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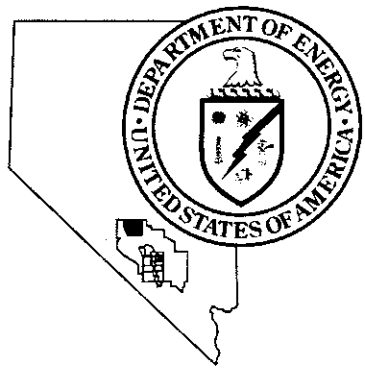

Corrective Action Decision Document/ Closure Report for Corrective Action Unit 406: Area 3 Building 03-74 & Building 03-58 Underground Discharge Points and Corrective Action Unit 429: Area 3 Building 03-55 & Area 9 Building 09-52 Underground Discharge Points, Tonopah Test Range, Nevada

Controlled Copy No.: ____
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March 2000

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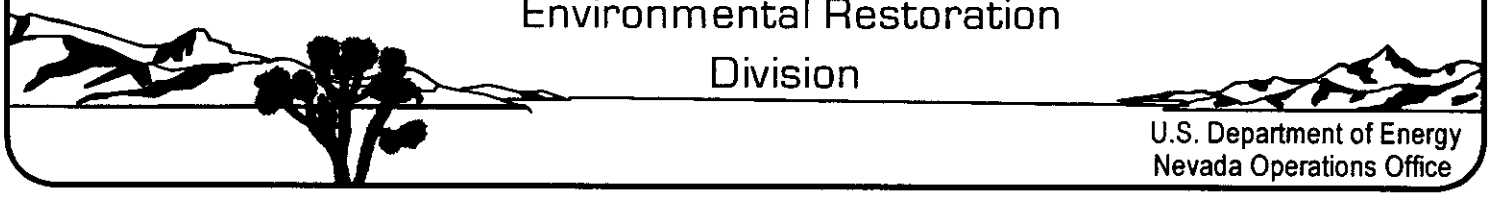

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CORRECTIVE ACTION DECISION DOCUMENT/ CLOSURE REPORT FOR CORRECTIVE ACTION UNIT 406: AREA 3 BUILDING 03-74 & BUILDING 03-58 UNDERGROUND DISCHARGE POINTS AND CORRECTIVE ACTION UNIT 429: AREA 3 BUILDING 03-55 & AREA 9 BUILDING 09-52 UNDERGROUND DISCHARGE POINTS, TONOPAH TEST RANGE, NEVADA

DOE Nevada Operations Office
Las Vegas, Nevada

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CORRECTIVE ACTION DECISION DOCUMENT/CLOSURE REPORT FOR CORRECTIVE ACTION UNIT 406: AREA 3 BUILDING 03-74 & BUILDING 03-58 UNDERGROUND DISCHARGE POINTS AND CORRECTIVE ACTION UNIT 429: AREA 3 BUILDING 03-55 & AREA 9 BUILDING 09-52 UNDERGROUND DISCHARGE POINTS, TONOPAH TEST RANGE, NEVADA

Approved by: Signature Approved Date: 3/23/2000

Janet Appenzeller-Wing, Project Manager
Industrial Sites Project

Approved by: Signature Approved Date: 3/23/2000

Runore C. Wycoff, Division Director
Environmental Restoration Division

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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
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DQO	Data Quality Objectives
EPA	U.S. Environmental Protection Agency
FFACO	*Federal Facility Agreement and Consent Order*
FSL	Field-screening level(s)
ft	Foot (feet)
ft^2	Square foot (feet)
GS	Gamma spectroscopy
HWAA	Hazardous Waste Accumulation Area
ICB	Initial calibration blank
ICP	Inductively coupled plasma
IDW	Investigation-derived waste
in.	Inch(es)
IsoU	Isotopic uranium
LCS	Laboratory control samples
MDC	Minimum detectable concentration

List of Acronyms and Abbreviations *(Continued)*

mg/kg	Milligram(s) per kilogram
mg/L	Milligram(s) per liter
mi	Mile(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
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)
PVC	Polyvinyl chloride
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RCA	Radioactive Control Area
RCRA	*Resource Conservation and Recovery Act*
RPD	Relative percent difference
SDG	Sample delivery group
SNL	Sandia National Laboratories
SVOC	Semivolatile organic compound(s)
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total petroleum hydrocarbon(s)
TTR	Tonopah Test Range
UDP	Underground discharge point(s)

List of Acronyms and Abbreviations (Continued)

µg/g	Microgram(s) per gram
µg/kg	Microgram(s) per kilogram
µg/L	Microgram(s) per liter
UPS	Uninterrupted power supply
VOC	Volatile organic compound(s)
WEC	Westinghouse Electric Company
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) 406: Area 3 Building 03-74 & Building 03-58 Underground Discharge Points (UDPs) and CAU 429: Area 3 Building 03-55 & Area 9 Building 09-52 UDPs in accordance with the *Federal Facility Agreement and Consent Order* (FFACO, 1996). Both CAUs are located within the Tonopah Test Range, Nevada.

Corrective Action Unit 406 is comprised of the following Corrective Action Sites (CASs):

- CAS 03-51-002-0374, Heavy Duty Shop (Building 03-74) UDP, Sumps
- CAS 03-51-003-0358, Uninterrupted Power Supply (UPS) (Building 03-58) UDP

Corrective Action Unit 429 is comprised of the following CASs:

- CAS 03-51-001-0355, Photo Shop (Building 03-55) UDP, Drains
- CAS 09-51-001-0952, Mobile Photographic Lab (Building 09-52) UDPs

The scope of this CADD/CR is to justify and recommend that no corrective action is required at CAUs 406 and 429. To achieve this, the following actions are required:

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

In July and August 1999, a corrective action investigation was performed as set forth in the Corrective Action Investigation Plan (DOE/NV, 1999). The objectives of the corrective action investigation are described as follows:

- Locate or verify the location of each UDP and determine the configuration of each identified UDP.
- 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.

- Complete the best management practices outlined in this CADD/CR prior to distribution of the final version of the CADD/CR.

Analytes detected during the corrective action investigation were evaluated against preliminary action levels to determine contaminants of concern for each CAS. There were no contaminants of concern identified in soil at CAS 03-51-002-0374, CAS 03-51-001-0355, or CAS 09-51-001-0952, so there is no need for corrective actions at these sites. Corrective Action Site 03-51-003-0358 had one sample that exceeded the preliminary action level for diesel-range organics; however, the contamination at this site is not associated with the UDPs, but rather previous spills not considered part of the CAU. The contamination discovered behind Building 03-58 is a result of operational spills at an active site and is not covered under the FFACO; therefore, no further action is required at this site under CAU 406. The U.S. Department of Energy, Nevada Operations Office provides the following recommendations:

- No corrective action is required for CAUs 406 and 429.

- No Corrective Action Plan is required.

- A Notice of Completion to the U.S. Department of Energy, Nevada Operations Office is requested from the Nevada Division of Environmental Protection for the closure of CAUs 406 and 429.

- Corrective Action Units 406 and 429 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 406 or CAU 429, CAS 09-51-001-0952 (Mobile Photographic Lab [Building 09-52] UDPs). However, CAU 429, CAS 03-51-001-0355 (Photo Shop [Building 03-55] UDP, Drains) has a use restriction for future utilization for residential purposes. There are no restrictions for future industrial activities (e.g., excavation for utility installation or maintenance at the CAS). Sandia National Laboratories has requested that the septic tank at CAU 429 be left in place for potential future use. The influent line to the septic tank remains; however, effluent lines have been removed to prevent further discharge to the UDPs. Additionally,

several housekeeping activities have been completed at the CAU 429 sites under best management practices including the following:

Area 3 Photoshop UDPs:

- Removed and/or grouted the transite discharge pipe between Building 03-55 and the primary UDP.
- Removed the overflow pipe between the two UDPs.
- Removed the UDP metal culverts and backfilled, as necessary.

Area 9 Mobile Photo Lab UDPs:

- Removed the septic tank contents for proper disposal.
- Removed and/or grouted the tie-in line from the Trailer 09-15 concrete pad and associated drains.
- Removed sections of the discharge pipe from the effluent end of the septic tank to the UDPs.
- Removed the concrete blocks comprising both UDPs and backfilled with soil.

1.0 Introduction

This Corrective Action Decision Document/Closure Report (CADD/CR) has been prepared for Corrective Action Unit (CAU) 406: Area 3 Building 03-74 & Building 03-58 Underground Discharge Points (UDPs) and CAU 429: Area 3 Building 03-55 & Area 9 Building 09-52 UDPs 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 no further actions are required for each of the Corrective Action Sites (CASs) within CAUs 406 and 429.

Corrective Action Unit 406 and CAU 429 are located in Area 3 and Area 9 of the Tonopah Test Range (TTR), Nevada. The TTR is approximately 140 miles (mi) northwest of Las Vegas, Nevada (Figure 1-1). Figure 1-2 shows the locations of the two CAUs within the TTR.

Corrective Action Unit 406 is comprised of the following CASs:

- CAS 03-51-002-0374, Heavy Duty Shop (Building 03-74) UDP, Sumps
- CAS 03-51-003-0358, Uninterrupted Power Supply (UPS) (Building 03-58) UDPs

Corrective Action Unit 429 is comprised of the following CASs:

- CAS 03-51-001-0355, Photo Shop (Building 03-55) UDP, Drains
- CAS 09-51-001-0952, Mobile Photographic Lab (Building 09-52) UDPs

1.1 Purpose

This CADD/CR provides justification for the closure of CAUs 406 and 429 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* (CAIP) *for Corrective Action Unit 406: Area 3 Building 03-74 & Building 03-58 Underground Discharge Points and Corrective*

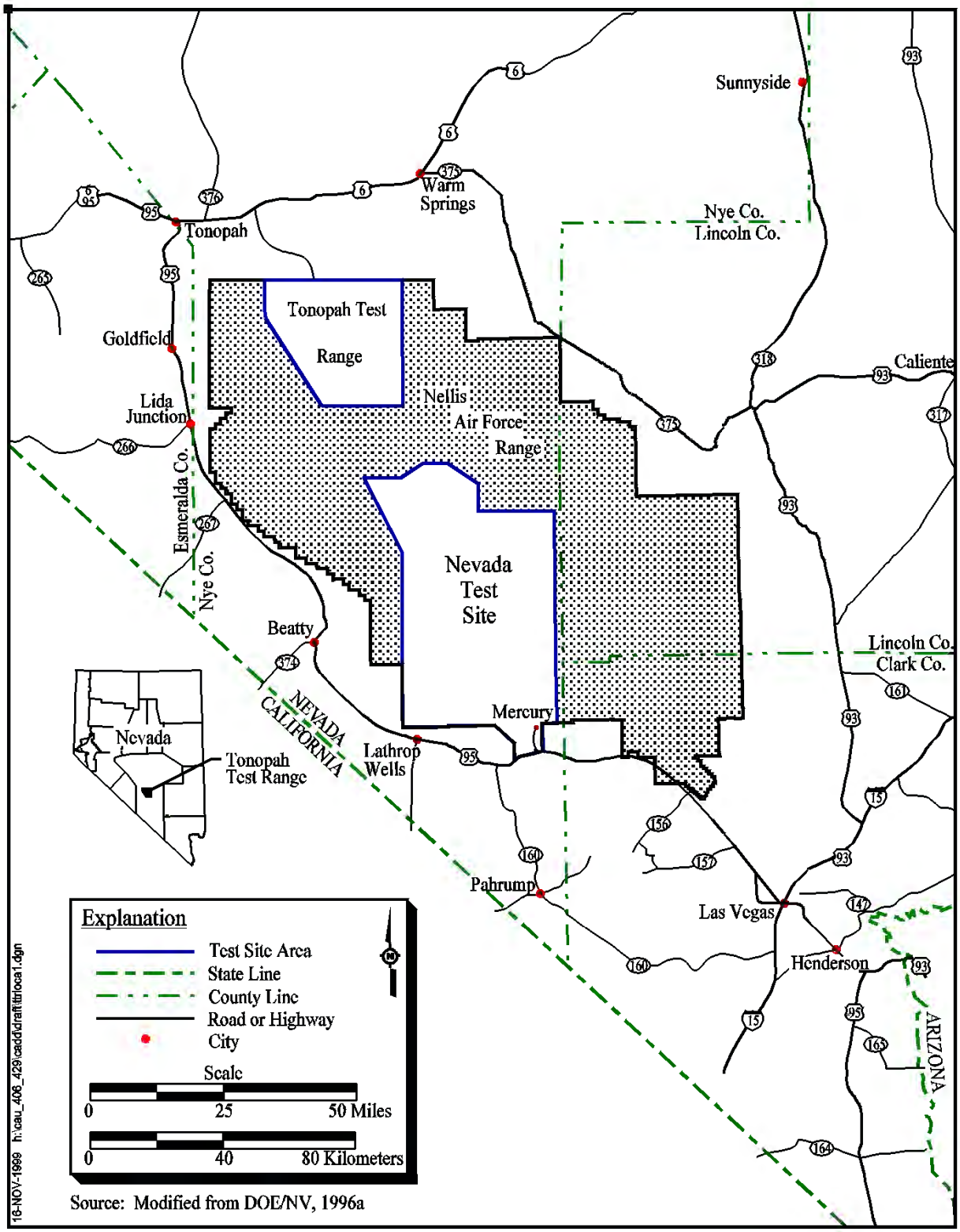
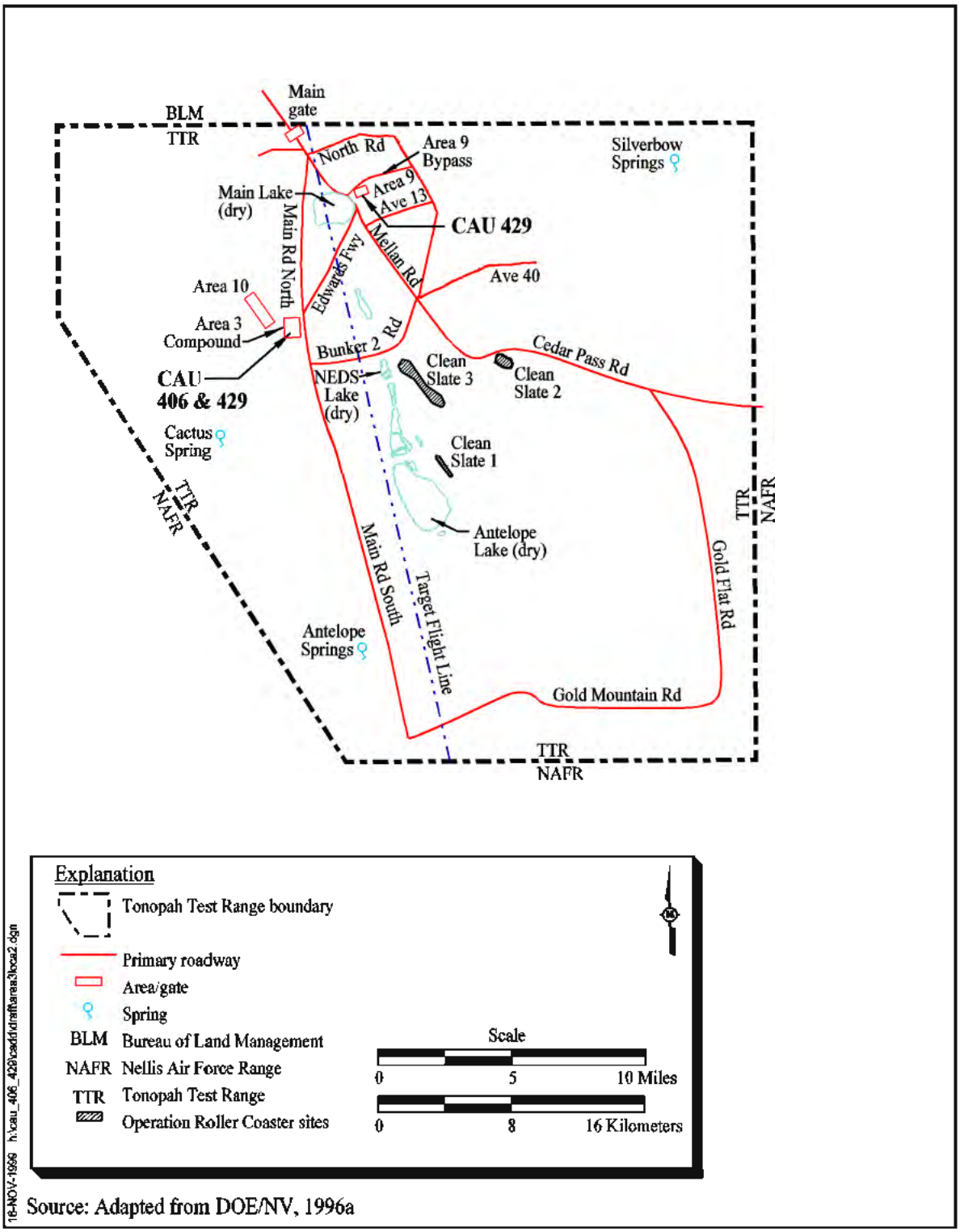


Figure 1-1
Tonopah Test Range Location Map



Source: Adapted from DOE/NV, 1996a

Figure 1-2
Location of CAUs 406 and 429 in Area 3 & Area 9, Tonopah Test Range, Nevada

Action Unit 429: Area 3 Building 03-55 & Area 9 Building 09-52 Underground Discharge Points, Tonopah Test Range, Nevada (DOE/NV, 1999) 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 CAUs 406 and 429 associated with effluent discharged to the UDPs.

1.2 Scope

The scope of this CADD/CR is to justify and recommend that no corrective action is required at CAUs 406 and 429. To achieve this scope the following actions are required:

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

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 the CAUs.

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

Appendix A: *Corrective Action Investigation Report for CAU 406: Area 3 Building 03-74 & Building 03-58 Underground Discharge Points and CAU 429: Area 3 Building 03-55 & Area 9 Building 09-52 Underground Discharge Points, Tonopah Test Range, Nevada*

Appendix B: Soil Boring Logs

Appendix C: Field Screening of Soil for Silver by X-Ray Fluorescence (XRF), CAU 406 & 429

Appendix D: Summary of Best Management Practices for Corrective Action Unit (CAU) 429: Area 3 Building 03-55 & Area 9 Building 09-52 Underground Discharge Points (UDPs), Tonopah Test Range, Nevada

Appendix E: Use Restriction Form

Appendix F: Nevada Environmental Restoration Project Document Review Sheet

All work was performed in accordance with the following documents:

- *Corrective Action Investigation Plan for Corrective Action Unit 406: Area 3 Building 03-74 & Building 03-58 Underground Discharge Points and Corrective Action Unit 429: Area 3 Building 03-55 & Area 9 Building 09-52 Underground Discharge Points, Tonopah Test Range, Nevada,* Rev. 0, DOE/NV--547 (DOE/NV, 1999)
- *Industrial Sites Quality Assurance Project Plan,* Rev. 1, DOE/NV--372 (DOE/NV, 1996b)
- *Corrective Action Unit Work Plan for the Tonopah Test Range,* DOE/NV--443 (DOE/NV, 1996a)
- FFACO (FFACO, 1996)
- *Project Management Plan* (DOE/NV, 1994)

2.0 Corrective Action Investigation Summary

The following sections describe and summarize the results of the investigation activities conducted at CAUs 406 and 429. For detailed investigation results, please refer to Appendix A.

2.1 Investigation Activities

Corrective action investigation activities were performed as set forth in the CAIP and Record of Technical Change Numbers 1, 2, and 3 (DOE/NV, 1999) from July 19 through August 4, 1999. The objectives of the investigation include:

- Locate or verify the location of each UDP and determine the configuration of each identified UDP.
- Identify the presence and the vertical and lateral extent of contaminants of potential concern (COPCs).
- Provide sufficient information and data to develop appropriate corrective actions for each CAS.
- Complete the best management practices outlined in Section 3.0 prior to distribution of the final CADD/CR.

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

CAU 406, Heavy Duty Shop UDP, Sumps, CAS 03-51-002-0374

- Excavated five trenches.
- Identified the discharge point.
- Conducted video surveys in portions of discharge pipe. Source of discharge was mitigated by grouting video mole access points within the discharge pipe.
- Field screened soil samples for volatile organic compounds (VOCs) and alpha/beta emitters.
- Collected surface and near-surface soil samples for laboratory analyses using direct-push (Geoprobe®) at five locations.

- Drilled one vertical borehole at the discharge point and submitted subsurface soil samples for laboratory analyses.

- Analyzed all environmental samples for total VOCs; total semivolatile organics (SVOCs); total *Resource Conservation and Recovery Act (*RCRA) metals; total polychlorinated biphenyls (PCBs); and total petroleum hydrocarbons (TPH) (gasoline and diesel); additionally, 25 percent of the samples were submitted for isotopic uranium analysis.

- Logged soil cuttings to assess site geology and collected one soil sample for geotechnical analyses.

CAU 406, UPS Building UDP, CAS 03-51-003-0358

- Excavated two trenches.

- Field screened soil samples for VOCs and alpha/beta emitters and conducted TPH field screening on three soil samples using the Hanby test kit.

- Submitted one confirmatory sample from each trench for laboratory analyses of TPH-diesel/oil and total PCBs.

CAU 429, Photoshop UDP, Drains, CAS 03-51-001-0355

- Excavated two trenches.

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

- Collected surface and near-surface samples for laboratory analyses using direct-push (Geoprobe®) at three locations.

- Drilled eight vertical boreholes and submitted subsurface soil samples for laboratory analyses.

- Analyzed all environmental samples for total VOCs, total SVOCs, and total RCRA metals. In addition, select samples were analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) for silver and isotopic uranium.

- Logged soil cuttings to assess site geology and collected one soil sample for geotechnical analyses.

CAU 429, Mobile Photographic Lab UDPs, CAS 09-51-001-0952

- Excavated down to the septic tank and collected two environmental samples from the tank contents (liquid and sludge) and one soil sample from each end of the tank. All samples were submitted for analyses.

- Field screened all samples (liquid, soil/sludge) for VOCs and alpha/beta emitters, and field screened soil samples for silver.

- Drilled five vertical boreholes and submitted subsurface soil samples for laboratory analyses.

- Analyzed all environmental samples for total VOCs, total SVOCs, and total RCRA metals. Select samples were also analyzed for TCLP-silver. The sludge sample from the septic tank was also analyzed for TCLP-metals (without mercury) and gamma spectroscopy.

- Logged soil cuttings to assess site geology and collected one soil sample for geotechnical analyses.

2.2 Results

Details of the methods used and results found during the investigation are presented in Appendix A.

The corrective action investigation results indicated the following:

- The locations and general configurations of three CASs were identified. No evidence of the UPS Building UDPs was identified during this investigation.

- All total VOCs, total SVOCs, and PCBs in soil samples were below the preliminary action levels (PALs) outlined in the CAIP (DOE/NV, 1999) at all CASs.

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

- Total petroleum hydrocarbons exceeded the Nevada Division of Environmental Protection (NDEP) action level of 100 milligrams per kilogram (mg/kg) for diesel in one soil sample collected at the UPS Building 03-58; however, this sample result is not associated with the UDP, but rather previous spills not considered a part of the CAU. The previous spill was reported in the Incident Notification Report Case Number H920225A. All other results either did not exceed action levels or were below the minimum reporting limits as specified in the CAIP (DOE/NV, 1999).

- Radiological results for soil samples are not considered to be statistically different from their respective established background levels and, therefore, are below PALs.

- Analytical results for the liquid sample collected from the septic tank at CAU 429 indicated detection of COPCs including 1, 4-dichlorobenzene, 2-butanone (methyl ethyl ketone), 4-methylphenol (p-cresol), benzoic acid, phenol, acetone, arsenic, barium, cadmium, chromium, lead, mercury, selenium, potassium-40, carbon disulfide, and toluene.

- Analytical results for the sludge sample collected from the septic tank at CAU 429 indicated detection of COPCs including 1, 4-dichlorobenzene, 2-butanone (methyl ethyl ketone), 4-methylphenol (p-cresol), phenol, acetone, arsenic, barium, cadmium, chromium, lead, mercury, silver, potassium-40, toluene, trichloroethene, benzene, ethylbenzene, tetracloroethene, bis(2-ethylhexyl)phthalate, total xylenes, and naphthalene.

- The contents of the septic tank were determined to be RCRA regulated hazardous material based on the TCLP-silver result above the regulatory limit of 5.0 milligrams per liter (mg/L) (CFR, 1999).

2.3 Need for Corrective Action

Analytes detected during the corrective action investigation were evaluated against PALs to determine COCs for CAUs 406 and 429. There were no COCs identified in soil at CAS 03-51-002-0374 (Heavy Duty Shop UDP, Sumps), CAS 03-51-001-0355 (Area 3 Photoshop UDP, Drains), or CAS 09-51-001-0952 (Area 9 Mobile Photo Lab UDPs), so there is no need for corrective actions at these sites. Corrective Action Site 03-51-003-0358 (UPS Building UDP) had one sample that exceeded PALs for TPH-diesel; however, the contamination at this site is not associated with the UDPs, but rather previous spills. The contamination discovered behind Building 03-58 is a result of operational spills at an active site and is not covered under the FFACO; therefore, no further action is required at this site under CAU 406.

3.0 Recommendation

Based on the results of the corrective action investigation discussed in Appendix A, no COCs have been identified in soil at the sites. Therefore, the U.S. Department of Energy, Nevada Operations Office (DOE/NV) provides the following recommendations:

- No further corrective action is required for CAUs 406 and 429.
- No Corrective Action Plan is required.
- A Notice of Completion to DOE/NV is requested from NDEP for the closure of CAUs 406 and 429.
- CAUs 406 and 429 should be moved from Appendix III to Appendix IV of the FFACO.

No use restrictions are required to be placed on CAU 406 or CAU 429, CAS 09-51-001-0952 (Mobile Photographic Lab [Building 09-52] UDPs). However, CAU 429, CAS 03-51-001-0355 (Photo Shop [Building 03-55] UDP, Drains) has a use restriction for future utilization for residential purposes. There are no restrictions for future industrial activities (e.g., excavation for utility installation or maintenance at the CAS). Sandia National Laboratories has requested that the septic tank at CAU 429 be left in place for potential future use. The influent line to the septic tank remains; however, effluent lines have been removed to prevent further discharge to the UDPs. Additionally, several housekeeping activities have been completed at the CAU 429 sites under best management practices (Appendix D). Activities included the following:

Area 3 Photoshop UDPs:

- Removed and/or grouted the transite discharge pipe between Building 03-55 and the primary UDP.
- Removed the overflow pipe between the two UDPs.
- Removed the UDP metal culverts and backfilled, as necessary.

Area 9 Mobile Photo Lab UDPs:

- Removed the septic tank contents for proper disposal.
- Removed and/or grouted the tie-in line from the Trailer 09-15 concrete pad and associated drains.
- Removed sections of the discharge pipe from the effluent end of the septic tank to UDPs.
- Removed the concrete blocks comprising both UDPs and backfilled with soil.

4.0 References

Code of Federal Regulations. 1999. Title 40 CFR Parts 261.24, "Toxicity Characteristic." Washington, DC: U.S. Government Printing Office.

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. 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. 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*, Rev. 0, DOE/NV--443. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1996b. *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. 1999. *Corrective Action Investigation Plan for Corrective Action Unit 406: Area 3 Building 03-74 & Building 03-58 Underground Discharge Points and Corrective Action Unit 429: Area 3 Building 03-55 & Area 9 Building 09-52 Underground Discharge Points, Tonopah Test Range, Nevada*, Rev. 0, DOE/NV--547. Las Vegas, NV.

Appendix A

Corrective Action Investigation Report for CAU 406: Area 3 Building 03-74 & Building 03-58 Underground Discharge Points and CAU 429: Area 3 Building 03-55 & Area 9 Building 09-52 Underground Discharge Points, 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 406 and CAU 429, Area 3 and Area 9 Underground Discharge Points. Corrective Action Unit 406 consists of two CASs: 03-51-002-0374 and 03-51-003-0358. Corrective Action Unit 429 consists of two CASs: 03-51-001-0355 and 09-51-001-0952. The corrective action investigation was conducted in accordance with the requirements set forth in the *Corrective Action Investigation Plan for Corrective Action Unit 406: Area 3 Building 03-74 & Building 03-58 Underground Discharge Points and Corrective Action Unit 429: Area 3 Building 03-55 & Area 9 Building 09-52 Underground Discharge Points, Tonopah Test Range, Nevada* (DOE/NV, 1999) as developed under the *Federal Facility Agreement and Consent Order* (FFACO, 1996).

The four CASs were investigated because process knowledge indicated that potentially contaminated effluent was discharged to UDPs from various operations at the TTR. The UDPs are typically subgrade shallow dry wells or excavations filled with gravel. Effluent was discharged to the UDPs through drainage pipes and allowed to percolate into the surrounding soil. Process knowledge indicated that soils surrounding the UDPs have likely been impacted by wastewater containing chemicals associated with maintenance (e.g., hydrocarbons or solvents) and/or photoprocessing operations (e.g., silver). Additional information relating to the site history, planning, and scope of the investigation is presented in the CAIP (DOE/NV, 1999) and will not be repeated in this report.

A.1.1 Project Objectives

The following were the primary objectives for this project:

- Identify or verify the UDP locations.
- Determine the UDP configurations.

- Identify the presence and the vertical and lateral extent of the COPCs.
- 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, 1999).

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 the field activities and sampling method.
- 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 406 and CAU 429.
- 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. These documents are retained in project files as both hard copy files and electronic media.

A.2.0 Field Investigation and Sampling Activities

The field investigation and sampling activities were conducted between July 19 and August 4, 1999. Several methods were utilized during the investigation of both CAUs and consisted of combinations of one or more of the following: excavation (by backhoe and/or hand), video survey, direct-push, and rotary sonic drilling.

The investigation and sampling program was managed in accordance with the requirements set forth in the CAIP (DOE/NV, 1999). The field activities were performed in accordance with an approved Site-specific Health and Safety Plan (IT, 1999). The 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, 1999) 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 *Industrial Sites Quality Assurance Project Plan* (QAPP) (DOE/NV, 1996b) 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 CAS:

- CAU 406, Heavy Duty Shop UDP Sumps, CAS 03-51-002-0374
  - Excavated five trenches.
  - Identified the discharge point.
  - Conducted video surveys in portions of discharge pipe. Source of discharge was mitigated by grouting video mole access points within the discharge pipe.
  - Field screened soil samples for VOCs and alpha/beta emitters.
  - Collected surface and near-surface soil samples for laboratory analyses using direct-push (Geoprobe®) at five locations.

- Drilled one vertical borehole at the discharge point and submitted subsurface soil samples for laboratory analyses.

- Analyzed all environmental samples for total VOCs; total SVOCs; total RCRA metals; PCBs; and TPH (gasoline and diesel). Additionally, 25 percent of samples were submitted for isotopic uranium analysis.

- Logged soil cuttings to assess site geology and collected one soil sample for geotechnical analyses.

• CAU 406, UPS UDPs, CAS 03-51-003-0358

- Excavated two trenches.

- Field screened soil samples for VOCs and alpha/beta emitters, and conducted TPH field screening on three soil samples using the Hanby test kit.

- Submitted one confirmatory sample from each trench for laboratory analyses of TPH-diesel/oil and total PCBs.

• CAU 429, Photoshop UDP Drains, CAS 03-51-001-0355

- Excavated two trenches.

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

- Collected surface and near-surface samples for laboratory analyses using direct-push (Geoprobe®) at three locations.

- Drilled eight vertical boreholes and submitted subsurface soil samples for laboratory analyses.

- Analyzed all environmental samples for total VOCs, total SVOCs, and total RCRA metals. In addition, select samples were analyzed for TCLP-silver and isotopic uranium.

- Logged soil cuttings to assess site geology and collected one soil sample for geotechnical analyses.

• CAU 429, Mobile Photo Lab UDPs, CAS 09-51-001-0952

- Excavated down to the septic tank and collected two environmental samples from the tank contents (liquid and sludge) and one soil sample from each end of the tank. All samples were submitted for analyses.

- Field screened all samples (liquid, soil/sludge) for VOCs and alpha/beta emitters, and field screened soil samples for silver.

- Drilled five vertical boreholes and submitted subsurface soil samples for laboratory analyses.

- Analyzed all environmental samples for total VOCs, total SVOCs, and total RCRA metals. Select samples were also analyzed for TCLP-silver. The sludge sample from the septic tank was also analyzed for TCLP-metals (minus mercury) and gamma spectrometry.

- Logged soil cuttings to assess site geology and collected one soil sample for geotechnical analyses.

All samples were field screened for VOCs and radiological constituents. The collection of soil for geotechnical analysis and the logging of soil cuttings were conducted only during drilling operations. Additionally, field screening for TPH was conducted at the UPS UDPs site (CAU 406) and field screening for silver by XRF was conducted at both CAU 429 CASs.

A.2.1 Site Description and Conditions

The corrective action investigations of CAU 406 and CAU 429 were conducted at Area 3 and Area 9 of the TTR. The TTR is approximately 140 mi northwest of Las Vegas, Nevada. Initial investigation locations were based on engineering drawings, historical aerial photos, and interviews with current and former TTR employees. Access to the investigation sites is restricted to authorized personnel. The subsurface investigation was restricted due to a variety of structures and extensive underground utilities.

A.2.1.1 Heavy Duty Shop UDP, Sumps

The Heavy Duty Shop UDP, Sumps (CAU 406, CAS 03-51-002-0374), hereafter referred to as "Heavy Duty Shop UDP," was verified to be located at the south end of the Area 3 west gate culvert. The Heavy Duty Shop UDP appeared to be a surface or near surface discharge point rather than a typical UDP. During excavation activities, the effluent end of the discharge pipe was located approximately 2.5 feet (ft) below the surface of the drainage ditch. There was no evidence of a gravel-filled, lined, large diameter boring or gravel-filled pit. The discharge pipe was located east

of the loading dock pad near Building 03-80. It is unknown how much of the pipe still exists between the loading dock and the source. Based on video surveys and multiple excavations downstream of the loading dock, the pipe appears to be in good condition and intact for most of its length to the discharge point.

A.2.1.2 UPS Building UDPs

The suspected UDPs and the associated discharge piping west of UPS Building 03-58 (CAU 406, CAS 03-51-003-0358) were not identified. The investigation for the two UDPs, hereafter referred to as the "UPS UDPs," was severely limited due to underground utilities in the area; however, based on process knowledge, two trenches were excavated in the most likely areas containing the UDPs. No evidence of the UPS UDPs was identified during this investigation. The UPS Building 03-58 investigation discovered shallow hydrocarbon-contaminated soil from previous spills not related to potential effluent from the UPS UDPs. Investigation of these fuel spills was not part of the original scope as defined in the CAIP. Subsequently, no attempt was made to investigate the vertical and lateral extent of this contaminated soil.

A.2.1.3 Photoshop UDP, Drains

The Photoshop UDP, Drains (CAU 429, CAS 03-51-001-0355), hereafter referred to as the "Area 3 Photoshop UDPs," were verified to be located in the southeast corner of the Area 3 compound as shown on historical drawings. The configuration of each UDP varied. The primary UDP consisted of a 3-ft diameter, corrugated steel lining that had been backfilled with sandy soil. The secondary UDP also had a 3-ft diameter, corrugated steel lining with an overflow pipe from the primary UDP located approximately 1.5 ft below ground surface (bgs). The secondary UDP had a void space to 8 ft bgs which was backfilled prior to drilling. The actual depth of the steel lining for both UDPs was not confirmed. The original discharge pipe from Building 03-55 to the primary UDP was verified to have been rerouted approximately 15 ft south of Building 03-55. The remaining length of pipe appears to be intact and was identified as 4-inch (in.) diameter transite pipe located approximately 3 ft bgs.

A.2.1.4 Mobile Photographic Lab UDPs

The Mobile Photographic Lab UDPs (CAU 429, CAS 09-51-001-0952), hereafter referred to as the "Area 9 Mobile Photo Lab UDPs," and the septic tank were verified to be located behind Building 09-52 as shown on historical drawings. The configurations of the Area 9 Mobile Photo Lab UDPs were similar to historical documentation with the exception that both UDPs had void spaces to a depth of 7 ft bgs. On the ground surface, 3-ft by 3-ft square areas composed of concrete blocks covered by wooden pallets marked the locations of the UDPs. The UDPs have 2- to 3-in. thick, 1.5-square feet (ft^2) concrete lids reinforced with rebar. Below the concrete lids, the diameters of the UDPs increase to approximately 7 or 8 ft with concrete block linings. The discharge pipes are visible approximately 3 ft bgs. The dimensions of the septic tank associated with the UDPs are approximately 5-ft wide, 5-ft deep, and 10-ft long. Contrary to process knowledge, Trailer 09-15 effluent was directly discharged to the UDPs, bypassing the septic tank, based on the identification of a discharge pipe that ties in downgradient of the tank. Both trailers housing the Mobile Photo Labs have been removed from behind Building 09-52. The pipe from the Building 09-52 restroom to the septic tank was not capped.

A.2.2 Investigation Logistics

This section describes the sample collection and investigation activities for each CAS included in CAUs 406 and 429. The investigation activities at each CAS were conducted in accordance with the CAIP (DOE/NV, 1999). Some sample locations vary slightly from those planned because of field observations or conditions encountered during the investigation. Figure A.2-1 shows the general locations of the CASs in the Area 3 Compound. Actual sampling and investigation activity locations for each CAS are shown in Figures A.2-2, A.2-3, A.2-4, and A.2-5. The alpha-numeric designations used for excavations, direct-push locations, and boreholes are provided in the following sections and will be used throughout the remainder of the report.

A.2.2.1 Utility Clearances

Utility clearances for both overhead and underground utilities were performed by Westinghouse Electric Company (WEC) personnel prior to the start of intrusive activities at each CAS. The utility clearance checklists were completed by both a WEC representative and the Site Supervisor, and

CAU 406
UPS Building UDPs
Suspected UDP
Location

2 to 4-inch Diameter
Metal Drainline

Drainage Ditch

Corrugated Metal Culvert

Suspected UDP Location for CAU 406
Heavy Duty Shop UDP

Associated Piping
to Drain in the
Heavy Duty Shop
(Building 0374)

CAU 429,
Area 3 Photoshop,
Primary UDP

Overflow Pipe

Secondary UDP

Bldg 0385
T035
T034
T033
T032
T031
T367
Bldg 0376
Bldg 0363
Bldg 0375
Bldg 0366
B01
B02
B03
B04
B05
B06
B07
B08
B09
B10
B11
B12
Bldg 0373
Sub Station 3-2
(wood) Dock
Bldg 0362
Bldg 0361
Bldg 0360
Bldg 0356
Port Bldg
Port Bldg
0381t
Bldg 382t
Bldg 0352
Bldg 0350
Bldg 0357
Bldg 0358
Fuel Tank
Cable Tray
Tele. Trlr 0368
0330
0364
0331
Sub Sta
0372
Bldg 0353
Bldg 0351
0332
0333
Bldg 0369
Bldg 0354
Port Bldg
Bldg 0355
Port Bldg
GAS PUMP ISLANDS
Bldg 0370
1602
Bldg 0367
Dock
Dumpster
Bldg 0380
Bldg 0374
To bldg 0365

Explanation

- Suspected Location of Discharge Line
- Discharge Line
- Fence Line
- UDP Location
- Paved Road
- Dirt Road

Note

All Locations are Approximate

Scale

0 100 200 Feet

0 30 60 Meters

h:\cau_406_429\cadd\finalla3udps_b1f.dgn

23-MAR-2000

Figure A.2-1
General Investigation Locations of Heavy Duty Shop UDPs, UPS Building UDPs and Area 3 Photoshop UDPs in Area 3, TTR

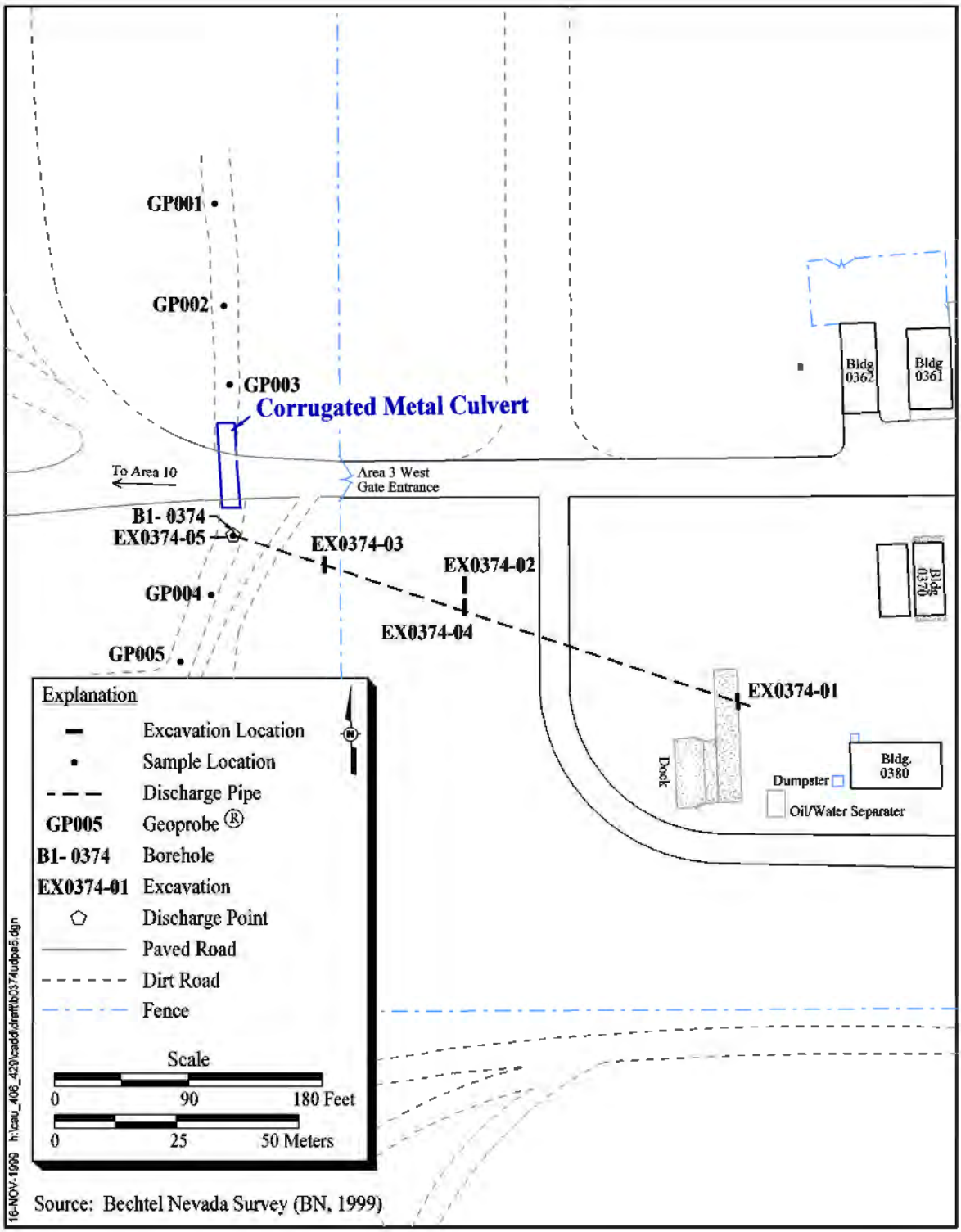


Figure A.2-2
CAS 03-51-002-0374, Heavy Duty Shop (Building 03-74) UDP

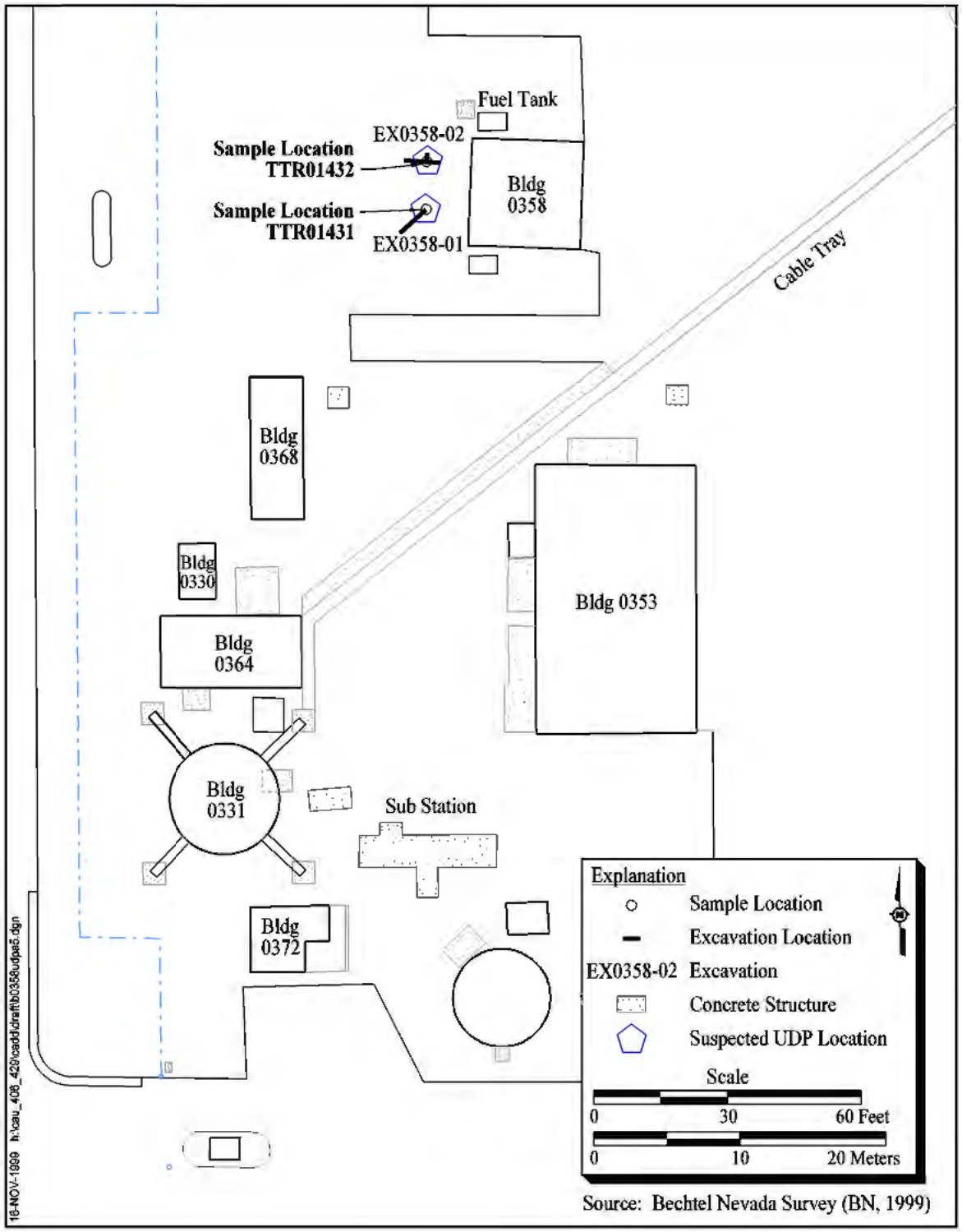


Figure A.2-3
CAS 03-51-003-0358, UPS (Building 03-58) UDPs

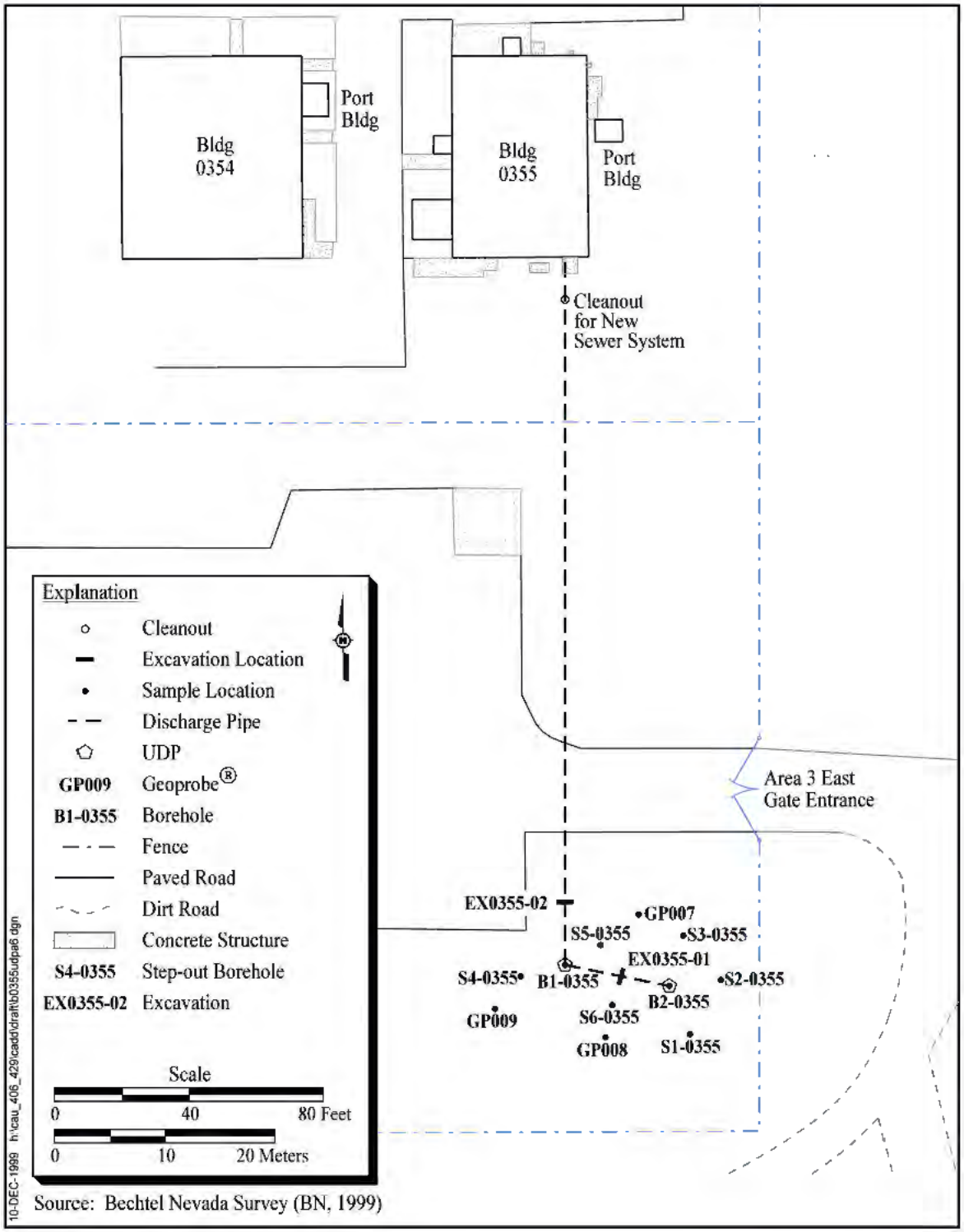


Figure A.2-4
CAS 03-51-001-0355, Area 3 Photoshop (Building 03-55) UDPs

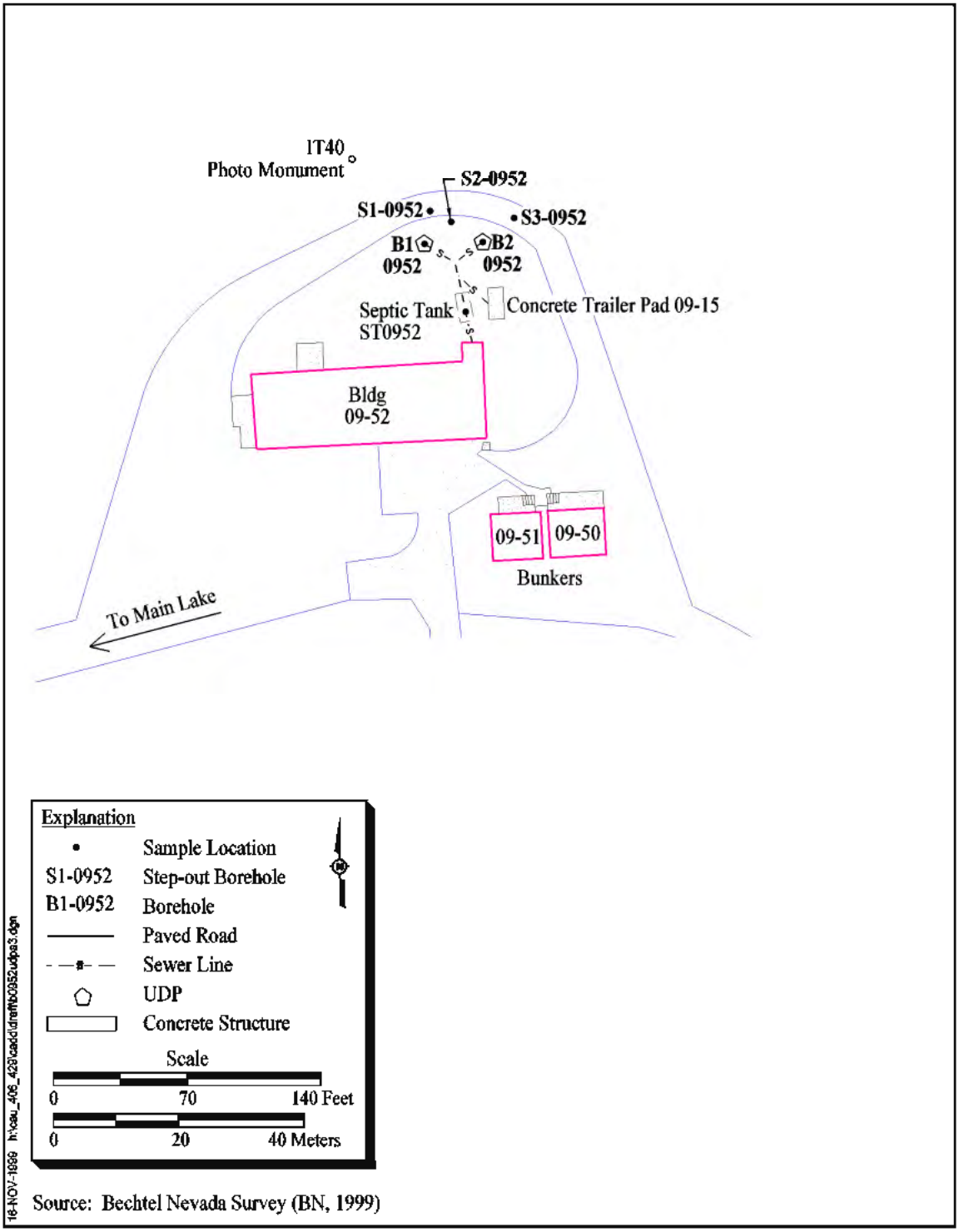


Figure A.2-5
CAS 09-51-001-0952, Area 9 Mobile Photo Lab (Building 09-52) UDPs

currently reside in project files. A Schonstedt metal detector was used extensively on conductive utilities. All identified utilities were marked on the ground surface with spray paint. An unmarked, active water line was breached during the investigation of the Heavy Duty Shop UDP, but it did not affect the collection or quality of environmental samples. Any unexpected utility lines identified during the investigation were noted in the Field Activity Daily Logs or placed on an appropriate map for reference.

A.2.2.2 Excavation

Excavations are designated by "EX" followed by the building number associated with the CAS, followed by the sequential number of excavations for that CAS. For example, EX0374-01, denotes the first excavation for the Heavy Duty Shop UDP, Building 03-74. The only exception to this designation is the excavation of the Area 9 septic tank which was designated as ST0952. This designation is also used for all the samples associated with the septic tank.

The purposes of these excavations were to either locate and identify discharge pipes and discharge points, gain access to a discharge pipe for video survey, or collect environmental samples to submit for analyses. A backhoe was used to excavate the trenches. Field screening was not conducted on soil overlying UDP system components. Field screening was conducted if excavation of soil beneath the system components was necessary. All spoils were backfilled to the location of removal.

A.2.2.3 Direct-push

Direct-push holes are designated by "GP" (Geoprobe®) followed by the sequential number of the holes as they were completed. For example, GP003, was the third direct-push location where samples were collected. The direct-push designations do not have an associated building number assigned. There is a gap in the sequential numbering of the Geoprobe® holes; GP006 was inadvertently left out in the labelling sequence of the sample locations.

All surface and near-surface samples collected at potential surface overflow areas were submitted for laboratory analyses. Soil samples were collected using a 2.2-in. diameter Macrocore® sampler

with polyvinyl chloride (PVC) liners. Extra soil remaining after sample collection was returned to its associated sample location.

A.2.2.4 Drilling

Drilled boreholes are designated by a one digit alpha code of "B" for initial borings (i.e., through the center of the UDPs) and "S" for step-out borings. The alpha code is followed by a numeric code denoting the number of each boring type at each CAS, followed by the building number associated with that CAS. For example, B2-0952, denotes a boring through the second UDP at the Area 9 Mobile Photo Lab UDP, Building 09-52; whereas, S2-0952 denotes the second step-out boring drilled at the Building 09-52 investigation site.

The rotary sonic ("sonic") drilling method was used for this investigation. The sonic drilling method produced continuous soil cores that were used for detailed field observations, visual classification of soils, field screening, and sampling of the subsurface soil at specified depth intervals. Soil cuttings were delivered to the field geologist and sampling team in labeled polyurethane bags in approximately 2.5-ft long sections. Field-screening results for radiation, VOCs (headspace screening), and silver (where applicable) were used to guide the lateral and vertical extent of the investigation in the field. Sampling intervals and sample submission frequency were based on minimum requirements established during the DQO process (DOE/NV, 1999), field-screening results, waste management needs, and the discretion of the Site Supervisor. For this project, 6-in. diameter core barrels and 8-in. diameter casing were advanced. The casing was removed upon completion of drilling and the boreholes, with the exception of the Area 9 Mobile Photographic Lab UDP borings B1-0952 and B2-0952, were filled with all excess drill cuttings that remained after sample collection. Borings B1-0952 and B2-0952 were filled with a bentonite grout mixture and all excess drill cuttings from these two borings were drummed as investigation-derived waste (IDW).

A.2.3 CAU 406 Investigation

A.2.3.1 Heavy Duty Shop UDP (Building 03-74)

The investigation of the Heavy Duty Shop UDP consisted of excavation, video survey, direct-push, and drilling activities to verify the location of both the discharge pipe and discharge point, and collect environmental samples to determine the presence and extent of COPCs. Table A.3-1 in Section A.3.0 discusses sample numbers, sample depths collected, and analyses performed for those samples submitted to the laboratory.

Excavation and Video Survey

Five excavations and limited video surveys were conducted along the discharge pipe. These activities determined the location and bearing of the discharge pipe, the condition of the pipe, and the location of the discharge point. Refer to Figure A.2-2 for the locations of investigation activities. All observed portions of the pipe were intact, in good condition, and relatively free of debris. The pipe is constructed of 4-in. diameter sections of PVC and metal. The location of the discharge point, marked by the open end of the discharge pipe, was confirmed at the south end of the culvert at a depth of approximately 2.5 to 3 ft below the surface of the ditch. During excavation field-screening levels (FSLs) were not exceeded, no leachrock/gravel were encountered, and no staining or odors were identified. In general, there was no evidence of a typical vertical UDP. The orientation of the discharge pipe suggests the effluent was either discharged to the historical surface of the ditch or just below the surface. The discharge source(s) associated with this investigation have been mitigated by grouting video mole access points within the discharge pipe.

Direct-push and Sample Collection

Eleven environmental samples were collected and submitted for laboratory analyses from five separate locations (GP001, GP002, GP003, GP004, and GP005) using direct-push. As prescribed in the CAIP, the direct-push locations were placed upstream and downstream from the suspected UDP and the depth intervals collected were 0 to 1 ft and 3 to 4 ft bgs. Refer to Figure A.2-2 for sample locations. Slight modifications to some of the proposed sample locations were necessary based on site conditions. Due to excavation activity disturbing the ground surface in the area

immediately south of the culvert, the surface and near-surface sample collection was abandoned. The proposed sample location at the north end of the culvert had to be moved 20 ft downstream due to the inaccessibility of the original location. The two sample locations proposed at 100 and 200 ft north of the culvert had to be moved upstream to 70 and 100 ft, respectively, due to closure boundaries of CAU 424, Landfill A3-3. Step-outs were not conducted using the direct-push method as field-screening levels were not exceeded and visual observations indicated no contamination present. In accordance with the CAIP (DOE/NV, 1999), 25 percent of the direct-push samples were submitted for isotopic uranium analysis.

Drilling and Sample Collection

One borehole, B1-0374, was drilled at the discharge point identified during excavation activities. Step-out borings were not conducted as field-screening levels were not exceeded. In order to set a drill rig over the UDP location, additional backfill and leveling of the ground surface was necessary. This resulted in the discharge point being covered with approximately 3 to 4 ft of fill. Due to this activity combined with the excavation activity, the 1 and 4 ft sample locations were abandoned as they no longer represented the native soil above the discharge point. Sample collection and field screening started at 5 ft bgs in soil undisturbed by this investigation. Because FSLs were not exceeded and staining or unusual odors were not detected during the examination and collection of soil, the decision was made to submit the 10-ft bgs interval sample for laboratory analyses. Process knowledge suggests this area was periodically mucked out by excavation, and since no evidence was encountered to suggest a UDP, a UDP base, or even a gravel-filled pit, the 10-ft bgs interval represents a sample depth of 4 to 5 ft below the discharge point and should have captured any remaining COPCs or vertically migrated COPCs below the previously excavated/ mucked out area. Nondetect samples (based on field-screening results) were collected and submitted from the 35-ft and 40-ft bgs intervals to bound the vertical extent of contamination and verify field-screening results. A field duplicate and geotechnical sample were collected from this borehole. The soil boring log located in Appendix B provides a detailed description of the soil boring.

A.2.3.2 Uninterrupted Power Supply UDPs (Building 03-58)

The investigation of the UPS UDPs consisted of excavation activities only. The UDPs and associated piping were not identified during this investigation. A confirmatory sample was collected from each excavation conducted at the site and submitted for laboratory analyses. Hydrocarbon-contaminated soil from previous spills was encountered but was not investigated as these soils were not in the scope of this investigation.

Excavation and Sample Collection

Two trenches, EX0358-01 and EX0358-02, were excavated at the UPS building to locate the UDPs reported to be on the west side of the building (see Figure A.2-3). Due to extensive underground utilities in the area, the originally proposed excavations as prescribed in the CAIP were not conducted. Instead, only one trench perpendicular to the building and one trench angled 45 degrees to the building were possible. The first excavation, EX0358-01, was started 10 ft west of the building and approximately 8 ft north of southern wall. The trench was oriented slightly northeast-southwest at a 45-degree angle to the west side of the building because of limited maneuvering space for the backhoe. The excavation eventually reached dimensions of approximately 4 ft deep, 8 ft long, and 4 ft wide. No evidence of the UDP was encountered; however, extensive hydrocarbon contamination was present in the soil. The location is consistent with previously known spills, and two sample survey stakes were uncovered during the excavation within the visibly stained soil with the initials “SNL” and the date of 1-31-92. A previous spill was reported in the incident Notification Report Case Number H920225A. A strong hydrocarbon odor accompanied the dark grayish-brown stains. Three TPH field-screening samples were collected and run with the Hanby test kit at various locations within EX0358-01. Results indicated levels of diesel fuel and fuel oil exceeding 1,000 mg/kg. The presence of this contamination complicated efforts of collecting a “clean” confirmatory sample at the base of EX0358-01. The confirmatory sample TTR01431 was taken within visibly stained soil at a depth of 3.7 ft bgs. Radiation field-screening results did not exceed FSLs.

The second excavation, EX0358-02, was started 7 ft west of the building and approximately 7 ft south of the northern wall. The orientation of the trench was east-west (perpendicular to the

building) as dictated by underground utilities. Because a backhoe could not safely excavate within the traced-out utilities at this location, a trencher was used to excavate an 8-in. wide trench to a depth of 3.25 ft and a length of 15 ft. The UDP was not located so a confirmatory sample, TTR01432, was collected at 10 ft west of the building at a depth of 3.25 ft bgs in the suspected UDP location. A small soil stain was observed a couple of inches below the ground surface at the head of the trench, otherwise, there was no evidence of surface soil contamination at this trench. A Hanby field-screening sample was run at the sample location and had a result of nondetect. A decision was made to continue attempts to locate the UDP by expanding the trench width with the use of an air knife to minimize chances of cutting an utility line. However, upon breaking apart the soil adjacent to the original trench, hydrocarbon-contaminated soil consistent with soil found in EX0358-01 was encountered and the use of the air knife halted. Hand excavation commenced and continued to expand the excavation an additional 2 ft north to a depth of 3 ft bgs and still no evidence of the UDP was encountered. The investigation ceased at this point. Although underground utilities restricted the subsurface investigation, process knowledge suggests that the UDP locations were in the same areas as the excavated trenches.

A.2.4 CAU 429 Investigation

A.2.4.1 Area 3 Photoshop UDPs (Building 03-55)

The investigation of the Area 3 Photoshop UDPs consisted of excavation, direct-push, and drilling activities to verify UDP locations and configurations, and collect environmental samples to determine the presence and extent of the COPCs. Table A.3-1 in Section A.3.0 discusses sample numbers, sample depths collected, and analyses performed for those samples submitted to the laboratory. The FSL for silver used during this investigation was 500 parts per million (ppm).

Excavation

EX0355-01 verified that the overflow pipe, constructed of 2.5-in. diameter metal, was still present between the primary and secondary UDP at a depth of approximately 18 in. bgs. EX0355-02 was excavated to introduce the video mole to verify that the discharge pipe to the primary UDP was rerouted or capped. An alternative excavation location about 200 ft south of Building 03-55 was necessary after it was determined that excavating near Building 03-55 was not possible due to

underground utilities. Upon breaking the pipe at EX0355-02, it was discovered that the discharge pipe was constructed of asbestos-lined transite pipe. Due to this unforeseen health hazard, the broken pipe was grouted, the video survey abandoned, and the excavation backfilled. All other proposed excavations on this pipe were abandoned in lieu of hand excavating the cleanout near Building 03-55 to verify that the effluent pipe was rerouted or capped.

Hand excavation was conducted on the cleanout located approximately 15 feet south of Building 03-55. The cleanout had concrete surrounding the vertical pipe which prevented further excavation downward. The cleanout cap was removed and visual observations were conducted. The PVC pipe was empty down to a 90-degree elbow that was directed west. There was no pipe opening leading to the south towards the primary UDP. This cleanout and elbow are new additions to reroute liquid waste from Building 03-55 as part of the new consolidated sewer system. This particular cleanout is not present on historical engineering drawings, but is depicted on new sewer layout engineering drawings.

Direct-push and Sample Collection

Six environmental samples were collected and submitted for laboratory analyses from three separate locations (GP007, GP008, and GP009) using the direct-push. As prescribed in the CAIP, the locations of the direct-push holes were configured in a roughly triangular pattern centered on the primary UDP, and the depth intervals collected were 0 to 1 ft and 2 to 3 ft bgs. Refer to Figure A.2-4 for sample locations. Field screening by XRF for silver was completed the following week due to complications in acquiring the XRF instrument on the originally scheduled days and times. This did not pose a problem because the drill rig would have performed any step-outs that may have been necessary. Field-screening levels were not exceeded in any of the direct-push samples.

Drilling and Sample Collection

Eight boreholes were drilled for the subsurface investigation of this site: an initial boring through the center of each UDP and six step-out borings (see Figure A.2-4). Drilling began first in the primary UDP (B1-0355) followed by the secondary UDP (B2-0355). For B1-0355, the UDP

base-native soil interface was interpreted by the Site Geologist at a depth of 6 ft bgs where greenish-black stained leachrock ended and sandy gravel began. Slight staining was identified in the top portion of the sandy gravel to a depth of 8 ft bgs. The highest field-screening result for silver was 1,000 ppm at 6.5-ft bgs, where results then dropped to below 500 ppm throughout the rest of the borehole. Environmental samples were submitted for laboratory analyses from the 6.5-ft and 10-ft bgs intervals. Nondetect samples (based on field-screening results) were collected and submitted from the 35-ft and 40-ft bgs intervals to bound the vertical extent of contamination and verify field-screening results for B1-0355.

For B2-0355, the secondary UDP, the UDP base-native soil interface was difficult to identify and could be interpreted at either 13 ft bgs or 35 ft bgs where abrupt changes occur in the geology. B2-0355 did not contain characteristic leachrock material or similar staining as seen in B1-0355. A piece of thick metal was found around 30 ft bgs. The soil above 35 ft bgs was slightly gray in color and could be attributed to silver contamination. These factors suggest the secondary UDP was constructed much deeper than the primary UDP. Field-screening results for silver in B2-0355 were elevated to a depth of 33 ft bgs with a maximum field-screening result of 5,909 ppm at 28 ft bgs. The depth of contamination may be attributed to the more porous fill material consisting of large gravel and cobble to boulder-sized clasts. Because of the elevated field-screening results at a depth of 33 ft bgs, drilling continued to a depth of 45 ft bgs to obtain two consecutive nondetect field-screening results. Based on sampling criteria outlined in the CAIP (DOE/NV, 1999), environmental samples were collected from the 13-ft, 28-ft, and 33-ft bgs intervals. Nondetect samples (based on field-screening results) were collected and submitted from the 35-ft and 40-ft bgs intervals to bound the vertical extent of contamination and verify field-screening results for B2-0355.

The FSL for silver (500 ppm) was used as guidance for determining the need for step-out borings. Three step-outs (S1-0355 through S3-0355) were drilled to a depth of 40 ft bgs based on the lowest vertical extent of contamination in B2-0355, which was 33 ft bgs as detected by field screening for silver. The 40-ft bgs drilling depth allowed for two consecutive nondetect field-screening results below the minimum depth of 33 ft bgs. The sample from the 35-ft bgs interval was submitted for laboratory analyses for all three step-outs as the first of two consecutive nondetect field-screening results as stated in the CAIP (DOE/NV, 1999). Another three step-outs (S4-0355 through S6-0355)

were drilled to a depth of 15 ft bgs based on the lowest vertical extent of contamination in B1-0355, which was 6.5 ft bgs as detected by field screening. The 15-ft bgs drilling depth allowed for two consecutive nondetect field-screening results below the minimum depth of 6.5 ft bgs. The sample from the 10-ft bgs interval was submitted for laboratory analyses for these three step-outs as the first of two consecutive nondetect field-screening results. The XRF field-screening results are available in Appendix C for every sample interval collected at each boring for this investigation site. Radiological and VOC field-screening results did not exceed FSLs for any of the borings. A geotechnical sample was collected from S5-0355. The soil boring logs located in Appendix B provide detailed descriptions of each soil boring.

A.2.4.2 Area 9 Mobile Photographic Lab UDPs (Building 09-52)

The investigation of the Area 9 Mobile Photographic Lab UDPs consisted of excavation and drilling activities to collect environmental samples to determine the presence and extent of COPCs. Table A.3-1 in Section A.3.0 discusses sample numbers, sample depths collected, and analyses performed for those samples submitted to the laboratory. The FSL for silver used during this investigation was 100 ppm.

Septic Tank Sampling

The septic tank system associated with the UDPs, designated as ST0952 for sample association, was excavated to uncover the tank lids as well as the influent and effluent ends of the tank for sampling purposes. The septic tank configuration consists of two concrete lids: the southern lid approximately 5-in. thick and the northern lid only 2-in. thick. The tank is apparently one compartment and has a breather riser which protrudes from the southern end of the tank. The dimensions of the septic tank are approximately 5-ft deep, 5-ft wide, and approximately 7- to 10-ft long. Approximate volume of septage is 175 to 225 cubic feet based on the conditions encountered while sampling. The northern lid was removed to collect one sample each from the liquid and sludge phases. The tank contents were within 6 to 8 in. of the top of the tank. A thick, light brown to dark grayish brown sludge, approximately 3 in. suspended atop the liquid phase was penetrated for sampling purposes. The underlying liquid phase was dark gray to black in color and had a strong septic odor. The underlying sludge phase was watery, light brown to dark brown in color

and had a strong septic odor. For waste management purposes, both the liquid and sludge samples were analyzed for gamma spectrometry, and the sludge sample was analyzed for TCLP metals that included silver, lead, cadmium, chromium, selenium, barium, and arsenic.

Soil samples were collected from both the influent and effluent ends of the septic tank as stated in the CAIP (DOE/NV, 1999). Soil was hand excavated for sample collection about 6 in. directly below the pipes (3.5 ft bgs) and adjacent to the tank wall. There was no visible staining or odor associated with the soil sampled at either end of the tank. While excavating the effluent end of the tank, a tie-in pipe from the Trailer 09-15 pad was identified. The pipe ties in north (downgradient) of the septic tank and connects directly into the UDP discharge line upstream of the y-junction where the discharge lines splits into two lines each directed to a UDP (see Figure A.2-5). The CAIP stated that an excavation would be conducted to cap off the bathroom access line to prevent unauthorized discharge to the UDP system. This excavation was not accomplished due to the potential release of raw septage upon accessing and breaching the pipe. The level of septage within the septic tank suggests that septage may still remain inside the discharge pipe. Additionally, SNL has requested the access line and septic tank remain intact for potential future use. Radiological and VOC field-screening results did not exceed FSLs for sample media associated with the septic tank. Field screening for silver was not conducted during this sampling event because all samples were submitted for laboratory analyses.

Drilling and Sample Collection

Five boreholes were drilled for the subsurface investigation of this site: an initial boring through the center of each UDP and three step-out borings (see Figure A.2-5). Contrary to historical documentation, the UDPs were not filled to the ground surface with gravel. Instead, the UDPs were void of debris and soil to 7 ft bgs. Because of void space in each UDP, drilling started at 7 ft bgs and commenced to the 40 ft bgs. For each UDP, the first sample interval was 8 ft bgs and then sample collection continued in 5-ft intervals beginning at 10 ft bgs until 40 ft bgs. The base of each UDP was determined to be at 9 to 9.5 ft bgs (see Appendix B for soil boring logs). B1-0952 had no visible soil staining or odor, but had a field-screening result for silver of 182 ppm at 8 ft bgs and 108 ppm at 10 ft bgs. Samples were collected and submitted for laboratory analyses at both intervals. B2-0952 had black soil staining at a depth of 9 to 9.5 ft bgs with silver field-screening

results of 182 ppm at 8 ft bgs and 47 ppm at 10 ft bgs. Samples were collected and submitted for laboratory analyses at both intervals. Nondetect samples (based on field-screening results) were collected and submitted from the 35-ft and 40-ft bgs intervals from each UDP boring to bound the vertical extent of contamination and verify field-screening results.

The FSL for silver (100 ppm) was used as guidance for determining the need for step-out borings. Three step-outs (S1-0952 through S3-0952) were drilled based on elevated field-screening results for silver. The locations of step-out borings were determined by site field conditions. All three step-outs were drilled to a depth of 15 ft bgs based on the lowest vertical extent of contamination (detected by field screening) in B1-0952 and B2-0952, which was 8 ft bgs for both UDPs. Drilling to a depth of 15 ft bgs allowed for two consecutive nondetect field-screening results below the minimum depth of 8 ft bgs. The sample from the 10-ft bgs interval was submitted for laboratory analysis from all three step-outs as the first of two consecutive nondetect field-screening results as stated in the CAIP (DOE/NV, 1999). The soil boring logs located in Appendix B provide detailed descriptions of each soil boring. The XRF field-screening results are available in Appendix C for every sample interval collected at each boring for this investigation site.

A.2.5 Field Screening

All samples were screened for unusual staining or odor. The sample collection logs and/or visual soil classification logs were used to record this information. Field-screening activities were performed as specified in the CAIP (DOE/NV, 1999). Established FSLs were used to guide sample collection both laterally and vertically and to provide a basis for the selection of additional environmental samples for laboratory analyses. Field-screening levels were determined for VOCs (headspace method using a photoionization detector) and for radiation (for alpha and beta using an Electra). The FSL for headspace VOCs was established at 20 ppm or 2.5 times background, whichever was greater. The radiological FSL was defined as the mean background activity level plus two times the standard deviation of 20 background sample readings. The radiological FSLs were determined prior to the start of field activities at both Area 3 and Area 9.

The Hanby test kit was used to field screen for TPH at the UPS UDP site. As established in the CAIP (DOE/NV, 1999), a FSL of 100 ppm was used. Field screening for TPH using the Hanby test

kit was originally planned for the Heavy Duty Shop UDP investigation; however, due to the potential to generate mixed waste, TPH field screening was not conducted at this site. Sample collection guidance was based instead on VOC field-screening results.

Field screening for silver, using a Spectrace Model 9240 XRF, was conducted at both CAU 429 sites. A FSL of 100 ppm was originally agreed upon in the DQO process; however, during the course of the field investigation, it was determined that all the samples collected from Area 3 and Area 9 produced a low, broad emission in the range of the silver emission and caused interference in the detection of silver at 100 ppm. The FSL was subsequently changed to 500 ppm after work was completed at Area 9 but prior to the Area 3 Photoshop investigation. A possible contribution to the interference may have been residual moisture in the samples. For details of the XRF use and results see Appendix C.

A.2.6 Sample Collection

Sample collection followed the procedures specified in the CAIP (DOE/NV, 1999). The only non-soil media collected during this investigation were septic tank samples at the CAU 429, Mobile Photographic Lab UDPs site. One liquid and one sludge sample were collected with and transferred directly from a long-handled, 500-milliliter plastic scoop to the appropriate sample containers that were then labeled and sealed with custody tape. A decontaminated, stainless steel funnel was used in the collection of the sludge to reduce spillage. The order of sample collection was total VOCs first, followed by total SVOCs, total RCRA metals, TCLP metals (sludge only), and gamma spectrometry.

For excavation, direct-push, and drilling activities, soil for volatile analytes (VOCs, TPH-gasoline), headspace field screening, and TPH field screening was obtained directly from the source of collection (i.e., Macro-core liner, polyurethane bag, or excavation) immediately after required health and safety screening was conducted. Soil to be analyzed for total SVOCs, total RCRA metals, PCBs, TPH-diesel/oil, TCLP-silver, isotopic uranium, gamma spectrometry, and XRF field-screening samples was then collected from soil representative of the sampling interval which was homogenized in a stainless steel bowl. Samples were collected in appropriate containers, temporarily labeled, and sealed with custody tape.

After samples were identified as laboratory samples, labels printed with the sample number, sample collection date/time, sampling team members, preservative, sample matrix, and requested analyses were attached to each of the containers. Each sample container was then 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.

Three geotechnical samples were collected to assess geological and hydrological parameters of the native soil beneath and/or surrounding the UDPs. Each sample was collected in three 6-in. brass sleeves using a California Modified split-spoon sampler. Sample TTR01442 was collected from native soil in boring B1-0952 for Area 9. Sample TTR01473 was collected from native soil in boring S5-0355 for the Area 3 Photoshop site. Sample TTR01482 was collected from native soil in boring B1-0374 for the Heavy Duty Shop site. A geotechnical sample was not required at the UPS UDP site as no UDPs were identified. These samples were not submitted for analyses because the geotechnical data would not offer useful information as no corrective actions are required for CAUs 406 and 429.

A.2.7 Waste Management

Investigation-derived waste that came in contact with potentially contaminated media was segregated into the following four waste streams:

- Personal protective equipment and sampling equipment
- Decontamination rinsate
- Soil and debris incidental to sample collection (e.g., soil cuttings, discarded samples bottles)
- Plastic or other material (e.g., decontamination pad liner, plastic sheeting placed under trenched spoils)

Potentially hazardous and/or radioactive waste generated during site operations was labeled as such and temporarily accumulated in a Hazardous Waste Accumulation Area (HWAA)/Radioactive Control Area (RCA) located within the boundaries of each CAS investigation area. Information regarding each container of IDW was documented in a project-specific waste management logbook.

As discussed in the CAIP (DOE/NV, 1999) IDW generated at each individual CAS was transferred to the Central HWAA/RCA located near the Area 3 compound at the conclusion of field activities.

A.2.8 Geology

Surface soils around the UDP sites consist of sand, gravel, and cobbles with sparse vegetation. Fill material, when identified, typically consisted of sands and gravels. Leachrock, when encountered in any UDP, typically consisted of 0.25-in. to 1.5-in. gravel. Native soil in Area 3 was typically poorly-graded silty to gravelly sand. Native soil in Area 9 consists of alternating layers of poorly graded sands to silty sands. Field descriptions were performed and documented for each drilled borehole by the field geologist. The soil boring logs can be found in Appendix B.

A.2.9 Hydrology

Depth to groundwater beneath the Area 3 compound is estimated at 360 to 394 ft bgs. Depth to groundwater beneath Area 9 is estimated at 131 ft bgs. The groundwater flow direction is generally to the north-northwest at Area 3 and to the southwest at Area 9 (DOE/NV, 1996a). Overall topography slopes gently to the northwest with surface drainage flowing in the same direction for most of the Area 3 UDPs, except for the Area 3 Photoshop UDPs where a gentle south to southeastward sloping gradient may cause surface drainage to flow in an opposite direction. The surface drainage flow at Area 9 is variable but appears to flow north to northeast behind Building 09-52. No saturated zones were found in the subsurface at any of the CASs.

A.3.0 Investigation Results

The analytical results of samples collected from the CAU 406 and CAU 429 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 direct-push and drilling phase activities, a total of 53 soil samples were collected and submitted for laboratory analyses. Additionally, a liquid and sludge sample were collected from a septic tank and submitted for laboratory analyses. A list of the samples collected at all four UDP site investigations 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 analyses were analyzed by DataChem Laboratories Inc., in Salt Lake City, Utah. Samples collected for radiological analyses were analyzed by Quanterra Environmental Services in Richland, Washington and/or Paragon Analytics Inc., in Fort Collins, Colorado.

The analytical parameters were selected through the application of site process knowledge according to the *Guidance for the Data Quality Objectives Process* (EPA, 1994c) 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 NDEP Corrective Action Regulations (NAC, 1997) and the U.S. Environmental Protection Agency (EPA) Preliminary Remediation Goals (PRGs) (EPA, 1998) 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 Nevada Test Site. The results of the DQO process are documented in the CAIP (DOE/NV, 1999) 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 and Analyzed During the CAU 406 and CAU 429 Field Investigation
(Page 1 of 4)

Sample Location	Sample Number	Depth[a] (in ft bgs)	Sample Matrix	Sample Type	Parameters Analyzed
CAU 406, CAS 03-51-002-0374 Heavy Duty Shop UDP					
N/A	TTR01400	N/A	Water	Trip Blank	Total VOC
GP001	TTR01401	1	Soil	Environmental	Set 1
	TTR01402	4	Soil	Environmental	Set 1, IsoU
GP002	TTR01403	1	Soil	Environmental	Set 1
	TTR01404	4	Soil	Environmental	Set 1
GP003	TTR01405	1	Soil	Environmental	Set 1
	TTR01406	4	Soil	Environmental	Set 1, IsoU
GP004	TTR01407	1	Soil	Environmental	Set 1
	TTR01408	4	Soil	Environmental	Set 1, IsoU
	TTR01409	4	Soil	Environmental Duplicate of TTR01408	Set 1, IsoU
GP005	TTR01410	1	Soil	Environmental	Set 1
	TTR01411	4	Soil	Environmental	Set 1
N/A	TTR01474	N/A	Water	Trip Blank	Total VOC
	TTR01475	N/A	Water	Field Blank	Set 1, IsoU, GS
B1-0374	TTR01476	N/A	Water	Trip Blank	Total VOC
	TTR01477	10	Soil	Environmental	Set 1, IsoU
	TTR01478	10	Soil	Environmental Duplicate of TTR01477	Set 1, IsoU
	TTR01479	15	Soil	Environmental MS/MSD	Set 1
	TTR01480	35	Soil	Environmental	Set 1
	TTR01481	40	Soil	Environmental	Set 1
CAU 406, CAS 03-51-003-0358 UPS UDP					
EX0358-01	TTR01431	3.7	Soil	Environmental	Set 2
EX0358-02	TTR01432	3.25	Soil	Environmental	Set 2

Table A.3-1
Samples Collected and Analyzed During the CAU 406 and CAU 429 Field Investigation
(Page 2 of 4)

Sample Location	Sample Number	Depth[a] (in ft bgs)	Sample Matrix	Sample Type	Parameters Analyzed
CAU 429, CAS 03-51-001-0355 Area 3 Photoshop UDP					
N/A	TTR01412	N/A	Water	Trip Blank	Total VOC
	TTR01413	N/A	Water	Source Blank	Set 1, IsoU, GS
	TTR01414	N/A	Water	Trip Blank	Total VOC
	TTR01415	N/A	Water	Equipment Blank	Set 1, IsoU, GS
GP007	TTR01417	1	Soil	Environmental	Set 3
	TTR01418	3	Soil	Environmental	Set 3
GP008	TTR01419	1	Soil	Environmental	Set 3
	TTR01420	3	Soil	Environmental MS/MSD	Set 3
GP009	TTR01421	1	Soil	Environmental	Set 3
	TTR01422	3	Soil	Environmental	Set 3
B1-0355	TTR01451	N/A	Water	Trip Blank	Total VOC
	TTR01452	6.5	Soil	Environmental	Set 3, TCLP, IsoU
	TTR01453	10	Soil	Environmental	TCLP, IsoU
	TTR01454	35	Soil	Environmental	Set 3
	TTR01455	40	Soil	Environmental MS/MSD	Set 3
B2-0355	TTR01456	N/A	Water	Trip Blank	Total VOC
	TTR01457	13	Soil	Environmental	Set 3, TCLP, IsoU
	TTR01458	13	Soil	Environmental Duplicate of TTR01457	Set 3, TCLP
	TTR01459	28	Soil	Environmental	Set 3, TCLP, IsoU
	TTR01460	33	Soil	Environmental	TCLP
	TTR01461	40	Soil	Environmental	Set 3, TCLP
	TTR01462	45	Soil	Environmental	Set 3, TCLP
N/A	TTR01463	N/A	Water	Trip Blank	Total VOC
S2-0355	TTR01464	35	Soil	Environmental	Set 3, TCLP
S1-0355	TTR01465	35	Soil	Environmental	Set 3, TCLP
N/A	TTR01466	N/A	Water	Trip Blank	Total VOC

Table A.3-1
Samples Collected and Analyzed During the
CAU 406 and CAU 429 Field Investigation
(Page 3 of 4)

Sample Location	Sample Number	Depth[a] (in ft bgs)	Sample Matrix	Sample Type	Parameters Analyzed
S4-0355	TTR01469	10	Soil	Environmental	Set 3, TCLP
S3-0355	TTR01470	35	Soil	Environmental	Set 3, TCLP
S5-0355	TTR01471	10	Soil	Environmental	Set 3, TCLP
S6-0355	TTR01472	10	Soil	Environmental	Set 3, TCLP
N/A	TTR01467	N/A	Water	Trip Blank	Total VOC
	TTR01468	N/A	Water	Equipment Blank	Set 1, IsoU, GS
CAU 429, CAS 09-51-001-0952 Area 9 Mobile Photo Lab UDPs					
N/A	TTR01423	N/A	Water	Trip Blank	Total VOC
	TTR01424	N/A	Water	Field Blank	Set 1, IsoU, GS
ST0952	TTR01425	N/A	Water	Trip Blank	Total VOC
	TTR01426	N/A	Liquid	Environmental	Set 3, GS
	TTR01427	N/A	Water	Trip Blank	Total VOC
	TTR01428	7	Sludge	Environmental	Set 3, GS, TCLP-metals[b]
ST0952P	TTR01429	3.5	Soil	Environmental	Set 3
ST0952D	TTR01430	3.5	Soil	Environmental	Set 3
N/A	TTR01433	N/A	Water	Trip Blank	Total VOC
	TTR01434	N/A	Water	Source Blank	Set 1, IsoU, GS
	TTR01435	N/A	Water	Trip Blank	Total VOC
	TTR01436	N/A	Water	Field Blank	Set 1, IsoU, GS

Table A.3-1
Samples Collected and Analyzed During the CAU 406 and CAU 429 Field Investigation
(Page 4 of 4)

Sample Location	Sample Number	Depth[a] (in ft bgs)	Sample Matrix	Sample Type	Parameters Analyzed
B2-0952	TTR01437	N/A	Water	Trip Blank	Total VOC
	TTR01438	8	Soil	Environmental	Set 3, TCLP
	TTR01439	10	Soil	Environmental	Set 3, TCLP
	TTR01440	35	Soil	Environmental	Set 3
	TTR01441	40	Soil	Environmental	Set 3
B1-0952	TTR01443	8.5	Soil	Environmental	Set 3, TCLP
	TTR01444	10	Soil	Environmental	Set 3, TCLP
	TTR01445	35	Soil	Environmental	Set 3
	TTR01446	40	Soil	Environmental	Set 3
N/A	TTR01447	N/A	Water	Trip Blank	Total VOC
S2-0952	TTR01448	10	Soil	Environmental	Set 3
S1-0952	TTR01449	10	Soil	Environmental	Set 3
S3-0952	TTR01450	10	Soil	Environmental	Set 3

[a] Soil samples collected from 1-ft interval ending at depth shown.
[b] TCLP metals includes silver, lead, barium, chromium, cadmium, selenium, and arsenic.
GP denotes Geoprobe® sample location
EX denotes excavation sample location
B or S denotes borehole sample location
ST denotes septic tank
N/A = Not Applicable
MS/MSD = Matrix Spike/Matrix Spike Duplicate
VOC = Volatile Organic Compound
SVOC = Semivolatile Organic Compound
RCRA = *Resource Conservation and Recovery Act*
PCB = Polychlorinated Biphenyls
TPH = Total Petroleum Hydrocarbons
Set 1: Total VOCs, total SVOCs, TPH (gasoline and diesel), total RCRA metals, PCBs
Set 2: TPH-diesel/waste oil, PCBs
Set 3: Total VOCs, total SVOCs, and total RCRA metals
IsoU = Isotopic uranium
GS = Gamma spectrometry
TCLP = Toxicity Characteristic Leaching Procedure for silver only unless otherwise noted

Table A.3-2
Laboratory Analytical Methods Used for the
CAU 406 and CAU 429 Investigation Samples

Analytical Parameter	Analytical Method
Total volatile organic compounds	EPA 8260B[a]
Total semivolatile organic compounds	EPA 8270C[a]
Total petroleum hydrocarbons - gasoline, diesel, oil	EPA 8015B (modified)[a]
Total polychlorinated biphenyls	EPA 8082[a]
Total RCRA metals (arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury)	EPA 6010B/7470A[a] EPA 6010B/7471A[a]
TCLP RCRA metals (arsenic, barium, cadmium, chromium, lead, selenium, and silver)	EPA 1311/6010B[a]
Isotopic Uranium	NAS-NS-3050[b,c]
Gamma Spectrometry	EPA 901.1[d] HASL-300[e]

[a]EPA Test Methods for Evaluating Solid Waste, 3rd Edition, Parts 1-4, SW-846 (EPA, 1996)
[b]*The Radiochemistry of Uranium* (Grindler, 1962) or equivalent method
[c]*Separation and Preconcentration of Uranium from Acidic Media by Extraction Chromatography* (Horwitz et al., 1992) or equivalent method
[d]*Prescribed Procedures for Measurements of Radioactivity in Drinking Water* (EPA, 1980) or equivalent method
[e]*Environmental Measurements Laboratory Procedures Manual*, HASL-300 (DOE, 1992)

A.3.1 Total Volatile Organic Compounds

The total VOC analytical results for soil samples detected above minimum reporting limits as specified in the CAIP (DOE/NV, 1999) and the associated PALs are presented in Table A.3-3. None of these results exceed the PALs (DOE/NV, 1999; EPA, 1998).

A.3.2 Total Semivolatile Organic Compounds

Soil sample TTR01438 and its reanalysis TTR01438R1, collected from B2-0952, had SVOCs detected above minimum reporting limits. 2,4-dimethylphenol was detected at 690 micrograms per kilogram (µg/kg) in TTR01438R1. 4-methylphenol was detected at 970 µg/kg (J) and 980 µg/kg in TTR01438 and TTR01438R1, respectively. Bis (2-ethylhexyl) phthalate was detected at 400 micrograms per kilograms (µg/kg) (J) and 540 µg/kg (J) in TTR01438 and TTR01438R1, respectively. Where assigned, samples were qualified with a J because of the existence of matrix

Table A.3-3
Soil Sample Results for Total Volatile Organic Compounds Detected Above Minimum Reporting Limits, Area 3 and 9 Underground Discharge Points, TTR

Sample Location	Sample Number	Start Depth (ft)	End Depth (ft)	Contaminants of Potential Concern (µg/kg)	
				2-Butanone	Acetone
	Preliminary Action Levels[a]			27,000,000	6,100,000
B2-0952	TTR01439	9	10	8.0	28
B2-0355	TTR01457	12	13	--	6.8
	TTR01458	12	13	--	6.8
	TTR01459	27	28	--	14

[a]EPA Region 9, Industrial PRGs (EPA, 1998)
-- = Not detected above minimum reporting limit
µg/kg = Micrograms per kilogram
ft = Foot (feet)

effects and the internal standard area count exceeding the QC limits resulting in estimated values. None of these results exceed PALs. All other SVOC results for soil samples were below minimum reporting limits. Therefore, SVOCs were not detected in soil samples at concentrations exceeding PALs (DOE/NV, 1999; EPA, 1998).

A.3.3 Total Petroleum Hydrocarbons

Soil sample TTR01407, collected within GP004 at the Heavy Duty Shop UDP site, had a concentration of 0.57 mg/kg in the TPH gasoline range, which is well below the NDEP regulatory action level of 100 mg/kg (DOE/NV, 1999; NAC, 1997). Soil sample TTR01431, collected from EX0358-01 behind the UPS building, had a concentration of 190 mg/kg in the TPH diesel range, which exceeds the NDEP regulatory action level of 100 mg/kg. The contamination at this site is not associated with the UDPs, but rather previous spills not considered part of this CAU. All other TPH results were below minimum reporting limits.

A.3.4 Total RCRA Metals

The total RCRA metals for soil samples detected above the minimum reporting limits (DOE/NV, 1999) are presented in Table A.3-4. Except for arsenic, all the total RCRA metal results were below PALs (DOE/NV, 1999; EPA, 1998).

Arsenic was detected above the PAL of 3.0 mg/kg in most of the samples analyzed. The arsenic concentrations for the samples analyzed ranged from 2.0 mg/kg to 29.0 mg/kg. The highest concentrations of arsenic (17 mg/kg and 29 mg/kg) were detected in samples collected from depths of 1 and 4 ft bgs at the Area 3 Photoshop site.

The PAL of 3.0 mg/kg is lower than the 7 to 8 ppm (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 several arsenic concentrations presented in Table A.3-4 exceed the PAL, these levels are considered representative of ambient conditions at the sites.

A.3.5 TCLP Silver Results

All soil sample results for TCLP silver at the CAU 429 sites were at concentrations below the minimum reporting limits (DOE/NV, 1999).

A.3.6 Total PCB Results

All soil sample results for PCBs were at concentrations below minimum reporting limits (DOE/NV, 1999).

A.3.7 Isotopic Uranium Results

Uranium results for soil samples detected above the minimum reporting limit (DOE/NV, 1999) are presented in Table A.3-5. The radiological results were not distinguishable from background concentrations listed in the *Off-Site Radiation Exposure Review Project, Phase II Soils Program*

Table A.3-4
Soil Sample Results for Total RCRA Metals Detected Above Minimum Reporting Limits, Area 3 and 9 Underground Discharge Points, TTR
(Page 1 of 4)

Sample Location	Sample Number	Start Depth (ft)	End Depth (ft)	Contaminants of Potential Concern (mg/kg)						
				Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Silver
	Preliminary Action Levels[a]			3.0	100,000	930	450	1,000	560	9,400
GP007	TTR01417	0	1	17	150 (J)[b]	--	5.6 (J)[b]	7.3	--	--
	TTR01418	2	3	29	130 (J)[b]	--	3.7 (J)[b]	5.6	--	--
GP008	TTR01419	0	1	9.3	160 (J)[b]	--	8.5 (J)[b]	11	--	--
	TTR01420	2	3	8.8	130 (J)[b]	--	2.6 (J)[b]	5.8	--	--
GP009	TTR01421	0	1	6.3	140 (J)[b]	--	9.3 (J)[b]	9.8	--	--
	TTR01422	2	3	9.2	120 (J)[b]	--	2.2 (J)[b]	3.8	--	--
B1-0355	TTR01452	5.5	6.5	5.6	73	1.5	17	16	0.17	200 (J)[b, c]
	TTR01454	34	35	13	80	--	8.5	5.5	--	--
	TTR01455	39	40	4.9	98	--	7.4	3.4	--	--
B2-0355	TTR01457	12	13	6.4	120	--	12 (J)[b]	10	--	290 (J)[c, d]
	TTR01458	12	13	5.4	93	--	8.4 (J)[b]	9.4	--	320 (J)[c, d]
	TTR01459	27	28	7.0	120	0.57	82 (J)[b]	13	--	2,900 (J)[c, d]
	TTR01461	39	40	6.9	140	--	6.7 (J)[b]	7.1	--	5.1 (J)[c, d]
	TTR01462	44	45	7.8	160	--	3.7 (J)[b]	7.3	--	3.0 (J)[c, d]
S2-0355	TTR01464	34	35	8.8	110	--	5.8 (J)[b]	6.9	--	--

Table A.3-4
Soil Sample Results for Total RCRA Metals Detected Above Minimum Reporting Limits, Area 3 and 9 Underground Discharge Points, TTR
(Page 2 of 4)

Sample Location	Sample Number	Start Depth (ft)	End Depth (ft)	Contaminants of Potential Concern (mg/kg)						
				Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Silver
	Preliminary Action Levels[a]			3.0	100,000	930	450	1,000	560	9,400
S1-0355	TTR01465	34	35	6.9	96	--	3.7 (J)[b]	5.6	--	--
S4-0355	TTR01469	9	10	7.6	87	--	--	6.8	--	--
S3-0355	TTR01470	34	35	12	130	--	7.4 (J)[b]	7.6	--	--
S5-0355	TTR01471	9	10	7.9	99	--	--	5.8	--	27 (J)[c, d]
S6-0355	TTR01472	9	10	6.2	91	--	--	6.8	--	7.6 (J)[c, d]
ST0952P	TTR01429	3.5	3.5	3.1	33 (J)[b]	--	1.8 (J)[b]	3.0	--	--
ST0952D	TTR01430	3.5	3.5	3.5	70 (J)[b]	--	4.3 (J)[b]	7.8	--	--
B2-0952	TTR01438	7	8	3.9	47	--	7.3	15	0.12	31 (J)[b, c]
	TTR01439	9	10	3.1	59	--	7.2	4.8	--	1.9 (J)[b, c]
	TTR01440	34	35	2.0	81	--	4.3	4.0	--	--
	TTR01441	39	40	2.7	140	--	6.2	4.8	--	--
B1-0952	TTR01443	7	8.5	4.7	58	0.50	7.6	9.1	--	24 (J)[b, c]
	TTR01444	9	10	3.7	49	--	6.8	4.4	--	4.1 (J)[b, c]
	TTR01445	34	35	2.6	200	--	5.6	4.5	--	--
	TTR01446	39	40	2.0	97	--	9.8	4.5	--	--
S2-0952	TTR01448	9	10	5.4	56	--	6.5	5.0	--	--

Table A.3-4
Soil Sample Results for Total RCRA Metals Detected Above Minimum Reporting Limits, Area 3 and 9 Underground Discharge Points, TTR
(Page 3 of 4)

Sample Location	Sample Number	Start Depth (ft)	End Depth (ft)	Contaminants of Potential Concern (mg/kg)						
				Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Silver
	Preliminary Action Levels[a]			3.0	100,000	930	450	1,000	560	9,400
S1-0952	TTR01449	9	10	2.9	31	--	2.1	2.5	--	--
S3-0952	TTR01450	9	10	4.7	57	--	6.0	5.4	--	--
GP001	TTR01401	0	1	3.8 (J)[d]	85	--	5.1 (J)[b]	9.3 (J)[b]	--	--
	TTR01402	3	4	2.6 (J)[d]	53	--	1.7 (J)[b]	5.5 (J)[b]	--	--
GP002	TTR01403	0	1	4.3 (J)[d]	93	--	5.8 (J)[b]	8.5 (J)[b]	--	--
	TTR01404	3	4	5.0 (J)[d]	85	--	5.5 (J)[b]	6.7 (J)[b]	--	--
GP003	TTR01405	0	1	4.0 (J)[d]	88	--	6.2 (J)[b]	11 (J)[b]	--	--
	TTR01406	3	4	4.8 (J)[d]	190	--	7.9 (J)[b]	11 (J)[b]	--	--
GP004	TTR01407	0	1	3.9 (J)[d]	78	--	7.6 (J)[b]	8.3 (J)[b]	--	--
	TTR01408	3	4	3.7 (J)[d]	86	--	5.2 (J)[b]	7.8 (J)[b]	--	--
	TTR01409	3	4	4.4 (J)[d]	95	--	6.4 (J)[b]	8.6 (J)[b]	--	--
GP005	TTR01410	0	1	5.0 (J)[d]	98	--	5.7 (J)[b]	11 (J)[b]	--	--
	TTR01411	3	4	4.6 (J)[d]	75	--	4.6 (J)[b]	9.6 (J)[b]	--	--

Table A.3-4
Soil Sample Results for Total RCRA Metals Detected Above Minimum Reporting Limits, Area 3 and 9 Underground Discharge Points, TTR
(Page 4 of 4)

Sample Location	Sample Number	Start Depth (ft)	End Depth (ft)	Contaminants of Potential Concern (mg/kg)						
				Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Silver
	Preliminary Action Levels[a]			3.0	100,000	930	450	1,000	560	9,400
B1-0374	TTR01477	9	10	3.5	80	--	4.2	8.0	--	--
	TTR01478	9	10	3.3	89	--	4.1	8.4	--	--
	TTR01479	14	15	3.9	82	--	3.9	6.4	--	--
	TTR01480	34	35	3.5	81	--	4.0	7.5	--	--
	TTR01481	39	40	3.6	57	--	4.3	7.2	--	--

[a]EPA Region 9, Industrial PRGs (EPA, 1998)
[b]J qualified because the duplicate precision analyses were outside control limits
[c]J qualified because spike recovery was outside control limits
[d]J qualified because ICP serial dilution recovery was not met
J = Estimated value
-- = Not detected above minimum reporting limit
mg/kg = Milligrams per kilogram
ft = Foot (feet)

Table A.3-5
Soil Sample Results for Isotopic Uranium Detected Above Contract-Required Detection Limit, Area 3 and 9 Underground Discharge Points, TTR

Sample Location	Sample Number	Start Depth (ft)	End Depth (ft)	Contaminants of Potential Concern (pCi/g)		
				Uranium-234[a]	Uranium-235[a]	Uranium-238[b]
	Background Concentration Ranges			0.10 - 2.6	0.05 - 0.10	0.21 - 3.2
B1-0355	TTR01452	5.5	6.5	1.63 ± 0.23	0.080 ± 0.032 (B)	1.44 ± 0.21
	TTR01453	9	10	1.07 ± 0.21	--	1.44 ± 0.25
B2-0355	TTR01457	12	13	1.64 ± 0.25	0.071 ± 0.034 (B)	1.41 ± 0.22
	TTR01459	27	28	1.13 ± 0.17	0.061 ± 0.026 (B)	1.19 ± 0.18
GP001	TTR01402	3	4	0.255 ± 0.078 (J)	--	0.275 ± 0.082 (J)
GP003	TTR01406	3	4	0.373 ± 0.10 (J)	--	0.461 ± 0.12 (J)
GP004	TTR01408	3	4	0.318 ± 0.092 (J)	--	0.300 ± 0.088 (J)
	TTR01409	3	4	0.354 ± 0.10 (J)	--	0.234 ± 0.076 (J)
B1-0374	TTR01477	9	10	0.356 ± 0.10 (J)	--	0.412 ± 0.11 (J)
	TTR01478	9	10	0.306 ± 0.091 (J	--	0.278 ± 0.086 (J)

[a]Background concentration listed in *Environmental Monitoring Report for the Proposed Ward Valley, California Low-Level Radioactive Waste (LLRW) Facility* (Atlan-Tech, 1992)
[b]Background concentration listed or derived in *Off-Site Radiation Exposure Review Project, Phase II Soils Program* (McArthur and Miller, 1989)

-- = Not detected above the minimum reporting limit
B = Analyte concentration is greater than the minimum detectable concentration (MDC), laboratory qualifier only not an estimated value
J = Estimated value because the lab did not certify their dilutions from parent National Institute for Standards and Technology (NIST) Standards
pCi/g = Picocuries per gram

(McArthur and Miller, 1989) or the *Environmental Monitoring Report for the Proposed Ward Valley, California Low-Level Radioactive Waste (LLRW) Facility* (Atlan-Tech, 1992), and therefore do not exceed PALs (DOE/NV, 1999).

A.3.8 Septic Tank Sampling Results

Septic tank sampling analytical results exceeding minimum reporting limits are shown in Table A.3-6. The COPCs detected in the liquid sample include 1, 4-dichlorobenzene, 2-butanone,

Table A.3-6
Summary of Septic Tank Results Detected Above Minimum Reporting Limits, Area 3 and 9 Underground Discharge Points, TTR
(Page 1 of 2)

Sample Matrix	Sample No.	Parameter	Result	Units
Water	TTR01426	1,4-Dichlorobenzene	5.9	µg/L
Water	TTR01426	2-Butanone	100	µg/L
Water	TTR01426	4-Methylphenol	71	µg/L
Water	TTR01426	Acetone	510	µg/L
Water	TTR01426	Arsenic	190	µg/L
Water	TTR01426	Barium	710	µg/L
Water	TTR01426	Benzoic Acid	49 (J)[a]	µg/L
Water	TTR01426	Cadmium	17	µg/L
Water	TTR01426	Chromium	26	µg/L
Water	TTR01426	Lead	34	µg/L
Water	TTR01426	Mercury	0.68	µg/L
Water	TTR01426	Potassium 40	1,350 ± 250 (J)[b]	pCi/L
Water	TTR01426	Phenol	160	µg/L
Water	TTR01426	Selenium	15	µg/L
Sludge	TTR01428	1,4-Dichlorobenzene	130,000	µg/kg
Sludge	TTR01428	2-Butanone	910	µg/kg
Sludge	TTR01428	4-Methylphenol	24,000	µg/kg
Sludge	TTR01428	Acetone	11,000	µg/kg
Sludge	TTR01428	Arsenic	28	µg/g
Sludge	TTR01428	Barium	790 (J)[c]	mg/kg
Sludge	TTR01428	Cadmium	95	µg/g
Sludge	TTR01428	Chromium	31 (J)[c]	mg/kg
Sludge	TTR01428	Lead	71	µg/g
Sludge	TTR01428	Mercury	2.4	mg/kg
Sludge	TTR01428	Phenol	190,000	µg/kg
Sludge	TTR01428	Potassium 40	47.6 ± 6.1 (J)[d]	pCi/g
Sludge	TTR01428	Silver	2,500	mg/kg

Table A.3-6
Summary of Septic Tank Results Detected Above Minimum Reporting Limits, Area 3 and 9 Underground Discharge Points, TTR
(Page 2 of 2)

Sample Matrix	Sample No.	Parameter	Result	Units
Sludge	TTR01428	Toluene	1,700	µg/kg
Sludge	TTR01428	Trichloroethene	2,300	µg/kg
Sludge	TTR01428	TCLP Barium	0.88	mg/L
Sludge	TTR01428	TCLP Silver	7.50	mg/L

J = Estimated
µg/kg = Micrograms per kilogram
µg/g = Micrograms per gram
mg/kg = Milligrams per kilogram
pCi/L = Picocuries per liter
µg/L = Micrograms per liter
mg/L = Milligrams per liter
pCi/g = Picocuries per gram

[a] J qualified because continuing calibration percent difference (%D) greater than 25%.
[b] Dilutions from parent NIST-traceable standards were not certified; the standards used for control checks on the Gamma Spec Data are not listed.
[c] J qualified because duplicate precision analyses were outside control limits.
[d] The standards used for the source checks are not known and the information was not provided by the lab; additionally, the Laboratory Control Sample (LCS) was counted on a detector that failed its source check several times.

4-methylphenol, benzoic acid, phenol, acetone, arsenic, barium, cadmium, chromium, lead, mercury, selenium, potassium-40, carbon disulfide, and toluene.

The COPCs detected in the sludge sample from the septic tank include 1, 4-dichlorobenzene, 2-butanone, 4-methylphenol, phenol, acetone, arsenic, barium, cadmium, chromium, lead, mercury, silver, potassium-40, toluene, trichloroethene, benzene, ethylbenzene, tetrachloroethene, bis (2-ethylhexyl) phthalate, total xylenes, and naphthalene.

Barium and silver were the only COPCs detected above minimum reporting limits for TCLP metals in the sludge sample. The results are shown at the bottom of Table A.3-6. All detections for the TCLP metals analyzed, except for silver, were within the maximum allowable concentrations for the toxicity characteristic (CFR, 1999).

The septic tank contents were determined to be RCRA-regulated hazardous material based on the TCLP-silver result above the regulatory limit of 5.0 mg/L (CFR, 1999).

A.4.0 Quality Assurance

The results of QA/QC activities for CAUs 406 and 429 UDP corrective action investigation sampling events are summarized in the following text. Detailed information regarding the QA program is contained in the Industrial Sites QAPP (DOE/NV, 1996b).

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 matrix spike/matrix spike duplicate (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, 1999) 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, 1996b).

The specified sampling locations were utilized as planned. All samples were collected as specified in the CAIP (DOE/NV, 1999) except for the surface and near-surface soil samples at the south end of the culvert associated with the Heavy Duty Shop UDP because the soil was disturbed and was no longer representative of the preinvestigation soil conditions. 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, 1996b).

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 UDP 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, 1999). 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, 1996b), 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 406 and CAU 429 have been evaluated for data quality according to EPA Functional Guidelines (EPA, 1994a and 1994b). These guidelines were implemented in a tiered process and are presented in the following text. There was one sample that was initially rejected; however, the sample was reextracted and reanalyzed and the subsequent result was usable. 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 the IT Corporation 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/analyzed 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

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

- Matrix spike/matrix spike duplicate percent recoveries (%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 (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 sources 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

The Tier III review 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, half-lives, and process knowledge and history of the facility and site

- 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 at least five percent of the sample analytical data was performed by Laboratory Data Consultants, Inc., in Carlsbad, California. The semivolatile data in Table A.3-6 for sample TTR01426, benzoic acid, was "J" qualified in this final version as a result of the Tier III review.

A.4.7 Quality Control Samples

Thirty quality control samples (i.e., 17 trip blanks, 2 equipment rinsate blanks, 3 field blanks, 2 source blanks, 3 field duplicates, and 3 MS/MSD) 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.

Three field duplicate soil samples were sent as blind samples to the laboratory to be analyzed for the analytical parameters listed in Table A.3-1. For these samples, the duplicate results precision (i.e., RPD between the environmental sample results and their corresponding field duplicate sample results) were evaluated to the guidelines set forth in EPA Functional Guidelines (EPA, 1994a and 1994b). 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 samples and their corresponding field duplicate samples 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 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.

Three field samples were 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 1994b). 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, 1994b). The data reviewer exercises professional judgment 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 judgment 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 not qualified, 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 DataChem. The results of these analyses were used to qualify associated environmental sample results according to EPA Functional Guidelines (EPA, 1994a and 1994b).

The EPA Functional Guidelines (EPA, 1994a and 1994b) 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

During the corrective action investigation, the DOE/NV, Environmental Management office conducted a surveillance of the field sampling procedures to verify that sampling activities were performed in accordance with applicable requirements. The results of the surveillance indicated no findings, deficiencies, or nonconformances with sampling activities as they met the requirements of

the plans and procedures governing the activities at the site. Documentation of these results is retained in project files.

A.4.9 Laboratory Nonconformances

Laboratory nonconformances are generally due to inconsistencies in analytical instrumentation operation, sample preparation, extractions, and fluctuations in internal standard and calibration results. A laboratory nonconformance resulted from failure to report the required initial calibration blank (ICB) data. The laboratory analyzed the ICB sample but the data was inadvertently not saved or printed. 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 CAUs 406 and 429 indicates the following:

- The locations and general configurations of three CASs were identified. The UPS UDPs were not identified during this investigation.
- All concentrations of total VOCs, total SVOCs, and PCBs in soil samples were below the PALs outlined in the CAIP (DOE/NV, 1999) at all CASs.
- All concentrations of total RCRA metals in soil samples were below PALs established in the CAIP (DOE/NV, 1999) except for arsenic. Although the concentrations of arsenic exceeded the PAL, the concentrations are considered representative of ambient conditions for the TTR.
- Total petroleum hydrocarbons exceeded the NDEP action level of 100 mg/kg for diesel in one soil sample collected at the UPS Building 03-58; however, this sample result is not associated with the UDP, but rather previous spills not considered a part of the CAU. All other results either did not exceed action levels or were below the minimum reporting limits as specified in the CAIP (DOE/NV, 1999).
- Radiological results for soil samples are not considered to be statistically different from their respective established background levels and, therefore, are below PALs.
- Analytical results from the liquid sample collected from the septic tank at CAU 429 indicated detection of COPCs to include 1, 4-dichlorobenzene, 2-butanone, 4-methylphenol, benzoic acid, phenol, acetone, arsenic, barium, cadmium, chromium, lead, mercury, selenium, potassium-40, carbon disulfide, and toluene.
- Analytical results from the sludge sample collected from the septic tank at CAU 429 indicated detection of COPCs to include 1, 4-dichlorobenzene, 2-butanone, 4-methylphenol, phenol, acetone, arsenic, barium, cadmium, chromium, lead, mercury, silver, potassium-40, toluene, trichloroethene, benzene, ethylbenzene, tetrachloroethene, bis (2-ethylhexyl) phthalate, total xylenes, and naphthalene.
- The contents of the septic tank were determined to be RCRA-regulated hazardous material based on the TCLP-silver result above the regulatory limit of 5.0 mg/L (CFR, 1999). The contents of the septic tank were removed for proper disposal. The supporting documentation is included in Appendix D.

A.6.0 References

Atlan-Tech. 1992. *Environmental Monitoring Report for the Proposed Ward Valley, California Low-Level Radioactive Waste (LLRW) Facility.* Rosewall, GA.

BN, see Bechtel Nevada.

Bechtel Nevada. 1999. Correspondence from Bechtel Nevada Survey Department to D. Arnold (SAIC) regarding coordinates surveyed on 8-19-99 and 9-08-99 for Area 3 and Area 9 Underground Discharge Points Investigation. Las Vegas, NV.

CFR, see *Code of Federal Regulations*.

Code of Federal Regulations. 1999. Title 40 CFR Parts 260-282, "RCRA Regulations." Washington, DC: U.S. Government Printing Office.

DOE, see U.S. Department of Energy.

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

EPA, see U.S. Environmental Protection Agency.

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.

Grindler, J.E. 1962. *The Radiochemistry of Uranium*, NAS-NS-3050. Washington, DC: National Academy of Science.

Horwitz, E.P., M.L. Dietz, R. Chiarizia, H. Diamond, A.M. Essling, and D. Graczyk. 1992. "Separation and Preconcentration of Uranium from Acidic Media by Extraction Chromatography." In *Analytica Chimica Acta,* 266: 25-37.

IT, see IT Corporation.

IT Corporation. 1999. *Site-Specific Health and Safety Plan for CAUs 406 and 429, Investigation of Underground Discharge Points, Tonopah Test Range.* Las Vegas, NV.

McArthur, R.D., and F.L. Miller. 1989. *Off-Site Radiation Exposure Review Project, Phase II Soil Program*, DOE/NV/10384--23. Las Vegas, NV: Desert Research Institute.

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

NAC, see *Nevada Administrative Code*.

NBMG, see Nevada Bureau of Mines and Geology.

Nevada Administrative Code. 1997. NAC 445A.227, "Contamination of soil: Order by director of corrective action; factors to be considered in determining whether corrective action is required." Carson City, NV.

Nevada Bureau of Mines and Geology. 1998. *Mineral and Energy Resource Assessment of the Nellis Air Force Range*, Open-File Report 98-1. Reno, NV.

SNL, see Sandia National Laboratories.

Sandia National Laboratories. 1999. *1998 Annual Site Environmental Report, Tonopah Test Range, Nevada*, SAND99-2279. Albuquerque, NM.

U.S. Department of Energy. 1992. *Environmental Measurements Laboratory Procedures Manual*, HASL-300. Washington, DC.

U.S. Department of Energy, Nevada Operations Office. 1996a. *Corrective Action Unit Work Plan, Tonopah Test Range, Nevada,* Rev. 0, DOE/NV--443. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1996b. *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. 1998. *Corrective Action Decision Document for the Area 3 Landfill Complex, Tonopah Test Range, Nevada, Corrective Action Unit 424,* Rev. 0, DOE/NV--496. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1999. *Corrective Action Investigation Plan for Corrective Action Unit 406: Area 3 Building 03-74 & Building 03-58 Underground Discharge Points and Corrective Action Unit 429: Area 3 Building 03-55 & Area 9 Building 09-52 Underground Discharge Points, Tonopah Test Range, Nevada,* Rev. 0, DOE/NV--547. Las Vegas, NV.

U.S. Environmental Protection Agency. 1980. *Prescribed Procedures for Measurements of Radioactivity in Drinking Water*, EPA-600/4-79-020. Washington, DC.

U.S. Environmental Protection Agency. 1987. *Data Quality Objectives for Remedial Response Activities*, EPA/540/G-87-003. Washington, DC.

U.S. Environmental Protection Agency. 1994a. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013. Washington, DC.

U.S. Environmental Protection Agency. 1994b. *Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA 540/R-94/012. Washington, DC.

U.S. Environmental Protection Agency. 1994c. *Guidance for the Data Quality Objectives Process*, EPA QA/G-4. Washington, DC.

U.S. Environmental Protection Agency. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, CDROM*, CDROM PB97-5019286GEI (CDROM contains updates 1986, 1992, 1994, and 1996). Washington, DC.

U.S. Environmental Protection Agency. 1998. Memo from S.J. Smucker to PRG Table Mailing List regarding Region 9 Preliminary Remediation Goals (PRGs), 1 August. San Francisco, CA.

Appendix B

Soil Boring Logs

SOIL BORING LOG

Project Name: Area 3 Heavy Duty Shop	BORING NUMBER: B1-0374
PROJECT NUMBER: 776712.20020100	DATE HOLE STARTED: 08/03/99
Surface Elevation:1674.06	DATE HOLE COMPLETED: 08/03/99
TOTAL DEPTH DRILLED (feet): 40.00	GEOLOGIST: R. Locklear
ENVIRONMENTAL CONTRACTOR: IT Corporation	QA CHECK: D. Arnold
DRILLING METHOD: Rotosonic	Northing: 4181931.76
DRILLING CONTRACTOR: Boart Longyear	Easting: 521308.92
	Comments: Soil colors per Munsell Soil Color Chart

Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		SP	Silty Sand, very pale brown (10YR 7/3) from 0-1 ft, yellowish brown (10YR 5/6) from 1-5 ft. Moist after the first 6 in, unconsolidated with no visible staining. Small amount of pea gravel noted from 4-5 ft depth.	Location: Area 3 Heavy Duty Shop. Organic material from 0-1 ft	
	1.0				Approximately 3 ft of fill was used to level surface at borehole location. This fill was generated by Westinghouse Front-End Loader from soil adjacent to borehole location in drainage ditch	
5.0				Gravelly Silty Sand, (10YR 5/6). Moist, unconsolidated with no staining. Mostly pea size gravel with a minimal amount of larger gravel.		
	2.0					
10.0	3.0			Silty Gravelly Sand, (10YR 5/6). Moist, partially consolidated with no staining. Fines content increased with depth. 11-12 ft showed increased moisture.	Sample TTR01478 was Field Duplicate of TTR01477	TTR01477 TTR01478
	4.0					
				No soil description available for Geotechnical Sample		TTR01479
15.0					Geotechnical Sample was collected at 15-16.5 ft depth	TTR01482
	5.0			Silty Gravelly Sand, (10YR 5/6). Moist, unconsolidated with no staining.		
20.0	6.0			Silty Gravelly Sand, (10YR 5/6). Moist, unconsolidated with no staining.		
	7.0					
25.0				Silty Gravelly Sand, (10YR 5/6). Moist, unconsolidated with no staining.		
	8.0					
	9.0					
30.0				Silty Gravelly Sand, brownish yellow (10YR 6/8) at 31 ft depth. Moist, unconsolidated with no staining.		
	10.0					TTR01480
35.0				Silty Gravelly Sand, (10YR 6/8). Moist, unconsolidated with no staining.	All samples have shown consistency	
	11.0					
	12.0					TTR01481
40.0						

SOIL BORING LOG	BORING NUMBER: B1-0952	CAU 406 & 429 CADD/CR Appendix B Revision: 0 Date: 03/24/2000 Page B-2 of B-14
Project Name: Area 9 Mobile Photo Lab	DATE HOLE STARTED: 07/28/99	
PROJECT NUMBER: 776712.20020100	DATE HOLE COMPLETED: 07/28/99	
Surface Elevation:1630.49	GEOLOGIST: R. Locklear	
TOTAL DEPTH DRILLED (feet): 40.00	QA CHECK: D. Arnold	
ENVIRONMENTAL CONTRACTOR: IT Corporation	Northing: 4188819.04	
DRILLING METHOD: Rotosonic	Easting: 525762.51	
DRILLING CONTRACTOR: Boart Longyear	Comments: Soil colors per Munsell Soil Color Chart	

Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0			Open Hole - No Formation / No Recovery	Location: Area 9 Mobile Photo Lab	
	1.0					
5.0				Sandy Gravel, dark yellowish brown (10YR 4/6). Dry, unconsolidated with no visible staining noted.		
	2.0		GP			TTR01443
			SM	Silty Sand, (10YR 4/6). Moist, partially consolidated with no staining.		TTR01444
10.0	3.0				Bottom of UDP determined to be at 9.5 ft bgs	
	4.0			Silty Sand, light brownish gray (10YR 6/2). Moist, consolidated, no staining with less than 5% fines.		
15.0				Silty Sand, pale brown (10YR 6/3). Moist, partially consolidated with no staining and greater than 5% fines.		TTR01442
	5.0				Geotechnical Sample collected at 15.5-16.5 ft depth	
	6.0		SP	Poorly Graded Sand, (10YR 6/3). Moist, partially consolidated with no staining and greater than 5% fines.		
	7.0					
25.0				Poorly Graded Sand, (10YR 6/3). Moist, unconsolidated with no staining and less than 5% fines.		
	8.0					
	9.0					
30.0				Silty Sand (10YR 6/3). Moist, partially consolidated with no staining and greater than 5% fines.	Difficulty encountered with casing coming out of the ground	
	10.0					
35.0						TTR01445
	11.0			Silty Sand, (10YR 6/3). Moist, unconsolidated with no staining and greater than 5% fines.		
	12.0					TTR01446
40.0						

SOIL BORING LOG	BORING NUMBER: B2-0952
Project Name: Area 9 Mobile Photo Lab	DATE HOLE STARTED: 07/28/99
PROJECT NUMBER: 776712.20020100	DATE HOLE COMPLETED: 07/28/99
Surface Elevation:1630.37	GEOLOGIST: R. Locklear
TOTAL DEPTH DRILLED (feet): 40.00	QA CHECK: D. Arnold
ENVIRONMENTAL CONTRACTOR: IT Corporation	Northing: 4188819.77
DRILLING METHOD: Rotosonic	Easting: 525771.11
DRILLING CONTRACTOR: Boart Longyear	Comments: Soil colors per Munsell Soil Color Chart

Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0			Open Hole - No Formation / No Recovery	Location: Area 9 Mobile Photo Lab	
	1.0			Sandy Gravel, dark yellowish brown (10YR 4/6). Dry, no staining noted. Large angular UDP rocks.		
5.0						
	2.0		GP	Silty Sand, (10YR 4/6). Moist, partially consolidated. Black staining noted from 9-9.5 ft depth.	There appears to be a 4 in x 4 in concrete block wall down to 7 ft	TTR01438
			SM	Gravelly Sand, gray (7.5YR 6/1). Moist, unconsolidated with no staining.	Bottom of UDP determined to be at 9 ft bgs	TTR01439
10.0	3.0		SP			
			SM	Silty Sand, (7.5YR 6/1). Moist, partially consolidated with no staining.		
	4.0					
15.0			SP	Silty Gravelly Sand, (7.5YR 6/1). Moist, partially consolidated with no staining. Increasing fines with depth.		
	5.0					
20.0	6.0			Sand, brown (10YR 5/3). Moist, unconsolidated with no staining and less than 5% fines.		
	7.0					
25.0				Sand, (10YR 5/3). Moist, unconsolidated with no staining and very few fines.		
	8.0					
	9.0					
30.0				Sand, light brownish gray (10YR 6/2). Moist, unconsolidated with no staining.		
	10.0					TTR01440
35.0				Sand, (10YR 6/2). Moist, unconsolidated with no staining and less than 5% fines.		
	11.0				Formation continues to be very consistent; only slight variation in color	
	12.0					TTR01441
40.0						

SOIL BORING LOG	BORING NUMBER: S1-0952	CAU 406 & 429 CADD/CR Appendix B Revision: 0 Date: 03/24/2000 Page B-4 of B-14
Project Name: Area 9 Mobile Photo Lab	DATE HOLE STARTED: 07/29/99	
PROJECT NUMBER: 776712.20020100	DATE HOLE COMPLETED: 07/29/99	
Surface Elevation:1630.10	GEOLOGIST: R. Locklear	
TOTAL DEPTH DRILLED (feet): 15.00	QA CHECK: D. Arnold	
ENVIRONMENTAL CONTRACTOR: IT Corporation	Northing: 4188825.09	
DRILLING METHOD: Rotosonic	Easting: 525763.47	
DRILLING CONTRACTOR: Boart Longyear	Comments: Soil colors per Munsell Soil Color Chart	

Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		SP	Poorly Graded Sand; white (10YR 8/1), dry from 0-6 in. Dark yellowish brown (10YR 4/4); moist, unconsolidated with no staining and a wide range of sand grain sizes from 6 in to 5 ft depth.	Location: Area 9 Mobile Photo Lab - Stepout #1	
	1.0					
5.0				Gravelly Sand, (10YR 4/4). Moist, unconsolidated with no staining.		
	2.0				7-8 ft XRF only	
				Gravelly Sand, dark yellowish brown (10YR 4/6). Moist, unconsolidated with no staining.		TTR01449
10.0	3.0		SM	Silty Sand, (10YR 4/6). Wet, partially consolidated with no staining and greater than 5% fines.		
			SP	Gravelly Sand, (10YR 4/4). Moist, unconsolidated with no staining noted.	Soil continued to be fairly consistent, varying slightly in	
	4.0					
15.0						

SOIL BORING LOG	BORING NUMBER: S2-0952
Project Name: Area 9 Mobile Photo Lab	DATE HOLE STARTED: 07/28/99
PROJECT NUMBER: 776712.20020100	DATE HOLE COMPLETED: 07/28/99
Surface Elevation:1630.25	GEOLOGIST: R. Locklear
TOTAL DEPTH DRILLED (feet): 15.00	QA CHECK: D. Arnold
ENVIRONMENTAL CONTRACTOR: IT Corporation	Northing: 4188823.38
DRILLING METHOD: Rotosonic	Easting: 525766.84
DRILLING CONTRACTOR: Boart Longyear	Comments: Soil colors per Munsell Soil Color Chart

Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		SP	Silty Gravelly Sand, brown (10YR 4/3). Dry, unconsolidated with no visible staining.	Location: Area 9 Mobile Photo Lab - Stepout #2	
	1.0			Silty Gravelly Sand, (10YR 4/3). Moist, unconsolidated with no staining.		
5.0						
	2.0				7-8 ft sample for XRF only	
						TTR01448
10.0	3.0		SM	Silty Sand, (10YR 4/3). Moist, unconsolidated with no staining noted.		
	4.0					
15.0						

SOIL BORING LOG	BORING NUMBER: S3-0952	CAU 406 & 429 CADD/CR Appendix B Revision: 0 Date: 03/24/2000 Page B-6 of B-14
Project Name: Area 9 Mobile Photo Lab	DATE HOLE STARTED: 07/29/99	
PROJECT NUMBER: 776712.20020100	DATE HOLE COMPLETED: 07/29/99	
Surface Elevation:1629.94	GEOLOGIST: R. Locklear	
TOTAL DEPTH DRILLED (feet): 15.00	QA CHECK: D. Arnold	
ENVIRONMENTAL CONTRACTOR: IT Corporation	Northing: 4188823.99	
DRILLING METHOD: Rotosonic	Easting: 525776.87	
DRILLING CONTRACTOR: Boart Longyear	Comments: Soil colors per Munsell Soil Color Chart	

Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		GP	First 6 inches were a dry gravel/sand mix.	Location: Area 9 Mobile Photo Lab - Stepout #3	
			SP	Gravelly Sand, brown (10YR 5/3). Moist, unconsolidated.		
	1.0					
5.0						
	2.0			Gravelly Sand, yellowish brown (10YR 5/6). Wet, unconsolidated with less than 5% fines.	7-8 ft sample analyzed for XRF only	
			SM	Silty Sand, light yellowish brown (10YR 6/4). Moist, partially consolidated with greater than 5% fines.	Soil continued to be fairly consistent, varying slightly in color	TTR01450
10.0	3.0		SP	Gravelly Sand, brownish yellow (10YR 6/8). Moist, unconsolidated with less than 5% fines. Soil had a reddish tint.		
	4.0		SM	Silty Sand, (10YR 6/4). Moist, unconsolidated with greater than 5% fines.		
15.0						

SOIL BORING LOG	BORING NUMBER: B1-0355	CAU 406 & 429 CADD/CR Appendix B Revision: 0 Date: 03/24/2000 Page B-7 of B-14
Project Name: Area 3 Photo Lab	DATE HOLE STARTED: 07/29/99	
PROJECT NUMBER: 776712.20020100	DATE HOLE COMPLETED: 07/29/99	
Surface Elevation:1680.80	GEOLOGIST: R. Locklear	
TOTAL DEPTH DRILLED (feet): 40.00	QA CHECK: D. Arnold	
ENVIRONMENTAL CONTRACTOR: IT Corporation	Northing: 4181850.38	
DRILLING METHOD: Rotosonic	Easting: 521614.47	
DRILLING CONTRACTOR: Boart Longyear	Comments: Soil colors per Munsell Soil Color Chart	

Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		GP	Pea gravel and sand mix, grayish brown (10YR 5/2). Soil became moist after 6 in.	Location: Area 3 Photo Lab	
				Open Hole, No Sediment / No Recovery		
	1.0					
5.0			GP	Black leachfield material, pea gravel and sand mixed. Staining noted.	Base of UDP was determined to be at 6 ft depth	
	2.0			Gravel/Sand Mix, reddish yellow (7.5YR 6/8). Moist, partial consolidation with some compaction. Greater than 5% fines with staining noted from 6.5 to 8 ft depth.	Boulder-size rock as large as baseballs noted from 5-10 ft depth.	TTR01452
10.0	3.0			Gravel/Sand Mix, (7.5 YR 6/8). Moist, partially consolidated with no staining noted. Large amounts of all sizes of gravel with fines and sand. Very consistent.		TTR01453
	4.0					
15.0				Gravel/Sand Mix, (7.5 YR 6/8). Moist, partially consolidated with increased sand.	Core samples alternating between sand and silt	
	5.0			Gravel/Sand Mix, dark yellowish brown (10YR 4/4). Moist, consolidated with increased silt.		
20.0	6.0			Gravel/Sand Mix, dark yellowish brown (10YR 4/6). Moist, unconsolidated sandy gravel with no staining.	Gravel size and content is decreasing	
	7.0			Gravelly Sand, (10YR 4/4). Moist, consolidated with greater than 5% fines. No staining noted.		
25.0			SP			
	8.0		GP	Gravel/Sand Mix, brown (10YR 5/3). Moist, unconsolidated with an increase in gravel and sand, and decrease in fines.		
				Gravel/Sand Mix, (7.5YR 6/8). Moist, unconsolidated with a decrease in gravel size.		
30.0	9.0				An obvious change in lithology to very fine grain sand with extreme compaction was noted from 34-35 ft depth	
	10.0			Gravelly Sand, white (7.5YR 8/1). Moist, partially consolidated silty sand.		TTR01454
35.0			SP			
	11.0		GP	Silty Sand with pea gravel (7.5YR 8/1). Soil was unconsolidated.	Sample came to surface very hot, dry and hard due to extreme heat generated downhole	
			SP	Very Silty Sand (7.5YR 8/1). Dry, unconsolidated and hard.		
	12.0					TTR01455
40.0						

SOIL BORING LOG	BORING NUMBER: B2-0355	CAU 406 & 429 CADD/CR Appendix B Revision: 0 Date: 03/24/2000 Page B-8 of B-14
Project Name: Area 3 Photo Lab	DATE HOLE STARTED: 07/29/99	
PROJECT NUMBER: 776712.20020100	DATE HOLE COMPLETED: 07/29/99	
Surface Elevation: 1680.45	GEOLOGIST: R. Locklear	
TOTAL DEPTH DRILLED (feet): 45.00	QA CHECK: D. Arnold	
ENVIRONMENTAL CONTRACTOR: IT Corporation	Northing: 4181848.45	
DRILLING METHOD: Rotosonic	Easting: 521623.98	
DRILLING CONTRACTOR: Boart Longyear	Comments: Soil colors per Munsell Soil Color Chart	

Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		GP	Gravel/Sand Mix, brown (7.5YR 5/4). Moist, unconsolidated with no visible staining. Large gravel noted at 9 ft, indicating UDP material.	Location: Area 3 Photo Lab	
	1.0				Open hole to 6 ft depth	
5.0						
	2.0			Gravel/Sand Mix, very pale brown (10YR 7/4). Soil was dry and unconsolidated.	When drilling began, drill went straight down to 10 ft, but only 48 in were recovered. Fill material may have been pushed to the side	
10.0	3.0			Silty Sand, yellowish brown (10YR 5/6). Soil was moist and consolidated.		
	4.0			Sandy Gravel, (10YR 7/4). Soil was dry and unconsolidated.	Sample TTR01458 was Field Duplicate of TTR01457	TTR01457 TTR01458
15.0				Gravel/Sand Mix, (10YR 5/6). Moist and unconsolidated with golf-ball size gravel noted. Consistent with previous core.	Casing run to 16 ft	
	5.0					
20.0	6.0			Brown (10YR 5/3). Moist, unconsolidated with large boulders and sand. At 24 ft depth the formation turned very dark gray (10YR 3/1).		
	7.0				Debris which appears to be a form of copper (man-made) was noted at 26 ft depth. Entire borehole is not consistent with any of the previous boreholes.	
25.0				Sandy Gravel, (10YR 3/1). Moist, unconsolidated with baseball size boulders.		
	8.0					TTR01459
30.0	9.0			Sandy Gravel, (10YR 3/1). Unconsolidated sand with boulder-size pieces. Very consistent with the 25-30 ft sample.	Suspect that core barrel is filling up and pushing remaining fill material to the side	
	10.0					TTR01460
35.0				Gravelly Sand, (10YR 5/6). Moist and partially consolidated. Distinct change at 35 ft depth; more sand than gravel with some silt.	The suspect backfill ended abruptly at 35 ft depth	
	11.0					
	12.0				35 to 45 ft was very consistent, appears to be native	TTR01461
40.0				Gravelly Sand, (10YR 5/6). Very consistent with 35-40 ft sample.		
	13.0					
45.0						TTR01462

SOIL BORING LOG	BORING NUMBER: S1-0355	CAU 406 & 429 CADD/CR Appendix B Revision: 0 Date: 03/24/2000 Page B-9 of B-14
Project Name: Area 3 Photo Lab	DATE HOLE STARTED: 07/30/99	
PROJECT NUMBER: 776712.20020100	DATE HOLE COMPLETED: 07/30/99	
Surface Elevation:1680.50	GEOLOGIST: R. Locklear	
TOTAL DEPTH DRILLED (feet): 40.00	QA CHECK: D. Arnold	
ENVIRONMENTAL CONTRACTOR: IT Corporation	Northing: 4181844.05	
DRILLING METHOD: Rotosonic	Easting: 521625.84	
DRILLING CONTRACTOR: Boart Longyear	Comments: Soil colors per Munsell Soil Color Chart	

Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		SP	Silty Gravelly Sand, yellowish brown (10YR 5/4). Moist, unconsolidated with no staining. Greater than 5% gravel with less than 5% fines, very consistent.	Location: Area 3 Photo Lab - Stepout #1	
	1.0					
5.0				Silty Gravelly Sand, (10YR 5/4). Moist, unconsolidated with no staining noted. Less than 5% gravel and silt. Very consistent with previous core.		
	2.0					
10.0	3.0			Gravelly Sand, brown (10YR 5/3). Moist, unconsolidated with no visible staining. Increase in gravel with a decrease in fines compared to 5-10 ft depth.	First casing set at 10 ft	
	4.0					
15.0				Gravelly Sand, (10YR 5/3). Moist, unconsolidated with no staining.		
	5.0					
20.0	6.0			Gravelly Sand, brownish yellow (10YR 6/8) from 20-22 ft, 10YR 5/3 from 22-25 ft. Moist, unconsolidated with no staining.		
	7.0					
25.0				Silty Gravelly Sand, (10YR 5/3). Moist, partially consolidated with no staining.		
	8.0			Silty Gravelly Sand, gray (10YR 6/1). Moist, partially consolidated with no staining.		
	9.0					
30.0				Silty Gravelly Sand, (10YR 5/3). Moist, partially compacted with no staining, and greater than 5% silt.		
	10.0			Gravelly Sand, yellowish brown (10YR 5/6). Moist, unconsolidated with no staining.		TTR01465
35.0				Silty Sandy Gravel,(10YR 5/3). Moist, unconsolidated with no staining. Core was consistent throughout.		
	11.0					
	12.0					
40.0						

SOIL BORING LOG	BORING NUMBER: S2-0355	CAU 406 & 429 CADD/CR Appendix B Revision: 0 Date: 03/24/2000 Page B-10 of B-14
Project Name: Area 3 Photo Lab	DATE HOLE STARTED: 07/30/99	
PROJECT NUMBER: 776712.20020100	DATE HOLE COMPLETED: 07/30/99	
Surface Elevation:1680.38	GEOLOGIST: R. Locklear	
TOTAL DEPTH DRILLED (feet): 40.00	QA CHECK: D. Arnold	
ENVIRONMENTAL CONTRACTOR: IT Corporation	Northing: 4181849.02	
DRILLING METHOD: Rotosonic	Easting: 521628.68	
DRILLING CONTRACTOR: Boart Longyear	Comments: Soil colors per Munsell Soil Color Chart	

Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		SP	Silty Gravelly Sand, yellowish brown (10YR 5/6). Moist, unconsolidated, pea-size gravel with no visible staining.		
	1.0					
5.0				Gravelly Sand, yellowish brown (10YR 5/4). Moist, unconsolidated with no staining. Gravel size increase (5% content) noted from 7-10 ft depth.		
	2.0					
10.0	3.0			Gravelly Sand, light yellowish brown (10YR 6/4). Moist, unconsolidated with no staining. Large gravel (25% content) was consistent with 7-10 ft depth.		
	4.0					
15.0				Gravelly Sand, (10YR 6/4). Moist, unconsolidated pea-size gravel with no staining noted.		
	5.0			Silty Gravelly Sand, reddish yellow (7.5YR 6/8). Moist, partially consolidated with no staining. Soil color appeared reddish brown.		
20.0	6.0			Silty Gravelly Sand, (7.5YR 6/8). Moist, unconsolidated pea size gravel with no staining.		
	7.0					
25.0				Silty Gravelly Sand, (7.5YR 6/8). Moist, unconsolidated pea size gravel with no staining. Increase in fines (less than 5%) from 29-30 ft depth, with slight color change to reddish yellow (7.5YR 6.6).		
	8.0					
30.0	9.0			Sandy Silty Clay, (10YR 5/6). Soil was moist and unconsolidated.		
			CL	Gravelly Sandy Clay, (7.5YR 6/8). Very high clay content with some sand and gravel.		
	10.0		SP			
35.0				Gravelly Silty Sand, light gray (10YR 7/1). Soil was dry and partially consolidated.		
	11.0					
				Silty Gravelly Sand, (7.5 YR 6/8). Soil was moist and unconsolidated.		
	12.0					
40.0						

SOIL BORING LOG	BORING NUMBER: S3-0355
Project Name: Area 3 Photo Lab	DATE HOLE STARTED: 08/02/99
PROJECT NUMBER: 776712.20020100	DATE HOLE COMPLETED: 08/02/99
Surface Elevation:1680.58	GEOLOGIST: R. Locklear
TOTAL DEPTH DRILLED (feet): 40.00	QA CHECK: D. Arnold
ENVIRONMENTAL CONTRACTOR: IT Corporation	Northing: 4181853.06
DRILLING METHOD: Rotosonic	Easting: 521625.24
DRILLING CONTRACTOR: Boart Longyear	Comments: Soil colors per Munsell Soil Color Chart

Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		SP	Gravelly Sand, light gray (10YR 7/2) from 0-1 ft; brownish yellow (10YR 6/6) from 1-5 ft. Moist, unconsolidated, with no visible staining noted.	Location: Area 3 Photo Lab - Stepout #3	
	1.0					
5.0				Gravelly Sand, (10YR 6/6). Moist, unconsolidated with no staining noted.		
	2.0					
				Gravelly Sand, brownish yellow (10YR 6/8). Partial consolidation with increased fines.		
10.0	3.0			Silty Gravelly Sand, (10YR 6/6). Moist, unconsolidated with no staining noted.	First casing run to 10 ft	
	4.0					
15.0				Silty Gravelly Sand, (10YR 6/6). Moist, partially consolidated with no staining.		
	5.0					
	6.0					
20.0				Gravelly Sand, (10YR 6/6). Moist, unconsolidated with no staining.	Formation showed consistency from 0-20 ft depth	
	7.0			Silty Gravelly Sand, (10YR 6/8). Moist, unconsolidated with no staining.		
25.0				Gravelly Sand, light yellowish brown (10YR 6/4). Moist, unconsolidated with no staining noted.		
	8.0					
	9.0					
30.0				Gravelly Sand, (10YR 6/4). Moist, unconsolidated with no staining.		
	10.0			Silty Gravelly Sand, very pale brown (10YR 7/4). Moist, partially consolidated.		TTR01470
35.0				Silty Gravelly Sand, (10YR 7/4). Moist, partially consolidated with no staining.		
	11.0					
	12.0					
40.0						

SOIL BORING LOG	BORING NUMBER: S4-0355	CAU 406 & 429 CADD/CR Appendix B Revision: 0 Date: 03/24/2000 Page B-12 of B-14
Project Name: Area 3 Photo Lab	DATE HOLE STARTED: 08/02/99	
PROJECT NUMBER: 776712.20020100	DATE HOLE COMPLETED: 08/02/99	
Surface Elevation:1680.96	GEOLOGIST: R. Locklear	
TOTAL DEPTH DRILLED (feet): 15.00	QA CHECK: D. Arnold	
ENVIRONMENTAL CONTRACTOR: IT Corporation	Northing: 4181849.33	
DRILLING METHOD: Rotosonic	Easting: 521610.43	
DRILLING CONTRACTOR: Boart Longyear	Comments: Soil colors per Munsell Soil Color Chart	

Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		SP	Gravelly Sand, pale brown (10YR 6/3); dry, unconsolidated with no visible staining noted from 0-6 in depth. Soil was yellowish brown (10YR 5/6); dry, unconsolidated with no staining from 6 in to 5 ft depth.	Location: Area 3 Photo Lab - Stepout #4	
	1.0					
5.0				Gravelly Sand, (10YR 5/6). Moist, unconsolidated with no staining.		
	2.0			Gravelly Sand, (10YR 6/3). Moist, unconsolidated with no staining. Soil began to turn reddish brown (5YR 5/6) at approximately 9.5 ft.		TTR01469
10.0	3.0			Gravelly Sand, yellowish red (5YR 5/6). Moist, unconsolidated with no staining noted.		
	4.0					
15.0						

SOIL BORING LOG	BORING NUMBER: S5-0355	CAU 406 & 429 CADD/CR Appendix B Revision: 0 Date: 03/24/2000 Page B-13 of B-14
Project Name: Area 3 Photo Lab	DATE HOLE STARTED: 08/02/99	
PROJECT NUMBER: 776712.20020100	DATE HOLE COMPLETED: 08/02/99	
Surface Elevation:1680.85	GEOLOGIST: R. Locklear	
TOTAL DEPTH DRILLED (feet): 16.50	QA CHECK: D. Arnold	
ENVIRONMENTAL CONTRACTOR: IT Corporation	Northing: 4181852.19	
DRILLING METHOD: Rotosonic	Easting: 521617.70	
DRILLING CONTRACTOR: Boart Longyear	Comments: Soil colors per Munsell Soil Color Chart	

Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		SP	Gravelly Sand, pale brown (10YR 6/3). Moist after first 6 in, unconsolidated with no visible staining noted.	Location: Area 3 Photo Lab - Stepout #5	
	1.0					
5.0				Gravelly Sand, yellowish brown (10YR 5/4). Moist, unconsolidated with no staining noted. Increased moisture noted at 5-10 ft depth.	Difficult to distinguish soil color between 10YR 6/3 and 10YR 5/6	
	2.0					
						TTR01471
10.0	3.0			Gravelly Sand, (10YR 5/4). Moist, unconsolidated with no staining. Soil was very consistent. Increased moisture noted from 10-15 ft depth.		
	4.0					
15.0				No soil description available.	Geotechnical Sample collected at 15.0-16.5 ft depth	TTR01473
	5.0					

SOIL BORING LOG	BORING NUMBER: S6-0355	CAU 406 & 429 CADD/CR Appendix B Revision: 0 Date: 03/24/2000 Page B-14 of B-14
Project Name: Area 3 Photo Lab	DATE HOLE STARTED: 08/02/99	
PROJECT NUMBER: 776712.20020100	DATE HOLE COMPLETED: 08/02/99	
Surface Elevation:1680.75	GEOLOGIST: R. Locklear	
TOTAL DEPTH DRILLED (feet): 15.00	QA CHECK: D. Arnold	
ENVIRONMENTAL CONTRACTOR: IT Corporation	Northing: 4181846.72	
DRILLING METHOD: Rotosonic	Easting: 521618.77	
DRILLING CONTRACTOR: Boart Longyear	Comments: Soil colors per Munsell Soil Color Chart	

Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		SP	Gravelly Sand, light gray (10YR 7/2); dry, unconsolidated with no visible staining noted from 0-6 in. Yellowish brown (10YR 5/6); moist, unconsolidated with no staining from 6 in to 5 ft depth.	Location: Area 3 Photo Lab - Stepout #6	
5.0	1.0			Gravelly Sand, (10YR 5/6). Moist, unconsolidated with no staining.		
	2.0					TTR01472
10.0	3.0			Silty Sand, (10YR 5/6). Wet, consolidated, greater than 5% fines with no staining.		
				Gravelly Sand, pale brown (10YR 6/3). Moist, unconsolidated with no staining.		
	4.0					
15.0						

Appendix C

Field Screening of Soil for Silver by X-Ray Fluorescence (XRF), CAU 406 & 429

(As received from Bechtel Nevada [BN])

FIELD SCREENING OF SOIL FOR SILVER BY X-RAY FLUORESCENCE (XRF) CAU 406 & CAU 429

Kraig Knapp, Bechtel Nevada, M/S NTS306, P.O. Box 98521, Las Vegas, NV 89193-8521
August 18, 1999

A Spectrace Model 9240 X-Ray Fluorescence (XRF) was used to screen soil samples in Area 3 and Area 9 (CAU 406 & 429) of the Tonopah Test Range (TTR) from July 27, 1999 through August 2, 1999. 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.

The method of analysis was to dry the sample in the sun if necessary. It 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 ~3.0g to ~10.0g. 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 particular instrument, and provides built-in software which compensates for these effects to calculate 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, once a day a pellet of pure iron and a cylinder of Teflon as the blank is run. The iron was always within 1 percent of the expected 100 percent, and the Teflon was always 0 percent iron.

Before going into the field, a set of soil samples known to have no silver from Area 9, had a known amount of silver nitrate added in solution. This produced a set of standards ranging from 0 ppm silver to 1,000 ppm silver. When in the field, 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 limit of detection of silver in a soil matrix was approximately 60 ppm.

Another factor was that 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 only explanation that can be offered is that the standards were carefully dried, while

most soils analyzed were a little damp. The broadness of this baseline rise indicates something other than fluorescence; possibly caused by the presence of water.

Silver is not very fluorescent in X-rays. The absolute count was never very high. This leads to a low signal/noise ratio. As can be seen in the spectra following this discussion, the program can interpret noise as silver. The instrument manual 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. Several spectra (GP007-3, GP008-1, GP008-3, and GP009-1) has the 249 ppm standard overlain on the sample spectra. This is to show what a positive hit looks like, and its relative intensity.

TABLE 1: SAMPLES RUN BY XRF

Sample ID[A]	Instrument Quantitation of Silver[B] (ppm)	Standard Deviation	Probable Quantitation[C] (ppm)	Page # of Spectra	Sample Mass[D] (g)	Date of Analysis
Teflon Blank	72	14.6	0	6	N/A	7/27/99
Iron Standard	0	0	0	6	N/A	7/27/99
B1035501_02	499	17.0	499	14	3.94	7/29/99
B1035502_6.5	1000	21.6	1000	14	5.50	7/29/99
B1035503_10	86	13.4	ND	14	3.82	7/29/99
B1035504_15	89	12.6	ND	15	2.96	7/29/99
B1035505_20	41	12.3	ND	15	3.51	7/29/99
B1035506_25	80	13.0	80		4.14	7/29/99
B1035507_30	85	13.6	85	15	4.83	7/29/99
B1035508_35	124	15.2	124	16	3.99	7/29/99
B1035509_40	72	13.2	ND	16	4.78	7/29/99
B1095201_08	182	14.9	182	8	6.8	7/28/99
B1095202_10	108	13.4	108	9	4.17	7/28/99

Sample ID[A]	Instrument Quantitation of Silver[B] (ppm)	Standard Deviation	Probable Quantitation[C] (ppm)	Page # of Spectra	Sample Mass[D] (g)	Date of Analysis
B1095203_15	94	13.4	94	9	5.72	7/28/99
B1095205_20	43	12.9	ND	9	7.95	7/28/99
B1095206_25	108	13.7	108	10	6.94	7/28/99
B1095207_30	84	13.1	ND	10	7.62	7/28/99
B1095208_35	81	12.9	ND	10	4.62	7/28/99
B1095209_40	40	13.3	ND	11	8.30	7/28/99
B2035501_10	472	16.4	472		5.97	7/29/99
B2035502_13	763	19.0	763	19	3.90	7/30/99
B2035503_18	434	16.3	434		6.05	7/29/99
B2035504_23	933	20.0	933	20	3.61	7/30/99
B2035505_28	5909	51.2	5909	20	5.66	7/30/99
B2035506_33	2474	29.8	2474	20	5.44	7/30/99
B2035506D33	2356	30.2	2356	21	6.41	7/30/99
B2035507_40	52	12.9	ND	21	3.90	7/30/99
B2035508_45	63	13.7	ND	21	5.08	7/30/99
B20355FD_13	709	18.1	709	22	3.20	7/30/99
B2095201_08	182	15.0	182	11	5.16	7/28/99
B2095202_10	47	13.2	ND	11	6.85	7/28/99
B2095203_15	56	13.6	ND	12	11.3	7/28/99
B2095204_20	63	13.3	ND	12	7.81	7/28/99
B2095205_25	29	12.4	ND	12	7.82	7/28/99
B2095206_30	50	12.6	ND	13	6.62	7/28/99
B2095207_35	42	11.9	ND	13	6.15	7/28/99
B2095208_40	63	13.1	ND	13	7.28	7/28/99
GP007-1	63	16.2	ND	6	10.00	7/27/99
GP007-3	63	16.2	ND	7	8.87	7/27/99

Sample ID[A]	Instrument Quantitation of Silver[B] (ppm)	Standard Deviation	Probable Quantitation[C] (ppm)	Page # of Spectra	Sample Mass[D] (g)	Date of Analysis
GP008-1	106	16.7	106	7	5.83	7/27/99
GP008-3	62	15.8	ND	7	7.61	7/27/99
GP009-1	84	16.7	ND	8	4.93	7/27/99
GP009-3	134	16.1	134	8	4.36	7/28/99
S1035501_05	60	14.0	ND	22	5.69	7/30/99
S1035502_10	64	13.3	ND	22	4.70	7/30/99
S1035503_15	91	13.6	ND	23	4.75	7/30/99
S1035504_20	56	12.7	ND	23	4.73	7/30/99
S1035505_25	64	13.6	ND	23	5.28	7/30/99
S1035506_30	73	14.4	ND	24	4.25	7/30/99
S1035507_35	56	13.9	ND	24	5.39	7/30/99
S1035508_40	80	14.2	ND	24	5.65	7/30/99
S10952_08	97	13.3	ND	16	5.93	7/29/99
S1095201_10	71	12.8	ND	17	5.20	7/29/99
S1095202_15	34	12.8	ND	17	9.24	7/29/99
S2035501_05	89	14.1	ND	25	7.38	7/30/99
S2035502_10	65	12.2	ND	25	2.66	7/30/99
S2035503_15	77	13.1	ND	25	5.23	7/30/99
S2035504_20	73	14.4	ND	26	7.04	7/30/99
S2035505_25	48	13.7	ND	26	5.93	7/30/99
S2035506_30	64	13.1	ND	26	3.82	7/30/99
S2035507_35	109	14.3	ND	27	3.61	7/30/99
S2035508_40	56	13.2	ND	27	4.53	7/30/99
S20952_08	66	13.2	ND	17	7.09	7/29/99
S2095201_10	77	12.8	ND	18	5.28	7/29/99
S2095202_15	44	12.6	ND	18	6.39	7/29/99

Sample ID[A]	Instrument Quantitation of Silver[B] (ppm)	Standard Deviation	Probable Quantitation[C] (ppm)	Page # of Spectra	Sample Mass[D] (g)	Date of Analysis
S3035501_08	85	18.1	ND	27	8.09	8/02/99
S3035502_10	68	16.5	ND	28	3.92	8/02/99
S3035503_15	57	16.7	ND	28	6.21	8/02/99
S3035504_20	53	16.0	ND	28	3.95	8/02/99
S3035505_25	75	17.9	ND	29	6.57	8/02/99
S3035506_30	94	17.7	ND	29	6.83	8/02/99
S3035507_35	36	16.0	ND	29	3.05	8/02/99
S3035508_40	53	14.9	ND	30	3.04	8/02/99
S30952_08	64	13.1	ND	18	6.08	7/29/99
S3095201_10	57	12.1	ND	19	3.20	7/29/99
S3095202_15	40	12.9	ND	19	8.34	7/29/99
S4035501_05	70	17.2	ND	30	4.73	8/02/99
S4035502_10	76	15.5	ND	30	3.25	8/02/99
S4035503_15	87	17.0	ND	31	4.93	8/02/99
S5035501_05	76	15.7	ND	31	3.37	8/02/99
S5035502_10	123	15.7	123	31	2.42	8/02/99
S5035503_15	43	16.3	ND	32	6.34	8/02/99
S6035501_05	73	15.8	ND	32	4.04	8/02/99
S6035502_10	71	15.3	ND	32	2.96	8/02/99
S6035503_15	124	16.2	124	33	3.90	8/02/99

[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 alphabetically here, rather than 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. ND 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.

Sample ID[1]	Instrument Quantitation of Silver[2] (ppm)	Standard Deviation	Probable Quantitation[3] (ppm)	Page # of Spectra	Sample Mass[4] (g)	Date of Analysis
S3035503_15	57	16.7	ND	28	6.21	8/02/99
S3035504_20	53	16.0	ND	28	3.95	8/02/99
S3035505_25	75	17.9	ND	29	6.57	8/02/99
S3035506_30	94	17.7	ND	29	6.83	8/02/99
S3035507_35	36	16.0	ND	29	3.05	8/02/99
S3035508_40	53	14.9	ND	30	3.04	8/02/99
S30952_08	64	13.1	ND	18	6.08	7/29/99
S3095201_10	57	12.1	ND	19	3.20	7/29/99
S3095202_15	40	12.9	ND	19	8.34	7/29/99
S4035501_05	70	17.2	ND	30	4.73	8/02/99
S4035502_10	76	15.5	ND	30	3.25	8/02/99
S4035503_15	87	17.0	ND	31	4.93	8/02/99
S5035501_05	76	15.7	ND	31	3.37	8/02/99
S5035502_10	123	15.7	123	31	2.42	8/02/99
S5035503_15	43	16.3	ND	32	6.34	8/02/99
S6035501_05	73	15.8	ND	32	4.04	8/02/99
S6035502_10	71	15.3	ND	32	2.96	8/02/99
S6035503_15	124	16.2	124	33	3.90	8/02/99

[1]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 alphabetically here, rather than by date analyzed.

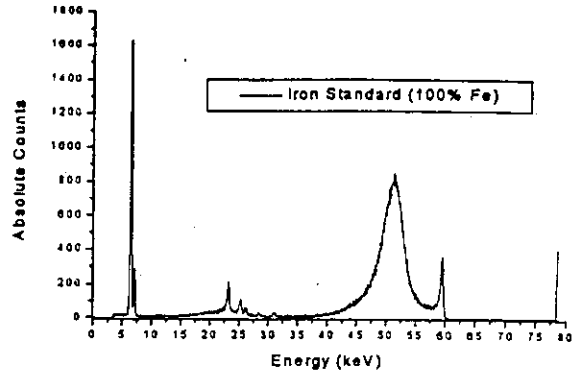
[2]This is the calculated result for silver by the XRF software. In looking at the actual spectra, it can be seen that the software aggressively quantitates silver, even though the "peak" seen is noise.

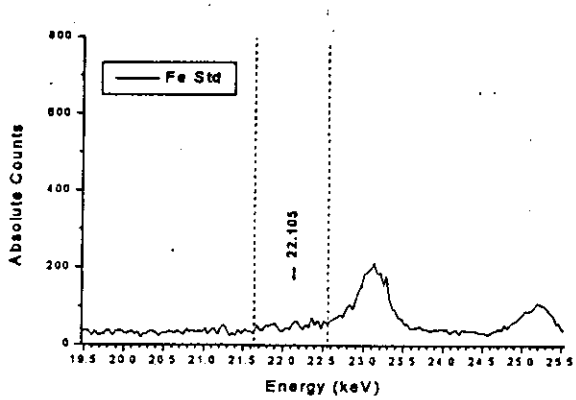
[3]This column is the analyst's professional opinion on the amount of silver actually in a sample. ND means the concentration of any silver is below the limit of detection. The detection limit is — ppm.

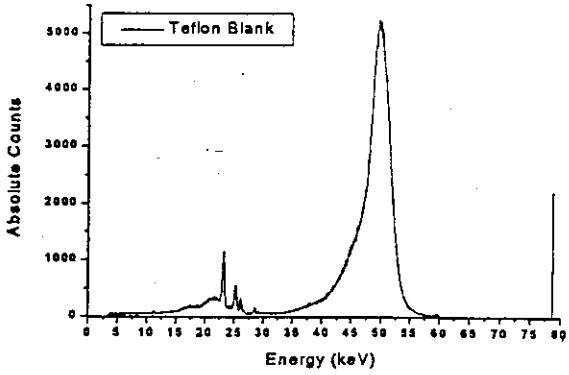
[4]Sample mass is listed here only for completeness. It is the volume of sample in the sample holder which is important.

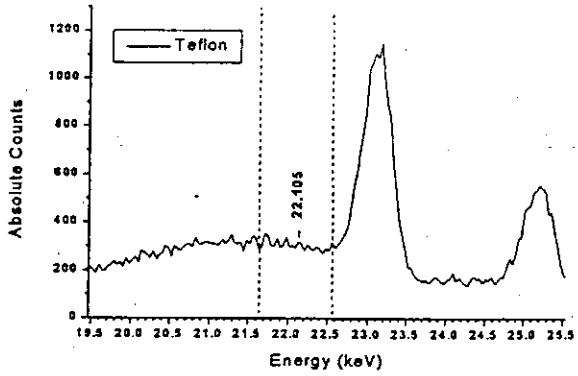
Sample ID[A]	Instrument Quantitation of Silver[B] (ppm)	Standard Deviation	Probable Quantitation[C] (ppm)	Page # of Spectra	Sample Mass[D] (g)	Date of Analysis
S3035501_08	85	18.1	ND	27	8.09	8/02/99
S3035502_10	68	16.5	ND	28	3.92	8/02/99
S3035503_15	57	16.7	ND	28	6.21	8/02/99
S3035504_20	53	16.0	ND	28	3.95	8/02/99
S3035505_25	75	17.9	ND	29	6.57	8/02/99
S3035506_30	94	17.7	ND	29	6.83	8/02/99
S3035507_35	36	16.0	ND	29	3.05	8/02/99
S3035508_40	53	14.9	ND	30	3.04	8/02/99
S30952_08	64	13.1	ND	18	6.08	7/29/99
S3095201_10	57	12.1	ND	19	3.20	7/29/99
S3095202_15	40	12.9	ND	19	8.34	7/29/99
S4035501_05	70	17.2	ND	30	4.73	8/02/99
S4035502_10	76	15.5	ND	30	3.25	8/02/99
S4035503_15	87	17.0	ND	31	4.93	8/02/99
S5035501_05	76	15.7	ND	31	3.37	8/02/99
S5035502_10	123	15.7	123	31	2.42	8/02/99
S5035503_15	43	16.3	ND	32	6.34	8/02/99
S6035501_05	73	15.8	ND	32	4.04	8/02/99
S6035502_10	71	15.3	ND	32	2.96	8/02/99
S6035503_15	124	16.2	124	33	3.90	8/02/99

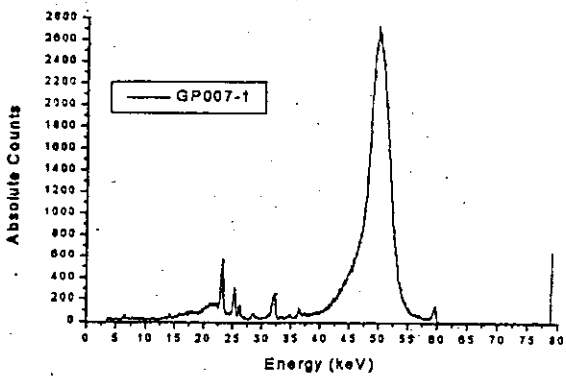
[A]Sample ID was made by taking the sample identification from the sample custodian, adding an underscore, and putting the maximum depth the drill bit reached. Samples are listed alphabetically here, rather than by date analyzed.
[B]This is the calculated result for silver by the XRF software. In looking 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. ND 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.

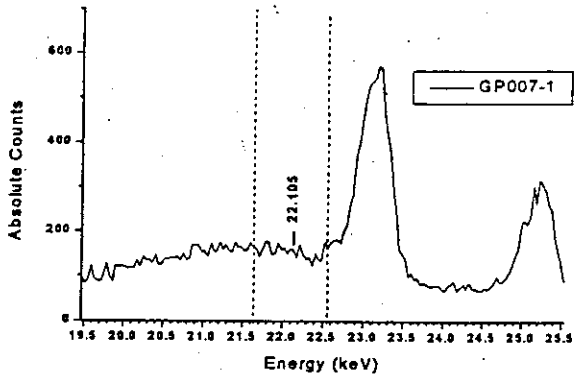

Iron Standard (100% Fe)
Absolute Counts
Energy (keV)

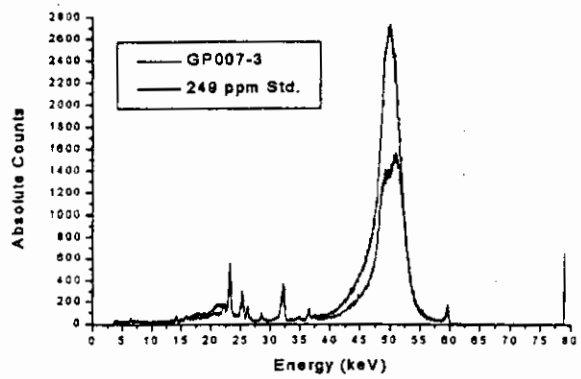

Fe Std
22.105
Absolute Counts
Energy (keV)

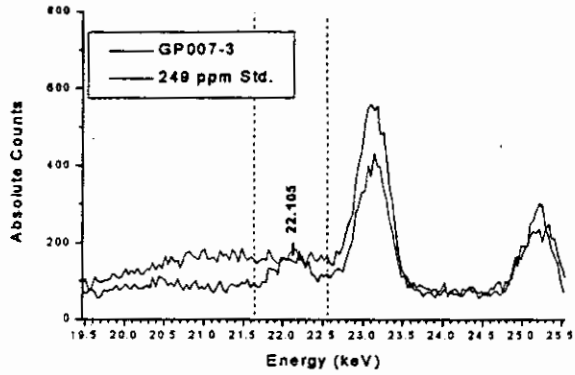

Teflon Blank
Absolute Counts
Energy (keV)

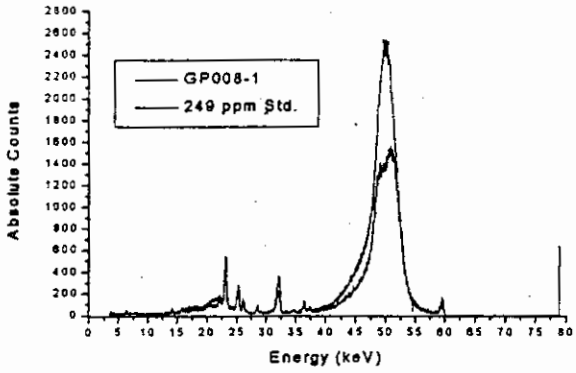

Teflon
22.105
Absolute Counts
Energy (keV)

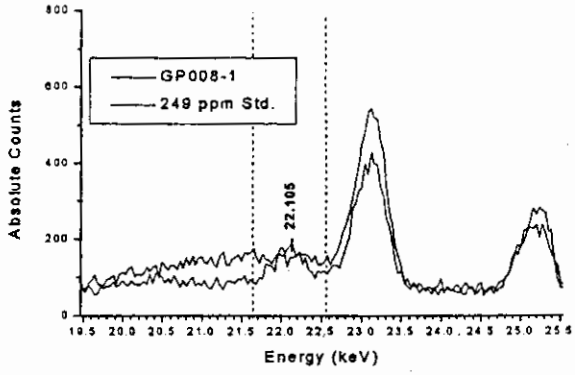

GP007-1
Absolute Counts
Energy (keV)

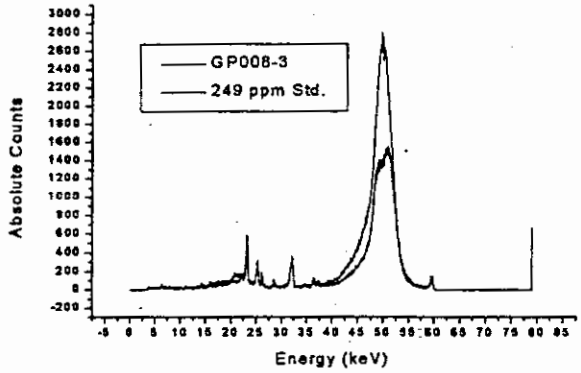

GP007-1
22.105
Absolute Counts
Energy (keV)

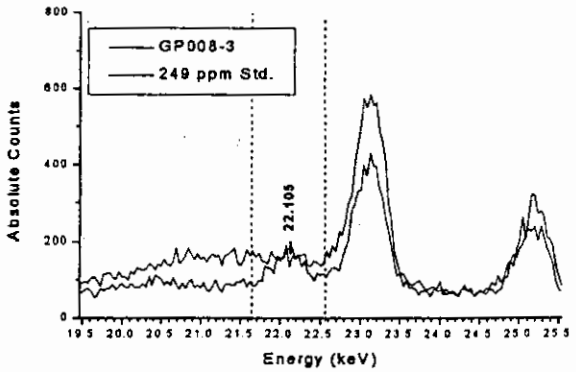

GP007-3
249 ppm Std.
Absolute Counts
Energy (keV)

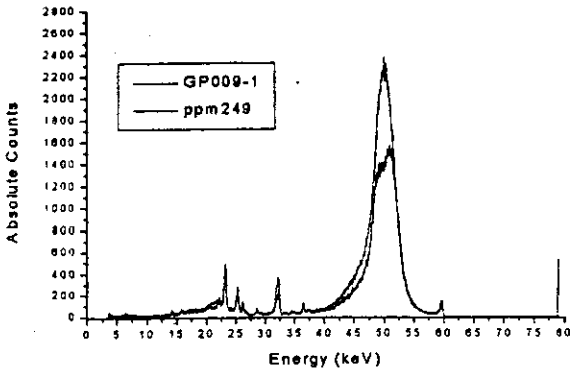

GP007-3
249 ppm Std.
22.105
Absolute Counts
Energy (keV)

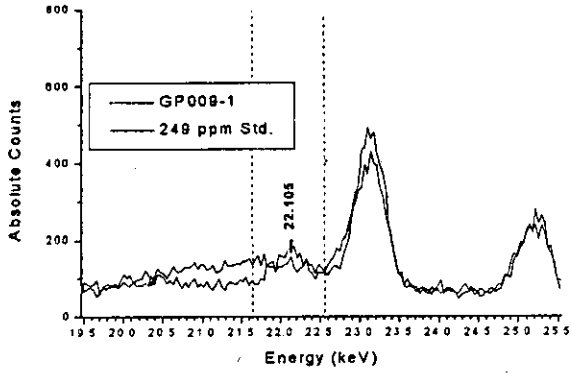

GP008-1
249 ppm Std.
Absolute Counts
Energy (keV)

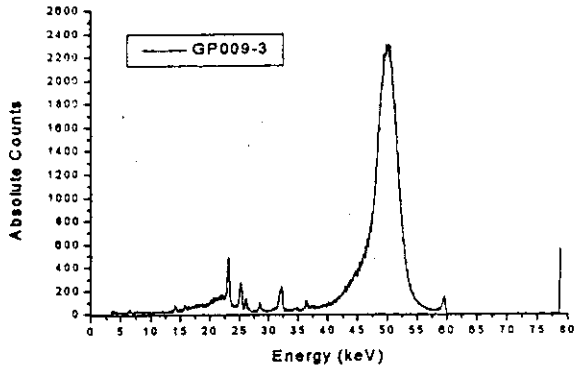

GP008-1
249 ppm Std.
22.105
Absolute Counts
Energy (keV)

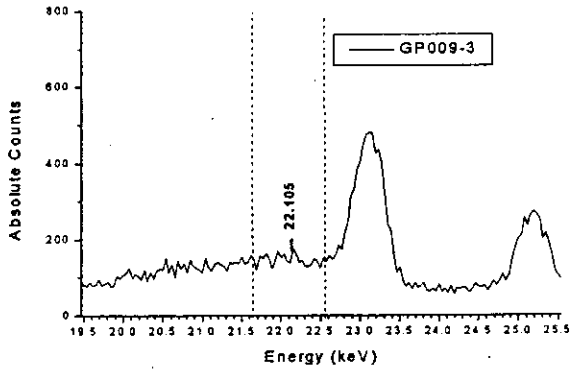

GP008-3
249 ppm Std.
Absolute Counts
Energy (keV)

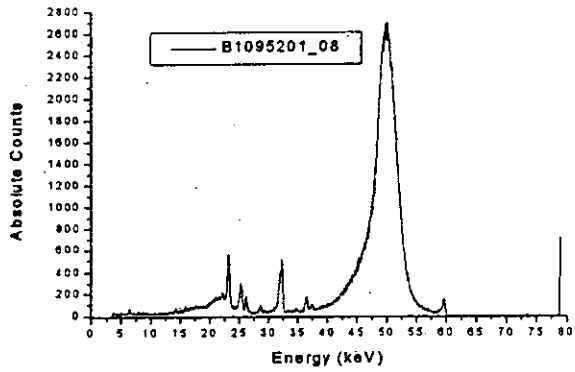

GP008-3
249 ppm Std.
22.105
Absolute Counts
Energy (keV)

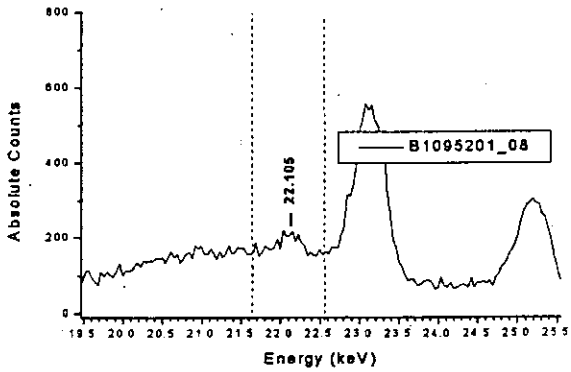

GP009-1
ppm249
Absolute Counts
Energy (keV)

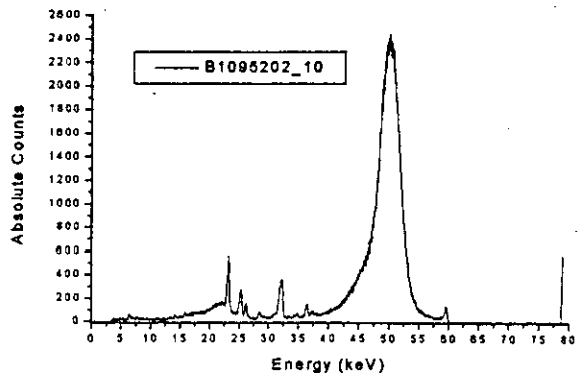

GP009-1
249 ppm Std.
22.105
Absolute Counts
Energy (keV)

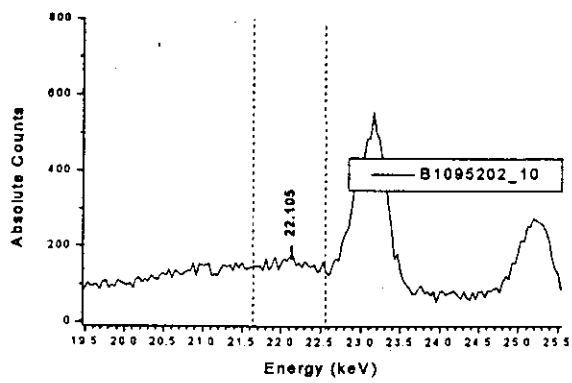

GP009-3
Absolute Counts
Energy (keV)

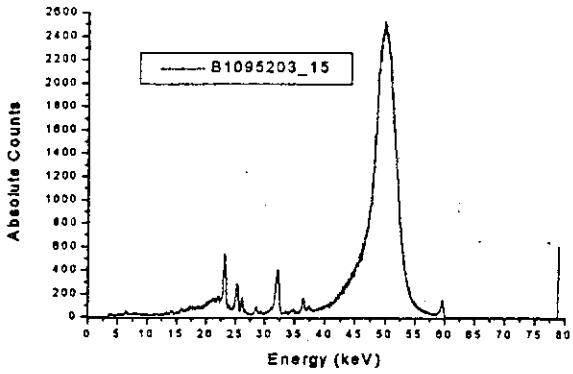

GP009-3
22.105
Absolute Counts
Energy (keV)

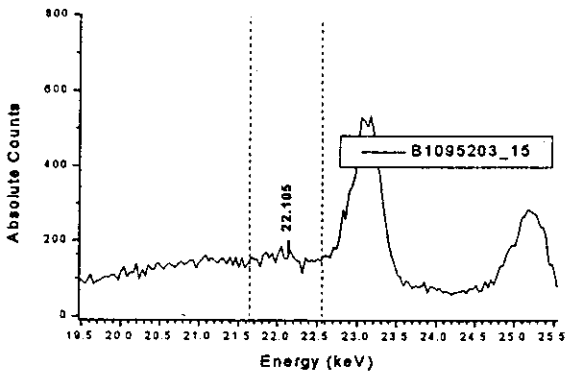

B1095201_08
Absolute Counts
Energy (keV)

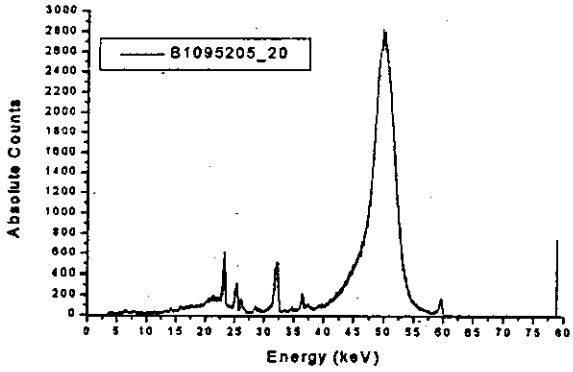

B1095201_08
22.105
Absolute Counts
Energy (keV)

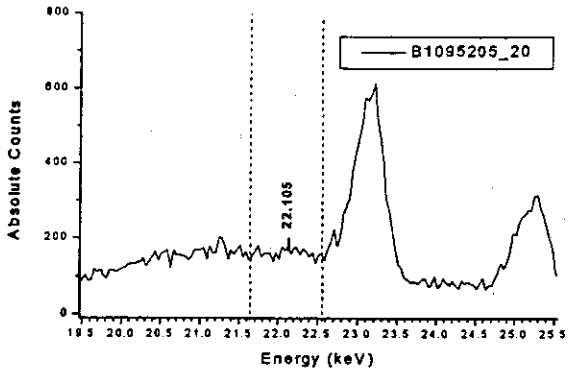

B1095202_10
Absolute Counts
Energy (keV)

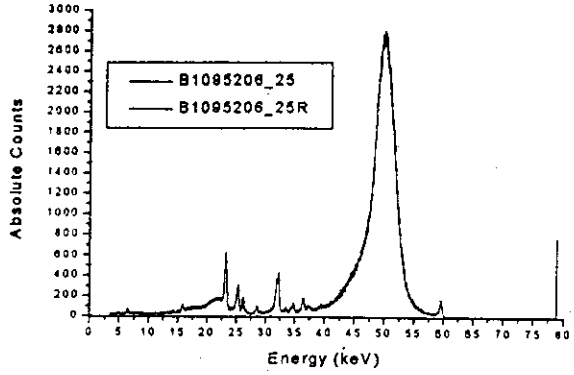

B1095202_10
22.105
Absolute Counts
Energy (keV)

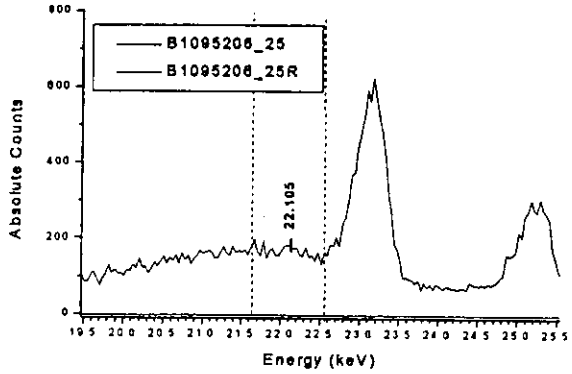

B1095203_15
Absolute Counts
Energy (keV)

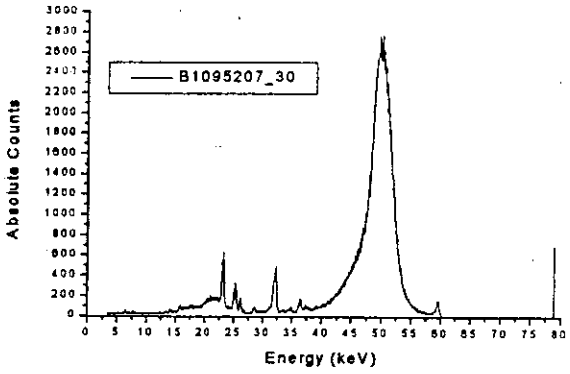

B1095203_15
22.105
Absolute Counts
Energy (keV)

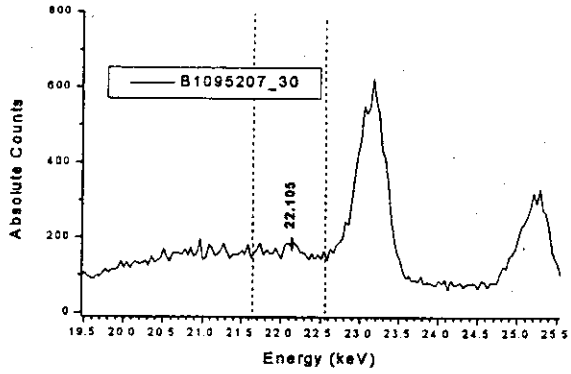

B1095205_20
Absolute Counts
Energy (keV)

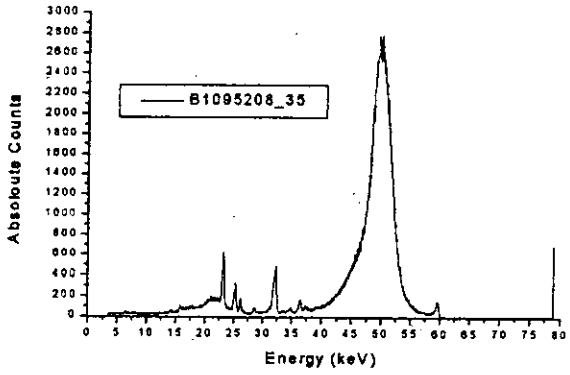

B1095205_20
22.105
Absolute Counts
Energy (keV)

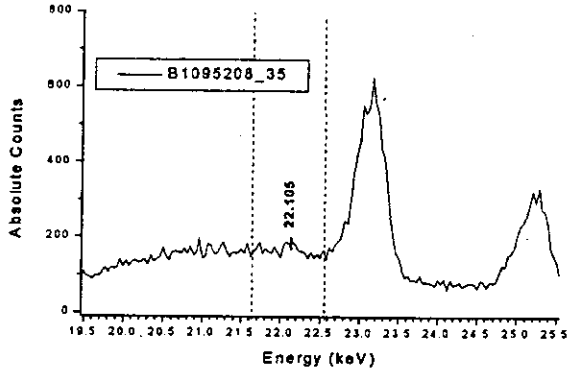

B1095206_25
B1095206_25R
Absolute Counts
Energy (keV)

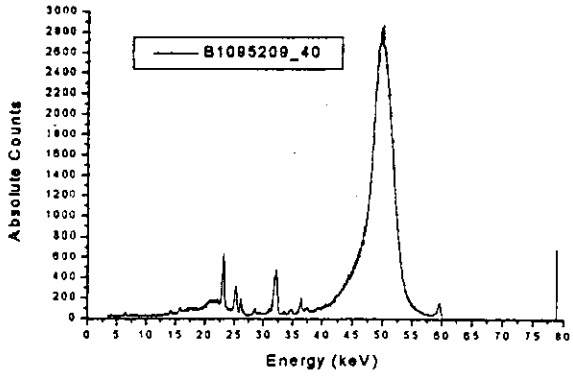

B1095206_25
B1095206_25R
22.105
Absolute Counts
Energy (keV)

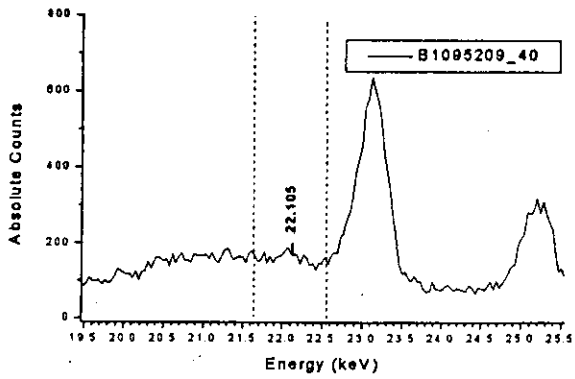

B1095207_30
Absolute Counts
Energy (keV)

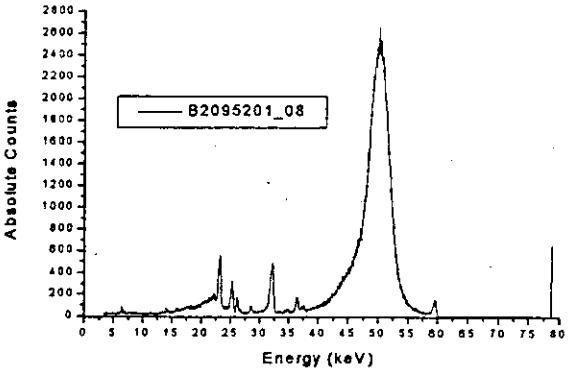

B1095207_30
22.105
Absolute Counts
Energy (keV)

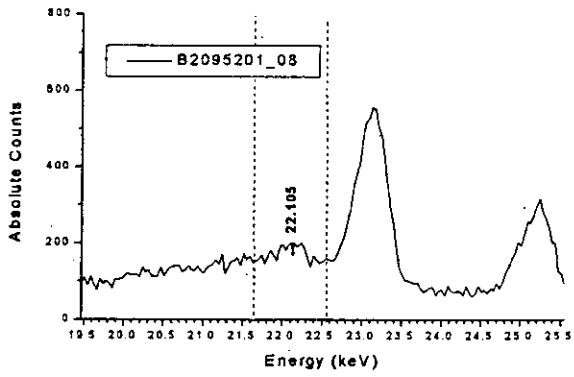

B1095208_35
Absolute Counts
Energy (keV)

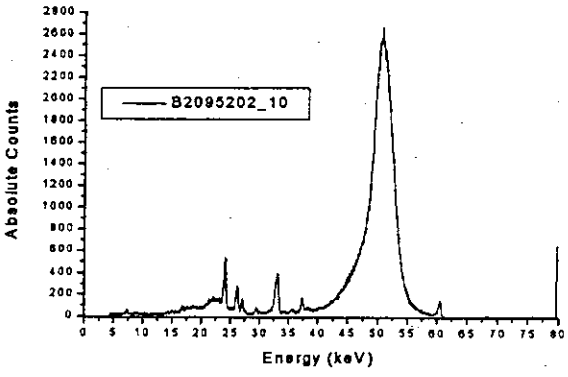

B1095208_35
22.105
Absolute Counts
Energy (keV)

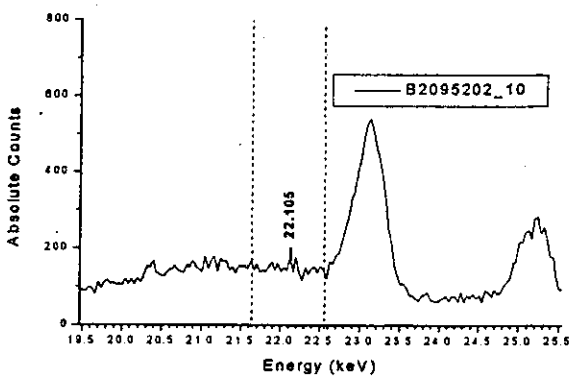

B1095209_40
Absolute Counts
Energy (keV)

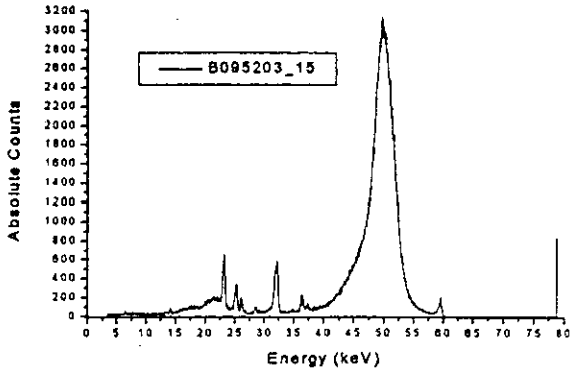

B1095209_40
22.105
Absolute Counts
Energy (keV)

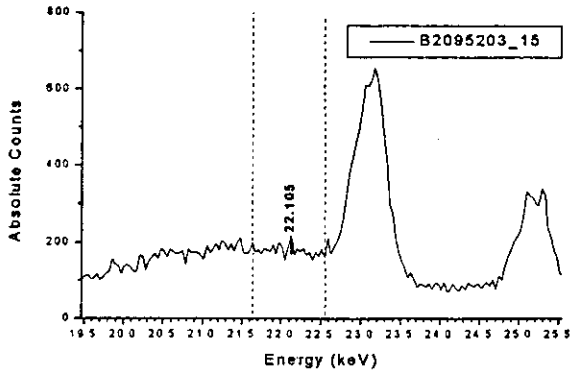

B2095201_08
Absolute Counts
Energy (keV)

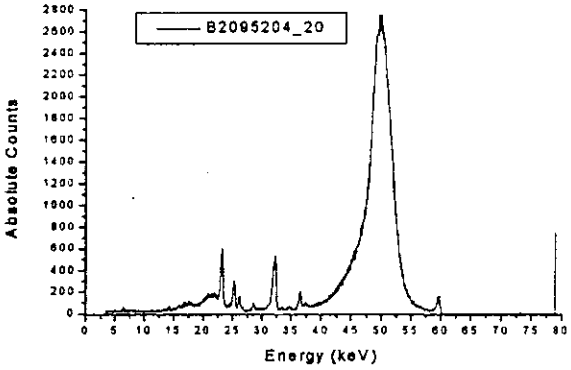

B2095201_08
22.105
Absolute Counts
Energy (keV)

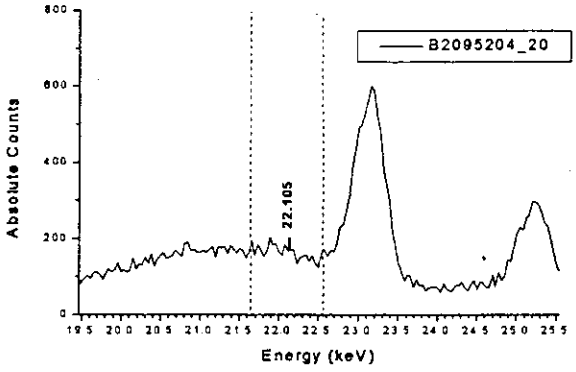

B2095202_10
Absolute Counts
Energy (keV)

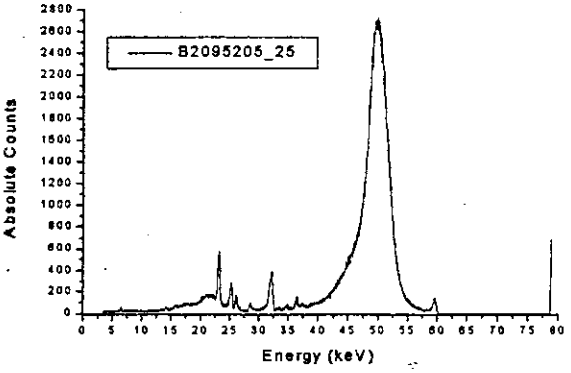

B2095202_10
22.105
Absolute Counts
Energy (keV)

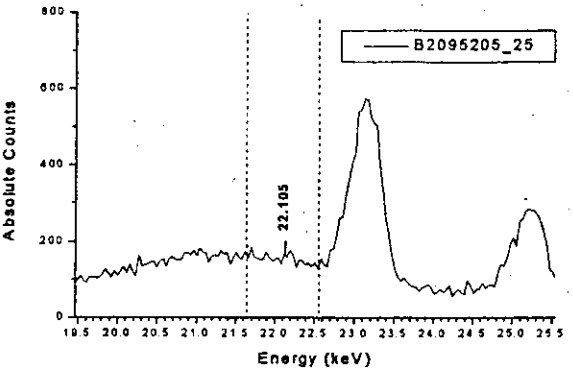

B095203_15
Absolute Counts
Energy (keV)

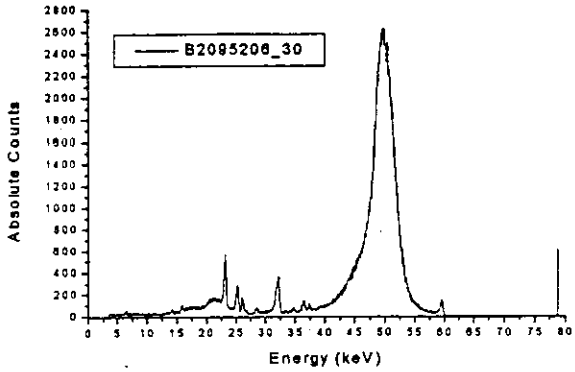

B2095203_15
22.105
Absolute Counts
Energy (keV)

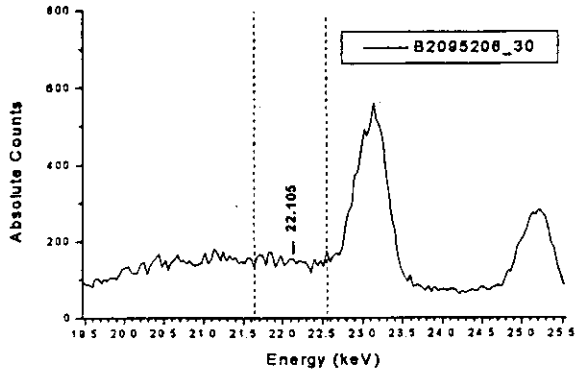

B2095204_20
Absolute Counts
Energy (keV)

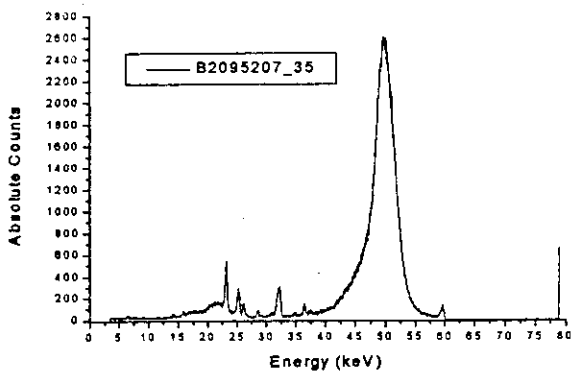

B2095204_20
22.105
Absolute Counts
Energy (keV)

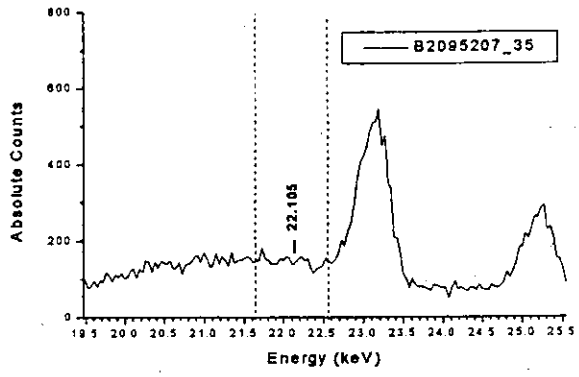

B2095205_25
Absolute Counts
Energy (keV)

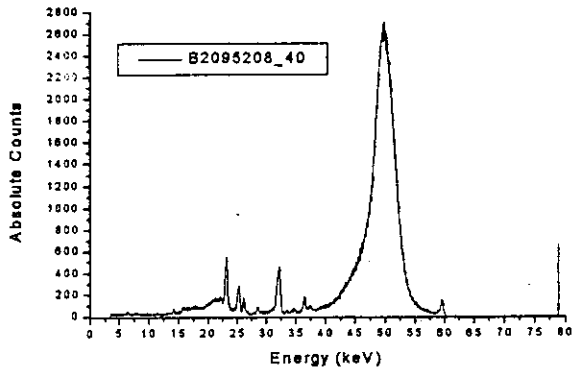

B2095205_25
22.105
Absolute Counts
Energy (keV)

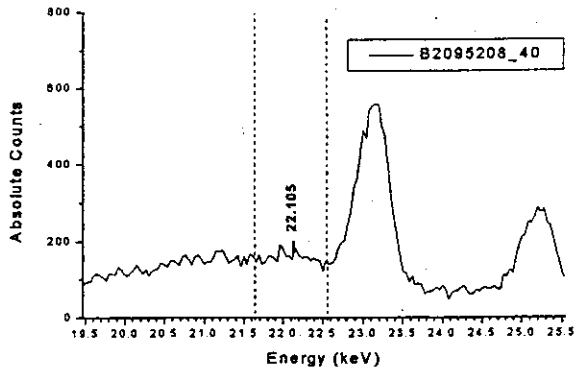

B2095206_30
Absolute Counts
Energy (keV)

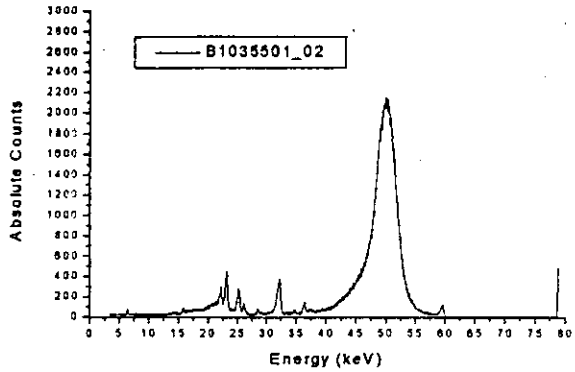

B2095206_30
22.105
Absolute Counts
Energy (keV)

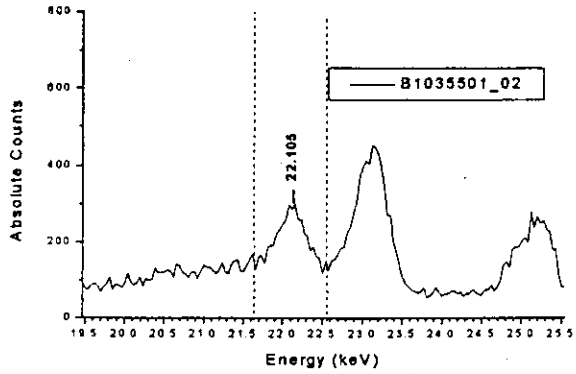

B2095207_35
Absolute Counts
Energy (keV)

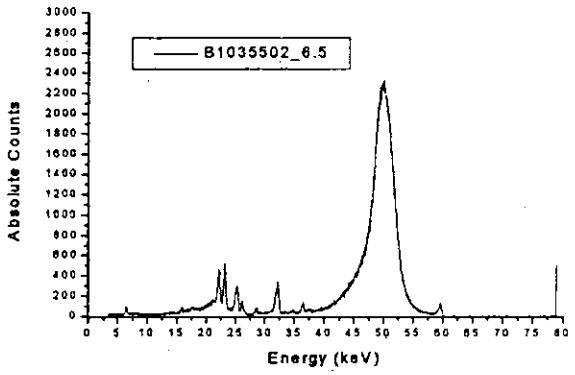

B2095207_35
22.105
Absolute Counts
Energy (keV)

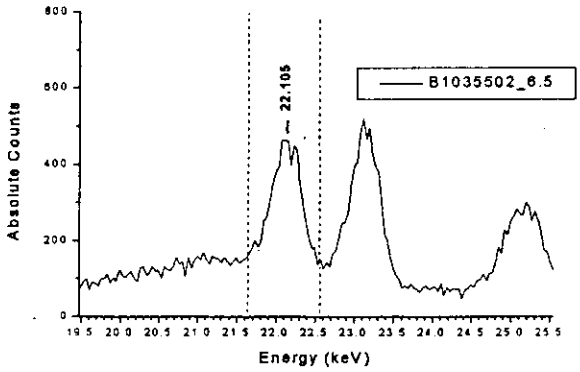

B2095208_40
Absolute Counts
Energy (keV)

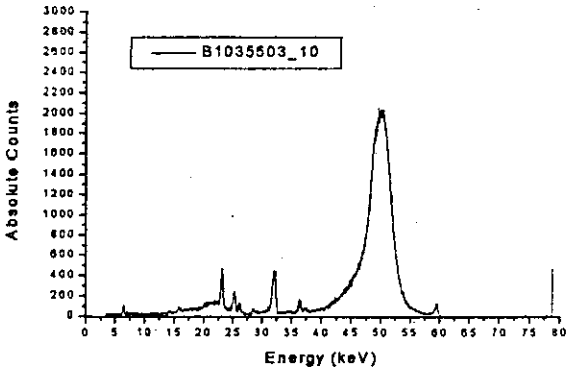

B2095208_40
22.105
Absolute Counts
Energy (keV)

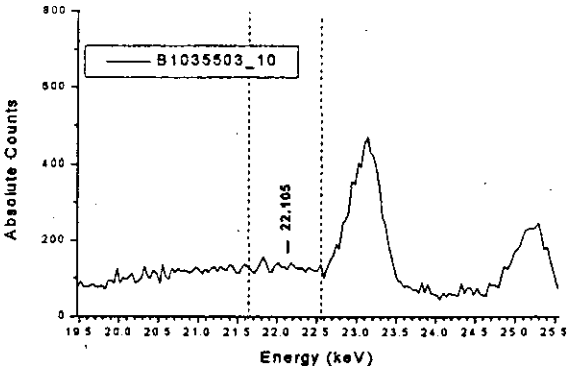

B1035501_02
Absolute Counts
Energy (keV)

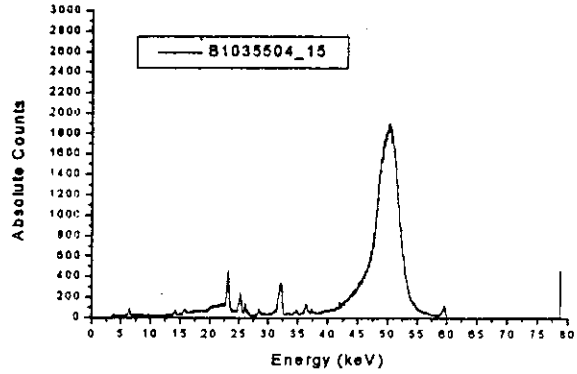

B1035501_02
22.105
Absolute Counts
Energy (keV)

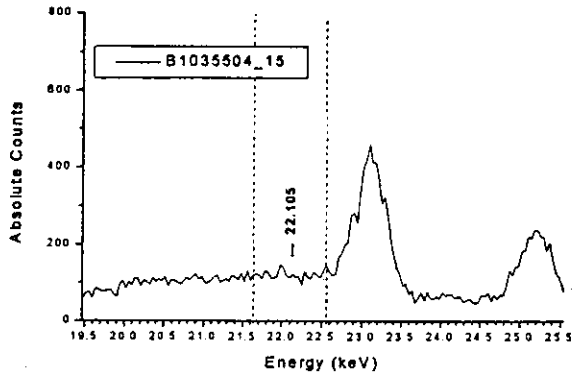

B1035502_6.5
Absolute Counts
Energy (keV)

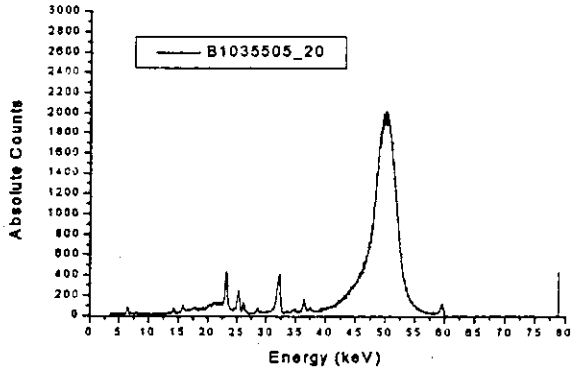

B1035502_6.5
22.105
Absolute Counts
Energy (keV)

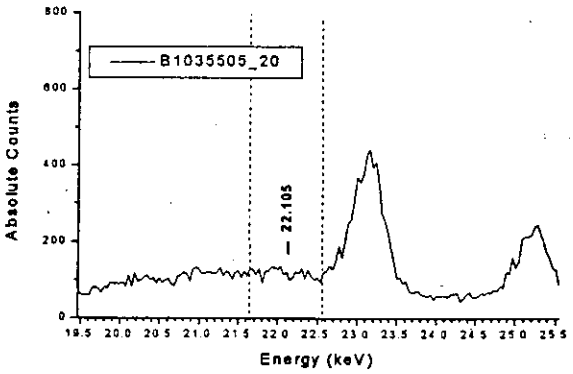

B1035503_10
Absolute Counts
Energy (keV)

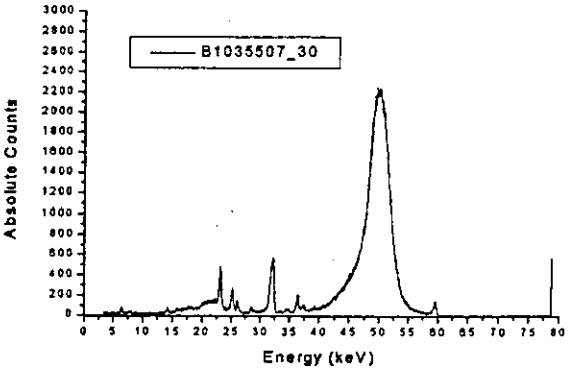

B1035503_10
22.105
Absolute Counts
Energy (keV)

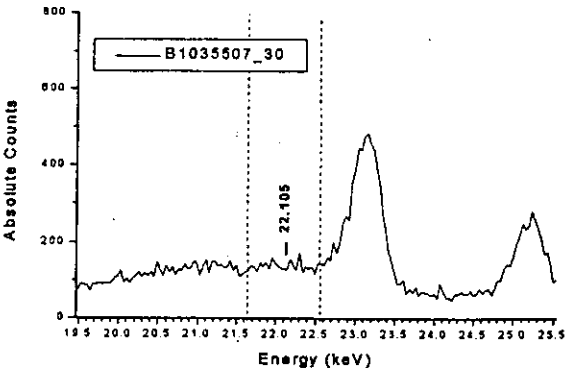

B1035504_15
Absolute Counts
Energy (keV)

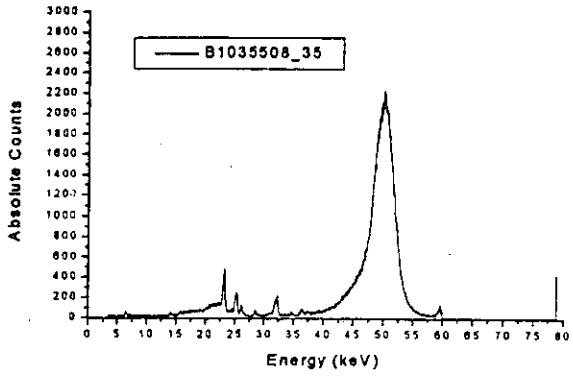

B1035504_15
22.105
Absolute Counts
Energy (keV)

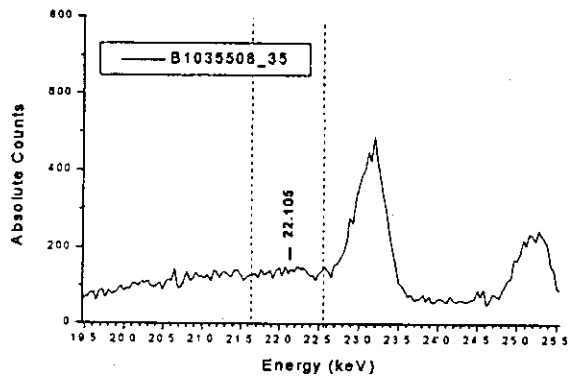

B1035505_20
Absolute Counts
Energy (keV)

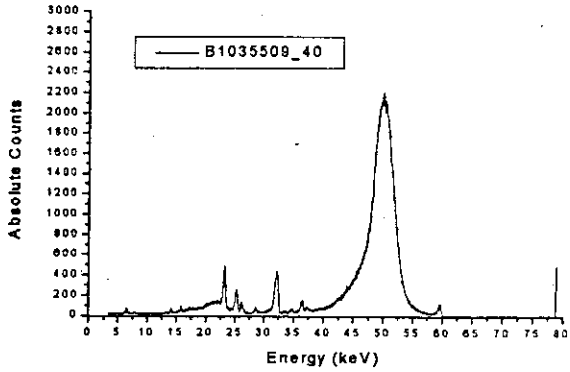

B1035505_20
22.105
Absolute Counts
Energy (keV)

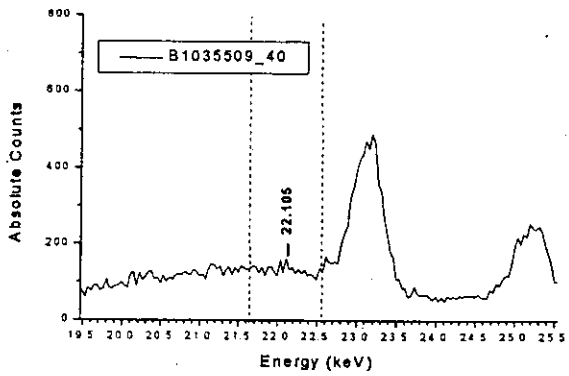

B1035507_30
Absolute Counts
Energy (keV)

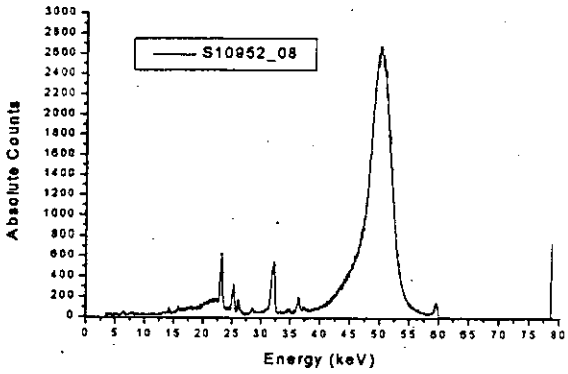

B1035507_30
22.105
Absolute Counts
Energy (keV)

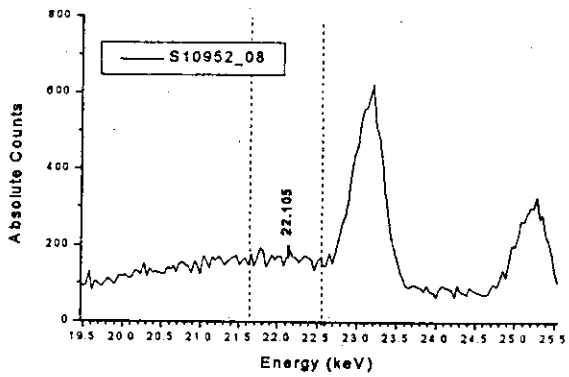

B1035508_35
Absolute Counts
Energy (keV)

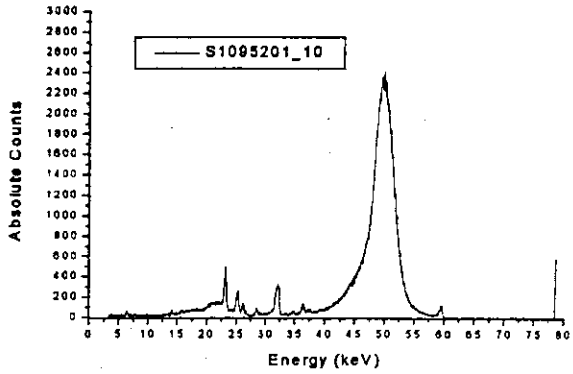

B1035508_35
22.105
Absolute Counts
Energy (keV)

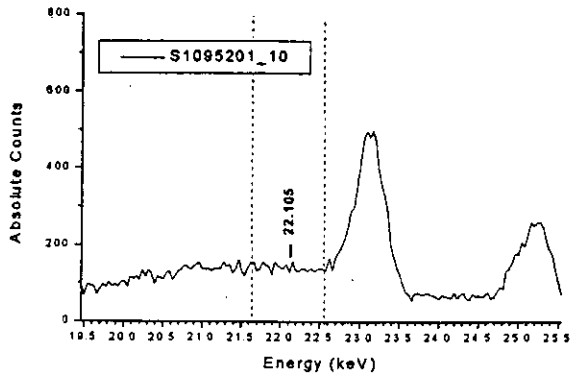

B1035509_40
Absolute Counts
Energy (keV)

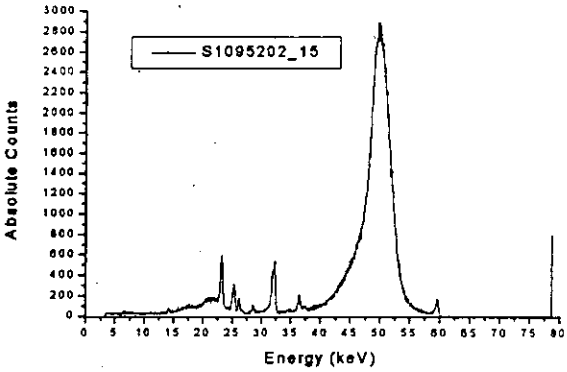

B1035509_40
22.105
Absolute Counts
Energy (keV)

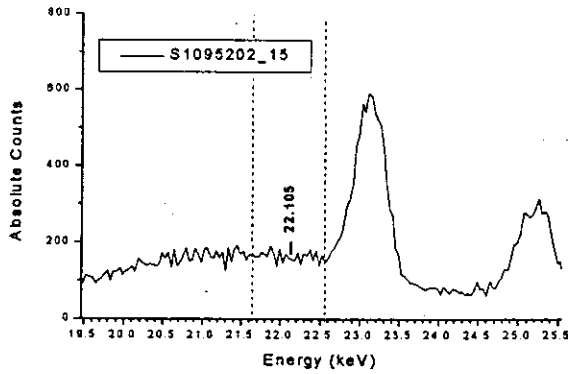

S10952_08
Absolute Counts
Energy (keV)

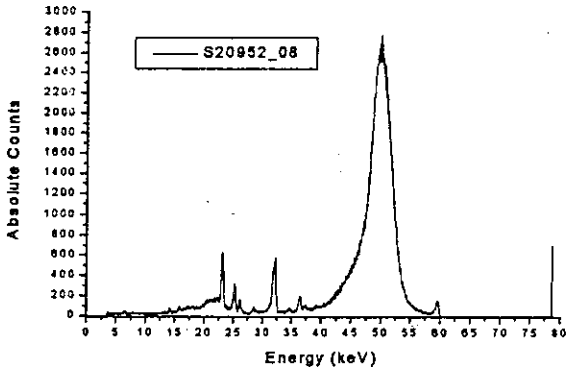

S10952_08
22.105
Absolute Counts
Energy (keV)

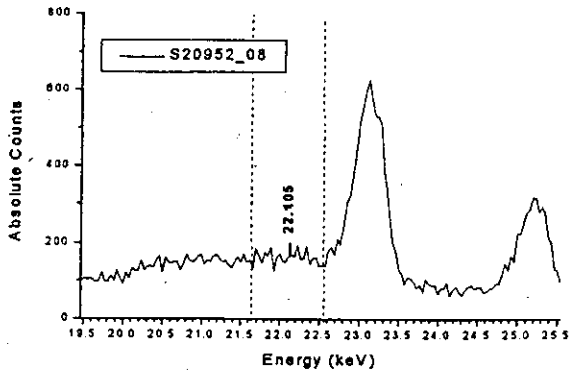

S1095201_10
Absolute Counts
Energy (keV)

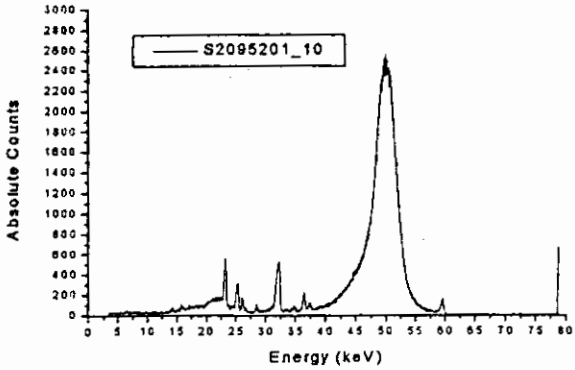

S1095201_10
22.105
Absolute Counts
Energy (keV)

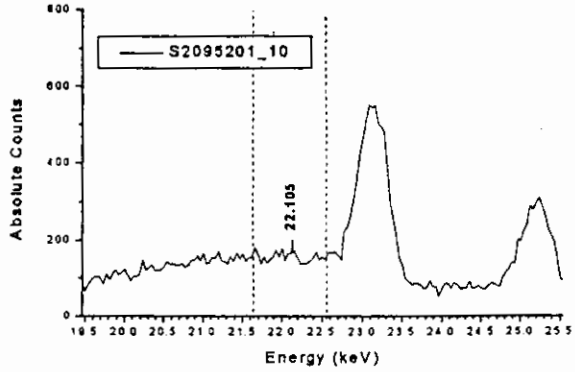

S1095202_15
Absolute Counts
Energy (keV)

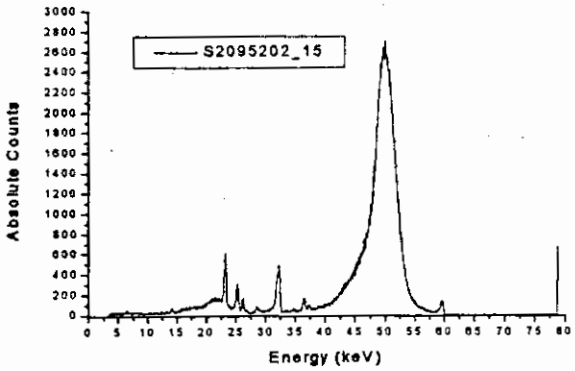

S1095202_15
22.105
Absolute Counts
Energy (keV)

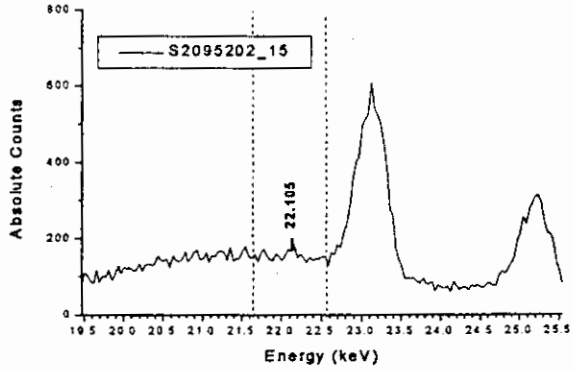

S20952_08
Absolute Counts
Energy (keV)

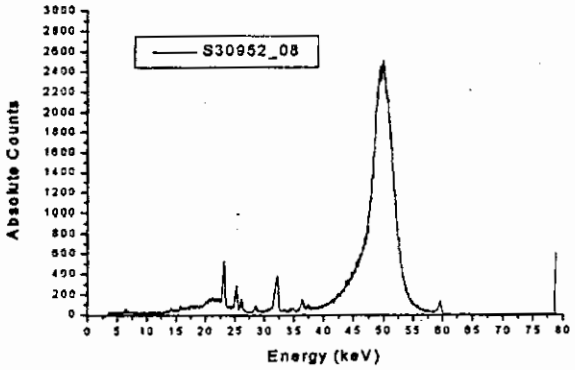

S20952_08
22.105
Absolute Counts
Energy (keV)

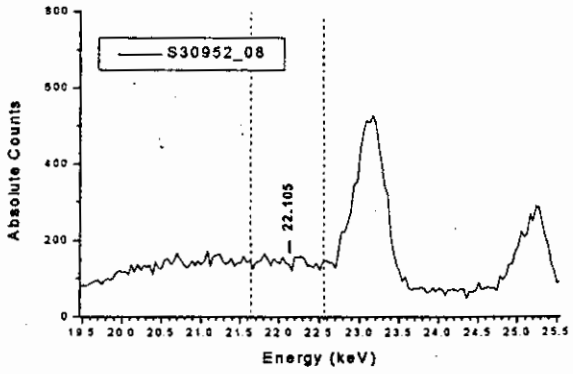

S2095201_10
Absolute Counts
Energy (keV)

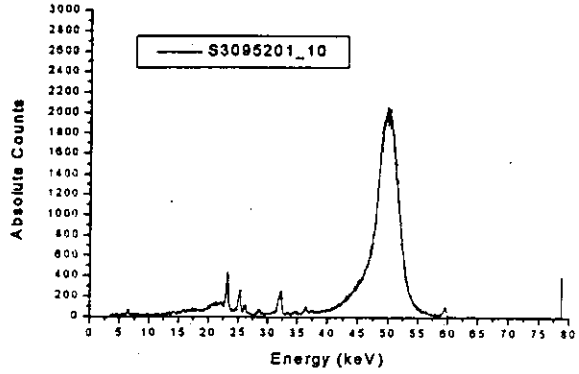

S2095201_10
22.105
Absolute Counts
Energy (keV)

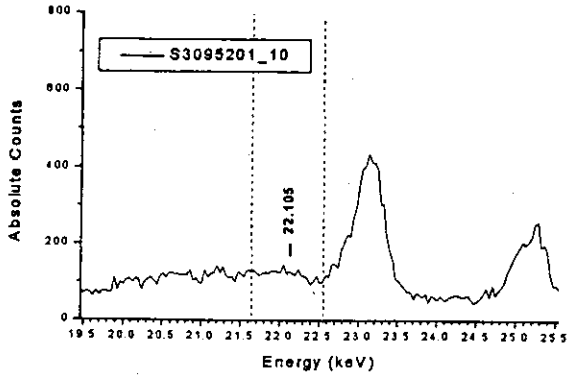

S2095202_15
Absolute Counts
Energy (keV)

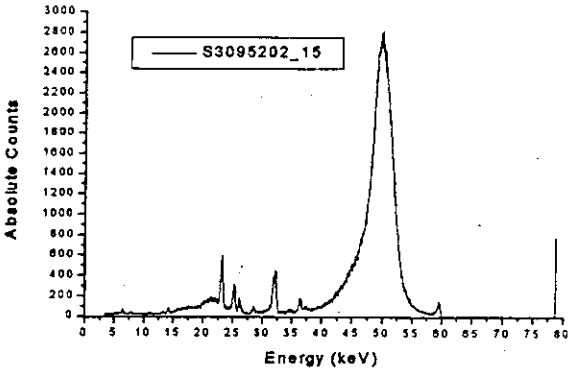

S2095202_15
22.105
Absolute Counts
Energy (keV)

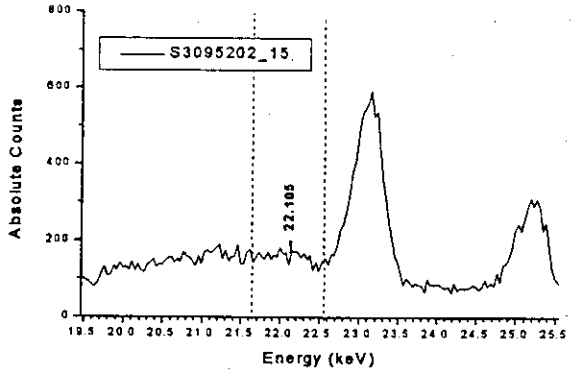

S30952_08
Absolute Counts
Energy (keV)

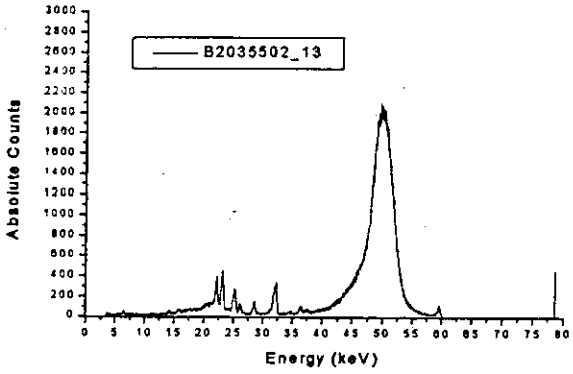

S30952_08
22.105
Absolute Counts
Energy (keV)

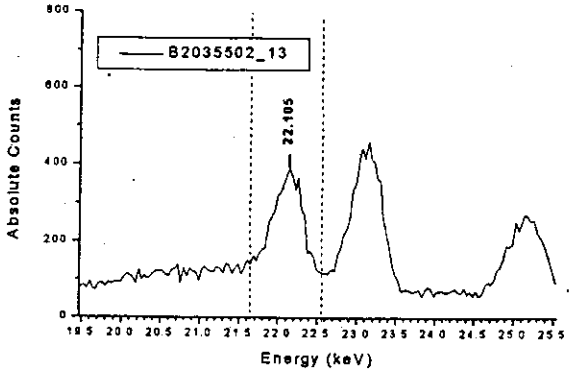

S3095201_10
Absolute Counts
Energy (keV)

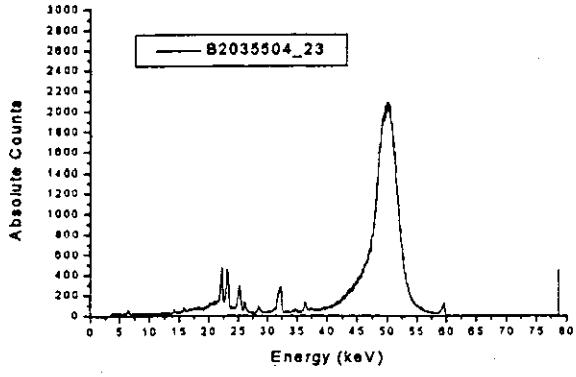

S3095201_10
22.105
Absolute Counts
Energy (keV)

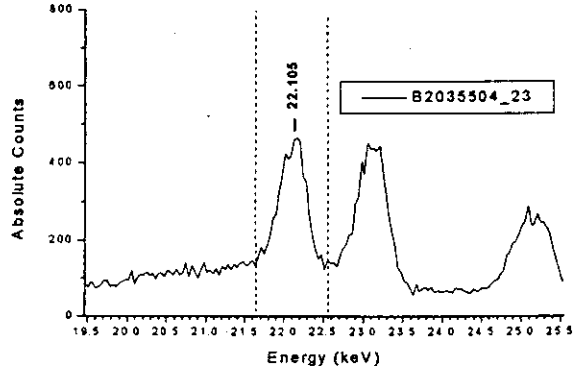

S3095202_15
Absolute Counts
Energy (keV)

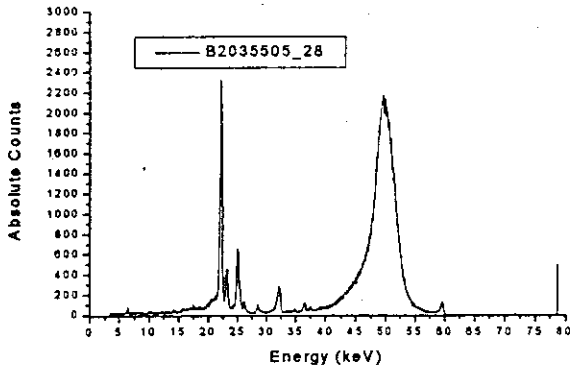

S3095202_15
22.105
Absolute Counts
Energy (keV)

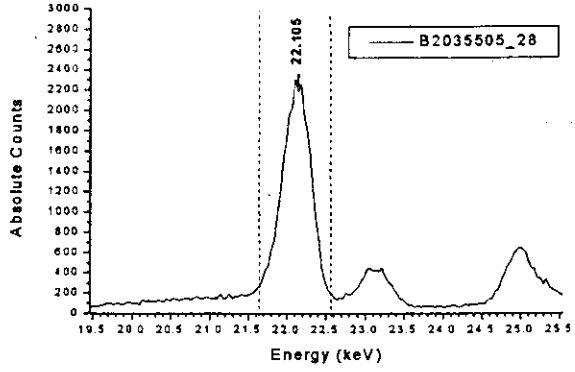

B2035502_13
Absolute Counts
Energy (keV)

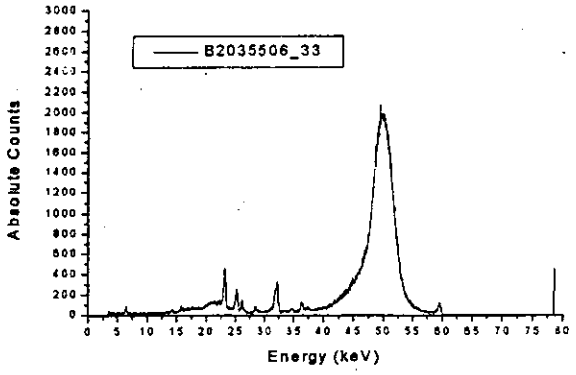

B2035502_13
22.105
Absolute Counts
Energy (keV)

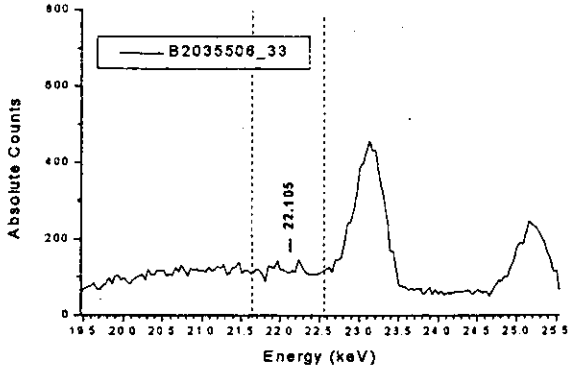

B2035504_23
Absolute Counts
Energy (keV)

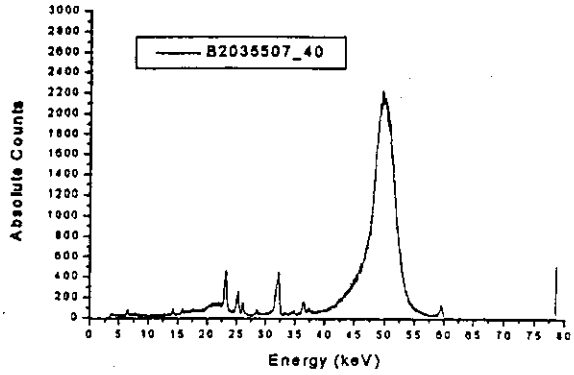

22.105
B2035504_23
Absolute Counts
Energy (keV)

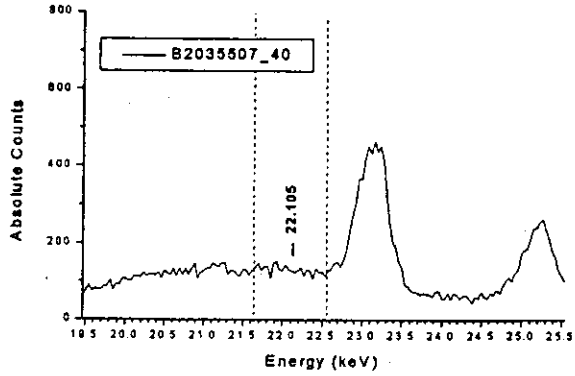

B2035505_28
Absolute Counts
Energy (keV)

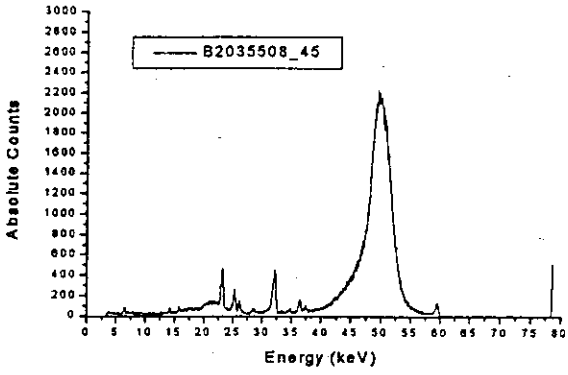

22.105
B2035505_28
Absolute Counts
Energy (keV)

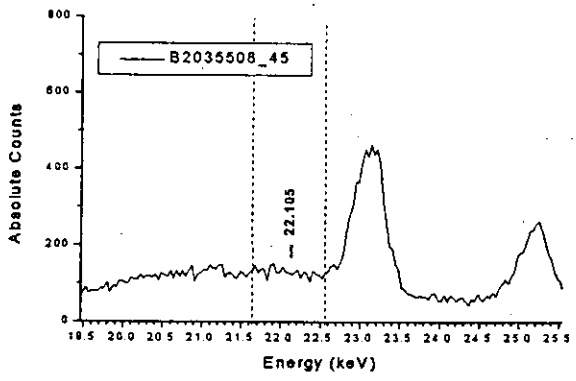

B2035506_33
Absolute Counts
Energy (keV)

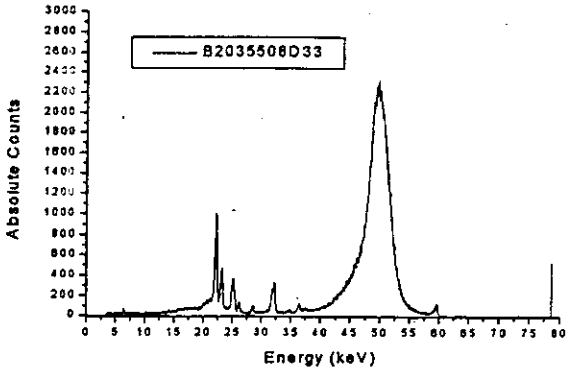

22.105
B2035506_33
Absolute Counts
Energy (keV)

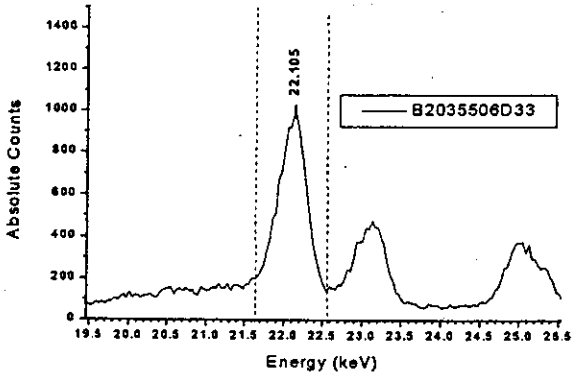

B2035507_40
Absolute Counts
Energy (keV)

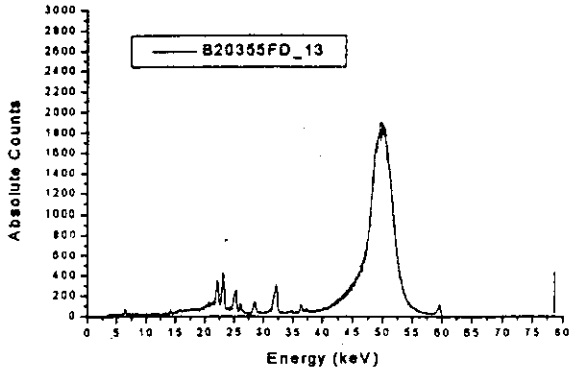

B2035507_40
22.105
Absolute Counts
Energy (keV)

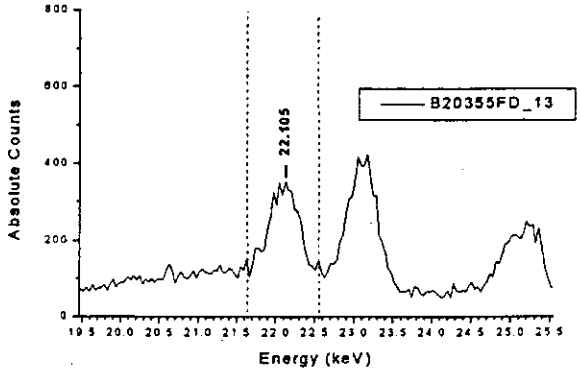

B2035508_45
Absolute Counts
Energy (keV)

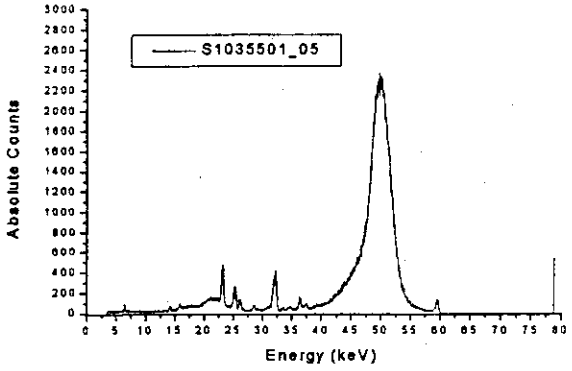

B2035508_45
22.105
Absolute Counts
Energy (keV)

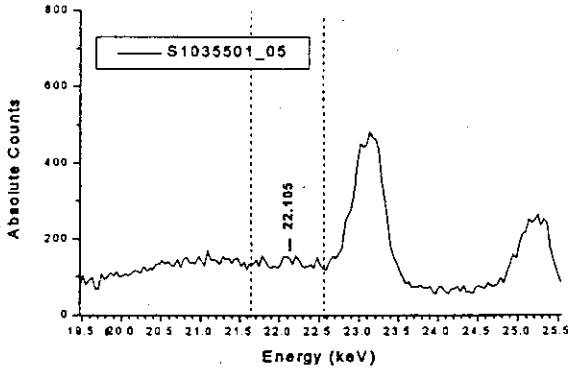

B2035506D33
Absolute Counts
Energy (keV)

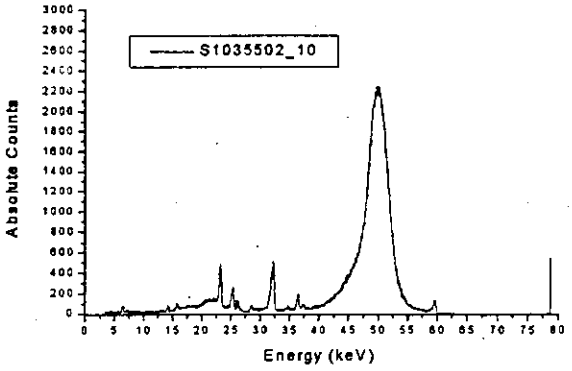

22.105
B2035506D33
Absolute Counts
Energy (keV)

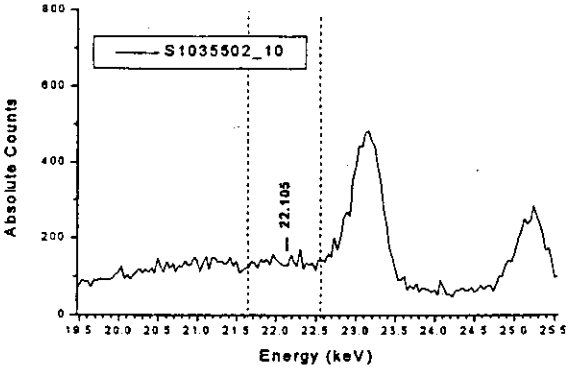

B20355FD_13
Absolute Counts
Energy (keV)

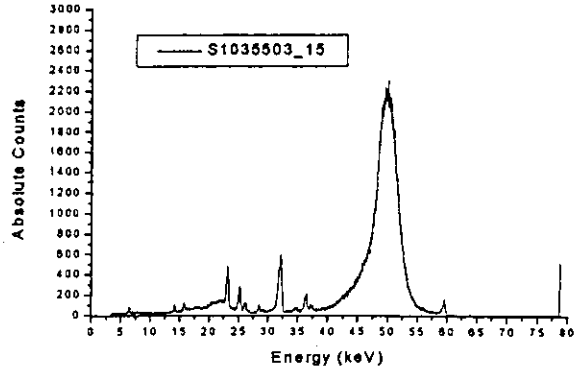

B20355FD_13
22.105
Absolute Counts
Energy (keV)

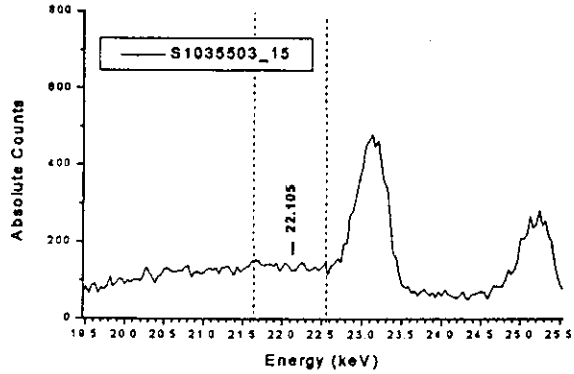

S1035501_05
Absolute Counts
Energy (keV)

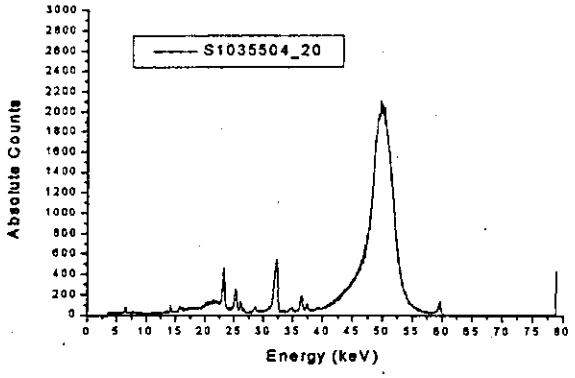

S1035501_05
22.105
Absolute Counts
Energy (keV)

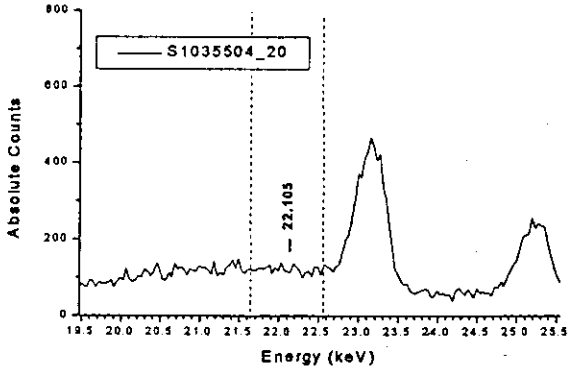

S1035502_10
Absolute Counts
Energy (keV)

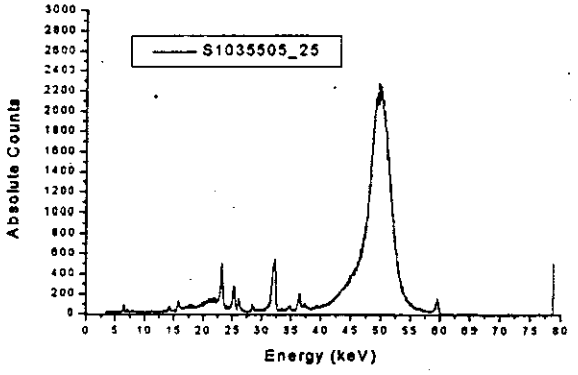

S1035502_10
22.105
Absolute Counts
Energy (keV)

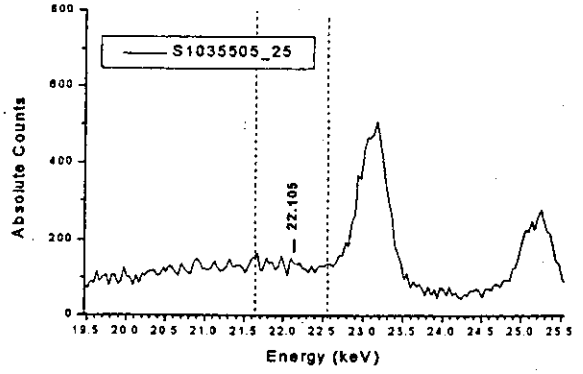

S1035503_15
Absolute Counts
Energy (keV)

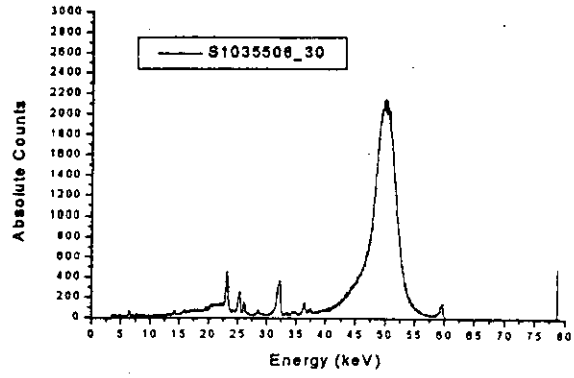

S1035503_15
22.105
Absolute Counts
Energy (keV)

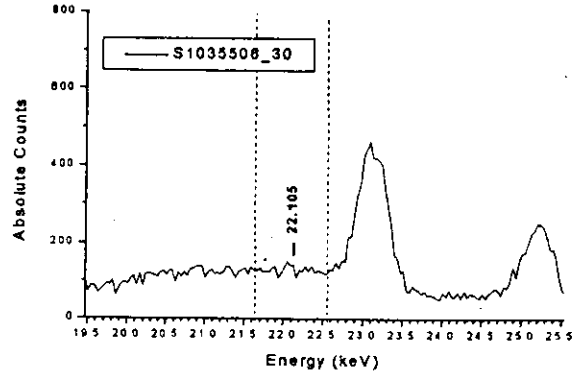

S1035504_20
Absolute Counts
Energy (keV)

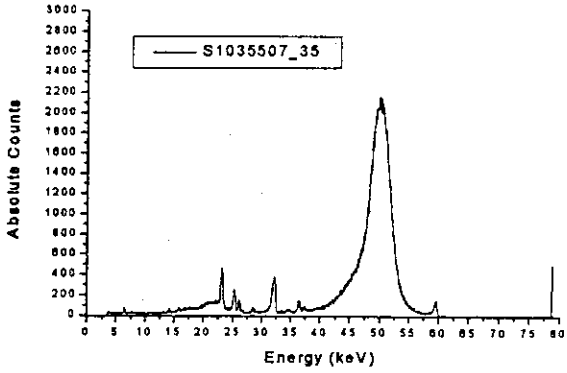

S1035504_20
22.105
Absolute Counts
Energy (keV)

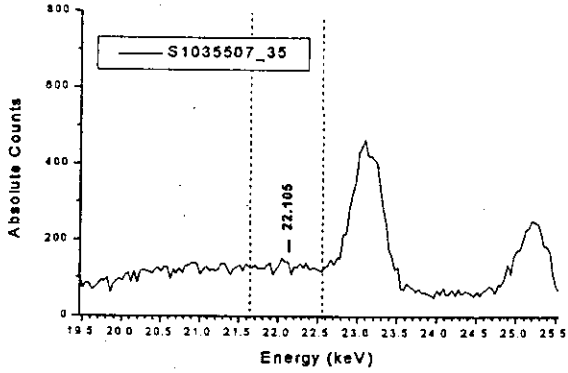

S1035505_25
Absolute Counts
Energy (keV)

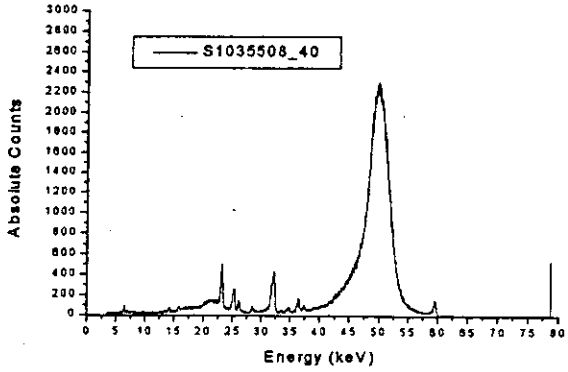

S1035505_25
22.105
Absolute Counts
Energy (keV)

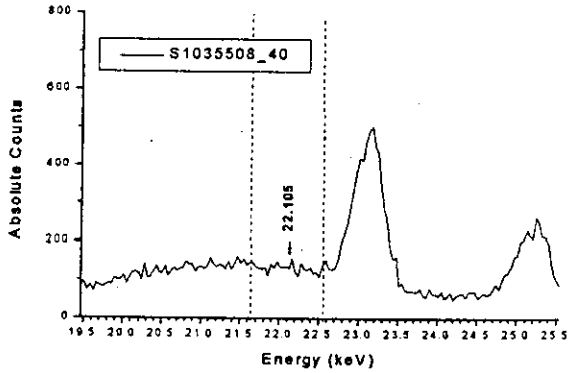

S1035506_30
Absolute Counts
Energy (keV)

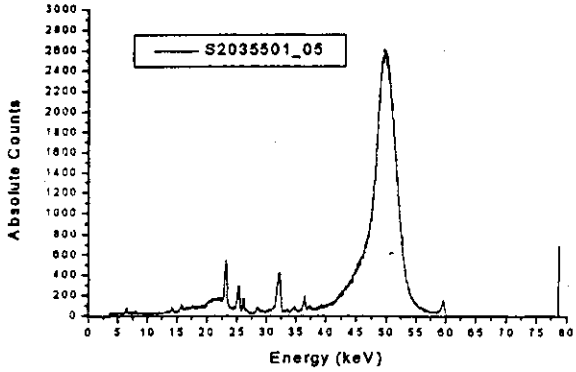

S1035506_30
22.105
Absolute Counts
Energy (keV)

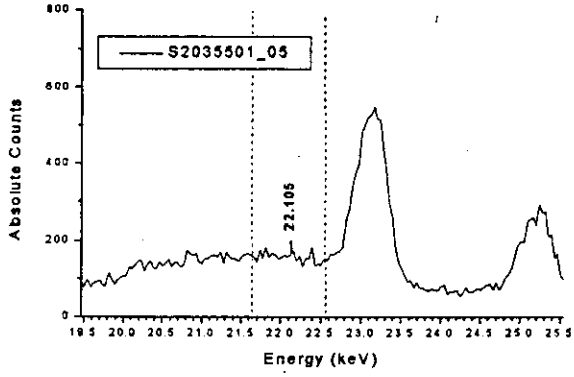

S1035507_35
Absolute Counts
Energy (keV)

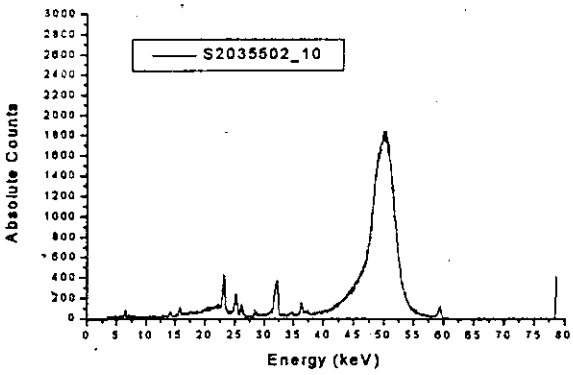

S1035507_35
22.105
Absolute Counts
Energy (keV)

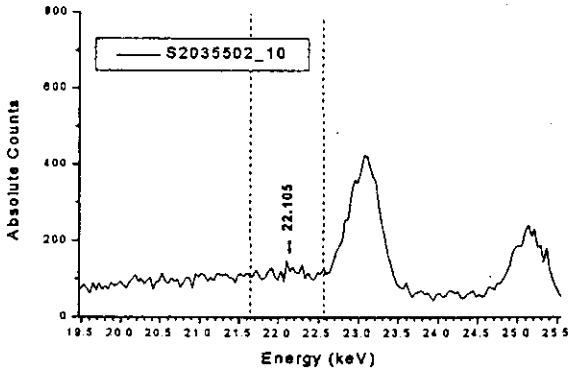

S1035508_40
Absolute Counts
Energy (keV)

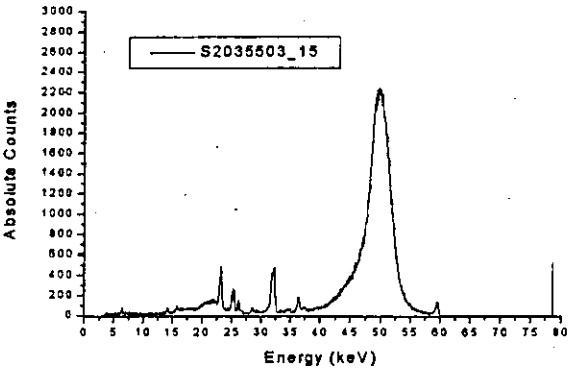

S1035508_40
22.105
Absolute Counts
Energy (keV)

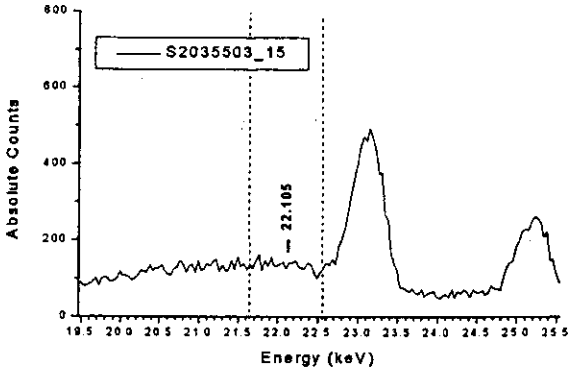

S2035501_05
Absolute Counts
Energy (keV)

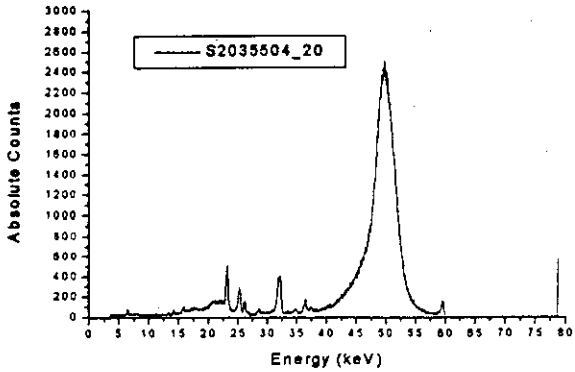

S2035501_05
22.105
Absolute Counts
Energy (keV)

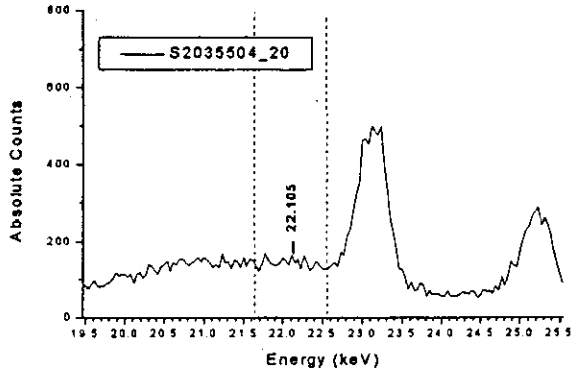

S2035502_10
Absolute Counts
Energy (keV)

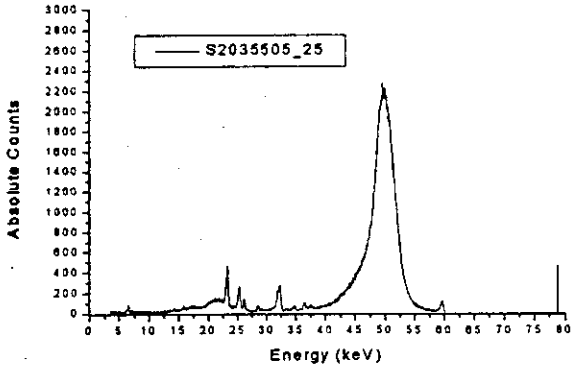

S2035502_10
22.105
Absolute Counts
Energy (keV)

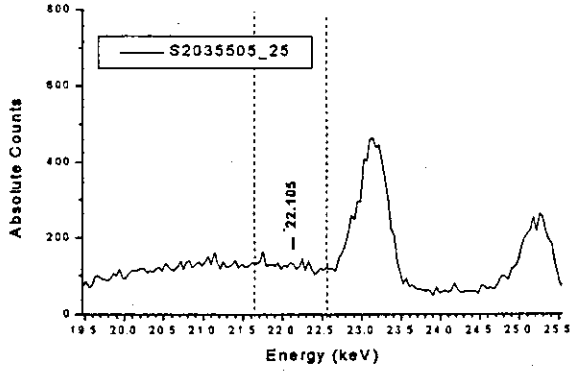

S2035503_15
Absolute Counts
Energy (keV)

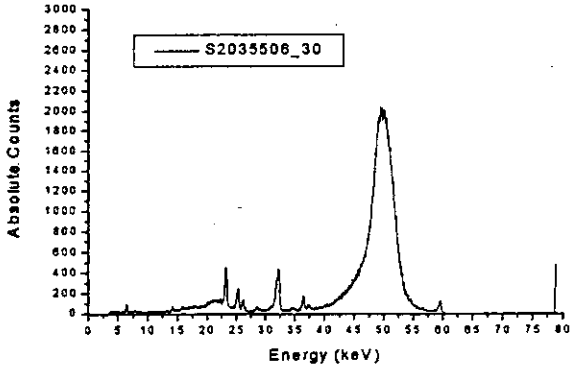

S2035503_15
22.105
Absolute Counts
Energy (keV)

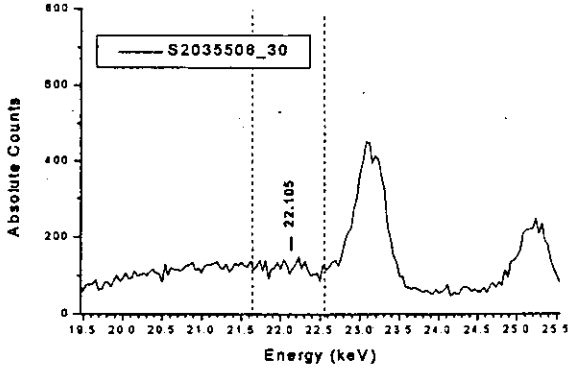

S2035504_20
Absolute Counts
Energy (keV)

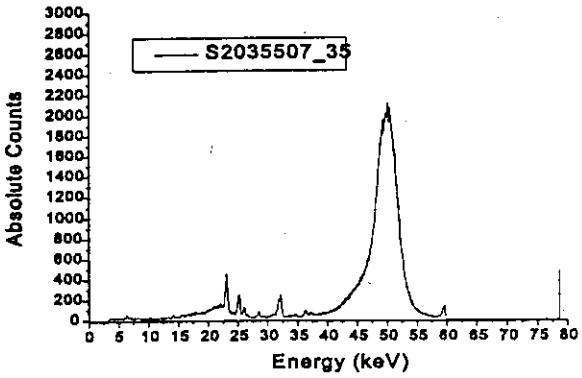

S2035504_20
22.105
Absolute Counts
Energy (keV)

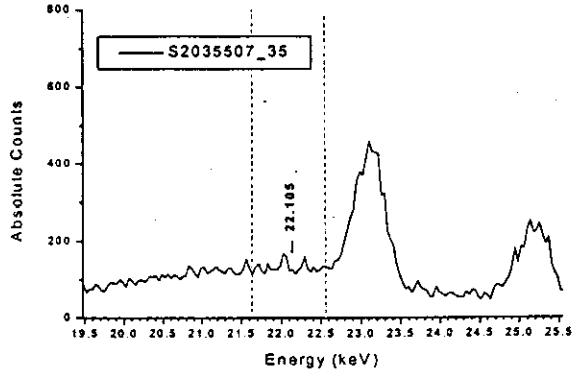

S2035505_25
Absolute Counts
Energy (keV)

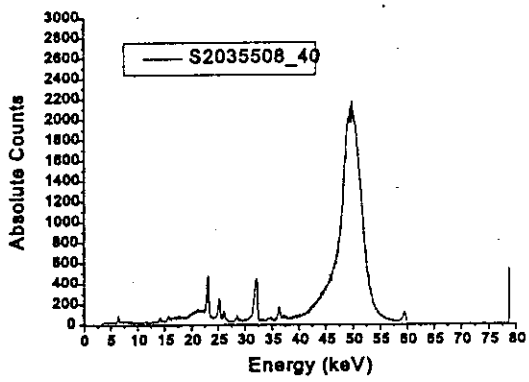

S2035505_25
22.105
Absolute Counts
Energy (keV)

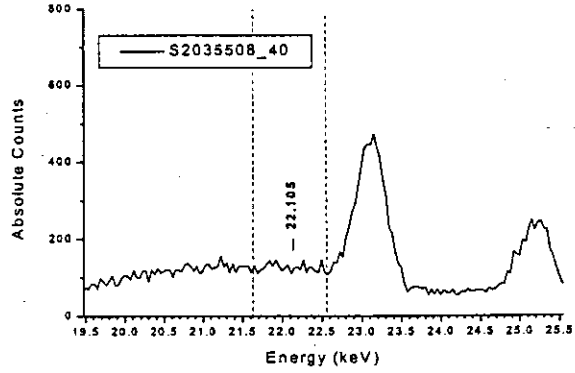

S2035506_30
Absolute Counts
Energy (keV)

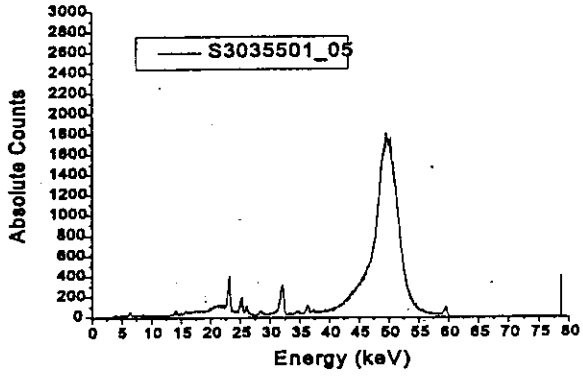

S2035508_30
22.105
Absolute Counts
Energy (keV)

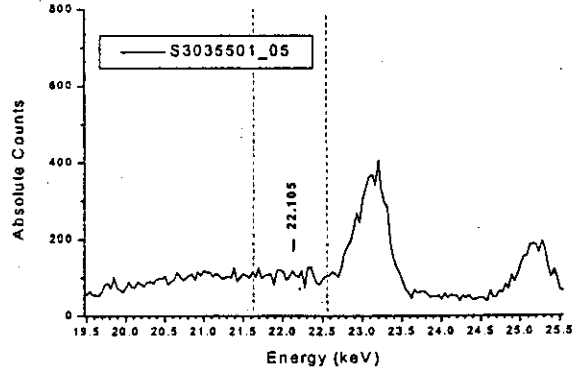

S2035507_35
Absolute Counts
Energy (keV)

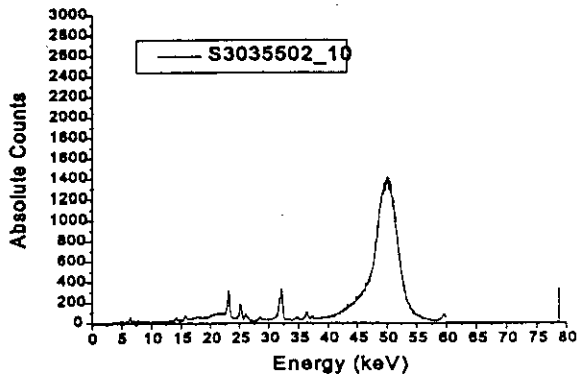

S2035507_35
22.105
Absolute Counts
Energy (keV)

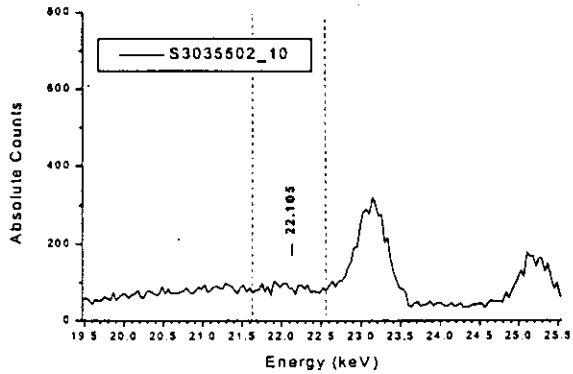

S2035508_40
Absolute Counts
Energy (keV)

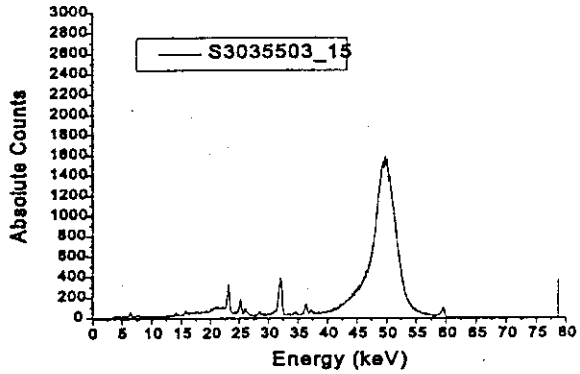

S2035508_40
22.105
Absolute Counts
Energy (keV)

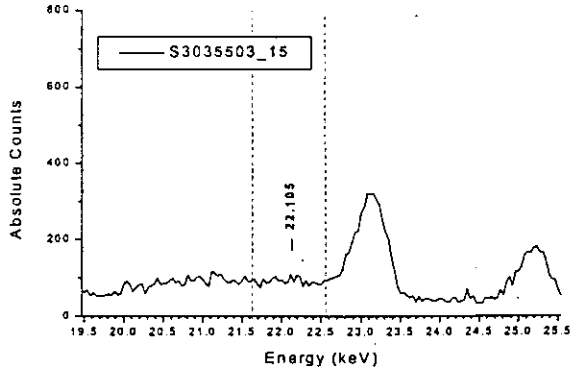

S3035501_05
Absolute Counts
Energy (keV)

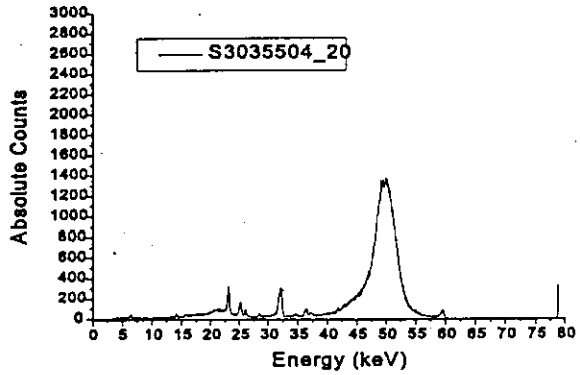

S3035501_05
22.105
Absolute Counts
Energy (keV)

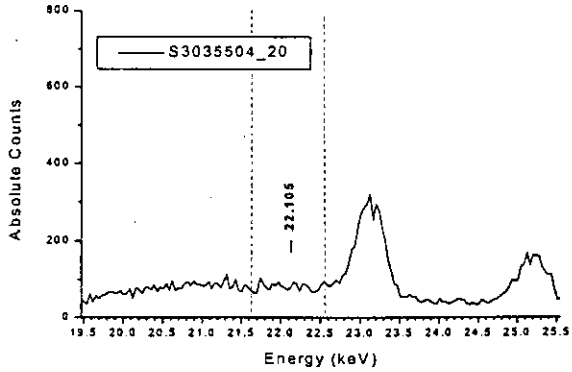

S3035502_10
Absolute Counts
Energy (keV)

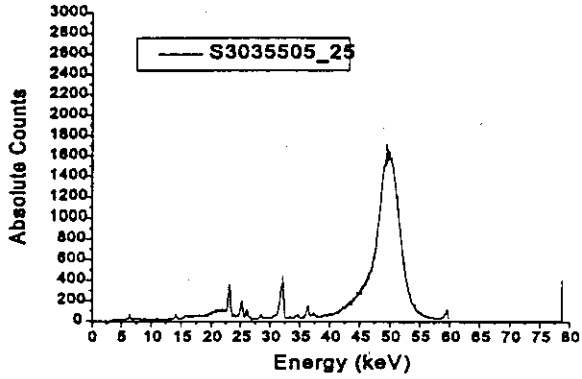

S3035502_10
22.105
Absolute Counts
Energy (keV)

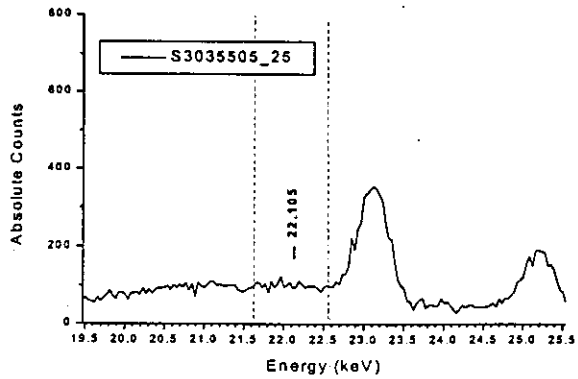

S3035503_15
Absolute Counts
Energy (keV)

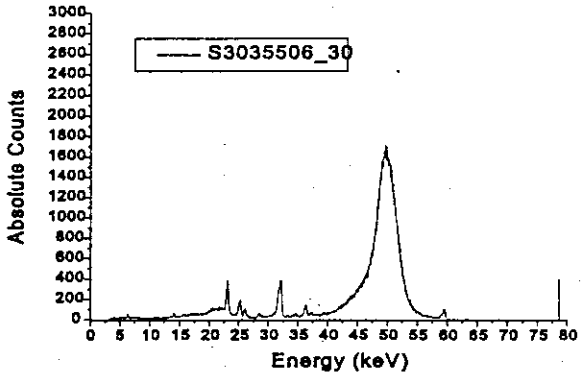

S3035503_15
22.105
Absolute Counts
Energy (keV)

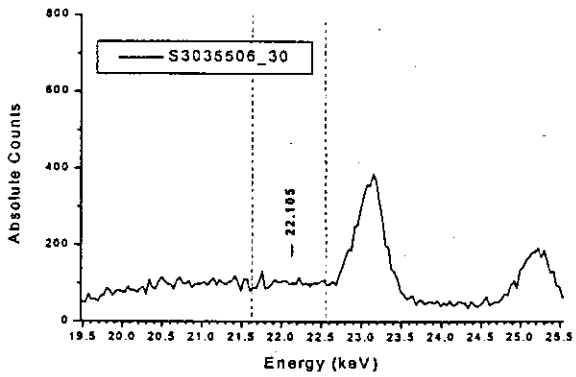

S3035504_20
Absolute Counts
Energy (keV)

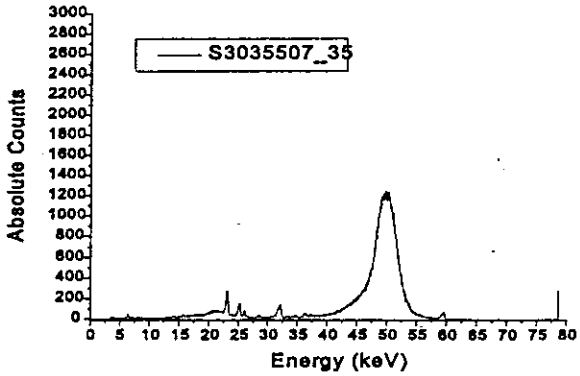

S3035504_20
22.105
Absolute Counts
Energy (keV)

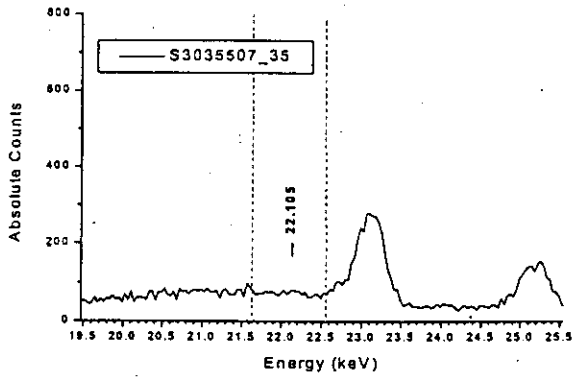

S3035505_25
Absolute Counts
Energy (keV)

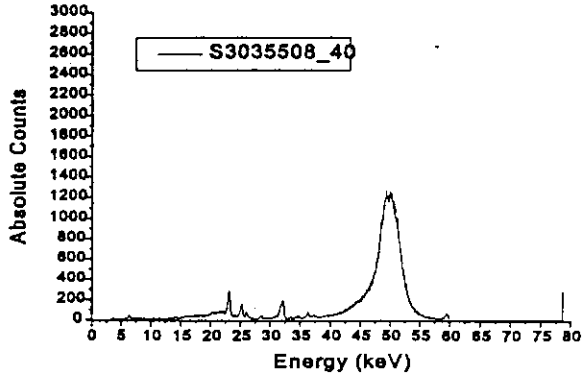

S3035505_25
22.105
Absolute Counts
Energy (keV)

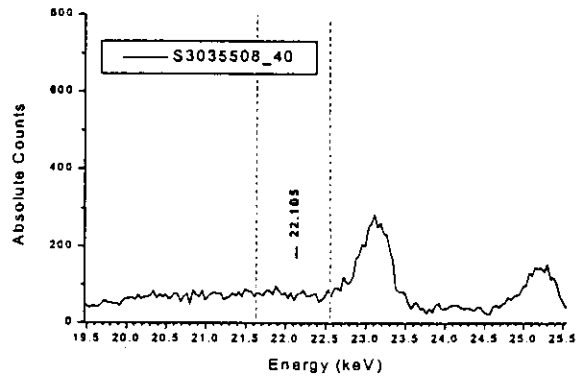

S3035506_30
Absolute Counts
Energy (keV)

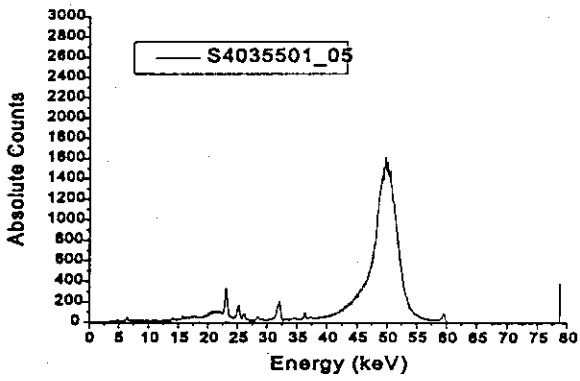

S3035506_30
22.105
Absolute Counts
Energy (keV)

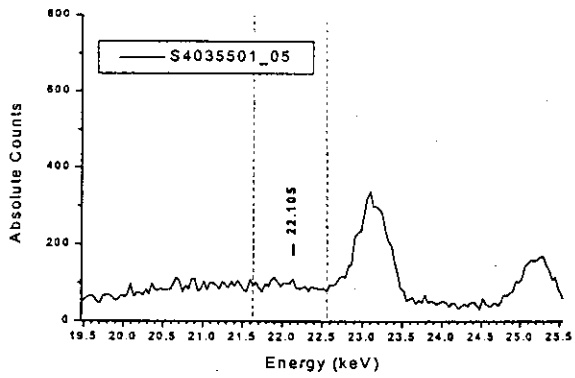

S3035507_35
Absolute Counts
Energy (keV)

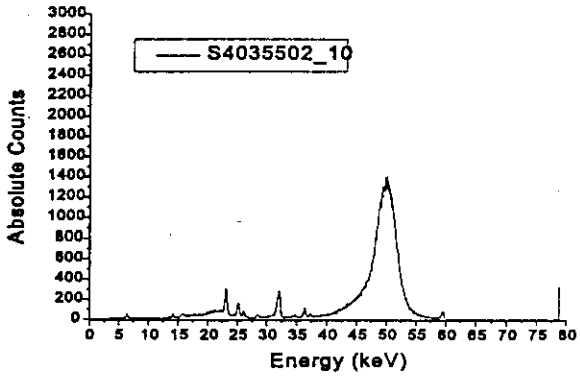

S3035507_35
22.105
Absolute Counts
Energy (keV)

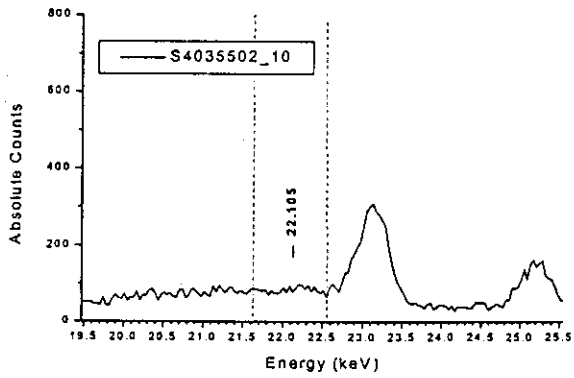

S3035508_40
Absolute Counts
Energy (keV)

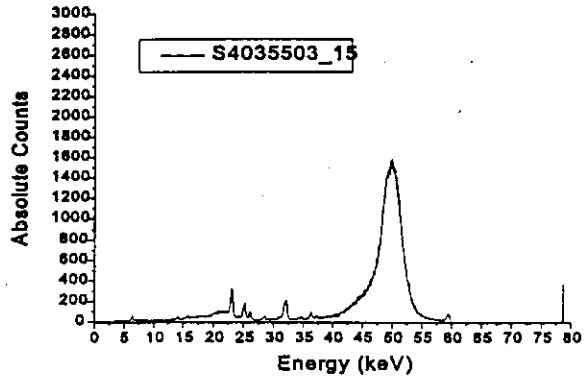

S3035508_40
22.105
Absolute Counts
Energy (keV)

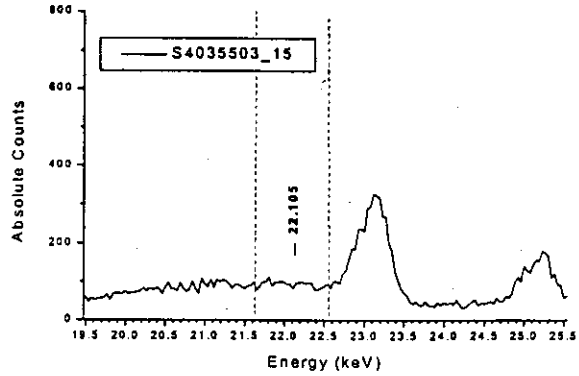

S4035501_05
Absolute Counts
Energy (keV)

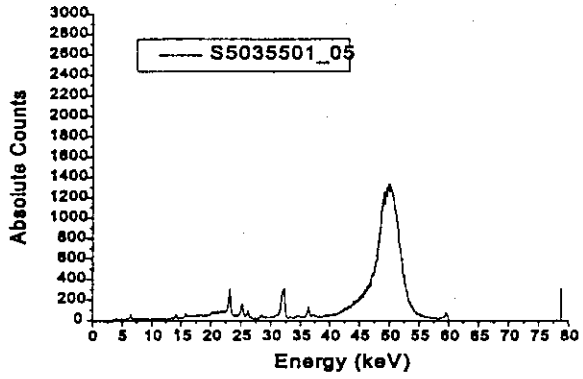

S4035501_05
22.105
Absolute Counts
Energy (keV)

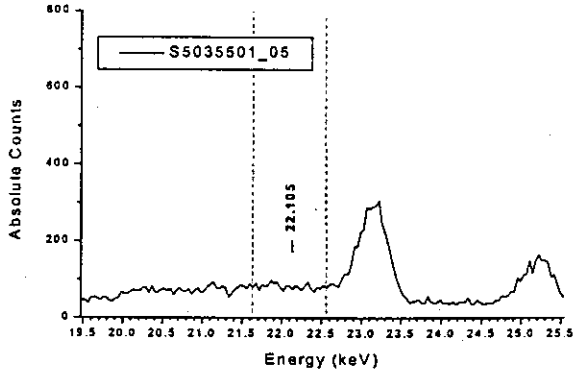

S4035502_10
Absolute Counts
Energy (keV)

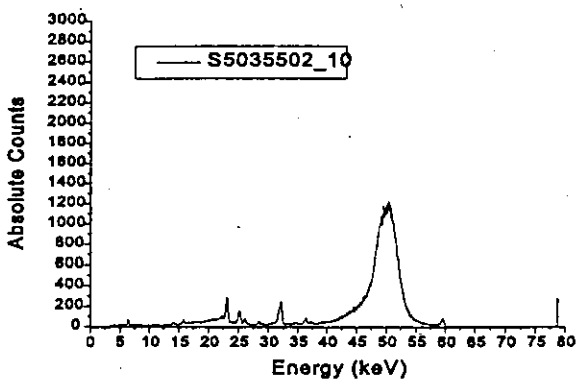

S4035502_10
22.105
Absolute Counts
Energy (keV)

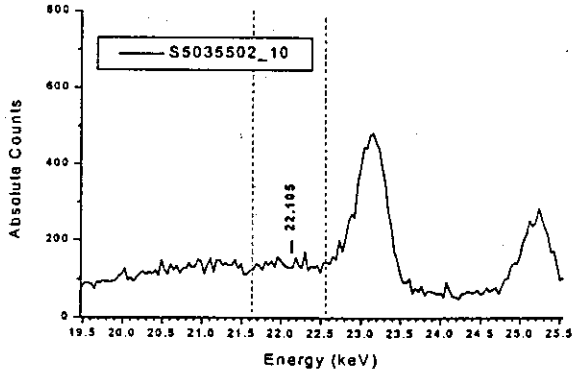

S4035503_15
Absolute Counts
Energy (keV)

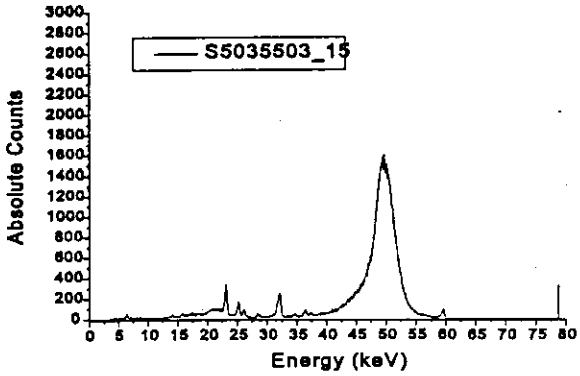

S4035503_15
22.105
Absolute Counts
Energy (keV)

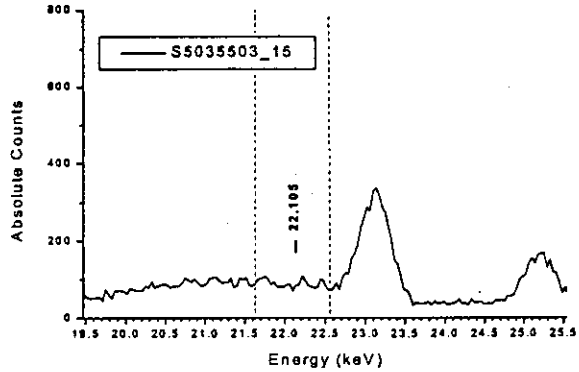

S5035501_05
Absolute Counts
Energy (keV)

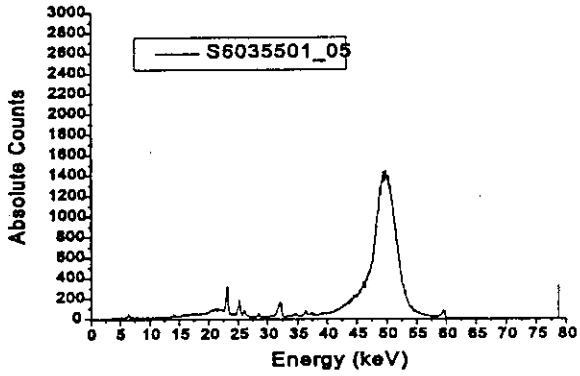

S5035501_05
22.105
Absolute Counts
Energy (keV)

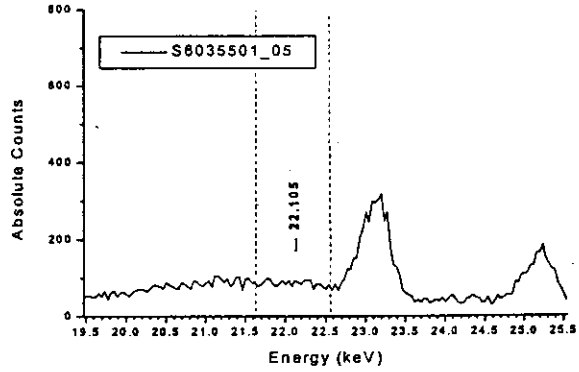

S5035502_10
Absolute Counts
Energy (keV)

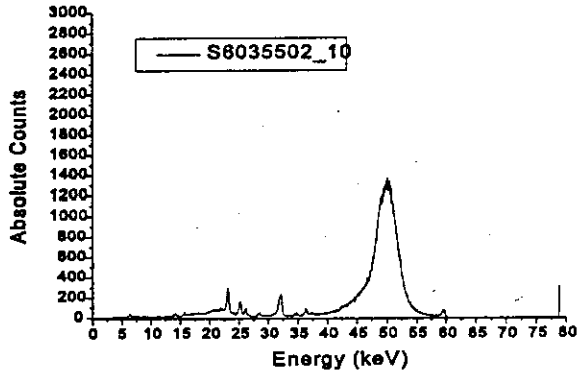

S5035502_10
22.105
Absolute Counts
Energy (keV)

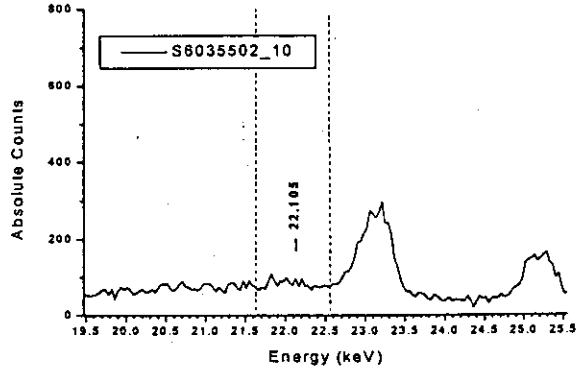

S5035503_15
Absolute Counts
Energy (keV)

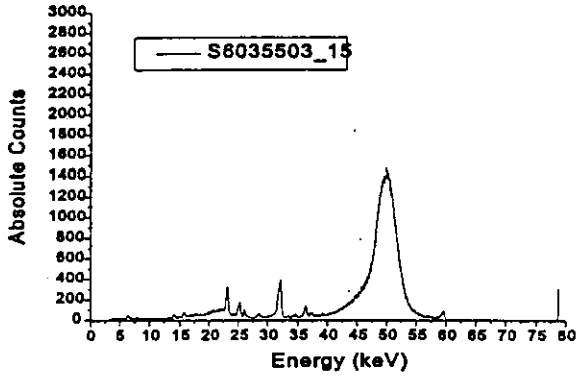

S5035503_15
22.105
Absolute Counts
Energy (keV)

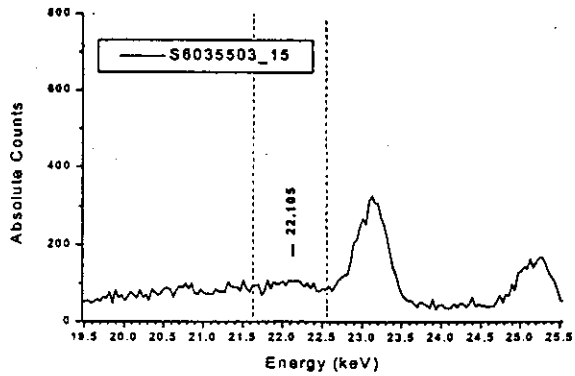

S6035501_05
Absolute Counts
Energy (keV)


S6035501_05
22.105
Absolute Counts
Energy (keV)


S6035502_10
Absolute Counts
Energy (keV)


S6035502_10
22.105
Absolute Counts
Energy (keV)


S6035503_15
Absolute Counts
Energy (keV)


S6035503_15
Absolute Counts
22.165
Energy (keV)

Appendix D

Summary of Best Management Practices for Corrective Action Unit (CAU) 429: Area 3 Building 03-55 & Area 9 Building 09-52 Underground Discharge Points (UDPs), Tonopah Test Range, Nevada

February 28, 2000

SUMMARY OF BEST MANAGEMENT PRACTICES FOR CORRECTIVE ACTION UNIT (CAU) 429: AREA 3 BUILDING 03-55 & AREA 9 BUILDING 09-52 UNDERGROUND DISCHARGE POINTS (UDPs), TONOPAH TEST RANGE, NEVADA

CAU 429 is located in Areas 3 and 9 of the Tonopah Test Range (TTR) (Figure 1) and is comprised of two Corrective Action Sites (CASs): CAS 03-51-0355, Area 3 Building 03-55 Photoshop UDPs and CAS 09-51-0952, Area 9 Building 09-52 Mobile Photographic Lab UDPs. Effluent from photoprocessing activities was discharged into the UDPs through underground drainage pipes. The Area 3 UDPs collected only effluent from photoprocessing activities while the Area 9 UDPs also collected effluent from the Building 09-52 septic tank.

Characterization activities conducted during July and August, 1999 determined that hazardous or radiological constituents had not impacted the environment at either the Area 3 or Area 9 UDP system. However, the septic tank in the Area 9 UDP system contained septage containing silver above the Resource Conservation and Recovery Act (RCRA) regulatory level.

As part of the Draft Corrective Action Decision Document/Closure Report (CADD/CR) for Corrective Action Unit 406: Area 3 Building 03-74 & Building 03-58 Underground Discharge Points and Corrective Action Unit 429: Area 3 Building 03-55 & Area 9 Building 09-52 Underground Discharge Points, Tonopah Test Range, Nevada, December 1999, the Department of Energy (DOE) proposed several best management practices for the CAU. The Nevada Division of Environmental Protection (NDEP) requested that these best management practices be completed prior to submitting the Final CADD/CR for the sites.

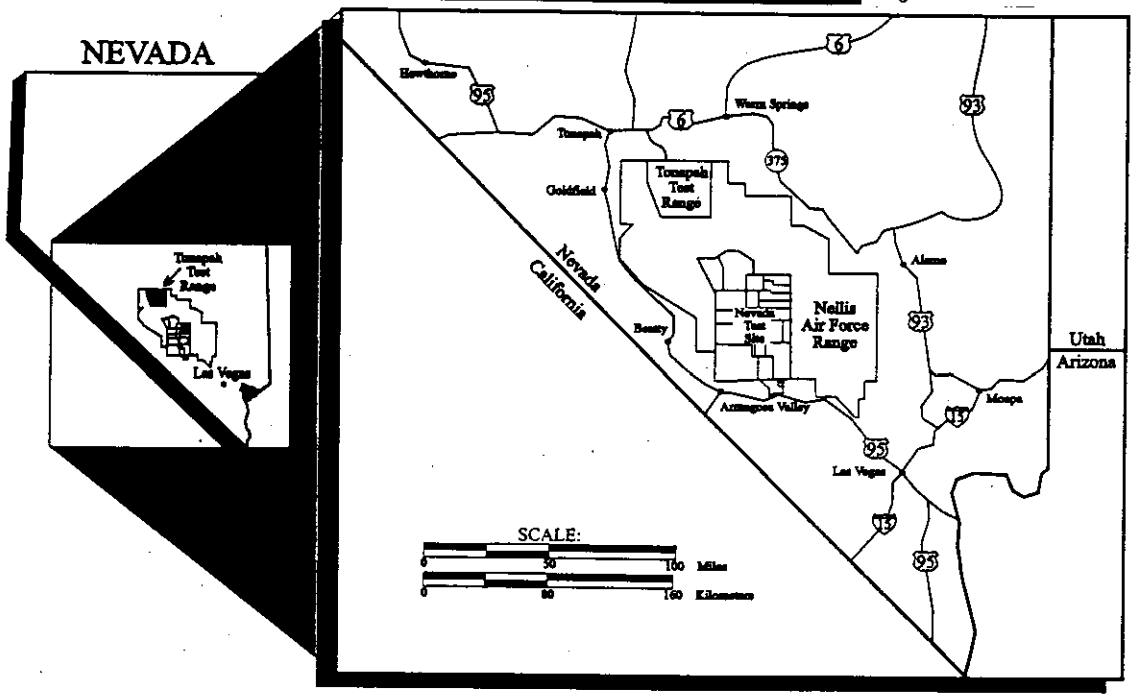
Best management practices at the sites were completed by conducting the following activities:

Pre-closure

- Preparation of field documents (Site Specific Health and Safety Plan [SSHASP], Unit Work Instructions [UWI], and Real Estate/Operations [REOPS] Permit).
- Obtain a National Environmental Policy Act [NEPA] determination and conduct utility clearances.

Area 9

- Disinfected septic tank contents by adding chlorine.
- Collected a sample for fecal coliform analysis.
- Pumped septic tank contents and disposed at an off site disposal facility.
- Removed piping from the septic tank to the UDPs.
- Grouted the end of the septic tank effluent line.



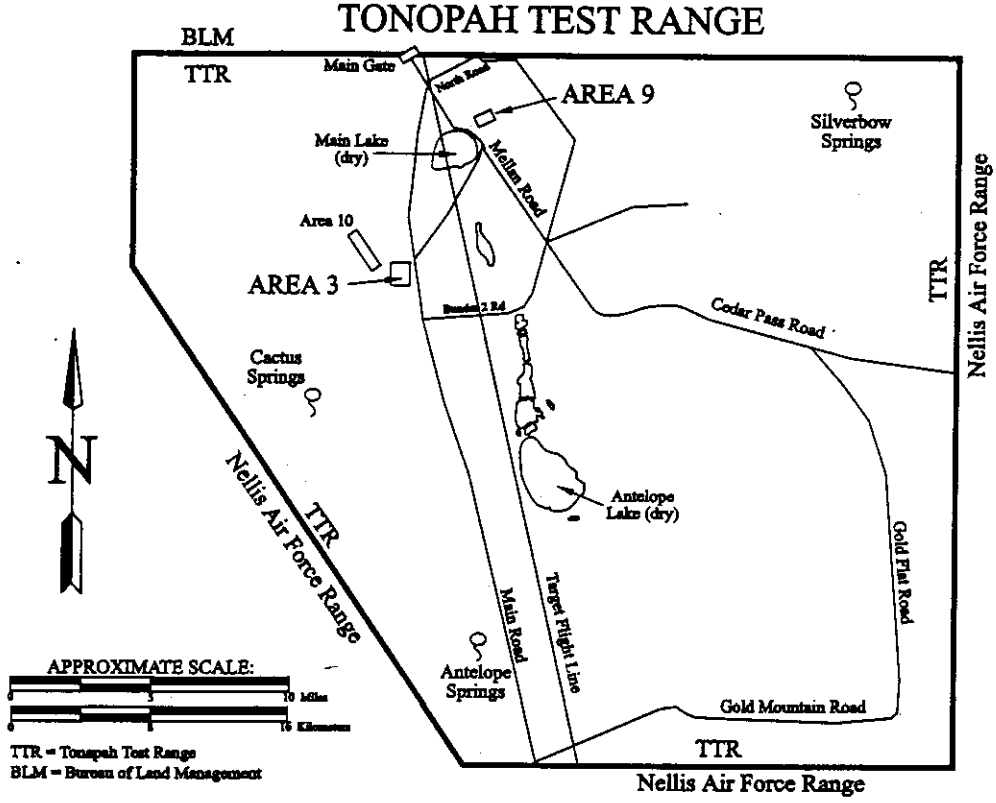


FIGURE 1
LOCATION OF AREA 3 AND AREA 9
AT THE TONOPAH TEST RANGE

- Removed Trailer 09-15 pad tie-in line and grouted line under the pad.
- Disposed of piping and UDPs at the TTR construction landfill.
- Backfilled all excavations.

Area 3

- Removed primary and secondary UDPs and metal overflow pipe.
- Removed transite (asbestos cement) discharge pipe from the primary UDP to a point 10 meters (m) (33 feet [ft]) south of the Area 3 Security Compound fence. Pipe was not removed from that point to Building 03-55 due to the presence of utilities. Pipe was also not removed where it ran under the main Area 3 access road.
- Filled remaining pipe with a grout slurry.
- Disposed of UDPs and metal overflow pipe at the TTR construction landfill.
- Disposed of the transite pipe at the Nevada Test Site (NTS) U10c Construction Landfill.
- Backfilled all excavations.

Post-closure

- Prepared this summary letter report.

PREFIELD ACTIVITIES

Several plans and permits were prepared prior to beginning field activities at CAU 429. These plans and permits included the SSHASP with an associated Hazard Analysis, UWI, REOPS Permit, and NEPA Checklist. A contract was set up with a hazardous waste disposal facility subcontractor to pump, transport, and dispose of the Area 9 septic tank contents. Site preparation involved coordinating with TTR personnel to conduct a utility survey, secure an Excavation Permit, and arrange for heavy equipment.

SEPTIC TANK DISINFECTION

Mobilization and site preparation began on January 24, 2000. The top of the Area 9 septic tank was exposed using a backhoe. In addition, the septic tank effluent line was exposed, separated, and plugged with grout. This was done to prevent the tank contents from spilling out during disinfection activities. Also at this time, the discharge line was removed from the septic tank to the east UDP.

Septic tank disinfection activities began on January 25, 2000. The access hatches were removed and a recirculating "trash" pump was used to mix the contents. The tank was disinfected by adding chlorine. The chlorine was in the form of dry, granular swimming pool "super shock" chlorine. It was necessary to chlorinate the septic tank contents because the disposal facility is not permitted to accept biological waste. Approximately 55 kilograms (120 pounds) of super shock was added to the septic tank.

Two samples of the tank contents were collected after the tank was disinfected for fecal coliform analysis and waste profiling. Both samples were transported off site on January 26, 2000. The fecal coliform sample was analyzed by a subcontract laboratory. The profile sample was analyzed by the subcontractor waste disposal facility.

UDP SYSTEM REMOVAL AND GROUTING

The UDPs and most of their associated piping were excavated and removed for disposal. Pipe that was not removed was filled with grout and closed in place (Figures 2 and 3). Pipe grouting occurred at the Area 3 UDPs where the pipe ran under the access road and in a 15 m (50 ft) section of pipe that ran south from Building 03-55 through a utility corridor.

Additionally, the Area 9 septic tank effluent line was plugged with grout. The tie-in line from the Trailer 09-15 pad was removed up to the pad and the remaining pipe was filled with grout. UDP system removal and grouting activities were completed on January 27, 2000. Verification samples were not collected from the piping and UDP excavations at either CAS because hazardous substances were not found during characterization activities.

The two Area 3 UDPs consisted of 1 m (3 ft) diameter by 2.4-3.0 m (8-10 ft) long corrugated steel pipe connected by a cast iron overflow pipe. The two Area 9 UDPs were each constructed of unmortared concrete blocks. They were 1.5 m (5 ft) in diameter by 2 m (7 ft) deep and were capped by a 2.4 m (8 ft) diameter reinforced concrete slab. They were connected to the septic tank by cast iron and plastic pipe.

The UDPs and all the piping was intact and in good condition. The soil in the UDPs and under the piping was dry with no staining, odors, or other evidence of leaks or spills.

SEPTIC TANK WASTE REMOVAL

The septic tank contents were removed on February 24, 2000. This was done by a subcontracted hazardous waste hauler who pumped the contents directly into a tanker truck. The tank was rinsed with clean water and the rinseate was also pumped into the tanker truck. A total of 11,356 liters (L) (3,000 gallons [gal]) of hazardous waste was generated.

Because of the presence of hazardous constituents, the tank is no longer considered a septic tank but is considered an underground storage tank (UST) containing hazardous substances. However, Sandia National Laboratories has plans to reuse the tank as a septic tank, which would be considered a change in service. Therefore, the tank was closed in accordance with 40 CFR 280.71(c) which covers a change in service for USTs. The regulation refers to American Petroleum Institute Publication 2015 "Cleaning Petroleum Storage Tanks" as a guidance for cleaning USTs containing hazardous substances prior to a change in service. Neither the regulations nor guidance call for sampling of the rinseate, therefore no verification sampling was done.

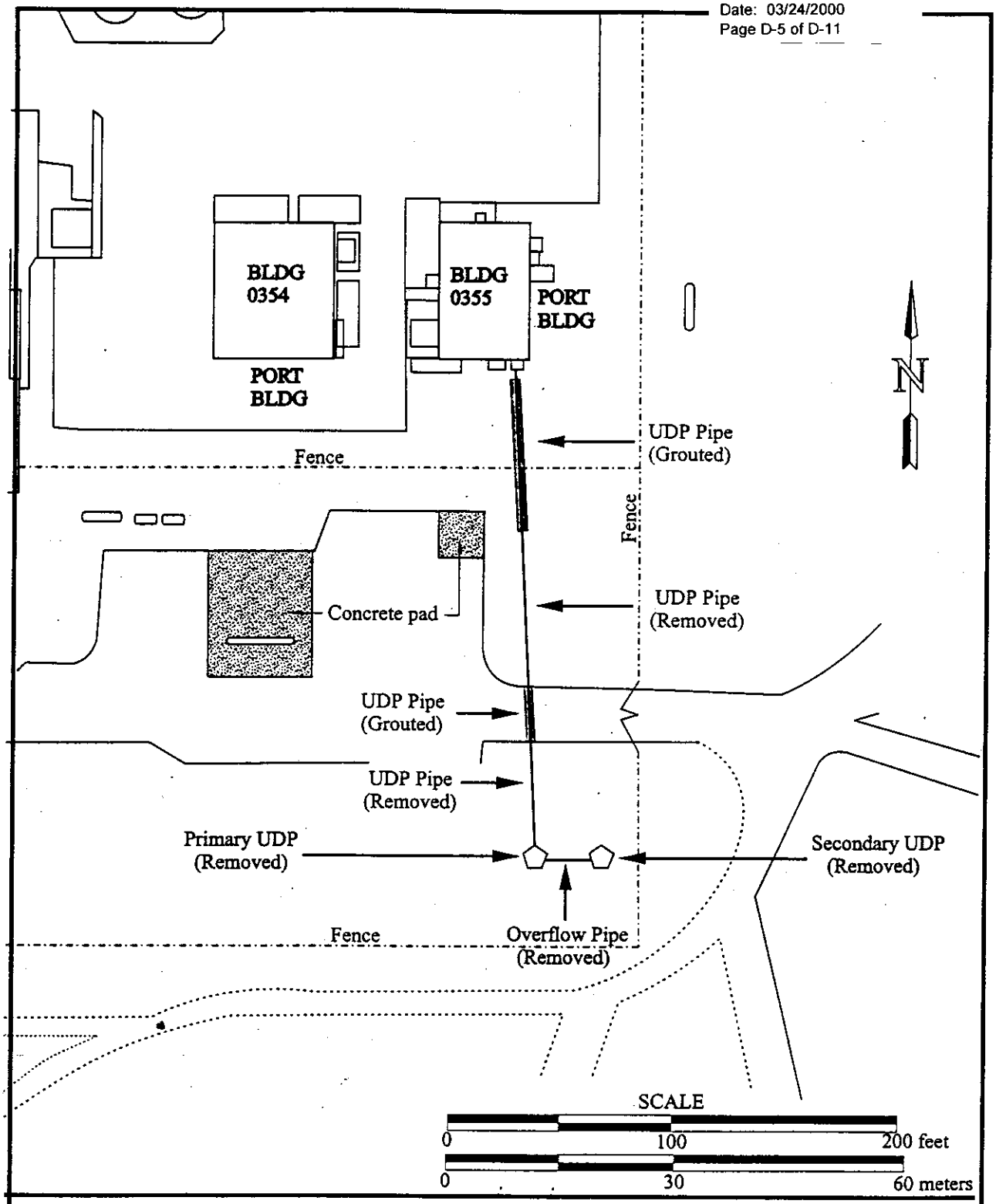


FIGURE 2
AREA 3 UDPs (AS COMPLETED)

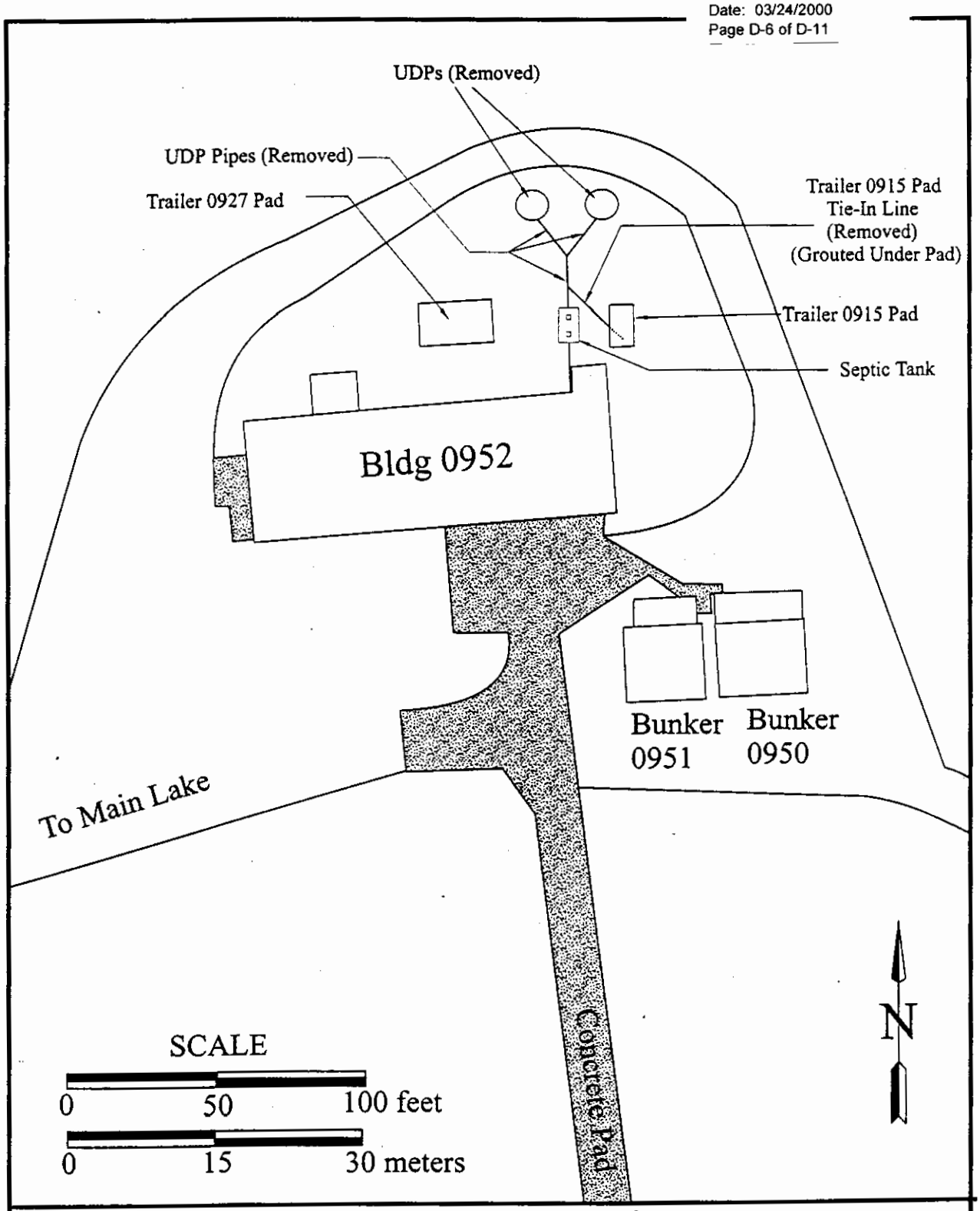


FIGURE 3
AREA 9 UDPs (AS COMPLETED)

WASTE MANAGEMENT

A total of approximately 11,356 L (3,000 gal) of waste was generated from the Area 9 septic tank, including rinse water. The waste was disposed at the Safety-Kleen Hazardous Waste Disposal Facility. The waste was pumped and transported on February 24, 2000. The shipping manifests are shown in Appendix A.

Approximately 21 m (70 ft) of transite pipe was removed from the Area 3 UDP system. This pipe was transported to the NTS U10c Construction Landfill for disposal.

All of the debris except the transite was disposed in the TTR construction landfill.

SUMMARY

Best management practices were done at CAU 429 by pumping and disposing the septic tank contents and by removing and disposing of the UDPs and most of their associated piping. Piping that was not removed was filled with grout and left in place. No verification samples were required from the Area 9 tank in accordance with 40 CFR 280.71(c) and the associated guidance. Verification samples were not collected from the piping and UDP excavations because no hazardous substances were found during characterization activities. It is anticipated that the site can be clean closed under the Final CADD/CR without further corrective action.

APPENDIX A

SHIPPING MANIFEST

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

Form Approved. OMB No. 2050-0039.

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. / Manifest Document No.: N V 3 8 9 0 0 9 0 0 0 1 0 0 0 0 6
2. Page 1 of 1 — Information in the shaded areas is not required by Federal law.

3. Generator's Name and Mailing Address:
Bechtel Nevada for USDOE
PO Box 98521 M/S NTS 207
Las Vegas, NV 89193-8521
4. Generator's Phone (702) 295-6400 CONTACT: ATTN: Craig Stowell

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

5. Transporter 1 Company Name: TRIAD Transport, Inc.
6. US EPA ID Number: O K D 9 8 1 5 8 8 7 9 1
C. State Transporter's ID:
D. Transporter's Phone: (800)324-1139

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:
Safety-Kleen Aragonite, Utah
11600 NORTH APTUS ROAD
Aragonite, UT 84029
10. US EPA ID Number: U T D 9 8 1 5 5 2 1 7 7
G. State Facility's ID:
H. Facility's Phone: (801) 531-4245

	11. US DOT Description (Including Proper Shipping Name, Hazard Class and ID Number)	HM	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.	Hazardous waste, liquid, n.o.s., 9, NA3082, PG-III (Silver and Acetone) D011	X	001	TT	3000	G	D011
b.							
c.							
d.							

J. Additional Descriptions for Materials Listed Above
A: 000187;ERG171;AP3000794 3,000gal total
B:
C:
D: TK 9921 Tk 108

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information
24 HR EMERGENCY CONTACT # (702) 295-6400
Certificate of Destruction is REQUIRED.
Use proper PPE when handling containers.

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, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government 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: Marshall Laub — Signature: /s/ Signature on File — Month Day Year: 02 24 00

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials
Printed/Typed Name: NEAL G THIES FOR TRIAD — Signature: /s/ Signature on File — Month Day Year: 02 24 00

18. Transporter 2 Acknowledgement of Receipt of Materials
Printed/Typed Name: — Signature: — Month Day Year:

FACILITY

19. Discrepancy Indication Space

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:

Style CF 17 LABELMASTER, AN AMERICAN LABELMARK CO., CHICAGO, IL 60646 (800)621-5808

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete

PRINTED ON RECYCLED PAPER USING SOY BEAN INK — PRINTED WITH SOY INK

WHITE - RETURN TO GENERATOR

LAIDLAW ENVIRONMENTAL SERVICES

FORM A

Page 1 of 2

Customer Notification And Certification

Generator Name/Location: *Bechtel Nevada for USDOE / Las Vegas, NV 89193-8521*

EPA I.D. Number: *NV3890090001*

Waste Profile or ARF Designation: *AP3000794*

Manifest Number: *00006*

EPA Waste Number(s): *D011*

Waste Analysis Available? **Yes (attached)** _____ **No** _____ **On file at receiving facility** X

Unrestricted Waste Notification *(Category 1)*

Mark the statement below if you generate a waste that is not a land disposal restricted waste (the waste has no applicable treatment standards).

☐ *I notify that I am familiar with the waste through analysis and testing or through knowledge of the waste to support this notification that the waste is not restricted as specified in 40 CFR 268, Subpart D or any applicable prohibitions set forth in 40 CFR 268.32 or RCRA Section 3004(d).*

Restricted Waste / Debris Notification *(Category 2)*

Mark statement (2a) below if you generate a waste that is restricted from land disposal (the waste has applicable treatment standards). NOTE-1: A waste may pass one or more standards and require treatment or be varianced for others. In this case, all applicable categories must be checked. NOTE-2: D001, ~~D002, and D012 – D043~~ D043 and wastes must be evaluated for underlying constituents found in 40 CFR 268.48 (Table UTS), that are reasonably expected to be present. A list of these constituents must be included on FORM B, or attached to and accompany this notification with each waste shipment. Mark statement (2b) if you generate a debris waste that will be treated to the alternate debris standards located in 40 CFR 268.45.

☒ **(2a) Restricted Waste Notification**
I notify that I am familiar with the waste through analysis and testing or through knowledge of the waste to support this notification that the waste is subject to the treatment standards specified in 40 CFR 268 Subpart D. The waste (a) must be treated to the appropriate regulatory treatment standard, by the appropriate regulatory treatment method; (b) qualifies for a variance as described in Category 3 below; or (c) meets some or all of the standards as described in Category 4 below.

☐ **(2b) Alternate Debris Treatment Notification:** This hazardous debris is subject to the alternate treatment standards of 40 CFR 268.45. The waste contains the following contaminants subject to treatment (check all that apply):

_____ 268.45(b)(1) - Toxicity characteristic debris;
_____ 268.45(b)(2) - Debris contaminated with listed waste;
_____ 268.45(b)(3) - Cyanide reactive debris.

Restricted Waste Variance Notification *(Category 3)*

Mark the statement below and list the applicable variance date on Form B, if you generate a waste which does not require treatment prior to land disposal because of a variance (including a case-by-case extension under 40 CFR 268.5, a nationwide variance under 40 CFR 268 Subpart C, a no migration petition under 40 CFR 268.6, or other applicable variance).

☐ *I notify pursuant to 40 CFR 268.7(a)(3) that I am familiar with the waste through analysis and testing or through knowledge of the waste to support this notification that this waste is subject to a national capacity variance under 40 CFR 268 Subpart C, or a case-by-case extension under 40 CFR 268.5, or an exemption under 40 CFR 268.6.*

Restricted Waste Certification (Treatment Standards Met) *(Category 4)*

Mark the certification statement below if you generate a waste that is restricted from land disposal (the waste has applicable treatment standards), and the waste meets the standards as generated. Note: All applicable constituent standards must be accounted for. A waste may pass one or more standards and require treatment or be variance for other constituents. In this case, all applicable categories must be checked.

☐ *I certify under penalty of law that I personally have examined and are familiar with the waste through analysis and testing or through knowledge of the waste to support this certification that the waste complies with the treatment standards specified in 40 CFR Part 268 Subpart D and all applicable prohibitions set forth in 40 CFR 268.32 or RCRA 3004(d). I believe that the information I submitted is true, accurate, and complete. I am aware that there are significant penalties for submitting a false certification, including the possibility of fine and imprisonment.*

SIGNATURE: /s/ Signature on File **DATE** 2-23-00

PRINT NAME: Marshall Lamb

FORM B1 *(Must be accompanied by Form A)*

Generator Name / Location: *Bechtel Nevada for USDOE / Las Vegas, NV 89193-8521* **Page** *2* **of** *2*

EPA I.D. Number: *NV3890090001* **Manifest:** *00006*

Waste Profile or ARF	Category No.	EPA or State Waste Code	Variance Date	Description / Sub Category	Treatability Group (WW or NWW)	Waste Constituents or Legend #
AP3000794	*2a*	*D011*		*Silver*	*NWW*	*51,58,63,64,65,66,81,82,108,109,110,111*
						112, 113, 129, 147, 148, 149, 150, 151, 162, 163 247, 250, 251, 255

CONSTITUENTS IN SOLVENT, CALIFORNIA LIST AND CHARACTERISTIC WASTES.

F001 - F005 spent solvents

Legend #	Constituent Name
1	Acetone
2	Benzene
3	n-Butyl alcohol
* 4	Carbon disulfide
5	Carbon tetrachloride
6	Chlorobenzene
7	Cresol (m- and p-isomers)
8	o-Cresol
* 9	Cyclohexanone
10	1,2-Dichlorobenzene
11	Ethyl Acetate
12	Ethyl Benzene
13	Ethyl Ether
14	Isobutyl alcohol
* 15	Methanol
16	Methylene Chloride
17	Methyl Ethyl Ketone
18	Methyl isobutyl ketone
19	Nitrobenzene
20	Pyridine
21	Tetrachloroethylene
22	Toluene
23	1,1,1-Trichloroethane
24	1,1,2-Trichloroethane
25	Trichlorothylene
26	1,1,2-Trichloro-1,2,2-trifluoroethane
27	Trichloromonofluoro-methane
28	Xylenes (total)

Legends 29-31 RESERVED

** If these constituents are present alone or in any combination of the three, then non waste water forms of these constituents must be treated to TCLP levels as indicated in 268.40.*

Technology-Based standards For F005 when the constituent is the only listed F001 - F005 solvent

Legend #	Constituent Name
32	2-Ethoxyethanol
33	2-Nitropropane

Legends 34-43 RESERVED

CALIFORNIA LIST WASTES

Legend #	Constituent Name
44	Nickel
45	Thallium
46	Cyanide (Liquid)
47	Liquid Polychlorinated Biphenyls (PCB's)
48	Halogenated Organic compounds (HOC's)

SEE BACK FOR THE UNIVERSAL TREATMENT STANDARDS (UTS), Legends 49 - 264

Appendix E

Use Restriction Form

DEPARTMENT OF THE AIR FORCE
99TH CIVIL ENGINEER SQUADRON (ACC)
NELLIS AIR FORCE BASE, NEVADA 89191

21 Mar 00

Ms. Eloisa Hopper
Chief, Environmental Management Flight
4349 Duffer Dr., Suite 1601
Nellis AFB NV 89191-7007

Ms. Runore C. Wycoff
Director, Environmental Restoration Division
DOE Nevada Operations Office
P.O. Box 98518
Las Vegas NV 89193-8518

RECORDATION OF CORRECTIVE ACTION UNIT (CAU) 429

Nellis Air Force Base (Nellis) has recorded the U.S. Department of Energy's (DOE) Use Restriction Information for Corrective Action Unit (CAU) 429. The information was placed in the Geographic Information System at the Range Management Office, Nellis.

Please contact me at 652-4123 if you have any questions.

Sincerely

/s/ Eloisa Hopper

ELOISA HOPPER
Chief, Environmental Management Flight

cc:
NDEP
HQ AWFC RMO/RML
HQ AWFC/JAV

CAU Use Restriction Information

CAU Number/Description: CAU 429 Area 3 Building 03-55 & Area 9 Building 09-52 UDPs

Applicable CAS Numbers/Descriptions: CAS 03-51-001-0355, Photo Shop (Building 03-55) UDP, Drains

Contact (organization/project): DOE/NV Industrial Sites Project Manager

Surveyed Area (UTM coordinates; Zone 11, NAD 27): Northing 4181848.45 Easting 521623.98

Survey Date: 8/18/99 **Survey Method (GPS, etc.):** Survey

Site Monitoring Requirements: None

Required Frequency (quarterly, annually?): Not Applicable

If Monitoring Has Started, Indicate Last Completion Date: Not Applicable

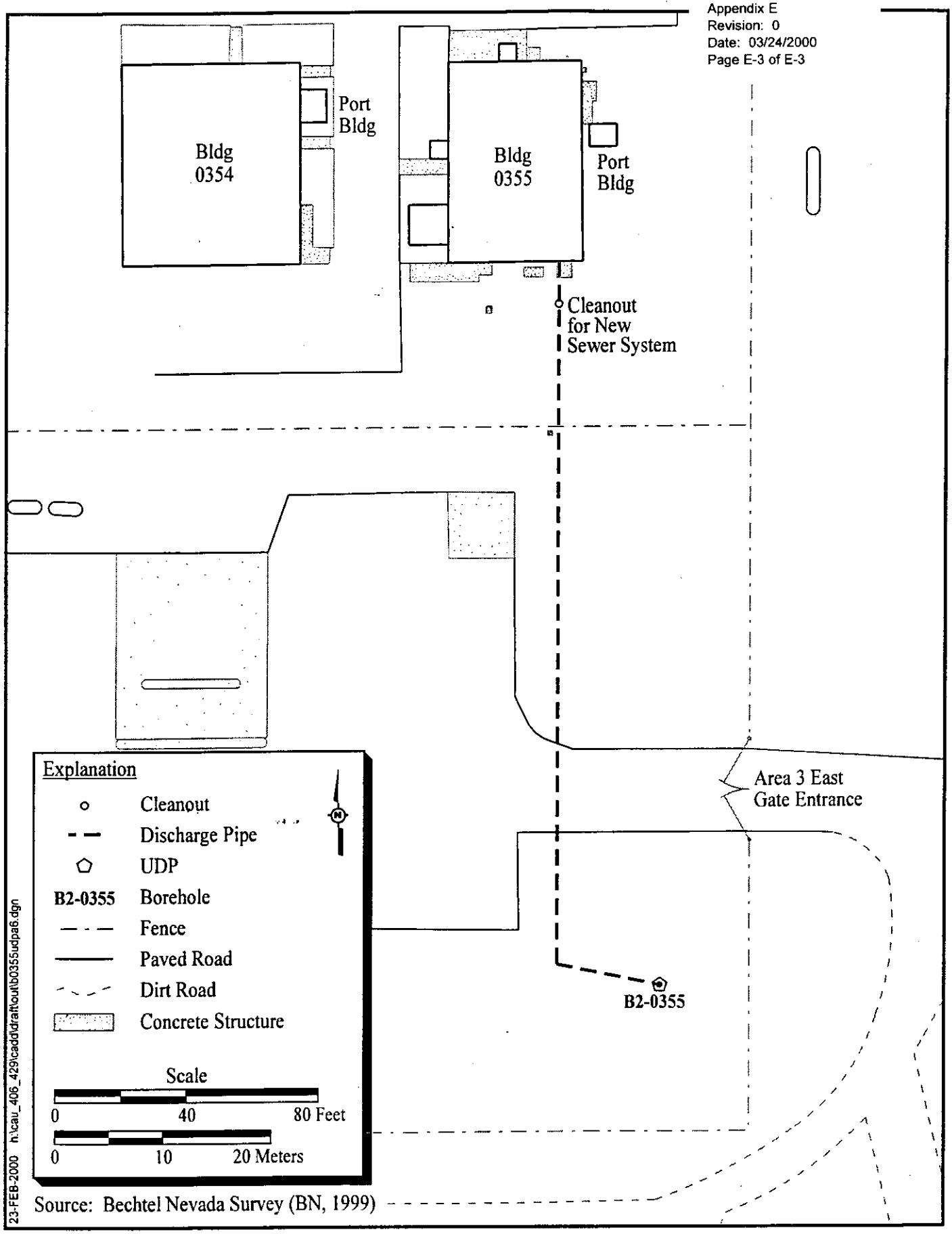
Use Restrictions

The future use of any land related to this Corrective Action Unit (CAU), as described by the above surveyed location, is restricted from any DOE or Air Force activity that may alter or modify the containment control as approved by the state and identified in the CAU Closure Report or other CAU documentation unless appropriate concurrence is obtained in advance.

Comments: See the CAU 406/429 Corrective Action Decision Document/Closure Report for additional information on the condition of the site. The site is restricted from future utilization for residential purposes. There are no restrictions for future industrial activities (e.g., excavation for utility installation or maintenance) at the site.

Submitted By: /s/ Kevin Cabble **Date:** 2/24/00

cc with copy of survey map (paper and digital (.dgn) formats):
CAU Files (2 copies)



CAS 03-51-001-0355 Area 3 Photoshop (Building 03-55) UDPs

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 406: Area 3 Building 03-74 & Building 03-58 Underground Discharge Points and Corrective Action Unit 429: Area 3 Building 03-55 & Area 9 Building 09-52 Underground Discharge Points, Tonopah Test Range, Nevada	2. Document Date: December 1999
3. Revision Number: 0	4. Originator/Organization: IT Corporation
5. Responsible DOE/NV ERP Project Mgr.: Janet Appenzeller-Wing	6. Date Comments Due: January 20, 2000
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) Page ES-2 of ES-3, 1st Paragraph After Bullets, 3rd Sentence		For the samples that exceeded the PALs for diesel-range organics which represent previous spills: please state if the previous spills were reported, and if they have CAS numbers to address their clean-up.	The previous spills were reported. The UPS building is still being used and the previous spills are considered to be operational. Therefore, no CAS has been assigned.	Yes
2) Page 8 of 11, Last Bullet		For those samples that represent previous spills: please include here the spill report numbers and their respective CAS numbers, if they have them.	Soil sample TTR01431, collected from EX0358-01 (behind the UPS building) was the only sample that exceeded the NDEP regulatory action level of 100 mg/kg. This sample location had a previous spill and is documented in the Incident Notification Report Case Number H920225A. This spill is not part of any CAU.	Yes
3) Page 10 of 11, 3rd Bullet		Assuming the housekeeping work described under Area 3 and Area 9 on page 10 of 11 is completed prior to distribution of the final version of this CADD/CR, the final letter of approval will serve as a Notice of Completion.	Work has been completed and documentation is included in Appendix D.	Yes
4) A-17 of A-55, 2nd Paragraph, 8th Sentence		Same comment as Comment No. 2.	See #2 response.	Yes
5) A-18 of A-55, 1st Paragraph, 6th Sentence		Same comment as Comment No. 2.	See #2 response.	Yes

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
6) A-18 of A-55, 2nd Paragraph, Last Sentence		"...500 parts per million..." Soil units should be milligrams per kilogram (mg/kg). Parts per million (ppm) are used only in low concentration aqueous solutions. All references to concentrations in soil should carry units in mg/kg.	Mg/kg is consistent with ppm.	No
7) A-20 of A-55, 1st Paragraph, 3rd Sentence		1,000 mg/kg in the soil is below the Industrial PRGs of 10,000 mg/kg but above residential PRGs of 390 mg/kg. This will prevent a clean closure, require the imposition of LURs for this CAS and notification to the CAB.	The 1,000 mg/kg results were from field screening. The laboratory analytical results for the confirmation sample # TTR01452 was 200 (J) mg/kg which is below both the industrial and residential PRG. However, sample TTR01459 results were 5,909 ppm for field screening and 2900 (J) mg/kg for laboratory analytical results. A use restriction has been submitted for unrestricted future use for industrial activities but restricted future residential use.	Yes
8) A-52 of A-55, Last Bullet		Indicate that the sludge was removed as stated on page 10 of 11, last paragraph, first bullet, and that the soil contains silver above residential PRGs with LURs, etc.	Statement was modified to include removal of the sludge.	Yes

[a] Comment Types: M = Mandatory, S = Suggested.
Return Document Review Sheets to DOE/NV Environmental Restoration Division, Attn: QAC, M/S 505.

Distribution

* Provide copy in distribution of Revision 0 and subsequent revisions if applicable.

Copies of the NDEP-approved document will be distributed to others.

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