM, June 1997) which is consistent with NMED guidelines (NMED, March 1998). The DQOs contained in the VCM Plan (SNL/NM July July 1997) are appropriate for use in screening risk assessments. The clean-up action and data collected, based upon sample location, density, and depth are representative of the site. The analytical requirements and results satisfy the DQOs. Data quality was independently reviewed. Therefore, there is no uncertainty associated with the data quality used to perform the screening risk assessment at SWMU 12B.

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 and near-surface soils and because of the location and physical characteristics of the site, there is little uncertainty in the exposure pathways relevant to the analysis.

A reasonable maximum exposure (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 EPA Region 9 (EPA 1996b) and EPA Region 3 (1997c) databases. Where values are not provided, information is not available from the HEAST (EPA 1997a), IRIS (EPA 1998a), or the EPA regions (EPA 1996b, EPA 1997c). Because of the conservative nature of the RME approach, uncertainties in toxicological values are not expected to change the conclusion from the risk assessment analysis.

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

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

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

## VI.9 Summary

SWMU 12B has identified COCs consisting of some inorganic, organic, and radiological compounds. Because of the location of the site, the designated recreational land-use scenario, and the nature of contamination, potential exposure pathways identified for this site included soil ingestion and dust and volatile inhalation for chemical constituents and soil ingestion, dust inhalation, and direct gamma exposure for radionuclides. Plant uptake was included as an exposure pathway for the residential land-use scenario.

Using conservative assumptions and 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  $2E-8$  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  $2.1E-8$  for the recreational land-use scenario. Incremental risk calculations indicate insignificant risk to human health for a recreational land-use scenario.

Incremental TEDE and corresponding estimated cancer risk from radiological COCs are much less than EPA guidance values; the estimated TEDE is 0.19 mrem/yr for the recreational land-use scenario. This value is much less than the numerical guidance of 15 mrem/yr in EPA guidance (EPA 1997b). The corresponding incremental estimated cancer risk value is  $2.6E-6$  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 4.49 mrem/yr with an associated risk of  $5.6E-5$ . The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, SWMU 12B is eligible for unrestricted radiological release.

Uncertainties associated with the calculations are considered small relative to the conservativeness of risk assessment analysis. It is, therefore, concluded that this site does not have potential to 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 12B. A component of the NMED Risk-Based Decision Tree is to conduct an ecological screening assessment that corresponds with that

presented in the 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 the scoping assessment (Section VII.2 of this report), with the exception of DQOs which are reviewed in Section II 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 conservatism 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 will involve a summary of the scoping results and a determination as to whether further examination of potential ecological impacts is necessary.

### VII.2.1 Data Assessment

As indicated in Section IV (Tables 3 and 4), constituents in soil within the 0- to 5-foot depth interval that exceeded background concentrations were as follows:

- Barium
- Cadmium
- Lead
- U-235
- U-238.

In addition, mercury and silver were not detected in soils from the site, but their detection limits exceeded the reported concentrations of these metals in background soil samples.

Organic analytes detected in soil include the following:

- 1,1-dichloroethene
- 1,4-dichlorobenzene
- 2-butanone
- 2-hexanone
- 2-chloroethylvinyl ether
- 2,4-dinitrotoluene



- 2,6-dinitrotoluene
- Acetone
- Bis(2-ethylhexyl)phthalate
- Chloroform
- Methylene chloride
- Tetrachloroethene
- Toluene
- Trichloroethene
- Trichlorofluormethane
- Vinyl chloride
- p,m-xylene.

### 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):

- Barium
- Cadmium
- Lead
- Mercury
- U-235
- U-238
- 1,4-dichlorobenzene
- 2,4-dinitrotoluene
- 2,6-dinitrotoluene
- Bis(2-ethylhexyl)phthalate
- Tetrachloroethene.

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 (BCFs) for aquatic species. Because only aquatic BCFs are used to evaluate the bioaccumulation potential for metals, bioaccumulation in terrestrial species is likely to be overpredicted.

### VII.2.3 Fate and Transport Potential

The potential for the COPECs to move from the source of contamination to other media or biota is discussed in Section V. As noted in Table 5 (Section V), surface-water runoff is expected to be of moderate significance, while wind dispersion and food chain uptake are expected to be of low significance for the COPECs at this site. For organic COPECs, the potential for biotransformation and degradation is considered of moderate to high significance at the site. For inorganics and radionuclides, degradation is of low significance. Migration to groundwater is not anticipated.

#### 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 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 [Environmental Restoration] Program” (IT July 1998) and are not duplicated here.

### VII.3.1.1 *Ecological Pathways and Setting*

SWMU 12B is located at the Lurance Canyon Burn Site in the upper part of the Lurance Canyon in the Manzanita Mountains. The site, which comprises approximately 0.3 acre, was a natural arroyo channel that had been filled by grading activities at the Burn Site. The site has recently been remediated and the drainage channel restored as part of a VCM. As a result, the area is highly disturbed, although ruderal and early successional vegetation is expected to become established at these site. The Burn Site is still active; however, wildlife receptors from the relatively undisturbed natural habitat (piñon-juniper woodland) that surrounds it may encroach on this SWMU or use it as a travel corridor. A biological and sensitive species survey of the Burn Site and surrounding areas was conducted in 1991, with no threatened, endangered, or sensitive species found (Biggs 1991a, 1991b).

Complete ecological pathways may exist at this site through the exposure of plants and wildlife to COPECs in surface and subsurface soil. Direct uptake of COPECs from soil was assumed to be the major route of exposure for plants, with exposure of plants to wind-blown soil assumed to be minor. Exposure modeling for the wildlife receptors was limited to the food and soil ingestion pathways. Because of the lack of surface water at this site, exposure to COPECs through the ingestion of surface water was considered insignificant. Inhalation and dermal contact were also considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Groundwater is not expected to be affected by COPECs at this site.

### VII.3.1.2 *COPECs*

The natural channel at SWMU 12B was filled beginning in about 1971. Waste (debris) associated with explosives and burn tests (SWMUs 65 and 94) may have been buried with the filling of this arroyo. Therefore, COPECs at SWMU 12B may include metals, HE, radionuclides, VOCs, and SVOCs. In order to provide conservatism in this ecological risk assessment, the assessment is based upon the maximum soil concentrations of the COPECs as measured in soil samples within the first 5 feet of soil. Both radiological and nonradiological COPECs are evaluated. The nonradiological COCs consist of inorganic analytes (i.e., metals) and a variety of SVOCs and VOCs. Inorganic analytes and radionuclides were screened against background concentrations, and those that exceeded the approved SNL/NM background screening levels (Dinwiddie September 24, 1997; Zamorski December 3, 1997) for the area were considered to be COPECs. Maximum COPEC concentrations are reported in Tables 3 and 4. Nonradiological inorganics that are essential nutrients such as iron, magnesium, calcium, potassium, and sodium were not included in this risk assessment per the EPA (1989).

### VII.3.1.3 *Ecological Receptors*

A nonspecific perennial plant was selected as the receptor to represent plant species at the site (IT July 1998). Vascular plants are the principal primary producers at the site and are key to the diversity and productivity of the wildlife community associate with the site. A deer mouse (*Peromyscus maniculatus*) and 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 as the top

predator. It is present in the grassland habitat at SNL/NM and is designated as 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). The burrowing owl is a small raptor and will therefore conservatively represent risk to other raptors potentially occurring in the woodland habitat, such as the western screech owl (*Otus kennicottii*).

### VII.3.2 Exposure Estimation

Direct uptake of COPECs 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 (or one-half the detection limit for mercury and silver) from soil samples within the 0- to 5-foot depth interval were used to conservatively estimate potential exposures and risks to plants and wildlife at this site.

For the radiological dose rate calculations, the deer mouse was modeled as an herbivore (100 percent of its diet as plants), and the burrowing owl was modeled as a strict predator on 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 U-235 and U-238. Internal and external dose rates to the deer mouse and burrowing owl are approximated using modified dose rate models from the *Hanford Site Risk Assessment Methodology* (DOE 1995) as presented in the ecological risk assessment methodology document for the SNL/NM ER Program (IT July 1998). Radionuclide-dependent data for the dose rate calculations were obtained from Baker and Soldat (1992). The external dose rate model examines the total-body dose rate to a receptor residing in soil exposed to radionuclides. The soil surrounding the receptor is assumed to be an infinite medium uniformly contaminated with gamma-emitting radionuclides. The external dose rate model is the same for both the deer mouse and the burrowing owl. The internal total-body dose rate model assumes that a fraction of the radionuclide concentration ingested by a receptor is absorbed by the body and concentrated at the center of a spherical body shape. This provides for a conservative estimate for absorbed dose. This concentrated radiation source at the center of the body of the

**Table 10**  
**Exposure Factors for Ecological Receptors at SWMU 12B**

Receptor Species	Class/Order	Trophic Level	Body Weight (kg) <sup>a</sup>	Food Intake Rate (kg/day) <sup>b</sup>	Dietary Composition <sup>c</sup>	Home Range (acres)
Deer Mouse ( <i>Peromyscus maniculatus</i> )	Mammalia/ Rodentia	Herbivore	2.39E-2 <sup>d</sup>	3.72E-3	Plants: 100% (+ Soil at 2% of intake)	2.7E-1 <sup>e</sup>
Deer Mouse ( <i>Peromyscus maniculatus</i> )	Mammalia/ Rodentia	Omnivore	2.39E-2 <sup>d</sup>	3.72E-3	Plants: 50% Invertebrates: 50% (+ Soil at 2% of intake)	2.7E-1 <sup>e</sup>
Deer Mouse ( <i>Peromyscus maniculatus</i> )	Mammalia/ Rodentia	Insectivore	2.39E-2 <sup>d</sup>	3.72E-3	Invertebrates: 100% (+ Soil at 2% of intake)	2.7E-1 <sup>e</sup>
Burrowing owl ( <i>Speotyto cunicularia</i> )	Aves/ Strigiformes	Carnivore	1.55E-1 <sup>f</sup>	1.73E-2	Rodents: 100% (+ Soil at 2% of intake)	3.5E+1 <sup>g</sup>

<sup>a</sup>Body weights are in kilograms wet weight.

<sup>b</sup>Food intake rates are estimated from the allometric equations presented in Nagy (1987). Units are kilograms dry weight per day.

<sup>c</sup>Dietary compositions are generalized for modeling purposes. Default soil intake value of 2% of food intake.

<sup>d</sup>From Silva and Downing (1995).

<sup>e</sup>EPA (1993), based upon the average home range measured in semiarid shrubland in Idaho.

<sup>f</sup>From Dunning (1993).

<sup>g</sup>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.

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 caused by exposure to radionuclides 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 presents benchmark toxicity values for the plant and wildlife receptors. For plants, the benchmark soil concentrations are based upon the lowest-observed-adverse-effect level (LOAEL). For wildlife, the toxicity benchmarks are based upon the no-observed-adverse-effect level (NOAEL) for chronic oral exposure in a taxonomically similar test species. Insufficient toxicity information was found to estimate the LOAELs or NOAELs for some COPECs for terrestrial plant life and wildlife receptors, respectively.

The benchmark used for exposure of terrestrial receptors to radiation was 0.1 rad/day. This value has been recommended by the International Atomic Energy Agency (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 per day should also offer sufficient protection to other components within the terrestrial habitat of SWMU 12B.

### VII.3.4 Risk Characterization

Maximum concentrations in soil and estimated dietary exposures were compared to plant and wildlife benchmark values, respectively. Results of these comparisons are presented in Table 14. HQs are used to quantify the comparison with benchmarks for plants and wildlife exposure.

Lead was the only analyte with an HQ exceeding unity for plants. Barium was the only analyte with an HQ exceeding unity for the deer mouse and this was only for the omnivorous and insectivorous exposure scenarios. Bis(2-ethylhexyl)phthalate resulted in an HQ greater than 1.0 for the burrowing owl, although HQs for the burrowing owl could not be determined for silver and most organics.

As directed by the NMED, HIs were calculated for each of the receptors (the HI is the sum of chemical-specific hazard quotients for all pathways for a given receptor). All receptors had HIs greater than unity, with a maximum HI of 9.4 for the burrowing owl.

Tables 15 and 16 summarize the internal and external dose rate model results for the two radionuclides. The total radiation dose rate to the deer mouse was predicted to be  $7.4E-4$  rad/day. Total dose rate to the burrowing owl was predicted to be  $3.8E-4$  rad/day. The

**Table 11**  
**Transfer Factors Used in Exposure Models for**  
**Constituents of Potential Ecological Concern at SWMU 12B**

Constituent of Potential Ecological Concern	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
<b>Inorganic</b>			
Barium	1.5E-1 <sup>a</sup>	1.0E+0 <sup>b</sup>	2.0E-4 <sup>c</sup>
Cadmium	5.5E-1 <sup>a</sup>	6.0E-1 <sup>d</sup>	5.5E-4 <sup>a</sup>
Lead	9.0E-2 <sup>c</sup>	4.0E-2 <sup>d</sup>	8.0E-4 <sup>c</sup>
Mercury	1.0E+0 <sup>c</sup>	1.0E+0 <sup>b</sup>	2.5E-1 <sup>a</sup>
Silver	1.0E+0 <sup>c</sup>	2.5E-1 <sup>d</sup>	5.0E-3 <sup>c</sup>
<b>Organic<sup>e</sup></b>			
1,1-Dichloroethene	2.3E+0	1.7E+1	2.9E-6
1,4-Dichloroethene	4.0E-1	2.0E+1	6.6E-5
2-Butanone	2.6E+1	1.4E+1	3.7E-8
2-Hexanone	6.2E+0	1.5E+1	4.9E-7
2-Chloroethylvinylether	1.0E+1	1.5E+1	1.9E-7
2,4-Dinitrotoluene	2.8E+0	1.7E+1	2.0E-6
2,6-Dinitrotoluene	3.9E+0	1.6E+1	1.1E-6
Acetone	5.3E+1	1.3E+1	1.0E-8
Bis(2-ethylhexyl)phthalate	2.3E-3	3.1E+1	6.4E-1
Chloroform	3.0E+0	1.6E+1	1.8E-6
Methylene chloride	7.3E+0	1.5E+1	3.6E-7
Tetrachloroethene	1.1E+0	1.8E+1	1.1E-5
Toluene	1.0E+0	1.8E+1	1.3E-1
Trichloroethene	1.1E+0	1.8E+1	1.2E-5
Trichlorofluoromethane	1.3E+0	1.8E+1	7.6E-6
Vinyl chloride	5.3E+0	1.6E+1	6.5E-7
Xylene	5.5E-1	1.9E+1	3.7E-5

<sup>a</sup>From Baes et al. (1984).

<sup>b</sup>Default value.

<sup>c</sup>NCRP (January 1989).

<sup>d</sup>From Stafford et al. (1991).

<sup>e</sup>Equations for the derivation of soil-to-plant and food-to-muscle transfer factors were obtained from Travis and Arms (1988). Equations used in the derivation of soil-to-invertebrate transfer factors were obtained from Connell and Markwell (1990).

SWMU = Solid waste management unit.

**Table 12**  
**Media Concentrations<sup>a</sup> for Constituents of**  
**Potential Ecological Concern at SWMU 12B**

Constituent of Potential Ecological Concern	Soil (maximum)	Plant Foliage <sup>b</sup>	Soil Invertebrate <sup>b</sup>	Deer Mouse Tissues <sup>c</sup>
<b>Inorganic</b>				
Barium	3.7E+2	5.6E+1	3.7E+2	1.4E-1
Cadmium	8.2E-1	4.5E-1	4.9E-1	8.4E-4
Lead	1.9E+2	1.7E+1	7.6E+0	4.0E-2
Mercury	6.0E-2 <sup>d</sup>	1.0E+0	6.0E-2	4.8E-2
Silver	6.0E-2 <sup>d</sup>	6.0E-2	1.5E-2	6.1E-4
<b>Organic</b>				
1,1-Dichloroethene	1.1E-3	2.5E-3	1.9E-2	9.6E-8
1,4-Dichlorobenzene	1.2E-3	4.8E-4	2.4E-2	2.5E-6
2-Butanone	2.3E-2	6.1E-1	3.1E-1	5.3E-8
2-Hexanone	2.5E-3	1.5E-2	3.9E-2	4.1E-8
2-Chloroethyl vinyl ether	1.0E-3	1.0E-2	1.5E-2	7.6E-9
2,4-Dinitrotoluene	7.2E-4	2.0E-3	1.2E-2	4.5E-8
2,6-Dinitrotoluene	8.4E-4	3.3E-3	1.4E-2	2.9E-8
Acetone	2.7E-2	1.7E+0	4.1E-1	3.4E-8
Bis(2-ethylhexyl)phthalate	1.3E+0	2.0E-3	4.1E+1	8.4E+1
Chloroform	8.1E-3	2.4E-2	1.3E-1	4.4E-7
Methylene chloride	5.1E-3	5.4E-2	1.1E-1	9.3E-8
Tetrachloroethene	2.2E-3	2.4E-3	3.9E-2	6.9E-7
Toluene	1.6E-3	1.6E-3	2.9E-2	6.1E-7
Trichloroethene	2.8E-3	2.9E-3	5.0E-2	1.0E-6
Trichlorofluoromethane	1.5E-3	2.0E-3	2.6E-2	3.4E-7
Vinyl chloride	6.4E-3	3.4E-2	1.0E-1	1.4E-7
Xylene	1.8E-3	9.9E-4	3.4E-2	2.1E-6

<sup>a</sup>In milligram(s) per kilogram.

<sup>b</sup>Product of the soil concentration and the corresponding transfer factor.

<sup>c</sup>Based upon the deer mouse with an omnivorous diet. Product of the average concentration in food times the food-to-muscle transfer factor times the wet weight-dry weight conversion factor of 3.125 (from EPA 1993).

<sup>d</sup>One-half of the reported detection limit.

SWMU = Solid waste management unit.



**Table 13**  
**Toxicity Benchmarks for Ecological Receptors at SWMU 12B**

Constituent of Potential Ecological Concern	Plant Benchmark <sup>a,b</sup>	Mammalian NOAELs			Avian NOAELs		
		Mammalian Test Species <sup>c,d</sup>	Test Species NOAEL <sup>d,e</sup>	Deer Mouse NOAEL <sup>e,f</sup>	Avian Test Species <sup>d</sup>	Test Species NOAEL <sup>d,e</sup>	Burrowing Owl NOAEL <sup>e,g</sup>
<b>Inorganic</b>							
Barium	500	Rat <sup>h</sup>	5.1	10.5	Chicks	20.8	20.8
Cadmium	3	Rat <sup>i</sup>	1.0	1.9	Mallard	1.45	1.45
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	34.8	--- <sup>j</sup>	---	---
<b>Organic</b>							
1,1-Dichloroethene	---	Rat <sup>k</sup>	29.3 <sup>k</sup>	58.7	---	---	---
1,4-Dichlorobenzene	---	Rat <sup>l</sup>	134 <sup>l</sup>	262	---	---	---
2-Butanone	---	Rat	1,771	3,460	---	---	---
2-Hexanone	---	Rat <sup>m</sup>	1,676 <sup>m</sup>	3,280	---	---	---
2-Chloroethyl vinyl ether	---	Rat <sup>n</sup>	8.6 <sup>n</sup>	16.8	---	---	---
2,4-Dinitrotoluene	---	Rat <sup>o</sup>	3.8 <sup>o</sup>	7.43	---	---	---
2,6-Dinitrotoluene	---	Rat <sup>p</sup>	7.2 <sup>o</sup>	14.1	---	---	---
Acetone	---	Rat	10	19.6	---	---	---
Bis(2-ethylhexyl)phthalate	---	Mouse	18.3	19.4	Ringed dove	1.1	1.1
Chloroform	---	Rat	15	29.3	---	---	---
Methylene chloride	---	Rat	5.85	11.4	---	---	---
Tetrachloroethene	---	Mouse	1.40	1.48	---	---	---
Toluene	200	Mouse	26.0	27.5	---	---	---
Trichloroethene	---	Mouse	0.70	0.74	---	---	---
Trichlorofluoromethane	---	Rat <sup>q</sup>	34.9 <sup>p</sup>	68.3	---	---	---

Refer to footnotes at end of table

**Table 13 (Concluded)  
Toxicity Benchmarks for Ecological Receptors at SWMU 12B**

Constituent of Potential Ecological Concern	Plant Benchmark <sup>a,b</sup>	Mammalian NOAELs			Avian NOAELs		
		Mammalian Test Species <sup>c,d</sup>	Test Species NOEL <sup>d,e</sup>	Deer Mouse NOEL <sup>e,f</sup>	Avian Test Species <sup>d</sup>	Test Species NOEL <sup>d,e</sup>	Burrowing Owl NOEL <sup>e,g</sup>
Vinyl chloride	---	Rat	0.33	0.17	---	---	---
Xylene	---	Mouse	2.22	2.1	---	---	---

<sup>a</sup>In milligram(s) per kilogram soil.

<sup>b</sup>From Efroymson et al. (1997).

<sup>c</sup>Body weights (in kilogram[s]) for the no-observed-adverse-effect level (NOAEL) conversion are as follows: lab mouse, 0.030; lab rat, 0.350 (except where noted).

<sup>d</sup>From Sample et al. (1996), except where noted.

<sup>e</sup>In milligram(s) per kilogram body weight per day.

<sup>f</sup>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.

<sup>g</sup>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.

<sup>h</sup>Body weight: 0.435 kilogram.

<sup>i</sup>Body weight: 0.303 kilogram.

<sup>j</sup>--- designates insufficient toxicity data.

<sup>k</sup>Test species NOAEL based upon the NOAEL for 1,2-dichloroethane (EPA 1998a) scaled to a rat body weight and rat LD<sub>50</sub> values for 1,2-dichloroethane and 1,1-dichloroethene (Micromedex 1998).

<sup>l</sup>Test species NOAEL based upon the rat NOAEL for 1,2-dichlorobenzene (EPA 1998a) and rat LD<sub>50</sub> values for 1,2-dichlorobenzene and 1,4-dichlorobenzene (Micromedex 1998).

<sup>m</sup>Test species NOAEL based upon the rat NOAEL for 2-butanone (EPA 1998a) and rat LD<sub>50</sub> values for 2-butanone and 2-hexanone (Micromedex 1998).

<sup>n</sup>Test species NOAEL based upon the rat subchronic NOAEL for ethyl ether (EPA 1998a) and rat LD<sub>50</sub> values for ethyl ether and 2-chloroethyl vinyl ether (Micromedex 1998).

<sup>o</sup>Based upon toxicity information from Etnier (1987).

<sup>p</sup>Based upon a chronic LOAEL (EPA 1998a) and an uncertainty factor of 0.1.

**Table 14**  
**Hazard Quotients for Ecological Receptors at SWMU 12B**

Constituent of Potential Ecological Concern	Plant HQ	Deer Mouse HQ (Herbivorous)	Deer Mouse HQ (Omnivorous) <sup>a</sup>	Deer Mouse HQ (Insectivorous)	Burrowing Owl HQ
<b>Inorganic</b>					
Barium	7.4E-1	9.3E-1	<b>3.3E+0<sup>a</sup></b>	<b>5.6E+0</b>	4.0E-2
Cadmium	2.7E-1	3.9E-2	4.0E-2	4.2E-2	1.3E-3
Lead	<b>3.8E+0</b>	2.1E-1	1.6E-1	1.1E-1	1.1E-2
Mercury (inorganic)	2.0E-1	6.8E-4	6.8E-4	6.8E-4	1.2E-2
Mercury (organic)	2.0E-1	1.5E-1	1.5E-1	1.5E-1	8.5E-1
Silver	3.0E-2	2.7E-4	1.7E-4	7.3E-5	--- <sup>b</sup>
<b>Organic</b>					
1,1-Dichloroethene	---	6.7E-6	2.8E-5	4.9E-5	---
1,4-Dichlorobenzene	---	3.0E-7	7.1E-6	1.4E-5	---
2-Butanone	---	2.7E-5	2.1E-5	1.4E-5	---
2-Hexanone	---	7.4E-7	1.3E-6	1.8E-6	---
2-Chloroethyl vinyl ether	---	9.6E-5	1.2E-6	1.4E-4	---
2,4-Dinitrotoluene	---	4.2E-5	1.5E-4	2.5E-4	---
2,6-Dinitrotoluene	---	3.7E-5	9.3E-5	1.5E-4	---
Acetone	---	1.4E-2	8.4E-3	3.3E-3	---
Bis(2-ethylhexyl)phthalate	---	2.3E-4	1.7E-1	3.3E-1	<b>8.5E+0</b>
Chloroform	---	1.3E-4	4.2E-4	7.1E-6	---
Methylene chloride	---	7.3E-4	1.1E-3	1.5E-3	---
Tetrachloroethene	---	2.6E-4	2.2E-3	4.1E-3	---
Toluene	8.0E-6	9.2E-6	8.6E-5	1.6E-4	---
Trichloroethene	---	6.3E-4	5.6E-3	1.1E-2	---
Trichlorofluoromethane	---	4.6E-6	3.2E-5	6.0E-5	---
Vinyl chloride	---	1.6E-2	3.1E-2	4.7E-2	---
Xylene	---	7.2E-5	1.2E-3	2.4E-3	---
<b>HI<sup>c</sup></b>	<b>5.0E+0</b>	<b>1.4E+0</b>	<b>3.6E+0</b>	<b>6.3E+0</b>	<b>9.4E+0</b>

<sup>a</sup> **Bold text** indicates HQ or HI exceeds unity.

<sup>b</sup> --- designates insufficient toxicity data available for risk estimation purposes.

<sup>c</sup> The HI is the sum of individual hazard quotients using the value for organic mercury as a conservative estimate of the HI.

HI = Hazard index.

HQ = Hazard quotient.

SWMU = Solid waste management unit.

**Table 15**  
**Internal and External Dose Rates for**  
**Deer Mice Exposed to Radionuclides at SWMU 12B**

<b>Radionuclide</b>	<b>Maximum Concentration (pCi/g)</b>	<b>Internal Dose (rad/day)</b>	<b>External Dose (rad/day)</b>	<b>Total Dose (rad/day)</b>
U-235	1.1E+0	1.2E-5	1.7E-5	2.9E-5
U-238	5.8E+1	5.9E-4	1.2E-4	7.1E-4
Total		6.0E-4	1.4E-4	7.4E-4

pCi/g = Picocurie(s) per gram.

SWMU = Solid waste management unit.

**Table 16**  
**Internal and External Dose Rates for**  
**Burrowing Owls Exposed to Radionuclides at SWMU 12B**

<b>Radionuclide</b>	<b>Maximum Concentration (pCi/g)</b>	<b>Internal Dose (rad/day)</b>	<b>External Dose (rad/day)</b>	<b>Total Dose (rad/day)</b>
U-235	1.1+0	4.7E-6	1.7E-5	2.2E-5
U-238	5.8E+1	2.4E-4	1.2E-4	3.6E-4
Total		2.4E-4	1.4E-4	3.8E-4

pCi/g = Picocurie(s) per gram.

SWMU = Solid waste management unit.

external dose rate due to exposure to these radionuclides for both receptors is the primary contributor to the total dose rate. 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 12B. These uncertainties result from assumptions used in calculating risk that may 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. Conservatism incorporated into this risk assessment include the use of maximum measured analyte concentrations in soil or one-half the detection limit 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 Program (IT July 1998).

Uncertainties associated with the estimation of risk to ecological receptors following exposure to U-235 and U-238 are primarily related to those inherent in the radionuclide-specific data. Radionuclide-dependent data are measured values that have their associated errors, which are typically negligible. The dose rate models used for these calculations are based upon conservative estimates on receptor shape, radiation absorption by body tissues, and intake parameters. The goal is to provide a realistic but conservative estimate of a receptor's exposure to radionuclides in soil, both internally and externally.

One large uncertainty associated with the prediction of ecological risks at this site is the use of the maximum measured concentrations in soil to evaluate risk. This results in a conservative exposure scenario that does not necessarily reflect actual site conditions. This is also true with regard to the use of detection limits in the estimation of risk.

The assumption of an area use factor of 1.0 is a source of uncertainty for the burrowing owl. Because SWMU 12B is less than one acre in size, an area use factor of less than 1.0 would be justified for this receptor. This is sufficient to reduce the HQ for bis(2-ethylhexyl)phthalate well below unity.

Analytical data were examined more closely to assess variability within the data. Barium was detected in all 57 soil samples collected from the site. Concentrations ranged from 71 to 370 mg/kg with an average concentration of 134 mg/kg. Bis(2-ethylhexyl)phthalate was only detected in 1 of 40 samples. It appears that use of maximum detected concentrations in the estimation of exposure and risk overpredicts actual exposure of the receptors to these constituents at the site.

In the estimation of ecological risk, background concentrations are included as a component of maximum on-site concentrations. Table 17 illustrates risk estimates associated with exposure of each of the receptors to background concentrations of the metal COPECs. With respect to

**Table 17**  
**HQs for Ecological Receptors Exposed to Background Concentrations for SWMU 12B**

Constituent of Potential Ecological Concern	Plant HQ <sup>a</sup>	Deer Mouse HQ (Herbivorous) <sup>a</sup>	Deer Mouse HQ (Omnivorous) <sup>a</sup>	Deer Mouse HQ (Insectivorous) <sup>a</sup>	Burrowing Owl HQ <sup>a</sup>
<b>Inorganic</b>					
Barium	4.9E-1	6.2E-1	<b>2.2E+0</b>	<b>3.7E+0</b>	2.7E-2
Cadmium	2.1E-1	3.0E-2	3.1E-2	3.3E-2	1.0E-3
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 <sup>c</sup>	<b>1.6E-0</b>	<b>8.1E-1</b>	<b>2.4E+0</b>	<b>3.9E+0</b>	<b>8.3E-1</b>

<sup>a</sup> **Bold** text indicates HQ or HI exceeds unity.

<sup>b</sup> --- designates insufficient toxicity data available for risk estimation purposes.

<sup>c</sup> 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.

the plant and deer mouse, an HQ greater than one was obtained for barium. Background alone results in an HQs of greater than 1.0 for the omnivorous and insectivorous deer mouse. In addition, the average barium concentration for the site is less than the background value. Based upon the uncertainties associated with exposure and toxicity, it is unlikely that barium, with exposure concentrations largely attributable to background, present significant ecological risk.

Based upon this uncertainty analysis, ecological risks at SWMU 12B 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, quality of analytical data, and the utilization of detection limits as exposure concentrations.

### VII.3.6 Risk Interpretation

Ecological risks associated with SWMU 12B were estimated through a screening assessment that incorporated site-specific information when available. Overall, ecological risks to plants are expected to be low because of the fact that predicted risks associated with exposure to barium, chromium (total), and selenium are based upon calculations using maximum detected values. With respect to the deer mouse, risk is also expected to be low. Predicted risks from exposure to barium and selenium were attributed to using maximum detected values. In addition, evaluation of background concentrations also contributed to reduction in the initially predicted risk estimates. Based upon this final analysis, ecological risks associated with SWMU 12B are expected to be low.

### VII.3.7 Screening Assessment Scientific/Management Decision Point

Once potential ecological risks associated with the site have been assessed, a decision is made as whether the site should be recommended for NFA or additional data should be collected to assess actual ecological risk at the site more thoroughly. With respect to this site, ecological risks were predicted to be low. The scientific/management decision is to recommend this site for NFA.

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## **Appendix 1 EXPOSURE PATHWAY DISCUSSION FOR CHEMICAL AND RADIONUCLIDE CONTAMINATION**

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), 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 the following:

- 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, Table 1 shows the exposure routes that will be considered. 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**

<b>Industrial</b>	<b>Recreational</b>	<b>Residential</b>
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 Quotient/Index, excess cancer risk, or radiation total effective dose equivalent [dose]) is similar for all exposure pathways and is given by:

$$\begin{aligned} \text{Risk (or Dose)} &= \text{Intake} \times \text{Toxicity Effect (either carcinogenic, noncarcinogenic, or radiological)} \\ &= C \times (\text{CR} \times \text{EFD}/\text{BW}/\text{AT}) \times \text{Toxicity Effect} \end{aligned} \quad (1)$$

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  $10^{-4}$  to  $10^{-6}$ . 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 use 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.

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DOE, see U.S. Department of Energy.

EPA, see U.S. Environmental Protection Agency.



**Table 2**  
**Default Parameter Values for Various Land Use Scenarios**

Parameter	Industrial	Recreational	Residential
<b>General Exposure Parameters</b>			
Exposure frequency (day/yr)	***	***	***
Exposure duration (yr)	30 <sup>a,b</sup>	30 <sup>a,b</sup>	30 <sup>a,b</sup>
Body weight (kg)	70 <sup>a,b</sup>	56 <sup>a,b</sup>	70 adult <sup>a,b</sup> 15 child
Averaging Time (days) for carcinogenic compounds (=70 y x 365 day/yr)	25550 <sup>a</sup>	25550 <sup>a</sup>	25550 <sup>a</sup>
for noncarcinogenic compounds (=ED x 365 day/yr)	10950	10950	10950
<b>Soil Ingestion Pathway</b>			
Ingestion rate	100 mg/day <sup>c</sup>	6.24 g/yr <sup>d</sup>	114 mg-yr/kg-day <sup>a</sup>
<b>Inhalation Pathway</b>			
Inhalation rate (m <sup>3</sup> /yr)	5000 <sup>a,b</sup>	146 <sup>d</sup>	5475 <sup>a,b,d</sup>
Volatilization factor (m <sup>3</sup> /kg)	chemical specific	chemical specific	chemical specific
Particulate emission factor (m <sup>3</sup> /kg)	1.32E9 <sup>a</sup>	1.32E9 <sup>a</sup>	1.32E9 <sup>a</sup>
<b>Water Ingestion Pathway</b>			
Ingestion rate (L/day)	2 <sup>a,b</sup>	2 <sup>a,b</sup>	2 <sup>a,b</sup>
<b>Food Ingestion Pathway</b>			
Ingestion rate (kg/yr)	NA	NA	138 <sup>b,d</sup>
Fraction ingested	NA	NA	0.25 <sup>b,d</sup>
<b>Dermal Pathway</b>			
Surface area in water (m <sup>2</sup> )	2 <sup>b,e</sup>	2 <sup>b,e</sup>	2 <sup>b,e</sup>
Surface area in soil (m <sup>2</sup> )	0.53 <sup>b,e</sup>	0.53 <sup>b,e</sup>	0.53 <sup>b,e</sup>
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 d/y.

<sup>a</sup>RAGS, Vol. 1, Part B (EPA 1991).

<sup>b</sup>Exposure Factors Handbook (EPA 1989b)

<sup>c</sup>EPA Region 6 guidance.

<sup>d</sup>For radionuclides, RESRAD (ANL 1993) is used for human health risk calculations; default parameters are consistent with RESRAD guidance.

<sup>e</sup>Dermal Exposure Assessment (EPA 1992).

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, U.S. Environmental Protection Agency, 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, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.





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**Statement of Basis  
Approval of No Further Action**

**January 2000**

**Solid Waste Management Unit 12B  
Operable Unit 1333  
Round 11**

RSI Originally Submitted September 1999

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## Site-Specific Comments

### *ER Site 12B, Burial Site*

**ER Site 12B is appropriate for NFA petition, pending submittal of the below requested information.**

- 1. Page 4-21, Section 4.4.4.2, 4<sup>th</sup> paragraph – Contaminated soil in Soil Pile SP-09 should be removed from the site. Please submit information on the disposition of Soil Pile SP-09, which contains radionuclide contaminated soil from Block 88.**

Response: The referenced paragraph is missing important information and is inaccurate. Soil Pile SP-09 does not contain radioactively contaminated soil, as implied in the referenced paragraph and stated in the comment above. Only soil that did not contain radioactive contamination, based on screening, was moved to Soil Pile SP-09 from Block 88. Approximately 2.5 gallons of schoepite and contaminated soil were segregated and removed from Block 88 soil and disposed of as radioactive waste. Sample CY12B-BL88-L00-04-S was collected from these 2.5 gallons of material for waste characterization purposes and to determine representative uranium isotopic ratios for depleted uranium (schoepite) at the site. The results do not represent soil placed in Soil Pile SP-09.

The referenced paragraph has been corrected and replaced. Please see Attachment B for the revised wording reflecting the information provided above.

- 2. Please also submit information on the volume of soil, the types of hazardous constituents/radionuclides present, and their respective concentrations/activities.**

Response: Soil Pile SP-09 is characterized by field screening logs and by the composite sample CY12B-SP09 (fractions 01-04), which is included in the data tables and risk assessment. The analytical results for this sample provide the requested information regarding hazardous constituents/radionuclides present, and their respective concentrations/activities. Soil Pile SP-09, located in the soil pile staging area at the Burn Site, contains approximately 235 cubic yards of soil that is clean based on project screening protocol.

The results of the human health and ecological risk screening assessments indicate that the soil piles, including SP-09, do not pose a significant threat to human health and the environment. Based on this information Sandia National Laboratories/New Mexico intends to regrade the soil pile material at the site. SP-12 contained soil that appeared to be radioactively contaminated, based on field screening, and has already been removed from the site and processed as radioactively contaminated waste.

In addition, Page 4-27, Section 4.4.4.2, 4th paragraph, should be modified for clarity. Please see Attachment C for the revised wording reflecting this change.





## Site-Specific Comments

3. **Page 4-50, Table 4.4.4-6 – Please provide the detection limit for barium.**

Response: The method detection limit for barium ranges from 0.098 to 0.110 mg/kg. A revised table is provided in Attachment D.

4. **Page 4-52, Table 4.4.4-7 – The unit of measurement ( $\mu\text{g}/\text{kg}$ ) is likely incorrect. Please verify the unit of measurement, and if erroneous, submit a revised table.**

Response: The unit of measure should be  $\mu\text{g}/\text{g}$ . A revised table is attached. See Attachment E.

4. **Page 4-56, Table 4.4.4-9 – Please provide the detection limits for barium and chromium.**

Response: The method detection limit for barium and chromium ranged from 0.455 to 0.481 mg/kg. A revised table is provided in Attachment F.

5. **Page 4-66, Table 4.4.4-15 -- The unit of measurement ( $\mu\text{g}/\text{kg}$ ) is likely incorrect. Please verify the unit of measurement, and if erroneous, submit a revised table.**

Response: The unit of measure should be  $\mu\text{g}/\text{g}$ . A revised table is attached. See Attachment G.





**ATTACHMENT B**

**ER SITE 12B  
REVISED PAGE 4-21, SECTION 4.4.4.2, PARAGRAPH 4**



## Site-Specific Comments

### 4.4.4 Investigation #3—SNL/NM ER Project Voluntary Corrective Measure and Confirmatory Sampling

#### 4.4.4.1 Nonsampling Data Collection

Nonsampling data were not collected during the beginning of the VCM activities. Activities were centered on VCM work plan preparation and VCM field work plans.

#### 4.4.4.2 Voluntary Corrective Measures Activities

The SWMU 12B VCM field work was performed from June through September 1997. Site preparation and surface-water control measures were installed in late June, and excavation of the arroyo began at the northern end of the site in early July. A complete discussion of the VCM's scope of work is provided in the "Voluntary Corrective Measure Plan for Excavation and Debris Removal at Environmental Restoration Site 12B, Operable Unit 1333, Canyon Test Area, Revision 1" (SNL/NM July 1997).

Characterization, cleanup, and restoration of the SWMU 12B Buried Arroyo was accomplished through excavating soil and debris from three areas of subsurface burial defined by geophysical anomalies and by the estimated arroyo boundaries (Figure 4.4.4-1). A backhoe equipped with a front loader bucket and an articulated front loader with a 3-cubic-yard bucket were used. Excavation of the three areas and the former arroyo channel proceeded from north to south in sequentially numbered, 10- by 10-foot grid blocks (Figure 4.4.4-2). Lifts from each grid block were initially removed in 2-foot depths in the northern part of the site: lift 1 = 0- to 2-foot depth, lift 2 = 2- to 4-foot depth interval, etc. However, south of the large geophysical anomaly most grid blocks were excavated to the total depth in one continuous digging event. The depth of excavation varied from approximately 3 to 6 feet and was generally deeper at the northern end of the site. The average depth was approximately 4 to 5 feet, except at the southern end where the arroyo intersects the southernmost road. Here the excavation depth varied from 2 to 4 feet deep. Excavation continued both downward and laterally out until no sign of debris was visible and/or until the point of the original arroyo channel was encountered.

After excavated materials were visually examined and thoroughly field-screened and surveyed for contamination in the screening/segregation area, the material was segregated based upon field-screening results and material type (debris or soil). Final characterization was conducted using appropriate screening and/or analytical methods. The VCM Plan (SNL/NM July 1997) discusses the details of the screening and segregation procedures, which were ultimately documented in field logs (Mitchell June 1997) that tracked results by excavation block number.

During excavation of Block 88, radioactive contamination was encountered in the form of oxidized depleted uranium (schoepite). Approximately 2.5 gallons of schoepite and contaminated soil was removed; the remainder of Block 88 soil was screened and placed in Soil Pile SP-09 based upon the screening results. A sample of the schoepite was collected for off-site analysis to characterize representative uranium isotopic ratios for schoepite at the Burn Site. All radioactive waste segregated during the project was disposed of properly according to SNL/NM Waste Management Policy.

~~During the excavation of Block 88, a sample was collected because anomalous radioactivity was found in the soils. This screened segregated block of material was placed in soil pile SP-09. Because of the high values of radionuclides detected in the soil, SP-09 data are not included in the risk assessment portions of this NFA. Further characterization of SP-09 will be conducted in the near future.~~







**ATTACHMENT C**

**ER SITE 12B**

**REVISED PAGE 4-27, SECTION 4.4.4.2, PARAGRAPH 4**

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## Site-Specific Comments

The following material was excavated, screened, and segregated (as set forth by the VCM work plan) during the VCM field effort:

- Approximately 3,300 cubic yards of soil, all field-screened clean except for
  - Approximately 2.5 cubic yards of potentially fuel-contaminated soil
  - Approximately 6 cubic yards of potentially radioactively contaminated soil
  - Approximately 75 cubic yards of debris and scrap metal, including 34 pallets of surveyed clean cable, metal scrap, and debris; 1 pallet of asbestos transite; 3 partially filled 55-gallon drums of lead metal; approximately 5 cubic yards of surveyed clean porous debris; and approximately 10 cubic yards of concrete blocks (surveyed clean)
- Two partially filled 55-gallon drums of batteries, one drum field-surveyed clean for radionuclides, and one drum with radioactive batteries.

After the digging was completed north and south of the site's southern access road, a final magnetometer survey was performed over the excavated area to verify that all buried metal was removed. Six trenches (approximately 15 x 2 x 4 feet deep) at the edges of the excavation and three trenches (approximately 18 x 2 x 2 feet deep) in the arroyo channel were excavated into areas (Figure 4.4.4-3) where the most debris and contamination had been encountered during the digging to allow visual examination by the regulators during their site inspection. On September 5, 1997, representatives of the New Mexico Environment Department (NMED) Surface Water Quality Board, NMED Hazardous and Radioactive Materials Bureau, and DOE Oversight Bureau performed a site inspection and, in general, indicated that the scope of excavation was acceptable. Confirmation sample locations were marked in the field with pinflags so the regulators could inspect and provide input. The regulators indicated that the locations were acceptable and requested no changes or additional locations. On October 14, 1997, after the inspection, the excavation field work was completed: i.e., the nine trenches were filled in and the southern access road was excavated to a depth of approximately 2 feet, as requested by the regulators. The culvert and roadway across the arroyo were completed on October 17, 1997, and the southernmost access road was graded to form a low-water crossing at the request of the Burn Site manager.

During site preparation and throughout the project, surface-water control measures were installed and maintained. Diversion dams/berms were installed in the channel north of the excavation site and in the excavation areas as had been detailed in the project waste management plan (SNL/NM July 1997). Silt fences were installed in the work area and downgradient in road ditches to control runoff from the site and the soil pile management area. Also, a diversion berm was constructed around the soil pile management area (on the north side) to prevent run-on. Another diversion berm was constructed along the back side (north side) of the cable rack to divert run-on into the diversion ditch that parallels the excavated arroyo channel and discharges through a silt fence. Figure 4.4.4-4 shows the location of silt fences that continue to be maintained at the site.

Fifteen soil piles are stored in the Burn Site an area to the west of just outside the cleaned-up arroyo. The piles were sampled and analyzed to determine whether contamination is present. The analytical data (except those for soil pile SP-09) were included in the risk assessment calculations. Based upon the results, SNL/NM plans to use the soil for backfill at the Bomb Burner site after successful completion of future work at this site.





**ATTACHMENT D**

**ER SITE 12B  
REVISED TABLE 4.4.4-6**



Table 4.4.4-6  
Summary of SWMU 12B Grid Sampling, Metals Analytical Results, September 1997  
(Off-site laboratory)

Sample Attributes			Metals (EPA 6010/7000) <sup>a</sup> (mg/kg)								
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
6899	CY12B/260/90/01-US	0-0.5	4.0	170 J (0.098-0.110)	0.57	0.25 J (0.55)	11	8.0	ND (0.11)	ND (0.44)	ND (0.11)
6899	CY12B/290/60/01-US	0-0.5	4.5	110 J (0.098-0.110)	0.32 J (0.51)	0.35 J (0.51)	9.1	10	ND (0.10)	0.43 J (0.51)	ND (0.10)
6899	CY12B/280/70/01-US	0-0.5	3.4	91 J (0.098-0.110)	0.26 J (0.51)	0.30 J (0.51)	7.9	6.0	ND (0.10)	ND (0.41)	ND (0.10)
6899	CY12B/270/60/01-US	0-0.5	3.6	130 J (0.098-0.110)	0.26 J (0.51)	0.31 J (0.51)	7.8	6.4	ND (0.094)	ND (0.41)	ND (0.10)
6899	CY12B/260/70/01-US	0-0.5	3.6	96 J (0.098-0.110)	0.27 J (0.52)	0.26 J (0.52)	8.1	6.3	ND (0.094)	ND (0.41)	ND (0.10)
6899	CY12B/250/80/01-US	0-0.5	3.9	170 J (0.098-0.110)	0.34 J (0.51)	0.34 J (0.51)	9.2	15	ND (0.10)	ND (0.41)	ND (0.10)
6899	CY12B/240/90/01-US	0-0.5	4.6	140 J (0.098-0.110)	0.50 J (0.55)	0.34 J (0.55)	12	19 <sup>c</sup>	ND (0.11)	ND (0.44)	ND (0.11)
6899	CY12B/230/70/01-US	0-0.5	3.9	150 J (0.098-0.110)	0.45 J (0.53)	0.30 J (0.53)	11	16	ND (0.10)	ND (0.42)	ND (0.11)
6899	CY12B/210/80/01-US	0-0.5	3.8	150 J (0.098-0.110)	0.42 J (0.55)	0.31 J (0.55)	11	8.1	ND (0.11)	ND (0.44)	ND (0.11)
6899	CY12B/210/60/01-US	0-0.5	3.6	110 J (0.098-0.110)	0.28 J (0.52)	0.34 J (0.52)	8.5	5.5	ND (0.095)	ND (0.41)	ND (0.10)
6899	CY12B/190/80/01-US	0-0.5	3.1	120 J (0.098-0.110)	0.28 J (0.53)	0.29 J (0.53)	8.5	7.8	ND (0.11)	ND (0.42)	ND (0.11)
6899	CY12B/180/60/01-US	0-0.5	3.9	93 J (0.098-0.110)	0.28 J (0.51)	0.36 J (0.51)	7.2	6.5	ND (0.098)	ND (0.41)	ND (0.10)
6899	CY12B/170/80/01-US	0-0.5	3.3	110 J (0.098-0.110)	0.32 J (0.52)	0.33 J (0.52)	9.3	7.0	ND (0.099)	ND (0.42)	ND (0.10)
6899	CY12B/150/70/01-US	0-0.5	4.8	370 J (0.098-0.110)	0.49 J (0.52)	0.33 J (0.52)	12	12	ND (0.10)	ND (0.41)	ND (0.10)
6899	CY12B/140/80/01-US	0-0.5	3.2	110 J (0.098-0.110)	0.32 J (0.49)	0.27 J (0.49)	8.9	9.3	ND (0.096) J	ND (0.39)	ND (0.087) J
6899	CY12B/120/70/01-US	0-0.5	2.8	100 J (0.098-0.110)	0.29 J (0.49)	0.21 J (0.49)	8.7	7.4	ND (0.098) J	ND (0.39)	ND (0.10) J
6899	CY12B/110/95/01-US	0-0.5	3.5	130 J (0.098-0.110)	0.32 J (0.53)	0.35 J (0.53)	10	6.7	ND (0.11)	ND (0.42)	ND (0.11)
6899	CY12B/100/60/01-US	0-0.5	4.6	210 J (0.098-0.110)	0.62	0.36 J (0.55)	15	12	ND (0.11)	ND (0.44)	ND (0.11)
6899	CY12B/90/100/01-US	0-0.5	4.0	140 J (0.098-0.110)	0.44 J (0.51)	0.29 J (0.51)	12	9.3	ND (0.10)	0.67	ND (0.10)
6899	CY12B/90/80/01-US	0-0.5	3.1	110 J (0.098-0.110)	0.33 J (0.51)	0.24 J (0.51)	8.9	6.8	ND (0.10)	ND (0.41)	ND (0.10)
6899	CY12B/80/100/01-US	0-0.5	4.0	140 J (0.098-0.110)	0.45 J (0.52)	0.33 J (0.52)	13	8.7	ND (0.10)	ND (0.42)	ND (0.10)
6899	CY12B/60/100/01-US	0-0.5	4.06	139 J (0.098-0.110)	0.454 J (0.53)	0.244 J (0.53)	11.4	10.2	ND (0.11)	ND (0.42)	ND (0.11)
6899	CY12B/40/100/01-US	0-0.5	2.69	90.1 J (0.098-0.110)	0.302 J (0.53)	0.16 J (0.53)	7.99	8.35	ND (0.11) J	ND (0.42)	ND (0.10) J
6899	CY12B/30/120/01-US	0-0.5	3.4	110 J (0.098-0.110)	0.31 J (0.53)	0.16 J (0.53)	9.1	6.6	ND (0.11) J	ND (0.42)	ND (0.10) J
6899	CY12B/10/110/01-US	0-0.5	3.5	140 J (0.098-0.110)	0.45 J (0.53)	0.22 J (0.53)	11	14	ND (0.11) J	ND (0.42)	ND (0.096) J
6899	CY12B/-10/130/01-US	0-0.5	2.9	100 J (0.098-0.110)	0.28 J (0.51)	0.22 J (0.51)	8.9	5.7	ND (0.10) J	ND (0.41)	ND (0.10) J
6899	CY12B/-10/100/01-US	0-0.5	3.3	120 J (0.098-0.110)	0.47 J (0.54)	0.13 J (0.54)	11	17	ND (0.11) J	ND (0.43)	ND (0.11) J
6899	CY12B/-30/122/01-US	0-0.5	2.9	97 J (0.098-0.110)	0.26 J (0.52)	0.16 J (0.52)	7.5	22	ND (0.087) J	ND (2.1)	ND (0.091) J
6899	CY12B/-50/120/01-US	0-0.5	2.3	71 J (0.098-0.110)	0.23 J (0.50)	0.18 J (0.50)	7.0	4.6	ND (0.10) J	ND (0.40)	ND (0.10) J
6899	CY12B/-50/140/01-US	0-0.5	3.3	130 J (0.098-0.110)	0.47 J (0.55)	0.19 J (0.55)	12	8.0	ND (0.096) J	ND (0.44)	ND (0.11) J
6899	CY12B/-70/120/01-US	0-0.5	2.8	83 J (0.098-0.110)	0.23 J (0.51)	0.28 J (0.51)	7.4	4.1	ND (0.099) J	ND (2.0)	ND (0.10) J
6899	CY12B/-80/140/01-US	0-0.5	3.0	120 J (0.098-0.110)	0.41 J (0.51)	0.14 J (0.51)	12	7.1	ND (0.10) J	ND (2.0)	ND (0.10) J
6899	CY12B/-90/120/01-US	0-0.5	2.7	82 J (0.098-0.110)	0.24 J (0.50)	0.60	7.2	5.5	ND (0.092) J	ND (0.40)	ND (0.098) J
6899	CY12B/-110/130/01-US	0-0.5	2.6	130 J (0.098-0.110)	0.21 J (0.51)	0.21 J (0.51)	7.1	4.1	ND (0.098) J	ND (0.41)	ND (0.093) J
6899	CY12B/-150/120/01-US	0-0.5	2.3	90 J (0.098-0.110)	0.29 J (0.51)	ND (0.10)	7.3	5.2	ND (0.098) J	ND (0.41)	ND (0.095) J
6899	CY12B/-180/130/01-US	0-0.5	2.3	120 J (0.098-0.110)	0.29 J (0.52)	0.25 J (0.52)	8.8	3.9	ND (0.094) J	ND (0.41)	ND (0.098) J
6899	CY12B/-200/130/01-US	0-0.5	5.6	77 J (0.098-0.110)	0.19 J (0.50)	0.20 J (0.50)	6.4	3.5	ND (0.10) J	ND (0.40)	ND (0.10) J
6899	CY12B/-200/140/01-US	0-0.5	3.2	110 J (0.098-0.110)	0.24 J (0.53)	0.33 J (0.53)	8.4	4.5	ND (0.10) J	ND (0.42)	ND (0.097) J

Refer to footnotes at end of table.





Table 4.4.4-6 (Concluded)  
 Summary of SWMU 12B Grid Sampling, Metals Analytical Results, September 1997  
 (Off-site laboratory)

Sample Attributes			Metals (EPA 6010/7000) <sup>a</sup> (mg/kg)								
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
6899	CY12B-SFN-01-S	0-0.5	3.8	150 J (0.098-0.110)	0.52 J (0.54)	ND (0.11)	14	8.7	ND (0.11) J	ND (0.43)	ND (0.10) J
6899	CY12B-SFSW-01-S	0-0.5	2.8	110 J (0.098-0.110)	0.38 J (0.51)	0.12 J (0.51)	10	5.3	ND (0.11) J	ND (0.41)	ND (0.10) J
Quality Assurance/Quality Control Sample (mg/L)											
6899	CY12B-EB-02	NA	ND (0.0030)	ND (0.0010)	ND (0.0010)	ND (0.0010)	ND (0.0010)	0.0026 J (0.0030)	ND (0.00020)	ND (0.0040)	ND (0.0010)
Background Soil Concentrations, Canyon Area <sup>c</sup>			9.8	246	0.75	0.64	18.8	18.9	0.055	3.0	<0.5

<sup>a</sup>EPA November 1986.

<sup>b</sup>Analysis Request/Chain-of-Custody.

<sup>c</sup>From Zamorski December 1997.

CY = Canyon.

EB = Equipment blank.

EPA = U.S. Environmental Protection Agency.

ER = Environmental Restoration.

ID = Identification.

J = The reported value was qualified as estimated during the data validation process.

J ( ) = The reported value is greater than or equal to the method detection limit (MDL) but is less than the practical reporting detection limit, shown in parenthesis.

mg/kg = Milligram(s) per kilogram.

mg/L = Milligram(s) per liter.

MDL = .098 to .110 mg/kg.

NA = Not applicable.

ND ( ) = Not detected above the MDL, shown in parenthesis.

S = Sediment sample.

SFN = Silt fence (north).

SFSW = Silt fence (southwest).

SWMU = Solid waste management unit.

US = Soil sample.





**ATTACHMENT E**  
**ER SITE 12B**  
**REVISED TABLE 4.4.4-7**



Site-Specific Comments

Table 4.4.4-7  
 Summary of HE Analytical Detection Limits  
 Used for SWMU 12B Grid Sampling,  
 September 1997  
 (Off-site laboratory)

Compounds	HE Detection Limits
	Off-Site Analyses by EPA Method 8330 <sup>a</sup> ( $\mu\text{g/g}$ ) ( $\mu\text{g/kg}$ )
1,3,5-trinitrobenzene	0.21-0.28
1,3-dinitrobenzene	0.21-0.28
2,4,6-trinitrotoluene	0.21-0.28
2,4-dinitrotoluene	0.22-0.29
2,6-dinitrotoluene	0.21-0.28
2-amino-4,6-dinitrotoluene	0.21-0.28
2-nitrotoluene	0.21-0.28
3-nitrotoluene	0.21-0.28
4-amino-2,6-dinitrotoluene	0.21-0.28
4-nitrotoluene	0.21-0.28
HMX	1.9-2.4
Nitrobenzene	0.22-0.29
Pentaerythritol tetranitrate	NA
RDX	0.84-1.1
Tetryl	0.55-0.72

<sup>a</sup>EPA November 1986.

- EPA = U.S. Environmental Protection Agency.
- HE = High explosive(s).
- HMX = 1,3,5,7-tetranitro-1,3,5,7-tetrazacyclooctane.
- NA = Not applicable.
- RDX = 1,3,5-trinitro-1,3,5-triazacyclohexane.
- Tetryl = 2,4,6-trinitrophenylmethyl nitramine.
- SWMU = Solid waste management unit.
- $\mu\text{g/kg}$  = Microgram(s) per kilogram.







**ATTACHMENT F**  
**ER SITE 12B**  
**REVISED TABLE 4.4.4-9**



Table 4.4.4-9  
Summary of SWMU 12B Grid Resampling, Metals Analytical Results, December 1997  
(Off-site laboratory)

Sample Attributes			Metals (EPA 6010/7000)* (mg/kg)								
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
510130	CY12B-240/90-02-US	0-0.5	3.13	136 J (0.455-0.481)	0.458 J (0.476)	0.209 J (0.476)	11.5 J (0.455-0.481)	22.3 <sup>c</sup>	ND (0.0173)	0.267 J (0.476)	ND (0.031)
510130	CY12B-210/80-02-US	0-0.5	3.14	143 J (0.455-0.481)	0.416 J (0.481)	0.254 J (0.481)	13.9 J (0.455-0.481)	9.16	ND (0.0173)	0.388 J (0.481)	ND (0.031)
510130	CY12B-210/60-02-US	0-0.5	3.42	125 J (0.455-0.481)	0.505	0.245 J (0.455)	13.0 J (0.455-0.481)	9.24	ND (0.0173)	0.225 J (0.455)	ND (0.031)
510130	CY12B-190/80-02-US	0-0.5	3.76	96.7 J (0.455-0.481)	0.291 J (0.481)	0.261 J (0.481)	10.9 J (0.455-0.481)	9.35	ND (0.0173)	ND (0.07)	ND (0.031)
510130	CY12B-170/80-02-US	0-0.5	2.38	88.8 J (0.455-0.481)	0.298 J (0.481)	0.293 J (0.481)	15.3 J (0.455-0.481)	5.27	ND (0.0173)	0.288 J (0.481)	ND (0.031)
510130	CY12B-180/60-02-US	0-0.5	2.49	117 J (0.455-0.481)	0.391 J (0.459)	0.165 J (0.459)	8.39 J (0.455-0.481)	10.4	ND (0.0173)	0.483	ND (0.031)
510130	CY12B-180/60-02-USD	0-0.5	3.05	135 J (0.455-0.481)	0.438 J (0.459)	0.180 J (0.459)	11.2 J (0.455-0.481)	11.2	ND (0.0173)	0.227 J (0.459)	ND (0.031)
Quality Assurance/Quality Control Sample (mg/L)											
510130	CY12B-EB-01	NA	ND (0.00293)	0.00177 J (0.00500)	ND (0.000223)	ND (0.000208)	0.00202 J (0.00500)	ND (0.000678)	ND (0.000104)	ND (0.0014)	ND (0.00062)
Background Soil Concentrations, Canyon Area <sup>d</sup>			9.8	246	0.75	0.64	18.8	18.9	0.055	3.0	<0.5

\*EPA November 1986.

<sup>b</sup>Analysis Request/Chain-of-Custody.

<sup>c</sup>Value in bold exceed background soil concentrations.

<sup>d</sup>From Zamorski December 1997.

CY = Canyon.

EB = Equipment blank.

EPA = U.S. Environmental Protection Agency.

ER = Environmental Restoration.

ID = Identification.

J = Analytical result was qualified as an estimation during data validation.

J ( ) = The reported value is greater than or equal to the method detection limit (MDL) but is less than the project reporting limit, shown in parenthesis.

MDL = .455 to .481 mg/kg

mg/kg = Milligram(s) per kilogram.

mg/L = Milligram(s) per liter.

NA = Not applicable.

ND ( ) = Not detected above the MDL, shown in parenthesis.

SWMU = Solid waste management unit.

US = Soil sample.

USD = Soil sample duplicate.





**ATTACHMENT G**  
**ER SITE 12B**  
**REVISED TABLE 4.4.4-15**





Table 4.4.4-15  
Summary of SWMU 12B Soil Pile Sampling, HE Analytical Results, August–September 1997  
(Off-site laboratory)

Sample Attributes			Explosives (EPA 8330)* (µg/g) (µg/kg)						
Record Number <sup>2</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	2,4,6-Trinitrotoluene	2,4-Dinitrotoluene	2,6-Dinitrotoluene	2 Amino, 4,6-Dinitrotoluene	4 Amino, 2,6-Dinitrotoluene	HMX	Nitrobenzene
06885	CY12B-SP01-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP01-01-SD	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP02-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP03-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP04-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP05-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP06-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP07-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP08-01-S	0–0.5	ND (0.11)	0.72 <sup>o</sup>	0.84	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP09-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06885	CY12B-SP10-01-S	0–0.5	ND (0.11)	ND (0.16)	ND (0.19)	ND (0.13)	ND (0.055)	ND (0.42)	ND (0.15)
06896	CY12B-SP11-01-S	0–0.5	ND (0.11) J	ND (0.16) J	ND (0.19) J	ND (0.13) J	ND (0.055) J	ND (0.42) J	ND (0.15)
06896	CY12B-SP11-01-SD	0–0.5	ND (0.11) J	ND (0.16) J	ND (0.19) J	ND (0.13) J	ND (0.055) J	ND (0.42) J	ND (0.15)
06896	CY12B-SP12-01-S	0–0.5	ND (0.11) J	ND (0.16) J	ND (0.19) J	ND (0.13) J	ND (0.055) J	ND (0.42) J	ND (0.15)
06896	CY12B-SP13-01-S	0–0.5	ND (0.11) J	ND (0.16) J	ND (0.19) J	ND (0.13) J	ND (0.055) J	ND (0.42) J	ND (0.15)
06896	CY12B-SP14-01-S	0–0.5	ND (0.11) J	ND (0.16) J	ND (0.19) J	ND (0.13) J	ND (0.055) J	ND (0.42) J	ND (0.15)
06896	CY12B-SP15-01-S	0–0.5	ND (0.11) J	ND (0.16) J	ND (0.19) J	ND (0.13) J	ND (0.055) J	ND (0.42) J	ND (0.15)
Quality Assurance/Quality Control Sample (µg/L)									
06885	CY12B-EB	NA	ND (0.030)	0.37 (0.26)	0.36 (0.25)	ND (0.040)	ND (0.050)	ND (0.080)	ND (0.040)

Refer to footnotes at end of table.



Table 4.4.4-15 (Concluded)  
 Summary of SWMU 12B Soil Pile Sampling, HE Analytical Results, August–September 1997  
 (Off-site laboratory)

Sample Attributes			Explosives (EPA 8330)* (µg/g) (µg/kg)						
Record Number <sup>b</sup>	ER Sample ID (Figure 4.4.4-5)	Sample Depth (feet)	RDX	Tetryl	1,3-Dinitrobenzene	2-Nitrotoluene	3-Nitrotoluene	4-Nitrotoluene	1,3,5-Trinitrobenzene
06885	CY12B-SP01-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP01-01-SD	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP02-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP03-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP04-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP05-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP06-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP07-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP08-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP09-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06885	CY12B-SP10-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070)
06896	CY12B-SP11-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070) J
06896	CY12B-SP11-01-SD	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070) J
06896	CY12B-SP12-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070) J
06896	CY12B-SP13-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070) J
06896	CY12B-SP14-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070) J
06896	CY12B-SP15-01-S	0–0.5	ND (0.19)	ND (0.34)	ND (0.10)	ND (0.070)	ND (0.16)	ND (0.17)	ND (0.070) J
Quality Assurance/Quality Control Sample (µg/L)									
06885	CY12B-EB	NA	ND (0.20)	ND (0.040)	ND (0.030)	ND (0.030)	ND (0.020)	0.31 (0.25)	ND (0.040)

\*EPA November 1986.

<sup>b</sup>Analysis Request/Chain-of-Custody.

\*Numbers in bold represent detected values.

CY = Canyon.

EB = Equipment blank.

EPA = U.S. Environmental Protection Agency.

ER = Environmental Restoration.

HE = High explosive.

HMX = 1,3,5,7-tetranitro-1,3,5,7-tetrazacyclooctane.

ID = Identification.

J = Analytical result was qualified as an estimation during data validation.

NA = Not applicable.

ND ( ) = Not detected above the method detection limit, shown in parenthesis.

RDX = 1,3,5-trinitro-1,3,5-triazacyclohexane.

Tetryl = 2,4,6-trinitrophenylmethylnitramine.

S = Soil sample.

SD = Soil sample duplicate.

SP = Soil pile designation within SWMU 12B.

SWMU = Solid waste management unit.

µg/kg = Microgram(s) per kilogram.

µg/L = Microgram(s) per liter