3-1-2005

Justification for Class III Permit Modification March 2005 SWMU 227 Operable Unit 1309 Bunker 904 Outfall (Southeast of Technical Area II)

Sandia National Laboratories/NM

This work supported by the
United States Department of Energy
under contract DE-AC04-94AL85000.

SWMU 227
Bunker 904 Outfall

Environmental Restoration Project

Site History

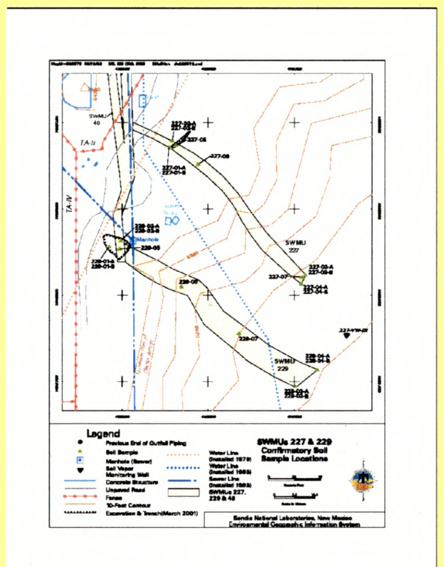
- SWMU 227, the Bunker 904 Outfall, is located just outside the southern apex of TA II, and is approximately 0.08 acres on the northern rim of Tijeras Arroyo.
- From 1947 to 1992, SWMU 227 Outfall was one of two discharge points for the Building 904 Drain System, SWMU 48. Floor drains in TA-II Buildings 904, 913, and 914 were connected to drain system piping that discharged at the SWMU 227 and the SWMU 229 Outfalls. The buildings were used for weapons assembly and research. Waste water containing organic solvents, HE compounds, metals, and radionuclides was discharged into the earthen ditch. The ditch was approximately 20-ft wide, and had a depth varying from 3 to 10 ft.
- The waste-water discharge at SWMU 227 was discontinued after the SWMU 48 HE drain system was connected to the COA sanitary sewer system in 1993.
- Buildings 904, 913, and 914 were demolished in 2001 and 2002.

Depth to Groundwater

- The regional aquifer is approximately 470 ft bgs, and a perched aquifer (not a source of drinking water) is approximately 270 ft bgs.

Constituents of Concern

- VOCs
- SVOCs
- HE compounds
- Metals
- Radionuclides



Investigations

- In June 1994, the ground surface at SWMU 227 was surveyed for UXO/HE and radioactive materials; none was found.
- In September 1994, soil samples were collected from along the outfall ditch to a maximum depth of 3 ft bgs. Three metals (arsenic, barium, and cadmium) had concentrations that exceeded background in one or more samples. Two radionuclides (Cs-137 and U-238) had activities above background. U-235 and U-238 had several MDAs that exceeded background values. Three VOCs and five SVOCs were detected. There were no detections of HE.
- Historical aerial photographs were reviewed several times. In February 2001, a comprehensive review of historical aerial photographs was conducted. The photographs showed that the ditch dimensions were relatively consistent during the period of 1951 to 1999. The photographs also showed that sewer and water lines had been installed between the TA-II fence and the SWMU 227 ditch in 1963, 1979, and 1993. The western end of the ditch was disturbed by the 1993 construction activities.
- In February 2001, a backhoe was used to dig an exploratory trench to a depth of 6 ft across the western end of the outfall ditch. The exploratory work confirmed that previous construction activities had removed the outfall pipe. However, layers of native soil showed that the ditch had not been significantly disturbed by the construction activities. The discharge end of the SWMU 227 outfall pipe had probably been buried at a depth of approximately 3 ft bgs.
- In February 2001, confirmatory soil samples were collected from the exploratory trench. The samples were composed of native (undisturbed) soil. The deepest sample was collected at 7 ft bgs. Slightly elevated levels of two radionuclides (Cs-137 and U-238) were present. A low concentration of one SVOC was reported. No HE was detected. No metal concentrations were above background values.
- In March 2001, soil-vapor monitoring well (227-VW-01) was installed approximately 80 ft southeast of SWMU 227. Soil samples were collected at depths of 20, 100, 150, 200, 250, and 275 ft bgs. There were detections of thee VOCs, one SVOC, chloride, and cyanide. No HE was detected. One metal, chromium, had a concentration above background. No radionuclide activities were above background; however, one sample had a U-235 MDL that exceeded the background activity.
- For five quarters in 2001 and 2002, soil-vapor samples were collected from sampling ports set at 25, 75, 125, 175, 225, and 275 ft bgs in monitoring well 227-VW-01. The samples were analyzed for VOCs. TCE consistently had the greatest concentration in soil vapor. The maximum TCE concentration was 14 ppmv from 225 ft bgs. The low concentrations of VOCs present in soil vapor were determined to not threaten groundwater quality.
- TCE and nitrate have been detected in groundwater monitoring wells in the vicinity of SWMU 227. The source has not yet been determined and is being investigated as part of the TAG investigation, separate from that related to SWMU 227.

Summary of Data Used for NFA Justification

- The soil samples collected and analyzed in September 1994, February 2001, and March 2001 were used in the final risk assessment presented in the July 2003 NOD Response. A total of 19 confirmatory soil samples were used.
- The soil samples were collected along the outfall ditch, from the exploratory trench, and from the deep borehole associated with the soil-vapor monitor well.

Recommended Future Land Use

- Industrial land use was established for this site.

Results of Risk Analysis

- The risk assessment results were calculated per NMED risk assessment guidance as presented in "Supplemental Risk Document Supporting Class 3 Permit Modification Process" (SNL October 2003).
- Because COCs were present in concentrations greater than background screening levels or because constituents were present that did not have background screening numbers, it was necessary to perform a risk assessment for the site. The risk assessment analysis evaluated the potential for adverse health effects for the residential land-use scenario.
- The residential HI (0.5) is below the NMED guidance. The total estimated excess cancer risk for the residential land-use scenario, 2E-5, is above the NMED guideline. However, the UCL of the average concentration for the main contributor to risk, arsenic, is below the background value and arsenic was eliminated from the risk calculation. With the removal of arsenic, the HI was reduced to 0.23 and the total estimated excess cancer risk was reduced to 1E-7. Thus, by using realistic concentrations in the risk calculations that more accurately depict actual site conditions, the total risk calculations are below NMED guidelines.
- The residential land-use scenario incremental TEDE was 3.4E-1 mrem/yr, which is below the EPA numerical guideline of 75 mrem/yr. Therefore, SWMU 227 is eligible for unrestricted radiological release.
- Using the SNL predictive ecological risk assessment methodology, the ecological risk for SWMU 227 is predicted to be low.
- In conclusion, human health and ecological risks are acceptable per NMED guidance. Thus, SWMU 227 is proposed for CAC without institutional controls.

Risk Assessment Values for SWMU 227 Nonradiological COCs

COC Name	Maximum Concentration / UCL (mg/kg)	Residential Land Use Scenario	
		Hazard Index	Cancer Risk
Inorganic			
Arsenic	5.9 / **3.9**	0.27 / **Below Background**	2E-5 / **Below Background**
Barium	210	0.04	--
Cadmium	2.9	0.07	2E-9
Chromium, total	25.2	0.00	--
Chromium VI	0.092 J	0.00	4E-10
Cyanide	0.159 J	0.00	--
Mercury	0.0106 J	0.00	--
Nitrate plus Nitrite	9.3	0.00	--
Selenium	0.864	0.00	--
Silver	0.25	0.00	--
Organic			
2-Butanone	0.0191	0.00	--
4-Methyl-2-pentanone	0.001 J	0.00	--
Acetone	0.0073	0.00	--
Benzo(b)fluoranthene	0.068 J	0.00	1E-7
Bis(2-ethylhexyl) phthalate	0.0885	0.00	2E-9
Chrysene	0.049 J	0.00	8E-10
Fluoranthene	0.094 J	0.00	--
Methylene chloride	0.00105 J	0.00	1E-8
Phenanathrene	0.084 J	0.10	--
Pyrene	0.062 J	0.00	--
Total		**0.5 / 0.23**	**2E-5 / 1E-7**

-- = Information not available.

For More Information Contact

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Justification for Class III Permit Modification
March 2005

SWMU 227
Operable Unit 1309
Bunker 904 Outfall (Southeast of Technical Area II)

NFA Originally Submitted August 1995
NOD Response October 1996
NOD Response January 2000
NOD Response September 2003

Environmental
Restoration
Project

United States Department of Energy
Sandia Site Office

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

NFA

Department of Energy
Albuquerque Operations Office
Kirtland Area Office
P. O. Box 5400
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AUG 28 1995

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. David Neleigh, Chief
New Mexico and Federal Facilities Section
RCRA Permits Branch
U. S. Environmental Protection Agency, Region VI
1445 Ross Avenue, Suite 1200
Dallas, TX 75202-2733

Dear Mr. Neleigh:

Enclosed are copies of the second set of No Further Action (NFA) proposals for 23 solid waste management units (SWMUs) from the Resource Conservation and Recovery Act (RCRA) Hazardous and Solid Waste Amendments (HSWA) Final Permit for Sandia National Laboratories/New Mexico (SNL/NM), ID No. NM5890110518.

Copies of these proposals are also being submitted for comment to the New Mexico Environment Department (NMED), Hazardous and Radioactive Materials Bureau. The Class 3 permit modification process will be initiated after regulatory comments are addressed.

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

Sincerely,

George K. Laskar

for Michael J. Zamorski
Acting Area Manager

Enclosures

cc w/enclosures:
T. Trujillo, AL, ERD
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PROPOSAL FOR NO FURTHER ACTION

Site 227, Bunker 904 Outfall Site
Operable Unit 1309

SANDIA NATIONAL LABORATORIES/NEW MEXICO

1. Introduction

1.1 ER Site Identification Number and Name

Sandia National Laboratories/New Mexico (SNL/NM) is proposing a risk-based no further action (NFA) decision for Environmental Restoration (ER) Site 227, Bunker 904 Outfall Site, Operable Unit (OU) 1309. ER Site 227 is listed in the Hazardous and Solid Waste Amendment (HSWA) Module IV (EPA August 1993) of the SNL/NM Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Facility Permit (NM5890110518) (EPA August 1992).

1.2 SNL/NM Risk-based NFA Process

This proposal for a determination of an administrative NFA decision has been prepared using the criteria presented in Section 4.5.3 of the SNL/NM Program Implementation Plan (PIP) (SNL/NM February 1994). Specifically, this proposal will "contain information demonstrating that this SWMU has never contained constituents of concern that may pose a threat to human health or the environment" [as proposed in the Code of Federal Regulations (CFR), Section 40 Part 264.51(a) (2)] (EPA July 1990). The HSWA Module IV contains the same requirements for an NFA demonstration:

> Based on the results of the RFI [RCRA Facility Investigation] and other relevant information, the Permittee may submit an application to the Administrative Authority for a Class III permit modification under 40 CFR 270.42(c) to terminate the RFI/CMS [corrective measures study] process for a specific unit. This permit modification application must contain information demonstrating that there are no releases of hazardous waste including hazardous constituents from a particular SWMU at the facility that pose threats to human health and/or the environment, as well as additional information required in 40 CFR 270.42(c) (EPA August 1993).

For a risk-based proposal, an SWMU is eligible for an NFA determination if the NFA criterion established by the SNL/NM permit is met. This criterion, found in Section M.1 of the permit, is as follows: "[T]here are no releases of hazardous waste including hazardous constituents...that pose threats to human health and/or the environment..." This risk-base proposal contains information needed to make the NFA determination.

This proposal is using the technical approach which is the foundation for the SNL/NM corrective action process. The details of the SNL/NM technical approach are provided in Appendix C of the SNL/NM PIP. The first step in the technical approach is the data qualitative review step (the same step used to determine whether the SWMU is eligible for administrative NFA). Should significant uncertainties remain, the assessment of the SWMU continues within the SNL/NM technical approach.

At this site, sufficient data were not available to compare to established action levels or to develop site-specific action levels. Background soil samples were collected and analyzed to develop upper tolerance limits (UTLs) for metals. Site-specific data were collected to compare to existing soil action levels (proposed subpart S levels) and UTLs. If site-specific concentrations exceeded the proposed Subpart S action levels or UTLs, then a risk assessment was performed. The site-specific concentrations were compared to the derived risk assessment action levels. Concentrations less than these action levels, either proposed Subpart S action levels, background UTLs, or derived risk-based values, triggered this NFA proposal for Site 227.

1.3 Local Setting

SNL/NM occupies 2,829 acres of land owned by the Department of Energy (DOE), with an additional 14,920 acres of land provided by land-use permits with Kirtland Air Force Base (KAFB), the United States Forest Service, the State of New Mexico, and the Isleta Indian Reservation. SNL/NM has been involved in nuclear weapons research, component development, assembly, testing, and other nuclear activities since 1945.

ER Site 227 (Figure 1) is located on land owned by DOE. The site is situated south of Technical Area (TA) II along the eastern edge of ER Site 45. Access to this site is along the TA-II perimeter road. This site is within the TA-II testing exclusion zone.

Surficial deposits in the SNL/KAFB area lie within four geomorphic provinces, which in turn contain nine geomorphic subprovinces. Site 227 lies within the Tijeras Arroyo subprovince. The Tijeras Arroyo subprovince is characterized by broad, west-sloping alluvial surfaces and the 50-meter-deep Tijeras Arroyo. The Tijeras Arroyo subprovince contains deposits derived from many sources, including granitic and sedimentary rocks of the Sandia Mountains, sedimentary and metamorphic rocks of the Manzanita Mountains, and sediments of the Upper Santa Fe Group.

2. History of the SWMU

2.1 Sources of Supporting Information

In support of the request for a risk-based NFA decision for ER Site 227, a background study was conducted to collect available and relevant site information. Interviews were conducted with SNL/NM staff and contractors familiar with site operational history.

The following information sources were available for the use in the evaluation of ER Site 227:

- Confirmatory sampling program conducted in September 1994
- Risk analysis for four radionuclides
- One surface radiation survey
- One unexploded ordnance/high explosives (UXO/HE) survey
- Interviews and personnel correspondence
- Historical aerial photographs spanning 40 years

2.2 Previous Audits, Inspections, and Findings

In November 1993, the Sandia ER staff recognized Site 227 as an SWMU based on the historical operations and the visual evidence of the Storm Drain System Outfall. ER Site 227 was not listed as a potential release site based on the Comprehensive Environmental Assessment and Response Program (CEARP) interviews in 1985 (DOE September 1987). In addition, Site 227 was not included in the Environmental Protection Agency (EPA) RCRA Facility Assessment (RFA) in 1987 (EPA April 1987) and Site 227 was not included in the Hazard Ranking System (DOE September 1987).

2.3 Historical Operations

The outfall discharged industrial effluent and storm water from TA-II (Figure 1). Currently it discharges only storm water. The specific constituents in the industrial effluent are not known. The possible discharge contaminants include chromates, antifoulants, chromium, sodium hydroxide, hydrochloric acid, chromosulfuric acid, diesel, and other petroleum products. Mineral oil is also being considered a potential soil contaminant due to a recent release (June 1994) of mineral oil at a similar outfall, Site 232.

3. Evaluation of Relevant Evidence

3.1 Unit Characteristics

The site is confined to the downstream natural drainage. All releases would be contained in this limited area.

3.2 Operating Practices

Based on interviews and personnel correspondence, the outfall discharged industrial effluent and storm water from approximately 1948 to 1991. Examination of aerial photographs confirms this time frame but provides no additional information.

3.3 Presence or Absence of Visual Evidence

The approximately 200-foot long outfall and the cement culvert are the only physical evidence of the outfall system. No discoloration of soils was observed during site reconnaissance and soil sampling activities.

3.4 Results of Previous Sampling/Surveys

In 1994, the site was visually surveyed for surface indications of UXO/HE. No UXO/HE were found (SNL/NM 1994a). Also in 1994, a surface radiation survey was conducted on the entire site using an Eberline ESP-2 portable scaler, with an Eberline SPA-8 (2 inch X 2 inch sodium iodide) detector. A 30-second integrated count was performed at each proposed sample location, while scanning the detector over an area approximately 2 feet in radius around the sample location. The alarm was set at 1.3 times the background count rate. No alarms occurred during the survey. No surface anomalies were detected (SNL/NM 1994b).

3.5 Assessment of Gaps in Information

No environmental sampling data existed for Site 227. If contamination was present, potential constituents of concern (metals, radioactive constituents and organic and anionic inorganic constituents), would be expected at shallow depths. Metals and radioactive constituents generally adsorb on soil and precipitate rather than remaining soluble. If organic or inorganic anionic constituents were introduced in the drainage, they should be detectable in surface or shallow subsurface soils.

3.6 Confirmatory Sampling

A surface (0-6 inches deep) and shallow subsurface (6-36 inches deep) soil sampling program was developed and implemented in September 1994. The Confirmatory Sampling and Analysis Plan (SAP) can be found in Appendix A. Those soil sample results exceeding an action level are summarized in Table 1. A complete list of "hits" or detections and quality assurance (QA) results can be found in Appendix B.

For health and safety purposes, a photoionization detector, OVM, was used throughout the field program. The OVM measured no anomalous vapor concentrations.

Surface and shallow subsurface soil samples were collected at the most likely locations of contamination. Four samples were collected at the "head" of the outfall (two surface and two shallow subsurface) and four samples were collected at the furthest extent of visible erosion and scour (two surface and two shallow subsurface), as shown in Figure 1. Every sample was analyzed for target analyte list (TAL) metals[1], chromium^{+6}, total Kjeldahl nitrogen (TKN), and nitrate/nitrite. The four subsurface samples also were analyzed for volatile organic compounds (VOCs). Four samples were analyzed for semivolatile organic compounds (SVOCs), cyanide, total petroleum hydrocarbon (TPH), and explosives. As a general check for radioactive constituents, all the samples were analyzed for tritium and with an in-house gamma spectroscopy, four samples were analyzed for isotopic uranium and plutonium, and two samples were screened with off-site gamma spectroscopy.

3.6.1. Background Samples for Metals and Radioactive Constituents

UTLs for background metals were calculated from analyses of 24 samples collected in the vicinity of the 11 sites discussed in the SAP (Appendix A). UTLs or background

[1] Although the TAL metals analytes include calcium, magnesium, potassium, and sodium, these nontoxic, major cations are not included in the evaluation. They do not pose a significant environmental or human health risk regardless of concentration.

95th percentiles for background radionuclides were calculated from samples collected throughout KAFB (IT 1994). A discussion of background calculations and supporting data and analyses are included in Appendices C and D.

3.6.2 Organic and Nitrogen Compounds

Organic compounds were only tentatively detected; 2-butanone, 4-methyl-2-pentanone, benzo(b)fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene were detected in one to four samples but all were below the quantification limit (qualified with a "J" in Table 1). None of these qualified detections indicate significant contamination. TPH, semivolatile organic compounds, cyanide, and explosives were not detected. Nitrate/nitrite was detected in five of eight samples with concentrations ranging from 2.2 to 14 milligrams per kilograms (mg/kg). TKN was detected in all eight samples, with concentrations ranging from 180 to 670 mg/kg. The main environmental or human health hazard pertaining to reduced nitrogen (as measured in TKN) is that it oxidizes to either nitrate or nitrite. Therefore, it is valid and conservative to compare TKN concentrations with action levels for nitrate and nitrite. The proposed Resource Conservation and Recovery Act (RCRA) Subpart S action levels for nitrate and nitrite are 100,000 mg/kg and 8,000 mg/kg, respectively. The organic and nitrogen compound data indicate an insignificant level of contamination.

3.6.3 Metals

Mercury, selenium, silver, and chromium^{+6} were not detected at Site 227. The maximum local background value for beryllium was 0.53 mg/kg. Beryllium was not detected above 0.53 mg/kg at Site 227. All other metal site concentrations were below UTLs. The metals data at Site 227 indicate no risk to human health and the environment.

3.6.4 Radionuclides

Lead-212 was detected in two samples at activities of 0.78 and 0.74 picocuries per gram (pCi/g), both of which are below the base-wide background UTL of 1.08 pCi/g. Lead-214 was detected in two samples at activities of 0.64 and 0.58 pCi/g, both of which are below the base-wide background UTL of 0.90 pCi/g. Thorium was detected in one sample (227-01-A) at an activity of 1.34 pCi/g, which is below the base-wide background UTL of 2.89 pCi/g. Tritium and plutonium-238 were not detected above the minimum detectable activity (MDA). Uranium-238 was detected in four samples with activities ranging from 0.40 to 0.70 pCi/g, which are all below the base-wide background 95th percentile of 1.0 pCi/g. Uranium-234 was detected in four samples with activities ranging from 0.61 to 0.73 pCi/g, which are all below the base-wide background 95th percentile of 1.1 pCi/g. Plutonium-239/240 was detected at activities of 0.004 and 0.009 pCi/g, both of which are below the one value from the local background analyses of 0.035 pCi/g.

Thallium was detected in Sample 227-03-A at an activity of 0.18 pCi/g. No background values of thallium are available for comparison. One sample of uranium-235/236 had an activity of 0.19 pCi/g, slightly above the base-wide background 95th percentile of 0.168 pCi/g but below the maximum local background activity of 0.33 pCi/g (based on six analyses). Potassium-40 was detected in Sample 227-03-A at an activity of 25.9 pCi/g, slightly above the base-wide background UTL of 25.34 pCi/g.

3.6.5 Quality Assurance Results

As discussed in the Confirmatory Sampling and Analysis Plan (Appendix A), quality assurance samples, including field duplicates, trip blanks and rinsates, were collected as part of the 11-site sampling program. Analyses indicate that the field soil duplicates were comparable to the original soil sample results. The trip blanks and rinsates indicated no significant sampling contamination. QA results can be found in Appendix B. Level I and Level II data verification was conducted on all data, as described in the PIP (SNL/NM 1994).

3.7 Risk Analysis

To further evaluate the site data for radionuclides with activities above background UTLs (or 95^{th} percentiles) or those without background UTLs, a risk assessment was performed for the combination of potassium-40, thallium, plutonium-239/240, and uranium-235/236, assuming the maximum detected activities.

The risk calculations were designed to produce conservatively large estimates of radioactive dose to counter uncertainties in the soil data. This approach facilitates the following decision regarding future activities at Site 227:

- If the conservative estimates based on the soil data result in an unacceptable dose (greater than 10 mrem/year), further investigation and/or remediation will be needed; or

- If the dose estimates are acceptable, the potential for health hazards at the site is extremely low, and further actions will not be needed.

Radionuclide doses were computed using methods and equations promulgated in proposed RCRA Subpart S documentation (EPA 1990). Accordingly, all calculations were based on the assumption that receptor doses from radionuclides result from ingestion of contaminated soil.

Calculation of radionuclide doses required values of dose conversion factors, which are used to convert radionuclide intakes (in units of pCi/year) into effective dose equivalents (in units of mrem/year). Published values of dose conversion factors (Eckerman et al., 1988 and Gilbert et al., 1989) exist for potassium-40, thallium, plutonium-239/240, and uranium-235/236.

To assure that the computed doses were conservatively large, only the maximum observed activity of each constituent at a site was employed. To consider combined effects, a radiological dose was calculated as the sum of the individual doses.

Following proposed Subpart S methodology, the equation and parameter values used to calculate the summed radioactive dose were:

$$\text{DOSE} = \sum_i [\text{DSR(i)} \times \text{S(i)}] \tag{1}$$

where:

DOSE	=	total effective dose equivalent (mrem/yr);
DSR(I)	=	dose-to-soil concentration ratio for the i^{th} radionuclide (mrem/yr)/(pCi/g), = I X DCF(I);
S(I)	=	soil concentration of the i^{th} radionuclide (pCi/g);
I	=	soil ingestion rate = 0.2 g/day = 73 g/yr; and
DCF(I)	=	dose conversion factor for the i^{th} radionuclide (mrem/pCi).

The PIP stipulates that, for the purpose of computing media action levels, the total radioactive dose at a site should not be greater than 10 mrem/year (SNL/NM 1994), which corresponds to a cancer risk of less that 10^{-6} excess deaths.

The input and results of the risk calculations are presented in Table 2. The summed radioactive dose is less than 10 mrem/year. Therefore, the site is considered to be risk-free in terms of radionuclide contamination.

3.8 Rationale for Pursuing a Risk-Based NFA Decision

Surface soil and shallow subsurface soil samples were collected at the "head" of the outfall (where the flow leaves the concrete flume and spills into the natural drainage) and at the furthest extent of visible erosion/scour where the discharged effluent would have most likely settled. These two areas are the most likely areas for contamination. SNL/NM is proposing a risk-based NFA because representative soil samples from ER Site 227 have concentrations less than action levels; either proposed Subpart S action levels, background UTLs, background 95^{th} percentiles, or derived risk-based values.

In addition

- A site visit in 1993 by ER personnel confirmed the presence of a confined natural drainage with no discoloration in the soils.

- In June 1994, a UXO/HE visual survey was conducted by KAFB Explosive Ordnance Division (EOD) and found no UXO/HE ordnance debris at Site 227 (SNL/NM 1994a).

- In September, 1994, as part of the surface soil sampling effort at Site 227, a surface radiation survey was conducted (SNL/NM 1994b). No surface anomalies were detected at Site 227.

4. Conclusion

Based upon the evidence cited above, ER Site 227 has no releases of hazardous waste or hazardous constituents that pose a threat to human health and/or the environment. Therefore, ER Site 227 is recommended for an NFA determination.

5. References

5.1 ER Site References

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

5.3 Aerial Photographs

Ebert & Associates, Inc., November 1994. "Photo-Interpretation and Digital Mapping of ER Sites 7,16,45,228 from Sequential Historical Aerial Photographs."

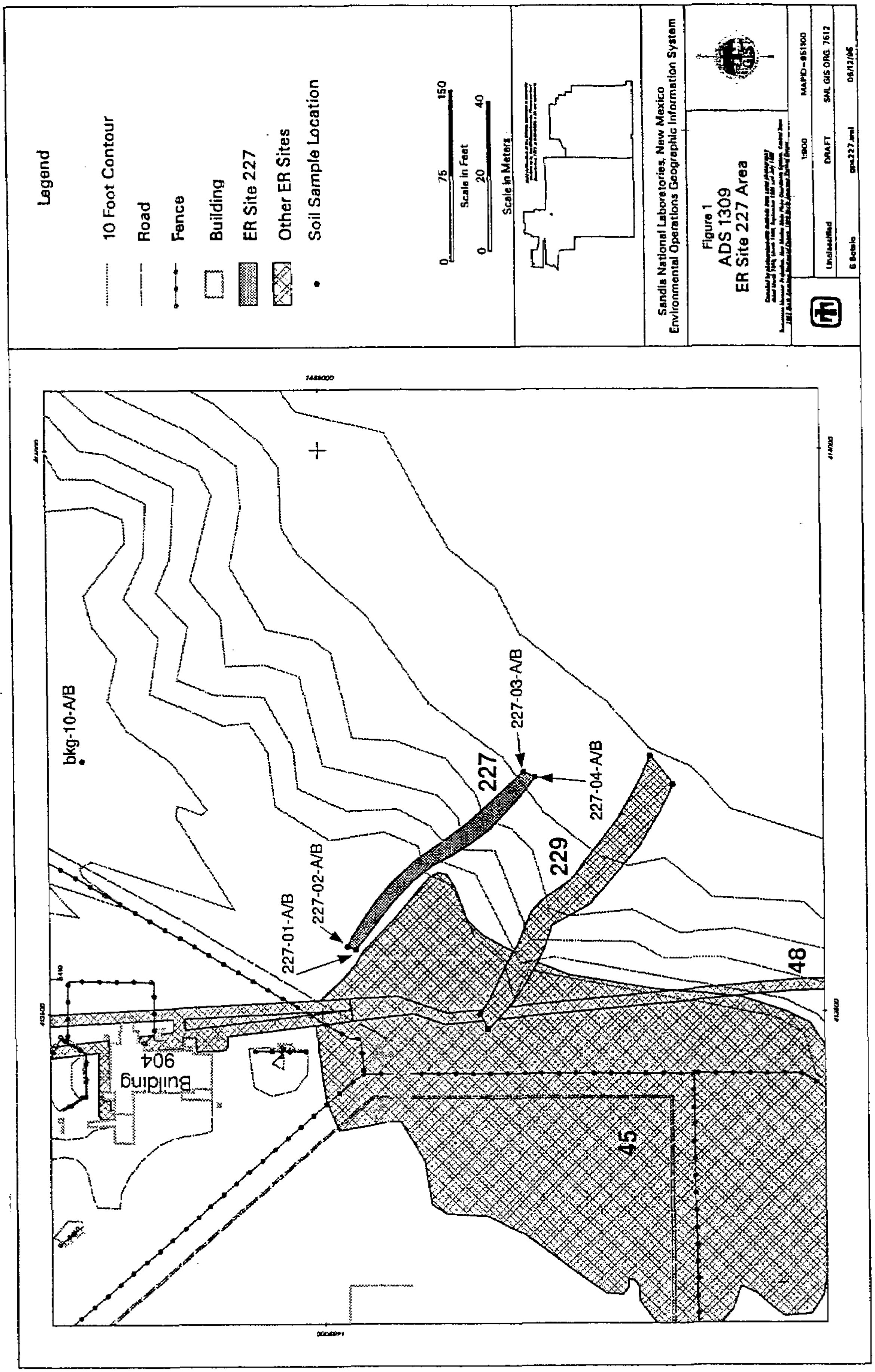

Figure 1. Bunker 904 Outfall Site 227.

Table 1. Site 227 - Results of Shallow Soil Sampling and Analysis

Sample Identifier	Analytical Method	Constituent	Concentration (mg/kg)	Qualifier	Background (mg/kg)	Action Level (mg/kg)
227-01-B	VOCs (8240)	2-butanone	0.007	J		
227-02-B	VOCs (8240)	2-butanone	0.004	J		
227-03-B	VOCs (8240)	2-butanone	0.005	J		
227-04-B	VOCs (8240)	2-butanone	0.004	J		
227-01-B	SVOCs (8270)	4-methyl-2-pentanone	0.001	J		
227-01-B	SVOCs (8270)	Benzo(b) fluoranthene	0.068	J		
227-01-B	SVOCs (8270)	Chrysene	0.049	J		
227-01-A	SVOCs (8270)	Fluoranthene	0.066	J		
227-01-B	SVOCs (8270)	Fluoranthene	0.094	J		
227-01-A	SVOCs (8270)	Phenanthrene	0.055	J		
227-01-B	SVOCs (8270)	Phenanthrene	0.084	J		
227-01-A	SVOCs (8270)	Pyrene	0.040	J		
227-01-B	SVOCs (8270)	Pyrene	0.062	J		
227-01-A	TKN (Acid Digestion)	TKN	450			100,000/8,000
227-01-B	TKN (Acid Digestion)	TKN	370			100,000/8,000
227-02-A	TKN (Acid Digestion)	TKN	400			100,000/8,000
227-02-B	TKN (Acid Digestion)	TKN	180			100,000/8,000
227-03-A	TKN (Acid Digestion)	TKN	300			100,000/8,000
227-03-B	TKN (Acid Digestion)	TKN	220			100,000/8,000
227-04-A	TKN (Acid Digestion)	TKN	670			100,000/8,000
227-04-B	TKN (Acid Digestion)	TKN	390			100,000/8,000
227-01-A	NO_3/NO_2 (353.2)	NO_3/NO_2	6.3			100,000/8,000
227-02-A	NO_3/NO_2 (353.2)	NO_3/NO_2	2.7			100,000/8,000
227-02-B	NO_3/NO_2 (353.2)	NO_3/NO_2	2.3			100,000/8,000
227-04-A	NO_3/NO_2 (353.2)	NO_3/NO_2	14			100,000/8,000
227-04-B	NO_3/NO_2 (353.2)	NO_3/NO_2	2.2			100,000/8,000
227-03-A	Gamma Spec (600 901.1)	Potassium 40	25.9 pCi/g		25.34 pCi/g	6,130 pCi/g
227-03-A	Gamma Spec (600 901.1)	Thallium	0.18 pCi/g			42.6 pCi/g
227-01-B	Isotopic Plutonium (600 7-79-081)	Plutonium 239/240	0.009 pCi/g		0.035 pCi/g	2.1 pCi/g
227-03-A	Isotopic Plutonium (600 7-79-081)	Plutonium 239/240	0.004 pCi/g		0.035 pCi/g	2.1 pCi/g
227-01-A	Isotopic Uranium (HASL-300 4.5)	Uranium 235/236	0.19 pCi/g		0.33/0.168 pCi/g	45 pCi/g

Table 1. Site 227 - Results of Shallow Soil Sampling and Analysis (Concluded)

Notes

A "J" qualifier means detected at a concentration below the laboratory reporting limit.

For uranium-235/236, the first background value is the maximum of six local background values; the second value is the base-wide background 95th percentile.

For plutonium-239/240, the background value is the maximum of six local background values.

For potassium-40, background is the 95 percent upper tolerance level for the base-wide background data.

Proposed Subpart S action levels for nitrate and nitrite are 100,000 and 8,000 mg/kg, respectively.

Radionuclide action levels are calculated risk-based levels.

Table 2. Radionuclide Risk Calculations for Site 227

Constituent	Activity (pCi/g)	DCF(I) (mrem/pCi)	Individual Dose (mrem/year)	Source of DCF
Plutonium-239	9.00E-03	4.30E-03	2.83E-03	Eckerman et al., 1988
Potassium-40	2.59E+01	1.90E-05	3.59E-02	Gilbert et al., 1988
Thallium-204	1.80E-01	3.20E-06	4.20E-05	Eckerman et al., 1988, assuming Thallium-204
Uranium-235	1.90E-01	2.60E-04	3.61E-03	Gilbert et al., 1989
Summed Dose			4.24E-02	

APPENDIX A

Confirmatory Sampling and Analysis Plan

APPENDIX B

Analytical Results

APPENDIX C

Background Calculations for Metals and Radionuclides

APPENDIX D

Probability Plots, Local Background UTL Calculations, and Base-wide Background UTLs for Radionuclides

Appendix A
Confirmatory Sampling and Analysis Plan

SAMPLING AND ANALYSIS PLAN FOR ELEVEN SITES IN TIJERAS ARROYO OPERABLE UNIT SANDIA NATIONAL LABORATORIES/ NEW MEXICO

Sampling and Analysis Plan for Eleven Sites in Tijeras Arroyo Operable Unit

Introduction

The purpose of the sampling and analysis described in this plan is to determine the appropriate way to proceed toward closure of 11 (of the 17) sites in the Tijeras Arroyo Operable Unit. Based on the surface and shallow subsurface soil samples and analyses for the constituents of concern (COCs), one of three approaches will be pursued for each site:

1. A petition for "No Further Action" (NFA) will be produced for regulatory consideration;
2. A voluntary corrective measure (VCM) will be designed and implemented, hopefully followed by an NFA petition; or
3. The site assessment and eventual closure will follow the standard RFI/CMS path

Most of the sites covered by this Sampling and Analysis Plan (SAP) are outfalls from the storm water and sanitary sewer systems emanating from Sandia Technical Areas (TAs) I, II, and IV. The general sampling program for the outfalls will be to collect four samples at the head of the outfall, two samples of surface soil (0 to 6 inches deep) and two samples of shallow subsurface soil (18 to 36 inches deep) and four samples (two surface soil and two shallow subsurface soil) at the furthest extent of channel erosion and scour. The analytes for most of the samples are volatile organic compounds, semi-volatile organic compounds (BNAs), metals, chromium$^{+6,}$ for samples where chromium is found in a metals analysis, total petroleum hydrocarbon (TPH), explosives, Total Kjeldahl Nitrogen (TKN), nitrate/nitrite, and Gamma Spectroscopy for radionuclides, isotopic uranium, isotopic plutonium, tritium, and chlorodiphenyls (PCBs).

Sampling Procedures and Volumes

Surface soil samples will be collected with a stainless steel scoopula or trowel and placed in a stainless steel bowl. After at least 1000 ml[1] of soil has been collected, the soil will be thoroughly mixed in the bowl and transferred to two or three 500-ml sample bottles with a stainless steel scoopula. Sample bottles will be labeled accordingly and the appropriate sample information (sample depth, collection date and time, etc.) will be documented on the chain-of custody (COC) after each sample is collected. Samples will then be packaged and cooled to 4 degrees Celsius.

Shallow subsurface soil samples (18-36 inches) will be collected with a 2-inch (minimum) hand auger. A soil sample is collected by turning the auger clockwise and advancing it into the ground until the bucket at the end of the auger (last 6-8 inches) is full of soil or refusal occurs. Several runs with the auger is anticipated in order to obtain the appropriate volume. A hand shovel may also be used to bypass large rocks in order to continue with the auger. The auger is then extruded counter-clockwise from the ground and the soil is removed from the auger and placed in a stainless steel bowl. After 1,125[2] ml of soil has been collected, the soil will be mixed in the bowl and transferred to two or three 500-ml sample bottles and one 125-ml sample bottle with a stainless steel scoopula. Sample bottles will be labeled accordingly and the appropriate sample information will be documented on the COC after each sample is collected. Samples will then be packaged and cooled to 4 degrees Celsius.

Waste Generation and Equipment Decontamination

Decontamination of sampling equipment will be done between each sample. Decontamination will include thoroughly washing the inside and outside of the sampling equipment with a spray of ALCONOX™ or LIQUINOX™ and water; rinsing with distilled,

[1]The sample volume varies between 1,000 and 1,500 ml depending on the analyses for the sample.

[2]The sample volume varies between 1,125 and 1,625 ml depending on the analyses for the sample.

deionized water; and drying before reusing. No soil waste will be generated. The soil removed from the hand-auger holes, while collecting samples at a depth of 18 to 36 inches, will be return to the hole. The sampling tools, which are scoopulas/trowels, hand-augers, and shovels, will be decontaminated with water and ALCONOX™ after each use. The decon leachate will be stored in capped 1-gallon containers. One or two containers will be used for each site and two to four containers will be used for the background samples. The containers will be labeled as "IDW" and the site number identified on each container. All the containers will be stored at Site 232, a central location. The leachate waste will be disposed according to the analytical results of the soil samples collected at the site.

Site Descriptions

The sites that will be sampled are

- Site 46, Old Acid Waste Line Outfall;
- Site 50, Old Centrifuge Site;
- Site 77, Oil Surface Impoundment;
- Site 227, Bldg. 904 outfall;
- Site 229, Storm Drain System Outfall;
- Site 230, Storm Drain System Outfall;
- Site 231, Storm Drain System Outfall;
- Site 232, Storm Drain System Outfall;
- Site 233, Storm Drain System Outfall;
- Site 234, Storm Drain System Outfall; and
- Site 235, Storm Drain System Outfall.

The site locations are shown in Figure 1. A description of the site history, conditions, previous investigations, and sampling plans are described in the following sections.

Site 46: Acid Waste Line Outfall

The Old Acid Waste Line carried wastes from several buildings in TA I. The waste line begins as a north-south trending, 750-feet long open trench in a grassy field northwest of Building 981-1 in TA IV. No pipe opening is visible at the "head" of the trench. As the trench crosses the field, it turns to the southeast and continues to a non-engineered spillway at the edge of Tijeras Arroyo. The spillway lies on a bank (40 to 50 feet of relief) composed of compacted alluvial sediment. Historical aerial photographs show vegetation, presumably supported by the discharge, growing southeast of the spillway to the active arroyo channel (about 200 feet distance from the spillway). The site is not restricted and is easily accessible.

During use, discharged effluent averaged an estimated 130,000 gallons per day. Use of the line has been discontinued. The line received wastes from plating, etching, and photo processing operations, and cooling tower "blow down". Acids and metals are target contaminants. Chromic acid and ferric chloride are mentioned specifically in the site history, and ferric chloride was found in the soils during a limited sampling event. Various radionuclides, possibly including tritium, uranium, and plutonium were used in TA I.

Building 863 was a source of discharge to the Acid Line. The information sheet for ER Site 98 (Building 863, TCA Photochemical Release: Silver Catch Boxes) indicates the presence of trichloromethane, silver, and photo-processing chemicals with an ammonia-like odor. The waste solution from the silver recovery unit reportedly was discharged to the Old Acid Waste Line, which is the only specific information about chemical discharges.

The site has been visually surveyed for surface indications of unexploded ordnance and high explosives (UXO/HE). No UXO/HE were found. Also, a surface radiation survey was conducted on the entire site. No surface radiation anomalies were detected.

The sampling program includes four samples collected at the "head" of the site outfall (by the fire extinguisher training area west of TA IV) and four samples collected by the spillway into the Tijeras Arroyo drainage (Figure 1). Every sample will be analyzed for tritium, metals, chromium^{+6} (if chromium is detected), TKN, and nitrate/nitrite. Half the samples will also be analyzed for semi-volatiles and cyanide. Additionally, all the subsurface samples will be analyzed for volatiles. The analytes are listed in Table 1. A "4" on the table indicates that ALL the samples will be analyzed
for that specific analyte whereas a "2" on the table indicates half the samples will have additional analyses for the analyte listed.

Site 50: Old Centrifuge
Site 50, Old Centrifuge, was an outdoor, rocket propelled centrifuge that was used in the early 1950s to test units under G forces. The facility is located east of the TA II fence in a slight depression on top the escarpment northwest of Tijeras Arroyo. The concrete centrifuge pad has a diameter of 80 to 90 feet. The site has a 7-foot high wooden retaining wall on the north, east, and south sides. The west side is open. The centrifuge arm assembly, which has a 20-foot radius, is sitting outside the wall to the north and appears to be intact. Control wiring to the center axis of the centrifuge was suspended from a cable between two telephone poles on the north and south side of the pad. The control wiring went to a bunker located to the southwest over the escarpment. The bunker had a electrical transformer containing PCB. The electrical transformer has been removed. The pad was not stained and no spills or leaks were reported.

The centrifuge was rocket driven by two T40 6-KS-3000 or two Deacon 3.5DS-5700 solid rocket motors. The combustion byproducts produced by these rocket motors were carbon dioxide, carbon monoxide, water, hydrochloric acid, aluminum oxide, and possibly barium oxide. No other HE is known or suspected at the site. The rocket orientation would expel combustion byproducts towards the retaining wall and the opening to the west. The rocket propellant would be consumed in the rocket motor case. Under normal operating conditions, no unburned propellant would be released.

In 1987, a reconnaissance investigation at five potential contaminated sites, including the Old Centrifuge Site, was conducted by the ER Project. Samples were analyzed for uranium, TNT, HSL inorganics, TCLP constituents, and EP Toxicity constituents. Metals, including barium, were detected at concentrations well below regulatory action levels. Total uranium concentrations were typical of area background levels. TNT, pesticides, PCBs, herbicides, and semi-volatiles TCLP compounds were not detected.

Prior to sampling, the surface will be surveyed for radiation. If contamination exists, it is expected to be around the edge of the centrifuge pad at the surface, probably along the open west side. The constituents of concern are metals (specifically lead, beryllium, and barium), depleted uranium, and high explosives. Four surface samples and four subsurface samples will be collected. The sampling locations will be biased toward the west side of the site because that is the open side (Figure 1). All surface samples will be analyzed for all the COCs. One-half of the subsurface samples will be analyzed for uranium and high explosives. All four subsurface samples will be analyzed for metals.

Site 77: Oil Surface Impoundment
The Oil Surface Impoundment Site is outside the TA IV fence, southeast of Building 981-1. The surface impoundment, which was constructed in the 1970's, is used to catch waste water from accelerators. At the time of the RCRA facilities environmental survey, the impoundment was unlined. Since then the impoundment was drained. Soil samples were analyzed for PCBs and

solvents. Based on the analytical results, the impoundment was determined to be clean. Subsequently, the impoundment was lined with geotextile and is now regulated under Sandia's Surface Water Discharge Program.

This site will not require UXO/HE or radiation surface surveys. Minimal confirmation sampling and analysis is proposed to verify that the site is clean. Three surface and three shallow subsurface samples are proposed. The samples will be collected along the perimeter of the existing lined pond (Figure 1). All the samples will be analyzed for PCBs. The subsurface soil samples also will be analyzed for volatile organic compounds (Table 1).

Site 227: Bunker 904 Outfall

Site 227 is an inactive outfall from the septic system for Building 904 (ER Site 48) in TA II. The site starts where the discharge exits the septic tank piping system, approximately 100 feet northeast of the southernmost point of TA II. The extent of the area influenced by the discharge may include the bank of Tijeras Arroyo below the outfall and some area between the outfall and the main channel of Tijeras Arroyo. The site is along the eastern edge of ER Site 45.

Building 904, built in 1948, was used for weapons assembly, HE testing, photo processing, and various other testing. Sanitary wastes were discharged to a septic tank, and other wastes were discharged to the outfall.

Mineral oil is also being considered a potential soil contaminant at all outfalls along the Tijeras Arroyo due to a recent release (June 1994) of mineral oil at Outfall 232 and vague historical records.

Possible soil contaminants are explosives, radioactive materials from weapons processing, including tritium, uranium, and plutonium, solvents (acetone, methylene chloride, methyl ethyl ketone, carbon tetrachloride, toluene, xylene, hexane, alcohols), and inorganics (ammonium hydroxide, barium, cadmium, silver, chromium, titanium, cyanide).

Access to this site is along the TA II perimeter road. This site is within the TA II testing exclusion zone. The best days to sample are generally Friday, Saturday, and Sunday, when testing ceases. Bruce Berry (telephone 845-8018) must be contacted to gain permission and access to this site. Prior to sampling

1. tumbleweeds will be cleared from locations to be sampled and placed adjacent to the drainage;
2. these locations will be visually scanned for UXO/HE; and
3. these locations will be screened for surface radiation anomalies.

The proposed sampling program is to collect four surface soil samples and four shallow subsurface samples. Two surface and two subsurface samples will be collected at the outfall. The other two surface and two subsurface samples will be collected at the furthest visible channel erosion and scour (Figure 1). The analytes are listed in Table 1.

Sites 229 - 235: Storm Drain Systems Outfalls

These sites consist of the discharge areas at seven outfalls along the northern embankment of Tijeras Arroyo. The outfalls discharged industrial effluent and storm water from TAs I, II, and IV. Presently they only discharge storm water. The outfalls receive runoff from Site 96 (Storm Drain System) and other engineered drain systems within the three TAs. The sites are along approximately ¾ miles of the embankment.

The specific constituents in the industrial effluent at these sites are not known. The possible discharged contaminants include chromates, antifoulants, chromium, sodium hydroxide, hydrochloric acid, chromosulfuric acid, diesel, and other petroleum products. To cover this array of possible contaminants, soil samples will be analyzed for volatiles (subsurface samples only), semi-volatiles, metals and chromium^{+6}, if chromium is found in the metals analysis.

Mineral oil is also being considered a potential soil contaminant at all outfalls along the Tijeras Arroyo due to a recent release (June '94) of mineral oil at Outfall 232 and vague historical records. Therefore, soil samples will also be analyzed for TPH.

At Sites 229 through 234, prior to sampling

1. tumbleweeds will be cleared from locations to be sampled and placed adjacent to the drainage;
2. these locations will be visually scanned for UXO/HE; and
3. these locations will be screened for surface radiation anomalies.

Site 229 is due east of the footings of the old guard tower and the south "corner" of the TA II fence. It discharges near the top of the embankment through the center of ER Site 45. Access to this site is along the TA II perimeter road. This site is within the TA II testing exclusion zone. The best days to sample are generally Friday, Saturday, and Sunday, when testing ceases. Bruce Berry (telephone 845-8018) must be contacted to gain permission and access to this site. Because this site discharges from TA II, various radionuclides, possibly including tritium, uranium, and plutonium are of concern. Four surface soil and four subsurface soil samples will be collected at this site (Figure 1). The analytes are listed in Table 1.

Site 230 is west of Building 970 in TA IV. A drain pipe discharges into a bowl-shaped concrete structure adjacent to Building 970A. Flow from this structure is directed to a drain and flume located approximately 120 feet further west. The flume carries the flow to a discharge point slightly above the base of the arroyo embankment. Doug Bloomquist (845-7455) must be contacted to ensure that no laser testing is being performed in the area. Four surface soil and four subsurface soil samples will be collected at this site (Figure 1). The analytes are listed in Table 1.

Site 231 is west of Building 970 in TA IV. A drain pipe discharges to a concrete flume near the top of the embankment. The flume carries the flow to a discharge point near the base of the slope. Doug Bloomquist (845-7455) must be contacted to ensure that no laser testing is being performed in the area..Four surface soil and four subsurface soil samples will be collected at this site (Figure 1). The analytes are listed in Table 1.

Site 232 consists of two outfalls. One outfall is south of Building 970A, east of the lined lagoon. A drain pipe discharges to a concrete flume near the top of the embankment. The flume carries the flow to at discharge point near the bottom of hillside. On June 1, 1994, about 150 to 350 gallons of mineral oil was spilled into this outfall through the storm water drain by building 986. The day after the spill the site was screened for radiation and UXO/HE. No surface radiation anomalies or UXO/HE were found. Also, four surface soil and four subsurface soil samples were collected. The samples were sent to Quintera Laboratory in Denver for analysis for organics, metals, chromium^{+6}, and gamma spec. Other than TPH from the mineral, no contaminants were detected. A Voluntary Corrective Measure was conducted in July and August to remove soil contaminated with mineral oil above 100 mg/kg of TPH.

The second outfall in Site 232 also is south of Building 970A, west of lined lagoon, and approximately 120 feet east of the other Site 232 outfall. Discharge occurs from a concrete structure opening near base of embankment. Access to the site is along the road outside the south side of TA IV. Four surface soil and four subsurface soil samples will be collected at this drainage Figure 1). The analytes are listed in Table 1.

Site 233 is south-southwest of Building 986. Near the top of an escarpment, a small metal drain pipe discharges to an open drain which directs flow within another pipe before discharging near the base of the hillslope. Access to the site is along the road outside the south side of TA IV. Four surface soil and four subsurface soil samples will be collected at this site (Figure 1). The analytes are listed in Table 1.

Site 234 is southeast of Building 981I (Inflatable Building) and a lagoon impoundment (Site 77).

The site discharges into a steep-sided, deeply incised channel cut into the hillside. The drainage channel splits directly uphill of a tree. Access to the site is along the road outside the south side of TA IV. Both channels will be sampled. Six surface soil and six subsurface soil samples will be collected at this site (Figure 1). The analytes are listed in Table 1.

Site 235 is immediately downstream of a large concrete spillway on the northeast side of Pennsylvania and south of the Skeet Range, at the point where the road comes off the north bank of the arroyo and descends into the channel. The flow moves in a confined channel after dropping down the spillway. The site has been cleared for visible surface UXO/HE and screened for surface radiation with no anomalies detected. This channel is considerably larger than the other outfall sites. Six surface soil and six subsurface soil samples will be collected at this site (Figure 1). The analytes are listed in Table 1.

Background

Background soil concentrations for organic contaminants should be negligible. Background concentrations for total metals and radionuclides must be determined for comparison to concentrations found at the sites. Twelve locations have been identified to collect samples for background determination (Figure 1). At each of these sites, one sample will be collected at a depth of 0-6 inches and a second sample collected at 18-36 inches (Table 1).. In addition, the background study report prepared by International Technology Corporation (May 1994) will also be used to evaluate the data.

Quality Assurance

As shown in Table 1, quality assurance samples will include the following:

- Field "duplicates" on more than 10 percent of the samples. These samples will be collected adjacent to the original surface soil sample and in the same hole as the original subsurface soil sample;
- Field soil blanks for more than 10 percent of the VOC analyses. These sample will be obtained from Sample Management Office (SMO) and will contain no VOCs; and
- One rinsate blank. All rinsate will be composited in one container. A sample of the rinsate will be analyzed for all constituents. The disposal method for the rinsate will be determined by the analytical results on this sample.

...Sampling and Analysis Plan

Site	Site Name	Potential Contaminants	...ils															Subsurface Soils															
			Number of Samples	BNAs (8270)	TAL Metals (6010/7000)	Cr^{+6}* (aqueous leaching)	Cyanide (acid digestion)	TPH (8015)	Explosives Res (8330)	TKN (acid digestion)	NO_3/NO_2 (353.2)	Gamma Spec (In-House) 600 901.1	Gamma Spec (Off-site) 600 901.1	PCBs (8080)	Tritium (600 906.0)	Isotopic Plutonium (600 7-79-081)	Isotopic Uranium (HASL-300 4.5)	Number of Samples	VOCs (8240)	BNAs (8270)	TAL Metals (6010/7000)	Cr^{+6}* (aqueous leaching)	Cyanide (acid digestion)	TPH (8015)	Explosives Res (8330)	TKN (acid digestion)	NO_3/NO_2 (353.2)	Gamma Spec (In-House) 600 901.1	Gamma Spec (Off-site) 600 901.1	PCBs (8080)	Tritium (600 906.0)	Isotopic Plutonium (600 7-79-081)	Isotopic Uranium (HASL-300 4.5)
46	Old Acid Waste Line Outfall (Tijeras Arroyo)	Ferric chloride, chromic acid and other acids, ammonia, photo processing chemicals and other unknown chemicals	4	2	4	4	2			4	4	4	2		4	2	2	4	4	2	4	4	2			4	4	4			4	2	2
50	Old Centrifuge Site (TA-2)	Rocket propellant and residues	4		4				4			2			2	1	2	4			4				2						1		1
77	Oil Surface Impoundment	Solvents and PCBs	4											4				4	4											4			
227	Bldg. 904 outfall (TA-2)	High explosives, radioactive materials, nitrate, toluene, methanol, other solvents, carbon tetrachloride, ammonium hydroxide, barium, cadmium, silver, chromium, titanium, cyanide	4	2	4	4	2	2	2	4	4	4	2		4	2	2	4	4	2	4	4	2	4	2	4	4	4			4	2	2
229	Storm Drain System Outfall	Chromates, antifoulants, chromium, sodium hydroxide, hydrochloric acid, chromosulfuric acid, diesel, other petroleum products	4	2	4	4		4				4	2		4	2	2	4	4	2	4	4		4				4			4	2	2
230	Storm Drain System Outfall	Chromates, antifoulants, chromium, sodium hydroxide, hydrochloric acid, chromosulfuric acid, diesel, other petroleum products	4	2	4	4		4				2			2	1	1	4	4	2	4	4		4				2					
231	Storm Drain System Outfall	Chromates, antifoulants, chromium, sodium hydroxide, hydrochloric acid, chromosulfuric acid, diesel, other petroleum products	4	2	4	4		4				2			2	1	1	4	4	2	4	4		4				2					
232	Storm Drain System Outfall	Chromates, antifoulants, chromium, sodium hydroxide, hydrochloric acid, chromosulfuric acid, diesel, other petroleum products	4	2	4	4		4				2			2	1	1	4	4	2	4	4		4				2					
233	Storm Drain System Outfall	Chromates, antifoulants, chromium, sodium hydroxide, hydrochloric acid, chromosulfuric acid, diesel, other petroleum products	4	2	4	4		4				2			2	1	1	4	4	2	4	4		4				2					
234	Storm Drain System Outfall	Chromates, antifoulants, chromium, sodium hydroxide, hydrochloric acid, chromosulfuric acid, diesel, other petroleum products	6	3	6	6		6				2			2	1	1	6	6	3	6	6		6				2					
235	Storm Drain System Outfall	Chromates, antifoulants, chromium, sodium hydroxide, hydrochloric acid, chromosulfuric acid, diesel, other petroleum products	4	2	4	4		4				2			2	1	1	4	4	2	4	4		4				2					
Na	Background		12		12							12			3	3	3	12			12							12			3	3	3
QA	Duplicates	Na		2	5	4	1	4	1	1	1		1	1			2		5	2	5	4	1	4	1	1	1			1			1
QA	Field Soil Blank	Na																	5														
QA	Rinsate	Na		1	1	1	1	1	1	1	1	1	1	1	1	1	1		1		1												
	Totals		58	22	60	43	6	37	8	10	10	39	8	6	30	17	20	58	53	21	60	42	5	38	5	9	9	36		5	16	9	11
	Totals - Surface Plus Subsurface		116	43	120	85	11	75	13	19	19	75	8	11	46	26	31		53														

* Analyze for Cr^{+6} only if Cr is detected in metals analysis

Appendix B
Analytical Results

ACRONYMS FOR ANALYTICAL DATA

Organic/metals data for soil = mg/kg
Radionuclides data for soil = pCi/g

ND = Not detected

NS = Not significant

MDA = Maximum Detectable Activity

J = Detected at a concentration below the laboratory reporting limit

B = Detected in the associated blank sample

Site 227 Soil Results

Sample Identifier	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Copper	Iron	Lead	Magnesium	Manganese	Mercury	Nickel	Potassium	Selenium
227-01-A	7100	12	5.1	160	0.3	2.6	37000	7	4.7	8.8	8.8	14000	11	3600	200	ND	6.3	22000	ND
227-01-B	6800	11	1.4	200	0.3	2	57000	5	4.3		9.1	10000	11	3800	220	ND	6	1700	ND
227-02-A	5800	9.3	5.9	180	ND	2.1	31000	7	4.1		7.8	13000	7.5	2800	160	ND	5.4	1600	ND
227-02-B	6100	10	5.3	210	0.3	2.2	45000	6	3.8		7.5	13000	7.9	3300	170	ND	5	1400	ND
227-03-A	4300	7.2	0.7	140	ND	2.3	32000	6	4		7.5	12000	9.6	2600	170	ND	4.6	1500	ND
227-03-B	5100	8.8	0.9	140	ND	2.1	23000	6	4.5		11	13000	7.5	3200	200	ND	5.4	1700	ND
227-04-A	6900	11	0.6	150	ND	2.3	43000	7	3.8		8.9	12000	11	3700	210	ND	6	2400	ND
227-04-B	8600	13	7.7	180	0.3	2.9	24000	9	5.1		10	15000	10	4300	280	ND	7.4	2700	ND

Sample Identifier	Silver	Sodium	Thallium	Vanadium	Zinc	Cr^{+6}*	Cyanide	Cesium 137	Potassium 40	Thallium	Lead 212	Lead 214	Thorium 234	Tritium	Plutonium 239/240	Plutonium 238	Uranium 238	Uranium 235/236	Uranium 234
227-01-A	ND	260	ND	28	53	ND	ND	ND	18		0.8	0.64	1.3	<0.013	<0.010	<0.008	0.6	0.19	0.7
227-01-B	ND	250	ND	20	50	ND	ND							<0.012	0.009	<0.007	0.4	0.054	0.6
227-02-A	ND	280	ND	27	51	ND								<0.010					
227-02-B	ND	260	ND	26	46	ND								<0.013					
227-03-A	ND	ND	ND	24	44	ND	ND	ND	26	0.2	0.7	0.56		<0.012	0.004	<0.007	0.4	0.15	0.6
227-03-B	ND	260	ND	25	48	ND	ND							<0.011	<0.008	<0.005	0.7	0.11	0.7
227-04-A	ND	270	ND	23	53	ND								<0.012					
227-04-B	ND	270	ND	28	59	ND								<0.014					

Concentrations in mg/kg
Activities in pCi/g
Sample Identifier XX-XX-A - surface soil samples
Sample Identifier XX-XX-B - subsurface soil samples

Quality Assurance Results for Organic Constituents

Sample Identifier	Sample Type	2-Butanone	2-Hexanone	4-Methyl-2-pentanone	Acetone	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Chrysene	Di-n-octyl phthalate	Fluoranthene	Methylene Chloride	Phenanthrene	Pyrene	Styrene	total-Xylenes	TPH
227-01-A	original										0.066 J		0.055 J	0.040 J			
227-01-A	duplicate										0.038 J		0.051 J				
227-01-B	original	0.007 J		0.001 J													
227-01-B	duplicate	0.006 J			0.006 J												
227-04-B	original	0.004 J															
227-04-B	duplicate	0.005 J				0.071 J	0.050 J	0.16 J	0.11 J		0.23 J		0.17 J	0.19 J			ND
229-01-A	original					0.006 J	0.092 J	0.16 J	0.12 J		0.20 J		0.18 J	0.28 J			81
229-01-A	duplicate																
229-02-B	original	0.006 J															
229-02-B	duplicate	0.006 J															
229-03-B	original	0.006 J															
229-03-B	duplicate	0.006 J								0.16 J							
230-04-B	original	0.003 JB															
230-04-B	duplicate																
235-02-B	original	0.006 JB															
235-02-B	duplicate	0.004 JB															
Site 227	trip blank	0.010 B	0.003 J	0.002 J	0.019												
Site 229	trip blank	0.009 JB			0.015							0.003 J					
Site 230	trip blank	0.004 JB															
Site 232	trip blank	0.007 JB													0.001 J		
Site 234	trip blank	0.007 JB			0.015											0.001 J	ND
Site 235	rinsate	0.005 JB			0.010												

Quality Assurance Results for Inorganic and Radiological Constituents

Sample Identifier	Sample Type	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Mercury	Nickel	Vanadium	Zinc
227-02-A	original	5800	9.3	5.9	180	ND	2.1	6.6	4.1	7.8	13000	7.5	160	ND	5.4	27	51
227-02-A	duplicate	6500	11	1.4	150	0.25	2.5	6.4	4.1	13	14000	9.1	170	ND	5.9	28	51
227-03-B	original	5100	8.8	0.92	140	ND	2.1	5.9	4.5	11	13000	7.5	200	ND	5.4	25	48
227-03-B	duplicate	6400	9.9	5.6	140	0.25	2.9	7.4	4.6	10	16000	8.9	230	ND	5.9	33	50
229-04-A	original	8100	13	5.7	150	0.32	2.3	8.0	4.2	7.9	13000	12	210	ND	6.3	24	55
229-04-A	duplicate	7700	12	1.5	140	0.30	2.2	8.0	4.2	7.7	12000	11	190	ND	6.2	24	52
230-04-B	original	1500	3.3	1.6	130	ND	0.61	2.3	ND	18	3500	4.2	110	ND	3.0	9.1	82
230-04-B	duplicate	2400	4.9	1.7	140	ND	0.68	3.1	2.5	15	4500	4.1	120	ND	3.4	9.7	71
235-01-A	original	3600	6.2	5.1	150	ND	2.7	6.0	8.4	6.6	20000	7.6	210	ND	4.5	36	66
235-01-A	duplicate	3000	5.3	1.3	160	ND	1.6	4.2	5.7	6.5	12000	9.4	180	ND	4.4	22	66
50-01-B	original	3100	6.5	2.1	110	0.25	1.3	4.1	3.9	6.2	7600	6.6	130	ND	4.5	17	18
50-01-B	duplicate	3900	7.5	2.0	110	0.26	1.3	4.3	4.0	5.7	8800	5.9	150	ND	4.2	18	21
50-02-A	original	5800	12	4.2	220	0.38	1.6	5.2	4.3	12	6700	25	210	ND	7.1	11	69
50-02-A	duplicate	7000	14	6.4	280	0.55	2.2	8.3	6.1	17	9000	35	290	0.04	9.4	18	61
Bkg-05-A	original	6400	13	5.7	210	0.53	1.8	6.1	6.6	14	10000	16	330	ND	8.9	22	37
Bkg-05-A	duplicate	5900	12	7.6	190	0.50	1.7	6.0	6.3	14	10000	16	320	ND	8.7	24	36
Site 235	rinsate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Sample Identifier	Sample Type	TKN	NO_3/NO_2	Potassium 40	Lead 212	Lead 214	Plutonium 239/240	Uranium 238	Uranium 235/236	Uranium 234
227-02-A	original	400	2.7							
227-02-A	duplicate	320	9.3							
227-03-A	original						0.004	0.4	0.15	0.61
227-03-A	duplicate							0.67	0.023	0.67
227-03-B	original							0.72	0.11	0.72
227-03-B	original	220	ND							
227-03-B	duplicate			27.8	0.71	0.7				
227-03-B	duplicate	190	1.4							
229-01-A	original						0.007	0.45	0.17	0.67
229-01-A	duplicate							0.73	0.034	0.6
229-03-B	original							0.45	0.058	0.45
229-03-B	duplicate							0.99	0.06	1

Notes on Quality Assurance Data

Explosive residues were not detected in Site 50 duplicate sample

Hexavalent chromium was not detected in five duplicates and one decon rinsate

Cyanide was not detected in two duplicates and one decon rinsate

PCBs were not detected in one Site 77 duplicate sample

Tritium and Plutonium-238 were not detected in four duplicate samples

Selenium, silver, and thallium were not detected in any quality assurance samples

Appendix C
Background Calculations for Metals and Radionuclides

Appendix C. Background Calculations for Metals and Radionuclides

To evaluate metals data, 24 background samples were collected for metals analyses.[4] Distribution analyses was performed first by constructing histograms. The histograms indicated a parametric distribution. Outliers were screened in a two-step process as described in the base wide background report (IT 1994). The first step is to perform an "a priori" screening for very high values relative to the rest of the data set. This is qualitatively performed by visually examining a column of sorted values. Maximum values that are a factor of 3 or 4 times higher than their nearest neighbor are removed from the data set during this step. None of the anomalous values were deleted by the "a priori" process.

The second step, from EPA, 1989, determines whether an observation that appears extreme fits the data distribution. A statistical parameter, T_n is calculated:

$$T_n = (X_n - X_a)/S$$

where:

X_n = questionable observation;

X_a = sample arithmetic mean; and

S = sample standard deviation

T_n is compared to a table of one-sided critical values for the appropriate significance level (upper 5 percent) and sample size from a table provided in EPA 1989. Extreme concentrations for barium, calcium, chromium, copper and nickel were identified as outliers and were excluded from the data set. These anomalous values may have resulted from laboratory or sampling error.

Probability plots were then replotted to determine whether the data fit normal or lognormal populations. These plots are shown in Appendix D. The UTL[5] was calculated for data sets that fit a normal or lognormal distribution. Data sets are provided in Appendix D. As recommended by EPA, a tolerance coefficient value of 95 percent was used (EPA 1989). Most metals background data fit lognormal distributions. Iron and zinc data fit normal distributions. UTLs were not calculated for mercury, selenium, and silver because mercury and selenium were not detected and silver was detected only once in the 24 background samples. The beryllium background data did not fit a normal or lognormal distribution. The maximum value in a data set is commonly taken as the UTL in a non-parametric setting (Guttman, 1970). The maximum background beryllium concentration was 0.53 mg/kg.

Base-wide background UTLs for radionuclides were established by International Technology (IT) Corporation to compare and evaluate radionuclide data (IT, 1994). A table is provided in Appendix

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[2]These data are referred to as local background data. The data collected throughout Kirtland Air Force Base (KAFB), with most of the data collected within SNL/NM technical areas, are called base-wide background data (IT 1994).

[3]$UTL = x + K \cdot S$, where:

UTL = Upper tolerance limit;
x = Sample arithmetic mean (for normal distribution), sample geometric mean (for lognormal distribution);
S = Sample standard deviation; and
K = One-sided normal tolerance factor (95 percent for these evaluations).

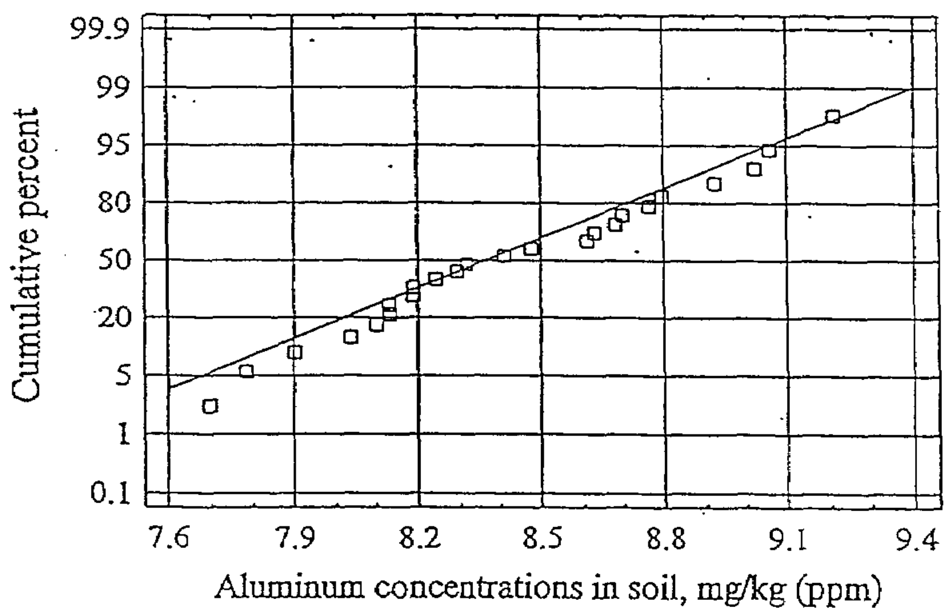
D with radionuclide background data and the corresponding UTLs. The maximum activity from the six local background samples for isotopic plutonium and isotopic uranium was used as an additional method to evaluate the data. Also, in-house gamma spectroscopy was performed on all 24 background samples and indicated low levels of radioactivity but no significant contamination.

Appendix D
Probability Plots, Local Background UTL Calculations, and Base-Wide Background UTLs for Radionuclides

statistics for Log(Aluminum)

```
 = 24
age = 8.42942
an = 8.36529
-
etric mean = 8.41976
ance = 0.170246
dard deviation = 0.412609
dard error = 0.0842235
mum = 7.69621
mum = 9.21034
e = 1.51413
r quartile = 8.13153
r quartile = 8.73178
rquartile range = 0.600253
ness = 0.132255
. skewness = 0.26451
osis = -0.792361
. kurtosis = -0.792361
f. of variation = 4.89487
= 202.306
```

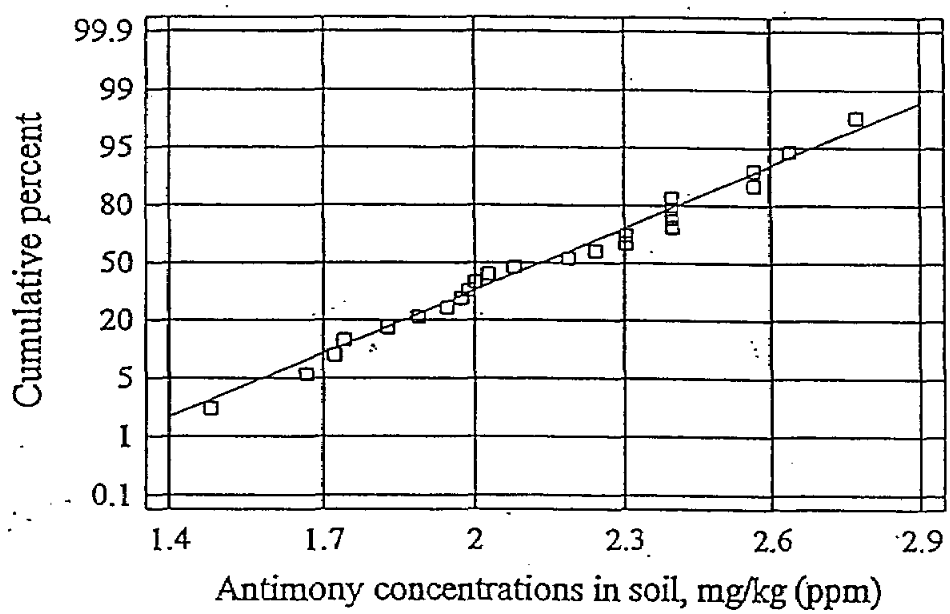
Lognormal Probability Plot for Aluminum



ımmacy Statistics for log(Antimony)

ount = 24
rerage = 2.14609
edian = 2.13275
ode = 2.3979
eometric mean = 2.12004
riance = 0.113831
tandard deviation = 0.337389
tandard error = 0.0688692
nimum = 1.4816
ximum = 2.77259
nge = 1.29098
wer quartile = 1.91649
per quartile = 2.3979
terquartile range = 0.481405
ewness = -0.040772
nd. skewness = -0.0815441
rtosis = -0.744171
nd. kurtosis = -0.744171
eff. of variation = 15.7211
m = 51.5062

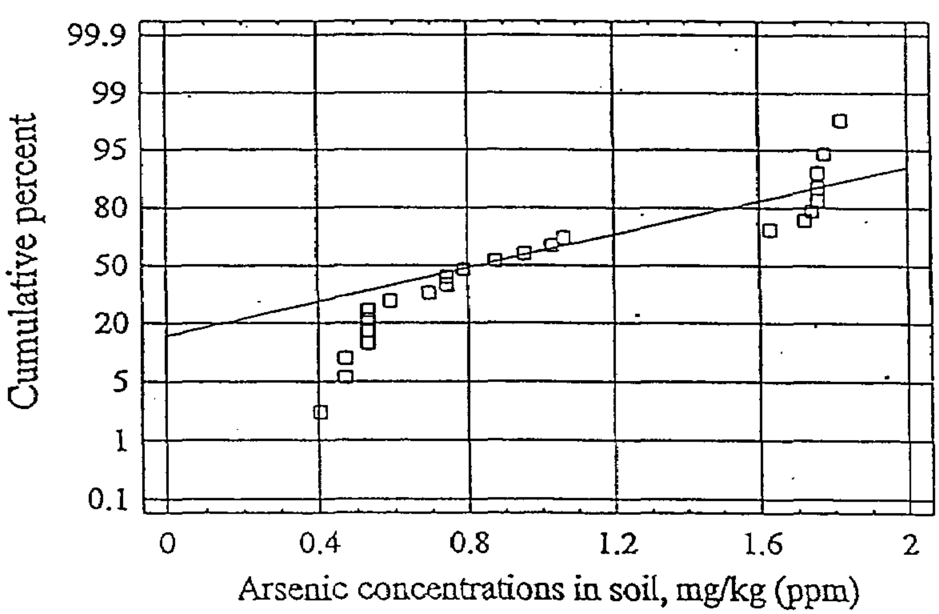
Lognormal Probability Plot for Antimony



Statistics for log(Arsenic)

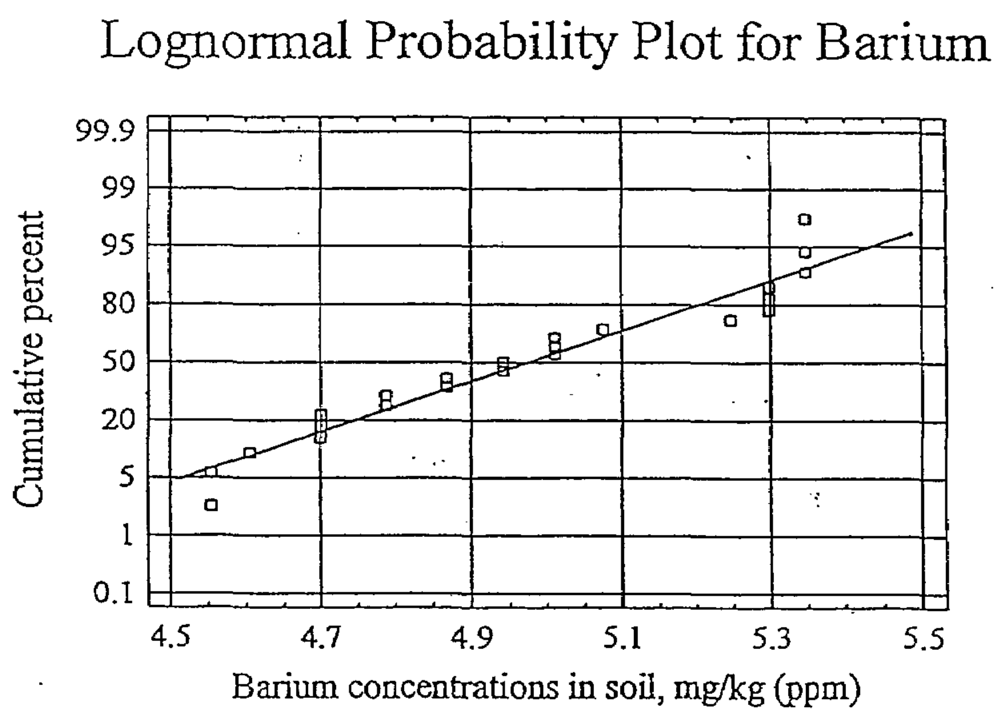
```
= 24
rage = 1.038
ian = 0.831963
e =
metric mean = 0.908119
iance = 0.291153
ndard deviation = 0.539586
ndard error = 0.110143
imum = 0.405465
imum = 1.82455
ge = 1.41908
er quartile = 0.530628
er quartile = 1.73162
erquartile range = 1.20099
wness = 0.463036
d. skewness = 0.926071
tosis = -1.58507
d. kurtosis = -1.58507
ff. of variation = 51.983
= 24.9121
```

Lognormal Probability Plot for Arsenic



mary Statistics for Log(Barium)

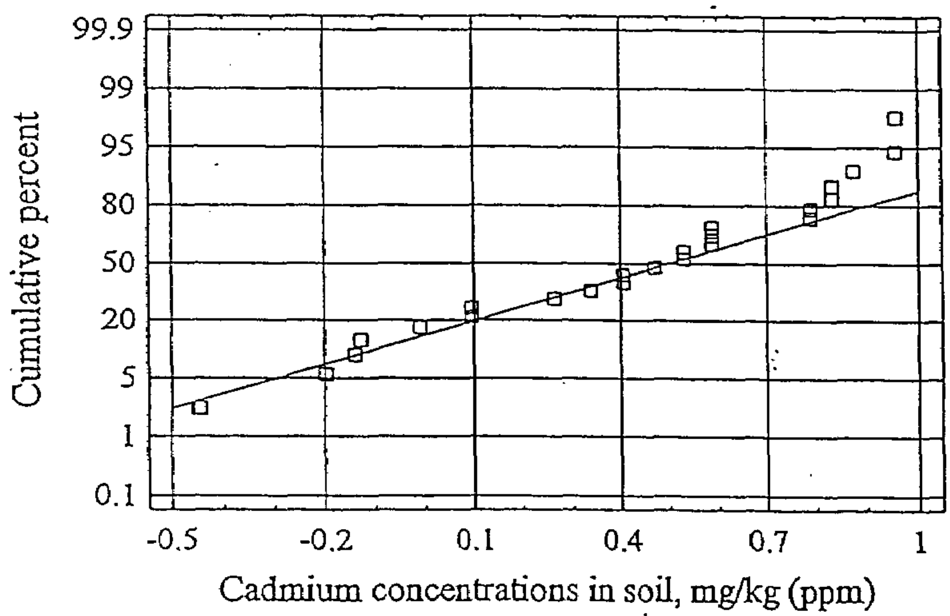
nt = 23
rage = 4.96940
ian = 4.94164
e = 5.34711
metric mean = 4.96236
iance = 0.0740602
ndard deviation = 0.27214
ndard error = 0.0567451
imum = 4.55388
imum = 5.34711
ge = 0.793231
r quartile = 4.70048
r quartile = 5.29832
rquartile range = 0.597837
ness = 0.0653415
. skewness = 0.127931
osis = -1.30542
. kurtosis = -1.27794
f. of variation = 5.47622
= 114.298



Statistics for log(Cadmium)

```
= 24
:age = 0.416764
dian = 0.500316
de =
ometric mean =
riance = 0.159937
andard deviation = 0.399922
andard error = 0.0816337
nimum = -0.446287
ximum = 0.955511
nge = 1.4018
wer quartile = 0.0953102
per quartile = 0.788457
terquartile range = 0.693147
ewness = -0.506707
d. skewness = -1.01341
rtosis = -0.674504
d. kurtosis = -0.674504
eff. of variation = 95.9587
= 10.0023
```

Lognormal Probability Plot for Cadmium

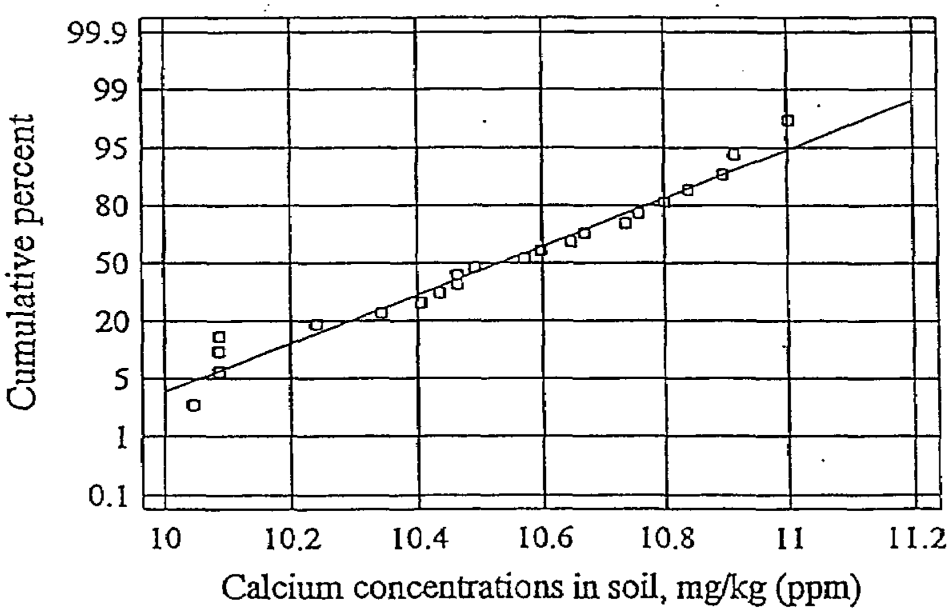


32

```
mary Statistics for log(Calcium)

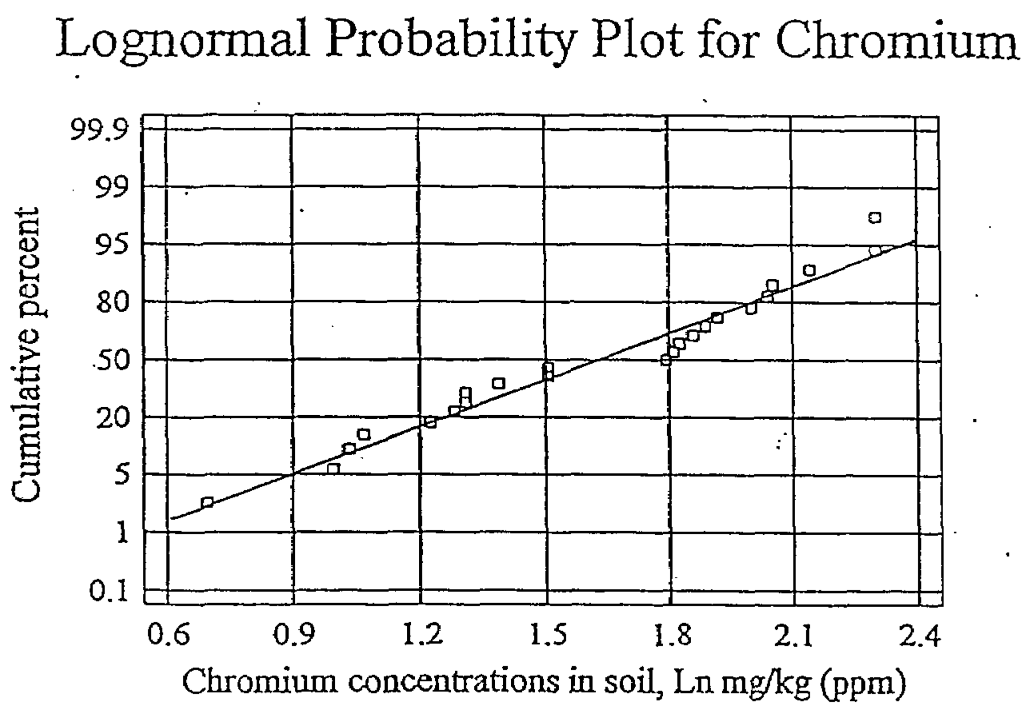
int = 23
rage = 10.5579
lian = 10.5713
le = 10.0050
metric mean = 10.5532
iance = 0.10513
ndard deviation = 0.324237
ndard error = 0.0676081
imum = 10.0432
imum = 11.2645
ige = 1.22121
er quartile = 10.3417
er quartile = 10.7996
erquartile range = 0.457833
wness = 0.109797
d. skewness = 0.214971
tosis = -0.415646
d. kurtosis = -0.406895
ff. of variation = 3.07103
 = 242.832
```

Lognormal Probability Plot for Calcium



Statistics for log(Chromium)

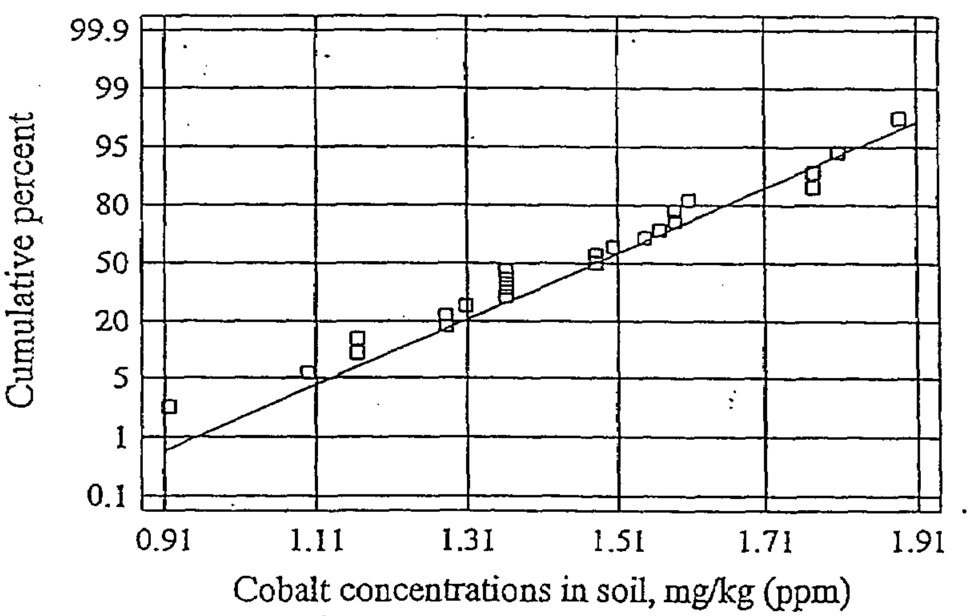
[illegible] = 23
[illegible]rage = 1.61841
[illegible]lian = 1.79176
[illegible]le =
[illegible]metric mean = 1.55042
[illegible]iance = 0.204195
[illegible]ndard deviation = 0.451879
[illegible]ndard error = 0.0942233
[illegible]imum = 0.693147
[illegible]imum = 2.30259
[illegible]ge = 1.60944
[illegible]er quartile = 1.28093
[illegible]er quartile = 2.00148
[illegible]erquartile range = 0.720546
[illegible]wness = -0.274151
[illegible]d. skewness = -0.536757
[illegible]tosis = -0.905395
[illegible]d. kurtosis = -0.886332
[illegible]ff. of variation = 27.9211
[illegible] = 37.2235



ummary Statistics for Log(Cobalt)

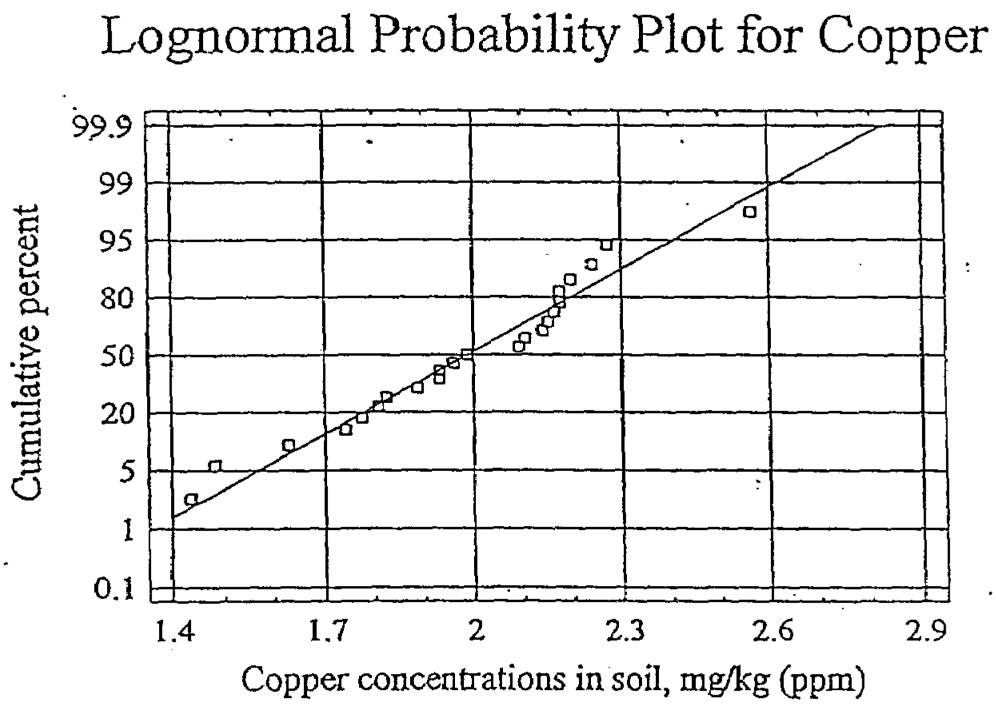
```
ount = 24
verage = 1.29969
edian = 1.42129
ode =
eometric mean =
riance = 0.574775
andard deviation = 0.758139
andard error = 0.154754
nimum = -2.07944
ximum = 1.88707
nge = 3.96651
wer quartile = 1.28093
per quartile = 1.58924
terquartile range = 0.308301
ewness = -4.13299
nd. skewness = -8.26598
rtosis = 18.9091
nd. kurtosis = 18.9091
eff. of variation = 58.3324
n = 31.1925
```

Lognormal Probability Plot for Cobalt



Statistics for log(Copper)

n 23
rage = 1.90556
ian = 1.90787
e =
metric mean = 1.96762
iance = 0.0713494
ndard deviation = 0.267113
ndard error = 0.0556969
imum = 1.43508
imum = 2.56495
ge = 1.12986
er quartile = 1.80829
er quartile = 2.17475
erquartile range = 0.366463
wness = -0.263077
d. skewness = -0.515077
tosis = 0.18883
d. kurtosis = 0.184854
ff. of variation = 13.4528
= 45.6679

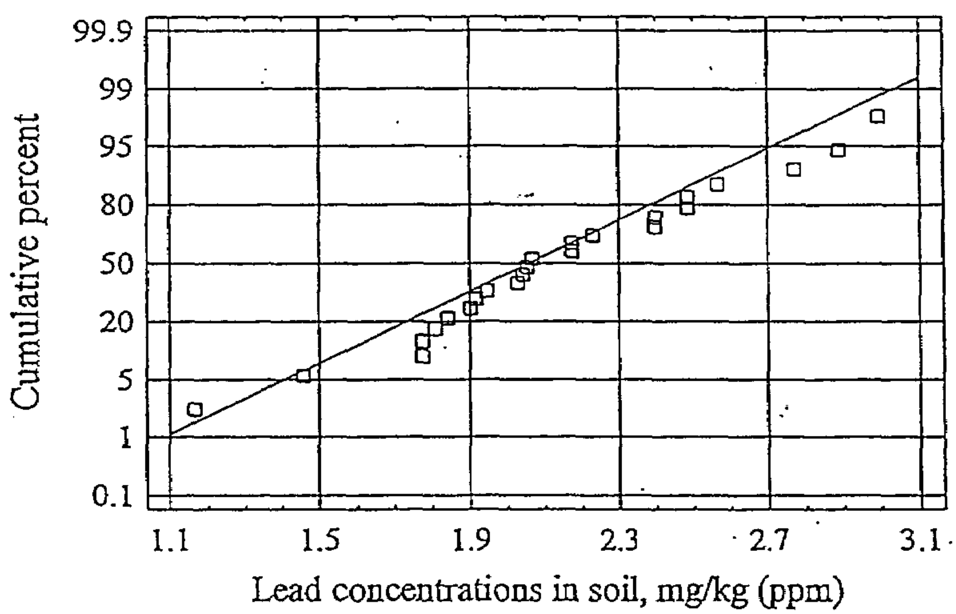


4

```
immary Statistics for Log(Lead)

ount = 24
erage = 2.13936
dian = 2.06049
de =
ometric mean = 2.09509
riance = 0.187882
andard deviation = 0.433454
andard error = 0.0884784
nimum = 1.16315
ximum = 2.99573
nge = 1.83258
wer quartile = 1.87133
per quartile = 2.4414
terquartile range = 0.570072
ewness = 0.0350174
nd. skewness = 0.0700348
rtosis = 0.200156
nd. kurtosis = 0.200156
eff. of variation = 20.261
im = 51.3446
```

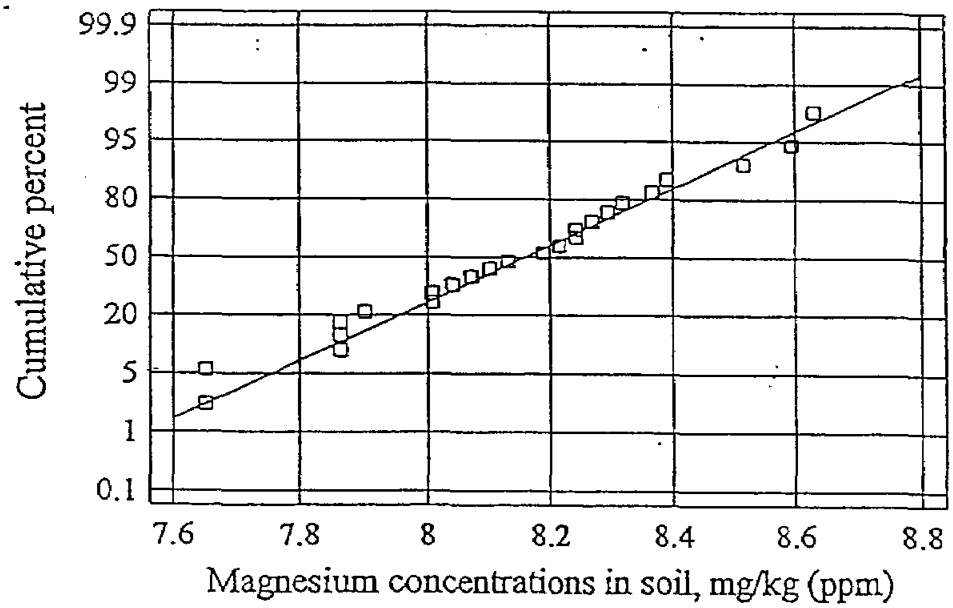
Lognormal Probability Plot for Lead



atistics for log(Magnesium)

```
 = 24
ige = 8.14232
in = 8.16011
 =
etric mean = 8.13815
ince = 0.0706013
iard deviation = 0.265709
iard error = 0.0542376
num = 7.64969
num = 8.63052
 = 0.980829
: quartile = 7.95369
: quartile = 8.3064
:quartile range = 0.352709
iess = -0.0600481
. skewness = -0.120096
>sis = -0.414246
. kurtosis = -0.414246
:. of variation = 3.26331
 195.416
```

Lognormal Probability Plot for Magnesium

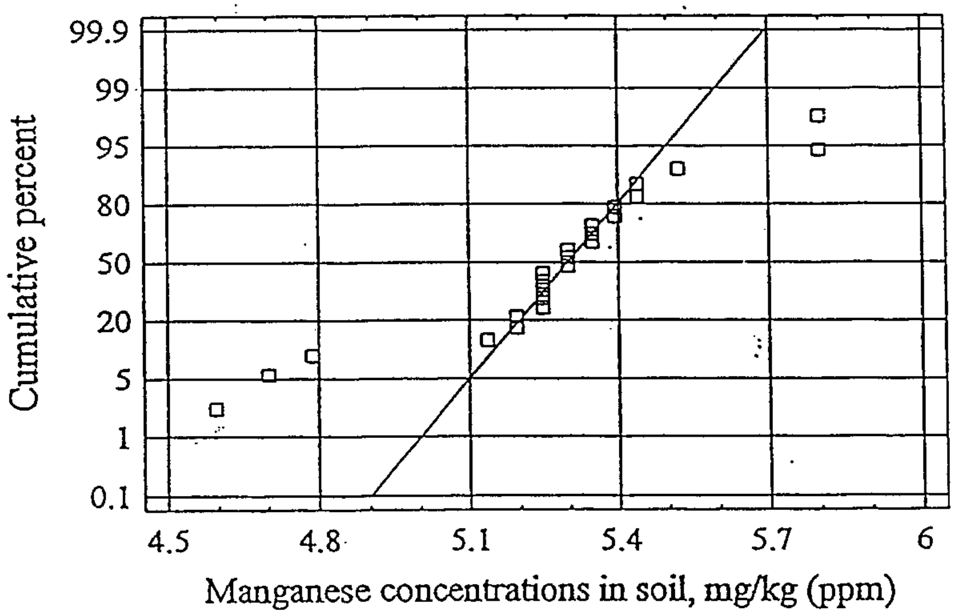


38

```
mary Statistics for Log(Manganese)

int = 24
rage = 5.2733
lian = 5.29832
le =
metric mean = 5.2661
iance = 0.0771874
ndard deviation = 0.277826
ndard error = 0.056711
imum = 4.59512
imum = 5.79909
ge = 1.20397
er quartile = 5.21999
er quartile = 5.39363
erquartile range = 0.173637
wness = -0.660387
d. skewness = -1.32077
tosis = 1.62566
d. kurtosis = 1.62566
ff. of variation = 5.26854
 = 126.559
```

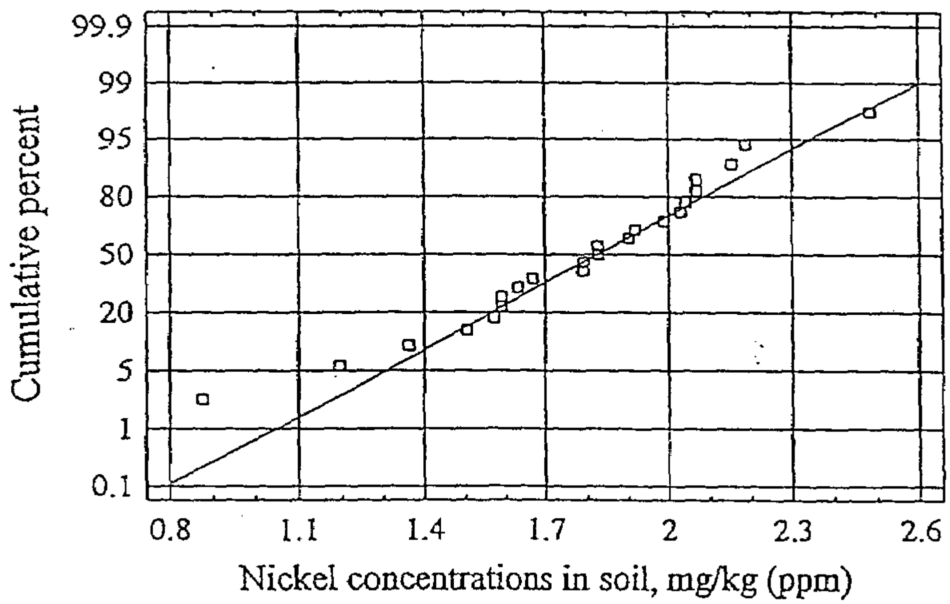
Lognormal Probability Plot for Manganese



```
Statistics for log(Nickel)

 = 23
erage = 1.78451
dian = 1.82455
de =
ometric mean = 1.74596
riance = 0.1246
andard deviation = 0.352987
andard error = 0.0736029
nimum = 0.875469
ximum = 2.48491
nge = 1.60944
wer quartile = 1.58924
per quartile = 2.04122
terquartile range = 0.451985
ewness = -0.609856
nd. skewness = -1.19403
rtosis = 0.992502
nd. kurtosis = 0.971605
eff. of variation = 19.7806
a = 41.0438
```

Lognormal Probability Plot for Nickel



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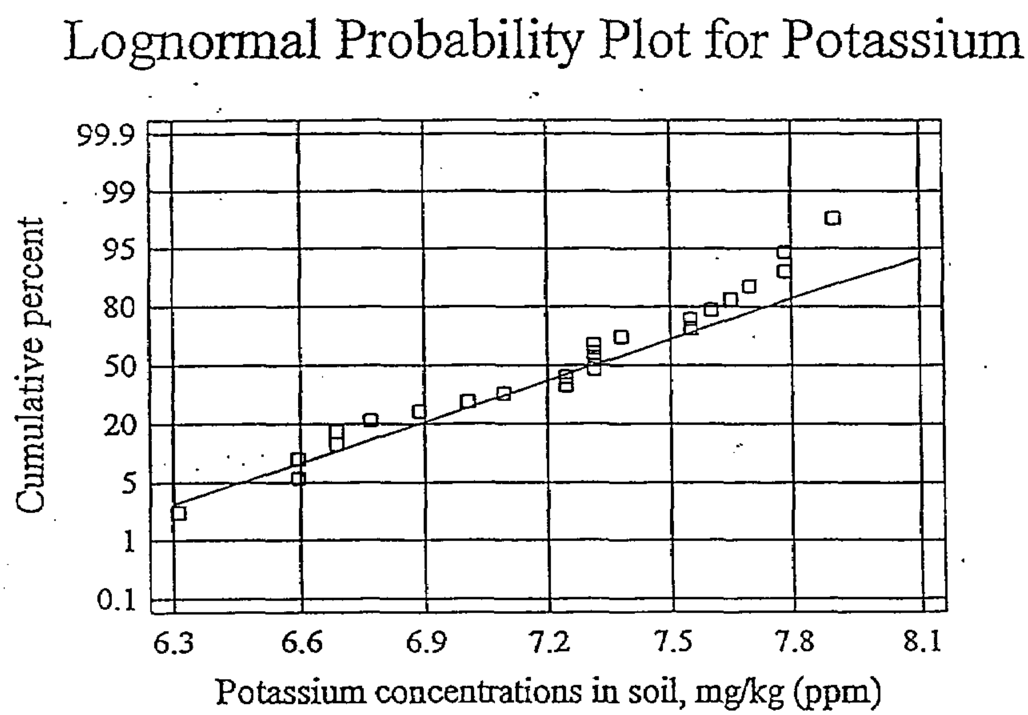
mary Statistics for log(Potassium)

nt = 24
rage = 7.21062
ian = 7.31322
e = 7.31322
metric mean = 7.20542
iance = 0.195599
ndard deviation = 0.442265
ndard error = 0.0902771
imum = 6.30992
imum = 7.90101
ge = 1.59109
er quartile = 6.82802
er quartile = 7.57526
erquartile range = 0.747233
wness = -0.373735
d. skewness = -0.74747
tosis = -0.83864
d. kurtosis = -0.83864
ff. of variation = 6.12673
 = 173.247
```

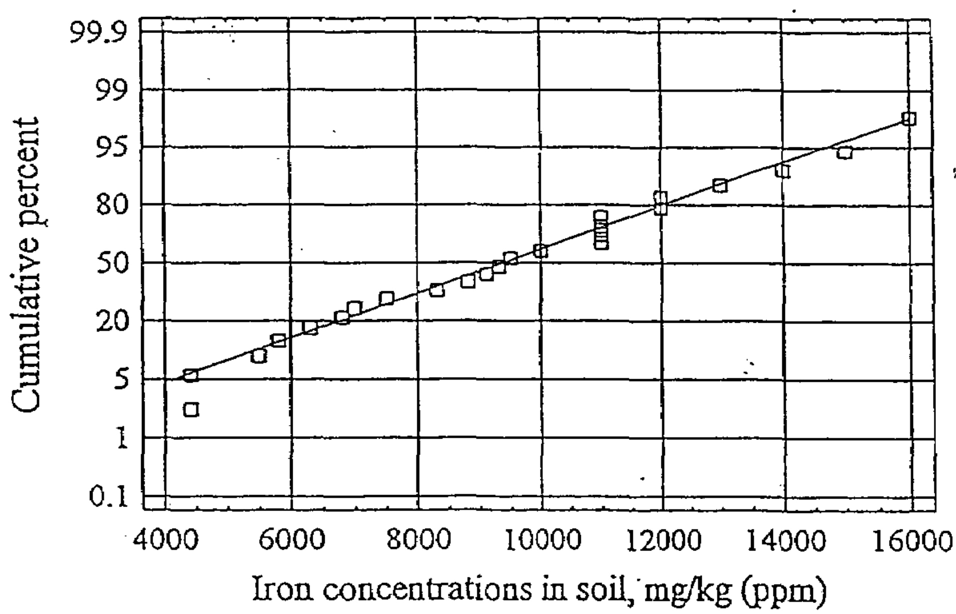


41

Statistics for Iron

. = 24
:rage = 9529.17
lian = 9400.0
le = 11000.0
metric mean = 8977.5
:iance = 1.0363E7
ndard deviation = 3219.17
ndard error = 657.109
imum = 4400.0
:imum = 16000.0
ige = 11600.0
rer quartile = 6900.0
er quartile = 11500.0
:erquartile range = 4600.0
wness = 0.20025
d. skewness = 0.400499
:tosis = -0.620589
d. kurtosis = -0.620589
ff. of variation = 33.7822
 = 228700.0

Normal Probability Plot for Iron

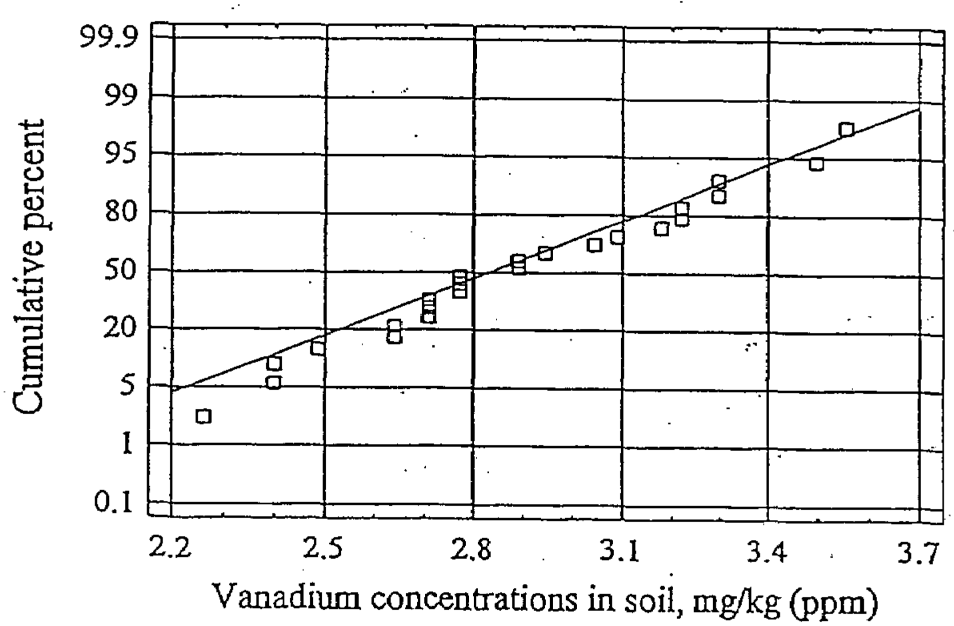


42

mmary Statistics for log(Vanadium)

```
unt = 24
erage = 2.89094
dian = 2.83148
de =
ometric mean = 2.87064
riance = 0.122444
andard deviation = 0.34992
andard error = 0.0714271
nimum = 2.26176
ximum = 3.55535
nge = 1.29358
wer quartile = 2.67355
per quartile = 3.19846
terquartile range = 0.524911
ewness = 0.158415
d. skewness = 0.316831
rtosis = -0.688491
d. kurtosis = -0.688491
ff. of variation = 12.104
= 69.3826
```

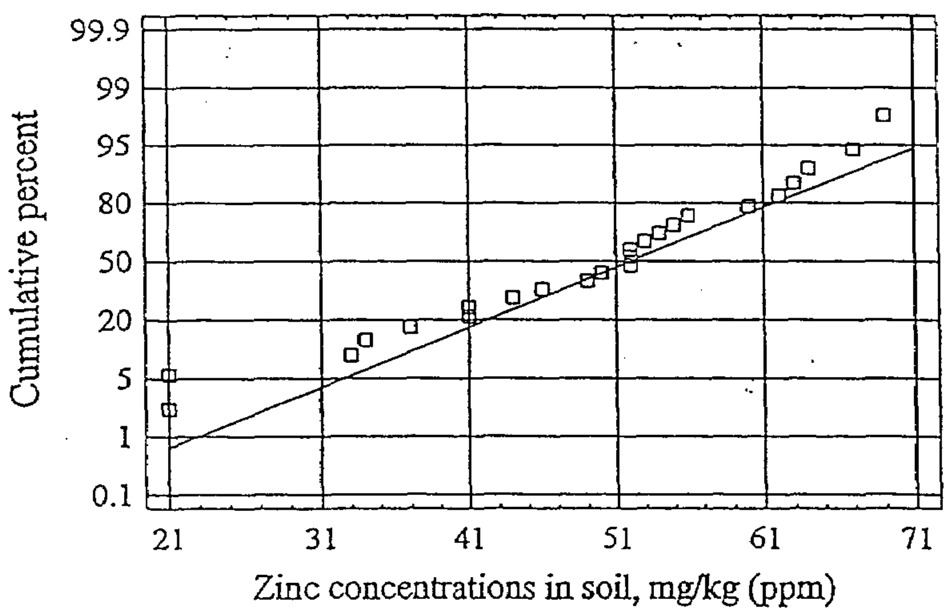
Lognormal Probability Plot for Vanadium



Statistics for Zinc

= 24
..age = 49.0
ian = 52.0
e = 52.0
metric mean = 46.9434
iance = 171.478
ndard deviation = 13.095
ndard error = 2.673
imum = 21.0
imum = 69.0
ge = 48.0
er quartile = 41.0
er quartile = 58.0
erquartile range = 17.0
wness = -0.633044
d. skewness = -1.26609
tosis = -0.0224531
d. kurtosis = -0.0224531
ff. of variation = 26.7244
= 1176.0

Normal Probability Plot for Zinc



Local Background Soil Results

Sample Identifier	Aluminum	Antimony	Arsenic	Barium	Beryllium	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium	Manganese	Mercury
Bkg-01-A	2700	6	2	110	ND	0.9	23000	3	3	6	5800	6	2100	190	ND
Bkg-01-B	4100	8	2	130	0.3	1.5	24000	5	4	7	8800	7	3100	230	ND
Bkg-02-A	2400	4	2	110	ND	0.8	35000	2	3	4	4400	3	2100	99	ND
Bkg-02-B	3400	7	2	130	ND	1	31000	3	3	6	6300	8	2700	210	ND
Bkg-03-A	4800	9	5	110	0.4	1.8	36000	6	5	9	11000	9	3700	210	ND
Bkg-03-B	6000	10	2	95	0.4	1.8	28000	7	5	9	11000	9	4400	250	ND
Bkg-04-A	4000	7	2	120	0.3	2.3	24000	9	4	13	9300	8	3000	190	ND
Bkg-04-B	3300	6	2	120	ND	1.4	24000	4	4	7	8300	6	2600	210	ND
Bkg-05-A	6400	13	6	210	0.5	1.8	78000	6	7	14	10000	16	5600	330	ND
Bkg-05-B	5500	10	6	140	0.5	1.7	33000	6	6	9	11000	11	3900	330	ND
Bkg-06-A	4500	9	6	150	0.3	1.5	46000	19	4	8	9100	8	3800	190	ND
Bkg-06-B	3800	8	2	150	0.3	1.1	51000	4	4	7	6800	7	3400	200	ND
Bkg-07-A	3100	6	2	95	0.3	1.1	34000.	4	4	6	7000	12	2600	170	ND
Bkg-07-B	3600	7	3	100	0.3	1.3	39000	4	4	6	7500	7	3000	180	ND
Bkg-08-A	2200	5	6	160	ND	0.6	54000	3	ND	4	4400	4	2600	110	ND
Bkg-08-B	3600	7	3	190	ND	1.6	60000	5	4	7	9500	6	4100	180	ND
Bkg-09-A	5900	11	6	210	0.4	1.7	49000	6	5	7	11000	8	5400	230	ND
Bkg-09-B	3400	7	3	210	0.3	0.9	82000	3	3	5	5500	6	3800	120	ND
Bkg-10-A	7500	11	2	140	0.3	2.3	42000	8	5	8	13000	12	3200	190	ND
Bkg-10-B	6600	11	6	150	0.3	2.6	35000	7	4	10	14000	11	3300	200	ND
Bkg-11-A	8300	13	2	200	0.4	2.2	43000	8	5	9	12000	18	3600	190	ND
Bkg-11-B	10000	16	2	200	0.5	2.4	40000	10	6	9	16000	20	4000	220	ND
Bkg-12-A	5600	11	2	200	0.3	2.2	55000	7	5	9	12000	9	4300	200	ND
Bkg-12-B	8600	14	6	290	0.4	2.6	47000	10	6	9	15000	13	5000	220	ND

Concentrations in mg/kg
Activities in pCi/g
Sample Identifier XX-XX-A - surface soil samples
Sample Identifier XX-XX-B - subsurface soil samples

Local Back[illegible]nd Soil Results

Sample Identifier	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Vanadium	Zinc	Tritium	Plutonium 239/24	Plutonium 238	Uranium-238	Uranium-235/236	Uranium-234
Bkg-01-A	4	1500	ND	ND	ND	ND	11	50						
Bkg-01-B	6	2000	ND	ND	ND	ND	16	63						
Bkg-02-A	2	730	ND	ND	ND	ND	9.6	41						
Bkg-02-B	5	1600	ND	ND	ND	ND	11	53						
Bkg-03-A	7	1500	ND	ND	ND	ND	19	56						
Bkg-03-B	9	1200	ND	ND	480	ND	15	62						
Bkg-04-A	12	1900	ND	1	ND	ND	18	55	<0.010	<0.009	<0.011	0.8	0.28	1
Bkg-04-B	5	1400	ND	ND	ND	ND	16	52	<0.022	<0.008	<0.009	0.3	0.02	0.3
Bkg-05-A	9	2700	ND	ND	ND	ND	22	37						
Bkg-05-B	8	1400	ND	ND	ND	ND	18	34						
Bkg-06-A	13	1500	ND	ND	ND	ND	16	52						
Bkg-06-B	6	800	ND	ND	420	ND	14	54						
Bkg-07-A	5	870	ND	ND	ND	ND	15	21						
Bkg-07-B	5	800	ND	ND	380	ND	15	21						
Bkg-08-A	3	730	ND	ND	ND	ND	12	33						
Bkg-08-B	5	980	ND	ND	430	ND	21	67						
Bkg-09-A	8	1100	ND	ND	280	ND	24	41						
Bkg-09-B	5	550	ND	ND	640	ND	14	44						
Bkg-10-A	6	2400	ND	ND	ND	ND	27	52						
Bkg-10-B	7	2200	ND	ND	ND	ND	27	49						
Bkg-11-A	7	2100	ND	ND	280	ND	25	60	<0.023	<0.007	<0.017		0.03	0.5
Bkg-11-B	8	2400	ND	ND	290	ND	35	64	<0.024	<0.012	<0.018		0.03	0.6
Bkg-12-A	6	1500	ND	ND	ND	ND	25	46	<0.084	<0.030	<0.017		0.17	0.8
Bkg-12-B	8	1900	ND	ND	620	ND	33	69	<0.023	0.035	0.038	0.6	0.33	0.9

Concentrations in mg/kg
Activities in pCi/g
Sample Identifier XX-XX-A - surface soil samples
Sample Identifier XX-XX-B - subsurface soil samples

Normal Parameters for Tijeras Arroyo Local Metal Background Data

Statistical Parameter	Aluminum	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Nickel	Vanadium	Zinc
median	4300	8.5	2	140	2	6	4.2	7.3	9400	7.9	200	6.2	17	52
geometric mean	4579.9	8.6	3	144	2	5	3.7	7.3	8977.5	8.5	195	6	18	47
maximum	10000	16	6	210	3	10	6.6	13	16000	20	330	12	35	69
minimum	2200	4.4	2	95	1	2	0.1	4.2	4400	3.2	99	2.4	9.6	21
arithmetic average	4970.8	9	3	149	2	5.5	4.2	7.5	9529.2	9.3	202	6.3	19	49
standard deviation	2095.4	3	2	40.5	1	2.3	1.3	2	3219.2	4.2	53.6	2.1	6.9	13
normal tolerance	2.309	2.3	2	2.33	2	2.3	2.3	2.3	2.309	2.3	2.31	2.3	2.3	2.3
UTL	4927.4	16	7	244	3	11	7.3	12	16962	19	326	11	35	79

Lognormal Parameters for Tijeras Arroyo Local Metal Background Data

Statistical Parameter	Aluminum	Antimony	Arsenic	Barium	Cadmium	Chromium	Cobalt	Copper	Iron	Lead	Manganese	Nickel	Vanadium	Zinc
arithmetic average	8.4294	2.2	1	4.97	0	1.6	1.3	2	9.1025	2.1	5.27	1.8	2.9	3.8
standard deviation	0.4126	0.3	1	0.27	0	0.5	0.8	0.3	0.3631	0.4	0.28	0.4	0.3	0.3
normal tolerance	2.309	2.3	2	2.33	2	2.3	2.3	2.3	2.309	2.3	2.31	2.3	2.3	2.3
UTL	9.3821	2.9	2	5.6	1	2.7	3.1	2.6	9.941	3.1	5.91	2.6	3.7	4.6
e^{UTL}	11874	19	10	271	4	14	21	14	20764	23	370	14	40	98

Insufficient data for mercury, selenium, silver, and thallium to calculate statistics
All concentrations in mg/kg

Summary of Background Concentrations for Radionuclides in Soil

Analyte	Original Number of Samples	Number of Detects	Number of Rejected Samples	Distribution Type	Range (pCi/g)	n[a]	Geometric Mean (pCi/g)	Median (pCi/g)	95th Upper Tolerance Limit (pCi/g)	95th Percentile (pCi/g)
Bismuth-212	324	17	307	Nonparametric	0.414–2.7	17	1.1055	1.0	–	2.7
Bismuth-214	340	321	19	Nonparametric	0.27–1.4	321	0.648	0.6	–	0.8
Cesium-137	802	561	26	–	–	–	–	–	–	–
(Surface)	–	–	–	Nonparametric	0.004–10.1	604	0.200	0.2495	–	0.92
(Subsurface)	–	–	–	Unknown[c]	<detection limit (<0.0686)	172	<detection limit (<0.0686)	<detection limit (<0.0686)	–	<detection limit (<0.0686)
Cobalt-60	321	11	74	Unknown	<detection limit (<0.0418)	247	<detection limit (<0.0418)	<detection limit (<0.0418)		<detection limit (<0.0418)
Lead-210[b]	338	40	292	Nonparametric	0.3–12.0	46	2.26838	2.835	–	8.8
Lead-212[b]	323	233	90	Lognormal	0.1–1.4	233	0.49689	0.5	1.0795	–
Lead-214[b]	249	241	9	Lognormal	0.29–1.13	240	0.549	0.56	0.90	–
Potassium-40	722	720	4	Normal	0.192–31.0	718	15.889	16.4	25.34	–
Radium-224	24	24	0	Nonparametric	0.43–0.97	24	0.8747	0.655	–	0.968
Radium-226	368	53	314	Lognormal	0.5–2.09	54	0.713	0.590	1.94	–
Radium-228	24	24	0	Nonparametric	0.45–1.05	24	0.695	0.630	–	1.05
Radon	0	0	0	Unknown	–	0	–	–	–	–
Strontium-90	54	45	9	Nonparametric	0.032–1.85	45	0.2528	0.2883	–	0.766
Thorium-232	136	136	0	Lognormal	0.23–1.20	136	0.7971	0.810	1.258	–
Thorium-234	365	52	330	Lognormal	0.324–3.0	35	0.7796	0.71	2.89	–
Tritium	0	0	0	Unknown	–	0	–	–	–	–
Uranium-234	4	4	0	Nonparametric	0.8–1.0	4	0.897	0.9	–	1.0
Uranium-235	95	21	75	Nonparametric	0.05–0.18	20	0.1198	0.1235	–	0.168
Uranium-238	223	206	17	Nonparametric	0.0033–2.065	206	0.506	0.763	–	1.1

[a]Sample size.
[b]These constituents are not listed as COC in Table 2-2 for this media.
[c]Constituents of concern are of unknown distribution type because data are either below the limit of detection, unusable, or nonexistent.

(IT, 1994)

NOD

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

OCT 17 1996

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Benito Garcia, Bureau Chief
New Mexico Environment Department
Hazardous and Radioactive Materials Bureau
2044 Galisteo Street
P.O. Box 26110
Santa Fe, NM 87505-2100

Dear Mr. Garcia:

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

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

Sincerely,

Michael J. Zamorski
Acting Area Manager

Enclosure

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

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

OCT 21 1996

Sandia National Laboratories
Albuquerque, New Mexico
October 1996

Environmental Restoration Project
Responses to NMED Technical Comments
on No Further Action Proposals
Dated June 1995

INTRODUCTION

This document responds to comments received in a letter from the State of New Mexico Environment Department to the U.S. Department of Energy (Zamorski, July 29, 1996) documenting the review of 23 No Further Action (NFA) Proposals submitted in June 1995.

This response document is organized in numerical order by operable unit (OU) and subdivided in numerical order by site number, Each OU section provides NMED comments repeated in **bold** by comment number and by site number in the same order as provided in the call for response to comments. The DOE/SNL response is written in normal font style on a separate line under "Response". Responses to general technical comments begin on page 3 and responses to site-specific technical comments begin on page 4. Responses to general risk assessment comments begin on page 143 and responses to specific risk assessment comments begin on page 144. Additional supporting information for the site-specific comments is included as figures and tables within each comment response and as attachments to each section of this document.

TABLE OF CONTENTS

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

GENERAL TECHNICAL COMMENTS

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

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

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

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

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

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

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

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

Response: As discussed in the June 1995 NFA Proposal, soil samples were collected before the impoundment was lined with a synthetic membrane. No PCBs or solvents were detected in the soil samples. Maintenance of the impoundment is the responsibility of TA-IV Organization 9300 under plan DP-530. No waste water is released from the impoundment due to significant evaporation. Eventual impoundment closure and soil sampling is the responsibility of SNL/NM Organization 9300.

SNL/NM believes that ER Site 77 should not be an ER site. As discussed above, the SNL/ER Project requests that NFA status be applied to ER Site 77 since NMED regulates the impoundment under 'Surface Water Discharge Plan 530' (DP-530).

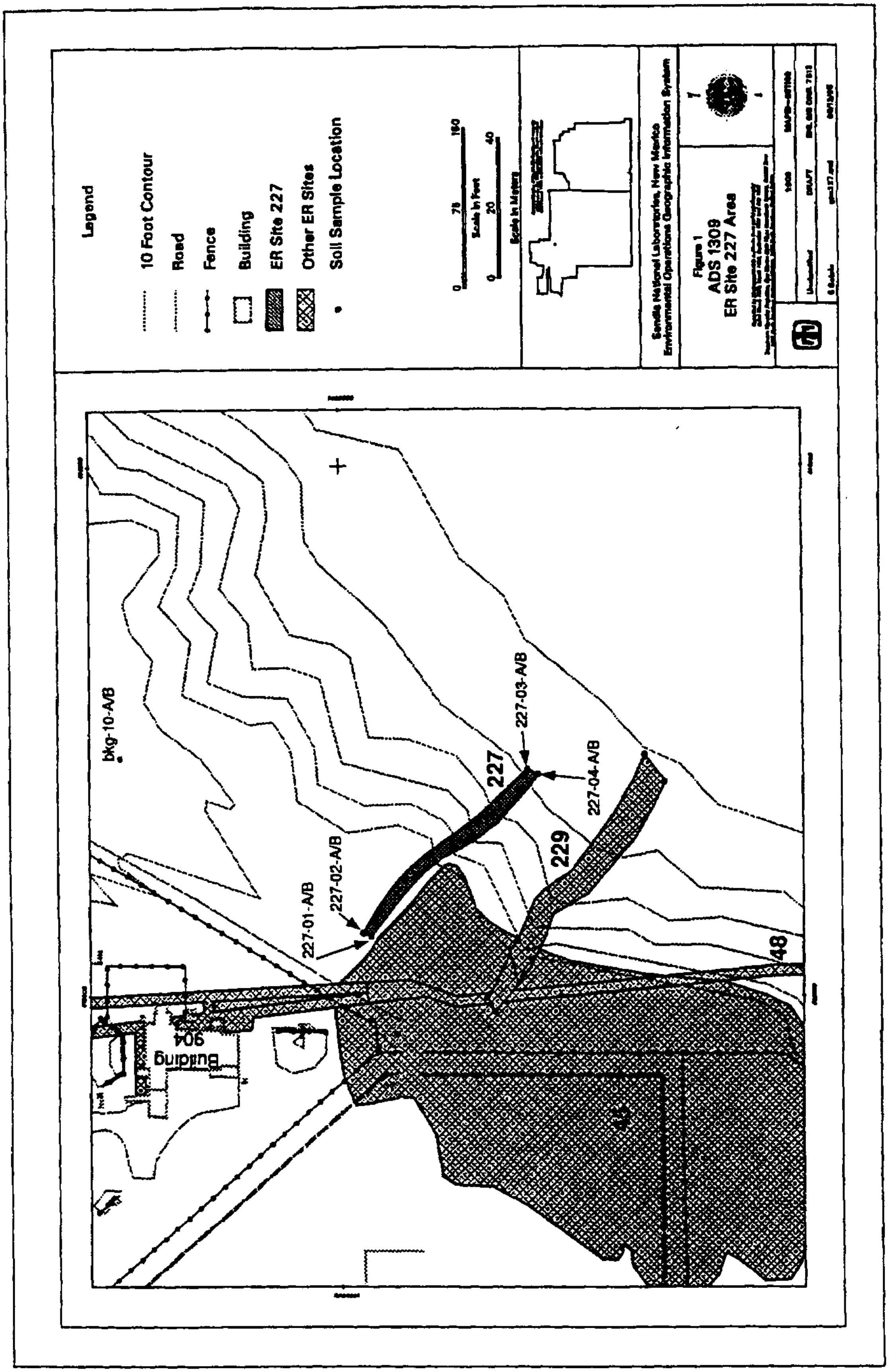
12. Site 227, OU 1309, Bunker 904 Outfall Site

a. NMED is concerned that Site 227 may not be accurately located because the pipe that discharged into the outfall (open trench) at the concrete headwall is not currently visible. Trenching and/or historical photographs may help to locate the pipe for the Bunker 904 Outfall Site.

Response: Historical aerial photographs from 1951, 1959, 1964, 1965, 1966, 1968, 1972 through 1980, and 1982 through 1993 were reviewed. No outfall pipe for ER Site 227 was apparent in these photographs. However, discharge to the 10-ft deep, drainage ditch was apparent in these photographs in the form of vegetation along the ditch floor. The soil sampling locations along the ER Site 227 drainage ditch are shown on Figures 1 and 2.

b. NMED understands that Site 227, Bunker 904 Outfall Site, Operable Unit 1309, discharged industrial effluent from Building 904, located at Technical Area 2 (TA-2). Building 904 was used for nuclear weapons assembly, high explosives testings, and photo processing. The outfall, connected to the piping of ER Site 48, was active for about 43 years (1948 to 1991). The average rate and volume of discharge were not reported by SNL/NM. Potential contaminants at Site 227 include metals, radionuclides, VOCs, SVOCs, explosives, and nitrate. NMED is concerned that effluent discharged at Site 227 may have contained contaminants at concentrations that are a threat to groundwater, even if such contaminants are not readily detectable in Site 227 soils.

Response: Specific discharge rates were not recorded and are not available. However, the potential contaminants of concern (COCs) are known from personnel interviews.



Legend
10 Foot Contour
Road
Fence
Building
ER Site 227
Other ER Sites
Soil Sample Location
0 75 150
Scale in Feet
0 20 40
Scale in Meters
Sandia National Laboratories, New Mexico
Environmental Operations Geographic Information System
Figure 1
ADS 1309
ER Site 227 Area
bkg-10-A/B
227-01-A/B
227-02-A/B
227-03-A/B
227-04-A/B
227
229
48
Building
904

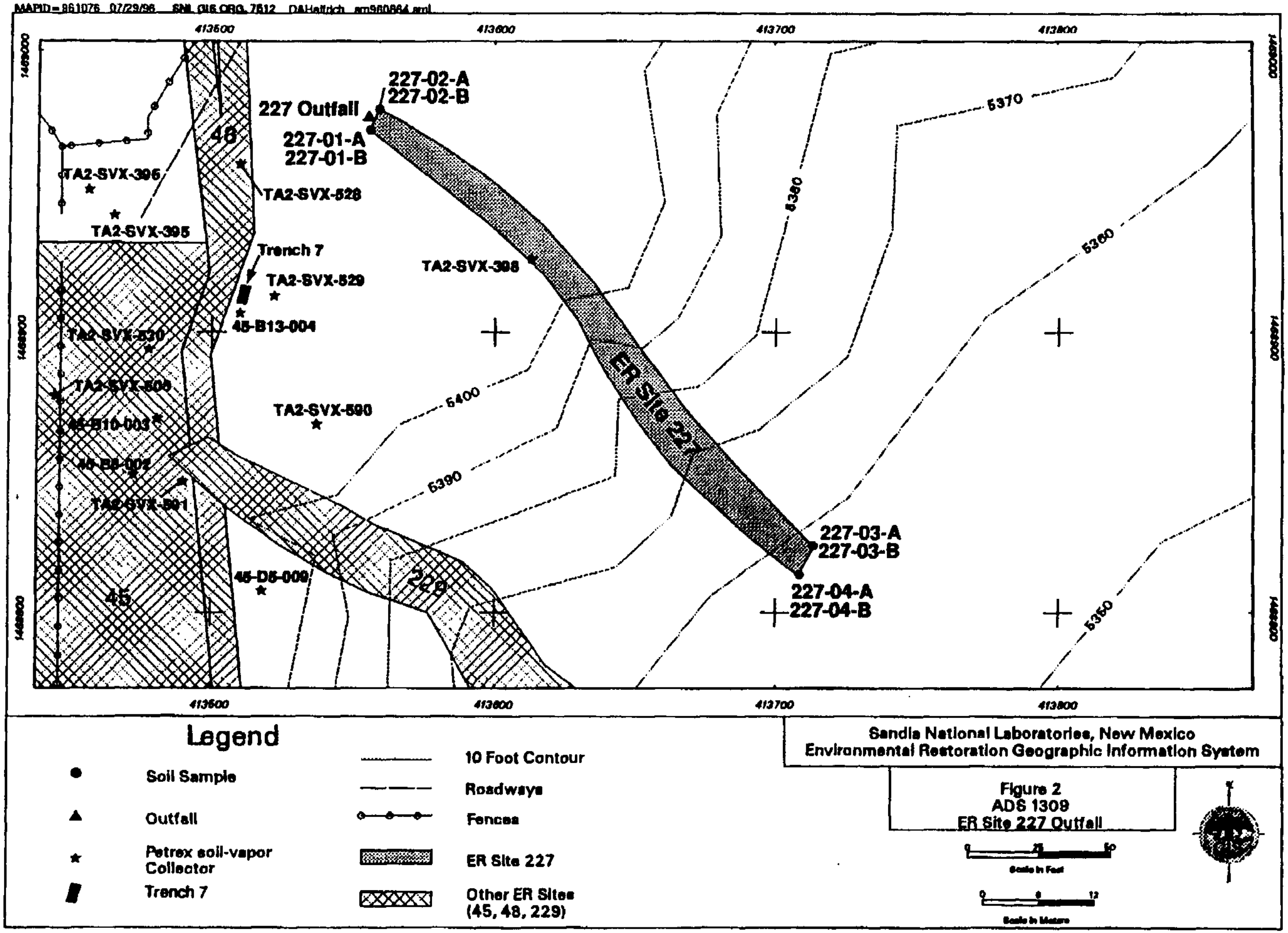


Figure 2
ADS 1309
ER Site 227 Outfall

c. Page 4, Section 3.5, in reference to SNL's statement "If contamination was present, potential constituents of concern... would be expected at shallow depths." The location and depth of the outfall are questionable. There is no guarantee that a maximum sampling depth of 6 to 36 inches was adequate. Also, why were samples potentially composited over as much as 30 inches? Why are actual sample depths not reported?

Response: SNL/NM asserts that the soil samples were appropriately located at the most likely release site at the ER Site 227 outfall and associated drainage ditch (Figure 2). Four soil samples were collected at the upper end of the ditch. An additional four samples were collected at the furthest extent of visible erosion and scour.

SNL/NM believes that the sampling interval was appropriate. Soil samples were collected from a depth of 0 to 36 inches at the outfall where the potential for contamination was greatest (Figure 2). Soil samples were composited for sampling simplicity due to the homogeneous nature of the soil. Each shallow sample was composited using soil from a depth interval of 0 - 6 inches. The samples shown in Table 4 with identification numbers that end in an "A" represent "shallow" soil (0 - 6 inches) samples. The mention of the subsurface-soil sampling interval being 6 - 36 inches is misleading. The subsurface-soil sampling interval was either 6 - 30 in. or 6 - 36 in., depending of the analytes of interest. For convenience sake, the sampling interval for all subsurface-soil samples was standardized on the sample collection logs as 6 - 36 in. The samples shown in Table 4 with identification numbers that end in an end in a "B" represent these "subsurface" samples. The sampling procedures are discussed in greater detail in Appendix A of the June 1995 *Proposal for NFA - Site 227*. More recent sampling results are presented below in SNL/NM Response to NMED Comment e.

d. Method detection limits are not provided in Table 1 and Appendix B.

Response: Method detection limits are listed in Attachment A of this response.

e. NMED has some concerns regarding the sampling performed at these SWMUs. Since these SWMUs have been releasing waste water for at least 15 years, NMED is concerned that no evidence of contamination was found in the soil or other media. NMED believes that the following additional work should be performed:

e-1. A soil gas survey should be performed near the outfall areas/drainage channel.

Response: While designing the 1994 characterization of ER Site 227, SNL/NM chose to conduct quantitative soil sampling instead of field screening soil-vapor samples. Soil sampling was preferred because the location of the release site was well known and the analytical results would be quantitative data suitable for risk and exposure calculations.

A 1995 research project has yielded soil-vapor data that are applicable to ER Site 227. These soil-vapor results were not reported in the June 1995 *Proposal for NFA - Site 227*. As shown on Figure 2, seven Petrex soil-vapor collectors were located at or near ER Site 227 ft as part of TA-II OU and Tijeras Arroyo OU soil-vapor investigations. One of the Petrex collectors (TA2-SVX-398) was located at the midpoint of the drainage ditch. Because no SVOCs or VOCs such as TCE, PCE, and BTEX were detected in any of the soil-vapor collectors (NERI, 1994; NERI, 1995), SNL/NM believes that collecting additional soil-vapor samples will not be beneficial.

e-2. Deeper soil samples (minimum 20 ft.) should be collected in the outfall areas/drainage channel. Locations may be based upon the soil gas survey results.

Response: The analytical data used in the risk assessment indicate that deeper soil samples are not necessary. Four soil samples (227-01-A, 227-01-B, 227-02-A, and 227-02-B) were collected at the head of the drainage ditch (Figure 2). An additional four soil samples (227-03-A, 227-03-B, 227-04-A, and 227-04-B) were collected approximately 220 ft to the southeast of the outfall at the lower end of the drainage ditch. The tail of the ditch is approximate 45 ft lower in elevation than the outfall. All soil samples were collected at depths ranging from of 0 to 36 in.

The analytical results that were previously presented in the June 1995 *Proposal for NFA - Site 227* as Table 1 and Appendix B have been reorganized in this NOD response (Tables 4, 5 and 6). The section SNL/NM Analytical Data Summary for ER Site 227 discusses the concentrations and potential risks of contaminants in soil.

e-3. Additional samples should be collected at the outfall areas/drainage areas that received the waste. NMED questions whether the soil sampling locations originally chosen actually received wastes.

Response: SNL/NM asserts that the eight soil samples were appropriately located at the ER Site 227 outfall (Figure 2). Four soil samples were collected at the head of the drainage ditch. An additional four samples were collected at the furthest extent of visible erosion and scour.

f. RECOMMENDATION: Based upon site concerns, including the potential contaminants of concern and the uncertainty about the volumes of industrial effluents discharged for a long period of time, as well the hazardous constituent detections in the perched groundwater (approximately 320 feet of depth) beneath TA-II in the vicinity of the Bunker 904 Outfall Site, NMED considers that NFA is not appropriate for Site 227 and recommends additional investigation is necessary at Site 48 and may require a RFI Workplan for this site.

Response: For three reasons, SNL/NM believes that additional soil sampling is not necessary at ER Site 227. (1) Previously unreported soil-vapor investigations have yielded soil-vapor data that are applicable to ER Site 227. These soil-vapor results were not reported in the June 1995 *Proposal for NFA - Site 227.* As shown on Figure 2, seven Petrex soil-vapor collectors were placed near ER Site 227 ft as part of TA-II OU and Tijeras Arroyo OU soil-vapor investigations. One of the Petrex collectors (TA2-SVX-398) was located at the midpoint of the drainage ditch. The Petrex collectors were buried for 2 - 3 weeks in dry soil. Because of a greater residence time, Petrex collectors offer an advantage of being able to collect soil vapors from a larger soil area than is possible with active-induced (pumping) sampling techniques. Because no SVOCs or VOCs such as TCE, PCE, and BTEX were detected in any of the soil-vapor collectors (NERI, 1994; NERI, 1995), SNL/NM believes that collecting additional soil-vapor samples will not be beneficial.

(2) Previously unreported soil sampling also has been conducted between ER Sites 227 and 229. Trench 7 was excavated in November 1993 as part of a SNL/NM Facilities Engineering Department project to connect the TA-II buildings to the city sanitary-sewer system. Soil samples were collected at depths of 0.5, 6.8, and 7.5 ft below ground surface (BGS). The three samples (ER92002060, ER92002061, ER92002062) were analyzed for VOCs, SVOCs, HE compounds, metals, and radionuclides using the methods listed in Attachment A. No VOCs, SVOCs, or HE compounds were reported in excess of the detection limits. All metals and radionuclides were less than the background values listed in Table 5 and 6.

(3) Site 227 does not have significant potential from either non-radioactive or radioactive contaminants to affect human health under either an industrial or a residential land-use scenario (Attachment F).

NMED's concerns about groundwater characterization will be addressed by the additional sampling that has been proposed in the *Sandia North Groundwater Investigation Plan* (GIP). As a separate initiative from the Tijeras Arroyo OU, SNL/NM has prepared the GIP (dated March 29, 1996) which discusses the sampling program for characterizing the distribution of chlorinated solvents in groundwater near TA-II (SNL/NM, 1996b). Soil, soil-vapor, and groundwater samples will be collected at various locations around TA-I, TA-II, and TA-IV. One of the GIP sampling locations will be near ER Site 227. The need for additional sampling will be reevaluated after results from the GIP field program are available.

The Building 904 Septic System (ER Site 48) is being separately managed by the TA-II OU. The soil sampling plans for ER Sites 48 and 227 are based upon the same list of COCs.

SNL/NM Analytical Data Summary for ER Site 227

Introduction

Since the submission of the June 1995 *Proposal for NFA - Site 227*, three significant approaches have been employed by the SNL/NM ER Project for evaluating the potential impact of contaminants upon human health. First, a site-wide (the KAFB and SNL/NM area) statistical study has been recently completed for determining the background concentrations of metals and radionuclides in soil and water (IT, 1996). These new background values are listed in Attachment F and have been through a more rigorous statistical analysis and therefore replace the values that were used in the June 1995 NFA proposals. Second, the Tijeras Arroyo background values in Attachment F have been recalculated using U.S. EPA guidance (EPA, 1989; EPA, 1992a; EPA, 1992b). Third, a standardized risk-assessment approach has been implemented by SNL/NM with U.S. EPA Region VI acceptance. These three approaches and the screening of regulatory standards have been incorporated in the ER Site 227 risk assessment that is presented in Attachment F. Elevated metals and other non-radioactive constituents were evaluated using U.S. EPA guidance (EPA, 1989; EPA, 1991). Radionuclides that exceeded background were evaluated using DOE guidance and the RESRAD computer code for residual radioactive material (ORNL, 1994).

Background Concentrations

As part of the site-wide study, background concentrations were calculated for both the surface and subsurface soils of the North Super Group, which is defined as soils present in TA-I, TA-II, TA-IV, the northern rim of Tijeras Arroyo, and the northeastern portion of KAFB (IT, 1996). The depth of six inches was used for defining surface soil from subsurface soil. Two background concentrations are therefore listed for most of the metals and radionuclides in Tables 5 and 6. The background concentrations consist of either Upper Tolerance Limits (UTLs) or 95th Percentiles. An UTL was calculated for those COCs with normal or lognormal distributions; the 95th percentile was calculated for those COCs with nonparametric distributions.

Quality Assurance / Quality Control

The analytical results that were previously presented in the June 1995 *Proposal for NFA - Site 227* as Table 1 and Appendix B have been reorganized in this NOD response to incorporate the three new approaches. To prevent confusion, the reorganized analytical data are presented herein as Tables 4, 5, and 6. The tables present the maximum concentrations for each detected analyte as reported by the two, CLP-certified, offsite analytical laboratories (the Quanterra Environmental Services - St. Louis Laboratory and the ENCOTEC - Ann Arbor laboratory). The actual laboratory reports are available for review at the ER Project Records Center in Building 6584.

Attachment A lists the analytical methods and detection limits that were used in the Tijeras Arroyo OU sampling program. Quality Assurance (QA) samples, including field duplicates, trip blanks and rinsate samples, also were collected as part of the Tijeras Arroyo OU site-sampling program. The QA results demonstrated the effectiveness of the decontamination procedures (Appendix B - June 1995 *Proposal for NFA - Site 227*). As shown in Attachment B, eleven QA-field duplicates were collected for the soil samples. Relative percent difference (RPD) values were calculated for the metals, nitrate/nitrite, and radionuclides. The lack of detectable VOCs, SVOCs, and HE compounds did not allow RPDs to be calculated for those compounds. Of the 111 detectable metal and nitrate/nitrite concentrations, 85% of the RPDs were below the EPA-recommended target of 35%. Fifteen percent of the remaining RPDs were above the 35% target and probably are a function of the soil heterogeneity rather than a systematic error in sampling or analytical procedures. Of the nine detectable radionuclide activities, six were above the EPA-recommended target of 35%. However, the use of RPDs to evaluate the radionuclides values does not appear to be realistic because the activities were less than one pCi/g. Such low activities are well below

Table 4. All reported concentrations of VOCs and SVOCs in ER Site 227 soil samples.

Sample Identifier[1]	Analyte	Type	Detection Limit (mg/kg, ppm)	Reported Concentration (mg/kg, ppm)	Qualifier
227-01-B	2-butanone	VOC[2]	0.010	0.007	J[3]
227-02-B	2-butanone	VOC	0.010	0.004	J
227-03-B	2-butanone	VOC	0.010	0.005	J
227-04-B	2-butanone	VOC	0.010	0.004	J
227-01-B	4-methyl-2-pentanone	VOC	0.010	0.001	J
227-01-B	Benzo (b) fluoranthene	SVOC[4]	0.330	0.068	J
227-01-B	Chrysene	SVOC	0.330	0.049	J
227-01-A	Fluoranthene	SVOC	0.330	0.066	J
227-01-B	Fluoranthene	SVOC	0.330	0.094	J
227-01-A	Phenanthrene	SVOC	0.330	0.055	J
227-01-B	Phenanthrene	SVOC	0.330	0.084	J
227-01-A	Pyrene	SVOC	0.330	0.040	J
227-01-B	Pyrene	SVOC	0.330	0.062	J

[1]Sample identifier: First set of numbers denotes ER Site, second set of numbers denotes sample location, letter designator denotes sample depth (A denotes sample depth of 0 - 6 inches; B denotes sample depth of 6 - 30 or 6 - 36 inches).
[2]VOC = Volatile organic compound (EPA Method 8240).
[3]J = Qualifier denotes that the analyte was reported at below the laboratory detection limit.
[4]SVOC = Semi-volatile organic compound (EPA Method 8270).

Table 5. Comparison of maximum concentrations in ER Site 227 soil versus Proposed Subpart S action levels and background UTLs and 95th Percentiles for North Super Group surface and subsurface soils.

Analyte	Maximum concentration in ER Site 227 soil (mg/kg, ppm)	Proposed Subpart S and Lead action levels (mg/kg, ppm) (EPA, 1990;EPA, 1994)	Surface soil UTL (mg/kg, ppm) (IT, 1996)	Surface soil 95th Percentile (mg/kg, ppm) (IT, 1996)	Subsurface soil UTL (mg/kg, ppm) (IT, 1996)	Subsurface soil 95th Percentile (mg/kg, ppm) (IT, 1996)
Metals						
Aluminum (Al)	8,600.0	n.s.[1]	n.c.[2]	n.c.	n.c.	n.c.
Antimony (Sb)	12.0	30.0	n.a.[3]	3.9	n.a.	3.9
Arsenic (As)	7.7	80.0	n.a.	5.6	n.a.	4.4
Barium (Ba)	210.0	4,000.0	n.a.	200.0	n.a.	336.0
Beryllium (Be)	0.3	0.2	n.a.	0.8	n.a.	0.8
Cadmium (Cd)	2.9	40.0	n.a.	1.6	n.a.	0.9
Calcium (Ca)	57,000.0	n.s.	n.c.	n.c.	n.c.	n.c.
Chromium (Cr)-total	9.0	n.s.	n.a.	17.3	n.a.	12.8
Chromium-VI (Cr+6)	<0.1	400.0	n.c.	n.c.	n.c.	n.c.
Cobalt (Co)	5.1	n.s.	n.a.	7.1	n.a.	8.8
Copper (Cu)	8.8	n.s.	n.a.	25.5	n.a.	88.2
Iron (Fe)	15,000.0	n.s.	n.c.	n.c.	n.c.	n.c.
Lead (Pb)	11.0	400.0.	68.0	n.a.	n.a.	11.2
Magnesium (Mg)	4,300.0	n.s.	n.c.	n.c.	n.c.	n.c.
Manganese (Mn)	280.0	n.s.	n.c.	n.c.	n.c.	n.c.
Mercury (Hg)	<0.04	20.0	n.a.	0.31	n.a.	<0.1
Nickel (Ni)	7.4	2,000.0	n.a.	25.4	n.a.	25.4
Potassium (K)	22,000.0	n.s.	n.c.	n.c.	n.c.	n.c.
Selenium (Se)	<0.25	n.s.	n.a.	<1.0	n.a.	<1.0
Silver (Ag)	<0.5	200.0	n.a.	2.0	n.a.	<1.0
Sodium (Na)	280.0	n.s.	n.c.	n.c.	n.c.	n.c.
Thallium (Tl)	0.2	n.s.	n.a.	<1.1	n.a.	<1.1
Vanadium (V)	28.0	n.s.	47.2	n.a.	n.a.	42.8
Zinc (Zn)	59.0	n.s.	n.a.	82.4	n.a.	82.4
Miscellaneous						
Cyanide	<0.1	2,000.0	n.c.	n.c.	n.c.	n.c.
Nitrate + Nitrite	14.0	8,000.0[4]	n.c.	n.c.	n.c.	n.c.
High Explosives	<1.25	n.s.	n.c.	n.c.	n.c.	n.c.
TPH	<40.0	n.s.	n.c.	n.c.	n.c.	n.c.

[1]n.s. = not specified.
[2]n.c. = not calculated. The analyte is not a COC at SNL or KAFB (IT, 1996).
[3]n.a. = not applicable. The UTL is provided for those COCs with normal or lognormal distributions; the 95th percentile is provided for those COCs with nonparametric distributions.
[4]The RCRA Subpart S value for nitrite (8,000 ppm) is lower than the nitrate value of 100,000 ppm (EPA, 1990).

Table 6. Comparison of all reported maximum radionuclide activities in ER Site 227 soil versus background UTLs and 95th Percentiles for SNL North Area Group surface and subsurface soils.

Radionuclide	Maximum activity in ER Site 227 soil (pCi/g)	Surface soil UTL (pCi/g) (IT, 1996)	Surface soil 95th Percentile (pCi/g) (IT, 1996)	Subsurface soil UTL (pCi/g) (IT, 1996)	Subsurface soil 95th Percentile (pCi/g) (IT, 1996)
Plutonium-238	<0.005	n.c.[1]	n.c.	n.c.	n.c.
Plutonium-239/240	0.009	n.c.	n.c.	n.c.	n.c.
Thorium-234	1.34	n.a.	1.4	n.a.	1.4
Tritium	<0.010	n.c.	n.c.	n.c.	n.c.
Uranium-234	0.73	1.6	n.a.	1.6	n.a.
Uranium-235/236	0.19	n.a.	0.18	n.a.	0.18
Uranium-238	0.72	n.a.	1.3	n.a.	1.3

[1]n.c. = not calculated. The analyte is not a COC at SNL or KAFB (IT, 1996).

[2]n.a. = not applicable. The UTL is provided for those COCs with normal or lognormal distributions; the 95th percentile is provided for those COCs with nonparametric distributions.

background and are reported with relatively large 2-sigma errors. For example, U-235/236 was reported at 0.023 pCi/g with a 2-sigma error of 0.018 pCi/g. With a 95% confidence interval, the U-235/236 activity is in the range of 0.005 to 0.041 pCi/g and could therefore actually be below the minimum detectable activity (MDA) of 0.009 pCi/g. Soil heterogeneity could also account for the range of RPD values for the radionuclides. To conclude, the RPD values indicate that both the metal, nitrate/nitrite, and radionuclide analyses are of sufficient precision for preparing this NOD response.

Table 4 is the most detailed table and contains the maximum concentrations as well as all reported concentrations, including 'J' and 'B' values, for VOCs and SVOCs. Table 5 compares the maximum concentrations of metals, cyanide, and nitrate/nitrite (NO2+NO3) in ER Site 227 soil versus the Proposed Subpart S action levels (EPA, 1990) and the newly available background values (IT, 1996). Table 6 compares the maximum radionuclide activities in ER Site 227 soil versus the background UTLs and 95th Percentiles.

No VOC or SVOC contamination was detected in the ER Site 227 soil samples. Six organic compounds were reported with a 'J' qualifier as being below the laboratory reporting limit (Table 4). TPH was not reported above the 40.0 mg/kg (ppm) detection limit. Likewise, no HE compounds were detected in any of the soil samples above the 1.25 mg/kg (ppm) detection limits (Tables 4 and 5).

Four radionuclides (lead-212, lead-214, thallium-208, potassium-40) that were discussed in the June 1995 *Proposal for NFA - Site 227* were discounted from this NOD response. Lead-212 and lead-214 were discounted on the basis of their respective short half-lives of 10.64 hours and 27 minutes. Similarly, the June 1995 *Proposal for NFA - Site 227* should not have included a risk calculation for radioactive thallium. Whereas the activity of thallium-208 in soil was 0.18 pCi/g, its half-life is only three minutes. No other thallium radionuclides were detected in the soil samples. The substitution of thallium-204 for thallium-208 in the June 1995 risk calculation was not realistic either. Potassium-40 was discounted because it is a naturally occurring radionuclide (Turner, 1992) that is not produced by SNL/NM reactors or accelerators.

Sampling Locations

Eight soil samples were collected at the site (Figure 2). Four soil samples (227-01-A, 227-01-B, 227-02-A, and 227-02-B) were collected at the head of the drainage ditch. An additional four soil samples (227-03-A, 227-03-B, 227-04-A, and 227-04-B) were collected approximately 220 ft to the southeast of the outfall at the lower end of the drainage ditch. The tail of the ditch is approximate 45 ft lower in elevation than the outfall. All soil samples were collected at depths ranging from of 0 to 36 inches. The analytical results that were previously presented in the June 1995 *Proposal for NFA - Site 227* as Table 1 and Appendix B have been reorganized in this NOD response.

Risk Assessment Conclusion

Using conservative assumptions and employing a Reasonable Maximum Exposure (RME) approach from RAGS (EPA, 1989), the risk assessment calculations show that for the industrial land-use scenario the Hazard Index (0.03) is significantly less than the U.S. EPA standard of 1. The estimated cancer risk (5×10^{-6}) is in the low-end of the suggested acceptable risk range (10^{-4} to 10^{-6}). The calculations show that for the residential land-use scenario the Hazard Index (0.1) is also significantly less than the U.S. EPA standard of 1. The estimated cancer risk (2×10^{-5}) is in the middle of the suggested acceptable risk range (10^{-4} to 10^{-6}). The dose and corresponding cancer risk from the radioactive components are much less than EPA guidance values; the estimated dose is 0.3 mrem/yr for both the industrial and residential land-use scenarios. This values are much less than the Total Effective Dose Equivalent (TEDE) goal of 15 mrem/yr (40 CFR Part 196, 1994). The corresponding estimated cancer risk value is 5×10^{-6} for the two land-use scenarios. This value is also much less than risk values calculated due to naturally occurring radiation. In conclusion, ER Site 227 does not have significant potential from either non-radioactive or radioactive contaminants to affect human health under either an industrial or a residential land-use scenario (Attachment F).

Based on the field investigation and the risk assessment, SNL/NM reiterates the request that ER Site 227 be approved for NFA status. However, as a separate initiative from the Tijeras Arroyo OU, additional sampling has been proposed in the *Sandia North Groundwater Investigation Plan* (GIP). The GIP discusses the proposed sampling program that will be used for characterizing the distribution of chlorinated solvents in groundwater near TA-II (SNL/NM, 1996b). Soil, soil-vapor, and groundwater samples will be collected at various locations around TA-I, TA-II, and TA-IV. One of the GIP sampling locations will be near ER Site 227.

ATTACHMENT A

ANALYTICAL METHODS FOR SOIL SAMPLES

Attachment A -
Analytical Methods for Soil Samples

Table A-1. Analytical Methods and Detection Limits for Cyanide, Nitrate/Nitrite, SVOCs, TKN, TPH, and VOCs in soil.

Analyte	Method	Detection Limit, mg/kg (ppm)	Analytical Lab
Cyanide	U.S. EPA Method 9010	0.10	ENCOTEC
Nitrate/Nitrite	U.S. EPA Method 353.2	100.0	ENCOTEC
SVOCs	U.S. EPA Method 8270	0.30 - 2.6	ENCOTEC
TPH	U.S. EPA Method 418.1	40.0	ENCOTEC
VOCs	U.S. EPA Method 8240	0.005 - 0.010	ENCOTEC

ENCOTEC = Environmental Control Technology Corporation, Ann Arbor, Michigan
SVOCs = Semi-volatile organic compounds
TKN = Total Kjedahl Nitrogen
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds

Table A-2. Analytical Methods and Detection Limits for Metals in soil.

Metal	U.S. EPA Method	Detection Limit (mg/kg, ppm)	Analytical Lab
Aluminum(Al)	6010	10	ENCOTEC
Antinomy (Sb)	6010	3.0	ENCOTEC
Arsenic (As)	6010	0.50	ENCOTEC
Barium (Ba)	6010	10	ENCOTEC
Beryllium (Be)	6010	0.25	ENCOTEC
Cadmium (Cd)	6010	0.27	ENCOTEC
Calcium (Ca)	6010	250	ENCOTEC
Chromium (Cr)-total	6010	1.0	ENCOTEC
Chromium-VI (Cr+6)	7196	0.1	ENCOTEC
Cobalt (Co)	6010	2.5	ENCOTEC
Copper (Cu)	6010	1.2	ENCOTEC
Iron (Fe)	6010	5.0	ENCOTEC
Lead (Pb)	6010	2.0	ENCOTEC
Magnesium (Mg)	6010	256	ENCOTEC
Manganese (Mn)	6010	0.75	ENCOTEC
Mercury (Hg)	7471	0.04	ENCOTEC
Nickel (Ni)	6010	2.0	ENCOTEC
Potassium (K)	6010	250	ENCOTEC
Selenium (Se)	7741	0.25	ENCOTEC
Silver (Ag)	6010	0.5	ENCOTEC
Sodium (Na)	6010	250	ENCOTEC
Thallium (Tl)	6020	0.5	ENCOTEC
Vanadium (V)	6010	2.5	ENCOTEC
Zinc (Zn)	6010	1.0	ENCOTEC

Table A-3. Analytical Methods and Detection Limits for High Explosive Compounds in soil.

High Explosive Compound	U.S. EPA Method	Detection Limit (mg/kg, ppm)	Analytical Lab
1,3-Dinitrobenzene	8330	1.25	ENCOTEC
2,4-Dinitrotoluene	8330	1.25	ENCOTEC
2,6-Dinitrotoluene	8330	1.25	ENCOTEC
HMX	8330	1.25	ENCOTEC
Nitrobenzene	8330	1.25	ENCOTEC
o-nitrotoluene	8330	1.25	ENCOTEC
m-nitrotoluene	8330	1.25	ENCOTEC
p-nitrotoluene	8330	1.25	ENCOTEC
RDX	8330	1.25	ENCOTEC
Tetryl	8330	1.25	ENCOTEC
1,3,5-Trinitrobenzene	8330	1.25	ENCOTEC
2,4,6-Trinitrotoluene	8330	1.25	ENCOTEC

Table A-4. Analytical Methods for Radionuclides in soil.

Radionuclide	Method	Analytical Lab
Americium-241	HASL 300 - Gamma Spectroscopy	Quanterra
Cadmium-109	HASL 300 - Gamma Spectroscopy	Quanterra
Cerium-139	HASL 300 - Gamma Spectroscopy	Quanterra
Cesium-137	HASL 300 - Gamma Spectroscopy	Quanterra
Cobalt-57	HASL 300 - Gamma Spectroscopy	Quanterra
Cobalt-60	HASL 300 - Gamma Spectroscopy	Quanterra
Iodine-129	HASL 300 - Gamma Spectroscopy	Quanterra
Lead-212/214	HASL 300 - Gamma Spectroscopy	Quanterra
Mercury-203	HASL 300 - Gamma Spectroscopy	Quanterra
Plutonium-238	NAS-NS-3058 /SL13028/SL13033	Quanterra
Plutonium-239/240	NAS-NS-3058 /SL13028/SL13033	Quanterra
Potassium-40	HASL 300 - Gamma Spectroscopy	Quanterra
Strontium-85	HASL 300 - Gamma Spectroscopy	Quanterra
Thorium-232	HASL 300 - Gamma Spectroscopy	Quanterra
Thorium-234	HASL 300 - Gamma Spectroscopy	Quanterra
Tin-113	HASL 300 - Gamma Spectroscopy	Quanterra
Tritium	EERF-H.01	Quanterra
Uranium-234	NAS-NS-3050	Quanterra
Uranium-235/236	NAS-NS-3050	Quanterra
Uranium-238	NAS-NS-3050	Quanterra
Yttrium-88	HASL 300 - Gamma Spectroscopy	Quanterra

Quanterra = Quanterra Environmental Services - St. Louis Laboratory

ATTACHMENT B

RPD VALUES FOR SOIL SAMPLES

Attachment B -
RPD Values for Soil Samples

Table B-1. RPD values for soil sample 227-03-B.

Analyte	Sample 227-03-B, concentration (mg/kg) or activity (pCi/g)	Sample 227-03-B-duplicate, concentration (mg/kg) or activity (pCi/g)	RPD (%)
Al	6400	5100	23
Sb	9.9	8.8	12
As	5.6	0.92	144
Ba	140	140	0
Be	0.25	<0.25	N/A
Cd	2.9	2.1	32
Cr	7.4	5.9	23
Co	4.6	4.5	2
Cu	11	10	10
Fe	16000	13000	21
Pb	8.9	7.5	17
Mn	230	200	14
Hg	<0.04	<0.04	N/A
Ni	5.9	5.4	9
V	33	25	28
Zn	50	48	4
Nitrate/Nitrite	1.4	<100	N/A
Pu-239/240	n.d.a.	n.d.a.	N/A
U-238	n.d.a.	n.d.a.	N/A
U-235/236	n.d.a.	n.d.a.	N/A
U-234	n.d.a.	n.d.a.	N/A
Tritium	n.d.a.	n.d.a.	N/A

RPD = Relative percent difference = $[\{D_1-D_2\}/\{(D_1+D_2)/2\}] \times 100$
n.d.a. = no duplicate analysis
N/A = not applicable

Table B-8. RPD values for soil sample 227-02-A.

Analyte	Sample 227-02-A, concentration (mg/kg) or activity (pCi/g)	Sample 227-02-A-duplicate, concentration (mg/kg) or activity (pCi/g)	RPD (%)
Al	6500	5800	11
Sb	11	9.3	17
As	5.9	1.4	123
Ba	180	150	18
Be	<0.25	<0.25	N/A
Cd	2.5	2.1	17
Cr	6.6	6.4	3
Co	4.1	4.1	0
Cu	13	7.8	50
Fe	14000	13000	7
Pb	9.1	7.5	19
Mn	170	160	6
Hg	<0.04	<0.04	N/A
Ni	5.9	5.4	9
V	28	27	4
Zn	51	51	0
Nitrate/Nitrite	9.3	2.7	N/A
Pu-239/240	n.d.a.	n.d.a.	N/A
U-238	n.d.a.	n.d.a.	N/A
U-235/236	n.d.a.	n.d.a.	N/A
U-234	n.d.a.	n.d.a.	N/A
Tritium	n.d.a.	n.d.a.	N/A

Table B-11. RPD values for soil sample 227-03-A.

Analyte	Sample 227-03-A, concentration (mg/kg) or activity (pCi/g)	Sample 227-03-A-duplicate, concentration (mg/kg) or activity (pCi/g)	RPD (%)
Al	n.d.a.	n.d.a.	N/A
Sb	n.d.a.	n.d.a.	N/A
As	n.d.a.	n.d.a.	N/A
Ba	n.d.a.	n.d.a.	N/A
Be	n.d.a.	n.d.a.	N/A
Cd	n.d.a.	n.d.a.	N/A
Cr	n.d.a.	n.d.a.	N/A
Co	n.d.a.	n.d.a.	N/A
Cu	n.d.a.	n.d.a.	N/A
Fe	n.d.a.	n.d.a.	N/A
Pb	n.d.a.	n.d.a.	N/A
Mn	n.d.a.	n.d.a.	N/A
Hg	n.d.a.	n.d.a.	N/A
Ni	n.d.a.	n.d.a.	N/A
V	n.d.a.	n.d.a.	N/A
Zn	n.d.a.	n.d.a.	N/A
Nitrate/Nitrite	n.d.a.	n.d.a.	N/A
Pu-239/240	n.d.a.	n.d.a.	N/A
U-238	0.67	0.4	50
U-235/236	0.15	0.023	147
U-234	0.67	0.61	9
Tritium	<0.012	<0.014	N/A

ATTACHMENT C

RELEVANT ENVIRONMENTAL ASPECTS OF TA-IV

Attachment C -
Relevant Environmental Aspects of TA-IV

Since submittal of the Tijeras Arroyo Operable Unit NFA Proposals in June 1995, SNL has collected additional historical, regulatory compliance, and process information for Technical Area IV (TA-IV). In April 1996, the *Environmental Assessment for Operation, Upgrades, and Modifications in SNL/NM Technical Area IV* was submitted to various agencies (SNL/NM, 1996). SNL Organization 9300, the Applied Physics, Engineering, and Testing Center, operates TA-IV. With research operation beginning in 1980, TA-IV is the newest SNL technical area and has always operated using modern environmental, safety, and health procedures and considerations. Approximately 750 people work at the 83 acre facility. The principal mission for TA-IV is the research, development, and testing of pulsed power technology. Other activities include computer science, flight dynamics, satellite processing, and robotics. Major facilities include the SATURN x-ray facility, the High Energy Radiation Megavolt Electron Source-III (HERMES-III) gamma-ray facility, and the Particle Beam Fusion Accelerator-II (PBFA-II). Other smaller facilities include the Rocket Systems and Flight Dynamic Laboratory, the Payload and Satellite Processing Facility, the parallel Computing Science Laboratory, the Robotics Laboratory, and seven small accelerators.

Biological resources were evaluated before the construction of various TA-IV buildings was begun. An *Environmental Assessment for Operation, Upgrades, and Modifications in SNL/NM Technical Area IV* be was submitted to various agencies in 1996 (SNL/NM, 1996). This evaluation of biological resources at TA-IV is relevant for ten of the ER Sites (sites 46, 50, 77, 227, 229, 230, 231, 233, 234, and 235). These ten sites are located along the northern rim of Tijeras Arroyo in the vicinity of TA-I, TA-II, TA-IV, Pennsylvania Avenue, a Skeet Range, KAFB Landfill 8, and the Albuquerque International Airport. No undisturbed natural habitat remains in the vicinity of TA-IV. Vegetation is limited to scattered ruderal plants and a row of ornamental ash trees. Sufficient food, water, and cover are not available to support wildlife. No federally-listed endangered or threatened species (plants or animals) or state-listed endangered wildlife species (Group 1 or Group 2) are known to occur within the vicinity of TA-IV, based on two biological surveys performed by IT Corporation in 1995 for the SNL/NM Environmental Restoration Project (IT, 1995). No natural lakes or wetlands are present and all drainage flows are intermittent, occurring during periods of precipitation. The Environmental Assessment report concluded that additional building construction would have no impact on biological resources.

Air monitoring is routinely conducted at TA-IV when the various accelerators are operating. The HERMES-III, PBFA-II, and SABRE accelerators generate short-lived nitrogen-13 and oxygen-15 radioactive air emissions but are in amounts million of times smaller than Clear Air Act standards (SNL/NM, 1995c). The half-lives for nitrogen-13 and oxygen-15 are 10 minutes and 2 minutes, respectively. The SATURN accelerator has historically released tritium, but the dose was at such a low level that the source was exempted from the National Emission Standards for Hazardous Air Pollutants (NESHAP) permit requirement.

No ER sites are located within TA-IV. Likewise, no septic tanks have been used at TA-IV. However, 21 aboveground and underground storage tanks (USTs) have been used, primarily for storing dielectric oil. Only above storage tanks (ASTs) are still in use at TA-IV. These 20 tanks store dielectric oil, acid, caustic, and deionized water. No USTs are currently registered with the NMED. A fuel-oil UST (970-1) was removed in 1994; no soil contamination was present.

The Storm Water Program in the SNL/NM Compliance and Generator Interface Department is responsible for measuring and reporting storm-water quality associated with storm-water outfalls located across SNL/NM. The storm-water results are reported annually in the Site Environmental Report (SNL/NM, 1995c). In accordance with National Pollutant Discharge Elimination System (NPDES) requirements, SNL/NM submitted an *Application For Permit to Discharge Stormwater - Discharges Associated with Industrial Activity* to U.S. EPA Region VI in 1992 (SNL/NM, 1992). Due to workload constraints, the U.S. EPA has not acted on the permit. In 1996, SNL/NM will submit a multi-sector permit to the U.S. EPA for their approval with State of New Mexico review and concurrence.

The Storm Drain System Outfall known as ER Site 235 is located about 500 ft southwest of TA-IV on the northern rim of Tijeras Arroyo near the Pennsylvania Avenue bridge. The site consists of a flood-control channel that extends for about 1,500 ft below a concrete baffle chute (energy dissipator). A storm-water monitoring station is located at the upper end of the baffle chute and is designated as Outfall 5 in the NPDES application (SNL, 1992). Sporadic storm water from the northeastern part of Kirtland Air Force Base (KAFB), including SNL Technical Areas I and IV, flows through the baffle chute and the channel before reaching Tijeras Arroyo. The outfall drains approximately 475 acres of which 65% is an impervious surface (SNL, 1996). Figures in the NOD response for ER Site 235 show the watershed. The SNL/NM Storm Water Program collected water samples from Outfall 5 on July 23, 1992, August 6, 1992, and May 25, 1994. Composite and grab samples were analyzed for total metals, general inorganics, and various other parameters. Since the NPDES application has not been reviewed by the U.S. EPA, the water samples have been compared to the most stringent standards available (Federal drinking water standards). Except for manganese and coliform, the quality of the storm water was better than the Federal standards (Tables C-1 and C-2). Manganese was reported at 0.13 mg/L (ppm) which is slightly above the Secondary Maximum Contaminant Level (SMCL) of 0.05 mg/L (ppm). However, the metal analyses were total values, not the dissolved values which are typically compared to drinking water standards. The presence of coliform at 2,000 colonies per 100 mL of water most likely reflects transient wildlife. Water samples were not collected in 1993 or 1995 because of insufficient precipitation.

In the June 1995 NFA Proposal, the SNL/NM ER project considered the potential COCs in soil at ER Site 235 to be: chromates, antifoulants, chromium, sodium hydroxide, hydrochloric acid, diesel fuel, and mineral oil. Both radiation and unexploded ordnance (UXO) field surveys have been conducted at ER Site 235; no anomalies were detected.

No stained soil or stressed vegetation has been documented at the site. The SNL/NM ER project collected soil samples along the drainage ditch in the Fall of 1994; the results are discussed in the NOD Response.

Five other outfalls (ER Sites 230, 231, 232, 233, and 234) are located along the steep, Tijeras Arroyo northern rim at the eastern and southern edges of TA-IV. The purpose of the TA-IV outfalls is to reduce the amount of soil erosion caused by storm water. Discharge of storm water only occurs several days per year. During the period of April 7 to December 31, 1995, an automatic flow meter recorded storm-water flows on ten different days. Engineering drawings for the TA-IV storm-water and sanitary-sewer systems are presented in the NOD responses for ER Sites 230, 231, 233, and 234. No process or waste waters flow into the outfalls. Such fluids are directed to the sanitary sewer system or two evaporative lagoons.

The five TA-IV outfalls were added to the ER site list in 1993. However, only one of the sites has been involved in the spill or release of a Reportable Quantity (SNL, 1995b). The sole incident occurred in 1994 when mineral oil was spilled at ER Site 232. The contaminated soil was subsequently removed for off-site disposal. A NFA proposal for ER Site 232 will be submitted to NMED in late 1996.

In the June 1995 NFA Proposals, the SNL/NM ER project considered the potential COCs in soil at ER Sites 230, 231, 233, and 234 to be: chromates, antifoulants, chromium, sodium hydroxide, hydrochloric acid, diesel fuel, petroleum products, and mineral oil. Both radiation and unexploded ordnance (UXO) field surveys have been conducted at each site; no anomalies were detected. No stained soil or stressed vegetation has been documented at any of the sites. The SNL/NM ER project collected soil samples at each site in the Fall of 1994; the results are discussed in the respective NOD Responses.

Outfall 6 is a catch basin that is located about 50 ft upslope of ER Site 233. According to NPDES guidance, only one of the TA-IV outfalls requires monitoring because all the TA-IV outfalls receive storm water from similar sources (Fink, 1996). Due to infrequent precipitation and the lack of an automatic sampler, only two water samples (July 31 and September 15, 1992) have been collected at Outfall 6. Except for manganese and coliform, the quality of storm water was better than the Federal standards for drinking water (Table C-3). Manganese was reported at 0.24 mg/L (ppm) which is slightly above the Secondary Maximum Contaminant Level (SMCL) of 0.05 mg/L (ppm). However, the metal analyses were total values, not the dissolved values which are typically compared to drinking water standards. The presence of coliform at 4,000 colonies per 100 mL of water most likely reflects transient wildlife.

Two evaporative lagoons (impoundments) are located at TA-IV and both serve similar functions. The primary purpose of the two lagoons is to store surface-water runoff from precipitation that collects in the sumps of the outdoor transformer-oil tank farm spill-containment areas (SNL/NM, 1995b). Both lagoons are lined with synthetic geotextile membranes. Surface-water runoff is pumped to the lagoons by manually operated sump pumps. If visible oil is present in the sumps, a manually operated skimmer is used to transfer the skimmed oil to an oil storage tank. Lagoon #1 (ER Site 77) is located to the south of TA-IV and also receives non-routine water and transformer oil spills from floor trenches in Buildings 981 and 983. The capacity of Lagoon #1 is 137,000 gallons. Lagoon #2 is located in the eastern section of TA-IV and also receives non-routine water and transformer oil spills from floor trenches in Building 970. The capacity of Lagoon #2 is 127,000 gallons.

Operation of the two lagoons is the responsibility of SNL/NM Organization 9300 with oversight by the Water Quality Program in SNL/NM Organization 7500. The lagoons are regulated by NMED under 'Surface Water Discharge Plan 530' (DP-530). The Water Quality Program conducts semiannual inspections that include the measurement of the water levels and the collection of water samples. To date, water has not overflowed onto the ground surface. The water is analyzed for major ions, total dissolved solids (TDS), volatile organics, and extractable organics. Water quality results have not necessitated the pumping of the water for off-site disposal. NMED inspected the surface impoundments twice during 1995; no deficiencies were noted. The SNL/NM Water Quality Program submits a lagoon-monitoring report to NMED on a semiannual basis. The report includes water level measurements and analytical data.

References

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Sandia National Laboratories / New Mexico (1992), *Application For Permit to Discharge Stormwater - Discharges Associated with Industrial Activity, Form 2F, National Pollutant Discharge Elimination System, EPA ID Number NM5890110518*, submitted to U.S. Environmental Protection Agency, September 29, 1992.

Sandia National Laboratories / New Mexico (1995a), *Technical Area I (ADS 1302) RCRA Facility Investigation Work Plan*, February 1995, Plate 5-11: ER Site 226, Acid Waste Line, Southern Section Showing Breaks Identified By Camera Survey And Proposed Sampling Locations.

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Table C-1. Comparison of Federal drinking water standards to maximum concentrations present in storm-water samples collected at NPDES Outfall 5 (ER Site 235) on July 23 and August 6, 1992 (SNL/NM, 1992).

Analyte	Maximum concentration of flow-weighted composite samples, mg/L (ppm)	Lowest MCL, MCLG, or SMCL, mg/L (ppm)	EPA method
Arsenic, total	0.0059	0.050	206.2
Barium, total	0.22	2.0	200.7
Cadmium, total	<0.0050	0.005	213.2
Chromium, total	<0.010	0.1	218.2
Copper, total	0.034	1.0	200.7
Lead, total	0.014	0.015	239.2
Manganese, total	0.13	0.05	200.7
Mercury, total	<0.00020	0.002	245.1
Nickel, total	<0.040	0.1	200.7
Selenium, total	<0.0050	0.05	270.2
Silver, total	<0.010	0.1	200.7
Zinc, total	0.18	5.0	200.7
BOD	11.0	n.s.	405.1
COD	87.9	n.s.	410.0
Cyanide	<0.010	n.s.	335.2
Fluoride	0.21	2.0	340.2
Gross Alpha	0±20 pCi/L	0 pCi/L	900.0/7110B
Gross Beta	10±20 pCi/L	0 mrem	900.0/7110B
HPLC Explosives	<0.032	0.0032	8330
Nitrate + Nitrite	0.76	10.0	353.2
Oil and Grease	<1.0	n.s.	413
Orthophosphate	0.18	n.s.	614
PCBs	<0.005	0.005	8080
Phenolics	0.016	n.s.	8040
Phosphorous as P	0.24	n.s.	365.3
Residual Chlorine	<0.20	n.s.	330
SVOCs	<0.085	0.085	8270
TDS	146.0	250.0	160.1
TKN	1.4	n.s.	351
Total Coliform	2,000 cl/100mL	0 cl/100mL	9230
TSS	221.0	n.s.	160.2
Volatile Organics	<0.005	n.s.	8240

Table C-2. Comparison of Federal drinking water standards to concentrations of total metals and general inorganics in storm-water samples collected at NPDES Outfall 5 (ER Site 235) on May 25, 1994.

Analyte	Composite sample concentration, mg/L (ppm)	Grab sample concentration, mg/L (ppm)	Lowest MCL, MCLG, or SMCL, mg/L (ppm)	EPA method
Antinomy, total	<0.060	<0.060	0.006	200.7
Arsenic, total	0.0033	<0.010	0.050	206.2
Beryllium, total	<0.0020	<0.0020	0.004	200.7
Cadmium, total	0.00076	0.0010	0.005	213.2
Chromium, total	0.0031	0.0044	0.1	218.2
Copper, total	0.0078	0.014	1.0	200.7
Lead, total	0.014	0.026	0.015	239.2
Mercury, total	<0.00020	<0.00020	0.002	245.1
Nickel, total	<0.040	<0.040	0.1	200.7
Selenium, total	<0.0050	<0.0050	0.05	270.2
Silver, total	<0.010	<0.010	0.1	200.7
Zinc, total	0.066	0.17	5.0	200.7
Alkalinity, total	57.2	46.2	n.s.	310.1
Ammonia as N	0.14	0.18	n.s.	350.1
Chloride	1.9	2.5	250.0	300.0
Fluoride	0.20	0.17	2.0	340.2
Nitrate + Nitrite	0.33	0.33	10.0	353.2
Phosphorous as P	0.25	0.36	n.s.	365.3
Sulfate	4.9	4.2	250.0	300.0
TDS	202.0	106.0	500.0	160.1
TSS	255.0	310.0	n.s.	160.2

All water analyses performed by the Quanterra Environmental Services, Inc. laboratory.
BOD = Biochemical Oxygen Demand
cl/mL = colonies per 100 milliliter of water
COD = Chemical Oxygen Demand
Drinking Water Standards: MCL = Maximum Contaminant Level; MCLG = Maximum Contaminant Level Goal; SMCL = Secondary Maximum Contaminant Level, (EPA, 1996). The lead value is an action level.
HPLC = High Performance Liquid Chromatography
mg/L = milligrams per liter = parts per million (ppm)
mrem = millirem
n.s. = not specified (U.S. EPA, 1996)
pCi/L = picocuries per liter
PCBs = Polychlorinated Biphenyls
TDS = Total Dissolved Solids
TKN = Total Kjedahl Nitrogen
TSS = Total Suspended Solids
VOCs = Volatile Organic Compounds. The reported concentrations of VOCs (2-hexanone at 0.011 mg/L (ppm), 2-butanone at 0.046 mg/L (ppm), and acetone at 0.0723 and 0.110 mg/L (ppm) are considered suspect because all three VOCs are common laboratory contaminants (Bleyler, 1988).

Table C-3. Comparison of Federal drinking water standards to maximum concentrations present in storm-water samples collected at NPDES Outfall 6 (catch basin above ER Site 233) on July 31 and September 15, 1992 (SNL/NM, 1992).

Analyte	Maximum concentration of flow-weighted composite samples, mg/L (ppm)	Lowest MCL, MCLG, or SMCL, mg/L (ppm)	EPA method
Arsenic, total	<0.0050	0.050	206.2
Barium, total	0.099	2.0	200.7
Cadmium, total	<0.0050	0.005	213.2
Chromium, total	<0.010	0.1	218.2
Copper, total	0.025	1.0	200.7
Lead, total	0.0067	0.015	239.2
Manganese, total	0.24	0.05	200.7
Mercury, total	<0.00080	0.002	245.1
Nickel, total	<0.040	0.1	200.7
Selenium, total	<0.010	0.05	270.2
Silver, total	<0.010	0.1	200.7
Zinc, total	0.20	5.0	200.7
BOD	62.8	n.s.	405.1
COD	422.0	n.s.	410.0
Cyanide	<0.010	n.s.	335.2
Fluoride	0.17	2.0	340.2
Gross Alpha	1±6 pCi/L	0 pCi/L	900.0/7110B
Gross Beta	10±3 pCi/L	0 mrem	900.0/7110B
HPLC Explosives	<0.0032	0.0032	8330
Nitrate + Nitrite	2.7	10.0	353.2
Oil and Grease	3.2	n.s.	413
Orthophosphate	<0.050	n.s.	614
PCBs	<0.005	0.005	8080
Phenolics	0.048	n.s.	8040
Phosphorous as P	0.060	n.s.	365.3
Residual Chlorine	1.9	n.s.	330
SVOCs	<0.085	0.085	8270
TDS	440.0	250.0	160.1
TKN	5.8	n.s.	351
Total Coliform	4,000 cl/100mL	0 cl/100mL	9230
TSS	56.0	n.s.	160.2
Volatile Organics	<0.005	n.s.	8240

ATTACHMENT F

ER SITE 227 RISK ASSESSMENT ANALYSIS

ATTACHMENT F - ER SITE 227: RISK ASSESSMENT ANALYSIS

I. Site Description and History

The Bunker 904 Outfall, ER Site 227, is located about 50 ft southeast of TA-II on the steep, northern rim of Tijeras Arroyo. The site begins at the outfall of septic-tank system piping and extends for about 200 ft along an unpaved ditch. During 1948 to 1991, the site received TA-II waste water from Building 904 and TA-II storm water. Potential constituents of concern (COCs) in soil at the outfall include high explosives (HE) compounds, plutonium, uranium, tritium, solvents, metals, and mineral oil. The list of COCs was conservatively based upon chemicals used at TA-II. Both radiation and unexploded ordnance (UXO) field surveys have been conducted; no anomalies were detected. No stained soil or stressed vegetation has been documented at the site.

II. Risk Assessment Analysis

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

Step 1.	Site data are described which provide information on the potential COCs, as well as the relevant physical characteristics and properties of the site.
Step 2.	Potential pathways by which a representative population might be exposed to the COCs are identified.
Step 3.	The potential intake of these COCs by the representative population is calculated using a tiered approach. The tiered approach includes screening steps, followed by potential intake calculations and a discussion or evaluation of the uncertainty in those calculations.
Step 4.	Data are described on the potential toxicity and cancer effects from exposure to the COCs and subsequent intake.
Step 5.	Potential toxicity effects (specified as a Hazard Index), cancer risks and radiation doses are calculated.
Step 6.	These values are compared with standards established by the USEPA and USDOE to determine if further evaluation, and potential site clean-up, is required.
Step 7.	Discussion of uncertainties in the previous steps.

II.1 Step 1. Site Data

Site history and site field characterization activities are used to identify potential COCs. The identification of COCs and the sampling to determine the concentration values of those COCs across the site are described in section SNL/NM Analytical Data Summary of the ER Site 227 NOD response. 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. Chemicals that are essential nutrients such as iron, magnesium, calcium, potassium, and sodium were not included in this risk assessment per USEPA 1989a. Both radioactive and nonradioactive COCs are evaluated. The nonradioactive chemicals are inorganics and organics.

II.2 Step 2. Pathway Identification

This site has been designated with a future land-use scenario of industrial (Attachment M). Because of the location and the characteristics of the potential contaminants, the primary pathway for human exposure is considered to be soil ingestion. The inhalation pathway for both chemicals and radionuclides is included because of the potential to inhale dust. Direct gamma exposure is also included in the radioactive contamination risk assessment. A groundwater pathway was not considered because no soil contamination was present in the sampling interval of 0 to 3 ft and the depth to groundwater is approximately 300 ft. Because of the lack of perennial surface water or other significant mechanisms for dermal contact, the dermal exposure pathway is considered to not be significant. No intake routes through plant, meat, or milk ingestion are considered appropriate.

PATHWAY IDENTIFICATION

Chemical Constituents	Radionuclide Constituents
Soil Ingestion	Soil Ingestion
Inhalation (Dust)	Inhalation (Dust and volatiles)
	Direct Gamma

II.3 Steps 3-5. Calculation of Hazard Indices and Cancer Risks

Steps 3 through 5 are discussed in this section. These steps include the discussion of the tiered approach in eliminating potential COCs from further consideration in the risk assessment process and the calculation of intakes from all identified exposure pathways, the discussion of the toxicity information, and the calculation of the hazard indices and cancer risks.

The risks from the COCs at ER Site 227 were evaluated using a tiered approach. First, the maximum concentrations of COCs for chemical constituents were compared to Tijeras Arroyo background screening levels using 95th UTLs or percentile values. If a maximum concentration of a particular COC exceeded the Tijeras Arroyo specific background screening level or if the COC was a radioactive constituent, then the COC was compared to the SNL/NM Site-Wide background screening level (IT, 1996). The Site-Wide UTL chosen for comparison was the minimum value when comparing surface and subsurface UTL values. This procedure was implemented to ensure use of the most conservative value during the comparison process and due to uncertainties associated with some sample depths. The maximum concentration of each COC was used in order to also provide a conservative estimate of the associated risk. Those COCs that were below the background screening level were not considered in further risk assessment analyses.

Second, the remaining maximum concentrations were compared with action levels calculated using methods and equations promulgated in the proposed RCRA Subpart S (40 CFR Part 264, 1990) and Risk Assessment Guidance for Superfund (RAGS) (USEPA, 1989a) documentation. Accordingly, all calculations were based on 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 or near-surface, this assumption is considered valid. If there are 10 or fewer COCs and each has a maximum concentration less than one-tenth of the action level, then the site would be judged to pose no significant health hazard to humans. If there are more than 10 COCs, the proposed Subpart S screening procedure was skipped.

Third, hazard indices and risk due to carcinogenic effects were calculated using Reasonable Maximum Exposure (RME) methods and equations promulgated in RAGS (USEPA, 1989a). The combined effects of all COCs in the soils that were above background concentration values were calculated. For toxic compounds, this was accomplished by summing the individual hazard quotients for each metal into a total Hazard Index. This Hazard Index is compared to the recommended standard of 1. For potentially carcinogenic compounds, the individual risks were summed. The total risk was compared to the recommended risk range of 10^{-4} to 10^{-6}. For the radioactive COCs, the cumulative dose was calculated and the corresponding excess cancer risk estimated.

II.3.1 Comparison to Background and Action Levels

Nonradioactive ER Site 227 COCs are listed in Table 1; radioactive COCs are listed in Table 2. Both tables show the 95th percentile or UTL background levels (IT, 1996). Background levels for chromium VI, cyanide, nitrate/nitrite, and high explosives are not available. Background levels for plutonium and tritium are not applicable because these radionuclides do not occur naturally, or due to fallout, at levels greater than typical detection limits of common laboratory instrumentation. Background concentrations have been recalculated for the Tijeras Arroyo background locations that were used in the June 1995 NFA proposals. The recalculated Tijeras Arroyo values were prepared using a more rigorous statistical approach according to USEPA guidance (USEPA, 1989b, 1992a, and 1992b). The Tijeras Arroyo background locations were not differentiated on the basis of depth because of the homogenous nature of the soil and the limited sampling depth of 0 to 36 inches. As part of the IT (1996) site-wide study, background concentrations were calculated for both the surface (0-6 inch depth) and subsurface (>6 inch depth) soils of the North Super Group, which is defined as soils present in TA-I, TA-II, TA-IV, the northern rim of Tijeras Arroyo, and the northeastern portion of KAFB. The Site-Wide background levels have not yet been approved by the USEPA or the NMED but are the result of a comprehensive study of joint Sandia and U.S. Air Force data from the Kirtland Air Force Base (KAFB). The report was submitted for regulatory review in early 1996. The values shown in Table 1 and Table 2 supersede the background values described in an interim background study report (IT, 1994). Several compounds have maximum measured values greater than background screening levels. Those compounds are retained for further analysis. Because organic compounds do not have calculated background values, this screening step was skipped, and all organics are carried into the risk assessment analyses.

Table 1. Nonradioactive Analytes at ER Site 227 and Comparison to the Background Screening Values.

Analyte	Maximum concentration (mg/kg)	Recalculated 95th % or UTL Level (mg/kg) for Tijeras Arroyo OU Background Locations	Is maximum COC concentration less than or equal to the applicable Tijeras Arroyo OU background screening level?	Site-Wide 95th % or UTL Level (mg/kg) for North Super Group Soils (IT, 1996)	Is maximum COC concentratio n less than background screening value?
Aluminum	8,600	11,874	Yes		
Antimony	12.0	18.6	Yes		
Arsenic	7.7	5.9	No	4.4	No
Barium	210.0	298	Yes		
Beryllium	0.3	0.58	Yes		
Cadmium	2.9	3.0	Yes		
Chromium-total	9.0	17.6	Yes		
Chromium VI	<0.1	NC	No	NC	No
Cobalt	5.1	7.3	Yes		
Copper	8.8	14.7	Yes		
Cyanide	<0.1	NC	No	NC	No
Lead	11.0	23.1	Yes		
Manganese	280.0	330	Yes		
Mercury	<0.04	NC	No	<0.1	No
Nickel	7.4	14.8	Yes		
Nitrate/Nitrite*	14.0	NC	No	NC	No
Selenium	<0.25	NC	No	<1.0	No
Silver	<0.50	NC	No	<1.0	No
Thallium	0.20	NC	No	<1.1	No
Vanadium	28.0	40.4	Yes		
Zinc	59.0	79.2	Yes		
High explosives**	<1.25	NC	No	NC	No

NC - not calculated

** Nitrate/Nitrite is assumed to be nitrite (most conservative)

* High explosives are assumed to be RDX (most conservative)

Table 2. Radioactive Analytes at ER Site 227 and Comparison to the Background Screening Values.

Analyte	Maximum concentration (pCi/g)	Site -Wide 95th % or UTL Level (pCi/g)	Is maximum COC concentration non-detect or less than background screening value?
Pu-238	ND	NC	Yes
Pu-239/240	0.009	NC	No
Tritium	ND	NC	Yes
U-234	0.73	1.6	Yes
U-235/236	0.19	0.18	No
U-238	0.72	1.3	Yes

NC - not calculated
ND - radionuclide not detected above minimum detectable activity

As part of the tiered approach to risk assessment, only those COCs that have values above the background screening level values are included in the next tier of risk assessment analyses. Also included in the next tier of analyses are COCs that do not have a background screening value. If less than ten COCs are above the background screening level, those COCs are screened using the proposed Subpart S action level procedure. Because there were more than 10 combined non-radioactive COCs above the background screening level or without a background screening level, this step (comparison to Subpart S) was skipped.

Radioactive contaminants do not have pre-determined action levels analogous to Subpart S and therefore this step in the screening process is not performed for radionuclides.

II.3.2 Identification of Toxicological Parameters

Tables 3 and 4 show the COCs that have been retained in the risk assessment and the values for the toxicological information available for those COCs.

Table 3. Toxicological Parameter Values for Nonradioactive COCs

COC name	RfD_o (mg/kg-d)	RfD_{inh} (mg/kg-d)	Confidence	SF_o (kg-d/mg)	SF_{inh} (kg-d/mg)	Cancer Class^
Arsenic	0.0003	--	M	1.5	15	A
Chromium VI	0.005	--	L	--	42	A
Cyanide	0.02	--	M	--	--	D
Mercury	0.0003	0.000086	--	--	--	D
Nitrate/ Nitrite*	0.1	--	H	--	--	D
Selenium	0.005	--	--	--	--	D
Silver	0.005	--	--	--	--	D
Thallium	--	--	--	--	--	D
High explosives**	0.0005	--	--	0.11	--	--
2-Butanone	0.6	0.29	--	--	--	D
4-Methyl-2-pentanone	--	--	--	--	--	--
Benzo(b) fluoranthene	--	--	--	0.73	0.61	B2
Chrysene	--	--	--	0.0073	0.0061	B2
Fluoranthene	0.04	--	L	--	--	D
Phenanthrene	--	--	--	--	--	D
Pyrene	0.03	--	L	--	--	D

* Nitrate/Nitrite is assumed to be nitrite (most conservative)
** High explosives assumed to be RDX (most conservative)
RfD_o - oral chronic reference dose in mg/kg-day
RfD_{inh} - inhalation chronic reference dose in mg/kg-day
SF_o - oral slope factor in $(mg/kg\text{-}day)^{-1}$
SF_{inh} - inhalation slope factor in $(mg/kg\text{-}day)^{-1}$
^ EPA weight-of-evidence classification system for carcinogenicity

A - human carcinogen
B1 - probable human carcinogen. 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 carcinogencity
E - evidence of noncarcinogenicity for humans

-- information not available
L - low
M - medium
H - high

Table 4. Toxicological Parameter Values for Radioactive COCs

COC name	SF_e (m^2/pCi-yr)	SF_o (1/pCi)	SF_{inh} (1/pCi)	Cancer Class^
Pu-239/240	1.95E -14	3.2E-10	2.8E-08	A
U-235/236	1.16E-11	4.7E-11	1.3E-8	A

SF_e - external exposure slope factor (risk/yr per pCi/m^2)
SF_o - oral (ingestion) slope factor (risk/pCi)
SF_{inh} - inhalation slope factor (risk/pCi)
^ EPA weight-of-evidence classification system for carcinogenicity

A - human carcinogen
B1 - probable human carcinogen. 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 carcinogencity
E - evidence of noncarcinogenicity for humans

II.3.3 Exposure Assessment and Risk Characterization

Section II.3.3.1 describes the exposure assessment for this risk assessment. Section II.3.3.2 provides the risk characterization including the Hazard Index value and the excess cancer risk for both industrial and residential land-uses.

II.3.3.1 Exposure Assessment

Attachment M shows the equations and parameter values used in the calculation of intake values and the subsequent Hazard Index and Excess Cancer Risk values for the individual exposure pathways. The appendix shows the parameters for the industrial and residential land-use scenarios. The equations are based on RAGS (USEPA, 1989a). The parameters are based on information from RAGS (USEPA, 1989a) as well as other EPA guidance documents and reflect the RME approach advocated by RAGS.

Although the designated land-use scenario is industrial for this site, the risk values for a residential land-use scenario are also presented. These residential risk values are presented to show the potential to risk to human health even under the more restrictive land-use scenario.

II.3.3.2 Risk Characterization

Table 5 shows the that for the nonradioactive COCs, the Hazard Index value is 0.03 and the excess cancer risk is 5 X 10^{-6} for the assumed industrial land-use scenario. The numbers presented included exposure from soil ingestion and dust inhalation for the nonradioactive COCs.

Table 5. Risk Assessment Values for ER Site 227 Nonradioactive COCs.

COC Name	Maximum concentration (mg/kg)	Industrial Land-use Scenario		Residential Land-use Scenario	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	7.7	0.03	5E-6	0.09	2E-5
Chromium VI	<0.1	0.00	3E-10	0.00	4E-10
Cyanide	<0.1	0.00	--	0.00	--
Mercury	<0.04	0.00	--	0.00	--
Nitrate/ Nitrite*	14.0	0.00	--	0.00	--
Selenium	<0.25	0.00	--	0.00	--
Silver	<0.50	0.00	--	0.00	--
Thallium	0.20	--	--	--	--
High explosives**	<1.25	0.00	6E-8	0.01	2E-7
2-Butanone	0.007 J	0.00	--	0.00	--
4-Methyl-2-pentanone	0.001 J	--	--	--	--
Benzo(b) fluoranthene	0.068 J	0.00	2E-8	0.00	8E-8
Chrysene	0.049 J	0.00	2E-10	0.00	6E-10
Fluoranthene	0.094 J	0.00	--	0.00	--
Phenanthrene	0.084 J	--	--	--	--
Pyrene	0.062 J	0.00	--	0.00	--
TOTAL		**0.03**	**5E-6**	**0.1**	**2E-5**

NC - not calculated
NA - not applicable
* assumed to be nitrite (most conservative)
** assumed to be RDX (most conservative)
-- information not available

For the residential land-use scenario, the Hazard Index value increases to 0.1 and the excess cancer risk is 2×10^{-5}. The numbers presented included exposure from soil ingestion and dust inhalation. Although USEPA (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, NM to be eroded and, subsequently, for dust to be present even in predominantly residential areas. Because of the nature of the local soil, other exposure pathways are not considered (see Attachment M).

For the radioactive COCs, contribution from the direct gamma exposure pathway is included. Table 6 shows the total effective dose equivalent (TEDE) for both an industrial (0.3 mrem/yr) and residential (0.3 mrem/yr) land-use. In accordance with proposed EPA guidance, the standard being utilized is an excess TEDE of 15 mrem/yr (40 CFR Part 196, 1994), corresponding to an excess cancer risk of approximately 3×10^{-4}; the calculated dose values for ER Site 227 for both industrial and residential land-uses are well below that standard. The average radiation exposure due to natural sources (radon, internal radiation, cosmic radiation, and terrestrial radiation) in the U.S. is approximately 295 mrem/yr total effective dose (NCRP, 1987), with approximately 198 mrem/yr due to radon, 40 mrem/yr due to internal radiation (mainly K-40), 29 mrem/yr due to cosmic radiation and 28 mrem/yr due to terrestrial caused radiation. The value of 295 mrem/yr corresponds to an estimated cancer risk of 6×10^{-3}.

For a perspective on the estimated risk associated with background levels of radionuclides, and to emphasize the conservativeness associated with RAGS RME risk and dose calculations, the excess cancer risk from background concentrations of radionuclides for relevant exposure pathways has also been estimated using RAGS methodologies. For an industrial or residential land-use scenario, using the 95th percentile or UTL values of radionuclides present in the background soil, the excess cancer risk from soil ingestion is calculated as 4×10^{-4}. The excess cancer risk for the inhalation pathway (i.e., inhalation of radon gas) is calculated as 0.1.

Table 6 shows not only the dose but also the estimated excess cancer risk as 8×10^{-6} for an industrial land-use and a value of 8×10^{-6} for a residential land-use. The excess cancer risk from the nonradioactive COCs and the radioactive COCs is not additive, as noted in RAGS (USEPA, 1989a).

Table 6. Risk Assessment Values for ER Site 227 Radioactive COCs.

COC Name	Max. Conc. (pCi/g)	Total Effective Dose Equivalent for Industrial Land-use (mrem/yr)	Total Effective Dose Equivalent for Residential Land-use (mrem/yr)	Excess Cancer Risk for Industrial Land-use	Excess Cancer Risk for Residential Land-use
Pu-239/240	0.009	1E-4	2E-4	3E-9	4E-9
U-235/236	0.19	0.3	0.3	8E-6	8E-6
TOTAL		**0.3**	**0.3**	**8E-6**	**8E-6**

II.4 <u>Step 6. Comparison of Risk Values to Numerical Standards.</u>

The risk assessment analyses considered the evaluation of the potential for adverse health effects for both an industrial land-use scenario, which is the designated land-use scenario for this site, and also a residential land-use scenario.

For the industrial land-use scenario, the Hazard Index calculated is 0.03; this is much less than the numerical standard of 1 suggested in RAGS (1989a). The excess cancer risk is estimated at 5×10^{-6}. In RAGS, the USEPA suggests that a range of values (10^{-6} to 10^{-4}) be used as the numerical standard; the value calculated for this site is in the low-end of the suggested acceptable risk range. Therefore, for an industrial land-use scenario, the Hazard Index risk assessment values are significantly less than the established numerical standard and the excess cancer risk is in the low-end of the suggested acceptable risk range.

For the radioactive components of the industrial land-use scenario, the calculated dose is 0.3 mrem/yr, which is significantly less than the numerical standard of 15 mrem/yr suggested in the draft EPA guidance. The excess cancer risk estimate is 8×10^{-6}, which is significantly less than the excess cancer risk from naturally occurring radioactive sources.

For the residential land-use scenario, the calculated Hazard Index is 0.1, which is again significantly less than the numerical guidance. The excess cancer risk is estimated at 2×10^{-5}; this value is in the middle of the suggested acceptable risk range. The dose from the radioactive components is 0.3 mrem/yr, which is significantly less than the numerical guidance. The associated cancer risk is 8×10^{-6}, significantly below background calculated risk values.

II.5 Uncertainty Discussion

The conclusion from the risk assessment analysis is that the potential effects on human health are small compared to established numerical standards when considering an industrial land-use scenario. Although the maximum arsenic concentration (7.7 mg/kg) exceeds the calculated UTL, it is within the range of arsenic concentration values measured in the Site-Wide background study and may be part of background. In addition, based on historical records, arsenic is not considered to be a potential COC. Therefore, this risk assessment is conservative as arsenic is a significant contributor to both the Hazard Index and the excess cancer risk. The uncertainty in this conclusion is considered to be small. Because of the location and history of the site, there is low uncertainty in the land-use scenario and the potentially affected populations that were considered in making the risk assessment analysis. An RME approach was used to calculate the risk assessment values, which means that the parameter values used in the calculations were conservative and that the calculated intakes are likely overestimates. Maximum measured values of the concentrations of the COCs were used to provide conservative results. Because the COCs are found in the 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. Table 3 shows the confidence in the toxicological parameter values. There is a mixture of estimated values and values from the Health Effects Assessment Summary Tables (HEAST) (EPA, 1996) and Integrated Risk Information System (IRIS) (EPA, 1988, 1994) data bases. The constituents without toxicological parameters have low concentrations and are judged to be insignificant contributors to the overall risk. Because of the conservative nature of the RME approach, the uncertainties in the toxicological values are not expected to be of high enough concern to change the conclusion from the risk assessment analysis. The overall uncertainty in all of the steps in the risk assessment process is considered to be not significant with respect to the conclusion reached.

III. Summary

The Bunker 904 Outfall, ER Site 227, had relatively minor contamination consisting of some inorganic, organic, and radioactive compounds. Although the maximum arsenic concentration (7.7 mg/kg) exceeds the calculated UTL, it is within the range of arsenic concentration values measured in the Site-Wide background study and may be part of background. Therefore, this risk assessment is conservative as arsenic is a significant contributor to both the Hazard Index and the excess cancer risk. Because of the location of the site on Kirtland AFB, the designated land-use scenario and the nature of the contamination, the potential exposure pathways identified for this site included soil ingestion and dust inhalation for chemical constituents and soil ingestion, dust inhalation, and direct gamma exposure for radionuclides. Using conservative assumptions and employing a RME approach to the risk assessment, the calculations show that for the industrial land-use scenario the Hazard Index (0.03) is significantly less than the USEPA standard of 1. The estimated cancer risk (5×10^{-6}) is in the low-end of the suggested acceptable risk range. The calculations show that for the residential land-use scenario the Hazard Index (0.1) is also significantly less than the USEPA standard of 1. The estimated cancer risk (2×10^{-5}) is in the middle of the suggested acceptable risk range. The dose and corresponding cancer risk from the radioactive components are much less than EPA guidance values; the estimated dose is 0.3 mrem/yr for both the industrial and residential land-use scenarios. This value is much less than the numerical guidance of 15 mrem/yr in draft EPA guidance. The corresponding estimated cancer risk value is 8×10^{-6} for the two land-use scenarios. This value is also much less than risk values calculated due to naturally occurring radiation.

The uncertainties associated with the calculations are considered small relative to the conservativeness of the risk assessment analysis. We therefore conclude that this site does not have significant potential to affect human health under either an industrial or a residential land-use scenario.

The ecological risk for this site has not been estimated at this time. Site-Wide ecological risk analyses are being conducted and the relevant analyses for this site will be presented when available.

IV. References

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ATTACHMENT M

SNL ER PROJECT EXPOSURE PATHWAY DISCUSSION FOR CHEMICAL AND RADIONUCLIDE CONTAMINATION

Sandia National Laboratories Environmental Restoration Program

EXPOSURE PATHWAY DISCUSSION FOR CHEMICAL AND RADIONUCLIDE CONTAMINATION

BACKGROUND

Sandia National Laboratories (SNL) 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 project site. 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 ER sites have similar types of contamination and physical settings, SNL believes that the risk assessment analyses at these sites will 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 views as resulting in a Reasonable Maximum Exposure (RME) value. Subject to comments and recommendations by the USEPA Region VI and NMED, SNL proposes that these default exposure routes and parameter values be used in future risk assessments.

At SNL/NM, all Environmental Restoration (ER) sites exist within the boundaries of the Kirtland AFB. 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/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 ER sites. At this time, all SNL/NM ER sites have been tentatively designated for either industrial or recreational future land use.

Based on this and other related information, 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 and risk values. EPA (EPA, 1989a) provides a summary of exposure routes that could potentially be of significance at a specific waste site. These potential exposure routes consist of:

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

- Inhalation of airborne compounds (vapor phase or particulate), and;
- External exposure to penetrating radiation (immersion in contaminated air; immersion in contaminated water and exposure from ground surfaces with photon-emitting radionuclides).

Based on the location of the sites and the characteristics of the surface of the sites, we have evaluated these potential exposure routes to determine which should be considered in risk assessment analyses (the last exposure route is pertinent to radionuclides only). At SNL/NM ER sites, there does not presently 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 computer code RESRAD manual (ANL, 1993), risks resulting from immersion in contaminated air or water are not significant compared to risks from other radiation exposure routes; these are therefore not included. SNL/NM ER has therefore excluded the following four potential exposure routes from further risk assessment evaluations at any SNL/NM ER site:

- Ingestion of contaminated fish and shell fish;
- Ingestion of contaminated fruits and vegetables;
- Ingestion of contaminated meat, eggs, and dairy products; and
- 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 future risk assessments, the exposure routes that will be considered are:

- Ingestion of contaminated drinking water;
- Ingestion of contaminated soil;
- Inhalation of airborne compounds (vapor phase or particulate).
- Dermal contact with chemicals in water;
- Dermal contact with chemicals in soils; and
- External exposure to penetrating radiation from ground surfaces with photon-emitting radionuclides.

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 six of the above routes will, however, be considered. The general equations for calculating potential intakes via these routes are shown below. The equations are from the Risk Assessment Guidance for Superfund: Volume 1 (EPA, 1989a and 1991). Also shown are the default values SNL/NM ER suggests for use in Reasonable Maximum Exposure (RME) risk assessment calculations for an industrial scenario, based on EPA and other governmental agency guidance. The pathways and values for chemical contaminants are discussed first, followed by those for radionuclide contaminants.

Chemicals

Ingestion of Chemicals in Drinking Water:

Scenario: A person ingests tap water and beverages made from tap water. All tap water consumed is assumed to come from an on-site drinking well. In accordance with EPA guidance, the default parameter values used reflect a residential exposure.

$$\text{Intake (mg/kg-day)} = \frac{CW \times IR \times EF \times ED}{BW \times AT}$$

CW = chemical concentration in water (mg/L)
IR = ingestion rate (L water/d);
EF = exposure frequency (d/yr);
ED = exposure duration (yr);
BW = body weight (kg);
AT = averaging time (d)

Parameter	Units	Point Value	Justification
CW	mg/L	site-specific	
IR	L/d	2	Exposure Factors Handbook (EPA, 1989b); reasonable worst-case value
EF	d/yr	350	Exposure Factors Handbook (EPA, 1989b) and RAGS, Vol 1, Part B (EPA, 1991), reasonable worst-case value
ED	yr	30	Exposure Factors Handbook (EPA, 1989b) and RAGS, Vol 1, Part B (EPA, 1991), reasonable worst-case value
BW	kg	70	Exposure Factors Handbook (EPA, 1989b); conservative estimate
AT	d	 10950 25500	RAGS (EPA, 1989a); ED x 365 d/y for noncarcinogenic effects; 70 yr x 365 d/y for carcinogenic effects.

Ingestion of Chemicals in Soil:
Scenario: A worker engages in a combination of indoor and outdoor activities for 8 hours per day with inadvertent ingestion of soil from a layer of soil on the inside surfaces of the fingers and thumb from outdoor activities or inadvertent ingestion of soil from handling of food or cigarettes. An EPA suggested average value of 100 mg/d is used for the ingestion rate.

$$\text{Intake (mg/kg-day)} = \frac{CS \times IR \times (10^{-6}\ \text{kg/mg}) \times EF \times FI \times ED}{BW \times AT}$$

CS = chemical concentration in soil (mg/kg);
IR = ingestion rate (mg soil/d);
FI = fraction ingested (default to 1);
EF = exposure frequency (d/yr);
ED = exposure duration (yr);
BW = body weight (kg);
AT = averaging time (d).

Parameter	Units	Point Value	Justification
CS	mg/kg	site-specific	
IR	mg/d	100	Exposure Factors Handbook (EPA, 1989b), RAGS (EPA, 1989a); conservative estimate
EF	d/yr	250	Reasonable worst-case value for worker; RAGS (EPA, 1989a)
FI	--	1	Worst-case value
ED	yr	30	Reasonable worst-case value for worker
BW	kg	70	Exposure Factors Handbook (EPA, 1989b); conservative estimate
AT	d	 10950 25500	RAGS (EPA, 1989a); ED x 365 d/y for noncarcinogenic effects; 70 yr x 365 d/y for carcinogenic effects.

Inhalation of Airborne (vapor phase or particulate) Chemicals:
Scenario: A worker is engaged in activities (indoors or outdoors) and inhales contaminant vapors present in the air or is exposed to contaminant particulates present in the air.

$$\text{Intake (mg/kg-day)} = \frac{CA \times IR \times ET \times EF \times ED}{BW \times AT}$$

CA = chemical concentration in air (mg/m^3);
IR = inhalation rate (m^3/h);
ET = exposure time (h/d);
EF = exposure frequency (d/yr);
ED = exposure duration (yr);
BW = body weight (kg);
AT = averaging time (d).

Parameter	Units	Point Value	Justification
CA	mg/m^3	site-specific	
IR	m^3/h	2.5	Exposure Factors Handbook (EPA, 1989b); reasonable worst-case value
EF	d/yr	250	Reasonable worst-case value for worker
ET	h/d	8	Reasonable worst-case value
ED	yr	30	Reasonable worst-case value for worker
BW	kg	70	Exposure Factors Handbook (EPA, 1989b); conservative estimate
AT	d	 10950 25500	RAGS (EPA, 1989a); ED x 365 d/y for noncarcinogenic effects; 70 yr x 365 d/y for carcinogenic effects.

The chemical concentration in air can be either measured or calculated based on the concentration of contaminants in the soil. If field measurements are not available, vapor-phase concentrations can be determined using a volatilization factor (VF) to define the relationship between the concentration of contaminant in soil and the volatilized contaminants in air. Likewise, chemical concentrations based on particulates can be determined using a particulate emission factor (PEF) to define the relationship between the contaminant concentration in soil with the concentration of respirable particles in air due to fugitive dust emissions. The volatilization factor was established as part of the Hwang and Falco (1986) model developed by EPA's Exposure Assessment group. The particulate emission factor is derived by Cowherd (1985), applicable to a typical hazardous waste site where the surface contamination provides a relatively continuous and constant potential for emission over an extended period of time. The equations for calculating VFs and PEFs can be found in EPA (EPA, 1991). Alternative methods for calculating these factors are also available. These alternative methods can be discussed with EPA/NMED staff for use in risk assessments if they can be shown to be technically consistent or superior to current published guidance.

Dermal Contact with Chemicals in Water:

Scenario: A worker is in contact with contaminants in water, primarily through hygienic activities as hand washing or showering.

$$\text{Absorbed Dose (mg/kg-day)} = \frac{CW \times SA \times 10^4\ cm^2/m^2 \times PC \times ET \times EF \times ED \times 1\ L/10^3\ cm^3}{BW \times AT}$$

CW = chemical concentration in water (mg/L);
SA = skin surface area for contact (m^2);
PC = chemical specific dermal permeability constant (cm/h);
ET = exposure time (h/d);
EF = exposure frequency (d/yr);
ED = exposure duration (yr);
BW = body weight (kg);
AT = averaging time (d)

Parameter	Units	Point Value	Justification
CW	mg/L	site-specific	
SA	m^2	2	Exposure Factors Handbook (EPA, 1989b); {represents total body exposure); reasonable worst-case value
PC	cm/h	chemical specific	see e.g., Dermal Exposure Assessment (EPA, 1992)
EF	d/yr	250	Reasonable worst-case value for worker
ET	h/d	0.25	Dermal Exposure Assessment (EPA, 1992); reasonable worst case value
ED	yr	30	Reasonable worst-case value for worker
BW	kg	70	Exposure Factors Handbook (EPA, 1989b); conservative estimate
AT	d	 10950 25500	RAGS (EPA, 1989a); ED x 365 d/y for noncarcinogenic effects; 70 yr x 365 d/y for carcinogenic effects.

Dermal Contact with Soil:
Scenario: A worker is in contact with contaminants in soil for an exposure duration determined through discussions with EPA/NMED staff. A worker gets exposure to the head, hands, forearms and lower legs.

$$\text{Absorbed Dose (mg/kg-day)} = \frac{CS \times (10^{-6}\ kg/mg) \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

CS = chemical concentration in soil (mg/kg);
SA = skin surface area for contact (m^2);
AF = soil to skin adherence factor (mg/cm^2);
ABS = absorption factor (unitless);
EF = exposure frequency (d/yr);
ED = exposure duration (yr);
BW = body weight (kg);
AT = averaging time (d).

Parameter	Units	Point Value	Justification
CS	mg/kg	site-specific	
SA	m^2	0.53	Dermal Exposure Assessment (EPA, 1992); {accounts for adult exposure to head, hands, forearms, and lower legs); reasonable worst-case value
AF	mg/cm^2	1.0	Dermal Exposure Assessment (EPA, 1992); reasonable worst-case value
ABS	--		
EF	d/yr	250	Reasonable worst-case value for worker
ET	h/d	TBD	To be determined based on discussions with NMED staff.
ED	yr	30	Reasonable worst-case value for worker
BW	kg	70	Exposure Factors Handbook (EPA, 1989b); conservative estimate
AT	d	 10950 25500	RAGS (EPA, 1989a); ED x 365 d/y for noncarcinogenic effects; 70 yr x 365 d/y for carcinogenic effects.

EPA (EPA, 1992) recognizes that dermal contact exposure remains the least well understood of the major exposure routes. Chemical-specific data are often not available and dose-response relationships specific to dermal contact are not available. EPA (EPA, 1992) provides guidance on assessment of dermal exposure, including determination of permeability coefficients and other related parameters.

In addition to the equations presented above for absorbed dose via steady-state dermal exposure, EPA (EPA, 1992) presents methods for calculation of absorbed doses for unsteady-state exposure; these methods generally produce lower estimates of absorbed dose. The document also presents a screening process for determining if site-specific calculations of dermal exposure are necessary, assuming that dermal exposure is deemed a potentially valid route of contaminant exposure. In general, SNL/NM ER will use the latest guidance available from EPA on dermal exposure. This is an area where discussions with EPA/NMED staff on appropriate assumptions and parameter values is essential. Discussions with EPA/NMED staff are also necessary to determine when this exposure route should be invoked.

Radionuclides

Radionuclide Carcinogenic Effects from Water: Residential

Scenario: A worker drinks radioactively-contaminated water and inhales vapor from the water.

Total risk = $(C_{rw} \times SF_o \times IR_w \times EF \times ED) + (C_{rw} \times SF_i \times IR_{air} \times K \times EF \times ED)$

C_{rw}	= radionuclide concentration in water (pCi/L)
SF_i	= inhalation slope factor (risk/pCi)
SF_o	= oral (ingestion) slope factor (risk/pCi)
EF	= exposure frequency (d/y)
ED	= exposure duration (y)
IR_{air}	= indoor inhalation rate (m^3/d)
IR_w	= water ingestion rate (L/d)
K	= volatilization factor (unitless)

Parameter	Units	Point Value	Justification
C_{rw}	pCi/L	site-specific	
SF_i	risk/pCi	radionuclide-specific	
SF_o	risk/pCi	radionuclide-specific	
EF	d/y	350	RAGS (EPA, 1989a)
ED	y	30	Reasonable worst-case estimate.
IR_{air}	m^3/d	15	RAGS (EPA, 1989a)
IR_w	L/d	2	Reasonable worst-case estimate.
K	unitless	0.5	RAGS (EPA, 1989a)

Radionuclide Carcinogenic Effects from Soil: Industrial

Scenario: A worker inadvertently ingests soil, inhales vapor and particulates from soil and is externally exposed to penetrating radiation ground surfaces contaminated with photon-emitting radionuclides.

$$\text{Total risk} = C_n \times ED \times [(SF_o \times 10^{-3} g/mg \times EF \times IR_{soil}) + (SF_i \times 10^3 g/kg \times EF \times IR_{air} / VF) + (SF_i \times 10^3 g/kg \times EF \times IR_{air} / PEF) + (SF_e \times 10^3 g/kg \times D \times SD \times (1-S_e) \times T_e)]$$

C_n	= radionuclide concentration (pCi/g)
SF_i	= inhalation slope factor (risk/pCi)
SF_o	= oral (ingestion) slope factor (risk/pCi)
SF_e	= external exposure slope factor (risk/y per pCi/m^2)
EF	= exposure frequency (d/y)
ED	= exposure duration (y)
IR_{air}	= inhalation rate (m^3/d)

IR_{soil} = soil ingestion rate (mg/d)
VF = soil-to-air volatilization factor (m^3/kg)
PEF = particulate emission factor (m^3/kg)
D = depth of radionuclides in soil (m)
SD = soil density (kg/m^3)
S_e = gamma shielding factor (unitless)
T_e = gamma exposure factor (unitless)

Parameter	Units	Point Value	Justification
C_T	pCi/g	site-specific	
SF_i	risk/pCi	radionuclide-specific	
SF_o	risk/pCi	radionuclide-specific	
SF_e	risk/y per pCi/m^2	radionuclide-specific	
EF	d/y	250	RAGS (EPA, 1989a)
ED	y	30	Reasonable worst-case estimate.
IR_{air}	m^3/d	20	RAGS (EPA, 1989a)
IR_{soil}	mg/d	100	Reasonable worst-case estimate.
VF	m^3/kg	nuclide-specific	
PEF	m^3/kg	1.32×10^9	Region VI guidance.
D	m	0.1	RAGS (EPA, 1989a)
SD	kg/m^3	1430	RAGS (EPA, 1989a)
S_e	unitless	0.2	RAGS (EPA, 1989a)
T_e	unitless	1	RAGS (EPA, 1989a)

Summary for an Industrial Land-Use Scenario

SNL proposes the described default exposure routes and parameter values for use in risk assessments at sites that have an industrial future land-use scenario. The parameter values are based on 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 will use them in risk assessments for all sites where the assumptions are consistent with site-specific conditions. All deviations will be documented.

Summary for an Residential Land-Use Scenario

Sandia may choose to evaluate some sites using a residential land-use scenario in order to provide an indication of the effects of data uncertainty on risk value calculations or in order to potentially mitigate the need for institutional controls or restrictions on Sandia ER sites. For a risk assessment evaluating a residential land-use scenario, Sandia will use parameter values as documented in the Risk Assessment Guidance for Superfund (RAGS, 1989a). That EPA guidance document provides detailed discussion on the appropriate values to use for all of the potential exposure pathways.

References

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ATTACHMENT N

REFERENCES FOR TIJERAS ARROYO OU NOD RESPONSES

References for Tijeras Arroyo Ou Nod Responses

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GENERAL RISK ASSESSMENT COMMENTS

1. **Conclusions throughout the report are based largely on comparisons with previously established upper tolerance limits (UTLs). These UTLs have not been approved by NMED or limits (UTLs). These UTLs have not been approved by NMED or EPA and are therefore considered draft. The presented values have been compared with protective screening values for human health. Both residential and industrial scenario screening values have been considered since Sandia does not have a final future land use plan *at this time.***

   Response: DOE/SNL understands that UTLs are considered draft until approved by NMED and EPA. As of April 1996, DOE/SNL has a final future land use plan and risk assessments will use future land use scenarios based upon that plan.

2. **The sites with reported radionuclides above background levels were evaluated based on a DOE established acceptable dose. EPA Region 6 policy requires that the evaluation of risk to radionuclides include an estimation of potential carcinogenic risk. A revision to the risk evaluation is requested.**

   Response: DOE/SNL will provide potential carcinogenic risk and dose due to radionuclide contamination in future NFA proposal submissions and resubmissions.

3. **For all sites, the following issues must be addressed: 1) potential ecological risk posed at the site, 2) the site as a potential source for ecological risk in transport of constituents through the septic system into Tijeras Arroyo, and 3) detection limits relative to human health-based screening levels.**

   Response: DOE/SNL is currently working on ecological risk assessments for all ER Sites which will be submitted as a supplemental document to NMED upon completion. DOE/SNL considers detection limits in preparing human health-based risk assessments.

10. Site 50, OU 1309, Old Centrifuge Site

The radioactive portion of the risk assessment was compared to a radioactive dose. It is EPA Region 6 policy to require the calculation of not only the radioactive dose present at a site, but also to require an evaluation of radioactive risk. SNL/NM should revise the risk evaluation accordingly.

Response: SNL/NM has recently completed a quantitative risk assessment for all contaminants, including cancer-causing radionuclides, in soil. The section Site 50, OU 1309, Old Centrifuge Site in NMED Site-Specific Technical Comments discusses the risk assessment.

11. Site 77, OU 1309, Oil Surface Impoundment Site

The data provided appear to support an NFA proposal from a human health standpoint. However, the proposal should provide information on the potential for ecological impact.

Response: The issue of ecological impact is not applicable to ER Site 77 at this time. ER Site 77 is an active, evaporative lagoon (impoundment) that is used by TA-IV for storing tank-farm surface water. The lagoon is regulated under NMED 'Surface Water Discharge Plan 530' (DP-530). Since the lagoon is already regulated, monitored, and inspected according to NMED regulations, ER Site 77 should be granted NFA status. SNL/NM Organization 9300 manages the lagoon with oversight by the Water Quality Program in SNL/NM Organization 7500. The section Site 77, OU 1309, Oil Surface Impoundment Site in NMED Site-Specific Technical Comments presents more details.

12. Site 227, OU 1309, Bunker 904 Outfall Site

The radioactive risk analysis was based on comparative doses. The evaluation of the risk due to the radioactive dose should be part of the risk analysis. Please revise accordingly. The NFA proposal should address the potential for ecological risk.

Response: SNL/NM has recently completed a quantitative risk assessment for all contaminants, including cancer-causing radionuclides, in soil. The section Site 227, OU 1309, Bunker 904 Outfall Site in NMED Site-Specific Technical Comments discusses the risk assessment. The issue of ecological risk is discussed in Item 3 of the NMED General Risk Assessment Comments section.

13. Site 229, OU 1309, Storm Drain System Outfall Site

The radioactive risk should be calculated also based on the potential carcinogenic risk presented by the radioactive dose.

Response: SNL/NM has recently completed a quantitative risk assessment for all contaminants, including cancer-causing radionuclides, in soil. The section Site 229, OU 1309, Storm Drain System Outfall Site in NMED Site-Specific Technical Comments discusses the risk assessment.

14. Site 230, OU 1309, Storm Drain System Outfall Site

The analysis of radioactive risk should include an estimation of carcinogenic risk due to radioactive constituents.

Response: SNL/NM has recently completed a quantitative risk assessment for all contaminants, including cancer-causing radionuclides, in soil. The section Site 230, OU 1309, Storm Drain System Outfall Site in NMED Site-Specific Technical Comments discusses the risk assessment.

15. Site 231, OU 1309, Storm Drain System Outfall Site

See comment to site 230 above. [The analysis of radioactive risk should include an estimation of carcinogenic risk due to radioactive constituents.]

Response: SNL/NM has recently completed a quantitative risk assessment for all contaminants, including cancer-causing radionuclides, in soil. The section Site 231, OU 1309, Storm Drain System Outfall Site in NMED Site-Specific Technical Comments discusses the risk assessment.

16. Site 233, OU 1309, Storm Drain System Outfall Site

See comment above. [The analysis of radioactive risk should include an estimation of carcinogenic risk due to radioactive constituents.]

Response: SNL/NM has recently completed a quantitative risk assessment for all contaminants, including cancer-causing radionuclides, in soil. The section Site 233, OU 1309, Storm Drain System Outfall Site in NMED Site-Specific Technical Comments discusses the risk assessment.

NOD

M.J.
Fran
David
Dick
Laine
N.TTK.
Brenda

Copied 1/31/00

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

JAN 26 2000

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

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

Dear Mr. Bearzi:

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

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

Sincerely,

Michael J. Zamorski
Area Manager

Enclosure

Sandia National Laboratories
Albuquerque, New Mexico
December 1999

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

INTRODUCTION

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

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

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Site-Specific Comments

OU 1309

ER Site 7, Gas Cylinder Disposal Pit

Additional site characterization work proposed includes:

1. **Collect subsurface soil samples from within the waste layer and immediately below the bottom of the landfill.**

2 **Subsurface samples will be collected from at least four (4) borings or trenches. At least one sample per boring/trench will be collected within 5 ft beneath the landfill. At least two samples per boring/trench will be collected at locations within the waste layer (more samples will be collected if the waste layer exceeds 15 ft thick).**

3. **The soil samples will be analyzed for radiological constituents, metals, volatile organic compounds, semi-volatile organic compounds, and high explosives.**

Response: Unfortunately the name for ER Site 7 is misleading and refers to ER Site 6A, a gas cylinder disposal pit that was remediated in 1995. ER Site 7 contains construction and demolition debris from the Veteran's Administration (VA) Hospital. Prior to disposal of the construction and demolition debris, SNL/NM used the location as a sand and gravel quarry from 1980 to 1986.

DOE, SNL/NM, and KAFB's Environmental Management agreed on November 15, 1999 that responsibility for this site should be transferred to the KAFB Installation Restoration Program (IRP). The IRP intends to accept ownership for this site. DOE and KAFB are currently working on the transfer process. Therefore, SNL/NM will not be performing the additional proposed site characterization. After the IRP assumes responsibility for this site, SNL/NM will submit an administrative NFA proposal for ER Site 7.

ER Sites 46, 232, 233, 234, 227, 229, 230, and 231 (OU 1309 Outfalls)

The outfalls at ER Sites 46 and 227 are of the most concern to the HRMB; the others, which are storm drain outfalls, are clustered near ER sites 46 and 227. More specifically, ER Sites 229, 230, and 231 are grouped near ER Site 227; whereas, ER Sites 232, 233, and 234 are located near ER Site 46. Additional site characterization work proposed includes:

1. **Locate each outfall accurately.**

Response: SNL/NM will locate each outfall accurately for ER Sites 46, 227, 229, 230, 231, 232, 233, and 234. The recent discussions have revealed that the type of water released to each site needs to be clarified. ER Site 46 received rinse waters from TA-I buildings. ER Sites 227 and 229 received rinse waters from TA-II buildings. ER Sites 230, 231, 232, and 233 currently receive storm water from TA-IV. ER Site 234 previously received storm water from TA-IV, but is now inactive. Except for ER Site 232, all of these OU 1309 sites were documented in the 2nd Round of the NFA proposals.

Site-Specific Comments

The NFA proposal for ER Site 232 was submitted in the 8th Round in July 1997; additional work for ER Site 232 is addressed in SNL/NM (1999).

2. **Collect and analyze soil samples at the points of surface discharge and along the drainage channels. Analytical results of previous sampling will be used, to the extent possible, to meet this requirement.**

Response: SNL/NM will collect and analyze soil samples at the points of surface discharge and along the drainage channels that are unlined. More details are presented in item #4 below. Analytical results of previous sampling will be used, to the extent possible, to meet the NMED requirement. The soil samples will be collected according to the following Fiscal Year (FY) schedule: ER Site 46 (FY01), ER Site 227 (FY01), ER Site 229 (FY01), ER Site 230 (FY02), ER Site 231 (FY02), ER Site 232 (FY01), ER Site 233 (FY02), and ER Site 234 (FY02).

3. **Collect deep soil samples and vapor samples at ER Sites 46 and 227. Two 150-ft deep boreholes should be drilled at ER Site 46; one similar borehole should be drilled at ER Site 227. The soil-vapor monitor wells will be permanent installations. Soil samples will be analyzed for radiological constituents, metals, volatile organic compounds, semi-volatile organic compounds, high explosives, hexavalent chromium, iron, and chloride.**

Response: SNL/NM will install two permanent 150-foot deep soil-vapor monitor wells at ER Site 46 and one similar monitor well at ER Site 227. At ER Site 46, the first well will be located at the end of the acid waste line, while the second well will be located at the southern end of the site. [The end (former outfall) of the acid waste line is estimated to be about 50 ft south-southwest of monitor well TJA-3.] The ER Site 227 well will be located at the eastern end of the site near the slope break. Soil samples will be analyzed for radiological constituents (gamma spectroscopy and gross alpha/beta), RCRA metals, volatile organic compounds, semi-volatile organic compounds, high explosives, hexavalent chromium, iron, and chloride. According to the FY00 baseline, performance of this fieldwork is scheduled for FY01.

4. **Collect shallow subsurface soil samples at each storm drain outfall (two boreholes at each location at maximum depths of 5 ft). The soil samples will be analyzed for radiological constituents, metals, volatile organic compounds, semi-volatile organic compounds, and high explosives.**

Response: SNL/NM will collect shallow subsurface samples at two locations each at the storm-drain outfalls (ER Sites 230, 231, 232, 233, and 234). The samples will be collected at a depth of five ft, bgs from hand-augered boreholes. Except for ER Site 234, the boreholes for the TA-IV storm-drain outfalls will be located 5 ft and 30 ft downslope from the lowermost concrete structures at ER Sites 230, 231, 232, and 233. Not to be forgotten, ER Site 232 is unique because two storm drains are located there. At the remaining TA-IV storm-drain outfall (ER Site 234), the boreholes will be located at a similar lateral spacing with the northernmost borehole being located at the lowermost tip of the site. The soil samples from each site will be analyzed for radiological constituents (gamma spectroscopy and gross alpha/beta), RCRA metals, volatile organic compounds, semi-volatile organic compounds, and high explosives.

5. **Collect a surface soil sample upstream of the drop inlet at ER Site 230. The soil sample will be analyzed for radiological constituents, metals, volatile organic compounds, semi-volatile organic compounds, and high explosives.**

   Response: SNL/NM also will collect a surface (0 – 0.5 ft, bgs) soil sample for ER Site 230. The sample will be collected upstream of the drop inlet and next to the chain-link fence. The soil sample will be analyzed for radiological constituents (gamma spectroscopy and gross alpha/beta), RCRA metals, volatile organic compounds, semi-volatile organic compounds, and high explosives.

6. **A new ground-water monitor well will be installed at the bottom of the slope at ER Site 46. The well will be completed in the regional aquifer, if perched water is not encountered.**

   Response: SNL/NM will install a groundwater monitor well at the bottom of the slope at ER Site 46. The well will be completed in the regional aquifer, if perched water is not encountered.

7. **Summarize in written form, as applicable, all geologic, hydrologic, and ground-water quality data for all boreholes and ground-water monitor wells in the vicinity of ER Sites 46 and 227. The information requested above for the TA-2 septic systems will meet this requirement for ER Site 227, which is located adjacent to TA-2.**

   Response: SNL/NM will summarize in written form, as applicable, all geologic, hydrologic, and groundwater quality data for all boreholes and groundwater monitor wells in the vicinity of ER Sites 46 and 227. This information will be presented in the Sandia North Groundwater Investigation Annual Report for FY01 or FY02.

8. **Revise and resubmit the data tables in the NFA proposals for each site, meeting the standards achieved in the 12th Round NFA proposals.**

   Response: After all the requested soil samples have been collected and the analytical results received, SNL/NM will revise and resubmit the soil-sample data tables for ER Sites 46, 227, 229, 230, 231, 232, 233, and 234 in a format meeting the standards set in the 12th Round NFA proposals. Risk assessments (human-health and ecological) will be prepared. The data tables and risk assessments will be incorporated into the 'statement of basis' format.

Reference (ER Site 7)

Sandia National Laboratories/New Mexico. Letter to Kirtland Area Office (KAO). "Transmittal of Responses to NMED for Request for Supplemental Information (RSI)," September 8, 1999.

NOD

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

SEP 17 2003

9/17/03
CC: Dick Fate
MJ Davis
Dwight
Sue Collins
John Copland
Records Center
MB

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

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

Dear Mr. Kieling:

Enclosed is one of two NMED copies of the Department of Energy (DOE) and Sandia National Laboratories/New Mexico response to the NMED Notice of Deficiency (NOD) for Solid Waste Management Units 227 and 229 Proposals for No Further Action, Dated June 1995 (2nd Round). Per our verbal agreement, the second NMED copy is being sent directly to the Sandia Staff Manager.

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

Sincerely,

Karen L Boardman

Karen L. Boardman
Manager

Enclosures

cc w/enclosures:
W. Moats, NMED-HWB (via Certified Mail)
L. King, EPA, Region 6 (2 copies via Certified Mail)
M. Gardipe, ERD
C. Voorhees, NMED-OB
R. Kennett, NMED-OB

cc w/o enclosures:
J. Estrada, SSO-AIP
F. Nimick, SNL, MS 1087
K. Thomas, EPA, Region 6
S. Martin, NMED-HWB, Santa Fe

Sandia National Laboratories
Albuquerque, New Mexico
June 2003

Environmental Restoration Project
Response to NMED Notice of Deficiency for
SWMUs 227 and 229
Proposals for No Further Action (2nd Round)
Dated June 1995

INTRODUCTION

Sandia National Laboratories/New Mexico (SNL/NM) is submitting this Notice of Deficiency (NOD) response for Solid Waste Management Units (SWMUs) 227 and 229, which are managed by the Tijeras Arroyo Operable Unit (TJAOU). This NOD response addresses the most current correspondence from the New Mexico Environment Department (NMED) by providing the requested information for the site-specific comments in Enclosure B of the October 13, 1999, NOD (NMED October 1999). The NMED site-specific comments are presented in **bold** as numbered statements, followed by the SNL/NM response in normal font style ("Response"). Supporting information is included as attachments.

The proposals for no further action (NFA) for SWMUs 227 and 229 were previously submitted in 1995 (SNL/NM June 1995a and b). This is the third NOD response for SWMUs 227 and 229. Two NOD responses were previously submitted in 1996 and 1999 (SNL/NM October 1996 and SNL/NM December 1999). This NOD response includes the results of soil and soil-vapor sampling conducted in 1994, 2001, and 2002 and addresses the NMED request for reorganizing the previously submitted 1994 analytical data. The attached human health and ecological risk screening assessments incorporate both the analytical results from all three rounds of confirmatory soil sampling at each site and relevant information from the Tijeras Arroyo Groundwater (TAG) Investigation (SNL/NM November 2002).

SWMU 227 is known as the "Bunker 904 Outfall." SWMU 229 should have a similar name because both sites served as the waste-water outfalls for the Technical Area (TA)-II high explosive (HE) drain system. However, SWMU 229 was assigned the name "Storm Drain System Outfall" in the early 1990s before the design of the TA-II utilities was well understood. Engineering drawings and recent excavation work have confirmed that SWMU 229 was never connected to a storm-water system. Historically, the area surrounding SWMUs 227 and 229 has been graded to direct storm water away from the outfall ditches.

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ENCLOSURE B—OPERABLE UNIT 1309

1. Locate each outfall accurately.

Response: SNL/NM has located each outfall accurately on Figure 1. SWMUs 227 and 229 encompass 0.08 and 0.16 acre, respectively, at the southern apex of TA-II. Both sites are shown in more detail on Figure 2. As discussed below, the outfall locations have been verified with historical aerial photographs, field inspections, and engineering drawings.

SWMUs 227 and 229 are the two outfall ditches into which waste water from the SWMU 48 HE drain system previously drained. The waste water discharged to the ground surface at the western upstream ends of the two outfall ditches (Figure 3). The TJAOU manages the outfall ditches, while the TA-II Operable Unit (OU) manages the SWMU 48 HE drain system. The HE drain system was the only SWMU 48 effluent systems that impacted SWMUs 227 and 229. A separate sanitary waste septic system for SWMU 48 was located in the southwestern part of TA-II (Figure 3).

Waste water from the SWMU 48 HE drain system flowed southeast along the outfall ditches, which extend down the steep northern rim of Tijeras Arroyo (Figures 3 and 4). Neither outfall ditch was constructed with concrete or any other type of liner. The SWMU 227 outfall ditch ranges in depth from about 3 to 10 feet and is approximately 130 feet long by 20 feet wide. The SWMU 229 outfall ditch was originally about the same dimensions, but only a short 40-foot-long segment remains today. Construction activities associated with SWMU 229 are discussed below.

From 1947 through 1992, TA-II waste water flowed through the buried piping of the SWMU 48 HE drain system and discharged at the SWMU 227 and 229 outfall ditches (Figure 3). The engineering drawings listed in Table 1 show that floor drains in three TA-II buildings (904, 913, and 914) were connected to the SWMU 48 HE drain system. Building 904, the largest of the three buildings consisting of approximately 10,000 square feet, was initially used during the late 1940s and 1950s for the assembly of nuclear weapons (IT December 1996). During the assembly process, HE shavings fell onto the floor, which was cleaned with water and possibly kerosene. The water flowed into floor drains connected to the SWMU 48 HE drain system. Mechanical filtration took place at an HE catch box (solids retention tank) located in the drain system piping that removed the HE particulates. Starting in the 1960s, Building 904 was used as an HE research laboratory and also may have contained laboratories for photographic processing and chemistry research.

Table 1
SNL/NM Facilities Engineering Drawings for Buildings 904, 913, and 914

Drawing Title	Drawing Number	Initial Date	Final Revision Date
Assembly Building No. 1 (Building 904) Plumbing—Floor Plan	30-05-01	2/10/48	5/16/71
Building 904 Evaporative Cooler	96376M001	11/20/59	11/20/59
Building 904 HVAC Modifications	98622/M-4	1/2/77	6/15/84
Building 904 HVAC Modifications	98622/M-2	6/15/89	6/15/89
Modifications to Buildings 913/914	93141/M-8	11/16/73	7/9/84
Modifications to Buildings 913/914	93141/M-1	12/17/74	4/20/82
CAD Compilation (TA-I, TA-II, TA-IV Utilities)	Not applicable	1980s	Continuously updated

CAD = Computer assisted design.
HVAC = Heating, ventilation, air conditioning.
SNL/NM = Sandia National Laboratories/New Mexico.
TA = Technical Area.

Process knowledge indicates that the Building 904 waste water possibly contained acetone, methylene chloride, trichloroethylene (TCE), methyl ethyl ketone, nitromethane, carbon tetrachloride, toluene, xylenes, Freon™ compounds, hexane, various alcohols (methanol and isopropyl), metals (barium, cadmium, chromium, lead, silver, and titanium), HE compounds (Baratol, Compound B, black powder, HMX [octogen], RDX [cyclonite]), ammonium hydroxide, cyanide, kerosene, and possibly traces of radionuclides such as cesium-137, uranium-235/238, plutonium-239, and tritium (SNL/NM June 1995a and b, October 1996, and December 1999).

Building 913 encompassed approximately 3,400 square feet and was primarily used for explosives testing; other uses included component assembly, high pressure testing, and security training. Chemicals used at Building 913 include acetone, boron, chromium, diborane, inert gases, isopropanol, mercury, nickel carbonyl, phosphine, phosphorous, titanium, and trichloroethane (IT December 1996). These chemicals are not known to have been discharged to the Building 913 floor drain. Building 914 (500 square feet) was used for the storage of maintenance equipment and supplies. Hazardous or radioactive materials are not suspected to have been stored in or used at Building 914.

Therefore, the contaminants of concern (COCs) for SWMUs 227 and 229 include volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), HE compounds, cyanide, metals, and radionuclides. The COCs consist of, or are indicative of, the materials used in Buildings 904 and 913.

To verify that SWMUs 227 and 229 were the actual locations where the TA-II waste water had discharged, a historical set of aerial photographs spanning the years from 1951 to 1999 was reviewed. Examples from 1995 and 1959 are presented as Figures 3 and 5, respectively. The aerial photographs were compared to historic and recent engineering drawings, such as Figure 6, and to utilities currently visible in the field. This comparison verified that SWMUs 227 and 229 were accurately depicted in figures previously presented in the NFA proposals (SNL/NM June 1995a and b) and the NOD responses

(SNL/NM October 1996 and December 1999). Interestingly, the 1951 photograph shows that not much soil erosion had occurred even though the discharge of waste water began in 1947. In fact, the depth and width of the outfall ditches varies little between the 1951 and 1999 photographs. The ditch walls have been remarkably stable with only minor sloughing because of the heavily cemented (caliche) soil and the arid desert climate. The waste water supported the growth of minor vegetation, such as weeds, shrubs, and grasses; however, no trees are visible in the photographs. The similar appearance of the outfall ditches to natural ditches along the arroyo rim suggests that the waste-water rate was not appreciable. The volumes of waste water discharged at the two sites cannot be quantified using the aerial photographs, but decreasing vegetative cover suggests that the waste-water discharge rate declined substantially after the early 1960s.

Septic water was not discharged at either SWMUs 227 or 229. Engineering drawings (Table 1) show that underground septic systems were connected to Buildings 904 and 913 before both buildings were connected to the City of Albuquerque (COA) sanitary sewer system in 1993. Toilet facilities were not installed in Building 914. The Building 904 septic system was located in the southwestern part of TA-II (Figure 3) and the Building 913 septic system at the southern part of TA-II (Figure 6). TA-IV construction activities removed the Building 913 septic system in the 1990s. The SNL/NM Drain and Septic Systems Project has identified the Building 913 septic system as SWMU 1069 and determined that the site does not require sampling or excavation (SNL/NM November 2001); NMED concurred with this determination (Moats February 2002).

The SWMU 48 HE drain system piping was constructed of 8-inch-diameter cement pipe. However, no documents are available that present the volumes of waste water that were discharged to the outfall ditches. The waste-water discharge at SWMUs 227 and 229 was discontinued after the SWMU 48 HE drain system was connected to the COA sanitary sewer system in 1993. Buildings 904, 913, and 914 were demolished in 2002.

The historical aerial photographs also document the various construction activities that have occurred at the southern apex of TA-II and the eastern side of TA-IV. As shown on Figure 2, water lines were installed in 1963 and 1979. The aerial photographs also show that the 1993 replacement of the SWMU 48 HE drain system piping disturbed the western upstream ends of the two outfall ditches. SWMU 229 was disturbed to a greater degree because a sewer-line junction box and manhole were installed on the north side of the site. SWMU 227 was disturbed to a lesser degree because the HE drain system piping was removed but not replaced there. In February 2001, exploratory trenching was conducted at SWMUs 227 and 229 to verify this interpretation of the aerial photographs.

On February 23, 2001, an exploratory trench was excavated at the western end of SWMU 227 (Figure 2). Approximately 10 cubic yards of sand and gravel were excavated with a backhoe. Figure 7 is a photograph of the exploratory trench, which was oriented perpendicular to the outfall ditch. The trench measured 30 feet long by 2 feet wide with a maximum depth of 6 feet. As suspected, the outfall piping was not present; however, a layer of undisturbed (native) sand and gravel were present at a depth of approximately 3 feet below ground surface (bgs) indicating that the piping had been buried at a depth of less than 3 feet bgs. No debris, odors, or stains were discovered during the excavation work. A soil sample was collected from the west wall of the exploratory trench at 5 feet bgs (Table 2, sample number TJAOU-227-GR-05-5). On February 28, 2001, the trench was backfilled with the excavated soil. Analytical results for the soil sample and other SWMU 227 soil samples are discussed in the SNL/NM response to NMED Site-Specific Comment 2.

Also on February 23, 2001, a backhoe was used to deepen the western end of the SWMU 229 outfall ditch (Figures 2 and 8). Approximately 30 cubic yards of fill (non-native soil) and a few pieces of wood and concrete rubble were excavated. The length of the exploratory excavation was 33 feet and the maximum width was approximately 23 feet. The maximum depth of the excavation was 9 feet bgs, approximately 6 feet deeper than the pre-existing ditch that had been left by construction crews in 1993. The 9-foot depth represented the safety limit for not destabilizing the adjacent sewer and water lines. The northern wall of the outfall ditch was extended northward as far as possible. However, as suspected, the outfall piping was not present in the excavation wall (Figure 9). The piping most likely would have been buried at a depth of approximately 3 feet bgs as it was at SWMU 227. No odors or stains were encountered during the excavation work.

The SWMU 229 excavation served as a useful location (Figure 10) for collecting samples of undisturbed (native) soil from beneath the location where the waste water had discharged from the outfall piping. The sides of the excavation were benched to allow personnel egress so that a hand auger could be used at the floor of the excavation. Native soil consisting of a damp, whitish-brown clayey sand was encountered at 13 feet bgs, which was 4 feet below the excavation floor. On March 1, 2001, soil samples TJAOU-229-GR-05-14 and TJAOU-229-GR-05-19 were collected from 14 and 19 feet bgs, respectively (Table 2). The analytical results for these and 12 other soil samples for SWMU 229 are discussed in the SNL/NM response to NMED Site-Specific Comment 2. In mid-March 2001, SNL/NM Facilities Engineering backfilled both the excavation and the westernmost portion of the outfall ditch with the 30 cubic yards of excavated soil and approximately 40 cubic yards of soil brought in from an off-site road construction project. The additional soil fill increases the stabilization of the sewer lines.

2. **Collect and analyze soil samples at the points of surface discharge and along the drainage channels. Analytical results of previous sampling will be used, to the extent possible, to meet this requirement.**

<u>Response</u>: In 2001, SNL/NM collected soil samples at the point of, and downstream from, where the Building 904 HE drain system outfall piping discharged at SWMUs 227 and 229. This soil sampling also satisfied the NMED request made during a meeting held on November 17, 1999, that samples be collected along the center line of each outfall ditch (Copland November 1999). The 2001 soil samples supplement the sampling that was conducted in 1994. Sampling locations, analytes, analytical laboratories, and results for the 1994 and 2001 sampling efforts are discussed in more detail below.

Site-Specific Comments

Table 2
Confirmatory Soil Samples Collected for SWMU 227 and SWMU 229

SWMU	Sample Number	Depth (ft bgs)	Location	Sampling Device	Sampling Date	Applicable to Risk
227	227-01-A	0.0–0.5	West end of outfall ditch	HT	9/29/94	yes
	227-01-B	0.5–3.0	West end of outfall ditch	HA	9/29/94	yes
	227-02-A	0.0–0.5	West end of outfall ditch	HT	9/29/94	yes
	227-02-B	0.5–3.0	West end of outfall ditch	HA	9/29/94	yes
	227-03-A	0.0–0.5	East end of site	HT	9/29/94	yes
	227-03-B	0.5–3.0	East end of site	HA	9/29/94	yes
	227-04-A	0.0–0.5	East end of site	HT	9/29/94	yes
	227-04-B	0.5–3.0	East end of site	HA	9/29/94	yes
	TJAOU-227-GR-05-5	5.0–5.5	Exploratory trench at waste-water discharge point	HT	2/27/01	yes
	TJAOU-227-GR-06-0	0.0–0.5	Center line of outfall ditch	HT	2/27/01	yes
	TJAOU-227-GR-06-5	5.0–6.5	Center line of outfall ditch	HA	2/27/01	yes
	TJAOU-227-GR-06-5-DU	5.0–6.5	Center line of outfall ditch	HA	2/27/01	yes
	TJAOU-227-GR-07-5	5.0–6.5	Center line of outfall ditch	HA	2/27/01	yes
	TJAOU-227-VW-01-20	20–22	80 ft southeast of SWMU 227	SS	3/26/01	yes
	TJAOU-227-VW-01-100	100–102	80 ft southeast of SWMU 227	SS	3/27/01	yes
	TJAOU-227-VW-01-150	150–152	80 ft southeast of SWMU 227	SS	3/27/01	yes
	TJAOU-227-VW-01-200	200–202	80 ft southeast of SWMU 227	SS	3/27/01	yes
	TJAOU-227-VW-01-250	250–252	80 ft southeast of SWMU 227	SS	3/28/01	yes
	TJAOU-227-VW-01-275	275–277	80 ft southeast of SWMU 227	SS	3/28/01	yes
229	229-01-A	0.0–0.5	West end of ditch	HT	9/29/94	no[a]
	229-01-B	0.5–3.0	West end of ditch	HA	9/29/94	no[a]
	229-02-A	0.0–0.5	West end of ditch	HT	9/29/94	no[a]
	229-02-B	0.5–3.0	West end of ditch	HA	9/29/94	no[a]
	229-03-A	0.0–0.5	East end of site	HT	9/29/94	yes
	229-03-B	0.5–3.0	East end of site	HA	9/29/94	yes
	229-04-A	0.0–0.5	East end of site	HT	9/29/94	yes
	229-04-B	0.5–3.0	East end of site	HA	9/29/94	yes
	TJAOU-229-GR-05-14	14–15	Exploratory excavation at waste-water discharge point	HA	3/1/01	yes
	TJAOU-229-GR-05-19	19–20	Exploratory excavation at waste-water discharge point	HA	3/1/01	yes
	TJAOU-229-GR-06-0	0.0–0.5	Center line of outfall ditch	HT	3/1/01	yes
	TJAOU-229-GR-06-5	5.0–6.5	Center line of outfall ditch	HA	3/1/01	yes
	TJAOU-229-GR-07-5	5.0–6.5	Center line of outfall ditch	HA	3/1/01	yes
	TJAOU-229-GR-07-5-DU	5.0–6.5	Center line of outfall ditch	HA	3/1/01	yes
	TJAOU-227-VW-01-20	20–22	50 ft northeast of SWMU 229	SS	3/26/01	yes
	TJAOU-227-VW-01-100	100–102	50 ft northeast of SWMU 229	SS	3/27/01	yes
	TJAOU-227-VW-01-150	150–152	50 ft northeast of SWMU 229	SS	3/27/01	yes
	TJAOU-227-VW-01-200	200–202	50 ft northeast of SWMU 229	SS	3/27/01	yes
	TJAOU-227-VW-01-250	250–252	50 ft northeast of SWMU 229	SS	3/28/01	yes
	TJAOU-227-VW-01-275	275–277	50 ft northeast of SWMU 229	SS	3/28/01	yes

[a]Sample is not applicable to the risk assessment process because the sample was collected in 1994 at the western end of the SWMU 229 outfall ditch, which was excavated in 2001. Therefore, the sample does not represent current *in situ* conditions.

bgs = Below ground surface.
DU = Duplicate.
ft = Foot/feet.
GR = Grab sample.
HA = Hand auger.
HT = Hand trowel.
SS = Split spoon (advanced by drill rig).
SWMU = Solid Waste Management Unit.
TJAOU = Tijeras Arroyo Operable Unit.
VW = Vapor well.

Site-Specific Comments

Sampling Locations

On September 29, 1994, soil samples were collected at SWMUs 227 and 229. Hand trowels and hand augers were used to collect soil samples from four locations at both sites (Figure 2) from two depth intervals at each location (Table 2). Surface-soil samples were collected from a depth of 0 to 0.5 foot bgs using a hand trowel. Subsurface soil samples were collected at 0.5 to 3 feet bgs using a hand auger. The eight soil samples collected at SWMU 227 were identified as 227-01-A through 227-04-B, and the eight soil samples collected at SWMU 229 were identified as 229-01-A through 229-04-B (Table 2).

The second round of soil sampling at SWMUs 227 and 229 was conducted in late February and early March 2001. The February and early March 2001 soil samples were collected using a hand trowel or hand auger. Three locations were sampled at each outfall ditch (Table 2). The first sampling location at each site was the approximate location where the SWMU 48 HE drain system piping discharged (Figure 2). The second and third sampling locations at each site were farther down the center-line of each outfall ditch. The proximity of potentially unstable ditch walls presented a safety concern that was considered when selecting the second and third sampling locations. The five soil samples collected at SWMU 227 were identified as TJAOU-227-GR-05-5 through TJAOU-227-GR-07-5 and the six soil samples collected at SWMU 229 were identified as TJAOU-229-GR-05-14 through TJAOU-229-GR-07-5-DU (Table 2).

In late March 2001, soil samples were collected with a split spoon during the drilling of a 275-foot deep borehole, which was subsequently converted into a soil-vapor monitoring well (227-VW-01). Monitoring well 227-VW-01 is located approximately 80 feet southeast of SWMU 227 and approximately 50 feet northeast of SWMU 229 (Figure 2). Layne-Western Inc. drilled the borehole as close as possible to the steep slope of the arroyo rim and used air-rotary casing hammer techniques. Because SWMUs 227 and 229 are in such close proximity and simultaneously received the same type of waste water, the soil samples are applicable to both sites. The soil samples were collected at 20, 100, 150, 200, 250, and 275 feet bgs (Table 2).

Analytes and Analytical Laboratories

The COCs for SWMUs 227 and 229 are similar and consist of Resource Conservation and Recovery Act (RCRA) metals, hexavalent chromium, VOCs, SVOCs, HE compounds, cyanide, tritium, and gamma-emitting radionuclides.

The 1994 soil samples were analyzed for RCRA metals, hexavalent chromium, VOCs, SVOCs, HE compounds, tritium, and gamma-emitting radionuclides. Additional analytes were cyanide, total petroleum hydrocarbons (TPH), nitrite plus nitrate, and total Kjeldahl nitrogen (TKN). The samples were analyzed by two off-site analytical laboratories (Quanterra Environmental Services, Inc. and Environmental Control Technology Corporation), and the on-site laboratory (SNL/NM Radiation Protection Sample Diagnostics [RPSD] Laboratory).

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The 2001 soil samples were analyzed for RCRA metals, hexavalent chromium, VOCs, SVOCs, HE compounds, cyanide, gamma-emitting radionuclides, and gross alpha/beta. The samples were analyzed by an off-site analytical laboratory (General Engineering Laboratories, Inc. [GEL]) and the on-site RPSD Laboratory.

Analytical Results

Analytical results for the three rounds of soil sampling at SWMU 227 are provided in Attachment A and summarized in Table A-1, which lists the maximum concentrations, averages, and background values for each of the analytes. All detections, qualified results, and detection limits are listed in the accompanying Tables A-2 through A-12. Highlights of the analytical results include:

- Four metals (arsenic, barium, cadmium, and chromium) were reported at levels slightly above background values (Table A-2).
- Two radionuclides (cesium-137 and uranium-238) were reported at levels slightly above background values (Table A-3).
- Low concentrations of four VOCs (2-butanone, acetone, methylene chloride, and 4-methyl-2-pentanone) were reported (Table A-4). The VOC detection limits are listed in Tables A-5 and A-6.
- Low concentrations of six SVOCs (benzo[b]fluoranthene, chrysene, fluoranthene, phenanthrene, pyrene, and bis[2-ethylhexyl] phthalate) were reported (Table A-7). The detections limits for all SVOCs are listed in Tables A-8 and A-9.
- No HE compounds were detected above the detection limits listed in Tables A-10 and A-11.
- Cyanide at 0.159 J milligrams (mg)/kilogram (kg) was reported for the 150-foot-bgs sample, but cyanide was not reported for the five other sampling depths (20, 100, 200, 250, and 275 feet bgs) (Table A-12).
- TKN concentrations ranged from 180 to 670 mg/kg (Table A-12).
- The nitrate plus nitrite concentrations ranged from nondetections (<1.0 mg/kg) to 9.3 mg/kg (Table A-12).
- No TPH were detected (Table A-12).

The data validation reports for SWMU 227 are presented in Attachment B; no significant quality assurance (QA)/quality control (QC) issues were identified. Attachment C presents the gamma-spectroscopy results from the on-site RPSD Laboratory.

Site-Specific Comments

Analytical results for the three rounds of soil sampling at SWMU 229 are provided in Attachment D and summarized in Table D-1, which lists the maximum concentrations, averages, and background values for each of the analytes. All detections, qualified results, and detection limits are listed in the accompanying Tables D-2 through D-12. Highlights of the analytical results include:

- Six metals (arsenic, barium, cadmium, chromium, lead, and silver) were reported at levels slightly above background values (Table D-2, Attachment D).
- Two radionuclides (cesium-137 and uranium-238) were reported at levels slightly above background values (Table D-3, Attachment D).
- Low concentrations of three VOCs (2-butanone, acetone, and methylene chloride) were reported (Table D-4, Attachment D). The VOC detection limits are listed in Tables D-5 and D-6 (Attachment D).
- Low concentrations of eleven SVOCs (acenaphthene, anthracene, benzo[a]anthracene, benzo[b]fluoranthene, benzo[a]pyrene, chrysene, fluoranthene, fluorene, phenanthrene, pyrene, and bis[2-ethylhexyl] phthalate) were reported (Table D-7, Attachment D). The detection limits for all SVOCs are listed in Tables D-8 and D-9 (Attachment D).
- No HE compounds were reported above the detection limits listed in Tables D-10 and D-11 (Attachment D).
- Cyanide at 0.159 J mg/kg was reported for the 150-foot-bgs sample, but cyanide was not reported for the five other sampling depths (20, 100, 200, 250, and 275 feet bgs) (Table D-12, Attachment D).
- The maximum TPH concentration was 81 mg/kg (Table D-12, Attachment D).

The data validation reports for SWMU 229 are presented in Attachment E; no significant QA/QC issues were identified. Attachment F presents the gamma-spectroscopy results from the on-site RPSD Laboratory.

Summary

The analytical results for the three rounds of soil sampling at SWMUs 227 and 229 have identified only minor amounts of soil contamination at the two outfall ditches. Table 2 lists the confirmatory soil samples that are applicable for the risk assessment process. All 19 soil samples collected at SWMU 227 were applicable to the risk assessment process. Of the 20 soil samples collected at SWMU 229, 16 were applicable to the risk assessment process. Four samples (229-01-A, 229-01-B, 229-02-A, 229-02-B) were not applicable because the samples did not represent current *in situ* conditions. The four samples were collected in 1994 at the western end of the SWMU 229 outfall ditch, which was excavated in 2001. The four nonapplicable soil samples did not contain any of the maximum concentrations or activities.

The maximum analyte values for each respective site were used in the risk assessments. The risk screening assessment for SWMU 227 is presented in Attachment G. The accompanying site conceptual model for SWMU 227 is presented in Attachment H. The risk screening assessment and the site conceptual model for SWMU 229 are presented in Attachments I and J, respectively.

3. **Collect deep soil samples and vapor samples at ER Sites 46 and 227. Two 150-ft deep boreholes should be drilled at ER Site 46; one similar borehole should be drilled at ER Site 227. The soil-vapor monitor wells will be permanent installations. Soil samples will be analyzed for radiological constituents, metals, volatile organic compounds, semi-volatile organic compounds, high explosives, hexavalent chromium, iron, and chloride.**

Response: SNL/NM has collected deep soil and soil-vapor samples at both SWMU 46 and SWMU 227. Sampling results for SWMU 46 are not applicable to SWMUs 227 and 229 and will be presented in a later document. At SWMU 227, soil samples were collected during the drilling of a 275-foot-deep borehole that was converted into a permanent soil-vapor monitoring well (Table 3). During February and March 2001, Layne-Western Inc. drilled the borehole using air-rotary casing hammer techniques. Figure 11 shows the location of soil-vapor monitoring well 227-VW-01, which is located approximately 80 feet southeast of SWMU 227 and approximately 50 feet northeast of SWMU 229. This location was as close as practical to the steep northern rim of Tijeras Arroyo (Figure 12). The maximum soil-sampling depth was 275 feet bgs. The depth to perched groundwater is approximately 280 feet beneath the Tijeras Arroyo floodplain near SWMU 227 (SNL/NM November 2002).

Monitoring well 227-VW-01 was installed in response to this NMED comment. The soil samples from the 227-VW-01 borehole were collected at 20, 100, 150, 200, 250, and 270 feet bgs with a split-spoon sampler. The soil samples were analyzed for radiological constituents (gamma spectroscopy and gross alpha/beta), RCRA metals, VOCs, SVOCs, HE compounds, hexavalent chromium, and chloride. Analyses were conducted by GEL. The samples were not analyzed for iron because SWMU 227 did not discharge waste water containing ferric chloride as SWMU 46 had. The analytical results for the 227-VW-01 soil samples are incorporated into Tables A-1 through A-12 (Attachment A) and were used as applicable in the SWMU 227 risk screening assessment (Attachment G).

Soil-vapor monitoring well 227-VW-01 was constructed on March 29, 2001, with a Flexible Liner Underground Technologies, Ltd. (FLUTe) sampling system. The system was assembled in Pojoaque, New Mexico, according to Environmental Restoration Project specifications and was constructed of a flexible, 8-inch-diameter, nylon liner with soil-vapor sampling ports set at 50-foot intervals. After the FLUTe system was installed

Site-Specific Comments

Table 3
TCE and Total VOC Concentrations in Soil-Vapor Samples Collected from Monitoring Well 227-VW-01

Quarterly Event	Sample ID	Sample Depth (ft bgs)	TCE Concentration (ppbv)	Total VOCs (ppbv)	Percentage of Total VOCs Comprised of TCE
April 2001	227-VW-01-SV-025	25	40	50	80.0
	227-VW-01-SV-075	75	2,500	2,507	99.7
	227-VW-01-SV-125	125	730	772	94.6
	227-VW-01-SV-175	175	3,700	3,725	99.3
	227-VW-01-SV-225	225	4,900	4,933	99.3
June 2001	227-VW-01-SV-025	25	55	61	90.2
	227-VW-01-SV-075	75	850	863	98.5
	227-VW-01-SV-125	125	2,700	2,709	99.7
	227-VW-01-SV-175	175	4,300	4,300	100.0
	227-VW-01-SV-225	225	8,800	8,800	100.0
	227-VW-01-SV-225-SD	225	9,500	9,500	100.0
September 2001	227-VW-01-SV-025	25	58	87	66.7
	227-VW-01-SV-075	75	900	961	93.7
	227-VW-01-SV-125	125	3,000	3,011	99.6
	227-VW-01-SV-175	175	5,300	5,300	100.0
	227-VW-01-SV-225	225	8,000	8,000	100.0
	227-VW-01-SV-225-SD	225	8,100	8,100	100.0
December 2001	227-VW-01-SV-025	25	600	600	100.0
	227-VW-01-SV-075	75	980	1,061	92.4
	227-VW-01-SV-125	125	3,600	3,617	99.5
	227-VW-01-SV-175	175	3,600	3,606	99.8
	227-VW-01-SV-225	225	5,000	5,011	99.8
	227-VW-01-SV-225-SD	225	7,000	7,000	100.0
March 2002	227-VW-01-SV-025	25	36	48	75.0
	227-VW-01-SV-125	125	4,500	4,688	96.0
	227-VW-01-SV-175	175	7,300	7,446	98.0
	227-VW-01-SV-175-SD	175	6,900	7,066	97.7
	227-VW-01-SV-225	225	14,000	14,044	100.0

Note: Sampling dates were April 23, 2001 (AR/COC 604434), June 26, 2001 (AR/COC 604643), September 25, 2001 (AR/COC 604921), December 11, 2001 (AR/COC 605162), and March 19, 2002 (AR/COC 605407). Analytical laboratory was Quanterra/Severn Trent Laboratories, Inc., California. Analytical method was EPA Method TO-14.

AR/COC = Analysis Request/Chain of Custody.
bgs = Below ground surface.
EPA = U.S. Environmental Protection Agency.
ft = Foot (feet).
ID = Identification number.
ppbv = Parts per billion on a volume/volume ratio.
SD = Soil vapor duplicate sample.
SV = Soil vapor.
TCE = Trichloroethylene.
VOC = Volatile organic compound.
VW = Vapor well (monitoring).

to total depth in the borehole, a tremie pipe was used to place silica sand into the interior of the liner in order to push the liner against the sides of the borehole. The sampling ports were set at 25, 75, 125, 175, 225, and 275 feet bgs and are linked to the ground surface with 0.25-inch-diameter, nylon tubing. The well construction diagram for 227-VW-01 is shown in Attachment K. The uppermost five sampling ports have yielded useful soil-vapor samples. Vacuum testing has shown that soil vapor cannot be collected from the 275-foot-bgs sampling port because hydrostatic forces associated with the capillary fringe exceed the sampling pump capabilities.

Soil-vapor samples were collected from monitoring well 227-VW-01 with Summa™ canisters for five quarterly events from April 2001 through March 2002 (Table 3). Samples were submitted to the Quanterra/Severn Trent Laboratories, Inc., California, and analyzed for VOCs using U.S. Environmental Protection Agency (EPA) Method TO-14. Table 3 summarizes the analytical results for the soil-vapor samples. Table L-1 (Attachment L) presents all the analytical results for the soil-vapor samples. Table L-2 (Attachment L) lists all the detection limits.

The maximum TCE concentration for the five quarters was 14,000 parts per billion on a volume/volume ratio (ppbv), which was collected from a depth of 225 feet bgs. As shown on Figure 13, TCE concentrations at monitoring well 227-VW-01 increased with depth, suggesting that VOC vapors are emanating from the perched system.

The maximum total VOC concentration at monitoring well 227-VW-01 was 14,044 ppbv (Table 3). For perspective, the soil-vapor investigation at the SNL/NM Chemical Waste Landfill (CWL) used a NMED-approved 100,000 ppbv threshold for defining the total VOC plume edge (SNL/NM December 1992, Sisneros February 1993). NMED has not specified a threshold value for SWMU 227. The CWL threshold value is nearly an order of magnitude greater than the maximum total VOC concentration from monitoring well 227-VW-01. Therefore, additional soil-vapor characterization at SWMU 227 does not appear to be necessary.

Values for total VOCs in soil vapor also are listed in Table 3 and reflect TCE and other VOCs, such as 1,1-dichloroethene (DCE), cis-1,2-DCE, and tetrachloroethene. Seventeen VOCs have been detected for monitoring well 227-VW-01, but most are single-digit values that were qualified with a "J" (estimated value less that the laboratory reporting limit). Table L-1 (Attachment L) lists all the detected VOCs (Skelly August 2002). Table L-2 (Attachment L) lists the TO-14 detection limits for all VOCs, including those which were not detected in the soil-vapor samples. The predominant VOC in soil vapor was TCE. The percentages of total VOCs that are attributable to TCE has ranged from 66.7 to 100 percent (Table 3). For the sampling ports at 75, 125, 175, and 225 feet bgs, TCE comprised 92.4 to 100 percent of the total VOC values. The sampling port at 25 feet bgs had consistently exhibited a more varied set of VOCs, but the associated VOC concentrations have been significantly less than deeper sampling results (Table L-1, Attachment L).

The installation of soil-vapor monitoring well 227-VW-01 by the TJAOU was in response to this NMED comment. The TA-II OU installed two soil-vapor monitoring wells (TA2-VW-20 and TA2-VW-21) in November 1996 for evaluating the vicinity of Buildings 904 and 913. The ground surface elevations at both TA-II monitoring wells are approximately 62 feet higher than soil-vapor monitoring well 227-VW-01, which is located on the Tijeras Arroyo floodplain. The TA-II soil-vapor monitoring wells are constructed with polyvinyl chloride (PVC) casing; stainless steel tubing extends from the screened intervals to the ground surface (Attachment K). Soil-vapor monitoring well TA2-VW-21 was installed approximately 110 feet northwest of SWMU 227 and is screened at depths of 47 to 53 and 90 to 94.5 feet bgs. Soil-vapor monitoring well TA2-VW-20 is located approximately 970 feet northwest of SWMU 227 and is screened at a single interval of 68 to 72 feet bgs.

Quarterly sampling for soil-vapor monitoring wells TA2-VW-20 and TA2-VW-21 began in July 1997. Summa™ canisters were used to submit soil-vapor samples to both on-site and off-site laboratories. The analytical results are presented in Table L-1 (Attachment L). Thirty different VOCs have been detected in the soil-vapor samples, but most are single-digit "J" values. The September 1998 and later quarterly results using EPA Method TO-14 from Quanterra/Severn Trent Laboratories, Inc., California, are considered to be the most reliable with fewer QA/QC problems (Skelly August 2002).

Lower TCE and total VOCs concentrations in soil vapor are present at the southern apex of TA-II. From September 1998 through March 2002, the maximum TCE concentration from soil-vapor monitoring well TA2-VW-21 at 50 feet bgs was 520 ppbv; the corresponding total VOCs value was 598 ppbv. The maximum TCE concentration at 92 feet bgs was 1,500 ppbv; the corresponding maximum total VOCs value was 1,890 ppbv. As shown on Figure 14, TCE concentrations in soil vapor from monitoring well TA2-VW-21 increased with depth, but decreased over time.

Much lower TCE and total VOCs concentrations in soil vapor are present in the central part of TA-II. From September 1998 through March 2002, the maximum TCE concentration from soil-vapor monitoring well TA2-VW-20 at 72 feet bgs was 47 ppbv; the corresponding maximum total VOCs value was 333 ppbv (Table L-1, Attachment L). Figure 15 shows that the low TCE concentrations are nearly stable with respect to time at soil-vapor monitoring well TA2-VW-20. The TCE concentrations have ranged from only 21 to 47 ppbv.

Groundwater information for SWMUs 227 and 229 was obtained from the TAG investigation (SNL/NM November 2002). Monitoring well TA2-W-19 is located directly downgradient of the two sites and is completed in the perched system at 263 to 283 feet bgs. The well is located approximately 500 feet southeast of SWMUs 227 and 229 (Figure 11). The last eight quarters (November 1999 through March 2002) of groundwater analyses for monitoring well TA2-W-19 are presented in Tables M-1 through M-5 (Attachment M). Analyses were performed by the Environmental Restoration Chemistry Laboratory. Sampling of TAG monitoring wells was suspended in April 2002 with NMED approval (Copland April 2002).

No significant groundwater contamination was evident for samples collected from monitoring well TA2-W-19. Four VOCs were reported (Table M-1, Attachment M). TCE concentrations in groundwater ranged from 0.96 to 2.3 micrograms (μg)/liter (L) and were below the EPA maximum contaminant level (MCL) of 5.0 μg/L (EPA July 2002). The other three VOCs (1,1-dichloroethane, bromomethane, and cis-1,2-dichloroethene) were reported with "J" values (Table M-1, Attachment M) and were below the respective MCLs. Table M-2 (Attachment M) lists the detection limits for VOCs that were not detected. None of the metal concentrations exceeded MCLs (Table M-3, Attachment M). Nitrate concentrations in groundwater ranged from 3.8 to 24 mg/L, with an average concentration of 10.3 mg/L, which is slightly above the nitrate MCL of 10 mg/L (Table M-4, Attachment M). However, nitrate results from the last four quarters of sampling were below the MCL and ranged from 3.8 to 8.8 mg/L. General chemistry parameters (alkalinity, bromide, chloride, fluoride, sulfate, and total dissolved solids) are listed in Table M-5 (Attachment M). Fluoride is the only parameter with a corresponding MCL, and none of the fluoride concentrations exceeded the MCL.

4. **Collect shallow subsurface soil samples at each storm drain outfall (two boreholes at each location at maximum depths of 5 ft). The soil samples will be analyzed for radiological constituents, metals, volatile organic compounds, semi-volatile organic compounds, and high explosives.**

   Response: Although this NMED comment mentions only the storm-drain outfalls, soil samples were collected from the outfall ditches because NMED requested that a similar sampling approach be used at SWMUs 227 and 229 during a November 1999 meeting (Copland November 1999). The sampling was conducted in February and March 2001. The samples were analyzed for radiological constituents, metals, VOCs, SVOCs, and HE compounds. The analytical results are discussed in the SNL/NM response to Site-Specific Comment 2.

5. **Collect a surface soil sample upstream of the drop inlet at ER Site 230. The soil sample will be analyzed for radiological constituents, metals, volatile organic compounds, semi-volatile organic compounds, and high explosives.**

   Response: This NMED comment is not applicable to either SWMU 227 or SWMU 229.

6. **A new ground-water monitor well will be installed at the bottom of the slope at ER Site 46. The will be completed in the regional aquifer, if perched water is not encountered.**

   Response: This NMED comment is not applicable to either SWMU 227 or SWMU 229.

7. **Summarize in written form, as applicable, all geologic, hydrologic, and ground-water quality data for all boreholes and ground-water monitor wells in the vicinity of ER Sites 46 and 227. The information requested above for the TA-2 septic systems will meet this requirement for ER Site 227, which is located adjacent to TA-2.**

Response: The *Tijeras Arroyo Groundwater (TAG) Continuing Investigation Report* (SNL/NM November 2002) summarizes the geologic, hydrologic, and groundwater quality data for all boreholes and groundwater monitoring wells in the vicinity of SWMUs 46 and 227. The report also discusses the TA-II septic systems.

8. **Revise and resubmit the data tables in the NFA proposals for each site, meeting the standards achieved in the 12th Round NFA proposals.**

Response: The analytical data tables in Attachments A and D conform to the format and standards set in the 12th Round NFA proposals. The 1994 and 2001 soil sampling analytical results for SWMU 227 are presented in Tables A-1 through A-12 (Attachment A). The 1994 and 2001 soil sampling analytical results for SWMU 229 are presented in Tables D-1 through D-12 (Attachment D). Evaluation of the analytical data for SWMUs 227 and 229 supports the recommendation for NFA and closure of the two sites.

Attachments G and H present the risk screening assessment and the accompanying site conceptual model, respectively, for SWMU 227. Based upon field investigation data and the human health and ecological risk screening assessments, the request for granting SWMU 227 NFA status is reiterated for the following reasons:

- The soil has been sampled for all relevant COCs.
- No nonradiological or radiological COCs are present in soil at levels that pose significant risk to human health for either an industrial or residential land use scenario.
- None of the nonradiological or radiological constituents warrant ecological concern.

Attachments I and J present the risk screening assessment and the accompanying site conceptual model, respectively, for SWMU 229. Based upon field investigation data and the human health and ecological risk screening assessments, the request for granting SWMU 229 NFA status is reiterated for the following reasons:

- The soil has been sampled for all relevant COCs.
- No nonradiological or radiological COCs are present in soil at levels that pose significant risk to human health for either an industrial or residential land use scenario.
- None of the nonradiological or radiological constituents warrant ecological concern.

Based upon the evidence provided in this NOD response, SWMUs 227 and 229 are proposed for an NFA decision in conformance with Criterion 5, which states that "[t]he SWMU/AOC has been characterized or remediated in accordance with current applicable state or Federal regulations and that available data indicate that contaminants pose an acceptable level of risk under current and projected future land use" (NMED March 1998).

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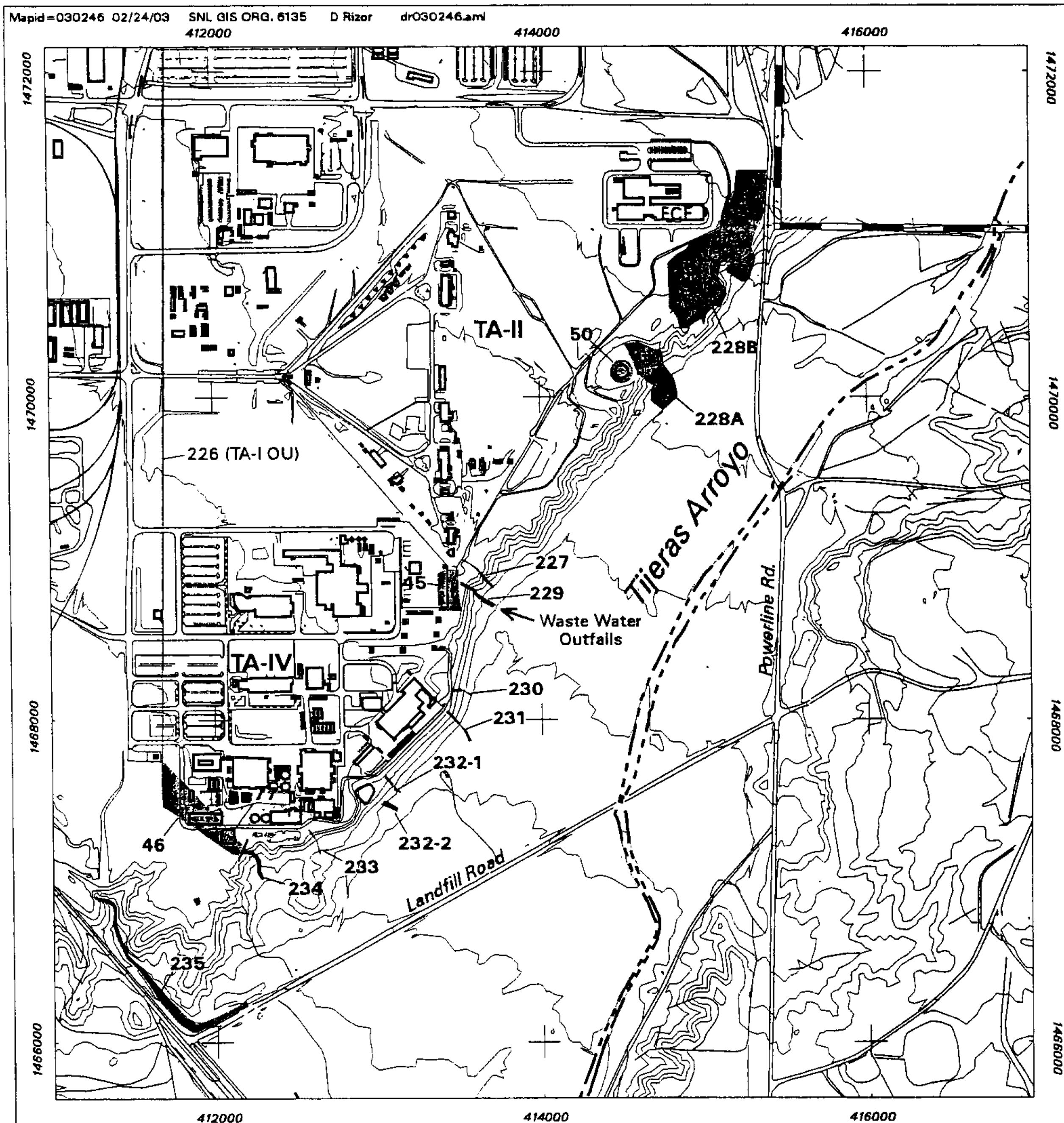
FIGURES



Legend

Road

10 Foot Contour

Tijeras Arroyo Channel

KAFB Boundary

Building / Structure

SWMU

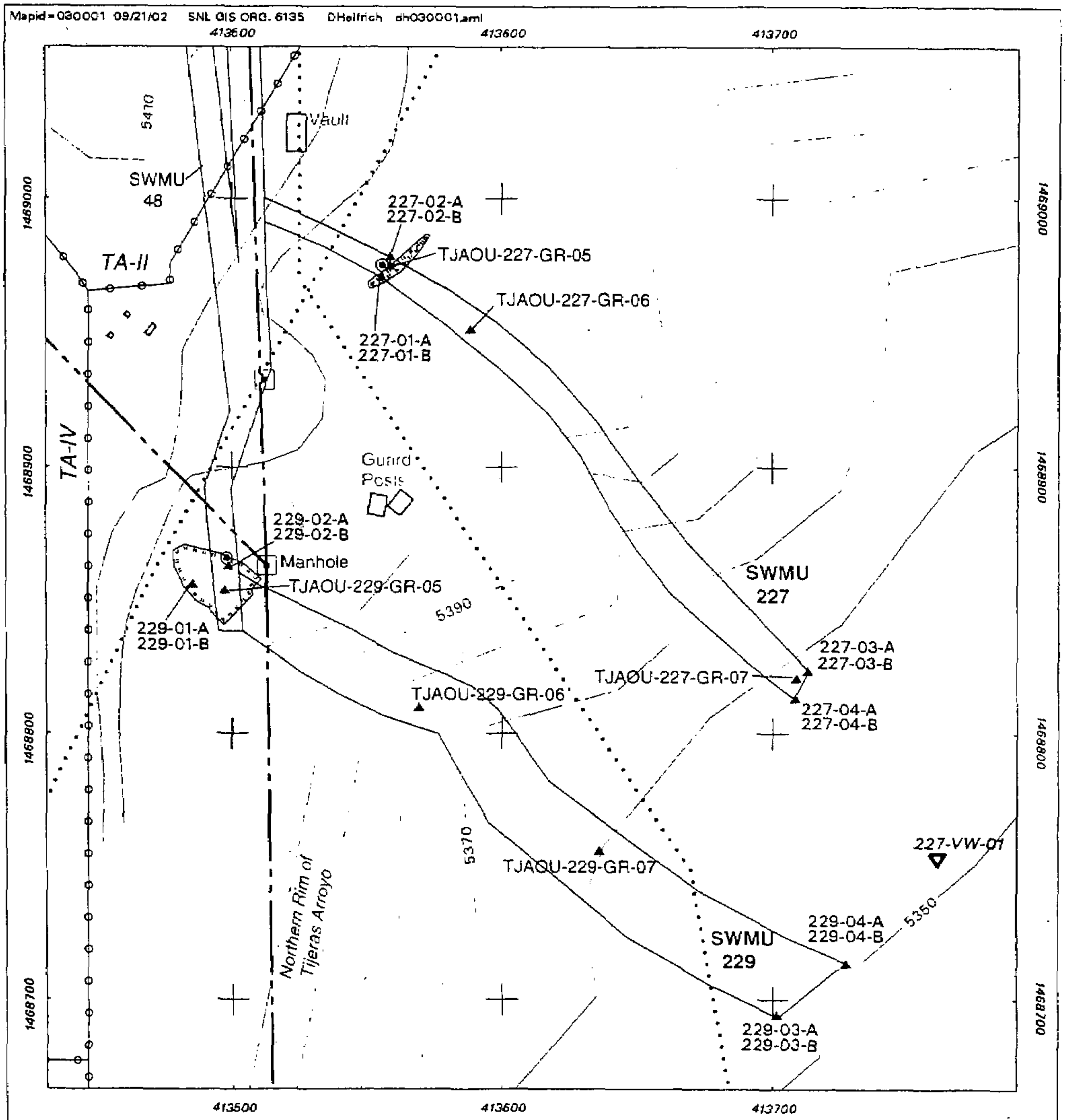
Figure 1
Tijeras Arroyo Operable Unit 1309
Solid Waste Management Units
(SWMUs) along Tijeras Arroyo

0 500 1000
Scale in Feet

0 120 240
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

840857.02060000 A3



Legend

- Previous End of Outfall Piping
- Soil Sample
- Manhole (Sewer)
- Soil Vapor Monitoring Well
- Concrete Structure
- Unpaved Road
- Fence
- 10-Foot Contour
- Excavation & Trench(March 2001)
- Water Line (Installed 1979)
- Water Line (Installed 1963)
- Sewer Line (Installed 1993)
- SWMUs 227, 229 & 48

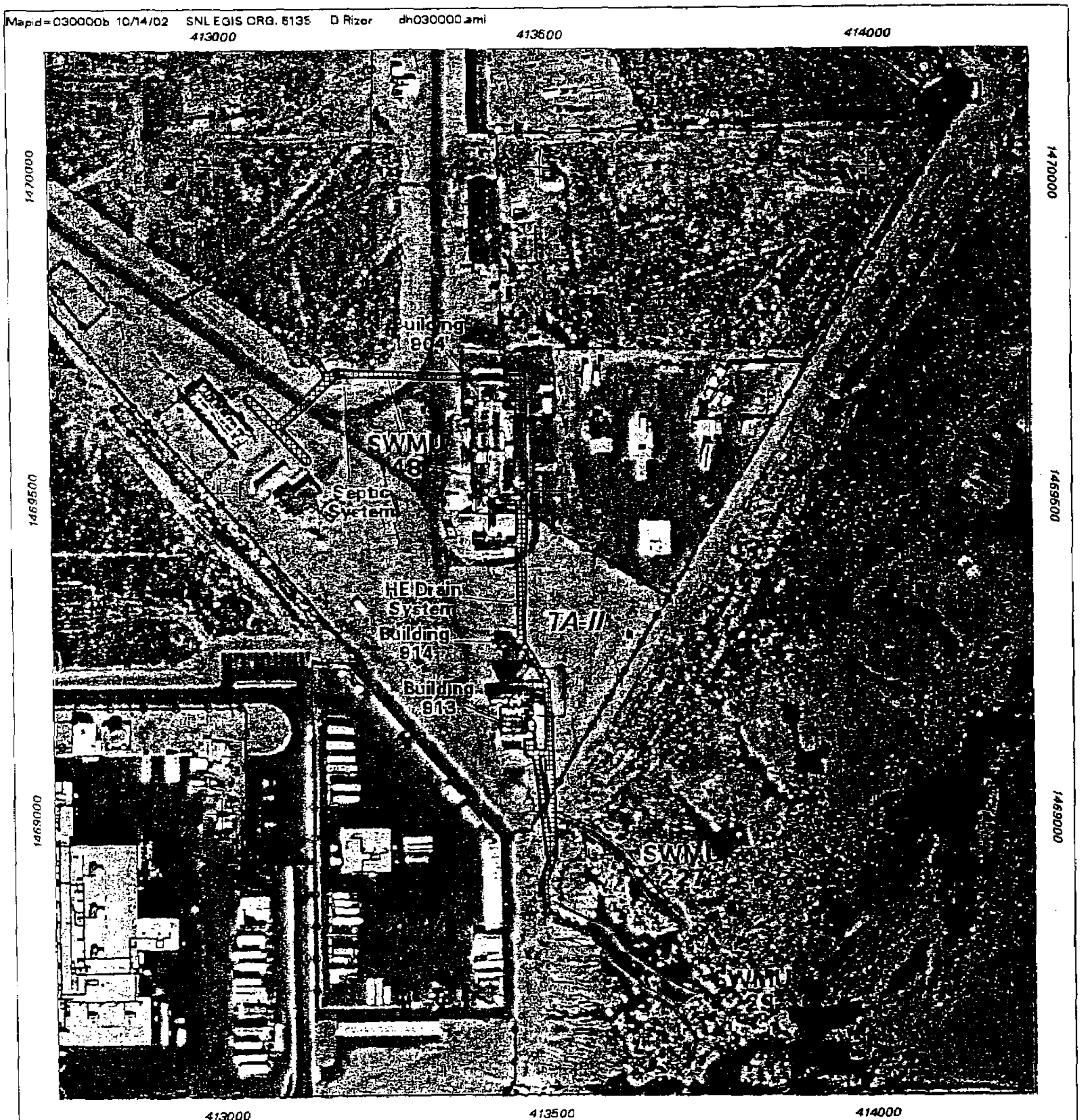
Figure 2
SWMUs 227 & 229 Confirmatory Soil Sample Locations

0 30 60
Scale in Feet

0 7.2 14.4
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

Mapid=030000b 10/14/02 SNL EGIS ORG. 6135 D Rizor dh030000.aml



Legend

Fence

SWMUs 227, 229 (Outfall Ditches)

SWMU 48 (HE Drain System and Septic System)

Figure 3
Aerial Photograph showing SWMUs 48, 227 and 229
October, 1995

0 125 250
Scale in Feet

0 30 60
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

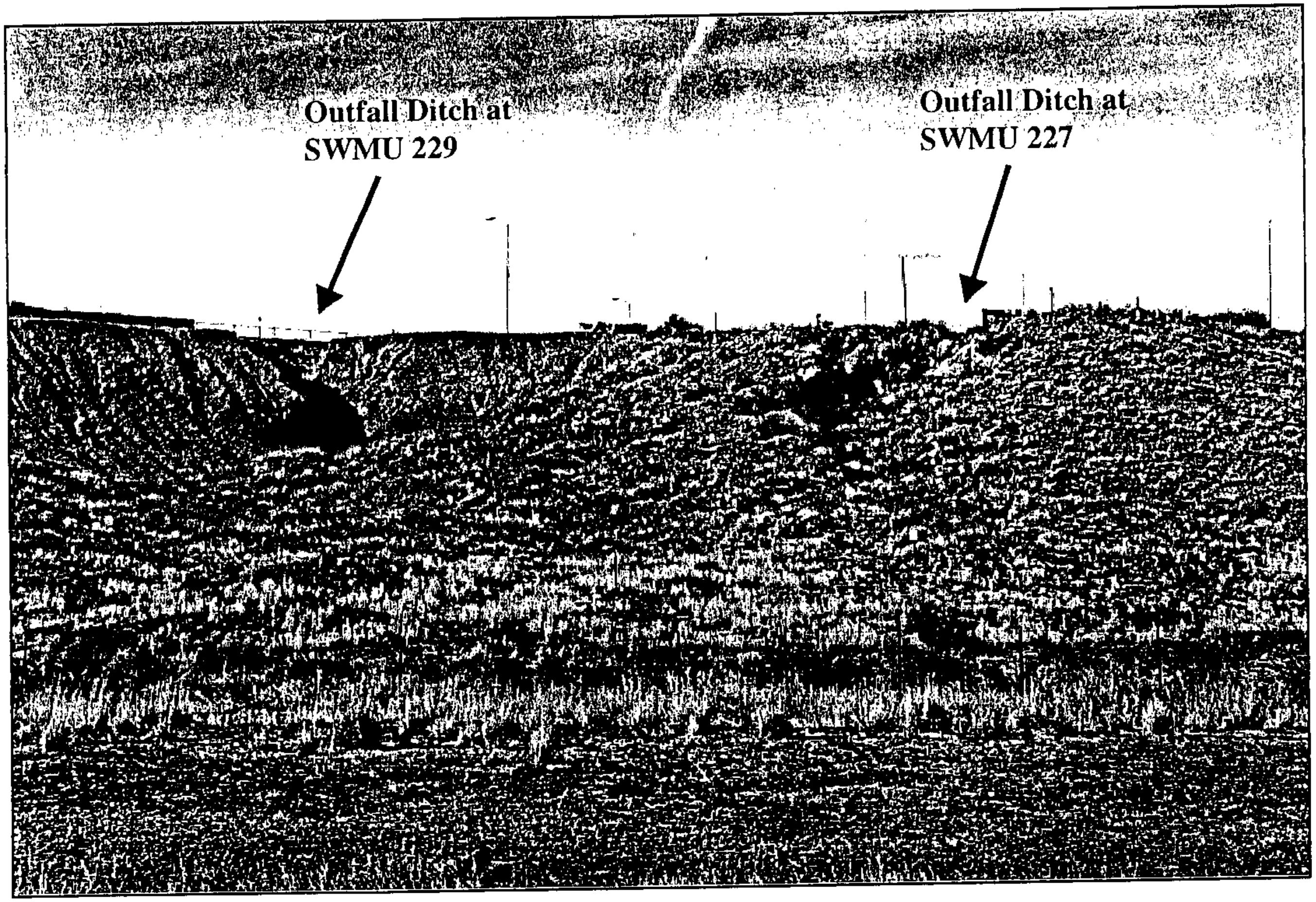


Figure 4
SWMU 227 and SWMU 229 outfall ditches along the northern rim of Tijeras Arroyo. (Light poles in background are located at TA-II and TA-IV. Floodplain visible in the foreground. View to the northwest, February 2001.)

Mapc - 030002.apr 10/03/02 SNL EGIS ORG. 6135 MDBARTH

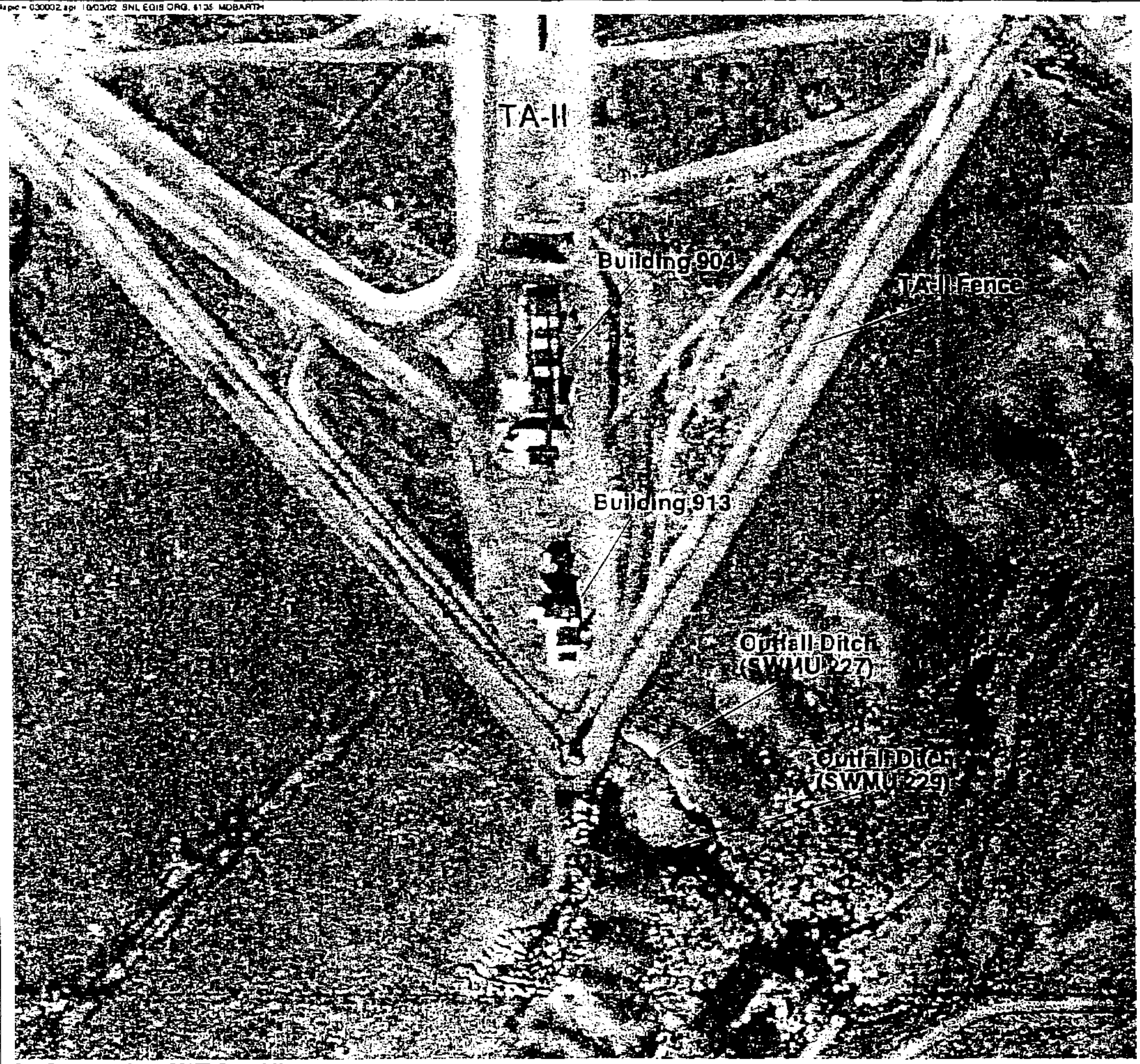


Photo Date: 11-6-59 Project: GS-VZR Frame: 2-33

Figure 5
Aerial Photograph showing
TA-II and SWMUs 227 & 229
November, 1959

0 125 250
Approximate Scale in Feet

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

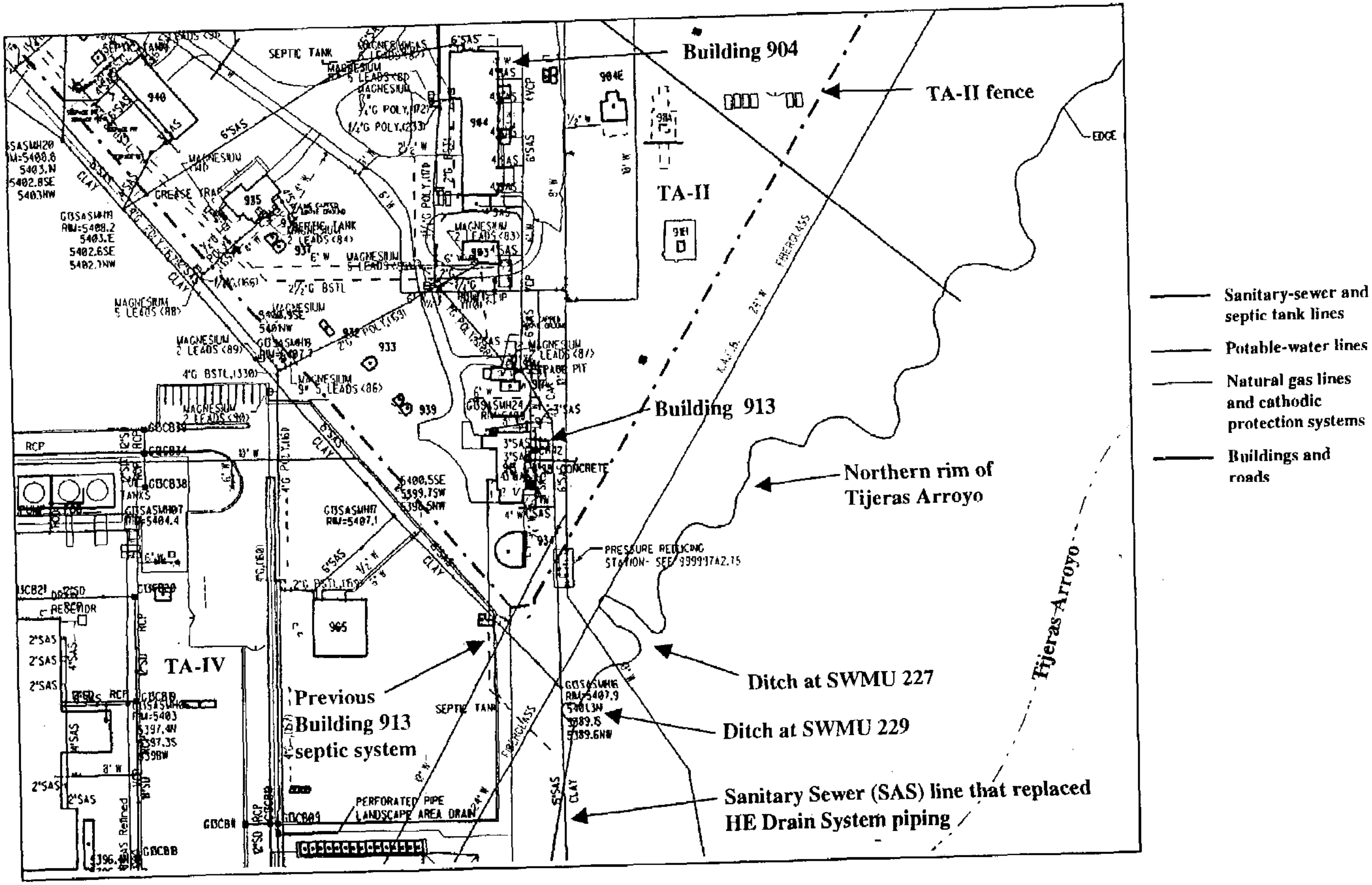


Figure 6
Engineering drawing showing underground utilities near SWMUs 227 and 229. (Facilities Engineering Department, 2001. Bold-black text with arrows was added by the ER Project.)

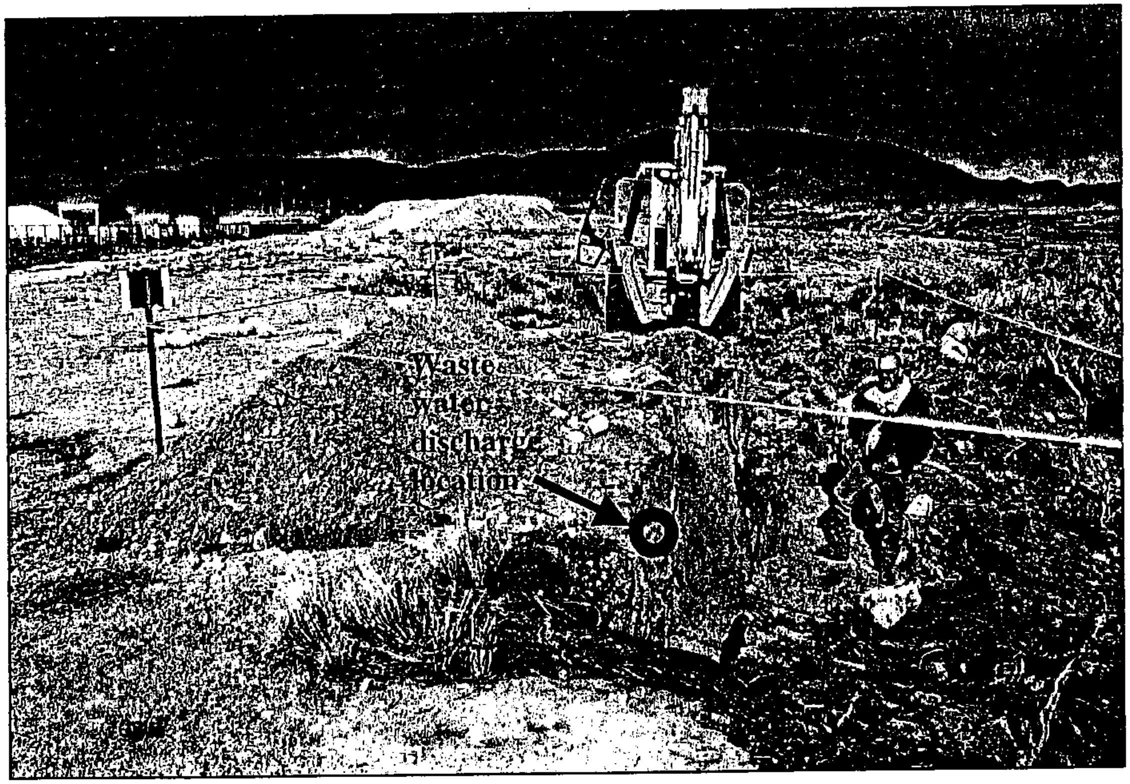
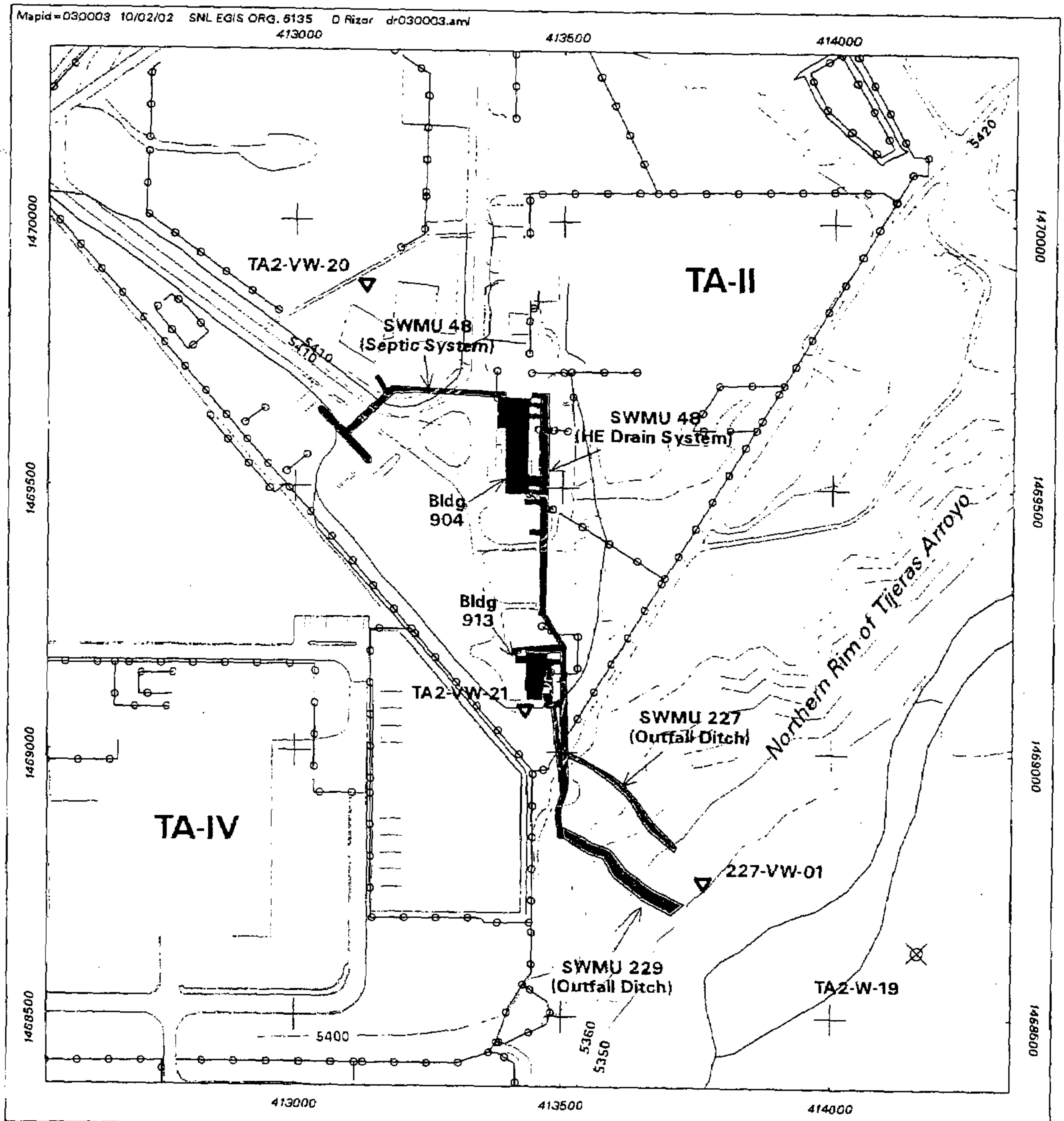


Figure 7
Exploratory trench at SWMU 227. (Technician is standing next to exploratory trench, and on floor of SWMU 227 outfall ditch. Black circle depicts estimated location for end of HE drain system piping. View to the north, February 2001.)



Legend

- Groundwater Monitoring Well
- Soil Vapor Monitoring Well
- SWMUs 227 & 229
- SWMU 48
- Building
- 10 Ft Contour
- Surface Drainage
- Fence

Figure 11
Monitoring Wells Adjacent to SWMU 227

0 150 300
Scale in Feet

0 36 72
Scale in Meters

Sandia National Laboratories, New Mexico
Environmental Geographic Information System

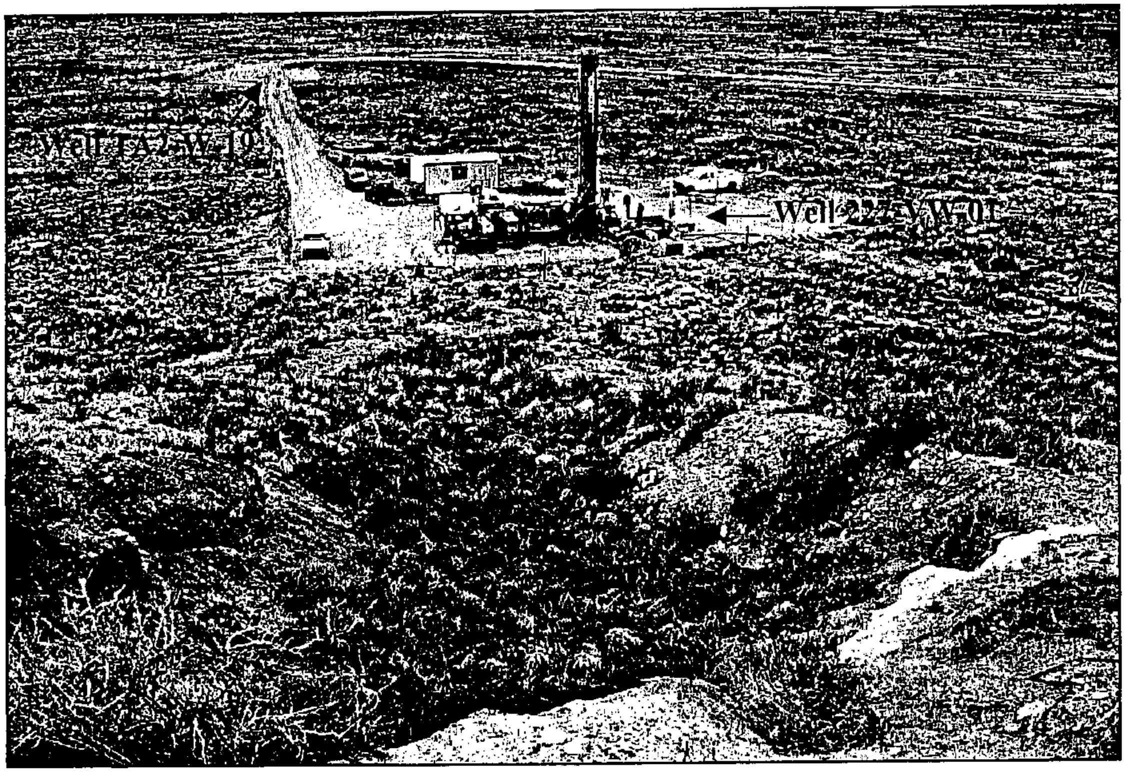


Figure 12
Installing soil-vapor monitoring well 227-VW-01. (SWMU 229 outfall ditch is visible in the foreground. Groundwater monitoring well TA2-W-19 is shown in upper left corner of photograph. View to the east, March 2001.)

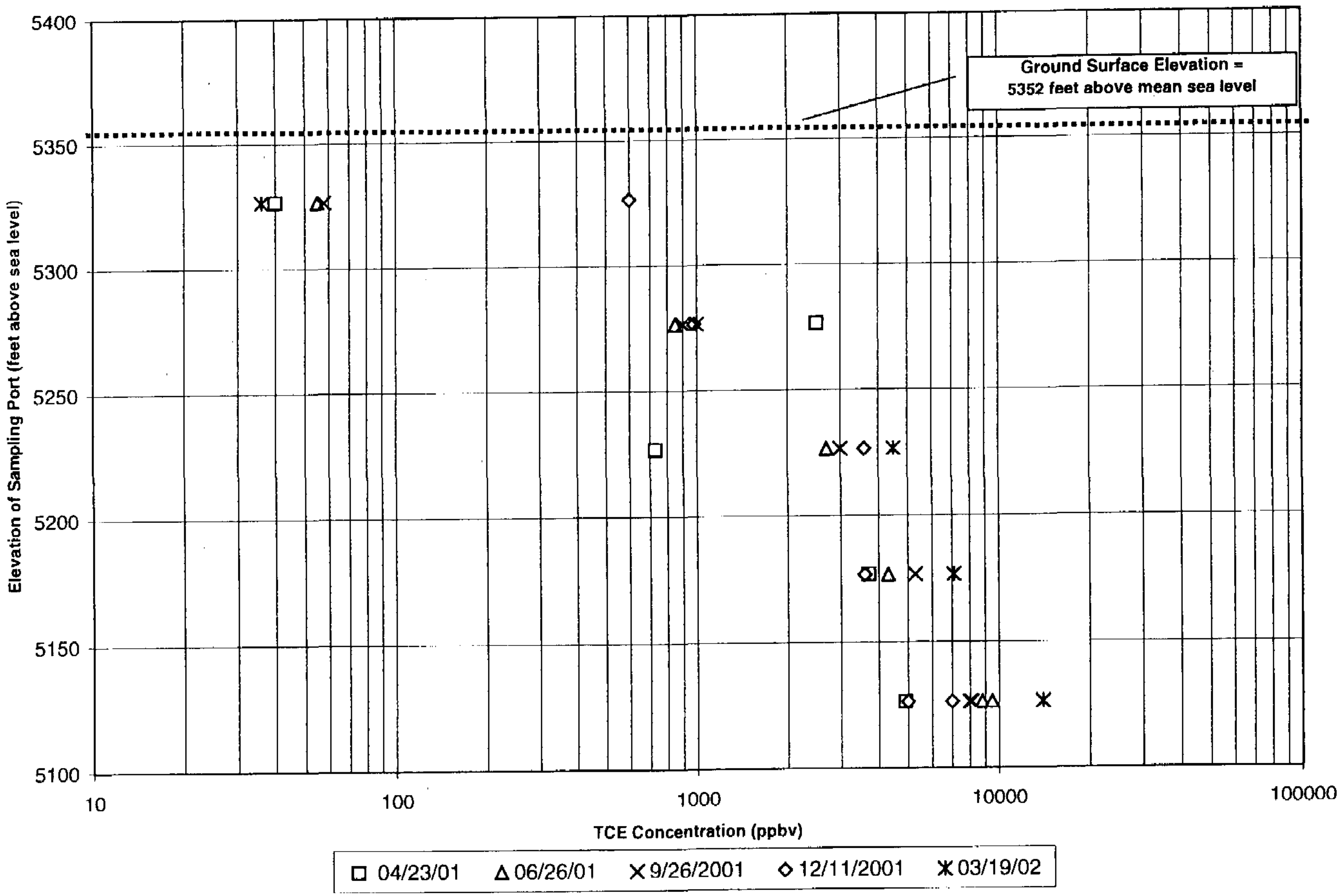


Figure 13
TCE Concentrations in Soil Vapor versus Depth, April 2001 - March 2002, Soil Vapor Monitoring Well 227-VW-01.

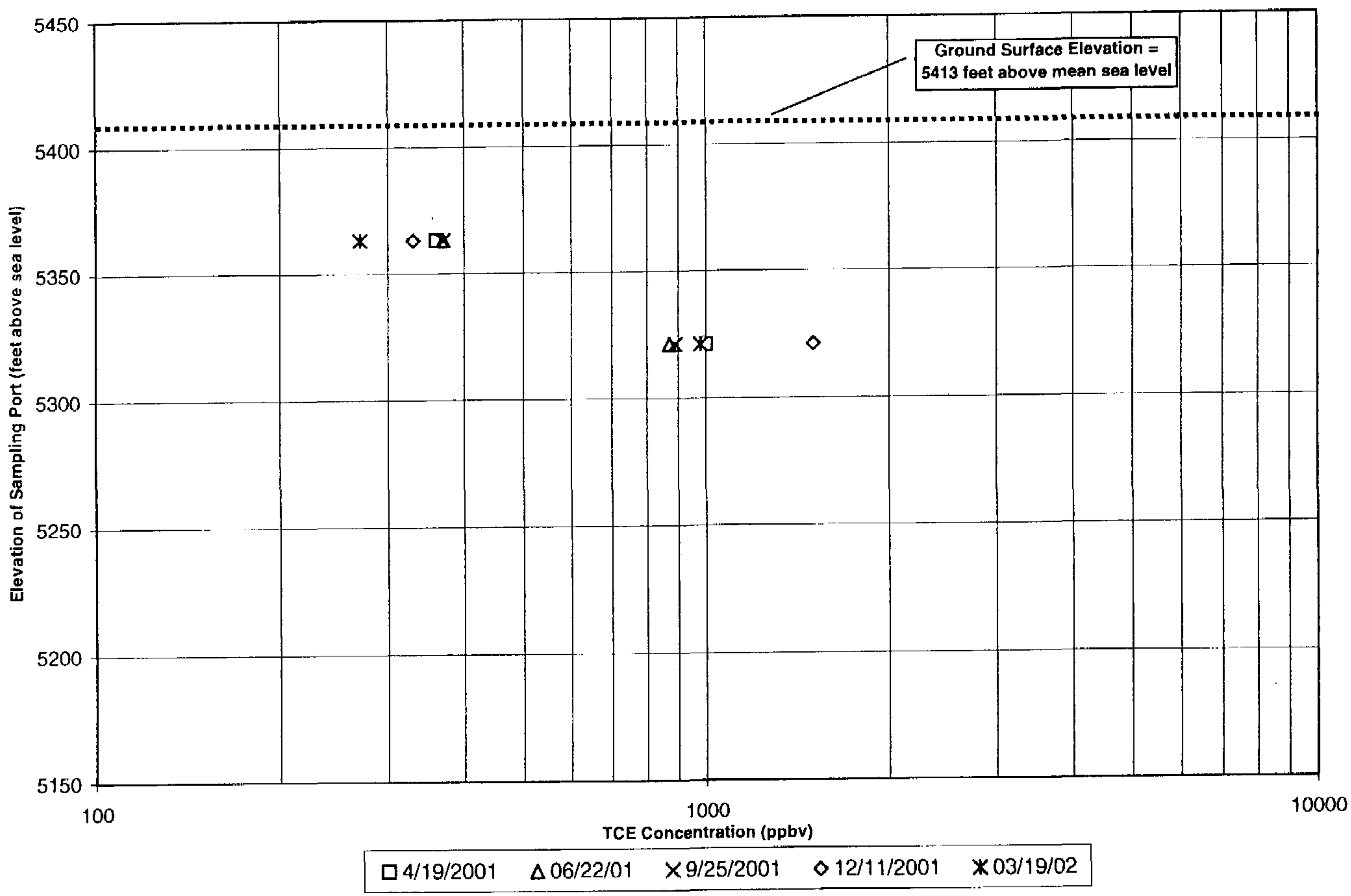


Figure 14
TCE Concentrations in Soil Vapor versus Depth, April 2001 - March 2002, Soil Vapor Monitoring Well TA2-VW-21.

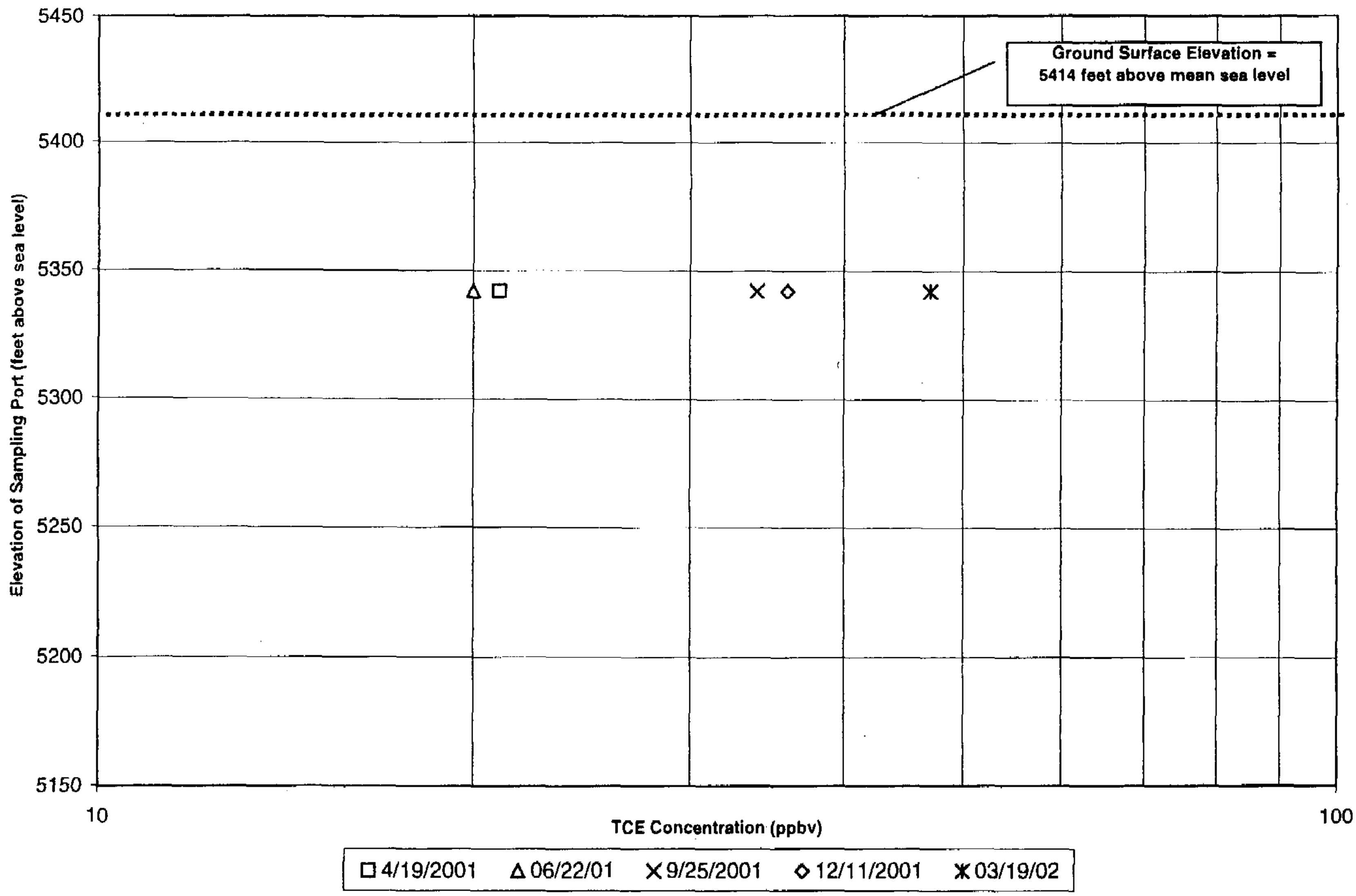


Figure 15
TCE Concentrations in Soil Vapor versus Depth, April 2001 - March 2002, Soil Vapor Monitoring Well TA2-VW-20.

ATTACHMENT A
SWMU 227—Soil Samples Analytical Data Summary
Tables A-1 through A-12

Table A-1
Summary of COCs for SWMU 227 Confirmatory Sampling

COC Type	Number of Samples	COCs Greater Than Background and Associated COCs	Maximum Background Limit North Supergroup[a] (mg/kg except where noted)	Maximum Concentration (mg/kg except where noted)	Average Concentration[b] (mg/kg except where noted)	Sampling Locations Where Background Concentration was Exceeded[c]
Metals	14 environmental; 3 duplicates	Arsenic	4.4	5.9	3.04	227-02-A 227-02-B 227-03-B (Duplicate)
		Barium	200	210	147	227-02-B
		Cadmium	0.9	2.9	1.41	227-01-A 227-01-B 227-02-A 227-02-A (Duplicate) 227-02-B 227-03-A 227-03-B 227-03-B (Duplicate) 227-04-A 227-04-B
		Chromium	12.8	25.2	8.69	TJAOU-227-VW-01-150.0-S
		Hexavalent Chromium	1	0.092 J	0.09	TJAOU-227-VW-01-20.0-S
		Lead	11.2	11	8.07	(All samples below background value)
		Mercury	<0.1	0.0106 J	0.026	(All samples below nonquantified background value)
		Selenium	<1	0.864	0.381	(All samples below nonquantified background value)
		Silver	<1	ND (0.50)	0.318	(All samples below nonquantified background value)
Radionuclides	23 environmental; 2 duplicates	Cesium-137	0.084 pCi/g	0.296 pCi/g	0.0689 pCi/g	227-01-B TJAOU-227-GR-07-5.0-S
		Thorium-232	1.54 pCi/g	1.19 pCi/g	0.841 pCi/g	(All samples below background value)
		Tritium	0.021 pCi/g[d]	ND (0.014) pCi/g	0.012 pCi/g	(All samples below background value)

Refer to footnotes at end of table.

Table A-1 (Continued)
Summary of COCs for SWMU 227 Confirmatory Sampling

COC Type	Number of Samples	COCs Greater Than Background and Associated COCs	Maximum Background Limit North Supergroup[a] (mg/kg except where noted)	Maximum Concentration (mg/kg except where noted)	Average Concentration[b] (mg/kg except where noted)	Sampling Locations Where Background Concentration was Exceeded[c]
Radionuclides (continued)		Uranium-235	0.18 pCi/g	ND (0.4411 pCi/g)	0.188 pCi/g	None Plus an additional 15 samples with nondetect results where the MDA exceeds background
		Uranium-238	1.3 pCi/g	ND (2.54 pCi/g)	1.18 pCi/g	227-02-B 227-04-B TJAOU-227-GR-05-7.0-S TJAOU-227-GR-07-5.0-S Plus an additional three samples with nondetect results where the MDA exceeds background
Volatile Organic Compounds	14 environmental; 4 duplicates	2-Butanone	NA	19.1 µg/kg	4.49 µg/kg	227-01-B 227-01-B (Duplicate) 227-02-B 227-03-B 227-04-B 227-04-B (Duplicate) TJAOU-227-VW-01-20.0-S TJAOU-227-VW-01-100.0-DU TJAOU-227-VW-01-200.0-S TJAOU-227-VW-01-250-S TJAOU-227-VW-01-275-S
		Acetone	NA	7.30 µg/kg	4.42 µg/kg	227-01-B (Duplicate) TJAOU-227-VW-01-200.0-S TJAOU-227-VW-01-250-S TJAOU-227-VW-01-275-S
		Methylene chloride	NA	1.05 J µg/kg	2.00 µg/kg	TJAOU-227-VW-01-250-S TJAOU-227-VW-01-275-S
		4-Methyl-2-pentanone	NA	1 J µg/kg	3.73 µg/kg	227-01-B
Semivolatile Organic Compounds	10 environmental; 3 duplicates	Benzo(b)fluoranthene	NA	68 J µg/kg	136 µg/kg	227-01-B TJAOU-227-GR-06-0.0-S
		Chrysene	NA	49 J µg/kg	135 µg/kg	227-01-B TJAOU-227-GR-06-0.0-S

Refer to footnotes at end of table.

Table A-1 (Concluded)
Summary of COCs for SWMU 227 Confirmatory Sampling

COC Type	Number of Samples	COCs Greater Than Background and Associated COCs	Maximum Background Limit North Supergroup[a] (mg/kg except where noted)	Maximum Concentration (mg/kg except where noted)	Average Concentration[b] (mg/kg except where noted)	Sampling Locations Where Background Concentration was Exceeded[c]
Semivolatile Organic Compounds (continued)		Fluoranthene	NA	94 J µg/kg	95.0 µg/kg	227-01-A 227-01-A (Duplicate) 227-01-B TJAOU-227-GR-06-0.0-S
		Phenanthrene	NA	84 J µg/kg	93.2 µg/kg	227-01-A 227-01-A (Duplicate) 227-01-B TJAOU-227-GR-06-0.0-S
		Pyrene	NA	62 J µg/kg	115 µg/kg	227-01-A 227-01-B TJAOU-227-GR-06-0.0-S
		bis(2-Ethylhexyl) phthalate	NA	88.5 µg/kg	167 µg/kg	TJAOU-227-GR-05-7.0-S TJAOU-227-GR-06-0.0-S TJAOU-227-GR-06-5.0-S TJAOU-227-GR-06-5.0-DU TJAOU-227-GR-07-5.0-S TJAOU-227-VW-01-20.0-S
HE compounds	10 environmental; 2 duplicates	none	NA	NA	NA	All samples nondetect
Inorganics and General Chemistry	2 environmental 0 duplicate	Chloride	NA	87.0	86.0	TJAOU-227-VW-01-20.0-S
	10 environmental; 1 duplicate	Cyanide	NA	0.159 J	0.11	TJAOU-227-VW-01-150.0-S
	8 environmental; 1 duplicate	Total Kjeldahl Nitrogen	NA	670	349	227-04-A
	8 environmental; 1 duplicate	Nitrate plus Nitrite	NA	9.3	4.12	227-02-A (Duplicate)

[a]From Dinwiddie (September 1997).
[b]Average concentration includes all samples. For nondetection results, the method detection limit is used to calculate the average.
[c]Includes samples with nondetection results where the MDL or MDA exceeds the approved background limit.
[d]The tritium background value of 0.021 pCi/g was calculated from the Tharp (February 1999) tritium background value of 420 pCi/L. The pCi/L value was converted to the pCi/g value using the assumption of 5 percent soil moisture and a soil density of 1 g/cubic centimeter.

COC = Constituent of concern.
DU = Duplicate sample.
g = Gram(s).
GR = Grab sample.
HE = High explosive(s).
J = Estimated value (see Data Validation Report [Attachment B]).
L = Liter(s).
µg/kg = Microgram(s) per kilogram.
mg/kg = Milligram(s) per kilogram.
MDA = Minimum detectable activity.
MDL = Method detection limit.
NA = Not applicable.
ND = Nondetect at the laboratory detection limit, show in parentheses (see Data Validation Report [Attachment B]).
pCi = Picocurie(s).
S = Soil sample.
SWMU = Solid Waste Management Unit.
TJAOU = Tijeras Arroyo Operable Unit.
VW = Vapor well.

Table A-2
Summary of SWMU 227 Confirmatory Soil Sampling Metals Analytical Results
September 1994 and February–March 2001
(Off-Site Laboratories[a])

Sample Attributes				Metals (EPA Method SW846 6010, 6020, 7470, 7471, 7741[b]) (mg/kg)				
Record Number[c]	ER Sample ID	Date Sampled	Sample Depth (ft)	Arsenic	Barium	Cadmium	Chromium	Hexavalent Chromium
00802	227-01-A	9-29-94	0–0.5	5.1	160	**2.6**	7.4	ND (1.0)
00802	227-01-B	9-29-94	0.5–3.0	1.4	200	**2.0**	5.4	ND (1.0)
00802	227-02-A	9-29-94	0–0.5	**5.9**	180	**2.1**	6.6	ND (1.0)
00802	227-02-A (Duplicate)	9-29-94	0–0.5	1.4	150	**2.5**	6.4	ND (1.0)
00802	227-02-B	9-29-94	0.5–3.0	**5.3**	**210**	**2.2**	6.2	ND (1.0)
00802	227-03-A	9-29-94	0–0.5	0.67	140	**2.3**	5.5	ND (1.0)
00802	227-03-B	9-29-94	0.5–3.0	0.92	140	**2.1**	5.9	ND (1.0)
00802	227-03-B (Duplicate)	9-29-94	0.5–3.0	**5.6**	140	**2.9**	7.4	ND (1.0)
00802	227-04-A	9-29-94	0–0.5	0.57	150	**2.3**	7.2	ND (1.0)
00802	227-04-B	9-29-94	0.5–3.0	**7.7**	180	**2.9**	8.5	ND (1.0)
604298	TJAOU-227-GR-05-7.0-S	2-27-01	7.0	2.16	121	ND (0.013)	9.20	NA
604298	TJAOU-227-GR-06-0.0-S	2-27-01	0.0	2.93	127	ND (0.013)	7.88	NA
604298	TJAOU-227-GR-06-5.0-S	2-27-01	5.0	2.94	89.5	ND (0.013)	9.66	NA
604298	TJAOU-227-GR-06-5.0-DU	2-27-01	5.0	2.93	114	ND (0.013)	10.3	NA
604298	TJAOU-227-GR-07-5.0-S	2-27-01	5.0	1.39	164	ND (0.013)	6.25	NA
604200	TJAOU-227-VW-01-20.0-S	3-26-01	20.0	2.72	138	ND (0.013)	12.8	0.092 J (0.200)
604200	TJAOU-227-VW-01-150.0-S	3-27-01	150.0	2.06	87.9	0.074 J (0.500)	**25.2**	ND (0.007)
Background Concentration (North Supergroup, surface soil)[e]				5.6	200	<1	17.3	NC
Background Concentration (North Supergroup, subsurface soil)[e]				4.4	200	0.9	12.8	NC
Quality Assurance/Quality Control Samples (mg/L)								
00932	Rinsate Blank	9-30-94	NA	ND (0.010)	ND (0.20)	ND (0.005)	ND (0.010)	ND (0.005)
604298	TJAOU-227-GR-EB-001	2-27-01	NA	ND (0.00457)	0.00118 J (0.005)	ND (0.000251)	ND (0.000781)	
604204	TJAOU-227-VW-01-EB1	3-29-01	NA	ND (0.00457)	0.000247 J (0.005)	ND (0.000251)	ND (0.000781)	ND (0.005)

Refer to footnotes at end of table.

Table A-2 (Continued)
Summary of SWMU 227 Confirmatory Soil Sampling Metals Analytical Results
September 1994 and February–March 2001
(Off-Site Laboratories[a])

Sample Attributes				Metals (EPA Method SW846 6010, 6020, 7470, 7471, 7741[b]) (mg/kg)			
Record Number[c]	ER Sample ID	Date Sampled	Sample Depth (ft)	Lead	Mercury	Selenium	Silver
00802	227-01-A	9-29-94	0–0.5	11	ND (0.04)	ND (0.25)	ND (0.50)
00802	227-01-B	9-29-94	0.5–3.0	11	ND (0.04)	ND (0.25)	ND (0.50)
00802	227-02-A	9-29-94	0–0.5	7.5	ND (0.04)	ND (0.25)	ND (0.50)
00802	227-02-A (Duplicate)	9-29-94	0–0.5	9.1	ND (0.04)	ND (0.25)	ND (0.50)
00802	227-02-B	9-29-94	0.5–3.0	7.9	ND (0.04)	ND (0.25)	ND (0.50)
00802	227-03-A	9-29-94	0–0.5	9.6	ND (0.04)	ND (0.25)	ND (0.50)
00802	227-03-B	9-29-94	0.5–3.0	7.5	ND (0.04)	ND (0.25)	ND (0.50)
00802	227-03-B (Duplicate)	9-29-94	0.5–3.0	8.9	ND (0.04)	ND (0.25)	ND (0.50)
00802	227-04-A	9-29-94	0–0.5	11	ND (0.04)	ND (0.25)	ND (0.50)
00802	227-04-B	9-29-94	0.5–3.0	10	ND (0.04)	ND (0.25)	ND (0.50)
604298	TJAOU-227-GR-05-7.0-S	2-27-01	7.0	5.62	0.0106 J	0.864	ND (0.0578)
604298	TJAOU-227-GR-06-0.0-S	2-27-01	0.0	7.30	0.0061 J	0.650	ND (0.0578)
604298	TJAOU-227-GR-06-5.0-S	2-27-01	5.0	7.39	ND (0.00455 J)[d]	0.815	ND (0.0578)
604298	TJAOU-227-GR-06-5.0-DU	2-27-01	5.0	6.01	0.00439 J	0.295 J (0.500)	ND (0.0578)
604298	TJAOU-227-GR-07-5.0-S	2-27-01	5.0	5.13	ND (0.00455 J)[d]	0.677	ND (0.0578)
604200	TJAOU-227-VW-01-20.0-S	3-26-01	20.0	6.81	ND (0.00455)	0.318 J (0.500)	ND (0.0578)
604200	TJAOU-227-VW-01-150.0-S	3-27-01	150.0	5.48	ND (0.00455)	0.352 J (0.500)	ND (0.0578)
Background Concentration (North Supergroup, surface soil)[e]				39	<0.25	<1	<1
Background Concentration (North Supergroup, subsurface soil)[e]				11.2	<0.1	<1	<1
Quality Assurance/Quality Control Samples (mg/L)							
00932	Rinsate Blank	9-30-94	NA	ND (0.003)	ND (0.0002)	ND (0.005)	ND (0.01)
604298	TJAOU-227-GR-EB-001	2-27-01	NA	ND (0.00344)	ND (0.000073)	ND (0.00309)	ND (0.000197)
604204	TJAOU-227-VW-01-EB1	3-29-01	NA	ND (0.00344)	ND (0.000073)	ND (0.00309)	ND (0.000197)

Note: Values in **bold** exceed background soil concentrations.
[a]1994 samples analyzed by Environmental Control Technology Corporation; 2001 samples analyzed by General Engineering Laboratories.
[b]EPA (November 1986).
[c]Analysis request/chain-of-custody record.
[d]Nondetection; uncertainty in the detection limit, shown in parentheses (see Data Validation Report [Attachment B]).
[e]From Dinwiddie (September 1997).

Table A-2 (Concluded)
Summary of SWMU 227 Confirmatory Soil Sampling Metals Analytical Results
September 1994 and February–March 2001
(Off-Site Laboratories[a])

DU	= Duplicate sample.
EB	= Equipment rinsate blank.
EPA	= U.S. Environmental Protection Agency.
ER	= Environmental Restoration.
ft	= Foot (feet).
GR	= Grab sample.
ID	= Identification.
J	= Estimated value less than the reporting limit, shown in parentheses
mg/kg	= Milligram(s) per kilogram.
mg/L	= Milligram(s) per liter.
NA	= Not analyzed.
NC	= Not calculated by Dinwiddie (September 1997)
ND ( )	= Not detected above the detection limit, shown in parentheses.
S	= Soil sample.
SWMU	= Solid Waste Management Unit.
TJAOU	= Tijeras Arroyo Operable Unit.
VW	= Vapor well.

Table A-3
Summary of SWMU 227 Gamma Spectroscopy and Tritium Analytical Results
September 1994 and February–March 2001
(On-Site and Off-Site Laboratories[a])

Sample Attributes				Radionuclides (gamma spectroscopy by EPA Method 901.1; tritium by EPA Method EERF H.01[b]) (pCi/g)			
				Cesium-137		Thorium-232	
Record Number[c]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[d]	Result	Error[d]
00806	227-01-A	9-29-94	0–0.5	0.0752	0.00986	0.671	0.0871
00806	227-01-B	9-29-94	0.5–3.0	**0.296**	0.0253	0.692	0.0921
00806	227-02-A	9-29-94	0–0.5	0.0243	0.00676	0.705	0.0913
00806	227-02-B	9-29-94	0.5–3.0	ND (0.0433)	--	0.706	0.0916
00806	227-03-A	9-29-94	0–0.5	0.139	0.0133	0.789	0.0965
00806	227-03-B	9-29-94	0.5–3.0	ND (0.0394)	--	0.773	0.0951
00806	227-04-A	9-29-94	0–0.5	0.261	0.0227	0.752	0.0960
00806	227-04-B	9-29-94	0.5–3.0	0.0424	0.00866	0.798	0.105
00055	227-01-A	9-29-94	0–0.5	ND (0.2121)	--	NA	--
00055	227-03-A	9-29-94	0–0.5	ND (0.09308)	--	NA	--
00055	227-03-B	9-29-94	0.5–3.0	ND (-0.04808)	--	NA	--
604299	TJAOU-227-GR-05-7.0-S	2-27-01	7.0	ND (0.0327)	--	1.06	0.481
604299	TJAOU-227-GR-06-0.0-S	2-27-01	0.0	0.107	0.0253	0.673	0.324
604299	TJAOU-227-GR-06-5.0-S	2-27-01	5.0	ND (0.0327)	--	0.786	0.386
604299	TJAOU-227-GR-06-5.0-DU	2-27-01	5.0	ND (0.0336)	--	0.784	0.398
604299	TJAOU-227-GR-07-5.0-S	2-27-01	5.0	ND (0.0322)	--	1.01	0.464
604298	TJAOU-227-GR-05-7.0-S	2-27-01	7.0	ND (-0.00301)	--	1.19	0.135
604298	TJAOU-227-GR-06-0.0-S	2-27-01	0.0	0.129	0.027	0.851	0.102
604298	TJAOU-227-GR-06-5.0-S	2-27-01	5.0	ND (-0.00352)	--	0.968	0.136
604298	TJAOU-227-GR-06-5.0-DU	2-27-01	5.0	ND (-0.0063)	--	0.916	0.111
604298	TJAOU-227-GR-07-5.0-S	2-27-01	5.0	**0.138**	0.0457	0.865	0.126
604199	TJAOU-227-VW-01-20.0-S	3-26-01	20.0	ND (0.0312)	--	0.910	0.432
604199	TJAOU-227-VW-01-150.0-S	3-27-01	150.0	ND (0.0267)	--	0.646	0.324
604200	TJAOU-227-VW-01-20.0-S	3-26-01	20.0	ND (0.000336)	--	1.11	0.124
604200	TJAOU-227-VW-01-150.0-S	3-27-01	150.0	ND (-0.00697)	--	0.852	0.0968
Background Activity (North Supergroup, surface soil)[e]				0.836	NA	1.54	NA
Background Activity (North Supergroup, subsurface soil)[e]				0.084	NA	1.54	NA

Refer to footnotes at end of table.

Table A-3 (Continued)
Summary of SWMU 227 Gamma Spectroscopy and Tritium Analytical Results
September 1994 and February–March 2001
(On-Site and Off-Site Laboratories[a])

Sample Attributes				Radionuclides (gamma spectroscopy by EPA Method 901.1; tritium by EPA Method EERF H.01[b]) (pCi/g)			
				Cesium-137		Thorium-232	
Record Number[c]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[d]	Result	Error[d]
Quality Assurance/Quality Control Samples (pCi/mL)							
00934	Rinsate Blank	9-30-94	NA	ND (0.0110)	--	ND (0.0539)	--
00933	Rinsate Blank	9-30-94	NA	ND (7.079)	--	NA	--
604299	TJAOU-227-GR-EB-001	2-27-01	NA	ND (0.0212)	--	ND (0.148)	--
604298	TJAOU-227-GR-EB-001	2-27-01	NA	ND (-1.17)	--	ND (5.38)	--
604205	TJAOU-227-VW-01-EB1	3-29-01	NA	ND (0.0239)	--	ND (0.156)	--
604204	TJAOU-227-VW-01-EB1	3-29-01	NA	8.80	4.27	ND (4.71)	--

Refer to footnotes at end of table.

Table A-3 (Continued)
Summary of SWMU 227 Gamma Spectroscopy and Tritium Analytical Results
September 1994 and February–March 2001
(On-Site and Off-Site Laboratories[a])

Sample Attributes				Radionuclides (gamma spectroscopy by EPA Method 901.1; tritium by EPA Method EERF H.01[b] (pCi/g)					
				Tritium		Uranium-235		Uranium-238	
Record Number[c]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[d]	Result	Error[d]	Result	Error[d]
00806	227-01-A	9-29-94	0–0.5	ND (0.013)	--	ND (0.260)	--	1.26	0.354
00806	227-01-B	9-29-94	0.5–3.0	ND (0.012)	--	ND (0.286)	--	ND (2.54)	--
00806	227-02-A	9-29-94	0–0.5	ND (0.010)	--	ND (0.276)	--	ND (2.46)	--
00806	227-02-B	9-29-94	0.5–3.0	ND (0.013)	--	ND (0.268)	--	1.45	0.392
00806	227-03-A	9-29-94	0–0.5	ND (0.012)	--	ND (0.248)	--	0.817	0.315
00806	227-03-B	9-29-94	0.5–3.0	ND (0.011)	--	ND (0.253)	--	ND (2.21)	--
00806	227-04-A	9-29-94	0–0.5	ND (0.012)	--	ND (0.277)	--	1.15	0.353
00806	227-04-B	9-29-94	0.5–3.0	ND (0.014)	--	ND (0.293)	--	1.40	0.403
00055	227-01-A	9-29-94	0–0.5	NA	--	ND (0.04275)	--	NA	--
00055	227-03-A	9-29-94	0–0.5	NA	--	ND (0.4411)	--	NA	--
00055	227-03-B	9-29-94	0.5–3.0	NA	--	ND (0.1407)	--	NA	--
604299	TJAOU-227-GR-05-7.0-S	2-27-01	7.0	NA	--	ND (0.233)	--	ND (0.848)	--
604299	TJAOU-227-GR-06-0.0-S	2-27-01	0.0	NA	--	ND (0.224)	--	ND (0.769)	--
604299	TJAOU-227-GR-06-5.0-S	2-27-01	5.0	NA	--	ND (0.237)	--	ND (0.827)	--
604299	TJAOU-227-GR-06-5.0-DU	2-27-01	5.0	NA	--	ND (0.239)	--	ND (0.848)	--
604299	TJAOU-227-GR-07-5.0-S	2-27-01	5.0	NA	--	ND (0.226)	--	ND (0.805)	--
604298	TJAOU-227-GR-05-7.0-S	2-27-01	7.0	NA	--	ND (0.0344)	--	1.39	0.660
604298	TJAOU-227-GR-06-0.0-S	2-27-01	0.0	NA	--	ND (0.074)	--	ND (0.584)	--
604298	TJAOU-227-GR-06-5.0-S	2-27-01	5.0	NA	--	ND (0.0787)	--	1.09	0.646
604298	TJAOU-227-GR-06-5.0-DU	2-27-01	5.0	NA	--	ND (0.0585)	--	ND (0.946)	--
604298	TJAOU-227-GR-07-5.0-S	2-27-01	5.0	NA	--	ND (0.0744)	--	1.74	0.745
604199	TJAOU-227-VW-01-20.0-S	3-26-01	20.0	NA	--	0.104	0.177	ND (0.779)	--
604199	TJAOU-227-VW-01-150.0-S	3-27-01	150.0	NA	--	ND (0.189)	--	ND (0.648)	--
604200	TJAOU-227-VW-01-20.0-S	3-26-01	20.0	NA	--	ND (0.0727)	--	0.809	0.646
604200	TJAOU-227-VW-01-150.0-S	3-27-01	150.0	NA	--	ND (0.0743)	--	ND (0.567)	--
Background activity (North Supergroup, surface soil)[e]				0.021[f]	NA	0.18	NA	1.3	NA
Background activity (North Supergroup, subsurface soil)[e]				0.021[f]	NA	0.18	NA	1.3	NA

Refer to footnotes at end of table.

Table A-3 (Concluded)
Summary of SWMU 227 Gamma Spectroscopy and Tritium Analytical Results
September 1994 and February–March 2001
(On-Site and Off-Site Laboratories[a])

Sample Attributes				Radionuclides (gamma spectroscopy by EPA Method 901.1; tritium by EPA Method EERF H.01[b]) (pCi/g)					
				Tritium		Uranium-235		Uranium-238	
Record Number[c]	ER Sample ID	Date Sampled	Sample Depth (ft)	Result	Error[d]	Result	Error[d]	Result	Error[d]
Quality Assurance/Quality Control Samples (pCi/mL)									
00934	Rinsate Blank	9-30-94	NA	NA	--	ND (0.0202)	--	ND (0.191)	--
00933	Rinsate Blank	9-30-94	NA	NA	--	-13.45	70.07	NA	--
604299	TJAOU-227-GR-EB-001	2-27-01	NA	NA	--	ND (0.161)	--	ND (0.410)	--
604298	TJAOU-227-GR-EB-001	2-27-01	NA	NA	--	ND (9.79)	--	ND (66.2)	--
604205	TJAOU-227-VW-01-EB1	3-29-01	NA	NA	--	ND (0.0998)	--	ND (0.24)	--
604204	TJAOU-227-VW-01-EB1	3-29-01	NA	NA	--	ND (10.2)	--	ND (110)	--

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

[a]Quanterra Environmental Services, Inc. performed analyses for Record Numbers 00055, 00933.
General Engineering Laboratories performed analyses for Record Numbers 604200, 604204, 604298.
SNL/NM on-site Radiation Protection Sample Diagnostics Laboratory performed analyses for Record Numbers 00806, 00934, 604199, 604205, 604299.

[b]EPA (November 1986).

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

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

[e]From Dinwiddie (September 1997).

[f]The tritium background value of 0.021 pCi/g was calculated from the Tharp (February 1999) tritium background value of 420 pCi/L. The pCi/L value was converted to the pCi/g value using the assumption of 5 percent soil moisture and a soil density of 1 g/cubic centimeter.

DU = Duplicate sample.
EB = Equipment blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
g = Gram(s).
GR = Grab sample.
ID = Identification.
NA = Not applicable or not analyzed.
ND ( ) = Not detected above minimum detectable activity, shown in parentheses.
pCi = Picocurie(s).
mL = Milliliter.
S = Soil sample.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.
VW = Vapor well.
-- = Error not calculated for nondetectable results.

Table A-4
Summary of SWMU 227 Confirmatory Soil Sampling VOC Analytical Results
September 1994 and February–March 2001
(Off-Site Laboratories[a])

Sample Attributes				VOCs (EPA Method SW846 8240/8260[b]) (µg/kg)			
Record Number[c]	ER Sample ID	Date Sampled	Sample Depth (ft)	2-Butanone	Acetone	Methylene chloride	4-Methyl-2-pentanone
00802	227-01-B	9-29-94	0.5–3.0	7 J (10)	ND (10)	ND (5)	1 J (10)
00802	227-01-B (Duplicate)	9-29-94	0.5–3.0	6 J (10)	6 J (10)	ND (5)	ND (10)
00802	227-02-B	9-29-94	0.5–3.0	4 J (10)	ND (10)	ND (5)	ND (10)
00802	227-03-B	9-29-94	0.5–3.0	5 J (10)	ND (10)	ND (5)	ND (10)
00802	227-04-B	9-29-94	0.5–3.0	4 J (10)	ND (10)	ND (5)	ND (10)
00802	227-04-B (Duplicate)	9-29-94	0.5–3.0	5 J (10)	ND (10)	ND (5)	ND (10)
604298	TJAOU-227-GR-05-7.0-S	2-27-01	7.0	ND (0.76)	ND (1.00)	ND (0.44)	ND (1.34)
604298	TJAOU-227-GR-06-0.0-S	2-27-01	0.0	ND (0.76)	ND (1.00)	ND (0.44)	ND (1.34)
604298	TJAOU-227-GR-06-5.0-S	2-27-01	5.0	ND (0.76)	ND (1.00)	ND (0.44)	ND (1.34)
604298	TJAOU-227-GR-06-5.0-DU	2-27-01	5.0	ND (0.76)	ND (1.00)	ND (0.44)	ND (1.34)
604298	TJAOU-227-GR-07-5.0-S	2-27-01	5.0	ND (0.76)	ND (1.00)	ND (0.44)	ND (1.34)
604200	TJAOU-227-VW-01-20.0-S	3-26-01	20.0	19.1	ND (1.00)	ND (0.44)	ND (1.34)
604200	TJAOU-227-VW-01-100.0-S	3-27-01	100.0	ND (0.76)	ND (1.00)	ND (0.44)	ND (1.34)
604200	TJAOU-227-VW-01-100.0-DU	3-27-01	100.0	1.23 J (5.00)	ND (1.00)	ND (0.44)	ND (1.34)
604200	TJAOU-227-VW-01-150.0-S	3-27-01	150.0	ND (0.76)	ND (1.00)	ND (0.44)	ND (1.34)
604200	TJAOU-227-VW-01-200.0-S	3-27-01	200.0	1.68 J (5.00)	1.96 J (5.00)	ND (0.44)	ND (1.34)
604204	TJAOU-227-VW-01-250-S	3-28-01	250.0	17.3	7.30	0.569 J (5)	ND (1.34)
604204	TJAOU-227-VW-01-275-S	3-28-01	275.0	5.19	5.25	1.05 J (5)	ND (1.34)
Quality Assurance/Quality Control Samples (µg/L, except Soil Trip Blank in mg/L)							
00802	Soil Trip Blank	9-29-94	NA	10	19	ND (5)	2 J (10)
00932	Rinsate Blank	9-30-94	NA	ND (10)	10	ND (5)	ND (10)
00932	Rinsate Blank	9-30-94	NA	5 J	23	ND (5)	ND (10)
604298	TJAOU-227-GR-TB-001	2-27-01	NA	ND (0.81)	ND (0.82)	ND (5)	ND (0.7)
604298	TJAOU-227-GR-EB-001	2-27-01	NA	ND (0.81)	3.15 J (5)	ND (5)	ND (0.7)
604200	TJAOU-227-VW-01-TB	3-26-01	NA	ND (0.81)	ND (0.82)	ND (0.63)	ND (0.7)
604204	TJAOU-227-VW-01-TB	3-29-01	NA	ND (0.81)	ND (0.82)	ND (0.63)	ND (0.7)
604204	TJAOU-227-VW-01-EB1	3-29-01	NA	ND (0.81)	ND (0.82)	ND (0.63)	ND (0.7)

Refer to footnotes at end of table.

Table A-4 (Concluded)
Summary of SWMU 227 Confirmatory Soil Sampling VOC Analytical Results
September 1994 and February–March 2001
(Off-Site Laboratories[a])

[a]1994 samples analyzed by Environmental Control Technology Corporation; 2001 samples analyzed by General Engineering Laboratories.
[b]EPA (November 1986).
[c]Analysis request/chain-of-custody record.

DU = Duplicate sample.
EB = Equipment blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
J = Estimated value less than the reporting limit, shown in parentheses.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
mg/L = Milligram(s) per liter.
NA = Not analyzed.
ND ( ) = Not detected above the detection limit, shown in parentheses.
S = Soil sample.
SWMU = Solid Waste Management Unit.
TB = Trip blank.
TJAOU = Tijeras Arroyo Operable Unit.
VOC = Volatile organic compound.
VW = Vapor well.

Table A-5
Summary of SWMU 227 VOC Analytical Detection Limits
September 1994
(Off-Site Laboratory[a])

Analyte	Method Detection Limit (µg/kg)
1,1,1-Trichloroethane	5
1,1,2,2-Tetrachloroethane	5
1,1,2-Trichloroethane	5
1,1-Dichloroethane	5
1,1-Dichloroethene	5
1,2-Dichloroethane	5
1,2-Dichloropropane	5
2-Butanone	10
2-Chloroethyl vinyl ether	10
2-Hexanone	10
4-Methyl-2-pentanone	10
Acetone	10
Benzene	5
Bromodichloromethane	5
Bromoform	5
Bromomethane	10
Carbon disulfide	5
Carbon tetrachloride	5
Chlorobenzene	5
Chloroethane	10
Chloroform	5
Chloromethane	10
Dibromochloromethane	5
Ethyl benzene	5
Methylene chloride	5
Styrene	5
Tetrachloroethene	5
Toluene	5
Trichloroethene	5
Vinyl acetate	10
Vinyl chloride	10
Xylene	5
total-1,2-Dichloroethene	5
cis-1,3-Dichloropropene	5
trans-1,3-Dichloropropene	5

[a]Environmental Control Technology Corporation.
µg/kg = Microgram(s) per kilogram.
SWMU = Solid Waste Management Unit.
VOC = Volatile organic compound.

Table A-6
Summary of SWMU 227 VOC Analytical Detection Limits
February–March 2001
(Off-Site Laboratory[a])

Analyte	Method Detection Limit (µg/kg)
1,1,1-Trichloroethane	0.29
1,1,2,2-Tetrachloroethane	0.3
1,1,2-Trichloroethane	0.36
1,1-Dichloroethane	0.41
1,1-Dichloroethene	0.262
1,2-Dichloroethane	0.27
1,2-Dichloropropane	0.32
2-Butanone	0.76
2-Hexanone	0.94
4-Methyl-2-pentanone	1.34
Acetone	1.00
Benzene	0.39
Bromodichloromethane	0.35
Bromoform	0.36
Bromomethane	0.31
Carbon disulfide	0.62
Carbon tetrachloride	0.26
Chlorobenzene	0.4
Chloroethane	0.28
Chloroform	0.47
Chloromethane	0.35
Dibromochloromethane	0.41
Ethyl benzene	0.35
Methylene chloride	0.44
Styrene	0.32
Tetrachloroethene	0.4
Toluene	0.5
Trichloroethene	0.72
Vinyl acetate	0.77
Vinyl chloride	0.3
Xylene	1.05
cis-1,2-Dichloroethene	0.41
cis-1,3-Dichloropropene	0.28
trans-1,2-Dichloroethene	0.37
trans-1,3-Dichloropropene	0.24

[a]General Engineering Laboratories.
µg/kg = Microgram(s) per kilogram.
SWMU = Solid Waste Management Unit.
VOC = Volatile organic compound.

Table A-7
Summary of SWMU 227 Confirmatory Soil Sampling SVOC Analytical Results
September 1994 and February–March 2001
(Off-Site Laboratories[a])

Sample Attributes				SVOCs (EPA Method SW846 8270[b]) (µg/kg)		
Record Number[c]	ER Sample ID	Date Sampled	Sample Depth (ft)	Benzo(b)fluoranthene	Chrysene	Fluoranthene
00802	227-01-A	9-29-94	0–0.5	ND (330)	ND (330)	66 J (330)
00802	227-01-A (Duplicate)	9-29-94	0–0.5	ND (330)	ND (330)	38 J (330)
00802	227-01-B	9-29-94	0.5–3.0	68 J (330)	49 J (330)	94 J (330)
00802	227-03-A	9-29-94	0–0.5	ND (330)	ND (330)	ND (330)
00802	227-03-B	9-29-94	0.5–3.0	ND (330)	ND (330)	ND (330)
00802	227-03-B (Duplicate)	9-29-94	0.5–3.0	ND (330)	ND (330)	ND (330)
604298	TJAOU-227-GR-05-7.0-S	2-27-01	7.0	ND (2.33)	ND (6.33)	ND (3.33)
604298	TJAOU-227-GR-06-0.0-S	2-27-01	0	ND (33.3 J)[d]	ND (33.3 J)[d]	ND (33.3 J)[d]
604298	TJAOU-227-GR-06-5.0-S	2-27-01	5.0	ND (2.33)	ND (6.33)	ND (3.33)
604298	TJAOU-227-GR-06-5.0-DU	2-27-01	5.0	ND (2.33)	ND (6.33)	ND (3.33)
604298	TJAOU-227-GR-07-5.0-S	2-27-01	5.0	ND (2.33)	ND (6.33)	ND (3.33)
604200	TJAOU-227-VW-01-20.0-S	3-26-01	20.0	ND (2.33)	ND (6.33)	ND (3.33)
604200	TJAOU-227-VW-01-150.0-S	3-27-01	150.0	ND (2.33)	ND (6.33)	ND (3.33)
Quality Assurance/Quality Control Samples (µg/L)						
00932	Rinsate Blank	9-30-94	NA	ND (10)	ND (10)	ND (10)
604298	TJAOU-227-GR-EB-001	2-27-01	NA	ND (0.13)	ND (0.12)	ND (0.12)
604204	TJAOU-227-VW-01-EB1	3-29-01	NA	ND (0.13)	ND (0.12)	ND (0.12)

Refer to footnotes at end of table.

Table A-7 (Concluded)
Summary of SWMU 227 Confirmatory Soil Sampling SVOC Analytical Results
September 1994 and February–March 2001
(Off-Site Laboratories[a])

Sample Attributes				SVOCs (EPA Method SW846 8270[b]) (µg/kg)		
Record Number[c]	ER Sample ID	Date Sampled	Sample Depth(ft)	Phenanthrene	Pyrene	bis(2-Ethylhexyl) phthalate
00802	227-01-A	9-29-94	0–0.5	55 J (330)	40 J (330)	ND (330)
00802	227-01-A (Duplicate)	9-29-94	0–0.5	37 J (330)	ND (330)	ND (330)
00802	227-01-B	9-29-94	0.5–3.0	84 J (330)	62 J (330)	ND (330)
00802	227-03-A	9-29-94	0–0.5	ND (330)	ND (330)	ND (330)
00802	227-03-B	9-29-94	0.5–3.0	ND (330)	ND (330)	ND (330)
00802	227-03-B (Duplicate)	9-29-94	0.5–3.0	ND (330)	ND (330)	ND (330)
604298	TJAOU-227-GR-05-7.0-S	2-27-01	7.0	ND (4.00)	ND (8.66)	20 J (33.3)
604298	TJAOU-227-GR-06-0.0-S	2-27-01	0	ND (33.3 J)[d]	ND (33.3 J)[d]	ND (33.3 J)[d]
604298	TJAOU-227-GR-06-5.0-S	2-27-01	5.0	ND (4.00)	ND (8.66)	26.0 J (33.3)
604298	TJAOU-227-GR-06-5.0-DU	2-27-01	5.0	ND (4.00)	ND (8.66)	14.7 J (33.3)
604298	TJAOU-227-GR-07-5.0-S	2-27-01	5.0	ND (4.00)	ND (8.66)	18.7 J (33.3)
604200	TJAOU-227-VW-01-20.0-S	3-26-01	20.0	ND (4.00)	ND (8.66)	88.5
604200	TJAOU-227-VW-01-150.0-S	3-27-01	150.0	ND (4.00)	ND (8.66)	ND (6.99)
Quality Assurance/Quality Control Samples (µg/L)						
00932	Rinsate Blank	9-30-94	NA	ND (10)	ND (10)	ND (10)
604298	TJAOU-227-GR-EB-001	2-27-01	NA	ND (0.12)	ND (0.14)	ND (0.04)
604204	TJAOU-227-VW-01-EB1	3-29-01	NA	ND (0.12)	ND (0.14)	ND (0.04)

[a]1994 samples analyzed by Environmental Control Technology Corporation; 2001 samples analyzed by General Engineering Laboratories.
[b]EPA (November 1986).
[c]Analysis request/chain-of-custody record.
[d]Nondetection; uncertainty in the detection limit, shown in parentheses (see Data Validation Report [Attachment B]).

DU = Duplicate sample.
EB = Equipment rinsate blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
GR = Grab sample.
ID = Identification.
J = Estimated value less than the reporting limit, shown in parentheses.
µg/kg = Microgram(s) per kilogram.
µg/L = Microgram(s) per liter.
NA = Not analyzed.
ND ( ) = Not detected above the detection limit, shown in parentheses.
S = Soil sample.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
TJAOU = Tijeras Arroyo Operable Unit.
VW = Vapor well.

Table A-8
Summary of SWMU 227 SVOC Analytical Detection Limits
September 1994
(Off-Site Laboratory[a])

Analyte	Method Detection Limit (µg/kg)
1,2,4-Trichlorobenzene	330
1,2-Dichlorobenzene	330
1,3-Dichlorobenzene	330
1,4-Dichlorobenzene	330
2,4,5-Trichlorophenol	330
2,4,6-Trichlorophenol	330
2,4-Dichlorophenol	330
2,4-Dimethylphenol	330
2,4-Dinitrophenol	1,670
2,4-Dinitrotoluene	330
2,6-Dinitrotoluene	330
2-Chloronaphthalene	330
2-Chlorophenol	330
2-Methylnaphthalene	330
2-Nitroaniline	1,670
2-Nitrophenol	330
3,3'-Dichlorobenzidine	670
3-Nitroaniline	1,670
4-Bromophenyl phenyl ether	330
4-Chloro-3-methylphenol	330
4-Chlorophenyl phenyl ether	330
4-Methylphenol	330
4-Nitroaniline	1,670
4-Nitrophenol	1,670
Acenaphthene	330
Acenaphthylene	330
Anthracene	330
Benzo(a)anthracene	330
Benzo(a)pyrene	330
Benzo(b)fluoranthene	330
Benzo(ghi)perylene	330
Benzo(k)fluoranthene	330
Butylbenzyl phthalate	330
Chrysene	330
Di-n-butyl phthalate	330
Di-n-octyl phthalate	330
Dibenz[a,h]anthracene	330
Dibenzofuran	330
Diethylphthalate	330
Dimethylphthalate	330
Fluoranthene	330
Fluorene	330
Hexachlorobenzene	330
Hexachlorobutadiene	330

Refer to footnotes at end of table.

Table A-8 (Concluded)
Summary of SWMU 227 SVOC Analytical Detection Limits
September 1994
(Off-Site Laboratory[a])

Analyte	Method Detection Limit (µg/kg)
Hexachlorocyclopentadiene	330
Hexachloroethane	330
Indeno(1,2,3-c,d)pyrene	330
Isophorone	330
Naphthalene	330
Nitrobenzene	330
Pentachlorophenol	1,670
Phenanthrene	330
Phenol	330
Pyrene	330
bis(2-Chloroethoxy)methane	330
bis(2-Chloroethyl)ether	330
bis(2-Ethylhexyl)phthalate	330
bis-Chloroisopropyl ether	330
n-Nitrosodipropylamine	330

[a]Environmental Control Technology Corporation.
µg/kg = Microgram(s) per kilogram.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.

Table A-9
Summary of SWMU 227 SVOC Analytical Detection Limits
February–March 2001
(Off-Site Laboratory[a])

Analyte	Method Detection Limit (µg/kg)
1,2,4-Trichlorobenzene	4.66
1,2-Dichlorobenzene	4.33
1,3-Dichlorobenzene	3.33
1,4-Dichlorobenzene	5.99
2,4,5-Trichlorophenol	42.3
2,4,6-Trichlorophenol	24.6
2,4-Dichlorophenol	7.99
2,4-Dimethylphenol	71.9
2,4-Dinitrophenol	15.0
2,4-Dinitrotoluene	5.00
2,6-Dinitrotoluene	3.00
2-Chloronaphthalene	34.0
2-Chlorophenol	5.00
2-Methyl-4,6-dinitrophenol	16
2-Methylnaphthalene	4.00
2-Nitrophenol	46.3
3,3'-Dichlorobenzidine	143
4-Bromophenyl phenyl ether	4.66
4-Chloro-3-methylphenol	36.6
4-Chlorobenzenamine	58.9
4-Chlorophenyl phenyl ether	3.33
4-Nitrophenol	21.0
Acenaphthene	4.00
Acenaphthylene	3.66
Anthracene	4.66
Benzo(a)anthracene	5.99
Benzo(a)pyrene	2.00
Benzo(b)fluoranthene	2.33
Benzo(ghi)perylene	5.00
Benzo(k)fluoranthene	5.00
Butylbenzyl phthalate	12.7
Carbazole	5.00
Chrysene	6.33
Dibenz[a,h]anthracene	2.66
Dibenzofuran	2.66
Diethylphthalate	19.6
Dimethylphthalate	11.7
Di-n-butyl phthalate	20.6
Di-n-octyl phthalate	8.99
Diphenyl amine	15.7
Fluoranthene	3.33
m,p-Cresols	5.66
m-Nitroaniline	86.6
o-Nitroaniline	80.9
p-Nitroaniline	83.9

Refer to footnotes at end of table.

Table A-9 (Concluded)
Summary of SWMU 227 SVOC Analytical Detection Limits
February–March 2001
(Off-Site Laboratory[a])

Analyte	Method Detection Limit (µg/kg)
Fluorene	3.00
Hexachlorobenzene	4.66
Hexachlorobutadiene	6.66
Hexachlorocyclopentadiene	33.0
Hexachloroethane	4.33
Indeno(1,2,3-c,d)pyrene	6.66
Isophorone	2.33
Naphthalene	3.33
Nitrobenzene	36.6
Pentachlorophenol	60.9
Phenanthrene	4.00
Phenol	3.66
Pyrene	8.66
bis(2-Chloroethoxy)methane	5.99
bis(2-Chloroethyl)ether	6.66
bis(2-Ethylhexyl)phthalate	6.99
bis-Chloroisopropyl ether	37.1
n-Nitrosodipropylamine	33.0
o-Cresol	47.6

[a]General Engineering Laboratories.
µg/kg = Microgram(s) per kilogram.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.

Table A-10
Summary of SWMU 227 HE Analytical Detection Limits
September 1994
(Off-Site Laboratory[a])

Analyte	Method Detection Limit (µg/kg)
1,3,5-Trinitrobenzene	1,250
1,3-Dinitrobenzene	1,250
2,4,6-Trinitrotoluene	1,250
2,4-Dinitrotoluene	1,250
2,6-Dinitrotoluene	1,250
HMX	1,250
m-Nitrotoluene	1,250
Nitrobenzene	1,250
o-Nitrotoluene	1,250
p-Nitrotoluene	1,250
RDX	1,250
Tetryl	2,500

[a]Environmental Control Technology Corporation.
HE = High explosive(s).
HMX = 1,3,5,7-tetranitro-1,3,5,7-tetrazacyclooctane.
µg/kg = Microgram(s) per kilogram.
RDX = 1,3,5-trinitro-1,3,5-triazacyclohexane.
SWMU = Solid Waste Management Unit.
Tetryl = 2,4,6-trinitrophenylmethylnitramine.

Table A-11
Summary of SWMU 227 HE Analytical Detection Limits
February–March 2001
(Off-Site Laboratory[a])

Analyte	Method Detection Limit (µg/kg)
1,3,5-Trinitrobenzene	11.9
2,4,6-Trinitrotoluene	14.1
2,4-Dinitrotoluene	12.0
2,6-Dinitrotoluene	15.7
2-Amino-4,6-dinitrotoluene	13.4
4-Amino-2,6-dinitrotoluene	10.1
HMX	16.8
m-Dinitrobenzene	13.4
m-Nitrotoluene	11.6
Nitrobenzene	14.0
o-Nitrotoluene	15.2
p-Nitrotoluene	11.6
RDX	12.5
Tetryl	15.5

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

Table A-12
Summary of SWMU 227 Confirmatory Soil Sampling Inorganic, General Chemistry, and Total Petroleum Hydrocarbons Analytical Results September 1994 and February–March 2001 (Off-Site Laboratories[a])

Sample Attributes				Inorganic and General Chemistry (EPA Methods 300.0, 9010, 351.2, 353.2[b]) and Total Petroleum Hydrocarbons (EPA Method 418.1[b]) (mg/kg)				
Record Number[c]	ER Sample ID	Date Sampled	Sample Depth (ft)	Chloride	Total Cyanide	Total Kjeldahl Nitrogen	Nitrate plus Nitrite	Total Petroleum Hydrocarbons
00802	227-01-A	9-29-94	0–0.5	NA	ND (0.10)	450	6.3	ND (40)
00802	227-01-A (Duplicate)	9-29-94	0–0.5	NA	NA	NA	NA	ND (40)
00802	227-01-B	9-29-94	0.5–3.0	NA	ND (0.10)	370	ND (1.0)	ND (40)
00802	227-02-A	9-29-94	0–0.5	NA	NA	400	2.7	NA
00802	227-02-A (Duplicate)	9-29-94	0–0.5	NA	ND (0.10)	320	9.3	NA
00802	227-02-B	9-29-94	0.5–3.0	NA	NA	180	2.3	NA
00802	227-03-A	9-29-94	0–0.5	NA	ND (0.10)	300	ND (1.0)	ND (40)
00802	227-03-B	9-29-94	0.5–3.0	NA	ND (0.10)	220	ND (1.0)	ND (40)
00802	227-03-B (Duplicate)	9-29-94	0.5–3.0	NA	ND (0.10)	190	1.4	ND (40)
00802	227-04-A	9-29-94	0–0.5	NA	NA	670	14	NA
00802	227-04-B	9-29-94	0.5–3.0	NA	NA	390	2.2	NA
604200	TJAOU-227-VW-01-20.0-S	3-26-01	20.0	87.0	ND (0.142)	NA	NA	NA
604200	TJAOU-227-VW-01-150.0-S	3-27-01	150.0	84.9	0.159 J (0.250)	NA	NA	NA
Quality Assurance/Quality Control Samples (mg/L)								
00932	Rinsate Blank	9-30-94	NA	NA	ND (0.01)	ND (0.10)	ND (0.05)	ND (1.0)
604204	TJAOU-227-VW-01-EB1	3-29-01	NA	0.340	ND (0.00276)	NA	NA	NA

[a]1994 samples analyzed by Environmental Control Technology Corporation; 2001 samples analyzed by General Engineering Laboratories.
[b]EPA (November 1986).
[c]Analysis request/chain-of-custody record.

EB = Equipment rinsate blank.
EPA = U.S. Environmental Protection Agency.
ER = Environmental Restoration.
ft = Foot (feet).
ID = Identification.
J ( ) = Estimated value less than the reporting limit, shown in parentheses.
mg/kg = Milligram(s) per kilogram.
mg/L = Milligram(s) per liter.
NA = Not analyzed.
ND ( ) = Not detected above the detection limit, shown in parentheses.
S = Soil sample.
SWMU = Solid Waste Management Unit.
TJAOU = Tijeras Arroyo Operable Unit.
VW = Vapor well.

ATTACHMENT B
SWMU 227—Data Validation Reports

227 - QUANTERRA

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

Project Name Tijeras Arroyo Site 227
Case Number 3632.300
Sample Numbers 017918-5, -11, -3, 017919-3, -8, 017920-7, -6, -12, -4, -5
017921-3, -7
AR/COC No. 00055 Analytical laboratory Quanterra SDG No. 6329
AR/COC No. ______ Analytical laboratory ______ SDG No. ______
AR/COC No. ______ Analytical laboratory ______ SDG No. ______
AR/COC No. ______ Analytical laboratory ______ SDG No. ______

In the tables below, mark any information that is missing or incorrect.

1.0 Sample Collection Log

Item	Complete? Yes	Complete? No	Corrected?[a] Yes	Corrected?[a] No
Date	✓			
Sheet number and total number of sheets below	✓			
General information	✓			
Sample description	✓			
Sample ID number(s) and fraction number(s)	✓			
Location	✓			
Time of sample collection	✓			
Sample type	✓			
Depth below surface	✓			
QC samples?	✓			
Comments[b]	✓			
Analyses requested	✓			
Project information	✓			
Project name	✓			
Case number/service order number	✓			
Contact information	✓			
Turnaround time	NA			
Regulatory program	NA			
Special QC requirements	NA			
Sample team member(s), their signature(s), and initials	✓			
Sample tracking information (the "Data Entered" and "By" spaces may be empty)	✓			

[a] Describe any uncorrected deficiencies in Section 5.0, "Completeness Assessment," below.
[b] Comments are only required for QC samples; for other samples, this item can be blank.

Reviewed by: AB Garcia

Date: 12-7-94

INFORMATION COPY

SHEARS # 4975

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1 — DV1)

2.0 Analysis Request and Chain of Custody Record

Item	Complete? Yes	Complete? No	Corrected? Yes	Corrected? No*
Page number and total number of pages	✓			
Project Information	✓			
Sample shipping Information	✓			
Contract and case number	✓			
SMO authorization signature	✓			
Location information	NA			
Sample number(s)/fraction number(s)	✓			
Sample ID information	✓			
Date/time sample(s) collected	✓			
Sample matrix	✓			
Container type(s)	✓			
Sample volume	✓			
Preservative (chemical and/or thermal)	✓			
Sample collection method	NA			
Sample type	✓			
Required analytical testing	✓			
Sample information	✓			
Special instruction/QC requirements	✓			
Custody records				
Lab sample number		✓		✓
Condition upon receipt		✓		✓

* Describe any uncorrected deficiencies in Section 5.0 "Completeness Assessment" below.

3.0 Document Comparison

Item	Complete? Yes	Complete? No	Corrected? Yes	Corrected? No*
Dates on Sample Collection Log and AR/COC agree.	✓			
Sample team members on the Sample Collection Log and the AR/COC agree.	✓			
Sample ID numbers on Sample Collection Log and AR/COC agree.	✓			
Date and time on Sample Collection Log and AR/COC agree.	✓			
Analyses requested on AR/COC agree with those shown on Sample Collection Log.	✓			
Project information on Sample Collection Log and AR/COC agree.	✓			
The sample location on the Sample Collection Log agrees with the AR/COC and project-specific plan requirements or authorized changes to the plan(s).				
The number of investigative and QC samples collected was that specified in the project-specific plan(s) or authorized changes to the plan(s).				
The analyses requested on the AR/COC were those specified in the project-specific plan(s) or authorized changes to the plan(s).				

to be verified [illegible] MB

* Describe any uncorrected deficiencies in Section 5.0, "Completeness Assessment," below.

Reviewed by: MBGarcia   Date: 12-7-94

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

4.0 Analytical Laboratory Report

Item	Complete? Yes	Complete? No	Corrected? Yes	Corrected? No[a]
Data reviewed, signature	✓			
Date samples received	✓			
Method reference number(s)	✓			
Quality control data	✓			
Matrix spike/matrix spike duplicate data	✓			
Narrative complete	NA ✓			

[a] Describe any uncorrected deficiencies in Section 5.0 "Completeness Assessment" below.

5.0 Completeness Assessment

For each section below, mark the appropriate box and describe any problems that remain unresolved.

5.1 Sample Collection Log

	Yes	No
All boxes on the Sample Collection Log are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☐	☐

If any boxes have been checked no, describe problem and resolution:

5.2 Analysis Request And Chain Of Custody Record AR/COC

	Yes	No
All boxes on the AR/COC review are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☑	☐

If any boxes have been checked no, describe problem and resolution:
Under Comments Section VI indicates samples were rec'd by Quanterra SL in good condition.

Reviewed by: M Garcia
Date: 12-7-94

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

5.3 Document Comparison

	Yes	No
All boxes on the Document Comparison are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☐	☐

If any boxes have been checked no, describe problem and resolution:

5.4 Analytical Laboratory Report

	Yes	No
All boxes on the Lab Report review are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☐	☐

If any boxes have been checked no, describe problem and resolution:

BASED ON THE REVIEW, DOCUMENTATION IS COMPLETE: ☑ Yes ☐ No

Reviewed by: MB Garcia   Approved by:*
Date: 12-7-94   Date:

* Task/Project Leader must approve data package.

COMMENTS: Level 2 attached

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

Project Name Tijeras Arroyo Site 227 Page 1 of 5
Case Number 3632.300
Sample Numbers 017918-5, -11-3, 017919-3, -8, 017920-7, -6, -12, -4, -5, 017921-3, -7

AR/COC No. 00055 Analytical laboratory Quanterra SDG No. 6329
AR/COC No. ______ Analytical laboratory ______ SDG No. ______
AR/COC No. ______ Analytical laboratory ______ SDG No. ______
AR/COC No. ______ Analytical laboratory ______ SDG No. ______

1.0 EVALUATION

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
1) Sample volume, container, and preservation correct?	✓		
2) Holding times met for all samples?	✓		
3) Reporting units appropriate for the matrix and meet project-specific requirements?	✓		
4) Quantitation limit met for all samples?		✓	017918-5 017920-4, -5 Gamma Spec
5) Accuracy a) Laboratory control sample accuracy reported and met for all samples?	✓		
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique?	NA		

Reviewed by: M. Garcia

Date: 12-7-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
c) Matrix spike recovery data reported and met for all samples for which it was requested?	NA		
6) Precision a) Laboratory control sample precision reported and met for all samples?	✓		
b) Matrix spike duplicate RPD data reported and met for all samples for which it was requested?	NA		
7) Blank data a) Method or reagent blank data reported and met for all samples?	✓		
b) Sampling blank (e.g., field, trip, and equipment) data reported and met?	NA		
8) Narrative included, correct, and complete?	✓		

2.0 COMMENTS: All items marked "No" above must be explained in this section. For each item, give SNL/NM ID No. and the analysis, if appropriate, of all samples affected by the finding.

4. The MDA specified by the contract were not met for gamma Spec Analysis for samples 017918-4, 017920-4 + -5. Samples were counted for 1000 minutes. Lab indicates in the narrative that it could be

Reviewed by: BGarcia

Date: 12-7-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

2.0 COMMENTS CONTINUATION SHEET

sample background which prevented the MDA from being met. See Section II for further explaination.

Reviewed by: [illegible]

Date: 12-7-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

3.0 SUMMARY: Summarize the findings in the table below. List only samples/fractions for which deficiencies have been noted. Use the qualifiers given at the end of the table if possible. Explain any other qualifiers in the comments column.

Sample/ Fraction No.	Analysis	Qualifiers	Comments

Attach continuation sheet for additional samples

QUALIFIERS:

J = Estimated quantity (provide reason)
B = Contamination in blank (indicate which blank)
P = Laboratory precision does not meet criteria
R = Reporting units inappropriate
N = There is presumptive evidence of the presence of the material
UJ = The material was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
Q = Quantitation limit does not meet criteria
A = Laboratory accuracy does not meet criteria
U = Analyte is undetected (indicate which analyte and reason for qualification)
NJ = There is presumptive evidence of the presence of the material at an estimated quantity.

Reviewed by: MGarcia

Date: 12-7-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

SAMPLE FINDINGS SUMMARY CONTINUATION SHEET

Sample/ Fraction No.	Analysis	Qualifiers	Comments

Reviewed by: M Baca Approved by:* ____________

Date: 12-7-94 Date: ____________

*Task/Project Leader must approve data package.

Sandia National Laboratories

SF 2001-SCL (12-93)

Quanterra - St. Louis

ENVIRONMENTAL PROGRAMS SAMPLE COLLECTION LOG

SCL- 01616

AR/COC No.: AR/COC- 00055

PAGE 1 OF 2

GENERAL INFORMATION	DATE: 9/29/94	WEATHER:	
	SAMPLING PROCEDURE REFERENCE: SAP		
	PURPOSE OF SAMPLING: Preliminary Investigation		
SAMPLING INFORMATION	ON-SITE CONTACT: JAN CURTIS	ORG: 7582	PHONE: 505-848-0345
	AREA: 309	LOCATION: Site 227	

SAMPLE DESCRIPTION

MATRIX: ☐ GAS ☐ LIQUID ☐ SLUDGE ☐ SOLID ☐ WATER ☐ OIL ☒ SOIL ☐ HAZ WASTE ☐ OTHER

COLLECTED FROM: ☐ DRUM ☐ TANK ☐ SURFACE WATER ☒ SOIL ☐ WASTE WATER ☐ GROUND WATER ☐ OTHER

Sample Number - Fraction	Time	LOCATION	COMMENTS	Sample Type Grab/Comp.	QC Sample (Y/N)	Gamma Spec.	Tritium/isotopic plutonium + uranium	Tritium	isotopic Uranium
017918-5	1026	Site 227-01-A	Surface soil 0-6"	C	N	X			
017918-11	1033	Site 227-01-B	Subsurface soil 6-36"	C	N		X		
017918-3	1026	Site 227-01-A	Surface soil 0-6"	C	N		X		
017919-3	1109	Site 227-02-A	Surface soil 0-6"	C	N			X	
017919-8	1123	Site 227-02-B	Subsurface soil 6-36"	C	N			X	
017920-7	1219	Site 227-03-A	Surface soil 0-6" (Duplicate)	C	Y				X
017920-6	1222	Site 227-03-A	Surface soil 0-6"	C	N		X		
017920-12	1217	Site 227-03-B	Subsurface soil 6-36"	C	N		X		

PROJECT	PROJECT NAME	CASE NUMBER	PROJECT CONTACT	ORG.	PHONE
	Tijeras Arroyo	3632.300	Jim Brinkman	7582	505-848-0455

*ADDITIONAL INFORMATION: (Log Book Ref. #)

SAMPLE TEAM MEMBERS	NAME	SIGNATURE	INIT	COMPANY/ORGANIZATION
	1. Jan Curtis	Jan Curtis	JC	Weston
	2.			
	3.			

SAMPLE TRACKING			
SAMPLE DISTRIBUTION: Quanterra - St Louis	TRANSPORTED BY:	SPECIAL HANDLING:	
DATE SHIPPED (MM-DD-YY): 9-30-94	DATA ENTERED (MM-DD-YY): 10-4-94	BY: [signature]	

*NOTE: Any additional sampling information must be recorded in an SNL-Issued Log Book or SCL Continuation Form with a Reference No. entered in this space.

WHITE - To Sample Management Office PINK- Originator ▒ TO BE COMPLETED BY SMO

Sandia National Laboratories

SF 2001-SCC (4-94)

ENVIRONMENTAL PROGRAMS SAMPLE COLLECTION LOG

(Continuation)

Quanterra - St. Louis

SCL- 01616

AR/COC No.: AR/COC- 00055

Sample Number - Fraction	Time	LOCATION	COMMENTS	Sample Type Grab/Comp.	QC Sample (Y/N)	Gamma Spec	Tritium					
017920 - 4	1228	Site 227-03-A	Surface soil 0-6"	C	N	X						
017920 - 5	1217	Site 227-03-B	Subsurface 6-36" (Duplicate)	C	Y	X						
017921 - 3	1422	Site 227-04-A	Surface soil 0-6"	C	N		X					
017921 - 7	1426	Site 227-04-B	Subsurface soil 6-36"	C	N		X					

WHITE - To Sample Management Office PINK - Originator

Sandia National Laboratories

SF 2001-COC (12-93)

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

AR/COC- 00055

PAGE 1 OF 2

Department No.:	7582	Date Samples Shipped:	SMO USE ONLY	Bill to:	Sandia National Laboratories
Project/Task Manager:	Jim Brinkman	Carrier/Waybill No.:			Supplier Services Department
Project Name:	Tijeras Arroyo - Site 227	Lab Destination:			P.O. Box 5800 MS 0154
Sample Team Members	Jon Curtis	Lab Contact:			Albuquerque, NM 87185-0154
		SMO Contact/Phone:		Contract No.:	12-0841A
		Send Report to SMO:		Case No.:	3632.3097
SCL or Logbook Ref. No.:	01616	SMO Reference No.:		SMO Authorization:	[signature]

Sample Number - Fraction	Sample Matrix	Date/Time Collected	Container Type	Sample Volume	Preservative	Required Analytical Testing	Lab Sample Number	Condition on Receipt
017918 - 5	Soil	9/29/94 1026	~~Glass~~ Poly	500	none	Gamma Spec (600 901.1)	LAB USE ONLY	
017918 - 11		1033	Glass	250		Tritium (600 906.0) Isotopic plutonium Isotopic Uranium		
017918 - 3		1026				" "		
017919 - 3		1109				Tritium		
017919 - 8		1123				" "		
017920 - 7		1219				Isotopic Uranium		
017920 - 6		1222				Tritium, Isotopic plutonium + Uranium		
017920 - 12		1217				" "		
017920 - 4		1228	Poly	500		Gamma Spec		
017920 - 5		1217				Gamma Spec		
0179201 - 3		1422	Glass	~~500~~ 250		Tritium		

Possible Hazard Identification
☒ Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Radiological

*Reference attached radiological screening for specific contact readings.

Turnaround Time
☒ Normal ☐ Rush ______ Required Report Date ______

Special Instructions/QC Requirements
Isotopic plutonium (600 7-79-081)
Isotopic Uranium (HASL-300 4.5)

Sample Disposal
☐ Return to Client ☒ Disposal by Lab Archive Until ______

1. Relinquished by [signature]	Org. 7582	Date 9/30/94	Time [illegible]	4. Relinquished by	Org.	Date	Time
1. Received by [signature]	Org. [illegible]	Date [illegible]	Time [illegible]	4. Received by	Org.	Date	Time
2. Relinquished by [signature]	Org. [illegible]	Date [illegible]	Time [illegible]	5. Relinquished by	Org.	Date	Time
2. Received by	Org.	Date	Time	5. Received by	Org.	Date	Time
3. Relinquished by	Org.	Date	Time	6. Relinquished by	Org.	Date	Time
3. Received by	Org.	Date	Time	6. Received by	Org.	Date	Time

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

Sandia National Laboratories

SF 2001-COD (12-93)

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD
(continuation)

AR/COC- 00055

PAGE 2 OF 2

Project Name: Tijeras Arroyo - Site 227 Project/Task Manager: Jim Brinkman

Case No.: 3632.300

Sample Number - Fraction	Sample Matrix	Date/Time Collected	Container Type	Sample Volume	Preservative	Required Analytical Testing	Lab Sample Number	Condition on Receipt
017921 -7	Soil	9/24/94 1426	Glass	250	none	Tritium		

FOR LAB USE ONLY

W... - To Ac...pany Samples, Laboratory Copy BLUE- To Accompany ...ples; ...urn to SMO YELLOW- SMO Suspense Copy PI... ...opy

227-ENCOTEC

ER SITE 227

AR/COC: 00802

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

Project Name Tijeras Arroyo; Site 227 Page 1 of 4
Case Number
Sample Numbers 017918, 017919, 017920, 017921, 018093

AR/COC No. 00802 Analytical laboratory ENCOTEC SDG No. 11-101
AR/COC No. ______ Analytical laboratory ______ SDG No. ______
AR/COC No. ______ Analytical laboratory ______ SDG No. ______
AR/COC No. ______ Analytical laboratory ______ SDG No. ______

In the tables below, mark any information that is missing or incorrect.

1.0 Sample Collection Log

Item	Complete? Yes	Complete? No	Corrected? Yes	Corrected? No[a]
Date	✓			
Sheet number and total number of sheets below	✓			
General information	✓			
Sample description	✓			
Sample ID number(s) and fraction number(s)		✓		
Location	✓			
Time of sample collection	✓			
Sample type	✓			
Depth below surface	✓			
QC samples[b]	✓			
Comments	✓			
Analyses requested	✓			
Project information	✓			
Project name	✓			
Case number/service order number	✓			
Contact information	✓			
Turnaround time	✓			
Regulatory program		✓		
Special QC requirements	✓			
Sample team member(s), their signature(s), and initials	✓			
Sample tracking information (the "Data Entered" and "By" spaces may be empty)	✓			

[a] Describe any uncorrected deficiencies in Section 5.0, "Completeness Assessment," below.
[b] Comments are only required for QC samples; for other samples, this item can be blank.

Reviewed by: [signature]

Date: 11-7-94

INFORMATION COPY

SHEARS # 49739

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

2.0 Analysis Request and Chain of Custody Record

Item	Complete?		Corrected?	
	Yes	No	Yes	No[a]
Page number and total number of pages	✓			
Project information	✓			
Sample shipping information	✓			
Contract and case number	✓			
SMO authorization signature	✓			
Location information	✓			
Sample number(s)/fraction number(s)		✓		
Sample ID information	✓			
Date/time sample(s) collected	✓			
Sample matrix	✓			
Container type(s)	✓			
Sample volume	✓			
Preservative (chemical and/or thermal)	✓			
Sample collection method	✓			
Sample type	✓			
Required analytical testing	✓			
Sample information	✓			
Special instruction/QC requirements	✓			
Custody records		✓		
Lab sample number	✓			
Condition upon receipt	✓			

[a] Describe any uncorrected deficiencies in Section 5.0 "Completeness Assessment" below.

3.0 Document Comparison

Item	Complete?		Corrected?	
	Yes	No	Yes	No[a]
Dates on Sample Collection Log and AR/COC agree.	✓			
Sample team members on the Sample Collection Log and the AR/COC agree.	✓			
Sample ID numbers on Sample Collection Log and AR/COC agree.	✓			
Date and time on Sample Collection Log and AR/COC agree.	✓			
Analyses requested on AR/COC agree with those shown on Sample Collection Log.	✓			
Project information on Sample Collection Log and AR/COC agree.	✓			
The sample location on the Sample Collection Log agrees with the AR/COC and project-specific plan requirements or authorized changes to the plan(s).	✓			
The number of investigative and QC samples collected was that specified in the project-specific plan(s) or authorized changes to the plan(s).	✓			
The analyses requested on the AR/COC were those specified in the project-specific plan(s) or authorized changes to the plan(s).	✓			

[a] Describe any uncorrected deficiencies in Section 5.0, "Completeness Assessment," below.

Reviewed by: [signature] Date: 11-7-94

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

4.0 Analytical Laboratory Report

Item	Complete? Yes	Complete? No	Corrected? Yes	Corrected? No[a]
Data reviewed, signature	✓			
Date samples received	✓			
Method reference number(s)	✓			
Quality control data	✓			
Matrix spike/matrix spike duplicate data	NA			
Narrative complete	✓			

[a] Describe any uncorrected deficiencies in Section 5.0 "Completeness Assessment" below.

5.0 Completeness Assessment For each section below, mark the appropriate box and describe any problems that remain unresolved.

5.1 Sample Collection Log

	Yes	No
All boxes on the Sample Collection Log are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☒	☐

If any boxes have been checked no, describe problem and resolution:

(1) Sample fraction numbers used to indicate different xyz locations and not sample analysis

5.2 Analysis Request And Chain Of Custody Record AR/COC

	Yes	No
All boxes on the AR/COC review are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☐	☐

If any boxes have been checked no, describe problem and resolution:

(1) See 5.1(1) (2) EnCoTEC did not sign the COC custody; EnCoTEC mailed a corrected

Reviewed by: [signature]
Date: 11-7-94

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

5.3 Document Comparison

	Yes	No
All boxes on the Document Comparison are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☑	☑

If any boxes have been checked no, describe problem and resolution:

5.4 Analytical Laboratory Report

	Yes	No
All boxes on the Lab Report review are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☑	☐

If any boxes have been checked no, describe problem and resolution:

BASED ON THE REVIEW, DOCUMENTATION IS COMPLETE: ☐ Yes ☐ No

Reviewed by: [signature] Approved by:*
Date: 11-7-94 Date:

* Task/Project Leader must approve data package.

COMMENTS:

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

Project Name Tijeras Arroyo; Site 227 Page 1 of 5
Case Number
Sample Numbers 017918; 017919; 017920, 017921, 018093

AR/COC No. 00802 Analytical laboratory ENCOTEC SDG No. TJ-101
AR/COC No. ________ Analytical laboratory ________ SDG No. ________
AR/COC No. ________ Analytical laboratory ________ SDG No. ________
AR/COC No. ________ Analytical laboratory ________ SDG No. ________

1.0 EVALUATION

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
1) Sample volume, container, and preservation correct?	✓		
2) Holding times met for all samples?		✓	Due to poor spike recoveries on 8330 the explosives had to be re-extracted after hold times. See 2.0 for sample no.
3) Reporting units appropriate for the matrix and meet project-specific requirements?	✓		
4) Quantitation limit met for all samples?	✓		
5) Accuracy a) Laboratory control sample accuracy reported and met for all samples?	✓		
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique?	✓		

Reviewed by: Doug Salmi
Date: 11-7-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
c) Matrix spike recovery data reported and met for all samples for which it was requested?	NA		—
6) Precision a) Laboratory control sample precision reported and met for all samples?	✓		
b) Matrix spike duplicate RPD data reported and met for all samples for which it was requested?	✓		
7) Blank data a) Method or reagent blank data reported and met for all samples?	✓		
b) Sampling blank (e.g., field, trip, and equipment) data reported and met?	✓		
8) Narrative included, correct, and complete?	✓		

2.0 COMMENTS: All items marked "No" above must be explained in this section. For each item, give SNL/NM ID No. and the analysis, if appropriate, of all samples affected by the finding.

Explosives past hold times: 017918-6, 017918-7, 017918-8
017920-1, 017920-9

Reviewed by: [signature]

Date: 11-7-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

2.0 COMMENTS CONTINUATION SHEET

Reviewed by: Doug Salmi

Date: 11-7-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

3.0 SUMMARY: Summarize the findings in the table below. List only samples/fractions for which deficiencies have been noted. Use the qualifiers given at the end of the table if possible. Explain any other qualifiers in the comments column.

Sample/ Fraction No.	Analysis	Qualifiers	Comments
018093	VOC	JB	2-Butanone, 4-methyl-2-pentanone, 2-Hexa[illegible]

Attach continuation sheet for additional samples

QUALIFIERS:

J = Estimated quantity (provide reason)
B = Contamination in blank (indicate which blank)
P = Laboratory precision does not meet criteria
R = Reporting units inappropriate
N = There is presumptive evidence of the presence of the material
UJ = The material was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
Q = Quantitation limit does not meet criteria
A = Laboratory accuracy does not meet criteria
U = Analyte is undetected (indicate which analyte and reason for qualification)
NJ = There is presumptive evidence of the presence of the material at an estimated quantity.

Reviewed by: [signature]

Date: 11-7-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

SAMPLE FINDINGS SUMMARY CONTINUATION SHEET

Sample/ Fraction No.	Analysis	Qualifiers	Comments

Reviewed by: [illegible]   Approved by:* ____________________

Date: 11-17-94   Date: ____________________

*Task/Project Leader must approve data package.

1½ Week

III
ev'd 9 Wells 11-12 COC

VOC Pete Shed Time

Merl,

1:00

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Sandia National Laboratories

2001-COD (12-93)

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD
(continuation)

AR/COC- 00802

Project Name: Tijeras Arroyo - Site 227 Project/Task Manager: Jim Brinkman Case No.: 3632.300

Sample Number - Fraction	Sample Matrix	Date/Time Collected	Container Type	Sample Volume	Preservative	Required Analytical Testing	Lab Sample Number	Condition on Receipt
017920-8	Soil	9/27/94 1217	Stainless steel	150	4°C	VOC (8240) ✓		
017920-2		1225	Glass	500		TAL Metals/Cr+6, Cyanide, TKN, NO3/NO2		
017920-1		1218				BNA (8270), TPH (8015), Explosives-RES (8330)		
017920-13		1217				TAL Metals/Cr+6, Cyanide, TKN, NO3/NO2		
017920-14		1217				TPH (8015), BNA (8270) ✓		
017920-9		1217				BNA, TPH, Explosives-RES ✓		
017920-10		1217				TAL Metals/Cr+6, cyanide, TKN, NO3/NO2		
017921-1		1420				TAL Metals/Cr+6, TKN, NO3/NO2		
017921-5		1427				" "		
017921-8		1430	S.S.	150		VOC ✓		
017921-4		1430	S.S.	150		VOC ✓		
018093	Soil	9/29 1045	Glass	125	4°	VOC ✓		

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? 2001-COC (12-93)

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

AR/COC-00802

PAGE 1 OF 2

Department No.: 7582
Project/Task Manager: Jim Brinkman
Project Name: Tijeras Arroyo - Site 227
Sample Team Members: Jan Curtis
SCL or Logbook Ref. No.: 01637

Date Samples Shipped:
Carrier/Waybill No.:
Lab Destination:
Lab Contact:
SMO Contact/Phone:
Send Report to SMO:
SMO Reference No.:

SMO USE ONLY

Bill to: Sandia National Laboratories
Supplier Services Department
P.O. Box 5800 MS 0154
Albuquerque, NM 87185-0154

Contract No.: 67-9736A
Case No.: 3632.389
SMO Authorization: Doug Salmi

Sample Number - Fraction	Sample Matrix	Date/Time Collected	Container Type	Sample Volume	Preservative	Required Analytical Testing
017918-2	Soil	9/29/94 1026	Glass	500	4°C	TAL metals/Cr+6*, Cyanide, TKN, NO3/NO2 Methods listed below
017918-6		1026				BNA (8270), TPH (8015), Explosives-8330
017918-1		1026				BNA (8270), TPH (8015), Explosives-8330
017918-9		1030				TAL metals/Cr+6, Cyanide, TKN, NO3/NO2
017918-8		1035				BNA (8270), TPH (8015), Explosives-8330
017918-7		1043	Stainless Steel	150		VOC (8240)
017918-12		1026	Stainless Steel	150		VOC (8240)
017919-4		1109	Glass	500		TAL metals/Cr+6, Cyanide, TKN, NO3/NO2
017919-1		1109	Glass	500		TAL metals/Cr+6, TKN, NO3/NO2
017919-5		1109	S.S.	150		VOC
017919-6		1125	Glass	500		TAL metals/Cr+6, TKN, NO3/NO2

FOR LAB USE ONLY

Possible Hazard Identification
☒ Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Radiological

*Reference attached radiological screening for specific contact readings.

Turnaround Time
☒ Normal ☐ Rush Required Report Date

Sample Disposal
☐ Return to Client ☒ Disposal by Lab Archive Until

Special Instructions/QC Requirements
For ALL Cr+6
TAL metals = 6010/7000, *Analyze for Cr+6 only if Cr is detected in metals analysis
Cyanide/TKN = acid digestion, NO3/NO2 (353.2)

	Org.	Date	Time		Org.	Date	Time
1. Relinquished by [signature]	7582	9/30/94	10:00	4. Relinquished by			
1. Received by [signature]	SMO 7576	9/30/94	10:??	4. Received by			
2. Relinquished by [signature]	SMO 7576	9/30/94	1400	5. Relinquished by			
2. Received by [signature]	Encotec	10/1/94	930	5. Received by			
3. Relinquished by				6. Relinquished by			

Sandia National Laboratories

SF 2001-SCC (4-94)

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ENVIRONMENTAL PROGRAMS SAMPLE COLLECTION LOG

(Continuation)

SCL- 01637

AR/COC No.: AR/COC- 00802

PAGE 2 OF 2

Sample Number - Fraction	Time	LOCATION	COMMENTS	Sample Type Grab/Comp.	QC Sample (Y/N)	ANALYSES: TAL metals/Cr+6, TKN, NO3/NO2	VOC	BNA/TPH explosives-RES	TAL metals/Cr+6, cyanide, TKN, NO3/NO2	TPH/BNA	TAL metals/Cr+6, TKN, NO3/NO2		
017919-1	1109	Site 227-02-A	Surface soil 0-6"	C	N	X							
017919-5	1109	Site 227-02-B	Subsurface soil 6-36"	C	N		X						
017919-6	1125	Site 227-02-B	Subsurface soil 6-36"	C	N	X							
017920-8	1217	Site 227-03-B	Subsurface soil 6-36"	C	N		X						
017920-1	1218	Site 227-03-A	Surface soil 0-6"	C	N			X					
~~017920-7~~	~~1219~~	~~Site 227-03-A~~	~~Surface soil 0-6" (Duplicate)~~	~~C~~	~~Y~~								
017920-2	1225	Site 227-03-A	Surface soil 0-6"	C	N				X				
017920-13	1217	Site 227-03-B	Subsurface 6-36" (Duplicate)	C	Y				X				
017920-14	1217	Site 227-03-B	Subsurface soil 6-36" (Duplicate)	C	Y					X			
017920-9	1217	Site 227-03-B	Subsurface soil 6-36"	C	N			X					
017920-10	1217	Site 227-03-B	Subsurface soil 6-36"	C	N				X				
017921-1	1420	Site 227-04-A	Surface soil 0-6"	C	N	X					X		
017921-5	1427	Site 227-04-B	Subsurface soil 6-36"	C	N	X					X		
017921-8	1430	Site 227-04-B	Subsurface soil 6-36" (Duplicate)	C	~~N~~ Y		X						
017921-4	1430	Site 227-04-B	Subsurface soil 6-36"	C	N		X						
018093	1045	SITE 227	SOIL BLANK				X						

WHITE - To Sample Management Office   PINK - Originator

Sandia National Laboratories

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SF 2001-SCL (12-93)

ENVIRONMENTAL PROGRAMS SAMPLE COLLECTION LOG

SCL- 01637

AR/COC No.: AR/COC-00802

PAGE 1 OF 2

GENERAL INFORMATION	
DATE: 9/27/94	WEATHER: Sunny, Clear 80°F
SAMPLING PROCEDURE REFERENCE: SAP	
PURPOSE OF SAMPLING: Preliminary Investigation	

SAMPLING INFORMATION	
ON-SITE CONTACT: JAN CURTIS	ORG. 7582
PHONE: 505-848-0345	
AREA: 7309	LOCATION: Site 227

SAMPLE DESCRIPTION

MATRIX: ☐ GAS ☐ LIQUID ☐ SLUDGE ☐ SOLID ☐ WATER ☐ OIL ☒ SOIL ☐ HAZ WASTE ☐ OTHER

COLLECTED FROM: ☐ DRUM ☐ TANK ☐ SURFACE WATER ☒ SOIL ☐ WASTE WATER ☐ GROUND WATER ☐ OTHER

Sample Number - Fraction	Time	LOCATION	COMMENTS	Sample Type Grab/Comp.	QC Sample (Y/N)	TAL metals (Cr+6), Cyanide, TKN, NO3/NO2	BNA/TPH/Explosives-AES	VOC					
017918-2	1026	Site 227-01-A	Surface soil 0-6"	C	N	X							
017918-6	1026	Site 227-01-4	Surface soil 0-6" (Duplicate)	C	Y		X						
017918-1	1026	Site 227-01-A	Surface soil 0-6"	C	N		X						
017918-9	1030	Site 227-01-B	Subsurface soil 6-36"	C	N	X							
017918-8	1035	Site 227-01-B	Subsurface soil 6-36"	C	N		X						
017918-7	1043	Site 227-01-B	Subsurface soil 6-36"	C	N			X					
017918-12	1026	Site 227-01-B	Subsurface soil 6-36" (Duplicate)	C	Y			X					
017919-4	1109	Site 227-02-A	Surface soil 0-6" (Duplicate)	C	Y	X							

PROJECT	
PROJECT NAME: Tijeras Arroyo (Site 227)	CASE NUMBER: 3632.300
PROJECT CONTACT: Tim Brinkman	ORG. 7582
PHONE: 505-848-045	

*ADDITIONAL INFORMATION: (Log Book Ref. #)

SAMPLE TEAM MEMBERS

	NAME	SIGNATURE	INIT	COMPANY/ORGANIZATION
1.	Jan Curtis	Jan Curtis	JC	Weston
2.				
3.				

SAMPLE TRACKING

SAMPLE DISTRIBUTION: Encotec	TRANSPORTED BY: A44237	SPECIAL HANDLING:
DATE SHIPPED (MM-DD-YY): 9/30/94	DATA ENTERED (MM-DD-YY): 10-3-94	BY: [signature]

*N[illegible] Any additional sampling information must be recorded in an SNL-I[illegible]ed Log Book or SCL Continuation Form with a Reference No. entered [illegible]his space.

WHITE - To [illegible]le Management Office PINK - Originator ▓ TO BE COMP[illegible] BY SMO

Equipment blanks for Site 227, ER Site 235 & 229.

Sampled 9/30
Received 10/4

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

Project Name Tijeras Arroyo Site 235 Backgrd. Page 1 of 4
Case Number 3637.300
Sample Numbers 018080/081/083/082/084/085/086

AR/COC No. 932 Analytical laboratory ENCOTEC SDG No. T1-107
AR/COC No. ______ Analytical laboratory ______ SDG No. ______
AR/COC No. ______ Analytical laboratory ______ SDG No. ______
AR/COC No. ______ Analytical laboratory ______ SDG No. ______

In the tables below, mark any information that is missing or incorrect.

1.0 Sample Collection Log

Item	Complete? Yes	Complete? No	Corrected? Yes	Corrected? No[a]
Date	✓			
Sheet number and total number of sheets below	✓			
General information	✓			
Sample description	✓			
Sample ID number(s) and fraction number(s)		✓		
Location	✓			
Time of sample collection	✓			
Sample type	✓			
Depth below surface	✓			
QC sample?[b]	✓			
Comments	✓			
Analyses requested	✓			
Project information	✓			
Project name	✓			
Case number/service order number	✓			
Contact information	✓			
Turnaround time	✓			
Regulatory program	✓			
Special QC requirements	✓			
Sample team member(s), their signature(s), and initials	✓			
Sample tracking information (the "Data Entered" and "By" spaces may be empty)	✓			

[a] Describe any uncorrected deficiencies in Section 5.0, "Completeness Assessment," below.
[b] Comments are only required for QC samples; for other samples, this item can be blank.

Reviewed by: Dave Sahlert

Date: 11-10-94

INFORMATION COPY

SHEARS # 49265

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

2.0 Analysis Request and Chain of Custody Record

Item	Complete?		Corrected?	
	Yes	No	Yes	No[a]
Page number and total number of pages	✓			
Project information	✓			
Sample shipping information	✓			
Contract and case number	✓			
SMO authorization signature	✓			
Location information	✓			
Sample number(s)/fraction number(s)	✓	✓		
Sample ID information	✓			
Date/time sample(s) collected	✓			
Sample matrix	✓			
Container type(s)	✓			
Sample volume	✓			
Preservative (chemical and/or thermal)	✓			
Sample collection method	✓			
Sample type	✓			
Required analytical testing	✓			
Sample information	✓			
Special instruction/QC requirements	✓			
Custody records	✓			
Lab sample number	✓			
Condition upon receipt	✓			

[a] Describe any uncorrected deficiencies in Section 5.0 "Completeness Assessment" below.

3.0 Document Comparison

Item	Complete?		Corrected?	
	Yes	No	Yes	No[a]
Dates on Sample Collection Log and AR/COC agree.	✓			
Sample team members on the Sample Collection Log and the AR/COC agree.	✓			
Sample ID numbers on Sample Collection Log and AR/COC agree.	✓			
Date and time on Sample Collection Log and AR/COC agree.	✓			
Analyses requested on AR/COC agree with those shown on Sample Collection Log.	✓			
Project information on Sample Collection Log and AR/COC agree.	✓			
The sample location on the Sample Collection Log agrees with the AR/COC and project- specific plan requirements or authorized changes to the plan(s).	?			
The number of investigative and QC samples collected was that specified in the project-specific plan(s) or authorized changes to the plan(s).	?			
The analyses requested on the AR/COC were those specified in the project-specific plan(s) or authorized changes to the plan(s).	?			

[a] Describe any uncorrected deficiencies in Section 5.0, "Completeness Assessment," below.

Reviewed by: [signature] Date: 11-10-94

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

4.0 Analytical Laboratory Report

Item	Complete? Yes	Complete? No	Corrected? Yes	Corrected? No[a]
Data reviewed, signature	✓			
Date samples received	✓			
Method reference number(s)	✓			
Quality control data	✓			
Matrix spike/matrix spike duplicate data	✓			
Narrative complete	✓			

[a] Describe any uncorrected deficiencies in Section 5.0 "Completeness Assessment" below.

5.0 Completeness Assessment For each section below, mark the appropriate box and describe any problems that remain unresolved.

5.1 Sample Collection Log

	Yes	No
All boxes on the Sample Collection Log are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☑	☐

If any boxes have been checked no, describe problem and resolution:

(1) Eastion numbers used for xyz locations not analysis request

5.2 Analysis Request And Chain Of Custody Record AR/COC

	Yes	No
All boxes on the AR/COC review are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☑	☐

If any boxes have been checked no, describe problem and resolution:

See 5.1(1)

Reviewed by: Doug Salmi
Date: 11-10-94

Site 235
+
BH 6, 11, 12
- Rinsate Blank

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

5.3 Document Comparison

	Yes	No
All boxes on the Document Comparison are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☑	☐

If any boxes have been checked no, describe problem and resolution:
Without SAP the boxes marked "?" could not be answered
Samples 018086-1 and 86-2 were received as water samples (rinsate) instead of soil samples. (see lab narrative)

5.4 Analytical Laboratory Report

	Yes	No
All boxes on the Lab Report review are complete:	☐	☐
Some boxes have been checked no; all problems are resolved.	☐	☐

If any boxes have been checked no, describe problem and resolution:

BASED ON THE REVIEW, DOCUMENTATION IS COMPLETE: ☐ Yes ☐ No

Reviewed by: [signature] Approved by:*
Date: 11-10-94 Date:

* Task/Project Leader must approve data package.

COMMENTS:

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

2.0 COMMENTS CONTINUATION SHEET

Reviewed by: Doug Selm

Date: 11-10-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

3.0 SUMMARY: Summarize the findings in the table below. List only samples/fractions for which deficiencies have been noted. Use the qualifiers given at the end of the table if possible. Explain any other qualifiers in the comments column.

Sample/ Fraction No.	Analysis	Qualifiers	Comments
018081-6	VOC	JB	2 Butanone
018083-8	"	"	"
018082-3	"	"	"
018082-4	"	"	"
018084-5	"	"	"
018086-1	"	"	"
018086-2	"	"	"

Attach continuation sheet for additional samples

QUALIFIERS:

J = Estimated quantity (provide reason)
B = Contamination in blank (indicate which blank)
P = Laboratory precision does not meet criteria
R = Reporting units inappropriate
N = There is presumptive evidence of the presence of the material
UJ = The material was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
Q = Quantitation limit does not meet criteria
A = Laboratory accuracy does not meet criteria
U = Analyte is undetected (indicate which analyte and reason for qualification)
NJ = There is presumptive evidence of the presence of the material at an estimated quantity.

Reviewed by: Doug Salmi

Date: 11-10-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

Project Name ______________________ Page 1 of 5

Case Number 3632.300

Sample Numbers 018080/081/083/082/084/085/086

AR/COC No. 932 Analytical laboratory ENSOTEC SDG No. TK102

AR/COC No. ______ Analytical laboratory ______ SDG No. ______

AR/COC No. ______ Analytical laboratory ______ SDG No. ______

AR/COC No. ______ Analytical laboratory ______ SDG No. ______

1.0 EVALUATION

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
1) Sample volume, container, and preservation correct?		✓	018081-6 was received in a 150 ml glass jar instead of 500 ml jar indicated on COC
2) Holding times met for all samples?		✓	018083-2 received at 4x hold time
3) Reporting units appropriate for the matrix and meet project-specific requirements?	✓		
4) Quantitation limit met for all samples?	✓		
5) Accuracy a) Laboratory control sample accuracy reported and met for all samples?	✓		
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique?	✓		

Reviewed by: [signature]

Date: 11-10-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
c) Matrix spike recovery data reported and met for all samples for which it was requested?	NA		—
6) Precision a) Laboratory control sample precision reported and met for all samples?	✓		
b) Matrix spike duplicate RPD data reported and met for all samples for which it was requested?	✓		
7) Blank data a) Method or reagent blank data reported and met for all samples?	✓		
b) Sampling blank (e.g., field, trip, and equipment) data reported and met?	✓		
8) Narrative included, correct, and complete?	✓		

2.0 COMMENTS: All items marked "No" above must be explained in this section. For each item, give SNL/NM ID No. and the analysis, if appropriate, of all samples affected by the finding.

Reviewed by: Dony Sathre

Date: 11-10-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

SAMPLE FINDINGS SUMMARY CONTINUATION SHEET

Sample/ Fraction No.	Analysis	Qualifiers	Comments

Reviewed by: Doug Salmi Approved by:* ____________

Date: 11-10-94 Date: ____________

*Task/Project Leader must approve data package.

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SF 2001-COC (12-93)

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

AR/COC- 00932

PAGE 1 OF 1

Department No.: 7582
Project/Task Manager: Jim Brinkman
Project Name: Tijeras Arroyo
Sample Team Members:

SCL or Logbook Ref. No.: 01762

Date Samples Shipped:
Carrier/Waybill No.:
Lab Destination:
Lab Contact:
SMO Contact/Phone:
Send Report to SMO:
SMO Reference No.:

SMO USE ONLY

Bill to: Sandia National Laboratories
Supplier Services Department
P.O. Box 5800 MS 0154
Albuquerque, NM 87185-0154

Contract No.: 67-0236 A
Case No.: 3632.380
SMO Authorization: D M

Sample Number - Fraction	Sample Matrix	Date/Time Collected	Container Type	Sample Volume	Preservative	Required Analytical Testing	Lab Sample Number	Condition on Receipt
018080-2	Soil	9/30/94 1015	Glass	500 ml	4°c	TAL Metals (6010/7000)	FOR LAB USE ONLY	
018080-5	↓	1012	↓	↓	↓	TAL Metals (6010/7000)		
018081-5		1102				TAL Metals, Cr^{+6} *		
018081-1		1105				TAL Metals Cr $^{+6}$ *		
018081-2		1106				TPH (8015), RNA (8270)		
018081-7		1104				TPH/RNA		
018081-8		1104				TAL Metals / Cr^{+6} *		
018081-10		1104				TPH		
018081-6	↓	1104	↓	↓	↓	VOC (8240)		
018083-5	Water	1300	Glass	1 Liter	Hcl	TPH		
018083-6	Water	↓ 1300	Poly	1 liter	NaoH	Cyanide		

Possible Hazard Identification
☒ Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Radiological

*Reference attached radiological screening for specific contact readings.

Turnaround Time
☒ Normal ☐ Rush _______ Required Report Date ________

Special Instructions/QC Requirements

Sample Disposal
☐ Return to Client ☒ Disposal by Lab / Archive Until

		Org.	Date	Time
1. Relinquished by	Jim B[illegible]	7582	10/3/94	1120
1. Received by	[signature]	SMO 7576	10/3/94	11:20
2. Relinquished by	[signature]	SMO-7576	10/3/94	1400
2. Received by				
3. Relinquished by				
3. Received by				
4. Relinquished by				
4. Received by				
5. Relinquished by				
5. Received by				
6. Relinquished by				
6. Received by				

National Laboratories

SF 2001-COD (12-93)

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD
(continuation)

AR/COC- 00805-5

PAGE 2 OF 2

Site 235 + BKG

Project Name: Tijeras Arroyo

Project/Task Manager: Jim Brinkman

Case No.: 3632.300

Sample Number - Fraction	Sample Matrix	Date/Time Collected	Container Type	Sample Volume	Preservative	Required Analytical Testing	FOR LAB USE ONLY
018083-4	Water	9/13/99 1300	Poly	500	Sulfuric Acid	TKN/NO3/NO2	
018083-2	Water	1300	Poly	250	4°C	Cr+6	
018083-3		1300	Poly	1 liter	Nitric Acid	TAL Metals	
018083-1		1300	Glass	2 liter	4°C	BNA, explosives, PCB	
018083-7		1300	Glass	40 ml	HCl	VOC	
018083-8		1300	Glass	40 ml	HCl	VOC	
018082-2	Soil	1435	Glass	500	4°C	TPH	
018082-1		1435				TAL metals / Cr+6 *	
018082-7		1435				TPH	
018082-5		1435				TAL metals / Cr+6 *	
018082-6		1435				TPH	
018082-3		1435	SS	150		VOC	
018082-4		1435	S.S.	150		VOC	
018084-1		1515	Glass	500		TPH/BNA	
018084-2		1520				TAL metals / Cr+6 *	
018084-7		1520				TPH/BNA	
018084-6		1520				TAL metals / Cr+6 *	
018084-5		1520	S.S.	150		VOC	
018085-1		1600	Glass	500		TAL Metals	
018085-4		1600				TAL Metals	
018086-1		1615	S.S.	150		VOC	
018086-2		1615	S.S.	150		VOC	

Sandia National Laboratories

SF 2001-SCC (4-94)

Encotec

ENVIRONMENTAL PROGRAMS SAMPLE COLLECTION LOG

(Continuation)

SCL- 01762

AR/COC No.: AR/COC- ~~00805~~ 00932

PAGE 3 OF 3

Sample Number - Fraction	Time	LOCATION	COMMENTS	Sample Type Grab/Comp.	QC Sample (Y/N)	ANALYSES: VOC	TAL metals						
018084-5	1520	Site 235-03-B	Subsurface ~~Soil~~ 6-36"	C	N	X							
~~01808~~ (JC)													
018085-1	16:00	~~Site 235~~ (JC) BKG-11-A	Surface Soil 0-6"	C	N		X						
018085-4	1600	BKG-11-B	Subsurface Soil 6-36"	C	N		X						
018086-1	1615	D.I. Rinse water	—	G	N	X							
018086-2	1615	D.I. Rinse water		G	N	X							

WHITE - To Sample Management Office PINK - Originator

SF 2001-SCC (4-94) back

SAMPLE COLLECTION LOG (CONTINUATION) COMPLETION INSTRUCTIONS

SCL NUMBER SECTION

SCL- : Enter SCL number that is pre-printed on page one.

AR/COC NO./PAGE NUMBER

AR/COC NO.: Enter Analytical Request/Chain of Custody Form Reference number from page one of SCL.
PAGE___ OF___: Enter the page number of this sheet and total number of pages.

SAMPLE DESCRIPTION SECTION

SAMPLE NUMBER-FRACTION: Enter the Sandia sample identification number and fraction number of container.

TIME: Enter the time of sample collection.

LOCATION (SAMPLE POINT): Describe the exact location at which the sample was collected at the general site (e.g. drum number or "NE corner").

COMMENTS: Include sufficient information to reconstruct entire sampling event. If more room is needed use SCL continuation form (Form No. SF 2001-SCM).

SAMPLE TYPE: Enter "C" if sample type is composite; Enter "G" if sample type is a grab sample.

QC SAMPLE: Enter Y (yes) if the sample is a duplicate or blank; other wise enter N (no).

ANALYSES: Check all the appropriate columns.

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SF 2001-SCL (12-93)

ENVIRONMENTAL PROGRAMS
SAMPLE COLLECTION LOG

SCL- 01762 J

AR/COC No.: AR/COC- ~~00805~~ 00732 JC

PAGE ___ OF ___

GENERAL INFORMATION

DATE: 9/30/94 WEATHER: Sunny/Clear 80° F

SAMPLING PROCEDURE REFERENCE: SAP

PURPOSE OF SAMPLING: Preliminary Investigation

SAMPLING INFORMATION

ON-SITE CONTACT: JAN CURTIS ORG.: 7582 PHONE: 505-263-3390

AREA: 1309 LOCATION: (JC) ~~S~~ Background - 12 / Site 235

SAMPLE DESCRIPTION

MATRIX: ☐ GAS ☐ LIQUID ☐ SLUDGE ☐ SOLID ☐ WATER ☐ OIL ☒ SOIL ☐ HAZ WASTE ☐ OTHER ______

COLLECTED FROM: ☐ DRUM ☐ TANK ☐ SURFACE WATER ☒ SOIL ☐ WASTE WATER ☐ GROUND WATER ☐ OTHER ______

Sample Number - Fraction	Time	LOCATION	COMMENTS	Sample Type Grab/Comp.	QC Sample (Y/N)	TAL metals	TAL metals/CH	TCH/BJA	TPH				
018080-2	1015	BKG-12-A	Surface soil 0-6"	C	N	X							
018080-5	1012	BKG-12-B	Subsurface 6-36"	C	N	X							
018081-5	1102	Site 235-01-A	Surface Soil 0-6" (Duplicate)	C	Y		X						
018081-1	1105	Site 235-01-A	Surface Soil 0-6"	C	N		X						
018081-2	1106	Site 235-01-A	Surface soil 0-6"	C	N			X					
018081-7	1104	Site 235-01-B	Subsurface Soil 6-36"	C	N			X					
018081-8	1104	Site 235-01-B	Subsurface Soil 6-36"	C	N		X						
018081-10	1104	Site 235-01-B	Subsurface Soil 6-36" (Duplicate)	C	Y				X				

PROJECT PROJECT NAME: Tijeras Arroyo CASE NUMBER: 3632.300 PROJECT CONTACT: Jim Brinkman ORG.: 7582 PHONE: 505-848-0455

*ADDITIONAL INFORMATION: (Log Book Ref. #)

SAMPLE TEAM MEMBERS

	NAME	SIGNATURE	INIT	COMPANY/ORGANIZATION
1.	Jan Curtis	Jan M. Curtis	JC	Weston
2.				
3.				

SAMPLE TRACKING

SAMPLE DISTRIBUTION: Encotec TRANSPORTED BY: A 44236 SPECIAL HANDLING:

DATE SHIPPED (MM-DD-YY): 10/3/94 DATA ENTERED (MM-DD-YY): 10-12-94 BY: [signature]

*NOTE: Any additional sampling information must be recorded in an SNL-Issued Log Book or SCL Continuation Form with a Reference No. entered in this space.

WHITE - To Sample Management Office PINK - Originator

SF 2001-SCC (4-94) back

SAMPLE COLLECTION LOG (CONTINUATION) COMPLETION INSTRUCTIONS

SCL NUMBER SECTION

SCL- : Enter SCL number that is pre-printed on page one.

AR/COC NO./PAGE NUMBER

AR/COC NO.: Enter Analytical Request/Chain of Custody Form Reference number from page one of SCL.
PAGE___ OF___: Enter the page number of this sheet and total number of pages.

SAMPLE DESCRIPTION SECTION

SAMPLE NUMBER-FRACTION: Enter the Sandia sample identification number and fraction number of container.

TIME: Enter the time of sample collection.

LOCATION (SAMPLE POINT): Describe the exact location at which the sample was collected at the general site (e.g., drum number or "NE corner").

COMMENTS: Include sufficient information to reconstruct entire sampling event. If more room is needed use SCL continuation form (Form No. SF 2001-SCM).

SAMPLE TYPE: Enter "C" if sample type is composite; Enter "G" if sample type is a grab sample.

QC SAMPLE: Enter Y (yes) if the sample is a duplicate or blank; other wise enter N (no).

ANALYSES: Check all the appropriate columns.

SAMPLE COLLECTION LOG COMPLETION INSTRUCTIONS

NOTE: This log is to be used for the collection of sample(s) from a single site and the same matrix.

AR/COC NO./PAGE NUMBER

AR/COC NO.: Enter Analytical Request/Chain of Custody Form reference number.
PAGE_OF_: Enter the page number of this sheet and the total number of pages.

GENERAL INFORMATION

DATE: Enter the date of sample collection in the form mm/dd/yy (e.g., 01/13/91).
WEATHER: Include approximate cloud cover, precipitation, winds and approximate temperature.
SAMPLING PROCEDURE REFERENCE: Reference sampling of field operating procedure used.
PURPOSE OF SAMPLING: Enter the purpose of sampling activity.

SAMPLING INFORMATION

ON-SITE CONTACT: Enter the name of the line organization staff responsible for the material sampled.
ORG.: Enter the Sandia organization number of the contact person.
PHONE: Enter the phone number of the contact person.
AREA: Enter the Sandia Technical Area from which the sample was collected.
LOCATION: Enter location of Sampling Site, Reference Log Book or SCL continuation form of map or drawing of sampling site.

SAMPLE DESCRIPTION

GENERAL: Check the most appropriate box in both sections.

ANALYSES:

Enter all the analyses to be conducted on the samples. For example, if one sample will be analyzed for metals and another for oil and grease, list both analyses.

SAMPLE DESCRIPTON SECTION

SAMPLE NUMBER-FRACTION: Enter the Sandia sample identification number and fraction number of container.
TIME: Enter the time of sample collection.
LOCATION: Describe the exact location at which the sample was collected at the general site (e.g., drum number or "NE corner").
SAMPLE TYPE: Enter "C" if sample type is composite, Enter "G" if sample type is a grab sample.
QC SAMPLE: Enter Y (yes) if the sample is a duplicate or blank; otherwise enter N (no).
ANALYSES: Check all the appropriate column(s).
COMMENTS: Incude sufficient information to reconstruct entire sampling event. *If more room is needed use SCL continuation form.*

PROJECT

PROJECT NAME: Enter the Sandia project name.
CASE NUMBER: Enter the Sandia case number.
PROJECT CONTACT: Enter the name of the person who should receive the laboratory report.
ORG.: Enter the organization number of the person receiving the laboratory report.
PHONE: Enter the phone number of the person receiving the laboratory report.

SAMPLE TEAM MEMBERS

NAME: Print the name(s) of the sampling team member(s).
[illegible] the sampling team member(s).

Sandia National Laboratories

SF 2001-SCC (4-94)

ENCOTEC

ENVIRONMENTAL PROGRAMS SAMPLE COLLECTION LOG

(Continuation)

SCL- 01762

AR/COC No.: AR/COC 00805 00932

PAGE 2 OF 3

Sample Number - Fraction	Time	LOCATION	COMMENTS	Sample Type Grab/Comp.	QC Sample (Y/N)	VOC	TPH	Cyanide	TKN/NO3/NO2	Cr+6	TAL metals	BNA/explosives/PCB	VOC (4)
018081-6	1104	Site 235-01-B	Subsurface 6-36"	C	N	X							
018083-5	1300	Site 235	Rinsate	G	Y		X						
018083-6	1300	Site 235	Rinsate	G	Y			X					
018083-4	1300	Site 235	Rinsate	G	Y				X				
018083-2	1300	Site 235	Rinsate	G	Y					X			
018083-3	1300	Site 235	Rinsate	G	Y						X		
018083-1	1300	Site 235	Rinsate	G	Y							X	
018083-7	1300	Site 235	Rinsate	G	Y	X							X
018083-8	1300	Site 235	Rinsate	G	Y	X							X
018082-2	1435	Site 235-02-A	Surface soil 0-6"	C	N		X						
018082-1	1435	Site 235-02-A	Surface Soil 0-6"	C	N					X	X		
018082-7	1435	Site 235-02-B	Subsurface 6-36" (Duplicate)	C	Y		X						
018082-5	1435	Site 235-02-B	Subsurface 6-36"	C	N					X	X		
018082-6	1435	Site 235-02-B	Subsurface 6-36"	C	N		X						
018082-3	1435	Site 235-02-B	Subsurface 6-36"	C	N	X							
018082-4	1435	Site 235-02-B	Subsurface 6-36" (Duplicate)	C	Y	X							
018084-1	1515	Site 235-03-A	Surface 0-6'	C	N								X
018084-2	1520	Site 235-03-A	Surface 0-6'	C	N					X	X		
018084-7	1520	Site 235-03-B	Subsurface 6-36"	C	N								X
0180[illegible]-6	1520	Site 235-03-B	Sub[illegible]ce 6-36"	C	N					X	X		

WHITE - To Sample Management Office PINK - Originator

Sandia National Laboratories

? 2001-COC (12-93)

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

940518

AR/COC- 00934

PAGE 1 OF 1

Department No.: 7582
Project/Task Manager: Jim Brinkman
Project Name: Tijeras Arroyo Site 235
Sample Team Members: Jan Curtis

SCL or Logbook Ref. No.: 01763

Date Samples Shipped: 10/3/94
Carrier/Waybill No.:
Lab Destination: [illegible]
Lab Contact: [illegible]
SMO Contact/Phone: [illegible]
Send Report to SMO: [illegible]
SMO Reference No.:

SMO USE ONLY

Bill to: Sandia National Laboratories
Supplier Services Department
P.O. Box 5800 MS 0154
Albuquerque, NM 87185-0154

Contract No.: N/A
Case No.: 3632.300
SMO Authorization: [illegible]

Sample Number - Fraction	Sample Matrix	Date/Time Collected	Container Type	Sample Volume	Preservative	Required Analytical Testing	Lab Sample Number	Condition on Receipt
018080-3	soil	9/20/94 1015	marinelli	500	None	Gamma Spec	FOR LAB USE ONLY	
018080-6	↓	1013	↓	↓	↓	↓		
018081-3	↓	1100	↓	↓	↓	↓		
018081-9	↓	1104	↓	↓	↓	↓		
018084-3	↓	1515	↓	↓	↓	↓		
018084-8	↓	1520	↓	↓	↓	↓		
018095-2	↓	1600	↓	↓	↓	↓		
018085-5	↓	1600	↓	↓	↓	↓		
018083-9	Water	↓ 1300	↓					

Possible Hazard Identification
☒ Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Radiological

*Reference attached radiological screening for specific contact readings.

Turnaround Time
☒ Normal ☐ Rush ______ Required Report Date ______

Special Instructions/QC Requirements

INFORMATION ONLY

Sample Disposal
☒ Return to Client ☐ Disposal by Lab Archive Until ______

	Org.	Date	Time		Org.	Date	Time
1. Relinquished by [signature]	7582	10/3/94	1125	4. Relinquished by			
1. Received by [signature]	SMO-7576	10/3/94	1125	4. Received by			
2. Relinquished by [signature]	SMO-7576	10/3/94	1423	5. Relinquished by			
2. Received by [signature]	SNL 7715	10/3/94	1423	5. Received by			
3. Relinquished by [signature]	SNL 7715	10/6/94	1419	6. Relinquished by			
3. Received by [signature]	[illegible]	10/6/94	1419	6. Received by			

Sandia National Laboratories

in-house

F 2001-SCL (12-93)

ENVIRONMENTAL PROGRAMS
SAMPLE COLLECTION LOG

SCL- 01763

AR/COC No.: ~~AR/COC 00805-4~~ 00934

PAGE 1 OF 2

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GENERAL INFORMATION

DATE: 9/30/94 WEATHER: Sunny/Clear 80°F

SAMPLING PROCEDURE REFERENCE: SAP

PURPOSE OF SAMPLING: Preliminary Investigation

SAMPLING INFORMATION

ON-SITE CONTACT: JAN CURTIS ORG: 7582 PHONE: 505-263-3390

AREA: 1307 LOCATION: Site 235 + BKG 12

SAMPLE DESCRIPTION

MATRIX: ☐ GAS ☐ LIQUID ☐ SLUDGE ☐ SOLID ☐ WATER ☐ OIL ☒ SOIL ☐ HAZ WASTE ☐ OTHER

COLLECTED FROM: ☐ DRUM ☐ TANK ☐ SURFACE WATER ☒ SOIL ☐ WASTE WATER ☐ GROUND WATER ☐ OTHER

Sample Number - Fraction	Time	LOCATION	COMMENTS	Sample Type Grab/Comp.	QC Sample (Y/N)	ANALYSES: Gamma Spec							
018080-3	1015	BKG-12-A	Surface soil 0-6"	C	N	X							
018080-6	1012	BKG-12-B	Subsurface soil 6-36"	C	N	X							
018081-3	1100	Site 235-01-A +	Surface soil 0-6"	C	N	X							
018081-9	1104	Site 235-01-B	Subsurface soil 6-36"	C	N	X							
018083-9	1300	Site 235	Rinsate	G	Y	X							
018084-3	1515	Site 235-03-A	Surface soil 0-6"	~~G~~ C JC	N	X							
018084-8	1520	Site 235-03-B	Subsurface soil 6-36"	C	N	X							
018085-2	1600	BKG-11-A	Surface soil 0-6"	C	N	X							

PROJECT

PROJECT NAME: Tijeras Arroyo CASE NUMBER: 3632.300 PROJECT CONTACT: Jim Brinkman ORG: 7582 PHONE: 505-848-0455

*ADDITIONAL INFORMATION: (Log Book Ref. #)

SAMPLE TEAM MEMBERS

	NAME	SIGNATURE	INIT	COMPANY/ORGANIZATION
1.	Jan Curtis	Jan Curtis	JC	Weston
2.				
3.				

SAMPLE TRACKING

SAMPLE DISTRIBUTION: SNL 7715 lab TRANSPORTED BY: HC SPECIAL HANDLING:

DATE SHIPPED (MM-DD-YY): 10/3/94 DATA ENTERED (MM-DD-YY): 10-11-94 BY: [signature]

*NOTE: Any additional sampling information must be recorded in an SNL-Issued Log Book or SCL Continuation Form with a Reference No. entered in this space.

WHITE - To Sample Management Office PINK- Originator ▒ TO BE COMPLETED BY SMO

```
***********************************************************************
* SNL Radiation Sample Diagnostic Program (7715)/881  04-OCT-94 10:02:07 *
***********************************************************************
J.BRINKMAN/E.RANKIN (7582/SMO)  018083-9

Operator: ____________ 10/6/94    Reviewed by ____ 10/6/94

***********************************************************************
                                         *
Data File   : 94051805.DAT               * Sample Quantity: 500.000  ML
Acquire Date: 04-OCT-94 08:17:02         * Efficiency File: WMAR1.EFF
Sample  Date: 30-SEP-94 13:00:00         * Library    File: RSDP.LIB
Sample  Type: LIQUID                     *
***********************************************************************
                                         *
Preset  Live Time: 6000.0  sec           * FWHM at 1332 KeV        : 2.0  KeV
Elapsed Live Time: 6000.0  sec           * Peak Search Sensitivity: 4.0
Elapsed Real Time: 6000.0  sec           * Gaussian Assymetry      : 10.0 %
***********************************************************************
                                         *
Detector    : DET1                       * Fit Iterations   : 20.
Calib Date  : 30-AUG-94 09:23:06         * Energy Tolerance: 1.5  KeV
KeV/Channel: .36608                      * Half Life Ratio  : 8.0
Offset      : -.14939                    * Abundance Limit  : 50.00 %
***********************************************************************

[Summary Report      -- SNL (7715) --       version 1.2]
```

Nuclide	Activity (PCI /ML)	2-sigma Error	MDA (PCI /ML)
U-238	Not Detected	--------	1.91E-01
TH-234	Not Detected	--------	1.92E-01
U-234	Not Detected	--------	3.66E+00
RA-226	Not Detected	--------	3.27E-01
PB-214	Not Detected	--------	2.74E-02
BI-214	Not Detected	--------	2.36E-02
PB-210	Not Detected	--------	0.00E+00
TH-232	Not Detected	--------	5.39E-02
RA-228	Not Detected	--------	5.39E-02
AC-228	Not Detected	--------	4.86E-02
TH-228	Not Detected	--------	2.46E-02
RA-224	Not Detected	--------	2.54E-01
PB-212	Not Detected	--------	2.47E-02
BI-212	Not Detected	--------	9.05E-02
TL-208	Not Detected	--------	3.29E-02
U-235	Not Detected	--------	2.02E-02
TH-231	Not Detected	--------	1.31E-01
PA-231	Not Detected	--------	3.84E-01
AC-227	Not Detected	--------	7.00E-01
TH-227	Not Detected	--------	7.75E-02
AM-241	Not Detected	--------	4.80E-02
NP-237	Not Detected	--------	7.59E-02
PA-233	Not Detected	--------	2.50E-02
TH-229	Not Detected	--------	4.36E-02

ID: J.BRINKMAN/E.RANKIN (7582/SMO) 018083-9

Nuclide	Activity (PCI /ML)	2-sigma Error	MDA (PCI /ML)
PU-239	Not Detected	---------	1.27E+02
AG-110	Not Detected	---------	9.83E-03
BE-7	Not Detected	---------	7.75E-02
AR-41	Short Half-Life	---------	---------
BA-133	Not Detected	---------	1.34E-02
BA-140	Not Detected	---------	4.09E-02
BI-207	Not Detected	---------	1.35E-02
CD-109	Not Detected	---------	2.70E-01
CE-139	Not Detected	---------	1.11E-02
CE-144	Not Detected	---------	8.44E-02
CO-56	~~4.35E-02~~	~~1.62E-02~~	~~---------~~ DJM 10/16/94 (N.D.
CO-57	Not Detected	---------	1.04E-02
CO-58	Not Detected	---------	1.21E-02
CO-60	Not Detected	---------	1.31E-02
CR-51	Not Detected	---------	1.01E-01
CS-134	Not Detected	---------	9.65E-03
CS-137	Not Detected	---------	1.10E-02
CU-64	Not Detected	---------	6.24E+02
EU-152	Not Detected	---------	3.10E-02
EU-154	Not Detected	---------	4.79E-02
EU-155	Not Detected	---------	4.44E-02
FE-59	Not Detected	---------	1.60E-02
GD-153	Not Detected	---------	3.11E-02
HG-203	Not Detected	---------	1.30E-02
I-125	Not Detected	---------	0.00E+00
I-129	Not Detected	---------	0.00E+00
I-131	Not Detected	---------	1.59E-02
IN-115M	Short Half-Life	---------	---------
IR-192	Not Detected	---------	1.02E-02
K-40	4.72E-01	1.76E-01	---------
LA-140	Not Detected	---------	4.64E-02
MN-54	Not Detected	---------	1.36E-02
MN-56	Short Half-Life	---------	---------
NA-22	Not Detected	---------	1.14E-02
NA-24	Not Detected	---------	6.99E-01
NB-95	Not Detected	---------	7.54E-02
RU-103	Not Detected	---------	1.02E-02
RU-106	Not Detected	---------	7.75E-02
SB-124	Not Detected	---------	9.56E-03
SB-125	Not Detected	---------	2.48E-02
SB-126	Not Detected	---------	8.30E-03
SC-46	Not Detected	---------	1.10E-02
SN-113	Not Detected	---------	1.32E-02
SR-85	Not Detected	---------	8.57E-03
TA-182	Not Detected	---------	7.58E-02
TE-123M	Not Detected	---------	1.17E-02
TL-201	Not Detected	---------	2.14E-01
XE-133	Not Detected	---------	4.94E-02
Y-88	Not Detected	---------	1.31E-02
ZN-65	Not Detected	---------	2.25E-02
ZR-95	Not Detected	---------	2.02E-02

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

Project Name Tijeras Arroyo Site 235
Case Number 3632.300
Sample Numbers 018080, 018081, 018083, 018084, 018085

AR/COC No. 00933 Analytical laboratory Quanterra SDG No. 63[illegible]
AR/COC No. ______ Analytical laboratory ______ SDG No. ______
AR/COC No. ______ Analytical laboratory ______ SDG No. ______
AR/COC No. ______ Analytical laboratory ______ SDG No. ______

In the tables below, mark any information that is missing or incorrect.

1.0 Sample Collection Log

Item	Complete? Yes	Complete? No	Corrected? Yes	Corrected? No
Date	✓			
Sheet number and total number of sheets below	✓			
General information	✓			
Sample description	✓			
Sample ID number(s) and fraction number(s)	✓			
Location	✓			
Time of sample collection	✓			
Sample type	✓			
Depth below surface	✓			
QC sample?[a]	✓			
Comments	✓			
Analyses requested	✓			
Project information				
Project name	✓			
Case number/service order number	✓			
Contact information	✓			
Turnaround time	NA			
Regulatory program	NA			
Special QC requirements	NA			
Sample team member(s), their signature(s), and initials	✓			
Sample tracking information (the "Data Entered" and "By" spaces may be empty)	✓			

[a] Describe any uncorrected deficiencies in Section 5.0, "Completeness Assessment," below.
[b] Comments are only required for QC samples; for other samples, this item can be blank.

Reviewed by: MB Garcia

Date: 12-7-94

INFORMATION COPY

SHEARS # 49764

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

2.0 Analysis Request and Chain of Custody Record

Item	Complete? Yes	Complete? No	Corrected? Yes	Corrected? No[a]
Page number and total number of pages	✓			
Project information	✓			
Sample shipping information	✓			
Contract and case number	✓			
SMO authorization signature	✓			
Location information	✓			
Sample number(s)/fraction number(s)	✓			
Sample ID information	✓			
Date/time sample(s) collected	✓			
Sample matrix	✓			
Container type(s)	✓			
Sample volume	✓			
Preservative (chemical and/or thermal)	✓			
Sample collection method	N/A			
Sample type	✓			
Required analytical testing	✓			
Sample information	✓			
Special instruction/QC requirements	✓			
Custody records				
Lab sample number		✓		✓
Condition upon receipt		✓		✓

[a] Describe any uncorrected deficiencies in Section 5.0 "Completeness Assessment" below.

3.0 Document Comparison

Item	Complete? Yes	Complete? No	Corrected? Yes	Corrected? No[a]
Dates on Sample Collection Log and AR/COC agree.	✓			
Sample team members on the Sample Collection Log and the AR/COC agree.	✓			
Sample ID numbers on Sample Collection Log and AR/COC agree.	✓			
Date and time on Sample Collection Log and AR/COC agree.	✓			
Analyses requested on AR/COC agree with those shown on Sample Collection Log.	✓			
Project information on Sample Collection Log and AR/COC agree.	✓			
The sample location on the Sample Collection Log agrees with the AR/COC and project-specific plan requirements or authorized changes to the plan(s).				
The number of investigative and QC samples collected was that specified in the project-specific plan(s) or authorized changes to the plan(s).				
The analyses requested on the AR/COC were those specified in the project-specific plan(s) or authorized changes to the plan(s).				

To Be Completed By Task Mgr. MBG

[a] Describe any uncorrected deficiencies in Section 5.0 "Completeness Assessment" below.

Reviewed by: MBGarcia

Date: 12-7-94 MBG

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

4.0 Analytical Laboratory Report

Item	Complete? Yes	Complete? No	Corrected? Yes	Corrected? No[a]
Data reviewed, signature	✓			
Date samples received	✓			
Method reference number(s)	✓			
Quality control data	✓			
Matrix spike/matrix spike duplicate data	✓			
Narrative complete	✓			

[a] Describe any uncorrected deficiencies in Section 5.0 "Completeness Assessment" below.

5.0 Completeness Assessment

For each section below, mark the appropriate box and describe any problems that remain unresolved.

5.1 Sample Collection Log

	Yes	No
All boxes on the Sample Collection Log are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☐	☐

If any boxes have been checked no, describe problem and resolution:

5.2 Analysis Request And Chain Of Custody Record AR/COC

	Yes	No
All boxes on the AR/COC review are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☐	☐

If any boxes have been checked no, describe problem and resolution:

Reviewed by: *NBGarcia*

Date: 12-7-94

DOCUMENTATION COMPLETENESS CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 1—DV1)

5.3 Document Comparison

	Yes	No
All boxes on the Document Comparison are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☐	☐

If any boxes have been checked no, describe problem and resolution:

5.4 Analytical Laboratory Report

	Yes	No
All boxes on the Lab Report review are complete:	☑	☐
Some boxes have been checked no; all problems are resolved.	☐	☐

If any boxes have been checked no, describe problem and resolution:
the COC requests specific methods. These methods were not used by the lab.

BASED ON THE REVIEW, DOCUMENTATION IS COMPLETE: ☑ Yes ☐ No

Reviewed by: MBGarcia Approved by:*
Date: 12-7-94 Date:

* Task/Project Leader must approve data package.

COMMENTS: Level 2 review attached

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

Project Name Tijeras Arroyo Site 235 Page 1 of 5
Case Number 3632.300
Sample Numbers 018080, 018081, 018083, 018084, 018085

AR/COC No. 00933 Analytical laboratory Quanterra SDG No. 6351
AR/COC No. ______ Analytical laboratory ______ SDG No. ______
AR/COC No. ______ Analytical laboratory ______ SDG No. ______
AR/COC No. ______ Analytical laboratory ______ SDG No. ______

1.0 EVALUATION

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
1) Sample volume, container, and preservation correct?	✓		
2) Holding times met for all samples?	✓		
3) Reporting units appropriate for the matrix and meet project-specific requirements?	✓		
4) Quantitation limit met for all samples?		✓	Gamma Spec + Iso Pu 018080, 018081, 018084, 018085 018080, 018083
5) Accuracy a) Laboratory control sample accuracy reported and met for all samples?	✓		
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique?	NA	—	

Reviewed by: MBGarcia

Date: 12-7-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
c) Matrix spike recovery data reported and met for all samples for which it was requested?			—
6) Precision			
a) Laboratory control sample precision reported and met for all samples?			
b) Matrix spike duplicate RPD data reported and met for all samples for which it was requested?			
7) Blank data			
a) Method or reagent blank data reported and met for all samples?			
b) Sampling blank (e.g., field, trip, and equipment) data reported and met?			
8) Narrative included, correct, and complete?			

2.0 COMMENTS: All items marked "No" above must be explained in this section. For each item, give SNL/NM ID No. and the analysis, if appropriate, of all samples affected by the finding.

4. Insufficient sample volume was received to achieve the desired MDA per the contract

Reviewed by: ______________________

Date: ______________________

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

2.0 COMMENTS CONTINUATION SHEET

Reviewed by: NB García

Date: 12-7-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

3.0 SUMMARY: Summarize the findings in the table below. List only samples/fractions for which deficiencies have been noted. Use the qualifiers given at the end of the table if possible. Explain any other qualifiers in the comments column.

Sample/ Fraction No.	Analysis	Qualifiers	Comments

Attach continuation sheet for additional samples

QUALIFIERS:

J = Estimated quantity (provide reason)
B = Contamination in blank (indicate which blank)
P = Laboratory precision does not meet criteria
R = Reporting units inappropriate
N = There is presumptive evidence of the presence of the material
UJ = The material was analyzed for but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
Q = Quantitation limit does not meet criteria
A = Laboratory accuracy does not meet criteria
U = Analyte is undetected (indicate which analyte and reason for qualification)
NJ = There is presumptive evidence of the presence of the material at an estimated quantity.

Reviewed by: RB Garcia

Date: 12-7-94

DATA QUALITY INDICATOR CHECKLIST
(DATA VERIFICATION/VALIDATION LEVEL 2—DV2)

SAMPLE FINDINGS SUMMARY CONTINUATION SHEET

Sample/ Fraction No.	Analysis	Qualifiers	Comments

Reviewed by: RB Garcia Approved by:* ______________

Date: 12-7-94 Date: ______________

*Task/Project Leader must approve data package.

Sandia National Laboratories

Temp 18°C
CUR # 1899

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

AR/COC- 00933

PAGE 1 OF 1

SF 2001-COC (12-93)

Department No.: 7582
Project/Task Manager: Jim Brinkman
Project Name: Tijeras Arroyo Site 235 + 846
Sample Team Members: Jim Curtis

SCL or Logbook Ref. No.: 01618

Date Samples Shipped: 10/3/94.
Carrier/Waybill No.: A 47289
Lab Destination: Quanterra St. Louis
Lab Contact: [illegible]
SMO Contact/Phone: Pam Puissant
Send Report to SMO: Debra Cangstaff
SMO Reference No.:

Bill to: Sandia National Laboratories
Supplier Services Department
P.O. Box 5800 MS 0154
Albuquerque, NM 87185-0154

Contract No.: 12-0841 A
Case No.: 3632.300
SMO Authorization: D McLaughl[illegible]

Sample Number - Fraction	Sample Matrix	Date/Time Collected	Container Type	Sample Volume	Preservative	Required Analytical Testing	Lab Sample Number	Condition on Receipt
018080-1	Soil	9/30/94 1016	Glass	250	None 4°C	H3, Iso Uranium + Plutonium		
018080-4	↓	1022	↓	↓	↓	↓ ↓ ↓		
018081-4	↓	1110	↓	↓	↓			
018083-10	Water	1300	Poly	1 liter	↓	H3		
018083-11	↓	1300	↓	"	↓	γ Spec (600 901.1)		
018083-12	↓	1300	↓	2 liter	↓	Iso. Uranium + Iso. Plutonium		
018084-4	Soil	1522	Glass	250	↓	H3, Iso. Uranium, Iso. Plutonium		
018085-6	↓	1600	↓	↓	↓	↓ ↓ ↓		
018085-3	↓	1601	↓	↓	↓			

Possible Hazard Identification
☒ Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Radiological

*Reference attached radiological screening for specific contact readings.

Turnaround Time
☒ Normal ☐ Rush ______ Required Report Date ______

Sample Disposal
☐ Return to Client ☒ Disposal by Lab / Archive Until ______

Special Instructions/QC Requirements:
Tritium (600 906.0) Gamma Spec (600 901.1)
Isotopic Uranium (HASL-300 4.5)
Isotopic Plutonium (600 7-79-081)

	Name	Org.	Date	Time
1. Relinquished by	[signature]	7582	10/3/94	1125
1. Received by	[signature]	Smo 7576	10/3/94	1125
2. Relinquished by	[signature]	Smo 7576	10/3/94	1400
2. Received by	[signature]	Quanterra	10-4-94	09:00
3. Relinquished by				
3. Received by				
4. Relinquished by				
4. Received by				
5. Relinquished by				
5. Received by				
6. Relinquished by				
6. Received by				

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

Sandia National Laboratories

Quanterra - St. Louis

SF 2001-SCL (12-93)

ENVIRONMENTAL PROGRAMS SAMPLE COLLECTION LOG

SCL- 01618

AR/COC No.: AR/COC- 008... PAGE 1 OF 2

GENERAL INFORMATION

DATE: 9/30/94 WEATHER: Sunny/Clear 80°F

SAMPLING PROCEDURE REFERENCE: SAP

PURPOSE OF SAMPLING: Preliminary Investigation

SAMPLING INFORMATION: ON-SITE CONTACT: JAN CURTIS ORG 7582 PHONE 505-263-3340 AREA 1307 LOCATION Site 235 and BKG

SAMPLE DESCRIPTION

MATRIX: ☐ GAS ☐ LIQUID ☐ SLUDGE ☐ SOLID ☐ WATER ☐ OIL ☒ SOIL ☐ HAZ WASTE ☐ OTHER

COLLECTED FROM: ☐ DRUM ☐ TANK ☐ SURFACE WATER ☒ SOIL ☐ WASTE WATER ☐ GROUND WATER ☐ OTHER

Sample Number - Fraction	Time	LOCATION	COMMENTS	Sample Type Grab/Comp.	QC Sample (Y/N)	ANALYSES: Tritium/isotopic plutonium + uranium	Tritium	Gamma Spec	isotopic Uranium + plutonium
018080-1	1016	BKG-12-A	Surface soil 0-6"	C	N	X			
018080-4	1012	BKG-12-B	Subsurface soil 6-36"	C	N	X			
018081-4	1110	Site 235-01-A	Surface soil 0-6"	C	N	X			
018083-10	1300	Site 235	Rinsate — same day as Site	G	Y		X		
018083-11	1300	Site 235	Rinsate — same day as Site	G	Y			X	
018083-12	1300	Site 235	Rinsate	G	Y				X
018084-4	1522	Site 235-03-A	Surface soil 0-6"	C	N	X			
018085-6	1600	~~Site~~ BKG-11-B	Subsurface 6-36"	C	N	X			

PROJECT: PROJECT NAME Tijeras Arroyo CASE NUMBER 3632.300 PROJECT CONTACT Jim Brinkman ORG 7582 PHONE 505-848-0...

*ADDITIONAL INFORMATION: (Log Book Ref. #)

SAMPLE TEAM MEMBERS

NAME	SIGNATURE	INIT	COMPANY/ORGANIZATION
1. Jan Curtis	Jan Curtis	JC	Weston
2.			
3.			

SAMPLE TRACKING

SAMPLE DISTRIBUTION: Quanterra - St. Louis TRANSPORTED BY: A 47284 SPECIAL HANDLING:

DATE SHIPPED (MM-DD-YY): 10/3/94 DATA ENTERED (MM-DD-YY): 10-13-94 BY: [signature]

*NOTE: Any additional sampling information must be recorded in an SNL-Issued Log Book or SCL Continuation Form with a Reference No. entered in this space.

WHITE - To Sample Management Office PINK - Originator ☐ TO BE COMPLETED BY SMO

SHEARS # 49764

Sandia National Laboratories Quanterra — St. Louis

SF 2001-SOC (4-94)

ENVIRONMENTAL PROGRAMS SAMPLE COLLECTION LOG

(Continuation)

SCL- 01618

AR/COC No.: AR/COC- 008050 933

Sample Number - Fraction	Time	LOCATION	COMMENTS	Sample Type Grab/Comp.	QC Sample (Y/N)	Tritium / isotopic plutonium + uranium	ANALYSES						
018085-3	1600	BKG-11-A	Surface 0-6"	C	N	X							

To Sample Management Office PINK - Originator

Sandia National Laboratories

SP 2001-COC (12-93)

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

AR/COC- 00934

PAGE 1 OF 1

Department No.: 7582
Project/Task Manager: Jim Brinkman
Project Name: Tijeras Arroyo Site 235
Sample Team Members: Jan Curtis

SCL or Logbook Ref. No.: 01763

Date Samples Shipped:
Carrier/Waybill No.:
Lab Destination:
Lab Contact:
SMO Contact/Phone:
Send Report to SMO:
SMO Reference No.:

SMO USE ONLY

Bill to: Sandia National Laboratories
Supplier Services Department
P.O. Box 5800 MS 0154
Albuquerque, NM 87185-0154

Contract No.: N/A
Case No.: 3632.300
SMO Authorization: [signature]

Sample Number - Fraction	Sample Matrix	Date/Time Collected	Container Type	Sample Volume	Preservative	Required Analytical Testing	Lab Sample Number	Condition on Receipt
018080-3	Soil	9/26/94 1015	Marinelli	500	None	Gamma Spec	FOR LAB USE ONLY	
018080-6	↓	1012	↓	↓	↓	↓		
018081-3		1100						
018081-9		1104						
018084-3		1515						
018084-8		1520						
018085-2		1600						
018085-5	↓	1600						
018083-9	Water	↓ 1300	↓					

Possible Hazard Identification
[X] Non-hazard [ ] Flammable [ ] Skin Irritant [ ] Poison B [ ] Radiological

*Reference attached radiological screening for specific contact readings.

Turnaround Time
[X] Normal [ ] Rush ____ Required Report Date ____

Special Instructions/QC Requirements

Sample Disposal
[X] Return to Client [ ] Disposal by Lab Archive Until ____

	Org.	Date	Time		Org.	Date	Time
1. Relinquished by [signature]	7582	10/3/94	1125	4. Relinquished by			
1. Received by [signature]	SMO-7576	10/3/94	1125	4. Received by			
2. Relinquished by [signature]	SMO-7576	10/3/94	1423	5. Relinquished by			
2. Received by [signature]	SNL 7715	10/3/94	1423	5. Received by			
3. Relinquished by [signature]	SNL 7715	10/6/94	1419	6. Relinquished by			
3. Received by [signature]	[illegible]	10/6/94	1419	6. Received by			

INFORMATION COPY

SHEARS # 31566

WHITE - To Accompany Samples BLUE - To Accompany Samples YELLOW - SMO Suspense Copy PINK - Field Copy

Sandia National Laboratories

F 2001-COC (12-93)

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

770578

AR/COC-07934

PAGE 1 OF 1

Department No.: 7582
Project/Task Manager: Jim Brinkman
Project Name: Tijeras Arroyo, Site 235
Sample Team Members: Ian Coletis

SCL or Logbook Ref. No.: 01763

Date Samples Shipped:
Carrier/Waybill No.:
Lab Destination:
Lab Contact:
SMO Contact/Phone:
Send Report to SMO:
SMO Reference No.:
SMO USE ONLY

Bill to: Sandia National Laboratories
Supplier Services Department
P.O. Box 5800 MS 0154
Albuquerque, NM 87185-0154

Contract No.: N/A
Case No.: 7637.310
SMO Authorization:

Sample Number - Fraction	Sample Matrix	Date/Time Collected	Container Type	Sample Volume	Preservative	Required Analytical Testing	Lab Sample Number	Condition on Receipt
018080-3	Soil	9/29/94 1015	whirlpak	500	None	Gamma Spec	FOR LAB USE ONLY	
018080-6		1012						
018081-3		1100						
018081-9		1104						
018084-3		1515						
018084-8		1520						
018085-2		1600						
018085-5		1600						
018083-9	Water	1300						

Possible Hazard Identification
☒ Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Radiological

*Reference attached radiological screening for *specific contact readings.*

Turnaround Time
☒ Normal ☐ Rush ______ Required Report Date ______

Special Instructions/QC Requirements

Sample Disposal
☒ Return to Client ☐ Disposal by Lab Archive Until ______

	Org.	Date	Time		Org.	Date	Time
1. Relinquished by [signature]	7582	10/3/94	1125	4. Relinquished by			
1. Received by [signature]	SMO-7576	10/3/94	1125	4. Received by			
2. Relinquished by [signature]	SMO 7576	10/3/94	1423	5. Relinquished by			
2. Received by [signature]	SNL 7715	10/3/94	1423	5. Received by			
3. Relinquished by [signature]	SNL 7715	10/6/94	1415	6. Relinquished by			
3. Received by [signature]	[illegible]	[illegible]	1415	6. Received by			

YELLOW- SMO Suspense Copy PINK- Field Copy

Sandia National Laboratories

in-house

SF 2001-SCL (12-93)

ENVIRONMENTAL PROGRAMS
SAMPLE COLLECTION LOG

(934)

SCL- 01763

AR/COC No.: AR/COC- ~~R0805-4~~ 00934

PAGE 1 OF 2

GENERAL INFORMATION	
DATE: 9/30/94	WEATHER: Sunny/Clear 80°F
SAMPLING PROCEDURE REFERENCE: SAP	
PURPOSE OF SAMPLING: Preliminary Investigation	

SAMPLING INFORMATION	
ON-SITE CONTACT: JAN CURTIS	ORG: 7582
PHONE: 505-263-3390	
AREA: 1307	LOCATION: Site 235 + BKG 12

SAMPLE DESCRIPTION

MATRIX: ☐ GAS ☐ LIQUID ☐ SLUDGE ☐ SOLID ☐ WATER ☐ OIL ☒ SOIL ☐ HAZ WASTE ☐ OTHER

COLLECTED FROM: ☐ DRUM ☐ TANK ☐ SURFACE WATER ☒ SOIL ☐ WASTE WATER ☐ GROUND WATER ☐ OTHER

Sample Number - Fraction	Time	LOCATION	COMMENTS	Sample Type Grab/Comp.	QC Sample (Y/N)	ANALYSES: Gamma Spec
018080-3	1015	BKG-12-A	Surface soil 0-6"	C	N	X
018080-6	1012	BKG-12-B	Subsurface soil 6-36"	C	N	X
018081-3	1100	Site 235-01-A +	Surface soil 0-6"	C	N	X
018081-9	1104	Site 235-01-B	Subsurface soil 6-36"	C	N	X
018083-9	1300	Site 235	Rinsate	G	Y	X
018084-3	1515	Site 235-03-A	Surface soil 0-6"	~~C~~ G JC	N	X
018084-8	1520	Site 235-03-B	Subsurface soil 6-36"	C	N	X
018085-2	1600	BKG-11-A	Surface soil 0-6"	C	N	X

PROJECT	
PROJECT NAME: Tijeras Arroyo	CASE NUMBER: 3632.300
PROJECT CONTACT: Jim Brinkman	ORG: 7582
PHONE: 505-848-0455	

*ADDITIONAL INFORMATION: (Log Book Ref. #)

SAMPLE TEAM MEMBERS	NAME	SIGNATURE	INIT	COMPANY/ORGANIZATION
1.	Jan Curtis	Jan Curtis	JC	Weston
2.				
3.				

SAMPLE TRACKING		
SAMPLE DISTRIBUTION: SNL 7715 lab	TRANSPORTED BY: HC	SPECIAL HANDLING:
DATE SHIPPED (MM-DD-YY): 10/3/97	DATA ENTERED (MM-DD-YY): 10-11-94	BY: Dean [illegible]

*NOTE: Any additional sampling information must be recorded in an SNL-Issued Log Book or SCL Continuation Form with a Reference No. entered in this space.

WHITE - To Sample Management Office PINK - Originator

▒ TO BE COMPLETED BY SMO

Sandia National Laboratories

SF 2001-SCC (4-94)

ENVIRONMENTAL PROGRAMS
SAMPLE COLLECTION LOG
(Continuation)

SCL- 01763

AR/COC No.: AR/COC- ~~00805~~-4 00934

PAGE 2 OF 2

In-house

Sample Number - Fraction	Time	LOCATION	COMMENTS	Sample Type/ Grab/Comp.	QC Sample (Y/N)	ANALYSES: Gamma Spec							
018085-5	1600	BKG-11-B	Subsurface soil 6-36"	C	N	X							

WHITE - Sample Management Office PINK - Originator

Sample Findings Summary

Site: Site 227 **AR/COC:** 604200 **Data Type:** Organic, Inorganic, Rad, and G. Chem.

Sample ID	Method/CAS Number (Analysis/Analyte) 79-01-6 (trichloroethene)											7439-97-6 (mercury)	5955-70-0 (total cyanide)	13981-16-3 (plutonium-238)	
054629-002 / TJAOU-227-VW-01-20.0-S	UJ														
054638-001 / TJAOU-227-VW-01-100.0-S	UJ														
054639-001 / TJAOU-227-VW-01-100.0-DU	UJ														
054637-002 / TJAOU-227-VW-01-150.0-S	UJ														
054640-001 / TJAOU-227-VW-01-TB	UJ														
054641-001 / TJAOU-227-VW-01-200.0-S	UJ														
054629-003 / TJAOU-227-VW-01-20.0-S	EPA8270: Qualify nondetects "UJ, A" and bis(2-ethylhexyl)phthalate "J, A."											UJ, B3			
054637-003 / TJAOU-227-VW-01-150.0-S	EPA8270: Qualify nondetects "UJ, A."											UJ, B3	J, A2		
054629-005 / TJAOU-227-VW-01-20.0-S														J	

Validated By: *Kevin A. Lambert* Date: 05/31/01

Analytical Quality Associates, Inc.
616 Maxine NE
Albuquerque, NM 87123
Phone: 505-299-5201
Fax: 505-299-6744
Email: minteer@aol.com

MEMORANDUM

DATE: May 31, 2001

TO: File

FROM: Kevin Lambert

SUBJECT: Radiochemical Data Review and Validation – SNL
Site 227 Drilling, AR/COC No. 604200, SDG No. 39900/39905 (GEL), and
Project/Task No. 7225.02.02.09

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

Summary

The samples were prepared and analyzed with accepted procedures and specified method (Tritium – EPA906.0, Gamma Spec. – HASL300, Isotopic Plutonium – HASL300, and Isotopic Uranium – HASL300. All analytes were successfully analyzed. A problem was identified with the data package that result in the qualification of data.

1. Isotopic Plutonium: For sample 39900-010, the tracer recovery (47%) was less than (<) the lower QC acceptance limit (50%). Plutonium-239/240 was non-detect and is not qualified as a result. Plutonium-238 was detect and is qualified "J."

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

Holding Times

Tritium, Gamma Spec., Isotopic Plutonium, and Isotopic Uranium: The samples were analyzed within the prescribed holding times.

Calibration

Tritium, Gamma Spec., Isotopic Plutonium, and Isotopic Uranium: Case narratives state all initial and continuing calibration requirements were met.

Blanks

Tritium, Gamma Spec., Isotopic Plutonium, and Isotopic Uranium: No target analytes were detected in the method blank (MB) except for U-233/234. Sample results were greater than (>) 5x the MB value; no data are qualified as a result.

Laboratory Control Sample (LCS) Analyses

Tritium, Gamma Spec., Isotopic Plutonium, and Isotopic Uranium: The LCS met QC acceptance criteria.

Matrix Spike (MS) Analyses

Tritium: No MS was run on this sample delivery group (SDG). An MS was run on another SDG in the batch and met QC acceptance criteria.

Gamma Spec., Isotopic Plutonium and Isotopic Uranium: Not Applicable

Replicate Analyses

Tritium: No replicate analysis was run on this SDG. A replicate analysis was run on another SDG in the batch and met QC acceptance criteria.

Gamma Spec., Isotopic Plutonium, and Isotopic Uranium: Replicate analyses met QC acceptance criteria.

Tracer Recovery

Isotopic Plutonium and Isotopic Uranium: The tracer recoveries met QC acceptance criteria except for plutonium in sample 39900-010. Plutonium in sample 39900-010 is qualified as noted above in summary section.

Other QC

Tritium, Gamma Spec., Isotopic Plutonium, and Isotopic Uranium: Not Applicable

No other specific issues were identified which affect data quality.

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

Analytical Quality Associates, Inc.
616 Maxine NE
Albuquerque, NM 87123
Phone: 505-299-5201
Fax: 505-299-6744
Email: minteer@aol.com

MEMORANDUM

DATE: May 31, 2001

TO: File

FROM: Kevin Lambert

SUBJECT: General Chemistry Data Review and Validation – SNL Site 227 Drilling, ARCOC No. 604200, SDG No. 3990/39905 (GEL), and Project/Task No. 7225.02.02.09

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

Summary

The samples were prepared and analyzed with accepted procedures and specified methods (Total Cyanide – EPA9012A, Chloride – EPA300.0, and Chromium VI – EPA7196A). All parameters were successfully analyzed. A problem was identified with the data package that result in the qualification of data.

1. Total Cyanide: The matrix spike percent recovery (MS %R) for total cyanide (135%) was greater than (>) the upper QC acceptance limit (130%). Sample 39900-006 was non-detect and is not qualified as a result. Sample 39900-007 was detect and is qualified "J, A2."

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

Holding Times

Total Cyanide, Chloride, and Chromium VI: The samples were analyzed within the prescribed holding times.

Calibration

Total Cyanide, Chloride, and Chromium VI: The initial and continuing calibration met QC *acceptance criteria.*

Blanks

Total Cyanide, Chloride, and Chromium VI: No target analytes were detected in the initial calibration blank (ICB), the continuing calibration blank (CCB), or method blank (MB).

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

Total Cyanide, Chloride, and Chromium VI: The LCS/LCSD met QC acceptance criteria.

Matrix Spike (MS) Analyses

Chloride and Chromium VI: The MS met QC acceptance criteria.

Total Cyanide: The MS did not meet QC acceptance criteria. Total cyanide is qualified as noted above in the summary section.

Replicate Analyses

Total Cyanide, Chloride, and Chromium VI: The replicate analysis met QC acceptance criteria.

Other QC

Total Cyanide, Chloride, and Chromium VI: Not applicable.

No other specific issues were identified which affect data quality.

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

Analytical Quality Associates, Inc.
616 Maxine NE
Albuquerque, NM 87123
Phone: 505-299-5201
Fax: 505-299-6744
Email: minteer@aol.com

MEMORANDUM

DATE: May 31, 2001

TO: File

FROM: Kevin Lambert

SUBJECT: Inorganic Data Review and Validation – SNL
Site 227 Drilling, ARCOC No. 604200, SDG No. 39900/39905 (GEL), and Project/Task No. 7225.02.02.09

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

Summary

The samples were prepared and analyzed with accepted procedures and specified methods (ICP – EPA6010B and CVAA – EPA7471A). All parameters were successfully analyzed. Problems were identified with the data package that result in the qualification of data.

1. CVAA Analysis: The continuing calibration blank (CCB) absolute value for mercury was > the detection limit (DL) but < the reporting limit (RL). The mercury results were non-detect and are qualified "UJ, B3."

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

Holding Times

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

Calibration

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

Blanks

ICP Analysis: No target analytes were detected in the initial calibration blank (ICB) except for cadmium, arsenic, and titanium. The ICB values for these analytes were > the DL but the sample results were non-detect or > 5x the ICB values; no data are qualified as a result. No target analytes were detected in the CCB except for barium and titanium. Barium and titanium CCB values were > the DL and sample results were > 5x the CCB values; no data are qualified as a result. No target analytes were detected in the method blank (MB) except for barium. Barium results were > 5x the MB value; no data are qualified as a result.

CVAA Analysis: Mercury was not detected in the ICB and MB. Mercury was detected in the CCB and was qualified as noted above in the summary section.

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

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

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

Matrix Spike (MS) Analyses

ICP Analysis: The MS met QC acceptance criteria.

CVAA Analysis: No MS was run on this sample delivery group (SDG). An MS was run on another SDG in the batch and met QC acceptance criteria.

Replicate Analyses

ICP Analysis: The replicate analyses met QC acceptance criteria.

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

ICP Interference Check Sample (ICS) Analysis

ICP Analysis: The ICS data met QC acceptance criteria.

ICP Serial Dilution

ICP Analysis: The serial dilution met QC acceptance criteria except for lead. The RPD for thallium (11%) was > 10% but the sample results were < 50x RL; no data are qualified as a result.

Other QC

ICP and CVAA Analysis: Not Applicable

No other specific issues were identified which affect data quality.

Analytical Quality Associates, Inc.
616 Maxine NE
Albuquerque, NM 87123
Phone: 505-299-5201
Fax: 505-299-6744
Email: minteer@aol.com

MEMORANDUM

DATE: May 31, 2001

TO: File

FROM: Kevin Lambert

SUBJECT: Organic Data Review and Validation – SNL
Site 227 Drilling, ARCOC No. 604200, SDG No. 39900/39905 (GEL), and
Project/Task No. 7225.02.02.09

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

Summary

The samples were prepared and analyzed with accepted procedures and specified methods (VOC – EPA8260B, SVOC – EPA8270C, and HE – EPA8330). All compounds were successfully analyzed. Problems were identified with the data package that result in the qualification of data.

1. VOC Analysis – Trip Blank (TB): The calibration response factor (RF) for trichloroethene (0.27) was less than (<) the specified minimum (0.30) but greater than (>) 0.01. Sample result was non-detect and data is qualified "UJ."

2. VOC Analysis – Soil Samples: The calibration RF for trichloroethene (0.24) was < the specified minimum (0.30) but > 0.01. Sample results were non-detect and data are qualified "UJ."

3. SVOC Analysis: More than half the LCS/LCSD compounds were outside percent recovery (%R) QC acceptance criteria (see worksheet). The LCS/LCSD relative percent difference (RPD) and the MS/MSD met QC acceptance criteria. Sample results that were non-detect and are qualified "UJ, A." Bis(2-ethylhexyl)phthalate in 39900-006 was detect and is qualified "J, A."

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

Holding Times

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

Calibration

VOC Analysis – TB: The initial calibration data met QC acceptance criteria except for trichloroethene. Trichloroethene is qualified as noted above in the summary section. The continuing calibration data met QC acceptance criteria except for acetone, 2-butanone, 2-hexanone, and xylenes. The continuing calibration verification percent difference (CCV %D) for these compounds (-27%, -32%, -23%, and –24% respectively) were > 20% and < 40%. All other QC met criteria and sample results were non-detect. As a result, based on professional judgment, no data are qualified.

VOC Analysis – Soil Samples: The initial calibration data met QC acceptance criteria except for trichloroethene. Trichloroethene is qualified as noted above in the summary section. The continuing calibration data met QC acceptance criteria except for 1,1,1-trichloroethane, carbon tetrachloride, and tetrachloroethane. The CCV %D for these compounds (24%, 30%, and 21% respectively) were > 20% but < 40%. All other QC met criteria and sample results were non-detect. As a result, based on professional judgment, no data are qualified.

SVOC Analysis: The initial calibration data met QC acceptance criteria except for acenaphthene. The calibration RF (0.88) was slightly < the specified minimum RF (0.90) and > 0.01. Sample results were non-detect and as a result, based on professional judgment, no data are qualified. The continuing calibration data met QC acceptance criteria except for 3-nitroaniline, 4-nitrophenol, 4-nitroaniline, and carbazole. The CCV %D for these compounds (26%, 28%, 38%, and 22% respectively) were > 20% but < 40%. Sample results were non-detect and as a result, based on professional judgment, no data are qualified.

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

Blanks

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

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

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

SVOC Analysis: The LCS/LCSD met QC acceptance criteria except for the %R for more than half of the LCS/LCSD compounds. Sample results are qualified as noted above in the summary section.

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

VOC Analysis – TB and Soil Samples: No MS/MSD was run on this sample delivery group (SDG). An MS/MSD was run on another SDG in the batch and met QC acceptance criteria.

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

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

Surrogates

VOC Analysis – TB and Soil Samples: The surrogate recoveries met QC acceptance criteria.

SVOC Analysis: The surrogate recoveries met QC acceptance criteria.

HE Analysis: The surrogate recoveries met QC acceptance criteria.

Internal Standards

VOC Analysis – TB and Soil Samples: Internal standards data met QC acceptance criteria.

SVOC Analysis: Internal standards data met QC acceptance criteria.

Confirmation

HE Analysis: Not required, sample results were non-detect.

Other QC

VOC Analysis: No target analytes were detected in the TB except for toluene. Sample results were non-detect and no data are qualified as a result. No equipment blank (EB) was submitted on the ARCOC. A field duplicate pair was submitted, however there are no "required" review criteria for field duplicate analyses comparability.

SVOC Analysis: Not Applicable

HE Analysis: Not Applicable

No other specific issues were identified which affect data quality.

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

Data Validation Summary

Site/Project: Site 227 Project/Task #: 7225.02.02.09 # of Samples: 14 Matrix: 13 Soil, 1 Aqueous

AR/COC #: 604200 Laboratory Sample IDs:

Laboratory: GEL 39900-001 to -013 (Soil)

Laboratory Report #: 39900/39905 39905-001 (TB)

QC Element	Analysis: Organics VOC	SVOC	Pesticide/PCB	HPLC (HE)	Inorganics ICP/AES	GFAA/AA	CVAA (Hg)	CN	RAD	Chloride ~~Other~~ CR+6 KAL 05/29/01
1. Holding Times/Preservation	✓	✓	NA	✓	✓	NA	✓	✓	✓	✓
2. Calibrations	UJ	✓		✓	✓		UJ	✓	✓	✓
3. Method Blanks	✓	✓		✓	✓		✓	✓	✓	✓
4. MS/MSD	NA	✓		✓	✓		NA	J	✓	✓
5. Laboratory Control Samples	✓	J, UJ		✓	✓		✓	✓	✓	✓
6. Replicates					✓		NA	✓	✓	✓
7. Surrogates	✓	✓		✓						NA
8. Internal Standards	✓	✓								
9. TCL Compound Identification	✓	✓								
10. ICP Interference Check Sample					✓					
11. ICP Serial Dilution					✓					
12. Carrier/Chemical Tracer Recoveries									J	
13. Other QC (Trip Blank)	UJ	NA		NA	NA		NA	NA	NA	

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

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

Reviewed By: Kevin A. Lambert KAL 05/29/01 Date: 05/29/01

Volatile Organics (SW 846 Method 8260)

Site/Project: Site 227 AR/COC #: 604200 # of Samples: 1 Matrix: Aqueous

Laboratory: GEL Laboratory Report #: 39900/39905 Laboratory Sample IDs: 39905-001 (TB)

Methods: EPA 8260B Batch #s: 71556

IS	CAS #	Name	C	Min RF	Intercept	① Cal RF >.05	② Cal %RSD <20% / 0.99	CCV %D 20%	Method Blank	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Equip Blank	Trip Blank		
1	74-87-3	Chloromethane	✓	0.10	✓	✓	✓	✓	✓							NA	NA	NA		
1	74-83-9	Bromomethane	✓	0.10		✓	✓													
1	75-01-4	vinyl chloride	✓	0.10		✓	✓						Was ran							
1	75-00-3	Chloroethane	✓	0.01		✓	✓													
1	75-09-2	methylene chloride (10xblk)	✓	0.01	✓	✓	✓						on this							
1	67-64-1	acetone(10xblk)	✓	0.01	✓	✓	✓													
1	75-15-0	carbon disulfide	✓	0.10		✓	✓	✓					SDG							
1	75-35-4	1,1-dichloroethene	✓	0.20	✓	✓	✓			✓	✓	✓								
1	75-34-3	1,1-dichloroethane	✓	0.10		✓	✓						[illegible]							
1	67-66-3	Chloroform	✓	0.20		✓	✓													
1	107-06-2	1,2-dichloroethane	✓	0.10		✓	✓	✓					another							
1	78-93-3	2-butanone(10xblk)	✓	0.05		✓	✓	-32												
2	71-55-6	1,1,1-trichloroethane	✓	0.10		✓	✓	✓					SDG in							
2	56-23-5	carbon tetrachloride	✓	0.10		✓	✓													
2	75-27-4	Bromodichloromethane	✓	0.20		✓	✓						the batch							
2	78-87-5	1,2-dichloropropane	✓	0.01		✓	✓													
2	10061-01-5	cis-1,3-dichloropropene	✓	0.20		✓	✓						And met							
2	79-01-6	Trichloroethene	✓	0.30		0.27	✓			✓	✓	✓								
2	124-48-1	Dibromochloromethane	✓	0.10		✓	✓						QC							
2	79-00-5	1,1,2-trichloroethane	✓	0.10		✓	✓													
2	71-43-2	Benzene	✓	0.50		✓	✓			✓	✓	✓								
2	10061-02-6	trans-1,3-dichloropropene	✓	0.10		✓	✓													
2	75-25-2	Bromoform	✓	0.10		✓	✓													
3	108-10-1	4-methyl-2-pentanone	✓	0.10		✓	✓													
3	591-78-6	2-hexanone	✓	0.01		✓	✓	-23												
3	127-18-4	Tetrachloroethene	✓	0.20		✓	✓	✓												
3	79-34-5	1,1,2,2-tetrachloroethane	✓	0.30		✓	✓													
3	108-88-3	toluene(10xblk)	✓	0.40		✓	✓			✓	✓	✓								
3	108-90-7	Chlorobenzene	✓	0.50		✓	✓			✓	✓	✓								
3	100-41-4	Ethylbenzene	✓	0.10	✓	✓	✓													
3	100-42-5	Styrene	✓	0.30		✓	✓													
3	1330-20-7	xylenes(total)	✓	0.30		✓	✓	-24												
3	540-59-0	1,2-dichloroethylene (total)	✓	0.07	✓	✓	✓	✓												
	110-75-8	2-chloroethyl vinyl ether																		
	108-05-4	vinyl acetate	✓			✓	✓													

Comments: NA - Not Applicable Notes: Shaded rows are RCRA compounds.

Reviewed By: Kevin A Lambert Date: 05/29/01

Volatile Organics

Site/Project: Site 227 AR/COC #: 604200 Batch #: 71556

Laboratory: GEL Laboratory Report #: 39900/39905 # of Samples: 1 Matrix: Aqueous

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

Sample	SMC 1	SMC 2	SMC 3	IS 1 Area	IS 1 RT	IS 2 Area	IS 2 RT	IS 3 Area	IS 3 RT
		Met				Met			
		Criteria				Criteria			

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

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

Comments:

① Trichloroethene => Calib RF (0.27) was < the specified min. RF (0.30) but > 0.01; Sample result was ND and is qualified "UJ."

② Acetone, 2-butanone, 2-hexanone, & xylenes => The CCV %Ds were > 20% but < 40%; (-27, -32, -23, & -24 respectively) All other QC met criteria. Sample results were ND ~~except for acetone in~~ KK 05/23/01 and as a result based on professional judgment no data are qualified.

Volatile Organics (SW 846 Method 8260)

Site/Project: Site 227 AR/COC #: 604200 # of Samples: 5 Matrix: soil

Laboratory: GEL Laboratory Report #: 39900/39905 Laboratory Sample IDs: 39900-001 to -005

Methods: EPA8260B Batch #s: 71109

IS	CAS #	Name		Min RF	Intercept	Cal RF (1) >.05	Cal RSD <20%/0.99	CCV %D (2) 20%	Method Blank	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Lab Dup RPD	Equip Blank	Trip Blank (3)		
1	74-87-3	Chloromethane	✓	0.10		✓	✓	✓	✓								NA	✓		
1	74-83-9	Bromomethane	✓	0.10		✓	✓													
1	75-01-4	vinyl chloride	✓	0.10		✓	✓													
1	75-00-3	Chloroethane	✓	0.01		✓	✓						Not Run							
1	75-09-2	methylene chloride (10xblk)	✓	0.01	✓	✓	✓													
1	67-64-1	acetone(10xblk)	✓	0.01		✓	✓						on this							
1	75-15-0	carbon disulfide	✓	0.10		✓	✓													
1	75-35-4	1,1-dichloroethene	✓	0.20		✓	✓			✓	✓	✓	SDG							
1	75-34-3	1,1-dichloroethane	✓	0.10		✓	✓													
1	67-66-3	Chloroform	✓	0.20		✓	✓						Run on							
1	107-06-2	1,2-dichloroethane	✓	0.10		✓	✓													
1	78-93-3	2-butanone(10xblk)	✓	0.01		✓	✓	✓					another							
2	71-55-6	1,1,1-trichloroethane	✓	0.10		✓	✓	24												
2	56-23-5	carbon tetrachloride	✓	0.10		✓	✓	20					SDG							
2	75-27-4	Bromodichloromethane	✓	0.20		✓	✓	✓												
2	78-87-5	1,2-dichloropropane	✓	0.01		✓	✓						the batch							
2	10061-01-5	cis-1,3-dichloropropene	✓	0.20		✓	✓			✓										
2	79-01-6	Trichloroethene	✓	0.30		0.24	✓						within							
2	124-48-1	Dibromochloromethane	✓	0.10		✓	✓													
2	79-00-5	1,1,2-trichloroethane	✓	0.10		✓	✓						QC criteria							
2	71-43-2	Benzene	✓	0.50		✓	✓			✓	✓									
2	10061-02-6	trans-1,3-dichloropropene	✓	0.10		✓	✓													
2	75-25-2	Bromoform	✓	0.10		✓	✓													
3	108-10-1	4-methyl-2-pentanone	✓	0.10		✓	✓													
3	591-78-6	2-hexanone	✓	0.01		✓	✓													
3	127-18-4	Tetrachloroethene	✓	0.20		✓	✓													
3	79-34-5	1,1,2,2-tetrachloroethane	✓	0.30		✓	✓													
3	108-88-3	toluene(10xblk)	✓	0.40		✓	✓			✓	✓	✓						0.345		
3	108-90-7	Chlorobenzene	✓	0.50		✓	✓			✓	✓	✓								
3	100-41-4	Ethylbenzene	✓	0.10		✓	✓													
3	100-42-5	Styrene	✓	0.30		✓	✓													
3	1330-20-7	xylenes(total)	✓	0.30		✓	✓													
3	540-59-0	1,2-dichloroethylene(total)	✓	0.01		✓	✓													
	110-75-8	2-chloroethyl vinyl ether																		
	108-05-4	vinyl acetate	✓			✓	✓													

Comments: NA - Not Applicable

Notes: Shaded rows are RCRA compounds.

Reviewed By: Kevin A Lambert Date: 05/29/01

Volatile Organics

Site/Project: Site 227 AR/COC #: 604200 Batch #s:

Laboratory: GEL Laboratory Report #: 39900/39905 # of Samples: 5 Matrix: soil

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

Sample	SMC 1	SMC 2	SMC 3	IS 1 area	IS 1 RT	IS 2 area	IS 2 RT	IS 3 area	IS 3 RT
		Met				Met			
	Criteria					Criteria			

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

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

Comments:

1. Trichloroethene => Calib RF (0.24) was < the specified min RF (0.30) but > 0.01; Sample results were ND and are qualified "UJ."
2. 1,1,1-Trichloroethane, carbon tetrachloride, & tetrachloroethene => The CCV %Ds (24, 30, +21 respectively) were > 20% but < 40%; Sample results were ND and as a result based on professional judgment no data are qualified

Toluene => Was detected in TB; Sample results were ND and no data are qualified a result.

Semivolatile Organics (SW 846 Method 8270)

Site/Project: Site 227 AR/COC #: 604200 Laboratory Sample IDs: 39900-006 & -007

Laboratory: GEL Laboratory Report #: 39900/39905

Methods: EPA8270C

# of Samples: 2 Matrix: soil Batch #: 72181

IS	BNA	CAS #	NAME	ICal	Min RF	Intercept	Calib RRF >.05	Calib RSD/R² <20%/0.99	CCV %D 20%	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Equip Blank	Field Blank		
1	A	108-95-2	Phenol	✓	0.80		✓	✓	✓	✓	54 (58)	✓	✓				NA	NA	NA		
1	BN	111-44-4	bis(2-Chloroethyl)ether	✓	0.70		✓	✓													
1	A	95-57-8	2-Chlorophenol	✓	0.80		✓	✓			52 (65)	58	✓	Not Run							
1	BN	541-73-1	1,3-Dichlorobenzene	✓	0.60		✓	✓													
1	BN	106-46-7	1,4-Dichlorobenzene	✓	0.50		✓	✓			57 (67)	✓		[illegible]							
1	BN	95-50-1	1,2-Dichlorobenzene	✓	0.40		✓	✓			KAL 05/29/01										
1	A	95-48-7	2-Methylphenol	✓	0.70		✓	✓			55 (68)	61	✓	SDG							
1	BN	108-60-1	bis(2-chloroisopropyl)ether	✓	0.01		✓	✓													
1	A	106-44-5	4-Methylphenol	✓	0.60		✓	✓			56 (70)	65	✓	Run on							
1	BN	621-64-7	N-Nitroso-di-n-propylamine	✓	0.50		✓	✓			53 (65)	61	✓								
2	BN	67-72-1	Hexachloroethane	✓	0.30		✓	✓			52 (65)	✓	✓	[illegible]							
2	BN	98-95-3	Nitrobenzene	✓	0.20		✓	✓			✓	(71)	(95)								
2	BN	78-59-1	Isophorone	✓	0.40		✓	✓						SMC SDG							
2	A	88-75-5	2-Nitrophenol	✓	0.10		✓	✓													
2	A	105-67-9	2,4-Dimethylphenol	✓	0.20		✓	✓						in batch							
2	BN	111-91-1	bis(2-Chloroethoxy)methane	✓	0.30		✓	✓													
2	A	120-83-2	2,4-Dichlorophenol	✓	0.20		✓	✓						And met							
2	BN	120-82-1	1,2,4-Trichlorobenzene	✓	0.20		✓	✓			58 (60)	✓	✓								
2	BN	91-20-3	Naphthalene	✓	0.70		✓	✓						QC Criteria							
2	BN	106-47-8	4-Chloroaniline	✓	0.01		✓	✓													
2	BN	87-68-3	Hexachlorobutadiene	✓	0.01		✓	✓			✓	✓	✓								
2	A	59-50-7	4-Chloro-3-methylphenol	✓	0.20		✓	✓			56 (67)	65	✓								
2	BN	91-57-6	2-Methylnaphthalene	✓	0.40		✓	✓													
	BN	77-47-4	Hexachlorocyclopentadiene	✓	0.01		✓	✓													
	A	88-06-2	2,4,6-Trichlorophenol	✓	0.20		✓	✓			60 (67)	✓	✓								
	A	95-95-4	2,4,5-Trichlorophenol	✓	0.20		✓	✓			65 (74)	✓	✓								

Notes: Shaded rows are RCRA compounds.

Comments:

Reviewed By: Kevin A Lambert Date: 05/29/01

Semivolatile Organics

Site/Project: Site 227 AR/COC #: 604200 Batch #s: 72181

Laboratory: GEL Laboratory Report #: 39900/39905 # of Samples: 2 Matrix: soil

IS	BNA	CAS #	NAME	TC	Min RF	Interceptor	Calib RF ①	Calib RSD/R²	CCV %D ②	Method Blanks	LCS ③	LCSD ③	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Equip Blanks	Field Blanks	[illegible]	[illegible]
							>.05	<20% / 0.99	20%												
3	BN	91-58-7	2-Chloronaphthalene	√	0.80		√	√	√	√							NA	NA	NA		
3	BN	88-74-4	2-Nitroaniline	√	0.01		√	√													
3	BN	131-11-3	Dimethylphthalate	√	0.01		√	√													
3	BN	208-96-8	Acenaphthylene	√	0.90		√	√													
3	BN	606-20-2	2,6-Dinitrotoluene	√	0.20		√	√	√ NA						See						
3	BN	99-09-2	3-Nitroaniline	√	0.01		√	√	36 26												
3	BN	83-32-9	Acenaphthene	√	0.90		0.18	√	√		√	√	√								
3	A	51-28-5	2,4-Dinitrophenol	√	0.01	√	√	√	√						Page						
3	A	100-02-7	4-Nitrophenol	√	0.01		√	√	28		√	√	√								
3	BN	132-64-9	Dibenzofuran	√	0.80		√	√	√						1.						
[illegible]	BN	[illegible]	[illegible]	[illegible]	0.20																
3	BN	84-66-2	Diethylphthalate	√	0.01		√	√													
3	BN	7005-72-3	4-Chlorophenyl-phenylether	√	0.40		√	√													
3	BN	86-73-7	Fluorene	√	0.90		√	√													
3	BN	100-01-6	4-Nitroaniline	√	0.01		√	√	38												
4	A	534-52-1	4,6-Dinitro-2-methylphenol	√	0.01		√	√	√												
4	BN	86-30-6	N-Nitrosodiphenylamine (1)	√	0.01		√	√													
4	BN	101-55-3	4-Bromophenyl-phenylether	√	0.10		√	√													
[illegible]	BN	[illegible]	[illegible]	√	[illegible]																
[illegible]	[illegible]	[illegible]	[illegible]	√	[illegible]																
4	BN	85-01-8	Phenanthrene	√	0.70		√	√													
4	BN	120-12-7	Anthracene	√	0.70		√	√													
4	BN	86-74-8	Carbazole	√	0.01		√	√	22												
4	BN	84-74-2	Di-n-butylphthalate	√	0.01		√	√	√												
4	BN	206-44-0	Fluoranthene	√	0.60		√	√													
5	BN	129-00-0	Pyrene	√	0.60		√	√			√	√	√								
5	BN	85-68-7	Butylbenzylphthalate	√	0.01		√	√													
5	BN	91-94-1	3,3'-Dichlorobenzidine	√	0.01		√	√													
5	BN	56-55-3	Benzo(a)anthracene	√	0.80		√	√													

Comments:

Semivolatile Organics

Site/Project: Site 227 AR/COC #: 604200 Batch #s: 72181

Laboratory: GEL Laboratory Report #: 39900/39905 # of Samples: 2 Matrix: soil

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

NA- Not Applicable

Surrogate Recovery Outliers

Sample	SMC 1	SMC 2	SMC 3	SMC 4	SMC 5	SMC 6	SMC 7	SMC 8
		Met Criteria						

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

Internal Standard Outliers

Sample	IS 1 Area	IS 1 RT	IS 2 Area	IS 2 RT	IS 3 Area	IS 3 RT	IS 4 Area	IS 4 RT	IS 5 Area	IS 5 RT	IS 6 Area	IS 6 RT
			Met Criteria									

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

Comments: ① Acenaphthene => The Calib RF (0.88) was slightly < the specified min. RF (0.90) and > 0.01; Sample results were ND and as a result based on professional judgment no data are qualified.

② 3-Nitroaniline, 4-Nitrophenol, 4-Nitroaniline, & carbazole => The CCV %Ds (26, 28, 38, & 22 respectively) were > 20% but < 40%. Sample results were ND and as a result based on professional judgment no data are qualified.

③ LCS/LCSD => More than half the compds were slightly outside %R acceptance criteria; RPDs met QC criteria, MS/MSD met QC criteria. Sample results were ND except for bis(2-ethylhexyl)phthalate in 39900-006; Detect is qualified "J,A." Based on professional judgment ND are qualified "UJ,A."

High Explosives (SW 846 Method 8330)

Site/Project: Site 227 AR/COC #: 604200 Laboratory Sample IDs: 39900-006 & -007

Laboratory: GEL Laboratory Report #: 39900/39905

Methods: EPA 8330

\# of Samples: 2 Matrix: soil Batch #s: 71590

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

Sample	SMC %REC	SMC RT	Sample	SMC %REC	SMC RT
	Met Criteria				

Comments: NA-Not Applicable

Confirmation

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

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

Reviewed By: Kevin A Lambert Date: 05/29/01

Inorganic Metals

Site/Project: Site 227 AR/COC #: 604200 Laboratory Sample IDs:

Laboratory: GEL Laboratory Report #: 39900/39905 39900-0068-007

Methods: EPA 6010B, EPA 7471A

# of Samples: 2 Matrix: Soil Batch #s: 71553 (ICP), 71706 (CVAA

CAS # / Analyte	TAL	ICV	CCV	ICB mg/l (1)	CCB mg/l (2)	Method Blank mg/kg (3)	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	Rep. RPD	ICS AB	Serial Dilution (4)	Field Dup. RPD	Equip. Blanks	Field Blanks		-
7429-90-5 Al											NA	NA				NA	NA	NA		
7440-39-3 Ba	✓	✓	✓	✓	[illegible]	[illegible]	✓	✓	✓	N/A			✓		✓					
7440-41-7 Be																				
7440-43-9 Cd	✓	✓	✓	[illegible]	✓	✓			✓				✓		[illegible]					
7440-70-2 Ca																				
7440-47-3 Cr	✓	✓	✓	✓	✓	✓	✓	✓	✓				✓		✓					
7440-48-4 Co																				
7440-50-8 Cu																				
7439-89-6 Fe																				
7439-95-4 Mg																				
7439-96-5 Mn																				
7440-02-0 Ni																				
7440-09-7 K																				
7440-22-4 Ag	✓	✓	✓	✓	✓	✓	✓	✓	✓											
7440-23-5 Na																				
7440-62-2 V																				
7440-66-6 Zn																				
7439-92-1 Pb	✓	✓	✓	[illegible]	✓	[illegible]	✓	✓					✓		[illegible]					
7782-49-2 Se	✓	✓	✓	✓	✓	✓	✓		✓	✓			✓		✓					
7440-38-2 As	✓	✓	✓	[illegible]	✓	✓			✓	✓			✓		✓					
7440-36-0 Sb				2.47J	KAL 05/29/01															
7440-28-0 Tl																				
7439-97-6 Hg	✓	✓	✓	[illegible]	[illegible]	✓	✓		✓	N/A			N/A		✓					
				KAL 05/29/01																
Cyanide CN																				
7440-32-6 Ti	✓	✓	✓	0.341J	0.543J	✓	✓	✓	✓	N/A	✓	✓	✓		✓	✓	✓	✓		

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

Comments: NA - Not Applicable
N/A → Spike % R limits do not apply; Sample [c] > 4x spike [c]

Reviewed By: Kevin A Lambert Date: 05/29/01

SEE OTHER Page

Inorganic Metals Site 7 COC# 604200

① Cd - The ICB value > the DL; Sample results were ND or > 5x ICB value; no data are qualified as a result

As - The ICB value > the DL; Sample results were > 5x ICB value; no data are qualified as a result

Tl - The ICB value > the DL; " " " " " " " " " " "

② Ba - The CCB value > the DL; Sample results were > 5x CCB value; no data are qualified as a result

Tl - " " " " " "; " " " " " "; " " " " " " "

Hg - The CCB absolute value > the DL but < the RL; sample results were ND and are qualified "UJ, B3"

③ Ba - The MB value > the DL; Sample results were > 5x MB value; no data are qualified as a result

④ Pb - The serial dilution RPD (11) was > 10% but sample results were < 50x the RL, no data are qualified as a result.

KHL
05/29/01

General Chemistry

Site/Project: ST 227 AR/COC #: 604200 Laboratory Sample IDs: 39900-006 & -007

Laboratory: GEL Laboratory Report #: 39900/39905

Methods: EPA 9012A, EPA 300.0, EPA 7196A

# of Samples: 2 Matrix: Soil Batch #s: 71967 (Total CN), 72517 (Chloride), 73538 (Cr+6)

CAS #	Analyte	TAL	ICV	CCV	ICB	CCB	Method Blanks	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	Rep. RPD	ICS AB	Serial Dilution	Field Dup. RPD	Equip. Blanks	Field Blanks	
5455-70-0	Total CN	✓	✓	✓	✓	✓	✓	✓	✓	✓	135 (130)	NA	NA	✓	NA	NA	NA	NA	NA	
16887-00-6	Chloride	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	✓	NA	NA				
18540-29-9	Cr+6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	✓	NA	NA				

Comments: NA - Not Applicable

(1) Total Cyanide - MS %R (135) was > the upper QC limit (130); Sample 39900-006 was ND and no data is qualified as a result; Sample 39900-007 was detect and is qualified "J, A2"

Reviewed By: Kevin A Lambert Date: 05/29/01

Radiochemistry

Site/Project: Site 227 AR/COC #: 604200 Laboratory Sample IDs:

Laboratory: GEL Laboratory Report #: 39900/39905 39900-008 to -013

Methods: HASL 300, EPA 906.0

# of Samples: 6 Matrix: soil Batch #s: 71634 (Pu), 71635 (U), 72255 (H^3), 71839 (G. Spec)

Analyte	Method Blanks (1)	LCS	MS	Rep RER	Equip. Blanks	Field Dup. RER	Field Blanks	Sample ID	Isotope	IS/Trace (2)	Sample ID	Isotope	IS/Trace
Criteria	U	20%	25%	<1.0	U	<1.0	U			50-105		-	50-105
H3	✓	✓	NA	NA	NA	NA	NA	39900-010	Pu	47	39900-010	U	✓
U-238	✓	✓	NA	✓				↓ -011	Pu	✓	↓ -011	U	✓
~~U-234~~ -233/234	0.0106		NA	✓									
U-235/-236	✓		NA	✓									
Th-232													
Th-228													
~~Th-230~~ Pu-238	✓		NA	✓									
Pu-239/-240	✓	✓	NA	✓									
Gross Alpha													
Nonvolatile Beta													
Ra-226													
Ra-28													
Ni-63													
Gamma Spec. Am-241	✓	✓	NA	✓									
Gamma Spec. Cs-137	✓	✓	NA	✓									
Gamma Spec. Co-60	✓	✓	NA	✓									
					↓	↓	↓						

KAL 05/29/01

KAL 05/29/01

NA - Not Applicable

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

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

Comments:

(1) U-233/234 => Was detected in MB; sample results were >5x the MB value; no data are qualified as a result.

(2) Pu => Tracer %R (47) was slightly < the lower QC limit (50). Pu-239/240 was ND and is not qualified as a result; Pu-238 was detected and is qualified ~~"J, A2."~~ "J."
KAL 05/29/01

Reviewed By: Kevin A Lambert Date: 05/29/01

Contract Verification Review (CVR)

Project Leader COLLINS | Project Name SITE 227 | Case No. 7225_02.02.09

AR/COC No. 604200 | Analytical Lab GEL | SDG No. 39900

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

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

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

2.0 Analytical Laboratory Report

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

3.0 Data Quality Evaluation

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

4.0 Calibration and Validation Documentation

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

Contract Verification Review (Concluded)

5.0 Problem Resolution

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

Sample/Fraction No.	Analysis	Problems/Comments/Resolutions

Were deficiencies unresolved? ☐ Yes ☑ No

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

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

Reviewed by: W. Palencia Date: 5-8-2001 Closed by: ____________________ Date: __________

SF 2001-COC (7/00)

CONTRACT LABORATORY
ANALYSIS REQUEST AND CHAIN OF CUSTODY

SDG#39900

Page 1 of 2

Internal Lab No. N/A

SAR/WR No. 3-28-01

AR/COC 604200

Dept. No./Mail Stop:	6133/1087			Contract No:	AJ2480A
Project/Task Manager:	Sue Collins			Project/Task No.:	7225/02.02.09
Project Name:	Site 227 drilling	Lab Contact:	Edie Kent	SMO Authorization:	
Record Center Code:	ER/1309/227/DAT	Lab Destination:	General Engineering Labs		
Logbook Ref. No.:	ER078	SMO Contact/Phone:	P. Pulasani/844-3185		
Service Order No.	CF0103-01	Send Report to SMO:	Suzi Jensen		
Location	Tech Area III	Reference LOV(available at SMO)			

☑ Waste Characterization
RCRA Date:
☐ Send:Preliminary/report to
☐ Validation Required
☐ Released by COC No.:

Bill To: Sandia National Labs (Accounts Payable)
PO Box 5800, MS-0154, Albuquerque, NM 87185-0154

Sample No.-Fraction	ER Sample ID or Sample Location Detail	Beginning Depth (ft)	ER Site No.	Date/Time(hr) Collected	Sample Matrix	Container Type	Container Volume	Preserve-ative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
054629-002	TJAOU-227-VW-01-20.0-S	20.0	227	3.26.01/1520	S	G	125 ml	4C	G	SA	VOCs (8260)	
054629-003	TJAOU-227-VW-01-20.0-S	20.0	227	3.26.01/1520	S	AG	500 ml	4C	G	SA	SVOCs (8270), RCRA metals + Titanium (6010/7471), Cr-6 (7196), HE (8330), Chloride (300.0), Cyanide	
054629-004	TJAOU-227-VW-01-20.0-S	20.0	227	3.26.01/1520	S	AG	2x1L	4C	G	SA	Tritium	
054629-005	TJAOU-227-VW-01-20.0-S	20.0	227	3.26.01/1520	S	AG	500 ml	4C	G	SA	Iso U/PU	
054629-006	TJAOU-227-VW-01-20.0-S	20.0	227	3.26.01/1520	S	AG	500 ml	4C	G	SA	~~Cs-137~~ Gamma SPEC DF 3/28/01	
054638-001	TJAOU-227-VW-01-100.0-S	100.0	227	3.27.01/0800	S	G	125 ml	4C	G	SA	VOCs (8260)	
054639-001	TJAOU-227-VW-01-100.0-DU	100.0	227	3.27.01/0800	S	G	125 ml	4C	G	DU	VOCs (8260)	

RMMA ☐ Yes ☑ No Ref. No.

Sample Disposal ☐ Return to Client ☑ Disposal by lab

Turnaround Time ☐ 7 Day* ☐ 15 Day* ☒ 30 Day

Return Samples By: ☐ Negotiated TAT

Special Instructions/QC Requirements:
EDD ☑ Yes ☐ No
Raw Data Package ☑ Yes ☐ No
*Send/e-mail report to:
*Please list as separate report.

Sample Team Members	Name	Signature	Init	Company/Organization/Phone/Cellular
	Robin Ryan	Robin Ryan	RR RR	GRAM/6133/845-8821

		Org.	Date	Time			Org.	Date	Time
1.Relinquished by	Robin Ryan	6133	3/28/01	1100	4.Relinquished by				
1. Received by	[illegible]	6132	3/28/01	1100	4. Received by				
2.Relinquished by	[illegible]	6132	3/29/01	1330	5.Relinquished by				
2. Received by	[illegible]	GEL	3/29/01	0805	5. Received by				
3.Relinquished by					6.Relinquished by				
3. Received by					6. Received by				

*7 & 15 Day Turnaround Time: ERCL requires prior notification.

SF 2001-COC (7/00)

CONTRACT LABORATORY
Analysis Request And Chain Of Custody (Continuation)

Page 2

AR/COC- 60[illegible]

Project Name: Site 227 Drilling		Project/Task Manager: Sue Collins					Project/Task No.: 7225402.02.09				
Location	Tijeras Arroyo										
Building	Room	Reference LOV (available at SMO)									Lab use

Sample No-Fraction	ER Sample ID or Sample Location detail	Beginning Depth (ft)	ER Site No.	Date/Time (hr) Collected	Sample Matrix	Container Type	Container Volume	Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
054637-002	TJAOU-227-VW-01-150.0-S	150.0	227	3.27.01/1040	S	G	125 ml	4C	G	SA	VOCs (8260)	[redacted]
054637-003	TJAOU-227-VW-01-150.0-S	150.0	227	3.27.01/1040	S	AG	500 ml	4C	G	SA	SVOCs (8270), RCRA metals + Titanium (6010/7471), Cr-6 (7196), HE (8330), Chloride (300.0), Cyanide	
054637-004	TJAOU-227-VW-01-150.0-S	150.0	227	3.27.01/1040	S	AG	2x1L	4C	G	SA	Tritium	
054637-005	TJAOU-227-VW-01-150.0-S	150.0	227	3.27.01/1040	S	AG	500 ml	4C	G	SA	Iso U/PU/~~Cs-137~~ [illegible]	
054637-006	TJAOU-227-VW-01-150.0-S	150.0	227	3.27.01/1040	S	AG	500 ml	4C	G	SA	~~Cs-137~~ Gamma Spec	
054640-001	TJAOU-227-VW-01-TB	N/A	227	3.28.01/1515	~~S~~ DIW	G	3x40 ml	4C, HCL	G	TB	VOCs (8260)	
054641-001	TJAOU-227-VW-01-200.0-S	200.0	227	3.27.01/1345	S	G	125 ml	4C	G	SA	VOCs (8260)	

Abnormal Conditions on Receipt [redacted]

SF 2001-COC (7/00)

CONTRACT LABORATORY
ANALYSIS REQUEST AND CHAIN OF CUSTODY

Page 1 of 2

Internal Lab No. N/A   SAR/WR No. 3-28-01

AR/COC 604200

Mail Stop:	6133/1087	Date Samples Shipped:		Contract No:	AJ2480A
Project Manager:	Sue Collins	Carrier/Waybill No.	742048	Project/Task No.:	7225/02.02.09
Project Name:	Site 227 drilling	Lab Contact:	Edie Kent	SMO Authorization:	
Record Center Code:	ER/1309/227/DAT	Lab Destination:	General Engineering Labs		
Logbook Ref. No.:	ER078	SMO Contact/Phone:	P. Pulsmant/844-3185		
Service Order No:	CF0103-01	Send Report to SMO:	Suzi Jensen		

☑ Waste Characterization
RCRA Date:
☐ Send Preliminary/report to
☐ Validation Required
☐ Released by COC No.:

Bill To: Sandia National Labs (Accounts Payable)
PO Box 5800, MS-0154, Albuquerque, NM 87185-0

Location: Tech Area II — Reference LOV(available at SMO)

Sample No.-Fraction	ER Sample ID or Sample Location Detail	Beginning Depth (ft)	ER Site No.	Date/Time(hr) Collected	Sample Matrix	Container Type	Container Volume	Preserve All@4C	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
054629-002	TJAOU-227-VW-01-20.0-S	20.0	227	3.26.01/1520	S	G	125 ml	4C	G	SA	VOCs (8260)	
054629-003	TJAOU-227-VW-01-20.0-S	20.0	227	3.26.01/1520	S	AG	500 ml	4C	G	SA	SVOCs (8270), RCRA metals + Titanium (6010/7471); Cr-6 (7196), HE (8330), Chloride (300.0), Cyanide	
054629-004	TJAOU-227-VW-01-20.0-S	20.0	227	3.26.01/1520	S	AG	2x1L	4C	G	SA	Tritium	
054629-005	TJAOU-227-VW-01-20.0-S	20.0	227	3.26.01/1520	S	AG	500 ml	4C	G	SA	Iso U/PU	
054629-006	TJAOU-227-VW-01-20.0-S	20.0	227	3.26.01/1520	S	AG	500 ml	4C	G	SA	Cs-137	
054638-001	TJAOU-227-VW-01-100.0-S	100.0	227	3.27.01/0800	S	G	125 ml	4C	G	SA	VOCs (8260)	
054639-001	TJAOU-227-VW-01-100.0-DU	100.0	227	3.27.01/0800	S	G	125 ml	4C	G	DU	VOCs (8260)	

RMMA ☐ Yes ☑ No   Ref. No.
Sample Disposal ☐ Return to Client ☑ Disposal by lab
Turnaround Time ☐ 7 Day* ☐ 15 Day* ☒ 30 Day
Return Samples By: ☐ Negotiated TAT

Sample Tracking — SMO Use
Date Entered(mm/dd/yy) 04/04/01
Entered by:
QC Inits.

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

*Please list as separate report.

Abnormal Conditions on Receipt

Sample Team Members	Name	Signature	Init	Company/Organization/Phone/Cellular
	Robin Ryan	Robin Ryan	RR	GRAM/6133/845-8821

	Org.	Date	Time		Org.	Date	Time
1. Relinquished by Robin Ryan	6133	3/28/01	1100	4. Relinquished by			
1. Received by	6132	3/28/01	1100	4. Received by			
2. Relinquished by	6132	3/28/01	1330	5. Relinquished by			
2. Received by				5. Received by			
3. Relinquished by				6. Relinquished by			
3. Received by				6. Received by			

*7/15 Day Turnaround Time: ERCL requires prior notification.

SF 2001-COC (7/00)

CONTRACT LABORATORY
Analysis Request And Chain Of Custody (Continuation)

Page 2 of 2

AR/COC- 604200

Project Name: Site 227 Drilling | Project/Task Manager: Sue Collins | Project/Task No.: [illegible]

Location: Tijeras Arroyo

Building / Room

Reference LOV (available at SMO)

Lab use

Sample No-Fraction	ER Sample ID or Sample Location detail	Beginning Depth (ft)	ER Site No.	Date/Time (hr) Collected	Sample Matrix	Container Type	Container Volume	Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
054637-002	TJAOU-227-VW-01-150.0-S	150.0	227	3.27.01/1040	S	G	125 ml	4C	G	SA	VOCs (8260)	
054637-003	TJAOU-227-VW-01-150.0-S	150.0	227	3.27.01/1040	S	AG	500 ml	4C	G	SA	SVOCs (8270), RCRA metals + Titanium (6010/7471), Cr-6 (7196), HE (8330), Chloride (300.0), Cyanide	
054637-004	TJAOU-227-VW-01-150.0-S	150.0	227	3.27.01/1040	S	AG	2x1L	4C	G	SA	Tritium	
054637-005	TJAOU-227-VW-01-150.0-S	150.0	227	3.27.01/1040	S	AG	500 ml	4C	G	SA	Iso U/PU/~~Cs-137~~	
054637-006	TJAOU-227-VW-01-150.0-S	150.0	227	3.27.01/1040	S	AG	500 ml	4C	G	SA	Cs-137	
054640-001	TJAOU-227-VW-01-TB	N/A	227	3.26.01/1515	S	G	3x40 ml	4C, HCL	G	TB	VOCs (8260)	
054641-001	TJAOU-227-VW-01-200.0-S	200.0	227	3.27.01/1345	S	G	125 ml	4C	G	SA	VOCs (8260)	

Abnormal Conditions on Receipt [illegible] LAB USE

[illegible] Initials [illegible]

Salmi, Douglas R

From: Salmi, Douglas R
Sent: March 29, 2001 10:11 AM
To: Ryan, Robin; Collins, Sue S
Cc: 'Edie/GEL'; 'David Setzer'
Subject: COC 604200; Analysis Clarifications; GEL

GEL received samples today on COC 604200 and has requested some clarification on some of the analysis request.

1) Samples 054629-003 and 054637-003 requested RCRA metals plus titanium. The titanium is written out as opposed to the chemical symbol (Tl) so the request for titanium appears explicit. Titanium is rarely asked for; could it be thallium or thorium?
(However thorium (Th) is often confused with thallium (Tl).)

2) Several samples request Cs 137 explicitly. Again Cs 137 is rarely asked for alone; it is usually included in the gamma spec library reported. GEL can report Cs 137 alone. Is that is what desired (it sure appears so) or is the whole gamma spec really wanted.

3) Sample number 054629-005 requested Iso U and Iso Pu; 054629-006 requested Cs 137. Sample number 054637-005 requested Iso U, Iso Pu, and Cs 137; sample number 054637-006 requested Cs 137. It is assumed that Cs 137 is really not requested from the two different fractions of sample number 054637 and that the Cs 137 request on 054637-005 be deleted.

Sample Findings Summary

Site: Site 227 | AR/COC: 604204 | Data Type: Inorganic

Sample ID	Method/CAS Number (Analysis/Analyte) 7439-97-6 (Hg)		18540-29-9 (Cr+6)												
054646-008 TJAOU-227-VW-01-EB1			UJ,HT												
054646-010 TJAOU-227-VW-01-EB1	UJ,B3														

Validated By: Mr. Kenneth Salaz

Date: 6/01/01

Sample Findings Summary

Site: Site 227 | AR/COC: 604204 | Data Type: Organic

	Method/CAS Number (Analysis/Analyte)															
Sample ID	VOCs:	79-01-6 (trichloroethene)		SVOCs:	83-32-9 (acenaphthene)		HEs:	88-72-2 (o-nitrotoluene)								
054644-001 TJAOU-227-VW-01-250-S		UJ														
054645-001 TJAOU-227-VW-01-275-S		UJ														
054646-002 TJAOU-227-VW-01-EB1		UJ														
054647-001 TJAOU-227-VW-01-TB		UJ														
054646-003 TJAOU-227-VW-01-EB1					UJ											
054646-009 TJAOU-227-VW-01-EB1								UJ,AP								

Validated By: Mr. Kenneth Salaz

Date: 6/01/01

Sample Findings Summary

Site: Site 227 **AR/COC:** 604204 **Data Type:** Radiochemical

Sample ID	Method/CAS Number (Analysis/Analyte) 10028-17-8 (tritium)															
054646-004 TJAOU-227-VW-01-EB1	R															

Validated By: Mr. Kenneth Salaz **Date:** 6/01/01

Analytical Quality Associates, Inc.
616 Maxine NE
Albuquerque, NM 87123
Phone: 505-299-5201
Fax: 505-299-6744
Email: minteer@aol.com

MEMORANDUM

DATE: June 1, 2001

TO: File

FROM: Kenneth Salaz

SUBJECT: Radiochemical Data Review and Validation - SNL Site 227, ARCOC #604204, GEL SDG #39990, Case No. 7225.02.02.09

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

Summary

All samples were prepared and analyzed with approved procedures using methods EPA906.0 Tritium, HASL300 Iso-Pu/U, and EPA901.1 Gamma Spec. A problem was identified with the data package that results in the qualification of data.

1. Tritium Analysis: The tritium result of sample 39990-005 was negative, and the absolute value was greater than (>) the MDA. Thus, this sample result will be qualified "R" (unusable).

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

Holding Times/Preservation

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

Calibration

All Analyses: The case narratives stated the instruments used were properly calibrated.

Blanks

All Analyses: No target analytes were detected in the method blanks at concentrations > the associated MDAs.

Matrix Spike (MS) Analysis

Gamma Spec/Tritium Analyses: The MS analyses were performed on samples from other SDGs. The case narratives stated that all QC acceptance criteria were met. No sample data were qualified as a result.

Iso-Pu/U Analyses: No MS analysis was performed for this method. No sample data were qualified as a result.

Laboratory Control Sample (LCS) Analysis

All Analyses: The LCS analyses met QC acceptance criteria.

Replicates

All Analyses: The replicate analyses were performed on samples from other SDGs. The case narratives stated that all QC acceptance criteria were met. No sample data were qualified as a result.

Tracer/Carrier Recoveries

Iso-Pu/U Analyses: All tracer recoveries met QC acceptance criteria.

Gamma Spec/Tritium Analyses: No tracers/carriers were required for these methods.

Negative Bias

All Analyses: All sample results met negative bias QC acceptance criteria except as noted above in the summary section.

Other QC

All Analyses: The samples were equipment blanks (EBs). No field duplicates or field blanks (FBs) were submitted on the ARCOC.

No other specific issues were identified which affect data quality.

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

Analytical Quality Associates, Inc.
616 Maxine NE
Albuquerque, NM 87123
Phone: 505-299-5201
Fax: 505-299-6744
Email: minteer@aol.com

MEMORANDUM

DATE: June 1, 2001

TO: File

FROM: Kenneth Salaz

SUBJECT: Organic Data Review and Validation - SNL
Site 227, ARCOC #604204,
GEL SDG #39990/39997, Project/Task No. 7225.02.02.09

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

Summary

All samples were prepared and analyzed with approved procedures using methods EPA8260A/B VOCs, EPA8270C SVOCs, EPA8330 HEs, and EPA8082 PCBs. Problems were identified with the data package that result in the qualification of data.

1. VOC Analysis: The initial calibration response factors (RFs) of trichloroethene for the soil samples, the equipment blank (EB), and the trip blank (TB), were less than (<) the required minimum but greater than (>) 0.01. All associated sample results were non-detect (ND) and will be qualified "UJ."

   SVOC Analysis: The initial calibration RF of acenaphthene was < the required minimum but >0.01. The associated result of sample 39990-004 was ND and will be qualified "UJ."

2. HE Analysis: The LCS percent recovery (%R) of o-nitrotoluene was < QC acceptance limits but >10%, and the LCSD relative percent difference (RPD) was > the QC acceptance limit. The associated result of sample 39990-009 was ND and will be qualified "UJ,A,P."

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

Holding Times/Preservation

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

Calibration

VOC Analysis: The initial and continuing calibrations met QC acceptance criteria except as noted above in the summary section and the following. The continuing calibration verification (CCV) percent differences (%Ds) of acetone, 2-butanone, 2-hexanone, and xylenes for the EB and TB were >20% but <40%. However, all associated sample results were ND. Thus, no sample data were qualified.

SVOC Analysis: The initial and continuing calibrations met QC acceptance criteria except as noted above in the summary section and the following. The CCV %Ds of N-nitroso-di-n-propylamine, di-n-butylphthalate, butylbenzylphthalate, and bis(2-ethylhexyl)phthalate were >20% but <40%. However, all associated sample results were ND. Thus, no sample data were qualified.

HE/PCB Analyses: The initial and continuing calibrations met QC acceptance criteria.

Blanks

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

Surrogates

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

Internal Standards (ISs)

VOC/SVOC Analyses: The IS areas and retention times (RTs) met QC acceptance criteria.

HE/PCB Analyses: No ISs were required for these methods.

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

VOC Analysis: The MS/MSD analyses for the soil samples met QC acceptance criteria. The MS/MSD analyses for the EB and TB were performed on a sample from another SDG. The case narrative stated that all QC acceptance criteria were met. No sample data were qualified as a result.

SVOC Analysis: The MS/MSD analyses met QC acceptance criteria.

HE Analysis: The MS/MSD analyses were performed on a sample from another SDG. The case narrative stated that all QC acceptance criteria were not met. However, no sample data were qualified as a result.

PCB Analysis: The MS/MSD analyses were performed on a sample from another SDG. The case narrative did not state whether or not QC acceptance criteria were met, and no data were provided. No sample data were qualified as a result.

Laboratory Control Samples (LCS/LCSD) Analysis

VOC Analysis: The LCS/LCSD analyses met QC acceptance criteria.

SVOC Analysis: The LCS/LCSD analyses met QC acceptance criteria except for the following. The LCS %R of phenol was slightly < the QC acceptance limit, and the LCSD RPD was > the QC limit. However, the LCSD and MS/MSD %Rs met QC acceptance criteria. Thus, no sample data were qualified. The LCSD RPD of 4-nitrophenol was > the QC acceptance limit. However, both %Rs met QC acceptance criteria. Thus, no sample data were qualified.

HE Analysis: The LCS/LCSD analyses met QC acceptance criteria except as noted above in the summary section and the following. The LCSD RPDs of several compounds (see Data Validation Worksheets) were > QC acceptance limits. However, all %Rs met QC acceptance criteria. Thus, no sample data were qualified.

PCB Analysis: The LCS/LCSD analyses met QC acceptance criteria except for the following. The LCSD RPD of Aroclor-1260 was > the QC acceptance limit. However, both %Rs met QC acceptance criteria. Thus, no sample data were qualified.

Other QC

VOC Analysis: In the EB, dibromochloromethane and bromoform were detected. However, all associated sample results were ND. Thus, no sample data were qualified. No target analytes were detected in the TB. No field duplicate was submitted on the ARCOC.

SVOC/HE/PCB Analyses: The samples were EBs. No field duplicates or field blanks (FBs) were submitted on the ARCOC.

No other specific issues were identified which affect data quality.

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

Analytical Quality Associates, Inc.
616 Maxine NE
Albuquerque, NM 87123
Phone: 505-299-5201
Fax: 505-299-6744
Email: minteer@aol.com

MEMORANDUM

DATE: June 1, 2001

TO: File

FROM: Kenneth Salaz

SUBJECT: Inorganic Data Review and Validation - SNL
Site 227, ARCOC #604204,
GEL SDG #39990, Project/Task No. 7225.02.02.09

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

Summary

All samples were prepared and analyzed with approved procedures using methods EPA6010B ICP-AES, EPA7470A CVAA, EPA7196A (Cr+6), EPA9012A (CN), and EPA300.0 (Cl). Problems were identified with the data package that result in the qualification of data.

1. Cr+6 Analysis: Sample 39990-001 was received by the laboratory beyond the method specified holding time. The sample was analyzed for Cr+6 beyond the holding time but within 2X the holding time. The associated sample result was non-detect (ND) and will be qualified "UJ,HT."

2. CVAA Analysis: In the initial calibration blank (ICB), mercury (Hg) was detected at a negative concentration. The absolute value was greater than (>) the detection limit (DL) but less than (<) the reporting limit (RL). The associated result of sample 39990-010 was ND and will be qualified "UJ,B3."

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

Holding Times/Preservation

All Analyses: All samples were analyzed within the prescribed holding times and properly preserved except as noted above in the summary section.

Calibration

All Analyses: The initial and continuing calibrations met QC acceptance criteria except for the following. The ICV percent recovery (%R) of CN was slightly > QC acceptance limits. However, the associated sample result was ND. Thus, no sample data were qualified.

Blanks

ICP Analysis: No target analytes were detected in the blanks except for the following. In the ICB and continuing calibration blank (CCB), titanium (Ti) was detected. In the ICB and method blank, cadmium (Cd) was detected. However, all associated sample results were ND. Thus, no sample data were qualified.

CVAA Analysis: No target analytes were detected in the blanks except as noted above in the summary section.

Cr+6/CN/Cl Analyses: No target analytes were detected in the blanks.

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

ICP/CVAA/CN Analyses: The MS analyses met QC acceptance criteria. No MSD analyses were performed. The replicate analyses were used as measures of laboratory precision.

Cr+6/Cl Analyses: The MS analyses were performed on samples from other SDGs. All QC acceptance criteria were met. No sample data were qualified as a result.

Laboratory Control Samples (LCS/LCSD) Analysis

All Analyses: The LCS/LCSD analyses met QC acceptance criteria.

Replicate Analysis

ICP/CVAA/CN Analyses: The replicate analyses met QC acceptance criteria.

Cr+6/Cl Analyses: The replicate analyses were performed on samples from other SDGs. All QC acceptance criteria were met. No sample data were qualified as a result.

ICP Interference Check Sample (ICS)

ICP Analysis: The ICS met QC acceptance criteria.

All Other Analyses: No ICS was required for these methods.

ICP Serial Dilution

ICP Analysis: The serial dilution analysis met QC acceptance criteria.

All Other Analyses: No serial dilution was required for these methods.

Other QC

All Analyses: The samples were equipment blanks (EBs). No field duplicates or field blanks (FBs) were submitted on the ARCOC.

No other specific issues were identified which affect data quality.

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

Data Validation Summary

Site/Project: Site 227 Project/Task #: 7225.02.02.09 # of Samples: 14 Matrix: 2 soil/12 aqueous

AR/COC #: 604204 Laboratory Sample IDs: 39997-001 to -002

Laboratory: GEL 39990-001 to -012

Laboratory Report #: 39997/39990

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

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

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

Reviewed By: [signature] Date: 8/1/01

Holding Time and Preservation

Site/Project: SiL 227 AR/COC #: 604204 Laboratory Sample IDs: 39997-001 & -002

Laboratory: CEL Laboratory Report #: 39997/39990 39990-001 to -012

# of Samples: 14 Matrix: 2 soil/12 aqueous

Sample ID	Analytical Method	Holding Time Criteria	Days Holding Time was Exceeded	Preservation Criteria	Preservation Deficiency	Comments
39990-001	EPA7196A(Cr6)	24 hrs (1 day)	1 Day	NA	NA	Received by lab outside holding time

Reviewed By: [signature] Date: 8/1/01

Volatile Organics (SW 846 Method 8260)

Site/Project: Site 227 AR/COC #: 604204 # of Samples: 2 Matrix: Soil

Laboratory: GEL SDG #: ~~51906~~ 5/31/01 39977 Laboratory Sample IDs: 39977-001 & -002

Methods: EPA 8260A Batch #: 71906

IS	CAS #	Name	TCL	Min RF	Intercept	Calib. RF >.05	Calib. RSD/ R^2 <20% / 0.99	CCV %D 20%	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Equip. Blanks	Trip Blanks		
1	74-87-3	Chloromethane	✓	0.10	NA	✓	✓	✓	✓							NA	✓	✓		
1	74-83-9	Bromomethane		0.10		✓	✓													-
1	75-01-4	vinyl chloride		0.10		✓	✓													
1	75-00-3	Chloroethane		0.01		✓	✓													
1	75-09-2	methylene chloride (10xblk)		0.01	✓	✓	✓													
1	67-64-1	acetone(10xblk)		0.01	NA	✓	✓													
1	75-15-0	carbon disulfide		0.10		✓	✓													
1	75-35-4	1,1-dichloroethene		0.20		✓	✓			✓	✓	✓	✓	✓	✓					
1	75-34-3	1,1-dichloroethane		0.10		✓	✓													
1	67-66-3	Chloroform		0.30		✓	✓													
1	107-06-2	1,2-dichloroethane		0.10		✓	✓													
1	78-93-3	2-butanone(10xblk)		0.01		✓	✓													
2	71-55-6	1,1,1-trichloroethane		0.10		✓	✓													
2	56-23-5	carbon tetrachloride		0.10		✓	✓													
2	75-27-4	Bromodichloromethane		0.20		✓	✓													
2	78-87-5	1,2-dichloropropane		0.01		✓	✓													
2	10061-01-5	cis-1,3-dichloropropene		0.20		✓	✓													
2	79-01-6	Trichloroethene		0.30		0.5[illegible]	✓				✓	✓	✓	✓	✓					
2	124-48-1	Dibromochloromethane		0.10		✓	✓										0.46			
2	79-00-5	1,1,2-trichloroethane		0.10		✓	✓										✓			
2	71-43-2	Benzene		0.50		✓	✓			✓	✓	✓	✓	✓	✓					
2	10061-02-6	trans-1,3-dichloropropene		0.10		✓	✓													
2	75-25-2	Bromoform		0.10		✓	✓										0.445			
3	108-10-1	4-methyl-2-pentanone		0.10		✓	✓										✓			
3	591-78-6	2-hexanone		0.01		✓	✓													
3	127-18-4	Tetrachloroethene		0.20		✓	✓													
3	79-34-5	1,1,2,2-tetrachloroethane		0.30		✓	✓													
3	108-88-3	toluene(10xblk)		0.40		✓	✓			✓	✓	✓	✓	✓	✓					
3	108-90-7	Chlorobenzene		0.30		✓	✓			✓	✓	✓	✓	✓	✓					
3	100-41-4	Ethylbenzene		0.10		✓	✓													
3	100-42-5	Styrene		0.30		✓	✓													
3	1330-20-7	xylenes(total)		0.30		✓	✓													
	540-59-0	1,2-dichloroethylene(total)		0.01		✓	✓													
	108-05-4	Vinyl Acetate				✓	✓													

Comments: Notes: Shaded rows are RCRA compounds. NA = Not Applicable

Reviewed By: [signature] Date: 5/31/01

Volatile Organics

Site/Project: Site 227 AR/COC #: 604204 Batch #: 71906

Laboratory: GEL SDG #: 39597 # of Samples: 2 Matrix: Soil

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

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

SMC 1: Bromofluorobenzene
SMC 2: Dibromofluormethane
SMC 3: Toluene-d8

IS 1: Fluorobenzene
IS 2: Chlorobenzene-d5
IS 3: 1,4-Dichlorobenzene-d4

Comments:

Volatile Organics (SW 846 Method 8260)

Site/Project: STK 227 AR/COC #: 604204 # of Samples: 2 Matrix: [illegible]

Laboratory: GEL SDG #: 35990 Laboratory Sample IDs: 37770-002 + -003

Methods: 8260B Batch #s: 71556

IS	CAS #	Name	TCL	Min. RF	Intercept	Calib. RF >.05	Calib. RSD/R² <20%/0.99	CCV %D ≤20%	Method Blks	LCS	LCSD	LCS RPD	① MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Trip Blanks		
1	74-87-3	Chloromethane	✓	0.10	NA	✓	✓	✓	✓				NA	NA	NA	NA	NA	NA		
1	74-83-9	Bromomethane		0.10	✓	✓	✓													
1	75-01-4	vinyl chloride		0.10	NA	✓	✓													
1	75-00-3	Chloroethane		0.01	NA	✓	✓													
1	75-09-2	methylene chloride (10xblk)		0.01	✓	✓	✓													
1	67-64-1	acetone(10xblk)		0.01	NA	✓	✓	-27.9												
1	75-15-0	carbon disulfide		0.10		✓	✓	✓												
1	75-35-4	1,1-dichloroethene		0.20		✓	✓			✓	✓	✓								
1	75-34-3	1,1-dichloroethane		0.10		✓	✓													
1	67-66-3	Chloroform		0.20		✓	✓													
1	107-06-2	1,2-dichloroethane		0.10		✓	✓													
1	78-93-3	2-butanone(10xblk)		0.01		✓	✓	-32.5												
2	71-55-6	1,1,1-trichloroethane	✓	0.10		✓	✓	✓												
2	56-23-5	carbon tetrachloride		0.10		✓	✓													
2	75-27-4	Bromodichloromethane		0.20		✓	✓													
2	78-87-5	1,2-dichloropropane		0.01		✓	✓													
2	10061-01-5	cis-1,3-dichloropropene		0.20		✓	✓													
2	79-01-6	Trichloroethene		0.30		0.26	✓	✓		✓	✓	✓								
2	124-48-1	Dibromochloromethane		0.10		✓	✓													
2	79-00-5	1,1,2-trichloroethane		0.10		✓	✓													
2	71-43-2	Benzene		0.50		✓	✓			✓	✓	✓								
2	10061-02-6	trans-1,3-dichloropropene		0.10		✓	✓													
2	75-25-2	Bromoform		0.10	✓	✓	✓													
3	108-10-1	4-methyl-2-pentanone		0.10	NA	✓	✓													
3	591-78-6	2-hexanone		0.01		✓	✓	-23.6												
3	127-18-4	Tetrachloroethene		0.20		✓	✓	✓												
3	79-34-5	1,1,2,2-tetrachloroethane		0.30		✓	✓													
3	108-88-3	toluene(10xblk)		0.40		✓	✓			✓	✓	✓								
3	108-90-7	Chlorobenzene		0.50		✓	✓			✓	✓	✓								
3	100-41-4	Ethylbenzene		0.10		✓	✓													
3	100-42-5	Styrene		0.30		✓	✓	✓												
3	1330-20-7	xylenes(total)		0.30		✓	✓	-24.6												
	540-59-0	1,2-dichloroethylene(total)		0.05		✓	✓	✓												
	108-05-4	Vinyl Acetate				✓	✓	✓												

Comments:
① MS/MSD performed on a sample from another SDG. All QC criteria were met.
(Case Narrative states)

Notes: Shaded rows are RCRA compounds.

NA = Not Applicable

Reviewed By: [signature] Date: 5/31/01

Volatile Organics

Site/Project: Site 227 AR/COC #: 604204 Batch #s: 71556

Laboratory: GEL SDG #: 35970 # of Samples: 2 Matrix: aqueous

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

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

SMC 1: Bromofluorobenzene
SMC 2: Dibromofluormethane
SMC 3: Toluene-d8

IS 1: Fluorobenzene
IS 2: Chlorobenzene-d5
IS 3: 1,4-Dichlorobenzene-d4

Comments:

Semivolatile Organics (SW 846 Method 8270)

Site/Project: SC 227 AR/COC #: 604204 Laboratory Sample IDs: 39990-024

Laboratory: GEL SDG #: 39970

Methods: 8AS270C

\# of Samples: 1 Matrix: aqueous Batch #s: 71761

IS	BNA	CAS #	NAME	TCL	Min RF	Intercept	Calib RF >.05	Calib RSD/R² <20%/0.99	CCV %D 20%	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Equip Blanks	Field Blanks		
1	A	108-95-2	Phenol	✓	0.80	NA	✓	✓	✓	✓	24 (213)	✓	36	✓	✓	✓	NA	NA	NA		
1	BN	111-44-4	bis(2-Chloroethyl)ether		0.70		✓	✓													
1	A	95-57-8	2-Chlorophenol		0.80		✓	✓			✓	✓	✓	✓	✓	✓					
1	BN	541-73-1	1,3-Dichlorobenzene		0.60		✓	✓													
1	BN	106-46-7	1,4-Dichlorobenzene		0.50		✓	✓			✓	✓	✓	✓	✓	✓					
1	BN	95-50-1	1,2-Dichlorobenzene		0.40		✓	✓													
1	A	95-48-7	o-cresol		0.70		✓	✓			✓	✓	✓								
1	BN	108-60-1	bis(2-chloroisopropyl)ether		0.01		✓	✓													
1	A	106-44-5	m,p-cresols		0.60		✓	✓			✓	✓	✓								
1	BN	621-64-7	N-Nitroso-di-n-propylamine		0.50		✓	✓	-23.8		✓	✓	✓	✓	✓	✓					
1	BN	67-72-1	Hexachloroethane		0.30		✓	✓	✓		✓	✓	✓								
2	BN	98-95-3	Nitrobenzene		0.20		✓	✓			✓	✓	✓								
2	BN	78-59-1	Isophorone		0.40		✓	✓													
2	A	88-75-5	2-Nitrophenol		0.10		✓	✓													
2	A	105-67-9	2,4-Dimethylphenol		0.20		✓	✓													
2	BN	111-91-1	bis(2-Chloroethoxy)methane		0.30		✓	✓													
2	A	120-83-2	2,4-Dichlorophenol		0.20		✓	✓													
2	BN	120-82-1	1,2,4-Trichlorobenzene		0.20		✓	✓			✓	✓	✓	✓	✓	✓					
2	BN	91-20-3	Naphthalene		0.70		✓	✓													
2	BN	106-47-8	4-Chloroaniline		0.01		✓	✓													
2	BN	87-68-3	Hexachlorobutadiene		0.01		✓	✓			✓	✓	✓								
2	A	59-50-7	4-Chloro-3-methylphenol		0.20		✓	✓			✓	✓	✓	✓	✓	✓					
2	BN	91-57-6	2-Methylnaphthalene		0.40		✓	✓													
3	BN	77-47-4	Hexachlorocyclopentadiene		0.01		✓	✓													
3	A	88-06-2	2,4,6-Trichlorophenol		0.20		✓	✓			✓	✓	✓								
3	A	95-95-4	2,4,5-Trichlorophenol		0.20		✓	✓			✓	✓	✓								

Comments:

Notes: Shaded rows are RCRA compounds.

NA - Dup Applies

Reviewed By: [signature] Date: 5/31/01

Semivolatile Organics

Site/Project: 5k 227 AR/COC #: 604204 Batch #s: 71761

Laboratory: GEL SDG #: 39990 # of Samples: 1 Matrix: aqueous

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		
							>.05	<20%/ 0.99	20%												
3	BN	91-58-7	2-Chloronaphthalene	✓	0.80	NA	✓	✓	✓	✓							NA	NA	NA		
3	BN	88-74-4	2-Nitroaniline (o-)		0.01		✓	✓													
3	BN	131-11-3	Dimethylphthalate		0.01		✓	✓													
3	BN	208-96-8	Acenaphthylene		0.90		✓	✓													
3	BN	606-20-2	2,6-Dinitrotoluene		0.20		✓	✓													
3	BN	99-09-2	3-Nitroaniline (m-)		0.01		✓	✓													
3	BN	83-32-9	Acenaphthene		0.90		0.84	✓			✓	✓	✓	✓	✓	✓					
3	A	51-28-5	2,4-Dinitrophenol		0.01	✓	✓	✓													
3	A	100-02-7	4-Nitrophenol		0.01	NA	✓	✓			✓	✓	40	✓	✓	✓					
3	BN	132-64-9	Dibenzofuran		0.80		✓	✓													
3	BN	121-14-2	2,4-Dinitrotoluene		0.20		✓	✓			✓	✓	✓	✓	✓	✓					
3	BN	84-66-2	Diethylphthalate		0.01		✓	✓													
3	BN	7005-72-3	4-Chlorophenyl-phenylether		0.40		✓	✓													
3	BN	86-73-7	Fluorene		0.90		✓	✓													
3	BN	100-01-6	4-Nitroaniline (p-)		0.01	✓	✓	✓													
4	A	534-52-1	4,6-Dinitro-2-methylphenol		0.01	✓	✓	✓													
4	BN	86-30-6	Diphenylamine		0.01	NA	✓	✓													
4	BN	101-55-3	4-Bromophenyl-phenylether		0.10		✓	✓													
4	BN	118-74-1	Hexachlorobenzene		0.10		✓	✓			✓	✓	✓								
4	A	87-86-5	Pentachlorophenol		0.05		✓	✓			✓	✓	✓	✓	✓	✓					
4	BN	85-01-8	Phenanthrene		0.70		✓	✓													
4	BN	120-12-7	Anthracene		0.70		✓	✓													
4	BN	86-74-8	Carbazole		0.01		✓	✓													
4	BN	84-74-2	Di-n-butylphthalate		0.01		✓	✓	-24.1												
4	BN	206-44-0	Fluoranthene		0.60		✓	✓	✓												
5	BN	129-00-0	Pyrene		0.60		✓	✓	✓		✓	✓	✓	✓	✓	✓					
5	BN	85-68-7	Butylbenzylphthalate		0.01		✓	✓	-28.7												
5	BN	91-94-1	3,3'-Dichlorobenzidine		0.01		✓	✓	✓												
5	BN	56-55-3	Benzo(a)anthracene		0.80		✓	✓	✓												

Comments:

Semivolatile Organics

Site/Project: Site 227 AR/COC #: 604204 Batch #s: 7/761

Laboratory: GEL SDG #: 39950 # of Samples: 1 Matrix: aqueous

IS	BNA	CAS #	NAME	TCL	Min RF	Intercept	Calib RF	Calib RSD/ R²	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Equip Blanks	Field Blanks		
							>.05	<20% / 0.99	20%												
5	BN	218-01-9	Chrysene	✓	0.70	NA	✓	✓	✓	✓							NA	NA	NA		
5	BN	117-81-7	bis(2-Ethylhexyl)phthalate		0.01	NA	✓	✓	17.7											-	-
6	BN	117-84-0	Di-n-octylphthalate		0.01	✓	✓	✓													
6	BN	205-99-2	Benzo(b)fluoranthene		0.70	NA	✓	✓													
6	BN	207-08-9	Benzo(k)fluoranthene		0.70		✓	✓													
6	BN	50-32-8	Benzo(a)pyrene		0.70		✓	✓	↓												
6	BN	193-39-5	Indeno(1,2,3-cd)pyrene		0.50		✓	✓	35.2												
6	BN	53-70-3	Dibenzo(a,h)anthracene		0.40		✓	✓	23.9												
6	BN	191-24-2	Benzo(g,h,i)perylene	↓	0.50	↓	✓	✓	26.4	↓							↓	↓	↓		

Surrogate Recovery Outliers

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

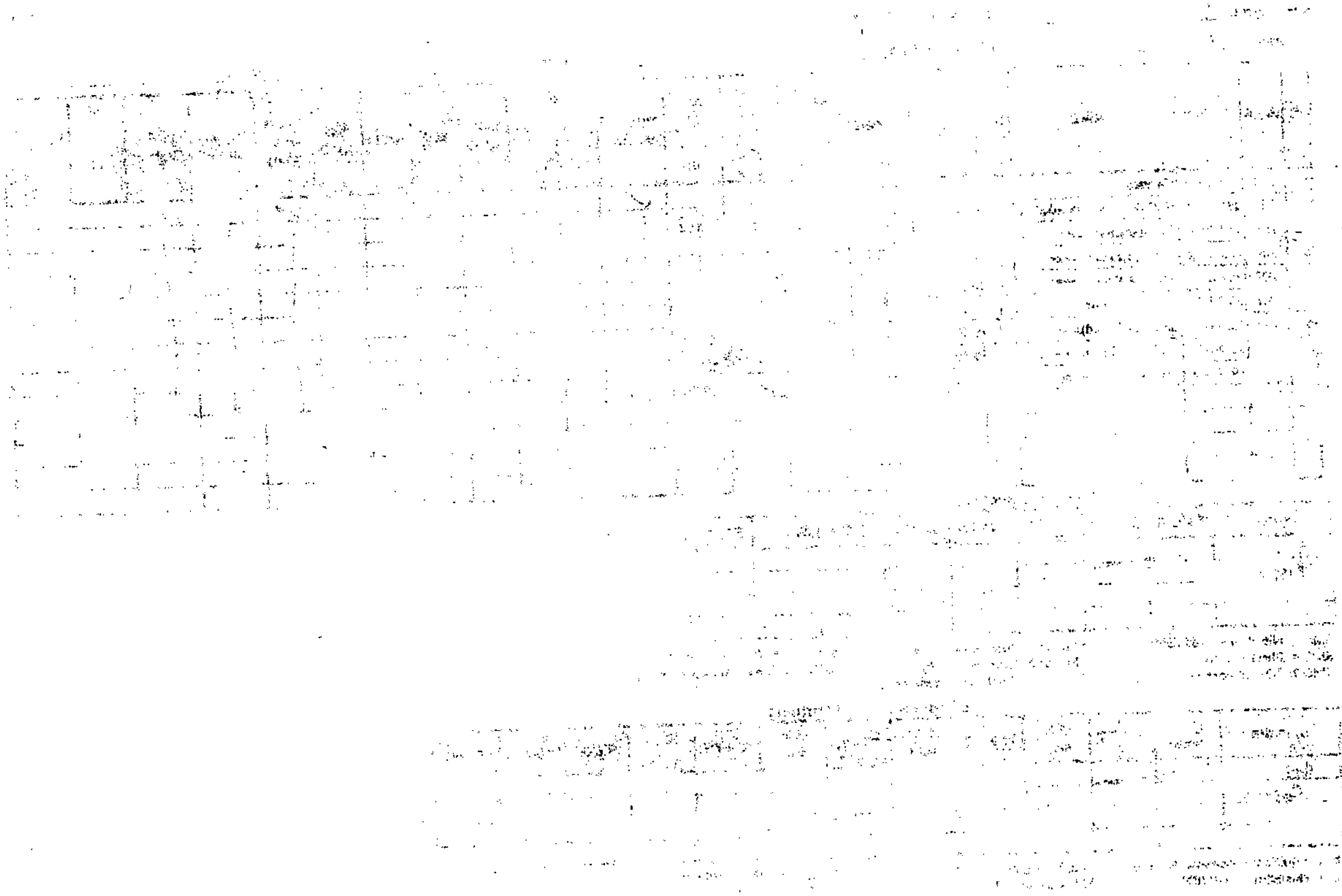
Comments:

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

Internal Standard Outliers

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

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



High Explosives (SW 846 Method 8330)

Site/Project: Site 227   AR/COC #: 604204   Laboratory Sample IDs: 39990-009

Laboratory: GEL   Laboratory Report #: 39990

Methods: EPA 8330

\# of Samples: 1   Matrix: aqueous   Batch #s: 71741

CAS #	NAME	TAL	Intercept	Curve R²	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	① MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks		
				.99	20%	U			20%			20%		U	U		
2691-41-0	HMX	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA		
121-82-4	RDX																
99-35-49	1,3,5-Trinitrobenzene																
99-65-0	1,3-dinitrobenzene (m-)						✓	✓	24								
98-95-3	Nitrobenzene						✓	✓	35								
479-45-8	Tetryl						✓	✓	✓								
118-96-7	2,4,6-trinitrotoluene																
35572-78-2	2-amino-4,6-dinitrotoluene																
19406-51-0	4-amino-2,6-dinitrotoluene																
121-14-2	2,4-dinitrotoluene						✓	✓	15								
606-20-2	2,6-dinitrotoluene						✓	✓	27								
88-72-2	2-nitrotoluene (o-)						65	✓	37								
99-99-0	4-nitrotoluene (p-)						✓	✓	33								
99-08-1	3-nitrotoluene (m-)						✓	✓	35								
78-11-5	PETN																

NA = Not Applicable

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

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

Confirmation

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

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

Reviewed By: [signature]   Date: 5/31/01

PCBs (SW 846 - Method 8082)

Site/Project: Site 227 AR/COC #: 604204 Laboratory Sample IDs: 39790-008

Laboratory: GEL Laboratory Report #: 39790

Methods: EPA 8082

# of Samples: 1 Matrix: aqueous Batch #: 72010

CAS #	Name	TCL	Intercept	Calib. RSD / R² <20% / 0.99	CCV %D 20%	Method Blanks	LCS	LCSD	LCS RPD 20%	① MS	MSD	MS RPD 20%	Field Dup. RPD	Equip. Blanks	Field Blanks		
12674-11-2	Aroclor-1016	✓	NA	✓	✓	✓				NA	NA	NA	NA	NA	NA		
11104-28-2	Aroclor-1221	↓	↓	↓	NA	↓				↓	↓	↓	↓	↓	↓		
11141-16-5	Aroclor-1232	↓	↓	↓	↓	↓				↓	↓	↓	↓	↓	↓		
53469-21-9	Aroclor-1242	↓	↓	↓	↓	↓				↓	↓	↓	↓	↓	↓		
12672-29-6	Aroclor-1248	↓	↓	↓	↓	↓				↓	↓	↓	↓	↓	↓		
11097-69-1	Aroclor-1254	↓	↓	↓	↓	↓				↓	↓	↓	↓	↓	↓		
11096-82-5	Aroclor-1260	↓	↓	↓	✓	↓	✓	✓	3.0	↓	↓	↓	↓	↓	↓		

NA = Not Applicable

Sample	SMC % REC	SMC RT	Sample	SMC % REC	SMC RT
~~39790-008~~ KAS 7/1/01	~~62-34~~				

Comments:
① MS/MSD performed on a sample from another SDG.

Confirmation

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

Reviewed By: [signature] Date: 8/1/01

Inorganic Metals

Site/Project: Site 227 AR/COC #: 604204 Laboratory Sample IDs: 37770-010

Laboratory: GEL SDG #: 37770 -

Methods: EPA 6010B (ICP), EPA 7471A (CVAA)

# of Samples: 1 Matrix: [illegible] Batch #s: 71918 / 71704

CAS # / Analyte	TAL	ICV	CCV	ICB (mg/L)	CCB (mg/L)	Method Blanks	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	Rep. RPD	ICS AB	Serial Dilution	Field Dup. RPD	Equip. Blanks	Field Blanks		
7429-90-5 Al																NA	NA	NA	-	
7440-39-3 Ba	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7440-41-7 Be																				
7440-43-9 Cd	✓	✓	✓	[illegible]	✓	(0.0029)	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7440-70-2 Ca																				
7440-47-3 Cr	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7440-48-4 Co																				
7440-50-8 Cu																				
7439-89-6 Fe																				
7439-95-4 Mg																				
7439-96-5 Mn																				
7440-02-0 Ni																				
7440-09-7 K																				
7440-22-4 Ag	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7440-23-5 Na																				
7440-62-2 V																				
7440-66-6 Zn																				
7439-92-1 Pb	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7782-49-2 Se	✓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
7440-38-2 As	✓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
7440-36-0 Sb																				
7440-28-0 Tl																				
Ti	✓	✓	✓	0.345	0.462	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7439-97-6 Hg	✓	✓	✓	-0.077	✓	✓	✓	✓	✓	✓	NA	NA	NA	NA	NA	✓				
Cyanide CN																				

Notes: Shaded rows are RCRA metals. Solids-to-aqueous conversion: mg / kg = µg / g : [(µg / g) x (sample mass (g) / sample vol. (ml)) x (1000 ml / 1 liter)] / Dilution Factor = µg / l NA = Not Applicable

Comments:

Reviewed By: [signature] Date: 8/1/01

[illegible]

General Chemistry

Site/Project: Site 227 AR/COC #: 604204 Laboratory Sample IDs: 39990-001, -006, -011

Laboratory: GEL Laboratory Report #: 39990

Methods: EPA7196A (Cr+6), EPA9012A (Tot. CN), EPA300.0(Cl)

# of Samples: 3 Matrix: aqueous Batch #s: 71269, 72366, 72788

CAS #	Analyte	QC Element: TAL	ICV	CCV	ICB	CCB	Method Blanks	LCS	LCSD	LCSD RPD	① MS	MSD	MSD RPD	Rep. RPD	ICS AB	Serial Dilution	Field Dup. RPD	Equip. Blanks	Field Blanks	
18540-29-9	Cr+6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	NA	NA	NA	NA	NA	
5955-70-0	Tot CN	✓	✓✓✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	↓	↓	↓	↓	↓	
16887-00-6	Chloride	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓ ~~NA~~ [illegible]	NA	NA	NA	↓	↓	↓	↓	↓	

NA = Not Applicable

Comments:
① MS & Rep. for Cr+6 and chloride performed on samples from other SDGs. All QC criteria were met.

Reviewed By: [signature] Date: 6/1/01

Radiochemistry

Site/Project: 604204 AR/COC #: 604204 Laboratory Sample IDs: 39970-005, -007, -012

Laboratory: GEL SDG #: 39990

Methods: EPA 901.1 (Gamma Spec), EPA 906.0 (H3), HASL 300 (Iso-U/Pu)

\# of Samples: 3 Matrix: aqueous Batch #s: 71361, 71863, 72290/72292

Analyte	QC Element												
	Method Blanks	LCS	MS ①	Rep RER	Equip. Blanks	Field Dup. RER	Field Blanks	Sample ID	Isotope	IS/Trace	Sample ID	Isotope	IS/Trace
Criteria	U	20%	25%	<1.0	U	<1.0	U			50-105			50-105
H3	✓	✓	NA	NA	NA	NA	NA						
U-238	✓	✓	NA	NA				All					
U-234/233													
U-235/-236								Passed					
Th-232													
Th-228													
Th-230													
Pu-239/-240	✓	✓	NA	NA									
Gross Alpha													
Nonvolatile Beta													
Ra-226													
Ra-228													
Ni-63													
Gamma Spec. Am-241	✓	✓	NA	NA									
Gamma Spec. Cs-137		✓											
Gamma Spec. Co-60		✓											
Th-234	✓		✓	✓									

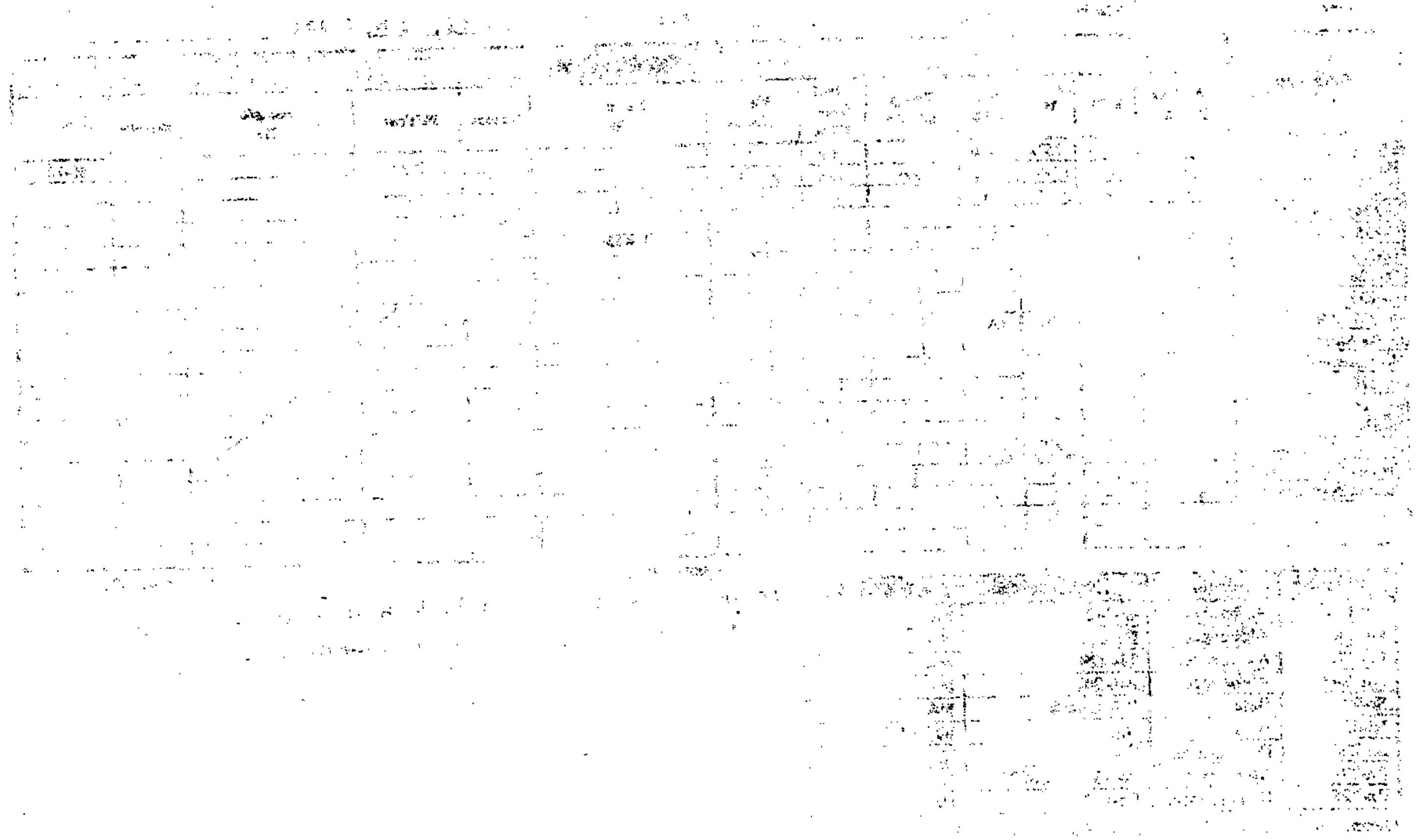
Comments: MS = Not Applicable

① MS & Rep. for Gamma Spec, H^3, and Rep. for Iso-U, Pu performed on samples from another SDG. Case narrative states all QC were met.

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

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

Reviewed By: [signature] Date: 6/1/01



Contract Verification Review (CVR)

Project Leader COLLINS | Project Name SITE 227 | Case No. 7225_02.02.08

AR/COC No. 604204 | Analytical Lab GEL | SDG No. 39990

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

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

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

2.0 Analytical Laboratory Report

Line No.	Item	Complete? Yes	Complete? No	If no, explain	Resolved? Yes	Resolved? No
2.1	Data reviewed, signature	X				
2.2	Method reference number(s) complete and correct	X				
2.3	QC analysis and acceptance limits provided (MB, LCS, Replicate)	X				
2.4	Matrix spike/matrix spike duplicate data provided(if requested)	X				
2.5	Detection limits provided; PQL and MDL(or IDL), MDA and L_c	X				
2.6	QC batch numbers provided	X				
2.7	Dilution factors provided and all dilution levels reported	X				
2.8	Data reported in appropriate units and using correct significant figures	X				
2.9	Radiochemistry analysis uncertainty (2 sigma error) and tracer recovery (if applicable) reported	X				
2.10	Narrative provided	X				
2.11	TAT met	X				
2.12	Hold times met		X	SAMPLE FOR Cr6+ ANALYSIS RECEIVED PAST HOLDING TIME	X	
2.13	Contractual qualifiers provided	X				
2.14	All requested result and TIC (if requested) data provided	X				

3.0 Data Quality Evaluation

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1 Are reporting units appropriate for the matrix and meet contract specified or project-specific requirements? Inorganics and metals reported as ppm (mg/liter or mg/Kg)? Tritium reported in picocuries per liter with percent moisture for soil samples? Units consistent between QC samples and sample data	X		
3.2 Quantitation limit met for all samples	X		
3.3 Accuracy a) Laboratory control samples accuracy reported and met for all samples		X	PHENOL FAILED RECOVERY LIMITS FOR SVOC LCS ACENAPHTHENE FAILED RECOVERY LIMITS FOR SVOC LCD 2-NITROTOLUENE & 4-NITROTOLUENE FAILED RECOVERY LIMITS FOR HE LCS
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique		X	SURROGATE FOR PCB SAMPLE #054646-007 FAILED RECOVERY LIMITS
c) Matrix spike recovery data reported and met	X		
3.4 Precision a) Replicate sample precision reported and met for all inorganic and radiochemistry samples	X		
b) Matrix spike duplicate RPD data reported and met for all organic samples	X		
3.5 Blank data a) Method or reagent blank data reported and met for all samples	X		
b) Sampling blank (e.g., field, trip, and equipment) data reported and met		X	BROMOFORM & DBCM DETECTED IN EQUIPMENT BLANK
3.6 Contractual qualifiers provided: "J"- estimated quantity; "B"-analyte found in method blank above the MDL for organic or above the PQL for inorganic; "U"-analyte undetected (results are below the MDL, IDL, or MDA (radiochemical)); "H"-analysis done beyond the holding time	X		
3.7 Narrative addresses planchet flaming for gross alpha/beta	NA		
3.8 Narrative included, correct, and complete	X		
3.9 Second column confirmation data provided for methods 8330 (high explosives) and pesticides/PCBs	X		

Contract Verification Review (Continued)

4.0 Calibration and Validation Documentation

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

Contract Verification Review (Concluded)

5.0 Problem Resolution

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

Sample/Fraction No.	Analysis	Problems/Comments/Resolutions
QC1000179209	SVOC	NO RPDs REPORTED FOR LCS/LCD (PG. 395)

Were deficiencies unresolved? ☑ Yes ☐ No

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

If no, provide: nonconformance report or correction request number 2517 and date correction request was submitted: 5-7-2001

Reviewed by: W. Palencia Date: 5-7-2001 Closed by: W. Palencia Date: 5-22-01

SF 2001-COC (7/00)

CONTRACT LABORATORY
ANALYSIS REQUEST AND CHAIN OF CUSTODY

Internal Lab Batch No. N/A   SAR/WR No.

Page 1 of 2

AR/COC 604204

Dept. No./Mail Stop:	6133/1087	Date Samples Shipped:	3-30-01	Contract No.:	AJ2480A
Project/Task Manager:	Sue Collins	Carrier/Waybill No.:	742050	Project/Task No.:	7223/02.02.09
Project Name:	Site 227 drilling	Lab Contact:	Edie Kent	SMO Authorization:	[signature]
Record Center Code:	ER/1309/227/DAT	Lab Destination:	General Engineering Labs		
Logbook Ref. No.:	ER078	SMO Contact/Phone:	P. Palmeri/844-3185		
Service Order No.	CF0103-01	Send Report to SMO:	Suzi Jensen		
Location	Tech Area Tijeras Arroyo	Reference LOV(available at SMO)			

☑ Waste Characterization
RCRA Date:
☐ Send Preliminary report to:
☐ Validation Required
☐ Released by COC No.:
Bill To: Sandia National Labs (Accounts Payable) PO Box 5800, MS-0154, Albuquerque, NM 87185-0154

Sample No.-Fraction	ER Sample ID or Sample Location Detail	Beginning Depth (ft)	ER Site No.	Date/Time(hr) Collected	Sample Matrix	Container Type	Container Volume	Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
054644-001	TJAOU-227-VW-01-250-S	250.0	227	3.28.01/1125	S	AG	125ml	4C	G	SA	VOCs (8260)	
054645-001	TJAOU-227-VW-01-275-S	275.0	227	3.28.01/1615	S	AG	125ml	4C	G	SA	VOCs (8260)	
054646-002	TJAOU-227-VW-01-EB1	N/A	227	3.29.01/1030	DIW	G	3x40 ml	4C, HCL	G	EB	VOCs (8260)	
054646-003	TJAOU-227-VW-01-EB1	N/A	227	3.29.01/1032	DIW	AG	2x1L	4C	G	EB	SVOCs (8270	
054646-004	TJAOU-227-VW-01-EB1	N/A	227	3.29.01/1033	DIW	AG	250 ml	4C	G	EB	Tritium	
054646-005	TJAOU-227-VW-01-EB1	N/A	227	3.29.01/1033	DIW	P	250 ml	4C	G	EB	Chloride (300.0)	
054646-006	TJAOU-227-VW-01-EB1	N/A	227	3.29.01/1035	DIW	~~G~~ P	1 L	4C, HNO3	G	EB	Iso U/Pu	
054646-007	TJAOU-227-VW-01-EB1	N/A	227	3.29.01/1036	DIW	AG	2x1L	4C	G	EB	PCBs (8080)	
054646-008	TJAOU-227-VW-01-EB1	N/A	227	3.29.01/1037	DIW	P	500 ml	4C	G	EB	Cr-6 (7196)	
054646-009	TJAOU-227-VW-01-EB1	N/A	227	3.29.01/1038	DIW	AG	4x1L	4C	G	~~SA~~ EB	HE (8330)	

RMMA ☐ Yes ☑ No Ref. No.

Sample Disposal ☐ Return to Client ☑ Disposal by lab

Turnaround Time ☐ 7 Day* ☐ 15 Day* ☑ 30 Day

Return Samples By: ☐ Negotiated TAT

Sample Tracking SMO Use: Date Entered(mm/dd/yy) 040401; Entered by: ; QC inits.

Special Instructions/QC Requirements:
EDD ☑ Yes ☑ No
Raw Data Package ☑ Yes ☐ No
*Send/e-mail report to:
*Please list as separate report.

Abnormal Conditions on Receipt

Sample Team Members	Name	Signature	Init	Company/Organization/Phone/Cellular
	Robin Ryan	RRyan	RR	GRAM/6133/845-8821

		Org.	Date	Time		Org.	Date	Time
1. Relinquished by Robin Ryan		6133	3/29/01	1430	4. Relinquished by			
1. Received by [signature]		6132	3/29/01	1430	4. Received by			
2. Relinquished by [signature]		6132	3/30/01	0800	5. Relinquished by			
2. Received by					5. Received by			
3. Relinquished by					6. Relinquished by			
3. Received by					6. Received by			

*7 & 15 Day Turnaround Time: ERCL requires prior notification.

SF 2001-COC (7/00)

CONTRACT LABORATORY
Analysis Request And Chain Of Custody (Continuation)

AR/COC- 604204

Project Name: Site 227 Drilling | Project/Task Manager: Sue Collins | Project/Task No.: 7225.02.02.08

Location: Building | Room

Reference LOV (available at SMO)

Sample No.-Fraction	ER Sample ID or Sample Location detail	Beginning Depth (ft)	ER Site No.	Date/Time (hr) Collected	Sample Matrix	Container Type	Container Volume	Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID (Lab use)
054646-010	TJAOU-227-VW-01-EB1	N/A	227	3.29.01/1039	DIW	P	500 ml	4C, HNO3	G	EB	RCRA Metals + Titanium (6010/7471)	
054646-011	TJAOU-227-VW-01-EB1	N/A	227	3.29.01/1039	DIW	P	500 ml	4C, NaOH	G	ETB	Cyanide	
054646-012	TJAOU-227-VW-01-EB1	N/A	227	3.29.01/1040	DIW	P	1 L	4C, HNO3	G	ETB	Cs-137	
054647-001	TJAOU-227-VW-01-TB	N/A	227	3.29.01/1025	DIW	G	3x40 ml	4C, HCL	G	TB	VOCs (8260)	

Abnormal Conditions on Receipt [illegible] LAB USE [illegible]

Recipient Initials [illegible]

Site: Site 227

AR/COC: 604298

Data Type: Organic

Sample ID	VOCs:	75-09-2 (methylene chloride)	79-01-6 (trichloroethene)	SVOCS:	All Acid Fraction SVOCs (see SVOC DV Worksheet)	83-32-9 (acenaphthene)	111-91-1 (bis(2-chloroethoxy)methane)	117-81-7 (bis(2-ethylhexyl)phthalate)	All other Base/Neutral SVOCs (see SVOC DV Worksheet), except...	85-01-8 (phenanthrene)	206-44-0 (fluoranthene)	129-00-0 (pyrene)	218-01-9 (chrysene)	56-55-3 (benzo(a)anthracene)	205-99-2 (benzo(b)fluoranthene)	50-32-8 (benzo(a)pyrene)
054670-002 TJAOU-227-GR-05-7.0-S			UJ													
054673-002 TJAOU-227-GR-07-5.0-S			UJ													
054675-002 TJAOU-227-GR-06-0.0-S			UJ													
054671-002 TJAOU-227-GR-06-5.0-S			UJ													
054672-002 TJAOU-227-GR-06-5.0-DU			UJ													
054678-002 TJAOU-227-GR-EB-001		5U,B	UJ													
054678-001 TJAOU-227-GR-TB-002		5U,B	UJ													
054670-003 TJAOU-227-GR-05-7.0-S					UJ,A	UJ		33.3U,B								
054673-003 TJAOU-227-GR-07-5.0-S					UJ,A	UJ		33.3U,B								
054675-003 TJAOU-227-GR-06-0.0-S					UJ,A,A1	UJ,A1	UJ,A1	33.3UJ,A1,B	UJ,A1	J,A1	J,A1	J,A1	J,A1	J,A1	J,A1	J,A1
054671-003 TJAOU-227-GR-06-5.0-S					UJ,A	UJ		33.3U,B								
054672-003 TJAOU-227-GR-06-5.0-DU					UJ,A	UJ		33.3U,B								
054678-003 TJAOU-227-GR-EB-001							UJ									

Validated By: Mr. Kenneth Salaz

Date: 5/18/01

[illegible]

Sample Findi[illegible] Summary

Site: Site 227

AR/COC: 604298

Data Type: Inorganic

Sample ID	Method/CAS Number (Analysis/Analyte)		
	7440-22-4 (Ag)	7440-39-3 (Ba)	7439-97-6 (Hg)
054670-003 TJAOU-227-GR-05-7.0-S	UJ,B3		J,B3
054673-003 TJAOU-227-GR-07-5.0-S	UJ,B3		UJ,B3
054675-003 TJAOU-227-GR-06-0.0-S	UJ,B3		J,B3
054671-003 TJAOU-227-GR-06-5.0-S	UJ,B3		UJ,B3
054672-003 TJAOU-227-GR-06-5.0-DU	UJ,B3		J,B3
054678-004 TJAOU-227-GR-EB-001		J,B	UJ,B3

Validated By: Mr. Kenneth Salaz

Date: 5/18/01

[illegible]

Sample Finding Summary

Site: Site 227

AR/COC: 604298

Data Type: Radiochemical

Sample ID	Method/CAS Number (Analysis/Analyte) NS631 (gross beta)															
054676-007 TJAOU-227-GR-EB-001	R															

Validated By: Mr. Kenneth Salaz

Date: 5/18/01

[illegible]

Analytical Quality Associates, Inc.
616 Maxine NE
Albuquerque, NM 87123
Phone: 505-299-5201
Fax: 505-299-6744
Email: minteer@aol.com

MEMORANDUM

DATE: May 18, 2001

TO: File

FROM: Kenneth Salaz

SUBJECT: Radiochemical Data Review and Validation - SNL
Site 227, ARCOC #604298,
GEL SDG #38454/38455, Case No. 7225.02.02.09

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

Summary

All samples were prepared and analyzed with approved procedures using methods EPA900.0 Gross Alpha/Beta and HASL300/EPA901.1 Gamma Spec. A problem was identified with the data package that results in the qualification of data.

1. Gross Alpha/Beta Analysis: The gross beta result of the equipment blank (EB) was negative, and the absolute value was greater than (>) the MDA. Thus, this sample result will be qualified "R" (unusable).

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

Holding Times/Preservation

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

Calibration

All Analyses: The case narratives stated the instruments used were properly calibrated.

Blanks

All Analyses: No target analytes were detected in the method blanks at concentrations > the associated MDAs.

Matrix Spike (MS) Analysis

Gross Alpha/Beta Analysis: The MS analyses met QC acceptance criteria.

Gamma Spec Analysis: No MS analysis was required for the soil samples. The MS analysis for the EB met QC acceptance criteria.

Laboratory Control Sample (LCS) Analysis

All Analyses: The LCS analyses met QC acceptance criteria.

Replicates

All Analyses: The replicate analyses met QC acceptance criteria.

Tracer/Carrier Recoveries

All Analyses: No tracers/carriers were required for these methods.

Negative Bias

All Analyses: All sample results met negative bias QC acceptance criteria except as noted above in the summary section.

Other QC

All Analyses: A field duplicate was submitted. However, there are no "required" review criteria for field duplicate analyses comparability. No target analytes were detected in the EBs at concentrations > the associated MDAs except K-40 for the gamma spec analysis. However, all associated sample results were greater than (>) 5X the blank activity. Thus, no sample data were qualified. No field blanks (FBs) were submitted on the ARCOC.

No other specific issues were identified which affect data quality.

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

Analytical Quality Associates, Inc.
616 Maxine NE
Albuquerque, NM 87123
Phone: 505-299-5201
Fax: 505-299-6744
Email: minteer@aol.com

MEMORANDUM

DATE: May 18, 2001

TO: File

FROM: Kenneth Salaz

SUBJECT: Organic Data Review and Validation - SNL
Site 227, ARCOC #604298,
GEL SDG #38454/38455, Project/Task No. 7225.02.02.09

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

Summary

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

1. VOC Analysis: The initial calibration response factor (RF) of trichloroethene for the soil samples, the equipment blank (EB), and the trip blank (TB), was less than (<) the required minimum but greater than (>) 0.01. All associated sample results were non-detect (ND) and will be qualified "UJ."

   SVOC Analysis: The initial calibration RFs of bis(2-chloroethoxy)methane for the EB and acenaphthene for the soil samples were < the required minimums but >0.01. All associated sample results were ND and will be qualified "UJ."

2. VOC Analysis: In the method blanks for the soil samples, the EB, and the TB, methylene chloride was detected. The associated results of the EB and the TB were detects, <10X the blank concentration, < the reporting limit (RL), and will be qualified "5U,B." All associated soil sample results were ND. Thus, no sample data were qualified.

   SVOC Analysis: In the method blank for the soil samples, bis(2-ethylhexyl)phthalate was detected. All associated sample results were detects, <10X the blank concentration, < the RL, and will be qualified "33.3U,B."

3. SVOC Analysis: All surrogate percent recoveries (%Rs) for sample 38454-008 were < QC acceptance limits but >10%. There was insufficient sample volume for re-extraction. The chrysene, fluoranthene, phenanthrene, pyrene, benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene results for this sample were detects and will be qualified "J,A1." All other results for this sample were ND and will be qualified "UJ,A1."

4. SVOC Analysis: The LCS/LCSD %Rs of seven of the nine acid fraction compounds (see Data Validation Worksheets) for the soil samles were < QC acceptance limits but >10%. All acid fraction results for all soil samples were ND and will be qualified "UJ,A."

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

Holding Times/Preservation

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

Calibration

VOC Analysis: The initial and continuing calibrations met QC acceptance criteria except as noted above in the summary section.

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

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

Blanks

VOC Analysis: No target analytes were detected in the method blanks except as noted above in the summary section.

SVOC Analysis: No target analytes were detected in the method blanks except as noted above in the summary section and diethylphthalate for the soil samples. However, all associated sample results were ND. Thus, no sample data were qualified.

HE Analysis: No target analytes were detected in the method blanks.

Surrogates

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

Internal Standards (ISs)

VOC/SVOC Analyses: The IS areas and retention times (RTs) met QC acceptance criteria.

HE Analysis: No ISs were required for this method.

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

VOC Analysis: The MS/MSD analyses for the soil samples met QC acceptance criteria. The MS/MSD analyses for the EB and TB were performed on a sample from another SDG. No sample data were qualified as a result. The case narratives stated that all QC acceptance criteria were met.

SVOC Analysis: The MS/MSD analyses for the EB met QC acceptance criteria. The MS/MSD analyses for the soil samples were performed on a sample from another SDG. The case narrative stated that all QC acceptance criteria were not met. However, no sample data were qualified as a result.

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

Laboratory Control Samples (LCS/LCSD) Analysis

VOC Analysis: The LCS/LCSD analyses met QC acceptance criteria.

SVOC Analysis: The LCS/LCSD analyses met QC acceptance criteria except as noted above in the summary section and the following. For the EB, the LCS %Rs of 1,2,4-trichlorobenzene, hexachlorobutadiene, and acenaphthene, as well as the LCSD %R of acenaphthene, were > QC acceptance limits. However, all associated sample results were ND. Thus, no sample data were qualified. For the soil samples, the LCS/LCSD %Rs of nitrobenzene were slightly < QC acceptance limits. However, the %Rs of all other base/neutral compounds met QC acceptance criteria. Thus, no sample data were qualified.

HE Analysis: The LCS/LCSD analyses met QC acceptance criteria except for the following. The LCSD %Rs several compounds for the EB (see Data Validation Worksheets) were < QC acceptance limits, and the LCSD relative percent differences (RPDs) were > QC acceptance limits. The case narrative stated that the LCSD low LCSD %Rs were the result of laboratory error, and all MS/MSD %Rs met QC acceptance criteria. Thus, no sample data were qualified.

Other QC

VOC Analysis: A field duplicate was submitted. However, there are no "required" review criteria for field duplicate analyses comparability. In the EB, acetone, dibromochloromethane, bromoform, and styrene were detected. However, all associated sample results were ND. Thus, no sample data were qualified. No target analytes were detected in the TB.

SVOC/HE Analyses: A field duplicate was submitted. However, there are no "required" review criteria for field duplicate analyses comparability. No target analytes were detected in the EBs. No field blanks (FBs) were submitted on the ARCOC.

No other specific issues were identified which affect data quality.

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

Analytical Quality Associates, Inc.
616 Maxine NE
Albuquerque, NM 87123
Phone: 505-299-5201
Fax: 505-299-6744
Email: minteer@aol.com

MEMORANDUM

DATE: May 18, 2001

TO: File

FROM: Kenneth Salaz

SUBJECT: Inorganic Data Review and Validation - SNL
Site 227, ARCOC #604298,
GEL SDG #38454/38455, Project/Task No. 7225.02.02.09

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

Summary

All samples were prepared and analyzed with approved procedures using methods EPA6010B ICP-AES and EPA7470/1A CVAA. Problems were identified with the data package that result in the qualification of data.

1. ICP Analysis: In the initial calibration blank (ICB) for the soil samples, silver (Ag) was detected at a negative concentration. The absolute value was greater than (>) the detection limit (DL) but less than (<) the reporting limit (RL). All associated sample results were non-detect (ND) and will be qualified "UJ,B3." In the method blank for the EB, barium (Ba) was detected. The associated sample result was a detect, <5X the blank concentration, and will be qualified "J,B."

   CVAA Analysis: In the ICB and continuing calibration blank (CCB) for the equipment blank (EB), and in the ICB for the soil samples, mercury (Hg) was detected at negative concentrations. The absolute values were > the DL but < the RL. The associated results of samples 38454-006, -008, and -010 were detects, <5X the DL, and will be qualified "J,B3." The associated results of samples 38455-004 (EB), 38454-007, and -009 were ND and will be qualified "UJ,B3."

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

Holding Times/Preservation

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

Calibration

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

Blanks

ICP Analysis: No target analytes were detected in the blanks except as noted above in the summary section and the following. In the ECB for the soil samples, lead (Pb) was detected at a negative concentration. The absolute value was > the DL but < the RL. However, all associated samples results were >5X the DL. Thus, no sample data were qualified. In the CCB for the EB and method blank for the soil samples, chromium (Cr) was detected, and cadmium (Cd) was also detected in the method blank. In the CCB for soil sample 38454-006 only, barium (Ba), Cr, and Ag were detected. In the method blank, Ba and Cd were detected. However, all associated sample results were either ND or >5X the blank concentrations. Thus, no sample data were qualified.

CVAA Analysis: No target analytes were detected in the blanks except as noted above in the summary section.

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

All Analyses: The MS analyses met QC acceptance criteria. No MSD analyses were performed. The replicate analyses were used as measures of laboratory precision.

Laboratory Control Samples (LCS/LCSD) Analysis

All Analyses: The LCS/LCSD analyses met QC acceptance criteria.

Replicate Analysis

All Analyses: The replicate analyses met QC acceptance criteria.

ICP Interference Check Sample (ICS)

ICP Analysis: The ICSs met QC acceptance criteria.

CVAA Analysis: No ICS was required for this method.

ICP Serial Dilution

ICP Analysis: The serial dilution analyses met QC acceptance criteria.

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

Other QC

All Analyses: A field duplicate was submitted. However, there are no "required" review criteria for field duplicate analyses comparability. No target analytes were detected in the EB except Ba. However, all associated sample results were >5X the blank concentration. Thus, no sample data were qualified. No field blank (FB) was submitted on the ARCOC.

No other specific issues were identified which affect data quality.

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

Data Validation Summary

Site/Project: Site 227 Project/Task #: 7225.02.02.09 # of Samples: 22 Matrix: 15 soil/7 aqueous

AR/COC #: 604298 Laboratory Sample IDs: 38454-001 to -015

Laboratory: GEL 38455-001 to -007

Laboratory Report #: 38454/38455

QC Element	Organics: VOC	Organics: SVOC	Organics: Pesticide/PCB	Organics: HPLC (HE)	Inorganics: ICP/AES	Inorganics: GFAA/AA	Inorganics: CVAA (Hg)	Inorganics: CN	RAD	Other
1. Holding Times/Preservation	✓	✓	NA	✓	✓	NA	✓	NA	✓	NA
2. Calibrations	UJ	UJ		✓	✓		MS ~~J,A2~~ SPM ~~UJ,B3~~ ✓		✓	
3. Method Blanks	5U,B	33,3U,B		✓	J,B UJ,B3		J,B3 UJ,B3		✓	
4. MS/MSD	✓	NA		✓	✓		✓		✓	
5. Laboratory Control Samples	✓	UJ,A		✓	✓		✓		✓	
6. Replicates					✓		✓		✓	
7. Surrogates	✓	J,A1 UJ,A1		✓						
8. Internal Standards	✓	✓								
9. TCL Compound Identification	✓	✓								
10. ICP Interference Check Sample					✓					
11. ICP Serial Dilution					✓					
12. Carrier/Chemical Tracer Recoveries									NA	
13. Other QC	✓	✓		✓	✓		✓		R	

J = Estimated Check (✓) = Acceptable
U = Not Detected Shaded Cells = Not Applicable (also "NA")
UJ = Not Detected, Estimated NP = Not Provided
R = Unusable Other: ______

Reviewed By: [signature] Date: 5/17/01

[illegible]

Volatile Organics (SW 846 Method 8260)

Site/Project: Sk 327 AR/COC #: 604298 # of Samples: 5 Matrix: ~~aqueous~~ Soil

Laboratory: GEL SDG #: 38454 Laboratory Sample IDs: 38454-001 to -005

Methods: EPA 8260A Batch #s: 67670

IS	CAS #	Name	TCL	Min. RF	Intercept	Calib. RF >.05	Calib. RSD/ R^2 <20% / 0.99	CCV %D 20%	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	(1) Field Dup. RPD	Equip. Blanks (N/A)	Trip Blanks (N/A)		
1	74-87-3	Chloromethane	✓	0.10	✓	✓	✓	✓	✓							NA	✓	✓		
1	74-83-9	Bromomethane		0.10	NA															
1	75-01-4	vinyl chloride		0.10																
1	75-00-3	Chloroethane		0.01	↓				↓											
1	75-09-2	methylene chloride (10xblk)		0.01	✓				303								↓			
1	67-64-1	acetone(10xblk)		0.01	✓				✓											
1	75-15-0	carbon disulfide		0.10	NA												✓			
1	75-35-4	1,1-dichloroethene		0.20	✓					✓	✓	✓	✓	✓	✓					
1	75-34-3	1,1-dichloroethane		0.10	NA															
1	67-66-3	Chloroform		0.20																
1	107-06-2	1,2-dichloroethane		0.10																
1	78-93-3	2-butanone(10xblk)		0.01																
2	71-55-6	1,1,1-trichloroethane		0.10																
2	56-23-5	carbon tetrachloride		0.10																
2	75-27-4	Bromodichloromethane		0.20																
2	78-87-5	1,2-dichloropropane		0.01																
2	10061-01-5	cis-1,3-dichloropropene		0.20		↓														
2	79-01-6	Trichloroethene		0.30		0.28				✓	✓	✓	✓	✓	✓		↓			
2	124-48-1	Dibromochloromethane		0.10		✓											0.375			
2	79-00-5	1,1,2-trichloroethane		0.10													✓			
2	71-43-2	Benzene		0.50						✓	✓	✓	✓	✓	✓					
2	10061-02-6	trans-1,3-dichloropropene		0.10													✓			
2	75-25-2	Bromoform		0.10													0.445			
3	108-10-1	4-methyl-2-pentanone		0.10													✓			
3	591-78-6	2-hexanone		0.01																
3	127-18-4	Tetrachloroethene		0.20																
3	79-34-5	1,1,2,2-tetrachloroethane		0.30																
3	108-88-3	toluene(10xblk)		0.40						✓	✓	✓	✓	✓	✓					
3	108-90-7	Chlorobenzene		0.50	↓					✓	✓	✓	✓	✓	✓					
3	100-41-4	Ethylbenzene		0.10	✓												↓			
3	100-42-5	Styrene		0.30	NA												0.176			
3	1330-20-7	xylenes(total)		0.30	NA												✓			
	540-59-0	1,2-dichloroethylene(total)		0.01	✓															
	108-05-4	Vinyl Acetate	↓		NA	↓	↓	↓	↓							↓	↓	↓		

Comments: Notes: Shaded rows are RCRA compounds.

(1) Field dup. submitted. No QC criteria.

NA = Not Applicable

Reviewed By: [signature] Date: 5/15/01

Volatile Organics

Site/Project: Sk 227 AR/COC #: 604298 Batch #: 67670

Laboratory: GEL SDG #: 38454 # of Samples: 5 Matrix: Soil

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

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

SMC 1: Bromofluorobenzene
SMC 2: Dibromofluormethane
SMC 3: Toluene-d8

IS 1: Fluorobenzene
IS 2: Chlorobenzene-d5
IS 3: 1,4-Dichlorobenzene-d4

Comments:

Volatile Organics (SW 846 Method 8260)

Site/Project: Site 227 AR/COC #: 604298 # of Samples: 2 Matrix: aqueous

Laboratory: GEL SDG #: 38455 Laboratory Sample IDs: 38455-001 (GW) & -002 (TS)

Methods: EPA8260B Batch #s: 67849

IS	CAS #	Name	TCL	Min. RF	Intercept	Calib. RF >.05	Calib. RSD/R² <20%/0.99	CCV %D 20%	Method Blks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Equip. Blanks	Trip Blanks		
1	74-87-3	Chloromethane	✓	0.10	✓	✓	✓	✓	✓							NA	NA	NA		
1	74-83-9	Bromomethane	✓	0.10	NA	✓	✓													
1	75-01-4	vinyl chloride	✓	0.10		✓	✓													
1	75-00-3	Chloroethane	✓	0.01		✓	✓													
1	75-09-2	methylene chloride (10xblk)	✓	0.01	✓	✓	✓		0.95J											
1	67-64-1	acetone (10xblk)	✓	0.01	✓	✓	✓		✓											
1	75-15-0	carbon disulfide	✓	0.10	NA	✓	✓													
1	75-35-4	1,1-dichloroethene	✓	0.20	✓	✓	✓			✓	✓	✓	NA	NA	NA					
1	75-34-3	1,1-dichloroethane	✓	0.10	NA	✓	✓													
1	67-66-3	Chloroform	✓	0.20		✓	✓													
1	107-06-2	1,2-dichloroethane	✓	0.10		✓	✓													
1	78-93-3	2-butanone (10xblk)	✓	0.01		✓	✓													
2	71-55-6	1,1,1-trichloroethane	✓	0.10		✓	✓													
2	56-23-5	carbon tetrachloride	✓	0.10		✓	✓													
2	75-27-4	Bromodichloromethane	✓	0.20		✓	✓													
3	78-87-5	1,2-dichloropropane	✓	0.01		✓	✓													
2	10061-01-5	cis-1,3-dichloropropene	✓	0.20		✓	✓													
2	79-01-6	Trichloroethene	✓	0.30		0.07	✓			✓	✓	✓	NA	NA	NA					
2	124-48-1	Dibromochloromethane	✓	0.10		✓	✓													
2	79-00-5	1,1,2-trichloroethane	✓	0.10		✓	✓													
2	71-43-2	Benzene	✓	0.50		✓	✓			✓	✓	✓	NA	NA	NA					
2	10061-02-6	trans-1,3-dichloropropene	✓	0.10		✓	✓													
2	75-25-2	Bromoform	✓	0.10		✓	✓													
3	108-10-1	4-methyl-2-pentanone	✓	0.10		✓	✓													
3	591-78-6	2-hexanone	✓	0.01		✓	✓													
3	127-18-4	Tetrachloroethene	✓	0.20		✓	✓													
3	79-34-5	1,1,2,2-tetrachloroethane	✓	0.30		✓	✓													
3	108-88-3	toluene(10xblk)	✓	0.40		✓	✓			✓	✓	✓	NA	NA	NA					
3	108-90-7	Chlorobenzene	✓	0.30		✓	✓			✓	✓	✓	NA	NA	NA					
3	100-41-4	Ethylbenzene	✓	0.10	✓	✓	✓													
3	100-42-5	Styrene	✓	0.30	NA	✓	✓													
3	1330-20-7	xylenes(total)	✓	0.30	NA	✓	✓													
	540-59-0	1,2-dichloroethylene(total)	✓	0.01	✓	✓	✓													
	108-05-4	Vinyl Acetate	✓		NA	✓	✓													

Comments:

Notes: Shaded rows are RCRA compounds.

NA = Not Applicable

MS/MSD performed on a Sample from another SDG. Compounds spiked all QC were met.

Reviewed By: [signature] Date: 5/15/01

Volatile Organics

Site/Project: Sk 227 AR/COC #: 604298 Batch #s: 67845

Laboratory: GEL SDG #: 38455 # of Samples: 2 Matrix: aqueous

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

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

SMC 1: Bromofluorobenzene
SMC 2: Dibromofluormethane
SMC 3: Toluene-d8

IS 1: Fluorobenzene
IS 2: Chlorobenzene-d5
IS 3: 1,4-Dichlorobenzene-d4

Comments:

Semivolatile Organics (SW 846 Method 8270)

Site/Project: SLC 227 AR/COC #: 604296 Laboratory Sample IDs: 38454-006 to -010

Laboratory: GEL Laboratory Report #: 38454

Methods: EPA 8270C

# of Samples: 5 Matrix: soil Batch #s: 67505

IS	BNA	CAS #	NAME	TCL	Min. RF	Intercept	Calib. RF	Calib. RSD/ R²	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	(1) MS	MSD	MS RPD	(2) Field Dup. RPD	Equip. Blanks	Field Blanks		
							>.05	<20%/ 0.99	20%												
1	A	108-95-2	Phenol	✓	0.80	NA	✓	✓	✓	✓	57	57	✓	NA	NA	NA	NA	✓	NA	-	
1	BN	111-44-4	bis(2-Chloroethyl)ether		0.70		✓	✓													
1	A	95-57-8	2-Chlorophenol		0.80		✓	✓			53	54	✓	NA	NA	NA					
1	BN	541-73-1	1,3-Dichlorobenzene		0.60		✓	✓													
1	BN	106-46-7	1,4-Dichlorobenzene		0.50		✓	✓			✓	✓	✓	NA	NA	NA					
1	BN	95-50-1	1,2-Dichlorobenzene		0.40		✓	✓													
1	A	95-48-7	2-Methylphenol (o-cresol)		0.70		✓	✓			59	59	✓	NA	NA	NA					
1	BN	108-60-1	bis(2-chloroisopropyl)ether		0.01		✓	✓													
~~1~~	~~A~~	~~106-44-5~~	~~4-Methylphenol~~		0.60																
1	BN	621-64-7	N-Nitroso-di-n-propylamine	✓	0.50		✓	✓	✓	✓	✓	✓	✓	NA	NA	NA		✓			
1	BN	67-72-1	Hexachloroethane		0.30		✓	✓			✓	✓	✓	[illegible]	[illegible]	[illegible]					
2	BN	98-95-3	Nitrobenzene		0.20		✓	✓			57	58	✓	[illegible]	[illegible]	NA					
2	BN	78-59-1	Isophorone		0.40		✓	✓													
2	A	88-75-5	2-Nitrophenol		0.10		✓	✓													
2	A	105-67-9	2,4-Dimethylphenol		0.20		✓	✓													
2	BN	111-91-1	bis(2-Chloroethoxy)methane		0.30		✓	✓													
2	A	120-83-2	2,4-Dichlorophenol		0.20		✓	✓													
2	BN	120-82-1	1,2,4-Trichlorobenzene		0.20		✓	✓			✓	✓	✓	NA	NA	NA					
2	BN	91-20-3	Naphthalene		0.70		✓	✓													
2	BN	106-47-8	4-Chloroaniline		0.01		✓	✓													
2	BN	87-68-3	Hexachlorobutadiene		0.01		✓	✓			✓	✓	✓	NA	NA	NA					
2	A	59-50-7	4-Chloro-3-methylphenol		0.20		✓	✓			64	61	✓	NA	NA	NA					
2	BN	91-57-6	2-Methylnaphthalene		0.40		✓	✓													
3	BN	77-47-4	Hexachlorocyclopentadiene		0.01	✓	✓	✓													
3	A	88-06-2	2,4,6-Trichlorophenol		0.20	NA	✓	✓			60	61	✓	NA	NA	NA					
3	A	95-95-4	2,4,5-Trichlorophenol		0.20	NA	✓	✓			71	69	✓	NA	NA	NA					

Notes: Shaded rows are RCRA compounds.

Comments:

(1) MS/MSD performed on a sample from another SDG. Case narrative stated that QC acceptance criteria were not met. No data were provided. Thus, no sample data were qualified.

(2) Field dup. submitted. No QC criteria.

Reviewed By: [signature] Date: 5/16/01

Semivolatile Organics

Site/Project: Sk 227　　AR/COC #: 604298　　Batch #: 67505

Laboratory: GEL　　Laboratory Report #: 38457　　# of Samples: 5　　Matrix: Soil

IS	BNA	CAS #	NAME	TCL	Min RF	Intercept	Calib. RF >.05	Calib. RSD/ R^2 <20% / 0.99	CCV %D 20%	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Equip Blanks	Field Blanks	[illegible]	[illegible]
3	BN	91-58-7	2-Chloronaphthalene	✓	0.80	NA	✓	✓	✓	✓							NA	✓	NA		
3	BN	88-74-4	2-Nitroaniline (o-)		0.01		✓	✓													
3	BN	131-11-3	Dimethylphthalate		0.01		✓	✓													
3	BN	208-96-8	Acenaphthylene		0.90		✓	✓													
3	BN	606-20-2	2,6-Dinitrotoluene		0.20		✓	✓													
3	BN	99-09-2	3-Nitroaniline (m-)		0.01		✓	✓													
3	BN	83-32-9	Acenaphthene		0.90		0.88	✓			✓	✓	✓	NA	NA	NA					
3	A	51-28-5	2,4-Dinitrophenol		0.01	✓	✓	✓													
3	A	100-02-7	4-Nitrophenol		0.01	✓	✓	✓			✓	✓	✓	NA	NA	NA					
3	BN	132-64-9	Dibenzofuran		0.80	NA	✓	✓													
3	BN	121-14-2	2,4-Dinitrotoluene		0.20		✓	✓			✓	✓	✓	NA	NA	NA					
3	BN	84-66-2	Diethylphthalate		0.01		✓	✓	-32.5	61.0											
3	BN	7005-72-3	4-Chlorophenyl-phenylether		0.40		✓	✓	✓	✓											
3	BN	86-73-7	Fluorene		0.90		✓	✓													
3	BN	100-01-6	4-Nitroaniline (p-)		0.01		✓	✓													
4	A	534-52-1	4,6-Dinitro-2-methylphenol		0.01	✓	✓	✓													
4	BN	86-30-6	N-Nitrosodiphenylamine (1)		0.01	NA	✓	✓													
4	BN	101-55-3	4-Bromophenyl-phenylether		0.10		✓	✓													
4	BN	118-74-1	Hexachlorobenzene		0.10		✓	✓			✓	✓	✓	NA	NA	NA					
4	A	87-86-5	Pentachlorophenol		0.05	✓	✓	✓			✓	✓	✓	NA	NA	NA					
4	BN	85-01-8	Phenanthrene		0.70	NA	✓	✓													
4	BN	120-12-7	Anthracene		0.70		✓	✓													
4	BN	86-74-8	Carbazole		0.01		✓	✓													
4	BN	84-74-2	Di-n-butylphthalate		0.01		✓	✓	-22.2												
4	BN	206-44-0	Fluoranthene		0.60		✓	✓	✓												
5	BN	129-00-0	Pyrene		0.60		✓	✓			✓	✓	✓	NA	NA	NA					
5	BN	85-68-7	Butylbenzylphthalate		0.01		✓	✓													
5	BN	91-94-1	3,3'-Dichlorobenzidine		0.01		✓	✓	-34.9												
5	BN	56-55-3	Benzo(a)anthracene		0.80		✓	✓	✓												

Comments:

Semivolatile Organics

Site/Project: SRC 227 AR/COC #: 604276 Batch #s: 67505

Laboratory: GEL Laboratory Report #: 38454 # of Samples: 5 Matrix: Soil

IS	BNA	CAS #	NAME	TCL	Min RF	Intercept	Calib. RF >.05	Calib. RSD/R² <20%/0.99	CCV %D 20%	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Equip. Blanks	Field Blanks		
5	BN	218-01-9	Chrysene	✓	0.70	NA	✓	✓	✓	✓							NA	✓	NA		
5	BN	117-81-7	bis(2-Ethylhexyl)phthalate		0.01	✓	✓	✓		38.3											
6	BN	117-84-0	Di-n-octylphthalate		0.01	NA	✓	✓		✓											
6	BN	205-99-2	Benzo(b)fluoranthene		0.70	✓	✓	✓													
6	BN	207-08-9	Benzo(k)fluoranthene		0.70	NA	✓	✓													
6	BN	50-32-8	Benzo(a)pyrene		0.70	✓ [illegible]	✓	✓													
6	BN	193-39-5	Indeno(1,2,3-cd)pyrene		0.50	✓	✓	✓													
6	BN	53-70-3	Dibenz(a,h)anthracene		0.40	✓	✓	✓													
6	BN	191-24-2	Benzo(g,h,i)perylene		0.50	NA	✓	✓													
	A	N22	m,p-cresol	↓		NA	✓	✓	↓	↓	63	63	✓	NA	NA	NA	↓	↓	↓		

Surrogate Recovery Outliers

	Sample	SMC 1	SMC 2	SMC 3	SMC 4	SMC 5	SMC 6	SMC 7	SMC 8
①	38454-008	50	51	61	47	52	42	NA	NA

Comments:
① Not enough sample for re-extraction.

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

Internal Standard Outliers

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

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

[illegible]

[illegible]

[illegible]

Semivolatile Organics (SW 846 Method 8270)

Site/Project: SL 227　　AR/COC #: 604298　　Laboratory Sample IDs: 38455-003

Laboratory: GEL　　Laboratory Report #: 38455

Methods: EPA8270C

# of Samples: 1　　Matrix: aqueous　　Batch #: 67712

IS	BNA	CAS #	NAME	TCL	Min RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Equip Blanks	Field Blanks		
							>.05	<20% / 0.99	20%												
1	A	108-95-2	Phenol	✓	0.30	NA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	-	
1	BN	111-44-4	bis(2-Chloroethyl)ether	✓	0.70		✓	✓													
1	A	95-57-8	2-Chlorophenol	✓	0.80		✓	✓			✓	✓	✓	✓	✓	✓					
1	BN	541-73-1	1,3-Dichlorobenzene	✓	0.60		✓	✓													
1	BN	106-46-7	1,4-Dichlorobenzene	✓	0.50		✓	✓			✓	✓	✓	✓	✓	✓					
1	BN	95-50-1	1,2-Dichlorobenzene	✓	0.40		✓	✓													
1	A	95-48-7	2-Methylphenol (o-cresol)	✓	0.70		✓	✓			✓	✓	✓								
1	BN	108-60-1	bis(2-chloroisopropyl)ether	✓	0.01		✓	✓													
~~1~~	~~A~~	~~106-44-5~~	~~4-Methylphenol~~		0.60																
1	BN	621-64-7	N-Nitroso-di-n-propylamine	✓	0.50		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					
1	BN	67-72-1	Hexachloroethane	✓	0.30		✓	✓			✓	✓	✓								
2	BN	98-95-3	Nitrobenzene	✓	0.20		✓	✓			✓	✓	✓								
2	BN	78-59-1	Isophorone	✓	0.40		✓	✓													
2	A	88-75-5	2-Nitrophenol	✓	0.10		✓	✓													
2	A	105-67-9	2,4-Dimethylphenol	✓	0.20		✓	✓													
2	BN	111-91-1	bis(2-Chloroethoxy)methane	✓	0.30		0.27	✓													
2	A	120-83-2	2,4-Dichlorophenol	✓	0.20		✓	✓													
2	BN	120-82-1	1,2,4-Trichlorobenzene	✓	0.20		✓	✓			109	✓	✓	✓	✓	✓					
2	BN	91-20-3	Naphthalene	✓	0.70		✓	✓													
2	BN	106-47-8	4-Chloroaniline	✓	0.01		✓	✓													
2	BN	87-68-3	Hexachlorobutadiene	✓	0.01		✓	✓			108	✓	✓								
2	A	59-50-7	4-Chloro-3-methylphenol	✓	0.20		✓	✓			✓	✓	✓	✓	✓	✓					
2	BN	91-57-6	2-Methylnaphthalene	✓	0.40		✓	✓													
3	BN	77-47-4	Hexachlorocyclopentadiene	✓	0.01		✓	✓													
3	A	88-06-2	2,4,6-Trichlorophenol	✓	0.20		✓	✓			✓	✓	✓								
3	A	95-95-4	2,4,5-Trichlorophenol	✓	0.20		✓	✓			✓	✓	✓								

Comments:

Notes: Shaded rows are RCRA compounds.

NA = Not Applicable

Reviewed By: [signature]　　Date: 5/16/01

Semivolatile Organics

Site/Project: S.R. 227 AR/COC #: 604298 Batch #s: 67712

Laboratory: GEL Laboratory Report #: 38455 # of Samples: 1 Matrix: aqueous

IS	BNA	CAS #	NAME	TCL	Min RF	Intercept	Calib RF >.05	Calib RSD/R² <20%/0.99	CCV %D 20%	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Equip Blanks	Field Blanks		
3	BN	91-58-7	2-Chloronaphthalene	✓	0.80	NA	✓	✓	✓	✓							NA	NA	NA		
3	BN	88-74-4	2-Nitroaniline (o-)	✓	0.01		✓	✓													
3	BN	131-11-3	Dimethylphthalate	✓	0.01		✓	✓													
3	BN	208-96-8	Acenaphthylene	✓	0.90		✓	✓													
3	BN	606-20-2	2,6-Dinitrotoluene	✓	0.20		✓	✓													
3	BN	99-09-2	3-Nitroaniline (m-)	✓	0.01		✓	✓													
3	BN	83-32-9	Acenaphthene	✓	0.90		✓	✓	✓		97	98	✓	✓	✓	✓					
3	A	51-28-5	2,4-Dinitrophenol	✓	0.01		✓	✓	22.6												
3	A	100-02-7	4-Nitrophenol	✓	0.01		✓	✓	34.5		✓	✓	✓	✓	✓	✓					
3	BN	132-64-9	Dibenzofuran	✓	0.20		✓	✓	✓												
3	BN	121-14-2	2,4-Dinitrotoluene	✓	0.20		✓	✓			✓	✓	✓	✓	✓	✓					
3	BN	84-66-2	Diethylphthalate	✓	0.01		✓	✓													
3	BN	7005-72-3	4-Chlorophenyl-phenylether	✓	0.40		✓	✓													
3	BN	86-73-7	Fluorene	✓	0.90		✓	✓													
3	BN	100-01-6	4-Nitroaniline (p-)	✓	0.01		✓	✓													
4	A	534-52-1	4,6-Dinitro-2-methylphenol	✓	0.01	✓	✓	✓													
4	BN	86-30-6	N-Nitrosodiphenylamine (1)	✓	0.01	NA	✓	✓													
4	BN	101-55-3	4-Bromophenyl-phenylether	✓	0.10		✓	✓													
4	BN	118-74-1	Hexachlorobenzene	✓	0.10		✓	✓			✓	✓	✓								
4	A	87-86-5	Pentachlorophenol	✓	0.05	✓	✓	✓			✓	✓	✓	✓	✓	✓					
4	BN	85-01-8	Phenanthrene	✓	0.70	NA	✓	✓													
4	BN	120-12-7	Anthracene	✓	0.70		✓	✓													
4	BN	86-74-8	Carbazole	✓	0.01		✓	✓													
4	BN	84-74-2	Di-n-butylphthalate	✓	0.01		✓	✓													
4	BN	206-44-0	Fluoranthene	✓	0.60		✓	✓													
5	BN	129-00-0	Pyrene	✓	0.60		✓	✓			✓	✓	✓	✓	✓	✓					
5	BN	85-68-7	Butylbenzylphthalate	✓	0.01		✓	✓													
5	BN	91-94-1	3,3'-Dichlorobenzidine	✓	0.01		✓	✓													
5	BN	56-55-3	Benzo(a)anthracene	✓	0.80		✓	✓													

Comments:

Semivolatile Organics

Site/Project: 52 227 AR/COC #: 604298 Batch #s: 67712

Laboratory: GEL Laboratory Report #: 38455 # of Samples: 1 Matrix: aqueous

IS	BNA	CAS #	NAME	TCL	Min RF	Intercept	Calib. RF	Calib. RSD/ R^2	CCV %D	Method Blanks	LCS	LCS D	LCS RPD	MS	MSD	MS RPD	Field Dup. RPD	Equip. Blanks	Field Blanks	[illegible]	[illegible]
							>.05	<20% / 0.99	20%												
5	BN	218-01-9	Chrysene	✓	0.70	NA	✓	✓	✓	✓							NA	NA	NA		
5	BN	117-81-7	bis(2-Ethylhexyl)phthalate	✓	0.01	✓	✓	✓													
6	BN	117-84-0	Di-n-octylphthalate	✓	0.01	NA	✓	✓													
6	BN	205-99-2	Benzo(b)fluoranthene	✓	0.70		✓	✓													
6	BN	207-08-9	Benzo(k)fluoranthene	✓	0.70		✓	✓													
6	BN	50-32-8	Benzo(a)pyrene	✓	0.70	✓	✓	✓													
6	BN	193-39-5	Indeno(1,2,3-cd)pyrene	✓	0.50	✓	✓	✓													
6	BN	53-70-3	Dibenz(a,h)anthracene	✓	0.40	NA	✓	✓													
6	BN	191-24-2	Benzo(g,h,i)perylene	✓	0.50		✓	✓													
	A	N22	m,p-cresol	✓			✓	✓			✓	✓	✓								

Surrogate Recovery Outliers

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

Comments:

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

Internal Standard Outliers

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

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

[illegible]

[illegible]

[illegible]

High Explosives (SW 846 Method 8330)

Site/Project: Site 227 AR/COC #: 604298 Laboratory Sample IDs: 38459-006 to -010

Laboratory: GEL Laboratory Report #: 38459

Methods: EPA 8330

# of Samples: 5 Matrix: soil Batch #: 67956

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

NA = Not Applicable

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

Comments:
① Field dup. submitted. NA QC criteria.

Confirmation

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

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

Reviewed By: [signature] Date: 5/16/01

High Explosives (SW 846 Method 8330)

Site/Project: Site 227 AR/COC #: 604298 Laboratory Sample IDs: 38455-005

Laboratory: GEL Laboratory Report #: 38455

Methods: EPA8330

# of Samples: 1 Matrix: aqueous Batch #: 67468

CAS #	NAME	T A C	Intercept	Curve R	CCV %D	Method Blanks	LCS	LCSD	LCS RPD	MS	MSD	MS RPD	Field Dup RPD	Equip. Blanks	Field Blanks	[illegible]	[illegible]
				.99	20%	U			20%			20%		U	U		
2691-41-0	HMX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA		
121-82-4	RDX						✓	✓	✓								
99-35-49	1,3,5-Trinitrobenzene						✓	✓	✓								
99-65-0	1,3-dinitrobenzene (m-)						✓	✓	21								
98-95-3	Nitrobenzene						✓	52	33								
479-45-8	Tetryl						✓	✓	✓								
118-96-7	2,4,6-trinitrotoluene						✓	✓	✓								
35572-78-2	2-amino-4,6-dinitrotoluene																
19406-51-0	4-amino-2,6-dinitrotoluene						↓	↓	↓								
121-14-2	2,4-dinitrotoluene						✓	70	17								
606-20-2	2,6-dinitrotoluene						✓	64	22								
88-72-2	2-nitrotoluene (o-)						✓	55	30								
99-99-0	4-nitrotoluene (p-)						✓	56	31								
99-08-1	3-nitrotoluene (m-)	↓	↓	↓	↓	↓	✓	55	33	↓	↓	↓	↓	↓	↓		
78-11-5	PETN																

NA = Not Applicable

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

Comments:
① Case Narrative states LCSD failure due to lab error.

Confirmation

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

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

Reviewed By: [signature] Date: 5/16/01

Inorganic Metals

Site/Project: SR 227 AR/COC #: 604298 Laboratory Sample IDs: 38454-006 to -010

Laboratory: GEL SDG #: 38454

Methods: EPA 6010B(ICP), EPA 7471A(CVAA)

# of Samples: 5 Matrix: soil Batch #s: 67349/68578, 67610

CAS #/ Analyte	TAL	ICV	CCV	ICB	① CCB	Method Blanks	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	Rep. RPD	ICS AB	Serial Dilution	② Field Dup. RPD	Equip. Blanks (MS/C)	Field Blanks		
7429-90-5 Al																NA		NA		
7440-39-3 Ba	✓	✓	✓	✓	0.507/✓	0.069	✓	✓	✓	NA	NA	NA	✓	✓	✓		1.16			
7440-41-7 Be																				
7440-43-9 Cd	✓	✓	✓	✓	✓	0.0315	✓	✓	✓	✓	NA	NA	NA	✓	NA		✓			
7440-70-2 Ca																				
7440-47-3 Cr	✓	✓	✓	✓	0.301/✓	✓	✓	✓	✓	✓	NA	NA	✓	✓	NA		✓			
7440-48-4 Co																				
7440-50-8 Cu																				
7439-89-6 Fe																				
7439-95-4 Mg																				
7439-96-5 Mn																				
7440-02-0 Ni																				
7440-09-7 K																				
7440-22-4 Ag	✓	✓	✓	0.376	1.24/✓	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA		✓			
7440-23-5 Na																				
7440-62-2 V																				
7440-66-6 Zn																				
7439-92-1 Pb	✓	✓	✓	2.23	✓	✓	✓	✓	✓	✓	NA	NA	✓	✓	NA		✓			
7782-49-2 Se	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	✓	✓	NA		✓			
7440-38-2 As	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	✓	✓	✓		✓			
7440-36-0 Sb																				
7440-28-0 Tl																				
7439-97-6 Hg	✓	✓	✓	0.0115	✓	✓	✓	✓	✓	✓	NA	NA	✓	NA	NA	✓	✓			
Cyanide CN																				

Notes: Shaded rows are RCRA metals. Solids-to-aqueous conversion: mg / kg = µg / g : [(µg / g) x (sample mass (g) / sample vol. (ml)) x (1000 ml / 1 liter)] / Dilution Factor = µg / l NA = Not Applicable

Comments:
① for Ba, Cr, Ag and CCB apply to sample -006 only.
② Field Dup. submitted. No QC criteria

Reviewed By: [signature] Date: 5/17/01

Inorganic Metals

Site/Project: Site 227 AR/COC #: 604298 Laboratory Sample IDs: 38455-004

Laboratory: GEL SDG #: 38455

Methods: EPA 6010B (ICP), EPA 7470A (CVAA)

\# of Samples: 1 Matrix: aqueous Batch #s: 67350, 67379

CAS # / Analyte	TAL	ICV	CCV	ICB (µg/L)	CCB (µg/L)	Method Blanks (µg/L)	LCS	LCSD	LCSD RPD	MS	MSD	MSD RPD	Rep. RPD	ICS AB	Serial Dilution	Field Dup. RPD	Equip. Blanks	Field Blanks		
7429-90-5 Al																NA	NA	NA		
7440-39-3 Ba	✓	✓	✓	✓	✓	0.357	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7440-41-7 Be																				
7440-43-9 Cd	✓	✓	✓	✓	✓	0.369	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7440-70-2 Ca																				
7440-47-3 Cr	✓	✓	✓	✓	1.07	0.515	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7440-48-4 Co																				
7440-50-8 Cu																				
7439-89-6 Fe																				
7439-95-4 Mg																				
7439-96-5 Mn																				
7440-02-0 Ni																				
7440-09-7 K																				
7440-22-4 Ag	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	NA	✓	NA					
7440-23-5 Na																				
7440-62-2 V																				
7440-66-6 Zn																				
7439-92-1 Pb	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	NA	NA	✓	NA					
7782-49-2 Se	✓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
7440-38-2 As	✓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					
7440-36-0 Sb																				
7440-28-0 Tl																				
7439-97-6 Hg	✓	✓	✓	0.147	0.0606	NA	✓	✓	✓	✓	NA	NA	NA	NA	NA					
Cyanide CN																				

Notes: Shaded rows are RCRA metals. Solids-to-aqueous conversion: mg / kg = µg / g : [(µg / g) x (sample mass (g) / sample vol. (ml)) x (1000 ml / 1 liter)] / Dilution Factor = µg / l NA = Not Applicable

Comments:

Reviewed By: [signature] Date: 5/17/01

Radiochemistry

Site/Project: Site 227   AR/COC #: 604298   Laboratory Sample IDs: 38459-011 to -015

Laboratory: GEL   SDG #: 38459

Methods: EPA900.0 (Gross α/β), UMC 300 (Gamma Spec)

# of Samples: 5   Matrix: Soil   Batch #s: 67411, 67415

Analyte	Method Blanks	LCS	①MS	Rep. RER	Equip. Blanks	③Field Dup. RER	Field Blanks	Sample ID	Isotope	IS/Trace	Sample ID	Isotope	IS/Trace
Criteria	U	20%	25%	<1.0	U	<1.0	U			50-105			50-105
H3								NA					
U-238													
U-234													
U-235/-236													
Th-232													
Th-228													
Th-230													
Pu-239/-240													
Gross Alpha	✓	✓	✓	✓	✓	NA	NA						
Nonvolatile Beta	✓	✓	✓	✓	NA	NA	NA						
Ra-226													
Ra-228													
Ni-63													
Gamma Spec. Am-241	✓	✓	NA	✓	✓	NA	NA						
Gamma Spec. Cs-137	↓	✓	↓	↓	↓	↓	↓						
Gamma Spec. Co-60	↓	✓	↓	↓	↓	↓	↓						
" K-40	~~46.4~~ ✓ [illegible]		↓	↓	46.1	↓	↓						

Comments: NA = Not Applicable

① No MS performed for Gamma Spec.

③ Field dup. submitted. No QC criteria.

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

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

Reviewed By: [signature]   Date: 5/17/01

Radiochemistry

Site/Project: Site 227 AR/COC #: 604278 Laboratory Sample IDs: 38455-006 + -007

Laboratory: GEL SDG #: 38455

Methods: EPA 901.1 (Gamma Spec), EPA 900.0 (Gross α/β),

\# of Samples: 2 Matrix: aqueous Batch #s: 67437, 67442,

Analyte	QC Element: Method Blanks	LCS	MS	Rep RER	Equip. Blanks	Field Dup. RER	Field Blanks	Sample ID	Isotope	IS/Trace	Sample ID	Isotope	IS/Trace
Criteria	U	20%	25%	<1.0	U	<1.0	U			50-105			50-105
H3													
U-238								NA					
U-234													
U-235/-236													
Th-232													
Th-228													
Th-230													
Pu-239/-240													
Gross Alpha	✓	✓	✓	✓	NA	NA	NA						
Nonvolatile Beta	✓	✓	✓	✓	NA	NA	NA						
Ra-226													
Ra-228													
Ni-63													
Gamma Spec. Am-241	✓	✓	✓	✓	NA	NA	NA						
Gamma Spec. Cs-137	✓	✓	✓	↓	↓	↓	↓						
Gamma Spec. Co-60	✓	✓	✓	↓	↓	↓	↓						
K-40													

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

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

Comments: [illegible]

Reviewed By: [signature] Date: 5/17/01

GENERAL ENGINEERING LABORATORIES
Meeting today's needs with a vision for tomorrow.

REVISED

RECEIVED

April 23, 2001

Sandia National Laboratories
1515 Eubank SE
Albuquerque, New Mexico 87123
Attention: Suzi Jensen, MS-1042, Org. 7578, Building T6/ Room 8

Re: ARCOC-604298 SDG# 38454

Dear Ms. Jensen:

Enclosed is the response to correction request number 2492 submitted by Wendy Palencia on April 5, 2001. The request involves samples from Chain of Custody (COC) number 604298 that were packaged in Sample Delivery Group (SDG) number 38454. The format for this response will be reiteration of the request followed by the appropriate laboratory response.

As always, General Engineering Laboratories, Inc. appreciates the opportunity to provide you with analytical data. If you have additional questions concerning this response or any other issue, please call me at (843) 556-8171 Extension 4208.

Yours very truly,

Nicole McCleary

Nicole McCleary
Quality Assurance Officer

fc: 2492.doc

P O Box 30712 • Charleston, SC 29417 • 2040 Savage Road • 29407
(843) 556-8171 • Fax (843) 766-1178

REVISED

SNLS #2492 Response

SNLS concerns:

- The mercury was incorrectly qualified with a "J" for sample #054672-003 (page 692). Please send a corrected narrative and the MDL table for mercury.

GEL Response:

- **A corrected narrative and the MDL table are included in this package.**

GENERAL ENGINEERING LABORATORIES
PO Box 30712 • Charleston, SC 29417 • 2040 Savage Road • 29407
(803) 556-8171 • Fax (803) 766-1178

7

REVISED

CASE NARRATIVE
for
Sandia National Laboratories
ARCOC-604298
SDG#38454
Case No. 7225.02.02.09
Addendum

April 19, 2001

Contractually, GEL is required to report static Method Detection Limits (MDLs) for all organic and inorganic results and qualify the data based on the effective MDLs. In the case of the Mercury results for these samples, the effective MDL was lower than the static MDL. Therefore, some Mercury results were "J" qualified with results that were below the static MDL. As a result, Sandia requested that GEL supply effective MDLs for all Mercury results for this SDG. The MDLs on the Certificates of Analysis (COAs) are the static MDLs. A spreadsheet has been provided to Sandia containing the effective MDLs for all Mercury results.

Edith M. Kent
Edith M. Kent
Project Manager

fc:snls38454addendum

Sample ID	GEL ID	Parameter	Qual	Result	Effective MDL	Static MDL
054670-003/TJAOU-227-GR-05-7.0-S	38454006	Mercury		0.0106	0.00446	0.00455
054673-003/TJAOU-227-GR-07-5.0-S	38454007	Mercury	U	0.00455	0.00443	0.00455
054675-003/TJAOU-227-GR-06-0.0-S	38454008	Mercury	J	0.0061	0.00442	0.00455
054671-003/TJAOU-227-GR-06-5.0-S	38454009	Mercury	U	0.00455	0.00405	0.00455
054672-003/TJAOU-227-GR-06-5.0-DU	38454010	Mercury	J	0.00439	0.00429	0.00455
	1000167226	Mercury	U	0.00455	0.00455	0.00455
054670-003	1000167227	Mercury		0.113	0.00409	0.00455
	1000167229	Mercury		3.26	0.0683	0.00455
054670-003	1000167230	Mercury		0.0118	0.00407	0.00455
	1000167231	Mercury		3.2	0.0683	0.00455

Date: 4-5-2001 **No. of Pages:** 1

Send to:	Edie Kent	**From:**	Wendy J. Palencia
Org/Company:	GEL	**Org:**	6133
Phone:	(843) 556-8171	**Phone:**	(505) 844-3132

Correction Request

COC: 604298 SDG: 38454 Tracking No: 2492

NOTE: Edie,
A "J" qualifier was used incorrectly on mercury for sample #054672-003 (pg.692).
Please send a corrected page.
Thanks,
Wendy

Sandia National Laboratories
Sample Management Office
P.O. Box 5800
Albuquerque, New Mexico 87185-1331

Palencia, Wendy J

From: Palencia, Wendy J
Sent: Thursday, April 05, 2001 11:25 AM
To: 'Edie Kent'
Cc: 'David Setzer'; 'Nicole McCleary'
Subject: Correction for COC604298 / SDG38454

Importance: Low

emailcorredie4-5-2001.doc

Contract Verification Review (CVR)

Project Leader COLLINS　　Project Name SITE 227　　Case No. 7225_02.02.09

AR/COC No. 604298　　Analytical Lab GEL　　SDG No. 38454

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

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

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

2.0 Analytical Laboratory Report

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

3.0 Data Quality Evaluation

Item	Yes	No	If no, Sample ID No./Fraction(s) and Analysis
3.1 Are reporting units appropriate for the matrix and meet contract specified or project-specific requirements? Inorganics and metals reported as ppm (mg/liter or mg/Kg)? Tritium reported in picocuries per liter with percent moisture for soil samples? Units consistent between QC samples and sample data	X		
3.2 Quantitation limit met for all samples	X		
3.3 Accuracy a) Laboratory control samples accuracy reported and met for all samples		X	LCS/LCD FAILED RECOVERY LIMITS FOR SVOCs SEVERAL ANALYTES FAILED RECOVERY LIMITS FOR HE LCD
b) Surrogate data reported and met for all organic samples analyzed by a gas chromatography technique		X	ALL SUROGATES FAILED RECOVERY LIMITS FOR SVOC SAMPLE #054675-003
c) Matrix spike recovery data reported and met	X		
3.4 Precision a) Replicate sample precision reported and met for all inorganic and radiochemistry samples		X	RPD FOR BETA FAILED ACCEPTANCE LIMITS
b) Matrix spike duplicate RPD data reported and met for all organic samples	X		
3.5 Blank data a) Method or reagent blank data reported and met for all samples		X	METHYLENE CHLORIDE DETECTED IN VOC METHOD BLANK DIETHYLPHTHALATE & BIS(2-ETHYLHEXYL)PHTHALATE DETECTED IN SVOC METHOD BLANK
b) Sampling blank (e.g., field, trip, and equipment) data reported and met		X	METHYLENE CHLORIDE DETECTED IN VOC TRIP BLANK SEVERAL ANALYTES DETECTED IN VOC EQUIPMENT BLANK
3.6 Contractual qualifiers provided: "J"- estimated quantity; "B"-analyte found in method blank above the MDL for organic or above the PQL for inorganic; "U"-analyte undetected (results are below the MDL, IDL, or MDA (radiochemical)); "H"-analysis done beyond the holding time		X	"J" QUALIFIER INCORRECTLY USED ON MERCURY FOR SAMPLE #054672-003
3.7 Narrative addresses planchet flaming for gross alpha/beta	X		
3.8 Narrative included, correct, and complete	X		
3.9 Second column confirmation data provided for methods 8330 (high explosives) and pesticides/PCBs	X		

Contract Verification Review (Continued)

4.0 Calibration and Validation Documentation

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

Contract Verification Review (Concluded)

5.0 Problem Resolution

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

Sample/Fraction No.	Analysis	Problems/Comments/Resolutions
054672-003	7471A	"J" QUALIFIER USED INCORRECTLY

Were deficiencies unresolved? ☑ Yes ☐ No

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

If no, provide: nonconformance report or correction request number 2492 and date correction request was submitted: 4-5-2001

Reviewed by: W. Palencia Date: 4-5-2001 Closed by: W. Palencia Date: 4-24-01

SF 2001-COC (7/00)

CONTRACT LABORATORY
ANALYSIS REQUEST AND CHAIN OF CUSTODY

Internal Lab Batch No. N/A SAR/WR No.

AR/COC 604298

Dept. No./Mail Stop:	6133/1087	Date Samples Shipped:	02-28-01	Contract No:	AJ2480A
Project/Task Manager:	Sue Collins	Carrier/Waybill No.	741519	Project/Task No.:	7229/02.02.09
Project Name:	Site 227 surface	Lab Contact:	Edie Kent	SMO Authorization:	[signature]
Record Center Code:	ER/1309/227/DAT	Lab Destination:	General Engineering Labs		
Logbook Ref. No.:	ER078	SMO Contact/Phone:	P. Puissant/844-3185		
Service Order No.	CF0103-01	Send Report to SMO:	Sad Jensen		

☑ Waste Characterization
RCRA Date:
☐ Send Preliminary report to:
☐ Validation Required
☐ Released by COC No.:
Bill To: Sandia National Labs (Accounts Payable)
PO Box 5800, MS-0154, Albuquerque, NM 87185-0154

Location: Tech Area — Reference LOV (available at SMO)

Sample No.-Fraction	ER Sample ID or Sample Location Detail	Beginning Depth (ft)	ER Site No.	Date/Time(hr) Collected	Sample Matrix	Container Type	Container Volume	Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
054670-002	TJAOU-227-GR-05-7.0-S	7.0	227	2.27.01/1425	S	G	125 ml	4C	G	SA	VOCs (8260)	
054670-003	TJAOU-227-GR-05-7.0-S	7.0	227	2.27.01/1425	S	AG	500 ml	4C	G	SA	SVOCs (8270), RCRA Metals (6010/7471), HE (8330)	
054670-004	TJAOU-227-GR-05-7.0-S	7.0	227	2.27.01/1425	S	AG	500 ml	4C	G	SA	Gamma Spec (HASL 300.0) Gross Alpha/Beta (900)	
054673-002	TJAOU-227-GR-07-5.0-S	5.0	227	2.27.01/1340	S	G	125 ml	4C	G	SA	VOCs (8260)	
054673-003	TJAOU-227-GR-07-5.0-S	5.0	227	2.27.01/1340	S	AG	500 ml	4C	G	SA	SVOCs (8270), RCRA Metals (6010/7471), HE (8330)	
054673-004	TJAOU-227-GR-07-5.0-S	5.0	227	2.27.01/1340	S	AG	500 ml	4C	G	SA	Gamma Spec (HASL 300.0) Gross Alpha/Beta (900)	

RMMA ☐ Yes ☑ No Ref. No.
Sample Disposal ☐ Return to Client ☑ Disposal by lab
Turnaround Time ☐ 7 Day* ☐ 15 Day* ☑ 30 Day
Return Samples By: ☐ Negotiated TAT

Sample Tracking — SMO Use
Date Entered (mm/dd/yy) 03/01/01
Entered by:
QC inits.

Special Instructions/QC Requirements:
EDD ☑ Yes ☐ No
Raw Data Package ☑ Yes ☐ No
*Send/e-mail report to:
*Please list as separate report.

Abnormal Conditions on Receipt

Sample Team Members	Name	Signature	Init	Company/Organization/Phone/Cellular
	Robin Ryan	[signature]	RR	GRAM/6133/845-8821
	Margaret Sanchez	[signature]	MS	Weston/ /845-3278

		Org.	Date	Time		Org.	Date	Time
1. Relinquished by	[signature]	6133	02/28/01	1050	4. Relinquished by			
1. Received by	[signature] SMO	6133	02/28/01	1050	4. Received by			
2. Relinquished by	[signature] SMO	6133	02/28/01	1200	5. Relinquished by			
2. Received by					5. Received by			
3. Relinquished by					6. Relinquished by			
3. Received by					6. Received by			

*7 & 15 Day Turnaround Time: ERCL requires prior notification.

SF 2001-COC (7/00)

CONTRACT LABORATORY

Analysis Request And Chain Of Custody (Continuation)

Page 2 of

AR/COC- 604298

Project Name: Site 227	Project/Task Manager: Sue Collins	Project/Task No.: 7223.02.02 09
Location: Tech Area II	3.5	
Building	Room	Reference LOV (available at SMO)

Sample No-Fraction	ER Sample ID or Sample Location detail	Beginning Depth (ft)	ER Site No.	Date/Time (hr) Collected	Sample Matrix	Container Type	Container Volume	Preservative	Collection Method	Sample Type	Parameter & Method Requested	Lab Sample ID
054675-002	TJAOU-227-GR-06-0.0-S	0.0	227	2.27.01/1440	S	AG	125 ml	4C	G	SA	VOCs (8260)	
054675-003	TJAOU-227-GR-06-0.0-S	0.0	227	2.27.01/1440	S	AG	500 ml	4C	G	SA	SVOCs (8270), RCRA Metals (6010/7471), HE (8330)	
054675-004	TJAOU-227-GR-06-0.0-S	0.0	227	2.27.01/1440	S	AG	500 ml	4C	G	SA	Gamma Spec (HASL 300.0) Gross Alpha/Beta (900)	
054671-002	TJAOU-227-GR-06-5.0-S	5.0	227	2.27.01/1455	S	AG	125 ml	4C	G	SA	VOCs (8260)	
054671-003	TJAOU-227-GR-06-5.0-S	5.0	227	2.27.01/1455	S	AG	500 ml	4C	G	SA	SVOCs (8270), RCRA Metals (6010/7471), HE (8330)	
054671-004	TJAOU-227-GR-06-5.0-S	5.0	227	2.27.01/1455	S	AG	500 ml	4C	G	SA	Gamma Spec (HASL 300.0) Gross Alpha/Beta (900)	
054672-002	TJAOU-227-GR-06-5.0-DU	5.0	227	2.27.01/1500	S	AG	125 ml	4C	G	DU	VOCs (8260)	
054672-003	TJAOU-227-GR-06-5.0-DU	5.0	227	2.27.01/1500	S	AG	500 ml	4C	G	DU	SVOCs (8270), RCRA Metals (6010/7471), HE (8330)	
054672-004	TJAOU-227-GR-06-5.0-DU	5.0	227	2.27.01/1500	S	AG	500 ml	4C	G	DU	Gamma Spec (HASL 300.0) Gross Alpha/Beta (900)	
054678-002	TJAOU-227-GR-EB-001	N/A	227	2.27.01/1525	DIW	G	3x40 ml	4C, HCL	G	EB	VOCs (8260)	
054678-003	TJAOU-227-GR-EB-001	N/A	227	2.27.01/1525	DIW	AG	2x1L	4C	G	EB	SVOCs (8270)	
054678-004	TJAOU-227-GR-EB-001	N/A	227	2.27.01/1526	DIW	P	500 ml	4C, HNO3	G	EB	RCRA METALS (6010/7471)	
054678-005	TJAOU-227-GR-EB-001	N/A	227	2.27.01/1526	DIW	AG	4x1L	4C	G	EB	HE (8330)	
054678-006	TJAOU-227-GR-EB-001	N/A	227	2.27.01/1527	DIW	P	1 L	4C, HNO3	G	EB	Gamma Spec (HASL 300.0)	
054678-007	TJAOU-227-GR-EB-001	N/A	227	2.27.01/1527	DIW	P	1 L	4C, HNO3	G	EB	Gross Alpha/Gross Beta (900)	
054676-001	TJAOU-227-GR-TB-001	N/A	227	2.27.01/1315	DIW	G	3x40ml	4C, HCL	G	TB	VOCs (8260)	

Abnormal Conditions on Receipt

LAB USE

Recipient Initials

ATTACHMENT C

SWMU 227—On-Site Laboratory Gamma Spectroscopy Results for Soil Samples

Sandia National Laboratories

SF 2001-SCL (12-93)

In-house

ENVIRONMENTAL PROGRAMS SAMPLE COLLECTION LOG

SCL- 01617

AR/COC No.: AR/COC- 00806

227-RPSD

PAGE 1 OF 1

GENERAL INFORMATION

DATE: 9/29/94 WEATHER: Sunny 85°F

SAMPLING PROCEDURE REFERENCE: SAP

PURPOSE OF SAMPLING: Preliminary Investigation

SAMPLING INFORMATION

ON-SITE CONTACT: JAN CURTIS ORG. 7582 PHONE 263-3390

AREA 1309 LOCATION Site 227

SAMPLE DESCRIPTION

MATRIX: ☐ GAS ☐ LIQUID ☐ SLUDGE ☐ SOLID ☐ WATER ☐ OIL ☒ SOIL ☐ HAZ WASTE ☐ OTHER

COLLECTED FROM: ☐ DRUM ☐ TANK ☐ SURFACE WATER ☒ SOIL ☐ WASTE WATER ☐ GROUND WATER ☐ OTHER

Sample Number - Fraction	Time	LOCATION	COMMENTS	Sample Type Grab/Comp.	QC Sample (Y/N)	ANALYSES: Gamma Spec
017918-10	1026	Site 227-01-B	Subsurface soil 6-36"	C	N	X
017918-4	1026	Site 227-01-A	Surface soil 0-6"	C	N	X
017919-2	1109	Site 227-02-A	Surface soil 0-6"	C	N	X
017919-7	1130	Site 227-02-B	Subsurface soil 6-36"	C	N	X
017920-3	1217	Site 227-03-A	Surface soil 0-6"	C	N	X
017920-11	1217	Site 227-03-B	Subsurface soil 6-36"	C	N	X
017921-2	1415	Site 227-04-A	Surface soil 0-6"	C	N	X
017921-6	1425	Site 227-04-B	Subsurface soil 6-36"	C	N	X

PROJECT

PROJECT NAME: Tijeras Arroyo CASE NUMBER: 3632.300 PROJECT CONTACT: Jim Brinkman ORG. 7582 PHONE 848-0455

***ADDITIONAL INFORMATION:** (Log Book Ref. #)

SAMPLE TEAM MEMBERS

	NAME	SIGNATURE	INIT	COMPANY/ORGANIZATION
1.	JAN Curtis	Jan Curtis	JC	Weston
2.				
3.				

SAMPLE TRACKING

SAMPLE DISTRIBUTION: SNL-7715 TRANSPORTED BY: HC SPECIAL HANDLING:

DATE SHIPPED (MM-DD-YY): 9/30/94 DATA ENTERED (MM-DD-YY): 10-11-94 BY: [illegible]

*NOTE: Any additional sampling information must be recorded in an SNL-Issued Log Book or SCL Continuation Form with a Reference No. entered in this space.

ENVIRONMENTAL PROGRAMS
SAMPLE COLLECTION LOG

Sample Number	Time	LOCATION	COMMENTS
[illegible]	[illegible]	[illegible]	[illegible]

PROJECT

*ADDITIONAL INFORMATION

SAMPLE TEAM MEMBERS	NAME	SIGNATURE	INIT	COMPANY/ORGANIZATION
	[illegible]	[illegible]	[illegible]	[illegible]

Sandia National Laboratories (in-house)

SF 2001-COC (12-93)

940515

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

AR/COC- 00806

PAGE 1 OF 1

Department No.: 7582
Project/Task Manager: Jim Brinkman
Project Name: Tijeras Arroyo - Site 227
Sample Team Members: Jon Curtis

SCL or Logbook Ref. No.: 01617

Date Samples Shipped:
Carrier/Waybill No.:
Lab Destination:
Lab Contact:
SMO Contact/Phone:
Send Report to SMO:
SMO Reference No.:

SMO USE ONLY

Bill to: Sandia National Laboratories
Supplier Services Department
P.O. Box 5800 MS 0154
Albuquerque, NM 87185-0154

Contract No.: N/A
Case No.: 3632.300
SMO Authorization:

Sample Number - Fraction	Sample Matrix	Date/Time Collected	Container Type	Sample Volume	Preservative	Required Analytical Testing	Lab Sample Number	Condition on Receipt
✓ 017918-10	Soil	9/29/94 1026	Marinelli	500	none	Gamma Spec	FOR LAB USE ONLY	
✓ 017918-4	Soil	1026						
✓ 017919-2		1109						
✓ 017919-7		1130						
✓ 017920-3		1217						
✓ 017920-11		1217						
✓ 017921-2		1415						
✓ 017921-6		1425						

Possible Hazard Identification
☒ Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Radiological

*Reference attached radiological screening for specific contact readings.

Turnaround Time
☒ Normal ☐ Rush ____ Required Report Date ____

Special Instructions/QC Requirements

Sample Disposal
☒ Return to Client ☐ Disposal by Lab Archive Until ____

	Name	Org.	Date	Time
1. Relinquished by	[signature]	7582	9/30/94	0915
1. Received by	[signature]	SMO-7576	9/30/94	0915
2. Relinquished by	[signature]	SMO-7576	9/30/94	1130
2. Received by	[signature]	7715	9/30/94	1131
3. Relinquished by	[signature]	SM 7715	10/6/94	1421
4. Relinquished by				
4. Received by				
5. Relinquished by				
5. Received by				
6. Relinquished by				

Sandia National Laboratories (in-house)

SF 2001-COC (12-93)

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

940515

AR/COC-00806

PAGE 1 OF 1

Department No.: 7582
Project/Task Manager: Jim Brinkman
Project Name: Tijeras Arroyo - Site 227
Sample Team Members: Jon Curtis

SCL or Logbook Ref. No.: 01617

Date Samples Shipped:
Carrier/Waybill No.:
Lab Destination:
Lab Contact:
SMO Contact/Phone:
Send Report to SMO:
SMO Reference No.:

SMO USE ONLY

Bill to: Sandia National Laboratories
Supplier Services Department
P.O. Box 5800 MS 0154
Albuquerque, NM 87185-0154

Contract No.: N/A
Case No.: 3632.300
SMO Authorization:

Sample Number - Fraction	Sample Matrix	Date/Time Collected	Container Type	Sample Volume	Preservative	Required Analytical Testing	Lab Sample Number	Condition on Receipt
017918-10	Soil	9/29/94 1026	Marinelli	500	none	Gamma Spec	FOR LAB USE ONLY	
017918-4	Soil	1026						
017919-2		1109						
017919-7		1130						
017920-3		1217						
017920-11		1217						
017921-2		1415						
017921-6	↓	↓ 1425	↓	↓	↓			

Possible Hazard Identification
☒ Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Radiological

*Reference attached radiological screening for specific contact readings.

Turnaround Time
☒ Normal ☐ Rush Required Report Date

Special Instructions/QC Requirements

Sample Disposal
☒ Return to Client ☐ Disposal by Lab Archive Until

1. Relinquished by [illegible]	Org. 7582	Date 9/30/94	Time 0915	4. Relinquished by	Org.	Date	Time
1. Received by [illegible]	Org. SMO 7576	Date 9/30/94	Time 0915	4. Received by	Org.	Date	Time
2. Relinquished by [illegible]	Org. SMO 7576	Date 9/30/94	Time 1130	5. Relinquished by	Org.	Date	Time
2. Received [illegible]	Org. 7715	Date 9/30/94	Time 1130	Received by	Org.	Date	Time
3. Relinquished [illegible]	Org. SMO 7715	Date 10/6/94	Time 1427	6. Relinquished by	Org.	Date	Time

```
**************************************************************************
* SNL Radiation Sample Diagnostic Program (7715)/881  04-OCT-94 14:47:12 *
**************************************************************************
J.BRINKMAN/E.RANKIN (7582/SMO)  018085-5

Operator: ______ 10/6/94      Reviewed by ______ 10/6/94
**************************************************************************
                                        *
Data File    : 94051809.DAT             * Sample Quantity: 850.000  GRAM
Acquire Date: 04-OCT-94 13:22:42        * Efficiency File: SMAR1.EFF
Sample  Date: 30-SEP-94 16:00:00        * Library    File: RSDP.LIB
Sample  Type: SOLID                     *
**************************************************************************
                                        *
Preset  Live Time: 3600.0  sec          * FWHM at 1332 KeV            : 2.0  KeV
Elapsed Live Time: 3600.0  sec          * Peak Search Sensitivity: 4.0
Elapsed Real Time: 3602.0  sec          * Gaussian Assymetry          : 10.0 %
**************************************************************************
                                        *
Detector     : DET1                     * Fit Iterations    : 20.
Calib Date : 30-AUG-94 09:23:06         * Energy Tolerance: 1.5  KeV
KeV/Channel: .36608                     * Half Life Ratio  : 8.0
Offset       : -.14939                  * Abundance Limit  : 50.00 %
**************************************************************************
```

[Summary Report -- SNL (7715) -- version 1.2]

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
U-238	1.35E+00	4.37E-01	--------
TH-234	1.35E+00	4.37E-01	--------
U-234	Not Detected	--------	9.83E+00
RA-226	1.72E+00	5.24E-01	--------
PB-214	7.29E-01	6.34E-02	--------
BI-214	7.12E-01	6.23E-02	--------
PB-210	Not Detected	--------	0.00E+00
TH-232	8.39E-01	1.27E-01	--------
RA-228	8.39E-01	1.27E-01	--------
AC-228	7.57E-01	1.14E-01	--------
TH-228	7.84E-01	4.40E-02	--------
RA-224	7.02E-01	5.30E-01	--------
PB-212	7.87E-01	4.42E-02	--------
BI-212	6.47E-01	1.70E-01	--------
TL-208	7.10E-01	8.70E-02	--------
U-235	Not Detected	--------	3.53E-02
~~TH-231~~	~~6.18E-01~~	~~2.50E-01~~	Not detected 10/6/94
PA-231	Not Detected	--------	6.95E-01
AC-227	Not Detected	--------	9.78E-01
TH-227	Not Detected	--------	1.31E-01
AM-241	Not Detected	--------	1.12E-01
NP-237	Not Detected	--------	1.82E-01
PA-233	Not Detected	--------	3.68E-02
TH-229	Not Detected	--------	7.34E-02

ID: J.BRINKMAN/E.RANKIN (7582/SMO) 018085-5

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
PU-239	Not Detected	--------	2.67E+02
AG-110	Not Detected	--------	1.42E-02
BE-7	Not Detected	--------	1.38E-01
AR-41	Short Half-Life	--------	--------
BA-133	Not Detected	--------	1.96E-02
BA-140	Not Detected	--------	5.25E-02
BI-207	Not Detected	--------	1.65E-02
CD-109	Not Detected	--------	6.97E-01
CE-139	Not Detected	--------	1.82E-02
CE-144	Not Detected	--------	1.32E-01
CO-56	Not Detected	--------	2.10E-02
CO-57	Not Detected	--------	1.70E-02
CO-58	Not Detected	--------	1.71E-02
CO-60	Not Detected	--------	2.35E-02
CR-51	Not Detected	--------	1.40E-01
CS-134	Not Detected	--------	1.40E-02
CS-137	3.38E-02	2.10E-02	--------
CU-64	Not Detected	--------	9.00E+02
EU-152	Not Detected	--------	5.09E-02
EU-154	Not Detected	--------	7.65E-02
EU-155	Not Detected	--------	8.32E-02
FE-59	Not Detected	--------	3.41E-02
GD-153	Not Detected	--------	5.41E-02
HG-203	Not Detected	--------	1.74E-02
I-125	Not Detected	--------	0.00E+00
I-129	Not Detected	--------	0.00E+00
I-131	Not Detected	--------	2.04E-02
IN-115M	Short Half-Life	--------	--------
IR-192	Not Detected	--------	1.60E-02
K-40	1.65E+01	6.71E-01	--------
LA-140	Not Detected	--------	5.80E-02
MN-54	Not Detected	--------	2.07E-02
MN-56	Short Half-Life	--------	--------
NA-22	Not Detected	--------	2.09E-02
NA-24	Not Detected	--------	1.03E+00
NB-95	Not Detected	--------	1.25E-01
RU-103	Not Detected	--------	1.31E-02
RU-106	Not Detected	--------	1.09E-01
SB-124	Not Detected	--------	1.37E-02
SB-125	Not Detected	--------	4.28E-02
SB-126	Not Detected	--------	1.82E-02
SC-46	Not Detected	--------	1.83E-02
SN-113	Not Detected	--------	1.91E-02
SR-85	Not Detected	--------	1.42E-02
TA-182	Not Detected	--------	1.48E-01
TE-123M	Not Detected	--------	1.70E-02
TL-201	Not Detected	--------	3.44E-01
XE-133	Not Detected	--------	1.06E-01
Y-88	Not Detected	--------	2.07E-02
ZN-65	Not Detected	--------	3.99E-02
ZR-95	Not Detected	--------	3.36E-02

```
*****************************************************************************
* SNL Radiation Sample Diagnostic Program (7715)/881  04-OCT-94 11:08:16 *
*****************************************************************************
J.BRINKMAN/E.RANKIN (7582/SMO)  018085-2

Operator: __JJ 10/6/94__________  Reviewed by __AJM 10/6/94__________
*****************************************************************************
                                   *
Data File    : 94051808.DAT        * Sample Quantity: 866.000  GRAM
Acquire Date: 04-OCT-94 10:03:39   * Efficiency File: SMAR2.EFF
Sample  Date: 30-SEP-94 16:00:00   * Library    File: RSDP.LIB
Sample  Type: SOLID                *
*****************************************************************************
                                   *
Preset  Live Time: 3600.0  sec     * FWHM at 1332 KeV          : 2.4  KeV
Elapsed Live Time: 3600.0  sec     * Peak Search Sensitivity: 4.0
Elapsed Real Time: 3602.0  sec     * Gaussian Assymetry      : 10.0 %
*****************************************************************************
                                   *
Detector    : DET2                 * Fit Iterations   : 20.
Calib Date  : 20-APR-94 16:41:18   * Energy Tolerance: 1.5  KeV
KeV/Channel: .36617                * Half Life Ratio  : 8.0
Offset      : .00135               * Abundance Limit  : 50.00 %
*****************************************************************************

[Summary Report      -- SNL (7715) --      version 1.2]

            Activity            2-sigma          MDA
Nuclide   (PCI /GRAM    )        Error       (PCI /GRAM    )
-------   --------------     -----------    --------------
U-238      7.85E-01          3.13E-01        ---------
TH-234     7.87E-01          3.13E-01        ---------
U-234      Not Detected      --------        2.47E+00
RA-226     1.43E+00          6.44E-01        ---------
PB-214     6.49E-01          7.12E-02        ---------
BI-214     6.18E-01          7.06E-02        ---------
PB-210     1.39E+00          6.93E-01        ---------

TH-232     9.38E-01          1.29E-01        ---------
RA-228     9.38E-01          1.29E-01        ---------
AC-228     8.46E-01          1.16E-01        ---------
TH-228     8.21E-01          5.45E-02        ---------
RA-224     5.88E-01          4.65E-01        ---------
PB-212     8.25E-01          5.48E-02        ---------
BI-212     5.19E-01          2.18E-01        ---------
TL-208     6.76E-01          9.04E-02        ---------

U-235      Not Detected      ---------       3.36E-02
TH-231     Not Detected      ---------       2.09E-01
PA-231     Not Detected      ---------       7.41E-01
AC-227     Not Detected      ---------       9.58E-01
TH-227     Not Detected      ---------       1.37E-01

AM-241     Not Detected      ---------       4.99E-02
NP-237     Not Significant   ---------       ---------
PA-233     Not Detected      ---------       3.99E-02
TH-229     Not Detected      ---------       7.22E-02
```

ID: J.BRINKMAN/E.RANKIN (7582/SMO) 018085-2

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
PU-239	Not Detected	--------	2.51E+02
AG-110	Not Detected	--------	1.61E-02
BE-7	Not Detected	--------	1.53E-01
AR-41	Short Half-Life	--------	--------
BA-133	Not Detected	--------	2.19E-02
BA-140	Not Detected	--------	6.92E-02
BI-207	Not Detected	--------	1.70E-02
CD-109	Not Detected	--------	5.25E-01
CE-139	Not Detected	--------	1.69E-02
CE-144	Not Detected	--------	1.28E-01
CO-56	Not Detected	--------	2.09E-02
CO-57	Not Detected	--------	1.63E-02
CO-58	Not Detected	--------	1.60E-02
CO-60	Not Detected	--------	2.88E-02
CR-51	Not Detected	--------	1.50E-01
CS-134	Not Detected	--------	1.72E-02
CS-137	4.32E-02	2.37E-02	--------
CU-64	Not Detected	--------	1.02E+03
EU-152	Not Detected	--------	4.79E-02
EU-154	Not Detected	--------	8.21E-02
EU-155	Not Detected	--------	6.73E-02
FE-59	Not Detected	--------	4.59E-02
GD-153	Not Detected	--------	4.16E-02
HG-203	Not Detected	--------	2.08E-02
I-125	Not Detected	--------	0.00E+00
I-129	Not Detected	--------	0.00E+00
I-131	Not Detected	--------	2.18E-02
IN-115M	Short Half-Life	--------	--------
IR-192	Not Detected	--------	1.70E-02
K-40	1.76E+01	7.44E-01	--------
LA-140	Not Detected	--------	8.45E-02
MN-54	Not Detected	--------	1.82E-02
MN-56	Short Half-Life	--------	--------
NA-22	Not Detected	--------	2.44E-02
NA-24	Not Detected	--------	1.14E+00
NB-95	Not Detected	--------	1.25E-01
RU-103	Not Detected	--------	1.82E-02
RU-106	Not Detected	--------	1.26E-01
SB-124	Not Detected	--------	1.77E-02
SB-125	Not Detected	--------	4.77E-02
SB-126	Not Detected	--------	2.11E-02
SC-46	Not Detected	--------	1.80E-02
SN-113	Not Detected	--------	2.22E-02
SR-85	Not Detected	--------	1.75E-02
TA-182	Not Detected	--------	1.91E-01
TE-123M	Not Detected	--------	1.66E-02
TL-201	Not Detected	--------	3.17E-01
XE-133	Not Detected	--------	7.07E-02
Y-88	Not Detected	--------	2.03E-02
ZN-65	Not Detected	--------	5.26E-02
ZR-95	Not Detected	--------	3.42E-02

```
*****************************************************************************
* SNL Radiation Sample Diagnostic Program (7715)/881  04-OCT-94 14:44:04 *
*****************************************************************************
J.BRINKMAN/E.RANKIN (7582)  018084-8

Operator: ________ 10/6/94     Reviewed by ________ 10/16/94
*****************************************************************************
                                      *
Data File    : 94051807.DAT           * Sample Quantity: 981.000  GRAM
Acquire Date: 04-OCT-94 13:19:47      * Efficiency File: SMAR2.EFF
Sample  Date: 30-SEP-94 15:20:00      * Library    File: RSDP.LIB
Sample  Type: SOLID                   *
*****************************************************************************
                                      *
Preset  Live Time: 3600.0  sec        * FWHM at 1332 KeV         : 2.4  KeV
Elapsed Live Time: 3600.0  sec        * Peak Search Sensitivity: 4.0
Elapsed Real Time: 3602.0  sec        * Gaussian Assymetry       : 10.0 %
*****************************************************************************
                                      *
Detector    : DET2                    * Fit Iterations   : 20.
Calib Date : 20-APR-94 16:41:18       * Energy Tolerance: 1.5  KeV
KeV/Channel: .36617                   * Half Life Ratio  : 8.0
Offset      : .00135                  * Abundance Limit  : 50.00 %
*****************************************************************************
```

[Summary Report -- SNL (7715) -- version 1.2]

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
U-238	9.19E-01	3.84E-01	--------
TH-234	9.20E-01	3.85E-01	--------
U-234	Not Significant	--------	--------
RA-226	1.14E+00	6.26E-01	--------
PB-214	5.16E-01	6.23E-02	--------
BI-214	4.68E-01	8.50E-02	--------
PB-210	Not Detected	--------	0.00E+00
TH-232	6.00E-01	1.24E-01	--------
RA-228	6.00E-01	1.24E-01	--------
AC-228	5.41E-01	1.12E-01	--------
TH-228	6.63E-01	4.05E-02	--------
RA-224	4.20E-01	4.48E-01	--------
PB-212	6.66E-01	4.07E-02	--------
BI-212	6.02E-01	2.00E-01	--------
TL-208	5.91E-01	9.08E-02	--------
U-235	Not Detected	--------	2.87E-02
TH-231	Not Detected	--------	1.86E-01
PA-231	Not Detected	--------	6.38E-01
AC-227	Not Detected	--------	8.62E-01
TH-227	Not Detected	--------	1.26E-01
AM-241	Not Detected	--------	4.46E-02
NP-237	Not Detected	--------	1.14E-01
PA-233	Not Detected	--------	3.46E-02
TH-229	Not Detected	--------	6.49E-02

ID: J.BRINKMAN/E.RANKIN (7582) 018084-8

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
PU-239	Not Detected	--------	2.16E+02
AG-110	Not Detected	--------	1.65E-02
BE-7	Not Detected	--------	1.23E-01
AR-41	Short Half-Life	--------	--------
BA-133	Not Detected	--------	1.96E-02
BA-140	Not Detected	--------	6.81E-02
BI-207	Not Detected	--------	1.53E-02
CD-109	Not Detected	--------	4.46E-01
CE-139	Not Detected	--------	1.56E-02
CE-144	Not Detected	--------	1.13E-01
CO-56	Not Detected	--------	1.74E-02
CO-57	Not Detected	--------	1.43E-02
CO-58	Not Detected	--------	1.47E-02
CO-60	Not Detected	--------	2.74E-02
CR-51	Not Detected	--------	1.36E-01
CS-134	Not Detected	--------	1.58E-02
CS-137	Not Detected	--------	1.57E-02
CU-64	Not Detected	--------	1.23E+03
EU-152	Not Detected	--------	4.23E-02
EU-154	Not Detected	--------	7.29E-02
EU-155	Not Detected	--------	6.06E-02
FE-59	Not Detected	--------	4.39E-02
GD-153	Not Detected	--------	3.80E-02
HG-203	Not Detected	--------	1.88E-02
I-125	Not Detected	--------	0.00E+00
I-129	Not Detected	--------	0.00E+00
I-131	Not Detected	--------	2.05E-02
IN-115M	Short Half-Life	--------	--------
IR-192	Not Detected	--------	1.49E-02
K-40	2.08E+01	7.44E-01	--------
LA-140	Not Detected	--------	6.75E-02
MN-54	Not Detected	--------	1.66E-02
MN-56	Short Half-Life	--------	--------
NA-22	Not Detected	--------	2.51E-02
NA-24	Not Detected	--------	1.40E+00
NB-95	Not Detected	--------	1.18E-01
RU-103	Not Detected	--------	1.58E-02
RU-106	Not Detected	--------	1.12E-01
SB-124	Not Detected	--------	1.58E-02
SB-125	Not Detected	--------	4.08E-02
SB-126	Not Detected	--------	1.92E-02
SC-46	Not Detected	--------	1.62E-02
SN-113	Not Detected	--------	1.85E-02
SR-85	Not Detected	--------	1.54E-02
TA-182	Not Detected	--------	1.86E-01
TE-123M	Not Detected	--------	1.44E-02
TL-201	Not Detected	--------	3.03E-01
XE-133	Not Detected	--------	6.41E-02
Y-88	Not Detected	--------	2.02E-02
ZN-65	Not Detected	--------	4.96E-02
ZR-95	Not Detected	--------	3.17E-02

```
*************************************************************************
* SNL Radiation Sample Diagnostic Program (7715)/881  04-OCT-94 13:22:33 *
*************************************************************************
J.BRINKMAN/E.RANKIN (7582/SMO)  018084-3

Operator: ______10/6/94______  Reviewed by ______10/6/94______

*************************************************************************
                                       *
Data File    : 94051806.DAT            * Sample Quantity: 814.000  GRAM
Acquire Date: 04-OCT-94 12:18:30       * Efficiency File: SMAR1.EFF
Sample  Date: 30-SEP-94 15:15:00       * Library    File: RSDP.LIB
Sample  Type: SOLID                    *
*************************************************************************
                                       *
Preset  Live Time: 3600.0  sec         * FWHM at 1332 KeV        : 2.0  KeV
Elapsed Live Time: 3600.0  sec         * Peak Search Sensitivity: 4.0
Elapsed Real Time: 3602.0  sec         * Gaussian Assymetry      : 10.0 %
*************************************************************************
                                       *
Detector    : DET1                     * Fit Iterations    : 20.
Calib Date  : 30-AUG-94 09:23:06       * Energy Tolerance: 1.5  KeV
KeV/Channel: .36608                    * Half Life Ratio : 8.0
Offset      : -.14939                  * Abundance Limit : 50.00 %
*************************************************************************
```

[Summary Report -- SNL (7715) -- version 1.2]

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
U-238	1.30E+00	4.09E-01	--------
TH-234	1.31E+00	4.10E-01	--------
U-234	Not Detected	--------	1.05E+01
RA-226	1.57E+00	6.82E-01	--------
PB-214	7.15E-01	6.78E-02	--------
BI-214	5.70E-01	6.35E-02	--------
PB-210	Not Detected	--------	0.00E+00
TH-232	9.01E-01	1.15E-01	--------
RA-228	9.01E-01	1.15E-01	--------
AC-228	8.13E-01	1.04E-01	--------
TH-228	7.93E-01	4.50E-02	--------
RA-224	2.62E+00	6.88E-01	--------
PB-212	7.97E-01	4.52E-02	--------
BI-212	4.99E-01	1.94E-01	--------
TL-208	7.68E-01	8.59E-02	--------
U-235	Not Detected	--------	3.50E-02
TH-231	Not Detected	--------	3.18E-01
PA-231	Not Detected	--------	7.05E-01
AC-227	Not Detected	--------	1.01E+00
TH-227	Not Detected	--------	1.37E-01
AM-241	Not Detected	--------	1.20E-01
NP-237	Not Detected	--------	1.87E-01
PA-233	Not Detected	--------	3.65E-02
TH-229	Not Detected	--------	7.40E-02

ID: J.BRINKMAN/E.RANKIN (7582/SMO) 018084-3

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
PU-239	Not Detected	--------	2.71E+02
AG-110	Not Detected	--------	1.56E-02
BE-7	Not Detected	--------	1.21E-01
AR-41	Short Half-Life	--------	--------
BA-133	Not Detected	--------	2.01E-02
BA-140	Not Detected	--------	6.71E-02
BI-207	Not Detected	--------	1.63E-02
~~CD-109~~	~~8.23E-01~~	~~7.75E-01~~	Not detected 10/6/94
CE-139	Not Detected	--------	1.83E-02
CE-144	Not Detected	--------	1.40E-01
CO-56	Not Detected	--------	2.31E-02
CO-57	Not Detected	--------	1.72E-02
CO-58	Not Detected	--------	1.99E-02
CO-60	Not Detected	--------	2.49E-02
CR-51	Not Detected	--------	1.42E-01
CS-134	Not Detected	--------	1.41E-02
CS-137	Not Detected	--------	1.73E-02
CU-64	Not Detected	--------	1.01E+03
EU-152	Not Detected	--------	5.14E-02
EU-154	Not Detected	--------	6.67E-02
EU-155	Not Detected	--------	8.66E-02
FE-59	Not Detected	--------	3.95E-02
GD-153	Not Detected	--------	5.46E-02
HG-203	Not Detected	--------	1.88E-02
I-125	Not Detected	--------	0.00E+00
I-129	Not Detected	--------	0.00E+00
I-131	Not Detected	--------	2.15E-02
IN-115M	Short Half-Life	--------	--------
IR-192	Not Detected	--------	1.56E-02
K-40	1.91E+01	7.26E-01	--------
LA-140	Not Detected	--------	5.04E-02
~~MN-54~~	~~2.34E-02~~	~~1.58E-02~~	Not detected 10/6/94
MN-56	Short Half-Life	--------	--------
NA-22	Not Detected	--------	2.29E-02
NA-24	Not Detected	--------	1.45E+00
NB-95	Not Detected	--------	1.31E-01
RU-103	Not Detected	--------	1.38E-02
RU-106	Not Detected	--------	1.11E-01
SB-124	Not Detected	--------	1.44E-02
SB-125	Not Detected	--------	4.05E-02
SB-126	Not Detected	--------	2.05E-02
SC-46	Not Detected	--------	1.86E-02
SN-113	Not Detected	--------	1.93E-02
SR-85	Not Detected	--------	1.37E-02
TA-182	Not Detected	--------	1.53E-01
TE-123M	Not Detected	--------	1.73E-02
TL-201	Not Detected	--------	3.43E-01
XE-133	Not Detected	--------	1.10E-01
Y-88	Not Detected	--------	2.22E-02
ZN-65	Not Detected	--------	4.38E-02
ZR-95	Not Detected	--------	3.25E-02

```
***************************************************************************
* SNL Radiation Sample Diagnostic Program (7715)/881   04-OCT-94 13:19:37 *
***************************************************************************
J.BRINKMAN/E.RANKIN (7582/SMO)   018081-9

Operator: ________ 10/6/94        Reviewed by ________ 10/6/94

***************************************************************************
                                 *
Data File    : 94051804.DAT      * Sample Quantity: 1019.000 GRAM
Acquire Date: 04-OCT-94 12:15:41 * Efficiency File: SMAR2.EFF
Sample  Date: 30-SEP-94 11:04:00 * Library    File: RSDP.LIB
Sample  Type: SOLID              *
***************************************************************************
                                 *
Preset  Live Time: 3600.0  sec   * FWHM at 1332 KeV        : 2.4  KeV
Elapsed Live Time: 3600.0  sec   * Peak Search Sensitivity: 4.0
Elapsed Real Time: 3603.0  sec   * Gaussian Assymetry      : 10.0 %
***************************************************************************
                                 *
Detector     : DET2              * Fit Iterations   : 20.
Calib Date   : 20-APR-94 16:41:18 * Energy Tolerance: 1.5  KeV
KeV/Channel: .36617              * Half Life Ratio  : 8.0
Offset       : .00135            * Abundance Limit  : 50.00 %
***************************************************************************

[Summary Report -- SNL (7715) --       version 1.2]
```

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
U-238	1.51E+00	2.97E-01	---------
TH-234	1.51E+00	2.97E-01	---------
U-234	Not Detected	---------	2.55E+00
RA-226	2.04E+00	4.94E-01	---------
PB-214	1.00E+00	7.01E-02	---------
BI-214	8.69E-01	8.16E-02	---------
PB-210	4.13E-01	4.26E-01	---------
TH-232	1.35E+00	1.62E-01	---------
RA-228	1.35E+00	1.62E-01	---------
AC-228	1.22E+00	1.46E-01	---------
TH-228	1.29E+00	5.67E-02	---------
RA-224	3.56E-01	4.29E-01	---------
PB-212	1.29E+00	5.69E-02	---------
BI-212	7.41E-01	1.60E-01	---------
TL-208	1.18E+00	1.14E-01	---------
U-235	Not Detected	---------	3.49E-02
TH-231	Not Detected	---------	2.23E-01
PA-231	Not Detected	---------	7.50E-01
AC-227	Not Detected	---------	1.06E+00
TH-227	Not Detected	---------	1.53E-01
AM-241	Not Detected	---------	5.02E-02
NP-237	Not Detected	---------	1.46E-01
PA-233	Not Detected	---------	3.79E-02
TH-229	Not Detected	---------	7.55E-02

ID: J.BRINKMAN/E.RANKIN (7582/SMO) 018081-9

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
PU-239	Not Detected	--------	2.60E+02
AG-110	Not Detected	--------	1.79E-02
BE-7	1.11E-01	1.23E-01	--------
AR-41	Short Half-Life	--------	--------
BA-133	Not Detected	--------	2.00E-02
BA-140	Not Detected	--------	7.55E-02
BI-207	Not Detected	--------	1.53E-02
CD-109	Not Detected	--------	5.56E-01
CE-139	Not Detected	--------	1.74E-02
CE-144	Not Detected	--------	1.38E-01
CO-56	Not Detected	--------	1.68E-02
CO-57	Not Detected	--------	1.71E-02
CO-58	Not Detected	--------	1.52E-02
CO-60	Not Detected	--------	2.51E-02
CR-51	Not Detected	--------	1.47E-01
CS-134	Not Detected	--------	1.65E-02
CS-137	Not Detected	--------	1.94E-02
CU-64	Not Detected	--------	1.23E+03
EU-152	Not Detected	--------	5.12E-02
EU-154	Not Detected	--------	7.06E-02
EU-155	Not Detected	--------	7.05E-02
FE-59	Not Detected	--------	3.83E-02
GD-153	Not Detected	--------	4.46E-02
HG-203	Not Detected	--------	2.07E-02
I-125	Not Detected	--------	0.00E+00
I-129	Not Detected	--------	0.00E+00
I-131	Not Detected	--------	2.18E-02
IN-115M	Short Half-Life	--------	--------
IR-192	Not Detected	--------	1.73E-02
K-40	1.35E+01	6.32E-01	--------
LA-140	Not Detected	--------	7.52E-02
MN-54	Not Detected	--------	1.75E-02
MN-56	Short Half-Life	--------	--------
NA-22	Not Detected	--------	2.04E-02
NA-24	Not Detected	--------	1.78E+00
NB-95	Not Detected	--------	1.44E-01
RU-103	Not Detected	--------	1.72E-02
RU-106	Not Detected	--------	1.35E-01
SB-124	Not Detected	--------	1.63E-02
SB-125	Not Detected	--------	4.72E-02
SB-126	Not Detected	--------	2.28E-02
SC-46	Not Detected	--------	1.80E-02
SN-113	Not Detected	--------	2.12E-02
SR-85	Not Detected	--------	1.76E-02
TA-182	Not Detected	--------	1.48E-01
TE-123M	Not Detected	--------	1.79E-02
TL-201	Not Detected	--------	3.58E-01
XE-133	Not Detected	--------	7.58E-02
Y-88	Not Detected	--------	2.00E-02
ZN-65	Not Detected	--------	4.25E-02
ZR-95	Not Detected	--------	3.26E-02

```
*************************************************************************
* SNL Radiation Sample Diagnostic Program (7715)/881  04-OCT-94 11:05:11 *
*************************************************************************
J.BRINKMAN/E.RANKIN (7582/SMO)  018081-3
```

Operator: [signature] 10/6/94 Reviewed by [signature] 10/6/94

```
*************************************************************************
                                    *
Data File    : 94051803.DAT         * Sample Quantity: 832.000  GRAM
Acquire Date: 04-OCT-94 10:02:17    * Efficiency File: SMAR1.EFF
Sample  Date: 30-SEP-94 11:00:00    * Library    File: RSDP.LIB
Sample  Type: SOLID                 *
*************************************************************************
                                    *
Preset  Live Time: 3600.0  sec      * FWHM at 1332 KeV        : 2.0  KeV
Elapsed Live Time: 3600.0  sec      * Peak Search Sensitivity: 4.0
Elapsed Real Time: 3602.0  sec      * Gaussian Assymetry      : 10.0 %
*************************************************************************
                                    *
Detector    : DET1                  * Fit Iterations    : 20.
Calib Date  : 30-AUG-94 09:23:06    * Energy Tolerance: 1.5  KeV
KeV/Channel: .36608                 * Half Life Ratio  : 8.0
Offset      : -.14939               * Abundance Limit  : 50.00 %
*************************************************************************
```

[Summary Report   -- SNL (7715) --   version 1.2]

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
U-238	2.02E+00	5.19E-01	--------
TH-234	2.02E+00	5.20E-01	--------
U-234	Not Detected	--------	1.09E+01
RA-226	1.68E+00	4.92E-01	--------
PB-214	9.23E-01	7.58E-02	--------
BI-214	8.25E-01	6.75E-02	--------
PB-210	Not Detected	--------	0.00E+00
TH-232	1.46E+00	1.39E-01	--------
RA-228	1.46E+00	1.39E-01	--------
AC-228	1.32E+00	1.26E-01	--------
TH-228	1.11E+00	5.14E-02	--------
RA-224	1.26E+00	6.78E-01	--------
PB-212	1.11E+00	5.16E-02	--------
BI-212	8.14E-01	2.27E-01	--------
TL-208	1.05E+00	1.02E-01	--------
U-235	Not Detected	--------	3.86E-02
~~TH-231~~	~~6.38E-01~~	~~3.02E-01~~	not detected [initials] 10/6/94
PA-231	Not Detected	--------	8.63E-01
AC-227	Not Detected	--------	1.13E+00
TH-227	Not Detected	--------	1.41E-01
AM-241	Not Detected	--------	1.28E-01
NP-237	Not Detected	--------	2.13E-01
PA-233	Not Detected	--------	3.77E-02
TH-229	Not Detected	--------	8.13E-02

ID: J.BRINKMAN/E.RANKIN (7582/SMO) 018081-3.

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
PU-239	Not Detected	--------	2.93E+02
AG-110	Not Detected	--------	1.67E-02
BE-7	Not Detected	--------	1.53E-01
AR-41	Short Half-Life	--------	--------
BA-133	Not Detected	--------	2.27E-02
BA-140	Not Detected	--------	6.44E-02
BI-207	Not Detected	--------	1.86E-02
CD-109	Not Detected	--------	8.05E-01
CE-139	Not Detected	--------	1.92E-02
CE-144	Not Detected	--------	1.50E-01
CO-56	Not Detected	--------	2.23E-02
CO-57	Not Detected	--------	1.92E-02
CO-58	Not Detected	--------	1.91E-02
CO-60	Not Detected	--------	2.38E-02
CR-51	Not Detected	--------	1.53E-01
CS-134	Not Detected	--------	1.45E-02
CS-137	Not Detected	--------	1.75E-02
CU-64	Not Detected	--------	1.06E+03
EU-152	Not Detected	--------	5.73E-02
EU-154	Not Detected	--------	8.07E-02
EU-155	Not Detected	--------	9.51E-02
FE-59	Not Detected	--------	4.50E-02
GD-153	Not Detected	--------	6.12E-02
HG-203	Not Significant	--------	--------
I-125	Not Detected	--------	0.00E+00
I-129	Not Detected	--------	0.00E+00
I-131	Not Detected	--------	2.25E-02
IN-115M	Short Half-Life	--------	--------
IR-192	Not Detected	--------	1.74E-02
K-40	1.76E+01	7.22E-01	--------
LA-140	Not Detected	--------	7.71E-02
MN-54	Not Detected	--------	2.14E-02
MN-56	Short Half-Life	--------	--------
NA-22	Not Detected	--------	1.81E-02
NA-24	Not Detected	--------	1.32E+00
NB-95	Not Detected	--------	1.38E-01
RU-103	Not Detected	--------	1.72E-02
RU-106	Not Detected	--------	1.21E-01
SB-124	Not Detected	--------	1.57E-02
SB-125	Not Detected	--------	4.44E-02
SB-126	Not Detected	--------	2.08E-02
SC-46	Not Detected	--------	1.77E-02
SN-113	Not Detected	--------	2.24E-02
SR-85	Not Detected	--------	1.41E-02
TA-182	Not Detected	--------	1.57E-01
TE-123M	Not Detected	--------	1.90E-02
TL-201	Not Detected	--------	3.59E-01
XE-133	Not Detected	--------	1.19E-01
Y-88	Not Detected	--------	2.06E-02
ZN-65	Not Detected	--------	4.83E-02
ZR-95	Not Detected	--------	3.70E-02

```
*****************************************************************************
* SNL Radiation Sample Diagnostic Program (7715)/881  04-OCT-94 12:18:17 *
*****************************************************************************
J.BRINKMAN/E.RANKIN (7582/SMO)  018080-6

Operator: JP 10/6/94            Reviewed by DJM 10/6/94

*****************************************************************************
                                 *
Data File    : 94051802.DAT      * Sample Quantity: 874.000  GRAM
Acquire Date: 04-OCT-94 11:05:19 * Efficiency File: SMAR1.EFF
Sample  Date: 30-SEP-94 10:12:00 * Library    File: RSDP.LIB
Sample  Type: SOLID              *
*****************************************************************************
                                 *
Preset  Live Time: 3600.0  sec   * FWHM at 1332 KeV         : 2.0  KeV
Elapsed Live Time: 3600.0  sec   * Peak Search Sensitivity: 4.0
Elapsed Real Time: 3602.0  sec   * Gaussian Assymetry       : 10.0 %
*****************************************************************************
                                 *
Detector    : DET1               * Fit Iterations   : 20.
Calib Date  : 30-AUG-94 09:23:06 * Energy Tolerance: 1.5  KeV
KeV/Channel: .36608              * Half Life Ratio  : 8.0
Offset      : -.14939            * Abundance Limit  : 50.00 %
*****************************************************************************
```

[Summary Report   -- SNL (7715) --   version 1.2]

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
U-238	1.83E+00	5.10E-01	--------
TH-234	1.84E+00	5.11E-01	--------
U-234	Not Detected	--------	1.01E+01
RA-226	2.13E+00	6.37E-01	--------
PB-214	7.23E-01	6.32E-02	--------
BI-214	6.64E-01	6.49E-02	--------
PB-210	Not Detected	--------	0.00E+00
TH-232	9.64E-01	1.28E-01	--------
RA-228	9.64E-01	1.28E-01	--------
AC-228	8.70E-01	1.16E-01	--------
TH-228	7.57E-01	4.29E-02	--------
RA-224	1.15E+00	4.50E-01	--------
PB-212	7.61E-01	4.31E-02	--------
BI-212	4.54E-01	2.04E-01	--------
TL-208	7.30E-01	8.84E-02	--------
U-235	Not Detected	--------	3.40E-02
~~TH-231~~	~~4.94E-01~~	~~2.03E-01~~	Not detected JP 10/6/94
PA-231	Not Detected	--------	6.89E-01
AC-227	Not Detected	--------	9.96E-01
TH-227	Not Detected	--------	1.33E-01
AM-241	Not Detected	--------	1.15E-01
NP-237	Not Detected	--------	1.79E-01
PA-233	Not Detected	--------	3.32E-02
TH-229	Not Detected	--------	7.23E-02

ID: J.BRINKMAN/E.RANKIN (7582/SMO) 018080-6

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
PU-239	Not Detected	--------	2.51E+02
AG-110	Not Detected	--------	1.51E-02
BE-7	Not Detected	--------	1.22E-01
AR-41	Short Half-Life	--------	--------
BA-133	Not Detected	--------	1.89E-02
BA-140	Not Detected	--------	5.87E-02
BI-207	Not Detected	--------	1.64E-02
CD-109	Not Detected	--------	6.85E-01
CE-139	Not Detected	--------	1.73E-02
CE-144	Not Detected	--------	1.33E-01
CO-56	Not Detected	--------	2.05E-02
CO-57	Not Detected	--------	1.71E-02
CO-58	Not Detected	--------	1.63E-02
CO-60	Not Detected	--------	2.32E-02
CR-51	Not Detected	--------	1.46E-01
CS-134	Not Detected	--------	1.29E-02
CS-137	Not Detected	--------	1.75E-02
CU-64	Not Detected	--------	9.64E+02
EU-152	Not Detected	--------	5.09E-02
EU-154	Not Detected	--------	7.63E-02
EU-155	Not Detected	--------	8.48E-02
FE-59	Not Detected	--------	3.78E-02
GD-153	Not Detected	--------	5.34E-02
HG-203	Not Detected	--------	1.81E-02
I-125	Not Detected	--------	0.00E+00
I-129	Not Significant	--------	--------
I-131	Not Detected	--------	1.83E-02
IN-115M	Short Half-Life	--------	--------
IR-192	Not Detected	--------	1.57E-02
K-40	1.69E+01	6.76E-01	--------
LA-140	Not Detected	--------	6.83E-02
MN-54	Not Detected	--------	1.75E-02
MN-56	Short Half-Life	--------	--------
NA-22	Not Detected	--------	1.88E-02
NA-24	Not Detected	--------	1.23E+00
NB-95	Not Detected	--------	1.32E-01
RU-103	Not Detected	--------	1.45E-02
RU-106	Not Detected	--------	1.04E-01
SB-124	Not Detected	--------	1.39E-02
SB-125	Not Detected	--------	3.90E-02
SB-126	Not Detected	--------	1.81E-02
SC-46	Not Detected	--------	1.69E-02
SN-113	Not Detected	--------	1.88E-02
SR-85	Not Detected	--------	1.27E-02
TA-182	Not Detected	--------	1.50E-01
TE-123M	Not Detected	--------	1.67E-02
TL-201	Not Detected	--------	3.45E-01
XE-133	Not Detected	--------	1.06E-01
Y-88	Not Detected	--------	1.91E-02
ZN-65	Not Detected	--------	4.36E-02
ZR-95	Not Detected	--------	3.12E-02

```
*****************************************************************************
* SNL Radiation Sample Diagnostic Program (7715)/881   04-OCT-94 12:15:32 *
*****************************************************************************
J.BRINKMAN/E.RANKIN (7582/SMO)   018080-3

Operator: ________ 10/6/94 ________  Reviewed by ________ 10/6/94 ________
*****************************************************************************
                                     *
Data File     : 94051801.DAT         * Sample Quantity: 868.000   GRAM
Acquire Date: 04-OCT-94 11:08:25     * Efficiency File: SMAR2.EFF
Sample  Date: 30-SEP-94 10:15:00     * Library    File: RSDP.LIB
Sample  Type: SOLID                  *
*****************************************************************************
                                     *
Preset  Live Time: 3600.0  sec       * FWHM at 1332 KeV         : 2.4  KeV
Elapsed Live Time: 3600.0  sec       * Peak Search Sensitivity: 4.0
Elapsed Real Time: 3602.0  sec       * Gaussian Assymetry       : 10.0 %
*****************************************************************************
                                     *
Detector    : DET2                   * Fit Iterations    : 20.
Calib Date  : 20-APR-94 16:41:18     * Energy Tolerance: 1.5   KeV
KeV/Channel: .36617                  * Half Life Ratio  : 8.0
Offset      : .00135                 * Abundance Limit  : 50.00 %
*****************************************************************************
```

[Summary Report -- SNL (7715) -- version 1.2]

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
U-238	8.36E-01	3.01E-01	--------
TH-234	8.37E-01	3.02E-01	--------
U-234	Not Detected	--------	2.51E+00
RA-226	1.87E+00	4.96E-01	--------
PB-214	7.48E-01	7.57E-02	--------
BI-214	6.40E-01	7.54E-02	--------
PB-210	9.93E-01	5.99E-01	--------
TH-232	8.02E-01	1.25E-01	--------
RA-228	8.02E-01	1.25E-01	--------
AC-228	7.24E-01	1.12E-01	--------
TH-228	8.61E-01	5.25E-02	--------
RA-224	4.65E-01	4.74E-01	--------
PB-212	8.65E-01	5.27E-02	--------
BI-212	6.34E-01	2.26E-01	--------
TL-208	7.64E-01	9.92E-02	--------
U-235	Not Detected	--------	3.41E-02
TH-231	Not Detected	--------	2.12E-01
PA-231	Not Detected	--------	6.85E-01
AC-227	Not Detected	--------	9.80E-01
TH-227	Not Detected	--------	1.37E-01
AM-241	Not Detected	--------	4.92E-02
NP-237	Not Detected	--------	1.34E-01
PA-233	Not Detected	--------	3.73E-02
TH-229	Not Detected	--------	7.20E-02

ID: J.BRINKMAN/E.RANKIN (7582/SMO) 018080-3

Nuclide	Activity (PCI /GRAM)	2-sigma Error	MDA (PCI /GRAM)
PU-239	Not Detected	--------	2.45E+02
AG-110	Not Detected	--------	1.60E-02
BE-7	Not Detected	--------	1.55E-01
AR-41	Short Half-Life	--------	--------
BA-133	Not Detected	--------	2.21E-02
BA-140	Not Detected	--------	8.02E-02
BI-207	Not Detected	--------	1.50E-02
CD-109	Not Detected	--------	5.20E-01
CE-139	Not Detected	--------	1.70E-02
CE-144	Not Detected	--------	1.29E-01
CO-56	Not Detected	--------	1.91E-02
CO-57	Not Detected	--------	1.64E-02
CO-58	Not Detected	--------	1.63E-02
CO-60	Not Detected	--------	2.36E-02
CR-51	Not Detected	--------	1.51E-01
CS-134	Not Detected	--------	1.68E-02
CS-137	Not Detected	--------	2.10E-02
CU-64	Not Detected	--------	1.49E+03
EU-152	Not Detected	--------	4.94E-02
EU-154	Not Detected	--------	8.74E-02
EU-155	Not Detected	--------	6.56E-02
FE-59	Not Detected	--------	4.46E-02
GD-153	Not Detected	--------	4.23E-02
HG-203	Not Detected	--------	1.99E-02
I-125	Not Detected	--------	0.00E+00
I-129	Not Detected	--------	0.00E+00
I-131	Not Detected	--------	2.22E-02
IN-115M	Short Half-Life	--------	--------
IR-192	Not Detected	--------	1.77E-02
K-40	1.70E+01	7.08E-01	--------
LA-140	Not Detected	--------	8.02E-02
MN-54	Not Detected	--------	1.89E-02
MN-56	Short Half-Life	--------	--------
NA-22	Not Detected	--------	2.18E-02
NA-24	Not Detected	--------	1.38E+00
NB-95	Not Detected	--------	1.27E-01
RU-103	Not Detected	--------	1.71E-02
RU-106	Not Detected	--------	1.31E-01
SB-124	Not Detected	--------	1.78E-02
SB-125	Not Detected	--------	4.21E-02
SB-126	Not Detected	--------	2.34E-02
SC-46	Not Detected	--------	1.82E-02
SN-113	Not Detected	--------	2.13E-02
SR-85	Not Detected	--------	1.95E-02
TA-182	Not Detected	--------	1.64E-01
TE-123M	Not Detected	--------	1.67E-02
TL-201	Not Detected	--------	3.40E-01
XE-133	Not Detected	--------	7.44E-02
Y-88	Not Detected	--------	1.98E-02
ZN-65	Not Detected	--------	4.66E-02
ZR-95	Not Detected	--------	3.37E-02

ON-SITE LABORATORY
ANALYSIS REQUEST AND CHAIN OF CUSTODY

227-RPSD

Internal Lab Batch No. 100501 | SAR/WR No. | Page 1 of 1 | AR/COC 604199

Dept. No./Mail Stop:	6133/1087	Date Samples Shipped:	3-28-01	Logged By:	
Project/Task Manager:	Sue Collins	Carrier/Waybill No.	HC	Project/Task No.:	7225.02.02.09
Project Name:	Site 40 drilling 227	Lab Contact:	Lorraine Herrera	SMO Authorization:	
Record Center Code:	ER1309/227/DAT	Lab Destination:	RPSD	Location:	Tech Area: Tijeras Arroyo
Logbook Ref. No.:	ER078	SMO Contact/Phone:	P. Puissant	Building:	Room:
Service Order No.:	CF0103-01				

☑ Characterization Only
☐ Waste Characterization
-Send preliminary/copy report to:
☐ Release to ERCL On-Site Lab
☐ Release to Off-Site Lab
-This COC Number Releases COC No(s).:

Sample No.-Fraction / RPSD No.-Fraction	ER Sample ID or Sample Location Detail / RPSD Remarks/Aliquot Amounts	Beginning Depth (ft) / Screen CPM	ER Site No. / Sample Mass	Date/Time(hr) Collected / Sample Quantity	Sample Matrix	Container Type	Container Volume	Preservative	Collection Method	Sample Type	Analysis Request
054829-001	TJAOU-227-VW-01-20.0-S	20	227	3.26.01/1520	S	M	500 ml	None	G	SA	Gamma Spec
01											
054837-001	TJAOU-227-VW-01-150.0-S	150	227	3.27.01/1040	S	M	500 ml	None	G	SA	Gamma Spec
02											
LCS											
03											

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

Sample Tracking — Smo Use
Date Entered(mm/dd/yy) 04/03/01
Entered by: JAC
QC inits.

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

*Non-release.
*Please list as separate report.

Sample Team Members	Name	Signature	Init	Company/Organization/Phone/Cellular
	Robin Ryan	[signature]	RR	GRAM/6133/845-8821

	Name	Org.	Date	Time		Name	Org.	Date	Time
1. Relinquished by	Robin Ryan	6133	3/28/01	1055	4. Relinquished by	[signature]	6132	3/29/01	1445
1. Received by	[signature] SMO	6132	3/28/01	1055	4. Received by	[signature]	6132	3/29/01	1445
2. Relinquished by	[signature] SMO	6132	3/28/01	1229	5. Relinquished by				
2. Received by	[signature]	7132	3/28/01	1229	5. Received by				
3. Relinquished by	[signature]	7132	3-29-01	0933	6. Relinquished by				
3. Received by	[signature] SMO	6132	3-29-01	0933	6. Received by				

[illegible]

```
****************************************************************************
*                     Sandia National Laboratories                          *
*   Radiation Protection Sample Diagnostics Program [806 Laboratory]        *
*                     3/28/01  1:34:49 PM                                   *
****************************************************************************
                                                                            *
* Analyzed by: K 3/28/01               Reviewed by:  JP K     3-29-2001     *
****************************************************************************
Customer                     : COLLINS/SALMI (6133/SMO)
Customer Sample ID           : 054629-001
Lab Sample ID                : 10050101

Sample Description           : TJAOU-227-VW-01-20.0-S
Sample Quantity              :   691.600  gram
Sample Date/Time             :  3/26/01    3:20:00 PM
Acquire Start Date/Time      :  3/28/01   11:33:51 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	----------	7.79E-001
RA-226	1.49E+000	6.39E-001	9.38E-001
PB-214	7.75E-001	1.21E-001	7.73E-002
BI-214	6.76E-001	1.16E-001	7.81E-002
PB-210	Not Detected	----------	3.44E+001
TH-232	9.10E-001	4.32E-001	2.39E-001
RA-228	9.16E-001	3.68E-001	1.50E-001
AC-228	8.77E-001	1.78E-001	1.49E-001
TH-228	1.12E+000	5.02E-001	7.27E-001
RA-224	9.87E-001	2.15E-001	6.46E-002
PB-212	9.53E-001	1.64E-001	4.00E-002
BI-212	1.04E+000	3.17E-001	3.88E-001
TL-208	8.38E-001	1.37E-001	8.27E-002
U-235	1.04E-001	1.77E-001	2.25E-001
TH-231	Not Detected	----------	1.28E+001
PA-231	Not Detected	----------	1.33E+000
TH-227	Not Detected	----------	3.80E-001
RA-223	Not Detected	----------	2.24E-001
RN-219	Not Detected	----------	3.64E-001
PB-211	Not Detected	----------	8.08E-001
TL-207	Not Detected	----------	1.26E+001
AM-241	Not Detected	----------	5.04E-001
PU-239	Not Detected	----------	4.25E+002
NP-237	Not Detected	----------	2.32E+000
PA-233	Not Detected	----------	5.60E-002
TH-229	Not Detected	----------	2.47E-001

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

[Summary Report] - Sample ID: : 10050101

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	----------	3.58E-002
AG-110m	Not Detected	----------	2.78E-002
BA-133	Not Detected	----------	4.82E-002
BE-7	Not Detected	----------	2.40E-001
CD-115	Not Detected	----------	1.17E-001
CE-139	Not Detected	----------	2.81E-002
CE-141	Not Detected	----------	5.08E-002
CE-144	Not Detected	----------	2.28E-001
CO-56	Not Detected	----------	3.10E-002
CO-57	Not Detected	----------	2.98E-002
CO-58	Not Detected	----------	3.06E-002
CO-60	Not Detected	----------	3.73E-002
CR-51	Not Detected	----------	2.30E-001
CS-134	Not Detected	----------	3.99E-002
CS-137	Not Detected	----------	3.12E-002
EU-152	Not Detected	----------	8.90E-002
EU-154	Not Detected	----------	1.73E-001
EU-155	Not Detected	----------	1.38E-001
FE-59	Not Detected	----------	7.15E-002
GD-153	Not Detected	----------	1.05E-001
HG-203	Not Detected	----------	3.11E-002
I-131	Not Detected	----------	2.93E-002
IR-192	Not Detected	----------	2.67E-002
K-40	2.21E+001	2.95E+000	2.54E-001
MN-52	Not Detected	----------	3.59E-002
MN-54	Not Detected	----------	3.31E-002
MO-99	Not Detected	----------	3.45E-001
NA-22	Not Detected	----------	4.13E-002
NA-24	Not Detected	----------	2.32E-001
ND-147	Not Detected	----------	2.07E-001
NI-57	Not Detected	----------	7.30E-002
RU-103	Not Detected	----------	2.83E-002
RU-106	Not Detected	----------	2.58E-001
SB-122	Not Detected	----------	6.01E-002
SB-124	Not Detected	----------	2.75E-002
SB-125	Not Detected	----------	7.77E-002
SN-113	Not Detected	----------	3.69E-002
SR-85	Not Detected	----------	3.65E-002
TA-182	Not Detected	----------	1.50E-001
TA-183	Not Detected	----------	5.60E-001
TL-201	Not Detected	----------	2.78E-001
Y-88	Not Detected	----------	2.41E-002
ZN-65	Not Detected	----------	1.01E-001
ZR-95	Not Detected	----------	5.39E-002

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
3/28/01 2:56:14 PM

Analyzed by: [signature] 3/29/01 Reviewed by: JP [signature] 3-29-2001

Customer	:	COLLINS/SALMI (6133/SMO)
Customer Sample ID	:	054637-001
Lab Sample ID	:	10050102
Sample Description	:	TJAOU-227-VW-01-150.0-S
Sample Quantity	:	826.200 gram
Sample Date/Time	:	3/27/01 10:40:00 AM
Acquire Start Date/Time	:	3/28/01 1:15:56 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	---------	6.48E-001
RA-226	1.47E+000	5.02E-001	6.95E-001
PB-214	5.10E-001	8.34E-002	5.90E-002
BI-214	4.52E-001	7.94E-002	5.50E-002
PB-210	Not Detected	---------	2.96E+001
TH-232	6.46E-001	3.24E-001	2.36E-001
RA-228	7.15E-001	2.52E-001	1.26E-001
AC-228	7.07E-001	1.41E-001	1.10E-001
TH-228	7.75E-001	3.88E-001	5.73E-001
RA-224	6.48E-001	1.50E-001	6.96E-002
PB-212	6.17E-001	1.91E-001	3.10E-002
BI-212	8.33E-001	2.65E-001	3.33E-001
TL-208	6.09E-001	1.04E-001	7.24E-002
U-235	Not Detected	---------	1.89E-001
TH-231	Not Detected	---------	1.06E+001
PA-231	Not Detected	---------	1.17E+000
TH-227	Not Detected	---------	2.96E-001
RA-223	Not Detected	---------	1.79E-001
RN-219	Not Detected	---------	2.97E-001
PB-211	Not Detected	---------	6.80E-001
TL-207	Not Detected	---------	1.17E+001
AM-241	Not Detected	---------	4.35E-001
PU-239	Not Detected	---------	3.57E+002
NP-237	Not Detected	---------	1.98E+000
PA-233	Not Detected	---------	4.66E-002
TH-229	Not Detected	---------	2.15E-001

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

[Summary Report] - Sample ID: : 10050102

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	----------	3.13E-002
AG-110m	Not Detected	----------	2.47E-002
BA-133	Not Detected	----------	4.00E-002
BE-7	Not Detected	----------	2.03E-001
CD-115	Not Detected	----------	7.48E-002
CE-139	Not Detected	----------	2.34E-002
CE-141	Not Detected	----------	4.20E-002
CE-144	Not Detected	----------	1.97E-001
CO-56	Not Detected	----------	2.95E-002
CO-57	Not Detected	----------	2.60E-002
CO-58	Not Detected	----------	2.86E-002
CO-60	Not Detected	----------	3.27E-002
CR-51	Not Detected	----------	2.01E-001
CS-134	Not Detected	----------	3.26E-002
CS-137	Not Detected	----------	2.67E-002
EU-152	Not Detected	----------	7.77E-002
EU-154	Not Detected	----------	1.50E-001
EU-155	Not Detected	----------	1.17E-001
FE-59	Not Detected	----------	6.52E-002
GD-153	Not Detected	----------	8.87E-002
HG-203	Not Detected	----------	2.55E-002
I-131	Not Detected	----------	2.42E-002
IR-192	Not Detected	----------	2.26E-002
K-40	2.84E+001	3.76E+000	2.75E-001
MN-52	Not Detected	----------	2.81E-002
MN-54	Not Detected	----------	1.76E-002
MO-99	Not Detected	----------	2.44E-001
NA-22	Not Detected	----------	3.87E-002
NA-24	Not Detected	----------	1.01E-001
ND-147	Not Detected	----------	1.69E-001
NI-57	Not Detected	----------	4.86E-002
RU-103	Not Detected	----------	2.25E-002
RU-106	Not Detected	----------	2.41E-001
SB-122	Not Detected	----------	4.19E-002
SB-124	Not Detected	----------	2.47E-002
SB-125	Not Detected	----------	6.77E-002
SN-113	Not Detected	----------	3.10E-002
SR-85	Not Detected	----------	2.95E-002
TA-182	Not Detected	----------	1.35E-001
TA-183	Not Detected	----------	4.33E-001
TL-201	Not Detected	----------	1.96E-001
Y-88	Not Detected	----------	1.72E-002
ZN-65	Not Detected	----------	8.84E-002
ZR-95	Not Detected	----------	4.68E-002

```
****************************************************************************
*                    Sandia National Laboratories                          *
*   Radiation Protection Sample Diagnostics Program [806 Laboratory]       *
*                      3/29/01  6:08:06 AM                                 *
****************************************************************************
*                                                                          *
* Analyzed by: [signature] 3/29/01         Reviewed by: [signature] 3-29-2001 *
****************************************************************************
Customer                      : COLLINS/SALMI (6133/SMO)
Customer Sample ID            : LAB CONTROL SAMPLE USING CG134
Lab Sample ID                 : 10050103

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       :  3/29/01    5:57:52 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	---------	4.18E+003
RA-226	Not Detected	---------	5.55E+003
PB-214	Not Detected	---------	6.16E+002
BI-214	Not Detected	---------	5.27E+002
PB-210	Not Detected	---------	2.55E+005
TH-232	Not Detected	---------	1.97E+003
RA-228	Not Detected	---------	2.05E+003
AC-228	Not Detected	---------	1.21E+003
TH-228	Not Detected	---------	2.74E+005
RA-224	Not Detected	---------	1.07E+004
PB-212	Not Detected	---------	2.06E+004
BI-212	Not Detected	---------	1.57E+005
TL-208	Not Detected	---------	3.47E+004
U-235	Not Detected	---------	1.59E+003
TH-231	Not Detected	---------	7.47E+004
PA-231	Not Detected	---------	1.28E+004
TH-227	Not Detected	---------	2.61E+003
RA-223	Not Detected	---------	1.00E+026
RN-219	Not Detected	---------	5.62E+003
PB-211	Not Detected	---------	1.31E+004
TL-207	Not Detected	---------	1.90E+005
AM-241	8.84E+004	1.40E+004	6.35E+003
PU-239	Not Detected	---------	2.80E+006
NP-237	Not Detected	---------	1.48E+004
PA-233	Not Detected	---------	5.58E+002
TH-229	Not Detected	---------	1.60E+003

[Summary Report] - Sample ID: : 10050103

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
AG-108m	Not Detected	---------	2.72E+002
AG-110m	Not Detected	---------	6.08E+007
BA-133	Not Detected	---------	7.45E+002
BE-7	Not Detected	---------	1.00E+026
CD-115	Not Detected	---------	1.00E+026
CE-139	Not Detected	---------	4.12E+010
CE-141	Not Detected	---------	1.00E+026
CE-144	Not Detected	---------	1.64E+007
CO-56	Not Detected	---------	2.00E+017
CO-57	Not Detected	---------	3.29E+006
CO-58	Not Detected	---------	3.74E+018
CO-60	8.51E+004	1.10E+004	8.00E+002
CR-51	Not Detected	---------	1.00E+026
CS-134	Not Detected	---------	8.16E+003
CS-137	7.62E+004	9.85E+003	3.37E+002
EU-152	Not Detected	---------	1.04E+003
EU-154	Not Detected	---------	2.72E+003
EU-155	Not Detected	---------	4.26E+003
FE-59	Not Detected	---------	1.00E+026
GD-153	Not Detected	---------	3.56E+007
HG-203	Not Detected	---------	1.00E+026
I-131	Not Detected	---------	1.00E+026
IR-192	Not Detected	---------	8.02E+017
K-40	Not Detected	---------	1.29E+003
MN-52	Not Detected	---------	1.00E+026
MN-54	Not Detected	---------	1.32E+006
MO-99	Not Detected	---------	1.00E+026
NA-22	Not Detected	---------	2.80E+003
NA-24	Not Detected	---------	1.00E+026
ND-147	Not Detected	---------	1.00E+026
NI-57	Not Detected	---------	1.00E+026
RU-103	Not Detected	---------	1.00E+026
RU-106	Not Detected	---------	3.18E+006
SB-122	Not Detected	---------	1.00E+026
SB-124	Not Detected	---------	2.51E+021
SB-125	Not Detected	---------	1.39E+004
SN-113	Not Detected	---------	3.47E+012
SR-85	Not Detected	---------	1.54E+020
TA-182	Not Detected	---------	8.53E+012
TA-183	Not Detected	---------	1.00E+026
TL-201	Not Detected	---------	1.00E+026
Y-88	Not Detected	---------	7.72E+012
ZN-65	Not Detected	---------	3.51E+007
ZR-95	Not Detected	---------	3.18E+020

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

Report Date	:	3/29/01 6:08:10 AM
QA File	:	C:\GENIE2K\CAMFILES\LCS2.QAF
Analyst	:	KICHAVE
Sample ID	:	10050103
Sample Quantity	:	1.00 Each
Sample Date	:	11/01/90 12:00:00 PM
Measurement Date	:	3/29/01 5:57:52 AM
Elapsed Live Time	:	600 seconds
Elapsed Real Time	:	605 seconds

Parameter	Mean	1S Error	New Value	< LU : SD : UD : BS >
AM-241 Activity	8.229E-002	3.555E-003	8.844E-002	< : : : >
CS-137 Activity	7.180E-002	2.650E-003	7.625E-002	< : : : >
CO-60 Activity	8.003E-002	2.983E-003	8.497E-002	< : : : >

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

Reviewed by: 3/29/01

Inorganic Metals Site 7 COC# 604200

227-RPSD

ON-SITE LABORATORY
ANALYSIS REQUEST AND CHAIN OF CUSTODY

Internal Lab

Page 1 of 1

Batch No 100326

SAR/WR No

AR/COC 604299

Dept No/Mail Stop	6133/1087	Date Samples Shipped	02-28-01	SMO USE Logged By	
Project/Task Manager	Sue Collins	Carrier/Waybill No.	HC	Project/Task No	7225.02.02.09
Project Name	Site 227 surface	Lab Contact	Lorraine Herrera	SMO Authorization	
Record Center Code	ER1309/227/DAT	Lab Destination	RPSD	Location	Tech Area Tijeras Arroyo
Logbook Ref No	ER078	SMO Contact/Phone	P. Puissant	Building	Room
Service Order No	CFD103-01				

☑ Characterization Only
☐ Waste Characterization
- Send preliminary/copy report to
☐ Release to ERCL On-Site Lab
☐ Release to Off-Site Lab
- This COC Number Releases COC No(s).:

Sample No.-Fraction / RPSD No.-Fraction	ER Sample ID or Sample Location Detail / RPSD Remarks/Aliquot Amounts	Beginning Depth (ft) / Screen CPM	ER Site No / Sample Mass	Date/Time(hr) Collected / Sample Quantity	Sample Matrix	Container Type	Container Volume	Preservative	Collection Method	Sample Type	Analysis Request
054670-001	TJAOU-227-GR-05-7.0-S	7.0	227	2.27.01/1425	S	M	500 ml	None	G	SA	Gamma Spec
01				668.29							
054671-001	TJAOU-227-GR-06-5.0-S	5.0	227	2.27.01/1455	S	M	500 ml	None	G	SA	Gamma Spec
02				542.3							
054672-001	TJAOU-227-GR-06-5.0-DU	5.0	227	2.27.01/1500	S	M	500 ml	None	G	DU	Gamma Spec
03				564.3							
054673-001	TJAOU-227-GR-07-5.0-S	5.0	227	2.27.01/1340	S	M	500 ml	None	G	SA	Gamma Spec
04				689.6							
054675-001	TJAOU-227-GR-05-0.0-S	0.0	227	2.27.01/1440	S	M	500 ml	None	G	SA	Gamma Spec
05				612.05							
054678-001	TJAOU-227-GR-EB-001	5.0	227	2.27.01/1525	DIW	M	500 ml	None	G	EB	Gamma Spec
06				408.79							

RMMA ☐ Yes ☑ No Ref. No.

Sample Disposal ☑ Return to Client ☐ Disposal by lab

Turnaround Time ☑ Normal ☐ Rush

Required Report Date

Sample Tracking — Smo Use
Date Entered(mm/dd/yy) 03/13/01
Entered by: TAC
QC inits.

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

*Non-release.
*Please ER as separate report.

Sample Team Members	Name	Signature	Init	Company/Organization/Phone/Cellular
	Robin Ryan	Robin Ryan	RR	GRAM/6133/845-8821
	Margaret Sanchez	M. Sanchez	MS	Weston/6135/845-3276

		Org	Date	Time			Org	Date	Time
1. Relinquished by	Robin Ryan	6133	2/28/01	1040	4. Relinquished by		6137	3/6/01	1150
1. Received by		6133	02/28/01	1040	4. Received by		6135	3-6-01	1150
2. Relinquished by		6133	2-28-01	1100	5. Relinquished by				
2. Received by		7132	2-28-01	1100	5. Received by				
3. Relinquished by		7132	3-5-01	13:39	6. Relinquished by				
3. Received by		6137	3/5/01	13:39	6. Received by				

[illegible]

****

Sandia National Laboratories

Radiation Protection Sample Diagnostics Program [806 Laboratory]

3/01/01 12:19:42 PM

****

Analyzed by: [signature] 3/1/01   Reviewed by: [signature] 03-02-01

****

Customer	:	COLLINS/SALMI (6133/SMO)
Customer Sample ID	:	054670-001
Lab Sample ID	:	10032601
Sample Description	:	TJAOU-227-GR-05-7.0-S
Sample Quantity	:	668.200 gram
Sample Date/Time	:	2/27/01 2:25:00 PM
Acquire Start Date/Time	:	3/01/01 10:39:26 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	---------	8.48E-001
RA-226	1.72E+000	6.46E-001	9.21E-001
PB-214	8.94E-001	1.33E-001	6.18E-002
BI-214	8.23E-001	1.31E-001	5.76E-002
PB-210	Not Detected	---------	3.62E+001
TH-232	1.06E+000	4.81E-001	1.55E-001
RA-228	1.02E+000	2.21E-001	1.40E-001
AC-228	9.55E-001	1.79E-001	1.17E-001
TH-228	6.96E-001	4.31E-001	6.55E-001
RA-224	1.01E+000	2.21E-001	6.42E-002
PB-212	9.42E-001	2.18E-001	4.08E-002
BI-212	1.24E+000	3.32E-001	3.72E-001
TL-208	8.79E-001	1.45E-001	9.39E-002
U-235	Not Detected	---------	2.33E-001
TH-231	Not Detected	---------	1.28E+001
PA-231	Not Detected	---------	1.39E+000
TH-227	Not Detected	---------	3.84E-001
RA-223	Not Detected	---------	2.25E-001
RN-219	Not Detected	---------	3.73E-001
PB-211	Not Detected	---------	8.20E-001
TL-207	Not Detected	---------	1.31E+001
AM-241	Not Detected	---------	5.40E-001
PU-239	Not Detected	---------	4.27E+002
NP-237	Not Detected	---------	2.39E+000
PA-233	Not Detected	---------	5.59E-002
TH-229	Not Detected	---------	2.52E-001

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

[Summary Report] - Sample ID: : 10032601

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	----------	3.74E-002
AG-110m	Not Detected	----------	2.97E-002
BA-133	Not Detected	----------	5.32E-002
BE-7	Not Detected	----------	2.34E-001
CD-115	Not Detected	----------	1.19E-001
CE-139	Not Detected	----------	2.87E-002
CE-141	Not Detected	----------	5.25E-002
CE-144	Not Detected	----------	2.32E-001
CO-56	Not Detected	----------	3.24E-002
CO-57	Not Detected	----------	3.04E-002
CO-58	Not Detected	----------	3.11E-002
CO-60	Not Detected	----------	3.54E-002
CR-51	Not Detected	----------	2.40E-001
CS-134	Not Detected	----------	4.13E-002
CS-137	Not Detected	----------	3.27E-002
EU-152	Not Detected	----------	9.13E-002
EU-154	Not Detected	----------	1.84E-001
EU-155	Not Detected	----------	1.42E-001
FE-59	Not Detected	----------	6.63E-002
GD-153	Not Detected	----------	1.03E-001
HG-203	Not Detected	----------	3.16E-002
I-131	Not Detected	----------	3.16E-002
IR-192	Not Detected	----------	2.73E-002
K-40	1.93E+001	2.60E+000	2.67E-001
MN-52	Not Detected	----------	3.65E-002
MN-54	Not Detected	----------	1.35E-002
MO-99	Not Detected	----------	3.53E-001
NA-22	Not Detected	----------	3.97E-002
NA-24	Not Detected	----------	2.37E-001
ND-147	Not Detected	----------	2.15E-001
NI-57	Not Detected	----------	6.12E-002
RU-103	Not Detected	----------	2.72E-002
RU-106	Not Detected	----------	2.60E-001
SB-122	Not Detected	----------	6.22E-002
SB-124	Not Detected	----------	2.81E-002
SB-125	Not Detected	----------	7.73E-002
SN-113	Not Detected	----------	3.76E-002
SR-85	Not Detected	----------	3.61E-002
TA-182	Not Detected	----------	1.58E-001
TA-183	Not Detected	----------	6.03E-001
TL-201	Not Detected	----------	2.86E-001
Y-88	Not Detected	----------	2.69E-002
ZN-65	Not Detected	----------	1.03E-001
ZR-95	Not Detected	----------	5.42E-002

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
3/01/01 2:01:39 PM

Analyzed by: K 3/1/01 Reviewed by: LH 03-02-01

Customer : COLLINS/SALMI (6133/SMO)
Customer Sample ID : 054671-001
Lab Sample ID : 10032602

Sample Description : TJAOU-227-GR-06-5.0-S
Sample Quantity : 592.300 gram
Sample Date/Time : 2/27/01 2:55:00 PM
Acquire Start Date/Time : 3/01/01 12:21:25 PM
Detector Name : LAB02
Elapsed Live/Real Time : 6000 / 6003 seconds

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

Comments:

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	----------	8.27E-001
RA-226	1.90E+000	6.04E-001	8.12E-001
PB-214	7.45E-001	1.25E-001	9.69E-002
BI-214	7.28E-001	1.23E-001	7.53E-002
PB-210	Not Detected	----------	3.92E+001
TH-232	7.86E-001	3.86E-001	2.54E-001
RA-228	9.05E-001	2.99E-001	1.42E-001
AC-228	7.87E-001	1.58E-001	1.15E-001
TH-228	1.33E+000	4.52E-001	5.91E-001
RA-224	8.58E-001	1.99E-001	8.80E-002
PB-212	8.64E-001	1.79E-001	4.23E-002
BI-212	9.79E-001	3.06E-001	3.68E-001
TL-208	8.21E-001	1.49E-001	1.24E-001
U-235	Not Detected	----------	2.37E-001
TH-231	Not Detected	----------	1.29E+001
PA-231	Not Detected	----------	1.41E+000
TH-227	Not Detected	----------	3.93E-001
RA-223	Not Detected	----------	2.21E-001
RN-219	Not Detected	----------	3.76E-001
PB-211	Not Detected	----------	8.74E-001
TL-207	Not Detected	----------	1.36E+001
AM-241	Not Detected	----------	5.37E-001
PU-239	Not Detected	----------	4.37E+002
NP-237	Not Detected	----------	2.45E+000
PA-233	Not Detected	----------	5.91E-002
TH-229	Not Detected	----------	2.51E-001

[Summary Report] - Sample ID : 10032602

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.79E-002
AG-110m	Not Detected	---------	2.90E-002
BA-133	Not Detected	---------	5.33E-002
BE-7	Not Detected	---------	2.45E-001
CD-115	Not Detected	---------	1.22E-001
CE-139	Not Detected	---------	2.86E-002
CE-141	Not Detected	---------	5.22E-002
CE-144	Not Detected	---------	2.33E-001
CO-56	Not Detected	---------	3.50E-002
CO-57	Not Detected	---------	3.03E-002
CO-58	Not Detected	---------	3.39E-002
CO-60	Not Detected	---------	3.77E-002
CR-51	Not Detected	---------	2.33E-001
CS-134	Not Detected	---------	4.37E-002
CS-137	Not Detected	---------	3.27E-002
EU-152	Not Detected	---------	9.05E-002
EU-154	Not Detected	---------	1.84E-001
EU-155	Not Detected	---------	1.42E-001
FE-59	Not Detected	---------	6.86E-002
GD-153	Not Detected	---------	1.04E-001
HG-203	Not Detected	---------	3.30E-002
I-131	Not Detected	---------	3.00E-002
IR-192	Not Detected	---------	2.66E-002
K-40	1.81E+001	2.46E+000	3.67E-001
MN-52	Not Detected	---------	3.69E-002
MN-54	Not Detected	---------	3.58E-002
MO-99	Not Detected	---------	3.74E-001
NA-22	Not Detected	---------	4.33E-002
NA-24	Not Detected	---------	2.56E-001
ND-147	Not Detected	---------	2.15E-001
NI-57	Not Detected	---------	9.19E-002
RU-103	Not Detected	---------	2.90E-002
RU-106	Not Detected	---------	2.86E-001
SB-122	Not Detected	---------	6.40E-002
SB-124	Not Detected	---------	3.03E-002
SB-125	Not Detected	---------	8.23E-002
SN-113	Not Detected	---------	3.69E-002
SR-85	Not Detected	---------	3.69E-002
TA-182	Not Detected	---------	1.58E-001
TA-183	Not Detected	---------	5.97E-001
TL-201	Not Detected	---------	2.91E-001
Y-88	Not Detected	---------	2.51E-002
ZN-65	Not Detected	---------	1.04E-001
ZR-95	Not Detected	---------	5.70E-002

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
3/01/01 3:43:42 PM

Analyzed by: Ut 03-02-01 Reviewed by: [signature] 3/2/01

Customer	:	COLLINS/SALMI (6133/SMO)
Customer Sample ID	:	054672-001
Lab Sample ID	:	10032603
Sample Description	:	TJAOU-227-GR-06-5.0-DU
Sample Quantity	:	564.300 gram
Sample Date/Time	:	2/27/01 3:00:00 PM
Acquire Start Date/Time	:	3/01/01 2:03:22 PM
Detector Name	:	LAB02
Elapsed Live/Real Time	:	6000 / 6003 seconds

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

Comments:

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	----------	8.48E-001
RA-226	1.65E+000	5.74E-001	7.91E-001
PB-214	7.80E-001	1.22E-001	7.06E-002
BI-214	6.90E-001	1.19E-001	7.59E-002
PB-210	Not Detected	----------	3.76E+001
TH-232	7.84E-001	3.98E-001	3.00E-001
RA-228	8.79E-001	2.06E-001	1.32E-001
AC-228	8.32E-001	1.65E-001	1.14E-001
TH-228	6.22E-001	3.75E-001	5.63E-001
RA-224	8.45E-001	1.99E-001	9.25E-002
PB-212	8.12E-001	4.06E-001	3.93E-002
BI-212	1.23E+000	3.70E-001	4.45E-001
TL-208	7.95E-001	1.33E-001	7.83E-002
U-235	Not Detected	----------	2.39E-001
TH-231	Not Detected	----------	1.33E+001
PA-231	Not Detected	----------	1.48E+000
TH-227	Not Detected	----------	3.94E-001
RA-223	Not Detected	----------	2.33E-001
RN-219	Not Detected	----------	3.95E-001
PB-211	Not Detected	----------	8.68E-001
TL-207	Not Detected	----------	1.47E+001
AM-241	Not Detected	----------	5.34E-001
PU-239	Not Detected	----------	4.57E+002
NP-237	Not Detected	----------	2.45E+000
PA-233	Not Detected	----------	5.82E-002
TH-229	Not Detected	----------	2.61E-001

[Summary Report] - Sample ID: : 10032603

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	----------	4.09E-002
AG-110m	Not Detected	----------	3.21E-002
BA-133	Not Detected	----------	5.36E-002
BE-7	Not Detected	----------	2.64E-001
CD-115	Not Detected	----------	1.27E-001
CE-139	Not Detected	----------	2.87E-002
CE-141	Not Detected	----------	5.45E-002
CE-144	Not Detected	----------	2.44E-001
CO-56	Not Detected	----------	3.48E-002
CO-57	Not Detected	----------	3.20E-002
CO-58	Not Detected	----------	3.25E-002
CO-60	Not Detected	----------	3.65E-002
CR-51	Not Detected	----------	2.43E-001
CS-134	Not Detected	----------	4.38E-002
CS-137	Not Detected	----------	3.36E-002
EU-152	Not Detected	----------	9.70E-002
EU-154	Not Detected	----------	1.99E-001
EU-155	Not Detected	----------	1.47E-001
FE-59	Not Detected	----------	7.50E-002
GD-153	Not Detected	----------	1.05E-001
HG-203	Not Detected	----------	3.35E-002
I-131	Not Detected	----------	3.39E-002
IR-192	Not Detected	----------	2.73E-002
K-40	1.84E+001	2.50E+000	3.04E-001
MN-52	Not Detected	----------	3.69E-002
MN-54	Not Detected	----------	3.77E-002
MO-99	Not Detected	----------	3.89E-001
NA-22	Not Detected	----------	3.84E-002
NA-24	Not Detected	----------	3.11E-001
ND-147	Not Detected	----------	2.23E-001
NI-57	Not Detected	----------	8.91E-002
RU-103	Not Detected	----------	2.93E-002
RU-106	Not Detected	----------	2.87E-001
SB-122	Not Detected	----------	7.08E-002
SB-124	Not Detected	----------	3.08E-002
SB-125	Not Detected	----------	8.06E-002
SN-113	Not Detected	----------	3.86E-002
SR-85	Not Detected	----------	3.68E-002
TA-182	Not Detected	----------	1.63E-001
TA-183	Not Detected	----------	6.09E-001
TL-201	Not Detected	----------	2.96E-001
Y-88	Not Detected	----------	2.96E-002
ZN-65	Not Detected	----------	1.07E-001
ZR-95	Not Detected	----------	5.84E-002

```
*************************************************************************
*                    Sandia National Laboratories                       *
*  Radiation Protection Sample Diagnostics Program [806 Laboratory]    *
*                         3/01/01  5:25:46 PM                           *
*************************************************************************
*                                                                       *
* Analyzed by: Ut 03.02.01            Reviewed by: 3/5/01               *
*************************************************************************
Customer                     : COLLINS/SALMI (6133/SMO)
Customer Sample ID           : 054673-001
Lab Sample ID                : 10032604

Sample Description           : TJAOU-227-GR-07-5.0-S
Sample Quantity              :    689.600   gram
Sample Date/Time             :   2/27/01    1:40:00 PM
Acquire Start Date/Time      :   3/01/01    3:45:26 PM
Detector Name                : LAB02
Elapsed Live/Real Time       :    6000 /    6003 seconds

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

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

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	---------	8.05E-001
RA-226	2.20E+000	8.01E-001	1.14E+000
PB-214	8.09E-001	1.24E-001	7.40E-002
BI-214	7.01E-001	1.15E-001	6.18E-002
PB-210	Not Detected	---------	3.65E+001
TH-232	1.01E+000	4.64E-001	1.67E-001
RA-228	1.06E+000	3.10E-001	1.43E-001
AC-228	1.05E+000	1.90E-001	1.09E-001
TH-228	5.81E-001	5.46E-001	8.66E-001
RA-224	9.51E-001	2.09E-001	6.82E-002
PB-212	9.27E-001	2.97E-001	4.00E-002
BI-212	1.36E+000	3.71E-001	4.34E-001
TL-208	8.21E-001	1.32E-001	6.95E-002
U-235	Not Detected	---------	2.26E-001
TH-231	Not Detected	---------	1.25E+001
PA-231	Not Detected	---------	1.37E+000
TH-227	Not Detected	---------	3.78E-001
RA-223	Not Detected	---------	2.22E-001
RN-219	Not Detected	---------	3.62E-001
PB-211	Not Detected	---------	7.88E-001
TL-207	Not Detected	---------	1.37E+001
AM-241	Not Detected	---------	5.10E-001
PU-239	Not Detected	---------	4.23E+002
NP-237	Not Detected	---------	2.38E+000
PA-233	Not Detected	---------	5.45E-002
TH-229	Not Detected	---------	2.54E-001

[Summary Report] - Sample ID: : 10032604

uclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	----------	3.88E-002
AG-110m	Not Detected	----------	2.96E-002
BA-133	Not Detected	----------	4.94E-002
BE-7	Not Detected	----------	2.38E-001
CD-115	Not Detected	----------	1.26E-001
CE-139	Not Detected	----------	2.76E-002
CE-141	Not Detected	----------	5.11E-002
CE-144	Not Detected	----------	2.28E-001
CO-56	Not Detected	----------	3.17E-002
CO-57	Not Detected	----------	3.00E-002
CO-58	Not Detected	----------	3.24E-002
CO-60	Not Detected	----------	3.69E-002
CR-51	Not Detected	----------	2.33E-001
CS-134	Not Detected	----------	4.13E-002
CS-137	Not Detected	----------	3.22E-002
EU-152	Not Detected	----------	9.00E-002
EU-154	Not Detected	----------	1.88E-001
EU-155	Not Detected	----------	1.44E-001
FE-59	Not Detected	----------	6.93E-002
GD-153	Not Detected	----------	1.06E-001
HG-203	Not Detected	----------	3.14E-002
I-131	Not Detected	----------	3.09E-002
IR-192	Not Detected	----------	2.61E-002
K-40	2.41E+001	3.21E+000	3.16E-001
N-52	Not Detected	----------	3.30E-002
N-54	Not Detected	----------	3.58E-002
MO-99	Not Detected	----------	3.81E-001
NA-22	Not Detected	----------	4.18E-002
NA-24	Not Detected	----------	3.29E-001
ND-147	Not Detected	----------	2.23E-001
NI-57	Not Detected	----------	7.21E-002
RU-103	Not Detected	----------	2.84E-002
RU-106	Not Detected	----------	2.68E-001
SB-122	Not Detected	----------	6.64E-002
SB-124	Not Detected	----------	2.83E-002
SB-125	Not Detected	----------	7.74E-002
SN-113	Not Detected	----------	3.66E-002
SR-85	Not Detected	----------	3.68E-002
TA-182	Not Detected	----------	1.62E-001
TA-183	Not Detected	----------	5.75E-001
TL-201	Not Detected	----------	2.97E-001
Y-88	Not Detected	----------	2.24E-002
ZN-65	Not Detected	----------	1.06E-001
ZR-95	Not Detected	----------	5.59E-002

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program [806 Laboratory]
3/01/01 7:07:49 PM

Analyzed by: LH 03-02-01 Reviewed by: [signature] 3/5/01

Customer : COLLINS/SALMI (6133/SMO)
Customer Sample ID : 054675-001
Lab Sample ID : 10032605

Sample Description : TJAOU-227-GR-06-0.0-S
Sample Quantity : 612.000 gram
Sample Date/Time : 2/27/01 2:40:00 PM
Acquire Start Date/Time : 3/01/01 5:27:29 PM
Detector Name : LAB02
Elapsed Live/Real Time : 6000 / 6002 seconds

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

Comments:

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
U-238	Not Detected	---------	7.69E-001
RA-226	1.23E+000	5.73E-001	8.47E-001
PB-214	6.11E-001	1.06E-001	8.89E-002
BI-214	5.83E-001	1.01E-001	6.57E-002
PB-210	Not Detected	---------	3.63E+001
TH-232	6.73E-001	3.24E-001	1.87E-001
RA-228	6.61E-001	2.74E-001	1.32E-001
AC-228	7.39E-001	1.46E-001	9.74E-002
TH-228	6.15E-001	4.39E-001	6.77E-001
RA-224	8.08E-001	1.85E-001	5.71E-002
PB-212	7.27E-001	1.30E-001	3.98E-002
BI-212	7.27E-001	2.95E-001	4.01E-001
TL-208	6.96E-001	1.19E-001	7.46E-002
U-235	Not Detected	---------	2.24E-001
TH-231	Not Detected	---------	1.17E+001
PA-231	Not Detected	---------	1.31E+000
TH-227	Not Detected	---------	3.54E-001
RA-223	Not Detected	---------	2.08E-001
RN-219	Not Detected	---------	3.68E-001
PB-211	Not Detected	---------	8.06E-001
TL-207	Not Detected	---------	1.24E+001
AM-241	Not Detected	---------	4.98E-001
PU-239	Not Detected	---------	4.16E+002
NP-237	Not Detected	---------	2.20E+000
PA-233	Not Detected	---------	5.22E-002
TH-229	Not Detected	---------	2.50E-001

[Summary Report] - Sample ID: 10032605

Nuclide Name	Activity (pCi/gram)	2-sigma Error	MDA (pCi/gram)
AG-108m	Not Detected	---------	3.46E-002
AG-110m	Not Detected	---------	3.84E-002
BA-133	Not Detected	---------	4.72E-002
BE-7	Not Detected	---------	2.37E-001
CD-115	Not Detected	---------	1.21E-001
CE-139	Not Detected	---------	2.67E-002
CE-141	Not Detected	---------	5.05E-002
CE-144	Not Detected	---------	2.16E-001
CO-56	Not Detected	---------	3.19E-002
CO-57	Not Detected	---------	2.88E-002
CO-58	Not Detected	---------	3.01E-002
CO-60	Not Detected	---------	3.29E-002
CR-51	Not Detected	---------	2.26E-001
CS-134	Not Detected	---------	3.99E-002
CS-137	1.07E-001	2.53E-002	2.60E-002
EU-152	Not Detected	---------	8.73E-002
EU-154	Not Detected	---------	1.67E-001
EU-155	Not Detected	---------	1.34E-001
FE-59	Not Detected	---------	6.63E-002
GD-153	Not Detected	---------	1.03E-001
HG-203	Not Detected	---------	3.02E-002
I-131	Not Detected	---------	3.04E-002
IR-192	Not Detected	---------	2.54E-002
K-40	1.54E+001	2.11E+000	3.32E-001
MN-52	Not Detected	---------	3.78E-002
MN-54	Not Detected	---------	3.29E-002
MO-99	Not Detected	---------	3.55E-001
NA-22	Not Detected	---------	3.67E-002
NA-24	Not Detected	---------	2.95E-001
ND-147	Not Detected	---------	2.13E-001
NI-57	Not Detected	---------	6.79E-002
RU-103	Not Detected	---------	2.75E-002
RU-106	Not Detected	---------	2.67E-001
SB-122	Not Detected	---------	6.17E-002
SB-124	Not Detected	---------	2.82E-002
SB-125	Not Detected	---------	7.74E-002
SN-113	Not Detected	---------	3.50E-002
SR-85	Not Detected	---------	3.63E-002
TA-182	Not Detected	---------	1.42E-001
TA-183	Not Detected	---------	5.60E-001
TL-201	Not Detected	---------	2.88E-001
Y-88	Not Detected	---------	2.43E-002
ZN-65	Not Detected	---------	9.14E-002
ZR-95	Not Detected	---------	4.86E-002

Sandia National Laboratories
Radiation Protection Sample Diagnostics Program (806 Laboratory)
3/05/01 9:05:31 AM

Analyzed by: [signature] 3/5/01 Reviewed by: [signature] 3-5-2001

Customer : COLLINS/SALMI (6133/SMO)
Customer Sample ID : 054678-001
Lab Sample ID : 10032606

Sample Description : TJAOU-227-GR-EB-001
Sample Quantity : 408.700 mL
Sample Date/Time : 2/27/01 3:25:00 PM
Acquire Start Date/Time : 3/01/01 7:09:32 PM
Detector Name : LAB02
Elapsed Live/Real Time : 6000 / 6001 seconds

Comments:

Nuclide Name	Activity (pCi/mL)	2-sigma Error	MDA (pCi/mL)
U-238	Not Detected	---------	4.10E-001
RA-226	Not Detected	---------	5.01E-001
PB-214	Not Detected	---------	4.81E-002
BI-214	Not Detected	---------	5.17E-002
PB-210	Not Detected	---------	1.39E+001
TH-232	Not Detected	---------	1.48E-001
RA-228	Not Detected	---------	1.46E-001
AC-228	Not Detected	---------	7.93E-002
TH-228	Not Detected	---------	5.16E-001
RA-224	Not Detected	---------	1.33E-001
PB-212	Not Detected	---------	4.01E-002
BI-212	Not Detected	---------	3.45E-001
TL-208	Not Detected	---------	6.76E-002
U-235	Not Detected	---------	1.61E-001
TH-231	Not Detected	---------	6.37E+000
PA-231	Not Detected	---------	1.04E+000
TH-227	Not Detected	---------	1.58E-001
RA-223	Not Detected	---------	1.15E-001
RN-219	Not Detected	---------	2.78E-001
PB-211	Not Detected	---------	6.33E-001
TL-207	Not Detected	---------	1.00E+001
AM-241	Not Detected	---------	2.69E-001
PU-239	Not Detected	---------	2.74E+002
NP-237	Not Detected	---------	1.48E+000
PA-233	Not Detected	---------	4.31E-002
TH-229	Not Detected	---------	1.45E-001

[Summary Report] -- Sample ID: 10032606

Nuclide Name	Activity (pCi/mL)	2-sigma Error	MDA (pCi/mL)
AG-108m	Not Detected	---------	2.37E-002
AG-110m	Not Detected	---------	2.09E-002
BA-133	Not Detected	---------	2.75E-002
BE-7	Not Detected	---------	1.90E-001
CD-115	Not Detected	---------	7.30E-002
CE-139	Not Detected	---------	2.07E-002
CE-141	Not Detected	---------	3.55E-002
CE-144	Not Detected	---------	1.60E-001
CO-56	Not Detected	---------	2.72E-002
CO-57	Not Detected	---------	1.98E-002
CO-58	Not Detected	---------	2.33E-002
CO-60	Not Detected	---------	2.72E-002
CR-51	Not Detected	---------	1.72E-001
CS-134	Not Detected	---------	2.50E-002
CS-137	Not Detected	---------	2.12E-002
EU-152	Not Detected	---------	5.73E-002
EU-154	Not Detected	---------	1.13E-001
EU-155	Not Detected	---------	9.19E-002
FE-59	Not Detected	---------	4.90E-002
GD-153	Not Detected	---------	6.15E-002
HG-203	Not Detected	---------	2.25E-002
I-131	Not Detected	---------	2.48E-002
IR-192	Not Detected	---------	2.03E-002
K-40	Not Detected	---------	3.32E-001
MN-52	Not Detected	---------	3.12E-002
MN-54	Not Detected	---------	2.09E-002
MO-99	Not Detected	---------	2.86E-001
NA-22	Not Detected	---------	2.12E-002
NA-24	Not Detected	---------	2.12E-001
ND-147	Not Detected	---------	1.61E-001
NI-57	Not Detected	---------	8.20E-002
RU-103	Not Detected	---------	2.21E-002
RU-106	Not Detected	---------	2.34E-001
SB-122	Not Detected	---------	4.56E-002
SB-124	Not Detected	---------	2.33E-002
SB-125	Not Detected	---------	5.58E-002
SN-113	Not Detected	---------	2.75E-002
SR-85	Not Detected	---------	3.22E-002
TA-182	Not Detected	---------	6.57E-002
TA-183	Not Detected	---------	3.05E-001
TL-201	Not Detected	---------	1.57E-001
Y-88	Not Detected	---------	2.97E-002
ZN-65	Not Detected	---------	4.68E-002
ZR-95	Not Detected	---------	3.24E-002

```
******************************************************************************
*                      Sandia National Laboratories                          *
*   Radiation Protection Sample Diagnostics Program [806 Laboratory]         *
*                        3/02/01  4:58:42 AM                                 *
******************************************************************************
*                                                                            *
* Analyzed by: UF 03-01-01            Reviewed by: 3/5/01                    *
******************************************************************************
Customer                   : COLLINS/SALMI (6133/SMO)
Customer Sample ID         : LAB CONTROL SAMPLE USING CG134
Lab Sample ID              : 10032607

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    : 3/02/01    4:48:28 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	---------	4.17E+003
RA-226	Not Detected	---------	5.74E+003
PB-214	Not Detected	---------	6.08E+002
BI-214	Not Detected	---------	5.41E+002
PB-210	Not Detected	---------	2.44E+005
TH-232	Not Detected	---------	1.91E+003
RA-228	Not Detected	---------	2.07E+003
AC-228	Not Detected	---------	1.26E+003
TH-228	Not Detected	---------	2.60E+005
RA-224	Not Detected	---------	1.22E+004
PB-212	Not Detected	---------	1.98E+004
BI-212	Not Detected	---------	1.48E+005
TL-208	Not Detected	---------	3.49E+004
U-235	Not Detected	---------	1.54E+003
TH-231	Not Detected	---------	7.35E+004
PA-231	Not Detected	---------	1.31E+004
TH-227	Not Detected	---------	2.56E+003
RA-223	Not Detected	---------	1.00E+026
RN-219	Not Detected	---------	5.77E+003
PB-211	Not Detected	---------	1.30E+004
TL-207	Not Detected	---------	1.96E+005
AM-241	8.57E+004	1.35E+004	5.67E+003
PU-239	Not Detected	---------	2.78E+006
NP-237	Not Detected	---------	1.52E+004
PA-233	Not Detected	---------	5.49E+002
TH-229	Not Detected	---------	1.63E+003

[Summary Report] - Sample ID: : 10032607

Nuclide Name	Activity (pCi/Each)	2-sigma Error	MDA (pCi/Each)
AG-108m	Not Detected	----------	2.65E+002
AG-110m	Not Detected	----------	5.63E+007
BA-133	Not Detected	----------	7.65E+002
BE-7	Not Detected	----------	1.00E+026
CD-115	Not Detected	----------	1.00E+026
CE-139	Not Detected	----------	3.56E+010
CE-141	Not Detected	----------	1.00E+026
CE-144	Not Detected	----------	1.54E+007
CO-56	Not Detected	----------	1.63E+017
CO-57	Not Detected	----------	3.19E+006
CO-58	Not Detected	----------	2.90E+018
CO-60	8.45E+004	1.10E+004	7.95E+002
CR-51	Not Detected	----------	1.00E+026
CS-134	Not Detected	----------	8.19E+003
CS-137	7.55E+004	9.76E+003	6.27E+002
EU-152	Not Detected	----------	1.08E+003
EU-154	Not Detected	----------	2.66E+003
EU-155	Not Detected	----------	4.16E+003
FE-59	Not Detected	----------	1.00E+026
GD-153	Not Detected	----------	3.32E+007
HG-203	Not Detected	----------	1.00E+026
I-131	Not Detected	----------	1.00E+026
IR-192	Not Detected	----------	6.52E+017
K-40	Not Detected	----------	1.33E+003
MN-52	Not Detected	----------	1.00E+026
MN-54	Not Detected	----------	1.25E+006
MO-99	Not Detected	----------	1.00E+026
NA-22	Not Detected	----------	2.70E+003
NA-24	Not Detected	----------	1.00E+026
ND-147	Not Detected	----------	1.00E+026
NI-57	Not Detected	----------	1.00E+026
RU-103	Not Detected	----------	1.00E+026
RU-106	Not Detected	----------	3.08E+006
SB-122	Not Detected	----------	1.00E+026
SB-124	Not Detected	----------	1.89E+021
SB-125	Not Detected	----------	1.35E+004
SN-113	Not Detected	----------	3.02E+012
SR-85	Not Detected	----------	1.12E+020
TA-182	Not Detected	----------	6.92E+012
TA-183	Not Detected	----------	1.00E+026
TL-201	Not Detected	----------	1.00E+026
Y-88	Not Detected	----------	5.69E+012
ZN-65	Not Detected	----------	3.15E+007
ZR-95	Not Detected	----------	2.33E+020

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

Report Date : 3/02/01 4:58:44 AM
QA File : C:\GENIE2K\CAMFILES\LCS2.QAF
Analyst : FCD
Sample ID : 10032607
Sample Quantity : 1.00 Each
Sample Date : 11/01/90 12:00:00 PM
Measurement Date : 3/02/01 4:48:28 AM
Elapsed Live Time : 600 seconds
Elapsed Real Time : 605 seconds

Parameter	Mean	1S Error	New Value	< LU : SD : UD : BS >
AM-241 Activity	8.227E-002	3.552E-003	8.571E-002	< : : : >
CS-137 Activity	7.177E-002	2.641E-003	7.552E-002	< : : : >
CO-60 Activity	8.000E-002	2.968E-003	8.392E-002	< : : : >

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

Reviewed by: ___ ljt 03.02.01 ___

ATTACHMENT G

SWMU 227—Risk Assessment

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LIST OF TABLES

LIST OF TABLES (Concluded)

LIST OF FIGURES

SWMU 227: RISK ASSESSMENT REPORT

I. Site Description and History

Solid Waste Management Unit (SWMU) 227 (the Bunker 904 Outfall) at Sandia National Laboratories/New Mexico (SNL/NM) is located about 80 feet east of the southern apex of Technical Area (TA)-II. The site encompasses 0.08 acre of unpaved ground on land that is owned by Kirtland Air Force Base (KAFB) and leased to the U.S. Department of Energy (DOE). SWMU 227 is situated at the slope break between the steeply sloping, northern rim of Tijeras Arroyo and the nearly flat floodplain below. Ground elevations range from approximately 5,350 to 5,400 feet above mean sea level (SNL/NM April 1995).

From 1947 through 1992, SWMU 227 was one of the two waste-water discharge points for the SWMU 48 High Explosive (HE) drain system that was connected to TA-II Buildings 904, 913, and 914. Waste water from floor drains located in the three buildings flowed by gravity via cement piping to the outfall ditches at SWMU 227 and SWMU 229. The outfall ditch at SWMU 227 was still visible in its entirety in 2001, measured approximately 130 feet long by 20 feet wide, and ranged in depth from 3 to 10 feet. The area surrounding SWMUs 227 and 229 has historically been sloped so that storm water was not directed into the outfall ditches. Similarly, sanitary (septic) waste was not discharged at either site.

Building 904, the largest of the three buildings consisting of approximately 10,000 square feet, was initially used in the 1950s for the assembly of nuclear weapons. During the assembly process, HE shavings fell onto the building floor, which was cleaned with water and possibly kerosene. The water flowed into floor drains connected to the HE drain system and discharged at the northern rim of the arroyo at SWMUs 227 and 229. Mechanical filtration took place at an HE catch box (solids retention tank) located in the drain system piping that removed the HE particulates. Starting in the 1960s, Building 904 was used as an HE research laboratory and also may have contained laboratories for photographic processing and chemistry research. Building 913 encompassed approximately 3,400 square feet and was primarily used for explosives testing; other uses included component assembly, high pressure testing, and security training. Building 914 (500 square feet) was used for the storage of maintenance equipment and supplies. Floor drains in Buildings 913 and 914 also were connected to the HE drain system (IT December 1996). Discharge of waste water at SWMU 227 was discontinued in 1993 when the HE drain system piping was replaced with a sewer line that was connected to the City of Albuquerque (COA) sewer system. Buildings 904, 913, and 914 were demolished in 2002.

Process knowledge indicates that the waste water from Building 904 possibly contained acetone, methylene chloride, trichloroethylene (TCE), methyl ethyl ketone, nitromethane, carbon tetrachloride, toluene, xylenes, Freon™ compounds, hexane, various alcohols (methanol and isopropyl), metals (barium, cadmium, chromium, lead, silver, and titanium), HE compounds (Baratol, Compound B, HMX [octogen], RDX [cyclonite], and black powder), ammonium hydroxide, cyanide, kerosene, and possibly traces of radionuclides such as Cs-137, U-235, U-238, Pu-239, and H-3. Chemicals used at Building 913 included acetone, boron, chromium, diborane, inert gases, isopropanol, mercury, nickel carbonyl, phosphine, phosphorous, titanium, and trichloroethane. These chemicals are not known to have been discharged to the Building 913 floor drain. Hazardous or radioactive materials are not suspected of being stored or used at Building 914.

As a result, the contaminants of concern (COCs) for SWMU 227 are volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), HE compounds, cyanide, metals, and radionuclides.

The volume of waste water discharged at SWMU 227 was not documented by TA-II personnel. However, historic aerial photographs suggest that the volume was not large. Even though the discharge of waste water began in 1947, the 1951 photograph does not show much soil erosion. The depth and width of the outfall ditch varies little between the 1951 and 1993 photographs. Only a minor amount of soil erosion is evident. Vegetation visible in the photographs suggests that the volume of waste water declined substantially after the early 1960s. The photographs also show that sewer and waste lines were installed in 1963, 1979, and 1993 near the west end of SWMU 227.

The Environmental Restoration [ER] Project has not observed any stained soil at SWMU 227 during inspections conducted between 1993 and 2003. In 1994, the ground surface was surveyed for unexploded ordnance/HE and radioactive materials; no anomalies were detected. Exploratory trenching was conducted in 2001 at SWMU 227 for the purposes of verifying the historical aerial photographs and for collecting soil samples. A 30-foot-long trench was excavated across the upper end of the outfall ditch where waste water had discharged from the HE drain system piping that verified the HE drain system piping had been removed. No stained soil was observed.

Three rounds of soil sampling have been conducted at SWMU 227. In September 1994, eight soil samples (227-01-A through 227-04-B) were collected from the outfall ditch. The sampling interval extended from the ground surface to 3 feet below ground surface (bgs). In February 2001, three hand-auguring locations (TJAOU-227-GR-05, TJAOU-227-GR-06, and TJAOU-227-GR-07) were sampled to a maximum depth of 7 feet bgs. The soil samples consisted of native soil and were collected from the exploratory trench and along the outfall ditch. In March 2001, soil samples were collected to a depth of 275 feet bgs during the drilling of soil-vapor monitoring well 227-VW-01, which is located approximately 80 feet southeast of the eastern end of SWMU 227. Soil samples were collected at depths of 20, 100, 150, 200, 250, and 275 feet bgs. Analytical results from the three rounds of sampling are discussed below in Section II (Data Quality Objectives).

Soil-vapor samples were collected from monitoring well 227-VW-01 during five quarterly events from April 2001 through March 2002. Summa™ canisters were used to collect soil-vapor samples from sampling ports set at depths of 25, 75, 125, 175, and 225 feet bgs. The samples were submitted to the Quanterra/Severn Trent, California, laboratory and analyzed for VOCs using U.S. Environmental Protection Agency (EPA) Method TO-14. Seventeen VOCs were detected, but most were single-digit "J" (analyte detected above the method detection limit but less than the practical quantitation limit) values. The predominant VOC in soil vapor was TCE. The maximum TCE concentration for the five quarters was 14,000 parts per billion on a volume/volume ratio (ppbv) in a sample collected from a depth of 225 feet bgs. The percentages of total VOCs that can be attributed to TCE ranged from 66.7 to 100 percent. For the sampling ports at 75, 125, 175, and 225 feet bgs, TCE comprised 92.4 to 100 percent of the total VOC values. The sampling port at 25 feet bgs consistently yielded a more varied set of

VOCs, but the associated VOC concentrations were orders of magnitude less than the deeper sampling results.

The maximum total VOC concentration at monitoring well 227-VW-01 was 14,044 ppbv. For perspective, the soil-vapor investigation at the SNL/NM Chemical Waste Landfill (CWL) used the New Mexico Environmental Department (NMED)-approved 100,000-ppbv threshold for defining the total VOC plume edge (SNL/NM December 1992, Sisneros February 1993). The NMED has not specified a threshold value for SWMU 227. The CWL threshold value is nearly an order of magnitude greater than the maximum total VOC concentration from monitoring well 227-VW-01. Therefore, additional soil-vapor characterization at SWMU 227 was not necessary.

Groundwater results were obtained from the Tijeras Arroyo Groundwater (TAG) Investigation (SNL/NM November 2002). The nearest well to SWMU 227 is monitoring well TA2-W-19, which is located approximately 500 feet southeast of SWMU 227 and directly downgradient of the site. The monitoring well is completed in the perched system at 263 to 283 feet bgs. The most recent eight quarters of groundwater analyses available for monitoring well TA2-W-19 are from November 1999 through March 2002. Analyses were performed by the ER Chemistry Laboratory. No significant groundwater contamination was evident for samples collected from monitoring well TA2-W-19. Four VOCs (TCE, 1,1-dichloroethene (DCE), bromomethane, and cis-1,2-DCE) were reported. TCE concentrations in groundwater ranged from 0.96 to 2.3 micrograms (μg)/liter (L) and were below the EPA maximum contaminant level (MCL) of 5.0 μg/L (EPA July 2002). The other three VOCs were reported with "J" values and were below the respective MCLs. Similarly, none of the metals exceeded MCLs. Nitrate concentrations in groundwater ranged from 3.8 to 24 milligrams (mg)/L. The average nitrate concentration was 10.3 mg/L, which was slightly above the MCL of 10 mg/L. Nitrate results from the last four quarters were below the MCL and ranged from 7.2 to 8.8 mg/L.

The annual precipitation for the area, as measured at Albuquerque International Sunport, is 8.1 inches (NOAA 1990). During most rainfall events, rainfall quickly infiltrates the soil near SWMU 227. However, virtually all of the moisture subsequently undergoes evapotranspiration. The estimates of evapotranspiration for the KAFB area range from 95 to 99 percent of the annual rainfall. Because of the steep slope along the northern rim of Tijeras Arroyo, a 1998 surface-water assessment determined that the site has a high erosion potential.

No springs or other perennial surface-water bodies are located within four miles of SWMU 227. The site is located approximately 1,500 feet west of the active channel of Tijeras Arroyo but not within the 100-year floodplain. Surface water flows only several times per year in that segment of the active channel nearest SWMU 227. Tijeras Arroyo is the most significant surface-water drainage feature on KAFB. The arroyo originates in Tijeras Canyon, which is bounded by the Sandia Mountains to the north and the Manzano Mountains to the south. The arroyo trends southwest across KAFB, eventually merging with the Rio Grande approximately 8.7 miles west of SWMU 227.

Groundwater monitoring for the area surrounding SWMU 227 is conducted as part of the TAG Investigation (SNL/NM November 2002). Two water-bearing zones, the perched system and the regional aquifer, underlie SWMU 227. The perched system is not used for water supply purposes. The depth to the perched system is approximately 270 feet bgs. The depth to the regional aquifer is approximately 470 feet bgs. The COA, KAFB, and the Veterans

Administration utilize the regional aquifer as a water supply source. The nearest downgradient water-supply well is KAFB-1, which is located approximately 1.4 miles northwest of the site.

Grasslands, including species such as blue/black grama and western cheatgrass, are the dominant plant community surrounding SWMU 227. The site also is vegetated by ruderal species, such as Russian thistle (tumbleweed). No threatened or endangered species have been identified in the vicinity of SWMU 227 (Hoagland September 1994, IT February 1995), and no cultural resources have been documented.

Soil at the site has been identified as the Bluepoint-Kokan Association (USDA 1977). For purposes of defining the background levels of metals and radionuclides in soil, this soil has been included as part of the Sandia North Supergroup. The Bluepoint-Kokan Association consists of Bluepoint loamy fine sand, which is developed on slopes of 5 to 15 percent, with Kokan gravelly sand on slopes of 15 to 40 percent (USDA 1977). These soils are slightly calcareous and mildly to moderately alkaline. The surficial deposits are underlain by the upper unit of the Santa Fe Group, which consists of coarse- to fine-grained fluvial deposits from the ancestral Rio Grande that interfinger with the coarse-grained alluvial fan/piedmont facies extending westward from the Sandia and Manzano Mountains (SNL/NM March 1995). The upper unit of the Santa Fe Group is approximately 3,000 feet in thickness in the vicinity of the site (SNL/NM November 2002).

II. Data Quality Objectives

The data quality objectives (DQOs) for SWMU 227 were presented in two documents: 1) the 1994 *Sampling and Analysis Plan for Eleven Sites in Tijeras Arroyo Operable Unit* [OU] (SNL/NM June 1994) and 2) the 2001 *Sampling and Analysis Plan – SWMUs 227 and 229 – Tijeras Arroyo OU 1309* (SNL/NM February 2001). The two sampling and analysis plans (SAPs) identified the site-specific confirmatory locations, sample depths, sampling procedures, and analytical requirements. The DQOs also outlined the quality assurance (QA)/quality control (QC) requirements necessary for producing defensible analytical data suitable for risk assessment purposes. The confirmatory sampling was designed to determine whether soil contamination had resulted from the discharge of TA-II waste water. Therefore, soil samples were collected along the outfall ditch at locations both beneath, and downslope of, the waste-water discharge point.

Tables 1, 2, and 3 list the soil samples that were collected at SWMU 227 during the three rounds of sampling. The tables also include the number and type of analyses for each soil sample. The soil samples from all three rounds were analyzed for VOCs, SVOCs, Resource Conservation and Recovery Act metals, chromium-VI, HE compounds, and gamma-emitting radionuclides. Samples from the first round also were analyzed for cyanide, nitrate plus nitrite, total Kjeldahl nitrogen (TKN), and H-3. Samples from the third round also were analyzed for chloride and cyanide. The analytical laboratories consisted of Environmental Control Technology Corporation (ENCOTEC), Quanterra Environmental Services, General Engineering Laboratories, Inc. (GEL), and the on-site SNL/NM Radiation Protection Sample Diagnostics (RPSD) Laboratory.

As shown in Table 1, the first round of sampling was conducted at the SWMU 227 outfall ditch in September 1994. The eight soil samples (227-01-A through 227-04-B) were collected with either a hand trowel or a hand auger to a maximum sampling depth of 3 feet bgs.

Table 1
Number of Off-Site Analyses for Soil Samples Collected at SWMU 227
September 1994

Sample Type[a,b,c]	VOCs	SVOCs	TPH	RCRA Metals[d]	HE Compounds	Cyanide	Nitrate + Nitrite	TKN	Radionuclides[e]	Number of Analyses
Soil	4	4	4	8	4	8	8	8	14	62
Duplicate	2	2	1	1	1	1	1	1	2	12
Equipment Blank	1	1	1	1	1	1	1	1	2	10
VOC Trip Blank	1	–	–	–	–	–	–	–	–	1
Total Samples	8	7	6	10	6	10	10	10	18	85

[a]Sample numbers: 227-01-A, 227-01-B, 227-02-A, 227-02-B, 227-03-A, 227-03-B, 227-04-A, 227-04-B.
[b]Sampling dates: September 29 and 30, 1994.
[c]AR/COC Forms: 000055 [SCL 01616], 000802 [SCL 01637], 000806 [SCL 01617], 000932 [SCL 01762], 000933 [SCL 01618], 000934 [SCL 01763].
[d]Includes the eight RCRA metals and chromium-VI.
[e]Includes gamma-emitting radionuclides and tritium.
AR/COC = Analysis Request/Chain of Custody.
HE = High explosive(s).
RCRA = Resource Conservation and Recovery Act.
SCL = Sample Collection Log.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
TKN = Total Kjeldahl nitrogen.
TPH = Total petroleum hydrocarbons.
VOC = Volatile organic compound.
– = Not analyzed.

Table 2
Number of Off-Site Analyses for Soil Samples Collected at SWMU 227
February 2001

Sample Type[a,b,c]	VOCs	SVOCs	RCRA Metals[d]	HE Compounds	Radionuclides[e]	Number of Analyses
Soil	4	4	4	4	8	24
Duplicate	1	1	1	1	2	6
Equipment Blank	1	1	1	1	1	5
VOC Trip Blank	1	–	–	–	–	1
Total Samples	7	6	6	6	11	36

[a]Sample numbers: TJAOU-227-GR-05-7.0-S, TJAOU-227-GR-06-0.0-S, TJAOU-227-GR-06-5.0-S, TJAOU-227-GR-06-5.0-DU, TJAOU-227-GR-07-5.0-S, TJAOU-227-GR-EB-001, TJAOU-227-GR-TB-001.
[b]Sampling date: February 27, 2001.
[c]AR/COC Forms: 604298, 604299.
[d]Includes the eight RCRA metals and chromium-VI.
[e]Includes gamma-emitting radionuclides and gross alpha/beta activity.
AR/COC = Analysis Request/Chain of Custody.
HE = High explosive(s).
RCRA = Resource Conservation and Recovery Act.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
VOC = Volatile organic compound.
– = Not analyzed.

Table 3
Number of Off-Site Analyses for Soil Samples Collected at the Borehole for Monitoring Well 227-VW-01
March 2001

Sample Type[a,b,c]	VOCs	SVOCs	RCRA Metals[d]	HE Compounds	Cyanide	Chloride	Radionuclides[e]	Number of Analyses
Soil	6	2	2	2	2	2	4	20
Duplicate	1	–	–	–	–	–	–	1
VOC Trip Blank	1	–	–	–	–	–	–	1
Equipment Blank	1	1	1	1	1	1	2	8
Total Samples	9	3	3	3	3	3	6	30

[a]Sample numbers: TJAOU-227-VW-01-20.0-S, TJAOU-227-VW-01-100.0-S, TJAOU-227-VW-01-100.0-DU, TJAOU-227-VW-01-150.0-S, TJAOU-227-VW-01-200.0-S, TJAOU-227-VW-1-250-S, TJAOU-227-VW-01-275-S, TJAOU-227-VW-EB-001, TJAOU-227-VW-TB-001.
[b]Sampling dates: March 26 through 29, 2001.
[c]AR/COC Forms: 604199, 604200, 604204, 604205.
[d]Includes the eight RCRA metals, chromium-VI, and titanium.
[e]Includes gamma-emitting radionuclides and tritium.
AR/COC = Analysis Request/Chain of Custody.
HE = High explosive(s).
RCRA = Resource Conservation and Recovery Act.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.
– = Not analyzed.

In February 2001, soil samples were collected with a hand auger at three locations (TJAOU-227-GR-05, TJAOU-227-GR-06, and TJAOU-227-GR-07) along the SWMU 227 outfall ditch (Table 2). A backhoe was also used to excavate a 30-foot-long exploratory trench to a maximum depth of 6 feet across the upper end of the outfall ditch where the waste water had discharged from the HE drain system piping. Undisturbed (native) soil samples were collected to a maximum depth of 7 feet bgs.

In March 2001, soil samples were collected with a split spoon during the drilling of soil-vapor monitoring well 227-VW-01 (Table 3). The well is located 80 feet southeast of the eastern end of SWMU 227. Soil samples were collected at depths of 20, 100, 150, 200, 250, and 275 feet bgs.

Analytical results from the three rounds of soil sampling are incorporated into this risk assessment. Four metals (arsenic, barium, cadmium, and chromium) were detected at levels slightly above background. Four VOCs (acetone, methylene chloride, 2-butanone, and 4-methyl-2-pentanone) were reported, with 2-butanone having the greatest VOC concentration at 0.0191 J mg/kilogram (kg). Six SVOCs, including benzo(b)fluoranthene, chrysene, fluoranthene, phenanthrene, pyrene, and bis(2-ethylhexyl) phthalate, were reported; benzo(b)fluoranthene had the greatest SVOC concentration at 0.216 J mg/kg. No total petroleum hydrocarbons or HE were detected in the soil samples. The maximum cyanide and chloride concentrations were 0.159 J and 87 mg/kg, respectively. The maximum TKN concentration was 670 mg/kg. The maximum concentration of nitrate plus nitrite was 9.3 mg/kg. Two radionuclides (Cs-137 and U-235) were reported at levels slightly above background.

Table 4 summarizes the analytical methods and the data quality requirements from the two SAPs. Excluding the 45 QA/QC analyses, a total of 120 analyses were reported for the SWMU 227 confirmatory soil samples. This includes 106 analyses from the off-site laboratories (ENCOTEC, Quanterra Environmental Services, and GEL) and 14 samples from the on-site RPSD Laboratory.

As shown in Tables 1, 2, and 3, the QA/QC analyses consisted of soil duplicates, VOC trip blanks, and equipment blanks. For the three rounds of soil sampling, duplicate samples were collected at ratios that ranged from one duplicate per four environmental samples to one duplicate per twenty environmental samples. This ratio range was adequate when compared to the ER Project Quality Assurance Project Plan (QAPjP) ratio of 1:20. The aqueous VOC trip blanks were supplied by the analytical laboratories. The equipment (aqueous rinsate) blanks were prepared in the field as part of the sampling effort. No significant QA/QC problems were identified in the analyses for the VOC trip and equipment blanks.

The analytical data were also verified/validated by SNL/NM in accordance with the QAPjP. The 1994 analytical data were reviewed using the Data Verification/Validation (DV) process (SNL/NM July 1994) involving DV1 and DV2 checklists (see Attachment B of the SNL/NM ER Project Response to NMED Notice of Deficiency for SWMUs 227 and 229 Proposals for No Further Action Dated June 1995 [NOD Response]). The 2001 analytical data were reviewed using DV3 procedures according to the "Data Validation Procedure for Chemical and Radiochemical Data" SNL/NM ER Project Analytical Operating Procedure (AOP) 00-03, Rev. 0 (SNL/NM January 2000). The DV3 reports also are presented in Attachment B of SNL/NM ER Project NOD Response. The gamma-spectroscopy data from the RPSD Laboratory were

Table 4
Summary of Data Quality Requirements and Total Number of Analyses for Confirmatory Soil Samples Collected at SWMU 227

Analytical Method[a]	Data Quality Level	Analyses From Off-Site Laboratories[b]	Analyses From On-Site Laboratory[c]
VOCs EPA Method 8240/8260	Defensible	14	–
SVOCs EPA Method 8270	Defensible	10	–
TPH EPA Method 8015	Defensible	4	–
RCRA metals, chromium-VI, titanium EPA Method 6010/7000	Defensible	14	–
HE Compounds EPA Method 8330	Defensible	10	–
Cyanide EPA Method 9010	Defensible	10	–
Chloride EPA Method 300	Defensible	2	–
TKN EPA Method 300	Defensible	8	–
Nitrate + Nitrite EPA Method 300	Defensible	8	–
Gamma Spectroscopy EPA Method 901.1	Defensible	12	14
Tritium EPA Method 901.1	Defensible	10	–
Gamma Spectroscopy, Gross Alpha/Beta Activity EPA Method 900	Defensible	4	–
Total number of analyses[d]		106	14

[a]EPA November 1986.
[b]The off-site laboratories are ENCOTEC, Quanterra Environmental Services, and GEL.
[c]The on-site laboratory is the RPSD Laboratory.
[d]The number of analyses does not include QA/QC samples (duplicates, equipment blanks, and VOC trip blanks).

ENCOTEC = Environmental Control Technology Corporation.
EPA = U.S. Environmental Protection Agency.
GEL = General Engineering Laboratories, Inc.
HE = High explosive(s).
QA = Quality assurance.
QC = Quality control.
RCRA = Resource Conservation and Recovery Act.
RPSD = Radiation Protection Sample Diagnostics.
SVOC = Semivolatile organic compound.
SWMU = Solid Waste Management Unit.
TKN = Total Kjeldahl Nitrogen.
TPH = Total Petroleum Hydrocarbons.
VOC = Volatile organic compound.
– = Not analyzed.

reviewed according to "Laboratory Data Review Guidelines," Procedure No. RPSD-02-11, Issue No. 02 (SNL/NM July 1996). Data packages from all of the analytical laboratories were determined to be defensible, and are therefore acceptable for use in the proposal for no further action (NFA) (SNL/NM June 1995). Therefore, the DQOs have been fulfilled.

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

III.1 Introduction

The determination of the nature, migration rate, and extent of contamination at SWMU 227 was based upon an initial conceptual model validated with confirmatory soil sampling. The initial conceptual model was developed from the review of engineering drawings and ER Project records. The DQOs contained in the SAPs identified the sample locations, sample density, sample depth, and analytical requirements. The sample data were subsequently used to develop the site conceptual model for SWMU 227, which is presented in Attachment H of the SNL/NM ER Project NOD Response. The quality of the data used to specifically determine the nature, migration rate, and extent of contamination is described in the following sections.

III.2 Nature of Contamination

Both the nature of contamination and the potential for the degradation of COCs at SWMU 227 were evaluated using laboratory analyses of the confirmatory soil samples (Section IV). The requirements included analyses for VOCs, SVOCs, metals, HE compounds, cyanide, chloride, nitrate, TKN, and radionuclides. The analyses characterized potential contaminants resulting from the discharge of TA-II waste water. The analytes and methods listed in Table 4 are appropriate for characterizing the COCs and potential degradation products at SWMU 227.

III.3 Rate of Contaminant Migration

SWMU 227 has been an inactive site since 1993. The rate of COC migration from surficial soil would be solely dependent upon direct precipitation as described in Section V. Data available from the TAG Investigation; numerous SNL/NM monitoring programs for air, water, and radionuclides; various biological surveys; and meteorological monitoring are adequate for characterizing the rate of COC migration at SWMU 227.

III.4 Extent of Contamination

Surface and subsurface confirmatory soil samples were collected from SWMU 227 in 1994 and 2001 to determine whether soil contamination was present. The locations and depths of the 2001 samples were determined using verbal guidance from NMED. The three rounds of confirmatory soil sampling were collected from the ground surface to a maximum depth of 275 feet. In summary, the design of the confirmatory sampling was appropriate and adequate to determine the nature, migration rate, and extent of residual COCs in surface and subsurface soils at SWMU 227.

IV. Comparison of COCs to Background Screening Levels

Site history and characterization activities were used to identify potential COCs. The SWMU 227 NFA proposal (SNL/NM June 1995) describes the identification of COCs and the sampling that was conducted in order to determine the concentration levels of those COCs across the site. Generally, COCs that were evaluated in this risk assessment included all detected organic compounds and all inorganic and radiological COCs for which samples were analyzed. When the detection limit of an organic compound was too high (i.e., could possibly cause an adverse effect to human health or the environment), the compound was retained. Nondetected organic compounds not included in this assessment were determined to have detection limits low enough to ensure protection of human health and the environment. In order to provide conservatism in this risk assessment, the calculation used only the maximum concentration value of each COC found for the entire site. The SNL/NM maximum background concentration (Dinwiddie September 1997) was selected to provide the background screening values listed in Tables 5 through 8.

Nonradiological inorganics that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, were not included in this risk assessment (EPA 1989). Both radiological and nonradiological COCs were evaluated. The nonradiological COCs evaluated included inorganic and organic compounds.

Tables 5 and 6 list the nonradiological COCs for the human health and ecological risk assessments at SWMU 227, respectively. Tables 7 and 8 list radiological COCs for the human health and ecological risk assessments, respectively. All tables show the associated SNL/NM maximum background concentration values (Dinwiddie September 1997 and Tharp 1999). Section VI.4 provides discussion of Tables 5 and 7 while Sections VII.2 and VII.3 provide discussion of Tables 6 and 8.

V. Fate and Transport

The primary releases of COCs at SWMU 227 occurred to the surface soil resulting from the discharge of waste water from Buildings 904, 913, and 914 at the SWMU 227 outfall. Wind, water, and biota are natural mechanisms of COC transport from the primary release point.

Water at SWMU 227 is received as precipitation (approximately 8.1 inches annually) that will either evaporate at or near the point of contact, infiltrate into the soil, or form runoff. Infiltration at the site is enhanced by the coarse texture of the soil, which is primarily the Bluepoint-Kokan Association consisting of Bluepoint loamy fine sand and Kokan gravelly sand (USDA 1977). COCs in the soil can migrate deeper into the subsurface soil as a result of water percolating through the soil; however, in general, the COCs at this site are not prone to rapid leaching. Furthermore, it is estimated that 95 to 99 percent of the annual precipitation in this area is lost through evapotranspiration. Therefore, the potential for significant downward movement of COCs through leaching is very limited. Because groundwater at this site is at depths greater than 270 feet bgs, the potential for COCs to reach groundwater through the unsaturated zone above the water table is extremely low.

Table 5
Nonradiological COCs for Human Health Risk Assessment at SWMU 227 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

COC	Maximum Concentration (mg/kg)	SNL/NM Background Concentration (mg/kg)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Log K_{ow} (for organic COCs)	Bioaccumulator?[b] (BCF>40, Log K_{ow}>4)
Arsenic	5.9	4.4	No	44[c]	–	Yes
Barium	210	200	No	170[d]	–	Yes
Cadmium	2.9	<1	No	64[c]	–	Yes
Chromium, total	25.2	12.8	No	16[c]	–	No
Chromium VI	0.092 J	NC	Unknown	16[c]	–	No
Cyanide	0.159 J	NC	Unknown	NC	–	Unknown
Lead	11	11.2	Yes	49[c]	–	Yes
Mercury	0.0106 J	<0.1	Unknown	5,500[c]	–	Yes
Nitrite plus Nitrate	9.3	NC	Unknown	NC	–	Unknown
Selenium	0.864	<1	Unknown	800[e]	–	Yes
Silver	0.25[f]	<1	Unknown	0.5[c]	–	No
2-Butanone	0.0191	NA	NA	1[g]	0.29[g]	No
4-Methyl-2-pentanone	0.001 J	NA	NA	5[h]	1.19[h]	No
Acetone	0.0073	NA	NA	0.69[g]	-0.24[g]	No
Benzo(b) fluoranthene	0.068 J	NA	NA	–	6.124[h]	Yes
bis(2-Ethylheyxl) phthalate	0.0885	NA	NA	851[i]	7.6[h]	Yes
Chrysene	0.049 J	NA	NA	18,000[h]	5.91[h]	Yes
Fluoranthene	0.094 J	NA	NA	12,302[h]	4.90[h]	Yes
Methylene chloride	0.00105 J	NA	NA	5[g]	1.25[g]	No
Phenanthrene	0.084 J	NA	NA	23,800[c]	4.63[c]	Yes
Pyrene	0.062 J	NA	NA	36,300[c]	5.32[h]	Yes

Refer to footnotes at end of table.

Table 5 (Concluded)
Nonradiological COCs for Human Health Risk Assessment at SWMU 227 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

Note: **Bold** indicates the COCs that exceed background screening values and/or are bioaccumulators.
[a]From Dinwiddie (September 1997) North Supergroup.
[b]NMED (March 1998).
[c]Yanicak (March 1997).
[d]Neumann (1976).
[e]Callahan et al. (1979).
[f]Parameter was not detected. Concentration is one-half the detection limit.
[g]Howard (1990).
[h]Micromedex (1998).
[i]Howard (1989).
BCF = Bioconcentration factor.
COC = Constituent of concern.
J = Estimated value.
K_{ow} = Octanol-water partition coefficient.
Log = Logarithm (base 10).
mg/kg = Milligram(s) per kilogram.
NA = Not applicable.
NC = Background value not calculated.
NMED = New Mexico Environment Department.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.
– = Information not available.

Table 6
Nonradiological COCs for Ecological Risk Assessment at SWMU 227 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

COC	Maximum Concentration (mg/kg)	SNL/NM Background Concentration (mg/kg)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Log K_{ow} (for organic COCs)	Bioaccumulator?[b] (BCF>40, Log K_{ow}>4)
Arsenic	5.9	4.4	No	44[c]	–	Yes
Barium	210	200	No	170[d]	–	Yes
Cadmium	2.9	<1	No	64[c]	–	Yes
Chromium, total	10.3	12.8	Yes	16[c]	–	No
Chromium VI	0.5[e]	NC	Unknown	16[c]	–	No
Lead	11	11.2	Yes	49[c]	–	Yes
Mercury	0.0061 J	<0.1	Unknown	5,500[c]	–	Yes
Nitrite plus Nitrate	9.3	NC	Unknown	NC	–	Unknown
Selenium	0.815	<1	Unknown	800[f]	–	Yes
Silver	0.25[e]	<1	Unknown	0.5[c]	–	No
2-Butanone	0.007 J	NA	NA	1[g]	0.29[g]	No
4-Methyl-2-pentanone	0.001 J	NA	NA	5[h]	1.19[h]	No
Acetone	0.006 J	NA	NA	0.69[g]	-0.24[g]	No
Benzo(b)fluoranthene	0.068 J	NA	NA	–	6.124[h]	Yes
bis(2-Ethylheyxl) phthalate	0.0260 J	NA	NA	851[i]	7.6[h]	Yes
Chrysene	0.049 J	NA	NA	18,000[h]	5.91[h]	Yes
Fluoranthene	0.094 J	NA	NA	12,302[h]	4.90[h]	Yes
Phenanthrene	0.084 J	NA	NA	23,800[c]	4.63[c]	Yes
Pyrene	0.062 J	NA	NA	36,300[c]	5.32[h]	Yes

Refer to footnotes at end of table.

Table 6 (Concluded)
Nonradiological COCs for Ecological Risk Assessment at SWMU 227 with Comparison to the Associated SNL/NM Background Screening Value, BCF, and Log K_{ow}

Note: **Bold** indicates the COCs that exceed background screening values and/or are bioaccumulators.
[a]From Dinwiddie (September 1997) North Supergroup.
[b]NMED (March 1998).
[c]Yanicak (March 1997).
[d]Neumann (1976).
[e]Parameter was not detected. Concentration is one-half the detection limit.
[f]Callahan et al. (1979).
[g]Howard (1990).
[h]Micromedex (1998).
[i]Howard (1989).

BCF	= Bioconcentration factor.
COC	= Constituent of concern.
J	= Estimated value.
K_{ow}	= Octanol-water partition coefficient.
Log	= Logarithm (base 10).
mg/kg	= Milligram(s) per kilogram.
NA	= Not applicable.
NC	= Background value not calculated.
NMED	= New Mexico Environment Department.
SNL/NM	= Sandia National Laboratories/New Mexico.
SWMU	= Solid Waste Management Unit.
–	= Information not available.

Table 7
Radiological COCs for Human Health Risk Assessment at SWMU 227 with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC	Maximum Activity (pCi/g)	SNL/NM Background Concentration (pCi/g)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Is COC a Bioaccumulator?[b] (BCF >40)
Cs-137	**0.296**	0.084	**No**	3,000[c]	**Yes**
H-3	ND (0.014)	0.021[e]	Yes	NA	No
U-235	0.104	0.18	Yes	900[d]	**Yes**
U-238	**ND (2.54)**	1.3	**No**	900[d]	**Yes**

Note: **Bold** indicates COCs that exceed background screening values and/or are bioaccumulators.
[a]From Dinwiddie (September 1997), North Supergroup.
[b]NMED (March 1998).
[c]From Whicker and Schultz (1982).
[d]From Baker and Soldat (1992).
[e]Tharp (1999).
BCF = Bioconcentration factor.
COC = Constituent of concern.
MDA = Minimum detectable activity.
NA = Not applicable.
ND ( ) = Not detected above the MDA, shown in parentheses.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

Table 8
Radiological COCs for Ecological Risk Assessment at SWMU 227 with Comparison to the Associated SNL/NM Background Screening Value and BCF

COC	Maximum Activity (pCi/g)	SNL/NM Background Concentration (pCi/g)[a]	Is Maximum COC Concentration Less Than or Equal to the Applicable SNL/NM Background Screening Value?	BCF (maximum aquatic)	Is COC a Bioaccumulator?[b] (BCF >40)
Cs-137	**0.296**	0.084	**No**	3,000[c]	**Yes**
H-3	ND (0.014)	0.021[e]	Yes	NA	No
U-235	**ND (0.44)**	0.18	**No**	900[d]	**Yes**
U-238	**2.54**	1.3	**No**	900[d]	**Yes**

Note: **Bold** indicates COCs that exceed background screening values and/or are bioaccumulators.
[a]From Dinwiddie (September 1997), North Supergroup.
[b]NMED (March 1998).
[c]From Whicker and Schultz (1982).
[d]From Baker and Soldat (1992).
[e]Tharp (1999).
BCF = Bioconcentration factor.
COC = Constituent of concern.
MDA = Minimum detectable activity.
NA = Not applicable.
ND ( ) = Not detected above the MDA, shown in parentheses.
NMED = New Mexico Environment Department.
pCi/g = Picocurie(s) per gram.
SNL/NM = Sandia National Laboratories/New Mexico.
SWMU = Solid Waste Management Unit.

Because of the sloping terrain of the site, water that does not infiltrate at the site will rapidly form runoff, which could carry soil particles. Therefore, runoff is a potential mechanism for COCs to be transported from the site. The extent of this transport is expected to be confined by the erosional channel leading down from the outfall.

COCs can enter the food chain through uptake by plant roots. COCs taken up by plant roots can be transported to aboveground tissues where they can be consumed by herbivores, which can in turn be eaten by predators. Once in the food web, COCs can be transported from the site by the movements of the organisms that contain them or other surficial transport mechanisms. However, because SWMU 227 occupies only a very small area (0.08 acre) with limited vegetative cover, food chain transport is expected to be of low significance at this site.

The COCs at SWMU 227 include both inorganic and organic analytes. The nonradiological inorganic COCs are elemental in form and not considered to be degradable. Transformations of these inorganic constituents could include changes in valence (oxidation/reduction reactions) or incorporation into organic forms (e.g., the conversion of selenite or selenate from soil to seleno-amino acids in plants). Radiological COCs will undergo decay to stable isotopes or radioactive daughter elements. However, because of the long half-lives of the radionuclides, the aridity of the environment at this site, and the lack of potential contact with biota, none of these mechanisms is expected to result in significant losses or transformations of the inorganic COCs.

The organic COCs at SWMU 227 may be subject to degradation through photolysis, hydrolysis, and biotransformation. Photolysis requires light, and therefore takes place in the air, at the ground surface, or in surface water. Hydrolysis includes chemical transformations in water and may occur in the soil solution. Biotransformation (i.e., transformation caused by plants, animals, and microorganisms) may occur; however, biological activity may be limited by the arid environment at this site. Some organic COCs (e.g., acetone, 2-butanone, 4-methyl-2-pentanone, and methylene chloride) may be lost through volatilization, with subsequent degradation in the air.

Table 9 summarizes the fate and transport processes that can occur at SWMU 227. COCs at this site include both radiological and nonradiological inorganic and organic analytes. For the reasons detailed above, wind and biota are considered to be of low significance as potential transport mechanisms at this site. Surface water may be of moderate significance. Significant leaching in the subsurface soil is unlikely and leaching into the groundwater at this site is highly unlikely. The potential for transformation of inorganic constituents is low, and loss through decay of radiological COCs is insignificant because of their long half-lives. For some organic compounds, loss through volatilization and eventual degradation may be of moderate significance.

Table 9
Summary of Fate and Transport at SWMU 227

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

SWMU = Solid Waste Management Unit

VI. Human Health Risk Assessment

VI.1 Introduction

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

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

VI.2 Step 1. Site Data

Section I of this risk assessment provides the site description and history for SWMU 227. Section II presents a comparison of results to DQOs. Section III discusses the nature, rate, and extent of contamination.

VI.3 Step 2. Pathway Identification

SWMU 227 has been designated with a future land use scenario of industrial (DOE et al. September 1995) (see Appendix 1 for default exposure pathways and parameters). However, the residential land use scenario is also considered in the pathway analysis. Because of the location and characteristics of the potential contaminants, the primary pathway for human exposure is considered to be soil ingestion for the nonradiological COCs and direct gamma exposure for the radiological COCs. The inhalation pathway for both nonradiological and radiological COCs is included because the potential exists to inhale dust and volatiles. Soil ingestion is included for the radiological COCs as well. The dermal pathway is included for the nonradiological COCs because of the potential exposure of the receptor to contaminated soil. No water pathways to the groundwater are considered. Depth to groundwater at SWMU 227 is approximately 270 feet bgs. No intake routes through plant, meat, or milk ingestion are considered appropriate for either the industrial or residential land use scenarios. Figure 1 shows the conceptual model flow diagram for SWMU 227.

Pathway Identification

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

VI.4 Step 3. Background Screening Procedure

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

VI.4.1 Methodology

Maximum concentrations of nonradiological COCs were compared to the approved SNL/NM maximum screening level for this area (Dinwiddie September 1997). The SNL/NM maximum background concentration was selected to provide the background screen in Table 5 and was used to calculate risk attributable to background in Sections VI.6.2 and VI.7. Only the COCs that were detected above the corresponding SNL/NM maximum background screening levels or did not have either a quantifiable or a calculated background screening level were considered in further risk assessment analyses.

For radiological COCs that exceeded the SNL/NM background screening levels, background values were subtracted from the individual maximum radionuclide concentrations. Those that did not exceed these background levels were not carried any further in the risk assessment. This approach is consistent with DOE Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE 1993). Radiological COCs that do not have a background screening value and were detected above the analytical minimum detectable activity (MDA) were carried through the risk assessment at their maximum levels. The resultant radiological COCs remaining after this step are referred to as background-adjusted radiological COCs.

VI.4.2 Results

Tables 5 and 7 show SWMU 227 maximum COC concentrations that were compared to the SNL/NM maximum background values (Dinwiddie September 1997) for the human health risk assessment. For the nonradiological COCs, four constituents were measured at concentrations greater than the corresponding background screening values, and six constituents do not have quantified background screening concentrations. Ten nonradiological COCs were organic compounds that do not have corresponding background screening values.

For the radiological COCs, two constituents (U-238 and Cs-137) had measured activity (or MDA) greater than their respective backgrounds.

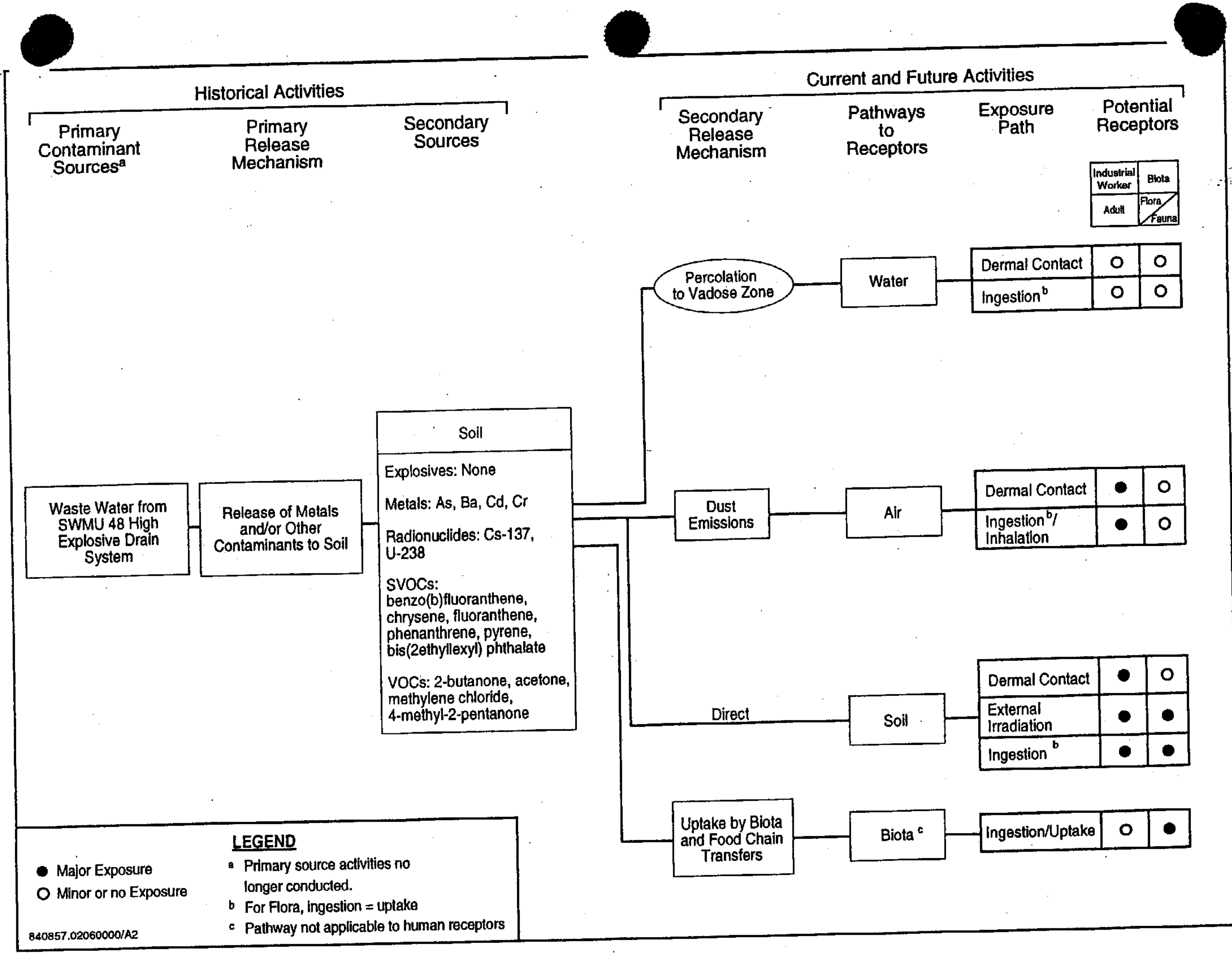

Figure 1

Conceptual Model Flow Diagram for SWMU 227

VI.5 Step 4. Identification of Toxicological Parameters

Tables 10 (nonradiological) and 11 (radiological) list the COCs retained in the risk assessment and the values for the available toxicological information. The toxicological values used for nonradiological COCs in Table 10 were obtained from the Integrated Risk Information System (IRIS) (EPA 2003), the EPA Region 6 (EPA 2002a), and the Risk Assessment Information System (ORNL 2003) electronic databases, as well as the Health Effects Assessment Summary Tables (HEAST) (EPA 1997a) and the Technical Background Document for Development of Soil Screening Levels (NMED December 2000). Dose conversion factors (DCFs) used in determining the excess TEDE values for radiological COCs for the individual pathways were the default values provided in the RESRAD computer code (Yu et al. 1993a) as developed in the following documents:

- DCFs for ingestion and inhalation were taken from "Federal Guidance Report No. 11, Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion" (EPA 1988).
- DCFs for surface contamination (contamination on the surface of the site) were taken from DOE/EH-0070, "External Dose-Rate Conversion Factors for Calculation of Dose to the Public" (DOE 1988).
- DCFs for volume contamination (exposure to contamination deeper than the immediate surface of the site) were calculated using the methods discussed in "Dose-Rate Conversion Factors for External Exposure to Photon Emitters in Soil" (Kocher 1983) and in ANL/EAIS-8, "Data Collection Handbook to Support Modeling the Impacts of Radioactive Material in Soil" (Yu et al. 1993b).

VI.6 Step 5. Exposure Assessment and Risk Characterization

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

VI.6.1 Exposure Assessment

Appendix 1 provides 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 the industrial and residential land use scenarios. The equations for nonradiological COCs are based upon the Risk Assessment Guidance for Superfund (RAGS) (EPA 1989). Parameters are based upon information from the RAGS (EPA 1989), the "Technical Background Document for Development of Soil Screening Levels" (NMED December 2000), as well as other EPA and NMED guidance documents, and reflect the reasonable maximum exposure (RME) approach advocated by the RAGS (EPA 1989). For

Table 10
Toxicological Parameter Values for SWMU 227 Nonradiological COCs

COC	RfD_o (mg/kg-d)	Confidence[a]	RfD_{inh} (mg/kg-d)	Confidence[a]	SF_o $(mg/kg\text{-}day)^{-1}$	SF_{inh} $(mg/kg\text{-}day)^{-1}$	Cancer Class[b]	ABS
Arsenic	3E-4[c]	M	–	–	1.5E+0[c]	1.5E+1[c]	A	0.03[d]
Barium	7E-2[c]	M	1.4E-4[e]	–	–	–	D	0.01[d]
Cadmium	5E-4[c]	H	5.7E-5[f]	–	–	6.3E+0[c]	B1	0.001[d]
Chromium, total	1.5E+0[c]	L	–	–	–	–	D	0.01[d]
Chromium VI	3E-3[c]	L	2.3E-6[c]	L	–	4.2E+1[c]	A	0.01[d]
Cyanide	2E-2[c]	M	–	–	–	–	D	0.1[d]
Mercury	3E-4[e]	–	8.6E-5[c]	M	–	–	D	0.01[d]
Nitrate plus Nitrite[g]	1.0E-1[c]	H	–	–	–	–	–	0.1[d]
Selenium	5E-3[c]	H	–	–	–	–	D	0.01[d]
Silver	5E-3[c]	L	–	–	–	–	D	0.01[d]
2-Butanone	6E-1[c]	L	2.9E-1[c]	L	–	–	D	0.1[d]
4-Methyl-2-pentanone	8E-2[e]	–	2.3E-2[e]	–	–	–	–	0.01[h]
Acetone	1E-1[c]	L	1E-1[f]	–	–	–	D	0.01[h]
Benzo(b)fluoranthene	–	–	–	–	7.3E-1[f]	3.1E-1[f]	B2	0.13[d]
bis(2-Ethylhexyl) phthalate	2E-2[f]	–	2E-2[f]	–	1.4E-2[f]	1.4E-2[f]	–	0.01[h]
Chrysene	–	–	–	–	7.3E-3[f]	3.1E-3[f]	B2	0.13[d]
Fluoranthene	4E-2[c]	L	4E-2[f]	–	–	–	D	0.13[d]
Methylene chloride	6E-2[c]	M	8.6E-1[e]	–	7.5E-3[c]	1.6E-3[c]	B2	0.1[d]
Phenanthrene[i]	3E-1[c]	L	3E-1[f]	–	–	–	D	0.1[d]
Pyrene	3E-2[c]	L	3E-2[f]	–	–	–	D	0.1[d]

Refer to footnotes at end of table.

Table 10 (Concluded)
Toxicological Parameter Values for SWMU 227 Nonradiological COCs

[a]Confidence associated with IRIS (EPA 2003) database values. Confidence: L = low, M = medium, H = high.
[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989) taken from IRIS (EPA 2003):
A = Human carcinogen.
B1 = Probable human carcinogen. Limited human data are available.
B2 = Probable human carcinogen. Indicates sufficient evidence in animals and inadequate or no evidence in humans.
D = Not classifiable as to human carcinogenicity.
[c]Toxicological parameter values from IRIS electronic database (EPA 2003).
[d]Toxicological parameter values from NMED December 2000.
[e]Toxicological parameter values from HEAST (EPA 1997a).
[f]Toxicological parameter values from EPA Region 6 electronic database (EPA 2002a).
[g]Assumed to be nitrite (most conservative).
[h]Toxicological parameter values from ORNL 2003.
[i]Toxicological parameter values for phenanthrene could not be found. Anthracene was used as a surrogate.

ABS = Gastrointestinal adsorption coefficient.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
HEAST = Health Effects Assessment Summary Tables.
IRIS = Integrated Risk Information System.
mg/kg-d = Milligram(s) per kilogram per day.
$(mg/kg\text{-}day)^{-1}$ = Per milligram per kilogram per day.
NMED = New Mexico Environmental Department.
ORNL = Oak Ridge National Laboratory.
RfD_{inh} = Inhalation chronic reference dose.
RfD_o = Oral chronic reference dose.
SF_{inh} = Inhalation slope factor.
SF_o = Oral slope factor.
SWMU = Solid Waste Management Unit.
– = Information not available.

Table 11
Toxicological Parameter Values for SWMU 227 Radiological COCs Obtained from RESRAD Risk Coefficients[a]

COC	SF_o (1/pCi)	SF_{inh} (1/pCi)	SF_{ev} (g/pCi-yr)	Cancer Class[b]
Cs-137	3.20E-11	1.90E-11	2.10E-06	A
U-238	6.20E-11	1.20E-08	6.60E-08	A

[a]From Yu et al. (1993a).
[b]EPA weight-of-evidence classification system for carcinogenicity (EPA 1989): A = Human carcinogen for high dose and high dose rate (i.e., greater than 50 rem per year). For low-level environmental exposures, the carcinogenic effect has not been observed and documented.
1/pCi = One per picocurie.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
g/pCi-yr = Gram(s) per picocurie per year.
SF_{ev} = External volume exposure slope factor.
SF_{inh} = Inhalation slope factor.
SF_o = Oral (ingestion) slope factor.
SWMU = Solid Waste Management Unit.

radiological COCs, the coded equations provided in the RESRAD computer code are used to estimate the incremental TEDE and cancer risk for individual exposure pathways. Further discussion of this process is provided in the *Manual for Implementing Residual Radioactive Material Guidelines Using RESRAD* (Yu et al. 1993a).

Although the designated land use scenario for this site is industrial, risk and TEDE values for a residential land use scenario are also presented.

VI.6.2 Risk Characterization

Table 12 shows an HI of 0.06 for the SWMU 227 nonradiological COCs and an estimated excess cancer risk of 4E-6 for the designated industrial land use scenario. The numbers presented include exposure from soil ingestion, dermal contact, and dust and volatile inhalation for nonradiological COCs. Table 13 shows an HI of 0.02 and an estimated excess cancer risk of 3E-6 for the designated industrial land use scenario.

For the radiological COCs, contribution from the direct gamma exposure pathway is included. For the industrial land use scenario, a TEDE was calculated for an individual who spends 4 hours per week on the site. This results in an incremental TEDE of 1.3E-1 millirem (mrem)/year (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 (industrial in this case); the calculated dose value for SWMU 227 for the industrial land use scenario is well below this guideline. The estimated excess cancer risk is 1.6E-6.

For the residential land use scenario nonradiological COCs, the HI is 0.5 and the estimated excess cancer risk is 2E-5 (Table 12). The numbers in the table include exposure from soil

Table 12
Risk Assessment Values for SWMU 227 Nonradiological COCs

COC	Maximum Concentration (mg/kg)	Industrial Land Use Scenario[a]		Residential Land Use Scenario[a]	
		Hazard Index	Cancer Risk	Hazard Index	Cancer Risk
Arsenic	5.9	0.02	4E-6	0.27	2E-5
Barium	210	0.00	–	0.04	–
Cadmium	2.9	0.01	9E-10	0.07	2E-9
Chromium, total	25.2	0.00	–	0.00	–
Chromium VI	0.092 J	0.00	2E-10	0.00	4E-10
Cyanide	0.159 J	0.00	–	0.00	–
Mercury	0.0106 J	0.00	–	0.00	–
Nitrate plus Nitrite	9.3	0.00	–	0.00	–
Selenium	0.864	0.00	–	0.00	–
Silver	0.25[b]	0.00	–	0.00	–
2-Butanone	0.0191	0.00	–	0.00	–
4-Methyl-2-pentanone	0.001 J	0.00	–	0.00	–
Acetone	0.0073	0.00	–	0.00	–
Benzo(b)fluoranthene	0.068 J	0.00	3E-8	0.00	1E-7
bis(2-Ethylhexyl) phthalate	0.0885	0.00	5E-10	0.00	2E-9
Chrysene	0.049 J	0.00	2E-10	0.00	8E-10
Fluoranthene	0.094 J	0.00	–	0.00	–
Methylene chloride	0.00105 J	0.00	7E-9	0.00	1E-8
Phenanthrene	0.084 J	0.03	–	0.10	–
Pyrene	0.062 J	0.00	–	0.00	–
Total		**0.06**	**4E-6**	**0.5**	**2E-5**

[a]From EPA (1989).
[b]Maximum concentration was one-half the detection limit.
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
J = Estimated value.
mg/kg = Milligram(s) per kilogram.
SWMU = Solid Waste Management Unit.
– = Information not available.

Table 13
Risk Assessment Values for SWMU 227 Nonradiological Background Constituents

COC	Background Concentration[a] (mg/kg)	Industrial Land Use Scenario[b] Hazard Index	Industrial Land Use Scenario[b] Cancer Risk	Residential Land Use Scenario[b] Hazard Index	Residential Land Use Scenario[b] Cancer Risk
Arsenic	4.4	0.02	3E-6	0.20	1E-5
Barium	200	0.00	–	0.04	–
Cadmium	<1	–	–	–	–
Chromium, total	12.8	0.00	–	0.00	–
Chromium VI	NC	–	–	–	–
Cyanide	NC	–	–	–	–
Mercury	<0.1	–	–	–	–
Nitrate plus Nitrite	NC	–	–	–	–
Selenium	<1	–	–	–	–
Silver	<1	–	–	–	–
Total		**0.02**	**3E-6**	**0.2**	**1E-5**

[a]From Dinwiddie (September 1997), North Supergroup.
[b]From EPA (1989).
COC = Constituent of concern.
EPA = U.S. Environmental Protection Agency.
mg/kg = Milligram(s) per kilogram.
NC = Background value not calculated.
SWMU = Solid Waste Management Unit.
– = Information not available.

ingestion, dermal contact, and dust and volatile inhalation. 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 13 shows that for the SWMU 227 associated background constituents, the HI is 0.2 and the estimated excess cancer risk is 1E-5.

For the radiological COCs, the incremental TEDE for the residential land use scenario is 3.4E-1 mrem/yr. The guideline being used is an excess TEDE of 75 mrem/yr (SNL/NM February 1998) for a complete loss of institutional controls (residential land use in this case); the calculated dose value for SWMU 227 for the residential land use scenario is well below this guideline. Consequently, SWMU 227 is eligible for unrestricted radiological release as the residential land use scenario resulted in an incremental TEDE of less than 75 mrem/yr to the on-site receptor. The estimated excess cancer risk is 4.4E-6. The excess cancer risk from the nonradiological COCs and the radiological COCs should be summed to provide risk estimates for persons exposed to both types of carcinogenic contaminants, as noted in OSWER Directive No. 9200-4-18 "Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination" (EPA 1997). This summation is tabulated in Section VI.9, Summary.

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

The human health risk assessment analysis evaluated the potential for adverse health effects for both the industrial land use scenario (the designated land use scenario for this site) and the residential land use scenario.

For the industrial land use scenario nonradiological COCs, the HI is 0.06 (less than the numerical guideline of 1 suggested in the RAGS [EPA 1989]). Excess cancer risk is estimated at 4E-6. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001). Thus the excess cancer risk for this site is below the suggested acceptable risk value. This assessment also determined risks considering background concentrations of the potential nonradiological COCs for both the industrial and residential land use scenarios. Under the industrial land use scenario, the HI is 0.02 and the excess cancer risk is 3E-6 for nonradiological COCs. Incremental risk is determined by subtracting risk associated with background from potential COC risk. These numbers are not rounded before the difference is determined and, therefore, may appear to be inconsistent with numbers presented in tables and within the text. For conservatism, the background constituents that do not have quantified background screening concentrations are assumed to have a hazard quotient (HQ) of 0.00. The incremental HI is 0.04 and the estimated incremental cancer risk is 1.04E-6 for the industrial land use scenario. These incremental risk calculations indicate insignificant risk to human health from nonradiological COCs considering an industrial land use scenario.

For radiological COCs under the industrial land use scenario, the incremental TEDE is 1.3E-1 mrem/yr, which is significantly less than EPA's numerical guideline of 15 mrem/yr. The incremental estimated excess cancer risk is 1.6E-6.

The calculated HI for the nonradiological COCs under the residential land use scenario is 0.5, which is below the numerical guidance. The excess cancer risk is estimated to be 2E-5. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (Bearzi January 2001). Thus the excess cancer risk for this site is above the suggested acceptable risk value. The HI for associated background for the residential land use scenario is 0.2; the estimated excess cancer risk is 1E-5. The incremental HI is 0.24 and the estimated incremental cancer risk is 1.01E-5 for the residential land use scenario. The incremental excess cancer risk calculation is slightly above the NMED guidelines considering a residential land use scenario.

The incremental TEDE from the radiological components under the residential land use scenario is 3.4E-1 mrem/yr, which is significantly less than the numerical guideline of 75 mrem/yr suggested in the SNL/NM "RESRAD Input Parameter Assumptions and Justification" (SNL/NM February 1998). The estimated excess cancer risk is 4.4E-6.

VI.8 Step 7. Uncertainty Discussion

The determination of the nature, rate, and extent of contamination at SWMU 227 was based upon an initial conceptual model that was validated with confirmatory soil sampling conducted across the site. The sampling was implemented in accordance with the two SAPs (SNL/NM June 1994 and SNL/NM February 2001). The DQOs in the SAPs are considered appropriate for use in the SWMU 227 risk assessment. The analytical data, based upon sample location, density, and depth, are representative of the site. The analytical results satisfy the DQOs and were verified/validated in accordance with SNL/NM procedures. The QA/QC findings demonstrate that the analytical data were of sufficient quality. Therefore, there is no uncertainty associated with the data quality used to perform the risk assessment at SWMU 227.

Because of the location, history of the site, and future land use (DOE et al. September 1995), there is low uncertainty in the land use scenario and the potentially affected populations that were considered in performing the risk assessment analysis. Because the COCs are found in surface and near-surface soil, and because of the location and physical characteristics of the site, there is little uncertainty in the exposure pathways relevant to the analysis.

An RME approach was used to calculate the risk assessment values. This means that the parameter values in the calculations are conservative and that calculated intakes are probably overestimated. Maximum measured values of COC concentrations are used to provide conservative results.

Table 10 shows the uncertainties (confidence level) in nonradiological toxicological parameter values. There is a mixture of estimated values and values from the IRIS (EPA 2003), HEAST (EPA 1997a), Technical Background Document for Development of Soil Screening Levels (NMED December 2000), the Risk Assessment Information System (ORNL 2003), and EPA Region 6 (EPA 2002a) electronic databases. Where values are not provided, information is not available from the HEAST (EPA 1997a), IRIS (EPA 2003), Technical Background Document for Development of Soil Screening Levels (NMED December 2000), the Risk Assessment Information System (ORNL 2003) or the EPA regions (EPA 2002a, EPA 2002b, EPA 2002c). Because of the conservative nature of the RME approach, uncertainties in toxicological values are not expected to change the conclusion from the risk assessment analysis.

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

Although the estimated excess cancer risk is slightly above the NMED guideline for the residential land use scenario, maximum concentrations were used in the risk calculation. Because the site has been adequately characterized, average concentrations are more representative of actual site conditions. The 95% upper confidence limit (UCL) of the average concentrations for arsenic, the main contributor to excess cancer risk (3.9 mg/kg), is below background and therefore eliminates arsenic from further evaluation. By eliminating the arsenic concentration, the total estimated excess cancer risk is reduced to 1E-7, and the incremental excess cancer risk is reduced to 1.15E-7. Thus, by using realistic concentrations in the risk calculations that more accurately depict actual site conditions, the incremental estimated excess cancer risk is below NMED guidelines.

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

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

VI.9 Summary

SWMU 227 contains identified COCs consisting of some inorganic, organic, and radiological compounds. Because of the location of the site, the designated industrial land use scenario, and the nature of contamination, potential exposure pathways identified for this site included soil ingestion, dermal contact, and dust and volatile inhalation for chemical COCs, and soil ingestion, dust inhalation, and direct gamma exposure for radionuclides. The same exposure pathways were applied to the residential land use scenario.

Using conservative assumptions and an RME approach to the risk assessment, calculations for nonradiological COCs show that for the industrial land use scenario the HI (0.06) is significantly less than the accepted numerical guidance from the EPA. The estimated excess cancer risk is 4E-6, also below the acceptable risk value provided by the NMED for an industrial land use scenario (Bearzi January 2001). The incremental HI is 0.04, and the incremental excess cancer risk is 1.04E-6 for the industrial land use scenario. The incremental risk calculations indicate insignificant risk to human health under an industrial land use scenario.

Using conservative assumptions and an RME approach to the risk assessment, calculations for nonradiological COCs show that for the residential land use scenario the HI (0.5) is also below the accepted numerical guidance from the EPA. The estimated excess cancer risk is 2E-5, which is above the acceptable risk value provided by the NMED for a residential land use scenario (Bearzi January 2001). The incremental HI is 0.24, and the incremental excess cancer risk is 1.01E-5 under the residential land use scenario.

Although the estimated excess cancer risk for the residential land use scenario is slightly above the NMED guideline, maximum concentrations were used in the risk calculation. Because the site has been adequately characterized, average concentrations are more representative of actual site conditions. The 95% UCL of the average concentrations for arsenic, the main contributor to excess cancer risk (3.9 mg/kg), is below background and therefore eliminates arsenic from further evaluation (Appendix 2). By eliminating the arsenic concentration, the total estimated excess cancer risk is reduced to 1E-7, and the incremental excess cancer risk is reduced to 1.15E-7. Thus, by using realistic concentrations in the risk calculations that more accurately depict actual site conditions, the incremental estimated excess cancer risk is below NMED guidelines.

The incremental TEDE and corresponding estimated cancer risk from radiological COCs are much less than EPA guidance values; the estimated TEDE is 1.3E-1 mrem/yr for the industrial land use scenario, much less than the EPA's numerical guidance of 15 mrem/yr (EPA 1997b). The corresponding incremental estimated cancer risk value is 1.6E-6 for the industrial land use scenario. Furthermore, the incremental TEDE for the residential land use scenario that results from a complete loss of institutional control is 3.4E-1 mrem/yr with an associated risk of 4.4E-6. The guideline for this scenario is 75 mrem/yr (SNL/NM February 1998). Therefore, SWMU 227 is eligible for unrestricted radiological release.

The summation of the nonradiological and radiological carcinogenic risks are tabulated in Table 14.

Table 14
Summation of Radiological and Nonradiological Risks from Site Carcinogens

Scenario	Nonradiological Risk	Radiologial Risk	Total Risk
Industrial	1.0E-6	1.6E-6	2.6E-6
Residential	1.2E-7	4.4E-6	4.5E-6

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

VII. Ecological Risk Assessment

VII.1 Introduction

This section addresses the ecological risks associated with exposure to constituents of potential ecological concern (COPECs) in soil at SWMU 227. A component of the NMED Risk-Based Decision Tree (NMED March 1998) is to conduct an ecological risk assessment that corresponds with that presented in EPA's Ecological RAGS (EPA 1997c). The current methodology is tiered and contains an initial scoping assessment followed by a more detailed ecological risk assessment. Initial components of NMED's decision tree (a discussion of DQOs, data assessment, and evaluations of bioaccumulation as well as fate and transport potential) are addressed in previous sections of this report. Following the completion of the scoping assessment, a determination is made as to whether a more detailed examination of potential ecological risk is necessary. If deemed necessary, the scoping assessment proceeds to a risk assessment whereby a more quantitative estimate of ecological risk is conducted. Although this assessment incorporates conservatisms in the estimation of ecological risks, ecological relevance and professional judgment also are used as recommended by the EPA (EPA 1998) to ensure that predicted exposures of selected ecological receptors reflect those reasonably expected to occur at the site.

VII.2 Scoping Assessment

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

VII.2.1 Data Assessment

As indicated in Section IV (Tables 6 and 8), inorganic constituents in soil within the 0- to 5-foot depth interval that exceeded background concentrations were as follows:

- Arsenic
- Barium
- Cadmium
- Chromium VI
- Mercury
- Nitrite and Nitrate
- Selenium
- Silver
- Cs-137
- U-235
- U-238

Organic analytes detected in soil were as follows:

- 2-Butanone
- 4-Methyl-2-pentanone
- Acetone
- Benzo(b)fluoranthene
- bis(2-Ethylhexyl) phthalate
- Chrysene
- Fluoranthene
- Phenanthrene
- Pyrene

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 6 and 8):

- Arsenic
- Barium
- Cadmium
- Mercury
- Selenium
- Benzo(b)fluoranthene
- bis(2-Ethylhexyl) phthalate
- Chrysene
- Fluoranthene
- Phenanthrene
- Pyrene
- Cs-137
- U-235
- U-238

It should be noted, however, that as directed by the NMED (NMED March 1998), bioaccumulation for inorganic constituents is assessed exclusively based upon maximum reported bioconcentration factors (BCFs) for aquatic species. Because only aquatic BCFs are used to evaluate the bioaccumulation potential for metals, bioaccumulation in terrestrial species is likely to be overpredicted.

VII.2.3 Fate and Transport Potential

The potential for the COPECs to migrate from the source of contamination to other media or biota is discussed in Section V. As noted in Table 9 (Section V), wind is expected to be of low significance as a transport mechanism for COPECs at this site, and surface-water runoff is potentially of moderate significance. Migration to groundwater is not anticipated. Food chain uptake is expected to be of low significance. Degradation (decay) and transformation of the inorganic COPECs and radionuclides are expected to be of low significance, but may be of moderate significance for the organic COPECs.

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 risk assessment was deemed necessary to predict the potential level of ecological risk associated with the site.

VII.3 Risk Assessment

As concluded in Section VII.2.4, both complete ecological pathways and COPECs are associated with this SWMU. The risk assessment performed for the site involves a quantitative estimate of current ecological risks using exposure models in association with exposure parameters and toxicity information obtained from the literature. The estimation of potential ecological risks is conservative to ensure that ecological risks are not underpredicted.

Components within the risk assessment include the following:

- Problem Formulation—sets the stage for the evaluation of potential exposure and risk.
- Exposure Estimation—provides a quantitative estimate of potential exposure.
- Ecological Effects Evaluation—presents benchmarks used to gauge the toxicity of COPECs to specific receptors.
- Risk Characterization—characterizes the ecological risk associated with exposure of the receptors to environmental media at the site.
- Uncertainty Assessment—discusses uncertainties associated with the estimation of exposure and risk.

- Risk Interpretation—evaluates ecological risk in terms of HQs and ecological significance.

- Risk Assessment Scientific/Management Decision Point—presents the decision to risk managers based upon the results of the risk assessment.

VII.3.1 Problem Formulation

Problem formulation is the initial stage of the ecological risk assessment that provides the introduction to the risk evaluation process. Components that are addressed in this section include a discussion of ecological pathways and the ecological setting, identification of COPECs, and selection of ecological receptors. The conceptual model, ecological food webs, and ecological endpoints (other components commonly addressed in an ecological risk assessment) are presented in the "Predictive Ecological Risk Assessment Methodology, Environmental Restoration Program, Sandia National Laboratories, New Mexico" (IT July 1998) and are not duplicated here.

VII.3.1.1 Ecological Pathways and Setting

SWMU 227 is approximately 0.08 acre in size. The site is located in an area dominated by grassland habitat. The southern exposure and sloping terrain of the site, however, result in a more arid microenvironment and a more limited vegetative cover than the grasslands of the adjacent mesa surfaces. The site is unpaved and open to use by wildlife. No threatened or endangered species are known to occur at this site (IT February 1995) and no surface-water bodies, seeps, or springs are associated with the site.

Complete ecological pathways may exist at this site through the exposure of plants and wildlife to COPECs in soil at this site. It was assumed that direct uptake of COPECs from soil is the major route of exposure for plants and that exposure of plants to wind-blown soil is minor. Exposure modeling for the wildlife receptors was limited to the food and soil ingestion pathways and external radiation. Because of the lack of surface water at this site, exposure to COPECs through the ingestion of surface water was considered insignificant. Inhalation and dermal contact were also considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Groundwater is not expected to be affected by COPECs at this site.

VII.3.1.2 COPECs

Discharges of waste water from the floor drains of Buildings 904, 913, and 914 were the primary sources of COPECs at SWMU 227. Inorganic and organic COPECs identified for SWMU 227 are listed in Section VII.2.1. The inorganic COPECs include both radiological and nonradiological analytes. The inorganic analytes were screened against background concentrations and those that exceeded the approved SNL/NM background screening levels (Dinwiddie September 1997) for the area were considered to be COPECs. Nonradiological inorganic constituents that are essential nutrients, such as iron, magnesium, calcium, potassium, and sodium, were not included in this risk assessment as set forth by the EPA (EPA 1989). All organic analytes detected within the upper 5 feet of soil were considered to be COPECs for the site. In order to provide conservatism, this ecological risk assessment was based upon the maximum soil concentrations of the COPECs measured in the upper 5 feet of soil at this site. Tables 6 and 8 present maximum concentrations for the COPECs.

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 associated with the site. The deer mouse (*Peromyscus maniculatus*) and the burrowing owl (*Speotyto cunicularia*) were used to represent wildlife use. Because of its opportunistic food habits, the deer mouse was used to represent a mammalian herbivore, omnivore, and insectivore. The burrowing owl was selected to represent a top predator at this site. The burrowing owl is present at SNL/NM and is designated a species of management concern by the U.S. Fish and Wildlife Service in Region 2, which includes the state of New Mexico (USFWS September 1995).

VII.3.2 Exposure Estimation

For nonradiological COPECs, direct uptake from the soil was considered the only significant route of exposure for terrestrial plants. Exposure modeling for the wildlife receptors was limited to food and soil ingestion pathways. Inhalation and dermal contact were considered insignificant pathways with respect to ingestion (Sample and Suter 1994). Drinking water was also considered an insignificant pathway because of the lack of surface water at this site. The deer mouse was modeled under three dietary regimes: as an herbivore (100 percent of its diet as plant material), as an omnivore (50 percent of its diet as plants and 50 percent as soil invertebrates), and as an insectivore (100 percent of its diet as soil invertebrates). The burrowing owl was modeled as a strict predator on small mammals (100 percent of its diet as deer mice). Because the exposure in the burrowing owl from a diet consisting of equal parts of herbivorous, omnivorous, and insectivorous mice would be equivalent to the exposure consisting of only omnivorous mice, the diet of the burrowing owl was modeled with intake of omnivorous mice only. Both species were modeled with soil ingestion comprising 2 percent of the total dietary intake. Table 15 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 1.0, implying that all food items and soil ingested come from the site being investigated. The maximum measured COPEC concentrations from the upper 5 feet of soil 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 Cs-137, U-235, and U-238. Internal and external dose rates to the deer mouse and the burrowing owl are approximated using modified dose-rate models from the DOE (DOE 1995) as presented in the ecological risk assessment methodology document for the SNL/NM ER Project (IT July 1998). Radionuclide-dependent data for the dose-rate

Table 15
Exposure Factors for Ecological Receptors at SWMU 227

Receptor Species	Class/Order	Trophic Level	Body Weight (kg)[a]	Food Intake Rate (kg/day)[b]	Dietary Composition[c]	Home Range (acres)
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Herbivore	2.39E-2[d]	3.72E-3	Plants: 100% (+ Soil at 2% of intake)	2.7E-1[e]
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Omnivore	2.39E-2[d]	3.72E-3	Plants: 50% Invertebrates: 50% (+ Soil at 2% of intake)	2.7E-1[e]
Deer Mouse (*Peromyscus maniculatus*)	Mammalia/ Rodentia	Insectivore	2.39E-2[d]	3.72E-3	Invertebrates: 100% (+ Soil at 2% of intake)	2.7E-1[e]
Burrowing owl (*Speotyto cunicularia*)	Aves/ Strigiformes	Carnivore	1.55E-1[f]	1.73E-2	Rodents: 100% (+ Soil at 2% of intake)	3.5E+1[g]

[a]Body weights are in kg wet weight.
[b]Food intake rates are estimated from the allometric equations presented in Nagy (1987). Units are kg dry weight per day.
[c]Dietary compositions are generalized for modeling purposes. Default soil intake value of 2% of food intake.
[d]From Silva and Downing (1995).
[e]EPA (1993), based upon the average home range measured in semiarid shrubland in Idaho.
[f]From Dunning (1993).
[g]From Haug et al. (1993).
EPA = U.S. Environmental Protection Agency.
kg = Kilogram(s).
SWMU = Solid Waste Management Unit.

calculations were obtained from Baker and Soldat (1992). The external dose-rate model examines the total-body dose rate to a receptor residing in soil exposed to radionuclides. The soil surrounding the receptor is assumed to be an infinite medium uniformly contaminated with gamma-emitting radionuclides. The external dose-rate model is the same for both the deer mouse and the burrowing owl. The internal total-body dose-rate model assumes that a fraction of the radionuclide concentration ingested by a receptor is absorbed by the body and concentrated at the center of a spherical body shape. This provides for a conservative estimate for absorbed dose. This concentrated radiation source at the center of the body of the receptor is assumed to be a "point" source. Radiation emitted from this point source is absorbed by the body tissues to contribute to the absorbed dose. Alpha and beta emitters are assumed to transfer 100 percent of their energy to the receptor as they pass through tissues. Gamma-emitting radionuclides transfer only a fraction of their energy to the tissues because gamma rays interact less with matter than do beta or alpha emitters. The external and internal dose-rate results are summed to calculate a total dose rate from exposure to Cs-137, U-235, and U-238 in soil.

Table 16 provides the transfer factors used in modeling the concentrations of COPECs through the food chain. Table 17 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 18 shows benchmark toxicity values for the plant and wildlife receptors. For plants, the benchmark soil concentrations are based upon the lowest-observed-adverse-effect level (LOAEL). For wildlife, the toxicity benchmarks are based upon the no-observed-adverse-effect level (NOAEL) for chronic oral exposure in a taxonomically similar test species. Sufficient toxicity information was not available to estimate the LOAELs or NOAELs for some COPECs.

The benchmark used for exposure of terrestrial receptors to radiation was 0.1 rad/day. This value has been recommended by the International Atomic Energy Agency (IAEA 1992) for the protection of terrestrial populations. Because plants and insects are less sensitive to radiation than vertebrates (Whicker and Schultz 1982), the dose of 0.1 rad/day should also protect other groups within the terrestrial habitat of SWMU 227.

VII.3.4 Risk Characterization

Maximum concentrations in soil and estimated dietary exposures were compared to plant and wildlife benchmark values, respectively. Table 19 presents the results of these comparisons. HQs are used to quantify the comparison with benchmarks for plant and wildlife exposure.

No HQs exceeded unity for plants, the herbivorous deer mouse, or the burrowing owl. For the omnivorous and insectivorous deer mice, HQs exceeded unity for arsenic and barium. Because of a lack of sufficient toxicity information, HQs for plants could not be determined for nitrite plus nitrate, 2-butanone, 4-methyl-2-pentanone, acetone, and bis(2-ethylhexyl) phthalate. Similarly, HQs could not be determined for the burrowing owl for chromium VI, silver, and all of the organic COPECs except bis(2-ethylhexyl) phthalate. As directed by the NMED, HIs were calculated for each of the receptors (the HI is the sum of chemical-specific HQs for all pathways

Table 16
Transfer Factors Used in Exposure Models for COPECs at SWMU 227

COPEC	Soil-to-Plant Transfer Factor	Soil-to-Invertebrate Transfer Factor	Food-to-Muscle Transfer Factor
Inorganic			
Arsenic	4.0E-2[a]	1.0E+0[b]	2.0E-3[a]
Barium	1.5E-1 [a]	1.0E+0 [b]	2.0E-4 [c]
Cadmium	5.5E-1 [a]	6.0E-1 [d]	5.5E-4 [a]
Chromium VI	4.0E-2 [c]	1.3E-1 [e]	3.0E-2 [c]
Mercury	1.0E+0 [c]	1.0E+0 [b]	2.5E-1 [a]
Nitrite + Nitrate	1.0E+0 [b]	1.0E+0 [b]	1.0E+0 [b]
Selenium	5.0E-1[c]	1.0E+0[b]	1.0E-1[c]
Silver	1.0E+0 [c]	2.5E-1[d]	5.0E-3 [c]
Organic [f]			
2-Butanone	2.6E+1	1.4E+1	3.7E-8
4-Methyl-2-pentanone	7.9E+0	1.5E+1	3.1E-7
Acetone	5.3E+1	1.3E+1	1.0E-8
Benzo(b)fluoranthene	6.2E-3	2.8E+1	1.1E-1
bis(2-Ethylhexyl) phthalate	1.6E-3	3.2E+1	1.3E+0
Chrysene	1.5E-2	2.6E+1	2.3E-2
Fluoranthene	5.7E-2	2.3E+1	2.1E-3
Phenanthrene	8.9E-2	2.2E+1	9.6E-4
Pyrene	3.3E-2	2.4E+1	5.8E-3

[a]From Baes et al. (1984).
[b]Default value.
[c]From NCRP (January 1989).
[d]From Stafford et al. (1991).
[e]From Ma (1982).
[f]Soil-to-plant and food-to-muscle transfer factors from equations developed in Travis and Arms (1988). Soil-to-invertebrate transfer factors from equations developed in Connell and Markwell (1990). All three equations based upon the relationship of the transfer factor to the Log K_{ow} value of compound.
COPEC = Constituent of potential ecological concern.
K_{ow} = Octanol-water partition coefficient.
Log = Logarithm (base 10).
NCRP = National Council on Radiation Protection and Measurements.
SWMU = Solid Waste Management Unit.

Table 17
Media Concentrations[a] for COPECs at SWMU 227

COPEC	Soil (maximum)[a]	Plant Foliage[b]	Soil Invertebrate[b]	Deer Mouse Tissues[c]
Inorganic				
Arsenic	5.9E+0	2.4E-1	5.9E+0	2.0E-2
Barium	2.1E+2	3.2E+1	2.1E+2	7.8E-2
Cadmium	2.9E+0	1.6E+0	1.7E+0	3.0E-3
Chromium VI	5.0E-1[d]	2.0E-2	6.5E-2	4.9E-3
Mercury	6.1E-3[e]	6.1E-3	6.1E-3	4.9E-3
Nitrite + Nitrate	9.3E+0	6.1E-3	6.1E-3	4.9E-3
Selenium	8.2E-1	9.3E+0	9.3E+0	3.0E+1
Silver	2.5E-1[d]	4.1E-1	8.2E-1	2.0E-1
Organic				
2-Butanone	7.0E-3[e]	1.8E-1	9.5E-2	1.6E-8
4-Methyl-2-pentanone	1.0E-3[e]	7.9E-3	1.5E-2	1.1E-8
Acetone	6.0E-3[e]	3.2E-1	7.7E-2	6.4E-9
Benzo(b)fluoranthene	6.8E-2[e]	4.2E-4	1.9E+0	3.4E-1
bis(2-Ethylhexyl) phthalate	2.6E-2[e]	4.1E-5	8.2E-1	1.7E+0
Chrysene	4.9E-2[e]	7.3E-4	1.3E+0	4.7E-2
Fluoranthene	9.4E-2[e]	5.4E-3	2.2E+0	7.2E-3
Phenanthrene	8.4E-2[e]	7.4E-3	1.9E+0	2.8E-3
Pyrene	6.2E-2[e]	2.0E-3	1.5E+0	1.4E-2

[a]In milligrams per kilogram. All biotic media are based upon dry weight of the media. Soil concentration measurements are assumed to have been based upon dry weight. Values have been rounded to two significant digits after calculation.
[b]Product of the soil concentration and the corresponding transfer factor.
[c]Based upon the deer mouse with an omnivorous diet. Product of the average concentration ingested in food and soil times the food-to-muscle transfer factor times a wet weight-dry weight conversion factor of 3.125 (EPA 1993).
[d]Maximum concentration of parameter was one-half the detection limit.
[e]Estimated value.
COPEC = Constituent of potential ecological concern.
EPA = U.S. Environmental Protection Agency.
SWMU = Solid Waste Management Unit.

Table 18
Toxicity Benchmarks for Ecological Receptors at SWMU 227

COPEC	Plant Benchmark[a,b]	Mammalian NOAELs			Avian NOAELs		
		Mammalian Test Species[c,d]	Test Species NOAEL[d,e]	Deer Mouse NOAEL[e,f]	Avian Test Species[d]	Test Species NOAEL[d,e]	Burrowing Owl NOAEL[e,g]
Inorganic							
Arsenic	10	Mouse	0.126	0.133	Mallard	5.14	5.14
Barium	500	Rat[h]	5.1	10.5	Chicken	20.8	20.8
Cadmium	3	Rat[i]	1.0	1.9	Mallard	1.45	1.45
Chromium VI	1	Rat	3.28	6.42	–	–	–
Mercury (Organic)	0.3	Rat	0.03	0.06	Mallard	0.0064	0.0064
Mercury (Inorganic)	0.3	Mouse	13.2	14.0	Japanese quail	0.45	0.45
Nitrite + Nitrate	–	Guinea pig	78.2[j]	192	Turkey	4.92[k]	4.92
Selenium	1	Rat	0.2	0.391	Screech owl	0.44	0.44
Silver	2	Rat	17.8[l]	34.8	–	–	–
Organic							
2-Butanone	–	Rat	1771	3,464	–	–	–
4-Methyl-2-pentanone	–	Rat	1346[m]	2,633	–	–	–
Acetone	–	Rat	10	19.6	–	–	–
Benzo(b)fluoranthene	18[n]	Mouse	1.0[o]	1.1	–	–	–
bis(2-Ethylhexyl) phthalate	–	Mouse	18.3	19.4	Ringed dove	1.1	1.1
Chrysene	18[n]	Mouse	1.0[o]	1.1	–	–	–
Fluoranthene	18[n]	Mouse	12.5[p]	13.2	–	–	–
Phenanthrene	18[n]	Mouse	1.0[o]	1.1	–	–	–
Pyrene	18[n]	Mouse	7.5[p]	7.9	–	–	–

Refer to footnotes at end of table.

Table 18 (Concluded)
Toxicity Benchmarks for Ecological Receptors at SWMU 227

[a]In mg/kg soil dry weight.
[b]From Efroymson et al. (1997).
[c]Body weights (in kg) for the NOAEL conversion are as follows: lab mouse, 0.030; lab rat, 0.350; guinea pig, 0.86 (except where noted).
[d]From Sample et al. (1996), except where noted.
[e]In mg/kg body weight per day.
[f]Based upon NOAEL conversion methodology presented in Sample et al. (1996), using a deer mouse body weight of 0.0239 kg and a mammalian scaling factor of 0.25.
[g]Based upon NOAEL conversion methodology presented in Sample et al. (1996). The avian scaling factor of 0.0 was used, making the NOAEL independent of body weight.
[h]Body weight: 0.435 kg.
[i]Body weight: 0.303 kg.
[j]From NLM (2003), based upon nitrite.
[k]From NLM (2003), based upon nitrate.
[l]Based upon a rat LOAEL of 89 mg/kg/d (EPA 2003) and an uncertainty factor of 0.2.
[m]Based upon NOAEL for 2-butanone and the ratio of LD_{50} values for 4-methyl-2-pentanone and 2-butanone (Micromedex 1998).
[n]From Sims and Overcash (1983).
[o]No data available. Toxicity value based upon NOAEL for benzo(a)pyrene.
[p]From EPA (2003).

COPEC	= Constituent of potential ecological concern.
kg	= Kilogram(s).
LD_{50}	= Lethal dose to 50% of the population.
LOAEL	= Lowest-observed-adverse-effect level.
mg	= Milligram(s).
mg/kg/d	= Milligram(s) per kilogram per day.
NOAEL	= No-observed-adverse-effect level.
SWMU	= Solid Waste Management Unit.
–	= Insufficient toxicity data.

Table 19
HQs for Ecological Receptors at SWMU 227

COPEC	Plant HQ	Deer Mouse HQ (Herbivorous)	Deer Mouse HQ (Omnivorous)	Deer Mouse HQ (Insectivorous)	Burrowing Owl HQ
Inorganic					
Arsenic	5.9E-1	4.1E-1	**3.7E+0**	**7.0E+0**	3.0E-3
Barium	4.2E-1	5.3E-1	**1.8E+0**	**3.2E+0**	2.3E-2
Cadmium	9.7E-1	1.4E-1	1.4E-1	1.5E-1	4.7E-3
Chromium VI	5.0E-1	7.3E-4	1.3E-3	1.8E-3	–
Mercury (Organic)	2.0E-2	1.5E-2	1.5E-2	1.5E-2	8.7E-2
Mercury (Inorganic)	2.0E-2	6.9E-5	6.9E-5	6.9E-5	1.2E-3
Nitrite + Nitrate	–	7.7E-3	7.7E-3	7.7E-3	6.8E-1
Selenium	8.2E-1	1.7E-1	2.5E-1	3.3E-1	5.4E-2
Silver	1.3E-1	1.1E-3	7.2E-4	3.0E-4	–
Organic					
2-Butanone	–	8.3E-6	6.3E-6	4.3E-6	–
4-Methyl-2-pentanone	–	4.7E-7	6.8E-7	8.9E-7	–
Acetone	–	2.5E-3	1.6E-3	6.1E-4	–
Benzo(b)fluoranthene	3.8E-3	2.6E-4	1.4E-1	2.8E-1	–
bis(2-Ethylhexyl) phthalate	–	4.5E-6	3.3E-3	6.6E-3	1.7E-1
Chrysene	2.7E-3	2.5E-4	9.4E-2	1.9E-1	–
Fluoranthene	5.2E-3	8.5E-5	1.3E-2	2.6E-2	–
Phenanthrene	4.7E-3	1.3E-3	1.4E-1	2.8E-1	–
Pyrene	3.4E-3	6.4E-5	1.5E-2	3.0E-2	–
HI[a]	**3.5E+0**	**1.3E+0**	**6.4E+0**	**1.1E+1**	1.0E+0

Note: **Bold** values indicate the HQ or HI exceeds unity.
[a]The HI is the sum of individual HQs.
COPEC = Constituent of potential ecological concern.
HI = Hazard index.
HQ = Hazard quotient.
SWMU = Solid Waste Management Unit.
– = Insufficient toxicity data available for risk estimation purposes.

for a given receptor). All receptors, except the burrowing owl, had total HIs greater than unity, with a maximum HI of 11 for the insectivorous deer mouse.

Tables 20 and 21 summarize the internal and external dose-rate model results for Cs-137, U-235, and U-238 for the deer mouse and burrowing owl, respectively. The total radiation dose rate to the deer mouse was predicted to be 4.5E-4 rad/day and that for the burrowing owl was 4.3E-4 rad/day. The dose rates for the deer mouse and the burrowing owl are less than the benchmark of 0.1 rad/day.

Table 20
Total Dose Rates for Deer Mice Exposed to Radionuclides at SWMU 227

Radionuclide	Maximum Activity (pCi/g)	Total Dose (rad/day)
Cs-137	0.296	2.27E-5
U-235	ND (0.44)	1.19E-5
U-238	2.54	4.11E-4
Total Dose		4.46E-4

MDA = Minimum detectable activity.
ND ( ) = Not detected above the MDA, shown in parentheses.
pCi/g = Picocurie(s) per gram.
SWMU = Solid Waste Management Unit.

Table 21
Total Dose Rates for Burrowing Owls Exposed to Radionuclides at SWMU 227

Radionuclide	Maximum Activity (pCi/g)	Total Dose (rad/day)
Cs-137	0.296	1.95E-5
U-235	ND (0.44)	9.1E-6
U-238	2.54	3.96E-4
Total Dose		4.25E-4

MDA = Minimum detectable activity.
ND ( ) = Not detected above the MDA, shown in parentheses.
pCi/g = Picocurie(s) per gram.
SWMU = Solid Waste Management Unit.

VII.3.5 Uncertainty Assessment

Many uncertainties are associated with the characterization of ecological risks at SWMU 227. These uncertainties result from assumptions used in calculating risk that could overestimate or underestimate true risk presented at the site. For this risk assessment, assumptions are made that are more likely to overestimate exposures and risk rather than to underestimate them. These conservative assumptions are used to be more protective of the ecological resources potentially affected by the site. Conservatisms incorporated into this risk assessment include the use of maximum analyte concentrations measured in soil to evaluate risk, the use of wildlife toxicity benchmarks based upon NOAEL values, and the incorporation of strict herbivorous and strict insectivorous diets for predicting the extreme HQ values for the deer mouse. Each of these uncertainties, which are consistent among each of the SWMU-specific ecological risk assessments, is discussed in greater detail in the uncertainty section of the ecological risk assessment methodology document for the SNL/NM ER Project (IT July 1998).

Uncertainties associated with the estimation of risk to ecological receptors following exposure to Cs-137, 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. The dose-rate models used for these calculations are based upon conservative estimates on receptor shape, radiation absorption by body tissues, and intake parameters. The goal is to provide a realistic but conservative estimate of a receptor's internal and external exposure to radionuclides in soil.

In the estimation of ecological risk, background concentrations are included as a component of maximum on-site concentrations. Conservatisms in the modeling of exposure and risk can result in the prediction of risk to ecological receptors when exposed at background concentrations. As shown in Table 22, HQs associated with exposures to background are greater than 1.0 for arsenic and barium. In these two cases, background may account for approximately 75 and 95 percent of the HQ values, respectively. Therefore, it is likely that the actual risks from arsenic and barium at SWMU 227 are overestimated by the HQs calculated in this risk assessment because of conservatisms incorporated into the exposure assessment and in the toxicity benchmarks for these COPECs (e.g., the use of NOAELs for wildlife receptors).

A significant source of uncertainty associated with the prediction of ecological risks at this site is the use of the maximum measured concentrations to evaluate exposure and risk. This results in a conservative exposure scenario that does not necessarily reflect actual site conditions. To assess the potential degree of overestimation caused by using the maximum measured soil concentrations in the exposure assessment, the 95% UCL of the mean soil concentration was calculated for each of the COPECs with HQs greater than unity to determine whether these HQs could be accounted for by the magnitude of the extreme measurement. The 95% UCLs of arsenic and barium (4.29 and 169 mg/kg, respectively) were found to be less than their corresponding background screening values. Therefore, risks from exposures to these COPECs at SWMU 227 are likely to be within the background levels as shown in Table 22. These results indicate that the predictions of potential risk to ecological receptors for arsenic and barium are primarily due to the use of the maximum values as the exposure point concentration for the entire site. When exposure is based upon a site wide average, as conservatively estimated by the 95% UCL of the mean, the potential for risk from these COPECs can be considered to be within the range of background.

Based upon this uncertainty analysis, the potential for ecological risks at SWMU 227 is expected to be 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 and the contribution of background risk.

VII.3.6 Risk Interpretation

Ecological risks associated with SWMU 227 were estimated through a risk assessment that incorporated site-specific information when available. Initial predictions of potential risk to the

Table 22
HQs for Ecological Receptors Exposed to Background Concentrations at SWMU 227

COPEC	Plant HQ	Deer Mouse HQ (Herbivorous)	Deer Mouse HQ (Omnivorous)	Deer Mouse HQ (Insectivorous)	Burrowing Owl HQ
Inorganic					
Arsenic	4.4E-1	3.1E-1	**2.8E+0**	**5.2E+0**	2.2E-3
Barium	4.0E-1	5.0E-1	**1.8E+0**	**3.0E+0**	2.2E-2
Cadmium	1.7E-1	2.4E-2	2.5E-2	2.6E-2	8.1E-4
Chromium VI	NC	NC	NC	NC	NC
Mercury (Organic)	1.7E-1	1.3E-1	1.3E-1	1.3E-1	7.1E-1
Nitrite + Nitrate	NC	NC	NC	NC	NC
Selenium	5.0E-1	1.0E-1	1.5E-1	2.0E-1	3.3E-2
Silver	2.5E-1	2.3E-3	1.4E-3	6.0E-4	–
HI[a]	**1.9E+0**	**1.1E+0**	**4.8E+0**	**8.6E+0**	7.7E-1

Note: **Bold** values indicate the HQ or HI exceeds unity.
[a]The HI is the sum of individual HQs.
COPEC = Constituent of potential ecological concern.
HI = Hazard index.
HQ = Hazard quotient.
NC = Background value not calculated.
SWMU = Solid Waste Management Unit.
– = Insufficient toxicity data available for risk estimation purposes.

deer mouse from exposures to arsenic and barium were based upon exposure calculations using maximum detected values. However, 75 and 95 percent of these maximum concentrations, respectively, can be attributed to background, and the 95% UCLs of the mean concentration of arsenic and barium were found to be within the background range. Based upon this final analysis, ecological risks associated with SWMU 227 are expected to be low and within the range of background.

VII.3.7 Risk Assessment Scientific/Management Decision Point

After potential ecological risks associated with the site have been assessed, a decision is made regarding whether the site should be recommended for NFA or whether additional data should be collected to assess actual ecological risk at the site more thoroughly. With respect to this site, ecological risks are predicted to be low. The scientific/management decision is to recommend this site for NFA.

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APPENDIX 1
EXPOSURE PATHWAY DISCUSSION FOR CHEMICAL AND RADIONUCLIDE CONTAMINATION

Introduction

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

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

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

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

- Ingestion of contaminated drinking water
- Ingestion of contaminated soil

- Ingestion of contaminated fish and shellfish
- Ingestion of contaminated fruits and vegetables
- Ingestion of contaminated meat, eggs, and dairy products
- Ingestion of contaminated surface water while swimming
- Dermal contact with chemicals in water
- Dermal contact with chemicals in soil
- Inhalation of airborne compounds (vapor phase or particulate)
- External exposure to penetrating radiation (immersion in contaminated air; immersion in contaminated water; and exposure from ground surfaces with photon-emitting radionuclides)

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

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

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

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

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

Table 1
Exposure Pathways Considered for Various Land Use Scenarios

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

Equations and Default Parameter Values for Identified Exposure Routes

In general, SNL/NM expects that ingestion of compounds in drinking water and soil will be the more significant exposure routes for chemicals; external exposure to radiation may also be significant for radionuclides. All of the above routes will, however, be considered for their appropriate land use scenarios. The general equation for calculating potential intakes via these routes is shown below. The equations are taken from "Assessing Human Health Risks Posed by Chemicals: Screening-Level Risk Assessment" (NMED March 6, 2000) and "Technical Background Document for Development of Soil Screening Levels" (NMED December 18, 2000). Equations from both documents are based upon the "Risk Assessment Guidance for Superfund" (RAGS): Volume 1 (EPA 1989, EPA 1991). These general equations also apply to calculating potential intakes for radionuclides. A more in-depth discussion of the equations used in performing radiological pathway analyses with the RESRAD code may be found in the RESRAD Manual (ANL 1993). RESRAD is the only code designated by the U.S. Department of Energy (DOE) in DOE Order 5400.5 for the evaluation of radioactively contaminated sites (DOE 1993). The Nuclear Regulatory Commission (NRC) has approved the use of RESRAD for dose evaluation by licensees involved in decommissioning, NRC staff evaluation of waste disposal requests, and dose evaluation of sites being reviewed by NRC staff. EPA Science Advisory Board reviewed the RESRAD model. EPA used RESRAD in their rulemaking on radiation site cleanup regulations. RESRAD code has been verified, undergone several benchmarking analyses, and been included in the International Atomic Energy Agency's VAMP and BIOMOVS II projects to compare environmental transport models.

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

Generic Equation for Calculation of Risk Parameter Values

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

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

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

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.

For nonradiological constituents of concern (COCs), the total risk/dose (either cancer risk or HI) is the sum of the risks/doses for all of the site-specific exposure pathways and contaminants. For radionuclides, the calculated radiation exposure, expressed as TEDE is compared directly to the exposure guidelines of 15 millirem per year (mrem/year) for industrial and recreational future use and 75 mrem/year for the unlikely event that institutional control of the site is lost and the site is used for residential purposes (EPA 1997).

The evaluation of the carcinogenic health hazard produces a quantitative estimate for excess cancer risk resulting from the COCs present at the site. This estimate is evaluated for determination of further action by comparison of the quantitative estimate with the potentially acceptable risk of 1E-5 for nonradiological carcinogens. The evaluation of the noncarcinogenic health hazard produces a quantitative estimate (i.e., the HI) for the toxicity resulting from the COCs present at the site. This estimate is evaluated for determination of further action by comparison of this quantitative estimate with the EPA standard HI of unity (1). The evaluation of the health hazard from radioactive compounds produces a quantitative estimate of doses resulting from the COCs present at the site. This estimated dose is used to calculate an assumed risk. However, this calculated risk is presented for illustration purposes only, not to determine compliance with regulations.

The specific equations used for the individual exposure pathways can be found in RAGS (EPA 1989) and are outlined below. The RESRAD Manual (ANL 1993) describes similar equations for the calculation of radiological exposures.

Soil Ingestion

A receptor can ingest soil or dust directly by working in the contaminated soil. Indirect ingestion can occur from sources such as unwashed hands introducing contaminated soil to food that is then eaten. An estimate of intake from ingesting soil will be calculated as follows:

$$I_s = \frac{C_s * IR * CF * EF * ED}{BW * AT}$$

where:

I_s = Intake of contaminant from soil ingestion (milligrams [mg]/kilogram [kg]-day)
C_s = Chemical concentration in soil (mg/kg)
IR = Ingestion rate (mg soil/day)
CF = Conversion factor (1E-6 kg/mg)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

It should be noted that it is conservatively assumed that the receptor only ingests soil from the contaminated source.

Soil Inhalation

A receptor can inhale soil or dust directly by working in the contaminated soil. An estimate of intake from inhaling soil will be calculated as follows (EPA August 1997):

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

where:

I_s = Intake of contaminant from soil inhalation (mg/kg-day)
C_s = Chemical concentration in soil (mg/kg)
IR = Inhalation rate (cubic meters [m^3]/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
VF = soil-to-air volatilization factor (m^3/kg)
PEF = particulate emission factor (m^3/kg)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

Soil Dermal Contact

$$D_a = \frac{C_s * CF * SA * AF * ABS * EF * ED}{BW * AT}$$

where:

D_a = Absorbed dose (mg/kg-day)
C_s = Chemical concentration in soil (mg/kg)
CF = Conversion factor (1E-6 kg/mg)
SA = Skin surface area available for contact (cm^2/event)
AF = Soil to skin adherence factor (mg/cm^2)
ABS = Absorption factor (unitless)
EF = Exposure frequency (events/year)

ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

Groundwater Ingestion

A receptor can ingest water by drinking it or through using household water for cooking. An estimate of intake from ingesting water will be calculated as follows (EPA August 1997):

$$I_w = \frac{C_w * IR * EF * ED}{BW * AT}$$

where:

I_w = Intake of contaminant from water ingestion (mg/kg/day)
C_w = Chemical concentration in water (mg/liter [L])
IR = Ingestion rate (L/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged) (days)

Groundwater Inhalation

The amount of a constituent taken into the body via exposure to volatilization from showering or other household water uses will be evaluated using the concentration of the constituent in the water source (EPA 1991 and 1992). An estimate of intake from volatile inhalation from groundwater will be calculated as follows (EPA 1991):

$$I_w = \frac{C_w * K * IR_i * EF * ED}{BW * AT}$$

where:

I_w = Intake of volatile in water from inhalation (mg/kg/day)
C_w = Chemical concentration in water (mg/L)
K = volatilization factor (0.5 L/m^3)
IR_i = Inhalation rate (m^3/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (period over which exposure is averaged—days)

For volatile compounds, volatilization from groundwater can be an important exposure pathway from showering and other household uses of groundwater. This exposure pathway will only be evaluated for organic chemicals with a Henry's Law constant greater than 1 X 10^{-5} and with a molecular weight of 200 grams/mole or less (EPA 1991).

Tables 2 and 3 show the default parameter values suggested for use by SNL/NM at SWMUs, based upon the selected land use scenarios for nonradiological and radiological COCs, respectively. References are given at the end of the table indicating the source for the chosen parameter values. SNL/NM uses default values that are consistent with both regulatory guidance and the RME approach. Therefore, the values chosen will, in general, provide a conservative estimate of the actual risk parameter. These parameter values are suggested for use for the various exposure pathways, based upon the assumption that a particular site has no unusual characteristics that contradict the default assumptions. For sites for which the assumptions are not valid, the parameter values will be modified and documented.

Summary

SNL/NM will use the described default exposure routes and parameter values in risk assessments at sites that have an industrial, recreational, or residential future land use scenario. There are no current residential land use designations at SNL/NM ER sites, but NMED has requested this scenario to be considered to provide perspective of the risk under the more restrictive land use scenario. For sites designated as industrial or recreational land use, SNL/NM will provide risk parameter values based upon a residential land use scenario to indicate the effects of data uncertainty on risk value calculations or in order to potentially mitigate the need for institutional controls or restrictions on SNL/NM ER sites. The parameter values are based upon EPA guidance and supplemented by information from other government sources. If these exposure routes and parameters are acceptable, SNL/NM will use them in risk assessments for all sites where the assumptions are consistent with site-specific conditions. All deviations will be documented.

Table 2
Default Nonradiological Exposure Parameter Values for Various Land Use Scenarios

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure Frequency (day/yr)	250[a,b]	8.7 (4 hr/wk for 52 wk/yr)[a,b]	350[a,b]
Exposure Duration (yr)	25[a,b,c]	30[a,b,c]	30[a,b,c]
Body Weight (kg)	70[a,b,c]	70 Adult[a,b,c] 15 Child[a,b,c]	70 Adult[a,b,c] 15 Child[a,b,c]
Averaging Time (days) for Carcinogenic Compounds (= 70 yr x 365 day/yr) for Noncarcinogenic Compounds (= ED x 365 day/yr)	25,550[a,b] 9,125[a,b]	25,550[a,b] 10,950[a,b]	25,550[a,b] 10,950[a,b]
Soil Ingestion Pathway			
Ingestion Rate (mg/day)	100[a,b]	200 Child[a,b] 100 Adult[a,b]	200 Child[a,b] 100 Adult[a,b]
Inhalation Pathway			
Inhalation Rate (m^3/day)	20[a,b]	15 Child[a] 30 Adult[a]	10 Child[a] 20 Adult[a]
Volatilization Factor (m^3/kg)	Chemical Specific	Chemical Specific	Chemical Specific
Particulate Emission Factor (m^3/kg)	1.36E9[a]	1.36E9[a]	1.36E9[a]
Water Ingestion Pathway			
Ingestion Rate (liter/day)	2.4[a]	2.4[a]	2.4[a]
Dermal Pathway			
Skin Adherence Factor (mg/cm^2)	0.2[a]	0.2 Child[a] 0.07 Adult[a]	0.2 Child[a] 0.07 Adult[a]
Exposed Surface Area for Soil/Dust (cm^2/day)	3,300[a]	2,800 Child[a] 5,700 Adult[a]	2,800 Child[a] 5,700 Adult[a]
Skin Adsorption Factor	Chemical Specific	Chemical Specific	Chemical Specific

[a]Technical Background Document for Development of Soil Screening Levels (NMED December 2000).
[b]Risk Assessment Guidance for Superfund, Vol. 1, Part B (EPA 1991).
[c]Exposure Factors Handbook (EPA August 1997).
ED = Exposure duration.
EPA = U.S. Environmental Protection Agency.
hr = Hour(s).
kg = Kilogram(s).
m = Meter(s).
mg = Milligram(s).
NA = Not available.
wk = Week(s).
yr = Year(s).

Table 3
Default Radiological Exposure Parameter Values for Various Land Use Scenarios

Parameter	Industrial	Recreational	Residential
General Exposure Parameters			
Exposure Frequency	8 hr/day for 250 day/yr	4 hr/wk for 52 wk/yr	365 day/yr
Exposure Duration (yr)	25[a,b]	30[a,b]	30[a,b]
Body Weight (kg)	70 Adult[a,b]	70 Adult[a,b]	70 Adult[a,b]
Soil Ingestion Pathway			
Ingestion Rate	100 mg/day[c]	100 mg/day[c]	100 mg/day[c]
Averaging Time (days) (= 30 yr x 365 day/yr)	10,950[d]	10,950[d]	10,950[d]
Inhalation Pathway			
Inhalation Rate (m^3/yr)	7,300[d,e]	10,950[e]	7,300[d,e]
Mass Loading for Inhalation g/m^3	1.36E-5[d]	1.36E-5[d]	1.36E-5[d]
Food Ingestion Pathway			
Ingestion Rate, Leafy Vegetables (kg/yr)	NA	NA	16.5[c]
Ingestion Rate, Fruits, Non-Leafy Vegetables & Grain (kg/yr)	NA	NA	101.8[b]
Fraction Ingested	NA	NA	0.25[b,d]

[a]Risk Assessment Guidance for Superfund, Vol. 1, Part B (EPA 1991).
[b]Exposure Factors Handbook (EPA August 1997).
[c]EPA Region VI guidance (EPA 1996).
[d]For radionuclides, RESRAD (ANL 1993).
[e]SNL/NM (February 1998).
EPA = U.S. Environmental Protection Agency.
g = Gram(s).
hr = Hour(s).
kg = Kilogram(s).
m = Meter(s).
mg = Milligram(s).
NA = Not applicable.
wk = Week(s).
yr = Year(s).

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APPENDIX 2
CALCULATION OF THE UPPER CONFIDENCE LIMITS OF MEAN CONCENTRATIONS

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

References

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ATTACHMENT H
SWMU 227—Site Conceptual Model

Site Conceptual Model for SWMU 227

The site conceptual model for Solid Waste Management Unit (SWMU) 227 is based upon historical records, aerial photography, engineering drawings, hydrogeologic studies, and the sampling of soil, soil-vapor, and groundwater. This section summarizes the nature and extent of contamination and the environmental fate of the contaminants of concern (COCs).

Nature and Extent of Contamination

The source of COCs was the disposal of Technical Area (TA)-II waste water from the SWMU 48 high explosive (HE) drain system. Waste water was discharged to the SWMU 227 outfall ditch from 1947 through 1992. Historical records indicate that the waste water possibly contained metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), HE compounds, and radionuclides. For risk assessment purposes, metal and radionuclide COCs were determined by comparing the soil sample results to background concentrations previously established for the North Area Supergroup (Dinwiddie September 1997). Any metal or radionuclide found to exceed background was considered to be a COC. Therefore, the metal COCs for SWMU 227 are arsenic, barium, cadmium, and chromium (Table A-1 in Attachment A of this SNL/NM ER Project Response to NMED Notice of Deficiency for SWMUs 227 and 229 Proposals for No Further Action Dated June 1995 [NOD Response]). The radionuclide COCs are cesium-137 and uranium-238. All detected VOCs and SVOCs were considered to be COCs. The VOCs include 2-butanone, acetone, methylene chloride, and 4-methyl-2-pentanone. The SVOCs include benzo(b)fluoranthene, chrysene, fluoranthene, phenanthrene, pyrene, and bis(2-ethylhexyl) phthalate. Table A-1 also summarizes basic statistics and the sample locations for all detected VOCs and SVOCs, as well as the metals and radionuclides that exceeded background concentrations.

Environmental Fate

Confirmatory soil samples were collected from the SWMU 227 outfall ditch where the waste water discharged. Because the disposal of waste water was discontinued in 1993 when the SWMU 48 HE drain system was removed from service, only secondary sources of COCs remain in the form of residual contaminants (metals, radionuclides, VOCs, and SVOCs) in SWMU 227 soil. The secondary release mechanisms at SWMU 227 are COC dissolution, percolation through the soil, direct contact with soil (radionuclides only), VOC vapor emanations, dust emissions, and uptake of COCs by biota (Figure H-1).

Surface-water runoff is considered to be a viable exposure mechanism because SWMU 227 is located on the steep northern rim of Tijeras Arroyo. However, the area surrounding SWMU 227 has historically been sloped so that surface water was not directed to the outfall ditch. Historical aerial photographs show that only minor amounts of soil erosion have occurred during the last 50 years at SWMU 227. The arid climate also limits soil erosion. The average annual precipitation is 8.1 inches (NOAA 1990). SWMU 227 is located outside the Tijeras Arroyo 100-year floodplain and more than 1,500 feet west of the active channel.

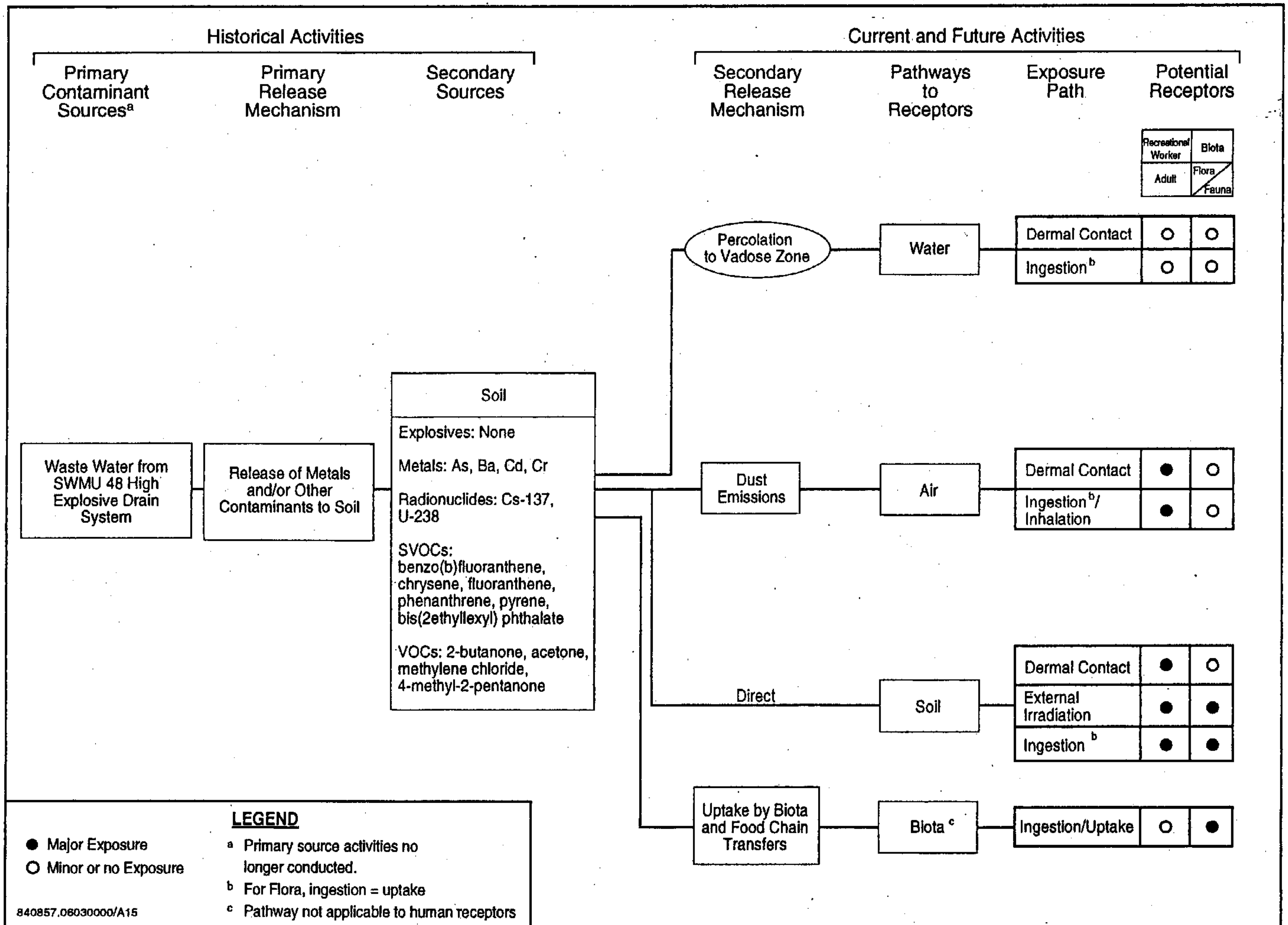

Figure H-1

Conceptual Site Model Flow Diagram for SWMU 227

Groundwater is not considered to be a possible exposure mechanism because the depth to groundwater at SWMU 227 is significant (approximately 270 feet below ground surface [bgs] for the perched system and 470 feet bgs for the regional aquifer) (SNL/NM November 2002).

The soil at SWMU 227 is poorly developed with high alkalinity (USDA 1977). The vadose zone is comprised of relatively impermeable carbonate-rich soil horizons and impermeable carbonate-cemented (caliche) horizons (SNL/NM March 1995). In addition, high-partitioning coefficients and low mobility in the transporting medium enhance dilution of the COC concentrations. As a result, the nature and extent of COCs do not render groundwater a viable contaminant pathway.

The pathways to receptors are soil, water, and air. Biota also provides a pathway through food chain transfers. However, no threatened or endangered species have been identified in the vicinity of SWMU 227 (Hoagland September 1994, IT February 1995). Section V of the risk assessment (Attachment G of this SNL/NM ER Project NOD Response) provides additional discussion of the fate and transport of COCs at SWMU 227.

Site Assessments

The site assessment process for SWMU 227 includes risk assessments followed by baseline risk assessments (as applicable) for human health and ecological risk. The current and future land use for SWMU 227 is industrial (DOE and USAF March 1996, SNL/NM January 2001); therefore, the potential human receptor at the site is an industrial worker. For all applicable pathways, the exposure route for the industrial worker is dermal contact, external irradiation, and ingestion/inhalation. Ingestion of soil, external irradiation from soil, and ingestion/inhalation of air are considered the major exposure routes for the industrial worker. Wildlife is considered to be the potential ecological receptor. Wildlife exposure can result from the ingestion of COCs through food chain transfers and the incidental ingestion of soil from the site. Sections VI and VII of the risk assessment (Attachment G of this SNL/NM ER Project NOD Response) provides additional discussion of potential exposure routes and receptors at SWMU 227. Attachment G also contains a complete discussion of the risk assessment process, results, and uncertainties. The following section summarizes the site assessment results.

Risk Assessments

Risk assessments were performed for both human health and ecological risk for SWMU 227.

Human Health

Because COCs are present in soil at concentrations or activities greater than background levels, it was necessary to perform a human health risk assessment analysis, which provides a quantitative evaluation of the potential adverse human health effects. This assessment included organic as well as metals and radionuclide COCs detected either above background levels and/or above minimum detectable activity (MDA). The risk assessment (Attachment G of this SNL/NM ER Project NOD) calculated the hazard index (HI) and excess cancer risk for an industrial land use scenario. In accordance with EPA (EPA 1989), the excess cancer risk from nonradiological COCs and the radiological COCs is not additive.

In summary, the HI calculated for SWMU 227 for nonradiological COCs is 0.06 for an industrial land use scenario, 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 0.04 for the industrial land use scenario. Both values were within New Mexico Environment Department (NMED) guidelines considering an industrial land use scenario.

The excess cancer risk for SWMU 227 for nonradiological COCs is 4E-6 for an industrial land use scenario. NMED guidance states that cumulative excess lifetime cancer risk must be less than 1E-5 (NMED March 2000); thus, the excess cancer risk for this site is below the suggested acceptable risk value. The incremental excess cancer risk is 1.04E-6.

The incremental total effective dose equivalent (TEDE) for radionuclides for an industrial land use scenario for SWMU 227 is 1.3E-1 millirem (mrem)/year (yr). This value is below the recommended dose limit of 15 mrem/yr, found in EPA's Office of Solid Waste and Emergency Response Directive No. 9200.4-18 (EPA 1997a) and reflected in the document "Sandia National Laboratories/New Mexico Environmental Restoration Project—RESRAD Input Parameter Assumptions and Justification" (SNL/NM February 1998). The incremental excess cancer risk for the radionuclides is 1.6E-6 for an industrial land use scenario.

The residential land use scenario for this site is presented only for comparison in the risk assessment report (Attachment G of this SNL/NM ER Project NOD Response). The report concludes that SWMU 227 does not have potential to affect human health under an industrial land use scenario.

Ecological

An ecological assessment that corresponds with the screening procedures in the EPA Ecological Risk Assessment Guidance for Superfund (EPA 1997b) was performed as set forth by the NMED Risk-Based Decision Tree (NMED March 1998). The scoping assessment focuses primarily on the likelihood of exposure of biota at or adjacent to the site to be exposed to COCs in soil at the site.

Baseline Risk Assessments

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

Human Health

Because the human health risk assessment indicates that SWMU 227 does not have the potential to affect human health under either an industrial or a residential land use scenario, a baseline human health risk assessment is not required for SWMU 227.

Ecological

Because the ecological risk assessment indicates that SWMU 227 has incomplete ecological pathways, a baseline ecological risk assessment is not required for SWMU 227.

Summary

The site assessment concludes that SWMU 227 does not have the potential to affect human health under an industrial land use scenario. After considering the uncertainties associated with the available data and the modeling assumptions, ecological risks associated with SWMU 227 were found to be low.

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ATTACHMENT K
Well Construction Diagrams

WELL DATABASE SUMMARY SHEET

Project Name: TIJERAS ARROYO GW
ER ADS #: 1303
Well Name: 227-VW-01
Owner Name: SNL-NM
Date Drilling Started: 26-MAR-01
Drilling Contractor: LAYNE
Drilling Method: ODEX
Borehole Depth: 275
Casing Depth:

Geo Location: S. OF TAII, N. OF T. ARROYO
Well Completion Date: 29-MAR-01
Completion Zone: SILT, SAND & GRAVEL
Formation of Completion: SANTA FE GROUP
Well Comment: MULTIPLE SAMPLE PORTS. INSTALLED FLUTE S.V. MONITOR WELL IN BOREHOLE. ALL ODEX CASING REMOVED. LOCKIN CAP INSTALLED.

Survey Data

Survey Date: 19-JUN-01
Surveyed By: ASCI, VLADIMIR JIRIK

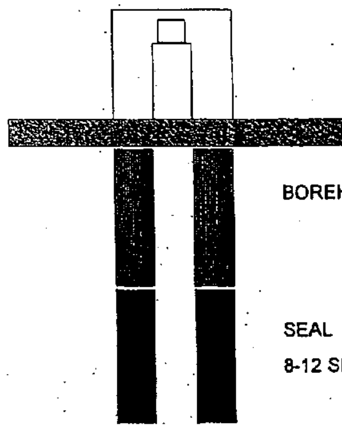
State Plane Coordinates

(X) Easting: 413761.01
(Y) Northing: 1468752.97

Surveyed Elevations (FAMSL)

Protective Casing: 5354.03
Top of Inner Well Casing:
Concrete Pad: 5351.8
Ground Surface: 5351.5

N



Completion Data Measured Depths (FBGS)

Casing Stickup:

Interval	Start	Stop
BOREHOLE	0'	275'
	O.D.	8"
SEAL	0'	275'
8-12 SILICA SAND		
SGSP 25		25'
SGSP 50		75'
SGSP 125		125'
SGSP 175		175'
SGSP 225		225'
SGSP 275		275'

Calculated Depths and Elevations

Initial Water Elevation: (FAMSL)

Initial Depth To Water: (FBGS)

Last measured water level was FASL
measured on

Date Updated: 11-MAR-02
Date Printed: 12-MAR-02

WELL DATABASE SUMMARY SHEET

Project Name: TAII

ER ADS #: 1303

Well Name: TA2-VW-20

Owner Name: SNL

Date Drilling Started: 14-NOV-96

Drilling Contractor: BEYLIK

Drilling Method: AUGER

Borehole Depth: 104

Casing Depth: 70

Geo Location: CENTER OF TAII

Well Completion Date: 05-DEC-96

Completion Zone: ALLUVIAL SAND AND GRAVEL

Formation of Completion: SANTA FE GROUP

Well Comment: **SEE VAPOR WELL COMMENTS AT BOTTOM OF REPORT**

Survey Data

Survey Date: 06-JUL-00

Surveyed By: DON HELFRICH

State Plane Coordinates

(X) Easting: 413130.312

(Y) Northing: 1469878.375

Surveyed Elevations (FAMSL)

Protective Casing:

Top of Inner Well Casing:

Concrete Pad: 5414

Ground Surface:

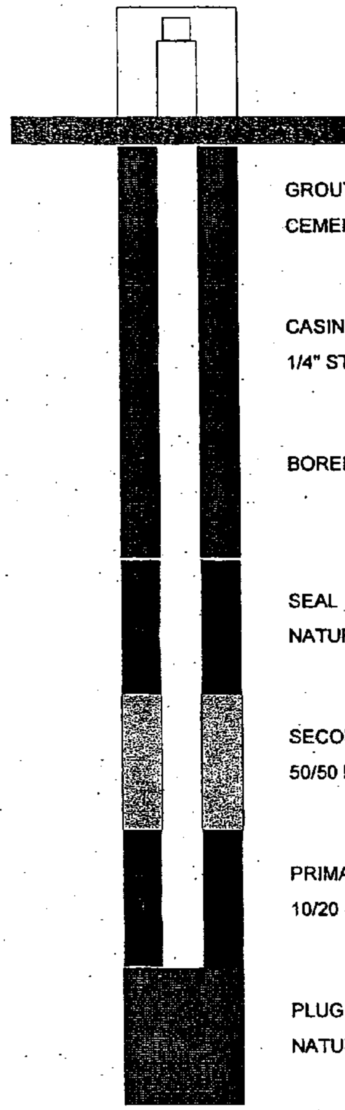
N

Calculated Depths and Elevations

Initial Water Elevation: (FAMSL)

Initial Depth To Water: (FBGS)

Last measured water level was FASL measured on



Completion Data Measured Depths (FBGS)

Casing Stickup:

Interval	Start	Stop
GROUT/BACKFILL	0'	11'
CEMENT BENT. GROUT		

Interval	Start	Stop
CASING	0'	70'
1/4" STAINLESS STEEL	O.D.	.25"

Interval	Start	Stop
BOREHOLE	0'	104'

Interval	Start	Stop
SEAL	11'	63'
NATURAL BACKFILL		

Interval	Start	Stop
SECONDARY SEAL	63'	68'
50/50 BENTONITE/GROU		

Interval	Start	Stop
PRIMARY PACK	68'	72'
10/20 SILICA SAND		

Interval	Start	Stop
PLUG BACK	72'	104'
NATURAL BACKFILL		

Date Updated: 18-APR-01

Date Printed: 14-APR-03

WELL DATABASE SUMMARY SHEET

Project Name: TA II
ER ADS #: 1303
Well Name: TA2-VW-21
Owner Name: SNL
Date Drilling Started: 12-NOV-96
Drilling Contractor: BEYLIK
Drilling Method: AUGER
Borehole Depth: 120
Casing Depth: 92

Geo Location: SOUTHERN MOST CORNER OF TA II
Well Completion Date: 06-DEC-96
Completion Zone: ALLUVIAL SAND AND GRAVEL
Formation of Completion: SANTA FE GROUP
Well Comment: **SEE VAPOR WELL COMMENTS AT BOTTOM OF REPORT**

Survey Data

Survey Date: 06-JUL-00
Surveyed By: DON HELFRICH

State Plane Coordinates

(X) Easting: 413432.125
(Y) Northing: 1469078.375

Surveyed Elevations (FAMSL)

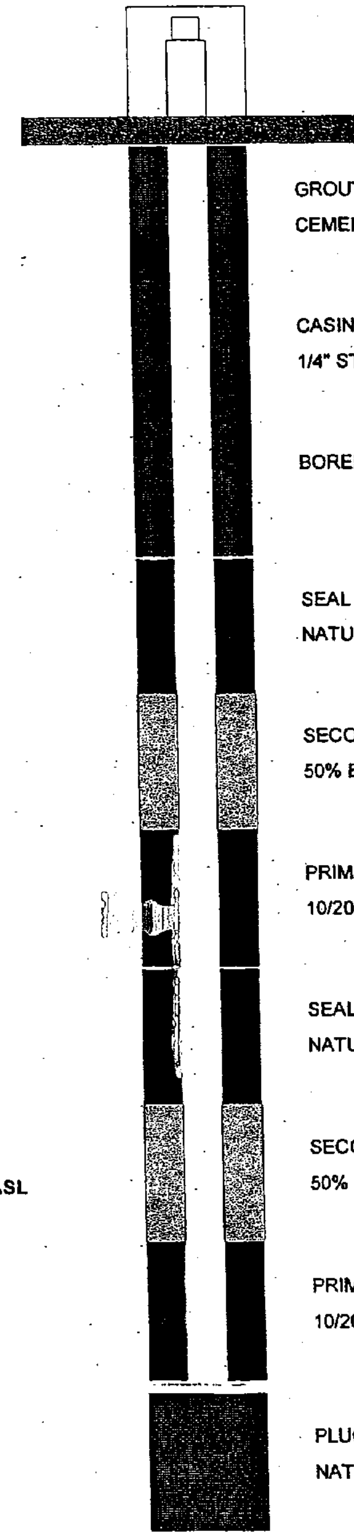
Protective Casing:
Top of Inner Well Casing:
Concrete Pad: 5413
Ground Surface:

N

Calculated Depths and Elevations

Initial Water Elevation: (FAMSL)
Initial Depth To Water: (FBGS)
Last measured water level was FASL
measured on

Date Updated: 14-JUN-02
Date Printed: 14-APR-03



Completion Data Measured Depths (FBGS)

Casing Stickup:

Interval	Start	Stop
GROUT/BACKFILL	0'	10'
CEMENT BENT. GROUT		
CASING	0'	92'
1/4" STAINLESS STEEL	O.D.	.25"
BOREHOLE	0'	120'
SEAL A	10'	42'
NATURAL BACKFILL		
SECONDARY SEAL A	42'	47'
50% BENT., 50% GROUT		
PRIMARY PACK A	47'	53'
10/20 SILICA SAND		
SEAL B	57'	84'
NATURAL BACKFILL		
SECONDARY SEAL B	84'	90'
50% BENT., 50% GROUT		
PRIMARY PACK B	90'	94.5'
10/20 SILICA SAND		
PLUG BACK	94.5'	120'
NATURAL BACKFILL		

ATTACHMENT L

Soil-Vapor Samples Analytical Data Summary Tables L-1 and L-2

Table L-1
Soil-Vapor Samples Analytical Data Summary

Sample Attributes						VOC (ppbv)															
Sample ID	Sample Date	Laboratory and Chain of Custody Number	Analytical Method	Remarks	Sample Depth (ft)	Acetone	Benzene	Bromodichloromethane	Bromomethane	2-Butanone	Carbon disulfide	Carbon tetrachloride	Chloroform	Chloromethane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethane	1,2-Dichloroethane
July 1997:																					
TA2-VW-20-SV-72P	7/17/1997	ERCL AR/COC 06173	Modified EPA 8260		72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-20-SV-72S				Duplicate	72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-50-P					50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-50-S				Duplicate	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-92-P					92	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-92-S				Duplicate	92	ND	1.5 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
September 1997:																					
TA2-VW-20-SV-72	9/4/1997	ERCL AR/COC 06942	Modified EPA 8260		72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-20-SV-72D				Duplicate	72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-50					50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-50D				Duplicate	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-92					92	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-92D				Duplicate	92	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
May 1998:																					
TA2-VW-20-SV-72	5/19/1998	Core AR/COC 600308	EPA TO-14		72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-20-SV-72D				Duplicate	72	ND	ND	ND	ND	ND	ND	ND	7.0	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-50					50	ND	ND	ND	ND	ND	ND	ND	7.0	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-92					92	ND	ND	ND	ND	ND	ND	ND	27	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-92D				Duplicate	92	ND	ND	ND	ND	ND	ND	ND	22	ND	ND	ND	ND	ND	ND	ND	ND
September 1998:																					
TA2-VW-20-SV-72	9/2/1998	Quanterra AR/COC 600796	EPA TO-14		72	16	0.97 J	ND	ND	ND	ND	2.6	5.6	ND	2.7	43	4.1	10	1.5 J	ND	ND
TA2-VW-20-SV-72D				Duplicate	72	20	ND	ND	ND	ND	ND	2.2	5.1	ND	1.7 J	29	2.7	6.9	1.4 J	ND	ND
TA2-VW-21-SV-50					50	11 J	ND	0.95 J	ND	ND	ND	ND	13	ND	ND	3.7 J	ND	ND	2.3 J	ND	ND
TA2-VW-21-SV-92					92	ND	ND	ND	ND	ND	ND	ND	19	ND	ND	30	ND	7.4 J	ND	ND	ND
TA2-VW-21-SV-92D				Duplicate	92	ND	ND	ND	ND	ND	ND	ND	21	ND	ND	19	ND	ND	ND	ND	ND

Table L-1
Soil-Vapor Samples Analytical Data Summary

Sample ID	1,1-Dichloroethene	cis-1,2-Dichloroethene	1,2-Dichloropropane	Ethylbenzene	4-Ethyl toluene	Methylene chloride	Tetrachloroethene	Toluene	1,2,4-Trichlorobenzene	1,1,1-Trichloroethane	Trichloroethene	Trichlorofluoromethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl chloride	Xylenes (total)	Total VOCs
	VOC (ppbv)																	
July 1997:																		
TA2-VW-20-SV-72P	ND	ND	ND	ND	ND	29	ND	6.5	ND	ND	ND	ND	ND	ND	ND	ND	5.2 J	40.7
TA2-VW-20-SV-72S	ND	ND	ND	ND	ND	18	ND	ND	ND	ND	ND	ND	1.8 J	ND	ND	ND	ND	19.8
TA2-VW-21-SV-50-P	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.9 J	ND	ND	ND	ND	ND	ND	2.9
TA2-VW-21-SV-50-S	ND	ND	ND	ND	ND	3.5 J	ND	ND	ND	ND	ND	ND	2 J	ND	ND	ND	ND	5.5
TA2-VW-21-SV-92-P	ND	ND	ND	ND	ND	1.9 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.9
TA2-VW-21-SV-92-S	ND	ND	ND	4 J	ND	37	ND	10	ND	ND	ND	ND	6.7	ND	ND	ND	29.2	88.4
September 1997:																		
TA2-VW-20-SV-72	ND	ND	ND	ND	ND	23,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	23,000
TA2-VW-20-SV-72D	ND	ND	ND	ND	ND	5,300	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5,300
TA2-VW-21-SV-50	ND	ND	ND	ND	ND	5,200	ND	ND	ND	ND	4,200 J	ND	ND	ND	ND	ND	ND	9,400
TA2-VW-21-SV-50D	ND	ND	ND	ND	ND	11,000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	11,000
TA2-VW-21-SV-92	ND	ND	ND	ND	ND	100,000	ND	ND	ND	ND	45,000	ND	1,700 J	ND	ND	ND	ND	146,700
TA2-VW-21-SV-92D	ND	ND	ND	ND	ND	74,000	ND	ND	ND	ND	8,900	ND	7,700	ND	ND	ND	ND	90,600
May 1998:																		
TA2-VW-20-SV-72	ND	ND	ND	ND	ND	ND	ND	9.0	6.3 J	ND	8.0	ND	42	ND	ND	ND	ND	65.3
TA2-VW-20-SV-72D	ND	ND	ND	ND	ND	4.0	ND	ND	4.4 J	ND	9.0	ND	38	ND	ND	ND	ND	62.4
TA2-VW-21-SV-50	ND	ND	ND	ND	ND	13	2.0	1.0	ND	ND	230	ND	ND	ND	ND	ND	ND	253
TA2-VW-21-SV-92	ND	ND	ND	ND	ND	10	ND	ND	ND	ND	190	ND	ND	ND	ND	ND	ND	227
TA2-VW-21-SV-92D	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	98	ND	ND	ND	ND	ND	ND	120
September 1998:																		
TA2-VW-20-SV-72	ND	ND	ND	1.9 J	0.48 J	ND	21	5.6	ND	ND	31	4.1	120	0.88 J	0.42 J	ND	9.3	282.7
TA2-VW-20-SV-72D	ND	ND	ND	1.2 J	0.31 J	ND	14	3.5	ND	ND	28	3.7	110	0.68 J	ND	ND	6.0	297.8
TA2-VW-21-SV-50	ND	ND	ND	ND	ND	ND	4.9 J	1.8 J	ND	ND	460	3.7 J	ND	ND	ND	ND	ND	509.7
TA2-VW-21-SV-92	ND	ND	ND	ND	ND	13 J	20	5.2 J	ND	ND	970	ND	ND	ND	ND	ND	10 J	1074.60
TA2-VW-21-SV-92D	ND	ND	ND	ND	ND	14 J	14 J	ND	ND	ND	1,100	2.0 J	ND	ND	ND	ND	ND	1,170

Table L-1
Soil-Vapor Samples Analytical Data Summary

Sample Attributes						VOC (ppbv)															
Sample ID	Sample Date	Laboratory and Chain of Custody Number	Analytical Method	Remarks	Sample Depth (ft)	Acetone	Benzene	Bromodichloromethane	Bromomethane	2-Butanone	Carbon disulfide	Carbon tetrachloride	Chloroform	Chloromethane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethane	1,2-Dichloroethane
December 1998:																					
TA2-VW-20-SV-72	12/7/1998	Quanterra AR/COC 601237	EPA TO-14		72	ND	ND	ND	ND	ND	ND	3.0	5.8	ND	ND	ND	ND	ND	1.6 J	ND	ND
TA2-VW-20-SV-72D				Duplicate	72	ND	ND	ND	ND	ND	ND	3.0	5.4	ND	ND	ND	ND	ND	1.5 J	ND	ND
TA2-VW-21-SV-50					50	ND	ND	ND	ND	ND	ND	ND	14	ND	ND	ND	ND	ND	2.5 J	ND	ND
TA2-VW-21-SV-92					92	ND	ND	ND	ND	ND	ND	ND	20 J	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-92D				Duplicate	92	ND	ND	ND.	ND	ND	ND	ND	20	ND	ND	ND	ND	ND	ND	ND	ND
March 1999:																					
TA2-VW-20-SV-72	3/22/1999	Quanterra AR/COC 601638	EPA TO-14		72	31	ND	ND	ND	ND	ND	3.6	6.8	ND	ND	1.0 J	ND	1.5 J	1.9 J	ND	ND
TA2-VW-20-SV-72D				Duplicate	72	23	ND	ND	ND	ND	ND	3.7	7.7	ND	ND	ND	ND	2.0	2.1	ND	ND
TA2-VW-21-SV-50					50	33	ND	2.8	ND	ND	ND	ND	20	ND	ND	ND	ND	0.82 J	3.0	ND	ND
TA2-VW-21-SV-92					92	16	ND	3.8	ND	ND	ND	ND	23	ND	ND	ND	ND	ND	1.0 J	ND	ND
TA2-VW-21-SV-92D				Duplicate	92	16 J	ND	3.4 J	ND	ND	ND	ND	22	ND	ND	ND	ND	ND	ND	ND	ND
June 1999:																					
TA2-VW-20-SV-72	6/24/1999	Quanterra AR/COC 601823	EPA TO-14		72	50	ND	ND	ND	3.0 J	ND	2.9	5.8	ND	ND	3.6	ND	ND	1.6 J	ND	ND
TA2-VW-20-SV-72D				Duplicate	72	43	ND	ND	ND	3.0 J	ND	3.2	6.0	ND	ND	4.5	ND	ND	1.8 J	ND	ND
TA2-VW-21-SV-50					50	6.9 J	ND	ND	ND	ND	ND	ND	17	ND	ND	ND	ND	ND	3.0 J	ND	ND
TA2-VW-21-SV-92					92	25 J	ND	ND	ND	ND	ND	ND	15	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-92D				Duplicate	92	26 J	ND	ND	ND	ND	ND	ND	24	ND	ND	ND	ND	ND	ND	ND	ND
September 1999:																					
TA2-VW-20-SV-72	9/7/1999	Quanterra AR/COC 602830	EPA TO-14		72	4.1 J	ND	ND	ND	ND	ND	2.7	5.9	ND	ND	ND	ND	ND	1.7 J	ND	ND
TA2-VW-20-SV-72D				Duplicate	72	6.9 J	ND	ND	ND	ND	ND	1.9 J	4.3	ND	ND	ND	ND	ND	1.2 J	ND	ND
TA2-VW-21-SV-50					50	ND	ND	ND	ND	ND	ND	ND	17	ND	ND	ND	ND	ND	2.2 J	ND	ND
TA2-VW-21-SV-92					92	ND	ND	ND	ND	ND	ND	ND	22	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-92D				Duplicate	92	ND	ND	ND	ND	ND	ND	ND	27	ND	ND	ND	ND	ND	ND	ND	ND

Table L-1
Soil-Vapor Samples Analytical Data Summary

Sample ID	1,1-Dichloroethene	cis-1,2-Dichloroethene	1,2-Dichloropropane	Ethylbenzene	4-Ethyl toluene	Methylene chloride	Tetrachloroethene	Toluene	1,2,4-Trichlorobenzene	1,1,1-Trichloroethane	Trichloroethene	Trichlorofluoromethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl chloride	Xylenes (total)	Total VOCs
	VOC (ppbv)																	
December 1998:																		
TA2-VW-20-SV-72	ND	ND	ND	ND	ND	ND	0.51 J	ND	ND	ND	21	4.0	120	ND	ND	ND	ND	138.5
TA2-VW-20-SV-72D	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	21	3.9	110	ND	ND	ND	ND	146.3
TA2-VW-21-SV-50	ND	ND	ND	ND	ND	ND	2.4 J	ND	ND	ND	510	3.9 J	ND	ND	ND	ND	ND	535.3
TA2-VW-21-SV-92	7.1 J	ND	ND	ND	ND	21 J	6.3 J	ND	ND	ND	1,300	ND	ND	ND	ND	ND	ND	1,889.70
TA2-VW-21-SV-92D	8.2 J	ND	ND	ND	ND	21	6.4 J	ND	ND	ND	1,400	ND	4.2 J	ND	ND	ND	ND	1,459.80
March 1999:																		
TA2-VW-20-SV-72	ND	ND	ND	ND	ND	ND	0.57 J	0.74 J	ND	ND	25	4.9	110	ND	ND	ND	2.02 J	189.03
TA2-VW-20-SV-72D	ND	ND	ND	ND	ND	ND	0.67 J	0.53 J	ND	ND	28	5.3	120	ND	ND	ND	1.1 J	231.6
TA2-VW-21-SV-50	ND	1.8 J	ND	ND	ND	ND	4.4	1.0 J	ND	0.74 J	520D	5.4	1.6 J	ND	ND	ND	ND	597.56
TA2-VW-21-SV-92	8.8	2.4	ND	ND	ND	23	10	ND	ND	1.0 J	1,200D	3.1	4.4	ND	ND	ND	1.3 J	1,298.80
TA2-VW-21-SV-92D	8.7	2.4 J	ND	ND	ND	22	6.3	ND	ND	ND	1,200D	2.9 J	4.2 J	ND	ND	ND	ND	1,287.90
June 1999:																		
TA2-VW-20-SV-72	ND	ND	ND	0.51 J	0.62 J	ND	3.6	2.5	ND	ND	24	4	97	1.0 J	ND	ND	4.6	206.33
TA2-VW-20-SV-72D	ND	ND	ND	ND	0.52 J	ND	4.5	1.8 J	ND	0.60 J	25	4.3	100	1.0 J	ND	ND	4.2	205.22
TA2-VW-21-SV-50	ND	ND	ND	ND	ND	ND	2.8 J	ND	ND	ND	410	4.6	1.7 J	ND	ND	ND	ND	449
TA2-VW-21-SV-92	3.4 J	ND	ND	ND	ND	13	5.2 J	2.5 J	ND	ND	530	ND	2.3 J	ND	ND	ND	ND	596.4
TA2-VW-21-SV-92D	5.9 J	ND	ND	ND	ND	20	7.7 J	ND	ND	ND	920	ND	ND	ND	ND	ND	ND	1,003.60
September 1999:																		
TA2-VW-20-SV-72	ND	ND	ND	ND	ND	ND	ND	0.51	ND	ND	20	4.7	130	ND	ND	ND	ND	169.81
TA2-VW-20-SV-72D	ND	ND	ND	0.55 J	0.70 J	ND	3.5	3.8	ND	0.84 J	17	3.1	95	0.99 J	ND	ND	3.05 J	142.83
TA2-VW-21-SV-50	ND	ND	ND	ND	ND	ND	2.9 J	ND	ND	ND	460	3.7 J	ND	ND	ND	ND	ND	485.8
TA2-VW-21-SV-92	4.7 J	ND	ND	ND	ND	14	6.2 J	8.6 J	ND	ND	960	ND	3.2 J	ND	ND	ND	ND	1,018.70
TA2-VW-21-SV-92D	6.4 J	ND	ND	ND	ND	16	6.9 J	ND	ND	ND	960	3.2 J	4.4 J	ND	ND	ND	ND	1,023.90

Table L-1
Soil-Vapor Samples Analytical Data Summary

Sample Attributes						VOC (ppbv)															
Sample ID	Sample Date	Laboratory and Chain of Custody Number	Analytical Method	Remarks	Sample Depth (ft)	Acetone	Benzene	Bromodichloromethane	Bromomethane	2-Butanone	Carbon disulfide	Carbon tetrachloride	Chloroform	Chloromethane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethane	1,2-Dichloroethane
December 1999:																					
TA2-VW-20-SV-72	12/7/1999	Quanterra AR/COC 602989	EPA TO-14		72	ND	ND	ND	ND	ND	ND	4.7	8.1	ND	ND	ND	ND	ND	2.2	ND	ND
TA2-VW-20-SV-72D				Duplicate	72	ND	ND	ND	ND	ND	ND	4.5	7.7	ND	ND	ND	ND	ND	2.1	ND	ND
TA2-VW-21-SV-50					50	ND	ND	3.6 J	ND	ND	ND	ND	20	ND	ND	ND	ND	ND	2.5 J	ND	ND
TA2-VW-21-SV-92					92	ND	ND	ND	ND	ND	ND	ND	23	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-92D				Duplicate	92	13 J	ND	4.0 J	ND	ND	ND	ND	24	ND	ND	ND	ND	ND	ND	ND	ND
March 2000:																					
TA2-VW-20-SV-72	3/1/2000	Quanterra/ Severn Trent AR/COC 603136	EPA TO-14		72	100	ND	ND	ND	ND	ND	2.8	5.0	ND	ND	ND	ND	ND	1.4 J	ND	ND
TA2-VW-20-SV-72D				Duplicate	72	42	ND	ND	ND	ND	ND	3.2	6.0	ND	ND	ND	ND	ND	1.7 J	ND	ND
TA2-VW-21-SV-50					50	ND	ND	2.5 J	ND	ND	ND	ND	18	ND	ND	ND	ND	ND	2.2 J	ND	ND
TA2-VW-21-SV-92					92	ND	ND	ND	ND	ND	ND	ND	21	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-92D				Duplicate	92	ND	ND	ND	ND	ND	ND	ND	16	ND	ND	ND	ND	ND	ND	ND	ND
June 2000:																					
TA2-VW-20-SV-72	6/20/2000	Quanterra/ Severn Trent AR/COC 603340	EPA TO14		72	14	1.9 J	ND	ND	ND	ND	3.1	5.2	ND	ND	ND	ND	ND	1.3 J	ND	ND
TA2-VW-20-SV-72D				Duplicate	72	9.8 J	1.9 J	ND	ND	ND	ND	3	5.3	ND	ND	ND	ND	ND	1.4 J	ND	ND
TA2-VW-21-SV-50					50	ND	2.6 J	2.7 J	ND	ND	ND	ND	16	ND	ND	ND	ND	ND	1.9 J	ND	ND
TA2-VW-21-SV-92					92	ND	ND	3.6 J	ND	ND	ND	ND	18	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-92D				Duplicate	92	ND	2.9 J	3.3 J	ND	ND	ND	ND	19	ND	ND	ND	ND	ND	ND	ND	ND
September 2000:																					
TA2-VW-20-SV-72	9/13/2000	Quanterra/ Severn Trent AR/COC 603661	EPA TO-14		72	7.4 J	ND	ND	ND	ND	ND	2.1	3.6	ND	ND	ND	ND	ND	1.1 J	ND	ND
TA2-VW-20-SV-72D				Duplicate	72	6.3 J	ND	ND	ND	ND	ND	2.7	4.6	ND	ND	ND	ND	ND	1.4 J	ND	ND
TA2-VW-21-SV-50					50	ND	ND	2.3 J	ND	ND	ND	ND	15	ND	ND	ND	ND	ND	1.8 J	ND	ND
TA2-VW-21-SV-92					92	ND	ND	3.5 J	ND	ND	ND	ND	19	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-92D				Duplicate	92	ND	ND	3.2 J	ND	ND	ND	ND	20	ND	ND	ND	ND	ND	ND	ND	ND

Table L-1
Soil-Vapor Samples Analytical Data Summary

Sample ID	VOC (ppbv) 1,1-Dichloroethene	cis-1,2-Dichloroethene	1,2-Dichloropropane	Ethylbenzene	4-Ethyl toluene	Methylene chloride	Tetrachloroethene	Toluene	1,2,4-Trichlorobenzene	1,1,1-Trichloroethane	Trichloroethene	Trichlorofluoromethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl chloride	Xylenes (total)	Total VOCs
December 1999:																		
TA2-VW-20-SV-72	ND	ND	ND	0.69 J	ND	0.82 J	0.59 J	1.8 J	0.67 J	ND	25	5.7	130	ND	ND	ND	4.89 J	185.16
TA2-VW-20-SV-72D	ND	ND	ND	ND	ND	0.93 J	0.73 J	0.69 J	ND	ND	25	5.7	120	ND	ND	ND	ND	167.35
TA2-VW-21-SV-50	ND	ND	ND	ND	ND	ND	3.1 J	ND	ND	ND	470	4.5	1.7 J	ND	ND	ND	ND	505.4
TA2-VW-21-SV-92	10 J	ND	ND	ND	ND	29	8.4 J	ND	ND	ND	1,500	3.7 J	6.6 J	ND	ND	ND	ND	1,580.70
TA2-VW-21-SV-92D	13	ND	ND	ND	ND	31	9.4	ND	ND	ND	1,500	4.4 J	7.7 J	ND	ND	ND	ND	1,606.50
March 2000:																		
TA2-VW-20-SV-72	ND	ND	ND	8.0	ND	ND	0.70 J	20	ND	ND	16	3.6	98	0.75 J	ND	ND	34.3	290.55
TA2-VW-20-SV-72D	ND	ND	ND	15	0.90 J	ND	ND	42	ND	ND	19	4.1	120	0.96 J	ND	ND	78	332.86
TA2-VW-21-SV-50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	440	3.6 J	ND	ND	ND	ND	ND	466.3
TA2-VW-21-SV-92	5.8 J	ND	ND	ND	ND	15	6.9 J	ND	ND	ND	1,200	ND	3.8 J	ND	ND	ND	ND	1,262.50
TA2-VW-21-SV-92D	4.4 J	ND	ND	ND	ND	14	5.5 J	ND	ND	ND	850	ND	3.1 J	ND	ND	ND	ND	893
June 2000:																		
TA2-VW-20-SV-72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	19	3.8	110	ND	ND	ND	ND	158.3
TA2-VW-20-SV-72D	ND	ND	ND	ND	ND	ND	0.51	ND	ND	ND	19	3.6	100	ND	ND	ND	ND	144.51
TA2-VW-21-SV-50	ND	ND	ND	ND	ND	ND	2.7	ND	ND	ND	470	3.0 J	1.0 J	ND	ND	ND	ND	499.9
TA2-VW-21-SV-92	4.0 J	ND	ND	ND	ND	14	5.2 J	ND	ND	ND	1,100	1.9 J	2.9 J	ND	ND	ND	ND	1,149.60
TA2-VW-21-SV-92D	4.1 J	ND	ND	ND	ND	15	4.4 J	ND	ND	ND	1,200	1.7 J	2.9 J	ND	ND	ND	ND	1,258.30
September 2000:																		
TA2-VW-20-SV-72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	13	2.7	73	ND	ND	ND	ND	102.9
TA2-VW-20-SV-72D	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	17	3.6	96	ND	ND	ND	ND	131.6
TA2-VW-21-SV-50	ND	ND	ND	ND	ND	ND	2.4 J	ND	ND	ND	400	3.0	1.0 J	ND	ND	ND	ND	425.5
TA2-VW-21-SV-92	4.0 J	ND	ND	ND	ND	12	4.3 J	ND	ND	ND	870	1.9 J	3.0 J	ND	ND	ND	ND	917.7
TA2-VW-21-SV-92D	4.3 J	ND	ND	ND	ND	12	4.2 J	ND	ND	ND	850	2.1 J	3.0 J	ND	ND	ND	ND	898.8

Table L-1
Soil-Vapor Samples Analytical Data Summary

Sample Attributes						VOC (ppbv)															
Sample ID	Sample Date	Laboratory and Chain of Custody Number	Analytical Method	Remarks	Sample Depth (ft)	Acetone	Benzene	Bromodichloromethane	Bromomethane	2-Butanone	Carbon disulfide	Carbon tetrachloride	Chloroform	Chloromethane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethane	1,2-Dichloroethane
December 2000:																					
TA2-VW-20-SV-72	12/11/2000	Quanterra/ Severn Trent AR/COC 603898	EPA TO-14		72	5.2 J	ND	ND	ND	ND	ND	4.3	7.0	ND	ND	ND	ND	ND	1.9 J	ND	ND
TA2-VW-20-SV-72D				Duplicate	72	4.3 J	ND	ND	ND	ND	5.3 J	4.5	7.1	ND	ND	ND	ND	ND	1.9 J	ND	ND
TA2-VW-21-SV-50					50	14	ND	2.6	ND	ND	16	ND	23	ND	ND	ND	ND	ND	2.5	ND	ND
TA2-VW-21-SV-92					92	5.9 J	ND	2.8 J	ND	ND	ND	ND	23	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-92D				Duplicate	92	2.0 J	ND	3.0	ND	ND	ND	ND	27	ND	ND	ND	ND	ND	ND	ND	ND
April 2001:																					
TA2-VW-20-SV-72	4/19/2001	Quanterra/ Severn Trent AR/COC 604434	EPA TO-14		72	9.0 J	ND	ND	1.7 J	2.3 J	ND	3.7	6.9	ND	ND	ND	ND	ND	2.6	ND	ND
TA2-VW-21-SV-50	4/19/2001				50	3.4 J	ND	2.3	ND	ND	ND	ND	24	ND	ND	ND	ND	ND	2.5	ND	ND
TA2-VW-21-SV-92	4/19/2001				92	ND	ND	ND	ND	ND	ND	ND	25	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-025	4/23/2001				25	3.1 J	ND	ND	ND	3.6 J	ND	ND	ND	ND	ND	ND	ND	ND	0.62 J	ND	ND
227-VW-01-SV-075	4/23/2001				75	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-125	4/23/2001				125	10 J	ND	ND	ND	7.7 J	ND	ND	3.8 J	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-175	4/23/2001				175	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-225	4/23/2001				225	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
June 2001:																					
TA2-VW-20-SV-72	6/22/2001	Quanterra/ Severn Trent AR/COC 604643	EPA TO-14		72	ND	ND	ND	ND	ND	ND	3.7	6.6	ND	ND	ND	ND	ND	2.3	ND	ND
TA2-VW-21-SV-50	6/22/2001				50	7.6 J	ND	2.8 J	ND	ND	ND	ND	21	ND	ND	ND	ND	ND	2.7 J	ND	ND
TA2-VW-21-SV-92	6/22/2001				92	ND	ND	ND	ND	ND	ND	ND	25	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-025	6/26/2001				25	4.2 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.81 J	ND	ND
227-VW-01-SV-075	6/26/2001				75	ND	ND	ND	ND	ND	ND	ND	4.9 J	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-125	6/26/2001				125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-175	6/26/2001				175	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-225	6/26/2001				225	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-225-SD	6/26/2001			Duplicate	225	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table L-1
Soil-Vapor Samples Analytical Data Summary

Sample ID	1,1-Dichloroethene	cis-1,2-Dichloroethene	1,2-Dichloropropane	Ethylbenzene	4-Ethyl toluene	Methylene chloride	Tetrachloroethene	Toluene	1,2,4-Trichlorobenzene	1,1,1-Trichloroethane	Trichloroethene	Trichlorofluoromethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl chloride	Xylenes (total)	Total VOCs
	VOC (ppbv)																	
December 2000:																		
TA2-VW-20-SV-72	0.94 J	ND	ND	ND	ND	ND	0.62 J	ND	ND	ND	20	4.8	120	ND	ND	ND	ND	164.76
TA2-VW-20-SV-72D	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	4.9	120	0.65 J	ND	ND	ND	168.65
TA2-VW-21-SV-50	ND	1.2 J	ND	ND	ND	ND	2.1	ND	ND	ND	350	3.9	1.6 J	ND	ND	ND	ND	416.9
TA2-VW-21-SV-92	8.1	ND	ND	ND	ND	14	6.5	ND	ND	ND	1,000	2.5 J	4.8 J	ND	ND	ND	ND	1,067.60
TA2-VW-21-SV-92D	8.8	2.4	ND	ND	ND	17	6.5	ND	ND	ND	1,100	3.0	5.7	ND	ND	ND	ND	1,175.40
April 2001:																		
TA2-VW-20-SV-72	0.94 J	ND	ND	0.75 J	ND	0.86 J	0.64 J	3.1	ND	ND	21	5.2	130	ND	ND	ND	2	189.15
TA2-VW-21-SV-50	ND	1.2 J	ND	ND	ND	ND	2.5	ND	ND	ND	360	3.8	1.5 J	ND	ND	ND	ND	401.2
TA2-VW-21-SV-92	6.9 J	ND	ND	ND	ND	21	6.2 J	ND	ND	ND	1,000	ND	5.0 J	ND	ND	ND	ND	1,064.10
227-VW-01-SV-025	ND	ND	ND	ND	ND	ND	ND	2.1	ND	ND	40	ND	ND	0.51 J	ND	ND	ND	49.9
227-VW-01-SV-075	ND	ND	ND	ND	ND	ND	7.0 J	ND	ND	ND	2,500	ND	ND	ND	ND	ND	ND	2,507.0
227-VW-01-SV-125	ND	ND	ND	ND	ND	3.5 J	3.9 J	13	ND	ND	730	ND	ND	ND	ND	ND	ND	771.9
227-VW-01-SV-175	ND	ND	ND	ND	ND	25 J	ND	ND	ND	ND	3,700	ND	ND	ND	ND	ND	ND	3,725.0
227-VW-01-SV-225	ND	ND	ND	ND	ND	33 J	ND	ND	ND	ND	4,900	ND	ND	ND	ND	ND	ND	4,933.0
June 2001:																		
TA2-VW-20-SV-72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	5.2	120	ND	ND	ND	ND	157.8
TA2-VW-21-SV-50	ND	ND	ND	ND	ND	ND	2.5 J	ND	ND	ND	370	3.9 J	1.5 J	ND	ND	ND	ND	412
TA2-VW-21-SV-92	5.7 J	ND	ND	ND	ND	14	5.3 J	ND	ND	ND	870	ND	3.9 J	ND	ND	ND	ND	923.9
227-VW-01-SV-025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	55	0.54 J	ND	ND	ND	ND	ND	60.6
227-VW-01-SV-075	ND	ND	ND	ND	ND	ND	5.2 J	3.0 J	ND	ND	850	ND	ND	ND	ND	ND	ND	863.1
227-VW-01-SV-125	ND	ND	ND	ND	ND	ND	8.8 J	ND	ND	ND	2,700	ND	ND	ND	ND	ND	ND	2,708.8
227-VW-01-SV-175	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4,300	ND	ND	ND	ND	ND	ND	4,300.0
227-VW-01-SV-225	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8,800	ND	ND	ND	ND	ND	ND	8,800.0
227-VW-01-SV-225-SD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	9,500	ND	ND	ND	ND	ND	ND	9,500.0

Table L-1
Soil-Vapor Samples Analytical Data Summary

Sample Attributes						VOC (ppbv)															
Sample ID	Sample Date	Laboratory and Chain of Custody Number	Analytical Method	Remarks	Sample Depth (ft)	Acetone	Benzene	Bromodichloromethane	Bromomethane	2-Butanone	Carbon disulfide	Carbon tetrachloride	Chloroform	Chloromethane	1,2-Dibromoethane	1,2-Dichlorobenzene	1,3-Dichlorobenzene	1,4-Dichlorobenzene	Dichlorodifluoromethane	1,1-Dichloroethane	1,2-Dichloroethane
September 2001:																					
TA2-VW-20-SV-72	9/25/2001	Quanterra/ Severn Trent AR/COC 604921	EPA TO-14		72	4.2 J	ND	ND	ND	ND	ND	4.1	6.2	ND	ND	ND	ND	ND	2.3	ND	ND
TA2-VW-21-SV-50	9/25/2001				50	4.6 J	ND	2.9	ND	ND	ND	ND	21	ND	ND	ND	ND	ND	2.5	ND	ND
TA2-VW-21-SV-92	9/25/2001				92	13 J	ND	ND	ND	ND	ND	ND	27	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-025	9/25/2001				25	2.6 J	ND	ND	ND	25	ND	ND	ND	ND	ND	ND	ND	ND	0.76 J	ND	ND
227-VW-01-SV-075	9/25/2001				75	ND	ND	ND	ND	48	ND	ND	5.2 J	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-125	9/25/2001				125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-175	9/25/2001				175	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-225	9/25/2001				225	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-225-SD	9/25/2001			Duplicate	225	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
December 2001:																					
TA2-VW-20-SV-72	12/11/2001	Quanterra/ Severn Trent AR/COC 605162	EPA TO-14		72	6.3 J,V	ND	ND	ND	ND	ND	2.5 J,V	5.8 V	ND	ND	ND	ND	ND	ND	ND	ND
TA2-VW-21-SV-50	12/11/2001				50	ND	ND	2.3	ND	ND	ND	ND	19	ND	ND	ND	ND	ND	0.88 J	ND	ND
TA2-VW-21-SV-92	12/11/2001				92	ND	ND	ND	ND	ND	ND	ND	18	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-025	12/11/2001				25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-075	12/11/2001				75	13 J	ND	ND	ND	11 J	ND	ND	3.9 J	ND	ND	ND	ND	2.4 J	ND	ND	ND
227-VW-01-SV-125	12/11/2001				125	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-175	12/11/2001				175	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-225	12/11/2001				225	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-225-SD	12/11/2001			Duplicate	225	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
March 2002:																					
TA2-VW-20-SV-72	3/19/2002	Quanterra/ Severn Trent AR/COC 605407	EPA TO-14		72	10	ND	ND	ND	2.4 J	ND	2.6	4.6	3.5 J	ND	ND	ND	ND	1.6 J	ND	ND
TA2-VW-021-SV-50	3/19/2002				50	3.8 J	ND	3.1	ND	4.6 J	ND	ND	15	ND	ND	ND	ND	ND	1.6 J	ND	ND
TA2-VW-021-SV-92	3/19/2002				92	ND	ND	4.4 J	ND	ND	ND	ND	19	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-025	3/19/2002				25	5.4 J	ND	ND	ND	ND	3.6 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-075	3/19/2002				75	25 J	ND	ND	ND	ND	ND	ND	4.5 J	ND	ND	ND	ND	ND	ND	ND	9.0 J
227-VW-01-SV-125	3/19/2002				125	58 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-175	3/19/2002				175	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	73 J
227-VW-01-SV-175-SD	3/19/2002			Duplicate	175	110 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
227-VW-01-SV-225	3/19/2002				225	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table L-1
Soil-Vapor Samples Analytical Data Summary

Sample ID	1,1-Dichloroethene	cis-1,2-Dichloroethene	1,2-Dichloropropane	Ethylbenzene	4-Ethyl toluene	Methylene chloride	Tetrachloroethene	Toluene	1,2,4-Trichlorobenzene	1,1,1-Trichloroethane	Trichloroethene	Trichlorofluoromethane	1,1,2-Trichloro-1,2,2-trifluoroethane	1,2,4-Trimethylbenzene	1,3,5-Trimethylbenzene	Vinyl chloride	Xylenes (total)	Total VOCs
	VOC (ppbv)																	
September 2001:																		
TA2-VW-20-SV-72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	34	5	110	ND	ND	ND	ND	165.8
TA2-VW-21-SV-50	ND	0.88 J	ND	ND	ND	ND	2.5	ND	ND	ND	370	4.3	1.5 J	ND	ND	ND	ND	410.18
TA2-VW-21-SV-92	5.3 J	13 J	ND	ND	ND	15	5.9 J	ND	ND	ND	890	ND	5.4 J	ND	ND	ND	ND	961.6
227-VW-01-SV-025	ND	ND	ND	ND	ND	ND	ND	0.93 J	ND	ND	58	ND	ND	ND	ND	ND	ND	87.3
227-VW-01-SV-075	ND	ND	ND	ND	ND	ND	4.8 J	3.0 J	ND	ND	900	ND	ND	ND	ND	ND	ND	961.0
227-VW-01-SV-125	ND	ND	ND	ND	ND	ND	11 J	ND	ND	ND	3,000	ND	ND	ND	ND	ND	ND	3,011.0
227-VW-01-SV-175	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5,300	ND	ND	ND	ND	ND	ND	5,300.0
227-VW-01-SV-225	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8,000	ND	ND	ND	ND	ND	ND	8,000.0
227-VW-01-SV-225-SD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	8,100	ND	ND	ND	ND	ND	ND	8,100.0
December 2001:																		
TA2-VW-20-SV-72	ND	ND	ND	0.87 J,V	1.6 J,V	ND	ND	3.5 V	ND	ND	36 V	4.1 V	92 V	3.3 V	1.5 J,V	2.3 J,V	ND	161.9
TA2-VW-21-SV-50	ND	ND	ND	ND	ND	ND	2.2	ND	ND	ND	330	2.8	1.2 J	ND	ND	ND	ND	358.4
TA2-VW-21-SV-92	10	ND	ND	ND	ND	25	9.5	ND	ND	ND	1,500	3.0 J	7.2 J	ND	ND	ND	ND	1,572.70
227-VW-01-SV-025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	600	ND	ND	ND	ND	ND	ND	600
227-VW-01-SV-075	ND	ND	ND	5.4	3.6 J	ND	4.2 J	12	ND	ND	980	ND	ND	5.4	ND	ND	20.3	1,061.20
227-VW-01-SV-125	5.8 J	ND	ND	ND	ND	ND	11 J	ND	ND	ND	3,600	ND	ND	ND	ND	ND	ND	3,616.80
227-VW-01-SV-175	ND	ND	ND	ND	ND	ND	6.2 J	ND	ND	ND	3,600	ND	ND	ND	ND	ND	ND	3,606.20
227-VW-01-SV-225	ND	ND	ND	ND	ND	ND	ND	11. J	ND	ND	5,000	ND	ND	ND	ND	ND	ND	5,011
227-VW-01-SV-225-SD	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7,000	ND	ND	ND	ND	ND	ND	7,000
March 2002:																		
TA2-VW-20-SV-72	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	47	3.1	67	ND	ND	ND	ND	141.8
TA2-VW-021-SV-50	ND	ND	ND	ND	ND	ND	1.5 J	ND	ND	ND	270	2.4 J	0.95 J	ND	ND	ND	ND	302.95
TA2-VW-021-SV-92	4.0 J	ND	ND	ND	ND	14	4.8 J	ND	ND	ND	980	3.0 J	3.2 J	ND	ND	ND	ND	1,029.40
227-VW-01-SV-025	ND	ND	ND	0.62 J	ND	ND	ND	ND	ND	ND	38	ND	ND	0.65 J	ND	ND	1.4 J	47.67
227-VW-01-SV-075	ND	ND	ND	6.4 J	26	4.4 J	5.1 J	19	ND	ND	1,000	ND	ND	33	9.2 J	ND	43	1,184.60
227-VW-01-SV-125	ND	ND	ND	ND	29 J	ND	ND	37 J	ND	ND	4,500	ND	ND	32 J	ND	ND	32 J	4,688
227-VW-01-SV-175	ND	ND	ND	ND	ND	ND	ND	44 J	ND	ND	7,300	ND	ND	29 J	ND	ND	ND	7,446
227-VW-01-SV-175-SD	ND	ND	ND	ND	ND	ND	ND	56 J	ND	ND	6,900	ND	ND	ND	ND	ND	ND	7,066
227-VW-01-SV-225	ND	ND	ND	ND	ND	ND	ND	44 J	ND	ND	14,000	ND	ND	ND	ND	ND	ND	14,044

Table L-1
Soil-Vapor Samples Analytical Data Summary

AR/COC = Analysis Request/Chain-of-Custody.
D = Duplicate.
EPA = U.S. Environmental Protection Agency.
ERCL = Environmental Restoration Chemistry Laboratory.
ft = Foot (feet).
ID = Identification.
J = Analyte detected below the quantitation limit.
ND = Not detected.
ppbv = Parts per billion on a volume to volume basis.
SV = Soil vapor.
TA = Technical Area.
V = ??
VOC = Volatile organic compound.
VW = Vapor well.

ATTACHMENT M
Groundwater Monitoring Results

Table M-1
Summary of Groundwater Monitoring Well TA2-W-19 VOC Analytical Results
November 1999–March 2002
(Off-Site Laboratory[a])

Well ID	Analyte	Sample Date	Sample No.	Analytical Method[b]	Units	MCL[c]	Result[d]	Lab Qualifier	Validation Qualifier
TA2-W-19	1,1-Dichloroethane	07-06-01	048782-001	EPA 8260	μg/L	NE	0.53 (2)	J	None
		10-02-01	049035-001	EPA 8260	μg/L	NE	0.54 (2)	J	None
		11-21-01	049178-001	EPA 8260	μg/L	NE	0.65 (2)	J	None
	Bromomethane	11-21-01	049178-001	EPA 8260	μg/L	NE	0.54 (2)	J	None
	Trichloroethene	03-15-00	048634-001	EPA 8260	μg/L	5.0	1.9 (2)	J	None
		01-04-01	049575-001	EPA 8260	μg/L	5.0	2.3		None
		03-08-01	049677-001	EPA 8260	μg/L	5.0	1.7		None
		07-06-01	048782-001	EPA 8260	μg/L	5.0	0.96		None
		10-02-01	049035-001	EPA 8260	μg/L	5.0	1.4		None
		11-21-01	049178-001	EPA 8260	μg/L	5.0	1.4		None
	cis-1,2-Dichloroethene	03-15-00	048634-001	EPA 8260	μg/L	70.0	0.53 (2)	J	None
		11-21-01	049178-001	EPA 8260	μg/L	70.0	0.67 (2)	J	None

[a]Analyses performed by the Environmental Restoration Chemistry Laboratory.
[b]EPA 1986.
[c]MCL established by the EPA Primary Drinking Water Regulations in 40 CFR 141, and subsequent amendments, or New Mexico Environmental Improvement Board in New Mexico Register, Title 20, Part I.
[d]If result detected below quantitation limit, then quantitation limit is indicated in parentheses.

CFR = Code of Federal Regulations.
EPA = U.S. Environmental Protection Agency.
ID = Identification.
J = Analyte is detected below the quantitation limit.
MCL = Maximum contaminant level.
μg/L = Microgram(s) per liter.
NE = Not established.
None = All quality control samples met acceptance criteria with respect to submitted samples.
TA = Technical Area.
VOC = Volatile organic compound.
W = Water.

Table M-2
Summary of VOC
Analytical Detection Limits
November 1999–March 2002
(On-Site Laboratory[a])

Analyte	Method Detection Limit (µg/L)
1,1,1-Trichloroethane	0.5
1,1,2,2-Tetrachloroethane	0.5
1,1,2-Trichloroethane	0.5
1,1-Dichloroethane	0.5
1,1-Dichloroethene	0.5
1,2-Dichloroethane	0.5
1,2-Dichloropropane	0.5
2-Butanone	0.5–11
2-Hexanone	0.5–10
4-Methyl-2-pentanone	0.5–5
Acetone	2–7
Benzene	0.5
Bromochloromethane	0.5
Bromodichloromethane	0.5
Bromoform	0.5
Bromomethane	0.5
Carbon disulfide	0.5
Carbon tetrachloride	0.5
Chlorobenzene	0.5
Chloroethane	0.5–2
Chloroform	0.5
Chloromethane	0.5
Dibromochloromethane	0.5
Ethyl benzene	0.5
Methylene chloride	0.5
m-Xylene, p-Xylene	0.5–1
o-Xylene	0.5
Styrene	0.5
Tetrachloroethene	0.5
Toluene	0.5
Trichloroethene	0.1–0.5
Vinyl chloride	0.1–0.5
cis-1,2-Dichloroethene	0.5
cis-1,3-Dichloropropene	0.5
trans-1,2-Dichloroethene	0.5–3
trans-1,3-Dichloropropene	0.5

[a]Environmental Restoration Chemistry Laboratory.
µg/L = Microgram(s) per liter.
VOC = Volatile organic compound.

Table M-3
Summary of Groundwater Monitoring Well TA2-W-19 Metals Analytical Results
November 1999–March 2002
(On-Site Laboratory[a])

Well ID	Analyte	Sample Date	Sample No.	Analytical Method[b]	Units	MCL[c]	Result[d]	Lab Qualifier	Validation Qualifier
TA2-W-19	Aluminum	11-30-99	048546-003	EPA 6020	µg/L	NE	ND (150)	U	A,A2,UJ
		03-15-00	048634-003	EPA 6020	µg/L	NE	180 (620)	J	None
		01-04-01	049575-003	EPA 6020	µg/L	NE	2000		None
		03-08-01	049677-009	EPA 6020	µg/L	NE	230 (620)	J	None
		07-06-01	048782-007	EPA 6020	µg/L	NE	ND (150)	U	None
		10-02-01	049035-007	EPA 6020	µg/L	NE	450 (620)	J	None
		11-21-01	049178-007	EPA 6020	µg/L	NE	310 (620)	J	A2,J,P1
		03-18-02	049369-007	EPA 6020	µg/L	NE	430 (620)	J,B	B,J
	Antimony	11-30-99	048546-003	EPA 6020	µg/L	6.0	ND (1.7)	U	None
		03-15-00	048634-003	EPA 6020	µg/L	6.0	ND (1.7)	U	None
		01-04-01	049575-003	EPA 6020	µg/L	6.0	ND (1.7)	U	None
		03-08-01	049677-009	EPA 6020	µg/L	6.0	ND (1.7)	U	None
		07-06-01	048782-007	EPA 6020	µg/L	6.0	ND (1.7)	U	None
		10-02-01	049035-007	EPA 6020	µg/L	6.0	ND (1.7)	U	None
		11-21-01	049178-007	EPA 6020	µg/L	6.0	ND (1.7)	U	None
		03-18-02	049369-007	EPA 6020	µg/L	6.0	ND (1.7)	U	None
	Arsenic	11-30-99	048546-003	EPA 6020	µg/L	10.0	ND (3.4)	U	None
		03-15-00	048634-003	EPA 6020	µg/L	10.0	ND (3.4)	U	None
		01-04-01	049575-003	EPA 6020	µg/L	10.0	ND (3.4)	U	None
		03-08-01	049677-009	EPA 6020	µg/L	10.0	ND (3.4)	U	None
		07-06-01	048782-007	EPA 6020	µg/L	10.0	ND (3.4)	U	None
		10-02-01	049035-007	EPA 6020	µg/L	10.0	ND (3.4)	U	None
		11-21-01	049178-007	EPA 6020	µg/L	10.0	ND (3.4)	U	None
		03-18-02	049369-007	EPA 6020	µg/L	10.0	ND (3.4)	U	None

Refer to footnotes at end of table.

Table M-3 (Continued)
Summary of Groundwater Monitoring Well TA2-W-19 Metals Analytical Results
November 1999–March 2002
(On-Site Laboratory[a])

Well ID	Analyte	Sample Date	Sample No.	Analytical Method[b]	Units	MCL[c]	Result[d]	Lab Qualifier	Validation Qualifier
TA2-W-19	Barium	11-30-99	048546-003	EPA 6020	µg/L	2,000	51		None
		03-15-00	048634-003	EPA 6020	µg/L	2,000	49		None
		01-04-01	049575-003	EPA 6020	µg/L	2,000	57		None
		03-08-01	049677-009	EPA 6020	µg/L	2,000	50		None
		07-06-01	048782-007	EPA 6020	µg/L	2,000	47		None
		10-02-01	049035-007	EPA 6020	µg/L	2,000	51		None
		11-21-01	049178-007	EPA 6020	µg/L	2,000	53		None
		03-18-02	049369-007	EPA 6020	µg/L	2,000	47		None
	Beryllium	11-30-99	048546-003	EPA 6020	µg/L	4.0	ND (0.11)	U	None
		03-15-00	048634-003	EPA 6020	µg/L	4.0	ND (0.11)	U	None
		01-04-01	049575-003	EPA 6020	µg/L	4.0	ND (0.11)	U	None
		03-08-01	049677-009	EPA 6020	µg/L	4.0	ND (0.11)	U	None
		07-06-01	048782-007	EPA 6020	µg/L	4.0	ND (0.11)	U	None
		10-02-01	049035-007	EPA 6020	µg/L	4.0	ND (0.11)	U	None
		11-21-01	049178-007	EPA 6020	µg/L	4.0	ND (0.11)	U	None
		03-18-02	049369-007	EPA 6020	µg/L	4.0	ND (0.11)	U	None
	Cadmium	11-30-99	048546-003	EPA 6020	µg/L	5.0	ND (0.23)	U	None
		03-15-00	048634-003	EPA 6020	µg/L	5.0	ND (0.23)	U	None
		01-04-01	049575-003	EPA 6020	µg/L	5.0	ND (0.23)	U	None
		03-08-01	049677-009	EPA 6020	µg/L	5.0	ND (0.23)	U	None
		07-06-01	048782-007	EPA 6020	µg/L	5.0	ND (0.23)	U	None
		10-02-01	049035-007	EPA 6020	µg/L	5.0	ND (0.23)	U	None
		11-21-01	049178-007	EPA 6020	µg/L	5.0	ND (0.23)	U	None
		03-18-02	049369-007	EPA 6020	µg/L	5.0	ND (0.23)	U	None

Refer to footnotes at end of table.

Table M-3 (Continued)
Summary of Metals Analytical Results[a] for Groundwater Monitoring Well TA2-W-19
November 1999–March 2002

Well ID	Analyte	Sample Date	Sample No.	Analytical Method[b]	Units	MCL[c]	Result[d]	Lab Qualifier	Validation Qualifier
TA2-W-19	Calcium	11-30-99	048546-003	EPA 6020	µg/L	NE	72,000	B	J,P2
		03-15-00	048634-003	EPA 6020	µg/L	NE	78,000		J,P2
		01-04-01	049575-003	EPA 6020	µg/L	NE	79,000		J,P2
		03-08-01	049677-009	EPA 6020	µg/L	NE	84,000	E	J,P2
		07-06-01	048782-007	EPA 6020	µg/L	NE	75,000		J,P2
		10-02-01	049035-007	EPA 6020	µg/L	NE	120,000	E,B	J,P2
		11-21-01	049178-007	EPA 6020	µg/L	NE	82,000	E	None
		03-18-02	049369-007	EPA 6020	µg/L	NE	68,000	E	J,P1
	Chromium	11-30-99	048546-003	EPA 6020	µg/L	100	ND (8.5)	U	None
		03-15-00	048634-003	EPA 6020	µg/L	100	ND (8.5)	U	None
		01-04-01	049575-003	EPA 6020	µg/L	100	ND (8.5)	U	None
		03-08-01	049677-009	EPA 6020	µg/L	100	ND (8.5)	U	None
		07-06-01	048782-007	EPA 6020	µg/L	100	ND (8.5)	U	None
		10-02-01	049035-007	EPA 6020	µg/L	100	ND (8.5)	U	None
		11-21-01	049178-007	EPA 6020	µg/L	100	ND (8.5)	U	None
		03-18-02	049369-007	EPA 6020	µg/L	100	ND (8.5)	U	None
	Cobalt	11-30-99	048546-003	EPA 6020	µg/L	NE	ND (0.23)	U	B
		03-15-00	048634-003	EPA 6020	µg/L	NE	0.49 (0.91)	J,B	B,J
		01-04-01	049575-003	EPA 6020	µg/L	NE	0.38 (0.91)	J,B	None
		03-08-01	049677-009	EPA 6020	µg/L	NE	0.34 (0.91)	J,B	B,J
		07-06-01	048782-007	EPA 6020	µg/L	NE	0.3 (0.91)	J,B	B,J
		10-02-01	049035-007	EPA 6020	µg/L	NE	0.97	B	B,J
		11-21-01	049178-007	EPA 6020	µg/L	NE	0.91	B	None
		03-18-02	049369-007	EPA 6020	µg/L	NE	ND (0.23)	U	None

Refer to footnotes at end of table.

Table M-3 (Continued)
Summary of Metals Analytical Results[a] for Groundwater Monitoring Well TA2-W-19
November 1999–March 2002

Well ID	Analyte	Sample Date	Sample No.	Analytical Method[b]	Units	MCL[c]	Result[d]	Lab Qualifier	Validation Qualifier
TA2-W-19	Copper	11-30-99	048546-003	EPA 6020	µg/L	NE	ND (5.7)	U	None
		03-15-00	048634-003	EPA 6020	µg/L	NE	ND (5.7)	U	None
		01-04-01	049575-003	EPA 6020	µg/L	NE	9.4 (23)	J	None
		03-08-01	049677-009	EPA 6020	µg/L	NE	ND (5.7)	U	None
		07-06-01	048782-007	EPA 6020	µg/L	NE	ND (5.7)	U	None
		10-02-01	049035-007	EPA 6020	µg/L	NE	ND (5.7)	U	None
		11-21-01	049178-007	EPA 6020	µg/L	NE	ND (5.7)	U	None
		03-18-02	049369-007	EPA 6020	µg/L	NE	ND (5.7)	U	None
	Iron	11-30-99	048546-003	EPA 6020	µg/L	NE	1000	B	B,J
		03-15-00	048634-003	EPA 6020	µg/L	NE	1300		None
		01-04-01	049575-003	EPA 6020	µg/L	NE	2100		None
		03-08-01	049677-009	EPA 6020	µg/L	NE	940		None
		07-06-01	048782-007	EPA 6020	µg/L	NE	580		A2,J,P1
		10-02-01	049035-007	EPA 6020	µg/L	NE	900		None
		11-21-01	049178-007	EPA 6020	µg/L	NE	1000		None
		03-18-02	049369-007	EPA 6020	µg/L	NE	540		A,J
	Lead	11-30-99	048546-003	EPA 6020	µg/L	NE	ND (1.7)	U	None
		03-15-00	048634-003	EPA 6020	µg/L	NE	ND (1.7)	U	None
		01-04-01	049575-003	EPA 6020	µg/L	NE	ND (1.7)	U	None
		03-08-01	049677-009	EPA 6020	µg/L	NE	ND (1.7)	U	None
		07-06-01	048782-007	EPA 6020	µg/L	NE	ND (1.7)	U	None
		10-02-01	049035-007	EPA 6020	µg/L	NE	ND (1.7)	U	None
		11-21-01	049178-007	EPA 6020	µg/L	NE	ND (1.7)	U	None
		03-18-02	049369-007	EPA 6020	µg/L	NE	ND (1.7)	U	None

Refer to footnotes at end of table.

Table M-3 (Continued)
Summary of Metals Analytical Results[a] for Groundwater Monitoring Well TA2-W-19
November 1999–March 2002

Well ID	Analyte	Sample Date	Sample No.	Analytical Method[b]	Units	MCL[c]	Result[d]	Lab Qualifier	Validation Qualifier
TA2-W-19	Magnesium	11-30-99	048546-003	EPA 6020	µg/L	NE	13,000		J,P2
		03-15-00	048634-003	EPA 6020	µg/L	NE	12,000		J,P2
		01-04-01	049575-003	EPA 6020	µg/L	NE	13,000		J,P2
		03-08-01	049677-009	EPA 6020	µg/L	NE	12,000		J,P2
		07-06-01	048782-007	EPA 6020	µg/L	NE	11,000		J,P2
		10-02-01	049035-007	EPA 6020	µg/L	NE	11,000		J,P2
		11-21-01	049178-007	EPA 6020	µg/L	NE	12,000		None
		03-18-02	049369-007	EPA 6020	µg/L	NE	11,000		None
	Manganese	11-30-99	048546-003	EPA 6020	µg/L	NE	ND (2.8)	U	None
		03-15-00	048634-003	EPA 6020	µg/L	NE	ND (2.8)	U	None
		01-04-01	049575-003	EPA 6020	µg/L	NE	22		None
		03-08-01	049677-009	EPA 6020	µg/L	NE	8 (11)	J	None
		07-06-01	048782-007	EPA 6020	µg/L	NE	ND (2.8)	U	None
		10-02-01	049035-007	EPA 6020	µg/L	NE	8.1 (11)	J	None
		11-21-01	049178-007	EPA 6020	µg/L	NE	5.1 (11)	J	None
		03-18-02	049369-007	EPA 6020	µg/L	NE	5.5 (11)	J	None
	Mercury	11-30-99	048546-003	EPA 6020	µg/L	2.0	ND (0.23)	U	None
		03-15-00	048634-003	EPA 6020	µg/L	2.0	ND (0.23)	U	None
		01-04-01	049575-003	EPA 6020	µg/L	2.0	ND (0.23)	U	None
		03-08-01	049677-009	EPA 6020	µg/L	2.0	ND (0.23)	U	None
		07-06-01	048782-007	EPA 6020	µg/L	2.0	ND (0.23)	U	None
		10-02-01	049035-007	EPA 6020	µg/L	2.0	ND (0.23)	U	None
		11-21-01	049178-007	EPA 6020	µg/L	2.0	ND (0.23)	U	None
		03-18-02	049369-007	EPA 6020	µg/L	2.0	ND (0.23)	U	None

Refer to footnotes at end of table.

Table M-3 (Continued)
Summary of Metals Analytical Results[a] for Groundwater Monitoring Well TA2-W-19
November 1999–March 2002

Well ID	Analyte	Sample Date	Sample No.	Analytical Method[b]	Units	MCL[c]	Result[d]	Lab Qualifier	Validation Qualifier
TA2-W-19	Nickel	11-30-99	048546-003	EPA 6020	µg/L	NE	ND (1.1)	U	None
		03-15-00	048634-003	EPA 6020	µg/L	NE	4.2 (4.5)	J	None
		01-04-01	049575-003	EPA 6020	µg/L	NE	4.8	B	B,J
		03-08-01	049677-009	EPA 6020	µg/L	NE	3.5 (4.5)	J	None
		07-06-01	048782-007	EPA 6020	µg/L	NE	13		None
		10-02-01	049035-007	EPA 6020	µg/L	NE	2.8 (4.5)	J	None
		11-21-01	049178-007	EPA 6020	µg/L	NE	8.2		None
		03-18-02	049369-007	EPA 6020	µg/L	NE	2.1 (4.5)	J	None
	Potassium	11-30-99	048546-003	EPA 6020	µg/L	NE	500 (680)	J	A,J
		03-15-00	048634-003	EPA 6020	µg/L	NE	1,500		None
		01-04-01	049575-003	EPA 6020	µg/L	NE	2,200		None
		03-08-01	049677-009	EPA 6020	µg/L	NE	1,900		A2,J
		07-06-01	048782-007	EPA 6020	µg/L	NE	1,800		None
		10-02-01	049035-007	EPA 6020	µg/L	NE	2,200		None
		11-21-01	049178-007	EPA 6020	µg/L	NE	2,100		None
		03-18-02	049369-007	EPA 6020	µg/L	NE	1,600		A2,J
	Selenium	11-30-99	048546-003	EPA 6020	µg/L	50.0	10		None
		03-15-00	048634-003	EPA 6020	µg/L	50.0	9.3		None
		01-04-01	049575-003	EPA 6020	µg/L	50.0	5.7 (6.8)	J,B	B,J
		03-08-01	049677-009	EPA 6020	µg/L	50.0	9.8		None
		07-06-01	048782-007	EPA 6020	µg/L	50.0	7.8		None
		10-02-01	049035-007	EPA 6020	µg/L	50.0	8.2	B	B,J
		11-21-01	049178-007	EPA 6020	µg/L	50.0	11		None
		03-18-02	049369-007	EPA 6020	µg/L	50.0	6.7 (6.8)	J	None

Refer to footnotes at end of table.

Table M-3 (Continued)
Summary of Metals Analytical Results[a] for Groundwater Monitoring Well TA2-W-19
November 1999–March 2002

Well ID	Analyte	Sample Date	Sample No.	Analytical Method[b]	Units	MCL[c]	Result[d]	Lab Qualifier	Validation Qualifier
TA2-W-19	Silver	11-30-99	048546-003	EPA 6020	µg/L	NE	ND (0.23)	U	None
		03-15-00	048634-003	EPA 6020	µg/L	NE	ND (0.23)	U	None
		01-04-01	049575-003	EPA 6020	µg/L	NE	0.34 (0.91)	J	None
		03-08-01	049677-009	EPA 6020	µg/L	NE	ND (0.23)	U	None
		07-06-01	048782-007	EPA 6020	µg/L	NE	ND (0.23)	U	A2,P2,UJ
		10-02-01	049035-007	EPA 6020	µg/L	NE	ND (0.23)	U	A,J
		11-21-01	049178-007	EPA 6020	µg/L	NE	ND (0.23)	U	None
		03-18-02	049369-007	EPA 6020	µg/L	NE	ND (0.23)	U	None
	Sodium	11-30-99	048546-003	EPA 6020	µg/L	NE	25,000		J,P2
		03-15-00	048634-003	EPA 6020	µg/L	NE	23,000		J,P2
		01-04-01	049575-003	EPA 6020	µg/L	NE	24,000		J,P2
		03-08-01	049677-009	EPA 6020	µg/L	NE	22,000		J,P2
		07-06-01	048782-007	EPA 6020	µg/L	NE	22,000		J,P2
		10-02-01	049035-007	EPA 6020	µg/L	NE	21,000		J,P2
		11-21-01	049178-007	EPA 6020	µg/L	NE	23,000		None
		03-18-02	049369-007	EPA 6020	µg/L	NE	21,000		None
	Thallium	11-30-99	048546-003	EPA 6020	µg/L	2.0	ND (1.7)	U	None
		03-15-00	048634-003	EPA 6020	µg/L	2.0	ND (1.7)	U	None
		01-04-01	049575-003	EPA 6020	µg/L	2.0	ND (1.7)	U	None
		03-08-01	049677-009	EPA 6020	µg/L	2.0	ND (1.7)	U	None
		07-06-01	048782-007	EPA 6020	µg/L	2.0	ND (1.7)	U	None
		10-02-01	049035-007	EPA 6020	µg/L	2.0	ND (1.7)	U	None
		11-21-01	049178-007	EPA 6020	µg/L	2.0	ND (1.7)	U	None
		03-18-02	049369-007	EPA 6020	µg/L	2.0	ND (1.7)	U	None

Refer to footnotes at end of table.

Table M-3 (Concluded)
Summary of Metals Analytical Results[a] for Groundwater Monitoring Well TA2-W-19
November 1999–March 2002

Well ID	Analyte	Sample Date	Sample No.	Analytical Method[b]	Units	MCL[c]	Result[d]	Lab Qualifier	Validation Qualifier
TA2-W-19	Vanadium	11-30-99	048546-003	EPA 6020	µg/L	NE	ND (2.8)	U	None
		03-15-00	048634-003	EPA 6020	µg/L	NE	7.4 (11)	J	None
		01-04-01	049575-003	EPA 6020	µg/L	NE	6.6 (11)	J	None
		03-08-01	049677-009	EPA 6020	µg/L	NE	ND (2.8)	U	None
		07-06-01	048782-007	EPA 6020	µg/L	NE	ND (2.8)	U	None
		10-02-01	049035-007	EPA 6020	µg/L	NE	5.3 (11)	J	None
		11-21-01	049178-007	EPA 6020	µg/L	NE	7.3 (11)	J	None
		03-18-02	049369-007	EPA 6020	µg/L	NE	4.8 (11)	J	None
	Zinc	11-30-99	048546-003	EPA 6020	µg/L	NE	ND (23)	U	B
		03-15-00	048634-003	EPA 6020	µg/L	NE	ND (23)	U	None
		01-04-01	049575-003	EPA 6020	µg/L	NE	ND (23)	U	None
		03-08-01	049677-009	EPA 6020	µg/L	NE	ND (23)	U	None
		07-06-01	048782-007	EPA 6020	µg/L	NE	ND (23)	U	None
		10-02-01	049035-007	EPA 6020	µg/L	NE	ND (23)	U	None
		11-21-01	049178-007	EPA 6020	µg/L	NE	ND (23)	U	None
		03-18-02	049369-007	EPA 6020	µg/L	NE	ND (23)	U	None

[a]Environmental Restoration Chemistry Laboratory.

[b]EPA 1986.

[c]MCL established by the EPA Primary Drinking Water Regulations in 40 CFR 141, and subsequent amendments, or New Mexico Environmental Improvement Board in New Mexico Register, Title 20, Part I.

[d]If result detected below quantitation limit, then quantitation limit is indicated in parentheses.

CFR = Code of Federal Regulations.
EPA = U.S. Environmental Protection Agency.
MCL = Maximum contaminant level.
µg/L = Microgram(s) per liter.
ND = Not detected (at method detection limit).
ND ( ) = Not detected above the detection limit, shown in parentheses.
NE = Not established.
TA = Technical Area.
W = Water.

Lab Qualifiers
B = Analyte is detected in associated laboratory method blank sample.
E = Result exceeds highest laboratory calibration level.
J = Analyte is detected below the quantitation limit.
U = Analyte is absent or below the method detection limit.

Validation Qualifiers
A = Laboratory accuracy and/or bias measurements for the laboratory control and duplicate control samples do not meet acceptance criteria.
A2 = Laboratory accuracy and/or bias measurements for the matrix spike and matrix spike duplicate samples do not meet acceptance criteria.
B = Analyte is present in associated laboratory method blank sample.
J = The associated value is an estimated quantity.
None = All quality control samples met acceptance criteria with respect to submitted samples.
P1 = Laboratory precision measurements for the matrix spike and matrix spike duplicate samples do not meet acceptance criteria.
P2 = Insufficient quality control data to determine laboratory precision.
UJ = Analyte was analyzed for but not detected, and the associated value is an estimate and may be inaccurate or imprecise.

Table M-4
Summary of Groundwater Monitoring Well TA2-W-19 Nitrate Analytical Results
November 1999–March 2002
(On-Site Laboratory[a])

Well ID	Analyte	Sample Date	Sample No.	Analytical Method[b]	Units	MCL[c]	Result	Lab Qualifier	Validation Qualifier
TA2-W-19	Nitrate (as Nitrogen)	11-30-99	048546-004	HACH_NO3	mg/L	10	9.9		None
		03-15-00	048634-004	HACH_NO3	mg/L	10	7.8		None
		01-04-01	049575-004	HACH_NO3	mg/L	10	13		None
		03-08-01	049677-016	HACH_NO3	mg/L	10	24		None
		07-06-01	048782-016	HACH_NO3	mg/L	10	7.2		None
		11-02-01	049035-016	HACH_NO3	mg/L	10	7.8		None
		11-21-01	049178-016	HACH_NO3	mg/L	10	3.8		None
		03-18-02	049369-016	Nitrate_EP	mg/L	10	8.8		None

Note: Values in **bold** exceed the associated MCL.
[a]Environmental Restoration Chemistry Laboratory.
[b]EPA 1986.
[c]MCL established by the EPA Primary Drinking Water Regulations in 40 CFR 141, and subsequent amendments, or New Mexico Environmental Improvement Board in New Mexico Register, Title 20, Part I.
EPA = U.S. Environmental Protection Agency.
MCL = Maximum contaminant level.
mg/L = Milligram(s) per liter.
None = All quality control samples met acceptance criteria with respect to submitted samples.
TA = Technical Area.
W = Water.

Table M-5
Summary of Groundwater Monitoring Well TA2-W-19 General Chemistry Analytical Results
November 1999–March 2002
(On-Site and Off-Site Laboratories[a])

Well ID	Analyte	Sample Date	Sample No.	Analytical Method[b]	Units	MCL[c]	Result[d]	Lab Qualifier	Validation Qualifier
TA2-W-19	Alkalinity as CaCo3	11-30-99	048546-005	HACH_ALK	mg/L	NE	110		None
		03-15-00	048634-005	HACH_ALK	mg/L	NE	100		None
		01-04-01	049575-005	HACH_ALK	mg/L	NE	100		None
		03-08-01	049677-013	HACH_ALK	mg/L	NE	110		None
		07-06-01	048872-113	HACH_ALK	mg/L	NE	99		None
		07-06-01	048782-013	EPA 310.1	mg/L	NE	88.4		
		10-02-01	049035-013	HACH_ALK	mg/L	NE	110		None
		11-21-01	049178-013	HACH_ALK	mg/L	NE	100		None
		03-18-02	049369-013	HACH_ALK	mg/L	NE	110		None
	Bromide	11-30-99	048546-005	Anions_CE	mg/L	NE	ND (0.4)	U	None
		03-15-00	048634-005	Anions_CE	mg/L	NE	ND (0.4)	U	None
		01-04-01	049575-005	Anions_CE	mg/L	NE	ND (0.4)	U	None
		03-08-01	049677-013	Anions_CE	mg/L	NE	ND (0.4)	U	None
		07-06-01	048872-013	EPA 300.0	mg/L	NE	0.837		
		10-02-01	049071-013	SW846 9056	mg/L	NE	0.679		
		11-21-01	049178-013	Anions_EPA	mg/L	NE	0.75		None
		03-18-02	049369-013	Anions_EPA	mg/L	NE	0.82		None
	Chloride	11-30-99	048546-005	Anions_CE	mg/L	NE	73		None
		03-15-00	048634-005	Anions_CE	mg/L	NE	70		None
		01-04-01	049575-005	Anions_CE	mg/L	NE	71		None
		03-08-01	049677-013	Anions_CE	mg/L	NE	76		None
		07-06-01	048872-013	EPA 300.0	mg/L	NE	68		
		10-02-01	049071-013	SW846 9056	mg/L	NE	76.6		
		11-21-01	049178-013	Anions_EPA	mg/L	NE	74		None
		03-18-02	049369-013	Anions_EPA	mg/L	NE	69		None

Refer to footnotes at end of table.

Table M-5 (Concluded)
Summary of Groundwater Monitoring Well TA2-W-19 General Chemistry Analytical Results
November 1999–March 2002
(On-Site and Off-Site Laboratories[a])

Well ID	Analyte	Sample Date	Sample No.	Analytical Method[b]	Units	MCL[c]	Result[d]	Lab Qualifier	Validation Qualifier
TA2-W-19	Fluoride	11-30-99	048546-005	Anions_CE	mg/L	4.0	ND (0.5)	U	None
		03-15-00	048634-005	Anions_CE	mg/L	4.0	ND (0.5)	U	None
		01-04-01	049575-005	Anions_CE	mg/L	4.0	ND (0.5)	U	None
		03-08-01	049677-013	Anions_CE	mg/L	4.0	ND (0.5)	U	None
		07-06-01	048872-013	EPA 300.0	mg/L	4.0	0.332		
		10-02-01	049071-013	SW846 9056	mg/L	4.0	0.22		
		11-21-01	049178-013	Anions_EPA	mg/L	4.0	0.34 (0.4)	J	None
		03-18-02	049369-013	Anions_EPA	mg/L	4.0	0.35 (0.4)	J	None
	Sulfate	11-30-99	048546-005	Anions_CE	mg/L	NE	68		None
		03-15-00	048634-005	Anions_CE	mg/L	NE	66		None
		01-04-01	049575-005	Anions_CE	mg/L	NE	65		None
		03-08-01	049677-013	Anions_CE	mg/L	NE	72		None
		07-06-01	048872-013	EPA 300.0	mg/L	NE	59.2		
		10-02-01	049071-013	SW846 9056	mg/L	NE	63.3		
		11-21-01	049178-013	Anions_EPA	mg/L	NE	66		None
		03-18-02	049369-013	Anions_EPA	mg/L	NE	71		None
	Total Dissolved Solids	03-08-01	049667-099	EPA 160.1	mg/L	NE	429		
		07-06-01	048782-099	EPA 160.1	mg/L	NE	455		

[a]All analyses performed by the Environmental Restoration Chemistry Laboratory (On-Site Laboratory) except the July 2001 alkalinity split (048782-013), the July and October 2001 anions, and the total dissolved solids, which were analyzed by General Engineering Laboratories, Inc. (Off-Site Laboratory).

[b]EPA 1986.

[c]MCL established by the EPA Primary Drinking Water Regulations in 40 CFR 141, and subsequent amendments, or New Mexico Environmental Improvement Board in New Mexico Register, Title 20, Part I.

[d]If result detected below quantitation limit, then quantitation limit is indicated in parentheses.

CFR = Code of Federal Regulations.
EPA = U.S. Environmental Protection Agency.
J = Analyte is detected below the quantitation limit.
MCL = Maximum contaminant level.
mg/L = Milligram(s) per liter.
ND ( ) = Not detected above the detection limit, shown in parentheses.
NE = Not established.
None = All quality control samples met acceptance criteria with respect to submitted samples.
S = Soil sample.

Lab Qualifiers
U = Analyte is absent or below the method detection limit.

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JUSTIFICATION FOR CLASS III
PERMIT MODIFICATION MARCH 2005
SWMU 227 OPERABLE UNIT 1309
BUILDING 904 OUTFALL SOUTHEAST OF
TECHNICAL AREA II