Nevada
Environmental
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Project

DOE/NV--1273

National Nuclear Security Administration

Corrective Action Decision Document/Closure Report for Corrective Action Unit 234: Mud Pits, Cellars, and Mud Spills Nevada Test Site, Nevada

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Environmental Restoration
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CORRECTIVE ACTION DECISION DOCUMENT/ CLOSURE REPORT FOR CORRECTIVE ACTION UNIT 234: MUD PITS, CELLARS, AND MUD SPILLS NEVADA TEST SITE, NEVADA

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

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CORRECTIVE ACTION DECISION DOCUMENT/CLOSURE REPORT
FOR
CORRECTIVE ACTION UNIT 234:
MUD PITS, CELLARS, AND MUD SPILLS
NEVADA TEST SITE, NEVADA

Approved by: /s/ Kevin J. Cabble Date: 4/30/2008

Kevin J. Cabble
Federal Sub-Project Director
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Approved by: /s/ John B. Jones Date: 4/30/2008

John B. Jones
Acting Federal Project Director
Environmental Restoration Project

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List of Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
bgs	Below ground surface
BMP	Best management practice
CADD	Corrective Action Decision Document
CAI	Corrective Action Investigation
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CLP	Contract Laboratory Program
cm	Centimeter
COC	Contaminant of concern
COPC	Contaminant of potential concern
CPS	Counts per second
CR	Closure Report
CSM	Conceptual site model
DOE	U.S. Department of Energy
DQA	Data quality assessment
DQI	Data quality indicator
DQO	Data quality objective
DRO	Diesel-range organics
EML	Environmental Measurements Laboratory
EPA	U.S. Environmental Protection Agency
FAL	Final action level
FD	Field duplicate
FFACO	*Federal Facility Agreement and Consent Order*
FSL	Field-screening level

List of Acronyms and Abbreviations *(Continued)*

FSR	Field-screening result
ft	Foot
ft^3	Cubic foot
gal	Gallon
GPS	Global Positioning System
HASL	Health and Safety Laboratory
ID	Identification
IDW	Investigation-derived waste
LCS	Laboratory control sample
MB	Method blank
MDC	Minimum detectable concentration
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mrem/yr	Millirem per year
MS	Matrix spike
MSD	Matrix spike duplicate
N/A	Not applicable
NAC	*Nevada Administrative Code*
NAD	North American Datum
NCRP	National Council on Radiation Protection and Measurements
NDEP	Nevada Division of Environmental Protection
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NTS	Nevada Test Site
NV/YMP	Nevada/Yucca Mountain Project

List of Acronyms and Abbreviations *(Continued)*

PAL	Preliminary action level
PB	Preparation blank
PCB	Polychlorinated biphenyl
pCi/g	Picocuries per gram
pCi/L	Picocuries per liter
POC	Performance objective criteria
PPE	Personal protective equipment
PRG	Preliminary Remediation Goal
PSM	Potential source material
PVC	Polyvinyl chloride
Pu	Plutonium
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RBCA	Risk-based corrective action
RBSL	Risk-based screening level
RCRA	*Resource Conservation and Recovery Act*
RPD	Relative percent difference
SCL	Sample collection log
SDG	Sample delivery group
SNJV	Stoller-Navarro Joint Venture
SOP	Standard operating procedure
Sr	Strontium
SSTL	Site-specific target level
SVOC	Semivolatile organic compound
TC	Toxicity characteristic

List of Acronyms and Abbreviations *(Continued)*

TCLP	Toxicity characteristic leaching procedure
TPH	Total petroleum hydrocarbons
U	Uranium
UST	Underground storage tank
UTM	Universal Transverse Mercator
VOC	Volatile organic compound
WM	Waste management
%R	Percent recovery
µR/hr	Microroentgens per hour

Executive Summary

This Corrective Action Decision Document/Closure Report has been prepared for Corrective Action Unit (CAU) 234, Mud Pits, Cellars, and Mud Spills, located in Areas 2, 3, 4, 12, and 15 at the Nevada Test Site, Nevada, in accordance with the *Federal Facility Agreement and Consent Order* (FFACO, 1996; as amended February 2008). Corrective Action Unit 234 is comprised of the following 12 corrective action sites:

- 02-09-48, Area 2 Mud Plant #1
- 02-09-49, Area 2 Mud Plant #2
- 02-99-05, Mud Spill
- 03-09-02, Mud Dump Trenches
- 04-44-02, Mud Spill
- 04-99-02, Mud Spill
- 12-09-01, Mud Pit
- 12-09-04, Mud Pit
- 12-09-08, Mud Pit
- 12-30-14, Cellar
- 12-99-07, Mud Dump
- 15-09-01, Mud Pit

The purpose of this Corrective Action Decision Document/Closure Report is to provide justification and documentation supporting the recommendation for closure of CAU 234 with no further corrective action. To achieve this, corrective action investigation (CAI) activities were performed as set forth in the *Corrective Action Investigation Plan for Corrective Action Unit 234*: *Mud Pits, Cellars, and Mud Spills* (NNSA/NSO, 2007). The purpose of the CAI was to fulfill the following data needs as defined during the data quality objective (DQO) process:

- Determine whether contaminants of concern are present.
- If contaminants of concern are present, determine their extent.
- Provide sufficient information and data to complete appropriate corrective actions.

The CAU 234 dataset from the investigation results was evaluated based on the data quality indicator parameters. This evaluation demonstrated the quality and acceptability of the dataset for use in fulfilling the DQO data needs.

Analytes detected during the CAI were evaluated against final action levels (FALs) established in this document. The FAL for total petroleum hydrocarbons-diesel-range organics was established as the U.S. Environmental Protection Agency Region 9 Preliminary Remediation Goal values for the individual hazardous constituents of diesel. No CAU 234 samples contained contaminants that exceeded their respective FALs. Therefore, the DQO data needs were met, and it was determined that no corrective action (based on risk to human receptors) is necessary for the site.

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

- No further corrective action is needed for CAU 234 corrective action sites.
- No Corrective Action Plan is necessary.
- A Notice of Completion to the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office is requested from the Nevada Division of Environmental Protection for closure of CAU 234.
- Corrective Action Unit 234 should be moved from Appendix III to Appendix IV of the *Federal Facility Agreement and Consent Order.*

1.0 Introduction

This Corrective Action Decision Document (CADD)/Closure Report (CR) presents information supporting closure of Corrective Action Unit (CAU) 234, Mud Pits, Cellars, and Mud Spills, Nevada Test Site (NTS), Nevada. The corrective actions proposed in this document are in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the State of Nevada; U.S. Department of Energy (DOE), Environmental Management; U.S. Department of Defense; and DOE, Legacy Management (FFACO, 1996; as amended February 2008). The NTS is approximately 65 miles northwest of Las Vegas, Nevada (Figure 1-1).

Corrective Action Unit 234 is comprised of the following 12 corrective action sites (CASs) that are shown on Figure 1-2:

- 02-09-48, Area 2 Mud Plant #1
- 02-09-49, Area 2 Mud Plant #2
- 02-99-05, Mud Spill
- 03-09-02, Mud Dump Trenches
- 04-44-02, Mud Spill
- 04-99-02, Mud Spill
- 12-09-01, Mud Pit
- 12-09-04, Mud Pit
- 12-09-08, Mud Pit,
- 12-30-14, Cellar
- 12-99-07, Mud Dump
- 15-09-01, Mud Pit

A detailed discussion of the history of this CAU is presented in the *Corrective Action Investigation Plan* (CAIP) *for Corrective Action Unit 234: Mud Pits, Cellars, and Mud Spills* (NNSA/NSO, 2007). This document provides or references the specific information necessary to support closure of this CAU.

1.1 Purpose

This CADD/CR provides justification why no further corrective action is necessary. This justification is based on the activities that were conducted in accordance with the CAIP (NNSA/NSO, 2007).

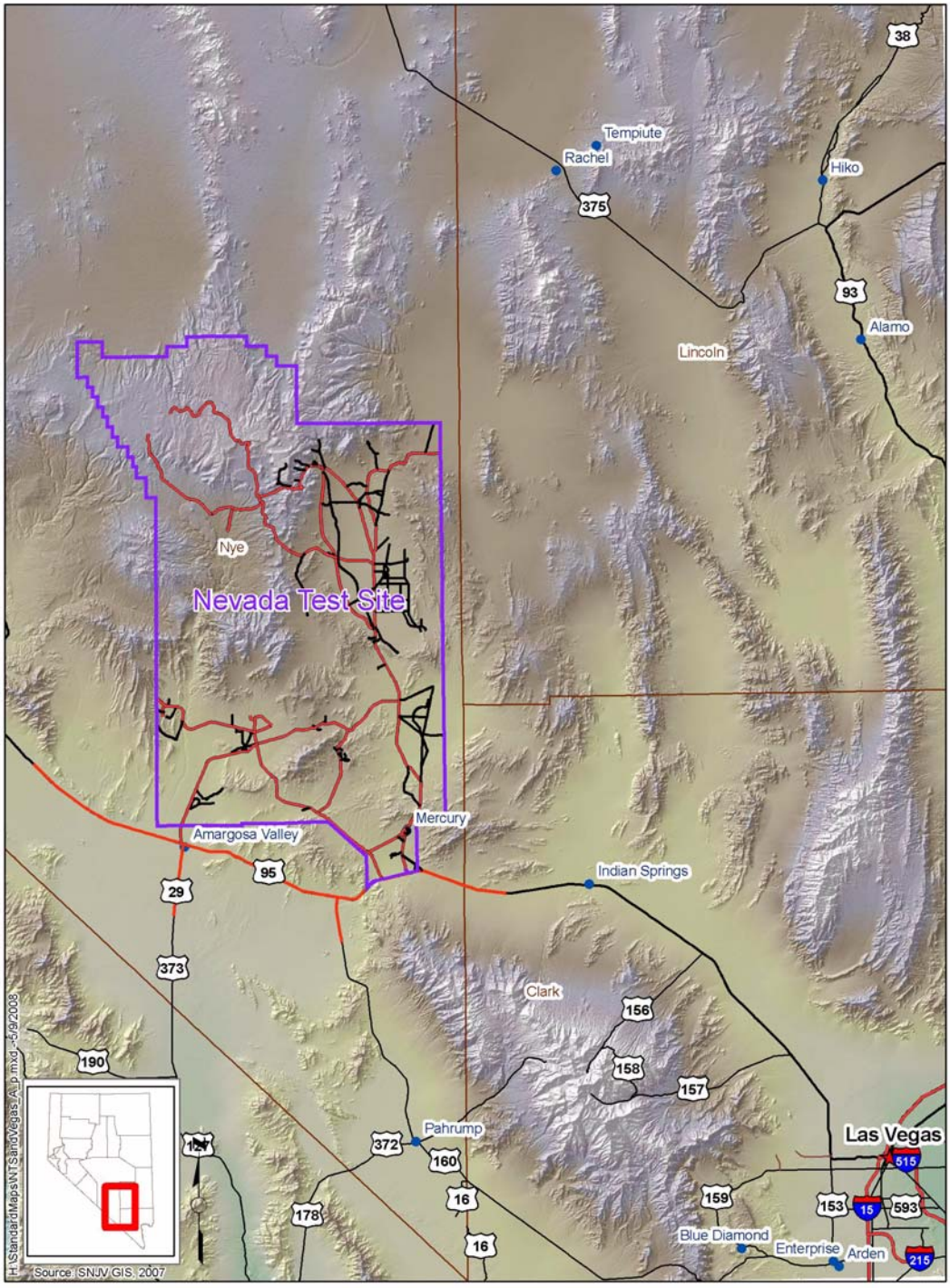

Figure 1-1
Nevada Test Site

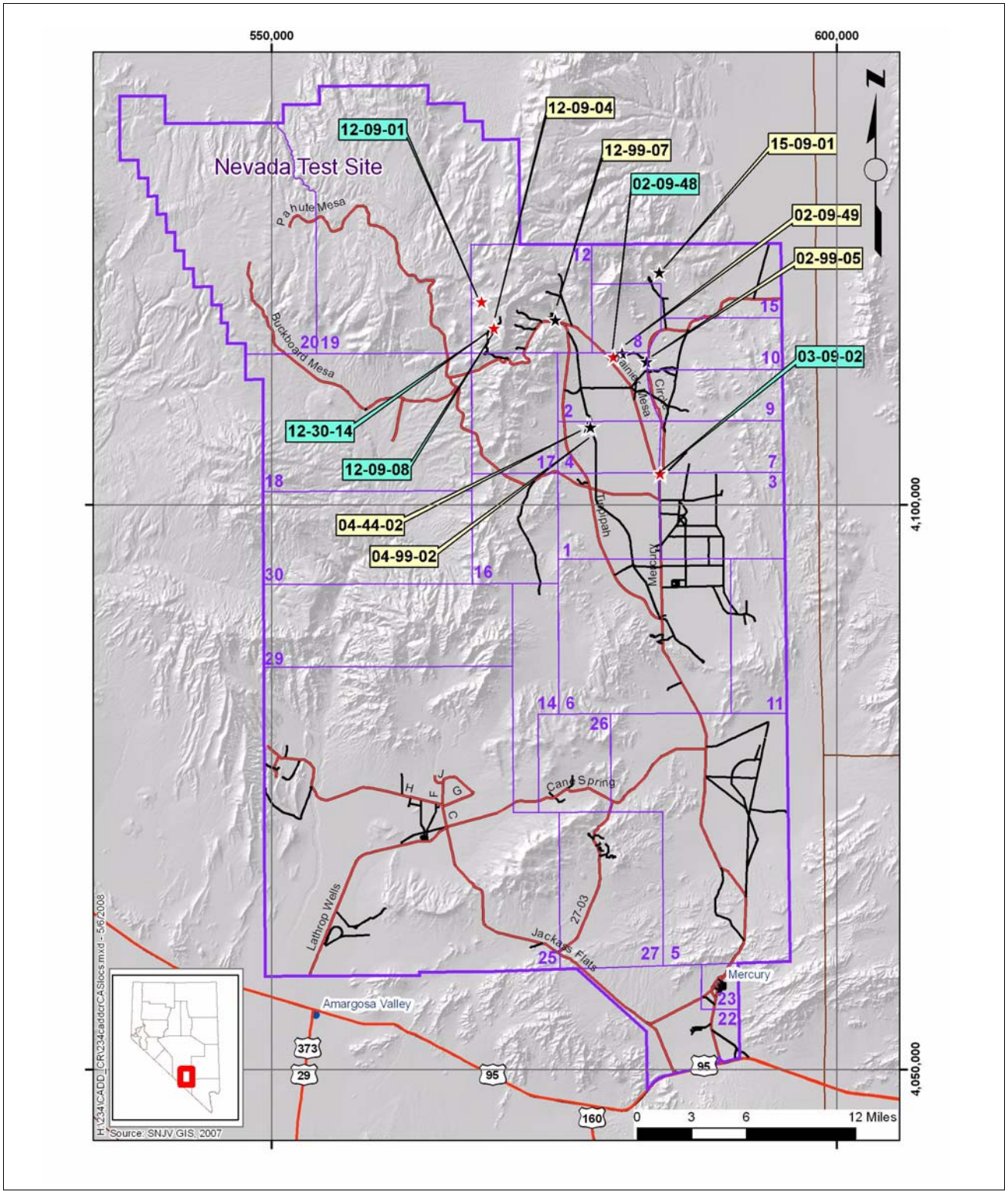

Figure 1-2
Corrective Action Unit 234, CAS Location Map

Corrective Action Unit 234, Mud Pits, Cellars, and Mud Spills, consists of 12 inactive sites located in the northwestern portion of Area 2; the northwestern corner of Area 3; the northwestern portion of Area 4; the south-central, southwestern, and western portions of Area 12; and the southeastern portion of the panhandle on the northwest corner of Area 15. The 12 CAU 234 sites consist of mud pits (suction, reserve, and return); mud dumps; mud spills; concrete dumps and spills; a cellar; and articles of debris not specifically associated with a mud pit or spill.

The CAU 234 CAIP describes the criteria by which seven of the 12 CASs were determined to have sufficient information to support a no further action closure (NNSA/NSO, 2007). Therefore, additional information was not collected (or reported in this CADD/CR) for the following CASs:

- 02-09-49, Area 2 Mud Plant #2
- 02-99-05, Mud Spill
- 04-44-02, Mud Spill
- 04-99-02, Mud Spill
- 12-09-04, Mud Pit
- 12-99-07, Mud Dump
- 15-09-01, Mud Pit

The remaining five CASs (02-09-48, 03-09-02, 12-09-01, 12-09-08, and 12-30-14; identified in green in Figure 1-2) contained debris or are associated with process knowledge that indicates potential presence of contaminants of potential concern (COPCs) not commonly associated with mud pits.

1.2 Scope

The scope of this CADD/CR is to justify that no further corrective action is required at CAU 234, Mud Pits, Cellars, and Mud Spills. The activities conducted to accomplish this scope included the following:

- Removal and disposal of surface debris and/or materials to facilitate sampling or as a best management practice (BMP)
- Radiological surveys
- Field screening
- Collection of environmental samples for laboratory analysis

- Collection of source material samples to determine the potential to generate contaminants of concern (COCs) if released to the environment
- Collection of waste samples to determine the proper disposal of wastes
- Collection of quality control (QC) samples

1.3 Corrective Action Decision Document/Closure Report Contents

This CADD/CR is divided into the following sections and appendices:

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

Section 2.0 – Corrective Action Investigation (CAI) Summary: Summarizes the investigation field activities, the results of the investigation, the need for corrective action, and a summary of the results of the data quality objective (DQO) assessment.

Section 3.0 – Recommendation: States why no further corrective action is required.

Section 4.0 – References: Provides a list of all referenced documents used in the preparation of this CADD/CR.

Appendix A – *Corrective Action Investigation Results:* Provides a description of the project objectives, field investigation and sampling activities, investigation results, waste management (WM), and quality assurance (QA).

Appendix B – *Data Assessment:* Provides a data quality assessment (DQA) that reconciles DQO assumptions and requirements to the investigation results.

Appendix C – *Risk Assessment:* Presents an evaluation of risk associated with the establishment of final action levels (FALs).

Appendix D – *Closure Activity Summary:* Provides details on the completed closure activities and supporting documentation.

Appendix E – *Sample Location Coordinates:* Provides the global positioning system (GPS) coordinates of sample locations for each CAS sampled during the CAI.

Appendix F – *Nevada Division of Environmental Protection* (NDEP) *Comments:* Contains an NDEP letter stating that there were no comments on the draft version of this document.

1.3.1 Applicable Programmatic Plans and Documents

All investigation activities were performed in accordance with the following documents:

- CAIP for CAU 234, Mud Pits, Cellars, and Mud Spills (NNSA/NSO, 2007)
- *Industrial Sites Quality Assurance Project Plan* (QAPP) (NNSA/NV, 2002)
- FFACO (1996, as amended February 2008)
- Approved procedures

1.3.2 Data Quality Assessment Summary

The DQA is presented in Appendix B and includes an evaluation of the data quality indicators (DQIs) to determine the degree of acceptability and usability of the reported data in the decision-making process. The DQO process ensures that the right type, quality, and quantity of data will be available to support the resolution of those decisions at an appropriate level of confidence. Using both the DQO and DQA processes helps to ensure that DQO decisions are sound and defensible.

The DQA process as presented in Appendix B is comprised of the following steps:

- Step 1: Review DQOs and Sampling Design.
- Step 2: Conduct a Preliminary Data Review.
- Step 3: Select the Test.
- Step 4: Verify the Assumptions.
- Step 5: Draw Conclusions from the Data.

Sample locations that support the DQO decisions at each CAS are shown in Appendix A. Based on the results of the DQA presented in Appendix B, the information generated during the investigation supports the conceptual site model (CSM) assumptions, and the data collected met the DQOs and support their intended use in the decision-making process.

2.0 Corrective Action Investigation Summary

The following sections summarize the investigation activities and investigation results, and justify why no further corrective action is needed at CAU 234. Detailed investigation activities and results for individual CAU 234 CASs are presented in Appendix A.

2.1 Investigation Activities

Corrective action investigation activities were performed as set forth in the CAU 234 CAIP (NNSA/NSO, 2007) from October 29 through November 7, 2007. Additional sampling was conducted on January 23, 2008. The purpose of the CAU 234 CAI was to address the decision statements in the project-specific DQOs by:

- Determining whether COCs are present in the soils associated with CAU 234.
- Determining the lateral and vertical extent of identified COCs.
- Ensuring adequate data have been collected to close the sites under NDEP, *Resource Conservation and Recovery Act* (RCRA) (CFR, 2006a), *Toxic Substances Control Act* (CFR, 2006b), and DOE requirements.

The scope of the CAI included the following activities:

- Performing radiological surveys (i.e., static, scanning, and swipe collection).
- Field screening soil samples for total alpha and beta/gamma radiation.
- Collecting environmental samples for laboratory analyses to determine the presence of COCs and to define the vertical and lateral extent of COCs, if present.
- Collecting QC samples for laboratory analyses to ensure that the data generated from the analysis of investigation samples meet the requirements of the DQIs.
- Collecting liquid and solid material samples from the cellar system components at CAS 12-30-14 to identify whether the material contained in this structure is a potential source of environmental contamination.

Judgmental sampling schemes were implemented to select sample locations and evaluate analytical results, as outlined in the CAIP (NNSA/NSO, 2007). Judgmental sampling allows the methodical

selection of sample locations that target the populations of interest (defined in the DQOs) rather than non-selective random locations.

For the judgmental sampling scheme, individual sample results (rather than average concentrations) are used to compare FALs. Therefore, statistical methods to generate site characteristics (averages) are not necessary. If good prior information is available on the target site of interest, then the sampling may be designed to collect samples only from areas known to have the highest concentration levels on the target site. If the observed concentrations from these samples are below the action level, then a decision can be made that the site contains safe levels of the contaminant without the samples being truly representative of the entire area (EPA, 2006).

The judgmental sampling design was used to confirm the existence of contamination at specific locations and provide information (such as extent of contamination) about specific areas of the site.

Confidence in judgmental sampling scheme decisions was established qualitatively by validation of the CSM and justification that sampling locations are the most likely locations to contain a COC, if a COC exists.

Waste characterization activities were conducted to gather sufficient information and data to support waste disposal decisions. Information regarding waste characterization is presented in Appendix A.

The following sections describe specific investigation activities conducted at each CAS. Additional information regarding the investigation is presented in Appendix A.

2.1.1 Area 2 Mud Plant #1 (CAS 02-09-48)

The following subsections summarize the activities conducted at CAS 02-09-48.

2.1.1.1 Radiological Survey

As presented in the CAIP (NNSA/NSO, 2007), a radiological walkover survey was conducted across the drilling mud sump on May 23, 2006. The survey results were not distinguishable from background. As a result, no additional biased sample locations were identified.

2.1.1.2 Visual Inspection

Visual inspections were conducted of the concrete sump and associated piping, and of the 55-gallon (gal) drum resting atop the drilling mud within the sump. No additional biased samples were identified.

2.1.1.3 Field Screening

The field-screening results (FSRs) were compared to field-screening levels (FSLs) to guide subsequent sampling decisions. No samples exceeded the FSLs established for the CAS. As a result, no additional samples were collected.

2.1.1.4 Sample Collection

Decision I sampling activities included the collection of five environmental soil samples (including one field duplicate [FD]) from the unused drilling mud within the sump. The sample identification (ID) numbers, locations, types, and analyses are listed in Table A.3-1. The sample locations are shown on Figure A.3-2. Samples were collected using grab sampling. Samples collected from this CAS are numbered 234A001 through 234A005.

2.1.1.5 Conceptual Site Model Validation

The CSM and associated discussion for this CAS are provided in the CAIP (NNSA/NSO, 2007). The information supporting the lack of contamination gathered during the CAI was consistent with the CSM, and all information gathered during the CAI supports and validates the CSM as presented in the CAIP (NNSA/NSO, 2007).

2.1.2 Mud Dump Trenches (CAS 03-09-02)

The following subsections summarize the activities conducted at CAS 03-09-02.

2.1.2.1 Radiological Survey

A radiological survey was conducted on October 25, 2007. Results of the radiological survey are presented as Figure A.4-3 and were not distinguishable from background readings. As a result, no additional samples were collected.

2.1.2.2 Visual Inspection

Visual inspections were made of the layout of the mud pits, their accessibility, and any other debris that would require investigation during the sampling effort. A length of blue pipe was identified under the tumbleweeds in the northern suction pit and was sampled at both ends. Otherwise, no additional sampling locations were identified.

2.1.2.3 Field Screening

Soil samples were screened in the field for alpha and beta/gamma radioactivity. The radiological FSRs were compared to FSLs to guide subsequent sampling decisions. The radiological FSRs were all below FSLs. As a result, no additional samples were collected.

2.1.2.4 Sample Collection

A total of 14 environmental soil characterization samples (including one FD and one matrix spike [MS]/matrix spike duplicate [MSD]) were collected from seven locations during investigation activities at CAS 03-09-02. The sample identification numbers, locations, types, and analyses are listed in Table A.4-1. The sample locations are shown in Figure A.4-4. Samples were collected using scoops and a hand auger. Samples collected at this CAS are numbered 234B001 through 234B014. A rinsate sample (234B501) was also collected and analyzed for all parameters plus gross alpha/beta and tritium.

Decision I surface and subsurface samples were collected from the lowest point of elevation within each of the mud pit trenches as identified through earlier photographs taken after rainstorms. The location of puddling of the rainwater indicated the low spots. No Decision II sampling was necessary as all Decision I sample results were below FALs.

2.1.2.5 Conceptual Site Model Validation

The CSM and associated discussion for this CAS are provided in the CAIP (NNSA/NSO, 2007). The information supporting the lack of contamination gathered during the CAI was consistent with the CSM, and all information gathered during the CAI supports and validates the CSM as presented in the CAIP (NNSA/NSO, 2007).

2.1.3 Mud Pit (CAS 12-09-01)

The following subsections summarize the activities conducted at CAS 12-09-01.

2.1.3.1 Radiological Survey

An aerial radiological survey was conducted in 1994 of Area 12, including CAS 12-09-01. The results of the survey were not distinguishable from background. As a result, no additional samples were collected (see Figure A.5-3).

2.1.3.2 Visual Inspection

A visual inspection was conducted of the length of metal pipe (approximately 20 feet [ft] long) and the cylindrical metal debris. No other biased conditions were identified during the visual inspection. As a result, no additional samples were collected.

2.1.3.3 Field Screening

The radiological FSRs were compared to FSLs to guide subsequent sampling decisions. The radiological FSRs were all below FSLs. As a result, no additional samples were collected.

2.1.3.4 Sample Collection

A total of six soil environmental samples (including 1 FD and one MS/MSD) were collected from five locations at CAS 12-09-01 The sample identification numbers, locations, types, and analyses are listed in Table A.5-1. The sample locations are shown in Figure A.5-3. Samples were collected using scoops and a hand auger. Samples collected at this CAS are numbered 234C001 though 234C006.

2.1.3.5 Conceptual Site Model Validation

The CSM and associated discussion for this CAS are provided in the CAIP (NNSA/NSO, 2007). The information supporting the lack of contamination gathered during the CAI was consistent with the CSM, and all information gathered during the CAI supports and validates the CSM as presented in the CAIP (NNSA/NSO, 2007).

2.1.4 Mud Pit (CAS 12-09-08)

The following subsections summarize the activities conducted at CAS 12-09-08.

2.1.4.1 Radiological Survey

An aerial radiological survey was performed in 1994 of Area 12, including CAS 12-09-08. The results of the survey were indistinguishable from background. As a result, no additional samples were collected (see Figure A.5-3).

2.1.4.2 Visual Inspection

A visual inspection was conducted of the CAS, and the only locations of environmental concern identified were the metal pipe sticking out of the ground at the top of one of the berm walls and a set of crushed 55-gal drums protruding from the eastern berm wall. The metal pipe was removed from the berm wall, placed on the ground, and the interior inspected. Nothing was identified within the pipe. No other items of concern were identified at the CAS. As a result, no additional samples were collected.

2.1.4.3 Field Screening

A handheld survey instrument was used to screen for alpha and beta/gamma radioactivity before soil samples were placed in sample jars. The radiological FSRs were compared to FSLs to guide subsequent sampling decisions. The radiological FSRs were all below FSLs.

2.1.4.4 Sample Collection

A total of seven soil environmental samples (including one FD and one MS/MSD) were collected from three locations at CAS 12-09-08. The sample identification numbers, locations, types, and analyses are listed in Table A.6-1. The sample locations are shown in Figure A.6-2. Samples were collected using scoops and a hand auger. Samples collected from this CAS are numbered 234D001 through 234D007.

2.1.4.5 Conceptual Site Model Validation

The CSM and associated discussion for this CAS are provided in the CAIP (NNSA/NSO, 2007). The information supporting the lack of contamination gathered during the CAI was consistent with the CSM, and all information gathered during the CAI supports and validates the CSM as presented in the CAIP (NNSA/NSO, 2007).

2.1.5 Cellar (CAS 12-30-14)

The following subsections summarize the activities conducted at CAS 12-30-14.

2.1.5.1 Radiological Survey

An aerial radiological survey was conducted in 1994 of Area 12, including CAS 12-30-14. The findings of the survey were indistinguishable from background. Therefore, no additional samples were collected (see Figure A.5-2).

2.1.5.2 Visual Inspection

A visual inspection was conducted of the CAS, and the only locations of environmental concern identified were the open cellar and its contents. A metal pipe is sticking out of the cellar, but it was determined that this pipe had been placed in the cellar and was not an integral part of the cellar components. Visual inspection resulted in no additional collection of samples.

2.1.5.3 Field Screening

Soil samples were screened in the field for alpha and beta/gamma radioactivity. A handheld survey instrument was used to screen for alpha and beta/gamma radioactivity before soil samples were placed in sample jars. A liquid sample and all sediment samples were analyzed for shipping purposes using the gamma spectrometer located in Building 23-153. The radiological FSRs were compared to FSLs to guide subsequent sampling decisions. The radiological FSRs were all below FSLs.

2.1.5.4 Sample Collection

A total of one liquid and three sediment environmental samples (including one FD) were collected from two locations at CAS 12-30-14. The sample identification numbers, locations, types, and

analyses are listed in Table A.7-1. The sample locations are shown in Figure A.7-2. Samples were collected using a Teflon beaker on a pole. The liquid sample was designated as 234E001, and the three sediment samples were designated 234E002 through 234E004.

2.1.5.5 Conceptual Site Model Validation

The CSM and associated discussion for this CAS are provided in the CAIP (NNSA/NSO, 2007). The information supporting the lack of contamination gathered during the CAI was consistent with the CSM, and all information gathered during the CAI supports and validates the CSM as presented in the CAIP (NNSA/NSO, 2007).

2.1.6 Summary of Analytical Data

Chemical and radiological results for environmental and cellar content samples collected at each of the CASs with results greater than their respective minimum detectable concentrations (MDCs) are summarized in Sections A.3.0 through A.7.0. Environmental samples are evaluated against FALs to determine the presence of COCs and the extent of COC contamination, if present. The CAS 12-30-14 liquid sample results are evaluated against RCRA toxicity characteristics [TCs] to determine whether a release of the cellar contents to the surrounding environmental media could cause the presence of a COC in the environmental media.

The preliminary action levels (PALs) for the CAU 234 investigation were determined during the DQO process and are discussed in Section 3.3 of the CAIP (NNSA/NSO, 2007). The FALs used for determining the presence of COCs and for evaluating the need for additional corrective action are defined in Section 2.3. Details about the methods used during this investigation and a comparison of environmental sample results to the FALs are presented in Appendix A.

2.2 Results

2.2.1 Summary of Analytical Data

All concentrations of the reported parameters were compared to and were less than the PALs. The FALs were established at the corresponding PAL concentrations. No COCs were identified at any of

the CASs and the CAS 12-30-14 cellar sample contents were less than the TC limits (i.e., no COCs identified).

The maximum concentration of each detected contaminant at CASs 02-09-48, 03-09-02, 12-09-01, 12-09-08, and 12-30-14 are listed in Tables 2-1 through 2-6, respectively.

2.2.2 Data Assessment Summary

The DQA is presented in Appendix B and includes an evaluation of the DQIs to determine the degree of acceptability and usability of the reported data in the decision-making process. The DQO process ensures that the right type, quality, and quantity of data will be available to support the resolution of those decisions at an appropriate level of confidence. Using both the DQO and DQA processes helps to ensure that DQO decisions are sound and defensible.

The DQA process as presented in Appendix B is comprised of the following steps:

- Step 1: Review DQOs and Sampling Design.
- Step 2: Conduct a Preliminary Data Review.
- Step 3: Select the Test.
- Step 4: Verify the Assumptions.
- Step 5: Draw Conclusions from the Data.

Sample locations that support the presence and/or extent of contamination at each CAS are shown in Appendix A. Based on the results of the DQA presented in Appendix B, the DQO requirements have been met. The DQA also determined that information generated during the investigation supports the CSM assumptions and the data collected support their intended use in the decision-making process.

2.3 Justification for No Further Action

No further corrective action is justified for all CAU 234 corrective action sites based on an evaluation of risk to ensure protection of the public and the environment in accordance with *Nevada Administrative Code* (NAC) 445A (NAC, 2006a), feasibility, and cost effectiveness. The decision that no further action is needed was determined from DQO decision statements based on a comparison of the analyte concentrations detected in CAI soil samples to the FALs defined in Section 2.3.1.

Table 2-1
Maximum Concentration of Detected Contaminants in Soil at CAS 02-09-48, Area 2 Mud Plant #1

Constituent	Maximum Result	Sample Number	Depth (ft bgs)	Location	FAL	Units
Actinium-228	3.72	234A005	0.5 - 1.0	A02	5	pCi/g
Arsenic	2.8	234A002	0.0 - 0.5	A01	23	mg/kg
Barium	100	234A001	0.0 - 0.5	A01	67,000	mg/kg
Benzo(b)Fluoranthene	0.18 (J)	234A002	0.0 - 0.5	A01	2.1	mg/kg
Bis(2-ethylhexyl)Phthalate	0.16 (J)	234A005	0.5 - 1.0	A02	120	mg/kg
Cadmium	0.65	234A001	0.0 - 0.5	A01	450	mg/kg
Chromium	3.8	234A001	0.0 - 0.5	A01	450	mg/kg
Di-n-butyl Phthalate	0.34 (J)	234A002	0.0 - 0.5	A01	62,000	mg/kg
Fluoranthene	0.28 (J)	234A002	0.0 - 0.5	A01	22,000	mg/kg
Lead	29	234A001	0.0 - 0.5	A01	800	mg/kg
Lead	29	234A004	0.0 - 0.5	A02	800	mg/kg
Lead	29	234A003	0.5 - 1.0	A01	800	mg/kg
Lead-212	4.12 (J)	234A003	0.5 - 1.0	A01	5	pCi/g
Lead-214	3.36 (J)	234A005	0.5 - 1.0	A02	5	pCi/g
Phenanthrene	0.2 (J)	234A002	0.0 - 0.5	A01	100,000	mg/kg
Plutonium-238	0.093	234A001	0.0 - 0.5	A01	13	pCi/g
Plutonium-239/240	0.35	234A001	0.0 - 0.5	A01	12.7	pCi/g
Pyrene	0.2 (J)	234A002	0.0 - 0.5	A01	29,000	mg/kg
Thorium-234	4.6 (J)	234A005	0.5 - 1.0	A02	105	pCi/g
Thorium-234	4.6 (J)	234A002	0.0 - 0.5	A01	105	pCi/g
Thallium-208	1.22	234A004	0.0 - 0.5	A02	5	pCi/g
Uranium-234	2.59	234A003	0.5 - 1.0	A01	143	pCi/g
Uranium-235	0.16	234A002	0.0 - 0.5	A01	17.6	pCi/g
Uranium-238	2.66	234A005	0.5 - 1.0	A02	105	pCi/g

bgs = Below ground surface
FAL = Final action level
ft = Foot
mg/kg = Milligrams per kilogram
pCi/g = Picocuries per gram
J = Estimated value

Table 2-2
Maximum Concentration of Detected Contaminants in Soil at CAS 03-09-02, Mud Dump Trenches

Constituent	Maximum Result	Sample Number	Depth (ft bgs)	Location	FAL	Units
Actinium-228	3.49	234B014	0.0 - 0.5	B07	5	pCi/g
Acetone	0.11	234B005	1.5 - 2.0	B01	54,000	mg/kg
Arsenic	9.5	234B012	0.0 - 0.5	B06	23	mg/kg
Barium	310	234B012	0.0 - 0.5	B06	67,000	mg/kg
Bis(2-ethylhexyl)Phthalate	0.35 (J)	234B004	1.5 - 2.0	B02	120	mg/kg
Cadmium	0.22	234B006	0.0 - 0.5	B03	450	mg/kg
Chromium	8.7	234B012	0.0 - 0.5	B06	450	mg/kg
Cesium-137	2.7	234B008	0.0 - 0.5	B04	12.2	pCi/g
Diesel-Range Organics	53	234B012	0.0 - 0.5	B06	100	mg/kg
Europium-155	0.274(J)	234B014	0.0 - 0.5	B07	135	pCi/g
Lead	17	234B006	0.0 - 0.5	B03	800	mg/kg
	17	234B014	0.0 - 0.5	B07		
Mercury	0.034	234B004	1.5 - 2.0	B02	310	mg/kg
Lead-212	3.75 (J)	234B014	0.0 - 0.5	B07	5	pCi/g
Lead-214	1.44 (J)	234B014	0.0 - 0.5	B07	5	pCi/g
Plutonium-239/240	0.239	234B001	0.0 - 0.5	B01	12.7	pCi/g
Selenium	0.55	234B004	1.5 - 2.0	B02	5,100	mg/kg
Thallium-208	1.14	234B014	0.0 - 0.5	B07	5	pCi/g
Thorium-234	4.72 (J)	234B014	0.0 - 0.5	B07	105	pCi/g
Uranium-234	1.44	234B008	0.0 - 0.5	B04	143	pCi/g
Uranium-235	0.094	234B003	0.0 - 0.5	B02	17.6	pCi/g
Uranium-238	1.56	234B008	0.0 - 0.5	B04	105	pCi/g

bgs = Below ground surface
FAL = Final action level
ft = Foot
mg/kg = Milligrams per kilogram
pCi/g = Picocuries per gram
J = Estimated value

Table 2-3
Maximum Concentration of Detected Contaminants in Soil at CAS 12-09-01, Mud Pit

Constituent	Maximum Result	Sample Number	Depth (ft bgs)	Location	FAL	Units
Actinium-228	2.64	234C001	0.0 - 0.33	C01	5	pCi/g
Arsenic	3.7	234C006	0.0 - 0.5	C05	23	mg/kg
Barium	120	234C001	0.0 - 0.33	C01	67,000	mg/kg
Barium	120	234C002	0.0 - 0.33	C01	67,000	mg/kg
Benzo(b)Fluoranthene	0.086 (J)	234C002	0.0 - 0.33	C01	2	mg/kg
Bis(2-ethylhexyl)Phthalate	0.12 (J)	234C001	0.0 - 0.33	C01	120	mg/kg
Cadmium	0.14	234C006	0.0 - 0.5	C05	450	mg/kg
Chromium	7.4	234C006	0.0 - 0.5	C05	450	mg/kg
Cesium-137	0.45	234C001	0.0 - 0.33	C01	12	pCi/g
Diesel-Range Organics	7	234C001	0.0 - 0.33	C01	100	mg/kg
Lead	33 (J)	234C006	0.0 - 0.5	C05	800	mg/kg
Mercury	0.026	234C005	0.0 - 0.5	C04	310	mg/kg
p-Isopropyltoluene	0.0022 (J)	234C004	0.0 - 0.5	C03	2,000	mg/kg
Lead-212	2.87 (J)	234C001	0.0 - 0.33	C01	5	pCi/g
Lead-214	1.55 (J)	234C003	0.0 - 0.33	C02	5	pCi/g
Plutonium-238	0.13	234C005	0.0 - 0.5	C04	13	pCi/g
Plutonium-239/240	0.66	234C005	0.0 - 0.5	C04	13	pCi/g
Selenium	0.46	234C002	0.0 - 0.33	C01	5,100	mg/kg
Silver	0.2	234C002	0.0 - 0.33	C01	5,100	mg/kg
Thallium-208	0.95	234C003	0.0 - 0.33	C02	5	pCi/g
Uranium-234	1.27	234C001	0.0 - 0.33	C01	143	pCi/g
Uranium-235	0.08	234C003	0.0 - 0.33	C02	18	pCi/g
Uranium-235	0.08	234C004	0.0 - 0.5	C03	18	pCi/g
Uranium-238	1.3	234C005	0.0 - 0.5	C04	105	pCi/g

bgs = Below ground surface
FAL = Final action level
ft = Foot
mg/kg = Milligrams per kilogram
pCi/g = Picocuries per gram
J = Estimated value

Table 2-4
Maximum Concentration of Detected Contaminants in Soil at CAS 12-09-08, Mud Pit

Constituent	Maximum Result	Sample Number	Depth (ft bgs)	Location	FAL	Units
Actinium-228	2.56	234D001	0.0 - 0.5	D01	5	pCi/g
Arsenic	4.5	234D001	0.0 - 0.5	D01	23	mg/kg
Barium	200	234D006	0.0 - 0.5	D03	67,000	mg/kg
Bis(2-ethylhexyl)Phthalate	0.18 (J)	234D007	1.0 - 1.5	D03	120	mg/kg
Cadmium	0.19	234D005	0.0 - 0.5	D03	450	mg/kg
Chromium	7	234D001	0.0 - 0.5	D01	450	mg/kg
Diesel-Range Organics	73	234D007	1.0 - 1.5	D03	100	mg/kg
Lead	22	234D006	0.0 - 0.5	D03	800	mg/kg
Lead-212	2.91 (J)	234D007	1.0 - 1.5	D03	5	pCi/g
Lead-214	1.26 (J)	234D007	1.0 - 1.5	D03	5	pCi/g
Plutonium-239/240	0.028	234D005	0.0 - 0.5	D03	12.7	pCi/g
Selenium	0.46	234D002	0.5 - 1.0	D01	5,100	mg/kg
Thallium-208	0.89	234D002	0.5 - 1.0	D01	5	pCi/g
Uranium-234	1.06	234D003	0.0 - 0.5	D02	143	pCi/g
Uranium-235	0.081	234D005	0.0 - 0.5	D03	17.6	pCi/g
Uranium-238	1.09	234D004	0.5 - 1.0	D02	105	pCi/g
Uranium-238	1.09	234D003	0.0 - 0.5	D02	105	pCi/g

bgs = Below ground surface
FAL = Final action level
ft = Foot
mg/kg = Milligrams per kilogram
pCi/g = Picocuries per gram
J = Estimated value

No contaminants were identified at concentrations exceeding their respective FALs (or the TC limit for the CAS 12-30-14 liquid cellar samples) in any of the CASs.

As no COCs were identified, no corrective action is required. Appendix C presents the justification for no further action based on risk.

Table 2-5
Maximum Concentration of Detected Sediment Contaminants for CAS 12-30-14, Cellar

Constituent	Maximum Result	Sample Number	Thickness[a]	Location	FAL	Units
Uranium-234	0.97	234E002	0.0 - 1.0	Cellar	143	pCi/g
Actinium-228	1.83	234E002	0.0 - 1.0	Cellar	5	pCi/g
Thallium-208	0.66	234E002	0.0 - 1.0	Cellar	5	pCi/g
Lead-214	1.48	234E002	0.0 - 1.0	Cellar	5	pCi/g
Lead-212	2.19	234E002	0.0 - 1.0	Cellar	5	pCi/g
Uranium-235	0.053	234E003	0.0 - 1.0	Cellar	17.6	pCi/g
Uranium-238	1.03	234E004	0.0 - 1.0	Cellar	105	pCi/g
Bis(2-ethylhexyl)Phthalate	0.64	234E004	0.0 - 1.0	Cellar	120	mg/kg
Acetone	0.059	234E002	0.0 - 1.0	Cellar	54,000	mg/kg
p-Isopropyltoluene	0.16	234E002	0.0 - 1.0	Cellar	2,000	mg/kg
Diesel-Range Organics	60	234E002	0.0 - 1.0	Cellar	100	mg/kg
Lead	210	234E002	0.0 - 1.0	Cellar	800	mg/kg
Arsenic	5	234E004	0.0 - 1.0	Cellar	23	mg/kg
Barium	3,100	234E002	0.0 - 1.0	Cellar	67,000	mg/kg
Cadmium	1	234E002	0.0 - 1.0	Cellar	450	mg/kg
Chromium	6.3	234E002	0.0 - 1.0	Cellar	450	mg/kg
Selenium	0.62	234E004	0.0 - 1.0	Cellar	5,100	mg/kg

[a]Thickness of sediment beneath water column.

FAL = Final action level
ft = Foot
mg/kg = Milligrams per kilogram
pCi/g = Picocuries per gram

As a BMP, housekeeping will be performed and documented in the final version of this document for those CASs where debris was encountered. Specifically, the items to be removed are as follows:

- CAS 02-09-48 (Area 2 Mud Plant #1): removal of the rusted 55-gal barrel from the mud sump.
- CAS 03-09-02 (Mud Dump Trenches): removal of blue pipe from within the suction pit.

Table 2-6
Maximum Concentration of Detected Liquid Contaminants for CAS 12-30-14, Cellar

Constituent	Maximum Result	Sample Number	Thickness[a] (ft bgs)	Location	PSM Criteria[b]	Units
Strontium-90	3.05	234E001	0.0 - 1.5	Cellar	N/A	pCi/L
Acetone	0.064	234E001	0.0 - 1.5	Cellar	None	mg/L
Lead	0.002	234E001	0.0 - 1.5	Cellar	5.0	mg/L
Arsenic	0.0082	234E001	0.0 - 1.5	Cellar	5.0	mg/L
Barium	0.15	234E001	0.0 - 1.5	Cellar	100.0	mg/L

[a]Thickness of water column above sediment on cellar floor.
[b]See Section A.7.2.

bgs = Below ground surface
ft = Foot
mg/L = Milligrams per liter
N/A = Not applicable
pCi/L = Picocuries per liter
PSM = Potential source material

- CAS 12-09-01 (Mud Pit): removal of the piece of metal pipe lying on the ground and the cylindrical metal debris.

- CAS 12-09-08 (Mud Pit): removal of the short length of pipe laying on the berm wall and the three crushed 55-gal drums located at the berm wall mud pit interface.

2.3.1 Final Action Levels

The CAU 234 FALs are risk-based cleanup goals that, if met, will ensure that each release site will not pose an unacceptable risk to human health and the environment and that conditions at each site are in compliance with all applicable laws and regulations. The risk-based corrective action (RBCA) process used to establish FALs is described in the *Industrial Sites Project Establishment of Final Action Levels* (NNSA/NSO, 2006). This process conforms with NAC Section 445A.227, which lists the requirements for sites with soil contamination (NAC, 2006b). For the evaluation of corrective actions, NAC Section 445A.22705 (NAC, 2006c) requires the use of American Society for Testing and Materials (ASTM) Method E 1739-95 (ASTM, 1995) to "conduct an evaluation of the site, based on the risk it poses to public health and the environment, to determine the necessary remediation standards (i.e., FALs) or to establish that corrective action is not necessary."

This RBCA process defines three tiers (or levels) of evaluation involving increasingly sophisticated analyses:

- Tier I evaluation - Sample results from source areas (highest concentrations) are compared to action levels based on generic (non-site-specific) conditions (i.e., the PALs established in the CAIP [NNSA/NSO, 2007]). The FALs may then be established as the Tier I action levels or calculated using a Tier II evaluation.

- Tier II evaluation - Conducted by calculating Tier II Site-Specific Target Levels (SSTLs) using site-specific information as inputs to the same or similar methodology used to calculate Tier I action levels. The Tier II SSTLs are then compared to individual sample results from reasonable points of exposure (as opposed to the source areas as is done in Tier I) on a point-by-point basis. Total concentrations of total petroleum hydrocarbons (TPH) will not be used for risk-based decisions under Tier II or Tier III. Rather, the individual chemicals of concern will be compared to the SSTLs.

- Tier III evaluation - Conducted by calculating Tier III SSTLs on the basis of more sophisticated risk analyses using methodologies described in Method E 1739-95 that consider site-, pathway-, and receptor-specific parameters.

A Tier I evaluation was conducted for all COPCs to determine whether contaminant levels satisfy the criteria for a quick regulatory closure or warrant a more site-specific assessment. This was accomplished by comparing individual source area contaminant concentration results to the Tier I action levels (the PALs established in the CAIP [NNSA/NSO, 2007]).

A Tier II evaluation was not required because all analytical results were below the risk-based screening level (RBSL) established at the Tier I level (i.e., results were all less than their respective PALs).

The FALs for all CAU 234 COPCs are shown in Table 2-7.

Table 2-7
Definition of Final Action Levels for CAU 234 Contaminants of Potential Concern

COPCs	Tier I-Based FALs	Tier II-Based FALs	Tier III-Based FALs
VOCs	All CASs	None	N/A
SVOCs	All CASs	None	N/A
PCBs	All CASs	None	N/A
RCRA metals	All CASs	None	N/A
TPH-DRO	All CASs	None	N/A
Radionuclides	All CASs	None	N/A

COPC = Contaminant of potential concern
DRO = Diesel-range organics
FAL = Final action level
N/A = Not applicable
PCB = Polychlorinated biphenyl
RCRA = *Resource Conservation and Recovery Act*
SVOC = Semivolatile organic compound
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compound

3.0 Recommendation

No further corrective action is required at CAU 234. Selection of this corrective action is consistent with past practices for CASs that do not contain COCs. No further action was evaluated based on technical merits focusing on performance, reliability, feasibility, and safety. Debris removal will be conducted as a BMP and documented in the final version of this document.

The DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) requests that NDEP issues a Notice of Completion for this CAU and approval to move the CAU from Appendix III to Appendix IV of the FFACO.

4.0 References

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EPA, see U.S. Environmental Protection Agency.

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Appendix A

Corrective Action Investigation Results

A.1.0 Introduction

This appendix presents the CAI activities and analytical results for CAU 234. Corrective Action Unit 234 is located in Areas 2, 3, 4, 12 and 15 of the NTS (Figure 1-1), and is comprised of the following 12 CASs:

- 02-09-48, Area 2 Mud Pit #1
- 02-09-49, Area 2 Mud Pit #2
- 02-99-05, Mud Spill
- 03-09-02, Mud Dump Trenches
- 04-44-02, Mud Spill
- 04-99-02, Mud Spill
- 12-09-01, Mud Pit
- 12-09-04, Mud Pit
- 12-09-08, Mud Pit
- 12-30-14, Cellar
- 12-99-07, Mud Dump
- 15-09-01, Mud Pit

Seven CASs — 02-09-49, 02-99-05, 04-44-02, 04-99-02, 12-09-04, 12-99-07, and 15-09-01 — are not included in the investigation for the reasons described in Section 1.1. These CASs meet the criteria defined in the *Closure Report for Corrective Action Units 530, 531, 532, 533, 534, 535: NTS Mud Pits, Nevada Test Site, Nevada* (NNSA/NSO, 2006a). The criteria allow mud pits or spills to be exempt from investigation if they are of the type described in the CR. These seven CASs meet the criteria.

The remaining five CASs (02-09-48, 03-09-02, 12-09-01, 12-09-08, and 12-30-14) were investigated because they contained debris or are associated with process knowledge that indicates potential presence of COPCs not commonly associated with mud pits.

Corrective Action Site 02-09-48 is located in Area 2 of the NTS and consists of a concrete-lined drilling mud sump used for storing unused drilling mud until needed for use. Some unused drilling mud remains in the sump. A 55-gal, rusted barrel sat on the drilling mud in the northwest corner of the sump.

Corrective Action Site 03-09-02 is located in Area 3 of the NTS and consists of a complex of mud pits, suction pits, and mud trenches. The system of pits and trenches was used for the drilling of emplacement hole U-3kz in June 1984. The northern section of the CAS contains a large mud pit, a suction pit, and a reserve suction pit. The southern section of the CAS contains two trenches, one elevated relative to the other and connected by a trench, that are carved out of what appears to have been a borrow pit.

Corrective Action Site 12-09-01 is located in Area 12 of the NTS and consists of a mud pit associated with the drilling of the U-12r PS #1A post-test cellar. Located within this CAS is a length of metal piping lying on the ground surface near the mud pit and a cylindrical piece of metal debris lying on its side, approximately 3.5 ft in diameter, open at one end, with an opening on the side where a hinged door used to be attached.

Corrective Action Site 12-09-08 is located in Area 12 of the NTS and consists of a mud pit associated with the drilling of the U12e.14 HFR CH#1 instrument hole that began on November 9, 1972. The mud pit contains a length of metal pipe protruding from the southwest corner of the berm by approximately 4 ft and at an approximate 45-degree angle. There are several crushed 55-gal drums located on the inner slope of the mud pit berm along the western edge.

Corrective Action Site 12-30-14 is located in Area 12 of the NTS and consists of an open 10-ft-diameter cellar used for the drilling of the U12r PS#1A and U12r PS#1AS post-test boreholes. The cellar is approximately 9 ft deep and is cased with corrugated metal. The post-test boreholes were drilled between January 19 and 24, 1969, to depths of approximately 2,000 ft below ground surface (bgs). Liquid resides within the cellar, and the depth fluctuates depending on precipitation and evaporation rates.

Additional information regarding the history of each site, planning, and the scope of the investigation is presented in the CAU 234 CAIP (NNSA/NSO, 2007).

A.1.1 Project Objectives

The primary objective of the investigation was to provide sufficient information to document completion of appropriate corrective actions for each CAS in CAU 234 to support a recommendation

for closure of the CASs in CAU 234. This objective was achieved by identifying the absence or presence of COCs and the vertical and lateral extent of the COCs, if present.

A.1.2 Contents

This appendix describes the investigation and presents the results. The contents of this appendix are as follows:

- Section A.1.0 describes the investigation background, objectives, and content.
- Section A.2.0 provides an investigation overview.
- Sections A.3.0 through A.7.0 provide CAS-specific information regarding the field activities, sampling methods, and laboratory analytical results from investigation sampling.
- Section A.8.0 summarizes waste management activities.
- Section A.9.0 discusses the QA and QC processes followed and the results of QA/QC activities.
- Section A.10.0 provides a summary of the investigation results.
- Section A.11.0 lists the cited references.

The complete field documentation and laboratory data — including field activity daily logs, sample collection logs (SCLs), analysis request/chain-of-custody forms, soil sample descriptions, laboratory certificates of analyses, analytical results, and surveillance results — are retained in project files as hard copy files or electronic media.

A.2.0 Investigation Overview

Field investigation and sampling activities for the CAU 234 CAI were conducted from October 31 through November 7, 2007. An additional sample was collected on January 23, 2008, from CAS 03-09-02. Table A.2-1 lists the CAI activities that were conducted at each of the CASs.

Table A.2-1
Corrective Action Investigation Activities Conducted at Each Corrective Action Site To Meet Corrective Action Investigation Plan Requirements for CAU 234

Corrective Action Investigation Activities	Corrective Action Site				
	02-09-48	03-09-02	12-09-01	12-09-08	12-30-14
Inspected and verified the CAS components identified in the Corrective Action Investigation Plan.	X	X	X	X	X
Performed site walkovers to identify biased sampling locations.	X	X	X	X	X
Conducted scanning radiological walkover surveys (i.e., soil, concrete surfaces, debris) using a handheld detector and a global positioning system (GPS) receiver with a TSCITM data logger.	X	X	X	X	X
Collected biased soil samples.	X	X	X	X	X
Field screened samples for alpha and beta/gamma radiation using a handheld survey instrument.	X	X	X	X	X
Analyzed samples for gamma radiation using a high-purity germanium gamma spectrometer (Building 23-153, Mercury, NV).	--	--	--	--	X
Collected liquid and sediment samples from the contents of the cellar for waste characterization to support disposal recommendations and determine whether the waste could be a potential source of contamination for the environment (i.e., soil).	--	--	--	--	X
Submitted select samples for offsite laboratory analysis.	X	X	X	X	X
Collected GPS coordinates for sample locations and points of interest.	X	X	X	X	X

-- = Not applicable

The investigation and sampling program was managed in accordance with the requirements set forth in the CAU 234 CAIP (NNSA/NSO, 2007). Samples were collected and documented following the CAU 234 CAIP. Quality control samples (e.g., field blanks, equipment rinsate blanks, trip blanks, and duplicate samples) were collected as required by the Industrial Sites QAPP (NNSA/NV, 2002) and the CAU 234 CAIP. During field activities, waste minimization practices were conducted according to approved procedures, including segregation of waste by waste type.

Weather conditions at the sites varied to include sun (moderate to low temperatures), no rainfall during sampling activities, intermittent cloudiness, and light winds.

The CASs were investigated by conducting site inspections, radiological surface screenings, and surveys; performing sampling of potential contaminant sources; and sampling surface and subsurface soils. Surface soil samples were collected by hand excavation. Subsurface soil samples were collected using hand augering. The soil samples were field screened at specific locations for alpha and beta/gamma radiation, and gamma-emitting radionuclides. The results were compared against screening levels to guide in the CAS-specific investigations. Samples of various media (e.g., soil, liquids, sediments) were collected to support both environmental and waste characterization using hand augers and plastic scoops.

Except as noted in the following CAS-specific sections, CAU 234 Decision I sampling locations were accessible, and sampling activities at planned locations were not restricted.

Sections A.2.1 through A.2.4 provide the investigation methodology, site geology and hydrology, and laboratory analytical information.

A.2.1 Sample Locations

Investigation locations selected for sampling were based on interpretation of existing engineering drawings, aerial and land photographs, interviews with former and current site employees, information obtained during site visits, and site conditions as provided in the CAU 234 CAIP (NNSA/NSO, 2007). The CAS-specific sampling points were selected based on physical characteristics of the CAS and the presence of debris. The planned biased sample locations (e.g., locations beneath debris) are discussed in text and represented on figures in the CAIP. Actual

environmental sample locations are shown on the figures included in Sections A.3.0 through A.7.0. Sample locations were staked where appropriate and labeled. A Trimble Geo-XT GPS instrument was used for determining the sample location coordinates as well as CAS points of interest. Appendix E presents these data in a CAS-specific figure format.

A.2.2 Investigation Activities

The investigation activities listed in Table A.2-1 were performed at CAU 234 consistent with the field investigation activities stipulated in the CAU 234 CAIP (NNSA/NSO, 2007). The investigation strategy required the nature and extent of contamination associated with each CAS to be established. The following sections describe the specific investigation activities that took place at CAU 234.

A.2.2.1 Radiological Surveys

Radiological surveys (i.e., scanning, static, and swipe collection) were performed at all CASs during the CAI. Radiological surveys were performed to identify the presence, nature, and extent of radiological contaminants at activities statistically distinguishable from background activities (more than two times background levels). The radiological surveys were conducted using a handheld plastic scintillation detector in conjunction with a GPS receiver and datalogger.

A.2.2.2 Field Screening

Field-screening activities were conducted for alpha and beta/gamma radiation, and gamma-emitting radionuclides as specified in the CAU 234 CAIP (NNSA/NSO, 2007). Site-specific FSLs for alpha and beta/gamma radiation were defined as the mean background activity level plus two times the standard deviation of readings from 10 background locations selected near each CAS. The radiation FSLs are instrument-specific and were established for each instrument and CAS before use.

The CAS-specific sections of this document identify the CASs where field screening was conducted and how the FSLs were used to aid in the selection of sample locations. Field-screening results are recorded on SCLs that are retained in project files.

A.2.2.3 Surface and Subsurface Soil Sampling

Soil samples were collected using "scoop and trowel" (surface hand-grab sampling) and hand auger procedures. All sample locations were initially field screened for alpha and beta/gamma radiation before the start of sampling. Additional screening was conducted during sample collection to both guide the investigation and serve as a health and safety control to protect the sampling team. Labeled sample containers were filled according to the following sequence: volatile organic compound (VOC) sample containers were filled with soil directly from the sample location. Additional soil was transferred into an aluminum pan, homogenized, and field screened for alpha and beta/gamma radiation. All remaining sample containers were then filled. Excess soil was returned to its original location and the sample containers appropriately disposed (based on field-screening and/or analytical results).

Surface soil samples were collected from 0.0 to 0.5 ft bgs at biased locations, except where refusal (a physical anomaly that does not allow further penetration below ground) was encountered due to shallow underlying bedrock. Subsurface soil samples were collected as a continuation at surface soil sample locations except where refusal was encountered. The SCLs describe when refusal conditions were encountered.

A.2.2.4 Waste Characterization and Potential Source Material Sampling

Characterization of CAS-specific components, objects, materials, and waste was performed to support disposal of these potential remediation wastes and to determine whether any materials located within the specific feature could be potential source material (PSM). Investigation methods included visual inspection, radiological surveys, and direct sampling of the contents of each feature, where available.

Samples were analyzed in accordance with the CAU 234 CAIP (NNSA/NSO, 2007). The specific analyses for each CAS are listed in CAS-specific sections, and the analytical results are compared to the federal limits for hazardous waste, landfill acceptance criteria, and the limits in the NTS performance objective criteria (POC) (BN, 1995). The POC limits have been established for NTS hazardous waste generators to ensure that all hazardous waste being shipped off site contains no "added radioactivity."

Specific waste characterization sampling and analysis was conducted on the following potential waste streams:

- The investigation-derived waste (IDW) rinsate drum generated at CAS 03-09-02
- Debris (see Table A.8-1)

Potential source material sampling and evaluation was performed on the following media:

- Liquids contained within the cellar at CAS 12-30-14.
- Sediment within the cellar at CAS 12-30-14.

A.2.3 Laboratory Analytical Information

Radiological and chemical analyses were performed by Paragon Analytics, Inc., of Fort Collins, Colorado. The analytical suites and laboratory analytical methods used to analyze investigation samples are listed in Table A.2-2. Analytical results are reported in this appendix if they were detected above the MDCs. The complete laboratory data packages are available in the project files. Validated analytical data for CAU 234 investigation samples have been compiled and evaluated to confirm the presence of contamination and define the extent of contamination, if present. The analytical results for each CAS are presented in Sections A.3.0 through A.7.0.

Table A.2-2
Laboratory Analytical Parameters and Methods, CAU 234 Investigation Samples[a]
(Page 1 of 2)

Analytical Parameter	Analytical Method[b]
Volatile Organic Compounds	EPA SW-846 8260B[c]
Semivolatile Organic Compounds	EPA SW-846 8270C[c]
Total Petroleum Hydrocarbons-Diesel Range Organics	EPA SW-846 8015B
RCRA Metals[d]	EPA SW-846 6010B/7470A/7471A[c]
Polychlorinated Biphenyls	EPA SW-846 8082[c]
Gamma Spectroscopy	DOE EML HASL 300[e] Approved Laboratory SOPs[f]
Isotopic Uranium	DOE EML HASL-300[e] U-02-RC Modified, Approved Laboratory SOPs[f]
Isotopic Plutonium	DOE EML HASL-300[e] PU-02-RC/PU-10-RC Modified, Approved Laboratory SOPs[f]

Table A.2-2
Laboratory Analytical Parameters and Methods, CAU 234 Investigation Samples[a]
(Page 2 of 2)

Analytical Parameter	Analytical Method[b]
Strontium-90	EPA 905.0[g] Modified, Approved Laboratory SOPs[f]
Gross Alpha/Beta	EPA 900.0[g] Modified, Approved Laboratory SOPs[f]
Tritium	EPA 906.0[g] Modified, Approved Laboratory SOPs[f]

[a]Investigation samples include both environmental and waste characterization samples and associated quality control samples.
[b]The most current EPA, DOE, ASTM, or NIOSH or equivalent accepted analytical method may be used.
[c]*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, 3rd edition, Parts 1-4, SW-846 CD-ROM (EPA, 1996).
[d]Arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver.
[e]*The Procedures Manual of the Environmental Measurements Laboratory*, HASL-300 (DOE, 1997).
[f]Laboratory Standard Operating Procedures approved by SNJV in accordance with industry standards and the SNJV Model Statement of Work requirements (SNJV, 2006).
[g]*Prescribed Procedures for Measurement of Radioactivity in Drinking Water* (EMSL/ORD, 1980).

Note: The term "modified" indicates modifications of approved methods. All modifications have been approved by the SNJV Analytical Services Department.

ASTM = American Society for Testing and Materials
DOE = U.S. Department of Energy
EML = Environmental Measurements Laboratory
EPA = U.S. Environmental Protection Agency
HASL = Health and Safety Laboratory
NIOSH = National Institute for Occupational Safety and Health
RCRA = *Resource Conservation and Recovery Act*
SNJV = Stoller-Navarro Joint Venture
SOP = Standard Operating Procedure
TCLP = Toxicity Characteristic Leaching Procedure

The analytical parameters are CAS-specific and were selected through the application of site process knowledge as described in the CAIP DQOs (NNSA/NSO, 2007).

A.2.4 Comparison to Action Levels

A COC is defined as any contaminant present in environmental media exceeding a FAL. A COC may also be defined as a contaminant that, in combination with other like contaminants, is determined to jointly pose an unacceptable risk based on a multiple constituent analysis (NNSA/NSO, 2006b). Multiple constituent analyses are presented in Appendix D.

If COCs are present, corrective action must be considered for the CAS. The FALs for the CAU 234 investigation are defined for each CAS in Section 2.3.1.

The evaluation of the need for corrective action will include the potential for wastes that are present at a site to cause the future contamination of site environmental media if the wastes were to be released. To evaluate the potential for cellar contents of CAS 12-30-14 to result in the introduction of a COC to the surrounding environmental media, the following conservative assumptions were made:

- The cellar containment would fail at some point, and the contents would be released to the surrounding media.
- The resulting concentration of contaminants in the surrounding media would be equal to the concentration of contaminants in the cellar.
- Any liquid contaminant in the cellar exceeding the RCRA TC concentration can result in a COC's introduction to the surrounding media.
- Sludge possibly containing a contaminant exceeding an equivalent FAL concentration would be considered to be PSM requiring a corrective action.
- Cellar liquids with possible contaminant concentrations exceeding an equivalent TC action level would be considered to be PSM requiring a corrective action.

A.3.0 Corrective Action Site 02-09-48, Area 2 Mud Plant #1

Corrective Action Site 02-09-48 is located at the Area 2 Mud Plant of the NTS (Figure A.3-1). The Area 2 Mud Plant manufactured drilling mud for use in drilling operations at the NTS. The CAS is a concrete-lined sump used for storage of drilling muds until they were needed for drilling operations. A rusted, 55-gal drum was located on the surface of the drilling mud within the sump. Additional detail is provided in the CAIP (NNSA/NSO, 2007).

Figure A.3-1
Corrective Action Site 02-09-48

A.3.1 Corrective Action Investigation

A total of five characterization samples (including one FD) were collected during investigation activities at CAS 02-09-48. The sample IDs, locations, types, and analyses are listed in Table A.3-1. The specific CAI activities conducted to satisfy the CAIP requirements at this CAS (NNSA/NSO, 2007) are described in the following sections.

Table A.3-1
Samples Collected at CAS 02-09-48, Area 2 Mud Plant #1

Sample Location	Sample Number	Depth (ft bgs)	Matrix	Purpose	Analyses
A01	234A001	0.0 - 0.5	Soil	Environmental	Set 1
	234A002	0.0 - 0.5	Soil	Field Duplicate of 234A001	Set 1
	234A003	0.5 - 1.0	Soil	Environmental	Set 1
A02	234A004	0.0 - 0.5	Soil	Environmental	Set 1
	234A005	0.5 - 1.0	Soil	Environmental	Set 1
N/A	234A301	N/A	Water	Trip Blank	VOCs only
N/A	234A302	N/A	Water	Trip Blank	VOCs only
N/A	234A303	N/A	Water	Field Blank	Set 1

Set 1 = VOCs, SVOCs, RCRA Metals, TPH-DRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90

bgs = Below ground surface
DRO = Diesel-range organics
ft = Foot
N/A = Not applicable
PCB = Polychlorinated biphenyl
RCRA = *Resource Conservation and Recovery Act*
SVOC = Semivolatile organic compound
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compound

A.3.1.1 Field Screening

Investigation samples were field screened for alpha and beta/gamma radiation. Gross alpha radiation FSLs were not exceeded in any of the samples. Beta/gamma radiation FSLs were not exceeded in any of the samples. Therefore, no additional biasing factors were identified, and no additional samples were collected.

A.3.1.2 Radiological Surveys

As presented in the CAIP (NNSA/NSO, 2007), a radiological walkover survey was conducted on May 23, 2006, on the mud sump. The survey did not identify radiation that was significantly different from background. Therefore, no additional biasing factors were identified, and no additional samples were collected.

A.3.1.3 Visual Inspections

One feature associated with the drilling mud sump other than the drilling mud itself was identified within the CAS. This feature consisted of a rusting, 55-gal drum. The drum was empty, so a sample of its contents was not collected. Initial inspection indicated that the drum was rusted and dry, and that the bungs had been removed.

Inspections of the drilling mud sump did not identify additional sample locations based on biasing factors (i.e., staining).

A.3.1.4 Sample Collection

Environmental sampling activities included the collection of biased surface and subsurface soil samples surrounding the rusted, 55-gal drum (Figure A.3-2).

A.3.1.5 Deviations

Investigation samples were collected as outlined in the CAU 234 CAIP (NNSA/NSO, 2007) and submitted for laboratory analysis with no deviations from the planned sample locations.

A.3.2 Investigation Results

The following sections provide analytical results from the samples collected to complete investigation activities as outlined in the CAIP (NNSA/NSO, 2007). Investigation samples were analyzed for the CAIP-specified COPCs, which included VOCs, semivolatile organic compounds (SVOCs), TPH-diesel-range organics (DRO), RCRA metals, gamma-emitting radionuclides, isotopic uranium (U), isotopic plutonium (Pu), and strontium (Sr)-90. The polychlorinated biphenyls (PCBs) are added parameters because these contaminants are a common concern at the NTS. The analytical parameters and laboratory methods used to analyze the investigation samples are listed in Table A.2-2. Table A.3-1 lists the sample-specific analytical suite for CAS 02-09-48.

Analytical results from the soil samples with concentrations exceeding MDCs are summarized in the following sections. An evaluation was conducted on all contaminants detected above MDCs by comparing individual concentration or activity results against the FALs. Establishment of the FALs is presented in Appendix C.

Figure A.3-2
Sample Locations for CAS 02-09-48

A.3.2.1 Volatile Organic Compounds

No VOC analytical results for environmental samples collected at this CAS were detected above their respective MDCs. Therefore, the FALs were established at the corresponding PAL concentrations.

A.3.2.2 Semivolatile Organic Compounds

The SVOCs analytical results for environmental samples collected at this CAS detected above their respective MDCs are shown in Table A.3-2. None of the results exceeded their respective PALs. Therefore, the FALs were established at the corresponding PAL concentrations.

Table A.3-2
Soil Sample Results of SVOCs Detected above
Minimum Detectable Concentrations at CAS 02-09-48, Area 2 Mud Plant #1

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)					
			Benzo(b)Fluoranthene	Bis(2-ethylhexyl)Phthalate	Di-n-butyl Phthalate	Fluoranthene	Phenanthrene	Pyrene
Final Action Levels[a]			**2.1**	**120**	**62,000**	**22,000**	**100,000**	**29,000**
A01	234A001	0.0 - 0.5	0.16 (J)	--	0.27 (J)	0.25 (J)	0.16 (J)	0.19 (J)
	234A002	0.0 - 0.5	0.18 (J)	--	0.34 (J)	0.28 (J)	0.2 (J)	0.2 (J)
A02	234A004	0.0 - 0.5	0.13 (J)	--	0.15 (J)	0.13 (J)	--	--
	234A005	0.5 - 1.0	--	0.16 (J)	--	--	--	--

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

bgs = Below ground surface
ft = Foot
mg/kg = Milligrams per kilogram
J = Estimated value
-- = Not detected above minimum detectable concentrations

A.3.2.3 Total Petroleum Hydrocarbons

Analytical results for soil samples collected at this CAS indicated that TPH-DRO was not detected above its respective MDC. Therefore, the FAL was established at the PAL concentration.

A.3.2.4 RCRA Metals

The RCRA metals analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.3-3. No metals were detected at concentrations exceeding their PALs. Therefore, the FALs were established at the corresponding PAL concentrations.

Table A.3-3
Soil Sample Results for RCRA Metals Detected above
Minimum Detectable Concentrations at CAS 02-09-48, Area 2 Mud Plant #1

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)				
			Arsenic	Barium	Cadmium	Chromium	Lead
Final Action Levels			**23[a]**	**67,000[b]**	**450[b]**	**450[b]**	**800[b]**
A01	234A001	0.0 - 0.5	2.3	100	0.65	3.8	29
	234A002	0.0 - 0.5	2.8	97	0.55	3.5	27
	234A003	0.5 - 1.0	1.6	91	0.28	--	29
A02	234A004	0.0 - 0.5	2.3	85	0.31	2.2	29
	234A005	0.5 - 1.0	1.7	58	0.19	--	24

[a]Based on the background concentrations for metals. Background is considered the mean plus two times the standard deviation for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (NBMG, 1998; Moore, 1999).
[b]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

bgs = Below ground surface
ft = Foot
mg/kg = Milligrams per kilogram
-- = Not detected above minimum detectable concentrations

A.3.2.5 Polychlorinated Biphenyls

Analytical results for soil samples collected at this CAS indicated that there were no PCBs detected above their respective MDCs. Therefore, the FALs were established at the corresponding PAL concentrations.

A.3.2.6 Gamma-Emitting Radionuclides

Gamma-emitting radionuclides analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.3-4. None of the analytical results were above the respective PALs for any of the analytes. Therefore, the FALs were established at the corresponding PAL concentrations.

Table A.3-4
Soil Sample Results for Gamma-Emitting Radionuclides Detected above Minimum Detectable Concentrations at CAS 02-09-48, Area 2 Mud Plant #1

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)								
			Actinium-228		Lead-212		Lead-214		Thorium-234	Thallium-208	
Final Action Levels			5[a]	15[a]	5[a]	15[a]	5[a]	15[a]	105[b]	5[a]	15[a]
A01	234A001	0.0 - 0.5	2.85	--	3.11 (J)	--	2.59 (J)	--	4.1 (J)	0.84	--
	234A002	0.0 - 0.5	2.57	--	2.99 (J)	--	2.76 (J)	--	4.6 (J)	0.87	--
	234A003	0.5 - 1.0	--	3.29	--	4.12 (J)	--	3.1 (J)	4.4 (J)	--	1.21
A02	234A004	0.0 - 0.5	3.31	--	3.18 (J)	--	2.93 (J)	--	3.8 (J)	1.22	--
	234A005	0.5 - 1.0	--	3.72	--	3.63 (J)	--	3.36 (J)	4.6 (J)	--	1.09

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead-212, lead-214, thallium-208, and thorium-232, as found in Chapter IV of DOE Order 5400.5, Change 2, "Radiation Protection of the Public and Environment." (DOE, 1993). The PALs for these isotopes are specified as 5 pCi/g averaged over the first 15 cm of soil and 15 pCi/g for deeper soils (DOE, 1993). For purposes of this document, 15 cm is assumed to be equivalent to 0.5 ft (6 inches); therefore, 5 pCi/g represents the PALs for these radionuclides in the surface soil (0 to 0.5 ft depth).
[b]Taken from the construction, commercial, industrial land use scenario in Table 2.1 of the NCRP Report No. 129, *Recommended Screening Limits for Contaminated Surface Soil and Review Factors Relevant to Site-Specific Studies* (NCRP, 1999). The values provided in this source document were scaled to a 25-millirem-per-year dose.

bgs = Below ground surface
cm = Centimeter
DOE = U.S. Department of Energy
ft = Foot
NCRP = National Council on Radiation Protection and Measurements
PAL = Preliminary action level
pCi/g = Picocuries per gram
J = Estimated value
-- = Not detected above minimum detectable concentrations

A.3.2.7 Plutonium, Strontium-90, and Uranium Isotopes

Isotopic Pu and isotopic U analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.3-5. No Sr-90 was identified above its MDC in any of the samples analyzed. None of the Pu, U, or Sr-90 isotope results were above their respective PALs in any of the samples analyzed. Therefore, the FALs were established at the corresponding PAL concentrations.

Table A.3-5
Soil Sample Results for Isotopes Detected above
Minimum Detectable Concentrations at CAS 02-09-48, Area 2 Mud Plant #1

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)				
			Plutonium-238	Plutonium-239/240	Uranium-234	Uranium-235	Uranium-238
Final Action Levels[a]			**13**	**12.7**	**143**	**17.6**	**105**
A01	234A001	0.0 - 0.5	0.093	0.35	2.5	0.113	2.37
	234A002	0.0 - 0.5	--	0.128	2.2	0.16	2.33
	234A003	0.5 - 1.0	--	--	2.59	0.147	2.48
A02	234A004	0.0 - 0.5	--	0.211	2.53	0.136	2.55
	234A005	0.5 - 1.0	--	0.036	2.36	0.145	2.66

[a]Taken from the construction, commercial, industrial land use scenario in Table 2.1 of the NCRP Report No. 129, *Recommended Screening Limits for Contaminated Surface Soil and Review Factors Relevant to Site-Specific Studies* (NCRP, 1999). The values provided in this source document were scaled to a 25-millirem-per-year dose.

bgs = Below ground surface
ft = Foot
NCRP = National Council on Radiation Protection and Measurements
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations

A.3.3 Nature and Extent of Contamination

Based on the analytical results for soil samples collected within CAS 02-09-48, none of the samples exceeded the FALs for any of the analytes identified above their MDCs. Therefore, no COCs are present at this CAS.

A.3.4 Revised Conceptual Site Model

The CAIP requirements (NNSA/NSO, 2007) were met at this CAS, and no revisions were necessary to the CSM.

A.4.0 Corrective Action Site 03-09-02, Mud Dump Trenches

Corrective Action Site 03-09-02 is located in the northwest corner of Area 3 of the NTS. This CAS consists of two distinct drilling mud suction/return pits used for the construction of the U-3kz emplacement hole. The two distinct systems are oriented north/south of each other and therefore are referred to as the northern footprint and the southern footprint of the CAS (Figures A.4-1 and A.4-2). The northern footprint also contains an area identified as "possible reserve suction pit," but it appears unlikely it was ever used as such. The southern footprint suction/return pits reside in a large area that was possibly used as a borrow pit before the dual pit construction used for drilling the emplacement hole. Dried drilling mud is visible in the northern footprint return pit and both the suction and return pits in the southern footprints. The northern footprint suction pit is filled with tumbleweeds. After removal of the tumbleweeds, it was discovered that a discarded length of blue pipe was located in the southern berm of the suction pit. Sampling occurred at the pipe as well as the points of lowest elevation within the two northern footprint suction/return pits. An additional sample location was identified within the "possible reserve suction pit" in the northern footprint at the location of lowest elevation.

A.4.1 Corrective Action Investigation

A total of 14 characterization samples (including one FD) were collected during investigation activities at CAS 03-09-02. The sample IDs, locations, types, and analyses are listed in Table A.4-1. The specific CAI activities conducted to satisfy the CAIP requirements at this CAS (NNSA/NSO, 2007) are described in the following sections.

A.4.1.1 Field Screening

Soil samples were field screened for alpha and beta/gamma radiation as specified in the CAU 234 CAIP (NNSA/NSO, 2007). The FSRs were compared to FSLs to guide subsequent sampling decisions where appropriate. Alpha and beta/gamma radiation FSLs were not exceeded during sampling activities. As a result, no additional samples were collected.

Figure A.4-1
Mud Trenches in Southern Footprint

Figure A.4-2
Suction Pit in Northern Footprint

Table A.4-1
Samples Collected at CAS 03-09-02, Mud Dump Trenches

Sample Location	Sample Number	Depth (ft bgs)	Matrix	Purpose	Analyses
B01	234B001	0.0 - 0.5	Soil	Environmental	Set 1
	234B002	0.0 - 0.5	Soil	Field Duplicate of 234B001	Set 1
	234B005	1.5 - 2.0	Soil	Environmental	Set 1
B02	234B003	0.0 - 0.5	Soil	Environmental	Set 1
	234B004	1.5 - 2.0	Soil	Environmental	Set 1
B03	234B006	0.0 - 0.5	Soil	Environmental	Set 1
	234B007	1.5 - 2.0	Soil	Environmental	Set 1
B04	234B008	0.0 - 0.5	Soil	Environmental	Set 1
	234B009	1.5 - 2.0	Soil	Environmental	Set 1
B05	234B010	0.0 - 0.5	Soil	Environmental	Set 1
	234B011	1.5 - 2.0	Soil	Environmental	Set 1
B06	234B012	0.0 - 0.5	Soil	Environmental	Set 1
	234B013	1.5 - 2.0	Soil	Environmental	Set 1
B07	234B014	0.0 - 0.5	Soil	Environmental	Set 1
N/A	234B301	N/A	Water	Trip Blank	VOCs only
N/A	234B302	N/A	Water	Equipment Rinsate Blank	Set 1
N/A	234B303	N/A	Water	Field Blank	Set 1
N/A	234B304	N/A	Water	Trip Blank	VOCs only
N/A	234B501	N/A	Liquid	Waste Management	Set 2

Set 1 = VOCs, SVOCs, RCRA Metals, TPH-DRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90
Set 2 = VOCs, SVOCs, RCRA Metals, TPH-DRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90, Grass Alpha/Beta, Tritium

bgs = Below ground surface
DRO = Diesel-range organics
ft = Foot
N/A = Not applicable
PCB = Polychlorinated biphenyl
RCRA = *Resource Conservation and Recovery Act*
SVOC = Semivolatile organic compound
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compound

A.4.1.2 Radiological Surveys

A radiological walkover survey was conducted on October 25, 2007, over the sampling areas of interest (i.e., mud pits, suction pits). This is presented in Figure A.4-3. The survey did not identify radiation that was distinguishable from background. As a result, no additional samples were collected.

A.4.1.3 Visual Inspections

The site was visually inspected for potential sources of contamination before sample collection. A length of blue piping was identified lying in the suction pit in the southern berm after all the tumbleweeds had been cleared out. No other points of interest were identified.

A small puddle of water was identified at the selected sample location within the mud trench (in the southern footprint). Sample location B02 was selected at the outer edge of the puddle of water, but was identified as a point that was not the lowest in the trench. On January 23, 2008, a sample was collected beneath the puddle of water at the location identified as the lowest point in the trench, in accordance with the requirements of the CAIP (NNSA/NSO, 2007).

A.4.1.4 Sample Collection

Decision I environmental sampling activities included the collection of biased surface and subsurface soil samples at the low elevations in each of the pits that handled drilling mud from the U-3kz emplacement hole project, as well as beneath a piece of blue pipe that was uncovered after removal of the tumbleweeds from the northern footprint suction pit. Sample locations for CAS 03-09-02 are shown in Figure A.4-4.

A.4.1.5 Deviations

Investigation samples were collected as outlined in the CAU 234 CAIP (NNSA/NSO, 2007) and submitted for laboratory analysis with no deviations from the planned sample locations.

Figure A.4-3
Radiological Survey for CAS 03-09-02

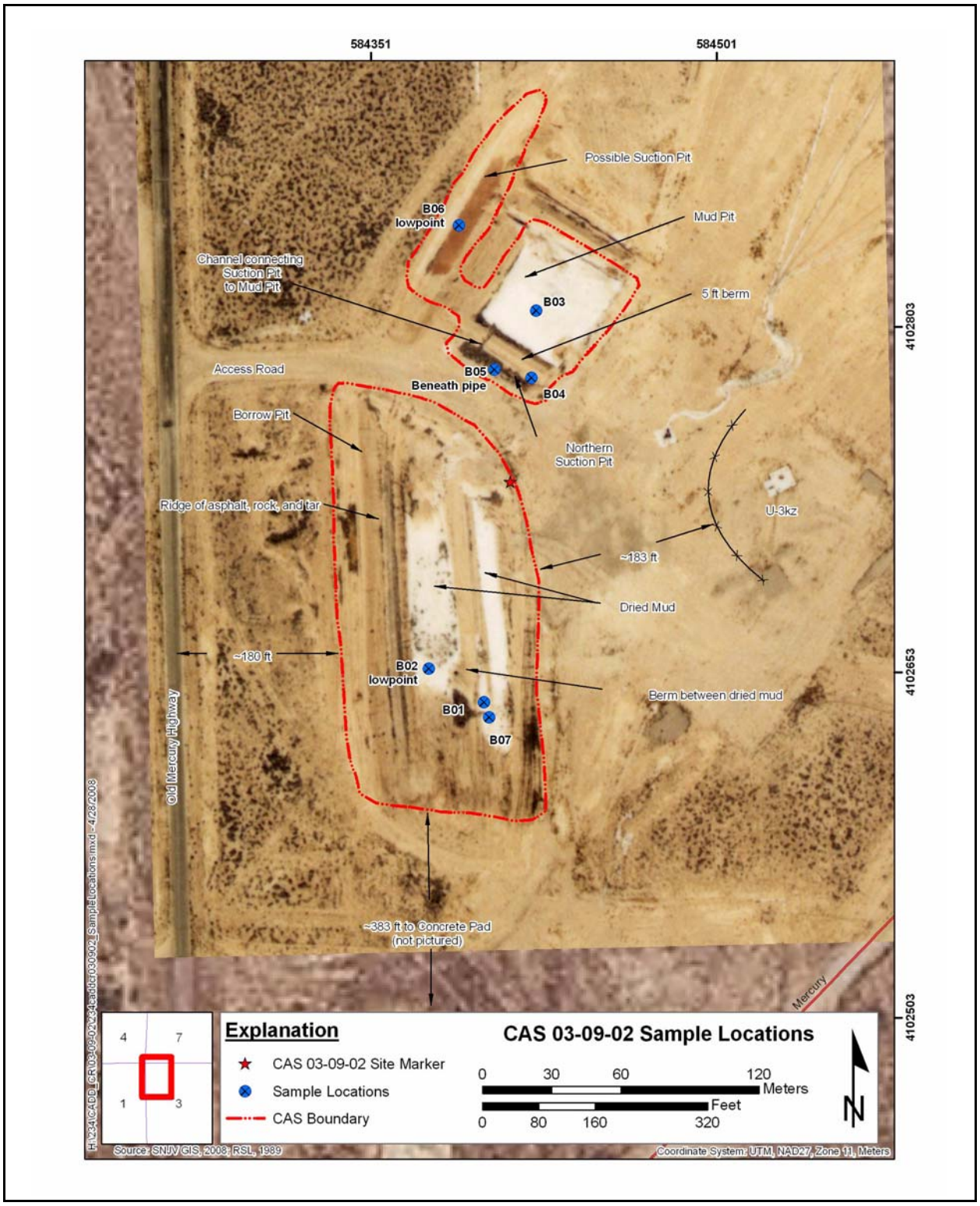

Figure A.4-4
Sample Locations for CAS 03-09-02

A.4.2 Investigation Results

The following sections provide analytical results from the samples collected to complete investigation activities as outlined in the CAIP (NNSA/NSO, 2007). Investigation samples were analyzed for the CAIP-specified COPCs, which included VOCs, SVOCs, TPH-DRO, RCRA metals, gamma-emitting radionuclides, isotopic U, isotopic Pu, and Sr-90. The PCBs are added parameters because these contaminants are a common concern at the NTS. The analytical parameters and laboratory methods used to analyze the investigation samples are listed in Table A.2-2. Table A.4-1 lists the sample-specific analytical suite for CAS 03-09-02.

Analytical results from the soil samples with concentrations exceeding MDCs are summarized in the following sections. An evaluation was conducted on all contaminants detected above MDCs by comparing individual concentration or activity results against the FALs. Establishment of the FALs is presented in Appendix C.

A.4.2.1 Volatile Organic Compounds

The VOCs analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.4-2. No VOCs were detected at concentrations exceeding their respective PALs. Therefore, the FALs were established at the PAL concentrations.

Table A.4-2
Soil Sample Results for VOCs Detected above
Minimum Detectable Concentrations at CAS 03-09-02, Mud Dump Trenches

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)
			Acetone
Final Action Levels[a]			54,000
B01	234B005	1.5 - 2	0.11

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

bgs = Below ground surface
ft = Foot
mg/kg = Milligrams per kilogram

A.4.2.2 Semivolatile Organic Compounds

The SVOCs analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.4-3. The constituent present above MDCs was bis(2-ethylhexyl)phthalate, which did not exceed the PAL of 120 milligrams per kilogram (mg/kg). Therefore, the FALs were established at the PAL concentrations.

Table A.4-3
Soil Sample Results for SVOCs Detected above
Minimum Detectable Concentrations at CAS 03-09-02, Mud Dump Trenches

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)
			Bis(2-ethylhexyl)Phthalate
Final Action Levels[a]			120
B01	234B002	0 - 0.5	0.088 (J)
B02	234B004	1.5 - 2	0.35 (J)

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

bgs = Below ground surface
ft = Foot
mg/kg = Milligrams per kilogram
J = Estimated value

A.4.2.3 Total Petroleum Hydrocarbons

The TPH-DRO analytical results for soil samples collected at this CAS that were detected above MDCs are presented in Table A.4-4. None of the samples exceeded the PAL of 100 mg/kg for TPH-DRO. Therefore, the FAL was established at the PAL concentration.

Table A.4-4
Soil Sample Results for TPH-DRO Detected above
Minimum Detectable Concentrations at CAS 03-09-02, Mud Dump Trenches

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)
			Diesel-Range Organics
Preliminary Action Levels[a]			100
B03	234B006	0.0 - 0.5	4.9 (J)
B06	234B012	0.0 - 0.5	53

[a]Based on *Nevada Administrative Code*, "Contamination of Soil: Establishment of Action Levels" (NAC, 2006).

bgs = Below ground surface
ft = Foot
mg/kg = Milligrams per kilogram
J = Estimated value

A.4.2.4 RCRA Metals

The RCRA metals analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.4-5. No metals were detected at concentrations exceeding their PALs. Therefore, the FALs were established at the corresponding PAL concentrations.

A.4.2.5 Polychlorinated Biphenyls

Analytical results for the soil samples collected at this CAS indicate that there are no PCBs present at concentrations above their respective MDCs. Therefore, the FALs were established at the corresponding PAL concentrations.

A.4.2.6 Gamma-Emitting Radionuclides

Gamma-emitting radionuclides analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.4-6. None of the gamma-emitting radionuclides exceeded their respective PALs. Therefore, the FALs were established at the corresponding PAL concentrations.

Table A.4-5
Soil Sample Results for RCRA Metals Detected above Minimum Detectable Concentrations at CAS 03-09-02, Mud Dump Trenches

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)						
			Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium
Final Action Levels			**23[a]**	**67,000[b]**	**450[b]**	**450[b]**	**800[b]**	**310[b]**	**5,100[b]**
B01	234B001	0.0 - 0.5	3.8	210	--	2.9	15	0.011	--
	234B002	0.0 - 0.5	4.4	210	--	3.1	15	0.011	--
	234B005	1.5 - 2.0	4.4	110	0.13	7.3	8.9	0.015	--
B02	234B003	0.0 - 0.5	4.6	230	--	3.4	15	0.018	--
	234B004	1.5 - 2.0	4.4	120	0.15	6.1	9.9	0.034	0.55
B03	234B006	0.0 - 0.5	3.3	170	0.22	7	17	0.016	--
	234B007	1.5 - 2.0	4.4	110	0.13	5.6	11	0.023	--
B04	234B008	0.0 - 0.5	4.5	190	0.18	6.9	16	0.0086	--
	234B009	1.5 - 2.0	2.3	82	0.093	1.6	6.7	0.0072	--
B05	234B010	0.0 - 0.5	2.9	230	0.19	4.4	14	0.0096	--
	234B011	1.5 - 2.0	3.7	100	0.13	5.6	7.7	0.0062	--
B06	234B012	0.0 - 0.5	9.5	310	--	8.7	16	0.022	--
	234B013	1.5 - 2.0	4	120	--	4.1	7.3	0.019	--
B07	234B014	0.0 - 0.5	4.8	220	--	4	17	--	0.53

[a]Based on the background concentrations for metals. Background is considered the mean plus two times the standard deviation for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (NBMG, 1998; Moore, 1999).
[b]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

bgs = Below ground surface
ft = Foot
mg/kg = Milligrams per kilogram
-- = Not detected above minimum detectable concentrations

Table A.4-6
Soil Sample Results for Gamma-Emitting Radionuclides Detected above Minimum Detectable Concentrations at CAS 03-09-02, Mud Dump Trenches
(Page 1 of 2)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)									
			Actinium-228		Cesium-137	Lead-212		Lead-214		Thallium-208		Thorium-234
Final Action Levels			5[a]	15[a]	12.2[b]	5[a]	15[a]	5[a]	15[a]	5[a]	15[a]	105[b]
B01	234B001	0.0 - 0.5	3.01	--	--	2.7 (J)	--	1.24 (J)	--	0.95	--	--
	234B002	0.0 - 0.5	2.31	--	--	3.07 (J)	--	1.39 (J)	--	0.96	--	--
	234B005	1.5 - 2.0	--	1.62	--	--	1.73 (J)	--	1.07 (J)	--	0.56	--
B02	234B003	0.0 - 0.5	2.48	--	--	3.25 (J)	--	1.33 (J)	--	0.79	--	--
	234B004	1.5 - 2.0	--	1.54	--	--	1.93 (J)	--	1.25 (J)	--	0.68	--
B03	234B006	0.0 - 0.5	2.59	--	--	2.43 (J)	--	1.23 (J)	--	0.65	--	--
	234B007	1.5 - 2.0	--	1.62	--	--	2.24 (J)	--	1.29 (J)	--	0.65	--
B04	234B008	0.0 - 0.5	2.89	--	2.7	3.27 (J)	--	1.23 (J)	--	0.96	--	--
	234B009	1.5 - 2.0	--	2.87	--	--	3.05 (J)	--	1.57 (J)	--	0.98	--
B05	234B010	0.0 - 0.5	1.28	--	1.1	1.88 (J)	--	1.21 (J)	--	0.66	--	--
	234B011	1.5 - 2.0	--	1.36	--	--	1.59 (J)	--	1.31 (J)	--	0.7	--
B06	234B012	0.0 - 0.5	2.31	--	--	2.64 (J)		1.2 (J)	--	0.74	--	--
	234B013	1.5 - 2.0	--	1.53	--	--	1.81 (J)	--	1.2 (J)	--	0.54	--
B07	234B014	0.0 - 0.5	3.49	--	--	3.75	--	1.74	--	1.14	--	4.72

Table A.4-6
Soil Sample Results for Gamma-Emitting Radionuclides Detected above Minimum Detectable Concentrations at CAS 03-09-02, Mud Dump Trenches
(Page 2 of 2)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)									
			Actinium-228		Cesium-137	Lead-212		Lead-214		Thallium-208		Thorium-234
Final Action Levels			5[a]	15[a]	12.2[b]	5[a]	15[a]	5[a]	15[a]	5[a]	15[a]	105[b]

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead-212, lead-214, thallium-208, and thorium-232, as found in Chapter IV of DOE Order 5400.5, Change 2, "Radiation Protection of the Public and Environment." (DOE, 1993). The PALs for these isotopes are specified as 5 pCi/g averaged over the first 15 cm of soil and 15 pCi/g for deeper soils (DOE, 1993). For purposes of this document, 15 cm is assumed to be equivalent to 0.5 ft (6 inches); therefore, 5 pCi/g represents the PALs for these radionuclides in the surface soil (0 to 0.5 ft depth).
[b]Taken from the construction, commercial, industrial land use scenario in Table 2.1 of the NCRP Report No. 129, *Recommended Screening Limits for Contaminated Surface Soil and Review Factors Relevant to Site-Specific Studies* (NCRP, 1999). The values provided in this source document were scaled to a 25-millirem-per-year dose.

bgs = Below ground surface
cm = Centimeter
DOE = U.S. Department of Energy
ft = Foot
NCRP = National Council on Radiation Protection and Measurements
PAL = Preliminary action level
pCi/g = Picocuries per gram
J = Estimated value
-- = Not detected above minimum detectable concentrations

A.4.2.7 Plutonium, Strontium-90, and Uranium Isotopes

Isotopic Pu and isotopic U analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.4-7. No Sr-90 was identified above its MDC in any of the samples analyzed. None of the Pu, U, or Sr-90 isotope results exceeded their respective PALs. Therefore, the FALs were established at the corresponding PAL concentrations.

Table A.4-7
Soil Sample Results for Isotopes Detected above
Minimum Detectable Concentrations at CAS 03-09-02, Mud Dump Trenches

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)			
			Plutonium-239/240	Uranium-234	Uranium-235	Uranium-238
Final Action Levels[a]			**12.7**	**143**	**17.6**	**105**
B01	234B001	0.0 - 0.5	0.239	1.21	--	1.46
	234B002	0.0 - 0.5	0.08	1.17	0.062	1.46
	234B005	1.5 - 2.0	--	1.23	0.048	1.3
B02	234B003	0.0 - 0.5	0.112	1.33	0.094	1.42
	234B004	1.5 - 2.0	0.071	0.96	0.061	1.13
B03	234B006	0.0 - 0.5	0.046	1.33	0.061	1.19
	234B007	1.5 - 2.0	--	1.2	0.057	1.26
B04	234B008	0.0 - 0.5	--	1.44	0.063	1.56
	234B009	1.5 - 2.0	--	1.19	0.078	1.33
B05	234B010	0.0 - 0.5	0.038	0.99	0.062	1.11
	234B011	1.5 - 2.0	--	1.16	0.071	1.39
B06	234B012	0.0 - 0.5	0.169	1.28	0.047	1.38
	234B013	1.5 - 2.0	--	1.02	--	1.01
B07	234B014	0.0 - 0.5	0.095 (J)	1.31	--	1.52

[a]Taken from the construction, commercial, industrial land use scenario in Table 2.1 of the NCRP Report No. 129, *Recommended Screening Limits for Contaminated Surface Soil and Review Factors Relevant to Site-Specific Studies* (NCRP, 1999). The values provided in this source document were scaled to a 25-millirem-per-year dose.

bgs = Below ground surface
ft = Foot
NCRP = National Council on Radiation Protection and Measurements
pCi/g = Picocuries per gram
J = Estimated
-- = Not detected above minimum detectable concentrations

A.4.3 Nature and Extent of Contamination

Based on the analytical results for soil samples collected within CAS 03-09-02, none of the samples exceeded the FALs for any of the analyses. Therefore, no COCs are present at this CAS.

A.4.4 Revised Conceptual Site Model

The results of the CAI at CAS 03-09-02 were consistent with the CSM. No revision of the CSM was necessary.

A.5.0 Corrective Action Site 12-09-01, Mud Pit

Corrective Action Site 12-09-01 consists of three distinct footprints in Area 12 of the NTS. The three footprints contain a mud pit, a piece of metal pipe, and a large cylindrical piece of metal debris (Figure A.5-1). The mud pit is associated with the drilling of the U12r PS#1A post-test cellar that was completed in December 1968. The mud pit is approximately 30 ft to the west of the cellar and is approximately 100 by 25 ft in area. The mud pit contains dry, cracked mud and little vegetation.

The piece of metal pipe and the cylinder are located approximately 60 ft to the northwest of the mud pit. The entire length of metal pipe is lying on the surface. The metal cylinder is lying on its side and contains an open bottom that has been covered by a metal grating, and an hole on the side of the cylinder that once had a hinged door that covered the opening. Within the metal cylinder are rusted cans and broken bottles, along with some small pieces of paper debris. It is unknown when or why the piece of pipe and metal cylinder were placed at the site. The soil beneath the debris was the scope of the CAI and investigated for impact due to potential for releases from the debris.

Figure A.5-1
Debris at CAS 12-09-01

A.5.1 Corrective Action Investigation

A total of six characterization samples (including one FD) were collected during investigation activities at CAS 12-09-01. The sample IDs, locations, types, and analyses are listed in Table A.5-1. The specific CAI activities conducted to satisfy the CAIP requirements at this CAS (NNSA/NSO, 2007) are described in the following sections.

Table A.5-1
Samples Collected at CAS 12-09-01, Mud Pit

Sample Location	Sample Number	Depth (ft bgs)	Matrix	Purpose	Analyses
C01	234C001	0.0 - 0.33	Soil	Environmental	Set 1
	234C002	0.0 - 0.33	Soil	Field Duplicate of 234C001	Set 1
C02	234C003	0.0 - 0.33	Soil	Environmental	Set 1
C03	234C004	0.0 - 0.5	Soil	Environmental	Set 1
C04	234C005	0.0- 0.5	Soil	Environmental	Set 1
C05	234C006	0.0 - 0.5	Soil	Environmental	Set 1
N/A	234C301	N/A	Water	Trip Blank	VOCs only

Set 1 = VOCs, SVOCs, RCRA Metals, TPH-DRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90

bgs = Below ground surface
DRO = Diesel-range organics
ft = Foot
N/A = Not applicable
PCB = Polychlorinated biphenyl
RCRA = *Resource Conservation and Recovery Act*
SVOC = Semivolatile organic compound
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compound

A.5.1.1 Field Screening

Decision I soil samples from each CAS were field screened for alpha and beta/gamma radiation as specified in the CAU 234 CAIP (NNSA/NSO, 2007). The FSRs were compared to FSLs to guide subsequent sampling decisions where appropriate. Alpha and beta/gamma radiation FSLs were not exceeded during sampling activities. Therefore, no additional samples were collected.

A.5.1.2 Radiological Surveys

An aerial radiological survey was conducted in 1994 of Area 12, including CAS 12-09-01 (BN, 1999). The findings of the survey were indistinguishable from background. Therefore, no additional samples were collected (see Figure A.5-2).

A.5.1.3 Visual Inspections

Two features associated with the CAS were identified. The first feature is a length of metal piping (approximately 15 ft in length) resting on the ground with no connections at either end. The second feature is a large cylindrical metal debris that is lying on its side. The cylinder has a diameter of approximately 40 inches and is approximately 8 ft long. The bottom of the cylinder is cut out, and a square opening on the side of the cylinder indicates the presence of an opening that once had a hinged cover for access. Currently, burned debris is located within the cylinder at the square opening, including glass and metal.

A.5.1.4 Sample Collection

Decision I sampling activities at CAS 12-09-01 included the collection of environmental soil samples from five locations identified in Figure A.5-3.

Soil samples were collected using scoops for surface samples and hand augers for subsurface samples. Refusal (volcanic tuff) was encountered at a depth of 0.33 ft bgs for all locations around the metal pipe and at 0.5 ft bgs at all locations around the cylindrical metal debris.

A.5.1.5 Deviations

The deviations to the sampling plans for CAS 12-09-01 investigation identified in the CAU 234 CAIP (NNSA/NSO, 2007) pertained to the depth to which samples could be collected. As indicated in Section A.5.1.4, refusal was encountered at a relatively shallow depth. Instead of the planned depth of 1 ft bgs, the maximum depth for samples collected around the metal pipe and the cylindrical metal debris were only 0.33 ft bgs and 0.5 ft bgs, respectively. This did not impact DQO decisions as no COCs are present within these surface samples; therefore, no additional samples were required.

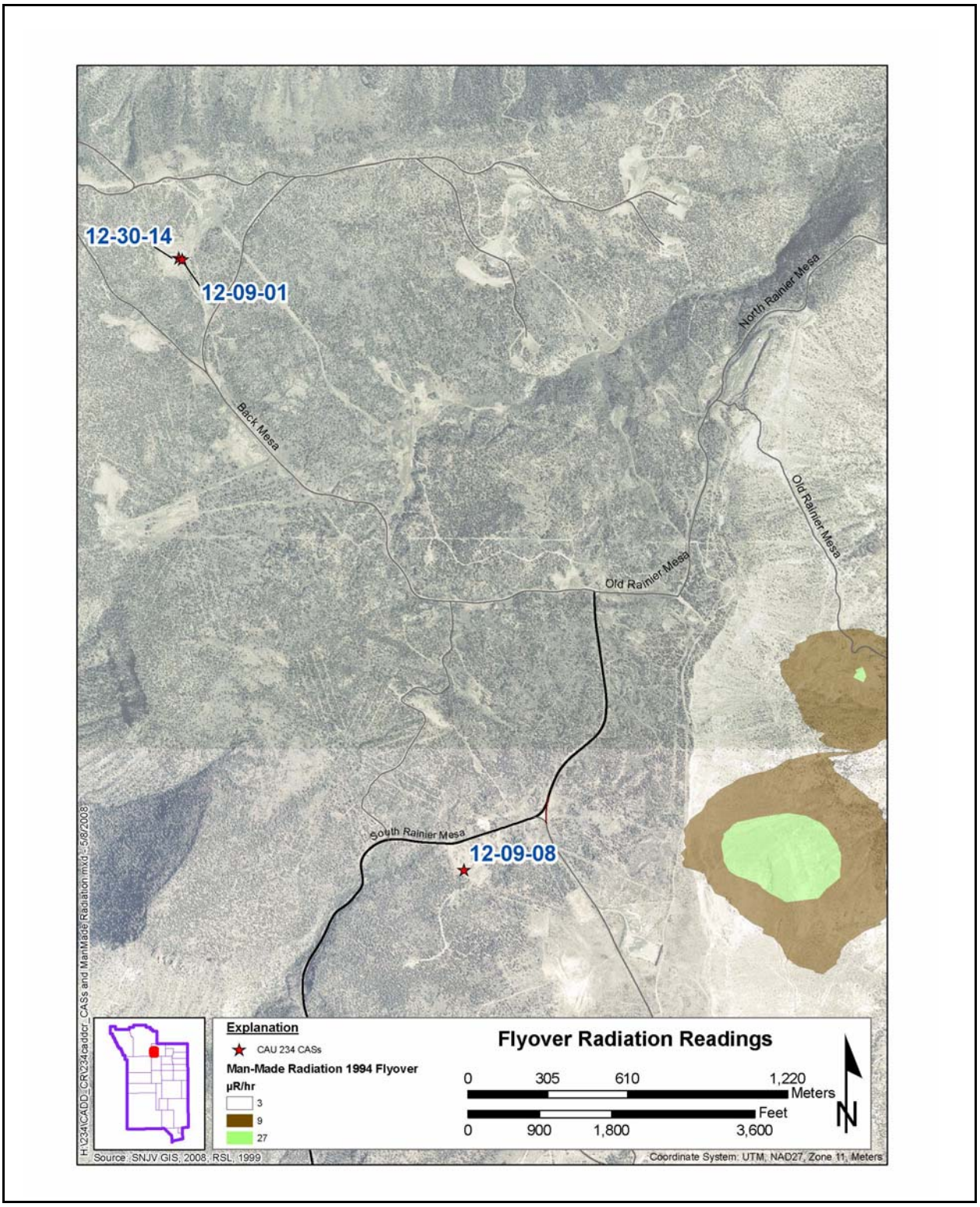

Figure A.5-2
Flyover Radiation Readings

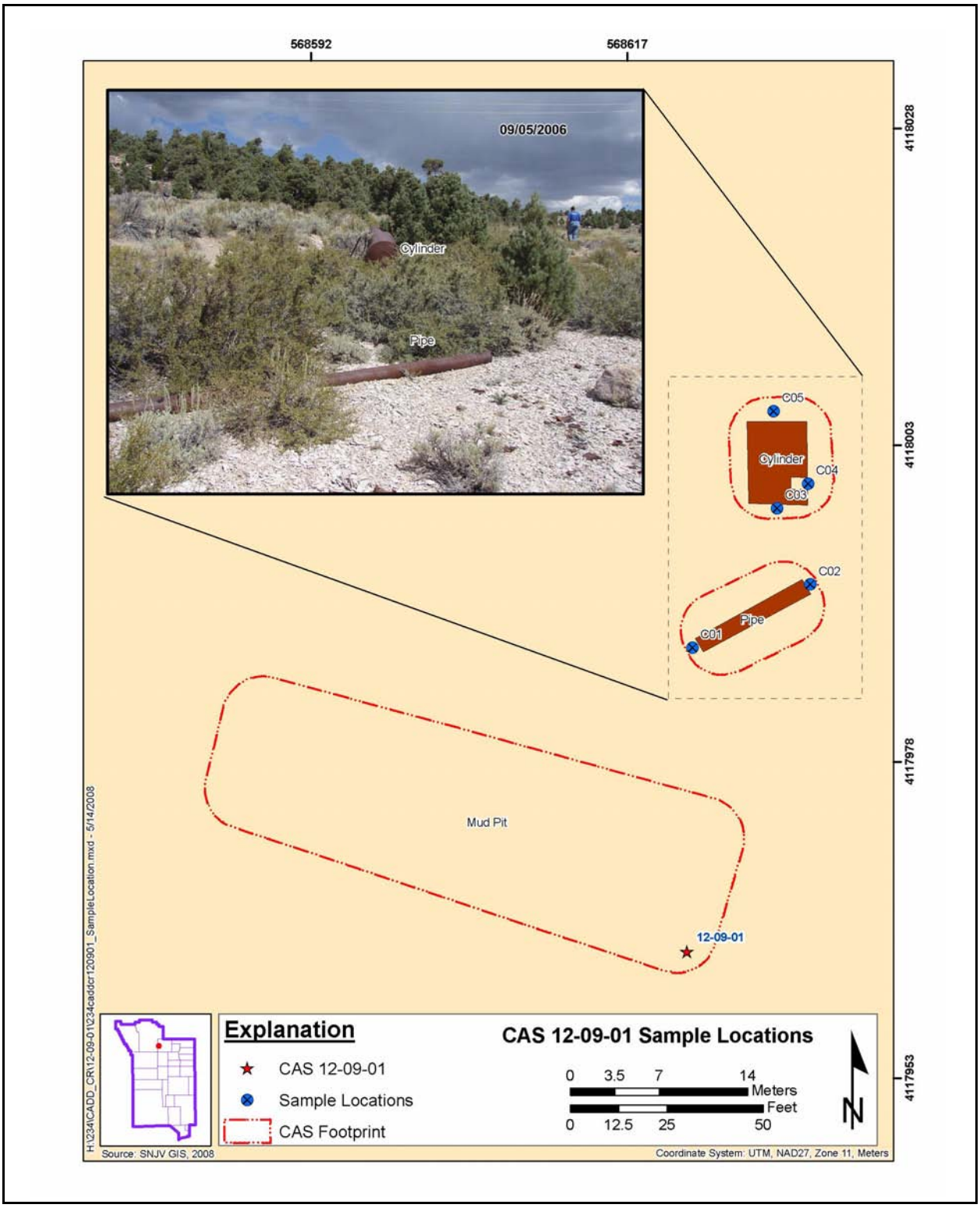

Figure A.5-3
Sample Locations for CAS 12-09-01

A.5.2 Investigation Results

The following sections provide analytical results from the samples collected to complete investigation activities as outlined in the CAIP (NNSA/NSO, 2007). Investigation samples were analyzed for the CAIP-specified COPCs, which included VOCs, SVOCs, TPH-DRO, RCRA metals, gamma-emitting radionuclides, isotopic U, isotopic Pu, and Sr-90. The PCBs are added parameters because these contaminants are a common concern at the NTS. The analytical parameters and laboratory methods used to analyze the investigation samples are listed in Table A.2-2. Table A.5-1 lists the sample-specific analytical suite for CAS 12-09-01.

Analytical results from the soil samples with concentrations exceeding MDCs are summarized in the following sections. An evaluation was conducted on all contaminants detected above MDCs by comparing individual concentration or activity results against the FALs. Establishment of the FALs is presented in Appendix D.

A.5.2.1 Volatile Organic Compounds

The VOCs analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.5-2. None of the sample results were above their respective PALs. Therefore, the FALs were established at their corresponding PAL concentrations.

Table A.5-2
Soil Sample Results for VOCs Detected above
Minimum Detectable Concentrations at CAS 12-09-01, Mud Pit

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)
			p-Isopropyltoluene
Final Action Levels[a]			2,000
C03	234C004	0.0 - 0.5	0.0022 (J)

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

bgs = Below ground surface
ft = Foot
mg/kg = Milligrams per kilogram
J = Estimated value

A.5.2.2 Semivolatile Organic Compounds

The SVOCs analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.5-3. None of the sample results were above their respective PALs. Therefore, the FALs were established at their corresponding PAL concentrations.

Table A.5-3
Soil Sample Results for SVOCs Detected above
Minimum Detectable Concentrations at CAS 12-09-01, Mud Pit

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)	
			Benzo(b)Fluoranthene	Bis(2-Ethylhexyl)Phthalate
Final Action Levels[a]			2.1	120
C01	234C001	0.0 - 0.33	0.074 (J)	0.12 (J)
	234C002	0.0 - 0.33	0.086 (J)	0.075 (J)

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

bgs = Below ground surface
ft = Foot
mg/kg = Milligrams per kilogram
J = Estimated value

A.5.2.3 Total Petroleum Hydrocarbons

The TPH-DRO analytical results for soil samples collected at this CAS that were detected above MDCs are presented in Table A.5-4. None of the sample results were above the PAL. Therefore, the FAL was established at the PAL concentration.

A.5.2.4 RCRA Metals

RCRA metals analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.5-5. None of the RCRA metals were detected above their respective PALs. Therefore, the FALs were established at their corresponding PAL concentrations.

A.5.2.5 Polychlorinated Biphenyls

Analytical results for the soil samples collected at this CAS indicate that there are no PCBs detected above their respective MDCs. Therefore, the FALs were established at the PAL concentrations.

Table A.5-4
Soil Sample Results for TPH-DRO Detected above Minimum Detectable Concentrations at CAS 12-09-01, Mud Pit

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)
			Diesel-Range Organics
Preliminary Action Levels[a]			**100**
C01	234C001	0.0 - 0.33	7
	234C002	0.0 - 0.33	5.4
C03	234C004	0.0 - 0.5	1.9 (J)

[a]Based on *Nevada Administrative Code,* "Contamination of Soil: Establishment of Action Levels" (NAC, 2006).

bgs = Below ground surface
ft = Foot
mg/kg = Milligrams per kilogram
J = Estimated value

Table A.5-5
Soil Sample Results for RCRA Metals Detected above Minimum Detectable Concentrations at CAS 12-09-01, Mud Pit

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)							
			Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
Final Action Levels			**23[a]**	**67,000[b]**	**450[b]**	**450[b]**	**800[b]**	**310[b]**	**5,100[b]**	**5,100[b]**
C01	234C001	0.0 - 0.33	2.3	120	--	5.3	20	--	0.37	--
	234C002	0.0 - 0.33	2.2	120	--	5	23	--	0.46	0.2
C02	234C003	0.0 - 0.33	2.6	42	--	4.5	18	--	--	--
C03	234C004	0.0 - 0.5	2.9	65	0.13	5.4	20 (J)	0.02	--	--
C04	234C005	0.0 - 0.5	2.5	68	0.064	5	14 (J)	0.026	--	--
C05	234C006	0.0 - 0.5	3.7	75	0.14	7.4	33 (J)	0.018	--	--

[a]Based on the background concentrations for metals. Background is considered the mean plus two times the standard deviation for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (NBMG, 1998; Moore, 1999).
[b]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

bgs = Below ground surface
ft = Foot
mg/kg = Milligrams per kilogram
J = Estimated value
-- = Not detected above minimum detectable concentrations

A.5.2.6 Gamma-Emitting Radionuclides

Gamma-emitting radionuclides analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.5-6. None of the gamma-emitting radionuclides were detected above their respective PALs. Therefore, the FALs were established as their corresponding PAL concentrations.

Table A.5-6
Soil Sample Results for Gamma-Emitting Radionuclides Detected above Minimum Detectable Concentrations at CAS 12-09-01, Mud Pit

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)				
			Actinium-228	Cesium-137	Lead-212	Lead-214	Thallium-208
Final Action Levels			5[a]	12.2[b]	5[a]	5[a]	5[a]
C01	234C001	0.0 - 0.33	2.64	0.45	2.87 (J)	1.53 (J)	0.78
	234C002	0.0 - 0.33	2.24	0.41	2.66 (J)	1.37 (J)	0.85
C02	234C003	0.0 - 0.33	2.5	--	2.38 (J)	1.55 (J)	0.95
C03	234C004	0.0 - 0.5	2.33	--	2.58 (J)	1.34 (J)	0.73
C04	234C005	0.0 - 0.5	2.21	0.3	2.58 (J)	1.28 (J)	0.79
C05	234C006	0.0 - 0.5	2.36	0.33	2.52 (J)	1.26 (J)	0.78

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead-212, lead-214, thallium-208, and thorium-232, as found in Chapter IV of DOE Order 5400.5, Change 2, "Radiation Protection of the Public and Environment." (DOE, 1993). The PALs for these isotopes are specified as 5 pCi/g averaged over the first 15 cm of soil and 15 pCi/g for deeper soils (DOE, 1993). For purposes of this document, 15 cm is assumed to be equivalent to 0.5 ft (6 inches); therefore, 5 pCi/g represents the PALs for these radionuclides in the surface soil (0 to 0.5 ft depth).
[b]Taken from the construction, commercial, industrial land use scenario in Table 2.1 of the NCRP Report No. 129, *Recommended Screening Limits for Contaminated Surface Soil and Review Factors Relevant to Site-Specific Studies* (NCRP, 1999). The values provided in this source document were scaled to a 25-millirem-per-year dose.

bgs = Below ground surface
cm = Centimeter
DOE = U.S. Department of Energy
ft = Foot
NCRP = National Council on Radiation Protection and Measurements
PAL = Preliminary action level
pCi/g = Picocuries per gram
J = Estimated value
-- = Not detected above minimum detectable concentrations

A.5.2.7 Plutonium, Strontium-90, and Uranium Isotopes

Isotopic Pu and isotopic U analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.5-7. No Sr-90 was identified above its MDC in any of the samples analyzed. No isotopic Pu or U sample results exceeded their respective PALs. Therefore, the FALs were established at the corresponding PAL concentrations.

Table A.5-7
Soil Sample Results for Isotopes Detected above
Minimum Detectable Concentrations at CAS 12-09-01, Mud Pit

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)				
			Plutonium-238	Plutonium-239/240	Uranium-234	Uranium-235	Uranium-238
Final Action Levels[a]			**13**	**12.7**	**143**	**17.6**	**105**
C01	234C001	0.0 - 0.33	--	--	1.27	0.05	1.27
	234C002	0.0 - 0.33	--	--	1.13	0.056	1.19
C02	234C003	0.0 - 0.33	--	--	1.08	0.08	1.15
C03	234C004	0.0 - 0.5	--	0.044	1.14	0.08	1.22
C04	234C005	0.0 - 0.5	0.13	0.66	0.97	0.043	1.3
C05	234C006	0.0 - 0.5	0.073	0.267	1.04	0.054	1.1

[a]Taken from the construction, commercial, industrial land use scenario in Table 2.1 of the NCRP Report No. 129, *Recommended Screening Limits for Contaminated Surface Soil and Review Factors Relevant to Site-Specific Studies* (NCRP, 1999). The values provided in this source document were scaled to a 25-millirem-per-year dose.

bgs = Below ground surface
ft = Foot
NCRP = National Council on Radiation Protection and Measurements
pCi/g = Picocuries per gram
J = Estimated value
-- = Not detected above minimum detectable concentrations

A.5.3 Nature and Extent of Contamination

Based on the analytical results for soil samples collected within CAS 12-09-01, no COCs are present at this CAS.

A.5.4 Revised Conceptual Site Model

The results of the CAI at CAS 12-09-01 did not contradict the CSM. No revision of the CSM was necessary.

A.6.0 Corrective Action Site 12-09-08, Mud Pit

Corrective Action Site 12-09-08 is located in the southwest corner of Area 12 of the NTS. This CAS consists of a drilling mud pit used for the construction of the U12e.14 HFR CH#1 instrument hole. The exact date of the construction of the mud pit is unknown; however, drilling of the instrument hole began on November 9, 1972. Two areas of potential release of contaminants are identified within the mud pit. The first is a length of metal piping that was protruding from the top of the berm wall by approximately 4 ft and not connected at either end. The second potential release of contaminants was identified as a set of crushed 55-gal drums against the inner side of one of the berm walls (Figure A.6-1).

Figure A.6-1
Debris at CAS 12-09-08

A.6.1 Corrective Action Investigation

A total of seven characterization samples (including one FD) were collected during investigation activities at CAS 12-09-08. The sample IDs, locations, types, and analyses are listed in Table A.6-1. The specific CAI activities conducted to satisfy the CAIP requirements at this CAS (NNSA/NSO, 2007) are described in the following sections.

Table A.6-1
Samples Collected at CAS 12-09-08, Mud Pit

Sample Location	Sample Number	Depth (ft bgs)	Matrix	Purpose	Analyses
D01	234D001	0.0 - 0.5	Soil	Environmental	Set 1
	234D002	0.5 - 1.0	Soil	Environmental	Set 1
D02	234D003	0.0 - 0.5	Soil	Environmental	Set 1
	234D004	0.5 - 1.0	Soil	Environmental	Set 1
D03	234D005	0.0 - 0.5	Soil	Environmental	Set 1
	234D006	0.0 - 0.5	Soil	Field Duplicate of 234D005	Set 1
	234D007	1.0 - 1.5	Soil	Environmental	Set 1
N/A	234D301	N/A	Water	Trip Blank	VOCs only
N/A	234D302	N/A	Water	Trip Blank	VOCs only
N/A	234D303	N/A	Water	Field Blank	Set 1

Set 1 = VOCs, SVOCs, RCRA Metals, TPH-DRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90

bgs = Below ground surface
DRO = Diesel-range organics
ft = Foot
N/A = Not applicable
PCB = Polychlorinated biphenyl
RCRA = *Resource Conservation and Recovery Act*
SVOC = Semivolatile organic compound
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compound

A.6.1.1 Field Screening

Decision I soil samples were field screened for alpha and beta/gamma radiation as specified in the CAU 234 CAIP (NNSA/NSO, 2007). The FSRs were compared to FSLs to guide subsequent sampling decisions where appropriate. Alpha and beta/gamma radiation FSLs were not exceeded during sampling activities.

A.6.1.2 Radiological Surveys

An aerial radiological survey was performed in 1994 of Area 12, including CAS 12-09-08 (BN, 1999). The results of the survey were indistinguishable from background. As a result, no additional samples were collected (see Figure A.5-2).

A.6.1.3 Deviations

There were no deviations from the proposed sampling plan as described in the CAU 234 CAIP (NNSA/NSO, 2007).

A.6.1.4 Visual Inspections

Visual inspections of the CAS before sampling identified no additional features of concern. The locations of the pipe and crushed drums were verified. No visible staining was associated with the metal piping. There was no indication of staining associated with the discarded drums. Therefore, no additional samples were collected.

A walkover was conducted within the drilling mud sump during the collection of the biased samples from locations shown in Figure A.6-2 to identify additional sample locations based on biasing factors (i.e., staining). No additional biased sample locations were identified.

A.6.1.5 Sample Collection

Intrusive investigation activities (i.e., surface and shallow subsurface soil sampling) were conducted to support investigation activities. Soil samples were collected using scoops for surface samples and hand augers for subsurface samples.

A.6.2 Investigation Results

The following sections provide analytical results from the samples collected to complete investigation activities as outlined in the CAU 234 CAIP (NNSA/NSO, 2007). Investigation samples were analyzed for the CAIP-specified COPCs, which included VOCs, SVOCs, TPH-DRO, RCRA metals, gamma-emitting radionuclides, isotopic U, isotopic Pu, and Sr-90. The PCBs are added parameters because these contaminants are a common concern at the NTS. The analytical parameters

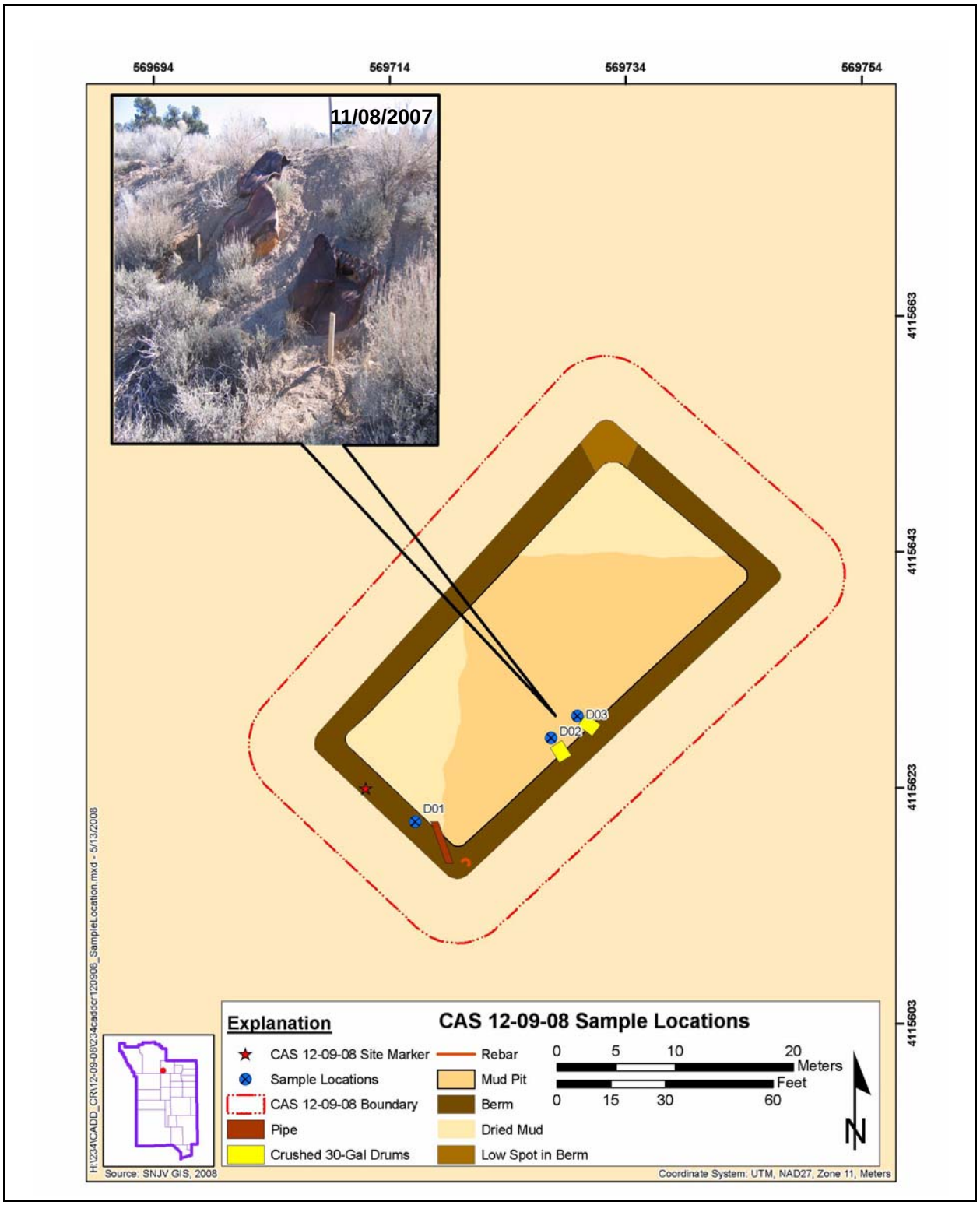

Figure A.6-2
Sample Locations for CAS 12-09-08

and laboratory methods used to analyze the investigation samples are listed in Table A.2-2. Table A.6-1 lists the sample-specific analytical suite for CAS 12-09-08.

Analytical results from the soil samples with concentrations exceeding MDCs are summarized in the following sections. An evaluation was conducted on all contaminants detected above MDCs by comparing individual concentration or activity results against the FALs. Establishment of the FALs is presented in Appendix D.

A.6.2.1 Volatile Organic Compounds

No VOC analytical results for environmental samples collected at this CAS were detected above their respective MDCs. Therefore, the FALs were established at the corresponding PAL concentrations.

A.6.2.2 Semivolatile Organic Compounds

The SVOCs analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.6-2. None of the analyte concentrations exceeded their PALs. Therefore, the FALs were established at their corresponding PAL concentrations.

Table A.6-2
Soil Sample Results for SVOCs Detected above
Minimum Detectable Concentrations at CAS 12-09-08, Mud Pit

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)
			Bis(2-Ethylhexyl)Phthalate
Final Action Levels[a]			120
D03	234D007	1.0 - 1.5	0.18 (J)

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

bgs = Below ground surface
ft = Foot
mg/kg = Milligrams per kilogram
J = Estimated value

A.6.2.3 Total Petroleum Hydrocarbons

The TPH-DRO analytical results for soil samples collected at this CAS that were detected above MDCs are presented in Table A.6-3. None of the samples had TPH-DRO concentrations above the PAL of 100 mg/kg. Therefore, the FAL was established at the PAL concentration.

Table A.6-3
Soil Sample Results for TPH-DRO Detected above
Minimum Detectable Concentrations at CAS 12-09-08, Mud Pit

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)
			Diesel-Range Organics
Preliminary Action Levels[a]			100
D03	234D007	1.0 - 1.5	73

[a]Based on *Nevada Administrative Code,* "Contamination of Soil: Establishment of Action Levels" (NAC, 2006).

bgs = Below ground surface
ft = Foot
mg/kg = Milligrams per kilogram

A.6.2.4 RCRA Metals

The RCRA metals analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.6-4. No metals were detected at concentrations exceeding their PALs. Therefore, the FALs were established at the corresponding PAL concentrations.

A.6.2.5 Polychlorinated Biphenyls

Analytical results for soil samples collected at this CAS indicate that there are no PCBs detected above their respective MDCs. Therefore, the FALs were established at the PAL concentrations.

Table A.6-4
Soil Sample Results for RCRA Metals Detected above Minimum Detectable Concentrations at CAS 12-09-08, Mud Pit

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)					
			Arsenic	Barium	Cadmium	Chromium	Lead	Selenium
Final Action Levels			**23[a]**	**67,000[b]**	**450[b]**	**450[b]**	**800[b]**	**5,100[b]**
D01	234D001	0.0 - 0.5	4.5	160	0.12	7	10	--
	234D002	0.5 - 1.0	4	160	0.065	6.5	10	0.46
D02	234D003	0.0 - 0.5	3.5	150	0.13	5.9	9.3	--
	234D004	0.5 - 1.0	2.8	100	0.063	4	7.2	--
D03	234D005	0.0 - 0.5	4.4	170	0.19	6.3	9.3	--
	234D006	0.0 - 0.5	4	200	0.12	6	22	--
	234D007	1.0 - 1.5	3.3	130	0.11	4.7	10	--

[a]Based on the background concentrations for metals. Background is considered the mean plus two times the standard deviation for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (NBMG, 1998; Moore, 1999).
[b]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

bgs = Below ground surface
ft = Foot
mg/kg = Milligrams per kilogram
-- = Not detected above minimum detectable concentrations

A.6.2.6 Gamma-Emitting Radionuclides

Gamma-emitting radionuclides analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.6-5. None of the gamma-emitting radionuclides were found at concentrations exceeding their respective PALs. Therefore, the FALs were established at the corresponding PAL concentrations.

A.6.2.7 Plutonium, Strontium-90, and Uranium Isotopes

Isotopic Pu and isotopic U analytical results for environmental samples collected at this CAS that were detected above MDCs are presented in Table A.6-6. No Sr-90 was identified above its MDC in any of the samples analyzed. No isotopic Pu or U exceeded the PALs. Therefore, the FALs were established at the corresponding PAL concentrations.

Table A.6-5
Soil Sample Results for Gamma-Emitting Radionuclides Detected above Minimum Detectable Concentrations at CAS 12-09-08, Mud Pit

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)							
			Actinium-228		Lead-212		Lead-214		Thallium-208	
Final Action Levels[a]			5	15	5	15	5	15	5	15
D01	234D001	0.0 - 0.5	2.56	--	2.77 (J)	--	1.24 (J)	--	0.84	--
	234D002	0.5 - 1.0	--	2.23	--	2.65 (J)	--	1.1 (J)	--	0.89
D02	234D003	0.0 - 0.5	2.16	--	2.62 (J)	--	1.14 (J)	--	0.66	
	234D004	0.5 - 1.0	--	2.14	--	2.54 (J)	--	0.95 (J)	--	0.71
D03	234D005	0.0 - 0.5	2.14	--	2.75 (J)	--	1.18 (J)	--	0.69	--
	234D006	0.0 - 0.5	2.12	--	2.48 (J)	--	1.25 (J)	--	0.81	--
	234D007	1.0 - 1.5	--	2.19	--	2.91 (J)	--	1.26 (J)	--	0.86

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead-212, lead-214, thallium-208, and thorium-232, as found in Chapter IV of DOE Order 5400.5, Change 2, "Radiation Protection of the Public and Environment." (DOE, 1993). The PALs for these isotopes are specified as 5 pCi/g averaged over the first 15 cm of soil and 15 pCi/g for deeper soils (DOE, 1993). For purposes of this document, 15 cm is assumed to be equivalent to 0.5 ft (6 inches); therefore, 5 pCi/g represents the PALs for these radionuclides in the surface soil (0 to 0.5 ft depth).

bgs = Below ground surface
cm = Centimeter
DOE = U.S. Department of Energy
ft = Foot
PAL = Preliminary action level
pCi/g = Picocuries per gram
J = Estimated value
-- = Not detected above minimum detectable concentrations

Table A.6-6
Soil Sample Results for Isotopes Detected above Minimum Detectable Concentrations at CAS 12-09-08, Mud Pit
(Page 1 of 2)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)			
			Plutonium-239/240	Uranium-234	Uranium-235	Uranium-238
Final Action Levels[a]			12.7	143	17.6	105
D01	234D001	0.0 - 0.5	--	0.96	0.047	0.96
	234D002	0.5 - 1.0	--	0.96	--	0.84
D02	234D003	0.0 - 0.5	--	1.06	--	1.09
	234D004	0.5 - 1.0	--	0.99	--	1.09

Table A.6-6
Soil Sample Results for Isotopes Detected above
Minimum Detectable Concentrations at CAS 12-09-08, Mud Pit
(Page 2 of 2)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)			
			Plutonium-239/240	Uranium-234	Uranium-235	Uranium-238
Final Action Levels[a]			**12.7**	**143**	**17.6**	**105**
D03	234D005	0.0 - 0.5	0.028	1.03	0.081	1.03
	234D006	0.0 - 0.5	--	0.91	0.053	0.92
	234D007	1.0 - 1.5	--	0.9	0.076	1.05

[a]Taken from the construction, commercial, industrial land use scenario in Table 2.1 of the NCRP Report No. 129, *Recommended Screening Limits for Contaminated Surface Soil and Review Factors Relevant to Site-Specific Studies* (NCRP, 1999). The values provided in this source document were scaled to a 25-millirem-per-year dose.

bgs = Below ground surface
ft = Foot
NCRP = National Council on Radiation Protection and Measurements
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations

A.6.3 Nature and Extent of Contamination

Based on the analytical results for soil samples collected within CAS 12-09-08, no COCs are present.

A.6.4 Revised Conceptual Site Model

The results of the CAI at CAS 12-09-08 did not contradict the CSM. No revision of the CSM was necessary.

A.7.0 Corrective Action Site 12-30-14, Cellar

Corrective Action Site 12-30-14 is located in the southwest corner of Area 12 of the NTS. This CAS consists of a cellar that was the site for the drilling of the U12r PS#1A and U12r PS#1AS post-test boreholes. U12r PS#1A (2,045 ft bgs) was drilled from January 19 to 23, 1969, and U12r PS#1AS (2,007 ft bgs) was drilled on January 23 and 24, 1969. The U12r Wineskin test took place on January 15, 1969. The open top cellar is approximately 9 ft deep and 10 ft in diameter. The inner wall of the cellar is lined with corrugated metal. Liquid can commonly be found within the cellar and has varied from approximately 7 ft deep to 1.5 ft deep during the site investigation, spanning approximately two years (Figure A.7-1).

Figure A.7-1
Cellar at CAS 12-30-14

A.7.1 Corrective Action Investigation

A total of four PSM samples (including one FD) were collected during investigation activities at CAS 12-30-14. The sample IDs, locations, types, and analyses are listed in Table A.7-1. The specific CAI activities conducted to satisfy the CAIP requirements at this CAS (NNSA/NSO, 2007) are described in the following sections.

Table A.7-1
Samples Collected at CAS 12-30-14, Cellar

Sample Location	Sample Number	Thickness (ft)	Matrix	Purpose	Analyses
E-Cellar	234E001	1.5[a]	Liquid	Environmental	Set 1
E-Sediment	234E002	1.0[b]	Sediment	Environmental	Set 1
E-Sediment	234E003	1.0[b]	Sediment	Environmental	Set 1
	234E004	1.0[b]	Sediment	Field Duplicate of 234E003	Set 1
N/A	234E301	N/A	Water	Trip Blank	VOCs only
N/A	234E302	N/A	Water	Field Blank	Set 1
N/A	234E303	N/A	Water	Trip Blank	VOCs only

Set 1 = VOCs, SVOCs, RCRA Metals, TPH-DRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90

[a]Thickness of water column above sediment on cellar floor.
[b]Thickness of sediment on cellar floor beneath water column.

RCRA = *Resource Conservation and Recovery Act*
DRO = Diesel-range organics
ft = Foot
N/A = Not applicable
PCB = Polychlorinated biphenyl
SVOC = Semivolatile organic compound
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compound

A.7.1.1 Field Screening

Samples were screened for gamma-emitting radionuclides using a gamma spectrometer at Building 23-153 due to the wet nature of the samples to compare to shipping requirements. The results were at background concentrations; therefore, no special packaging was required.

A.7.1.2 Radiological Surveys

An aerial radiological survey was conducted in 1994 of Area 12, including CAS 12-30-14 (BN, 1999). The findings of the survey were indistinguishable from background. Therefore, no additional samples were collected (see Figure A.5-2).

A.7.1.3 Visual Inspections

Other than the PSM located within the cellar, no additional locations were identified that required sample collection. Therefore, no additional samples were collected.

A.7.1.4 Sample Collection

Sampling activities at CAS 12-30-14 included the collection of environmental liquid and sediment samples from both the liquid and sediment phases identified in Figure A.7-2. Liquid samples were collected using a scoop on a pole. Scoops were used for the collection of sediment from the cellar base, then transferred to aluminum pans for processing.

A.7.1.5 Deviations

There were no deviations to the CAIP requirements (NNSA/NSO, 2007) for sampling at this CAS.

A.7.2 Investigation Results

The following sections provide analytical results from the samples collected to complete investigation activities as outlined in the CAIP (NNSA/NSO, 2007). Investigation samples were analyzed for the CAIP-specified parameters, which included VOCs, SVOCs, TPH-DRO, RCRA metals, gamma-emitting radionuclides, isotopic U, isotopic Pu, and Sr-90. The PCBs are added parameters because these contaminants are a common concern at the NTS. The analytical parameters and laboratory methods used to analyze the investigation samples are listed in Table A.2-2. Table A.7-1 lists the sample-specific analytical suite for CAS 12-30-14.

Analytical results from the PSM samples with concentrations exceeding MDCs are summarized in the following sections. An evaluation was conducted on all contaminants detected above MDCs by

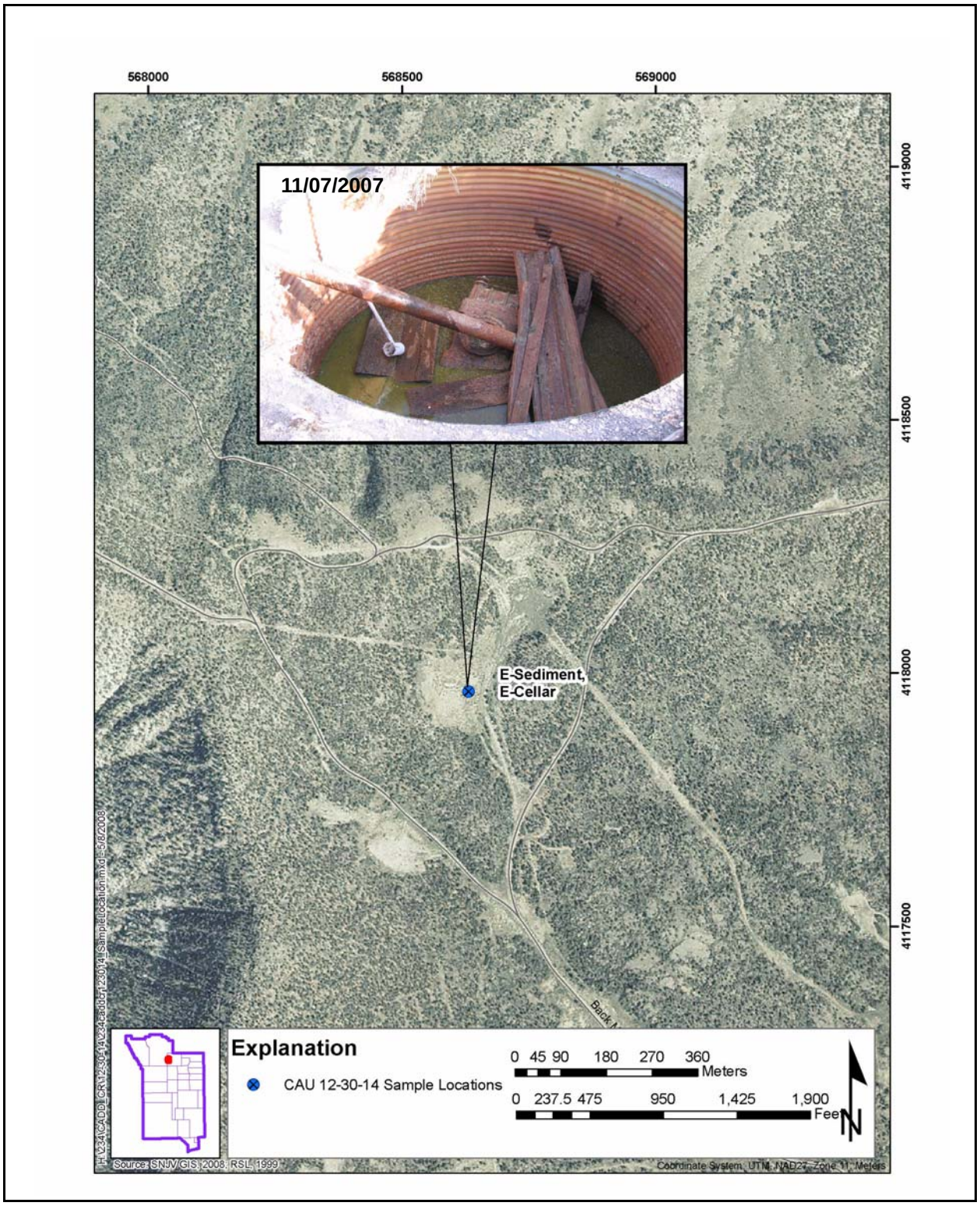

Figure A.7-2
Sample Locations for CAS 12-30-14

comparing individual concentration or activity results against the PSM criteria established in the CAIP (NNSA/NSO, 2007).

A.7.2.1 Volatile Organic Compounds

The VOCs analytical results for PSM samples collected at this CAS that were detected above MDCs are presented in Tables A.7-2 and A.7-3. Table A.7-2 lists the contaminants identified above their respective MDCs in the sediment contents of the cellar. Table A.7-3 lists the contaminants identified above their respective MDCs in the liquid contents of the cellar. No VOCs were detected at concentrations exceeding their respective PSM criteria in either phase.

Table A.7-2
Sediment PSM Sample Results for VOCs Detected above Minimum Detectable Concentrations at CAS 12-30-14, Cellar

Sample Location	Sample Number	Thickness (ft)	Contaminants of Potential Concern (mg/kg)	
			Acetone	p-Isopropyltoluene
PSM Criteria[a]			54,000	2,000
E-Sediment	234E002	1.0[b]	0.059	0.16
E-Sediment	234E003	1.0[b]	0.012 (J)	0.030
E-Sediment	234E004	1.0[b]	--	0.049

[a]Based on U.S. Environmental Protection Agency *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).
[b]Thickness of sediment on cellar floor.

ft = Foot
mg/kg = Milligrams per kilogram
PSM = Potential source material
J = Estimated value
-- = Not detected above minimum detectable concentrations

A.7.2.2 Semivolatile Organic Compounds

The SVOCs analytical results for PSM samples collected in the sediment contents of this CAS that were detected above MDCs are presented in Table A.7-4. No SVOCs were detected in the liquid contents of the cellar. No SVOCs were detected at concentrations exceeding the PSM criteria.

Table A.7-3
Liquid PSM Sample Results for VOCs Detected above Minimum Detectable Concentrations at CAS 12-30-14, Cellar

Sample Location	Sample Number	Thickness (ft)	Contaminants of Potential Concern (mg/L)
			Acetone
PSM Criteria[a]			None
E-Cellar	234E001	1.5[b]	0.064

[a]Based on *Code of Federal Regulations,* Title 40 CFR Part 261, "Identification and Listing of Hazardous Waste" (CFR, 2006).
[b]Thickness of water column above sediment on cellar floor.

ft = Foot
mg/L = Milligrams per liter
PSM = Potential source material

Table A.7-4
Sediment PSM Sample Results for SVOCs Detected above Minimum Detectable Concentrations at CAS 12-30-14, Cellar

Sample Location	Sample Number	Thickness (ft)	Contaminants of Potential Concern (mg/kg)
			Bis(2-Ethylhexyl)Phthalate
PSM Criteria[a]			120
E-Sediment	234E004	1.0[b]	0.640

[a]Thickness on U.S. Environmental Protection Agency *Region 9 Preliminary Remediation Goals* (PRGs) (EPA, 2004).
[b]Thickness of water column above sediment on cellar floor.

ft = Foot
mg/kg = Milligrams per kilogram
PSM = Potential source material

A.7.2.3 Total Petroleum Hydrocarbons

The TPH-DRO analytical results for environmental samples collected in the sediment at this CAS that were detected above MDCs are presented in Table A.7-5. No TPH-DRO results exceeded the PSM criteria of 100 mg/kg. No TPH-DRO was identified in samples collected from the liquid contents of the cellar.

Table A.7-5
Sediment PSM Sample Results for TPH-DRO Detected above Minimum Detectable Concentrations at CAS 12-30-14, Cellar

Sample Location	Sample Number	Thickness (ft)	Contaminants of Potential Concern (mg/kg)
			Diesel-Range Organics
PSM Criteria[a]			100
E-Sediment	234E002	1.0[b]	60
E-Sediment	234E003	1.0[b]	35
E-Sediment	234E004	1.0[b]	49

[a]Based on *Nevada Administrative Code,* "Contamination of Soil: Establishment of Action Levels" (NAC, 2006).
[b]Thickness of sediment on cellar floor beneath water column.

ft = Foot
mg/kg = Milligrams per kilogram
PSM = Potential source material

A.7.2.4 RCRA Metals

The RCRA metals analytical results for PSM samples collected from the sediment portion of this CAS that were detected above MDCs are presented in Table A.7-6. The RCRA metals analytical results for PSM samples collected from the liquid portion of this CAS that were detected above MDCs are presented in Table A.7-7. No metals were detected at concentrations exceeding the PSM criteria in either phase.

A.7.2.5 Polychlorinated Biphenyls

Analytical results for PSM samples collected at this CAS indicate that there are no PCBs detected above their respective MDCs.

A.7.2.6 Gamma-Emitting Radionuclides

Gamma-emitting radionuclides analytical results for PSM samples collected at this CAS that were detected above MDCs are presented in Table A.7-8. No gamma-emitting radionuclide exceeded PSM criteria.

Table A.7-6
Sediment PSM Sample Results for RCRA Metals Detected above Minimum Detectable Concentrations at CAS 12-30-14, Cellar

Sample Location	Sample Number	Thickness (ft)	Contaminants of Potential Concern (mg/kg)						
			Arsenic	Barium	Cadmium	Chromium	Lead	Selenium	Silver
PSM Criteria			**23[a]**	**67,000[b]**	**450[b]**	**450[b]**	**800[b]**	**5,100[b]**	**5,100[b]**
E-Sediment	234E002	1.0[c]	3.1	3,100	1	6.3	210	--	0.71
E-Sediment	234E003	1.0[c]	4.1	130	--	5.6	16	0.57	--
E-Sediment	234E004	1.0[c]	5	150	0.84	5	23	0.62	--

[a]Based on the background concentrations for metals. Background is considered the mean plus two times the standard deviation for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (NBMG, 1998; Moore, 1999).
[b]Based on U.S. Environmental Protection Agency *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).
[c]Thickness of sediment on cellar floor beneath water column.

ft = Foot
mg/kg = Milligrams per kilogram
PSM = Potential source material
-- = Not detected above minimum detectable concentrations

Table A.7-7
Liquid PSM Sample Results for RCRA Metals Detected above Minimum Detectable Concentrations at CAS 12-30-14, Cellar

Sample Location	Sample Number	Thickness (ft)	Contaminants of Potential Concern (mg/L)		
			Arsenic	Barium	Lead
PSM Criteria[a]			**5.0**	**100.0**	**5.0**
E-Cellar	234E001	1.5[b]	0.0082	0.15	0.002

[a]Based on *Code of Federal Regulations,* Title 40 CFR Part 261, "Identification and Listing of Hazardous Waste" (CFR, 2006).
[b]Thickness of water column above sediment on cellar floor.

ft = Foot
mg/L = Milligrams per liter
PSM = Potential source material

Table A.7-8
Sediment PSM Sample Results for Gamma-Emitting Radionuclides Detected above Minimum Detectable Concentrations at 12-30-14, Cellar

Sample Location	Sample Number	Thickness (ft)	Contaminants of Potential Concern (pCi/g)			
			Actinium-228	Lead-212	Lead-214	Thallium-208
PSM Criteria[a]			5	5	5	5
E-Sediment	234E002	1.0[b]	1.83	2.19 (J)	1.48 (J)	0.66
E-Sediment	234E003	1.0[b]	1.72	1.67 (J)	1.29 (J)	0.56
E-Sediment	234E004	1.0[b]	1.53	1.61 (J)	1.01 (J)	0.47

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead-212, lead-214, thallium-208, and thorium-232, as found in Chapter IV of DOE Order 5400.5, Change 2, *Radiation Protection of the Public and Environment* (DOE, 1993). The PALs for these isotopes is specified as 5 pCi/g averaged over the first 15 cm of soil and 15 pCi/g for deeper soils (DOE, 1993). For purposes of this document, 15 cm is assumed to be equivalent to 0.5 ft (6 inches); therefore, 5 pCi/g represents the PALs for these radionuclides in the surface soil (0 to 0.5 ft depth).
[b]Thickness of sediment on cellar floor beneath water column.

cm = Centimeter
DOE = U.S. Department of Energy
ft = Foot
PAL = Preliminary action level
pCi/g = Picocuries per gram
PSM = Potential source material
J = Estimated value

A.7.2.7 Plutonium, Strontium-90, and Uranium Isotopes

The Sr-90 and isotopic U analytical results for PSM sediment samples collected at this CAS that were detected above MDCs are presented in Table A.7-9. No isotopic Pu was detected in any of the samples analyzed. No Sr-90 or isotopic U exceeded PSM criteria in either phase. The only result above MDCs for the liquid sample 234E001 was Sr-90 at 3.05 picocuries per liter (pCi/L). There is no radiological PSM criteria for comparison to the liquid sample.

A.7.3 Nature and Extent of Contamination

Based on the analytical results for the PSM samples collected within CAS 12-30-14, no PSM was identified at this CAS.

Table A.7-9
Sediment PSM Sample Results for Isotopes Detected above Minimum Detectable Concentrations at CAS 12-30-14, Cellar

Sample Location	Sample Number	Thickness (ft)	Contaminants of Potential Concern (pCi/g)		
			Uranium-234	Uranium-235	Uranium-238
PSM Criteria[a]			143	17.6	105
E-Sediment	234E002	1.0[b]	0.97	--	0.98
E-Sediment	234E003	1.0[b]	0.93	0.053	1
E-Sediment	234E004	1.0[b]	0.85	--	1.03

[a]Taken from the construction, commercial, industrial land use scenario in Table 2.1 of the NCRP Report No. 129, *Recommended Screening Limits for Contaminated Surface Soil and Review Factors Relevant to Site-Specific Studies* (NCRP, 1999). The values provided in this source document were scaled to a 25-millirem-per-year dose.
[b]Thickness of sediment on cellar floor beneath water column.

ft = Foot
NCRP = National Council on Radiation Protection and Measurements
pCi/g = Picocuries per gram
PSM = Potential source material
-- = Not detected above minimum detectable concentrations

A.7.4 Revised Conceptual Site Model

The results of the CAI at CAS 12-30-14 did not contradict the CSM. No revision of the CSM was necessary.

A.8.0 Waste Management

Sections A.8.1 through A.8.3 address IDW, and Sections A.8.4 and A.8.5 address potential disposal and remediation of the wastes.

A.8.1 Investigation-Derived Waste

Investigation-derived waste was generated during the field investigation activities of CAU 234. The waste streams generated include decontamination rinsate water, disposable personal protective equipment (PPE), and disposable sampling equipment. Investigation-derived waste was segregated to the greatest extent possible, and waste minimization techniques were integrated into the field activities to reduce the amount of waste generated. Controls were in place to minimize the use of hazardous materials and the unnecessary generation of hazardous and/or mixed waste. Decontamination activities were planned and executed to minimize the volume of rinsate generated.

One drum of IDW was generated during the investigation; it contained the decontamination rinsate from the equipment used at CAS 03-09-02.

A.8.2 IDW Waste Streams

Investigation-derived waste generated during the investigation was segregated into the following waste streams:

- Disposable PPE and sampling equipment
- Decontamination rinsate
- Debris including, but not limited to: plastic sheeting, glass/plastic sample jars, PPE, soil, sampling scoops, aluminum foil, and bowls

Sanitary industrial waste was inspected and disposed of in designated sanitary industrial waste bins located at Building 23-153 and allocated for disposal at the NTS industrial waste landfill.

A.8.3 Waste Characterization

The IDW waste streams were characterized as sanitary waste based on process knowledge, site environmental samples, and direct samples of the waste. The characterization and disposition was based on federal and state regulations, permit limitations, and acceptance criteria.

A.8.4 Waste Disposal

The rinsate waste stream was solidified and shipped to the Area 9 U10c Landfill. The cellar liquids and cellar sediment have been evaluated for potential release considerations and were not PSM.

A.8.5 Potential Remediation Wastes

Table A.8-1 presents a summary of the estimated volumes, characterizations, and disposition pathways of these potential waste streams for each applicable CAS.

Table A.8-1
CAU 234 Projected Waste Inventory and Preliminary Disposal Recommendation Summary

CAS	Waste Item	Volume Capacity	Process Knowledge	Analytical Suite	Landfill Limits	NTS POC	Lagoon Criteria	Recommended Disposal Pathway
02-09-48	Rusted drum	55 gal	N/A	Sanitary[a, b]	Meets	Meets	N/A	Area 9 U10c Landfill[a]
03-09-02	Decontamination rinsate	5 gal	N/A	Sanitary[b]	N/A	Meets	Meets	Area 23 Lagoon[b]
	Four pieces of loose empty metal; PVC pipe section	N/A	N/A	N/A	Meets	Meets	N/A	Area 9 U10c Landfill[a]
		N/A	N/A	N/A	Meets	Meets	N/A	Area 9 U10c Landfill[a]
12-09-01	Metal cylinder, metal pipe	Cylinder - 45 ft^3 Pipe - 20 ft in length	N/A	Sanitary[a,b]	Meets	Meets	N/A	Area 9 U10c Landfill[a]
	Glass and metal trash from inside the cylinder	N/A	N/A	N/A	Meets	Meets	N/A	Area 9 U10c Landfill[a]
12-09-08	Crushed drums, metal pipe	Drums - 30-gal Pipe - 4 ft in length	N/A	Sanitary[a,b]	Meets	Meets	N/A	Area 9 U10c Landfill[a]
	Drum	55 gal	N/A	Sanitary[a,b]	Meets	Meets	N/A	Area 9 U10c Landfill[a]
	Rusted drum	Unknown	N/A	N/A	Meets	Meets	N/A	Area 9 U10c Landfill[a]
	Motor vehicle exhaust pipe	Unknown	N/A	N/A	Meets	Meets	N/A	Area 9 U10c Landfill[a]

[a]Analytical results of surrounding soil was used to characterize the waste items in addition to radiological screening to meet landfill acceptance criteria.
[b]Full analytical suite consists of the following analyses: Total VOCs, Total SVOCs, PCBs, RCRA Metals, TPH-DRO, and radiological (gamma, isotopic uranium, isotopic plutonium, and strontium-90).

DRO = Diesel-range organics
ft = Foot
ft^3 = Cubic foot
gal = Gallon
N/A = Not applicable
PCB = Polychlorinated biphenyl
POC = Performance objective criteria
PVC = Polyvinyl chloride
RCRA = *Resource Conservation and Recovery Act*
SVOC = Semivolatile organic compound
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compound

A.9.0 Quality Assurance

This section contains a summary of QA/QC measures implemented during the sampling and analysis activities conducted in support of the CAU 234 CAI. The following sections discuss the data validation process, QC samples, and nonconformances. A detailed evaluation of the DQIs is presented in Appendix B.

Laboratory analyses were conducted for samples used in the decision-making process to provide a quantitative measurement of any COPCs present. Rigorous QA/QC was implemented for all laboratory samples including documentation, verification and validation of analytical results, and affirmation of DQI requirements related to laboratory analysis. Detailed information regarding the QA program is contained in the Industrial Sites QAPP (NNSA/NV, 2002).

A.9.1 Data Validation

Data validation was performed in accordance with the Industrial Sites QAPP and approved protocols and procedures. All laboratory data from samples collected and analyzed for CAU 234 were evaluated for data quality in a tiered process and are presented in Sections A.9.1.1 through A.9.1.3. Data were reviewed to ensure that samples were appropriately processed and analyzed, and the results were evaluated using validation criteria. Documentation of the data qualifications resulting from these reviews is retained in project files as a hard copy and electronic media.

One hundred percent of the data analyzed as part of this investigation were subjected to Tier I and Tier II evaluations. A Tier III evaluation was performed on 10 percent of the data analyzed.

A.9.1.1 Tier I Evaluation

Tier I evaluation for chemical and radiochemical analysis examines, but is not limited to:

- Sample count/type consistent with chain of custody.
- Analysis count/type consistent with chain of custody.
- Correct sample matrix.
- Significant problems and/or nonconformances stated in cover letter or case narrative.
- Completeness of certificates of analysis.
- Completeness of Contract Laboratory Program (CLP) or CLP-like packages.

- Completeness of signatures, dates, and times on chain of custody.
- Condition-upon-receipt variance form included.
- Requested analyses performed on all samples.
- Date received/analyzed given for each sample.
- Correct concentration units indicated.
- Electronic data transfer supplied.
- Results reported for field and laboratory QC samples.
- Whether or not the deliverable met the overall objectives of the project.

A.9.1.2 Tier II Evaluation

Tier II evaluation for chemical analysis examines, but is not limited to:

- Correct detection limits achieved.
- Sample date, preparation date, and analysis date for each sample.
- Holding time criteria met.
- Quality control batch association for each sample.
- Cooler temperature upon receipt.
- Sample pH for aqueous samples, as required.
- Detection limits properly adjusted for dilution, as required.
- Blank contamination evaluated and applied to sample results/qualifiers.
- Matrix spike/MSD percent recoveries (%R) and relative percent differences (RPDs) evaluated and qualifiers applied to laboratory results, as necessary.
- Field duplicate RPDs evaluated using professional judgment and qualifiers applied to laboratory results, as necessary.
- Laboratory duplicate RPDs evaluated and qualifiers applied to laboratory results, as necessary.
- Surrogate %R evaluated and qualifiers applied to laboratory results, as necessary.
- Laboratory control sample (LCS) %R evaluated and qualifiers applied to laboratory results, as necessary.
- Initial and continuing calibration evaluated and qualifiers applied to laboratory results, as necessary.
- Internal standard evaluation.
- Mass spectrometer tuning criteria.
- Organic compound quantitation.

- Inductively coupled plasma interference check sample evaluation.
- Graphite furnace atomic absorption QC.
- Inductively coupled plasma serial dilution effects.
- Recalculation of 10 percent of laboratory results from raw data.

Tier II evaluation for radiochemical analysis examines, but is not limited to:

- Correct detection limits achieved.
- Blank contamination evaluated and, if significant, qualifiers are applied to sample results.
- Certificate of Analysis consistent with data package documentation.
- Quality control sample results (duplicates, LCSs, laboratory blanks) evaluated and used to determine laboratory result qualifiers.
- Sample results, uncertainty, and MDC evaluated.
- Detector system calibrated with National Institute of Standards and Technology (NIST)-traceable sources.
- Calibration sources preparation was documented, demonstrating proper preparation and appropriateness for sample matrix, emission energies, and concentrations.
- Detector system response to daily or weekly background and calibration checks for peak energy, peak centroid, peak full-width half-maximum, and peak efficiency, depending on the detection system.
- Tracers NIST-traceable, appropriate for the analysis performed, and recoveries that met QC requirements.
- Documentation of all QC sample preparation complete and properly performed.
- Spectra lines, photon emissions, particle energies, peak areas, and background peak areas support the identified radionuclide and its concentration.

A.9.1.3 Tier III Evaluation

The Tier III review is an independent examination of the Tier II evaluation. A Tier III review of 10 percent of the sample analytical data was performed by TLI Solutions, of Golden, Colorado.

Tier II and Tier III results were compared and where differences were noted, data were reviewed and did not result in any changes to the data. This review included the following additional evaluations:

Review of:

- Case narrative, chain of custody, and sample receipt forms
- Lab qualifiers (applied appropriately)
- Method of analyses performed as dictated by the chain of custody
- Raw data, including chromatograms, instrument printouts, preparation logs, and analytical logs
- Manual integrations to determine whether the instrument response is appropriate
- Data package for completeness

Determine sample results qualifiers through the evaluation of (but not limited to):

- Tracers and QC sample results (e.g., duplicates, LCSs, blanks, MSs) evaluated and used to determine sample results qualifiers
- Sample preservation, sample preparation/extraction and run logs, sample storage, and holding time
- Instrument and detector tuning
- Initial and continuing calibrations
- Calibration verification (initial, continuing, second source)
- Retention times
- Second column and/or second detector confirmation
- Mass spectra interpretation
- Interference check samples and serial dilutions
- Post-digestion spikes and method of standard additions
- Breakdown evaluations

Calculation checks of:

- At least one analyte per QC sample checked for its recovery
- At least one analyte per initial calibration curve, continuing calibration verification, and second source recovery
- At least one analyte per sample that contains positive results (hits). Radiochemical results only require calculation checks on activity concentrations (not error)

There is also verification that the target compound detects identified in the raw data are reported on the results form. There is also a document of any anomalies found during the review for the laboratory to clarify or rectify. The contractor is notified of any anomalies found.

A.9.2 Field Quality Control Samples

Field QC samples consisted of nine trip blanks, one equipment rinsate blank, four field blanks, one source blank, five MS/MSDs, and five FDs collected and submitted for analysis by the laboratory analytical methods shown in Table A.2-2. The QC samples were assigned individual sample numbers and sent to the laboratory "blind." Additional samples were selected by the laboratory to be analyzed as laboratory duplicates.

During the CAI, five FDs were sent as blind samples to the laboratory to be analyzed for the investigation parameters listed in Table A.2-2. For these samples, the duplicate results precision (i.e., RPDs between the environmental sample results and their corresponding FD sample results) were evaluated. All duplicate precision targets were met.

A.9.2.1 Laboratory Quality Control Samples

Analyses of preparation (PB) blanks were performed on each sample delivery group (SDG) for inorganics. Analysis for surrogate spikes and method blanks (MBs) were performed on each SDG for organics only. Initial and continuing calibration and LCSs were performed for each SDG. The results of these analyses were used to qualify associated environmental sample results. Documentation of data qualifications resulting from the application of these guidelines is retained in project files as both hard copy and electronic media.

The laboratory included a PB, LCS, and laboratory duplicate sample with each batch of field samples analyzed for radionuclides.

A.9.3 Field Nonconformances

There were no field nonconformances identified for the CAI.

A.9.4 Laboratory Nonconformances

Laboratory nonconformances are generally due to inconsistencies in the analytical instrumentation operation, sample preparations, extractions, missed holding times, and fluctuations in internal standard and calibration results. Five nonconformances were issued by the laboratory. These laboratory nonconformances were accounted for and resolved during the data validation and qualification process.

A.10.0 Summary

Organic, inorganics, and radionuclide contaminants detected in environmental samples during the CAI were evaluated against FALs to determine the nature and extent of COCs for CAU 234. Assessment of the data generated from investigation activities indicates no FALs were exceeded for any of the COPCs within the CASs of CAU 234.

A.11.0 References

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Appendix B

Data Assessment

B.1.0 Data Assessment

The DQA process is the scientific evaluation of the actual investigation results to determine whether the DQO criteria established in the CAU 234 CAIP (NNSA/NSO, 2007) were met and whether DQO decisions can be resolved at the desired level of confidence. The DQO process ensures that the right type, quality, and quantity of data will be available to support the resolution of those decisions at an appropriate level of confidence. Using both the DQO and DQA processes helps to ensure that DQO decisions are sound and defensible.

The DQA involves five steps that begin with a review of the DQOs and end with an answer to the DQO decisions. The five steps are briefly summarized as follows:

Step 1: Review DQOs and Sampling Design – Review the DQO process to provide context for analyzing the data. State the primary statistical hypotheses; confirm the limits on decision errors for committing false negative (Type I) or false positive (Type II) decision errors; and review any special features, potential problems, or deviations to the sampling design.

Step 2: Conduct a Preliminary Data Review – Perform a preliminary data review by reviewing QA reports and inspecting the data both numerically and graphically, validating and verifying the data to ensure that the measurement systems performed in accordance with the criteria specified, and using the validated dataset to determine whether the quality of the data is satisfactory.

Step 3: Select the Test – Select the test based on the population of interest, population parameter, and hypotheses. Identify the key underlying assumptions that could cause a change in one of the DQO decisions.

Step 4: Verify the Assumptions – Perform tests of assumptions. If data are missing or are censored, determine the impact on DQO decision error.

Step 5: Draw Conclusions from the Data – Perform the calculations required for the test.

B.1.1 Review DQOs and Sampling Design

This section contains a review of the DQO process presented in Appendix A of the CAU 234 CAIP (NNSA/NSO, 2007). The DQO decisions are presented with the DQO provisions to limit false negative or false positive decision errors. Special features, potential problems, or any deviations to the sampling design are also presented.

B.1.1.1 Decision I

The Decision I statement as presented in the CAU 234 CAIP is: "Is any COC present within the CAS?" (NNSA/NSO, 2007).

Decision I Rules:

- If the population parameter of any COPC in a target population exceeds the FAL for that COPC, then that COPC is identified as a COC.
- If a COC is detected, then the Decision II statement must be resolved.
- If COCs are not identified, then the investigation is complete.

B.1.1.1.1 DQO Provisions To Limit False Negative Decision Error

A false negative decision error (where consequences are more severe) was controlled by meeting the following criteria:

1. Having a high degree of confidence that locations selected will identify COCs if present anywhere within the CAS.
2. Having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples at an acceptable level of sensitivity.
3. Having a high degree of confidence that the dataset is of sufficient quality and completeness.

Criterion 1:

The following methods (stipulated in the CAU 234 DQOs [NNSA/NSO, 2007]) were used in selecting sample locations.

1. Selection of sampling locations associated with surface and subsurface staining, odors, presence of debris, and other items was accomplished by visual field observations.

2. Selection of sampling locations associated with professional judgment based on acceptable knowledge was accomplished by:

    - Source and location of release
    - Chemical nature and fate properties
    - Physical transport pathways and properties
    - Transport drivers

Criterion 2:

All samples were analyzed using the analytical methods listed in Table 3-3 of the CAIP and for the chemical and radiological constituents listed in Section 3.2 of the CAIP (NNSA/NSO, 2007). Table B.1-1 provides a reconciliation of samples analyzed to the planned analytical program.

Table B.1-1
CAU 234 Analyses Performed

CAS	Total VOCs	Total SVOCs	PCBs	Metals	TPH-DRO	Gamma Spectroscopy	Isotopic Uranium	Isotopic Plutonium	Strontium-90
02-09-48	RS	RS	RS	RS	RS	RS	RS	RS	RS
03-09-02	RS	RS	RS	RS	RS	RS	RS	RS	RS
12-09-01	RS	RS	RS	RS	RS	RS	RS	RS	RS
12-09-08	RS	RS	RS	RS	RS	RS	RS	RS	RS
12-30-14	RS	RS	RS	RS	RS	RS	RS	RS	RS

DRO = Diesel-range organics
PCB = Polychlorinated biphenyl
SVOC = Semivolatile organic compound
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compound

RS = Required and submitted

Samples were submitted for all of the analytical methods specified in the analytical program specified in Section 3.2 of the CAIP (NNSA/NSO, 2007).

Sample results were assessed against the acceptance criterion for the DQI of sensitivity as defined in the Industrial Sites QAPP (NNSA/NV, 2002). The sensitivity acceptance criterion defined in the

CAIP is that analytical detection limits will be less than the corresponding action level (NNSA/NSO, 2007). This criterion was achieved for the analytical results for CAU 234.

Criterion 3:

To satisfy the third criterion, the entire dataset, as well as individual sample results, were assessed against the acceptance criteria for the DQIs of precision, accuracy, comparability, completeness, and representativeness, as defined in the Industrial Sites QAPP (NNSA/NV, 2002). The DQI acceptance criteria are presented in Table 6-1 of the CAIP (NNSA/NSO, 2007).

Precision

Precision was evaluated as described in Section 6.2 of the CAIP (NNSA/NSO, 2007). While three samples were qualified for lead and one for Pu-239/240 duplicate precision for the laboratory QC sample, the 80 percent acceptance criteria was met (Table B.1-2).

Table B.1-2
Precision Qualifications for CAU 234

Constituent	CAS Number	Analysis	Samples Qualified	Total Measurements	Percent Acceptable
Lead	7439-92-1	METALS	3	32	90.6
Plutonium-239/240	15117-48-3	PLUTONIUM	1	32	96.9

Sensitivity

Sensitivity was evaluated as described in Section 6.2 of the CAIP (NNSA/NSO, 2007). The dataset is acceptable for the DQI sensitivity.

Accuracy

Accuracy was evaluated as described in Section 6.2 of the CAIP (NNSA/NSO, 2007). Table B.1-3 provides the chemical accuracy analysis results for all constituents qualified for accuracy. Accuracy rates are above the CAIP criterion of 80 percent. There were no radiological data qualified for accuracy.

Table B.1-3
Accuracy Measurements for CAU 234

Constituent	CAS Number	User Test Panel	Number of Measurements Qualified	Number of Measurements Performed	Percent within Criteria
Benzene	71-43-2	EPA 8260C	1	32	96.9
Toluene	108-88-3	EPA 8260C	1	32	96.9
Chlorobenzene	108-90-7	EPA 8260C	2	32	93.8
Lead	7439-92-1	EPA 6010B	3	32	90.6

CAS = Chemical Abstract Service
EPA = Environmental Protection Agency, SW-846 methods (EPA, 1999 and 2002)

Representativeness

The DQO process as identified in Appendix A of the CAU 234 CAIP (NNSA/NSO, 2007) was used to address sampling and analytical requirements for CAU 234. During this process, appropriate locations were selected that enabled the samples collected to be representative of the population parameters identified in the DQO (the most likely locations to contain contamination and locations that bound COCs). The sampling locations identified in the Criterion 1 discussion meet this criterion. Therefore, the analytical data acquired during the CAU 234 CAI are considered representative of the population parameters.

Comparability

Field sampling, as described in the CAU 234 CAIP (NNSA/NSO, 2007), was performed and documented in accordance with approved procedures that are comparable to standard industry practices. Approved analytical methods and procedures per DOE were used to analyze, report, and validate the data. These are comparable to other methods used not only in industry and government practices, but most importantly are comparable to other investigations conducted for the NTS. Therefore, project datasets are considered comparable to other datasets generated using these same standardized DOE procedures, thereby meeting DQO requirements.

Also, standard, approved field and analytical methods ensured that data were appropriate for comparison to the investigation action levels specified in the CAIP.

Completeness

The CAU 234 CAIP (NNSA/NSO, 2007) defines acceptable criteria for completeness to be that the dataset is sufficiently complete to be able to make the DQO decisions. This is initially evaluated as 80 percent of CAS-specific non-critical analytes identified in the CAIP having valid results and 100 percent of critical analytes (including Decision II samples) having valid results. No critical analytes were identified for CAU 234.

Rejected data (either qualified as rejected or data that failed the criterion of sensitivity) are not used in the resolution of DQO decisions and are not counted toward meeting the completeness acceptance criterion. However, no data were rejected in the analyses for CAU 234. All data are within acceptable criteria.

B.1.1.1.2 DQO Provisions To Limit False Positive Decision Error

The false positive decision error was controlled by assessing the potential for false positive analytical results. Quality assurance/QC samples such as field blanks, trip blanks, LCSs, and MBs were used to determine whether a false positive analytical result may have occurred. This provision is evaluated during the validation process where appropriate qualifications are applied.

Proper decontamination of sampling equipment and the use of certified clean sampling equipment and containers also minimized the potential for cross contamination that could lead to a false positive analytical result.

B.1.1.2 Decision II

Decision II as presented in the CAU 234 CAIP is: "If a COC is present, is sufficient information available to evaluate appropriate corrective action alternatives?" (NNSA/NSO, 2007). Sufficient information is defined to include:

- Identifying the volume of media containing any COC bounded by analytical sample results in lateral and vertical directions.
- The information needed to determine potential remedial waste types.

Sample results for samples collected at the CASs of CAU 234 confirmed the absence of COCs. Therefore, no remediation is necessary, and no alternatives need be considered.

B.1.1.3 Sampling Design

The CAIP (NNSA/NSO, 2007) made the following commitments for sampling:

All samples collected were based on judgmental design. All biased locations will have soil samples collected beneath and/or adjacent to the items of interest to identify releases of contaminants and investigate the integrity of any formally enclosed items (e.g., drums, pipes). For CAS 03-09-02, samples were collected from the true low points within each mud pit feature as being representative of the location of the potential highest concentration of contaminants.

Result: All samples were collected at each CAS by hand excavation and soil samples were collected adjacent to and from beneath the required components such as the base of drums, pipes, and cylindrical debris. Corrective Action Site 12-30-14 samples of liquid and sediment were collected to evaluate PSM.

B.1.2 Conduct a Preliminary Data Review

A preliminary data review was conducted by reviewing QA reports and inspecting the data. The contract analytical laboratories generate a QA non-conformance report when data quality does not meet contractual requirements. All data received from the analytical laboratories met contractual requirements, and a QA non-conformance report was not generated. Data were validated and verified to ensure that the measurement systems performed in accordance with the criteria specified. The validated dataset quality was found to be satisfactory.

B.1.3 Select the Test and Identify Key Assumptions

The test for making DQO Decision I was the comparison of the maximum analyte result from each CAS to the corresponding FAL. The test for making DQO Decision II was the comparison of all COC analyte results from each bounding sample to the corresponding FALs.

The key assumptions that could impact a DQO decision are listed in Table B.1-4.

Table B.1-4
Key Assumptions

Exposure Scenario	Site workers are only exposed to contaminants of concern (COCs) through oral ingestion, inhalation, external exposure to radiation, or dermal contact (by absorption) of COCs absorbed onto the soils. Exposure to contamination is limited to industrial site workers, construction/remediation workers, and military personnel conducting training.
Affected Media	Surface soil, shallow subsurface soil, and potentially perched (shallow) groundwater. Deep groundwater contamination is not a concern. Contaminants migrating to regional aquifers are not considered.
Location of Contamination/Release Points	The area of contamination is contiguous. The extent of COC concentration decreases away from the area of contamination.
Transport Mechanisms	Surface transport may occur as a result of a spill or stormwater runoff. Surface transport beyond shallow substrate is not a concern.
Preferential Pathways	None.
Lateral and Vertical Extent of Contamination	Subsurface contamination, if present, is contiguous and decreases with distance and depth from the source. Surface contamination may occur laterally as a result of a spill or stormwater runoff.
Groundwater Impacts	None.
Future Land Use	Nonresidential.
Other Data Quality Objective Assumptions	None.

B.1.4 Verify the Assumptions

The results of the investigation support the key assumptions identified in the CAU 234 DQOs and Table B.1-4.

All data collected during the CAI did not invalidate the CSMs presented in the CAIP (NNSA/NSO, 2007), nor did they necessitate revisions to the CSMs.

B.1.4.1 Other DQO Commitments

The CAIP (NNSA/NSO, 2007) made the following commitments for sampling:

1. Decision II sampling will consist of defining the extent of contamination where COCs have been confirmed at the Decision I locations. If COCs extend beyond Decision I locations, then additional Decision II samples will be collected from sample locations in the direction outward and potentially in the inferred downgradient direction should the contamination be subsurface. The Decision II samples will be located at an adequate distance from the original sample location and be advanced to provide samples and to profile COC concentrations through the upper and

lower boundaries of detectable contamination. A clean sample (i.e., COCs are less than PALs) collected from the Decision I and II sampling will define the vertical extent of contamination at the respective locations. A minimum of one analytical result less than the PAL from the vertical direction will be required to define the depth of COC contamination, and the lateral extent of contamination may be defined by sample analysis or based on modeling. The contamination boundaries may need to be extrapolated to give an overall view of the lateral and vertical extent of COC concentrations at the site.

Result: No decision II samples were required to be collected at any CAS at CAU 234, as no COCs are present.

B.1.5 Draw Conclusions from the Data

This section resolves the two DQO decisions for each of the CAU 234 CASs.

B.1.5.1 Decision Rules for Decision I

Decision Rule: If the concentration of any COPC in a target population exceeds the FAL for that COPC during the initial investigation, then that COPC is identified as a COC and Decision II sampling will be conducted.

Result: No COCs were identified in any sample from CAU 234.

Decision Rule: If all COPC concentrations are less than the corresponding FALs, then the decision will be no further action.

Result: No COCs were identified in samples collected from all CASs in CAU 234. No further action was identified as the corrective action for these CASs.

B.1.5.2 Decision Rules for Decision II

Decision Rule: If the observed concentration of any COC in a Decision II sample exceeds the FALs, then additional samples will be collected to complete the determination of the extent.

Result: Samples to define extent were not necessary as no COPCs were detected above their respective FALs during Decision I sampling.

Decision Rule: If all observed COC population parameters are less than the FALs, then the decision will be that the extent of contamination has been defined in the lateral and/or vertical direction.

Result: No Decision II samples were collected from any CAS at CAU 234.

B.2.0 References

EPA, see U.S. Environmental Protection Agency.

NNSA/NSO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office.

NNSA/NV, see U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office.

U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office. 2002. *Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada,* Rev. 3, DOE/NV--372. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2007. *Corrective Action Investigation Plan for Corrective Action Unit 234: Mud Pits, Cellars, and Mud Spills, Nevada Test Site, Nevada*, Rev. 0, DOE/NV--1216. Las Vegas, NV.

U.S. Environmental Protection Agency. 1999. *Contract Laboratory Program National Functional Guidelines for Organic Data Review,* EPA 540/R-99/008.

U.S. Environmental Protection Agency. 2002. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review,* EPA 540/R-01/-008.

Appendix C

Risk Assessment

C.1.0 Risk Assessment

The RBCA process used to establish FALs is described in the *Industrial Sites Project Establishment of Final Action Levels* (NNSA/NSO, 2006). This process conforms with NAC Section 445A.227, which lists the requirements for sites with soil contamination (NAC, 2006a). For the evaluation of corrective actions, NAC Section 445A.22705 (NAC, 2006b) requires the use of ASTM Method E 1739-95 (ASTM, 1995) to "conduct an evaluation of the site, based on the risk it poses to public health and the environment, to determine the necessary remediation standards (i.e., FALs) or to establish that corrective action is not necessary."

The evaluation of the need for corrective action will include the potential for wastes that are present at a site to cause the future contamination of site environmental media if the wastes were to be released. To evaluate the potential for cellar contents (liquid and sediment) to result in the introduction of a COC to the surrounding environmental media, the following conservative assumptions were made:

- The cellar containment would fail at some point and the contents would be released to the surrounding media.
- The resulting concentration of contaminants in the surrounding media would be equal to the concentration of contaminants in the cellar waste.
- Any liquid contaminant in the cellar exceeding the RCRA TC concentration can result in a COC's introduction to the surrounding media.

Sediment containing a contaminant exceeding an equivalent FAL concentration would be considered to be PSM and would require a corrective action. Cellar liquids with contaminant concentrations exceeding an equivalent TC action level would be considered to be PSM and would require a corrective action.

This section contains documentation of the RBCA process used to establish FALs described in the *Industrial Sites Project Establishment of Final Action Levels* (NNSA/NSO, 2006). This process defines three tiers (or levels) to establish FALs used to evaluate DQO decisions:

- Tier I – Sample results from source areas (highest concentrations) compared to RBSLs (i.e., PALs) based on generic (non-site-specific) conditions.

- Tier II – Sample results from exposure points compared to SSTLs calculated using site-specific inputs and Tier I formulas.

- Tier III – Sample results from exposure points compared to SSTLs and points of compliance calculated using chemical fate/transport and probabilistic modeling.

The risk-based corrective action decision process stipulated in the *Industrial Sites Project Establishment of Final Action Levels* (NNSA/NSO, 2006) is summarized in Figure C.1-1.

C.1.1 A. Scenario

Corrective Action Unit 234, Mud Pits, Cellars, and Mud Spills, consists of the following 12 inactive sites within Areas 2, 3, 4, 12, and 15 of the NTS:

- 02-09-48, Area 2 Mud Plant #1
- 02-09-49, Area 2 Mud Plant #2
- 02-99-05, Mud Spill
- 03-09-02, Mud Dump Trenches
- 04-44-02, Mud Spill
- 04-99-02, Mud Spill
- 12-09-01, Mud Pit
- 12-09-04, Mud Pit
- 12-09-08, Mud Pit
- 12-30-14, Cellar
- 12-99-07, Mud Dump
- 15-09-01, Mud Pit

All of the CASs listed above are inactive and abandoned. Only five of the CASs (02-09-48, 03-09-02, 12-09-01, 12-09-08, and 12-30-14) were sampled during the CAI for the reasons described in the CAU 234 CAIP (NNSA/NSO, 2007).

Corrective Action Site 02-09-48 is a drilling mud sump adjacent to Mud Plant #2, and contains drilling mud and a rusted 55-gal drum.

Corrective Action Site 03-09-02 is a set of suction and return mud pits, and is divided into a "northern" and "southern" footprint, divided by a service road that runs between them. The drilling mud at this CAS potentially contained radioactivity from an intercepted underground plume of radioactivity from the Sandreef test, conducted several years before the drilling of the U-3kz emplacement hole.

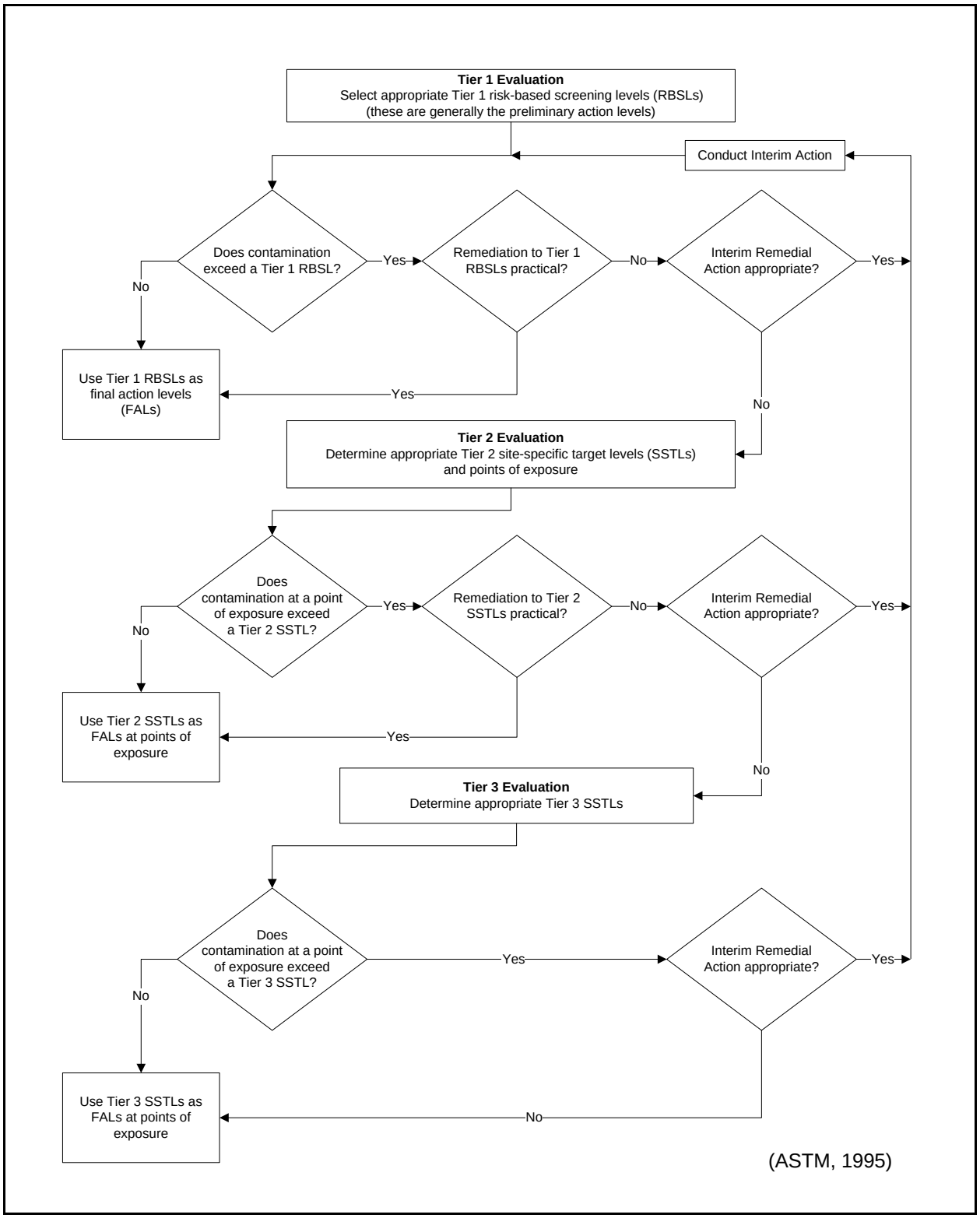

Figure C.1-1
Risk-Based Corrective Action Decision Process

Corrective Active Site 12-09-01 consists of a mud pit and a piece of unconnected loose metal piping lying on the ground surface and a large cylindrical piece of metal debris approximately 4 ft in diameter containing a large-pore grating on one end. It also contains a hole where an access door would have been on one side of the cylinder. These features were located in the same CAS as the mud pit for CAS 12-09-01, but in separate footprints.

Corrective Active Site 12-09-08 consists of a mud pit containing a piece of metal piping protruding from the top of one of the berm walls, and a set of crushed and rusted 55-gal drums lying on the inside of one of the walls of the berm.

Corrective Active Site 12-30-14 is a post-test cellar that is lined from top to bottom with corrugated steel and measures approximately 10 ft in diameter and is approximately 9 ft deep. Liquid is present within the open cellar and varies in depth according to the amount of rainfall/snowmelt that drains from the surrounding sloped area into the cellar.

C.1.2 B. Site Assessment

The CAI at CASs 02-09-48, 03-09-02, 12-09-01, 12-09-08, and 12-30-14 involved visual inspections and soil sampling (sediment and liquid sampling for CAS 12-30-14) adjacent to and/or beneath debris identified as potential sources for contaminant releases. The CAI results indicate that liquid and sediment are present in the cellar; however, the analytical results for the liquid and the underlying sediment indicate no contamination is present for potential release. Analytical results for all other CASs indicate that no COCs are present.

The maximum concentration of contaminants identified at each CAS, and their corresponding PALs, are presented in Tables 2-1 through 2-6.

C.1.3 C. Site Classification and Initial Response Action

The four major site classifications listed in Table 3 of the ASTM Standard are (1) immediate threat to human health, safety, and the environment; (2) short-term (0 to 2 years) threat to human health, safety, and the environment; (3) long-term (greater than 2 years) threat to human health, safety, or the environment; and (4) no demonstrated long-term threats.

Based on the CAI, none of the CASs present an immediate threat to human health, safety, and the environment; therefore, no interim response actions are necessary at these sites. Based on this information, all five CASs are determined to be Classification 4 sites as defined by ASTM Method E 1739-95 (ASTM, 1995) and pose no demonstrated near- or long-term threats.

C.1.4 D. Development of Tier I Lookup Table of Risk-Based Screening Levels

Tier I action levels have been defined as the PALs established during the DQO process. The PALs are a tabulation of chemical-specific (but not site-specific) screening levels based on the type of media (soil) and potential exposure scenarios (industrial). These are very conservative estimates of risk, are preliminary in nature, and are used as action levels for site screening purposes. Although the PALs are not intended to be used as FALs, a FAL may be defined as the Tier I action level (i.e., PAL) value if individual contaminant analytical results are below the corresponding Tier I action level value. The FAL may also be established as the Tier I action level value if individual contaminant analytical results exceed the corresponding Tier I action level value and implementing a corrective action based on the FAL is practical. The PALs are defined as:

- The U.S. Environmental Protection Agency (EPA) Region 9 Risk-Based Preliminary Remediation Goals (PRGs) for Industrial Soils (EPA, 2004).

- Background concentrations for RCRA metals will be evaluated when natural background exceeds the PAL, as is often the case with arsenic. Background is considered the mean plus two times the standard deviation of the mean based on data published in Mineral and Energy Resource Assessment of the Nellis Air Force Range (NBMG, 1998; Moore, 1999).

- The TPH concentrations above the action level of 100 mg/kg per NAC 445A.2272 (NAC, 2006c).

- For COPCs without established PRGs, a protocol similar to EPA Region 9 will be used to establish an action level; otherwise, an established PRG from another EPA region may be chosen.

- The PALs for material, equipment, and structures with residual surface contamination are the allowable total residual surface contamination values for unrestricted release of material and equipment listed in the DOE Order 5400.5 (DOE, 1993), which is also Table 4-2 of the *NV/YMP Radiological Control Manual* (NNSA/NSO, 2004).

- The PALs for radioactive contaminants are based on the National Council on Radiation Protection and Measurements (NCRP) Report No. 129 recommended screening limits for

construction, commercial, industrial land-use scenarios (NCRP, 1999) scaled to 25-millirem-per-year dose constraint (Appenzeller-Wing, 2004) and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993).

The PALs were developed based on an industrial scenario. Because the CAU 234 CASs are not assigned work stations and are considered to be in remote or occasional use areas, the use of industrial reuse based PALs is conservative. The Tier I lookup table is defined as the PAL concentrations or activities defined in the CAIP (NNSA/NSO, 2007).

C.1.5 E. Exposure Pathway Evaluation

The DQOs stated that site workers would only be exposed to COCs through oral ingestion, inhalation, or dermal contact (absorption) due to exposure to potentially contaminated media (i.e., soil) at the CASs. The results of the CAI showed that no COCs are present at CASs within CAU 234. Because no COCs were identified at any of the CASs no potential exposure pathways exist.

C.1.6 F. Comparison of Site Conditions with Tier I Risk-Based Screening Levels

All analytical results from CAU 234 samples were less than corresponding Tier 1 action levels (i.e., RBSLs).

C.1.7 G. Evaluation of Tier I Results

For all contaminants at all CASs, the FALs were established as the Tier 1 RBSLs. It was determined that no further action is required at these CASs.

C.1.8 H. Tier I Remedial Action Evaluation

The corrective action alternative of no further action was implemented based on Tier I RSBL.

C.1.9 I. Tier II Evaluation

Because no analytes were identified in any of the CASs above their respective FALs, no Tier II evaluations are necessary.

C.2.0 Recommendations

As all of the site contaminant concentrations in soils from the analysis of CAU 234 samples were less than the corresponding FALs at all locations, and because the liquid and sediment at CAS 12-30-14 do not pose as PSM, it was determined that there is no significant risk to human health or the environment. No COCs were identified at any of the CASs in CAU 234; therefore, no corrective action is necessary. However, this does not preclude the consideration of these sites for additional protective measures that will be implemented as BMPs.

Based on the analytical results of all samples collected from the investigation of CAU 234, no corrective actions are required.

C.3.0 References

ASTM, see American Society for Testing and Materials.

American Society for Testing and Materials. 1995. *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*, ASTM E 1739-95 (Reapproved 2002). Philadelphia, PA.

Appenzeller-Wing, J., U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2004. Letter to T.A. Maize (NDEP) entitled, "Submittal of Proposed Radiological Preliminary Action Levels (PALs) for the Industrial Sites Project," 15 January. Las Vegas, NV.

DOE, see U.S. Department of Energy.

EPA, see U.S. Environmental Protection Agency.

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

NAC, see *Nevada Administrative Code.*

NBMG, see Nevada Bureau of Mines and Geology.

NCRP, see National Council on Radiation Protection and Measurements.

NNSA/NSO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office.

National Council on Radiation Protection and Measurements. 1999. *Recommended Screening Limits for Contaminated Surface Soil and Review of Factors Relevant to Site-Specific Studies/National Council on Radiation Protection and Measurements*, NCRP Report No. 129. Bethesda, MD.

Nevada Administrative Code. 2006a. NAC 445A.227, "Contamination of Soil: Order by Director for Corrective Action; Factors To Be Considered in Determining Whether Corrective Action Required." Carson City, NV. As accessed at http://www.leg.state.nv.us/nac on 22 January 2008.

Nevada Administrative Code. 2006b. NAC 445A.22705, "Contamination of Soil: Evaluation of Site by Owner or Operator; Review of Evaluation by Division." Carson City, NV. As accessed at http://www.leg.state.nv.us/nac on 22 January 2008.

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U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2006. *Industrial Sites Project Establishment of Final Action Levels,* Rev. 0, DOE/NV--1107. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2007. *Corrective Action Investigation Plan for Corrective Action Unit 234: Mud Pits, Cellars, and Mud Spills, Nevada Test Site, Nevada*, Rev. 0, DOE/NV--1216. Las Vegas, NV.

U.S. Environmental Protection Agency. 2004. *Region 9 Preliminary Remediation Goals (PRGs)*. As accessed at http://www.epa.gov/region09/waste/sfund/prg/index.htm on 22 January 2008.

Appendix D

Closure Activity Summary

D.1.0 Closure Activity Summary

Closure activities were not required at any of the CASs of CAU 234; however, debris was removed as a BMP.

Debris was removed from four of the five CASs sampled during the investigation. Below is a list, by CAS, of the nonhazardous, nonradioactive, and nonhydrocarbon debris identified for removal and disposal (with reference to the associated photographs of the "before" and "after" removal of the debris):

- **CAS 02-09-48**: One partially rusted-out 55-gal empty metal drum that was located within the drilling mud sump, then staged for removal. (Waste Item #234AD1) (Figures D.1-1 and D.1-2).
- **CAS 03-09-02**: Four pieces of loose empty metal and a polyvinyl chloride (PVC) pipe section from the suction pit in the northern footprint of the CAS (Waste Item #234BP1) (Figures D.1-3 and D.1-4).
- **CAS 12-09-01**: One empty metal pipe, approximately 20 ft in length (Waste Item #234CP1), and one metal cylinder, approximately 4 by 8 ft and weighing approximately 250 pounds, that appears to have been converted into a trash incinerator (Waste Item #234CC1) (Figures D.1-5 through D.1-7); glass and metal trash from inside the cylinder (Waste Item #234CT1) (not shown in figures).
- **CAS 12-09-08**: One 4-ft section of empty metal pipe (Waste Item #234DP1), two crushed (empty) 30-gal metal open-top drums (Waste Items #234DD1 and #234DD2), one 55-gal crushed metal closed-top drum (Waste Item #234DD3), one rusted drum (Waste Item #234DD4), one motor vehicle exhaust pipe (Waste Item #234DP2) (Figures D.1-8 through D.1-11).

The debris has been characterized as nonhazardous and nonradioactive and was disposed of in the Area 9 U10c Industrial Landfill. The waste disposal form to document this effort is included as Attachment D-1. Although four separate disposal forms were generated, one for each CAS, all the waste was loaded to and transported in the same vehicle, so acceptance and disposal of all waste was executed on the first disposal document only.

Figure D.1-1
Debris at CAS 02-09-48

Figure D.1-2
Area after Debris Removal at CAS 02-09-48

Figure D.1-3
Debris at CAS 03-09-02

Figure D.1-4
Area after Debris Removal at CAS 03-09-02

Figure D.1-5
Debris at CAS 12-09-01

Figure D.1-6
Area after Pipe Debris Removal at CAS 12-09-01

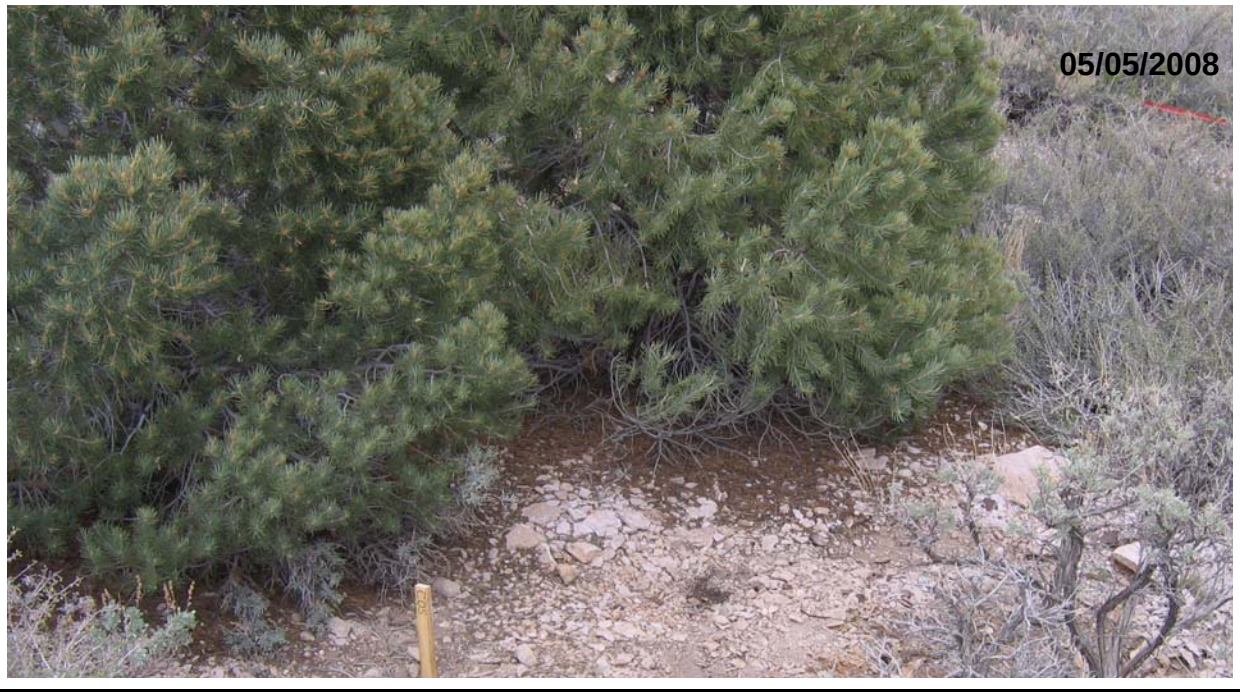

Figure D.1-7
Area after Cylinder Debris Removal at CAS 12-09-01

Figure D.1-8
Debris at CAS 12-09-08

Figure D.1-9
Area after Pipe and Drum Debris Removal at CAS 12-09-08

Figure D.1-10
Debris at CAS 12-09-08

Figure D.1-11
Area after Drum Debris Removal at CAS 12-09-08

Attachment D-1

Load Verification Forms

(1 Page)

NSTec Form FRM-0918

NTS LANDFILL LOAD VERIFICATION

08/23/06 Rev. 0 Page 1 of 2

SWO USE (Select One) AREA ☐ 23 ☐ 6 ☒ 9 ☒ **LANDFILL**

For waste characterization, approval, and/or assistance, contact Solid Waste Operation (SWO) at 5-7898.

REQUIRED: WASTE GENERATOR INFORMATION

(This form is for rolloffs, dump trucks, and other onsite disposal of materials.)

Waste Generator: Rene Robles (SNJV, WO) Phone Number: 5-2100

Location / Origin: CAU 234, CAS 03-09-02, Area 3; 4,pieces of loose empty metal & PVC pipes (WasteID#234BP1)

Waste Category: (check one)		☐ Commercial	☒ Industrial	
Waste Type: (check one)	☐ NTS	☐ Putrescible	☒ FFACO-onsite	☐ WAC Exception
	☐ Non-Putrescible	☐ Asbestos Containing Material	☐ FFACO-offsite	☐ Historic DOE/NV
Pollution Prevention Category: (check one)		☒ Environmental management	☐ Defense Projects	☐ YMP
Pollution Prevention Category: (check one)		☒ Clean-Up	☐ Routine	
Method of Characterization: (check one)		☒ Sampling & Analysis	☒ Process Knowledge	☐ Contents

Prohibited Waste at all three NTS landfills: Radioactive waste; RCRA waste; Hazardous waste; Free liquids, PCBs above TSCA regulatory levels, and Medical wastes (needles, sharps, bloody clothing).

Additional Prohibited Waste at the Area 9 U10C Landfill: Sewage Sludge, Animal carcasses, Wet garbage (food waste); and Friable asbestos

REQUIRED: WASTE CONTENTS ALLOWABLE WASTES

Check all allowable wastes that are contained within this load:

NOTE: Waste disposal at the Area 6 Hydrocarbon Landfill must have come into contact with petroleum hydrocarbons or coolants, such as: gasoline (no benzene, lead); jet fuel; diesel fuel; lubricants and hydraulics; kerosene; asphaltic petroleum hydrocarbon; and ethylene glycol.

Acceptable waste at any NTS landfill:

☐ Asphalt ☒ Metal ☐ Wood ☐ Soil ☐ Paper ☐ Rocks / unaltered geologic materials ☐ Rubber (excluding tires) ☐ Insulation (non-Asbestosform) ☐ Empty containers ☐ Demolition debris ☐ Cement & concrete

☒ Plastic ☐ Wire ☐ Cable ☐ Cloth

☐ Manufactured items: (swamp coolers, furniture, rugs, carpet, electronic components, PPE, etc.)

Additional waste accepted at the Area 23 Mercury Landfill: ☐ Office Waste ☐ Food Waste ☐ Animal Carcasses

☐ Asbestos ☐ Friable ☐ Non-Friable (contact SWO if regulated load) Quantity: _____

Additional waste accepted at the Area 9 U10c Landfill:

☐ Non-friable asbestos ☐ Drained automobiles and military vehicles ☐ Solid fractions from sand/oil/water

☐ Light ballasts (contact SWO) ☐ Drained fuel filters (gas & diesel) ☐ Deconned Underground and Above Ground Tanks

☐ Hydrocarbons (contact SWO) ☐ Other _____

Additional waste accepted at the Area 6 Hydrocarbon Landfill: ☐ _____

☐ Septic sludge ☐ Rags ☐ Drained fuel filters (gas & diesel) ☐ Crushed non-teme plated oil filters

☐ Plants ☐ Soil ☐ Sludge from sand/oil/water separators ☐ PCBs below 50 parts per million

REQUIRED: WASTE GENERATOR SIGNATURE

Initials: _____ **(if initialed, no radiological clearance is necessary.)**

The above mentioned waste was generated outside of a Controlled Waste Management Area (CWMA) and to the best of my knowledge, does not contain radiological materials.

To the best of my knowledge, the waste described above contains only those site. I have verified this through the waste characterization method identified prohibited and allowable waste items. I have contacted Property Management is approved for disposal in the landfill.

Print Name: Joe Mellen

Signature: Joe Mellen Date: 4/1/08

Note: "Food waste, office trash and animal carcasses do not require a radiolog must have signed removal certification statement with Load Verification."

Radiological Survey Release for Waste Disposal

RCT Initials

✓ **This container/load meets the criteria for no added man-made radioactive material**

___ **This container/load meets the criteria for Radcon Manual Table 4.2 release limits.**

___ **This container/load is exempt from survey due to process knowledge and origin.**

SIGNATURE: OP TECH **DATE:** 4/1/08

EN-0648 (10/05)

SWO USE ONLY

Load Weight (net from scale or estimate): 2200 Signature of Certifier: D. Bickford 5/6/08

Appendix E

Sample Location Coordinates

E.1.0 Sample Location Coordinates

Sampling location coordinates for the CAI sampling were determined using a Trimble Geo-XT GPS unit. The CAU 234 Decision I sampling locations are presented with easting and northing coordinates in Figures E.1-1 through E.1-5.

Figure E.1-1
Sample Location Coordinates for CAS 02-09-48

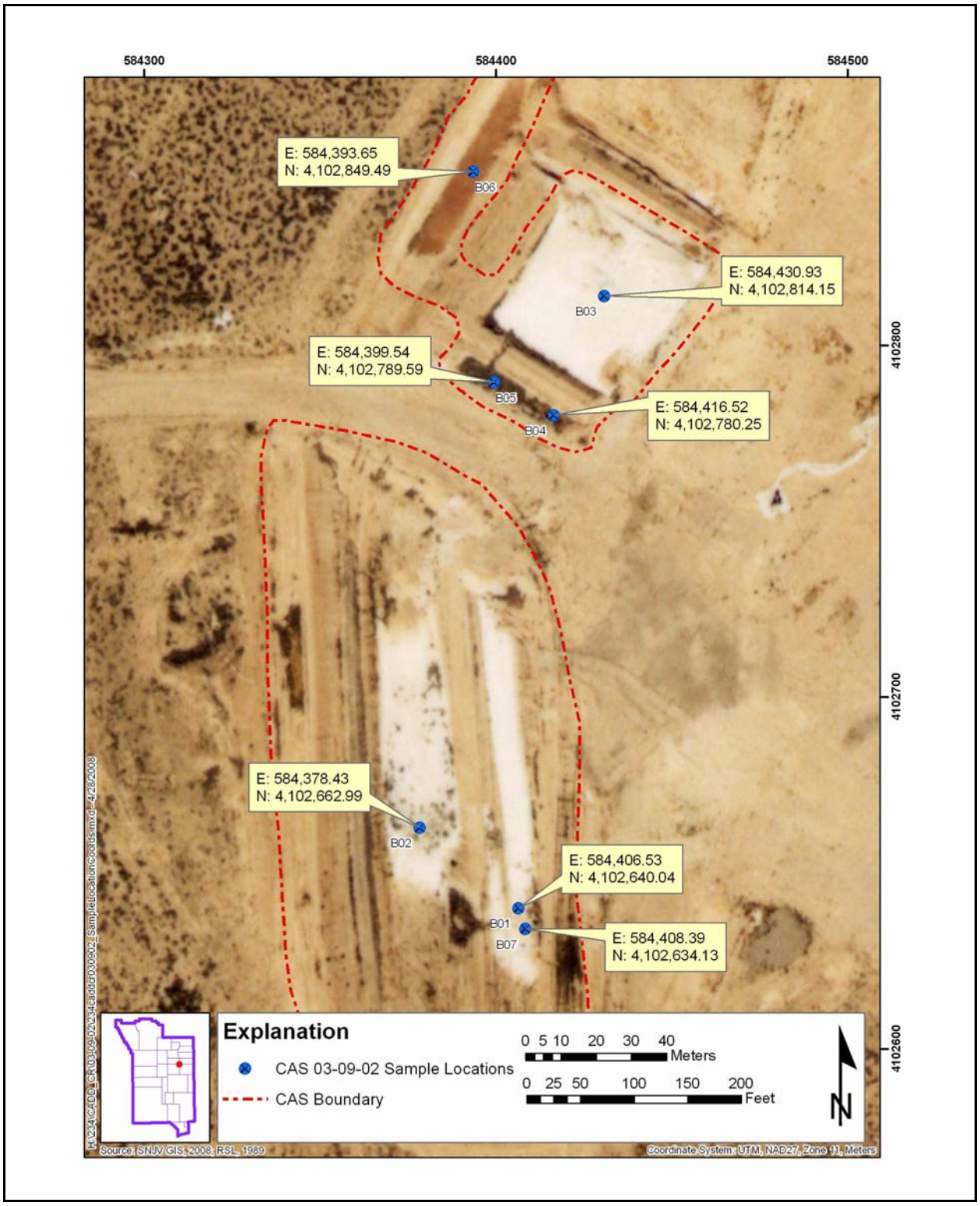

Figure E.1-2
Sample Location Coordinates for CAS 03-09-02

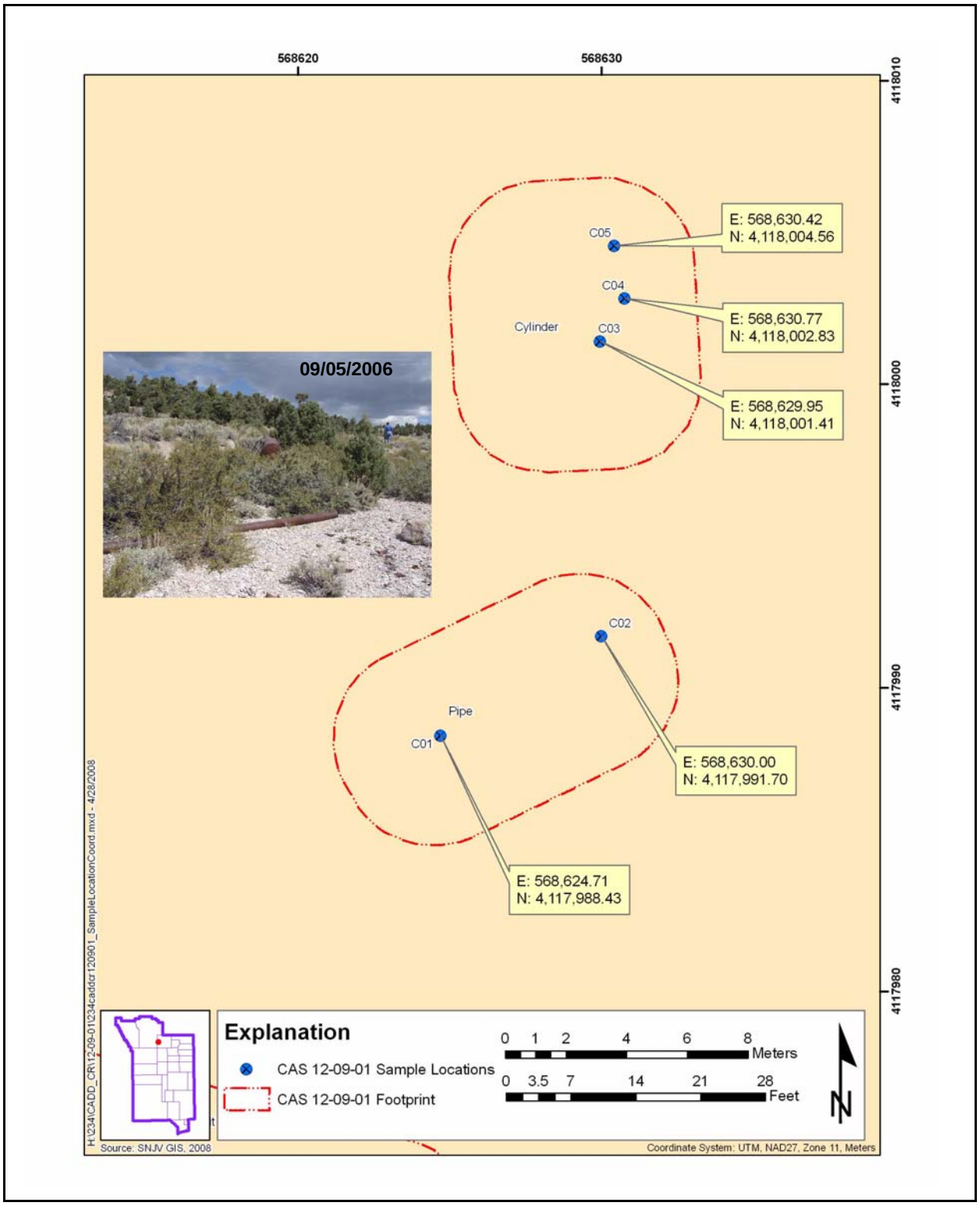

Figure E.1-3
Sample Location Coordinates for CAS-12-09-01

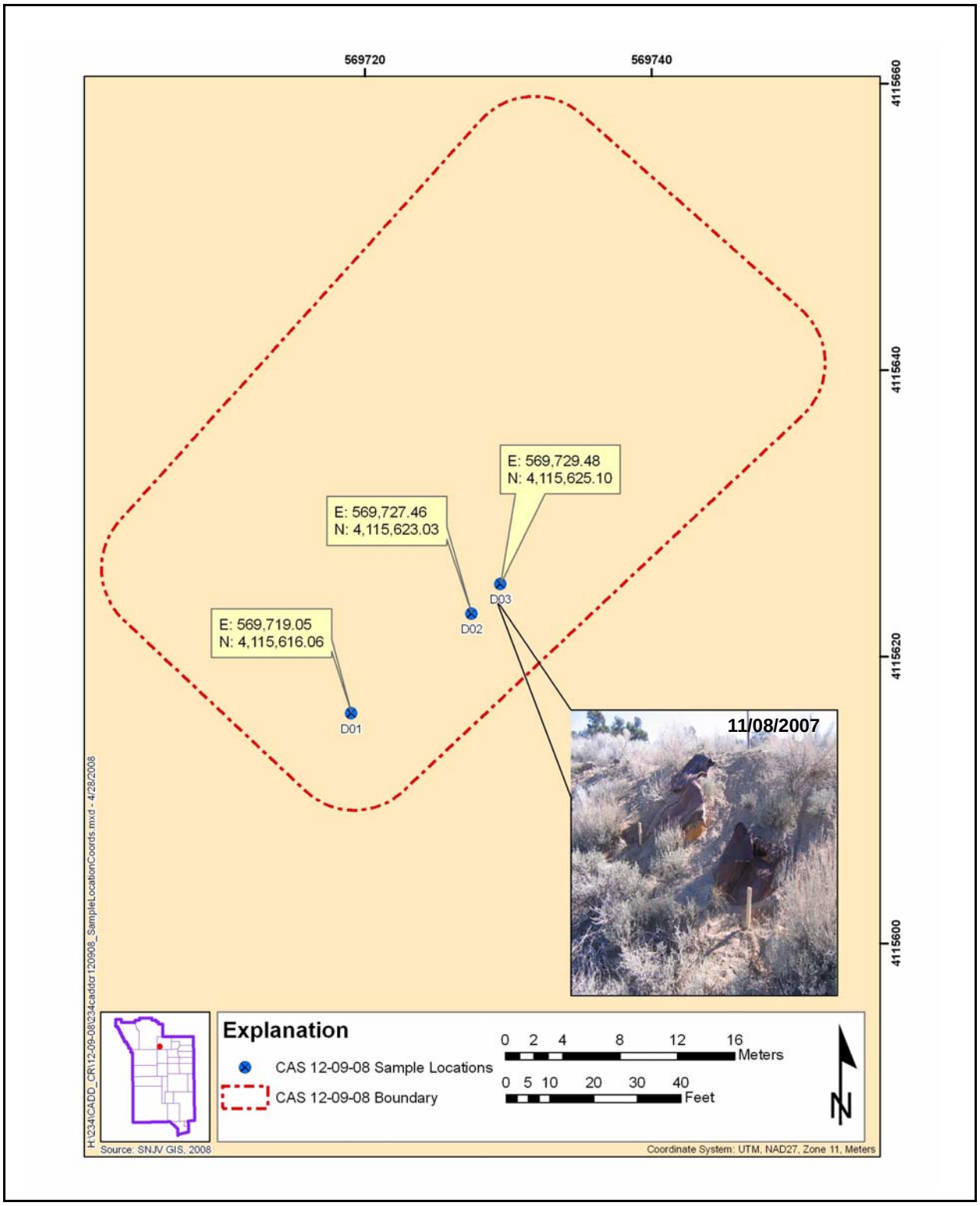

Figure E.1-4
Sample Locations Coordinates for CAS 12-09-08

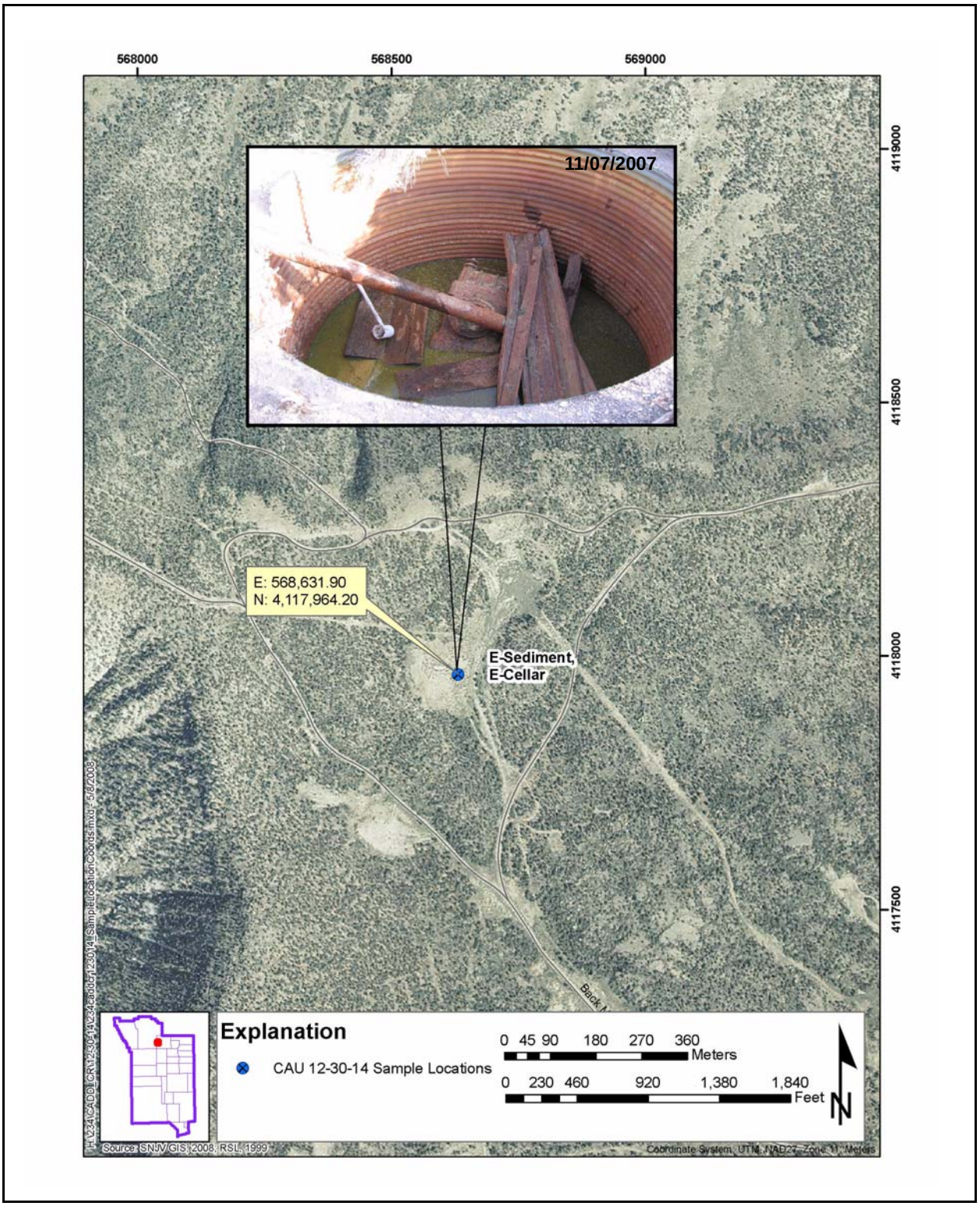

Figure E.1-5
Sample Location Coordinates for CAS 12-30-14

E.2.0 References

RSL, see Remote Sensing Laboratory.

Remote Sensing Laboratory. 1989. Aerial photograph "6612-146." Las Vegas, NV.

Remote Sensing Laboratory. 1993. Aerial photograph "7427-04#2" showing Area 2 mud and crater storage sumps, 1 June. Las Vegas, NV: EG&G Energy Measurements, Inc.

Remote Sensing Laboratory. 1999. Digital Orthophoto Quarter Quads. Las Vegas, NV.

SNJV GIS, see Stoller-Navarro Joint Venture Geographic Information Systems.

Stoller-Navarro Joint Venture Geographic Information Systems. 2008. ESRI ArcGIS Software.

Appendix F

Nevada Division of Environmental Protection Comments

(2 Pages)

ndep
NEVADA DIVISION OF ENVIRONMENTAL PROTECTION
protecting the future for generations

STATE OF NEVADA
Department of Conservation & Natural Resources
DIVISION OF ENVIRONMENTAL PROTECTION

Jim Gibbons, Governor
Allen Biaggi, Director
Leo M. Drozdoff, P.E., Administrator

April 18, 2008

Mr. John B. Jones
Acting Federal Project Director, Environmental Restoration Project
National Nuclear Security Administration
Nevada Site Office
P. O. Box 98518
Las Vegas, NV 89193-8518

RE: Review of the draft Corrective Action Decision Document/Closure Report (CADD/CR) Corrective Action Unit (CAU) 234: Mud Pits, Cellars, and Mud Spills Nevada Test Site, Nevada, Revision 0, Federal Facility Agreement and Consent Order

Dear Mr. Jones:

The Nevada Division of Environmental Protection (NDEP), Bureau of Federal Facilities staff has reviewed the draft Corrective Action Decision Document/Closure Report (CADD/CR) for Corrective Action Unit (CAU) 234: Mud Pits, Cellars, and Mud Spills. After reviewing the summary of investigation activities, sample results, and the submitted analytical data and quality control summaries, NDEP concurs with the proposed corrective action alternative that no further action is required for the 12 sites comprising CAU 234. NDEP does not have any comments regarding the draft CADD/CR. Upon receipt of the final CADD/CR, NDEP will issue a Notice of Completion for the closure of CAU 234.

If you have any questions regarding this matter, please contact me at (702) 486-2850, extension 233 or John Wong at extension 245.

Sincerely,

Jeff MacDougall, Ph. D,
Supervisor,
Bureau of Federal Facilities

THM/JJM/jaw

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