Nevada
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Restoration
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DOE/NV--729

Corrective Action Decision Document/ Closure Report for Corrective Action Unit 409: Other Waste Sites, Tonopah Test Range, Nevada

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Revision No.: 0

June 2001

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DOE/NV--729

CORRECTIVE ACTION DECISION DOCUMENT/ CLOSURE REPORT FOR CORRECTIVE ACTION UNIT 409: OTHER WASTE SITES, TONOPAH TEST RANGE, NEVADA

U.S. Department of Energy
National Nuclear Security Administration
Nevada Operations Office
Las Vegas, Nevada

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CORRECTIVE ACTION DECISION DOCUMENT/CLOSURE REPORT FOR CORRECTIVE ACTION UNIT 409: OTHER WASTE SITES, TONOPAH TEST RANGE, NEVADA

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List of Acronyms and Abbreviations

bgs	Below ground surface
CADD	Corrective Action Decision Document
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CLP	Contract Laboratory Program
COC	Contaminant(s) of concern
COPC	Contaminant(s) of potential concern
CR	Closure Report
CRDL	Contract-Required Detection Limit
DOE	U.S. Department of Energy
DQO	Data Quality Objectives
DRO	Diesel-range organics
EM	Electromagnetic
EPA	U.S. Environmental Protection Agency
FFACO	*Federal Facility Agreement and Consent Order*
FSL	Field-screening level(s)
ft	Foot (feet)
GPR	Ground-penetrating radar
GPS	Global Positioning System
GRO	Gasoline-range organics
ICP	Inductively coupled plasma
IDW	Investigation-derived waste
in.	Inch(es)
LCS	Laboratory control samples
mg/kg	Milligram(s) per kilogram

List of Acronyms and Abbreviations *(Continued)*

mg/L	Milligram(s) per liter
mi	Mile(s)
MRL	Minimum reporting limit(s)
MS/MSD	Matrix spike/matrix spike duplicate
NAC	*Nevada Administrative Code*
NDEP	Nevada Division of Environmental Protection
NIST	National Institute for Standards and Technology
NTS	Nevada Test Site
PAL	Preliminary action level(s)
PCB	Polychlorinated biphenyl(s)
pCi/g	Picocurie(s) per gram
ppm	Part(s) per million
PRG	Preliminary remediation goal(s)
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RCRA	*Resource Conservation and Recovery Act*
RPD	Relative percent difference
SDG	Sample delivery group
SVOC	Semivolatile organic compound(s)
TCLP	Toxicity Characteristic Leaching Procedure
Th	Thorium
TPH	Total petroleum hydrocarbon(s)
TTR	Tonopah Test Range
U	Uranium
VOC	Volatile organic compound(s)

List of Acronyms and Abbreviations (Continued)

XRF	X-ray fluorescence
%R	Percent recovery

Executive Summary

This Corrective Action Decision Document/Closure Report (CADD/CR) has been prepared for Corrective Action Unit (CAU) 409: Other Waste Sites, Tonopah Test Range (TTR), Nevada, in accordance with the *Federal Facility Agreement and Consent Order* (FFACO, 1996). This CAU is located within the Tonopah Test Range, Nevada.

Corrective Action Unit 409 is comprised of the following Corrective Action Sites (CASs):

- CAS RG-24-001-RGCR, Battery Dump Site
- CAS TA-53-001-TAB2, Septic Sludge Disposal Pit
- CAS TA-53-002-TAB2, Septic Sludge Disposal Pit

The scope of this CADD/CR is to justify and recommend that no corrective action is required at CAU 409. To achieve this, the following actions are required:

- Review the current site conditions, including the concentration and extent of contamination.
- Document closure of the CAU.

In November 2000, a corrective action investigation was performed as set forth in the *Corrective Action Investigation Plan for Corrective Action Unit 409: Other Waste Sites, Tonopah Test Range, Nevada* (DOE/NV, 2000). The objectives of the corrective action investigation are described as follows:

- Verify the location of the Septic Sludge Disposal Pits.
- Identify the presence and the vertical and lateral extent of contaminants of potential concern.
- Provide sufficient information and data to develop appropriate corrective actions for each CAS.

Analytes detected during the corrective action investigation were evaluated against preliminary action levels to determine contaminants of concern for CAU 409. Analysis of the data generated from corrective action investigation activities indicates the preliminary action levels were not exceeded for total volatile organic compounds, Toxicity Characteristic Leaching Procedure

(TCLP) volatile organic compounds, total semivolatile organic compounds, TCLP semivolatile organic compounds, total *Resource Conservation and Recovery Act* metals (except arsenic), TCLP *Resource Conservation and Recovery Act* metals, polychlorinated biphenyls, total petroleum hydrocarbons as gasoline-range organics, total petroleum hydrocarbons as diesel-range organics, isotopic uranium (U), and gamma-emitting radionuclides (except thorium [Th]-234) for any of the soil samples collected from CAU 409.

Concentrations of arsenic were detected above the preliminary action level in all samples; however, the concentrations are considered representative of ambient conditions at the site. Thorium-234 was tentatively identified (estimated value) in one sample; however, the concentration is considered no greater than background.

The U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office, provides the following recommendations:

- No corrective action is required at CAU 409.
- No Corrective Action Plan is required.
- A Notice of Completion to the U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office, is requested from the Nevada Division of Environmental Protection for the closure of CAU 409.
- Corrective Action Unit 409 should be moved from Appendix III to Appendix IV of the *Federal Facility Agreement and Consent Order.*
- No use restrictions are required to be placed on CAU 409.

Additionally, several housekeeping activities were completed at CAS RG-24-001-RGCR, Battery Dump Site, under best management practices. Verification samples were collected from three locations of discolored soil or debris associated with the discarded batteries and damaged casings. Discarded batteries were transported to the TTR recycling collection point or the TTR Hazardous Waste Accumulation Facility, construction debris was transferred to the TTR scrap yard, and confirmatory photographs of the site cleanup were taken.

1.0 Introduction

This Corrective Action Decision Document (CADD)/Closure Report (CR) has been prepared for Corrective Action Unit (CAU) 409: Other Waste Sites, Tonopah Test Range, Nevada, in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the State of Nevada, the U.S. Department of Energy (DOE), and the U.S Department of Defense (FFACO, 1996). The CADD and CR have been combined into one report because sample data collected during corrective action investigation activities showed no evidence of contamination in soil at the sites associated with the CAU. The CADD/CR provides or references the specific information necessary to recommend the "no further action" alternative for each of the Corrective Action Sites (CASs) within CAU 409.

Corrective Action Unit 409 is located near Area 3 of the Tonopah Test Range (TTR), Nevada. The TTR is approximately 140 miles (mi) northwest of Las Vegas, Nevada, as shown in Figure 1-1. The location of CAU 409 within the TTR is shown in Figure 1-2.

Corrective Action Unit 409 is comprised of the following CASs:

- CAS RG-24-001-RGCR, Battery Dump Site
- CAS TA-53-001-TAB2, Septic Sludge Disposal Pit (hereinafter referred to as Septic Sludge Disposal Pit #1)
- CAS TA-53-002-TAB2, Septic Sludge Disposal Pit (hereinafter referred to as Septic Sludge Disposal Pit #2)

1.1 Purpose

This CADD/CR provides justification for the closure of CAU 409 without further action. This justification is based on process knowledge and the results of investigative activities conducted in accordance with the *Corrective Action Investigation Plan for Corrective Action Unit 409: Other Waste Sites, Tonopah Test Range, Nevada* (DOE/NV, 2000), and described in Appendix A.

The corrective action investigation analytical results indicated that no contaminants of concern (COCs) were identified in soil samples collected at CAU 409 associated with Septic Sludge

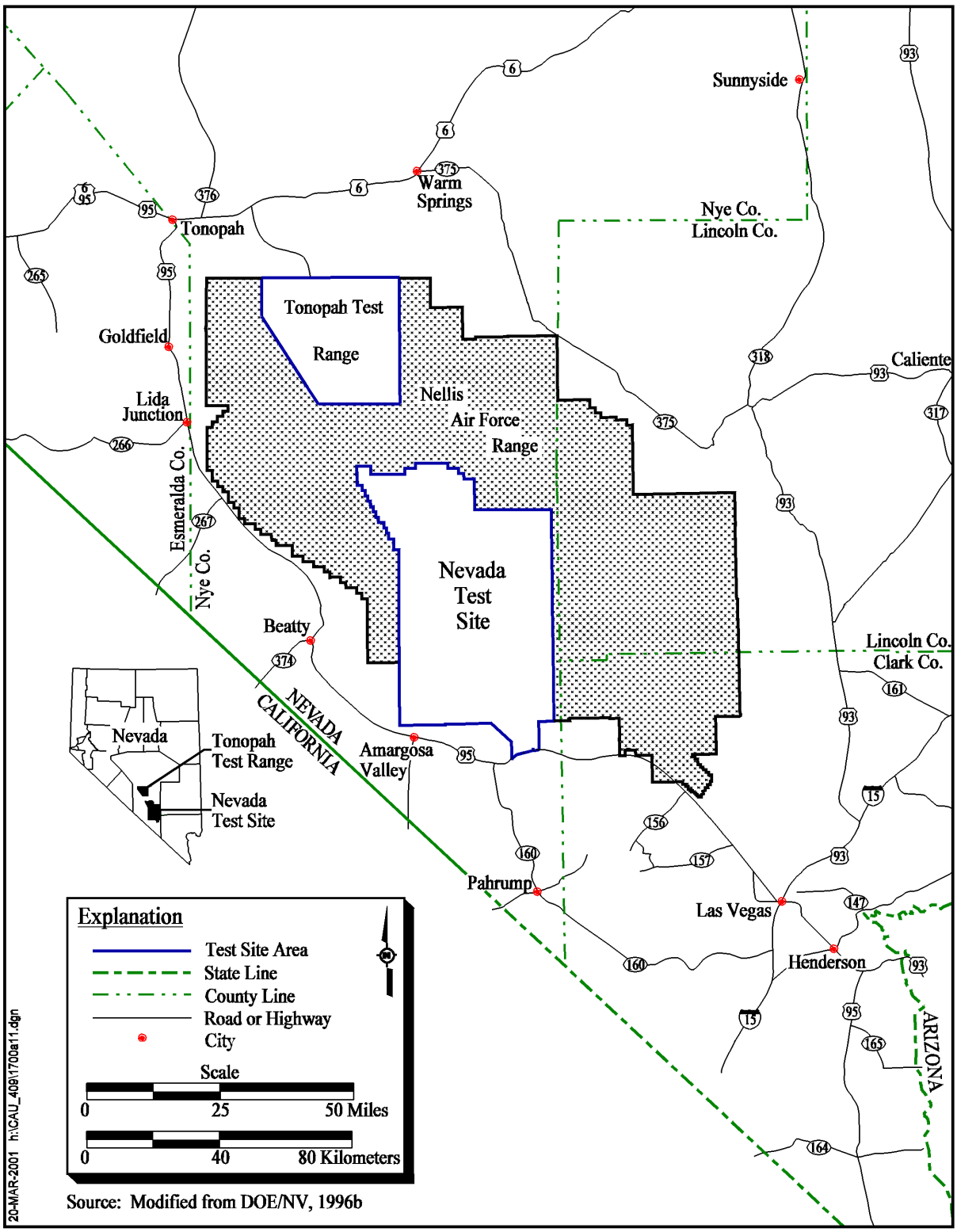

Figure 1-1
Tonopah Test Range Location Map

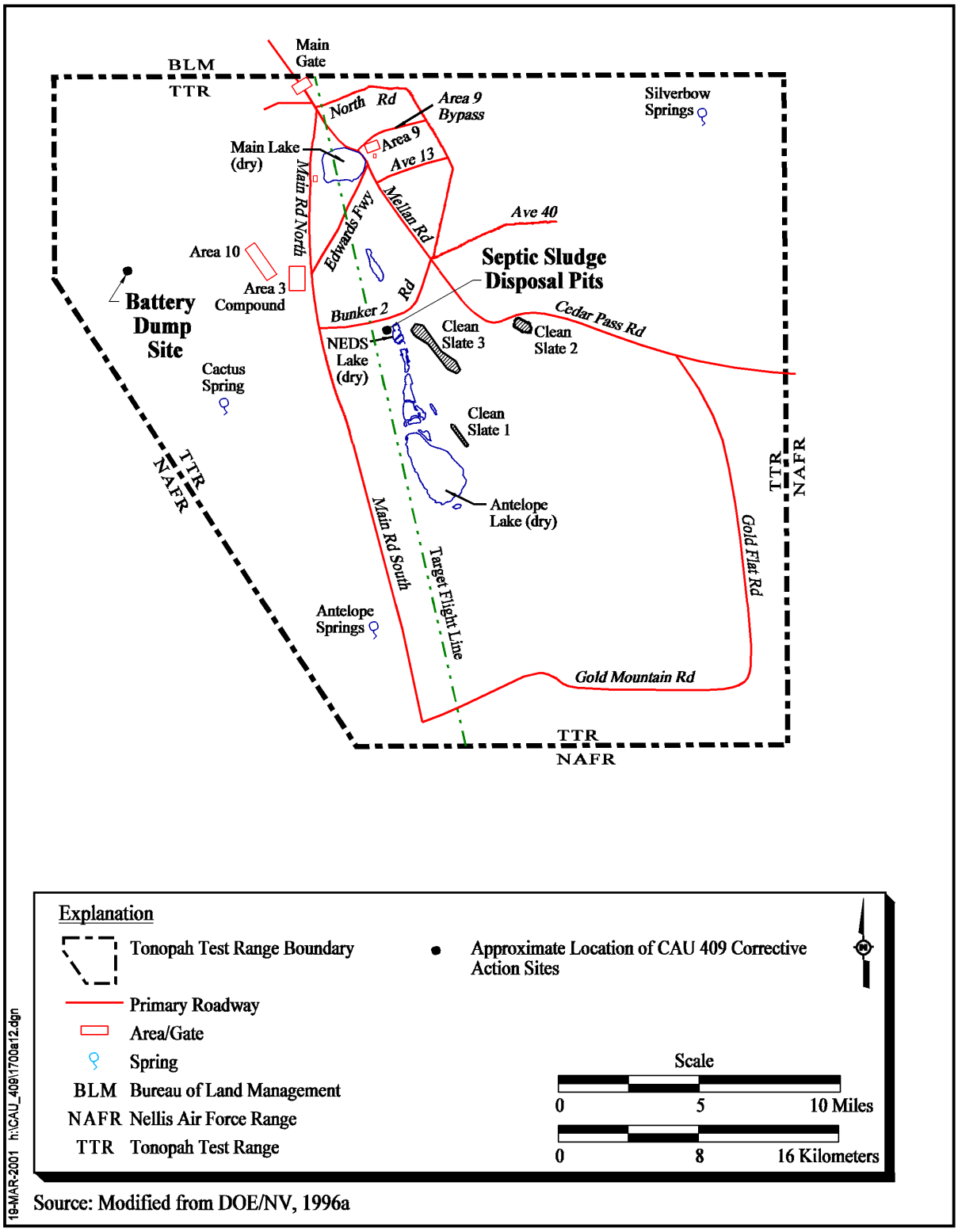

Figure 1-2
Location of CAU 409 at Tonopah Test Range

Disposal Pit #1, and Septic Sludge Disposal Pit #2. Verification sample results indicate that no COCs remain at the Battery Dump Site.

1.2 Scope

The scope of this CADD/CR is to justify and recommend that no corrective action is required at CAU 409. To achieve this scope, the following actions are required:

- Review the current site conditions, including the concentration and extent of contamination.
- Document closure of CAU 409.

1.3 CADD/CR Contents

This CADD/CR is divided into the following sections:

Section 1.0 - Introduction: summarizes the purpose, scope, and contents of this CADD/CR.

Section 2.0 - Corrective Action Investigation Summary: summarizes the investigation field activities, the results of the investigation, and the need for corrective action.

Section 3.0 - Recommendation: recommends no further action and closure of CAU 409.

Section 4.0 - References: provides a list of all referenced documents.

Appendix A: *Corrective Action Investigation Report for CAU 409: Other Waste Sites, Tonopah Test Range, Nevada*

Appendix B: Soil Boring Logs

Appendix C: Field Screening of Soil for Silver by X-Ray Fluorescence (XRF)

Appendix D: Geotechnical Analytical Results

Appendix E: Documentation of Housekeeping Closure Activities

Appendix F: Nevada Environmental Restoration Project Document Review Sheets

All work was performed in accordance with the following documents:

- *Corrective Action Investigation Plan for Corrective Action Unit 409: Other Waste Sites, Tonopah Test Range, Nevada,* Rev. 0, DOE/NV--649 (DOE/NV, 2000)
- *Industrial Sites Quality Assurance Project Plan* (QAPP), Rev. 1, DOE/NV--372 (DOE/NV, 1996c)
- FFACO (1996)
- *Project Management Plan,* Rev. 0 (DOE/NV, 1994)

2.0 Corrective Action Investigation Summary

The following sections describe and summarize the results of the investigation activities conducted at CAU 409. For detailed investigation results, please refer to Appendix A.

2.1 Investigation Activities

Corrective action investigation activities were performed as set forth in the CAU 409 Corrective Action Investigation Plan (CAIP) (DOE/NV, 2000) from November 7 through November 28, 2000. The objectives of the investigation include:

- Collect the discarded batteries and associated debris at the Battery Dump Site for proper disposal and recycling. Collect verification samples, as necessary.
- Identify the presence and the vertical and lateral extent of the contaminants of potential concern (COPCs) at the two Septic Sludge Disposal Pits.
- Investigate the subsurface geology and configuration of two anomalies, identified during a summer 2000 geophysical investigation.
- Determine local geologic strata.
- Provide sufficient information and data to develop appropriate corrective actions for each CAS.

Investigation activities were conducted at each CAS. These activities are summarized below:

- CAS RG-24-001-RGCR, Battery Dump Site
  - Collected 17 discarded lead-acid batteries and associated construction debris.
  - Photographed the site before and after clean-up activities.
  - Transferred the batteries to the TTR recycling center or the TTR Hazardous Waste Accumulation Facility and the construction debris to the TTR scrap yard.
  - Removed a small amount of discolored soil and minor debris, less than 1 ft^3, associated with the discarded batteries.
  - Collected verification samples at three locations where debris and discolored soil associated with the discarded batteries and damaged casings were removed. Submitted six verification samples for total *Resource Conservation and Recovery Act* (RCRA) metals analysis.

- CAS TA-53-001-TAB2, Septic Sludge Disposal Pit #1

  - Collected radiological background samples from a boring located in an undisturbed area of the site to establish subsurface radiological field-screening levels. Submitted three radiological background samples for isotopic uranium and gamma spectrometry confirmatory analyses.

  - Collected surface and subsurface soil samples for laboratory analysis using continuous coring techniques. Submitted three environmental soil samples for the following analyses: total volatile organic compounds (VOCs), Toxicity Characteristic Leaching Procedure (TCLP) VOCs, total semivolatile organic compounds (SVOCs), TCLP SVOCs, total RCRA metals, TCLP RCRA metals, polychlorinated biphenyls (PCBs), total petroleum hydrocarbons (TPH) diesel-range organics (DRO), TPH gasoline-range organics (GRO), isotopic uranium, and gamma-emitting radionuclides.

  - Field screened soil samples for VOCs, alpha/beta-emitters, and silver.

  - Logged soil core to assess disposal pit geology.

- CAS TA-53-002-TAB2, Septic Sludge Disposal Pit #2

  - Collected surface and subsurface soil samples for laboratory analysis using continuous coring techniques. Submitted three environmental soil samples for the following analyses: total VOCs, TCLP VOCs, total SVOCs, TCLP SVOCs, total RCRA metals, TCLP RCRA metals, PCBs, TPH (DRO), TPH (GRO), isotopic uranium, and gamma-emitting radionuclides.

  - Field screened soil samples for VOCs, alpha/beta emitters, and silver.

  - Collected and submitted one sample for geotechnical analysis.

  - Logged soil core to assess disposal pit geology.

In addition to the boreholes drilled at the Septic Sludge Disposal Pits, the following boreholes were drilled:

- Anomaly Boreholes

  - Drilled boreholes at the two anomalies identified during the summer 2000 geophysical investigation. Continuous coring and auguring was used to advance the boreholes to total depth.

  - Logged soil core to assess site geology.

- Geologic Background Boreholes

  - Continuously cored two boreholes in undisturbed locations and logged soil core to assess site geology.

2.2 Results

The corrective action investigation results indicated the following:

- The Battery Dump Site was located and verification samples were collected from three locations where debris and discolored soil associated with discarded batteries and damaged casings were removed. All concentrations of total RCRA metals in the verification samples were below the Preliminary Action Levels (PALs) established in the CAIP (DOE/NV, 2000) except for arsenic. Although the concentrations of arsenic exceeded the PAL, the concentrations are considered representative of ambient conditions for the TTR (NBMG, 1998; Moore, 1999). The discarded batteries were transferred to the TTR recycling center or the TTR Hazardous Waste Accumulation Facility, the construction debris was transferred to the TTR scrap yard, and confirmatory photographs of the site cleanup were taken.

- A small amount of debris and discolored soil, less than 1cubic foot, associated with the discarded batteries were removed from the Battery Dump Site as part of the housekeeping activities. Samples of the discolored soil were not collected. Verification sample analytical results collected where discolored soil and debris were removed show that there is no contamination above action levels remaining at the site. There are no records available documenting the disposal of the specific debris/soil removed as part of the housekeeping activities.

- The locations and general configurations of the two Septic Sludge Disposal Pits were identified. The disposal pits were found to be shallower than anticipated and neither contained any identifiable septic sludge or other contamination.

- The Septic Sludge Disposal Pits are discrete features. There are no trench-like features or anomalous depositional features between the two disposal pits.

- One of the anomalies detected during the summer 2000 geophysical investigation was drilled and is not believed to be a disposal pit, based on lithology and visual observation of soil core. Drilling did not locate the other identified anomaly.

- All concentrations of total VOCs, total SVOCs, TPH (DRO), TPH (GRO), TCLP VOCs, TCLP SVOCs, TCLP RCRA metals, and PCBs in soil samples were below the PALs outlined in the CAIP (DOE/NV, 2000).

- All concentrations of total RCRA metals in soil samples were below PALs established in the CAIP (DOE/NV, 2000) except for arsenic. Although the concentrations of arsenic exceeded the PAL, the concentrations are considered representative of ambient conditions for the TTR (NBMG, 1998; Moore, 1999).

- Isotopic uranium results for soil samples are not considered to be statistically different from their respective established background levels; therefore, they are below PALs.

- Gamma spectrometry results for soil samples, except for thorium (Th)-234 detected in one sample, are not considered to be statistically different from their respective established background levels; therefore, they are below PALs. The Th-234 result was tentatively identified by the laboratory, is an estimated value, and is a naturally occurring decay product of the uranium (U)-238 series. Therefore, the Th-234 concentration is considered no greater than background.

- Field-screening results did not exceed established field-screening levels.

2.3 Need for Corrective Action

Analytes detected during the corrective action investigation were evaluated against PALs to determine COCs for CAU 409. Analytical results did not exceed PALs except for arsenic concentrations in all soil samples and Th-234 in one soil sample. The concentrations of arsenic are considered ambient at this site (NBMG, 1998; Moore, 1999), and the Th-234 concentration is considered no greater than background. Therefore, no corrective action is necessary for this site.

3.0 Recommendation

Based on the results of the corrective action investigation discussed in Appendix A, no COCs have been identified in the soil at CAU 409. Therefore, the U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office provides the following recommendations:

- No corrective action or use restriction is required at CAU 409.
- No Corrective Action Plan is required.
- A Notice of Completion to U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office is requested from NDEP for the closure of CAU 409.
- CAU 409 should be moved from Appendix III to Appendix IV of the FFACO.

4.0 References

DOE/NV, see U.S. Department of Energy, Nevada Operations Office.

FFACO, see *Federal Facility Agreement and Consent Order.*

Federal Facility Agreement and Consent Order. 1996 (as amended). Agreed to by the State of Nevada, the U.S. Department of Energy, and the U.S. Department of Defense.

Moore, J., Science Applications International Corporation. 1999. Memorandum to M. Todd (SAIC), entitled "Background Concentrations for NTS and TTR Soil Samples," 3 February. Las Vegas, NV: IT Corporation.

NBMG, see Nevada Bureau of Mines and Geology.

Nevada Bureau of Mines and Geology. 1998. *Mineral and Energy Resource Assessment of the Nellis Air Force Range,* Open-File Report 98-1. Prepared by J.V. Tingley, S.B. Castor, S.I. Weiss, L.J. Garside, J.G. Price, D.D. LaPointe, H.F. Bonham, and T.P. Lugaski. Reno, NV.

U.S. Department of Energy, Nevada Operations Office. 1994. *Project Management Plan,* Rev. 0. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1996a. *Corrective Action Unit Work Plan, Tonopah Test Range, Nevada,* DOE/NV--443. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1996b. *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada,* DOE/EIS 0243. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1996c. *Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada,* Rev. 1, DOE/NV--372. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 2000. *Corrective Action Investigation Plan for Corrective Action Unit 409: Other Waste Sites, Tonopah Test Range, Nevada,* Rev. 0, DOE/NV--649. Las Vegas, NV.

Appendix A

Corrective Action Investigation Report for CAU 409: Other Waste Sites, Tonopah Test Range, Nevada

A.1.0 Introduction

The report contained in this appendix presents the investigation activities and analytical results from the corrective action investigation conducted at CAU 409: Other Waste Sites, Tonopah Test Range, Nevada. Corrective Action Unit 409 consists of three CASs:

- CAS RG-24-001-RGCR, Battery Dump Site
- CAS TA-53-001-TAB2, Septic Sludge Disposal Pit
- CAS TA-53-002-TAB2, Septic Sludge Disposal Pit

The corrective action investigation was conducted in accordance with the requirements set forth in the *Corrective Action Investigation Plan for Corrective Action Unit 409: Other Waste Sites, Tonopah Test Range, Nevada* (DOE/NV, 2000), as developed under the *Federal Facility Agreement and Consent Order* (FFACO, 1996).

The Battery Dump Site consisted of discarded lead-acid batteries and associated construction debris. This site is a Housekeeping Category site and the only activities associated with this CAS were collecting the batteries, debris, and soil for recycling or disposal, photographing site cleanup, and verification sampling. Documentation of these housekeeping activities and waste disposal of the batteries are included in Appendix E. Samples of the discolored soil were not collected. Verification sample analytical results collected where discolored soil and debris were removed show that there is no contamination above action levels remaining at the site. There are no records available documenting the disposal of the specific debris/soil removed as part of the housekeeping activities.

The Septic Sludge Disposal Pits were investigated because process knowledge indicated that the pits were used through the late 1980s as disposal sites for sludge from septic tanks located in Area 3 of the TTR. Effluent generated within the facilities in Area 3 were routed through sanitary waste collection systems. The sanitary waste systems were designed to dispose of sanitary or process effluent; however, analytical results from previous sampling of the septic tanks indicate the systems may have received potentially contaminated effluent. Additional information relating to the site history, planning, and scope of the investigation is presented in the CAIP (DOE/NV, 2000) and will not be repeated in this report.

A.1.1 Project Objectives

The following were the primary objectives for this project:

- Collect the discarded batteries and associated debris at the Battery Dump Site for proper disposal or recycling in accordance with the Sectored Clean-up Work Plan for Housekeeping Category Waste Sites. Collect verification samples as necessary.
- Identify the presence and the vertical and lateral extent of the COPCs at the two Septic Sludge Disposal Pits.
- Investigate the subsurface geology and configuration of two anomalies, identified during a summer 2000 geophysical survey.
- Establish subsurface geologic control throughout the site.
- Provide sufficient information and data to develop appropriate corrective actions for each CAS.

The selection of locations for soil sample collection were based on site conditions and the strategy devised in the Data Quality Objectives (DQO) process as outlined in the CAIP (DOE/NV, 2000). During the site investigation, additional boreholes were drilled to establish subsurface geologic control throughout the site.

A.1.2 Report Content

This report contains information and data in sufficient detail to support the recommendation for no further action in the CADD/CR. The contents of this report are as follows:

- Section A.1.0 describes the investigation background, objectives, and the report content.
- Section A.2.0 provides information regarding field activities and sampling methods.
- Section A.3.0 summarizes the results of the laboratory analyses from the investigation sampling.
- Section A.4.0 discusses the quality assurance (QA) and quality control (QC) procedures that were followed and the results of the QA and QC activities.

- Section A.5.0 is a summary of the investigation results for CAU 409.
- Section A.6.0 cites the references.

The complete field documentation and laboratory data, including Field Activity Daily Logs, Sample Collection Logs, Analysis Request/Chain-of-Custody Forms, soil sample descriptions, laboratory certificates of analyses, analytical results, and surveillance results are not contained in this report and are retained in project files.

A.2.0 Field Investigation and Sampling Activities

The CAU 409 field investigation was conducted between November 7 and November 28, 2000. Hollow-stem auger drilling and continuous split-spoon sampling were used to investigate the Septic Sludge Disposal Pits and the two geophysical anomalies.

The investigation and sampling program was managed in accordance with the requirements set forth in the approved CAIP (DOE/NV, 2000), which addressed the Sectored Clean-up Work Plan for Housekeeping Category Waste Sites requirements. Field activities were performed in accordance with an approved site-specific health and safety plan (IT, 2000a). Samples were collected by following approved protocols and procedures for sample collection, decontamination, chain of custody, shipping, and radiation screening as indicated in the CAIP (DOE/NV, 2000) and documented using Field Activity Daily Logs, soil boring logs, and sample collection logs. Quality control samples (e.g., field blanks, equipment rinsate blanks, trip blanks, and sample duplicates) were collected as required by the CAIP (DOE/NV, 2000), the Industrial Sites QAPP (DOE/NV, 1996), and approved procedures. During field activities, waste minimization practices were followed according to approved procedures, including segregation of the waste by waste stream.

The following is a brief summary of the corrective action investigation activities performed at each of the three CASs contained in this CAU:

- CAS RG-24-001-RGCR, Battery Dump Site
  - Collected 17 discarded lead-acid batteries and associated construction debris.
  - Photographed the site before and after clean-up activities.
  - Transferred the batteries to the TTR recycling collection point or the TTR Hazardous Waste Accumulation Facility and the construction debris to the TTR scrap yard.
  - Removed a small amount of discolored soil and minor debris, less than 1 ft^3, associated with the discarded batteries.
  - Collected six verification samples from three locations of discolored soil or debris associated with the discarded batteries and damaged casings. Submitted the verification samples for total RCRA metals analysis.

- CAS TA-53-001-TAB2, Septic Sludge Disposal Pit #1

  - Collected surface and subsurface soil samples for laboratory analysis using continuous coring techniques. Submitted three environmental soil samples for the following analyses: total VOCs, TCLP VOCs, total SVOCs, TCLP SVOCs, total RCRA metals, TCLP RCRA metals, PCBs, TPH (DRO), TPH (GRO), isotopic uranium, and gamma-emitting radionuclides.

  - Field screened soil samples for VOCs, alpha/beta emitters, and silver.

  - Logged soil core to assess disposal pit geology.

- CAS TA-53-002-TAB2, Septic Sludge Disposal Pit #2

  - Collected surface and subsurface soil samples for laboratory analysis using continuous coring techniques. Submitted three environmental soil samples for the following analyses: total VOCs, TCLP VOCs, total SVOCs, TCLP SVOCs, total RCRA metals, TCLP RCRA metals, PCBs, TPH (DRO), TPH (GRO), isotopic uranium, and gamma-emitting radionuclides.

  - Field screened soil samples for VOCs, alpha/beta emitters, and silver.

  - Collected and submitted one sample for geotechnical analysis.

  - Logged soil core to assess disposal pit geology.

In addition to the boreholes drilled through the Septic Sludge Disposal Pits, the following boreholes were drilled:

- Anomaly Boreholes

  - Drilled boreholes at the two anomalies identified during the summer 2000 geophysical investigation. Continuous coring and auguring was used to advance the boreholes to total depth.

  - Logged soil core to assess site geology.

- Geologic Background Boreholes

  - Continuously cored three boreholes in undisturbed locations and logged soil core to assess site geology. Collected radiological background samples from one of these boreholes to establish subsurface radiological field-screening levels (FSLs). Submitted three radiological background samples for isotopic uranium and gamma spectrometry confirmatory analyses.

A.2.1 Site Description and Conditions

The CAU 409 Corrective Action Investigation was conducted at the Cactus Flat Repeater Station and near Area 3 of the TTR along the Bunker 2 Road. The TTR is approximately 140 mi northwest of Las Vegas, Nevada (Figure 1-1). Initial investigation locations were based on site visits, previous investigations, process knowledge, and interviews with TTR employees.

A.2.1.1 Battery Dump Site

The Battery Dump Site is located between Cactus Peak and Cactus Spring approximately 0.1 mi west of Cactus Peak Road. Historically, the Cactus Repeater Station consisted of a mast anchored on or next to a corrugated metal pipe. The power source for the repeater consisted of two celled lead acid batteries. The corrugated pipe was used to store new batteries.

During a 1998 visit, the site was found to consist of 17 discarded batteries, a metal corrugated pipe 2 feet (ft) in diameter and 2 ft long, the signal repeater mast, and associated construction debris. Several battery casings were damaged and observed to contain associated battery material and windblown soil. The corrugated pipe was intact and no soil staining was observed.

A.2.1.2 Septic Sludge Disposal Pits #1 and #2

The Septic Sludge Disposal Pits are located south of Bunker 2 Road approximately 500 ft east of Bunker 2. The pits are expressed on the surface as round depressions about 3 ft in diameter and several inches deep. The pit sites were initially identified in the TTR Site Priority Ranking Model (DOE/NV, 1994) during the Preliminary Assessment interview process. According to an interview, a septic tank pumping truck from the Nevada Test Site (NTS) periodically pumped septic sludge out of septic tanks in Area 3 of the TTR during the 1980s. It was believed the sludge was disposed into augured holes along Bunker 2 Road and backfilled. Another interview indicated a subcontractor was hired to pump out the tanks in Area 3 during the 1980s and the septic tank sludge was disposed of off site. Pumping was abandoned in 1990 when a consolidated sewer system was installed and activated in and around Area 3.

A.2.1.3 Geophysical Anomalies

During the summer of 2000, a geophysical survey was performed at the site of the Septic Sludge Disposal Pits (IT, 2000b). Electromagnetic (EM-31) and ground-penetrating radar (GPR) methods were used. Two anomalies were detected with the EM-31 in the quadrature or conductivity data and not in the in-phase data. This indicates the anomalies are not metal but a difference in soil conductivities. The anomalies were scanned with the GPR. However, no significant anomaly was observed in the GPR records.

A.2.2 Drilling

Boreholes were assigned a five-place alphanumeric designation describing the location and the sequential number of borings at that location. This numbering scheme was created to allow for the numeration of step-out borings associated with a particular site. However, step-out borings were not necessary at any of the locations, as determined by visual examination and field-screening results. Appendix B contains detailed boring and lithology logs of all boreholes.

Three radiological/geologic background borings were drilled and were designated RBK01, RBK02, and RBK03. Two Septic Sludge Disposal Pit borings were drilled and were designated DP101 (the first and only boring drilled at Disposal Pit #1) and DP201 (the first and only boring drilled at Disposal Pit #2). The anomaly boreholes were designated AN101 (the first and only boring drilled at anomaly #1) and AN201 (the first and only boring drilled at anomaly #2). Additional borehole information concerning drilling, sampling, and geology is presented in Section A.2.4.

A combination of auguring and continuous coring was used to advance boreholes to total depth. Boreholes RBK01, RBK02, RBK03, DP101, and DP201 were continuously cored (i.e., soil core was collected from the surface to total depth). Boreholes AN101 and AN201 were spot cored (i.e., soil core was collected only at designated intervals). In these instances, the borehole was continuously cored to a designated depth, augured to another depth, then continuously cored to total depth.

Upon completion, each boring was completely backfilled to surface grade with stockpiled excess drill cuttings. Cuttings were placed back in the boreholes in the same approximate location from which they were removed.

A.2.3 Sample Collection

Sample collection followed the procedures specified in the CAIP (DOE/NV, 2000). Soil cores from the Septic Sludge Disposal Pits were collected for detailed field observations, visual classification of soils, field screening, and sampling of the subsurface soil at specified depth intervals. Soil core was collected in 2.5-ft runs in a 5-ft long, 4-inch (in.) diameter, decontaminated split-spoon sampler that was delivered to the sampling team with the uphole and downhole ends noted. The total VOC, TCLP VOC, TPH (GRO), and VOC field-screening aliquots were collected directly from the split-spoon sampler and immediately placed in glass jars to minimize volatilization. The remaining soil was homogenized and aliquots for total SVOCs, TCLP SVOCs, total RCRA metals, TCLP RCRA metals, PCBs, TPH (DRO), isotopic uranium, gamma spectrometry, and silver field screening were then collected. Samples were placed in appropriate containers, labeled, and sealed with custody tape.

Verification samples were collected from three locations of discolored soil or debris at the Battery Dump Site. Surface samples (0 to 3 inches below ground surface [bgs]) were collected in decontaminated stainless-steel bowls and homogenized and containerized with disposable plastic scoops. The samples were analyzed for total RCRA metals.

Each sample container identified for laboratory analysis was wrapped in protective bubble wrap (if applicable), placed into a sealable bag, and stored in either an iced cooler or refrigerator with a trip blank (if applicable). Sample media collected but not submitted to the laboratory was placed with soil cuttings and returned to the collection site.

A.2.4 Boreholes Drilled at CAU 409

This section describes specific drilling, sampling, and subsurface geologic information for each of the borings drilled to investigate CAU 409. Figure A.2-1 shows the location of each boring, and

Appendix B contains detailed lithologic/boring logs. Section A.3.0 presents analytical results for soil samples submitted to the laboratory.

A.2.4.1 Radiological Background Boring

Radiological background boring RBK01 was drilled to establish radiological FSLs and to establish the subsurface geology of the site. The boring was drilled in an undisturbed portion of the exclusion zone.

Drilling and Sampling

Borehole RBK01 was continually cored to a total depth of 62.5 ft bgs. Twenty-one foot long subsurface soil cores were collected at approximately 3-ft intervals in unlined, decontaminated split-spoon samplers. These samples were bagged and labeled with appropriate sampling information and were used to establish subsurface radiological field-screening levels. Three background soil samples (RBK0103, RBK0104, and RBK0105) were collected in unlined, decontaminated split-spoon samplers and submitted for laboratory analyses of isotopic uranium and gamma-emitting radionuclides.

Geology at RBK01

The subsurface geology at RBK01 consists of a poorly sorted, crudely bedded, silty sand sequence. The cores were very friable and broke readily along fissile bedding planes. Although friable, the sequence was fairly hard. Possible crystalline evaporite mineralization was noted occasionally throughout the boring. Angular to subrounded clasts and pebbles were common. Based on this lithology, it was determined that RBK01 was drilled in an unexcavated and undisturbed area of the site, and the subsurface geology is representative of native soil.

A.2.4.2 Septic Sludge Disposal Pit #1 Boring

Borehole DP101 was drilled to verify the location of Disposal Pit #1 and to collect soil samples to establish the vertical and lateral extent of contamination. Boring DP101 was sited at the presumed center of Disposal Pit #1, identified by a circular depression and a stake placed by the Preliminary Assessment field crew.

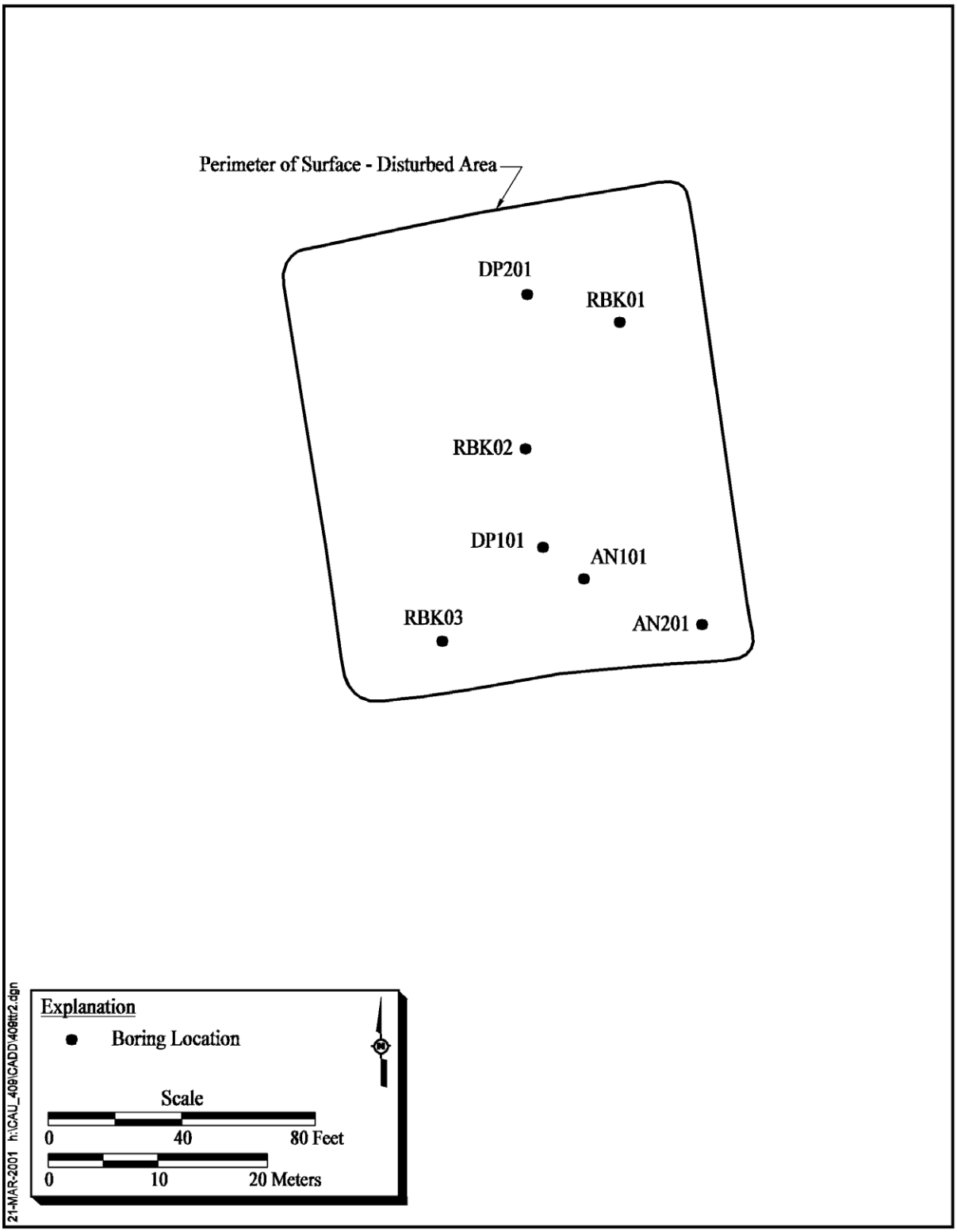

Figure A.2-1
Boring Locations at CAU 409

Drilling and Sampling

Borehole DP101 was continuously cored to a total depth of 40.0 ft bgs and soil cores were collected in decontaminated split-spoon samplers. Initially, lexan liners were used in the split-spoon sampler. In the first core run (0.0-5.0 ft bgs), the lexan liner was crumpled and only 0.5 ft of core was recovered. The second run (5.0-7.5 ft bgs) was shortened to minimize core loss. Full recovery was achieved in this run, but it was not possible to observe the core through the lexan liner. As a result, the use of lexan liners was abandoned for the completion of this borehole and for all remaining boreholes in the investigation.

Five environmental soil samples and a duplicate QC soil sample were collected from DP101 at approximate 10-ft intervals. The following samples were submitted for laboratory analysis based on criteria set forth in the CAIP:

- The sample directly at the fill/native soil interface (DP10106)
- The first of two consecutive samples where FSRs were less than FSLs (DP10107)
- The sample with the highest FSR (arbitrarily chosen as DP10103 because FSRs did not exceed background)
- The duplicate QC sample (DP10199)

The samples were analyzed for total VOCs, TCLP VOCs, total SVOCs, TCLP SVOCs, total RCRA metals, TCLP RCRA metals, PCBs, TPH (DRO), TPH (GRO), isotopic uranium, and gamma spectrometry.

Geology at DP101

The subsurface geology at DP101 consisted of a poorly developed soil from the surface to 10 ft bgs, characterized by abundant organic material. From 10.0 ft bgs to 32.5 ft bgs, a very soft, unconsolidated, sandy silt was encountered. The driller noted very fast drilling times through this interval. From 32.5 ft bgs to total depth of 40.0 ft bgs, the sequence consisted of a poorly graded sandy silt, with faint bedding planes and zones of crystalline mineralization. The driller noted harder drilling through this interval. Based on this lithology, it was determined that DP101 penetrated fill material to a depth of 32.5 ft bgs which was logged as the fill/native soil interface. No identifiable septic sludge material was encountered in DP101.

A.2.4.3 Septic Sludge Disposal Pit #2 Boring

Borehole DP201 was drilled to verify the location of Disposal Pit #2 and to collect soil samples to establish the vertical and lateral extent of contamination. DP201 was sited at the presumed center of Disposal Pit #2, identified by a circular depression and a stake placed by the Preliminary Assessment field crew.

Drilling and Sampling

Borehole DP201 was continuously cored to a total depth of 50.0 ft bgs, and soil cores were collected in unlined and decontaminated split-spoon samplers.

Seven environmental soil samples were collected from DP201 at approximate 10-ft intervals. The following samples were submitted for laboratory analysis based on criteria set forth in the CAIP:

- The sample directly at the fill/native soil interface and the first of two consecutive samples where FSRs were less than FSLs (DP20106 met both these criteria)
- The samples with the highest FSRs (arbitrarily chosen as DP20102 and DP20104 because FSRs did not exceed background)

The samples were analyzed for total VOCs, TCLP VOCs, total SVOCs, TCLP SVOCs, total RCRA metals, TCLP RCRA metals, PCBs, TPH (DRO), TPH (GRO), isotopic uranium, and gamma spectrometry. A geotechnical sample was collected from 50.0 to 51.0 ft bgs in native soil and submitted for analysis of initial moisture content, dry bulk density, calculated porosity, moisture retention characteristics, particle size distribution, and saturated and unsaturated hydraulic conductivity.

Geology at DP201

The subsurface geology of DP201 is similar to that of DP101. A poorly developed soil was logged from the surface to 5.0 ft bgs, and very soft, unconsolidated fill material was logged from 5.0 ft bgs to 42.0 ft bgs. From 42.0 ft bgs to total depth of 51.0 ft bgs, the sequence was a fairly cohesive, sandy silt with zones of scattered crystalline mineralization. Based on this lithology, it was determined that DP201 penetrated fill material to a depth of 42.0 ft bgs, which was logged as the fill/native soil interface. No identifiable septic sludge material was encountered in DP201.

A.2.4.4 Geophysical Anomaly Borings

Boreholes AN101 and AN201 were drilled to determine if the two anomalies identified during the summer 2000 geophysical investigation were additional disposal pits or features associated with disposal of septic tank sludge. The anomalies were not staked, so a Trimble TSC1 Global Positioning System (GPS) unit was used to navigate to the survey coordinates. After completion of the boreholes, coordinates of the drilled locations were recorded. Statistical analysis of the pre- and post-drilling coordinates show that AN101 was drilled within 7.5 ft of the edge of the first anomaly and that AN201 was drilled within the boundary of the second anomaly.

Drilling and Sampling

AN101 was continuously cored from the surface to 15.0 ft bgs, augured to 40.0 ft bgs, then cored to a total depth of 42.5 ft bgs. AN201 was continuously cored from the surface to 12.5 ft bgs, augured to 40.0 ft bgs, then cored to a total depth of 42.5 ft bgs. This drilling plan was selected when examination of the surface cores showed that was penetrated, indicating the borings were not sited on disposal features. The bottom cores were collected to confirm this observation.

One environmental surface sample was collected from AN101. Based on visual observation and field-screening results, this sample was not submitted for laboratory analysis. There were no samples collected from AN201.

Geology at AN101 and AN201

The lithology of the cored intervals at AN101 and AN201 consisted of a thin soil underlain by soft, crumbly, fissile sandy silt with occasional clasts. This lithology was identified as native soil and no fill material was encountered during coring. No staining was observed in cores from either boring. Based on these observations, it is believed that AN101 and AN201 did not penetrate disposal pits.

A.2.4.5 Geologic Background Borings

Geologic background borings RBK02 and RBK03 were drilled to confirm the presence or absence of trench-like features or anomalous depositional features.

Drilling and Sampling

Borehole RBK02 was continuously cored from the surface to a total depth of 12.5 ft bgs. Borehole RBK03 was continuously cored from the surface to a total depth of 7.5 ft bgs. No samples were collected from either boring.

Geology at RBK02 and RBK03

Both borings penetrated a poorly developed surface soil, then crudely bedded, soft, friable, sandy silt sequences with scattered zones of crystallization. This lithology consisted of native soil and is similar to lithology logged in other boreholes at the site. No fill material was encountered in either boring.

A.2.5 Field Screening

Field screening was performed as specified in the CAIP (DOE/NV, 2000). Samples were field screened for VOCs, alpha/beta-emitting radionuclides, and silver. Established FSLs were used to guide sample collection and to provide a basis for the selection of additional environmental samples for laboratory analyses.

Volatile organic compounds were field screened with a photoionization detector, using the headspace method. The FSL for headspace VOCs was established at 20 parts per million (ppm) or 2.5 times background, whichever was greater. None of the samples exceeded VOC FSLs.

Radionuclides (alpha- and beta-emitters) were field screened with an Electra alpha/beta scintillator. The radiological FSL was defined as the mean background activity level plus two times the standard deviation of 20 background sample readings. Radiological FSLs were established for both surface and subsurface samples. Surface FSLs were determined by collecting readings from twenty background surface samples collected from an undisturbed portion of the site. Subsurface FSLs were determined from twenty subsurface samples collected from borehole RBK01, as described in Section A.2.4.1. None of the samples (surface or subsurface) exceeded radiological FSLs.

Silver was field screened with a Spectrace Model 9240 XRF. A FSL of 1,000 ppm was established in the DQO process and none of the samples exceeded this FSL. For details of the XRF use and results, see Appendix C.

A.3.0 Investigation Results

The analytical results of samples collected from the CAU 409 investigation have been compiled and evaluated to determine the presence and/or extent of contamination. The analytical results are summarized in the following subsections. The complete laboratory result data packages are retained in the project files.

During the site investigation, a total of 23 environmental soil samples were collected (including two QC field duplicates) and 16 samples were submitted for laboratory analyses. In addition, one geotechnical sample, two QC source blanks, two matrix spike/matrix spike duplicates (MS/MSD), one QC field blank, one QC equipment rinsate blank, and seven QC trip blanks were collected and submitted for laboratory analysis. A list of the samples collected and the parameters analyzed for are presented in Table A.3-1. The analytical parameters and laboratory analytical methods used for these investigations are presented in Table A.3-2. Samples collected for chemical and radiological analyses were analyzed by Paragon Analytics, Inc. in Fort Collins, Colorado. The geotechnical sample was analyzed by Daniel B. Stephens & Associates, Inc. in Albuquerque, New Mexico.

The analytical parameters were selected through the application of site process knowledge according to the *Guidance for the Data Quality Objectives Process* (EPA, 1994b) and agreed upon during the DQO meeting. Preliminary action levels for off-site laboratory analytical methods were determined during the DQO process and are based on Nevada Division of Environmental Protection (NDEP) Corrective Action Regulations (NAC, 1999) and the U.S. Environmental Protection Agency (EPA) Preliminary Remediation Goals (PRGs) (EPA, 1999b) for chemical parameters under the industrial scenario. The PALs for laboratory radiological methods are isotope-specific and are defined as the maximum activity for that isotope found in previously analyzed environmental samples taken from undisturbed background locations from Area 3 and Area 9 at TTR as well as the NTS. The results of the DQO process are documented in the CAIP (DOE/NV, 2000), with the remainder of the documentation retained in the project files. Sampling activities were designed to detect contaminants of potential concern and conducted to either confirm or disprove the assumptions made in the DQO process.

Table A.3-1
Samples Collected During the CAU 409 Field Investigation
(Page 1 of 2)

Sample Location	Sample Number	Depth bgs	Sample Matrix	Sample Type	Parameters Analyzed
Environmental (Characterization) Soil Samples					
RBK01	RBK0103	9-10 ft	Soil	Environmental	IsoU, GS
	RBK0104	26.5-27.5 ft	Soil	Environmental	IsoU, GS
	RBK0105	53-54 ft	Soil	Environmental	IsoU, GS
DP101	DP10103	0.0-0.5 ft	Soil	Environmental, MS/MSD	Analytical Set 2
	DP10199	0.0-0.5 ft	Soil	Duplicate of DP10103	Analytical Set 2
	DP10106	30-31 ft	Soil	Environmental	Analytical Set 2
	DP10107	37.5-38.5 ft	Soil	Environmental	Analytical Set 2
DP201	DP20102	10-11 ft	Soil	Environmental	Analytical Set 2
	DP20104	30-31 ft	Soil	Environmental	Analytical Set 2
	DP20106	42-43 ft	Soil	Environmental	Analytical Set 2
	DP201GT	50-51 ft	Soil	Geotechnical	Analytical Set 3
Battery Dump Site	BDS0101	0-1 in.	Soil	Verification, MS/MSD	Total RCRA Metals
	BDS0102	0-1 in.	Soil	Duplicate of BDS0101	Total RCRA Metals
	BDS0103	2-3 in.	Soil	Verification	Total RCRA Metals
	BDS0201	0-1 in.	Soil	Verification	Total RCRA Metals TCLP Lead and Mercury
	BDS0301	0-1 in.	Soil	Verification	Total RCRA Metals
	BDS0302	1-2 in.	Soil	Verification	Total RCRA Metals
Field Quality Control Samples					
Prepackaged	RBK0101	N/A	Water	Trip Blank	Total VOCs
Outside EZ	RBK0102	N/A	Water	Source Blank	Analytical Set 1
Prepackaged	409TRIP	N/A	Water	Trip Blank	Total VOCs
Decon Pad	409ER01	N/A	Water	Equipment Blank	Analytical Set 1
Prepackaged	RBK0106	N/A	Water	Trip Blank	Total VOCs
Prepackaged	DP10101	N/A	Water	Trip Blank	Total VOCs
Outside EZ	RBK0107	N/A	Water	Source Blank	Analytical Set 1
Prepackaged	DP101TA	N/A	Water	Trip Blank	Total VOCs

Table A.3-1
Samples Collected During the CAU 409 Field Investigation
(Page 2 of 2)

Sample Location	Sample Number	Depth bgs	Sample Matrix	Sample Type	Parameters Analyzed
Prepackaged	40900TC	N/A	Water	Trip Blank	Total VOCs
Outside EZ	409FB01	N/A	Water	Field Blank	Analytical Set 1
Prepackaged	40900TB	N/A	Water	Trip Blank	Total VOCs

Analytical Set 1 = total VOCs, total SVOCs, total RCRA Metals, PCBs, TPH (GRO), TPH (DRO), IsoU, GS
Analytical Set 2 = Analytical Set 1 plus TCLP VOCs, TCLP SVOCs, TCLP RCRA Metals
Analytical Set 3 = initial moisture content, dry bulk density, calculated porosity, moisture retention characteristics, particle size distribution, saturated and unsaturated hydraulic conductivity
Total RCRA Metals = arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver
TCLP RCRA Metals = arsenic, barium, cadmium, chromium, lead, selenium, silver
N/A = Not Applicable
IsoU = Isotopic uranium
GS = Gamma spectrometry
TCLP = Toxicity Characteristic Leaching Procedure
EZ = Exclusion zone

A.3.1 Total Volatile Organic Compound Results

All total VOC results for soil samples submitted for analysis were below minimum reporting limits (MRLs) as established in the CAIP (DOE/NV, 2000). Therefore, total VOCs were not detected in soil samples at concentrations exceeding PALs (EPA, 1999b).

A.3.2 Total Semivolatile Organic Compound Results

All total SVOC results for soil samples submitted for analysis were below MRLs as established in the CAIP (DOE/NV, 2000). Therefore, total SVOCs were not detected in soil samples at concentrations exceeding PALs (EPA, 1999b).

A.3.3 Total Petroleum Hydrocarbons - Gasoline-Range Organics Results

All TPH (GRO) results for soil samples submitted for analysis were below MRLs as established in the CAIP (DOE/NV, 2000). Therefore, TPH (GRO) was not detected in soil samples at concentrations exceeding PALs (NAC, 1999).

Table A.3-2
Laboratory Analytical Methods Used for the
CAU 409 Investigation Samples

Analytical Parameter	Analytical Method
Total volatile organic compounds	SW-846 8260B[a]
Total semivolatile organic compounds	SW-846 8270C[a]
Total petroleum hydrocarbons - gasoline-range	SW-846 8015B modified[a]
Total petroleum hydrocarbons - diesel-range	SW-846 8015B modified[a]
Polychlorinated biphenyls	SW-846 8082[a]
Total RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver)	Water - SW-846 6010B/7470A[a] Soil - SW-846 6010B/7471A[a]
TCLP RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver)	SW-846 1311/6010B/7470A[a]
TCLP volatile organic compounds	SW-846 1311/8260B[a]
TCLP semivolatile organic compounds	SW-846 1311/8270C[a]
Isotopic Uranium	Water - HASL-300[b] and EPA 908.0[c] Soil - HASL-300[b]
Gamma Spectrometry	Water - EPA 901.1[c] Soil - HASL-300[b]

[a]EPA *Test Methods for Evaluating Solid Waste*, Physical/Chemical Methods, 3rd Edition, Parts 1-4, SW-846 (EPA, 1996)
[b]*Environmental Measurements Laboratory Procedures Manual*, HASL-300 (DOE, 1997)
[c]*Prescribed Procedures for Measurements of Radioactivity in Drinking Water* (EPA, 1980) or equivalent method

A.3.4 Total Petroleum Hydrocarbons - Diesel-Range Organics Results

All TPH (DRO) results for soil samples submitted for analysis were below MRLs as established in the CAIP (DOE/NV, 2000). Therefore, TPH (DRO) was not detected in soil samples at concentrations exceeding PALs (NAC, 1999).

A.3.5 Polychlorinated Biphenyls Results

All PCB results for soil samples submitted for analysis were below MRLs as established in the CAIP (DOE/NV, 2000). Therefore, PCBs were not detected in soil samples at concentrations exceeding PALs (EPA, 1999b).

A.3.6 Total RCRA Metal Results

The total RCRA metals results for soil samples detected above MRLs (DOE/NV, 2000) are presented in Table A.3-3. Arsenic, barium, chromium, and lead were the only metals detected above MRLs. Except for arsenic, all the total RCRA metal results were below PALs (DOE/NV, 2000; EPA, 1999b).

Arsenic was detected above the PAL of 2.7 milligrams per kilogram (mg/kg) in all of the soil samples analyzed. The arsenic concentrations for the samples analyzed ranged from 2.8 mg/kg (Battery Dump Site) to 8.4 mg/kg (Septic Sludge Disposal Pit #2) with a mean concentration of 5.7 mg/kg.

The PAL of 2.7 mg/kg is lower than the 7 to 8 mg/kg mean concentration of arsenic in silt from the Nellis Air Force Range (NBMG, 1998; Moore, 1999) and lower than range of concentrations of 6 to 43 mg/kg in soils from locations near the TTR (SNL, 1999). Data from previous sampling efforts in or near Area 3 also reveal arsenic concentrations as high as 24.1 mg/kg from undisturbed locations (DOE/NV, 1998). Although arsenic concentrations presented in Table A.3-3 exceed the PAL of 2.7 mg/kg, these levels are considered representative of ambient conditions at the sites.

A.3.7 TCLP Volatile Organic Compound Results

All TCLP VOC results for soil samples submitted for analysis were below MRLs as established in the CAIP (DOE/NV, 2000). Therefore, TCLP VOCs were not detected in soil samples at concentrations exceeding PALs (CFR, 2000).

A.3.8 TCLP Semivolatile Organic Compound Results

All TCLP SVOC results for soil samples submitted for analysis were below MRLs as established in the CAIP (DOE/NV, 2000). Therefore, TCLP SVOCs were not detected in soil samples at concentrations exceeding PALs (CFR, 2000).

Table A.3-3
Soil Sample Results for Total RCRA Metals Detected Above Minimum Reporting Limits

Sample Location	Sample Number	Depth Below Ground Surface	Contaminants of Potential Concern (mg/kg)					
			Arsenic	Barium	Chromium	Lead	Selenium	Mercury
	Preliminary Action Levels (mg/kg)[a]		2.7	100,000	450	1,000	10,000	610
DP101	DP10103	0.0 - 0.5 ft	6.6	140	7.2	12	--	--
	DP10199	0.0 - 0.5 ft	6.5	140	6.8	12	--	--
	DP10106	30 - 31 ft	6.9	79	4.6	5.5	--	--
	DP10107	37.5 - 38.5 ft	4.4	91	6.0	6.9	--	--
DP201	DP20102	10 - 11 ft	6.9	110	6.0	8.6	--	--
	DP20104	30 - 31 ft	8.4	120	5.5	8.7	--	--
	DP20106	42 - 43 ft	6.0	130	5.6	9.9	--	--
Battery Dump Site	BDS0101	0 -1 in.	4.8	120	5.8	21	0.7	4.8
	BDS0102	0 -1 in.	5.1	120	6.2	23	0.76	3.7
	BDS0103	2-3 in.	5.8	160	7.8	14	0.64	1.2
	BDS0201	0-1 in.	5.8	150	8.2	71	0.77	19
	BDS0301	0-1 in.	4	110	5.5	14	--	2.4
	BDS0302	1-2 in.	2.8	90	3.8	12	--	4.8

[a]EPA Region 9, Industrial PRGs (EPA, 1999b)
-- = Non Detect

A.3.9 TCLP RCRA Metals Results

All TCLP RCRA metals results for soil samples submitted for analysis were below MRLs as established in the CAIP (DOE/NV, 2000). Therefore, TCLP RCRA metals were not detected in soil samples at concentrations exceeding PALs (CFR, 2000).

A.3.10 Isotopic Uranium Results

Isotopic uranium results for soil samples detected above MRLs (DOE/NV, 2000) are presented in Table A.3-4. All results are within two sigma error of the background range and are not distinguishable from background concentrations listed in the *Off-Site Radiation Exposure Review Project, Phase II Soils Program* (McArthur and Miller, 1989) or the *Environmental Monitoring Report for the Proposed Ward Valley, California, Low-Level Radioactive Waste (LLRW) Facility* (Atlan-Tech, 1991); therefore, they do not exceed PALs (DOE/NV, 2000).

A.3.11 Gamma Spectrometry Results

Gamma spectrometry results for soil samples detected above MRLs (DOE/NV, 2000) are presented in Table A.3-5. Except for Th-234 detected in sample DP20104, the results are within two sigma error of background range and are not distinguishable from background concentrations listed in the *Off-Site Radiation Exposure Review Project, Phase II Soil Program* (McArthur and Miller, 1989) or the *Environmental Monitoring Report for the Proposed Ward Valley, California, Low-Level Radioactive Waste (LLRW) Facility* (Atlan-Tech, 1991); therefore, they do not exceed PALs (DOE/NV, 2000).

Thorium-234 was detected at an estimated concentration of 7.5 ± 3.1 picocuries per gram (pCi/g) in sample DP20104. However, Th-234 should be in secular equilibrium with the parent radionuclide, U-238, and have the same radioactivity. U-238 was analyzed using alpha spectrometry, a more accurate method for determining radioactivity. The U-238 concentration for this same sample was reported at 1.54 +/- 0.24 pCi/g. The true Th-234 concentration should be similar to this value, and can be considered no greater than background.

Table A.3-4
Soil Sample Results for Isotopic Uranium Detected Above Minimum Reporting Limits

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)		
			Uranium-234[a]	Uranium-235[a]	Uranium-238[b]
	Background Concentration Range		0.10 - 2.6	<0.05 - 0.10	0.21 - 3.2
DP101	DP10103	0.0 - 0.5	1.29 ± 0.21	0.076 ± 0.031	1.21 ± 0.20
	DP10199	0.0 - 0.5	1.29 ± 0.21	0.063 ± 0.027	1.23 ± 0.20
	DP10106	30 - 31	1.99 ± 0.31	0.107 ± 0.038	1.85 ± 0.29
	DP10107	37.5 - 38.5	1.91 ± 0.28	0.096 ± 0.032	1.85 ± 0.28
DP201	DP20102	10 - 11	1.56 ± 0.24	0.071 ± 0.027	1.49 ± 0.23
	DP20104	30 - 31	1.85 ± 0.28	0.099 ± 0.035	1.54 ± 0.24
	DP20106	42 - 43	1.70 ± 0.25	0.075 ± 0.026	1.56 ± 0.23
RBK01	RBK0103	9 - 10	1.45 ± 0.24	0.067 ± 0.029	1.13 ± 0.19
	RBK0104	26.5 - 27.5	1.74 ± 0.26	0.102 ± 0.033	1.51 ± 0.23
	RBK0105	53 - 54	1.81 ± 0.27	0.091 ± 0.031	1.64 ± 0.25

[a]Background concentration listed in *Environmental Monitoring Report for the Proposed Ward Valley, California, Low-Level Radioactive Waste (LLRW) Facility* (Atlan-Tech, 1991)
[b]Background concentration listed or derived in *Off-Site Radiation Exposure Review Project, Phase II Soil Program* (McArthur and Miller, 1989)

Although alpha spectrometry was utilized to verify Th-234 activity with that of U-238, ITLV has a high degree of confidence in the remaining gamma spectrometry results. All radioanalytical data undergoes data verification and validation prior to being reported.

A.3.12 Geotechnical Results

Sample DP201GT was collected from undisturbed strata at the base of boring DP201. The sample was collected from 50.0 to 51.0 ft bgs in two, 6-in. long, brass sleeves which were capped to retain *in situ* hydraulic and physical properties. The sample was analyzed for parameters shown in Table A.3-1, and analytical results (presented in Appendix D) indicate that the native soil consists of loose, unconsolidated, silty sand.

Table A.3-5
Soil Sample Results for Gamma Spectrometry Detected Above Minimum Reporting Limits

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)								
			Ac-228[a]	Bi-212[b]	Bi-214[a]	Cs-137[b]	K-40[a]	Pb-212[a]	Pb-214[b]	Th-234[b]	Tl-208[a]
	Background Concentration Range		<0.4 - 3.64	0.49 - 2.4	<0.1 - 3.47	0.04 - 7.0	11 - 96	0.86 - 2.9	0.5 - 2.9	0.21 - 3.2	0.5 - 3.4
DP101	DP10103	0.0 - 0.5	2.68 ± 0.63	--	1.79 ± 0.46	0.61 ± 0.23	30.3 ± 5.2	1.85 ± 0.34	2.09 ± 0.53	--	0.85 ± 0.24
	DP10199	0.0 - 0.5	2.31 ± 0.63	--	1.86 ± 0.48	0.49 ± 0.14	30.5 ± 4.7	1.69 ± 0.30	1.66 ± 0.39	--	0.82 ± 0.32
	DP10106	30 - 31	2.32 ± 0.56	--	2.02 ± 0.43	--	31.4 ± 4.7	1.68 ± 0.27	2.11 ± 0.43	--	0.61 ± 0.14
	DP10107	37.5 - 38.5	2.13 ± 0.72	2.88 ± 0.82	2.36 ± 0.49	--	33.4 ± 5.4	1.95 ± 0.34	2.12 ± 0.51	--	0.81 ± 0.18
DP201	DP20102	10 - 11	1.57 ± 0.39	--	1.76 ± 0.37	--	29.8 ± 4.4	1.67 ± 0.27	1.86 ± 0.38	--	0.76 ± 0.18
	DP20104	30 - 31	2.20 ± 0.59	--	1.94 ± 0.42	--	24.6 ± 4.1	2.20 ± 0.73	2.04 ± 0.46	7.5 ± 3.1(J)	0.64 ± 0.16
	DP20106	42 - 43	2.38 ± 0.61	--	1.95 ± 0.48	--	28.9 ± 4.2	1.86 ± 0.29	1.83 ± 0.41	--	0.80 ± 0.21
RBK01	RBK0103	9 - 10	2.16 ± 0.58	--	1.56 ± 0.39	--	24.3 ± 3.9	1.49 ± 0.27	1.70 ± 0.38	--	0.54 ± 0.19
	RBK0104	26.5 - 27.5	2.39 ± 0.62	--	1.97 ± 0.56	--	28.4 ± 4.8	2.85 ± 0.56	1.77 ± 0.43	--	0.61 ± 0.19
	RBK0105	53 - 54	3.02 ± 0.69	--	1.72 ± 0.43	--	30.2 ± 4.8	2.24 ± 0.36	1.71 ± 0.37	--	0.98 ± 0.23

[a]Background concentration listed in *Environmental Monitoring Report for the Proposed Ward Valley, California, Low-Level Radioactive Waste (LLRW) Facility* (Atlan-Tech, 1991)
[b]Background concentration listed or derived in *Off-Site Radiation Exposure Review Project, Phase II Soil Program* (McArthur and Miller, 1989)

-- = Not detected above minimum detectable concentration
J = Estimated value tentatively identified by laboratory
Ac = Actinium
Bi = Bismuth
Cs = Cesium
K = Potassium
Pb = Lead
Th = Thorium
Tl = Thallium

A.4.0 Quality Assurance

The results of QA/QC activities for the CAU 409 corrective action investigation are summarized in the following text. Detailed information regarding the QA program is contained in the Industrial Sites QAPP (DOE/NV, 1996).

Quality control results are typically discussed in terms of precision, accuracy, representativeness, completeness, and comparability. These terms are described in the following sections.

A.4.1 Precision

Precision is a quantitative measure of the variability of a group of measurements from their average value. Precision is assessed for inorganic analysis by collecting and analyzing duplicate field samples and comparing the results with the original sample. Precision is also assessed by creating, preparing, analyzing, and comparing laboratory duplicates from one or more field samples in inorganic analyses and MS/MSD samples for organic analyses. Precision is reported as relative percent difference (RPD), which is calculated as the difference between the measured concentrations of duplicate samples, divided by the average of the two concentrations, and multiplied by 100. Any deviation from these requirements has been documented and explained and the related data qualified accordingly. The qualification process is described in Section A.4.7.1.

A.4.2 Accuracy

Analytical accuracy is defined as the nearness of a measurement to the true or accepted reference value. It is the composite of the random and systematic components of the measurement system and measures bias in a measurement system. The random component of accuracy is measured and documented through the analyses of spiked samples. Sampling accuracy is assessed by evaluating the results of spiked samples and laboratory control samples. Accuracy measurements are calculated as percent recovery (%R) by dividing the measured sample concentration by the true concentration and multiplying the quotient by 100.

Field accuracy is assessed by confirming that the documents of record track the sample from origin, through transfer of custody, to disposal. The goal of field accuracy is for all samples to be collected

from the correct locations at the correct time, placed in a correctly labeled container with the correct preservative, and sealed with custody tape to prevent tampering. All samples in this sampling event were properly collected and forwarded to the laboratory as described above.

A.4.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition (EPA, 1987). Sample representativeness was achieved through the implementation of a sampling program designed to ensure proper sampling locations, number of samples, and the use of validated analytical methods. Representativeness was assessed through analysis of duplicate samples. Representativeness of the samples taken in this sampling event was assured by collecting the specified number of samples (DOE/NV, 2000) and by analyzing them using the approved analytical methods shown in Table A.3-2.

A.4.4 Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid. A sampling and analytical requirement of 80 percent completeness was established and achieved for this project (DOE/NV, 1996).

The specified sampling locations were utilized as planned. All samples were collected as specified in the CAIP (DOE/NV, 2000), with the exception that only one geotechnical sample was collected. All sample containers reached the laboratory intact and properly preserved (when applicable). Sample temperature was maintained during shipment to the laboratory, and sample chain of custody was maintained during sample storage and/or shipment (DOE/NV, 1996).

A.4.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another (EPA, 1987). To ensure comparability, the field and sampling activities were performed and documented in accordance with approved procedures, and all samples were collected in accordance with the CAIP (DOE/NV, 2000). Approved standardized methods and

procedures were also used to analyze and report the data (e.g., Contract Laboratory Program [CLP] and/or CLP-like data packages). This approach ensures that the data from this project can be compared to other data sets. Based on the minimum comparability requirements specified in the Industrial Sites QAPP (DOE/NV, 1996), all requirements were met.

Field (i.e., sample-handling) documentation, laboratory nonconformance reports, and the precision and accuracy of quality-control sample results were evaluated for their effect on the results of the associated environmental soil samples. The environmental sample results were then qualified according to processes outlined in the following sections. Documentation of the data qualifications resulting from these reviews is retained in project files as both hard copy and electronic media.

A.4.6 Tier I and Tier II Data Evaluations

All laboratory data from samples collected at CAU 409 have been evaluated for data quality according to *EPA Functional Guidelines* (EPA, 1994a and 1999a). These guidelines were implemented in a tiered process and are presented in the following text. Only valid data, whether estimated (i.e., J-qualified) or not, were used.

Changes resulting from the data evaluation process are documented in project files and summarized in memoranda for each sample delivery group (SDG). These memoranda are maintained with the SDGs in project files.

A.4.6.1 Tier I Evaluation

Tier I evaluation for both chemical and radiological analysis examines (but is not limited to):

- Sample count/type consistent with chain of custody
- Analysis count/type consistent with chain of custody
- Correct sample matrix
- Significant problems stated in cover letter or case narrative
- Completeness of certificates of analysis
- Completeness of CLP or CLP-like packages
- Completeness of signatures, dates, and times on chain of custody
- Condition-upon-receipt, variance form included
- Requested analyses performed on all samples
- Date received/analyses given for each sample
- Correct concentration units indicated

- Electronic data transfer supplied
- Results reported for field and laboratory QC samples
- Whether or not the deliverable met the overall objectives of the project
- Proper field documentation accompanies project packages

A.4.6.2 Tier II Evaluation

Tier II evaluation for both chemical and radiological analysis examines (but is not limited to):

Chemical:

- Correct detection limits achieved
- Sample date, preparation date, and analysis date for each sample
- Holding time criteria met
- QC batch association for each sample
- Cooler temperature upon receipt
- Sample pH for aqueous samples, as required
- Detection limits properly adjusted for dilution, as required
- Blank contamination evaluated and applied to sample results/qualifiers
- MS/MSD %R and RPDs evaluated and applied to laboratory results/qualifiers
- Field duplicate RPDs evaluated using professional judgement and applied to laboratory results/qualifiers
- Laboratory duplicate RPDs evaluated and applied to laboratory results/qualifiers
- Surrogate %Rs evaluated and applied to laboratory results/qualifiers
- Laboratory control sample %R evaluated and applied to laboratory results/qualifiers
- Initial and continuing calibration evaluated and applied to laboratory results/qualifiers
- Internal standard evaluated and applied to laboratory results/qualifiers
- Mass spectrometer tuning criteria
- Organic compound quantitation
- Inductively coupled plasma (ICP) interference check sample evaluation
- Graphite furnace atomic absorption quality control
- ICP serial dilution effects

- Recalculation of 10 percent of laboratory results from raw data

Radioanalytical:

- Correct detection limits achieved
- Blank contamination evaluated and applied to sample results/qualifiers
- Certificate of Analysis consistent with data package documentation
- Quality control sample results (e.g., duplicates, laboratory control samples, laboratory blanks) evaluated and applied to laboratory result qualifiers
- Sample results, error, and minimum detectable activity evaluated and applied to laboratory result qualifiers
- Detector system calibrated to National Institute for Standards and Technology (NIST)-traceable sources
- Calibration source preparation was documented, demonstrating proper preparation and appropriateness for sample matrix, emission energies, and concentrations
- Detector system response to daily, weekly, and monthly background and calibration checks, which may include peak energy, peak centroid, peak full-width half-maximum, and peak efficiency, depending on the detection system
- Tracers NIST-traceable, appropriate for the analysis performed, and recoveries that met QC requirements
- Documentation of all QC sample preparation complete and properly performed
- QC sample results (e.g., calibration source concentration, percent recovery, and RPD) verified
- Spectra lines, emissions, particle energies, peak areas, and background peak areas support the identified radionuclide and its concentration
- Recalculation of 10 percent of laboratory results from raw data

A.4.6.3 Tier III Evaluation

A Tier III evaluation looks at all the items evaluated in the Tier II evaluation, but for only a limited number of samples (typically 5 percent). It serves as a check on the Tier II process. The Tier III review includes the additional evaluations:

Chemical:

- Recalculation of laboratory results from raw data for all samples submitted for Tier III

Radioanalytical:

- Radionuclides and their concentration appropriate considering their decay schemes and half-lives
- Each identified line in spectra verified against emission libraries and calibration results
- Independent identification of spectra lines, area under the peaks, and quantification of radionuclide concentration in a random number of sample results
- Recalculation of laboratory results from raw data for all samples submitted for Tier III

A Tier III review of 5 percent of the samples was conducted by TechLaw, Inc. in Lakewood, Colorado. No changes to analytical results or qualifiers occurred as a result of the review.

A.4.7 Quality Control Samples

Thirteen QC samples (i.e., two source blanks, one MS/MSD, one field blank, one field duplicate, one equipment rinsate blank, and seven trip blanks) were collected and submitted for laboratory analyses, as shown in Table A.3-1. The blanks and duplicates were assigned individual sample numbers and sent to the laboratory "blind." Additional samples were selected by the laboratory to be analyzed as laboratory duplicates. Documentation related to the collection and analysis of these samples is retained in project files.

A.4.7.1 Field Quality Control Samples

Review of the field-collected blank analytical data for the investigation sampling indicates that cross-contamination did not occur during sample collection. Field blanks, source blanks, and equipment rinsate blanks were analyzed for the parameters listed in Table A.3-1, and trip blanks were analyzed for total VOCs only.

Arsenic was detected at 0.013 milligrams per liter (mg/L) in QC source blank sample RBK0107. This concentration is barely above the Contract-Required Detection Limit (CRDL) of 0.01 mg/L. The sample was collected from the water storage tank on the decontamination unit which had been filled with water pumped from Well #6 at the TTR. Arsenic was not detected in QC equipment rinsate blank sample 409ER01, demonstrating the efficacy of the decontamination procedure. As a result, the arsenic detection in sample RBK0107 did not affect analytical results of environmental soil samples, and did not impact the data validation process.

One field duplicate soil sample (DP10199) was sent as a blind sample to the laboratory to be analyzed for the analytical parameters listed in Table A.3-1. For this sample, the duplicate results precision (i.e., RPD between the environmental sample results and its corresponding field duplicate sample results) were evaluated to the guidelines set forth in *EPA Functional Guidelines* (EPA, 1994a and 1999a). The *EPA Functional Guidelines* state that there are no required review criteria for field duplicate analyses comparability, but allow the data reviewer to exercise professional judgement. The RPD between some environmental sample results and their corresponding field duplicate sample results exceeded the 20 percent criteria stated in the Industrial Sites QAPP (DOE/NV, 1996b) for some target analytes. The variability in the results between the environmental sample and its corresponding field duplicate sample could be attributed to nonhomogeneous samples and the difficulties associated with collecting identical soil field samples. It is expected that soil field duplicate results will have a greater variance than water matrices.

The laboratory duplicate samples were compared to the criteria set forth in the *EPA Functional Guidelines* (EPA, 1994a and 1999a), and the associated sample results were qualified accordingly. Both detections and nondetections have been qualified as estimated (J and UJ, respectively) if the relative percent difference between an environmental sample and its laboratory duplicate fell outside established criteria.

One field sample (DP10103) was selected for use as MS/MSD samples. The %R of these samples (a measure of accuracy) and the RPDs in these sample results (a measure of precision) were compared to *EPA Functional Guideline* criteria (EPA, 1994a and 1999a). The results were used to qualify associated environmental sample results accordingly.

The *EPA Functional Guidelines* for review of organic data state that no data qualification action is taken on the basis of MS/MSD results alone (EPA, 1999a). The data reviewer exercises professional judgement in considering these results in conjunction with the results of laboratory control samples (LCSs) and other QC criteria in applying qualifications to the data.

The *EPA Functional Guidelines* for inorganic data review allows professional judgement to be applied in evaluating the results of matrix spikes (EPA, 1994a). Generally, if spike recovery is

greater than the upper acceptance limits (>125%), nondetections are acceptable for use. If spike recovery is greater than the upper acceptance limit (>125%) or less than the lower acceptance limit (<75%), positive results are qualified as estimated (J). If spike recovery falls within the range of 30-74%, nondetections are qualified as estimated (UJ). If spike recovery is less than 30 percent (grossly low), positive results are qualified as estimated (J), and nondetections are qualified as unusable (R).

A.4.7.2 Laboratory Quality Control Samples

Analysis of method QC blanks and surrogate spikes for organic analyses, method blanks, preparation blanks, initial and continuing calibration blanks for total metals, and LCS were performed for each SDG by Paragon Analytics, Inc. The results of these analyses were used to qualify associated environmental sample results according to *EPA Functional Guidelines* (EPA, 1994a and 1999a).

The *EPA Functional Guidelines* (EPA, 1994a and 1999a) state that no qualification action is taken if a compound is found in an associated blank, but not in the sample, or if a compound is found in the sample, but not in an associated blank. The action taken when a compound is detected in both the sample and the associated blank varies depending upon the analyte involved and is described as "The 5X/10X Rule."

For most VOCs, SVOCs, herbicides, PCBs, and pesticides, if an analyte is detected in the sample and was also detected in an associated blank, the result is qualified as undetected (U) if the sample concentration is less than five times (5X) the blank concentration.

For the common laboratory contaminants (e.g., methylene chloride, acetone, 2-butanone [methyl ethyl ketone or MEK], and phthalate esters [especially bis {2-ehtylhexyl} phthalate]), the factor is raised to ten times (10X) the blank concentration. The sample result is elevated to the quantitation limit if it is less than the quantitation limit, or remains unaltered if the sample result is greater than or equal to the quantitation limit, and qualified as undetected (U).

For inorganics (i.e., metals), sample results greater than the instrument detection limit, but less than five times (5X) the amount found in an associated blank, are qualified as undetected (U). There are

no common metallic laboratory contaminants, so there is no "10X rule" for metals, and the sample result is never altered. When applying the 5X criteria to soil sample data or calibration blank data, the raw data results are used to evaluate and qualify the reported results on the Certificate of Analysis.

Surrogate spikes, or system monitoring compounds, are added to the environmental samples analyzed by chromatographic techniques for VOCs, SVOCs, pesticides, PCBs, herbicides, gasoline, and diesel. Surrogate compounds are analytes that are not expected to be present in associated environmental samples, but behave similar to target compounds chromatographically. Known amounts of each surrogate are added prior to sample preparation and are carried throughout the preparation/analysis procedure. The percent recoveries of these surrogate compounds give some measure of the anticipated recoveries of the target compounds whose chromatographic behavior they mimic.

If any surrogate percent recoveries are out of the acceptable range (which differs for each surrogate in each method), laboratory protocol requires the sample be reprepared and/or reanalyzed. When the surrogate recoveries are acceptable on the second run, only the second analysis results are reported. When both analyses yield the same unacceptable range, the results of both analyses are reported.

The evaluation of surrogate spike recovery results is not straightforward. The functional guidelines suggest several optional approaches, but require the data reviewer to exercise professional judgement in reviewing surrogate data and qualifying associated data as estimated (J or UJ, for detections or nondetections, respectively) or unusable (R).

One laboratory duplicate analysis for metals was performed for each SDG that reported total metals. The duplicate results are compared to the results of the original sample to give a measure of analytical laboratory precision. If the results from a duplicate analysis for a particular analyte fall outside the control limits, the *EPA Functional Guidelines for Inorganic Data Review* (EPA, 1994a) call for all results for that analyte in all associated samples of the same matrix to be qualified as estimated (J).

Laboratory control samples, also known as blank spikes, consist of known quantities of target compounds added to purified sand or deionized, distilled water, prepared and analyzed along with the environmental samples in the sample delivery group. The percent recoveries of the compounds in the LCS give a measure of laboratory accuracy. The functional guidelines call for the data reviewer to use professional judgement to qualify associated data according to established criteria. Documentation of data qualification resulting from the application of these guidelines is retained in project files as both hard copy and electronic media.

A.4.8 Field Nonconformances

Three field nonconformances were noted for this project. One nonconformance pertained to collection of investigation-derived waste (IDW) samples. An IDW rinsate sample was not collected as stipulated in the CAIP. These samples are collected for waste management determinations so this nonconformance did not compromise data quality. The other nonconformance pertained to chain-of-custody documentation. Two chain-of-custody forms were improperly signed. However, the samples documented on these forms were received by the laboratory intact with unbroken custody tape so this nonconformance did not compromise data quality. Documentation of the nonconformances are retained in project files.

Another nonconformance was identified as it relates to the collection of biased soil samples. A small amount of debris and discolored soil, less than 1 cubic foot, was removed from the Battery Dump Site as part of the housekeeping activities. Samples of the discolored soil were not collected. Verification sample analytical results collected where discolored soil and debris were removed show that there is no contamination above action levels remaining at the site. There are no records available documenting the disposal of the specific debris/soil removed as part of the housekeeping activities.

A.4.9 Laboratory Nonconformances

One laboratory nonconformance was noted for this project. The nonconformance resulted from equipment failure during the zero headspace extraction process. This nonconformance has been accounted for in the data qualification process. Documentation of these results is retained in project files.

A.5.0 Summary

Analysis of the data generated from corrective action investigation activities at CAU 409 indicates the following:

- The Battery Dump Site was located and verification samples were collected from three locations where debris or discolored soil associated with discarded batteries and damaged casings were removed. All concentrations of total RCRA metals were below PALs established in the CAIP (DOE/NV, 2000) except for arsenic. Although the concentrations of arsenic exceeded the PAL, the concentrations are considered representative of ambient conditions for the TTR. The discarded batteries were transferred to the TTR recycling collection point or the TTR Hazardous Waste Accumulation Facility, the construction debris was transferred to the TTR scrap yard, and confirmatory photographs of the site cleanup were taken.
- A small amount of debris and discolored soil, less than 1 cubic foot, was removed from the Battery Dump Site as part of the housekeeping activities. Samples of the discolored soil were not collected. Verification sample analytical results collected where discolored soil and debris were removed show that there is no contamination above action levels remaining at the site. There are no records available documenting the disposal of the specific debris/soil removed as part of the housekeeping activities.
- The locations and general configurations of the two Septic Sludge Disposal Pits were identified. The disposal pits were found to be shallower than anticipated and neither of them contained any identifiable septic sludge or other contamination.
- The Septic Sludge Disposal Pits are discrete features. There are no trench-like features or anomalous depositional features between the two disposal pits.
- One of the anomalies detected during the summer 2000 geophysical investigation was drilled and is not believed to be a disposal pit, based on lithology and visual observation of soil core. Drilling did not locate the other identified anomaly.
- All concentrations of total VOCs, total SVOCs, TPH (DRO), TPH (GRO), TCLP VOCs, TCLP SVOCs, TCLP RCRA metals, and PCBs in soil samples were below the PALs outlined in the CAIP (DOE/NV, 2000).
- All concentrations of total RCRA metals in soil samples were below PALs established in the CAIP (DOE/NV, 2000) except for arsenic. Although the concentrations of arsenic exceeded the PAL, the concentrations are considered representative of ambient conditions for the TTR.
- Isotopic uranium results for soil samples are not considered to be statistically different from their respective established background levels and, therefore, are below PALs.
- Gamma spectrometry results for soil samples, except for Th-234 detected in one sample, are not considered to be statistically different from their respective established background

levels and, therefore, are below PALs. Thorium-234 was tentatively identified (estimated value) in one sample. However, Th-234 should be in secular equilibrium with the parent radionuclide, U-238, and have the same radioactivity. The U-238 concentration for this same sample was reported at a concentration below the established background level. The true Th-234 concentration should be similar to this value, and can be considered no greater than background.

- Field-screening results did not exceed established FSLs.

A.6.0 References

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Appendix B

Soil Boring Logs

Project Name: CAU 409, Other Waste Sites
Project Number: 799417.01060110
Borehole Number: DP101
Logged By: John Davis
Drilled By: Stewart Brothers
Drilling Method: Hollow Stem Auger

Date Started: 11/14/00
Date Completed: 11/15/00
Elevation: 1630.4 m
Northing: 4180104.1 m
Easting: 526275.8 m
Total Depth: 40 ft

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Depth (ft)	Lithology	Lithologic Description	Sample Number ft bgs	Field Screening α/β dpm	Field Screening VOCs ppm	Field Screening Silver ppm
0		Soil. Dark brown, sandy, with abundant organic material	DP10103 0.0 - 0.5	5/634	0.0	0.0
		Core loss. Lexan liner crumpled in split-spoon sampler preventing recovery.				
-5		Soil. Dark brown to grayish brown, sandy, hard and compacted, minor organic material.				
			DP10104 8 - 9	2/633	0.0	0.0
-10		Core loss.				
		Fill material. Sandy silt, very soft, noncompacted, unconsolidated, undifferentiated, well sorted. Driller notes very fast drilling. From 24.0 - 25.0; hard, consolidated fragments common. From 27.5 - 30.0; slightly harder; trace very hard, vuggy fragments. From 30.0 - 31.5; driller notes slower drilling; blocked off at 31.5.				
-15						
-20			DP10105 20 - 21	4/621	0.0	0.0
-25						
-30			DP10106 30 - 31	5/641	0.0	0.0
		Native soil. Silty sand, poorly sorted, with scattered fragments. Occasional zones with faint bedding planes, crumbly, vuggy, weathered crystallization. From 37.5 - 40.0; bedding is more apparent; numerous white, weathered clasts with possible iron oxidation.				
-35						
			DP10107 37.5-38.5	NA	0.0	0.0
-40						

Project Name: CAU 409, Other Waste Sites
Project Number: 799417.01060110
Borehole Number: DP201
Logged By: John Davis
Drilled By: Stewart Brothers
Drilling Method: Hollow Stem Auger

Date Started: 11/15/00
Date Completed: 11/16/00
Elevation: 1628.7 m
Northing: 4180127.3 m
Easting: 526274.3 m
Total Depth: 51 ft

Depth (ft)	Lithology	Lithologic Description	Sample Number ft bgs	Field Screening α/β dpm	Field Screening VOCs ppm	Field Screening Silver ppm
0		Soil. Medium brownish-gray, loose and unconsolidated.	DP20101 0.0-0.5	2/611	0.0	0.0
-5		Core loss.				
		Fill material. Sandy silt, very soft and unconsolidated, scattered large, hard fragments of native soil material. Driller notes very fast drilling.				
-10		Core loss.	DP20102 10 - 11	7/621	0.0	0.0
		Fill material. Very soft and unconsolidated, some intervals slightly more compacted, scattered very hard, subangular fragments. From 30.0 - 40.0; intervals containing numerous, hard fragments.				
-15						
-20			DP20103 20 - 21	4/635	0.1	0.0
-25						
-30			DP20104 30 - 31	8/620	0.0	0.0
-35						
-40			DP20105 40 - 41	5/583	0.0	0.0
		Native soil. Sandy silt, fairly cohesive, crumbly and friable along apparent bedding planes, vuggy with weathered fragments, slightly clayey. Driller notes distinctive harder drilling at 42.0 ft. From 45.0 - 47.5; scattered crystallization; red weathered fragments common; moderately consolidated	DP20106 42 - 43	0/657	0.0	0.0
-45			DP20107 49 - 50	4/656	0.0	0.0
			DP201GT 50 - 51	N/A	N/A	N/A
-50						

Project Name: CAU 409, Other Waste Sites
Project Number: 799417.01060110
Borehole Number: RBK01
Logged By: John Davis
Drilled By: Stewart Brothers
Drilling Method: Hollow Stem Auger

Date Started: 11/13/00
Date Completed: 11/14/00
Elevation: 1634.4 m
Northing: 4180124.6 m
Easting: 526282.8 m
Total Depth: 62.5 ft

Depth (ft)	Lithology	Lithologic Description	Sample Number ft bgs	Field Screening α/β dpm	Field Screening VOCs ppm	Field Screening Silver ppm
0		Native soil. Sandy silt, pale yellowish-brown, well sorted, slightly cohesive; scattered, hard fragments.				
-5						
-10			RBK0103 9 - 10	7/588	NA	NA
		Core loss.				
-15		Native soil. Silty sand, grayish-orange; increasing number of hard, angular to subrounded fragments. At 13.5; thin stringer of dark, hard, black volcanic (?) chips.				
-20		Core loss.				
		Native soil. Sandy silt, grayish-orange, moderately sorted; abundant small, hard, grayish-orange fragments. From 26.0 - 27.0; abundant veinlets of white, hard evaporite (?) crystallization; harder drilling. From 29.0 - 30.0; color changes to dark yellowish-orange. From 32.5 - 34.0; interval is very soft with thin stringers containing numerous black fragments.	RBK0104 26.5 - 27.5	3/576	NA	NA
-25						
-30						
-35		Native soil. Silty sand, grayish-orange, poorly sorted, fairly hard, faint bedding, abundant fragments. Very friable and crumbly along bedding planes. Scattered zones and stringers of white, evaporite (?) crystallization. From 47.5 - 54.0; softer, driller notes drilling break at 47.5.				
-40						
-45						
-50						
-55			RBK0105 53 - 54	NA	NA	NA
		Core loss.				
-60		Native soil. Silty sand, grayish-orange, hard, friable, bedding planes apparent; abundant white and red fragments. From 56.0 - 58.0; abundant streaks and pinpoint evaporite (?) crystallization.				
		Native soil. Silty sand, cohesive, moderately hard, slightly sticky, abundant fragments; alternating layers of dark grayish-orange and very pale orange bands, inclined at 30 degrees.				

Project Name: CAU 409, Other Waste Sites
Project Number: 799417.01060110
Borehole Number: RBK02
Logged By: John Davis
Drilled By: Stewart Brothers
Drilling Method: Hollow Stem Auger

Date Started: 11/27/00
Date Completed: 11/27/00
Elevation: 1635.0 m
Northing: 4180112.6 m
Easting: 526273.9 m
Total Depth: 12.5 ft

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Depth (ft)	Lithology	Lithologic Description	Sample Number ft bgs	Field Screening α/β dpm	Field Screening VOCs ppm	Field Screening Silver ppm
0		Soil. Sandy silt, dark orange-brown, very soft, noncohesive, unlithified.	NA	NA	NA	NA
-5		Native soil. Sandy silt, light gray, very crumbly and fissile, crude bedding planes. Some root material, pinpoint and streaks of white, weathered crystallization common, abundant weathered fragments. From 6.0 - 6.5; zone of soft, unconsolidated material. From 6.5 - 7.5; color changes to medium orange-brown, very crumbly and loose, crude bedding planes, very poorly lithified, very weathered.				
		Core loss.				
-10		Native soil. Strata consists of very loose, unconsolidated, moderately sorted material. Driller notes firm drilling.				
		Native soil. Sandy silt, mottled dark orange-brown and gray, crumbly, crude bedding. Poorly sorted, abundant pebbles and fragments, abundant crystallization.				

Project Name: CAU 409, Other Waste Sites
Project Number: 799417.01060110
Borehole Number: RBK03
Logged By: John Davis
Drilled By: Stewart Brothers
Drilling Method: Hollow Stem Auger

Date Started: 11/27/00
Date Completed: 11/27/00
Elevation: 1631.8 m
Northing: 4180095.5 m
Easting: 526266.5 m
Total Depth: 7.5 ft

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Depth (ft)	Lithology	Lithologic Description	Sample Number ft bgs	Field Screening α/β dpm	Field Screening VOCs ppm	Field Screening Silver ppm
0		Soil. Sandy silt with some clay, dark reddish-brown, loose and unconsolidated, poorly sorted, some root material. From 2.0 - 3.0; color grades to light gray.	NA	NA	NA	NA
-5		Native soil. Sandy silt, crumbly and friable, crude bedding. Abundant root material, abundant weathered white fragments, streaks and stringers of white weathered crystalline material common. From 3.5 - 4.0; zone of very soft and unlithified material, driller notes firm drilling.				

Project Name: CAU 409, Other Waste Sites
Project Number: 799417.01060110
Borehole Number: AN101
Logged By: John Davis
Drilled By: Stewart Brothers
Drilling Method: Hollow Stem Auger

Date Started: 11/15/00
Date Completed: 11/16/00
Elevation: 1628.4 m
Northing: 4180101.2 m
Easting: 526279.5 m
Total Depth: 42.5 ft

Depth (ft)	Lithology	Lithologic Description	Sample Number ft bgs	Field Screening α/β dpm	Field Screening VOCs ppm	Field Screening Silver ppm
0		Soil. Sandy silt with clay, dark reddish-brown, crudely bedded, crumbly and friable, soft, abundant roots	AN10101	4/695	0.0	NA
-5		Native soil. Sandy silt, medium gray, poorly sorted, very loose and unconsolidated.				
-10		Native soil. Sandy silt, light orange-brown, compact, very friable and crumbly, bedding planes apparent. Scattered crystallization, some root material, vuggy and weathered. From 5.0 - 8.5; color changes to light brownish-gray. From 8.5 - 9.5; color changes to dark reddish-brown.				
-15		Native soil. Coarse sand with silt, dark brown, poorly sorted, very crumbly, poorly consolidated. Abundant black and clear fragments.				
-20		Augered interval. Medium brown to dark reddish-brown.				
-25						
-30						
-35						
-40		Native soil. Silty sand, medium grayish-brown, crumbly, very friable along bedding planes, abundant clasts.				

Project Name: CAU 409, Other Waste Sites
Project Number: 799417.01060110
Borehole Number: AN201
Logged By: John Davis
Drilled By: Stewart Brothers
Drilling Method: Hollow Stem Auger

Date Started: 11/27/00
Date Completed: 11/27/00
Elevation: 1632.8 m
Northing: 4180097.0 m
Easting: 526290.3 m
Total Depth: 42.5 ft

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Depth (ft)	Lithology	Lithologic Description	Sample Number ft bgs	Field Screening α/β dpm	Field Screening VOCs ppm	Field Screening Silver ppm
0		Soil. Sandy silt, medium orange-brown grading to medium gray, very loose and unconsolidated, unlithified, moderately sorted.	NA	NA	NA	NA
-5		Native soil. Medium orange-brown, firm, slightly cohesive, crudely bedded, poorly sorted, crumbly, friable, and fissile. From 5.0 - 12.0; mottled orange-brown and light gray, abundant weathered clasts, poorly defined bedding planes. From 11.5 - 12.5; core is harder.				
-10						
-15		Augered interval.				
-20						
-25						
-30						
-35						
-40		Native soil. Sandy silt, light gray, poorly sorted, crumbly and friable, bedding planes apparent. Abundant weathered clasts. Occasional vertical stress fractures (?).				

Appendix C

Field Screening of Soil for Silver by X-Ray Fluorescence (XRF)

(As received from Bechtel Nevada [BN])

FIELD SCREENING OF SOIL FOR SILVER BY X-RAY FLUORESCENCE (XRF) CAU 409: OTHER WASTE SITES, TONOPAH TEST RANGE, MARCH 7, 2001

The purpose of this analysis conducted by Bechtel Nevada Environmental Restoration was to screen soil samples near Area 3 (CAU 409) of the Tonopah Test Range (TTR) from November 13, 2000 through November 27, 2000. A Spectrace Model 9240 X-Ray Fluorescence (XRF) instrument was used. This instrument has three radioisotope sources for generating the X-Rays (gamma rays): Iron-55 (Fe-55), Cadmium-109 (Cd-109), and Americium-241 (Am-241). The instrument exposes samples to each radioisotope successively. This produces three separate spectra for one sample.

Sample preparation started by drying the sample in the sun if necessary. The sample was then passed through a 100 mesh sieve to collect the fines. These were used to fill a sample cup designed to go into the XRF. Soil sample masses ranged from approximately 3.0 grams to 10.0 grams. Sample size is mentioned here as an indicator only. The sample only has to be thick enough to stop the X-rays. Each sample was placed in the instrument and exposed to Fe-55 and Cd-109 for 150 seconds each, and to Am-241 for 300 seconds. Silver is most sensitive to the emissions of Am-241. Therefore the Am-241 spectra is used to determine the presence of silver and quantitate it.

XRF instruments come precalibrated. Analysis of spectra is complicated, due to conditions which are highly dependent on the physical characteristics of the sample and the presence of emissions caused by other factors besides fluorescence. These factors include backscatter, Compton Effects, and diffraction. The manufacturer has performed numerous calculations for their instrument, and built-in software compensates for these effects and calculates the concentration(s) for the various elements. It is not possible for the end-user to change this calibration. Physical characteristics of the sample are determined by exposing the sample to each radioisotope successively. Backscatter is compared for the different energies of X-rays emitted and appropriate, and proprietary, compensations are calculated.

XRF is highly linear over nearly the entire range of concentrations it can measure. As an instrument check, a pellet of pure iron and a cylinder of Teflon (as the blank) are run once a day. For this investigation, the iron was always within 1 percent of the expected 100 percent, and the Teflon was always 0 percent iron.

Since soil is a complex matrix and silver has a relatively low response, it was necessary to determine sensitivity of the instrument using soil similar to that encountered at the site. This had been done the year before for another project but using the same XRF. A set of soil samples from TTR Area 9 believed to be undisturbed soil, had a known amount of silver nitrate solution added. This produced a set of standards ranging from 0 ppm silver to 1,000 ppm silver. These standards were tested to determine the lower limit of detectibility. It was found the 50 ppm silver standard showed a positive result, but the response was nearly the same as the 100 ppm silver. The sensitivity is then about 50 ppm, but quantitation cannot be reliable until at least 100 ppm silver is present. The manufacturers listed detection limit of silver in a soil matrix was approximately 60 ppm.

Soil used to prepare standards had a near zero baseline in the immediate vicinity of the silver emission, while all samples showed a broad, low emission through the same area. The difference between the soil samples is that the standards were carefully dried, while soils analyzed in the field were not dried. The broadness of this baseline rise indicates something other than fluorescence, probably water induced, caused this.

Silver is not very fluorescent in X-rays. The absolute count was never very high. This leads to a low signal to noise ratio. As can be seen in the spectra following this discussion, the program can interpret noise as silver. The instrument manual[1] recommends that concentration for a hit be five times the standard deviation before considering it a positive result. Based on what the spectra show, this is not at all too conservative.

Table 1 lists all sample runs made on the XRF. Also included is a Teflon blank and iron pellet run. Two spectra are printed for each sample or standard. The spectrum on the left is the complete Am-241 spectrum, while the spectrum on the right is a detail of the region where silver fluoresces. The labeled line at 22.105 keV is the center of the silver emission, while the two vertical dotted lines on each side (21.64 & 22.57 keV) are the limits for the silver emission. Examination of the silver emission area can determine if silver is present or if the spectrum is simply noisy. No other elements interfere with this emission line of silver, so false positives cannot occur by this mechanism.

TABLE 1- SAMPLES RUN BY XRF

SAMPLE ID[A]	INSTRUMENT QUANTITATION OF SILVER[B] (ppm)	STANDARD DEVIATION	PROBABLE QUANTITATION OF SILVER[C] (ppm)	PAGE # OF SPECTRA	SAMPLE MASS[D] (g)	DATE OF ANALYSIS
Teflon Blank	<50	14.0	0	4	N/A	11/13/00
Iron Std (run1)	<50	80.6	0	N/A	N/A	11/13/00
Iron Std (run 2)	<50	84.1	0	4	N/A	11/13/00
Teflon Blank	31	14.2	0	4	N/A	11/14/00
Iron Std	<50	0	0	5	N/A	11/14/00
DP10103_0	<50	0	0	5	4.23	11/14/00
DP10105_20	57	14.0	0	5	5.97	11/14/00
Teflon Blank	<50	0	0	6	N/A	11/15/00
Iron Std	<50	0	0	6	N/A	11/15/00
DP10106_30	<50	0	0	6	6.52	11/15/00
DP10107_37.5	15	13.3	0	7	4.96	11/15/00

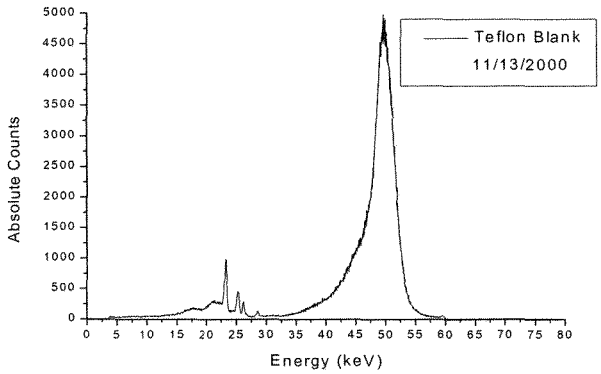
SAMPLE ID[A]	INSTRUMENT QUANTITATION OF SILVER[B] (ppm)	STANDARD DEVIATION	PROBABLE QUANTITATION OF SILVER[C] (ppm)	PAGE # OF SPECTRA	SAMPLE MASS[D] (g)	DATE OF ANALYSIS
DP20101_0	26	14.8	0	7	6.92	11/15/00
DP20102_10	<50	0	0	7	6.82	11/15/00
DP20103_20	54	14.9	0	8	6.75	11/15/00
DP20104_30	27	14.6	0	8	7.03	11/15/00
DP20105_40	<50	0	0	8	5.11	11/15/00
DP20106_42	43	13.2	0	9	4.3	11/15/00
Teflon Blank	15	14.1	0	9	N/A	11/16/00
Iron Std	<50	0	0	9	N/A	11/16/00
DP20107_49	20	13.7	0	10	6.13	11/16/00
AN10101_0	63	16.1	0	10	8.71	11/16/00
Teflon Blank	35	17.3	0	10	N/A	11/27/00
Iron Std	<50	0	0	11	N/A	11/27/00

[A]Sample ID was made by taking the sample identification from the sample custodian, adding an underscore, and putting the maximum depth the drill bit reached. Samples are listed by date analyzed.
[B]This is the calculated result for silver by the XRF software. In looking at the actual spectra, it can be seen that the software aggressively quantitates silver, even though the "peak" seen is noise.
[C]This column is the analyst's professional opinion on the amount of silver actually in a sample. <50 means the concentration of any silver is below the limit of detection.
[D]Sample mass is listed here only for completeness. It is the volume of sample in the sample holder which is important.

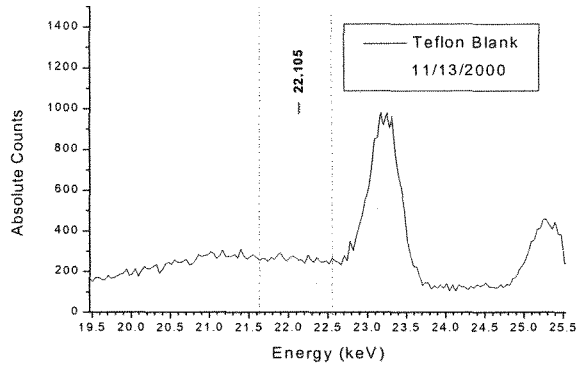
[1]Spectrace Portable XRF Analyzer, Part No. 717715 Rev. 1.1, August 1994

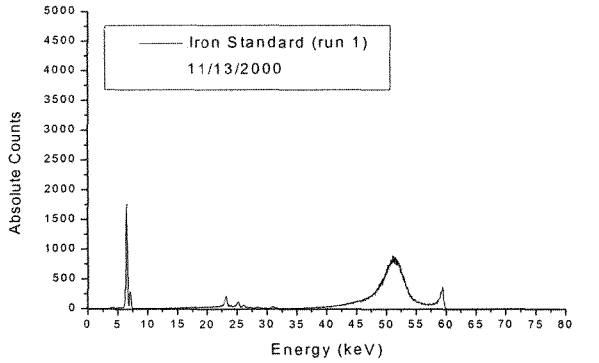
X-RAY FLUORESCENCE SPECTRA

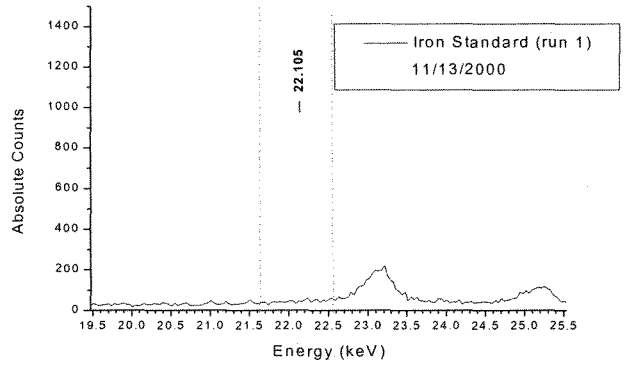
Complete Am-241 Spectra

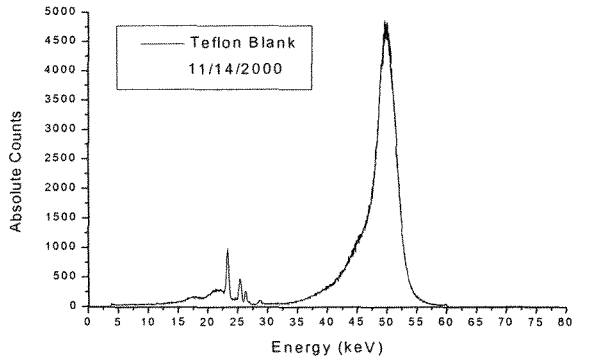


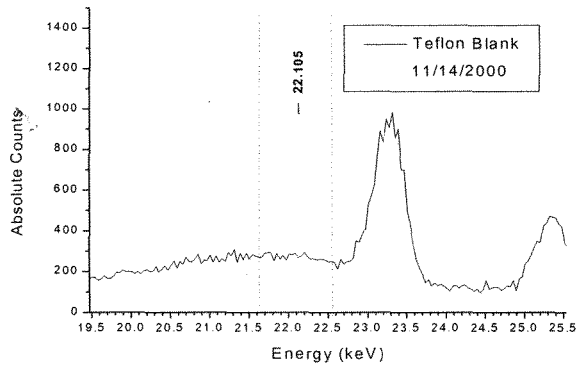
Detail of Silver Range





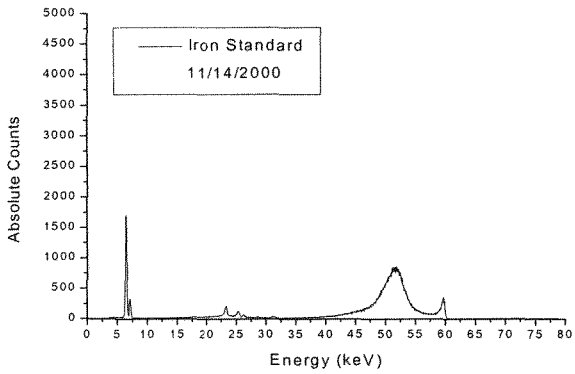


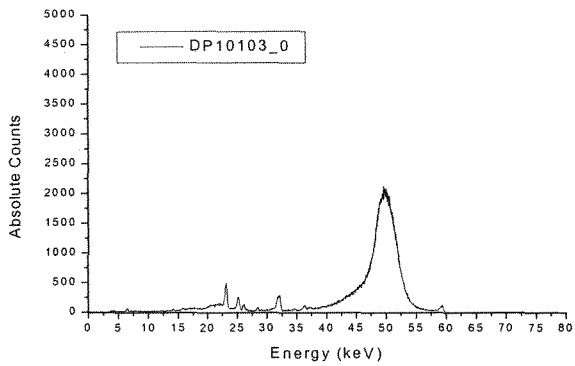


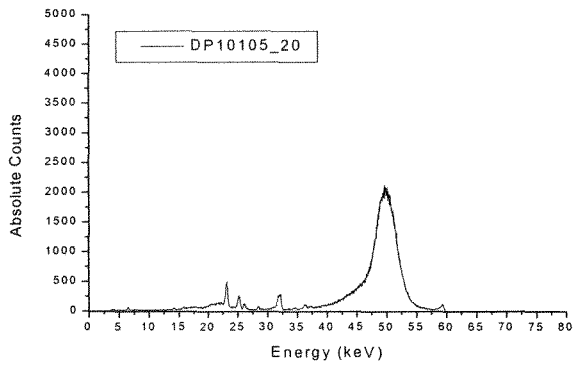


X-RAY FLUORESCENCE SPECTRA

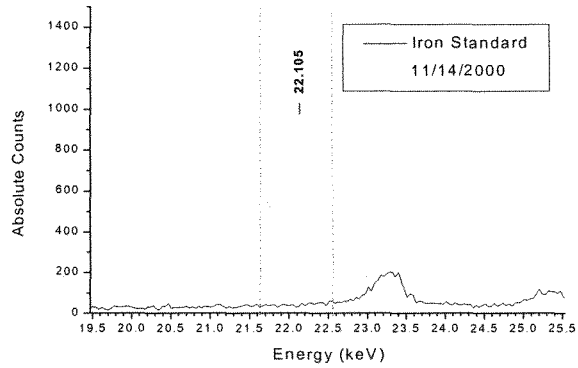
Complete Am-241 Spectra

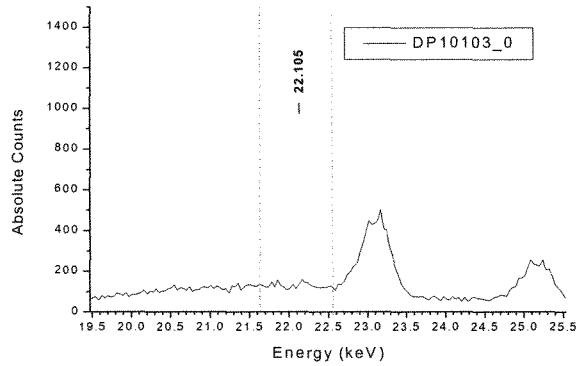


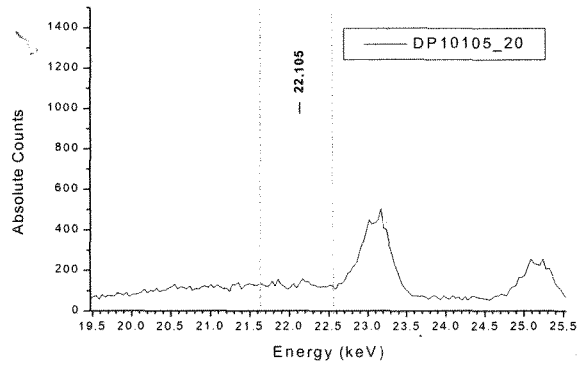




Detail of Silver Range

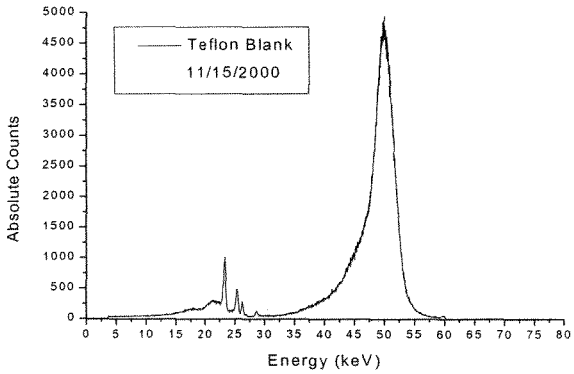




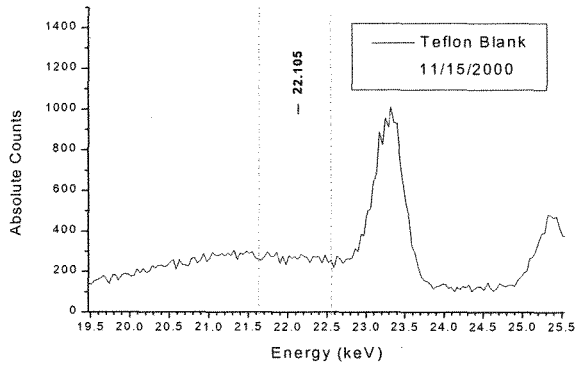


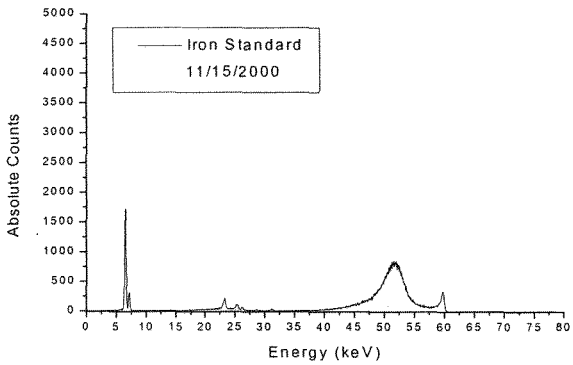
X-RAY FLUORESCENCE SPECTRA

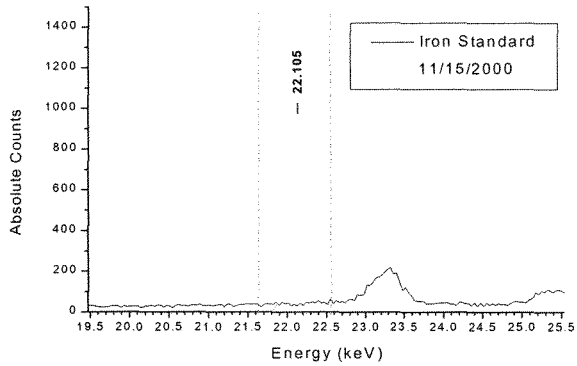
Complete Am-241 Spectra

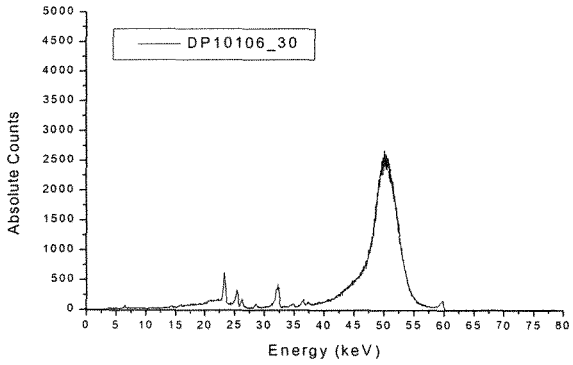


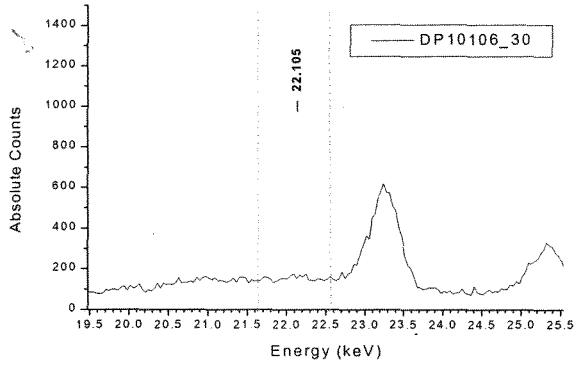
Detail of Silver Range





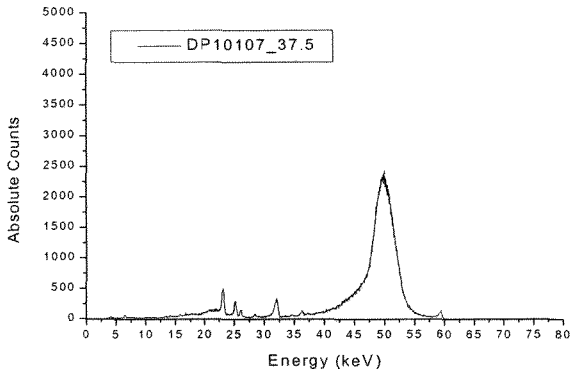




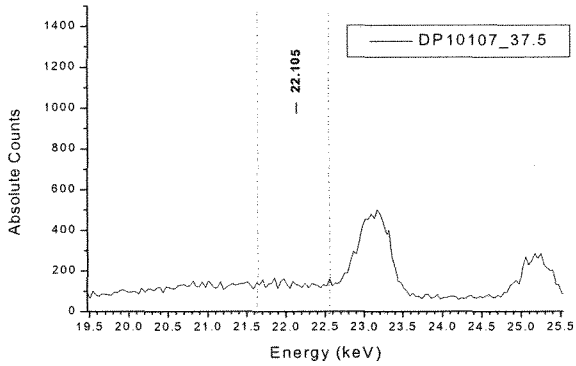


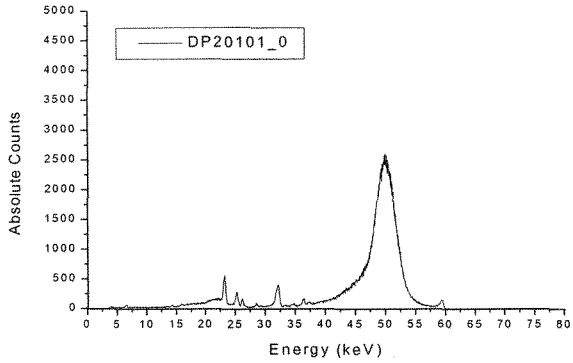
X-RAY FLUORESCENCE SPECTRA

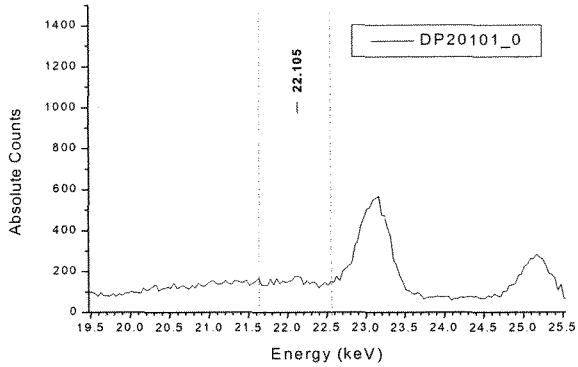
Complete Am-241 Spectra

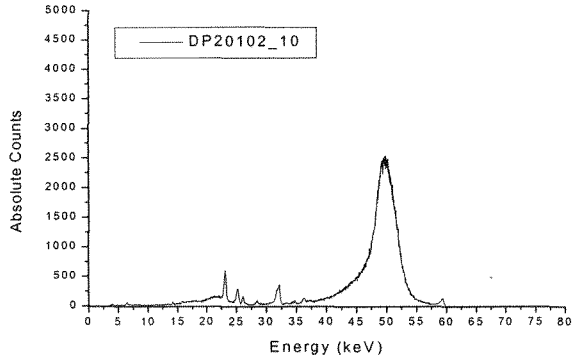


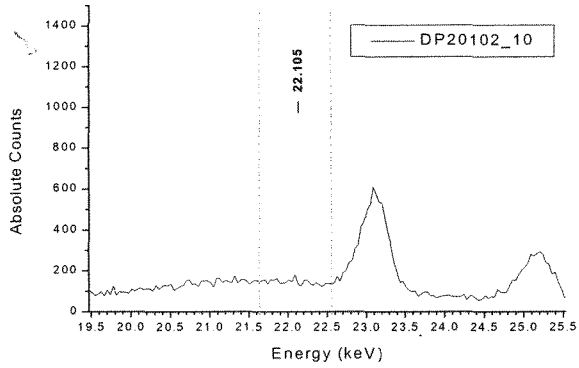
Detail of Silver Range





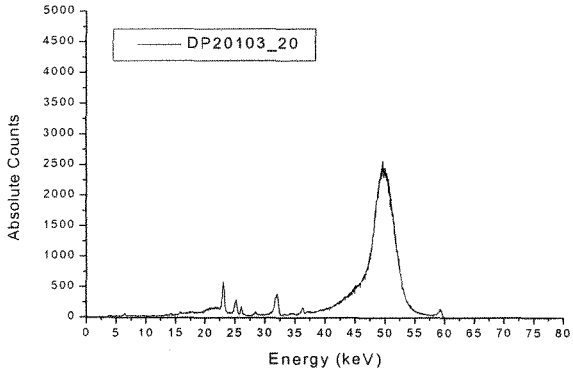




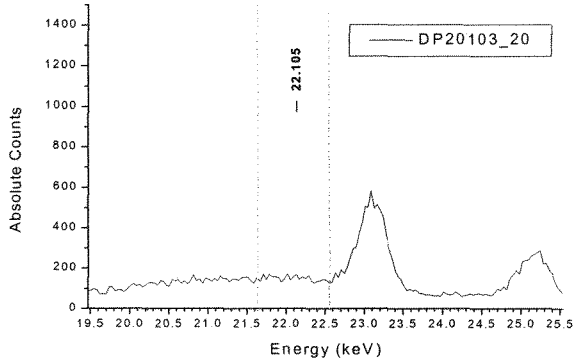


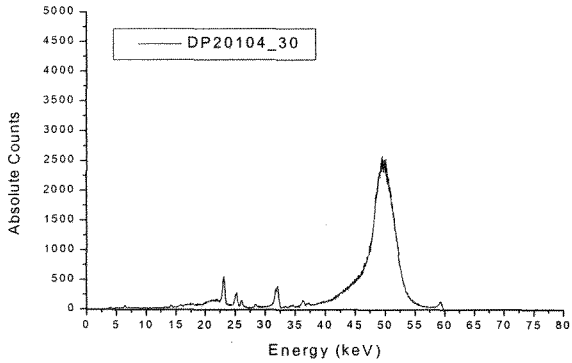
X-RAY FLUORESCENCE SPECTRA

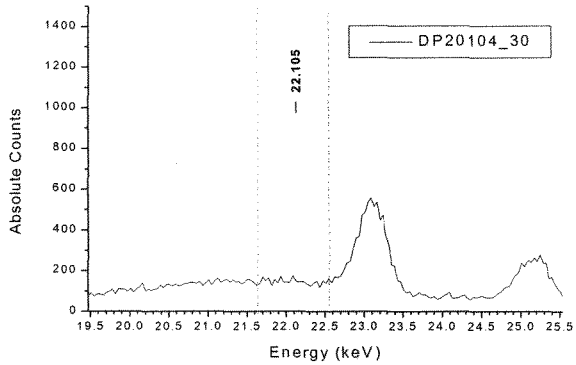
Complete Am-241 Spectra

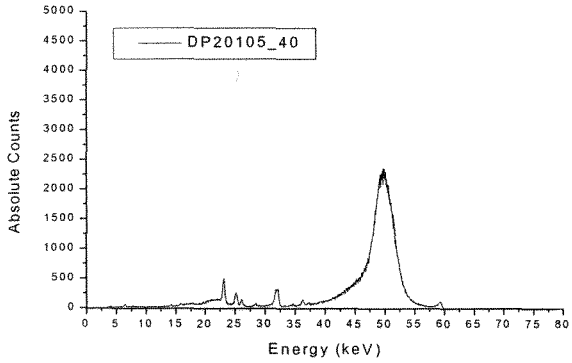


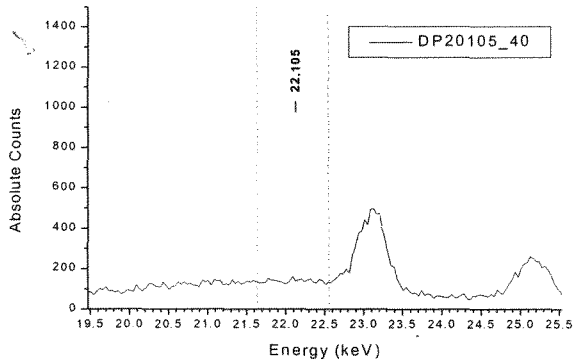
Detail of Silver Range





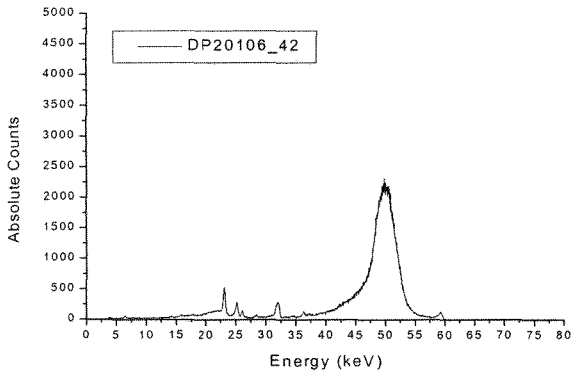


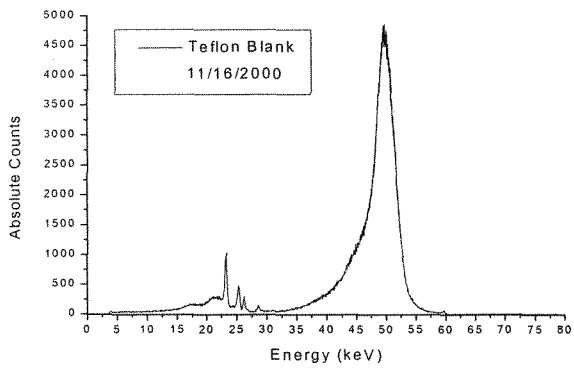


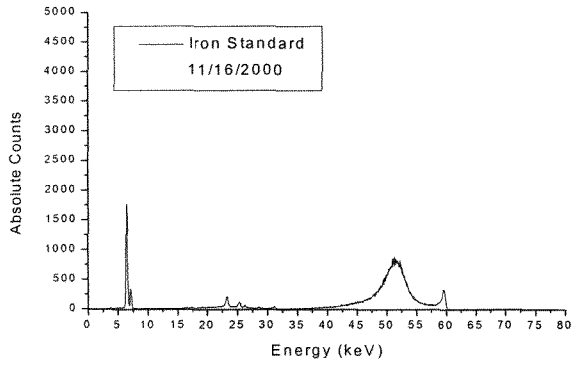


X-RAY FLUORESCENCE SPECTRA

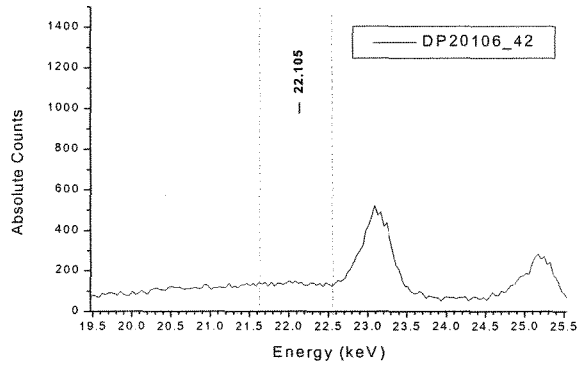
Complete Am-241 Spectra

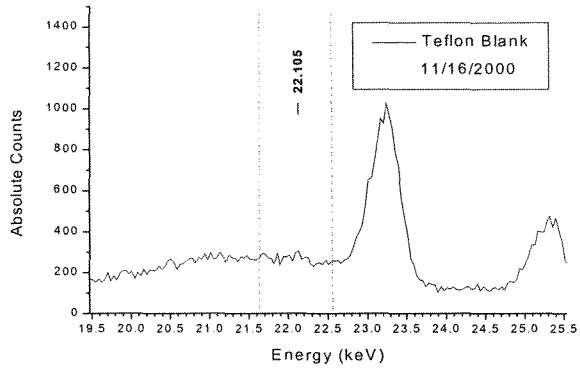


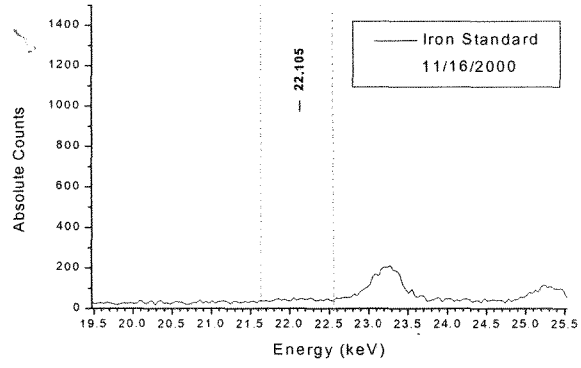




Detail of Silver Range

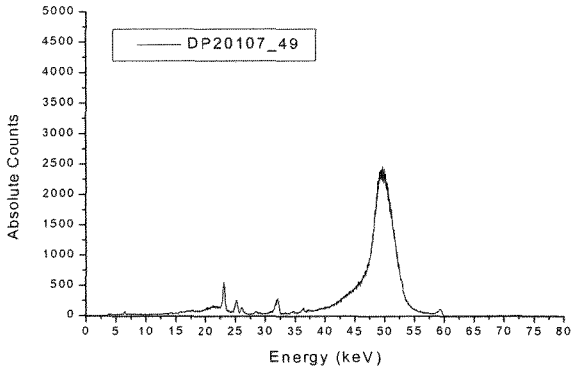




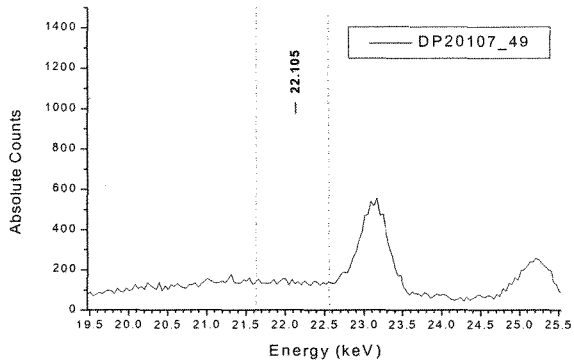


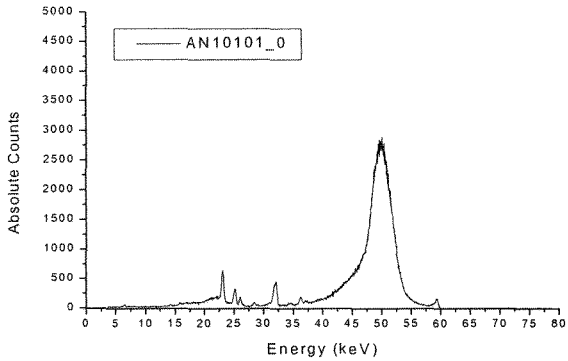
X-RAY FLUORESCENCE SPECTRA

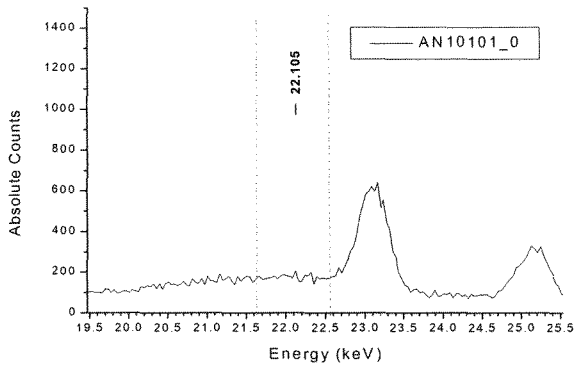
Complete Am-241 Spectra

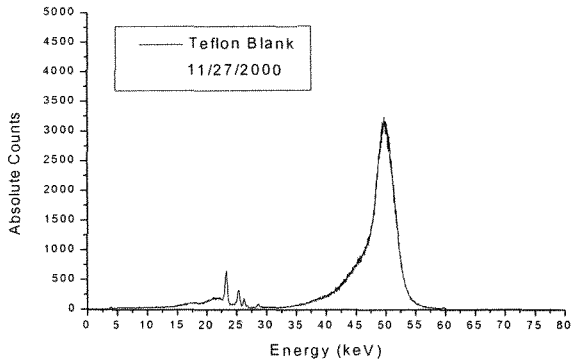


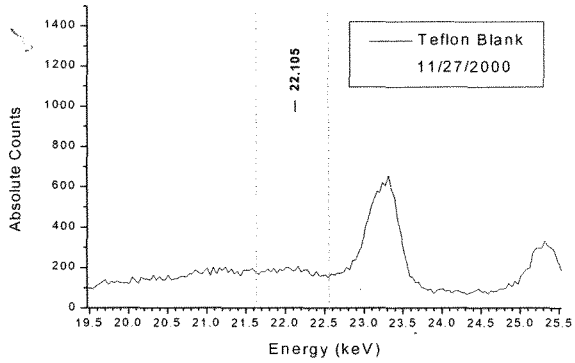
Detail of Silver Range





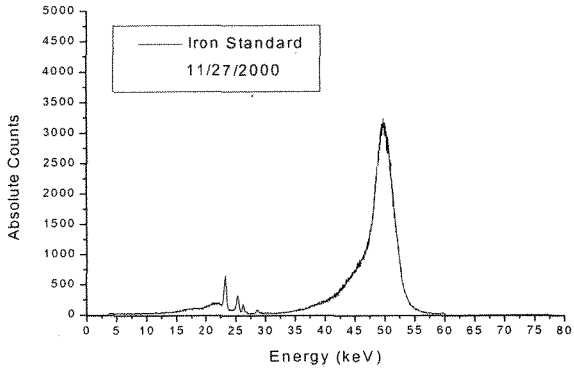




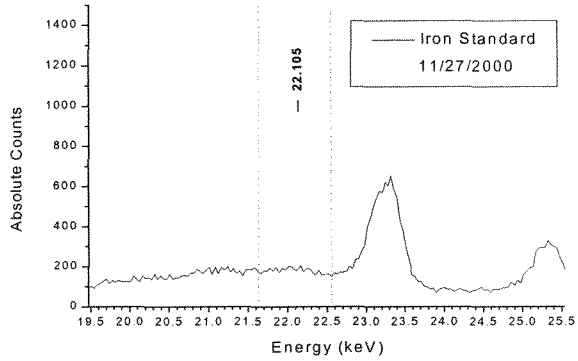


X-RAY FLUORESCENCE SPECTRA

Complete Am-241 Spectra



Detail of Silver Range



Appendix D

Geotechnical Analytical Results

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Initial Moisture Content		Dry Bulk Density	Wet Bulk Density	Calculated Porosity
	Gravimetric (%, g/g)	Volumetric (%, cm^3/cm^3)	(g/cm^3)	(g/cm^3)	(%)
DP201GT	20.1	21.5	1.07	1.29	59.6

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: IT
Job Number: 9881.01
Sample Number: DP201GT
Ring Number: NA
Depth: NA
Test Date: 4-Dec-00

Field weight of sample* (g): 216.42
Tare weight, ring (g): 66.63
Tare weight, cap/plate/epoxy (g): 0.00

Dry weight of sample (g): 124.75
Sample volume (cm^3): 116.53
Assumed particle density: 2.65

Initial Volumetric Moisture Content (% vol): 21.5
Initial Gravimetric Moisture Content (% g/g): 20.1
Dry bulk density (g/cm^3): 1.07
Wet bulk density (g/cm^3): 1.29
Calculated Porosity (% vol): 59.6
Percent Saturation: 36.1

Comments:

* Weight including tares

Laboratory analysis by: D. O'Dowd
Data entered by: M. Devine
Checked by: R. Smith

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Method of Analysis	
		Constant Head	Falling Head
DP201GT	4.1E-04	X	

Saturated Hydraulic Conductivity
Constant Head Method

Job name: IT
Job number: 9881.01
Sample number: DP201GT
Ring number: NA
Depth: NA

Type of water used: TAP
Collection vessel tare (g)*:* 10.70
Sample length (cm)*:* 6.28
Sample diameter (cm)*:* 4.86
Sample x-sectional area (cm^2)*:* 18.56

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
12-Dec-00	13:16:06	18.0	6.0	20.8	10.1	1744	3.3E-04	3.4E-04
12-Dec-00	13:45:10							
Test # 2:								
13-Dec-00	08:51:51	18.0	6.0	15.4	4.7	621	4.3E-04	4.4E-04
13-Dec-00	09:02:12							
Test # 3:								
13-Dec-00	12:41:00	18.0	6.0	17.3	6.6	852	4.3E-04	4.5E-04
13-Dec-00	12:55:12							

Average Ksat* (cm/sec)*: **4.1E-04**

Comments:

Laboratory analysis by: R. Smith
Data entered by: M. Devine
Checked by: R. Smith

Summary of Moisture Characteristics of the Initial Drainage Curve

Sample Number	Pressure Head (-cm water)	Moisture Content (%, cm^3/cm^3)
DP201GT	0	45.2
	17	42.7
	44	36.2
	148	28.4
	510	25.5
	7343	21.0
	16725	19.4
	851293	6.0

Summary of Calculated Unsaturated Hydraulic Properties

	α (cm^{-1})			N (dimensionless)				
	Calculated	95% Confidence Limits		Calculated	95% Confidence Limits			
Sample Number	Value	Lower	Upper	Value	Lower	Upper	θ_r	θ_s
DP201GT	0.1013	0.0000	0.3313	1.1379	1.0815	1.1942	0.0000	0.4578

Moisture Retention Data

Hanging Column/Pressure Plate/Thermocouple

(Main Drainage Curve)

Job Name: IT
Job Number: 9881.01
Sample Number: DP201GT
Ring Number: NA
Depth: NA

Dry wt. of sample (g): 124.75
Tare wt., screen & clamp (g): 23.97
Tare wt., ring (g): 66.63
Tare wt., epoxy (g): 0.00
Sample volume (cm^3): 116.53

Saturated weight at 0 cm tension* (g): 267.99
Volume of water† in saturated sample (cm^3): 52.64
Saturated moisture content (% vol): 45.17
Sample bulk density (g/cm^3): 1.07

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Hanging column:	13-Dec-00 / 16:30	267.99	0.00	45.17
	18-Dec-00 / 10:00	265.15	16.50	42.74
	20-Dec-00 / 13:40	257.48	43.70	36.15
	27-Dec-00 / 12:30	248.44	148.00	28.40
Pressure plate:	29-Dec-00 / 12:15	245.07	509.90	25.50

Comments:

* Weight including tares
† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: R. Smith

Moisture Retention Data

Water Activity Meter/Relative Humidity Box

(Main Drainage Curve)

Job Name: IT
Job Number: 9881.01
Sample Number: DP201GT
Ring Number: NA
Depth: NA

Dry weight of water activity meter sample* (g): 137.33
Tare weight, jar (g): 113.91
Sample bulk density (g/cm^3): 1.07

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Water Activity Meter:	05-Dec-00 / 14:20	141.92	7342.6	20.98
	05-Dec-00 / 10:15	141.58	16724.7	19.43

Dry weight of relative humidity box sample* (g): 70.59
Tare weight (g): 38.65
Sample bulk density (g/cm^3): 1.07

	Date/Time	Weight* (g)	Matric Potential (-cm water)	Moisture Content† (% vol)
Relative humidity box:	09-Dec-00 / 11:30	72.39	851293	6.03

Comments:

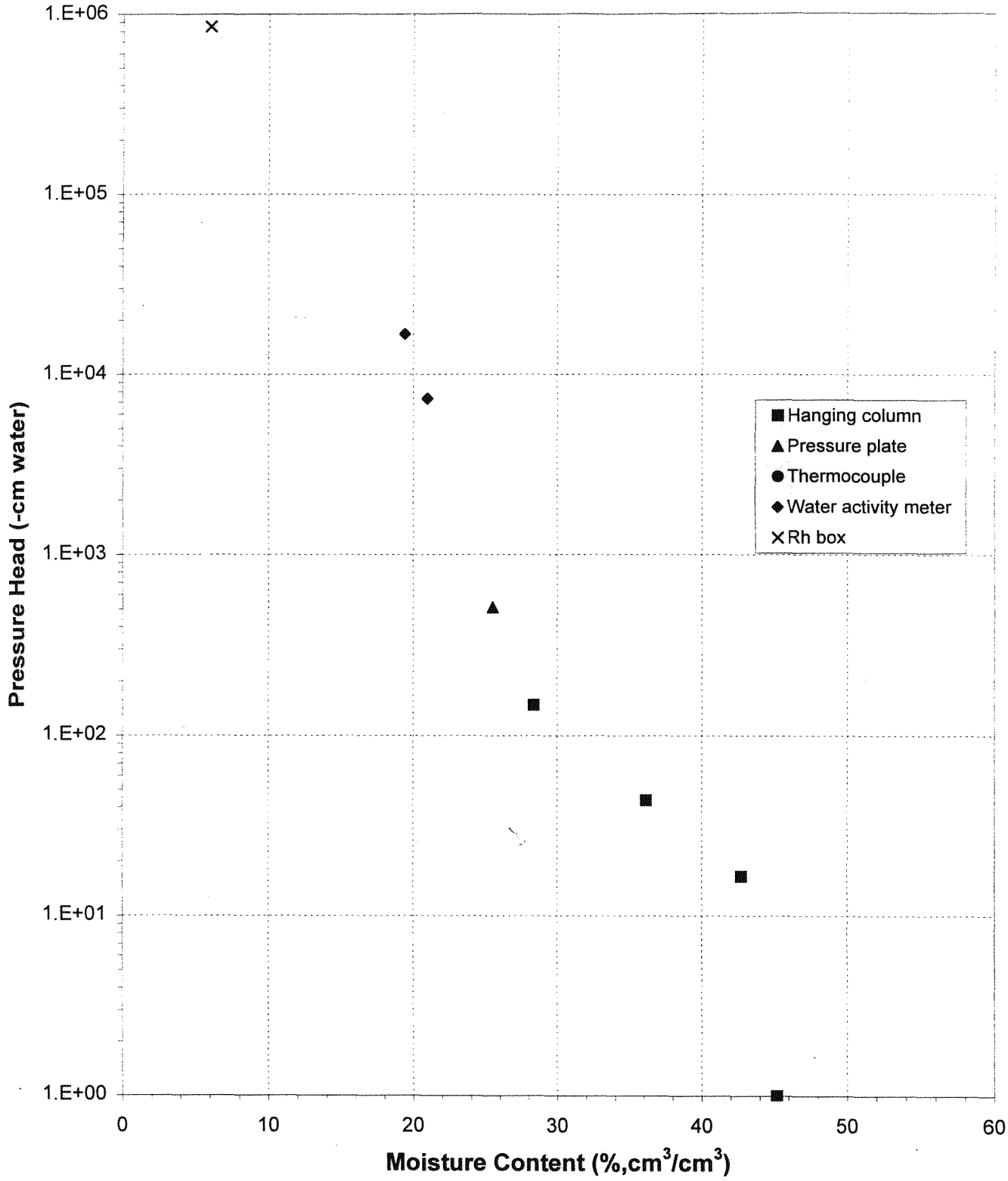
* Weight including tares

† Assumed density of water is 1.0 g/cm^3

Laboratory analysis by: D. O'Dowd
Data entered by: D. O'Dowd
Checked by: R. Smith

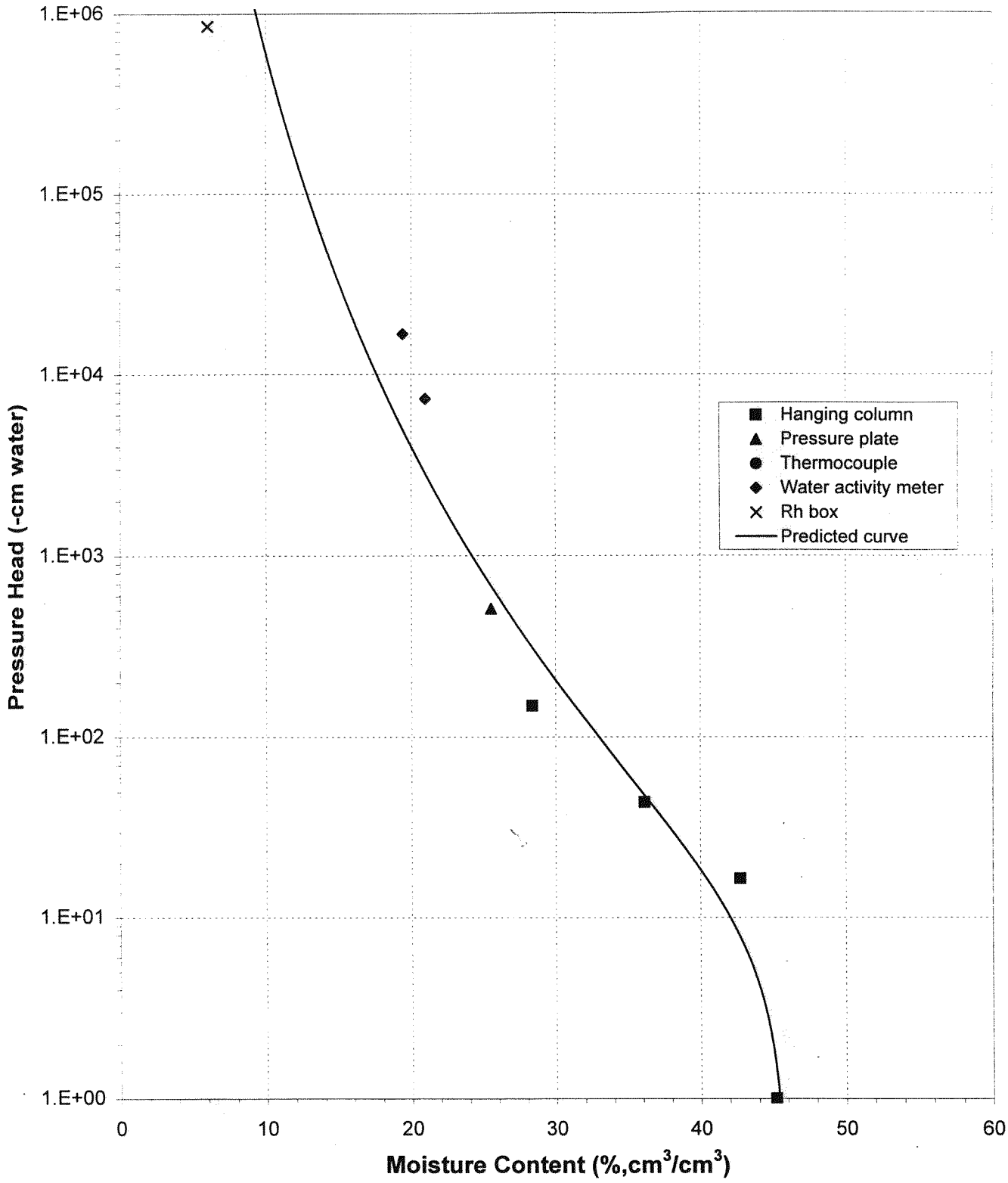
Water Retention Data Points

Sample Number: DP201GT



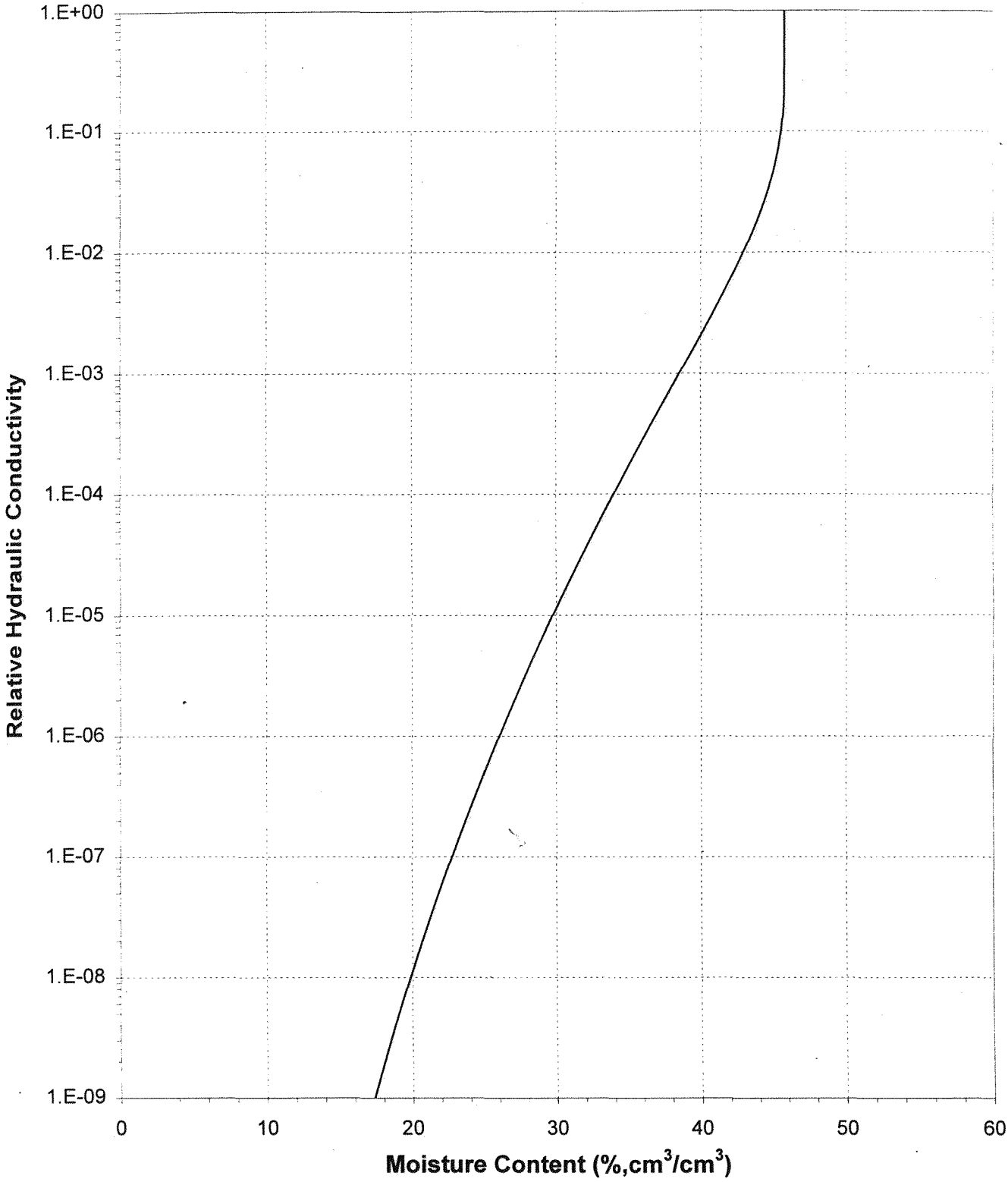
Predicted Water Retention Curve and Data Points

Sample Number: DP201GT



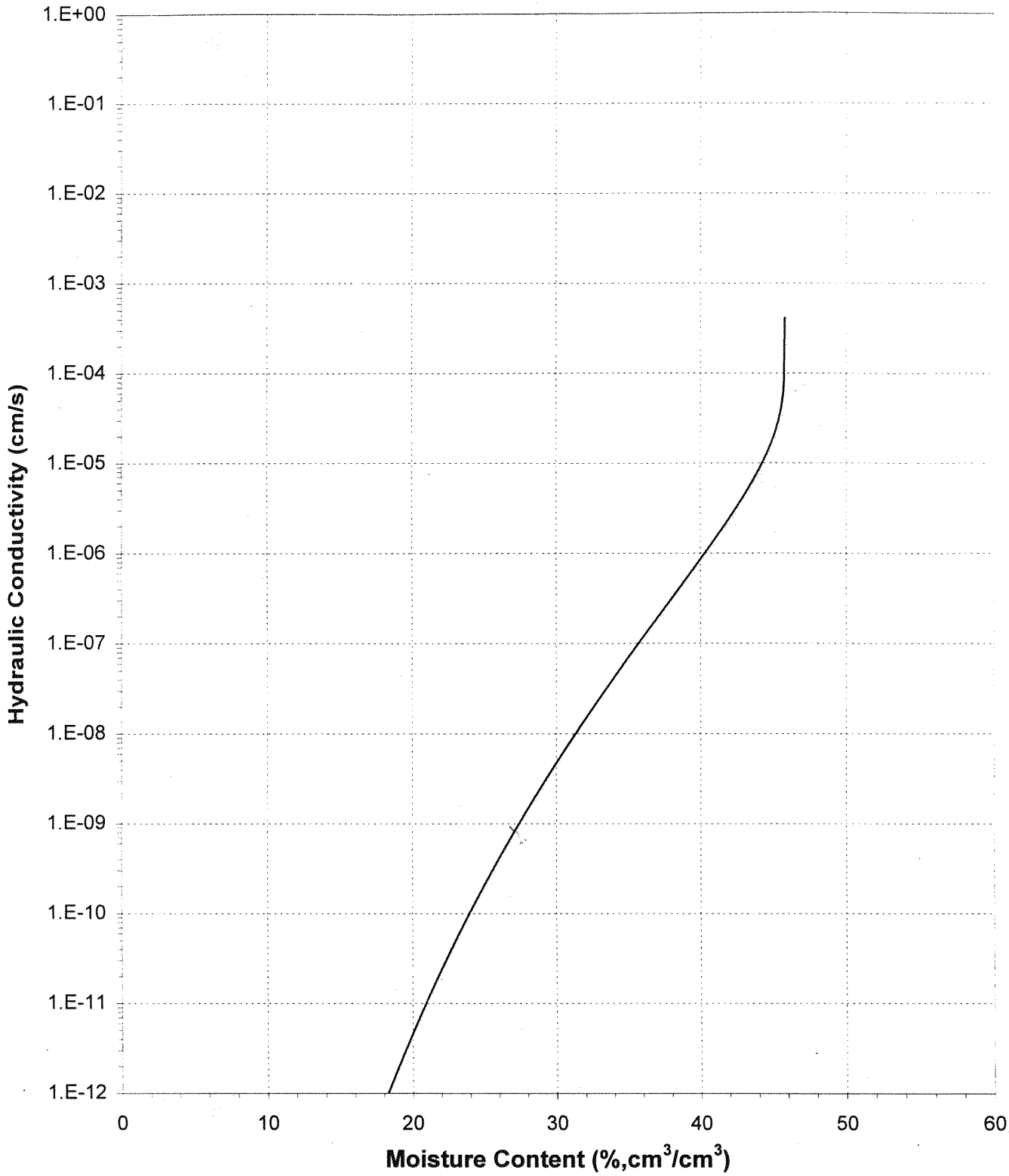
Plot of Relative Hydraulic Conductivity vs Moisture Content

Sample Number: DP201GT



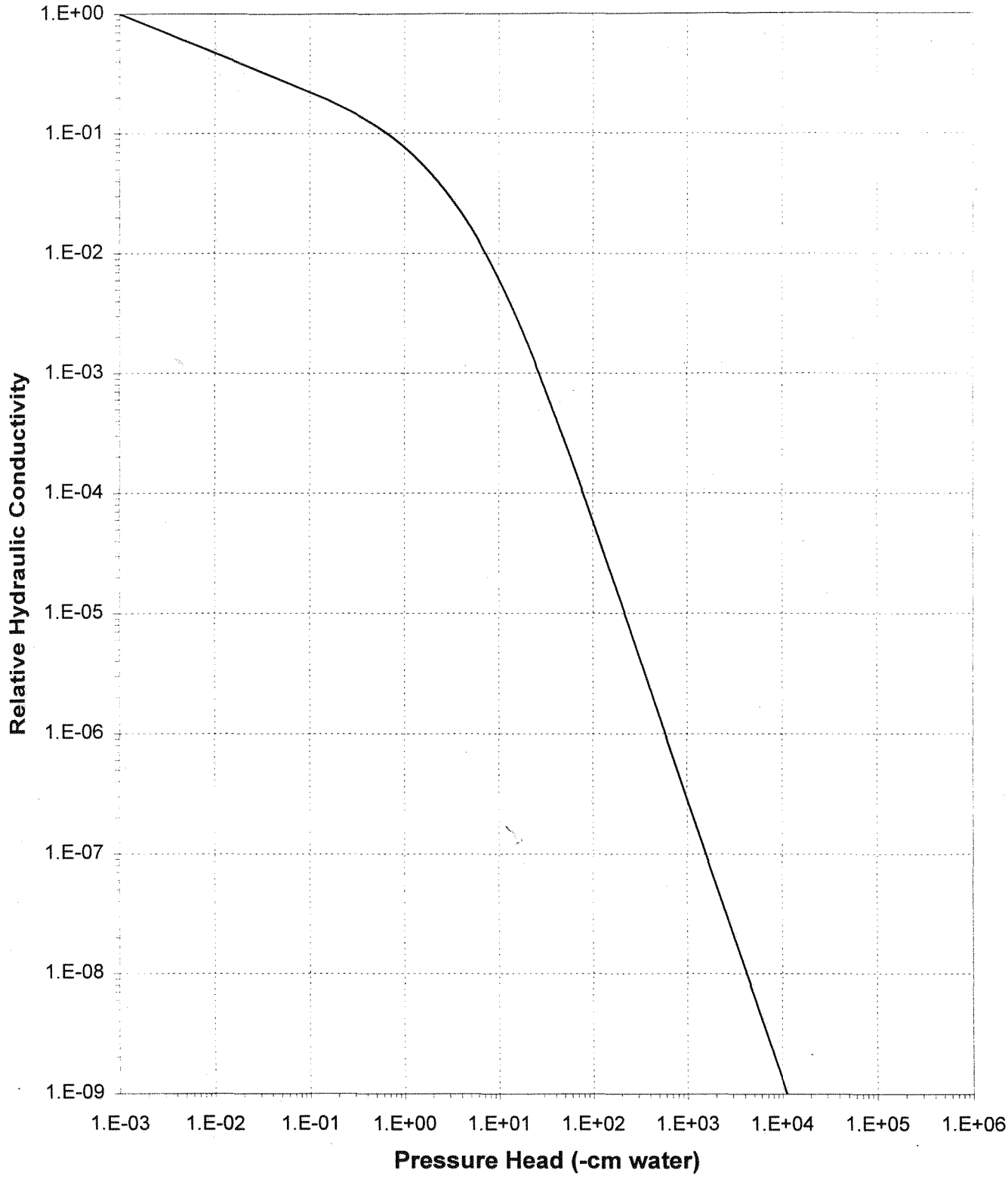
Plot of Hydraulic Conductivity vs Moisture Content

Sample Number: DP201GT



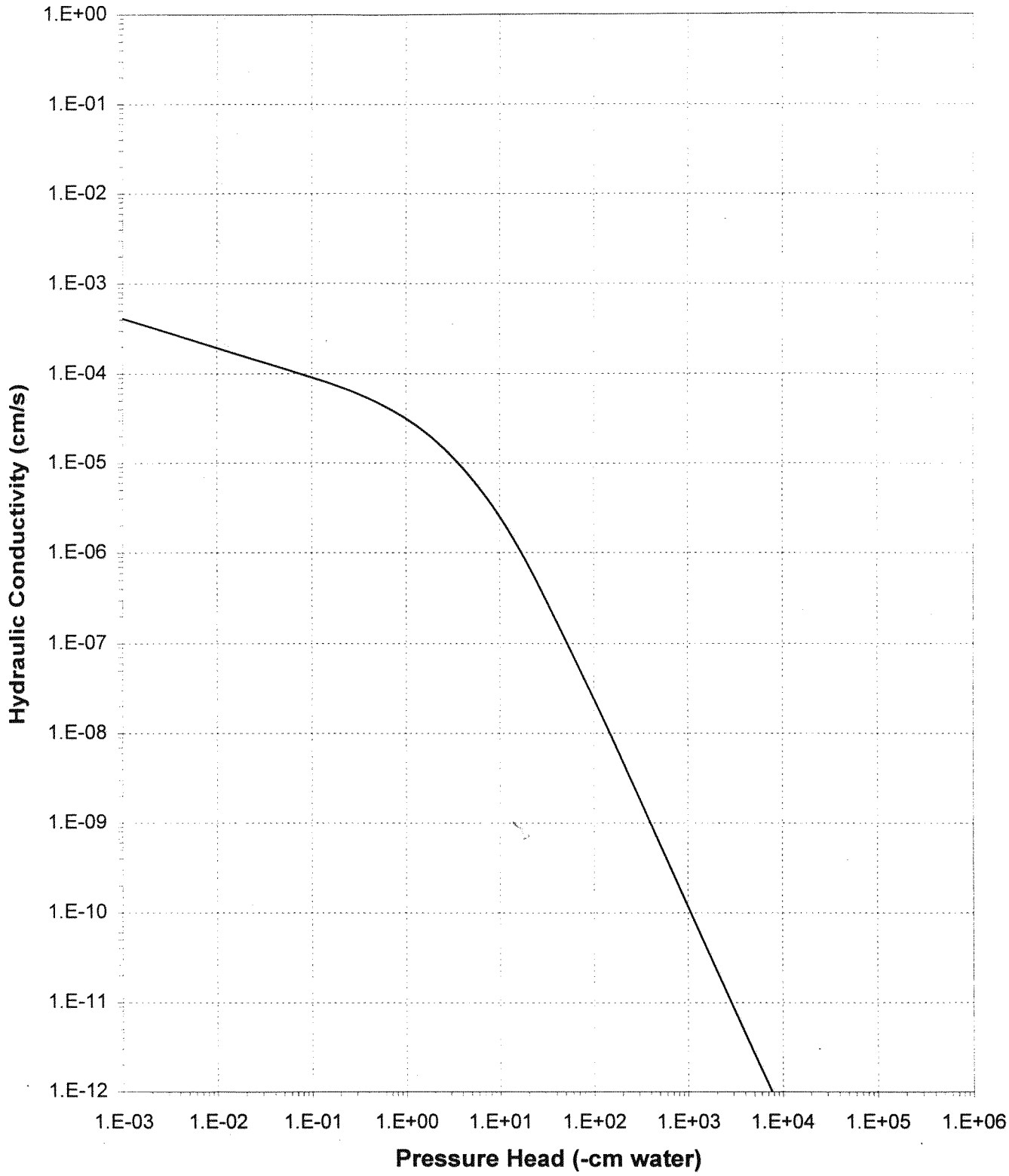
Plot of Relative Hydraulic Conductivity vs Pressure Head

Sample Number: DP201GT



Plot of Hydraulic Conductivity vs Pressure Head

Sample Number: DP201GT



Summary of Particle Size Characteristics

Sample Number	d_{10} (mm)	d_{50} (mm)	d_{60} (mm)	C_u	C_c	Method	Classification
DP201GT	0.0033	0.10	0.16	48	2.7	WS/H	Classification by ASTM 2487 requires Atterberg test

d_{50} = Median particle diameter

Est = Reported values for d_{10}, C_u, C_c, and soil classification are estimates, since extrapolation was required to obtain the d_{10} diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

Particle Size Analysis
Wet Sieve Data (#10 Split)

Job Name: IT
Job Number: 9881.01
Sample Number: DP201GT
Ring Number: NA
Depth: NA
Test Date: 4-Dec-00

Initial Dry Weight of Sample (g): 236.00
Weight Passing #10 (g): 220.83
Weight Retained #10 (g): 15.17
Weight of Hydrometer Sample (g): 50.35
Calculated Weight of Sieve Sample (g): 53.81

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10						
	3"	75	0.00	0.00	236.00	100.00
	1.5"	38.1	0.00	0.00	236.00	100.00
	3/4"	19.0	0.00	0.00	236.00	100.00
	3/8"	9.5	0.00	0.00	236.00	100.00
	4	4.75	3.68	3.68	232.32	98.44
	10	2.00	11.49	15.17	220.83	93.57
-10			(Based on calculated sieve wt.)			
	20	0.85	4.22	7.68	46.13	85.73
	40	0.425	4.52	12.20	41.61	77.33
	60	0.250	3.37	15.57	38.24	71.07
	140	0.106	10.76	26.33	27.48	51.07
	200	0.075	6.39	32.72	21.09	39.19
	dry pan		1.77	34.49	19.32	
	wet pan			19.32	0.00	

d_{10} (mm): 0.0033
d_{16} (mm): 0.0048
d_{30} (mm): 0.038
d_{50} (mm): 0.10
d_{60} (mm): 0.16
d_{84} (mm): 0.74

Median Particle Diameter--d_{50} (mm): 0.10
Uniformity Coefficient, Cu--$[d_{60}/d_{10}]$ (mm): 48
Coefficient of Curvature, Cc--$[(d_{30})^2/(d_{10}*d_{60})]$ (mm): 2.7
Mean Particle Diameter--$[(d_{16}+d_{50}+d_{84})/3]$ (mm): 0.28

Soil Classification: Classification by ASTM 2487 requires Atterberg test

Laboratory analysis by: D. O'Dowd
Data entered by: M. Devine
Checked by: R. Smith

Particle Size Analysis
Hydrometer Data

Job Name: IT
Job Number: 9881.01
Sample Number: DP201GT
Ring Number: NA
Depth: NA

Test Date: 6-Dec-00
Start Time: 8:40

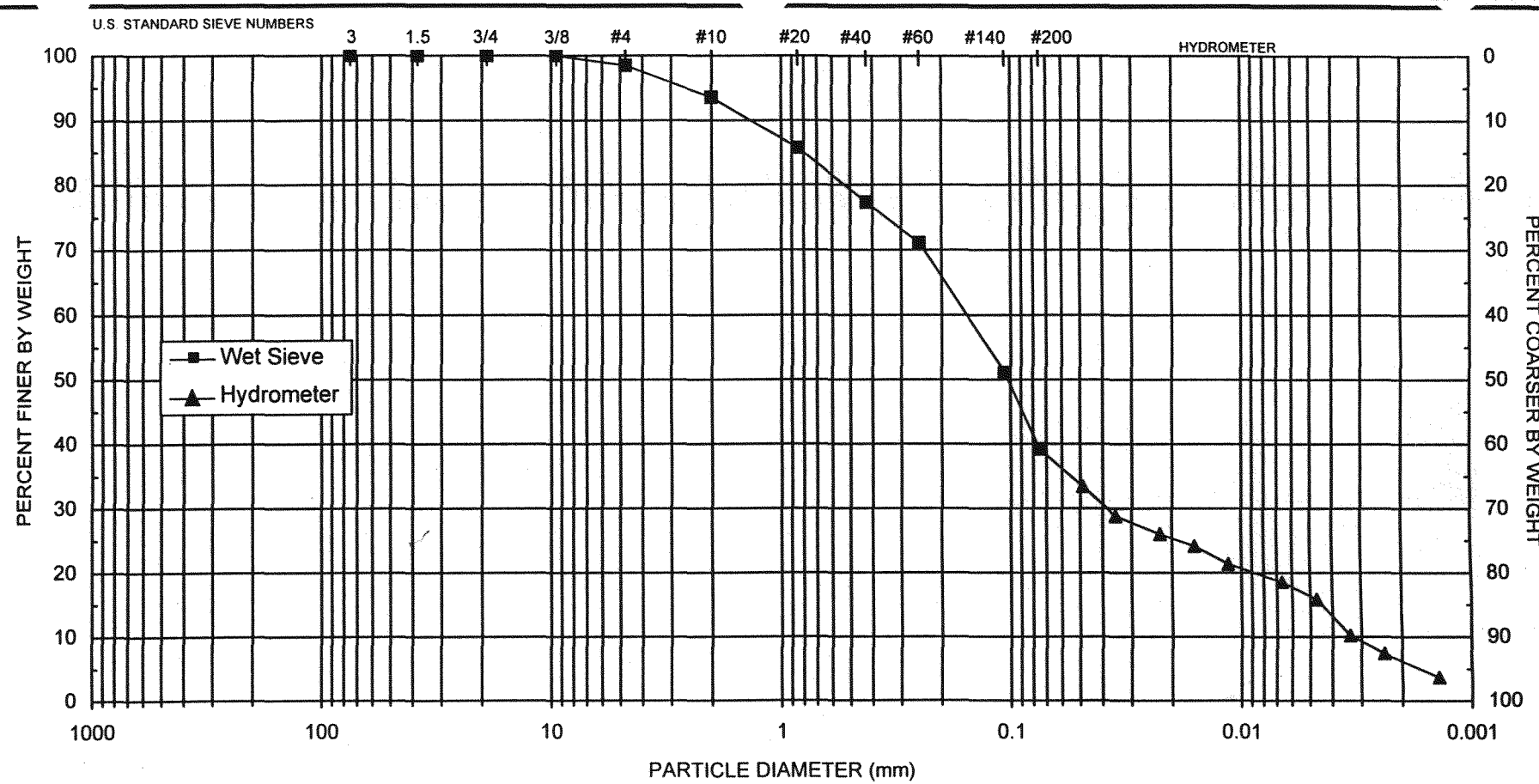
Type of Water Used: DISTILLED
Reaction with H_2O_2*:* Strong
Dispersant: $(NaPO_3)_6$
Assumed particle density: 2.65

Initial Wt. (g): 50.35
Total Sample Wt. (g): 236.00
Wt. Passing #10 (g): 220.83

Date	Time (min)	Temp (°C)	R (g/L)	R_L (g/L)	R_{corr} (g/L)	L (cm)	D (mm)	P (%)	% Finer
20-Dec-00	1	18.0	24.5	6.5	18.0	12.3	0.04900	35.7	33.5
	2	18.0	22.0	6.5	15.5	12.7	0.03522	30.8	28.8
	5	18.0	20.5	6.5	14.0	12.9	0.02249	27.8	26.0
	10	18.0	19.5	6.5	13.0	13.1	0.01600	25.8	24.2
	20	18.0	18.0	6.5	11.5	13.3	0.01142	22.8	21.4
	60	18.0	16.5	6.5	10.0	13.6	0.00665	19.9	18.6
	120	19.0	15.0	6.5	8.5	13.8	0.00469	16.9	15.8
	240	19.5	12.0	6.5	5.5	14.3	0.00335	10.9	10.2
	480	20.0	10.0	6.0	4.0	14.7	0.00238	7.9	7.4
21-Dec-00	1440	20.0	8.0	6.0	2.0	15.0	0.00139	4.0	3.7

Comments:

Laboratory analysis by: M. Devine
Data entered by: M. Devine
Checked by: R. Smith



UNIFIED	COBBLES	GRAVEL		SAND			SILT OR CLAY
		Coarse	Fine	Coarse	Medium	Fine	
USDA	COBBLES	GRAVEL		SAND					SILT	CLAY
				Very coarse	Coarse	Medium	Fine	Very fine		

d_{10} = **0.0033**	d_{30} = **0.038**	d_{50} = **0.10**	d_{60} = **0.16**	C_u = **48**	C_c = **2.7**
SAMPLE NUMBER	DEPTH	ASTM CLASSIFICATION			
DP201GT	**NA**	**Classification by ASTM 2487 requires Atterberg test**			

Appendix E

Documentation of Housekeeping Closure Activities

FFACO CORRECTIVE ACTION SITE
HOUSEKEEPING CLOSURE VERIFICATION FORM

Closure Verification Date: November 8, 2000
CAS Number: RG-24-001-RGCR
CAU Number: 409
General Location: Tonopah Test Range
Elevation: Unknown
Latitude: 37.749891030 degrees
Northing: 4177869 meters
Longitude: -116.865057700 degrees
Easting: 511888 meters

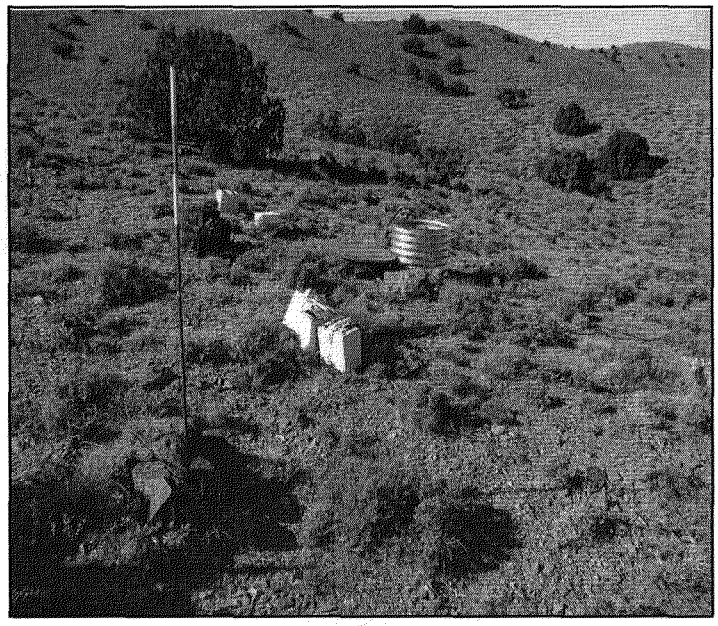
Coordinate/Elevation Data Obtained from NORTH AMERICAN DATUM, 1927.

Site Access Route: From TTR Main Gate, take Main Road south to Brown's Lake Road/Cactus Spring Road, turn right (west) and drive for 4.8 miles to Cactus Spring Ranch. Continue west on the dirt road passing to the right (north) of the ranch, approximately 0.9 mile to the jeep track on the right (north). Follow the jeep track approximately 0.3 mile to the junction of Cactus Peak Road and Repeater Road. Take the left (west) fork (Cactus Peak Road) and continue approximately 2.4 miles to the saddle between the rocky outcrops. Take the faint trail to the left (west) approximately 0.1 mile to the site.

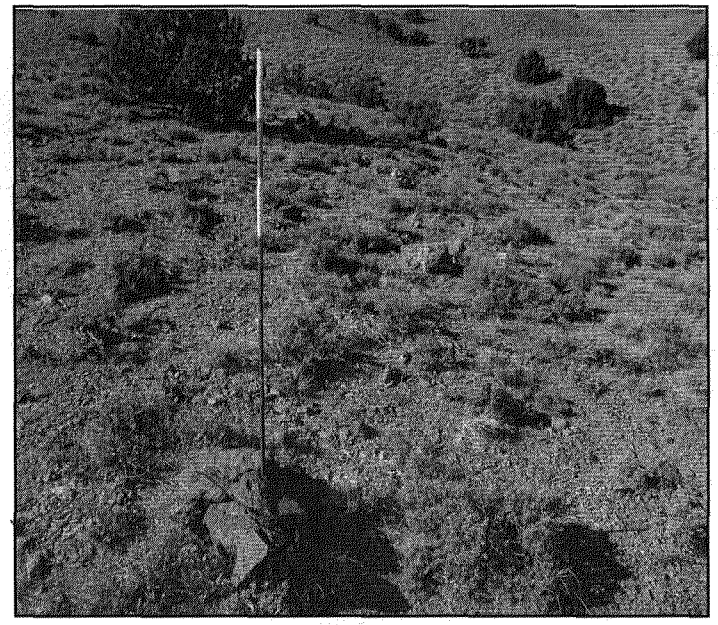
Waste Item(s) Originally at Site	Apparent Waste Type*
Discarded batteries and associated construction debris	Ordinary, Scrap Metal, Salvageable, Other

*** Ordinary, Scrap Metal, Asbestos, PCB, Salvageable, Hazardous, Radioactive, Mixed, Unknown, Other**

Current Site Description/Observations: The discarded batteries and associated construction debris were removed on November 8, 2000, during the ITLV CAU 409 Corrective Action Investigation. The batteries were taken to the TTR recycling collection point and the debris was taken to the TTR scrap yard. There are no remaining environmental concerns at the site.



CAS Prior to Cleanup
Photograph date: 11/8/2000



CAS After Cleanup
Photograph date: 11/8/2000

✓ **No Further Action Required at Corrective Action Site**

Lowell Wille (Industrial Sites Acting Project Manager) — Signature on File

Corrective Action Coordinator/Designee — **(Signature)** — **Date**

WESTINGHOUSE
Tonopah Test Range
P.O. Box 528
Tonopah, NV 89049
Phone (702) 295-8385
FAX (702) 295-8460

8339

FAX COVER SHEET

TO JOHN DAVIS FAX # 702 295 2025

FROM JIM SFERRA

DATE 6 4 01 PAGES (Including Cover Sheet) 2

MESSAGE:

JOHN BY THE NOTE YOU CAN SEE THEY DIDN'T CONSIDER 6 BATTERIES - BATTERIES.

06/04/01 13:30 FAX 702 295 8460 WESTINGHOUSE ☑001

Sandia National Laboratories

ALBUQUERQUE, NEW MEXICO 87185
LIVERMORE, CALIFORNIA 94551

STRAIGHT BILL OF LADING - DOMESTIC - ORIGINAL - NOT NEGOTIABLE

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading,

the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown), marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Official, Southern, Western, and Illinois Freight Classification in effect on the date hereof, if this is a rail or a rail-water shipment, or (2) in the applicable motor carrier classification of tariff if this is a motor carrier shipment.

Shipper hereby certifies it is familiar with all the terms and conditions of the said bill of lading, including those on the back thereof set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for itself and its assigns.

Transportation Company Tendered to: J & D Auto Parts

Traffic Control No.: 78208

Consignee: J & D Auto Parts

From: Sandia National Laboratories
FOR THE USDOE
Tonopah Test Range, NV 89049

Date B/L Issued: 11/16/00

Full Name of Shipper: SANDIA NATIONAL LABORATORIES

Destination: Tonopah, NV 89049

State of:

Marks:

VIA: J & D Auto Parts

Charges to be Billed To: ☐ Consignee ☐ Sandia National Laboratories

Mail Bills To:
☐ Sandia Traffic, P.O. Box 5800, Albuquerque, NM 87185
☐ Sandia Traffic, P.O. Box 969, Livermore, CA 94551

PACKAGES No.	PACKAGES Kind	HM	DESCRIPTION OF MATERIALS (Use of Carriers' Classification or Tariff Description if Possible. Otherwise a clear Nontechnical Description.)	WEIGHTS *	RATE	CHARGES
13	ea	N	Batteries for recycling & core charge	525#		
			FROM I.T. CORP			
			SIX UNITS PER RECYCLER COULD			
			NOT BE CALLED LEAD ACID BATTERIES			

Subject to Section 7 of conditions of applicable bill of lading, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement:

The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges.

Per _____ (Signature of Consignor)

FREIGHT CHARGES
☐ Collect
☒ Prepaid

This shipment is consigned by Sandia National Laboratories for the U.S. Department of Energy which will assume the freight charges, and is subject to the same terms and conditions set forth in the standard form of the U.S. Government bill of lading and to any special rate or charges.

If the charges are $10,000 or more, except as otherwise provided therein, the clauses contained in Executive Order No. 11246 as amended by Executive Order No. 11375 relative to employment opportunity for all persons without regard to race, color, religion, sex, or national origin and the implementing rules and regulations prescribed by the Secretary of Labor are incorporated herein.

* If the shipment moves between two ports by a carrier by water, the law requires that the bill of lading shall state whether it is "carrier's or shipper's weight." Show also cubic measurements for shipments via air, truck, or water carrier where required.

TARIFF OR SPECIAL RATE AUTHORITIES

NOTE - Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property.
The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding _____ per _____

Car or Vehicle Initials and No.:

Date of Receipt of Shipment:

Initial Carrier's Agent, by signature below, certifies he received the original Bill of Lading (Indicated by Check) ☐ Yes

Signature of Agent: _____ Per: _____

This is to certify that the above named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation, according to the applicable regulations of the Department of Transportation.

Signature of Issuing Officer

11/16/00
Date

SANDIA TRAFFIC DIVISION

SF 6424-A (4-93)

WESTINGHOUSE
Tonopah Test Range
P.O. Box 528
Tonopah, NV 89049
Phone (702) 295-8181
FAX (702) 295-8460
E-Mail: jellist@sandia.gov

FAX COVER SHEET

TO Jeff Johnson FAX # 702-295-2025

FROM **Jerry W. Elliston, Project Manager**

DATE 6/13/01 PAGES (Including Cover Sheet) 6

MESSAGE:

Jeff

Batteries are on page 3

Item # 28-B.

Jerry

Arkansas Department of Environmental Quality
Hazardous Waste Division
P.O. Box 8913, Little Rock, AR 72219-8913
Telephone: (501) 682-0833

CAU 409 CADD/CR
Appendix E
Revision: 0
Date: 06/15/2001
Page E-5 of E-9

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

AR-2-99

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No.: N V 1 6 9 0 0 1 1 9 9 1 5 9 2 5 3
Manifest Document No.:
2. Page 1 of 5
Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address
SANDIA NATIONAL LABS/USDOE/TTR
TONOPAH TEST RANGE
TONOPAH, NV 89049 ATTN: WILLIAM FORSTON
4. Generator's Phone (702) 295-8124 (702) 295-8124

A. State Manifest Document Number: AR- 1159253
B. State Generator's ID:

5. Transporter 1 Company Name: TRIAD TRANSPORT INC (D) 3-29-01
6. US EPA ID Number: OKD981588791
C. State Transporter's ID:
D. Transporter's Phone: 1-800-369-1139

7. Transporter 2 Company Name:
8. US EPA ID Number:
E. State Transporter's ID:
F. Transporter's Phone: ( ) -

9. Designated Facility Name and Site Address
ENSCO, INC.
309 AMERICAN CIRCLE
EL DORADO, AR 71730
10. US EPA ID Number: A R D 0 6 9 7 4 8 1 9 2
G. State Facility's ID: A R D 0 6 9 7 4 8 1 9 2
H. Facility's Phone: (870) 863-7173

11. US DOT Description (Including Proper Shipping Name, Hazard Class and ID Number)	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a. WASTE COMPRESSED GASES, FLAMMABLE, N.O.S., 2.1, UN1954(starting fluid, thin walled) (pf: 12015), (), (erg: 115)	0 0 1	D F	(D) 3-29-01 ~~E S T~~ 0 0 0 1 6	K	D001
b. WASTE AEROSOLS, FLAMMABLE, N.O.S., 2.1, UN1950(aerosol cans) [limted quantity) (pf: 772935), (), (erg: 126)	0 0 5	D F	(D) 3-29-01 ~~E S T~~ 0 0 0 5 0	K	D001
c. WASTE COMPRESSED GASES, N.O.S., 2.2, UN1956(empty pentane/air mixture in thin walled container) (pf: ~~1346250~~), (), (erg: 126) GC-02 1346250 (DN)	0 0 1	D F	(D) 3-29-01 ~~E S T~~ 0 0 0 0 6	K	NR (DN) ~~D001~~
d. WASTE FIRE EXTINGUISHERS, 2.2, UN1044(thin walled cylinder) (pf: 1346247), (), (erg: 126) GC-03	0 0 1	D F	0 0 0 0 6	K	NR

J. Additional Description for Materials Listed Above
* ** ** ** *

K. Emergency Response Information:
POISON CONTROL CENTER
(505) 272-2222

if no alternate TSDF, return to generator 14510

15. Special Handling Instructions and Additional Information
Enpak Job #50981-07 / ERG Guide 115 , 126

16. GENERATOR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packaged, marked, and labeled/placarded, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations and Arkansas state regulations.
If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; OR, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name	Signature	Month Day Year
MAX SAAD	Max Saad	03 29 01

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year
DANNY J WARD	[signature]	03 29 01

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name	Signature	Month Day Year

19. Discrepancy Indication Space
Changed 11c from D001 to NR per letter attached 4/11 (DN)
Changed PF # on 11c per letter attached 4/11 (DN)

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name	Signature	Month Day Year
Angie Pendleton	Angie Pendleton	04 30 01

EPA Form 8700-22 (Rev. 9-88) Previous edition is obsolete.

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST *(Continuation Sheet)*

21. Generator's US EPA ID No.: NV1890011991 | Manifest Document No.: 59253 | Page: 2 of 5 | Information in the shaded areas is not required by Federal law.

23. Generator's Name
SANDIA NATIONAL LABS/USDOE/TTR
TONOPAH TEST RANGE
TONOPAH, NV 89049 ATTN: WILLIAM FORSTON
(702)295-8134 (702)295-8134

L. State Manifest Document Number: 1153253
M. State Generator's ID:

24. Transporter ___ Company Name | 25. US EPA ID Number | N. State Transporter's ID | O. Transporter's Phone

26. Transporter ___ Company Name | 27. US EPA ID Number | P. State Transporter's ID | Q. Transporter's Phone

	28. US DOT Description *(Including Proper Shipping Name, Hazard Class, and ID Number)*	HM	29. Containers No.	Type	30. Total Quantity	31. Unit Wt/Vol	R. Waste No.
a.	WASTE FIRE EXTINGUISHERS, 2.2, UN1044(thin walled container)(pf: 1346247),(),(erg: 126) GC-04		001	DF	00030	K	[illegible]
b.	FIRE EXTINGUISHERS, 2.2, UN1044(spherical cylinder)(pf: 1346246),(),(erg: 126)		001	DM	00034	K	[illegible]
c	COMPRESSED GASES, N.O.S., 2.2, UN1956(empty pentane/air mixure)(pf: 1346249),(),(erg: 126) GC-01		001	DF	00006	K	[illegible]
d.	WASTE FLAMMABLE LIQUIDS, N.O.S., 3, UN1993, PG II(pf: 1346241),(),(erg: 128) S-06		001	DF	00002	K	D001
e.	WASTE PETROLEUM DISTILLATES, N.O.S., 3, UN1268, PG II(naphtha)(pf: 772926),(),(erg: 128)		001	DM	00108	K	D001
f.	WASTE CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S., 8, UN3265, PG II(pf: 1346241),(),(erg: 153) S-02		001	DF	00008	K	D002
g.	WASTE HYPOCHLORITE SOLUTIONS, 8, UN1791, PG II(pf: 1346241),(),(erg: 154) S-03		001	DF	00006	K	D002
h.	WASTE CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S., 8, UN3267, PG II(pf: 1346241),(),(erg: 153) S-04		001	DF	00004	K	D002
i.	BATTERIES, DRY, CONTAINING POTASSIUM HYDROXIDE SOLID, 8, UN3028, PG III(alkaline batteries)(pf: 618378),(),(erg: 154)		001	DM	00178	K	[illegible]

GENERATOR

S. Additional Descriptions for Materials Listed Above
* ** ** ** 28D: LABPACK ** 28E: D006,D008 ** 28F: LABPACK ; DOT-E 11153 DOT-E 10441 ** 28G: LABPACK ; DOT-E 11153, DOT-E 10441 ** 28H: LABPACK ; DOT-E 11153, DOT-E 10441 ** *

T. Handling Codes for Wastes Listed Above

32. Special Handling Instructions and Additional Information
Enpak Job #50981-07 / ERG Guide 126 , 128 , 153 , 154

TRANSPORTER

33. Transporter ___ Acknowledgement of Receipt of Materials | Printed/Typed Name | Signature | Date: Month Day Year

34. Transporter ___ Acknowledgement of Receipt of Materials | Printed/Typed Name | Signature | Date: Month Day Year

FACILITY

35. Discrepancy Indication Space

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST (Continuation Sheet)

21. Generator's US EPA ID No.	Manifest Document No.	22. Page	Information in the shaded areas is not required by Federal law.
NV1890011991	59253	3 of 5	

23. Generator's Name
SANDIA NATIONAL LABS/USDOE/TTR
TONOPAH TEST RANGE
TONOPAH, NV 89049 ATTN: WILLIAM FORSTON
(702)295-6124 (702)295-6124

L. State Manifest Document Number: 1159253
M. State Generator's ID:

24. Transporter Company Name — 25. US EPA ID Number — N. State Transporter's ID — O. Transporter's Phone

26. Transporter Company Name — 27. US EPA ID Number — P. State Transporter's ID — Q. Transporter's Phone

	HM	28. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	29. Containers No.	Type	30. Total Quantity	31. Unit Wt/Vol	R. Waste No.
a.		WASTE BATTERIES, DRY, CONTAINING POTASSIUM HYDROXIDE SOLID, 8, UN3028, PG III(nicad batteries)(pf: 772405),(),(erg: 154)	001	DF	00002	K	D006
b.		BATTERIES, WET, FILLED WITH ACID, 8, UN2794, PG III(lead acid batteries)(pf: 773247),(),(erg: 154)	002	DF	00126	K	D008
c.		WASTE CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S., 8, UN3266, PG II(photographic developer)(pf: 1315086),(),(erg: 154)	001	DF	00022	K	D002
d.		HAZARDOUS WASTE, LIQUID, N.O.S., 9, NA3082, PG III(epinephrin)(pf: 1346241),(S-05),(erg: 171) S-05	001	DM	00002	K	F042
e		HAZARDOUS WASTE, SOLID, N.O.S., 9, NA3077, PG III(solvent contaminated rags)(pf: 772933),(S-02),(erg: 171)	002	DM	00080	K	F002
f		HAZARDOUS WASTE, SOLID, N.O.S., 9, NA3077, PG III(cadmium contaminated soil)(pf: 1346243),(S-03),(erg: 171)	001	DM	00298	K	D006
g.		HAZARDOUS WASTE, SOLID, N.O.S., 9, NA3077, PG III(sodium vapor lamps)(pf: 274599),(),(erg: 171)	001	CF	00012	K	D005
h.		HAZARDOUS WASTE, SOLID, N.O.S., 9, NA3077, PG III(respirator cartridges)(pf: 1346241),(),(erg: 171) S-11	001	DM	00060	K	D007
i.		HAZARDOUS WASTE, LIQUID, N.O.S., 9, NA3082, PG III(photographic fixer)(pf: 1346241),(),(erg: 171) S-08,S-09,S-10	003	DF	00092	K	D011

GENERATOR

S. Additional Descriptions for Materials Listed Above
* ** ** ** 38D: LABPACK ** ** ** ** 38H: LABPACK ** 38I: LABPACK *

T. Handling Codes for Wastes Listed Above

32. Special Handling Instructions and Additional Information
Empak Job #50981-07 / ERG Guide 154 , 171

TRANSPORTER

33. Transporter ____ Acknowledgement of Receipt of Materials — Printed/Typed Name — Signature — Date (Month Day Year)

34. Transporter ____ Acknowledgement of Receipt of Materials — Printed/Typed Name — Signature — Date (Month Day Year)

FACILITY

35. Discrepancy Indication Space

Please print or type. (Form designed for use on elite (1 :h) typewriter.) OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST (Continuation Sheet)

21. Generator's US EPA ID No.	Manifest Document No.	22. Page	Information in the shaded areas is not required by Federal law.
NV1890011991	59253	4 of 5	

23. Generator's Name
SANDIA NATIONAL LABS/USDOE/TTR
TONOPAH TEST RANGE
TONOPAH, NV 89049
ATTN: WILLIAM TORSTON

L. State Manifest Document Number: 1159253
M. State Generator's ID:

24. Transporter ___ Company Name | EPA ID Number
N. State Transporter's ID
O. Transporter's Phone

26. Transporter ___ Company Name | 27. US EPA ID Number
P. State Transporter's ID
Q. Transporter's Phone

	28. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	HM	29. Containers No.	Type	30. Total Quantity	31. Unit Wt/Vol	R. Waste No.
a.	NON-RCRA/NON-HAZARDOUS MATERIAL, LIQUID(fluorescent bulbs)[FOR RECYCLE](pf: 227479),(),(erg:)		003	BW	00062	K	NR
b.	NON-RCRA/NON-HAZARDOUS MATERIAL, Liquid(used motor oil)(pf: 772931),(),(erg:)		024	DM	04450	K	NR
c.	NON-RCRA HAZARDOUS WASTE, Liquids(labpack)[auto grease)(pf: 1346241),(),(erg:) S-01		001	DF	00012	K	NR
d.	NON-RCRA HAZARDOUS WASTE, Liquids(separator sludge)(pf: 1346242),(S-01),(erg:)		001	DM	00098	K	NR
e.	NON-RCRA/NON-HAZARDOUS MATERIAL, SOLID(oil filters)(pf: 818375),(S-06),(erg:)		001	DM	00172	K	NR
f.	NON-RCRA/NON-HAZARDOUS MATERIAL, SOLID(oily rags)(pf: 772929),(S-04),(erg:)		003	DM	00156	K	NR
g.	NON-RCRA/NON-HAZARDOUS MATERIAL, Solid(empty cans)(pf: 773245),(S-11),(erg:)		001	CW	00025	K	NR
h.	NON-RCRA/NON-HAZARDOUS MATERIAL, Solid(incandescent bulbs)(pf: 772215),(),(erg:)		001	DF	00018	K	NR
i.	NON-RCRA/NON-HAZARDOUS MATERIAL, Solid(fluorescent bulbs)(pf: 227479),(S-08),(erg:)		001	CW	00110	K	NR

GENERATOR

S. Additional Descriptions for Materials Listed Above
* ** ** 48C: LABPACK ** ** ** ** ** ** *

T. Handling Codes for Wastes Listed Above

32. Special Handling Instructions and Additional Information
Enpak Job #50981-07

TRANSPORTER

33. Transporter ___ Acknowledgement of Receipt of Materials | Printed/Typed Name | Signature | Date (Month Day Year)

34. Transporter ___ Acknowledgement of Receipt of Materials | Printed/Typed Name | Signature | Date (Month Day Year)

FACILITY

35. Discrepancy Indication Space

Please print or type. (Form designed for use on elite (1 :h) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST (Continuation Sheet)	21. Generator's US EPA ID No.	Manifest Document No.	2z. Page	Information in the shaded areas is not required by Feceral law.
	NV1890011991	59253	5 of 9	

23. Generator's Name
SANDIA NATIONAL LABS/USDOE/TTR
TONOPAH TEST RANGE
TONOPAH, NV 89049 ATTN: WILLIAM FORSTON
(702)295-8124 (702)295-8124

L. State Manifest Document Number: 1159253
M. State Generator's ID:

24. Transporter ___ Company Name | 25. US EPA ID Number | N. State Transporter's ID | O. Transporter's Phone

26. Transporter ___ Company Name | 27. US EPA ID Number | P. State Transporter's ID | Q. Transporter's Phone

	28. US DOT Description (Including Proper Shipping Name, Hazard Class, and ID Number)	HM	29. Containers No.	29. Containers Type	30. Total Quantity	31. Unit Wt/Vol	R. Waste No.
a.	NON-RCRA/NON-HAZARDOUS MATERIAL, Solid(non-pcb capacitors) (pE: 1346241),(S-07,S-09,S-10),(erg:) S-07		001	DM	00002	K	NA.
b.							
c.							
d.							
e.							
f.							
g.							
h.							
i.							

GENERATOR

S. Additional Descriptions for Materials Listed Above
* NON-HAZARDOUS *

T. Handling Codes for Wastes Listed Above

32. Special Handling Instructions and Additional Information
Enpak Job #50981-07

TRANSPORTER

33. Transporter ____ Acknowledgement of Receipt of Materials | Printed/Typed Name | Signature | Date (Month Day Year)

34. Transporter ____ Acknowledgement of Receipt of Materials | Printed/Typed Name | Signature | Date (Month Day Year)

FACILITY

35. Discrepancy Indication Space

Appendix F

Nevada Environmental Restoration Project
Document Review Sheet

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

1. Document Title/Number: Draft Corrective Action Decision Document/Closure Report for Corrective Action Unit 409: Other Waste Sites, Tonopah Test Range, Nevada	2. Document Date: April 2001
3. Revision Number: 0	4. Originator/Organization: IT Corporation
5. Responsible DOE/NV ERP Project Mgr.: Janet Appenzeller-Wing	6. Date Comments Due: May 10, 2001
7. Review Criteria: Full	
8. Reviewer/Organization/Phone No.: Gregory A. Raab, NDEP, 486-2867	9. Reviewer's Signature:

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
1)		In accordance with requirements specified in the revised standardized outline for CADD/CRs, March 2001, the following section needs additional information pertaining to DQOs: 1.3-*CADD/CR Contents.* In addition, the following sections need to be added to the CADD/CR: Section 2.2.1; Section 2.2.2; an Appendix on *DQOs as Developed in the CAIP*; and an Appendix on *Data Assessment*.	The revised standardized outline of CADD/CRs will be implemented starting July 1, 2001.	Yes
2) Section A.3.11 Gamma Spectrometry Results		Since the gamma-spectrometry result for Th-234 (7.5+/-3.1 pCi/g) is being discounted, and the "true" Th-234 activity is actually equivalent to the alpha-spectroscopy result of U-238 (1.54+/-0.24 pCi/g), how much confidence to you have in the other gamma-spectrometry results?	Added sentence: Although alpha spectrometry was utilized to verify Th-234 activity with the U-238 activity, ITLV has a high degree of confidence in the remaining gamma spectrometry results. All radioanalytical data undergoes data verification and validation prior to being reported.'	Yes

[a] Comment Types: M = Mandatory, S = Suggested.
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