Nevada
Environmental
Restoration
Project

DOE/NV--649

Corrective Action Investigation Plan
for Corrective Action Unit 409:
Other Waste Sites
Tonopah Test Range, Nevada

Controlled Copy No.: ____

Revision No.: 0

October 2000

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**CORRECTIVE ACTION INVESTIGATION PLAN
FOR CORRECTIVE ACTION UNIT 409:
OTHER WASTE SITES
TONOPAH TEST RANGE, NEVADA**

DOE Nevada Operations Office
Las Vegas, Nevada

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**CORRECTIVE ACTION INVESTIGATION PLAN
FOR CORRECTIVE ACTION UNIT 409:
OTHER WASTE SITES
TONOPAH TEST RANGE, NEVADA**

Approved by: _____ Date: _____

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List of Acronyms and Abbreviations

ALARA	As-low-as-reasonably-achievable
bgs	Below ground surface
BN	Bechtel Nevada
CADD	Corrective Action Decision Document
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site(s)
CAU	Corrective Action Unit(s)
CFR	<i>Code of Federal Regulations</i>
COPC	Contaminant(s) of potential concern
CV	Coefficient of Variation
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DOT	U.S. Department of Transportation
DQO	Data Quality Objective(s)
EPA	U.S. Environmental Protection Agency
FFACO	<i>Federal Facility Agreement and Consent Order</i>
FSL	Field-screening level(s)
FSR	Field-screening result(s)
ft	Foot (feet)
GDRO	Gasoline- and diesel-range organics
GPR	Ground penetrating radar
HWAA	Hazardous Waste Accumulation Area
IDW	Investigation-derived waste
in.	Inch(es)
IS	Industrial Sites

List of Acronyms and Abbreviations (Continued)

ITLV	IT Corporation, Las Vegas Office
LLW	Low-level radioactive waste
mg/kg	Milligram(s) per kilogram
mi	Mile(s)
MS/MSD	Matrix spike/matrix spike duplicate(s)
NAC	<i>Nevada Administrative Code</i>
NDEP	Nevada Division of Environmental Protection
NEPA	<i>National Environmental Policy Act</i>
NTS	Nevada Test Site
NTSWAC	Nevada Test Site Waste Acceptance Criteria
PA	Preliminary Assessment
PAL	Preliminary action level(s)
PCB	Polychlorinated biphenyl(s)
PID	Photoionization detector
PM	Project Manager
PPE	Personal protective equipment
ppm	Part(s) per million
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
QA	Quality assurance
QC	Quality control
RCRA	<i>Resource Conservation and Recovery Act</i>
SAA	Satellite Accumulation Area
SS	Site Supervisor
SSHASP	Site-specific health and safety plan
SVOC	Semivolatile organic compound(s)

List of Acronyms and Abbreviations (Continued)

SWS	Septic Waste System
TCLP	Toxicity Characteristic Leaching Procedure
TEM	Technical Execution Manager
Th	Thorium
TM	Task Manager
TPH	Total petroleum hydrocarbon(s)
TTR	Tonopah Test Range
U	Uranium
UVF	Ultraviolet fluorescence
VOC	Volatile organic compound(s)
XRF	X-ray fluorescence

Executive Summary

The Corrective Action Investigation Plan for Corrective Action Unit 409, Other Waste Sites (TTR) has been developed in accordance with the *Federal Facility Agreement and Consent Order* that was agreed to by the U.S. Department of Energy, Nevada Operations Office; the State of Nevada Division of Environmental Protection; and the U.S. Department of Defense. Corrective Action Unit 409 consists of three Corrective Action Sites:

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

This Corrective Action Investigation Plan will be used in conjunction with the *Work Plan for Leachfield Corrective Action Units: Nevada Test Site and Tonopah Test Range, Nevada*, Rev. 1 (DOE/NV, 1998), since the materials being investigated at the two Septic Sludge Disposal Pits are correlative to materials and potential contamination associated with leachfields. The Leachfield Work Plan was developed to streamline investigations at leachfield Corrective Action Units. This Corrective Action Investigation Plan provides investigative details specific to Corrective Action Unit 409.

The Corrective Action Sites addressed by Corrective Action Unit 409 are located at the abandoned Cactus Repeater Station, and near Bunker Two close to Area 3 of the Tonopah Test Range. The Cactus Repeater Station was a remote, battery powered, signal repeater station. The Septic Sludge Disposal Pits were used through the late 1980s as disposal sites for sludge from septic tanks located in Area 3. Effluents generated within the facilities in Area 3 were routed through sanitary waste collection systems. The sanitary waste systems were designed to dispose of sanitary or process effluents; however, analytical results from previous sampling of the septic tanks indicate the systems received hazardous effluents.

Based on site history collected to support the Data Quality Objectives process, contaminants of potential concern are the same for the two disposal pits and include volatile organic compounds, semivolatile organic compounds, total petroleum hydrocarbons as gasoline- and diesel-range organics, polychlorinated biphenyls, *Resource Conservation and Recovery Act* metals, and radionuclides (plutonium and depleted uranium). Additional samples will be analyzed for

geotechnical and hydrological properties and bioassessment analyses may be performed. The volumes and concentrations of these contaminants of potential concern are unknown.

Corrective Action Site RG-24-001-RGCR (Battery Dump Site) at the Cactus Repeater Station consists of discarded lead-acid batteries and associated construction debris. This site is a Housekeeping Category site and no contaminants are expected to be encountered during the cleanup.

Detailed conceptual site models for the Corrective Action Sites are presented in [Section 3.0](#) and [Appendix A](#) of this plan. The conceptual site models serve as the basis for the sampling strategies.

The technical approach for investigating the Corrective Action Sites within this Corrective Action Unit consists of the following activities:

- Collect the discarded batteries and associated construction debris at the Battery Dump Site for proper disposal and recycling, and document the clean-up by photographing the site. The batteries are recyclable items.
- In an undisturbed area, drill a boring near the disposal pits (Corrective Action Sites TA-53-001-TAB2 and TA-53-002-TAB2) to collect background radiological data.
- Collect soil samples from borings drilled through the center of the disposal pits suspected locations. The two geophysical anomalies will be drilled and sampled also.
- Field screen samples for volatile organic compounds, total petroleum hydrocarbons, silver, and radiological constituents.
- Analyze select samples for total volatile organic compounds, total semivolatile organic compounds, total *Resource Conservation and Recovery Act* metals, total petroleum hydrocarbons (gasoline- and diesel-range organics), total polychlorinated biphenyls, and radionuclides (plutonium and uranium).
- Collect samples from native soils beneath the disposal pits and analyze for geotechnical/hydrologic parameters.
- Collect and analyze bioassessment samples at the discretion of the Site Supervisor, if volatile organic compounds or total petroleum hydrocarbons contamination concentrations exceed field-screening levels.

Additional sampling and analytical details are presented in [Section 4.0](#) of this plan. Details of the waste management strategy for the Corrective Action Unit are included in [Section 5.0](#).

Under the *Federal Facility Agreement and Consent Order*, this Corrective Action Investigation Plan will be submitted to the Nevada Division of Environmental Protection for approval. Field work will be conducted following approval of the plan. The results of the field investigation will be used to evaluate corrective action alternatives in the Corrective Action Decision Document.

1.0 Introduction

This Corrective Action Investigation Plan (CAIP) has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the U.S. Department of Energy, Nevada Operations Office (DOE/NV); the State of Nevada Division of Environmental Protection (NDEP); and the U.S. Department of Defense (DoD) (FFACO, 1996).

It is intended that this CAIP will be used in conjunction with the *Work Plan for Leachfield Corrective Action Units: Nevada Test Site and Tonopah Test Range, Nevada*, Rev. 1 (DOE/NV, 1998), hereafter referred to as the Leachfield Work Plan. This CAIP contains Corrective Action Unit (CAU)-specific information including facility descriptions, environmental sample collection objectives, and the criteria for conducting site investigation activities at the three Corrective Action Sites (CASs) that comprise CAU 409, Other Waste Sites (TTR). The Tonopah Test Range (TTR), included in the Nellis Air Force Range, is approximately 140 miles (mi) northwest of Las Vegas, Nevada ([Figure 1-1](#)).

Corrective Action Unit 409 is comprised of a Battery Dump Site (CAS RG-24-001-RGCR) located near Cactus Peak Road at the Cactus Repeater location, as well as a Septic Sludge Disposal Pit (CAS TA-53-001-TAB2, hereafter referred to as Septic Sludge Pit #1); and a second Septic Sludge Disposal Pit (CAS TA-53-002-TAB2, hereafter referred to as Septic Sludge Pit #2), located near Bunker Two close to Area 3 of the TTR ([Figure 1-2](#)).

The two Septic Sludge Disposal Pits were used for the disposal of sludge from the septic tanks located in Area 3. The Septic Sludge Disposal Pits received material until the late 1980s. There is no documentation of the dates of operation for the Septic Sludge Disposal Pits.

1.1 Purpose

This CAIP describes the investigation of the nature and extent of contaminants of potential concern (COPCs) at CAU 409. The general purpose of this CAIP is to:

- Determine if COPCs are present at each CAS.
- Determine if COPC concentrations exceed field-screening levels (FSLs).

Figure 1-1
Tonopah Test Range Location Map

Figure 1-2
Location of Area 3 and Cactus Springs Area Tonopah Test Range

- Determine if COPC concentrations exceed preliminary action levels (PALs).
- Determine the nature and extent of contamination with enough certainty to support selection of corrective action alternatives for each CAS.

This CAIP was developed using the U.S. Environmental Protection Agency's (EPA) Data Quality Objectives (DQOs) (EPA, 1994) process to define the goals for collecting environmental data, determine data end uses, and design a data collection program that will satisfy these goals and uses. A DQO scoping meeting was held prior to preparation of this plan. A brief summary of the DQOs is presented in [Section 3.4](#) and a more detailed summary of the DQO process and results are included in [Appendix A](#).

1.2 Scope

The scope of this CAIP is to resolve the problem statement identified in the DQO process, which states that potentially hazardous wastes were discharged to the two Septic Sludge Disposal Pits (see [Appendix A](#)). Additionally, existing information about the nature and extent of contamination at the CASs is insufficient to evaluate and select preferred corrective actions for the sites. The scope of the corrective action investigation for each CAS includes the activities described in the following sections to answer the problem statement.

The Battery Dump Site is included in the FFACO as a "Housekeeping Waste" functional category. Therefore, this CAS will be addressed under the *Sectoral Clean-up Work Plan for Housekeeping Category Waste Sites* (DOE/NV, 2000b).

1.2.1 CAS RG-24-001-RGCR, Battery Dump Site

Investigation activities at this CAS include:

- Photograph discarded batteries and associated construction material/debris.
- Collect batteries and associated construction material.
- Photograph locations of items collected to confirm cleanup.

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

Investigation activities at this CAS include:

- Collect subsurface radiological background samples from a borehole drilled at an undisturbed location to 60 feet (ft) below ground surface (bgs). Field-screen samples for alpha/beta-emitting radionuclides. Data will be used to establish radiological FSLs. Three samples will be submitted for laboratory analysis of isotopic uranium, isotopic plutonium, and gamma spectrometry.
- Conduct exploratory drilling through the center of the disposal pit to collect soil samples for field screening and laboratory analyses and determine the vertical extent of contamination.
- Conduct additional step-out drilling to delineate the lateral extent of contamination, if necessary. Collect additional samples if field-screening results (FSRs) indicate contamination extends laterally beyond the wall of the disposal pit.
- Conduct field screening for volatile organic compounds (VOCs), total petroleum hydrocarbons (TPH), silver, and alpha/beta-emitting radionuclides during drilling activities.
- Collect samples, at Site Supervisor's discretion, for geotechnical/hydrological and bioassessment analyses.

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

Investigation activities at this CAS include:

- Conduct exploratory drilling through the center of the disposal pit to collect soil samples for field screening and laboratory analyses and determine the vertical extent of contamination.
- Conduct additional step-out drilling to delineate the lateral extent of contamination, if necessary. Collect additional samples if FSRs indicate contamination extends laterally beyond the wall of the disposal pit.
- Conduct field screening for VOCs, TPH, silver, and alpha/beta-emitting radionuclides during drilling activities.
- Collect samples, at Site Supervisor's discretion, for geotechnical/hydrological and bioassessment analyses.

1.3 CAIP Contents

[Section 1.0](#) of this CAIP provides an introduction to the project, including the purpose and scope for this corrective action investigation. [Section 2.0](#) provides a facility description and historical summary. The remainder of the document details the investigation strategy. The FFACO (1996) requires that CAIPs address the elements discussed in the following sections.

1.3.1 Management

The managerial aspects of this project are discussed in the DOE/NV *Project Management Plan* (DOE/NV, 1994a) and a site-specific Field Management Plan that will be developed prior to field activities.

1.3.2 Technical Aspects

Technical aspects of this CAIP are contained in [Section 3.0](#) and [Section 4.0](#), and in the DQO summary presented in [Appendix A](#).

1.3.3 Quality Assurance

General field and laboratory quality assurance (QA) and quality control (QC) issues, including collection of QC samples, are presented in the *Industrial Sites Quality Assurance Project Plan* (QAPP) (DOE/NV, 1996c). In addition, the methods for field QA/QC are further discussed in approved procedures.

1.3.4 Health and Safety

Field activities will be performed according to the current version of the IT Corporation, Las Vegas Office (ITLV), *Health and Safety Plan* (IT, 2000) and will also be supplemented with a site-specific health and safety plan written prior to the start of field work. As required by the U.S. Department of Energy (DOE) Integrated Safety Management System, these documents outline the requirements for protecting the health and safety of workers and the public, and procedures for protection of the environment.

1.3.5 Public Involvement

No CAU-specific public involvement activities are planned at this time; however, an overview of public involvement is documented in the *Public Involvement Plan* in Appendix V of the FFACO (1996).

1.3.6 Field Sampling and Waste Management

Field sampling activities are discussed in [Section 4.0](#) of this CAIP, and waste management issues are discussed in [Section 5.0](#). The project schedule and records availability information are discussed in [Section 6.0](#), and [Section 7.0](#) provides a list of project references.

2.0 Facility Description

[Appendix A](#) provides general background information and knowledge as examined during the DQO process as it relates to the history of the TTR and CAU 409. This information includes historical aerial photographs, ground-level photographs and site maps, and interviews with TTR personnel.

2.1 Physical Setting

The topography in and around TTR is characterized by north-northwest trending mountain ranges and closed alluvial basins. The TTR itself is situated in a broad, closed structural basin named Cactus Flat. Cactus Flat is a relatively flat, internally drained basin, covered almost entirely by alluvial material estimated to be greater than 800 ft thick. The general location of the Septic Sludge Disposal Pits lie within Cactus Flat near Area 3. Topography at TTR indicates that surface water eventually flows into Cactus Flat, which includes Main and Antelope Lakes. Cactus Flat has a mean elevation of approximately 5,300 ft above mean sea level.

Depth to groundwater at the Septic Sludge Disposal Pits is estimated to be in excess of 395 ft, with groundwater flow direction generally to the north-northwest (DOE/NV, 1996b). Depth to groundwater at the Battery Dump Site is estimated at approximately 170 ft.

2.2 Operational History

2.2.1 Battery Dump Site

The Battery Dump Site is located between Cactus Peak and Cactus Springs approximately 0.1 mile west of Cactus Peak Road. Historically, the Cactus Repeater Station consisted of a mast (approximately 12 ft tall) anchored on or next to a corrugated metal pipe (approximately 2 ft in diameter and 2 ft tall), and guyed by three wires/stakes. The power source for the repeater is two celled lead acid batteries. The corrugated metal pipe was covered with a wood lid and used to store new batteries. During a 1998 visit, the site was found to consist of 17 discarded batteries scattered in and around the corrugated metal pipe, along with the associated construction debris and the mast ([Figure 2-1](#)).

**Figure 2-1
Battery Dump Site Photo Taken on 04/29/1998 Facing South**

Site investigations conducted in 1998 indicated no evidence of staining near the discarded batteries or other equipment, materials, and debris located at the Battery Dump Site.

2.2.2 Septic Sludge Disposal Pits #1 and #2

The Septic Sludge Disposal Pits are located south of Bunker 2 Road approximately 500 ft east of Bunker Two and approximately 800 ft west of the dry lakebeds. The site is located within an area of disturbed ground measuring approximately 120 ft east-west by 110 ft north-south (Figure 2-2). The pits are round depressions about 3 ft in diameter and 3 to 6 inches (in.) deep (Figure 2-3 and Figure 2-4). Septic Sludge Disposal Pit #1 is located at the southeast corner of the disturbed area (Figure 2-2). There is no apparent surface soil staining at either pit. The pit sites were initially identified in the *Tonopah Test Range Site Priority Ranking Model* (DOE/NV, 1994c) during the Preliminary Assessment interview process. According to the interview, a septic tank pumping truck from the Nevada Test Site (NTS) periodically pumped sludge out of the septic tanks in Area 3. The sludge was disposed into augured holes along Bunker 2 Road, and then backfilled. An interview held in May 2000 (Elliston, 2000) indicated a subcontractor was hired to pump out the septic tanks in Area 3 during the 1980s. The interviewee also believed the septic tank sludge was disposed of off site.

In 1990, a consolidated sewer system was installed and activated to replace the system of discrete septic tanks and leachfields in and around Area 3. Pumping the sludge out of the septic tanks has not occurred since 1990. The effluent generated in the Area 3 facility is now discharged to a nearby flocculating lagoon owned and maintained by the U.S. Air Force (DOE/NV, 1996a).

2.3 Waste Inventory

Unknown volumes and concentrations of hydrocarbon and chemical contaminants may have been released to subsurface soils at the two Septic Sludge Disposal Pits via the septic tank sludge. Contaminants potentially contained in the sludge would be related to the liquids passing through the Area 3 Septic Waste Systems used at TTR prior to 1990. Liquid effluent typically associated with the various shops that supported TTR daily operations included waste oil, greases, paints, solvents, fuels, and cleaning supplies. Specific details concerning the waste inventory within the source buildings

Figure 2-2
Photograph Showing Disturbed Vegetation Area
Where the Septic Sludge Disposal Pits are Located - Photo Taken 03/14/1999

Figure 2-3
Septic Sludge Disposal Pit #1
Photo Taken 07/24/1993 Facing East

Figure 2-4
Septic Sludge Disposal Pit #2
Photo Taken 07/24/1993 Facing Northeast

during the various years of operation are limited (DOE/NV, 1996b). Records of liquid waste quantities discharged through the septic waste collection systems are not available.

2.4 Release Information

Exact quantities of contaminants released at the Septic Sludge Disposal Pits are unknown. Lateral and vertical migration of COPCs is expected to be minimal due to expected low concentrations of COPCs in possible releases, and limited driving forces.

2.5 Investigation Background

In accordance with the DOE/NV *National Environmental Policy Act* (NEPA) compliance program, a NEPA checklist will be completed prior to commencement of site investigation activities at CAU 409. This checklist compels DOE/NV to evaluate their proposed project against a list of several potential environmental impacts which include, but are not limited to, air quality, chemical use, waste generation, noise levels, and land use. Completion of the checklist results in a determination of the appropriate level of NEPA documentation by the DOE/NV NEPA Compliance Officer.

According to the *Resource Conservation Recovery Act Facility Investigation Work Plan for the U.S. Department of Energy Environmental Restoration Sites, Tonopah Test Range, Nevada* (DOE/NV, 1994b), a soil sampling and analysis strategy was developed for this site. However, there is no evidence to indicate this sampling effort was conducted.

Residual septage within septic tanks 33-1A, 33-1B, 33-1C, 33-2, 33-3, 33-8, and 33-10 (Area 3) at TTR was sampled by Sandia National Laboratories and analyzed in March 1991 (IT, 1991) and again in 1993 (Septic Tanks 33-1, 33-3, and 33-10 [SNL, 1994]). As part of the CAU 428 field investigation, septic sludge from septic tanks 33-1A, 33-1B, 33-3, and 33-10 was sampled and analyzed (DOE/NV, 2000a). Analytical results ([Appendix D](#)) indicated the majority of the analyzed chemical constituents were detected at trace concentrations or were not detected. Concentrations of thorium (Th)-234, uranium (U)-234, U-235, U-238; VOCs; semivolatile organic compounds (SVOCs); oils, and grease were detected at levels above background or Preliminary Remediation Goals (PRGs).

Because the samples analyzed during this investigation were collected directly from the septic tanks, they may be representative of concentrations of constituents present in the septic tanks in years previous to 1991 (IT, 1991).

In July 1993, geophysical surveys were conducted at sites believed to be Septic Sludge Disposal Pits #1 and #2. The geophysical instruments utilized were ground penetrating radar (GPR) and a EM-31 electromagnetic unit. A radiological survey was also performed during the 1993 geophysical surveys.

A geophysical survey report of the 1993 field investigations was prepared in 1997 (IT, 1997). The GPR data was acquired along one south-north line and one west-east line over each disposal pit using a 300 megahertz antenna. The GPR data was not successful in delineating the disposal pits from the adjacent soils. The 1997 report also stated the EM-31 instrument survey resulted in no observed changes in conductivity over the pits.

The Environmental Restoration Sites Inventory field team performed a radiological survey using a beta-gamma pancake probe. According to the report, the measured response was within the statistical variability of the instrument utilized and was not considered above background.

3.0 Objectives

The DQOs are qualitative and quantitative statements that specify the quality of the data required to support potential courses of action for CAU 409. The DQOs were developed to clearly define the purposes for which environmental data will be used and to design a data collection program that will satisfy these purposes. One element of the DQO process is the formulation of a site conceptual model.

3.1 Conceptual Site Model

The conceptual models for the CASs included in CAU 409 are shown in [Table A.2-1](#) and [Table A.2-3](#) of [Appendix A](#). The scope and strategy of this investigation will be revised if the conceptual models provided in this CAIP fail. The conceptual models may fail if substantially different historical or operational information is discovered, or field observations demonstrate the nature and extent of contamination associated with the CASs are substantially different than anticipated. If necessary, a rescoping of the investigation will be conducted.

A brief version of the conceptual model for each CAS is provided in the following subsections.

3.1.1 Battery Dump Site

Located near Cactus Peak, a communications repeater station was battery powered due to the remote location. Based on preliminary investigations, it appears that new batteries were placed in a corrugated metal pipe, approximately 2 ft in diameter and 2 ft tall, and covered with a wooden lid. The wooden lid was attached to the metal pipe with a chain. Spent/dead batteries were discarded in the area around the corrugated metal pipe. In addition to the batteries, associated construction material/debris is scattered around the metal pipe.

3.1.2 Septic Sludge Disposal Pits

Based on process knowledge and early 1990s interviews of TTR workers, sludge was pumped out of the Area 3 septic tanks every few years and buried in augured holes that measured approximately 3 ft in diameter and 49 ft deep.

The two pits have a combined volume of approximately 5,280 gallons. This volume would accommodate backfill material used as a cap between pumping events and approximately 10 or more pumping and disposal events.

These pumping and disposal activities are believed to have occurred until the late 1980s. Septic tank contents consisted of sanitary wastewater and small amounts of industrial wastewater containing Stoddard solvent, cutting oils, cleaning solutions, photo chemicals, medical/laboratory waste (based on a medical trailer identified as a source building for one of the Area 3 septic waste systems), and paint solvents. Unknown volumes and concentrations of these materials and other chemicals may have been released in surface and subsurface soils at the two Septic Sludge Disposal Pits. No radiological waste was documented as being disposed of in the Area 3 septic waste systems.

Based on the limited history discussed in the preceding paragraphs, it is believed the two Septic Sludge Disposal Pits contain alternating layers of septic sludge material and backfill material (composed of cuttings generated when the pits were initially augured). These layers most likely range in thickness of 1 to 4 ft each. The upper 4 to 6 ft of the pits is most likely cuttings or clean backfill material used as a final capping material.

3.2 Contaminants of Potential Concern

3.2.1 Battery Dump Site

As a result of the Preliminary Assessment, site history, and field data, no COPCs were identified for the Battery Dump Site.

3.2.2 Septic Sludge Disposal Pits

During the DQO process, COPCs for the Septic Sludge Disposal Pits were identified through process knowledge and site history. The following list provides the site-specific analytes to be measured to determine the nature and extent of potential contamination at each disposal pit:

- Total VOCs
- Total SVOCs
- Total *Resource Conservation and Recovery Act* (RCRA) metals
- TPH (gasoline- and diesel-range organics [GDRO])

- Total Polychlorinated Biphenyls (PCBs)
- Radionuclides (isotopic plutonium and isotopic uranium)

Table A.2-2 in [Appendix A](#) lists the COPCs to be analyzed for, including FSLs and PALs.

[Appendix C](#) provides the analytical requirements which include minimum reporting limits, analytical methods, precision, and accuracy for all the analytes. Specific analyses required for disposal of investigation-derived waste (IDW) are identified in [Section 5.0](#) of this CAIP.

Geotechnical and hydrological analysis will be performed to support closure in place of subsurface debris. Bioassessment samples may be collected if field screening detects VOC or TPH concentrations greater than FSLs. Volatile organic compounds and hydrocarbon contamination may respond to bioremediation-based corrective actions.

3.3 Preliminary Action Levels

The following subsections describe the FSLs and PALs for CAU 409. The FSLs for on-site, field-screening methods will be used to determine the presence of contamination and guide the investigation.

3.3.1 Field-Screening Levels

The following FSLs will be used for on-site, field-screening methods:

- Volatile organic compound headspace screening levels using a photoionization detector (PID) are established at 20 parts per million (ppm) or 2.5 times background, whichever is greater.
- Total petroleum hydrocarbon screening levels using appropriate field-screening methods (i.e., siteLab Ultraviolet Fluorescence [UVF] Test Kit or equivalent) are established at 75 ppm.
- RCRA metals - Silver screening levels using appropriate field-screening methods (i.e., x-ray fluorescence [XRF] or other appropriate test instruments) are established at 1,000 ppm (based on experience at CAU 406/429, and the PRG for silver of 10,000 milligrams per kilogram [mg/kg]) in soil.
- Radiation (alpha and beta) screening levels are established as the mean background activity, plus two times the standard deviation for 20 background sample readings. The background sample readings will consist of 20 data points, collected from a “radiological background

borehole,” as described in [Section 4.3.2](#). An FSL will be established for each instrument to be used in the field.

Concentrations exceeding FSLs will indicate potential contamination at that sample location. This information will be documented and the investigation will continue to delineate the extent of the contamination. Additionally, this data may be used to select discretionary laboratory sample locations.

3.3.2 Chemical Preliminary Action Levels

Off-site laboratory analytical results will be compared to the following PALs to evaluate the need for possible corrective actions:

- EPA Region IX PRGs for industrial soils (EPA, 1999)
- TPH concentrations above the TPH limit of 100 ppm per the NAC 445A.2272 (NAC, 1999c)

The comparison of laboratory results to preliminary action levels will be discussed in the Corrective Action Decision Document (CADD). Laboratory results above PALs indicate the presence of COPCs at levels that may require corrective action. Laboratory results below PALs indicate that corrective action is not necessary. Based on the results of this field investigation, the evaluation of potential corrective actions and the justification for a preferred action will be included in the CADD.

3.3.3 Radiological Preliminary Action Levels

The PALs for radionuclides in soils are isotope-specific and defined as the maximum concentration for that isotope found in environmental samples taken from undisturbed background locations. Environmental background samples previously taken near Area 3 and Area 9 at the TTR (McArthur and Miller, 1989) will be compared with the results of the background radiological field screening and sampling to be conducted for the disposal pits. In addition, the radionuclide concentrations in the CAU 409 environmental samples and background samples will be compared with the radionuclide concentrations found in environmental samples taken from undisturbed background locations in the vicinity of the NTS and TTR, presented in McArthur and Miller (1989) and Atlan-Tech (1992).

3.4 Data Quality Objectives Process Discussion

Details of the DQO process are presented in [Appendix A](#). The DQO process involves identification of the problem and a discussion of the site history and previous background data that has been collected. As concluded during the DQO meeting, based on the site history and current knowledge, the field activities at the Battery Dump Site will only involve the collection and removal of batteries and related construction debris. If during the removal activities evidence of soil staining or contamination are found, the investigation will be reevaluated.

Additionally, results of the DQO meeting indicate the need for biased sampling from the Septic Sludge Disposal Pits. Due to the potential for subsurface migration of COPCs, an investigation consisting of surface and subsurface sampling was identified. [Table A.3-1](#) in [Appendix A](#) provides decision points and rules specific to the Septic Sludge Disposal Pits that will be used to guide the field investigation.

4.0 Field Investigation

This section of the CAIP contains the sampling approach for investigating CAU 409. All sampling activities will be conducted in compliance with the Industrial Sites QAPP (DOE/NV, 1996c) and other applicable, approved procedures and instructions. Quality assurance and QC requirements for field and laboratory environmental sampling are provided in [Section 4.4.2](#) and conform to the QA/QC requirements contained in the Industrial Sites QAPP.

Field activities will be performed in accordance with an approved site-specific health and safety plan (SSHASP) which incorporates the principles of the DOE Integrated Safety Management System. Safety, health, and protection of the environment take precedence over expediency. Site personnel will take every reasonable step to reduce the possibility of injury, illness, or accident, and to protect the environment during all project activities. The following will be taken into consideration when assessing the hazards associated with field activities:

- Potential hazards to site personnel and the public include, but are not limited to, chemicals (such as RCRA metals, VOCs, SVOCs, PCBs, and TPH), adverse and rapidly changing weather, remote location, and drilling activities.
- Proper training of all site personnel to recognize and mitigate the anticipated hazards.
- Work controls to reduce or eliminate the hazards including engineering controls, substitution of less hazardous materials, and personal protective equipment (PPE).
- Occupational exposure monitoring to prevent overexposures to hazards such as radionuclides, chemicals, and physical agents (heat, cold, high winds).
- Use of the “as-low-as-reasonably-achievable” (ALARA) principle when dealing with radiological hazards.
- Emergency and contingency planning and communications to include medical care and evacuation, decontamination and spill control measures, and appropriate notification of project management and emergency responders.

4.1 Technical Approach

The following list describes general activities that may be executed during site investigations for CAU 409. Specific details of activities for the individual CASs are provided in [Section 4.3.1](#) and [Section 4.3.2](#), including optional scenarios dependent on field-screening results and decisions.

- Collect surface soil samples at biased locations via hand excavation.
- Photograph clean-up/material removal activities.
- Drill a borehole in an undisturbed location and collect samples to establish background radiological activity.
- Collect subsurface soil samples at biased locations via drilling methods.
- Field-screen samples for VOCs, TPH, silver, and alpha/beta-emitting radionuclides.
- Analyze selected soil samples for total VOCs, total SVOCs, total RCRA metals, TPH (GDRO), total PCBs, isotopic uranium, and isotopic plutonium. Selected samples will also be analyzed for gamma spectrometry to assist in waste management decisions.
- Collect samples from the interface of native soils and disposal features, as defined by soil staining, geology, and the presence of sludge material.
- Collect and analyze geotechnical samples.
- Collect and analyze bioassessment samples from intervals where VOCs or TPH exceed FSLs.
- Collect QC samples.

This investigation strategy will allow the nature and extent of contamination associated with each CAS to be determined. In general, each boring location will be advanced until FSRs are below FSLs for two consecutive drilling intervals to ensure the vertical extent of contamination has been established. Step-out borings may be drilled based on FSRs to determine the lateral extent of contamination.

4.2 Field Activities

Drilling will be the primary investigative technique to characterize CAU 409. Biased samples will be collected and field screened for VOCs, TPH, silver, and alpha/beta-emitting radionuclides (except

those that may be collected at the Battery Dump Site, as described in [Section 4.3.1](#)). Based on FSRs, select samples will be submitted for laboratory analysis of COPCs identified in [Table A.2-2](#).

4.2.1 Drilling Methods

Drilling will consist of hollow-stem auger, roto sonic, or other appropriate drilling methods. If elevated FSRs are identified during advancement of the borings in the Septic Sludge Disposal Pits, step-out borings will be advanced to evaluate the extent of lateral and vertical contaminant migration. The location of the initial step-out borings will be dictated by individual site conditions. Based on FSRs, additional step-outs may be needed to delineate plume geometry. At a minimum, step-out borings will be advanced to the lowest vertical extent of contamination (as detected by field screening) in the initial locations. Excess drill cuttings not collected as samples will be returned to the boring in the same approximate location from which they originated. Upon completion of sampling activities, all open boreholes will be filled to the ground surface with a bentonite grout mixture. If settling occurs, boreholes will be revisited and additional grout or soil will be added to bring the boreholes to grade.

4.2.2 Field Screening

Samples will be field screened for VOCs, TPH, silver, and alpha/beta-emitting radionuclides (except those that may be collected at the Battery Dump Site, as described in [Section 4.3.1](#)). The FSRs will guide the investigation and sampling selection and assist with health and safety and waste management decisions. The headspace method with a PID will be used to field screen for VOCs. A siteLab UVF Test Kit or equivalent will be used to field screen for TPH, and an XRF instrument (i.e., Spectrace Model 9240 X-Ray Fluorescence or equivalent) will be used for silver. An alpha/beta scintillator (i.e., Electra or equivalent) will be used to field screen for alpha/beta-emitting radionuclides. The FSLs for these field-screening methods are detailed in [Section 3.3.1](#).

4.3 CAS Site-Specific Investigation Strategy

The following sections provide investigative details specific to the Battery Dump Site and the Septic Sludge Disposal Pits. Additional details are found in [Section A.4.0](#).

4.3.1 Battery Dump Site

This section includes discussions of a Primary Investigation Plan and a Contingency Plan that may be implemented if site conditions warrant.

Primary Investigation Plan

The following activities, constituting the Primary Investigation Plan, will be conducted to characterize the Battery Dump Site:

- Take a landmarked photograph of the Battery Dump Site that encompasses all the items to be collected.
- Photograph each discarded battery and each piece of associated construction material and/or debris in place before removal.
- Photograph the location of each battery or piece of associated debris after removal to document the clean-up.

Contingency Plan

The following activities will be performed if any soil staining is found associated with the batteries or construction debris:

- Collect biased surface and subsurface soil samples with hand tools to confirm the presence and define lateral extent of contamination at specific sites.
- Analyze site-specific soil samples for total RCRA metals.
- Mark the location where the soil samples were collected for laboratory analysis.
- Collect QC samples.

If contamination is confirmed by the laboratory analysis of the samples, the housekeeping clean-up of the Battery Dump Site will be reevaluated to include additional investigation activities and development of a CADD.

4.3.2 Septic Sludge Disposal Pits

This section includes discussions of a Primary Investigation Plan and two Contingency Plans that may be implemented if site conditions warrant.

Primary Investigation Plan

The following activities, constituting the Primary Investigation Plan, will be conducted to characterize Septic Sludge Disposal Pit #1 and Septic Sludge Disposal Pit #2. The activities discussed in the Primary Investigation Plan assume location markers for the disposal pits are accurate and that septic sludge can be differentiated from backfill/capping material and native soil.

- Drill a “radiological background borehole” at an undisturbed location in the general area of the disposal pits. Field-screen samples for radiological activity at 3-ft intervals to 60 ft bgs for a total of 20 field-screening data points. These field-screening data will be used to establish radiological FSLs, as described in [Section 3.3.1](#). Submit three samples with the highest FSRs to the laboratory for isotopic uranium, isotopic plutonium, and gamma spectrometry analysis.
- Drill an initial borehole through the center of each disposal pit and collect soil samples from every septic sludge layer encountered or at least every 10 ft. Field-screen samples for VOCs, TPH, silver, and alpha/beta-emitting radionuclides. The minimum depth of these boreholes shall be 60 ft bgs and will be advanced until FSRs are below FSLs for two consecutive boring intervals.
- Submit a minimum of three samples from each initial disposal pit borehole for laboratory analysis. The sample directly below the fill/native soil interface, from the basal sludge unit, and the first of two consecutive samples where FSRs are below FSLs will be submitted. The Site Supervisor may submit additional samples for laboratory analysis, based on FSRs and visual observation. [Table 4-1](#) describes the material expected to be encountered and sampling criteria.
- Collect a sample from a septic sludge unit for bioassessment if VOC or TPH FSRs exceed FSLs, at the Site Supervisor’s discretion.
- Collect a sample from native soil beneath the disposal pits for geotechnical analysis.
- Collect QC samples.

**Table 4-1
Sample Collection Locations and Sampling Criteria**

Interval (Feet [ft])	Material Description	Criteria
0 to 4 ft	This should be the final capping material (est. of 4 to 6 feet thick).	Determine thickness of capping material and collect sample where staining may exist or FSLs exceeded. If these conditions are not present, collect a representative sample. Location will be at Site Supervisor's discretion.
4 to 10 ft	Expect this material to be septic sludge material (fairly soft and retaining some characteristics of septic sludge [i.e., medium brown color]).	Determine thickness of septic sludge material by identifying the intermediate capping material below the sludge. Collect sample where staining may exist or FSLs are exceeded. If these conditions are not present, collect a representative sample. Location will be at Site Supervisor's discretion.
10 to 13 ft	Expect this material to be intermediate capping material (most likely clean fill or cuttings).	Determine thickness of intermediate capping material and collect sample where staining may exist or FSLs are exceeded. If these conditions are not present, collect a sample from the upper six inches of the capping material. Based on actual field conditions, the location may be changed at Site Supervisor's discretion.
14 to 49 ft	Expect alternating layers of septic sludge material and intermediate capping material.	For each layer of sludge material use the criteria discussed above for the 4- to 10-ft interval.
50 to 60 ft	The bottom of the pit is expected at 49 ft. Undisturbed native material should be encountered.	Collect a sample at 1 foot into the undisturbed material. Collect additional samples every 2 or 5 feet (at discretion of Site Supervisor) and/or at any obvious staining, or if FSLs are exceeded. Sampling may cease if 2 consecutive samples do not exceed FSLs.

If contamination is encountered in the initial disposal pit boreholes (i.e., FSRs exceed FSLs), step-out boreholes will be advanced per the following criteria:

- The first step-out borehole will be drilled at a 5-ft center from the disposal pit. Subsequent step-out boreholes (if necessary [i.e., if contamination is encountered]) will be at 10-ft centers. Continue step-out boreholes until no contamination is encountered.
- Advance step-out boreholes to a depth sufficient to sample the interval correlative to deepest contamination above FSLs encountered in the initial borehole.
- Collect soil samples from intervals correlative with contamination found in the initial borehole and/or at locations of obvious staining or contamination. Field-screen samples for VOCs, TPH, silver, and alpha/beta-emitting radionuclides.

- Submit at least one sample from each step-out borehole for laboratory analysis. The sample(s) submitted will be from the depth(s) corresponding to contamination in the initial borehole. In addition, the Site Supervisor may submit additional samples for analysis based on FSRs and areas of obvious staining or contamination.

Contingency Plan #1

The following activities will be performed if visual inspection of borehole returns shows no differentiation or layering (i.e., uniform color and texture):

- Field-screen soil samples for VOCs, TPH, silver, and alpha/beta-emitting radionuclides every 10 ft to a depth of 60 ft bgs (or deeper at Site Supervisor's discretion).
- Submit a minimum of three samples from each borehole for laboratory analysis. The sample directly below the fill/native soil interface (if identified), the sample with the highest FSR, and the first of two consecutive samples where FSRs are below FSLs will be submitted. If the fill/native soil interface is not identified, this sample will be replaced with another sample at the discretion of the Site Supervisor. The Site Supervisor may submit additional samples for laboratory analysis, based on FSRs and visual observation.
- Collect sample for bioassessment if the FSL for VOCs or TPH is exceeded, at Site Supervisor's discretion.
- Collect sample from native soil beneath disposal pit for geotechnical analysis.
- Collect QC samples.
- If step-out borings are required, they will be advanced as described above in the Primary Investigation Plan.

This investigation strategy will allow the nature and extent of contamination associated with each CAS to be determined. In general, the contents of each location and the underlying soil will be investigated until two consecutive soil samples with contamination concentrations below appropriate FSLs are obtained. If contamination is more extensive than anticipated, the maximum investigation depth will be limited by the capability of the selected drilling method. If this occurs, the investigation will be reevaluated.

Contingency Plan #2

These activities will be executed if the previously identified location of Septic Sludge Disposal Pit #1 is inaccurate and/or does not contain septic tank sludge.

The preliminary assessment and previous geophysical investigations of the Septic Sludge Disposal Pits were unable to determine the exact locations of the disposal pits. The Site Supervisor and/or the Site Geologist will inspect the material recovered from Septic Sludge Disposal Pit #1 and determine if undisturbed native material or septic tank sludge material is being encountered.

If an undisturbed native stratigraphic interval is encountered at the location believed to be Septic Sludge Disposal Pit #1, drilling activities will be stopped. At a minimum, the boring shall reach 40 ft bgs before terminating drilling activities at this location.

Field activities will transfer to the previously identified location of Septic Sludge Disposal Pit #2 and executed as discussed in the Primary Investigation Plan or Contingency Plan #1 (as appropriate). If an undisturbed native stratigraphic interval is encountered at the Septic Sludge Disposal Pit #2 location (after drilling to a minimum depth of 40 ft bgs), investigative field activities will be terminated, DOE/NV and NDEP notified, and the investigation reevaluated.

4.4 Sampling Criteria

All sampling activities for CAU 409 will be conducted in compliance with the requirements of the Industrial Sites QAPP (DOE/NV, 1996c) and this CAIP. [Section 4.4.1](#) through [Section 4.4.6](#) provide details on the type of sample collection that will be performed during the field investigation. The CAS-specific investigation strategy and proposed sampling locations are provided in [Section 4.3](#).

Records will be maintained for a visual classification of the soil from boreholes, field-screening measurements, and all other pertinent data. Relevant and required sampling information (e.g., date, time, sample interval) will be documented in accordance with the Industrial Sites QAPP. Approved chain of custody procedures (DOE/NV, 1994a) will be followed to ensure sample integrity.

All equipment which contacts soil to be sampled will be decontaminated in accordance with written, approved, and controlled procedures. All sampling equipment will be decontaminated prior to each sampling event to minimize the potential for cross-contamination of samples from different locations.

All samples will be field screened (except those that may be collected at the Battery Dump Site, as described in [Section 4.3.1](#)) for VOCs, TPH, silver, and alpha/beta-emitting radionuclides and a limited number of these samples will be submitted to the off-site laboratory. Samples to be analyzed will be selected based on the results of field screening and minimum sampling requirements. The actual number of samples analyzed will depend on decisions made in the field.

4.4.1 Environmental Samples

Environmental samples collected for laboratory analyses will consist of unused media. Samples targeted for VOC analysis will be given highest priority when being collected. Samples with no volatilization concerns will be collected with priority given to those with the shortest holding times.

Samples collected from the disposal pits will be analyzed for total VOCs, total SVOCs, total RCRA metals, PCBs, TPH (GDRO), isotopic uranium, and isotopic plutonium. In addition, selected samples will be analyzed for gamma spectrometry to assist in waste management decisions. If samples are collected from the Battery Dump Site, they will be analyzed for total RCRA metals. All samples submitted to the laboratory will be analyzed in accordance with [Appendix C](#).

4.4.2 Quality Control Samples

Quality control samples will be collected as required by the Industrial Sites QAPP (DOE/NV, 1996c). These samples will include trip blanks, equipment blanks, source blanks, field blanks, field duplicates, and matrix spike/matrix spike duplicates (MS/MSD) samples. Quality control samples will be analyzed for those parameters listed in [Table A.2-2](#) with the exception that trip blanks will only be analyzed for VOCs, and QC samples that may be collected at the Battery Dump Site will only be analyzed for total RCRA metals. With the exception of MS/MSD, QC samples will be submitted to the laboratory blind. Additional QC samples may be submitted at the discretion of the Site Supervisor.

4.4.3 Background Samples

Background data for radionuclides will be collected by drilling a boring in an undisturbed area approximately 50 ft to 100 ft from the disposal pits. Samples will be field screened for radiological activity every 3 ft from the surface to 60 ft bgs. These field-screening data will be used to establish FSLs as described in [Section 3.3.1](#). Three samples will be analyzed to confirm the background data collected and to assist in waste management decisions. Background data on RCRA metals have been previously generated for Area 3 and Area 9 during past investigations and will be used to evaluate data to be presented in the CADD.

4.4.4 Geotechnical Samples

In addition to environmental samples, at least one geotechnical sample will be collected at the Site Supervisor's discretion from the Septic Sludge Disposal Pits to characterize the geologic and hydrologic properties of soils. Analysis of geotechnical parameters listed in [Table 4-2](#) will be performed by an off-site laboratory. The methods shown are minimum standards, and other equivalent or superior testing methods may be used.

Table 4-2
Geotechnical Analyses

Analysis	Method
Initial moisture content	ASTM ^a D 2216
Dry bulk density	EM ^b -1110-2-1906
Calculated porosity	EM ^b -1110-2-1906
Saturated hydraulic conductivity	ASTM ^a D 5084
Unsaturated hydraulic conductivity	van Genuchten ^c
Particle-size distribution	ASTM ^a D 422-63(90)
Water-release (moisture retention) curve	ASTM ^a D 3152

^aAmerican Society for Testing and Materials (ASTM, 1996)

^bU.S. Army Corps of Engineers (USACE, 1970)

^cvan Genuchten, 1980

4.4.5 Bioassessment Samples

One or more bioassessment samples will be collected, at the discretion of the Site Supervisor, if FSRs detect VOCs or TPH significantly above FSLs. Bioassessment is a series of tests designed to evaluate the physical, chemical, and microbiological characteristics of soil. These tests include determination

of nutrient availability, soil pH, microbial population density, and the availability of the microbial population to grow under enhanced conditions. These samples will be collected within brass sleeves (or other container, as appropriate to the sample collection methodology) to preserve the natural physical characteristics of the soil. The data will be used in the evaluation of alternatives in the CADD.

4.4.6 Waste Management Samples

To characterize waste generated during this investigation, all soil samples submitted to the off-site laboratory will be analyzed for gamma spectrometry. The laboratory will also be required to generate and hold leachate from samples to be used for potential Toxicity Characteristic Leaching Procedure (TCLP) for VOCs and SVOCs . In addition, TCLP for metals may also be requested to assist in waste management decisions. Rinsate samples from investigation activities will be analyzed for isotopic uranium, isotopic plutonium, gross alpha, gross beta, and gamma spectrometry.

5.0 Waste Management

Management of IDW will be based on regulatory requirements, field observations, field screening, and laboratory analysis of CAU 409 investigation samples. Decontamination activities will be performed according to approved contractor procedures as specified in the field sampling instructions and as appropriate for the COPCs likely to be identified within each CAS.

Waste other than soil is potentially contaminated waste only by virtue of contact with potentially contaminated media. Therefore, sampling and analysis of IDW, separate from analyses of site characterization samples, may not be necessary. However, rinsate or other samples may be taken to support waste management activities. The data generated as a result of site characterization and process knowledge will be used, whenever possible, to assign the appropriate waste type (i.e., solid waste (nonhazardous), hydrocarbon, hazardous, low-level radioactive waste [LLW], or mixed) to the IDW. Solid waste (nonhazardous), hydrocarbon, hazardous, radioactive, and/or mixed waste, if generated, will be managed and disposed of in accordance with DOE Orders, U.S. Department of Transportation (DOT) regulations, RCRA regulations, State of Nevada requirements and agreements, and permits between DOE and NDEP.

5.1 Waste Minimization

Corrective action investigation activities have been planned to minimize IDW generation. Decontamination activities will only use as much water as necessary to decontaminate equipment and personnel to minimize the amount of rinsate generated. Disposable sampling equipment, decontamination rinsate, and PPE will be segregated to the greatest extent possible to minimize the generation of hazardous, radioactive, and/or mixed waste.

5.2 Potential Waste Streams

Process knowledge indicates the potential for hazardous and/or radioactive materials to be present at CAU 409. There is a potential that solid/sanitary (nonhazardous), LLW, hazardous, mixed, and

hydrocarbon waste may be generated during field activities. Specific waste materials generated during the investigation may include, but are not limited to, the following:

- Decontamination rinsate
- Potentially contaminated disposable sampling equipment (e.g., plastic, paper, sample containers, aluminum foil, trowels, hand augers)
- PPE potentially contaminated during field activities

For administrative purposes, waste will be segregated into multiple waste streams: containerized soil, solid waste (nonhazardous), potentially contaminated PPE, and decontamination rinsate. Further segregation may be implemented within each waste stream, as appropriate.

5.3 Investigation-Derived Waste Management

Waste will be managed according to the requirements identified in Section 5.3 of the Leachfield Work Plan until laboratory analyses are received and a final waste determination is made. Applicable waste management regulations and requirements are listed in [Table 5-1](#).

Table 5-1
Waste Management Regulations and Requirements

Waste Type	Federal Regulation	Additional Requirements
Solid/Sanitary (Nonhazardous)	NA	NRS 444.440 - 444.620 ^a NAC 444.570 - 444.7499 ^b
Hydrocarbon	NA	NAC 445A.2272 ^c
Hazardous	RCRA	NRS 459.400 - 459.600 ^d NAC 444.850 - 444.8746 ^e POC ^f
Low-Level Radioactive	NA	DOE Orders and NTSWAC ^g
Mixed	RCRA	NTSWAC ^g POC ^f

NA = Not Applicable

^aNevada Revised Statutes (NRS, 1998a)

^bNevada Administrative Code (NAC, 1999a)

^cNevada Administrative Code (NAC, 1999c)

^dNevada Revised Statutes (NRS, 1998b)

^eNevada Administrative Code (NAC, 1999b)

^fNevada Test Site Performance Objective for the Certification of Nonradioactive Hazardous Waste (BN, 1995)

^gNevada Test Site Waste Acceptance Criteria, Rev. 2 (DOE/NV, 1999)

Management requirements for solid waste (nonhazardous), LLW, hydrocarbon, hazardous, and mixed waste are discussed further in the following sections. All IDW generated will be managed according to mixed waste requirements until a waste determination is made.

Any IDW generated during this investigation will be segregated by waste stream and placed in DOT-compliant packages appropriate for the type and amount of waste generated.

5.3.1 Solid Waste (Nonhazardous)

Solid waste will be contained in plastic bags, dumpsters, or packages and will be disposed of in a solid waste management unit.

5.3.2 Low-Level Radioactive Waste

Low-level radioactive waste, if generated, will be managed and characterized in accordance with DOE Orders and the requirements of the *Nevada Test Site Waste Acceptance Criteria* (NTSWAC) (DOE/NV, 1999). Characterization will be based on laboratory results, field screening, process knowledge, or a combination thereof. Potentially contaminated IDW, such as PPE, will be placed in plastic bags, containerized, and marked with the date and associated sample location. The plastic bags and any other LLW, such as containerized soil, will be placed in marked packages meeting DOT specifications (49 *Code of Federal Regulations* [CFR] 172 [CFR, 1998]) and locked or fitted with tamper-indicating devices. The drums will be staged at a designated Radioactive Materials Area pending disposal in accordance with NTSWAC requirements (DOE/NV, 1999). Drums will be marked "Radioactive Material Pending Analysis" until a final waste characterization can be made.

Rinsate that is potentially contaminated with radioactive material will be collected in packages meeting DOT specifications (49 CFR 172) (CFR, 1998). Gross alpha, gross beta, gamma spectrometry, isotopic uranium, and isotopic plutonium analysis will be performed on rinsate samples (a composite sample can be collected from up to three drums of rinsate) and the results will be used to determine final disposition. Additionally, the soil characterization results may be applied to the rinsate as part of the determination of final disposition.

Any waste to be disposed of in LLW landfills at the NTS will be characterized in accordance with the requirements of the NTSWAC and the contractor-specific waste certification program plan and implementing procedures.

5.3.3 Hazardous Waste

Suspected hazardous waste will be managed in accordance with the procedures outlined in this section, which are based on RCRA and Nevada hazardous waste regulations. Such waste will be placed in properly marked packages meeting DOT specifications as per 49 CFR 172 (CFR, 1998). Container markings and field records will allow wastes to be traceable back to the source. Additionally, waste may be directly sampled for characterization purposes. The type of container used will be appropriate for the particular waste in storage as specified in 40 CFR 265.172 (CFR, 1999a). No incompatible waste is expected to be generated; however, if incompatible waste is encountered in the field, it will be managed in accordance with 40 CFR 265.177 (CFR, 1999b).

Hazardous waste will be characterized in accordance with the requirements of 40 CFR 261 (CFR, 1999c). Characterization will be based on analytical data, field-screening results, process knowledge, or a combination thereof. Containers holding wastes pending characterization will be identified with "Hazardous Waste Pending Analysis" markings until the regulatory status can be determined. Depending on the nature and amount of waste generated, waste management control areas may be established, such as a Satellite Accumulation Area (SAA) or Hazardous Waste Accumulation Area (HWAA).

Hazardous waste will not be stored at the site of generation for more than 90 days unless accumulated in a SAA in accordance with 40 CFR 262.34 (CFR, 1999d). Hazardous waste will be shipped to a permitted hazardous waste treatment, storage, or disposal facility before the expiration of the 90-day storage limit. The waste will be transported by a licensed hazardous waste hauler and accompanied by a Uniform Hazardous Waste Manifest, in accordance with DOT shipping requirements. A copy of the manifest will be provided to the NDEP in accordance with state regulatory requirements.

At a minimum, the characterization of hazardous waste (which may include rinsate), generated during investigative activities, will comply with the *NTS Performance Objective for Certification of Nonradioactive Hazardous Waste* (BN, 1995).

5.3.4 Mixed Waste

Mixed waste, if generated, will be managed in accordance with RCRA (CFR, 1999c) and NAC regulations (NAC, 1999d), as well as DOE requirements for radioactive waste. Where there is a conflict in regulations or requirements, the most stringent will apply. For example, the 90-day accumulation limit and weekly inspections required by RCRA regulations will be applied to mixed waste, even though it is not required for radioactive waste. Conversely, while RCRA does not require traceability, the NTS waste acceptance program for LLW does; therefore, records allowing traceability will be maintained. Containers holding wastes pending characterization will be identified with “Awaiting Analysis” markings until the regulatory status can be determined.

In general, mixed waste will be handled in the same manner as hazardous waste, but with the added LLW management program requirements. Mixed waste will be transported to the NTS transuranic waste storage pad pending treatment or disposal. Mixed waste with hazardous constituents that are below land disposal restrictions may be disposed of at the Area 5 Radioactive Waste Management Site. Mixed waste not meeting land disposal restrictions will remain at the transuranic waste storage pad pending development of a treatment plan in accordance with the requirements of the 1995 Mutual Consent Agreement between DOE and the State of Nevada (NDEP, 1995).

At a minimum, the characterization of mixed waste (which may include rinsate), generated during investigative activities, will comply with the *NTS Performance Objective for Certification of Nonradioactive Hazardous Waste* (BN, 1995).

5.3.5 Hydrocarbon Waste

The action level for soil contaminated with hydrocarbons is 100 mg/kg in the state of Nevada (NAC, 1999c). Containerized soil and associated IDW with TPH levels above 100 mg/kg shall be managed as hydrocarbon waste and shall be disposed of in accordance with all applicable regulations in a hydrocarbon landfill.

5.4 Analysis Required for the Disposal of IDW

Additional analytical data may be required to characterize the IDW, as discussed in [Section 4.4.6](#). These analyses will support waste classification to meet waste acceptance criteria prior to disposal at

on-site NTS and off-site locations. For instance, gamma spectrometry analysis is required to characterize waste which will be transported to the NTS. Additional analyses may include TCLP VOC, TCLP SVOC, and TCLP RCRA metals. Each of the CASs have been reviewed to ensure that sufficient analyses to support IDW disposal have been planned. Rinsate generated during this site investigation will be analyzed for isotopic uranium, isotopic plutonium, gross alpha, gross beta, and gamma spectrometry.

6.0 Duration and Records Availability

6.1 Duration

After submittal of the Final CAIP for CAU 409 to NDEP (FFACO milestone deadline of November 30, 2000), the following is a tentative schedule of activities (in calendar days):

- Day 0: Preparation for field work will begin.
- Day 45: The field work, including field screening and sampling will begin. Samples will be shipped to meet laboratory holding times.
- Day 90: The field work will be completed and unvalidated data will be returned from the analytical laboratory.
- Day 120: The quality-assured analytical sample data will be available for NDEP review.
- The FFACO date for the CADD to NDEP is September 28, 2001.

6.2 Records Availability

Historic information and documents referenced in this plan are retained in the DOE/NV project files in Las Vegas, Nevada, and can be obtained through written request to the DOE/NV Project Manager. This document is available in the DOE public reading rooms located in Las Vegas and Carson City, Nevada, or by contacting the DOE Project Manager. The NDEP maintains the official Administrative Record for all activities conducted under the auspices of the FFACO.

7.0 References

ASTM, see American Society of Testing Materials.

American Society for Testing and Materials. 1996. Section 04.08 and 04.09, "Construction."
In *Annual Book of ASTM Standards*. Philadelphia, PA.

Atlan-Tech. 1992. *Environmental Monitoring Report for the Proposed Ward Valley, California
LLRW Facility*. Rosewall, GA: Atlan-Tech Inc.

BN, see Bechtel Nevada.

Bechtel Nevada. 1995. *Nevada Test Site Performance Objective for Certification of Nonradioactive
Hazardous Waste*, G-E11/96.01, Rev. 0. Las Vegas, NV.

CFR, see *Code of Federal Regulations*.

Code of Federal Regulations. 1998. 49 CFR 172, "Hazardous Materials Table, Special Provisions,
Hazardous Materials Communications, Emergency Response Information, and Training
Requirements." Washington, DC: U.S. Government Printing Office.

Code of Federal Regulations. 1999a. 40 CFR 265.172, "Compatibility of Waste with Containers."
Washington, DC: U.S. Government Printing Office.

Code of Federal Regulations. 1999b. 40 CFR 265.177, "Special Requirements for Incompatible
Waste." Washington, DC: U.S. Government Printing Office.

Code of Federal Regulations. 1999c. 40 CFR 261, "Identification and List of Hazardous Waste."
Washington, DC: U.S. Government Printing Office.

Code of Federal Regulations. 1999d. 40 CFR 262.34, "Accumulation Time." 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.

Elliston, J. 2000. Record of Telecon with B. McCall (ITLV) regarding the operational history of the
Septic Tank Systems in Area 3, 3 May. Las Vegas, NV: IT Corporation.

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.

IT, see IT Corporation.

IT Corporation. 1991. *Tonopah Test Range Septic Tank Sampling and Analysis Final Report.* Albuquerque, NM.

IT Corporation. 1997. *Initial Surface Geophysical Survey Report For The Tonopah Test Range Environmental Restoration Sites*, Vol. 1 of 2, ITLV10972--93. Las Vegas, NV.

IT Corporation. 2000. *Health and Safety Plan*, March, ITLV13052--105. Las Vegas, NV.

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

NAC, see *Nevada Administrative Code*.

Nevada Administrative Code. 1999a. NAC 444.570 - 444.7499, "Solid Waste Disposal." Carson City, NV.

Nevada Administrative Code. 1999b. NAC 444.850 - 444.8746, "Disposal of Hazardous Waste." Carson City, NV.

Nevada Administrative Code. 1999c. NAC 445A.2272, "Contamination of Soil: Establishment of Action Levels." Carson City, NV.

Nevada Administrative Code. 1999d. NAC 444, "Sanitation." Carson City, NV: Nevada Division of Environmental Protection.

NDEP, see Nevada Division of Environmental Protection.

Nevada Division of Environmental Protection. 1995. "Mutual Consent Agreement Between the State of Nevada and the Department of Energy for the Storage of Low-Level Land Disposal Restricted Mixed Waste." Transmittal from P. Liebendorfer (NDEP) to D. Elle (DOE/NV), 7 June. Carson City, NV.

NRS, see *Nevada Revised Statutes*.

Nevada Revised Statutes. 1998a. NRS 444.440 - 444.620, "Collection and Disposal of Solid Waste." Carson City, NV.

Nevada Revised Statutes. 1998b. NRS 459.400 - 459.600, "Disposal of Hazardous Waste." Carson City, NV.

Remote Sensing Laboratory. 1999. Aerial Photograph Number 9997-28, 14 March. Nellis Air Force Base, NV: Photo Archive Library.

SNL, see Sandia National Laboratories.

Sandia National Laboratories. 1994. *Septic Tank Monitoring Report, Tonopah Test Range and Nevada Test Site*, June. Albuquerque, NM.

USACE, see U.S. Army Corps of Engineers.

U.S. Army Corps of Engineers. 1970. "Laboratory Soils Testing." In *Engineering Manual* 1110-2-1906, Appendix II. Washington, DC.

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

U.S. Department of Energy, Nevada Operations Office. 1994b. *Resource Conservation and Recovery Act Facility Investigation Work Plan, U.S. Department of Energy Environmental Restoration Sites, Tonopah Test Range, Nevada*, Draft, Vol. 1 and 2, May. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1994c. *Tonopah Test Range Site Priority Ranking Model*, September. Las Vegas, NV.

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

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

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

U.S. Department of Energy, Nevada Operations Office. 1998. *Work Plan for Leachfield Corrective Action Units: Nevada Test Site and Tonopah Test Range, Nevada*, Rev. 1, DOE/NV--514. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1999. *Nevada Test Site Waste Acceptance Criteria (NTSWAC)*, Rev. 2. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 2000a. *Corrective Action Decision Document for Corrective Action Unit 428: Area 3 Septic Waste Systems 1 and 5, Tonopah Test Range, Nevada*, Rev. 0, DOE/NV--587. Las Vegas, NV.

- U.S. Department of Energy, Nevada Operations Office. 2000b. *Sectored Clean-up Work Plan for Housekeeping Category Waste Sites*, Rev. 0, DOE/NV--579. Las Vegas, NV.
- U.S. Environmental Protection Agency. 1994. *Guidance for the Data Quality Objectives Process*, EPA QA/G-4. Washington, DC.
- U.S. Environmental Protection Agency. 1999. Memo from S.J. Smucker to table mailing list regarding *Region 9 Preliminary Remediation Goals (PRGs)*, 1 October. San Francisco, CA.
- van Genuchten, M. 1980. "A Closed Form Equation for Predicting the Hydraulic Conductivity of Unsaturated Soils." In *Soil Science Society of America Journal*, 44: 892-898. El Cerritos, CA.

Appendix A

Data Quality Objectives Worksheets

A.1.0 Introduction

The information developed as part of the DQO process is presented in this appendix. The DQO Process is a strategic planning approach used to prepare for data collection activities. It provides a systematic procedure for defining when to collect samples, the tolerable level of decision errors for the investigation, and how many samples to collect. These DQOs will drive the investigative activities to be performed at CAU 409 and are the basis for the CAIP.

Discussions in this Appendix include:

- Problem Statement for CAU 409
- DQO Process Overview
- Conceptual Model (including COPCs)
- Decisions and Inputs
- Field Activity Strategies
- Decision Rules and
- Decision Errors

CAU 409 is composed of the following three CASs:

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

A.1.1 Problem Statement

CAS RG-24-001-RGCR, Battery Dump Site

The Battery Dump Site is a remote location where lead-acid batteries were stockpiled and later discarded when the batteries were dead. These discarded batteries and associated construction material/debris could potentially be a source of contamination. This CAS is included in the “Housekeeping Site” functional category in the FFACO, 1996. Therefore, this CAS will be addressed within the *Sectoral Clean-up Work Plan for Housekeeping Category Waste Sites* (DOE/NV, 2000).

CAS TA-53-001-TAB2 and CAS TA-53-002-TAB2, Septic Sludge Disposal Pits

Potentially hazardous wastes were discharged to the septic waste systems in Area 3 of the TTR and may also be contained in the septic tank sludge that was disposed of at the two Septic Sludge Disposal Pits. Existing information about the nature and extent of contamination is insufficient to evaluate and select preferred corrective actions for the Septic Sludge Disposal Pits.

These sites will be investigated based on DQOs developed by representatives of NDEP and DOE/NV. This investigation will determine if COPCs are present and if concentrations exceed regulatory levels in soils underlying and immediately surrounding the Septic Sludge Disposal Pits and the Battery Dump Site. If COPCs are detected, the lateral and vertical extent of contamination will be determined. This investigation will focus on collection of data adequate to close the sites under NDEP, RCRA, and DOE requirements.

A.1.2 DQO Process Overview

The DQO Process is a strategic planning approach used to:

- Prepare for data collection activities.
- Provide a mechanism to document activities and decisions.
- Communicate the data collection design to the participants in CAU 409.

This communication among all the participants is one of the central tenets of quality management practices, thereby enabling the data users and relevant technical experts to participate in data collection planning and to specify their particular needs prior to data collection. Implementation of this communication among the participants is accomplished by holding a formal DQO Kickoff Meeting (required by the FFACO). [Table A.1-1](#) lists the participants present at the CAU 409 DQO Kickoff Meeting.

Through the DQO Kickoff Meeting, data users are encouraged to clarify vague objectives and to limit the number of decisions that will be made. Through the DQO process, the decision performance requirements of the data collected, appropriate for the intended uses of the data, are to be defined. The performance requirements will be defined by considering the consequences of decision errors and then placing tolerable limits on the probability that the data will mislead the

**Table A.1-1
DQO Kickoff Meeting Participants**

Proposed Participants	Affiliation	Role	Meeting Date
			Kickoff Meeting 04/27/2000
Kevin Cabble	DOE/NV	Task Manager	X
Lydia Coleman	ITLV	Analytical/Reg Support	X
Brad Jackson	ITLV	IS Project Manager	X
Syl Hersh	ITLV	QA Oversight	X
Mark Holmes	ITLV	Technical Execution Manager	X
Gregg Raab	NDEP	Task Manager	X
Allison Urbon	BN	Task Manager	X
James Traynor	BN	Task Manager	X
Trenton Richards	ITLV	IS Task Manager	X
Milinka Watson-Garrett	ITLV	Analytical/Reg Support	X
Jeanne Wightman	ITLV	QA	X

BN - Bechtel Nevada
DOE/NV - U.S. Department of Energy, Nevada Operations Office
ITLV - IT Corporation, Las Vegas
NDEP - Nevada Division of Environmental Protection

decision makers into committing a decision error. A sampling design can then be generated to provide the most efficient method for controlling decision errors and satisfying the DQOs.

The goal to be reached through the DQO process is to establish the quantity and quality of environmental data required to support corrective action decisions for CAU 409. To attain this goal, the following topics are considered:

- Types of data expected to be utilized
- Types of data expected to be collected
- End users of data
- What data quality is to be expected
- Decision makers
- Expectations to close the sites under NDEP, RCRA, and DOE requirements

The process ensures the information collected can be used to technically defend the chosen corrective action for each of the three CASs in CAU 409. The roles and expectations that will ensure the DQO process is successful are discussed in the following paragraphs.

Types of Data to be Utilized

From the Preliminary Assessment (PA) to the CAIP, data collected will have different end users and the expectations of what that data will determine will be based on the role of the end user. The first type of data used in this process is PA data which includes historic data and current physical site condition data. The end users of the PA data may determine if additional PA-type data is needed.

Field data will be collected at the time of the investigation and used in the corrective action decision. The end users of the data are those team members in the field and the decision makers.

Analytical data will be used in the final characterization of the site and to decide which corrective actions will be implemented. The end users of the data are the Industrial Sites (IS) Project Manager (PM), IS Task Manager (TM), the NDEP and DOE/NV decision makers, and the TM for the remediation contractor.

Types of Data Expected to be Collected

Soil/sludge samples will be collected from the Septic Sludge Disposal Pits. Both field-screening data and analytical data related to the samples will be collected and evaluated. Analytic data will address COPCs that are radioactive in nature and those that are not radioactive.

End Users of Data

Field-screening data will be used by the Site Supervisor (SS), Field Geologist/Engineer/Scientist, and the Health Physics Group. They will use the data to determine where and how many samples to collect and which samples are to be sent to laboratories for analysis; ensure that samples are properly labeled, handled, and transported; and confirm that appropriate health and safety controls are being implemented at the investigation site.

All analytical data received from laboratories will be used by many different groups involved in the process of developing an appropriate corrective action to address these CASs. Analytical Services will validate the data. The Quality Processes group will ensure that the quantity and quality of the data collected is adequate and the analytical results are properly presented in the CADD. The IS PM and TMs, DOE/NV TM, and NDEP TM will use the data to evaluate remedial alternatives and select an appropriate corrective action. Depending on the remedial alternative selected, the remediation contractor TM may use the data to implement the selected remedial alternative.

What Data Quality is to be Expected

The quality of the data will be sufficient to ensure adequate data validation. Sampling and analytical procedures should result in data that meets the requirements of precision, accuracy, representativeness, completeness, and comparability as stated in the IS QAPP (DOE/NV, 1996c).

Additionally, the data quality will be sufficient to characterize the investigation-derived waste and the contaminated media in order to determine if the material can meet the waste acceptance criteria of potential disposal facilities.

Decision Makers

Decisions are made at many stages of this process. Data collected in the PA will be used by the IS TMs, DOE/NV TM, and NDEP TM to develop the CAIP strategy. Decision makers at the field investigation site include the TM, SS, and/or CAU Lead. Decision makers during the preparation of the Final CAIP document will use the analytical data as well as the field data. The decision makers at this stage include the IS PM, TM, DOE/NV TM, NDEP TM, and the remediation contractor TM.

What is to be expected to close the sites under NDEP, RCRA, and DOE requirements

The data will provide sufficient and reliable information to identify, evaluate, and technically defend the chosen corrective action. This chosen corrective action will meet the NDEP, RCRA, and DOE requirements at a minimum.

Unless otherwise required by the results of this DQO and stated in the CAIP, this investigation will adhere to the IS QAPP (DOE/NV, 1996c). Clean-up activities associated with the Battery Dump Site Investigation will adhere to the *Sectorized Clean-up Work Plan For Housekeeping Category Waste Sites* (DOE/NV, 2000), hereafter referred to as the Sectorized Clean-up Work Plan. Clean-up activities at the two Septic Sludge Disposal Pits will adhere to the *Work Plan for Leachfield Corrective Action Units: Nevada Test Site and Tonopah Test Range, Nevada* (DOE/NV, 1998), hereafter referred to as the Leachfield Work Plan.

A.2.0 Conceptual Models

Conceptual models of the CASs that make up CAU 409 are discussed in the following paragraphs. The models will include suspected sources of contamination, COPCs, affected media, and potential routes of migration. This effort, in addition to assisting in identifying locations where sampling is necessary, will also assist in the identification and support of corrective action decisions for the CAU 409 CASs.

A.2.1 Battery Dump Site

In addition to the spent/dead batteries, the Battery Dump Site includes associated construction material and/or debris.

A.2.1.1 Contaminants of Potential Concern

No COPCs have been identified or associated with CAS RG-24-001-RGCR. Clean-up of this CAS is being handled as a housekeeping site; therefore, the work will be performed under the Sector Clean-up Work Plan.

A.2.1.2 Physical Setting

Located near Cactus Peak, a communications repeater station was battery powered because of its remote location. Based on PA investigations, it appears new batteries were placed in a corrugated metal pipe, approximately 2 ft in diameter and 2 ft tall, and covered with a wood lid. The wood lid was attached to the metal pipe with a chain. Spent/dead batteries were discarded in the area around the corrugated metal pipe. In addition to the batteries, associated construction material/debris is scattered around the metal pipe.

An outline of site-specific elements of the conceptual model for the Battery Dump Site is provided in [Table A.2-1](#).

A.2.2 Septic Sludge Disposal Pits

These disposal pits are augured holes approximately 3 ft in diameter and assumed to be approximately 50 ft deep. Septic Sludge Disposal Pit #1 is located 75 ft south of Septic Sludge Disposal Pit #2. [Figure A.2-1](#) provides a diagrammatic sketch of the disposal pits.

Table A.2-1
Conceptual Model for CAS RG-24-001-RGCR, Battery Dump Site

Conceptual Model Element	Assumptions	Source
Physical Setting	The location of the repeater tower is approximately 2.4 miles west of the junction of Cactus Peak Road and Repeater Road. The batteries, mast, stakes, and wire are located approximately 0.1 mile west of Cactus Peak Road in a saddle between two rocky outcrops.	(IT, 1998a)
	Currently no evidence of staining of soil on surface.	(IT, 1998a)
System Dynamics	No driving forces other than infiltration of limited precipitation. Groundwater contamination is unlikely due to environmental conditions at the site, such as an arid climate and depth to groundwater.	Knowledge of Similar Sites (DOE/NV, 1996a)
Source Locations	Batteries used as power supply for repeater equipment and discarded on the surface near the repeater mast.	(IT, 1998a)
Contaminants of Potential Concern	None identified to date.	Process knowledge (IT, 1998a)
Lateral Extent of Potential Contaminants	No potential contaminants identified to date.	Process knowledge (IT, 1998a)
Vertical Extent of Potential Contaminants	No potential contaminants identified to date.	(IT, 1998a)
Physical and Practical Constraints	U.S. Air Force and/or Sandia range activities, adverse weather conditions, restricted access, health and safety concerns, and approval of the CAIP.	Site knowledge and Site Visit (IT, 1998a)
Future Use	<i>The Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada</i> states that future use will be similar to current use. Current use only includes industrial and research and development related activities at TTR.	Assumptions are defined in the <i>Final Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada</i> (DOE/NV, 1996b)
Potential Exposures	None identified to date.	Site knowledge and Site Visit (IT, 1998a)
Waste Management	No waste will be generated during this activity.	Site knowledge and Site Visit (IT, 1998a)

Figure A.2-1
Diagrammatic Sketch of Septic Sludge Disposal Pits
Area 3, Tonopah Test Range

A.2.2.1 Contaminants of Potential Concern

The COPCs are the same for both CAS TA-53-001-TAB2 and CAS TA-53-002-TAB2. Septic tank sludge from Septic Waste System (SWS) 1 and 5 disposed of in these two pits is assumed to contain COPCs similar to the sludge material sampled directly from the septic tanks. Previous septic tank sampling efforts (conducted at CAU 427 in 1991, 1993, 1998, and CAU 428 in 1999) and process knowledge identify the following potential contaminants for SWS 1 and 5:

- SWS 1 served several buildings in the northern portion of the Area 3 compound. This system was used from the construction of Building 03-50 until completion of the consolidated sewer system in 1990. Potentially contaminated sanitary effluent discharged to the system produced elevated levels of COPCs within the septic waste system. Septic tank sampling has identified VOCs, SVOCs, RCRA metals, petroleum hydrocarbons, phenolics, PCBs, and elevated radiological activities.
- SWS 5 may have received effluent contaminated with RCRA metals (especially silver) associated with the photo processing laboratory in Building 03-50. The system also received effluent from floor drains that may have been contaminated with constituents produced by janitorial activities or by operations within Building 03-50.

Based on the above information, the following COPCs will be considered for the Septic Sludge Disposal Pits: total VOCs, total SVOCs, total RCRA metals, total PCBs, TPH (GDRO), isotopic plutonium, and isotopic uranium. These constituents may have been produced by activities within buildings served by SWS 1 and 5. Phenolics will be detected by SVOC analyses. Cyanide is not considered a COPC as the concentrations in the three samples were well below the EPA PRGs and very near the laboratory detection limits. A summary of analytical results from previous sampling events is provided in [Appendix D](#). Additional information on the COPCs for CAU 409, including PALs and QA/QC requirements, are provided in [Section 3.0](#) of the CAIP.

[Table A.2-2](#) lists the COPCs for the Septic Sludge Disposal Pits and their associated field-screening methods and levels as well as the PALs.

A.2.2.2 Physical Setting

Based on process knowledge and interviews of TTR workers, sludge was pumped out of the Area 3 septic tanks every few years and buried in augered holes that measured approximately 3 ft in diameter and 49 ft deep (Elliston, 2000). Approximately eight tanks ranging from 750- to 1,500-gallon capacity were pumped during these activities.

Table A.2-2
COPCs for CAS TA-53-001-TAB2, Septic Sludge Disposal Pit #1 and
CAS TA-53-002-TAB2, Septic Sludge Disposal Pit #2

Potential Contaminants	Field-Screening Method	Field-Screening Level	Preliminary Action Level	Analytical Method	Practical Quantitation Limit (soil/water)
Volatile Organic Compounds	Headspace	20 ppm or 2.5X background (use greater value)	PRGs ^a NAC445A ^b	See Appendix C	See Appendix C
Semivolatile Organic Compounds	NA	NA	PRGs ^a NAC445A ^b		
Total RCRA Metals	NA	1,000 ppm (silver only)	PRGs ^a NAC445A ^b		
PCBs	NA	NA	PRGs ^a NAC445A ^b		
Total Petroleum Hydrocarbons	Ultraviolet Fluorescence	75 ppm	100 ppm NAC445A ^b		
Radionuclides (plutonium and uranium)	Electra (alpha/beta scintillator)	Mean plus 2 standard deviations of 20 background sample readings	Isotope-specific value based on maximum isotopic background data		

^a EPA Region IX Industrial Preliminary Remediation Goals (PRGs) (EPA, 1999)

^b Nevada Administrative Code (NAC, 1999)

NA = Not applicable

The following assumptions were used to evaluate the volume of material potentially disposed of in the two pits versus the volume of the disposal pits:

- Tanks pumped out when full
- An average tank volume of 1,000 gallons
- Tanks would only need pumping after 2 to 3 years of use
- When full, the tanks contained 10 percent scum, 40 percent liquid, and 50 percent sludge
- When sludge is dewatered after placement in the pits, approximately 10 percent of the original volume would remain

Based on these assumptions, a single pumping event would result in a total of 400 gallons of dewatered sludge material remaining in the pits. The two pits have a combined volume of

approximately 5,280 gallons. This volume would accommodate backfill material used as a cap between pumping events and approximately 10 pumping and disposal events.

These pumping and disposal activities are believed to have continued until the late 1980s. Septic tank contents consisted of sanitary wastewater and small amounts of industrial wastewater containing Stoddard solvent, cutting oils, cleaning solutions, photo chemicals, medical/laboratory waste (based on a medical trailer identified as a source building for one of the Area 3 septic waste systems), and paint solvents. Unknown volumes and concentrations of these materials and other chemicals may have been released in surface and subsurface soils at the two Septic Sludge Disposal Pits. No radiological waste was documented as being disposed of in Area 3 septic waste systems.

Based on the limited history discussed in the preceding paragraphs, it is believed the two Septic Sludge Disposal Pits contain alternating layers of septic sludge material and backfill material (composed of cuttings generated when the disposal pits were initially augered). These layers most likely range in thickness of 1 to 4 ft each. The upper 4 to 6 ft of the disposal pits is most likely cuttings or clean backfill material used as a final capping material.

An outline of site-specific elements of the conceptual model for the Septic Sludge Disposal Pits is provided in [Table A.2-3](#). [Section 2.0](#) of the CAIP describes the operational histories, waste inventories, release information, and investigative background for each of the CASs.

Table A.2-3
Conceptual Model for CAS TA-53-001-TAB2, Septic Sludge Disposal Pit #1 and
CAS TA-53-002-TAB2, Septic Sludge Disposal Pit #2
(Page 1 of 2)

Conceptual Model Element	Assumptions	Source
Physical Setting	The location of Pit #1 is approximately 680 ft east of RB-35 gate near Bunker 2; Pit #2 is located approximately 75 ft north of Pit #1(aerial photo). The location of the pits appear as round depressions approximately 3 ft in diameter and 2 in. deep near a sparsely vegetated (disturbed area) tract measuring approximately 110 ft x 120 ft.	(Aerial photograph, RSL 9997-28 3/14/99) (IT, 1998b) (DOE/NV, 1994)
	Currently no evidence of staining of soil on surface. Geophysical surveys (ground penetrating radar and electromagnetic survey) conducted specifically for these CASs were inconclusive with respect to defining the extent of the pits.	(IT, 1997)
System Dynamics	No driving forces other than infiltration of limited precipitation.	Knowledge of similar sites, CAU Work Plan (DOE/NV, 1996a)
	Groundwater contamination is unlikely due to environmental conditions at the site, such as an arid climate, low permeabilities, and depth to groundwater greater than 360 ft.	(DOE/NV, 1996a)
Source Locations	Sludge pumped from various Area 3 septic tanks. SWS 1 received effluent from several buildings in the northern portion of the Area 3 compound. Source buildings for SWS 1 include: 03-50, Medical Trailer, 03-73, 03-75, 03-63, 03-76, various buildings on the northwest corner of the Area 3 compound, and the former DoD buildings and trailers north of the Area 3 compound.	Archival engineering drawings and site visits (SNL, 1992)
	Septic Waste System 5 (SWS 5) received effluent from a former photo processing laboratory and floor drains in Building 03-50.	Archival engineering drawings and site visits (SNL, 1992)
Contaminants of Potential Concern	VOCs, SVOCs, RCRA metals, petroleum hydrocarbons, phenolics, PCBs, and elevated radiological activities detected by previous sampling of several SWS 1 septic tanks.	Septic tank sampling efforts (IT, 1991 and 1994)
	Concentrations of COPCs determined for disposal of SWS 1 septic tank contents in a public-owned treatment works. Analysis based on <i>Clean Water Act</i> Maximum Contaminant Levels.	Septic tank sampling efforts (IT, 1991 and 1994)

Table A.2-3
Conceptual Model for CAS TA-53-001-TAB2, Septic Sludge Disposal Pit #1 and
CAS TA-53-002-TAB2, Septic Sludge Disposal Pit #2
(Page 2 of 2)

Conceptual Model Element	Assumptions	Source
Lateral Extent of Potential Contaminants	Lateral extent of potential contamination is unknown; however, subsurface effects are limited by relatively low contaminant concentrations and low volume (based on Septic Tank Sampling) and/or low mobility of constituents due to the lack of a hydraulic driving force.	Process knowledge, and CAU 428 CADD
	The radius of lateral contamination is not expected to extend beyond 10 ft from the outer edge of the borehole the septic sludge was placed in.	Process knowledge
Vertical Extent of Potential Contaminants	The vertical extent of potential contamination is unknown. Vertical extent should be limited by low contaminant concentrations and low volumes, minimal driving forces, relatively low mobility of COPCs and very low vertical permeability of the evaporite rocks found at the sludge rock interface at the bottom of the boring.	Process knowledge
	Vertical extent of potential contamination is not expected to extend beyond a depth of 53 ft bgs.	Ecology and Environment, Inc. 1989, and SNL, 1992.
Physical and Practical Constraints	U.S. Air Force and/or Sandia range activities; underground/aboveground utilities; adverse weather conditions; restricted access; heavy equipment and resource availability; health and safety concerns; approval of the CAIP.	Site knowledge, Site Visits (IT, 1998b)
Future Use	The <i>Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada</i> states that future use will be similar to current use. Current use only includes industrial and research and development related activities in Area 3 and Area 9.	Assumptions are defined in the <i>Final Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada</i> (DOE/NV, 1996b)
Potential Exposures	Ingestion, inhalation, or dermal contact (absorption) of COPCs in the soil due to inadvertent exposure during investigation.	Process knowledge
Waste Management	No evidence of listed waste has been found; waste will be considered characteristic unless contradictory information is discovered during the investigation.	Process knowledge

A.3.0 Decisions and Inputs

A.3.1 Decisions

Decisions to be resolved by the activities and investigations at the CASs include:

- Determine if COPCs are present at the sites.
- Determine if COPC concentrations exceed FSLs.
- Determine if COPC concentrations exceed PALs.
- Determine the nature and extent of contamination with enough certainty to develop and evaluate a range of potential corrective actions, including closure in place and clean closure.

A.3.2 Inputs and Strategy

Inputs to the decisions include those elements of information used to support the decisions in addressing the problems stated in [Section A.1.1](#).

Battery Dump Site

The Battery Dump Site will be addressed under the Sectorized Clean-up Work Plan and no contamination is expected to be encountered. Input and strategy is to locate all the batteries and other materials related to the repeater, and photograph the items before and after removal to document the clean-up.

Septic Sludge Disposal Pits

A list of information inputs, existing data, identified data gaps, and brief strategies are discussed in [Table A.3-1](#).

Table A.3-1
Decisions, Inputs, and General Strategies
(Page 1 of 3)

Decision	Input	Existing Data	Data Gap	Strategy
Are COPCs present above PALs at site?	Potential contaminant identification	Septic tank sampling efforts (IT, 1991 and 1994)	Exact/complete list of COPCs	Collect laboratory samples; analyze for COPCs based on CAU 427 and 428 sampling results
	Potential contaminant concentration	Septic tank sampling efforts (IT, 1991 and 1994)	COPC concentrations produced by SW 846 methods. Do concentrations exceed PALs?	Collect samples from soil; perform field screening and compare results to FSLs; submit samples for laboratory analysis from biased locations that represent worst case for contamination and confirmatory clean locations; compare results to PALs
	Potential contaminant distribution	Approximate boundaries of disposal pit sites are known; vertical and lateral extent limited by minimal driving forces, low volumes, and concentrations	Vertical and lateral extent of COPCs	Use drilling to establish potential depth of COPCs; conduct step-outs as required to determine lateral extent if COPCs are detected; collect laboratory samples to confirm extent

Table A.3-1
Decisions, Inputs, and General Strategies
(Page 2 of 3)

Decision	Input	Existing Data	Data Gap	Strategy
Are potential contaminants migrating?	Meteorologic data	Data on annual precipitation, evapotranspiration, and weather	None identified	No specific meteorological data collection anticipated; general weather and wind speed and direction noted on daily field logs
	Geologic/hydrologic data	General geologic/hydrologic characteristics of site; specific geologic conditions of nearby sites (i.e., CAU 428); background concentrations for arsenic typically higher than PALs	Existence and characteristics of differing permeability zones	Field log all core by qualified geologist; collect and analyze geotechnical samples at discretion of Site Supervisor (native soil below septic sludge is critical)
	Biological degradation factors	Potential hydrocarbon release; biologic conditions of nearby sites (i.e., CAU 428)	Presence of Biomass; biological parameters to evaluate natural biological process	May collect bioassessment samples from samples based on field-screening results
	Radioactive decay	1991 and 1993 Septic tank sampling effort identified U^{238} , U^{234} , and elevated gross alpha and gross beta counts for some samples. Only gross beta particle activity slightly above proposed Safe Drinking Water Act, Maximum Contaminant Level threshold value in Septic Tank 33-10; confirmed by 1993 resampling. Sampling results are discussed in Section A.2.2 and provided in Appendix D .	Presence and type of radionuclides	Establish background; field screen for alpha/beta-emitting radionuclides using an alpha/beta scintillation detector (i.e., Electra); collect limited samples for gamma spectroscopy, isotopic uranium, and isotopic plutonium analysis depending on field-screening results

Table A.3-1
Decisions, Inputs, and General Strategies
(Page 3 of 3)

Decision	Input	Existing Data	Data Gap	Strategy
Data sufficient to support closure options?	No further action	Historical evidence that COPCs were released to the environment; assume no actions	Presence, concentration, and extent of COPCs	Insufficient evidence to proceed without investigation; collect field and laboratory samples; compare analytical results to PALs; if no COPCs above PALs, prepare CADD/ Closure Report
	Closure in place	Potential for RCRA and TPH constituents; assume industrial PRGs and 100 ppm TPH per NAC 445A (NAC, 1999); assume use restrictions	Presence of regulated COPCs; concentrations above PALs; septic tank sampling efforts (IT, 1991 and 1994)	Collect field and laboratory samples; compare analytical results to PALs; if TPH above PAL, prepare A through K evaluation per NAC 445A; if no COPCs above PALs, prepare CADD/CR; otherwise prepare CADD
	<i>In situ</i> bioremediation	Oil and grease detected above PALs by septic tank sampling; assume 100 ppm PAL per NAC 445A (NAC, 1999)	Presence, concentration, and extent of COPCs; biodegradation parameters	Collect field and laboratory samples; compare analytical results to PALs; if no COPCs above PALs, prepare CADD/CR; otherwise prepare CADD
	Clean closure by contaminant removal	Potential for RCRA and TPH constituents; assume industrial PRGs and 100 ppm TPH per NAC 445A (NAC, 1999)	Presence, concentration, and extent of COPCs; volume of contaminated material above PALs	Collect field and laboratory samples; compare analytical results to PALs; if no COPCs above PALs, prepare CADD/CR; otherwise prepare CADD

A.4.0 Field Activity/Investigation Strategy

The following sections will discuss the activities/investigations to be conducted at each of the CASs in CAU 409. Those activities considered most likely to occur will be discussed as the Primary Investigation Plan. If circumstances or conditions arise that prevent the Primary Investigation Plan from being executed, but not significant enough to require rescoping of the effort, the Contingency Plan will be implemented. Both plans will be discussed for the Battery Dump Site as well as the Septic Sludge Disposal Pits.

A.4.1 Battery Dump Site Primary Investigation Plan

The field activities anticipated to occur at the Battery Dump Site include collecting the batteries and other debris located at the site and documenting the clean-up by photographing the site.

A.4.2 Battery Dump Site Contingency Plan

If soil staining is identified during the clean-up activities, biased soil sampling will be conducted. The surface soil samples will be excavated with hand tools and submitted for laboratory analysis of total RCRA metals to confirm the presence of contamination.

Laboratory confirmation of contamination present at the site will result in rescoping of the Battery Dump Site to include activities to adequately characterize the site and provide the information necessary to select a corrective action.

A.4.3 Septic Sludge Disposal Pits Primary Investigation Plan

Investigation activities to be conducted at the disposal pits include drilling, and selecting samples for field screening and laboratory analysis. The basis for selecting the samples will be a biased sampling strategy.

A.4.3.1 Biased Sampling Strategy

Due to the dimensions of the two Septic Sludge Disposal Pits, a small surface expression of approximately 3 ft in diameter and 50 ft deep, COPCs do not exist in a “Normal Distribution” setting. Therefore, biased sampling will be conducted at the two Septic Sludge Disposal Pits. A biased sampling strategy is intended to target the worst-case contamination by sampling locations

with the highest potential for contamination. It is anticipated that the areas of highest potential contamination will be encountered by drilling and collecting biased samples through the center of the disposal pits. The COPCs in the pits will be identified and representative concentrations determined. The lateral extent of the COPCs, if present, will be determined by the installation of step-out borings.

The biased sampling will assess the extent of COPCs and determine if COPC concentrations exceed PALs for the sites. Samples collected from the CASs will be analyzed for COPCs listed in [Table A.2-2](#). This will ensure that the vertical extent of possible contamination has been adequately characterized. Planned sample intervals may be substituted at the Site Supervisor's discretion with intervals that indicate highest contamination for that sample location as determined by visual and/or other field-screening techniques. At least one sample with FSRs below FSLs will be obtained from the predetermined sampling locations to define the lower limit of the contamination (if any) on soils. Field-screening results will be confirmed by off-site laboratory analysis for these samples. This sampling strategy will ensure that contamination in the soil has been adequately located, identified, and quantified.

A.4.3.2 Sampling Locations

Samples will be collected at CAU 409 using roto sonic, hollow-stem auger, or other drilling methods. The borings will be extended to a minimum of 60 ft bgs and will be advanced until FSRs are below FSLs for two consecutive boring intervals. Sample locations within the borehole are discussed in the following sections.

To determine background radiological values, a boring will be drilled to 60 ft bgs, prior to drilling the borehole in Disposal Pit #1, at a location where similar stratigraphic and geologic characteristics are expected. Downhole radiation measurement will be performed in the borehole. Alpha and beta count rates will be logged at 3-ft intervals (for a total of 20 data points) to provide a vertical profile of background radiological activity in the subsurface soils. These data will be used to establish FSLs for radioactivity by calculating the mean background activity and adding two standard deviations. Samples will be collected in this boring from the three intervals with the highest activity and submitted for laboratory analysis as a quality control check.

Field-Screening Sample Locations

Samples for field screening will be collected from the upper capping material and each layer of septic sludge in the disposal pit, and/or at locations of obvious staining or contamination. All soil samples will be field screened for VOCs, TPH, silver, and alpha/beta-emitting radionuclides (except those that may be collected at the Battery Dump Site, as described in [Section A.4.2](#)). The headspace method with a PID will be used for VOCs. Ultraviolet fluorescence will be used for TPH, X-ray fluorescence will be used for silver, and an alpha/beta scintillator will be used to detect radioactivity.

Sample Locations for Laboratory Analysis

A minimum of three samples from each disposal pit will be submitted for laboratory analysis of COPCs identified in [Table A.2-2](#). The sample from the basal sludge unit, from an interval directly below the fill/native soil interface, and the first of two samples where FSRs are less than FSLs will be submitted. Additional samples for laboratory analysis may be submitted based on FSRs and visual observations. All samples with FSRs above FSLs will be documented in the field log and boring log. Sampling location criteria are discussed in [Table A.4-1](#).

Geotechnical and bioassessment samples may be collected at the Site Supervisor's discretion. Bioassessment samples will be collected if FSRs for VOCs or TPH significantly exceed FSLs. Geotechnical samples will be analyzed using the methods in Table 3-2 of the Leachfield Work Plan to measure the following parameters:

- Initial moisture content
- Dry bulk density
- Calculated porosity
- Moisture retention characteristics
- Particle size distribution
- Saturated and unsaturated hydraulic conductivity

Step-Out Boring Sampling Locations

Step-out borings will be located in a triangular pattern (5 ft and 10 ft from edge of pit) around the disposal pits, if FSLs are exceeded at any interval in the initial borehole. The first step-out boring will be drilled at a 5-ft center from the edge of the pit. Based on FSRs, additional step-outs may

Table A.4-1
Sample Collection Locations for Laboratory Analysis

Interval Feet (ft)	Material Description	Criteria
0 to 4 ft	This should be the final capping material (est. of 4 to 6 ft thick).	Determine thickness of capping material and collect sample where staining may exist or FSLs are exceeded. If these conditions are not present, collect a representative sample. Location will be at the Site Supervisor's discretion.
4 to 10 ft	Expect this material to be septic sludge material (fairly soft and retaining some characteristics of septic sludge [i.e., medium brown color]).	Determine thickness of septic sludge material by identifying the intermediate capping material below the sludge. Collect sample where staining may exist or FSLs are exceeded. If these conditions are not present, collect a representative sample. Location will be at the Site Supervisor's discretion.
10 to 13 ft	Expect this material to be intermediate capping material (most likely clean fill or cuttings).	Determine thickness of intermediate capping material and collect sample where staining may exist or FSLs are exceeded. If these conditions are not present, collect a sample from the upper six inches of the capping material. Based on actual field conditions, the location may be changed at the Site Supervisor's discretion.
14 to 49 ft	Expect alternating layers of septic sludge material and intermediate capping material.	For each layer of sludge material, use the criteria discussed above for the 4- to 10-ft interval.
50 to 60 ft	The bottom of the pit is expected at 49 ft. Undisturbed native material should be encountered.	Collect a sample at 1 ft into the undisturbed material. Collect additional samples every 2 or 5 ft (at discretion of the Site Supervisor), or at any obvious staining or if FSLs are exceeded. Sampling may cease if two consecutive samples do not exceed FSLs.

be needed to delineate contaminant plume geometry. Step-out drilling will continue at intervals of 10 ft until no contamination is encountered. Field screening will be conducted at intervals correlative to those intervals in the disposal pits where FSLs were exceeded and/or locations of obvious staining or contamination. Borings will be drilled to a depth sufficient to evaluate the deepest interval in the disposal pit where FSLs were exceeded. Drilling depths may exceed 60 ft bgs at the Site Supervisor's discretion.

At least one sample from each of the step-out boreholes will be submitted to the laboratory for analysis. The sample(s) will be selected from the interval(s) that correlate with contamination detected in the borehole (based on FSRs) that initiated the advancement of that step-out boring.

A.4.4 Septic Sludge Disposal Pits Contingency Plan

In the event soil sampling locations cannot be determined as specified in the Primary Investigation Plan, sampling locations will be selected based on this Contingency Plan. For example, if the cored soil material appears to be uniform color from the surface to 50 ft bgs, the locations for field screening will be determined as stated in the following paragraphs.

A.4.4.1 Field-Screening Locations

If the layers of septic sludge material cannot be distinguished, samples for field screening will be collected at 10-ft intervals and/or at locations of obvious staining.

A.4.4.2 Sample Locations for Laboratory Analysis

A minimum of three samples will be submitted for laboratory analysis. The sample directly below the fill/native soil interface (if identified), the sample with the highest FSR, and the first of two consecutive samples where FSRs are below FSLs will be submitted. If the fill/native soil interface is not identified, this sample will be replaced with another sample at the discretion of the Site Supervisor. The Site Supervisor may submit additional samples for analysis, based on FSRs and visual observations. If step-out borings are required in this Contingency Plan, drilling and sampling decision points will be similar to those discussed in [Section A.4.3.2](#). Samples that exceed FSLs and are submitted to the laboratory for analysis will be documented in the field log and boring log. Sampling location criteria are discussed in [Table A.4-1](#).

A.4.5 Special Laboratory Requirements

As a precaution, the off-site laboratory used to analyze the soil samples will be required to generate and hold a leachate from samples to be used for a potential VOC and/or SVOC TCLP analysis. A metals TCLP analysis may also be requested. A TCLP analysis may be needed to characterize and dispose of IDW generated at the Septic Sludge Disposal Pits.

A.5.0 Decision Rules

The following decision rules will be used to guide the investigation and subsequent data evaluation for CAU 409:

- If in the course of the investigation either of the following occur, the investigation will be halted and rescoped as necessary:
 - The conceptual model fails to such a degree that rescoping is required.
 - Sufficient data are collected to support evaluation of corrective actions.
- At each prescribed subsurface location, if field screening indicates no COPCs above FSLs, a sample at the next prescribed subsurface location will be field screened.
- If field screening indicates the presence of COPCs above FSLs, the investigation will continue to determine the vertical and lateral extent of COPCs. Disposal pit sampling will continue until two consecutive soil samples with contaminant concentrations below appropriate FSLs are obtained; whereupon, a sample will be submitted for laboratory analysis to verify field-screening results. Samples will also be submitted for laboratory analysis from the subsurface interval that represents the worst-case based on FSRs or at the discretion of the Site Supervisor. Additional samples may be required for waste management purposes.
- If laboratory results indicate the presence of contaminants of concern above PALs, a CADD will be prepared.
- If no COPCs are identified above PALs, a CADD/Closure Report will be prepared according to the outline agreed upon by NDEP and DOE/NV. This document incorporates the elements of the CADD and the corrective action plan and serves as the closure report for the site.

[Table A.5-1](#) provides additional decision points and rules.

Table A.5-1
Activity-Specific Decision Points and Rules

Investigation Activity	Decision Point	Decision Result	Decision Rule
Drilling	Can an interface be determined (identified by fill/native soil)?	Yes	Collect samples from required locations based on FSRs. Field screen the 1-ft depth intervals above and below the interface; submit the interval with highest FSR.
		No	Continue drilling and collecting samples below the 51-ft interval until the sludge and native soil interface is identified.
	Do COPCs extend vertically beyond extent of drilling rig capabilities?	Yes	Collect and submit deepest sample with elevated FSRs within the boring, then initiate an appropriate drilling method.
		No	Submit sample from upper interval with FSRs below FSLs.
Sampling	Can samples be recovered from/around Septic Sludge Disposal Pit?	Yes	Continue subsurface investigation with drilling.
		No	Samples that cannot be collected will be replaced or eliminated at the Site Supervisor's discretion. Justification for such omissions will be provided to the DOE/NV Task Manager and presented in the CADD.
	Can sludge material be differentiated from the capping/fill material?	Yes	Continue subsurface investigation with drilling and sample collection, as stated in Section A.4.3.1 .
		No	Collect samples from the cored material as defined in Section A.4.4 (contingency plan).
	Are field data above FSLs?	Yes	Submit samples with highest FSRs for laboratory analysis. Collect additional samples from greater depths or using step-outs, as required.
		No	Submit samples to laboratory for confirmation, as required.
	Do COPCs exceed PALs?	Yes	Prepare CADD. Additional sampling may be required.
		No	Prepare CADD/Closure Report.

A.6.0 Decision Error

A.6.1 Primary Investigation Plan

As discussed in [Section A.4.3.1](#), biased sampling will be conducted at the two Septic Sludge Disposal Pits as opposed to conducting random sampling. Random sampling is appropriate where COPCs are expected to occur in a normal distribution across the area to be investigated. The COPCs in the disposal pits do not exist under a normal distribution and all layers of septic sludge that may contain COPCs can be sampled from a single borehole drilled through the center of the disposal pits (3 ft in diameter). Therefore, since biased sampling will be conducted instead of random sampling, confidence levels cannot be calculated for the sampling of the disposal pits.

This sampling strategy targets the worst-case contamination by sampling through the center of the disposal pits, which represents an area with the highest potential for contamination and will ensure that the extent of the contamination has been adequately located and identified. Two consecutive samples below FSLs will be obtained from the predetermined sampling locations to define the lower limit of the affected soils. Field-screening results will be confirmed by off-site laboratory analysis of these samples.

A.6.2 Contingency Plan

If the cored (recovered) material from the Septic Sludge Disposal Pits is of uniform color and texture and cannot be differentiated for biased sampling, a random sampling method will be employed for determining the number of samples to be collected from the cored material. This approach will ensure detection of potentially contaminated material present in the disposal pits.

The indicator parameters for field screening at CAU 409 are VOCs. Field screening for VOCs will be accomplished using the HNu Model DL-101 Photoionization Analyzer. The manufacturer of the Model DL-101 claims a reproducibility of ± 1 percent at a detection limit of 100 parts per billion in headspace air (as called for in [Table A.2-2](#)). This is assumed to be the relative standard deviation, or Coefficient of Variation (CV).

SW-846 Method 8260B gives individual coefficients of variation for each analyte determined by the method. While these range from as low as 3.5 percent to as high as 39.6 percent for garden soil spiked at the 4 mg/kg, the average CV is approximately 7.5 percent.

For the purposes of the CAU 409 investigation, the CV will be assumed to be 10 percent (i.e., more conservative reproducibility than the literature claims).

A relative error of 10-20 percent from the true mean at a confidence limit of 90 percent is considered acceptable for remedial response studies (EPA, 1989).

By substituting the appropriate values for t (any of the values for the one-tailed Student's t at the 90 percent confidence limit), CV (10 percent) and e_r (10 percent) into this equation and iterating the equation several times, the number of samples, n , converges to 2. Since no meaningful statistical assessment can be conducted on the results of as few as two samples, the number of samples should be increased to three for the purposes of this investigation. Thus, collecting a minimum of three samples from each Septic Sludge Disposal Pit for laboratory analysis will allow the determination of the VOCs concentration within 10 percent of the true mean at a confidence limit of 90 percent.

$$n = (t_{0.90,n-1} \frac{CV}{e_r})^2,$$

The number of samples required to characterize the site to an acceptable level of confidence will be calculated using Equation 8 from Chapter 9 of SW-846 (EPA, 1996).

A.7.0 References

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

EPA, see U.S. Environmental Protection Agency.

Ecology and Environment, Inc. 1989. *Federal Facility Preliminary Assessment Review of TTR Facilities*. San Francisco, CA.

Elliston, J. 2000. Record of Telecon with B. McCall (ITLV) regarding the operational history of the Septic Tank Systems in Area 3, 3 May. Las Vegas, NV: IT Corporation.

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.

IT, see IT Corporation.

IT Corporation. 1991. *Tonopah Test Range Septic Tank Sampling and Analysis Final Report*, September. Albuquerque, NM.

IT Corporation. 1994. *Sandia National Laboratories / New Mexico, Septic Tank Monitoring Report, Tonopah Test Range and Nevada Test Site*, June. Tonopah, NV.

IT Corporation. 1997. *Initial Surface Geophysical Survey Report for the Tonopah Test Range Environmental Restoration Sites*, Vol. 1 of 2, ITLV10972--93. Las Vegas, NV.

IT Corporation. 1998a. Field Form titled, "Phase I Assessment Form," 29 April. Las Vegas, NV.

IT Corporation. 1998b. Field Form titled, "Phase I Assessment Form," 4 September. Las Vegas, NV.

NAC, see *Nevada Administrative Code*.

Nevada Administrative Code. 1999. NAC445A.2272, "Contamination of Soil: Establishment of Action Levels." Carson City, NV: Nevada Division of Environmental Protection.

RSL, see Remote Sensing Laboratory.

Remote Sensing Laboratory. 1999. Aerial photograph Number 9997-28, 14 March. Nellis Air Force Base, NV: Photo Archive Library.

SNL, see Sandia National Laboratories.

Sandia National Laboratories. 1992. *Environmental Restoration Program Information Sheet*. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1994. *Resource Conservation Recovery Act Facility Investigation Work Plan for the U.S. Department of Energy Environmental Restoration Sites, Tonopah Test Range, Nevada*, Volume 1, May. 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. *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada*, DOE/EIS 0243. Las Vegas, NV.

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

U.S. Department of Energy, Nevada Operations Office. 1998. *Work Plan for Leachfield Corrective Action Units: Nevada Test Site and Tonopah Test Range, Nevada*, Rev. 1, DOE/NV--514. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 2000. *Sectored Clean-up Work Plan For Housekeeping Category Waste Sites*, Rev. 0, DOE/NV--579. Las Vegas, NV.

U.S. Environmental Protection Agency. 1989. *Soil Sampling Quality Assurance User's Guide*, Second Edition, EPA/600/8-89/046. Washington, DC.

U.S. Environmental Protection Agency. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, Third Edition, CD ROM, PB97-501928GEI (CD ROM includes revisions to 1986, 1992, and 1994). Washington, DC.

U.S. Environmental Protection Agency. 1999. Memo from S.J. Smucker to table mailing list regarding *Region IX Preliminary Remediation Goals (PRGs)*, 1 October. San Francisco, CA.

Appendix B

Project Organization

B.1.0 Project Organization

The DOE/NV Industrial Sites Project Manager is Janet Appenzeller-Wing and her telephone number is (702) 295-0461.

The names of the project Health and Safety Officer and the Quality Assurance Officer can be found in the appropriate DOE/NV plan. However, personnel are subject to change, and it is suggested that the Project Manager be contacted for further information. The Task Manager will be identified in the FFACO Biweekly Activity Report prior to the start of field activities.

Appendix C

Analytical Table

Table C.1-1
Laboratory Chemical, Toxicity Characteristic Leaching Procedure, and
Radiochemistry Analytical Requirements for Industrial Sites
(Page 1 of 6)

Parameter or Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	Regulatory Limit	Relative Percent Difference (RPD) ^a	Percent Recovery (%R) ^b
ORGANICS						
Total Volatile Organic Compounds (VOCs)	Water	8260B ^c	Analyte-specific estimated quantitation limits ^d	Not Applicable (NA)	14 ^e	61-145 ^e
	Soil				24 ^e	59-172 ^e
Toxicity Characteristic Leaching Procedure (TCLP) VOCs						
Benzene	Aqueous	1311/8260B ^c	0.050 mg/L ^d	0.5 mg/L ^d	14 ^e	61-145 ^e
Carbon Tetrachloride			0.050 mg/L ^d	0.5 mg/L ^d		
Chlorobenzene			0.050 mg/L ^d	100 mg/L ^d		
Chloroform			0.050 mg/L ^d	6 mg/L ^d		
1,2-Dichloroethane			0.050 mg/L ^d	0.5 mg/L ^d		
1,1-Dichloroethene			0.050 mg/L ^d	0.7 mg/L ^d		
Methyl Ethyl Ketone			0.050 mg/L ^d	200 mg/L ^d		
Tetrachloroethene			0.050 mg/L ^d	0.7 mg/L ^d		
Trichloroethene			0.050 mg/L ^d	0.5 mg/L ^d		
Vinyl Chloride			0.050 mg/L ^d	0.2 mg/L ^d		
Total Semivolatile Organic Compounds (SVOCs)	Water	8270C ^c	Analyte-specific estimated quantitation limits ^d	NA	50 ^e	9-127 ^e
	Soil				50 ^e	11-142 ^e
TCLP SVOCs						
o-Cresol	Aqueous	1311/8270C ^c	0.10 mg/L ^d	200 mg/L ^d	50 ^e	9-127 ^e
m-Cresol			0.10 mg/L ^d	200 mg/L ^d		
p-Cresol			0.10 mg/L ^d	200 mg/L ^d		
Cresol (total)			0.30 mg/L ^d	200 mg/L ^d		
1,4-Dichloro-benzene			0.10 mg/L ^d	7.5 mg/L ^d		
2,4-Dinitrotoluene			0.10 mg/L ^d	0.13 mg/L ^d		

Table C.1-1
Laboratory Chemical, Toxicity Characteristic Leaching Procedure, and
Radiochemistry Analytical Requirements for Industrial Sites
(Page 2 of 6)

Parameter or Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	Regulatory Limit	Relative Percent Difference (RPD) ^a	Percent Recovery (%R) ^b
Hexachloro-benzene	Aqueous	1311/8270C ^c	0.10 mg/L ^d	0.13 mg/L ^d	50 ^e	9-127 ^e
Hexachloro-butadiene			0.10 mg/L ^d	0.5 mg/L ^d		
Hexachloro-ethane			0.10 mg/L ^d	3 mg/L ^d		
Nitrobenzene			0.10 mg/L ^d	2 mg/L ^d		
Pentachloro-phenol			0.50 mg/L ^d	100 mg/L ^d		
Pyridine			0.10 mg/L ^d	5 mg/L ^d		
2,4,5-Trichloro-phenol			0.10 mg/L ^d	400 mg/L ^d		
2,4,6-Trichloro-phenol			0.10 mg/L ^d	2 mg/L ^d		
Total Pesticides	Water	8081A ^c	Analyte-specific (CRQL) ^e	NA	27 ^e	38-131 ^e
	Soil				50 ^e	23-139 ^e
TCLP Pesticides						
Chlordane	Aqueous	1311/8081A ^c	0.0005 mg/L ^e	0.03 mg/L ^d	27 ^e	38-131 ^e
Endrin			0.001 mg/L ^e	0.02 mg/L ^d		
Heptachlor			0.0005 mg/L ^e	0.008 mg/L ^d		
Heptachlor Epoxide			0.0005 mg/L ^e	0.008 mg/L ^d		
Gamma-BHC (Lindane)			0.0005 mg/L ^e	0.4 mg/L ^d		
Methoxychlor			0.005 mg/L ^e	10 mg/L ^d		
Toxaphene			0.05 mg/L ^e	0.5 mg/L ^d		
Polychlorinated Biphenyls (PCBs)	Water	8082 ^c	Analyte-specific contract-required quantitation limits (CRQL) ^e	NA	Lab-specific ^d	Lab-specific ^d
	Soil					
Total Herbicides	Water	8151A ^c	1.3 µg/L ^c	NA	Lab-specific ^d	Lab-specific ^d
	Soil		66 µg/kg ^c			
TCLP Herbicides						

Table C.1-1
Laboratory Chemical, Toxicity Characteristic Leaching Procedure, and
Radiochemistry Analytical Requirements for Industrial Sites
(Page 3 of 6)

Parameter or Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	Regulatory Limit	Relative Percent Difference (RPD) ^a	Percent Recovery (%R) ^b
2,4-D	Aqueous	1311/8151A ^c	0.002 mg/L ^d	10 mg/L ^d	Lab-specific ^f	Lab-specific ^f
2,4,5-TP			0.00075 mg/L ^d	1 mg/L ^d		
Total Petroleum Hydrocarbons (TPH)	Water Gasoline	8015B modified ^c	0.1 mg/L ^g	NA	Lab-specific ^f	Lab-specific ^f
	Soil Gasoline		0.5 mg/kg ^g			
	Water Diesel		0.5 mg/L ^g			
	Soil Diesel		25 mg/kg ^g			
Polychlorinated Dioxins and Furans	Water	8280A/8290 ^c	0.05 µg/L ^c	NA	Lab-specific ^f	Lab-specific ^f
	Soil		5 µg/kg ^c			
INORGANICS						
Total Resource Conservation and Recovery Act (RCRA) Metals						
Arsenic	Water	6010B/7470A ^c	10 µg/L ^{g,h}	NA	20 ^h	75-125 ^h
	Soil	6010B/7471A ^c	1 mg/kg ^{g,h}			
Barium	Water	6010B/7470A ^c	200 µg/L ^{g,h}			
	Soil	6010B/7471A ^c	20 mg/kg ^{g,h}			
Cadmium	Water	6010B/7470A ^c	5 µg/L ^{g,h}			
	Soil	6010B/7471A ^c	0.5 mg/kg ^{g,h}			
Chromium	Water	6010B/7470A ^c	10 µg/L ^{g,h}			
	Soil	6010B/7471A ^c	1 mg/kg ^{g,h}			
Lead	Water	6010B/7470A ^c	3 µg/L ^{g,h}			
	Soil	6010B/7471A ^c	0.3 mg/kg ^{g,h}			
Mercury	Water	6010B/7470A ^c	0.2 µg/L ^{g,h}			
	Soil	6010B/7471A ^c	0.1 mg/kg ^{g,h}			
Selenium	Water	6010B/7470A ^c	5 µg/L ^{g,h}			
	Soil	6010B/7471A ^c	0.5 mg/kg ^{g,h}			
Silver	Water	6010B/7470A ^c	10 µg/L ^{g,h}			
	Soil	6010B/7471A ^c	1 mg/kg ^{g,h}			

Table C.1-1
Laboratory Chemical, Toxicity Characteristic Leaching Procedure, and
Radiochemistry Analytical Requirements for Industrial Sites
(Page 4 of 6)

Parameter or Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	Regulatory Limit	Relative Percent Difference (RPD) ^a	Percent Recovery (%R) ^b
TCLP RCRA Metals						
Arsenic	Aqueous	1311/6010B ^c 1311/7470A ^c	0.10 mg/L ^{g,h}	5 mg/L ^d	20 ^h	75-125 ^h
Barium			2 mg/L ^{g,h}	100 mg/L ^d		
Cadmium			0.05 mg/L ^{g,h}	1 mg/L ^d		
Chromium			0.10 mg/L ^{g,h}	5 mg/L ^d		
Lead			0.03 mg/L ^{g,h}	5 mg/L ^d		
Mercury			0.002 mg/L ^{g,h}	0.2 mg/L ^d		
Selenium			0.05 mg/L ^{g,h}	1 mg/L ^d		
Silver			0.10 mg/L ^{g,h}	5 mg/L ^d		
Cyanide	Water	9010B ^c	0.01 mg/L ^h	NA	20 ^h	75-125 ^h
	Soil		1.0 mg/kg ^h			
Sulfide	Water	9030B/9034 ^c	0.4 mg/L ^c	NA	Lab-specific ^f	Lab-specific ^f
	Soil or Sediment		10 mg/kg ^g			
pH/Corrosivity	Water	9040B ^c	NA	pH >2 ⁱ	Lab-specific ^f	Lab-specific ^f
	Soil	9045C ^c		pH <12.5 ⁱ		
Ignitability	Water	1010 ^c	NA	Flash Point <140° F ^d	NA	NA
	Soil	1030 ^c		Burn Rate ^c >2.2 mm/sec nonmetals; >0.17 mm/sec metals		

Table C.1-1
Laboratory Chemical, Toxicity Characteristic Leaching Procedure, and
Radiochemistry Analytical Requirements for Industrial Sites
(Page 5 of 6)

Parameter or Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	Regulatory Limit	Relative Percent Difference (RPD) ^a	Percent Recovery (%R) ^b
RADIOCHEMISTRY						
Gamma-Emitting Radionuclides ^l	Water	EPA 901.1 ^k	Isotope-specific ^m	NA	20	Tracer Yield 30-105 Laboratory Control Sample Yield 80-120
	Soil	HASL 300 ^l			35	
Isotopic Plutonium ^j	Water	HASL 300 ^l or ASTM D3865-97 ^{n,o}	0.1 pCi/L	NA	20	
	Soil	HASL 300 ^l or ASTM C1001-90 ^{n,o}	0.05 pCi/g ^p		35	
Isotopic Uranium ^j	Water	HASL 300 ^l or ASTM D3972-97 ^{n,o}	0.1 pCi/L	NA	20	
	Soil	HASL 300 ^l or ASTM C1000-90 ^{n,o}	0.05 pCi/g		35	
Strontium - 90 ^j	Water	ASTM D 5811-95 ^{n,o}	1 pCi/L	NA	20	
	Soil	ASTM D 5811-95 ^{n,o}	0.5 pCi/g ^q		35	
Gross Alpha	Water	EPA 900.0 ^k	4 pCi/L	NA	20	Tracer Yield 30-105 Laboratory Control Sample Yield 80-120
	Soil	SM 7110 ^r	4 pCi/g		35	
Gross Beta	Water	EPA 900.0 ^k	4 pCi/L	NA	20	Tracer Yield 30-105 Laboratory Control Sample Yield 80-120
	Soil	SM 7110 ^r	4 pCi/g		35	

Table C.1-1 Laboratory Chemical, Toxicity Characteristic Leaching Procedure, and Radiochemistry Analytical Requirements for Industrial Sites (Page 6 of 6)

^aRPD is used to Calculate Precision.

Precision is estimated from the relative percent difference of the concentrations measured for the matrix spike and matrix spike duplicate analyses of unspiked field samples, or field duplicates of unspiked samples. It is calculated by:

$RPD = 100 \times \{(|C_1 - C_2|) / [(C_1 + C_2) / 2]\}$, where C_1 = Concentration of the analyte in the first sample aliquot, C_2 = Concentration of the analyte in the second sample aliquot.

^b%R is used to Calculate Accuracy.

Accuracy is assessed from the recovery of analytes spiked into a blank or sample matrix of interest, or from the recovery of surrogate compounds spiked into each sample. The recovery of each spiked analyte is calculated by: $\%R = 100 \times (C_s - C_u / C_n)$, where C_s = Concentration of the analyte in the spiked sample, C_u = Concentration of the analyte in the unspiked sample, C_n = Concentration increase that should result from spiking the sample.

^cU.S. Environmental Protection Agency's (EPAs) *Test Methods for Evaluating Solid Waste*, 3rd Edition, Parts 1-4, SW-846 (EPA, 1996)

^dEstimated Quantitation Limit as given in SW-846 (EPA, 1996)

^eEPA *Contract Laboratory Program Statement of Work for Organic Analysis* (EPA, 1988b; 1991; and 1994b)

^fIn-House Generated RPD and %R Performance Criteria

It is necessary for laboratories to develop in-house performance criteria and compare them to those in the methods. The laboratory begins by analyzing 15-20 samples of each matrix and calculating the mean %R for each analyte. The standard deviation (SD) of each %R is then calculated, and the warning and control limits for each analyte are established at ± 2 SD and ± 3 SD from the mean, respectively. If the warning limit is exceeded during the analysis of any sample delivery group (SDG), the laboratory institutes corrective action to bring the analytical system back into control. If the control limit is exceeded, the sample results for that SDG are considered unacceptable. These limits are reviewed after every 20-30 field samples of the same matrix and are updated at least semiannually. The laboratory tracks trends in both performance and control limits by the use of control charts. The laboratory's compliance with these requirements is confirmed as part of an annual laboratory audit. Similar procedures are followed in order to generate acceptance criteria for precision measurements.

^g*Industrial Sites Quality Assurance Project Plan* (DOE/NV, 1996)

^hEPA *Contract Laboratory Program Statement of Work for Inorganic Analysis* (EPA, 1988a, 1994a, and 1995)

ⁱRCRA Regulations and Keyword Index, 1998 Edition

^jIsotopic minimum detectable concentrations are defined during the DQO process and specified in the CAIP as applicable.

^k*Prescribed Procedures for Measurements of Radioactivity in Drinking Water* (EPA, 1980) or equivalent method

^l*Environmental Measurements Laboratory Procedures Manual* (DOE, 1997) or equivalent method

^mIsotope-Specific Minimum Reporting Limit to be specified in CAIP

ⁿOr equivalent method approved by IT Las Vegas Analytical Services

^oAmerican Society for Testing and Materials

^pThe *Nevada Test Site Performance Objective Criteria* requirement for certifying that hazardous waste has no added radioactivity requires that the total plutonium (the sum of the Pu-238, 239, 240 concentrations) not exceed 0.5 pCi/g (BN, 1995).

^qThe 1.0 pCi/g concentration is approximately twice the concentration of fallout Sr-90 in background surface soils reported in the *Environmental Monitoring Report for the Proposed Ward Valley California Low-Level Radioactive Waste Facility* (Atlan-Tech, 1992).

^r*Standard Methods for the Examination of Water and Waste Water* (APHA, 1995) or equivalent method

Definitions:

µg/kg = Microgram(s) per kilogram

mg/kg = Milligram(s) per kilogram

pCi/L = Picocurie(s) per liter

mg/L = Milligram(s) per liter

pCi/g = Picocurie(s) per gram

µg/L = Microgram(s) per liter

C.1.0 References

APHA, see American Public Health Association.

American Public Health Association. 1995. *Standard Methods for the Examination of Water and Waste Water*, 19th Edition. Washington, DC.

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

BN, see Bechtel Nevada.

Bechtel Nevada. 1995. *Nevada Test Site Performance Objective for Certification of Nonradioactive Hazardous Waste*, Rev. 0, G-E11/96.01. Las Vegas, NV.

RCRA Regulations and Keyword Index. 1998. ISSN 1074-1364. New York, NY:
Elsevier Science, Inc.

U.S. Department of Energy. 1997. *Environmental Measurements Laboratory Procedures Manual*, HASL-300, 28th Edition, Vol. 1. New York, NY.

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

U.S. Environmental Protection Agency. 1980. *Prescribed Procedures for Measurements of Radioactivity in Drinking Water*, EPA-600/4-80-032. Washington, DC.

U.S. Environmental Protection Agency. 1988a. *Contract Laboratory Program Statement of Work for Inorganic Analysis*, SOW No. 788, EPA/540/R-94/093. Washington, DC.

U.S. Environmental Protection Agency. 1988b. *Contract Laboratory Program Statement of Work for Organic Analysis*, SOW No. 2/88, EPA/540/R-94/096. Washington, DC.

U.S. Environmental Protection Agency. 1991. *Contract Laboratory Program Statement of Work for Organic Analysis*, OLMO 1.8, EPA/540/R-94/078. Washington, DC.

U.S. Environmental Protection Agency. 1994a. *Contract Laboratory Program Statement of Work for Inorganic Analysis*, ILMO 3.0, EPA/540/R-94/076. Washington, DC.

U.S. Environmental Protection Agency. 1994b. *Contract Laboratory Program Statement of Work for Organic Analysis*, OLMO 3.1, EPA/540/R-94/073. Washington, DC.

U.S. Environmental Protection Agency. 1995. *Contract Laboratory Program Statement of Work for Inorganic Analysis*, ILMO 4.0, EPA/540/R-95/121. Washington, DC.

U.S. Environmental Protection Agency. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, 3rd Edition (which includes updates to 1986, 1992, and 1994 revisions), CD-ROM PB97-501928GEI. Washington, DC.

Appendix D

Summary of Analytical Results

Table D-1
Summary of Analytical Results for Detected Parameters, Tonopah Test Range, Septic Tank Sampling
1991 Sampling Event¹
(Page 1 of 3)

Parameter	Units	33-1A	33-1B	33-1C	33-2	33-3	33-8	33-8 DUP	33-10
Volatile Organics									
Acetone	µg/L	--	--	49	--	34	230.0 ² (µg/kg)	270.00 (µg/kg)	100 ³
2-Butanone	µg/L	--	--	--	--	--	62.0 (µg/kg)	59.0 (µg/kg)	49
Ethylbenzene	µg/L	--	--	--	--	--	--	--	60
Toluene	µg/L	--	--	--	--	220	41.0 (µg/kg)	--	92
Xylenes	µg/L	--	--	--	12	--	--	--	270
Total Toxic Organics	µg/L	--	--	--	--	220	41 (µg/kg)	--	17152
Semivolatile Organics									
4-Methylphenol	µg/L	--	--	1000	--	--	--	--	17000
Naphthalene	µg/L	--	--	430	--	--	--	--	--
Metals									
Arsenic	mg/L	0.015	0.016	--	0.015	0.019	2.7 (mg/kg)	2.3 (mg/kg)	0.048
Barium	mg/L	0.036	0.33	0.64	0.039	0.17	127.0 (mg/kg)	117.0 (mg/kg)	1.9
Cadmium	mg/L	--	0.011	0.0098	--	0.0074	0.63 (mg/kg)	1.5 (mg/kg)	0.086
Chromium	mg/L	--	0.021	0.013	--	0.013	3.8 ⁴ (mg/kg)	2.2 (mg/kg)	0.23
Copper	mg/L	0.026	0.14	0.20	0.070	0.18	19.0 (mg/kg)	25.1 (mg/kg)	6.4

Table D-1
Summary of Analytical Results for Detected Parameters, Tonopah Test Range, Septic Tank Sampling
1991 Sampling Event¹
(Page 2 of 3)

Parameter	Units	33-1A	33-1B	33-1C	33-2	33-3	33-8	33-8 DUP	33-10
Lead	mg/L	--	0.016	0.015	--	--	3.2 (mg/kg)	7.1 (mg/kg)	1.7
Manganese	mg/L	0.057	0.12	0.39	0.026	0.19	127.0 (mg/kg)	150.0 (mg/kg)	5.1
Mercury	mg/L	0.00097	0.0033	0.0029	--	0.0014	0.35 (mg/kg)	0.28 (mg/kg)	0.037
Nickel	mg/L	--	--	--	--	--	--	--	0.37
Silver	mg/L	--	--	--	--	--	--	--	0.066
Zinc	mg/L	0.18	1.2	1.8	0.066	1.4	166.0 (mg/kg)	145.0 (mg/kg)	41.1
Total Metals	mg/L	<0.256	<1.4	<2.05	<0.186	<1.63	193.0 (mg/kg)	<176.0 (mg/kg)	<48.1
General Inorganics									
Nitrate plus Nitrite	mg/L	--	--	--	0.25	--	--	--	--
Phenolics	mg/L	0.012	0.041	0.27	0.027	0.29	--	--	0.29
Oil and Grease	mg/L	3.0	180	70.4	5.7 (units unknown)	36.1	9180.0 (mg/kg)	7300.0 (mg/kg)	36.1
Cyanide	unknown	--	--	--	0.020	--	--	--	--
Radiological									
Radium-226	pCi/gm	--	--	--	--	--	--	1.7 ± 0.2 (pCi/gm)	--
Uranium-234	pCi/L	--	--	2.9 ± 0.5 ⁵	11 ± 3	2.2 ± 0.5 ⁵	87 ± 14 (pCi/gm)	26 ± 6 (pCi/gm)	--
Uranium-235	pCi/L	--	--	--	1.1 ± 1.0	--	7.2 ± 4 (pCi/gm)	2.4 ± 1.7 (pCi/gm)	--

Table D-1
Summary of Analytical Results for Detected Parameters, Tonopah Test Range, Septic Tank Sampling
1991 Sampling Event¹
(Page 3 of 3)

Parameter	Units	33-1A	33-1B	33-1C	33-2	33-3	33-8	33-8 DUP	33-10
Uranium-238	pCi/L	--	--	470 ± 70	1.6 ± 1.3	--	9.9 ± 4.8 (pCi/gm)	3.2 ± 2.0 (pCi/gm)	--
Potassium-40	pCi/L	690 ± 70 ^{5,6}	590 ± 70 ^{5,6}	20 ± 16	720 ± 80 ^{5,6}	740 ± 80 ^{5,6}	42 ± 5 ⁶ (pCi/gm)	49 ± 5 (pCi/gm)	640 ± 70 ^{5,6}
Gross Alpha	pCi/L	3.8 ± 2.7	--	96 ± 20	--	21 ± 10	11 ± 5 (pCi/gm)	11 ± 5 (pCi/gm)	130 ± 60
Gross Beta	pCi/L	36 ± 8	38 ± 10	2 ± 0.2	63 ± 10	56 ± 14	34 ± 6 (pCi/gm)	46 ± 6 (pCi/gm)	190 ± 80
Tritium	pCi/mL	--	--	--	--	--	--	--	--
Polychlorinated Biphenyls									
Aroclor 1242	µg/L	--	0.92	--	--	--	--	--	--

Note: Values for samples considered liquid by the laboratory provided in volume units (i.e., mg/L). Values for samples considered solid by the laboratory provided in mass units (i.e., mg/kg).

¹IT Corporation. 1994. *Sandia National Laboratories/New Mexico, Septic Tank Monitoring Report, Tonopah Test Range and Nevada Test Site*, June. Tonopah, NV.

²Method blank contained 11 µg/kg acetone

³Method blank contained 24 µg/L acetone

⁴Method blank contained 1.2 mg/L chromium

⁵2 sigma error

⁶Method blank contained 480±70 pCi/L potassium-40

--Not detected

pCi/gm = Picocuries per gram

pCi/mL = Picocuries per milliliter

µg/L = Micrograms per liter

mg/L = Milligrams per liter

µg/kg = Micrograms per kilogram

pCi/L = Picocuries per liter

Table D-2
Results of Septic Tank Sample Analysis, Tonopah Test Range,
1993 Sampling Event¹
(Page 1 of 3)

Parameter	Units	33-1	33-3	33-10
Volatile Organics (EPA 624) (Aqueous Sample)				
Methylene Chloride	mg/L	0.0054	J (0.0014)	J (0.0027)
1,4-Dichlorobenzene	mg/L	0.037	0.034	0.120
Ethylbenzene	mg/L	--	--	0.049
Toluene	mg/L	0.12	J (0.0032)	0.280
Semivolatile Organics (EPA 625) (Aqueous Sample)				
Naphthalene	mg/L	0.120	J (0.0086)	J (0.011)
1,4-Dichlorobenzene	mg/L	0.038	0.027	0.070
Dibenz(a,h)anthracene	mg/L	J (0.0025)	--	--
Bis(2-ethylhexyl)phthalate	mg/L	J (0.0032)	0.015	--
Benzo(g,h,i,)perylene	mg/L	J (0.0039)	--	--
Indeno(1,2,3)-cd pyrene	mg/L	J (0.0028)	--	--
Pesticides (EPA 608) (Aqueous Sample)				
Endosulfan Sulfate	mg/L	J (0.00026)	--	--
PCBs (EPA 608) (Aqueous Sample)				
PCBs	mg/L	--	--	--
Metals (Aqueous Sample)				
Arsenic	mg/L	0.025	0.013	0.11
Barium	mg/L	0.12	0.094	0.79
Cadmium	mg/L	J (0.0011)	u (0.00050)	J (0.0020)
Chromium	mg/L	u (0.010)	J (0.0089)	0.032
Copper	mg/L	0.036	J (0.014)	0.18
Lead	mg/L	J (0.0031)	J (0.0034)	J (0.0032)
Manganese	mg/L	0.22	0.48	2.6
Mercury	mg/L	u (0.00020)	u (0.00020)	u (0.00020)
Nickel	mg/L	J (0.025)	J (0.010)	0.049
Selenium	mg/L	u (0.010)	u (0.010)	u (0.050)
Silver	mg/L	J (0.0063)	J (0.00044)	J (0.0075)
Uranium	mg/L	0.00195	0.000321	0.00556
Zinc	mg/L	0.30	0.056	0.93
Miscellaneous Analytes (Aqueous Sample)				
Phenolic Compounds	mg/L	0.010	0.030	0.051
Nitrates/Nitrites	mg/L	u (1.0)	u (1.0)	u (1.0)
Formaldehyde	mg/L	u (1.2)	u (0.50)	2.5

Table D-2
Results of Septic Tank Sample Analysis, Tonopah Test Range,
1993 Sampling Event¹
(Page 2 of 3)

Parameter	Units	33-1	33-3	33-10
Fluoride	mg/L	0.13	0.32	0.51
Cyanide	mg/L	0.038	u (0.010)	u (0.010)
Oil and Grease	mg/L	8.3	3.1	14.0
Radionuclides (Aqueous Sample)				
Gross Alpha	pCi/L	5.18 ± 3.95	0.836 ± 1.8	11.2 ± 5.28
Gross Beta	pCi/L	49.2 ± 6.72	24.0 ± 3.31	75.9 ± 9.48
Tritium	pCi/L	-292 ± 180	-294 ± 180	-223 ± 181
Radium-226	pCi/L	0.211 ± 0.099	0.149 ± 0.072	0.307 ± 0.101
Radium-228	pCi/L	0.334 ± 0.358	0.402 ± 0.246	0.382 ± 0.287
Metals (Sludge Sample)				
Arsenic	mg/kg	2.6	3.4	2.1
Barium	mg/kg	10.5	9.0	49.2
Cadmium	mg/kg	u (0.50)	u (0.50)	u (0.50)
Chromium	mg/kg	J (0.86)	1.2	6.3
Lead	mg/kg	1.6	10.7	2.4
Mercury	mg/kg	0.16	u (0.10)	0.13
Selenium	mg/kg	u (0.50)	J (0.41)	0.32
Silver	mg/kg	J (0.84)	2.3	0.57
Radionuclides (Sludge Sample)				
Gross Alpha	pCi/L	10.7 ± 2.95	19.9 ± 4.77	13.3 ± 3.41
Gross Beta	pCi/L	15.3 ± 3.55	35.6 ± 7.41	24.3 ± 5.24
Tritium (pCi/L)	pCi/L	-43 ± 177	-140 ± 174	-47.6 ± 177
Actinium-228	pCi/L	ND (0.438)	1.67 ± 0.43	1.31 ± 0.36
Americium-241	pCi/L	ND (0.094)	ND (0.098)	ND (0.096)
Bismuth-212	pCi/L	--	--	1.49 ± 0.82
Bismuth-214	pCi/L	0.264 ± 0.148	1.27 ± 0.28	1.24 ± 0.25
Cadmium-109	pCi/L	--	2.90 ± 0.984	2.21 ± 0.85
Cerium-144	pCi/L	ND (0.277)	ND (0.29)	ND (0.26)
Cobalt-60	pCi/L	ND (0.084)	ND (0.11)	ND (0.11)
Chromium-51	pCi/L	ND (1.18)	ND (1.48)	ND (1.38)
Cesium-134	pCi/L	ND (0.078)	ND (0.084)	ND (0.077)
Cesium-137	pCi/L	ND (0.103)	ND (0.12)	ND (0.11)
Europium-155	pCi/L	--	--	0.067 ± 0.10
Iron-59	pCi/L	ND (0.290)	ND (0.33)	ND (0.34)

Table D-2
Results of Septic Tank Sample Analysis, Tonopah Test Range,
1993 Sampling Event¹
(Page 3 of 3)

Parameter	Units	33-1	33-3	33-10
Lead-210	pCi/L	1.10 ± 0.915	2.35 ± 0.940	3.57 ± 1.13
Lead-212	pCi/L	0.464 ± 0.121	1.75 ± 0.26	1.53 ± 0.22
Lead-214	pCi/L	0.513 ± 0.149	1.27 ± 0.23	1.10 ± 0.22
Potassium-40	pCi/L	6.24 ± 1.44	24.5 ± 3.60	19.6 ± 3.00
Radium-224	pCi/L	1.40 ± 0.830	3.02 ± 1.08	3.14 ± 1.03
Radium-226	pCi/L	0.513 ± 0.149	1.27 ± 0.23	1.10 ± 0.22
Radium-228	pCi/L	ND (0.440)	1.67 ± 0.43	1.38 ± 0.36
Ruthenium-106	pCi/L	ND (0.799)	ND (0.83)	ND (0.80)
Strontium-85	pCi/L	0.115 ± 0.083	--	--
Thallium-208	pCi/L	0.204 ± 0.084	0.661 ± 0.14	0.51 ± 0.11
Thorium-228	pCi/L	--	2.52 ± 2.85	3.05 ± 2.62
Thorium-231	pCi/L	ND (5.26)	ND (6.62)	ND (6.02)
Thorium-234	pCi/L	5.89 ± 1.34	3.36 ± 1.26	6.07 ± 1.25
Uranium-235	pCi/L	0.332 ± 0.080	0.24 ± 0.078	0.37 ± 0.084
Uranium-238	pCi/L	5.89 ± 1.34	3.36 ± 1.26	6.07 ± 1.25
Zirconium-95	pCi/L	ND (0.209)	ND (0.25)	ND (0.26)

¹IT Corporation. 1994. *Sandia National Laboratories/New Mexico Septic Tank Monitoring Report, Tonopah Test Range and Nevada Test Site*, June. Tonopah, NV.

J - Analyte present in sample below the quantitation limit listed in parentheses.

ND - Radionuclide not detected in sample at minimum detectable activity listed in parentheses.

u - Analyte not detected at laboratory detection limit listed in parentheses.

mg/L - Milligrams per liter

pCi/L - Picocuries per liter

mg/kg - Milligrams per kilogram

-- None detected above laboratory reporting limits

Table D-3
Summary of Sludge Sample Results for Detected Parameters
Tonopah Test Range
1999 Sampling Event
(Page 1 of 5)

Sample No.	Parameter	Results	Units
Septic Tank 33-1A			
TTR01185	1,4-Dichlorobenzene	880,000	µg/kg
TTR01185	2-Butanone	180, 000 (B) ^c	µg/kg
TTR01185	Napthalene	540,000 (J) ^a	µg/kg
TTR01185	p-Isopropyltoluene	470,000 (B) ^c	µg/kg
TTR01185	1,4-Dichlorobenzene	1,200,000 (J) ^d	µg/kg
TTR01185	Arsenic	30.9	mg/kg
TTR01185	Barium	771	mg/kg
TTR01185	Cadmium	17.5	mg/kg
TTR01185	Chromium	33.3	mg/kg
TTR01185	Lead	46.4	mg/kg
TTR01185	Mercury	4.2	mg/kg
TTR01185	Selenium	4.4 (B) ^b	mg/kg
TTR01185	Silver	6.8 (B) ^b	mg/kg
TTR01185	Diesel-Range Organics	8,900 (J) ^e	mg/kg
TTR01185	1,4-Dichlorobenzene	0.57	mg/L
TTR01185	Arsenic	52.1 (B) ^b	µg/L
TTR01185	Barium	2,110	µg/L
TTR01185	Chromium	9.2 (B) ^b	µg/L
TTR01185	K-40	10.4 ± 3.7 (J)	pCi/g
TTR01185	Pb-212	0.65 ± 0.32 (J)	pCi/g
Septic Tank 33-1B			
TTR01187	1,4-Dichlorobenzene	110,000	µg/kg
TTR01187	p-Isopropyltoluene	560,000 (B) ^c	µg/kg
TTR01187	Arsenic	44.6	mg/kg
TTR01187	Barium	426	mg/kg
TTR01187	Cadmium	15.2	mg/kg
TTR01187	Chromium	21.5	mg/kg

Table D-3
Summary of Sludge Sample Results for Detected Parameters
Tonopah Test Range
1999 Sampling Event
(Page 2 of 5)

Sample No.	Parameter	Results	Units
Septic Tank 33-1B			
TTR01187	Lead	52.2	mg/kg
TTR01187	Mercury	1.6	mg/kg
TTR01187	Selenium	2.2 (B) ^b	mg/kg
TTR01187	Silver	6.6	mg/kg
TTR01187	Diesel-Range Organics	3,400 (J) ^e	mg/kg
TTR01187	Arsenic	75.8 (B) ^b	μg/L
TTR01187	Barium	922 (B) ^b	μg/L
TTR01187	Chromium	6.3 (B) ^b	μg/L
TTR01187	Silver	6 (B) ^b	μg/L
TTR01187	Th-234	6.3 ± 2.8 (J)	pCi/g
TTR01187	U-234	11.4 ± 1.4	pCi/g
TTR01187	U-235	0.40 ± 0.10 (LT)	pCi/g
TTR01187	U-238	6.56 ± 0.85	pCi/g
Septic Tank 33-3			
TTR01197	1,2,4-Trimethylbenzene	3,300 (J) ⁱ	μg/kg
TTR01197	1,3,5-Trimethylbenzene	2,000 (J) ⁱ	μg/kg
TTR01197	1,4-Dichlorobenzene	9,000	μg/kg
TTR01197	Acetone	1,800 (J) ^{a,h}	μg/kg
TTR01197	Isopropylbenzene	590 (J) ⁱ	μg/kg
TTR01197	m+p-Xylene	1,000 (J) ⁱ	μg/kg
TTR01197	Napthalene	1,400	μg/kg
TTR01197	o-Xylene	490 (J) ⁱ	μg/kg
TTR01197	p-Isopropyltoluene	800 (J) ⁱ	μg/kg
TTR01197	Tert-Butylbenzene	370 (J) ⁱ	μg/kg
TTR01197	Toluene	1,500	μg/kg
TTR01197	Arsenic	72.2	mg/kg
TTR01197	Barium	152	mg/kg

Table D-3
Summary of Sludge Sample Results for Detected Parameters
Tonopah Test Range
1999 Sampling Event
(Page 3 of 5)

Sample No.	Parameter	Results	Units
Septic Tank 33-3			
TTR01197	Cadmium	14.3	mg/kg
TTR01197	Chromium	46	mg/kg
TTR01197	Lead	213	mg/kg
TTR01197	Mercury	4.1 (J) ^g	mg/kg
TTR01197	Diesel-Range Organics	1,800 (J) ^e	mg/kg
TTR01197	Arsenic	114	µg/L
TTR01197	Barium	1,940	µg/L
TTR01197	Mercury	0.23 (B) ^b	µg/L
TTR01197	K-40	8.3 ± 3.9 (J)	pCi/g
TTR01197	Th-234	11.7 ± 3.5 (J)	pCi/g
TTR01197	U-234	28.9 ± 3.5	pCi/g
TTR01197	U-235	0.93 ± 0.18	pCi/g
TTR01197	U-238	15.6 ± 1.9	pCi/g
Septic Tank 33-3 Duplicate			
TTR01205	1,2-Dichlorobenzene	59	µg/kg
TTR01205	1,2,4-Trimethylbenzene	520	µg/kg
TTR01205	1,3,5-Trimethylbenzene	230	µg/kg
TTR01205	1,4-Dichlorobenzene	1,300	µg/kg
TTR01205	2-Chlorotoluene	79	µg/kg
TTR01205	Acetone	190 (B) ^c	µg/kg
TTR01205	Ethylbenzene	59	µg/kg
TTR01205	Isopropylbenzene	67	µg/kg
TTR01205	m+p-Xylene	260	µg/kg
TTR01205	n-Butylbenzene	61	µg/kg
TTR01205	n-Propylbenzene	120	µg/kg
TTR01205	o-Xylene	130	µg/kg
TTR01205	p-Isopropyltoluene	180	µg/kg
TTR01205	Toluene	150	µg/kg

Table D-3
Summary of Sludge Sample Results for Detected Parameters
Tonopah Test Range
1999 Sampling Event
(Page 4 of 5)

Sample No.	Parameter	Results	Units
Septic Tank 33-3 Duplicate			
TTR01205	Bis(2-Ethylhexyl)Phthalate	68,000	µg/kg
TTR01205	Arsenic	62.5	mg/kg
TTR01205	Barium	218 (J) ^g	mg/kg
TTR01205	Cadmium	34.3	mg/kg
TTR01205	Chromium	211	mg/kg
TTR01205	Lead	1,490 (J) ⁱ	mg/kg
TTR01205	Mercury	3.5 (J) ^g	mg/kg
TTR01205	Silver	6.3 (B) ^b	mg/kg
TTR01205	Diesel-Range Organics	49,000	mg/kg
TTR01205	K-40	12.3 ± 5.1 (J)	pCi/g
TTR01205	Th-234	10.5 ± 3.3 (J)	pCi/g
TTR01205	U-234	2.26 ± 0.34	pCi/g
TTR01205	U-235	0.099 ± 0.048 (B)	pCi/g
TTR01205	U-238	1.79 ± 0.28	pCi/g
Septic Tank 33-10			
TTR01200	Acetone	82 (J) ^k	µg/kg
TTR01200	Arsenic	14.2	mg/kg
TTR01200	Barium	93.1	mg/kg
TTR01200	Cadmium	3.6 (J) ⁱ	mg/kg
TTR01200	Chromium	19.9	mg/kg
TTR01200	Lead	101 (J) ^{g,j}	mg/kg
TTR01200	Mercury	3.8	mg/kg
TTR01200	Selenium	9.5	mg/kg
TTR01200	Silver	3.9	mg/kg
TTR01200	Diesel-Range Organics	1,300	mg/kg
TTR01200	Arsenic	167	µg/L
TTR01200	Barium	2,200	µg/L
TTR01200	K-40	18.1 ± 6.2 (J)	pCi/g

Table D-3
Summary of Sludge Sample Results for Detected Parameters
Tonopah Test Range
1999 Sampling Event
(Page 5 of 5)

Sample No.	Parameter	Results	Units
Septic Tank 33-10			
TTR01200	Pb-212	0.88 ± 0.46 (J)	pCi/g
TTR01200	U-234	13.5 ± 1.7	pCi/g
TTR01200	U-235	0.371 ± 0.096 (LT)	pCi/g
TTR01200	U-238	7.36 ± 0.94	pCi/g

Shaded data is Toxicity Characteristic Leaching Procedure result.

^a Associated continuing calibration showed elevated %D for compound.

^b Reported value was obtained from a reading that was less than the Contract-Required Detection Limit (CRDL), but greater than or equal to the Instrument Detection Limit (IDL) for the inorganic analyses.

^c Analyte is detected in the associated method blank as well as the sample for organic analyses.

^d Surrogates diluted out.

^e Surrogate recovery exceeded the lower limit.

^f Internal standard area count exceeded the QC limits.

^g Duplicate precision analyses were outside control limits.

^h Average relative response factor <0.05.

ⁱ Mass spectra do not match reference spectra.

^j Spike recovery was outside control limits.

^k Surrogate recovery exceeded the upper limits.

^l ICP serial dilution recovery was not met.

J - Estimated value

B - Analyte concentration greater than Minimum Detectable Concentration

LT - Concentration is greater than the Minimum Detectable Concentration, but less than the reporting level

µg/kg - Microgram(s) per kilogram

pCi/kg - Picocurie(s) per kilogram

mg/kg - Milligram(s) per kilogram

mg/L - Milligram(s) per liter

µg/L - Microgram(s) per liter

Appendix E

Response to NDEP Comments

NEVADA ENVIRONMENTAL RESTORATION PROJECT DOCUMENT REVIEW SHEET

1. Document Title/Number: Draft Corrective Action Investigation Plan for Corrective Action Unit 409: Other Waste Sites, Tonopah Test Range, Nevada			2. Document Date: July 2000	
3. Revision Number:			4. Originator/Organization: IT Corporation	
5. Responsible DOE/NV ERP Project Mgr.: Janet Appenzeller-Wing			6. Date Comments Due: August 18, 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) 2 nd Paragraph 3 rd Sentence Page A-3 of A-28		<i>"...Those basic expectations and roles are...". What follows, except for the last bullet, is not a listing of basic expectations or roles. As this apparently is part of a "boiler-plate" document, it may have been compromised in replication, and not properly edited. Since the use of boiler plates assumes across the board acceptance, this should be reviewed at the next FFACO meeting for discussion. It needs to be rewritten to reflect that the types of data must fall within the data quality objective requirements. The DQOs are set to meet the expectations to close under NDEP requirements.</i>	NDEP comment interpreted to mean that the phrase "clear expectations and roles of responsibility" is not representative of the bullets that follow, rather than the bullets and accompanying text are inaccurate or inappropriate. To address the comment, second and third sentences in the second paragraph on page A-3 were rewritten as follows: "To attain this goal, the following topics are considered:"	Yes
2) 3 rd Paragraph 1 st Sentence Page A-5 of A-28		<i>"...The quantity of data should be statistically valid to ensure the CASs are properly characterized...". Clarify how is this done, especially in the light of the statement on page A-25, first paragraph, last sentence: "...since biased sampling will be conducted instead of random sampling, confidence levels cannot be calculated for the sampling of the disposal pits..."</i>	Third paragraph, first sentence, page A-5 deleted. The sentence is not appropriate to the topic. A biased sampling approach in the primary investigation plan (as opposed to a statistically-generated random approach) is explained and justified in Section A.6.1.	Yes
3) Table A.2-3 Page A-12 of A-28		<i>Conceptual Site Model: Although there is no requirement for a diagram or cross section of the model, one would make it easier to visualize and understand.</i>	A diagrammatic sketch of the disposal pits has been drawn and inserted. The following sentence added to Section A.2.2, page A-9: "Figure A.2-1 provides a diagrammatic sketch of the disposal pits."	Yes

^a Comment Types: M = Mandatory, S = Suggested.

Return Document Review Sheets to DOE/NV Environmental Restoration Division, Attn: QAC, M/S 505.

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