Nevada
Environmental
Restoration
Project

DOE/NV--837-REV 1

Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 358: Areas 18, 19, 20 Cellars/Mud Pits, Nevada Test Site, Nevada

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Revision: 1

February 2003

Environmental Restoration
Division

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

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STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION PLAN FOR CORRECTIVE ACTION UNIT 358: AREAS 18, 19, 20 CELLARS/MUD PITS, NEVADA TEST SITE, NEVADA

Prepared for:
U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office
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ERRATA SHEET

On page 42 of the Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 358: Areas 18, 19, 20 Cellars/Mud Pits, Nevada Test Site, Nevada (DOE/NV--837-Rev 1, 2003) the first sentence of the second paragraph incorrectly states there are five open cellars. There are currently six open cellars within CAU 358, as indicated elsewhere in the plan. The first sentence of the second paragraph on page 42 should read as follows:

"Six of the eight CASs listed above are open cellars that are currently posted as 'Underground Radioactive Material' areas due to the fact that, at each site, a borehole was drilled to access a cavity created by the detonation of a nuclear device."

Per NNSA/NSO April 30, 2003 Letter entitled: SUBMITTAL OF ERRATA SHEET FOR THE STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION PLAN FOR CORRECTIVE ACTION UNIT 358: AREAS 18, 19, 20 CELLARS/MUD PITS, NEVADA TEST SITE, NEVADA, REVISION 1, FEBRUARY 2003.

STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION PLAN FOR CORRECTIVE ACTION UNIT 358: AREAS 18, 19, 20 CELLARS/MUD PITS, NEVADA TEST SITE, NEVADA

Approved by: _____ Date: 2/20/03
Janet L. Appenzeller-Wing, Project Manager
Industrial Sites Project

Approved by: _____ Date: 2/20/03
Runore C. Wycoff, Director
Environmental Restoration Division

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

FIGURES

TABLE OF CONTENTS (continued)

TABLES

APPENDICES

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ACRONYMS AND ABBREVIATIONS

BN	Bechtel Nevada
BOP	Blow Out Preventor
CAS	Corrective Action Site
CAU	Corrective Action Unit
CFR	Code of Federal Regulations
cm	centimeter(s)
CMP	corrugated metal pipe
COC	contaminant(s) of concern
CR	Closure Report
CSM	conceptual site model
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DQI	data quality indicator
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FFACO	Federal Facility Agreement and Consent Order
ft	foot/feet
gal	gallon(s)
GZ	Ground Zero
in	inch(es)
IT	International Technology Corporation
L	liter(s)
LLNL	Lawrence Livermore National Laboratory
m	meter(s)
m^3	cubic meter(s)
mg/kg	milligram(s) per kilogram
mg/L	milligram(s) per liter
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NNSA/NV	U.S. Department of Energy, National Nuclear Security Administrations Nevada Operations Office

ACRONYMS AND ABBREVIATIONS (continued)

NTS	Nevada Test Site
pCi/g	picoCuries per gram
PCB	polychlorinated biphenyls
PPE	personal protective equipment
ppm	parts per million
PRG	preliminary remediation goals
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
RSM	Radiological Safe Marker
SAA	Satellite Accumulation Area
SAFER	Streamlined Approach for Environmental Restoration
SD	standard deviation
SDG	sample delivery group
SVOC	semivolatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
TPH	total petroleum hydrocarbon
µg/kg	microgram(s) per kilogram
µg/L	microgram(s) per liter
UGTA	Underground Test Area
VOC	volatile organic compound
yd^3	cubic yard(s)
yd	yard(s)
%R	percent recovery

EXECUTIVE SUMMARY

This Streamlined Approach for Environmental Restoration Plan provides the details for the closure of Corrective Action Unit (CAU) 358: Areas 18, 19, 20 Cellars/Mud Pits. CAU 358 consists of sites located in Areas 2, 3, 12, 18, 19, and 20 of the Nevada Test Site (NTS) and is currently listed in Appendix III of the Federal Facility Agreement and Consent Order (FFACO, 1996). CAU 358 as currently listed in the FFACO consists of 27 Corrective Action Sites (CASs). Ten of these CASs are located in "Potential Crater Areas" and because of this, pose a potential safety risk to workers performing closure activities at these CASs. For this reason, an FFACO modification requesting that these ten CASs be removed from CAU 358 has been prepared and is pending approval. Upon approval of the modification request, these will be removed from CAU 358 and placed in CAU 544, which is to be closed at a future date. Pending the approval of this FFACO modification, CAU 358 consists of the following 17 CASs:

- CAS 02-99-01, Oil Stained Dirt on Concrete
- CAS 03-22-33, Bucket; Spill; Debris
- CAS 03-99-04, Spill
- CAS 12-30-02, Drill Holes
- CAS 18-09-01, Mud Pit
- CAS 19-09-05, Mud Pit
- CAS 19-09-06, Mud Pit
- CAS 19-09-07, Mud Pit
- CAS 20-09-05, Mud Pit
- CAS 20-09-08, Mud Spill
- CAS 20-23-02, Postshot Cellar
- CAS 20-23-03, Cellar
- CAS 20-23-04, Postshot Cellar
- CAS 20-23-05, Sump (Cellar)
- CAS 20-23-06, Cellar
- CAS 20-37-01, Cellar & Mud Pit
- CAS 20-37-05, Cellar

Pending the approval of the FFACO modification request, the following ten CASs will be removed from CAU 358 and placed into CAU 544: Cellars, Mud Pits, and Oil Spills.

- CAS 19-09-01, Mud Pits (2)
- CAS 19-09-03, Mud Pit
- CAS 19-09-04, Mud Pit
- CAS 20-09-01, Mud Pits (2)
- CAS 20-09-02, Mud Pit
- CAS 20-09-03, Mud Pit
- CAS 20-09-04, Mud Pits (2)
- CAS 20-09-06, Mud Pit
- CAS 20-09-07, Mud Pit
- CAS 20-09-10, Mud Pit

Based on the results of site characterization sampling, process knowledge, waste characterization sampling, and the results of Data Quality Objectives (Appendix A1), closure of CAU 358 will be accomplished by: closing six CASs by taking no further action, closing three CASs by clean closure, and closing eight CASs in place with administrative controls.

The following six CASs will be closed by taking no further action. At these sites, sample results showed no contaminants of concern (COCs) present above action levels.

- CAS 12-30-02, Drill Holes
- CAS 18-09-01, Mud Pit (debris removed as best management practice)
- CAS 19-09-06, Mud Pit
- CAS 19-09-07, Mud Pit
- CAS 20-09-05, Mud Pit
- CAS 20-09-08, Mud Spill

Three CASs will be clean-closed by the removal of impacted soil/material. Sufficient information exists for the following CASs to be clean-closed by excavation/removal and disposal of impacted soil/material:

- CAS 02-99-01, Oil Stained Dirt on Concrete
- CAS 03-22-33, Bucket; Spill; Debris
- CAS 03-99-04, Spill

In addition, debris, broken battery pieces, and associated impacted soil will be removed from CAS 18-09-01 and disposed of appropriately.

Eight CASs will be closed in place with administrative controls, i.e., use restrictions implemented. The only COC present at these sites is total petroleum hydrocarbons as diesel/oil. Six of the eight sites are postshot cellars that are currently open, i.e., not backfilled. These cellars are associated with postshot boreholes that are identified to be plugged and abandoned by the Borehole Management Program. The scope of the Borehole Management Program will also include clearing the cellars of any brush and debris to a degree necessary to expose the top of the wellhead. The casing will then be extended from the cellar to a point above the ground level, thus allowing access to the borehole for plugging in the future. After the casing has been extended, the cellars will be backfilled with native material. The following eight sites will be closed in place with administrative controls:

- CAS 19-09-05, Mud Pit
- CAS 20-23-02, Postshot Cellar
- CAS 20-23-03, Cellar
- CAS 20-23-04, Postshot Cellar
- CAS 20-23-05, Postshot Cellar
- CAS 20-23-06, Cellar
- CAS 20-37-01, Cellar & Mud Pit (Cellar only, the mud pit will be closed by taking no further action.)
- CAS 20-37-05, Cellar

1.0 INTRODUCTION

This Streamlined Approach for Environmental Restoration (SAFER) plan details the activities necessary to close Corrective Action Unit (CAU) 358: Areas 18, 19, 20 Cellars/Mud Pits. CAU 358 consists of sites located in Areas 2, 3, 12, 18, 19, and 20 of the Nevada Test Site (NTS), and is currently listed in Appendix III of the Federal Facility Agreement and Consent Order (FFACO, 1996). CAU 358 as currently listed in the FFACO, consists of 27 Corrective Action Sites (CASs). Ten of these CASs are located in "Potential Crater Areas" and because of this, pose a potential safety risk to workers performing closure activities at these sites. For this reason, a FFACO modification requesting removal of these ten CASs from CAU 358 has been prepared and submitted for approval. Upon approval of the modification request, ten CASs will be removed from CAU 358 and placed in CAU 544, which is to be closed at a future date. Pending the approval of this FFACO modification, CAU 358 consists of the following 17 CASs (Figure 1):

- CAS 02-99-01, Oil Stained Dirt on Concrete
- CAS 03-22-33, Bucket; Spill; Debris
- CAS 03-99-04, Spill
- CAS 12-30-02, Drill Holes
- CAS 18-09-01, Mud Pit
- CAS 19-09-05, Mud Pit
- CAS 19-09-06, Mud Pit
- CAS 19-09-07, Mud Pit
- CAS 20-09-05, Mud Pit
- CAS 20-09-08, Mud Spill
- CAS 20-23-02, Postshot Cellar
- CAS 20-23-03, Cellar
- CAS 20-23-04, Postshot Cellar
- CAS 20-23-05, Sump (Cellar)
- CAS 20-23-06, Cellar
- CAS 20-37-01, Cellar & Mud Pit
- CAS 20-37-05, Cellar

1.1 SAFER PROCESS

CAUs that may be closed using the SAFER process have conceptual corrective actions that are clearly identified. Consequently corrective action alternatives can be chosen prior to the completion of a Corrective Action Investigation given anticipated investigation results.

The SAFER process combines elements of the data quality objectives (DQOs) process and the observational approach to help plan and conduct corrective actions. DQOs are used to identify a problem and define the type and quality of data needed to complete the investigation phase of the process. The purpose of the investigation phase in the SAFER process is to verify the adequacy of existing information to implement the corrective action. The observational approach provides a framework for managing uncertainty and planning decision making.

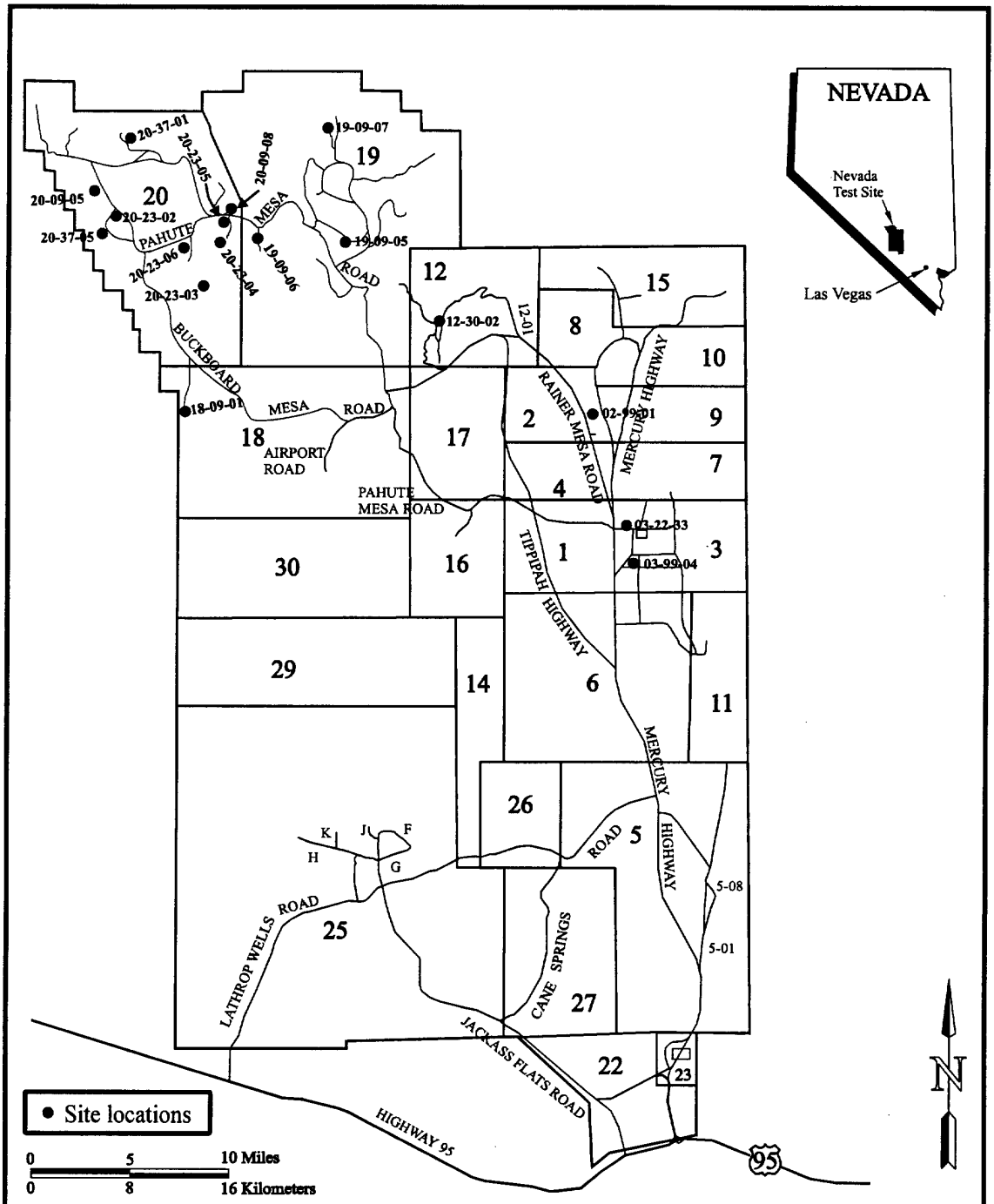

FIGURE 1
CAU 358 SITE LOCATION MAP

Use of the SAFER process allows technical decisions to be made based on incomplete but sufficient information and the experience of the decision maker. Any uncertainties are addressed by documenting assumptions that are verified by sampling and analysis, data evaluation, and onsite observation as planned activities progress, and by contingency plans, as necessary. Remediation and closure may proceed simultaneously with site characterization as sufficient data are gathered to confirm or disprove the assumptions made in selecting the closure method. If at any time during the site closure new information is developed that indicates that the closure method should be revised, the closure activities will be modified to implement the revised closure method.

1.2 SUMMARY OF PROPOSED CORRECTIVE ACTION

Based on the results of site characterization sampling, process knowledge, waste characterization sampling, and the results of Data Quality Objectives (Appendix A1), closure of CAS 358 will be accomplished by: closing six CASs by taking no further action, closing three CASs by removing impacted material, and closing eight CASs in place with administrative controls.

The following six CASs will be closed by taking no further action. At these CASs, sample results showed no evidence of contaminants of concern (COCs) above action levels.

- CAS 12-30-02, Drill Holes
- CAS 18-09-01, Mud Pit (debris removed as best management practice)
- CAS 19-09-06, Mud Pit
- CAS 19-09-07, Mud Pit
- CAS 20-09-05, Mud Pit
- CAS 20-09-08, Mud Spill

In addition, debris, a bucket of suspected pipe dope, broken battery pieces, and associated impacted soil will be removed from CAS 18-09-01 and disposed of appropriately.

Three CASs will be clean-closed by removal of impacted soil/material. Sufficient information exists for the following CASs to be clean-closed by excavation and disposal of impacted soil/material:

- CAS 02-99-01, Oil Stained Dirt on Concrete
- CAS 03-22-33, Bucket; Spill; Debris
- CAS 03-99-04, Spill

Eight CASs will be closed in place with administrative controls, i.e., use restrictions. This closure alternative is supported by the fact that at these sites the only COC present is total petroleum hydrocarbons as diesel/oil. Also, based on an "A through K" risk assessment (Section 445A.227 of the Nevada Administrative Code, [NAC, 2002b]) included in Section 3 of the Data Quality Objectives (Appendix A1) for CAU 358, these sites pose minimal risk to the environment or health of personnel.

Six of these CASs are open cellars that are associated with postshot drill-back activities. In addition to implementing use restrictions as part of the CAU 358 closure, these cellars are scheduled to be closed as part of the Borehole Management Program at a future date. At that time, the cellars will be closed by clearing any brush and debris to a degree necessary to expose the top of the wellhead, extending the casing from the cellar to a point above the surrounding ground surface, thus allowing access to the borehole for plugging in the future, and backfilling the cellar with native material. The Borehole Management Program will obtain approval from Nevada Division of Environmental Protection (NDEP) prior to starting any closure activities at sites with an active use restriction in force. In addition, all current radiological postings that are in place will remain in place after the sites are closed as part of CAU 358. The following eight CASs will be closed in place with administrative controls:

- CAS 19-09-05, Mud Pit
- CAS 20-23-02, Postshot Cellar
- CAS 20-23-03, Cellar
- CAS 20-23-04, Postshot Cellar
- CAS 20-23-05, Postshot Cellar
- CAS 20-23-06, Cellar
- CAS 20-37-01, Cellar & Mud Pit (Cellar only, mud pit closed by no further action.)
- CAS 20-37-05, Cellar

The following ten CASs are located in "Potential Crater Areas" and, pending approval of a FFACO modification request, will be removed from CAU 358 and placed into CAU 544, which will be closed at a later date:

- CAS 19-09-01, Mud Pits (2)
- CAS 19-09-03, Mud Pit
- CAS 19-09-04, Mud Pit
- CAS 20-09-01, Mud Pits (2)
- CAS 20-09-02, Mud Pit
- CAS 20-09-03, Mud Pit
- CAS 20-09-04, Mud Pits (2)
- CAS 20-09-06, Mud Pit
- CAS 20-09-07, Mud Pit
- CAS 20-09-10, Mud Pit

1.3 HOLD/DECISION POINTS

During closure activities, certain conditions affecting the project schedule and budget may require decisions to be made prior to continuing work. Work will be temporarily suspended if any of the following conditions occur:

- Out-of-scope work activities such as the detection of a considerably larger release of any COC than originally planned for, and/or other technical factors requiring the preparation of a Record of Technical Change.

- Unsafe condition or work practice posing a threat to personnel, equipment, or the environment not originally documented in the Site-Specific Health and Safety Plan.

If any of these conditions occur, work will stop and the U.S. Department of Energy (DOE), National Nuclear Security Administration Nevada Site Office (NNSA/NSO) and/or the NDEP will be notified. Work will continue when a resolution has been agreed upon and a Record of Technical Change, if required, has been approved by NNSA/NSO and NDEP.

1.4 SAFER WORK PLAN CONTENTS

This SAFER Work Plan has been developed to support the closure of CAU 358 according to the required FFACO format and includes the following:

- Section 1.0 - Introduction
- Section 2.0 - Unit Description
- Section 3.0 - Field Activities and Closure Objectives
- Section 4.0 - Reports and Records Availability
- Section 5.0 - Investigation/Remediation Waste Management
- Section 6.0 - Quality Assurance/Quality Control
- Section 7.0 - References
- Appendix A1 - Data Quality Objectives
- Appendix A2 - Project Organization
- Appendix A3 - Nevada Environmental Restoration Project Document Review Sheet

This SAFER plan was developed using guidance provided from the following documents:

- Federal Facility Agreement and Consent Order (FFACO, 1996).
- Section 445A.2272 of Nevada Administrative Code (NAC, 2002a).
- Section 445A.227 of Nevada Administrative Code (NAC, 2002b)
- Title 29 Code of Federal Regulations (CFR) 1910.120, Hazardous Waste Operations and Emergency Response (CFR, 2001).
- Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada, Revision 3 (U.S. Department of Energy, National Nuclear Security Administrations Nevada Operations Office [NNSA/NV], 2002).
- U.S. Environmental Protection Agency (EPA) Region IX Preliminary Remediation Goals (PRGs) (EPA, 2002).
- Title 40 CFR 261.24, "Toxicity Characteristic" (EPA, 2001).

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2.0 UNIT DESCRIPTION

CAU 358 is comprised of CASs located in Areas 2, 3, 12, 18, 19, and 20 of the NTS (Figure 1) and the physical settings for these CASs can be described by the following:

- Area 2 and 3 CASs: Area 2 is located on the Yucca Flat, which is a transition region between the Great Basin Desert Region and the Mojave Desert Region. Yucca Flat lies within a highly faulted intermountain basin that is surrounded by upland cenozoic volcanic, mesozoic plutonic, and paleozoic sedimentary rocks. The erosion of upland material fills the basin and has created a layer of alluvium (Lawrence Livermore National Laboratory [LLNL], date unknown). The elevation for the Area 2 site is approximately 1,278 meters (m) (4,193 feet [ft]) and the elevations for the Area 3 sites are approximately 1,181 and 1,217 m (3,875 and 3,993 ft) above mean sea level.

- Area 12 CAS: This site (CAS 12-30-02) is located on the eastern edge of Rainier Mesa, which consists of Tertiary volcanic tuff that is part of the Great Basin Desert Region (USGS, 1990). The site elevation is approximately 2,414 m (7,920 ft) above mean sea level.

- Area 18 CAS: This site (CAS 18-09-01) is located on Buckboard Mesa, which lies within the northeastern part of the Timber Mountain caldera moat in the Great Basin Desert Region (USGS, 1981). The elevation of this area is approximately 1,710 m (5,610 ft) above mean sea level.

- Area 19 and 20 CASs: These sites are located in the eastern part of Pahute Mesa, which is part of the Great Basin Desert Region. Pahute Mesa is a volcanic plateau underlain by tuff and lavas from the Timber Mountain Oasis Valley caldera complex, Silent Canyon and Black Mountain calderas, north of Timber Mountain (DOE/NV, 1996). Average elevation of the known Area 19 sites are approximately 2,087 m (6,847 ft) and average elevation of the known Area 20 sites are approximately 1,779 m (5,837 ft) above mean sea level.

2.1 HISTORY

2.1.1 CAS 02-99-01, Oil Stained Dirt on Concrete

Historical information about CAS 02-99-01 (Figure 2) is limited. The origin of the magnetite material and hydrocarbon spill is unknown. The area south of the concrete pad is covered with asphalt indicating that the former structure (concrete pad) and associated area may have been used as a storage facility.

The site is listed as Oil Stained Dirt on Concrete (FFACO, 1996). International Technology Corporation (IT) Industrial Sites Preliminary Assessment group visited the site in 1998 and 1999 and determined it to be a large pile of magnetite and a hydrocarbon spill on the soil near the concrete pad. The dimensions of the magnetite pile measures approximately 13 by 14 m (42 by 45 ft) with a height of 1.8 m (6 ft). The dimensions of the hydrocarbon spill were measured to be 3.4 by 3 m (11 by 10 ft), with an assumed depth of 0.9 to 1.2 m (3 to 4 ft).

2.1.2 CAS 03-22-33, Bucket; Spill; Debris

CAS 03-22-33 (Figure 3) consists of several small piles of magnetite on soil. The material was determined to be magnetite by its appearance and magnetic properties during a site visit. Historical information about the site is limited and the origin of the magnetite material is unknown. A site visit by IT in 1993 determined that a previously reported bucket had been removed; this was verified during a Bechtel Nevada (BN) site visit on June 8, 2001. The total spill area is approximately 44 by 6.7 m (145 by 22 ft) with an average thickness of 0.3 m (1 ft).

2.1.3 CAS 03-99-04, Spill

CAS 03-99-04 (Figure 4) is an epoxy tar spill to the soil. The origin of the epoxy tar is unknown. However, from process knowledge of other sites containing similar material, it was determined that the spill is epoxy tar. There are several small pieces of epoxy tar spread over a large area and it appears that the soil is not stained. Within this area are small dirt mounds that also contained pieces of the epoxy tar on the ground surface. The spill covers a total area of approximately 38 by 15.2 m (125 by 50 ft).

2.1.4 CAS 12-30-02, Drill Holes

CAS 12-30-02 (Figure 5) consists of a large mound of drill cuttings/fill material covering nine plugged instrumentation drill holes and one plugged exploratory drill hole and miscellaneous housekeeping debris associated with B Tunnel drilling activities. According to the *Underground Test Area Borehole Index* (DOE/NV, 2001b) all the drill holes associated with CAS 12-30-02 are plugged and/or grouted under the mound. The dimensions of the mound are approximately 46 by 26.5 m (151 by 87 ft) with a height of approximately 2.4 m (8 ft). There are two plugged drill hole pipes protruding from the mound that measure approximately 7.6 centimeters (cm) (3 inches [in]) in diameter. No drilling records were identified for these particular drill holes. It is also unknown if the drill cuttings/fill material came from the drilling of these holes or from another location (DOE/NV, 2001a). It is reported that the mound was created to contain leakage of radioactive gases (Butler, 2000).

2.1.5 CAS 18-09-01, Mud Pit

CAS 18-09-01 (Figure 6) consists of a mud pit and housekeeping debris located within the mud pit. The drilling mud is dry and light gray in color covering the bottom of the mud pit. The housekeeping debris consists of a bucket containing an unknown material (possibly pipe dope) and a small area of broken pieces of alkaline batteries. The mud pit measures 36.5 by 21.3 m (120 by 70 ft) with an approximate depth of the drilling mud of 0.3 m (1 ft).

2.1.6 CAS 19-09-05, Mud Pit

CAS 19-09-05 (Figure 7) consists of a mud pit containing light gray drilling mud that is dry and cracked. The mud pit measures 29.5 by 24.6 m (97 by 81 ft) with the maximum depth of the drilling mud at 0.3 m (1 ft).

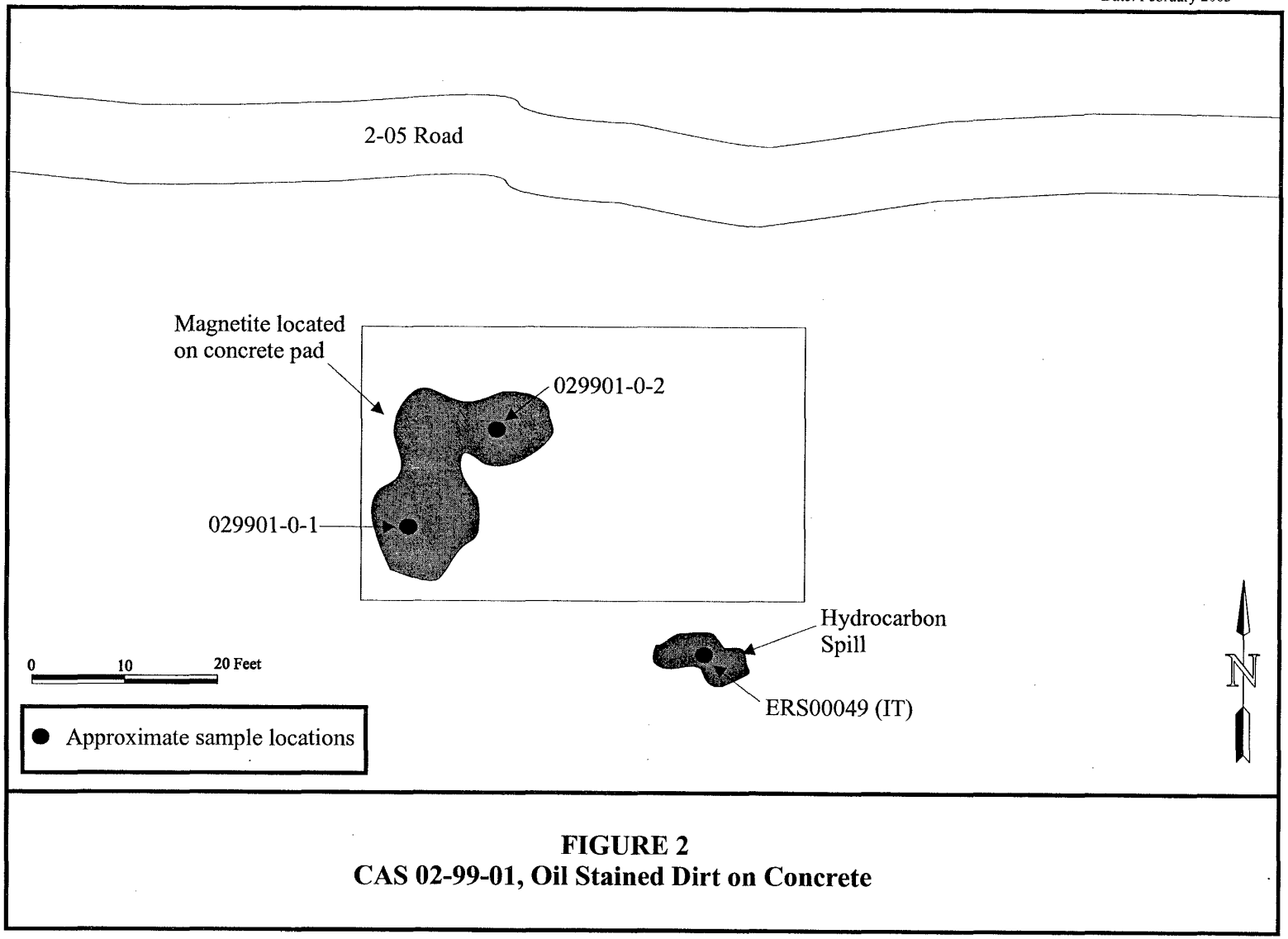

FIGURE 2
CAS 02-99-01, Oil Stained Dirt on Concrete

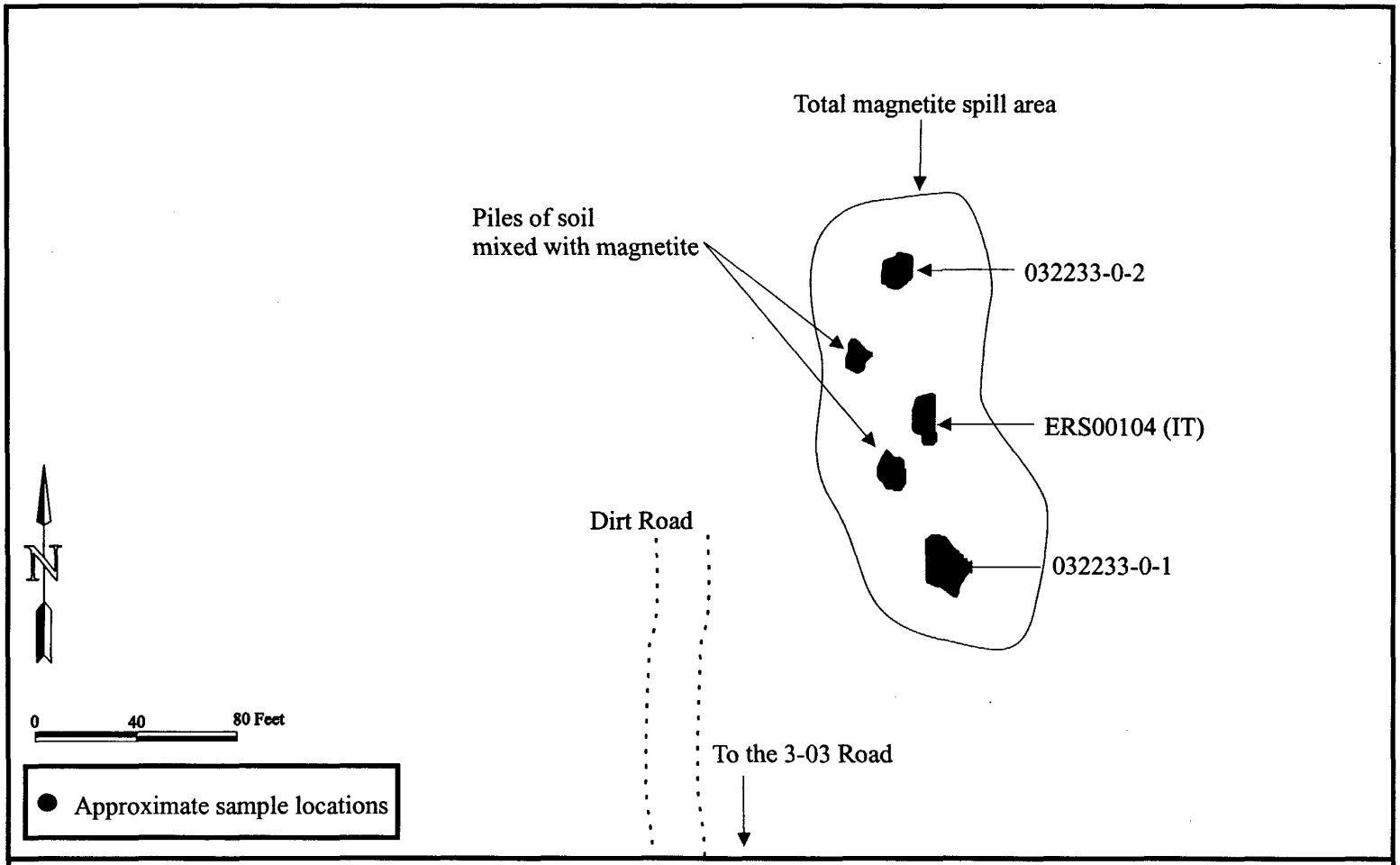

FIGURE 3
CAS 03-22-33, Bucket; Spill; Debris

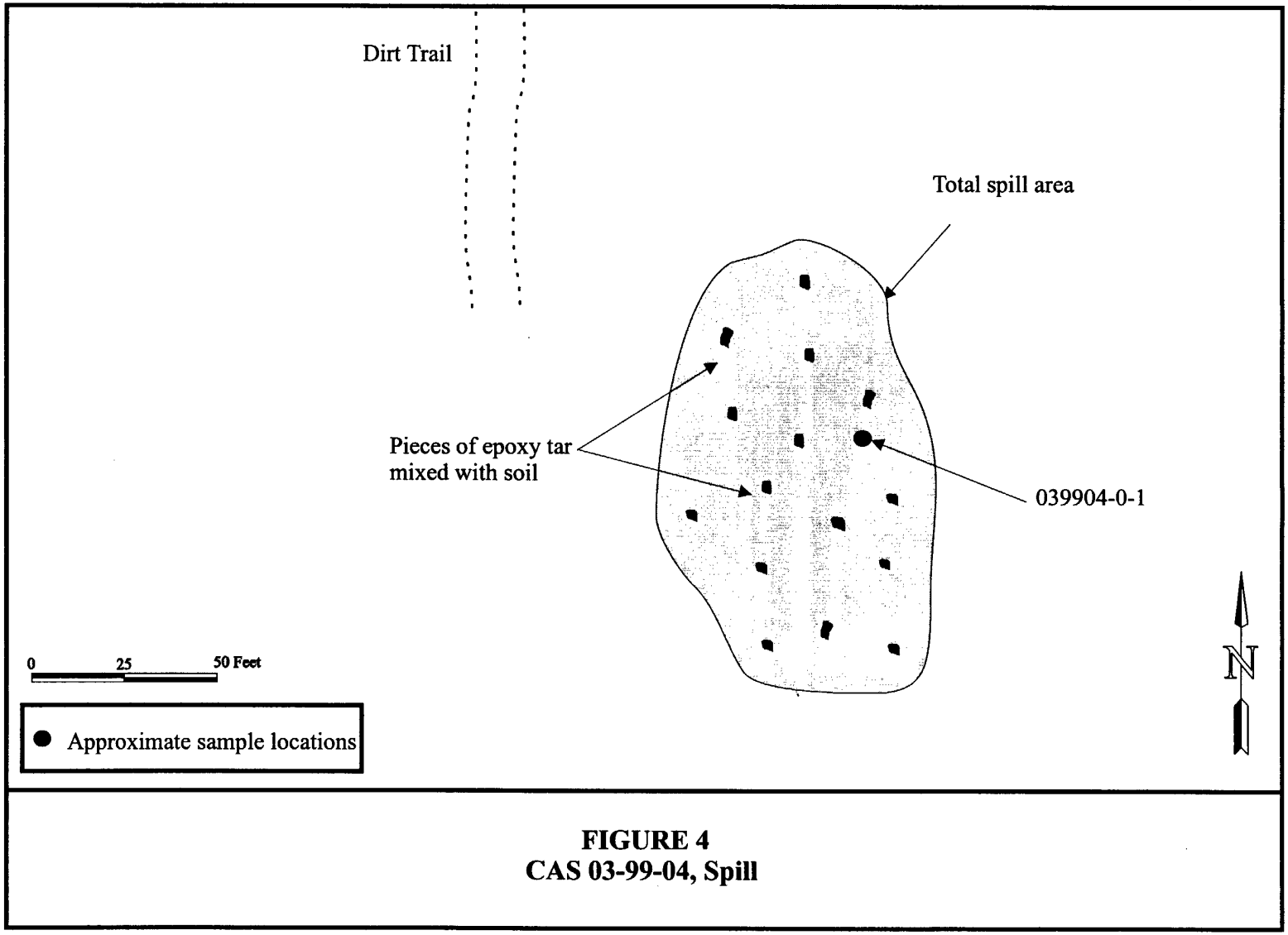

FIGURE 4
CAS 03-99-04, Spill

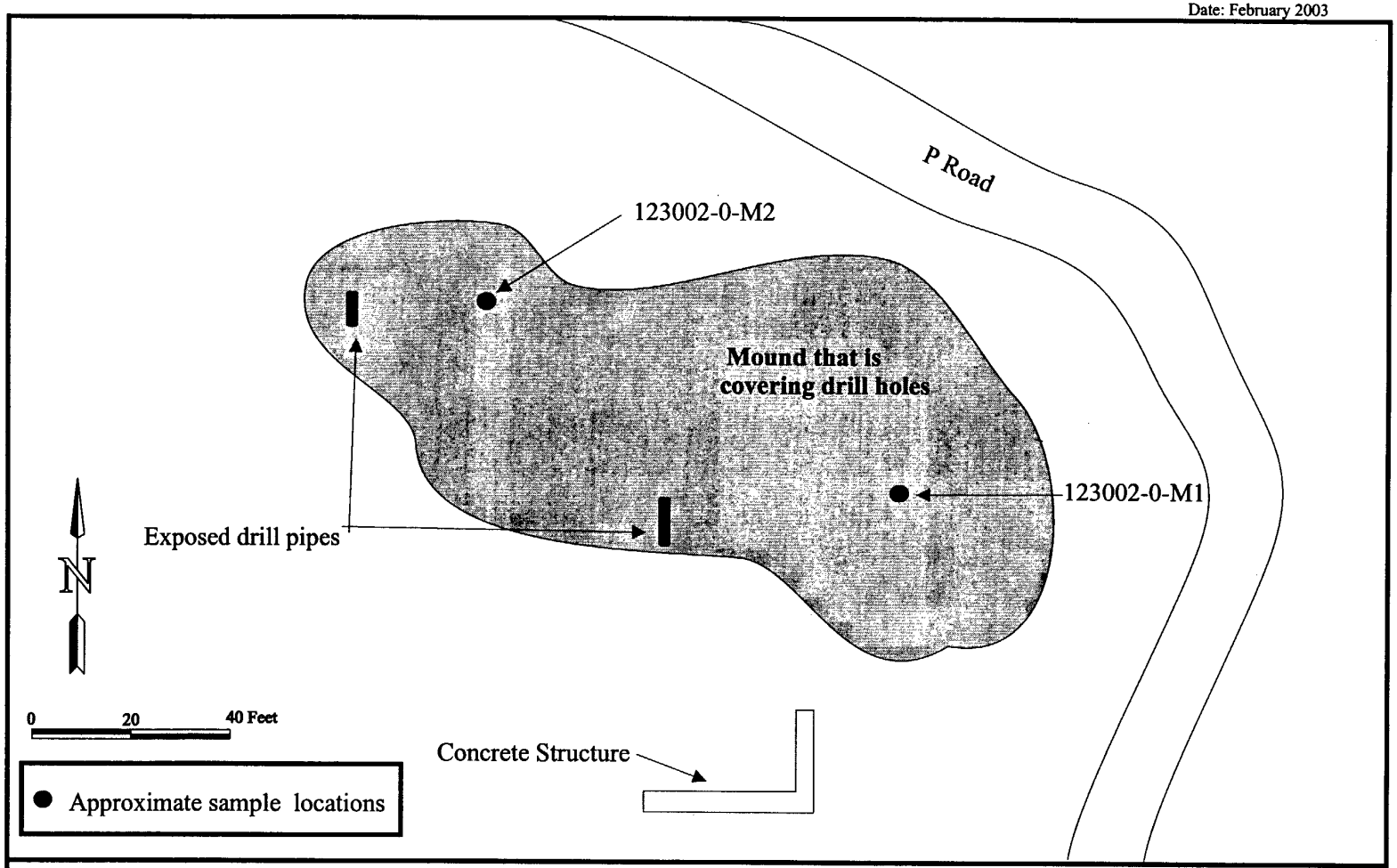

FIGURE 5
CAS 12-30-02, Drill Holes

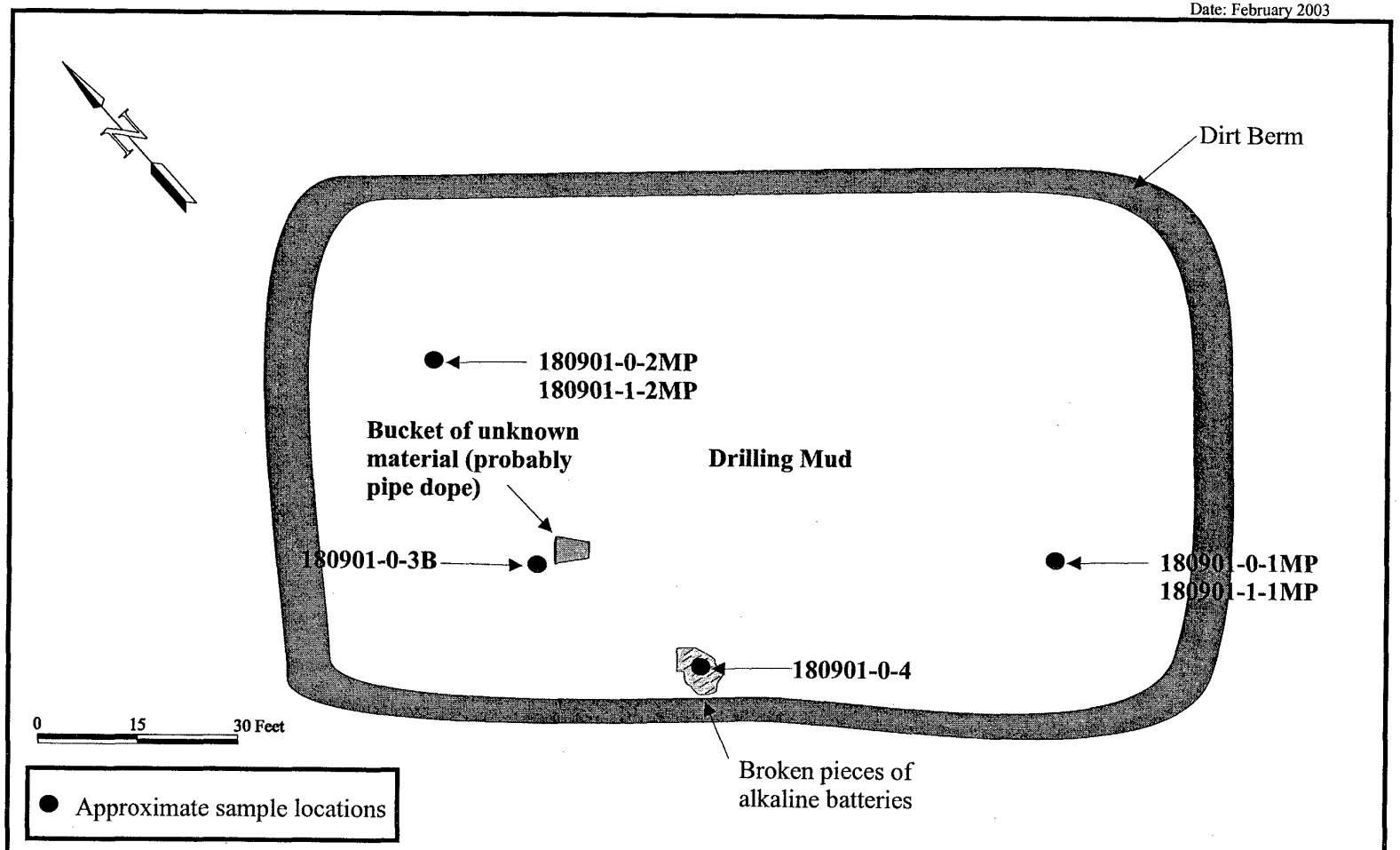

FIGURE 6
CAS 18-09-01, Mud Pit

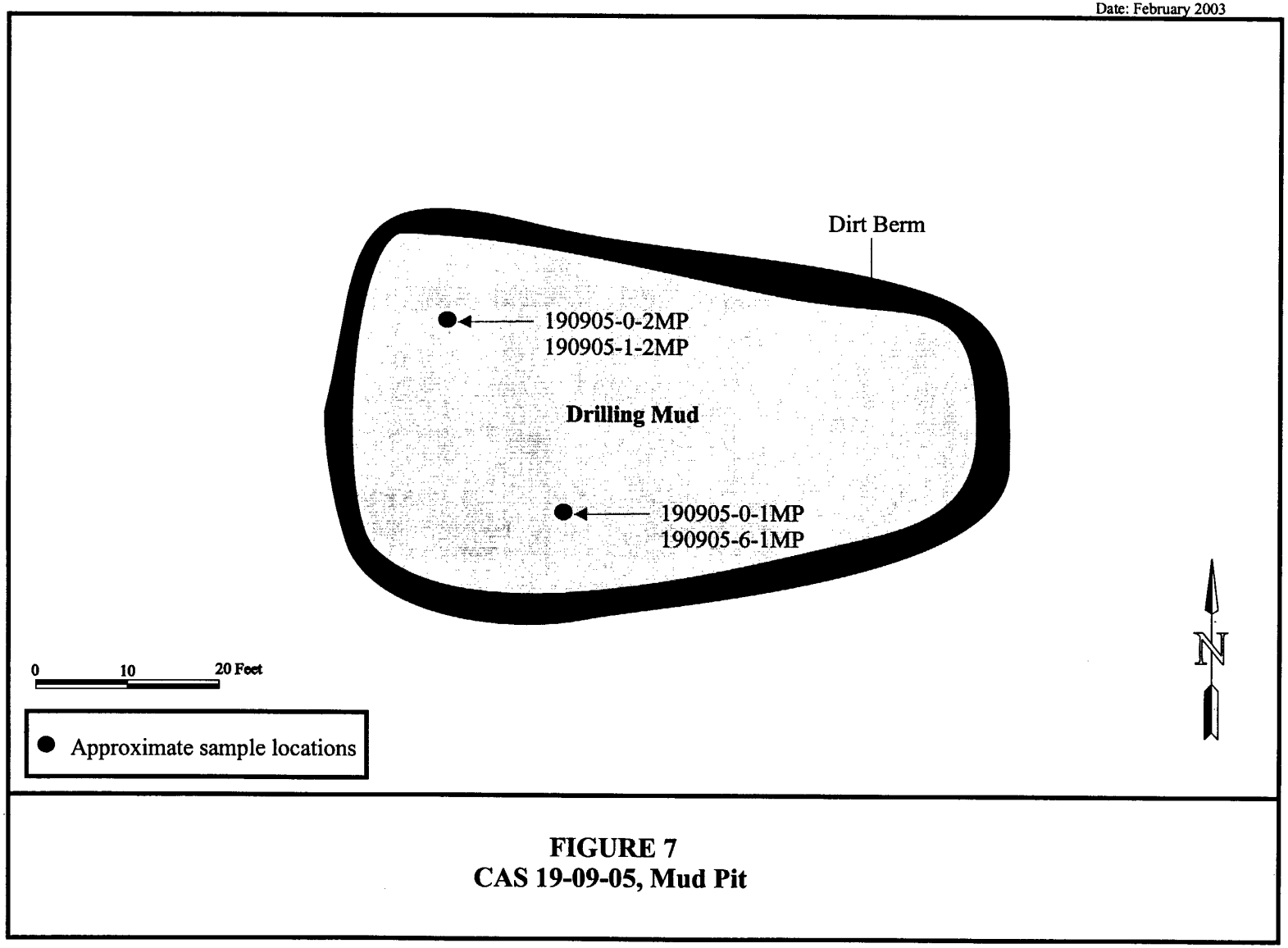

FIGURE 7
CAS 19-09-05, Mud Pit

2.1.7 CASs 19-09-06, 19-09-07, 20-09-05 , 20-09-08 and 20-37-01, Mud Pits and Mud Spill

CASs 19-09-06, 19-09-07, 20-09-05, 20-09-08, and 20-37-01 (mud pit only, cellar discussed in Section 2.1.8) (Figures 8 - 12) consist of mud pits containing drilling mud and/or drill cuttings. The surface area of the mud pits range from approximately 50.3 by 48.8 m (165 by 160 ft) to 6 by 4.5 m (20 by 15 ft) with an assumed depth ranging from 2.5 cm (1 in) to 2.4 m (8 ft). CAS 20-09-08 is the only mud spill identified in CAU 358 and it measured approximately 68.5 by 27.4 m (225 by 90 ft) with a depth of 7.6 cm (3 in). The mud spill at CAS 20-09-08 extended into a "Potential Crater Area," however, samples were collected from the portion of the mud spill outside the fencing.

2.1.8 CASs 20-23-02, 20-23-03, 20-23-04, 20-23-05, 20-23-06, 20-37-05 and 20-37-01, Cellars

These CASs (Figures 13 and 14) are postshot cellars that are open with the exception of CAS 20-23-04, which was backfilled with soil/gravel. The cellars range from approximately 2.7 to 3.6 m (9 to 12 ft) in diameter and are approximately 2.7 to 4.5 m (9 to 15 ft) deep. The cellar floors contain an unknown amount of soil with small amounts of organic material and possible drilling material. The walls of the cellars are lined with corrugated steel with the exception of CAS 20-37-01, which is lined with a square metal casing.

2.2 SITE LOCATION AND DESCRIPTION

The CAU 358 CASs have the following coordinate locations using the North American Datum of 1927, Universal Transverse Mercator, Zone 11, meters:

CAS	Easting (m)	Northing (m)
02-99-01	582,077.00	4,110,756.00
03-22-33	585,796.00	4,100,789.00
03-99-04	585,839.00	4,097,702.00
12-30-02	570,739.00	4,116,689.00
18-09-01	549,376.73	4,109,776.59
19-09-05	560,666.11	4,124,578.81
19-09-06	555,280.47	4,123,200.93
19-09-07	560,620.67	4,132,944.54
20-09-05	545,352.07	4,124,147.67
20-09-08	545,283.82	4,124,111.54
20-23-02	546,482.00	4,123,605.00
20-23-03	552,394.54	4,120,701.52
20-23-04	552,021.00	4,124,678.00
20-23-05	552,052.00	4,125,288.00
20-23-06	550,985.00	4,122,389.00
20-37-01	546,262.00	4,129,147.00
20-37-05	545,324.00	4,122,124.00

Source: IT Industrial Sites Preliminary Assessments Group.

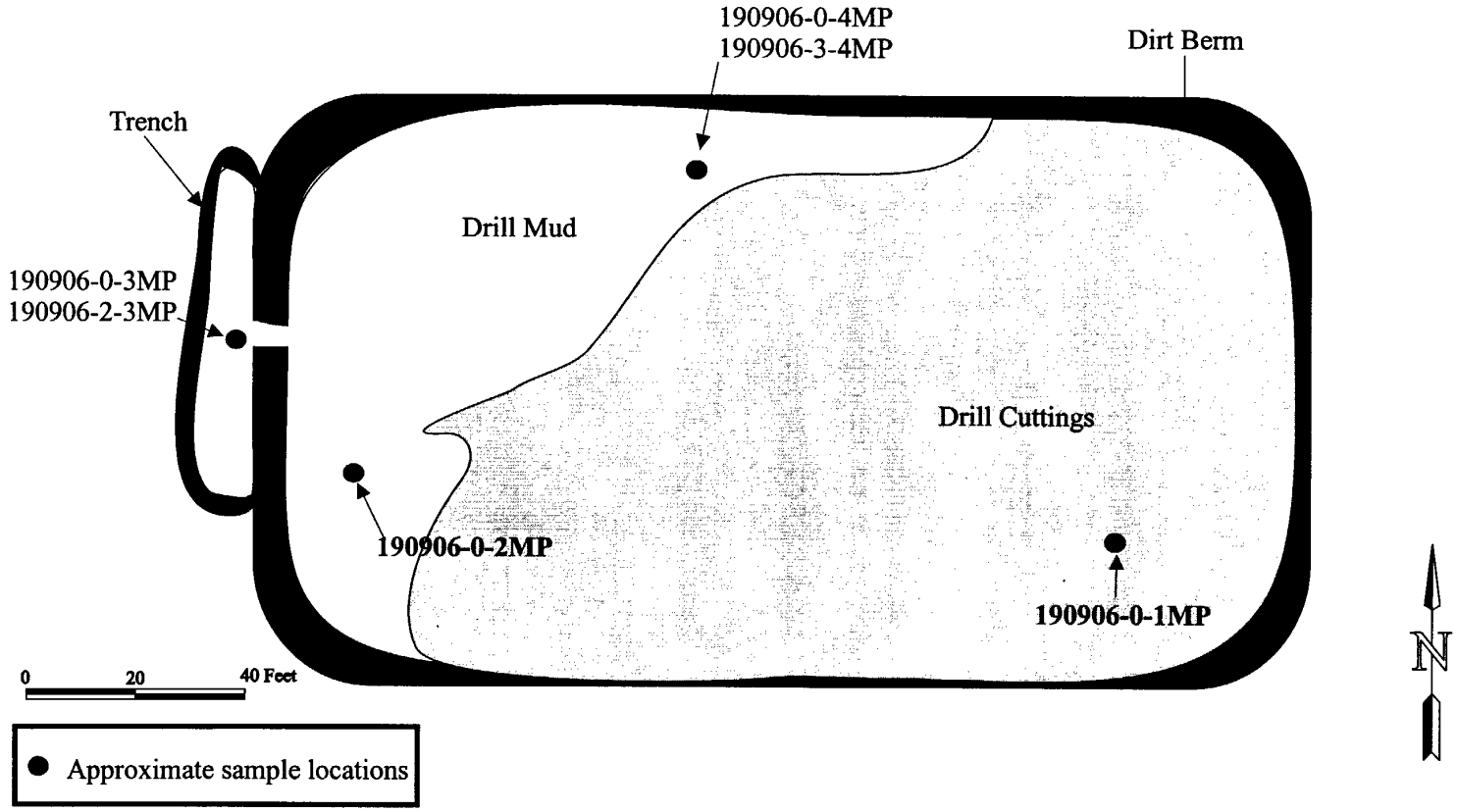

FIGURE 8
CAS 19-09-06, Mud Pit

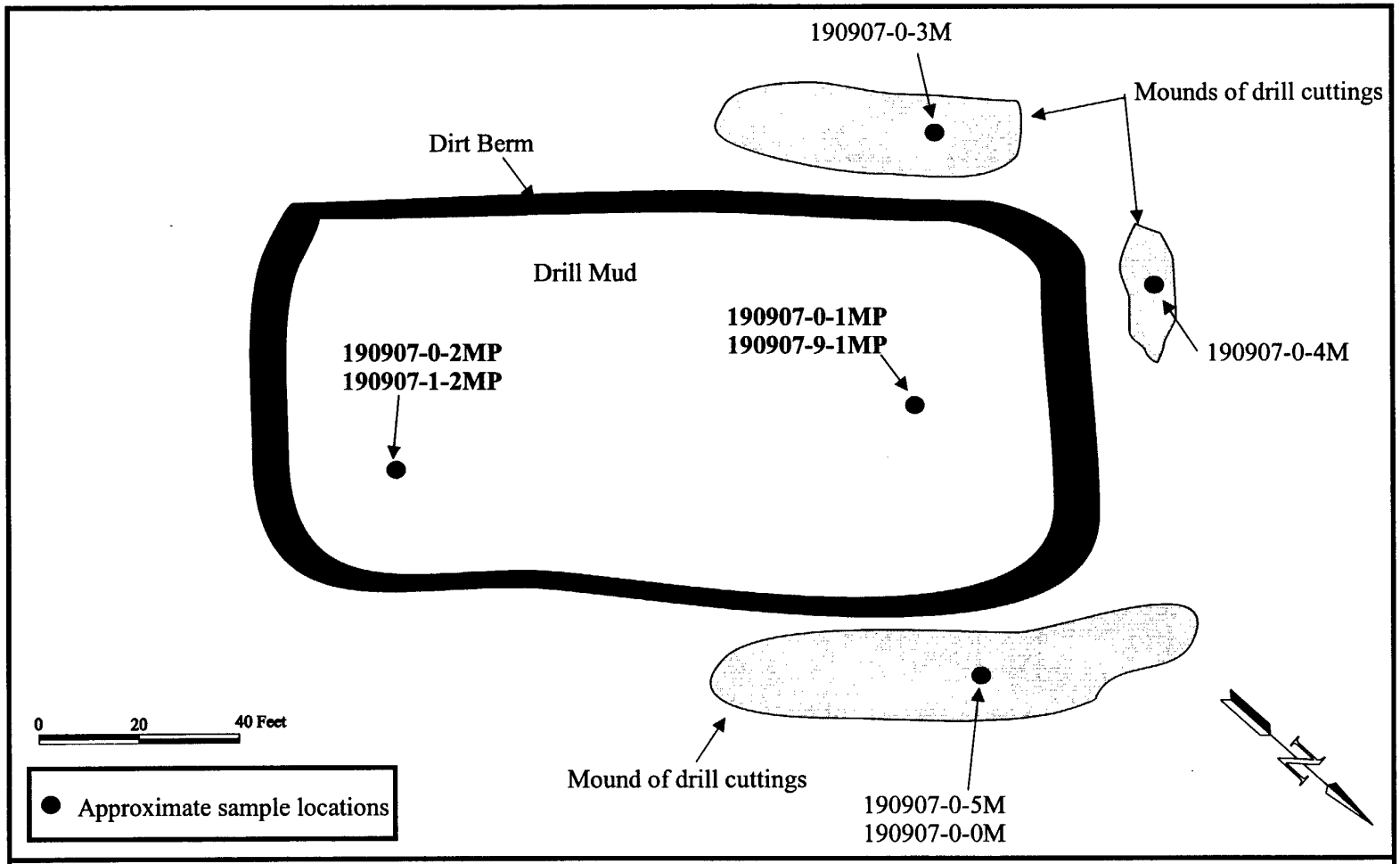

FIGURE 9
CAS 19-09-07, Mud Pit

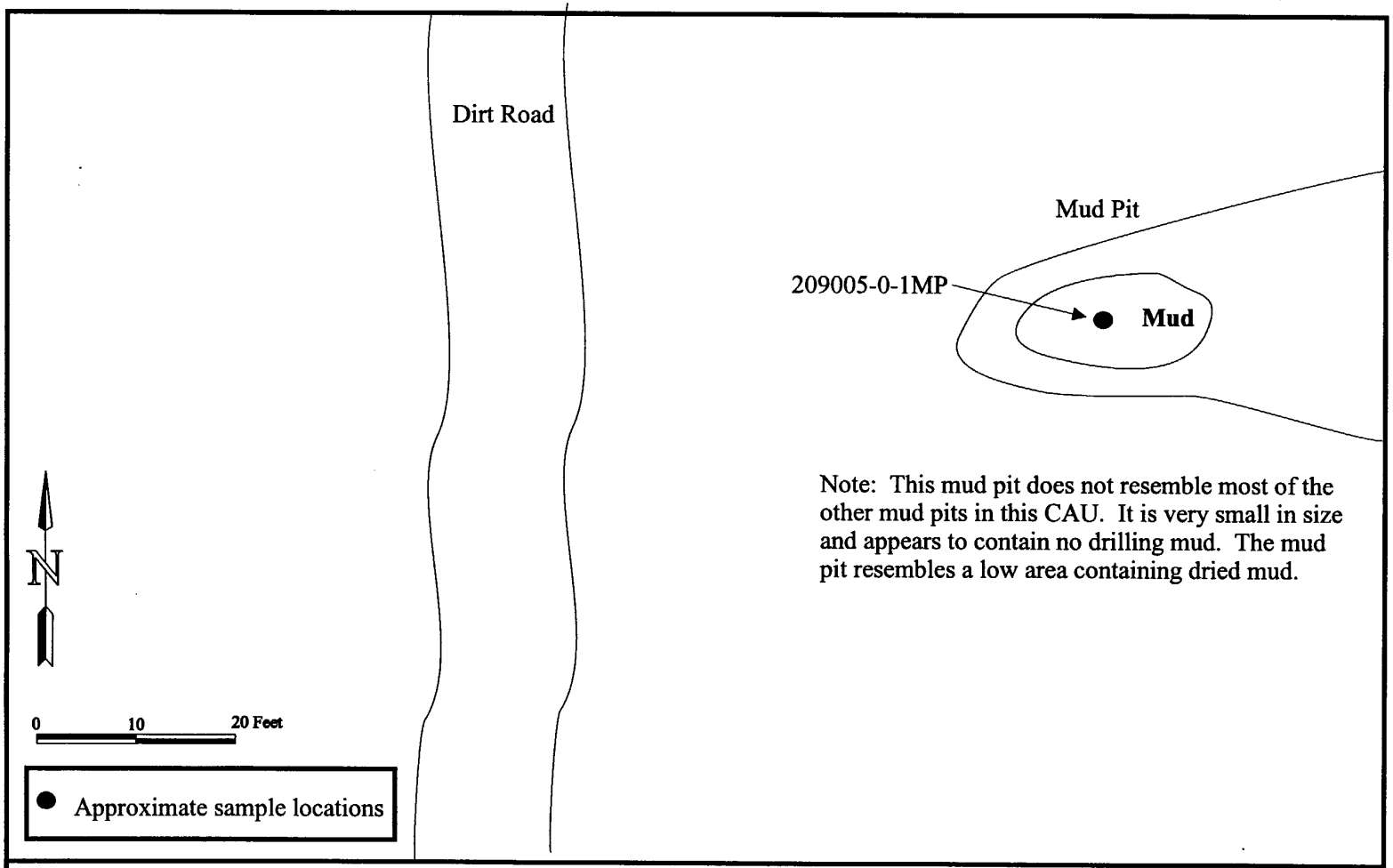

FIGURE 10
CAS 20-09-05, Mud Pit

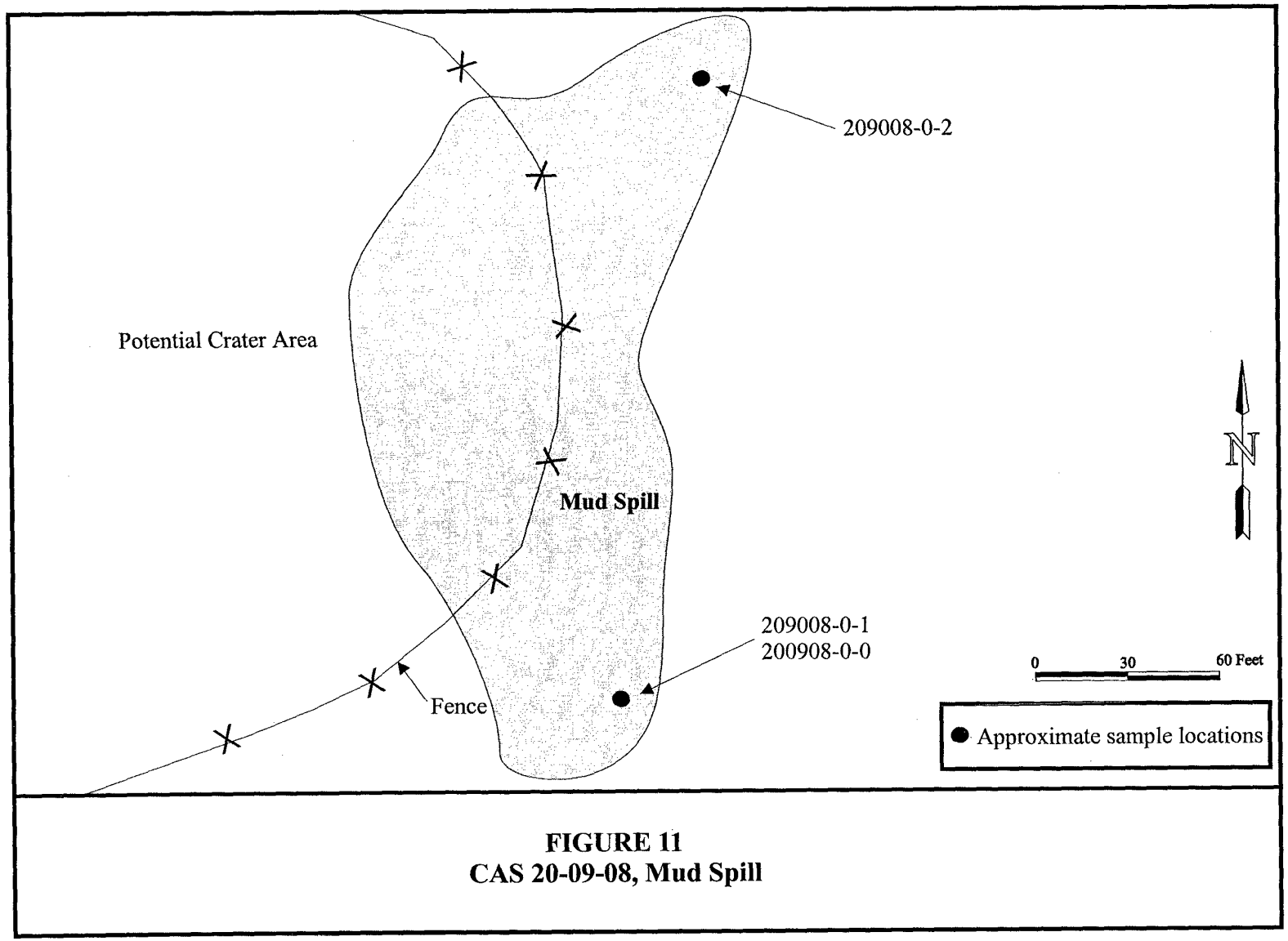

FIGURE 11
CAS 20-09-08, Mud Spill

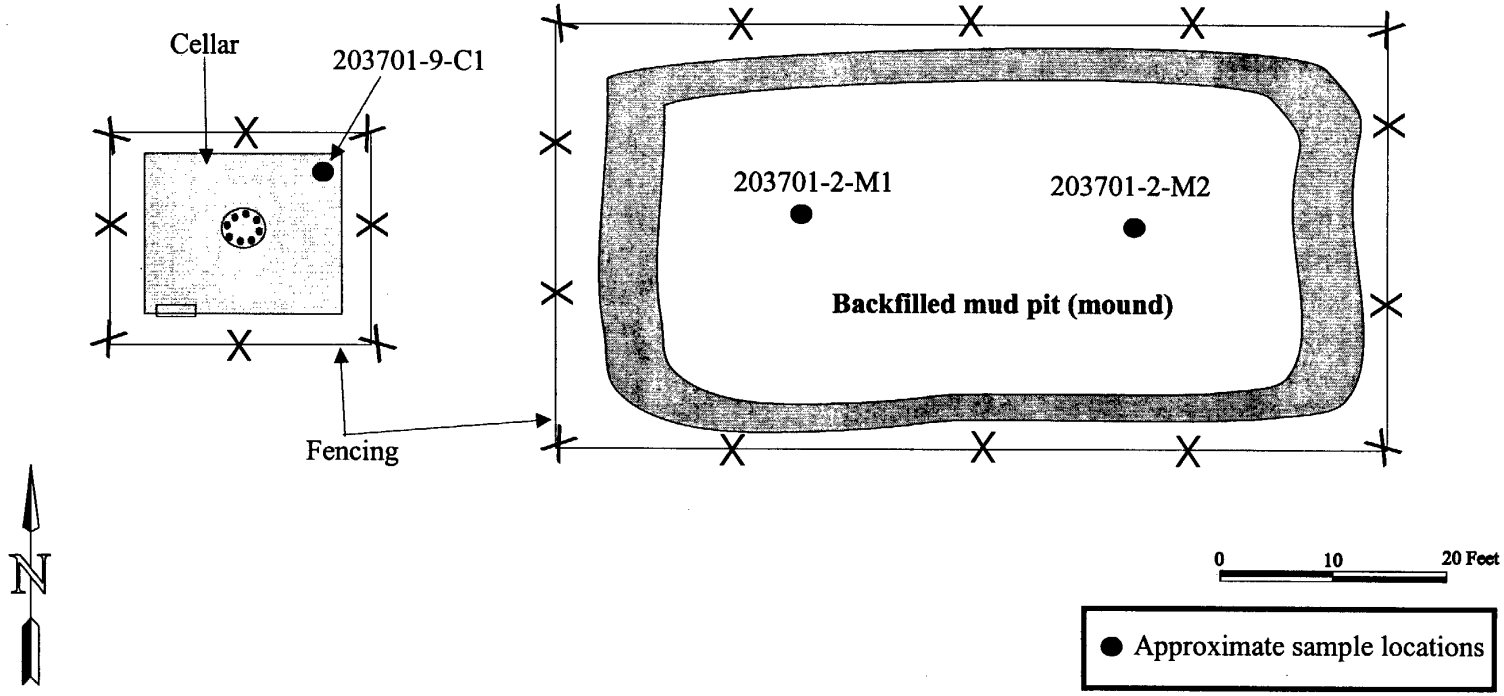

FIGURE 12
CAS 20-37-01, Cellar & Mud Pit

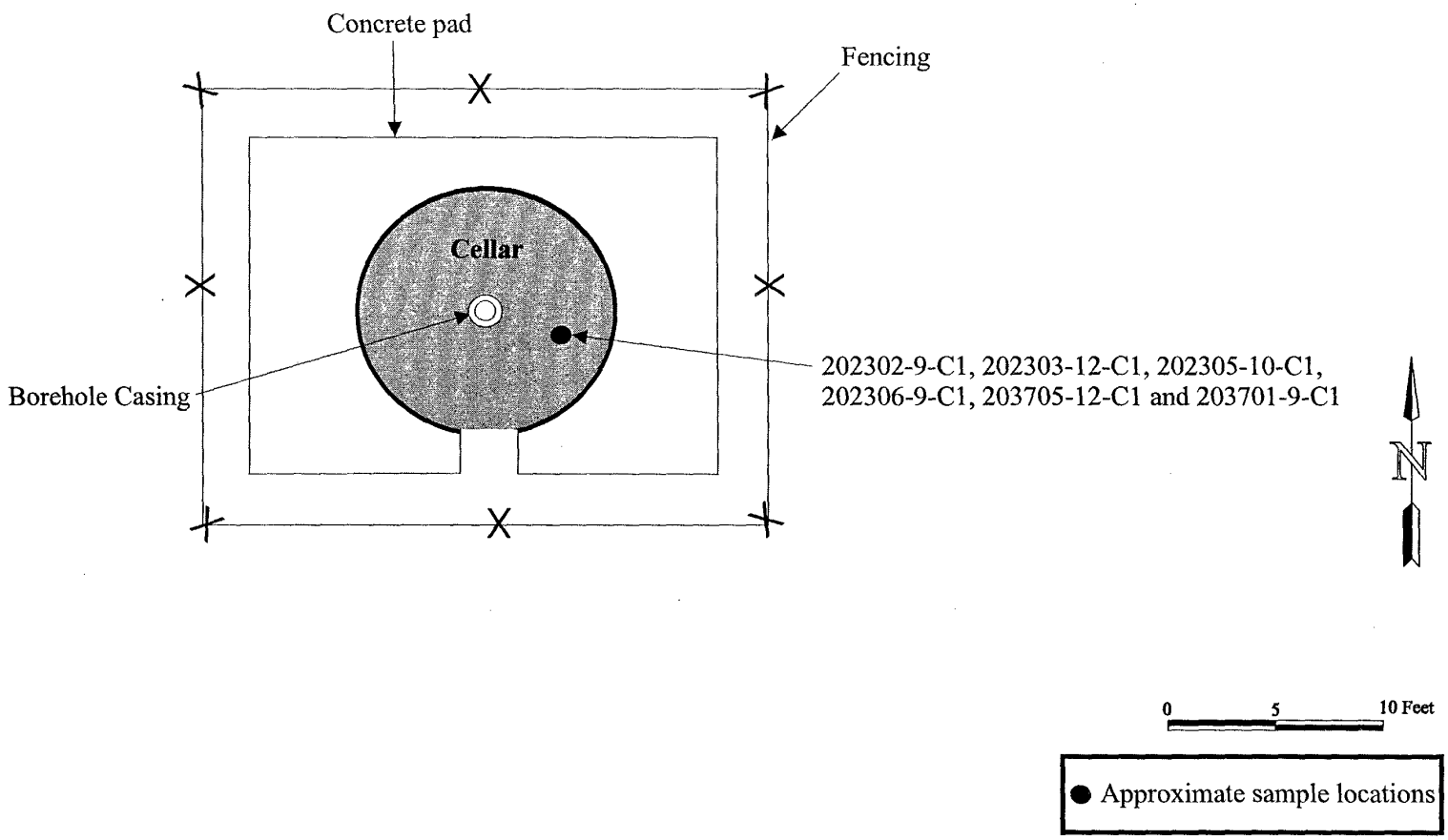

FIGURE 13
Applicable to CASs 20-23-02, 20-23-03, 20-23-05, 20-23-06, 20-37-01 and 20-37-05, Postshot Cellars

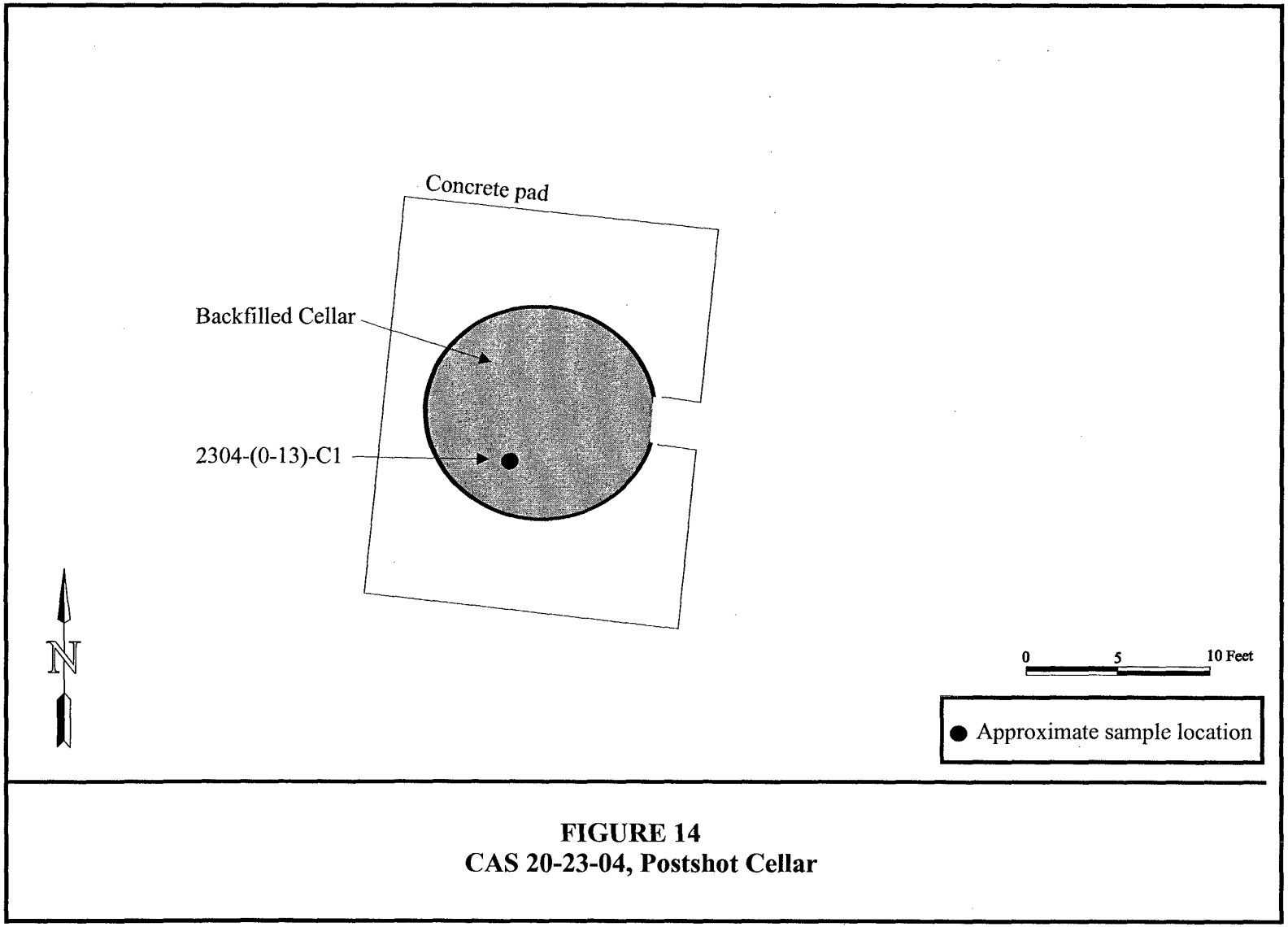

FIGURE 14
CAS 20-23-04, Postshot Cellar

2.2.1 CAS 02-99-01, Oil Stained Dirt on Concrete

CAS 02-99-01 is located on the south side of the 2-05 Road just before the intersection with the 2-03 Road on a concrete pad. During site visits in 1998 and 1999 by IT, the material on the concrete pad was described as being oil stained dirt; however, after further investigation in 2001 by BN, the material was determined to be magnetite. In addition, a hydrocarbon spill was also identified in the original characterization activities and was sampled at that time by IT. The hydrocarbon spill is located near the southeast corner of the concrete pad measuring 3.4 by 3 m (11 by 10 ft). The dimensions of the magnetite pile are approximately 13 by 14 m (42 by 45 ft) with the height of 1.8 m (6 ft).

Soil samples were collected by IT on November 25, 1998, from the center of the hydrocarbon spill and analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCBs), total Resource Conservation and Recovery Act (RCRA) metals, gross alpha and beta, and gamma spectroscopy. Sample results showed the presence of TPH above the Nevada State regulatory level of 100 milligram per kilogram (mg/kg) (NAC, 2002a) in the hydrocarbon spill (Table 1).

BN collected samples from two locations on the magnetite pile on June 7, 2001. The magnetite material sampled was black, medium-grained and sandy, and was analyzed for total RCRA metals and gamma spectroscopy. Sample results show no COCs present above action limits (Table 1). No other chemical and radiological COCs were identified at this CAS.

CAS 02-99-01 will be closed by removing the pile of magnetite and disposing of it as sanitary waste in an appropriate NTS landfill. The area of the TPH spill will be excavated and the TPH-impacted soil transported and disposed of in the NTS Area 6 Hydrocarbon landfill. The extent of the excavation will be determined by TPH field screening results. Verification soil samples will be collected and submitted for TPH analysis. After verification sample results show that the area is clean of TPH, the area will be regraded to the approximate original site topography.

2.2.2 CAS 03-22-33, Bucket; Spill; Debris

CAS 03-22-33 is located on a dirt road approximately 300 m (1,000 ft) north of the 3-03 Road with U-3mc located to the west. During a site visit by IT in 1999 the material was determined to be magnetite spilled on surface soil. No bucket was found during this site visit, which was later confirmed by a BN site visit in 2001. Spilled magnetite is found on the ground and in small piles of soil covering an estimated area of 44 by 6.7 m (145 by 22 ft) with an average thickness of 0.3 m (1 ft). General debris in the area includes cable, rope, and wood. The magnetite material was sampled by IT on August 27, 1997, and analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, gross alpha and beta, and gamma spectroscopy. Sampling results show no COCs present above action limits (Table 1).

Samples of magnetite material were collected by BN from two different locations on June 8, 2001, and analyzed for total RCRA metals, Toxicity Characteristic Leaching Procedure (TCLP)-selenium and gamma spectroscopy. Sample results show no COCs present above action limits (Table 1).

CAS 03-22-33 will be closed by removing the piles of magnetite and soil and disposing of the material as sanitary waste in an appropriate NTS landfill. Once the area is clean of magnetite and associated soil as verified by visual inspection, the area will be regraded to the approximate original site topography.

2.2.3 CAS 03-99-04, Spill

CAS 03-99-04 is located on a skid trail off of the 3-07 Road (3B Road) near U-3ky. During a site visit in 1999 by IT, the spilled material was determined to be epoxy tar. This was confirmed by a BN site visit in 2001. The epoxy tar pieces are scattered on the ground surface and in small piles of soil in an area measuring approximately 38 by 15.2 m (125 by 50 ft). IT Industrial Sites Preliminary Site Assessment group conducted a site assessment on July 6, 1999, and described the epoxy tar as solid, black, shiny material that is broken into pieces and spread over a large area. There are small dirt mounds with epoxy tar protruding from them. Samples of the epoxy tar and associated soil were collected on June 11, 2001, by BN and analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. Sample results indicated the presence of TPH and several SVOCs above action levels (Table 1). No other chemical or radiological contaminants were present above action levels.

CAS 03-99-04 will be closed by removing the pieces of epoxy tar and associated soil and disposing of them in the Area 6 Hydrocarbon Landfill. Verification soil samples will be collected from the area beneath the epoxy tar pieces and submitted for TPH and SVOC analysis.

Once verification sample results show that the area is clean of TPH and SVOCs, the area will be regraded to the approximate original site topography.

2.2.4 CAS 12-30-02, Drill Holes

CAS 12-30-02 is located near the P Road on Rainier Mesa in Area 12 and is associated with the B Tunnel drilling activities. This site was described as a large mound covering possible drill holes. After reviewing available site documentation and conducting several site visits, BN determined that the mound is composed of possible drill cuttings/fill material covering nine plugged instrumentation drill holes and one plugged exploratory drill hole with miscellaneous housekeeping debris in the area. The mound was reportedly used to contain leakage of radioactive gases (Butler, 2000). Two plugged drill holes protrude from the mound and measure 7.6 cm (3 in) in diameter. The mound measures 46 by 26.5 m (151 by 87 ft) with a height of approximately 2.4 m (8 ft).

BN collected samples from two surface locations on April 24, 2001, from the mound. The samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. Sample results for the mound show no COCs present above action levels (Table 1).

2.2.5 CAS 18-09-01, Mud Pit

CAS 18-09-01 is located at the end of the 18-05 Road, 65 ft east of UE-18r. The site is a mud pit containing dry, light gray drilling mud with the sides of the mud pit covered with vegetation.

Also located in the mud pit is housekeeping debris consisting of a 5-gallon (gal) bucket containing an unknown material (possibly pipe dope) and broken pieces of alkaline batteries. The mud pit measures 36.5 by 21.3 m (120 by 70 ft) with the approximate depth of the drilling mud being 0.3 m (1 ft).

Soil samples were collected at the site by BN on February 7, 2002, at two locations within the drilling mud. At each location samples were collected from the surface and at 1-ft depths. Additional samples were collected from the bucket containing the unknown material and from the area covered by broken pieces of batteries. Mud pit and bucket samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. The samples from the pieces of alkaline batteries were analyzed for total RCRA metals only. Sample results for the drilling mud show no COCs above action limits; however, the bucket containing unknown material showed TPH and lead levels slightly higher than regulatory levels for TCLP lead (RCRA Table 261.24 Toxicity characteristic) (EPA, 2001). Biased sample results near the alkaline batteries indicate mercury concentrations slightly higher than regulatory for TCLP mercury (RCRA Table 261.24 Toxicity characteristic) (EPA, 2001). No other chemical or radiological contaminants were present above action levels.

CAS 18-09-01 will be closed by removing debris, a bucket and associated soil, and broken pieces of alkaline batteries and associated soil as a best management practice. The waste generated from the bucket and battery clean up will be disposed of as hazardous waste at an approved offsite facility. In addition, soil verification samples will be collected from the area of the bucket and battery pieces after debris removal and submitted for total RCRA lead and mercury analysis. One verification soil sample from the area of the bucket and two samples from the area of battery pieces will be collected and submitted for analysis.

2.2.6 CAS 19-09-05, Mud Pit

CAS 19-09-05 is located just south of a dirt road coming off of Dead Horse Flats Road at Radiological Safe Marker (RSM) 19 C6. This site contains light gray drilling mud that is dry and cracked. The mud pit measures 29.5 by 24.6 m (97 by 81 ft) with a maximum depth of the drilling mud at 0.3 m (12 ft).

Soil samples were collected in the drilling mud by BN on February 11, 2002. Samples were collected from the surface mud and depths of 15.2 cm (6 in) and 0.3 m (1 ft) at two separate locations. All samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. Sample results indicate that TPH is the only COC present above action limits at this site (Table 1).

2.2.7 CAS 19-09-06, Mud Pit

CAS 19-09-06 is located on U-19av access road just off of Pahute Mesa Road. This site consists of a large mud pit containing white/gray drilling mud with the majority of the mud pit filled with drill cuttings. The mud pit measures 50.2 by 48.7 m (165 by 160 ft) with a depth of the drill cuttings being at least 1 m (3 ft) with the white/gray drilling mud just a few inches thick.

TABLE 1 - CAU 358 SAMPLE ANALYTICAL RESULTS

SAMPLE IDENTIFICATION NUMBER	DIESEL (mg/kg)[a]	OIL (mg/kg)	GASOLINE (mg/kg)	TPH[b] (mg/kg)	VOCs[c] (µg/kg)[d]	SVOC[e] (µg/kg)	Total RCRA[f] METALS (mg/kg)	PCBs[g] (µg/kg)	GAMMA SPECTROSCOPY (pCi/g)[h]
ACTION LEVEL	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**EPA PRGs**	**EPA PRGs**	**EPA PRGs**	**1 µg/kg**	**NTS Background**
CAS 02-99-01 (SDG[i] V1147) and (ERS 00049 [IT])									
029901-0-1	NS[j]	NS	NS	NS	NS	NS	< Action levels	NS	< Background levels
ERS00049	250	1,100	NS	1,350	< Action levels	< Action levels		< Action levels	
CAS 03-22-33 (SDG V1147 and V1212) and (ERS 00104 [IT])									
032233-0-1	NS	NS	NS	NS	NS	NS	< Action levels	NS	< Background levels
032233-0-2	NS	NS	NS	NS	NS	NS		NS	
032233-0-2A,B	NS	NS	NS	NS	NS	NS		NS	NS
ERS00104	25	42	NS	67	< Action levels	< Action levels		< Action levels	< Background levels
CAS 03-99-04 (SDG V1154 and V1155)									
039904-0-1	610	2,900	ND[k]	3,510	< Action levels	Six above action levels (See Table 2)	< Action levels	< Action levels	< Background levels
CAS 12-30-02 (SDG V1562 and V1563)									
123002-0-M1	ND	ND	ND	ND	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
123002-0-M2	ND	ND	ND	ND					

TABLE 1 - CAU 358 SAMPLE ANALYTICAL RESULTS (continued)

SAMPLE IDENTIFICATION NUMBER	DIESEL (mg/kg)[a]	OIL (mg/kg)	GASOLINE (mg/kg)	TPH[b] (mg/kg)	VOCs[c] (µg/kg)[d]	SVOC[e] (µg/kg)	(Total) RCRA[f] METALS (mg/kg)	PCBs[g] (µg/kg)	GAMMA SPECTROSCOPY (pCi/g)[h]
ACTION LEVEL	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**EPA PRGs**	**EPA PRGs**	**EPA PRGs**	**1 µg/kg**	**NTS Background**
CAS 18-09-01 (SDG V1426 and V1427)									
180901-0-1MP	ND	15	ND	15	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
180901-1-1MP	ND	58	ND	58					
180901-0-2MP	ND	44	ND	44					
180901-1-2MP	ND	68	ND	68					
180901-0-3B	48,000	190,000	ND	238,000					
180901-0-4	NS	NS	NS	NS	NS	NS	Mercury - 7.0 All others < Action levels	NS	NS
CAS 19-09-05 (SDG V1431 and V1433)									
190905-0-1MP	138	970	ND	1,108	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
190905-6-1MP	17	150	3.5	170.5					
190905-0-2MP	15	170	3.2	188.2					
190905-1-2MP	22	170	ND	192					

TABLE 1 - CAU 358 SAMPLE ANALYTICAL RESULTS (continued)

SAMPLE IDENTIFICATION NUMBER	DIESEL (mg/kg)[a]	OIL (mg/kg)	GASOLINE (mg/kg)	TPH[b] (mg/kg)	VOCs[c] (µg/kg)[d]	SVOC[e] (µg/kg)	(Total) RCRA[f] METALS (mg/kg)	PCBs[g] (µg/kg)	GAMMA SPECTROSCOPY (pCi/g)[h]
ACTION LEVEL	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**EPA PRGs**	**EPA PRGs**	**EPA PRGs**	**1 µg/kg**	**NTS Background**
CAS 19-09-06 (SDG V1439 and V1440)									
190906-0-1MP	ND	14	ND	14	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
190906-0-2MP	ND	ND	ND	ND					
190906-0-3MP	ND	ND	ND	ND					
190906-2-3MP	ND	ND	ND	ND					
190906-0-4MP	ND	ND	ND	ND					
190906-3-4MP	ND	ND	ND	ND					
CAS 19-09-07 (SDG V1433 and V1434)									
190907-0-1MP	ND	ND	ND	ND	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
190907-9-1MP	ND	ND	ND	ND					
190907-0-2MP	ND	ND	ND	ND					
190907-1-2MP	ND	ND	ND	ND					
190907-0-3M	ND	ND	ND	ND					
190907-0-4M	ND	ND	ND	ND					
190907-0-5M	ND	ND	ND	ND					
190907-0-0M	ND	ND	ND	ND					

TABLE 1 - CAU 358 SAMPLE ANALYTICAL RESULTS (continued)

SAMPLE IDENTIFICATION NUMBER	DIESEL (mg/kg)[a]	OIL (mg/kg)	GASOLINE (mg/kg)	TPH[b] (mg/kg)	VOCs[c] (µg/kg)[d]	SVOC[e] (µg/kg)	(Total) RCRA[f] METALS (mg/kg)	PCBs[g] (µg/kg)	GAMMA SPECTROSCOPY (pCi/g)[h]
ACTION LEVEL	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**EPA PRGs**	**EPA PRGs**	**EPA PRGs**	**1 µg/kg**	**NTS Background**
CAS 20-09-05 (SDG V1439 and V1440)									
209005-0-1MP	ND	40	ND	40	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
CAS 20-09-08 (SDG V1426 and V1427)									
200908-0-0	ND	ND	ND	ND	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
200908-0-1	ND	ND	ND	ND					
209008-0-2	ND	23	ND	23					
CAS 20-23-02 (SDG V1559 and V1560)									
202302-9-C1	280	2,600	ND	2,880	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
CAS 20-23-03 (SDG V1550 and V1551)									
202303-12-C1	430	4,900	ND	5,330	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
CAS 20-23-04 (SDG V1508, V1509, and V1560)									
2304-(0-13)-C1	ND	17	ND	17	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels

TABLE 1 - CAU 358 SAMPLE ANALYTICAL RESULTS (continued)

SAMPLE IDENTIFICATION NUMBER	DIESEL (mg/kg)[a]	OIL (mg/kg)	GASOLINE (mg/kg)	TPH[b] (mg/kg)	VOCs[c] (µg/kg)[d]	SVOC[e] (µg/kg)	(Total) RCRA[f] METALS (mg/kg)	PCBs[g] (µg/kg)	GAMMA SPECTROSCOPY (pCi/g)[h]
ACTION LEVEL	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**EPA PRGs**	**EPA PRGs**	**EPA PRGs**	**1 µg/kg**	**NTS Background**
CAS 20-23-05 (SDG V1550 and V1551)									
202305-10-C1	360	2,700	ND	3,000	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
CAS 20-23-06 (SDG V1550 and V1551)									
202306-9-C1	18	230	ND	248	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
CAS 20-37-01 (SDG V1541, V1542, V1550, and V1551)									
203701-9-C1	40	250	ND	290	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
203701-2-M1	ND	ND	ND	ND					
203701-2-M2	ND	ND	ND	ND					
CAS 20-37-05 (SDG V1559 and V1560)									
203705-12-C1	35	3,700	0.11	3,735.1	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels

[a]milligram(s) per kilogram
[b]total petroleum hydrocarbons
[c]volatile organic compounds
[d]microgram(s) per kilogram
[e]semivolatile organic compounds
[f]Resource Conservation and Recover Act
[g]polychlorinated biphynels
[h]picoCurie(s) per gram
[i]Sample Selivery Group
[j]not sampled
[k]not detected or less than detection limits

Soil samples were collected in the drilling mud and drill cuttings by BN on February 7, 2002. Samples were collected from the surface mud and/or depths ranging from the surface down to 1 m (3 ft). All samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. All samples show no COCs present above action levels (Table 1).

2.2.8 CAS 19-09-07, Mud Pit

CAS 19-09-07 can be located by traveling on Pahute Mesa Road to Dead Horse Flats Road and proceed to the U-19j area. The site is approximately 30 m (100 ft) east from U-19j crater fencing. This site consists of a mud pit containing light gray drilling mud with large piles of drill cuttings in and around the mud pit. The mud pit measures approximately 36.5 by 35.6 m (120 by 117 ft) with a maximum depth of 0.3 m (1 ft). The large piles of drill cuttings are composed of small, loose grained material and light gray in color with sparse vegetation growing from them.

Soil samples were collected in the drilling mud and on piles of drill cuttings by BN on February 12, 2002. Samples were collected from the surface mud and/or depths ranging from the surface down to 0.3 m (1 ft). Samples were collected from the surface of all the piles of drill cuttings. All samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. All samples show no COCs present above action levels (Table 1).

2.2.9 CAS 20-09-05, Mud Pit

CAS 20-09-05 can be located by traveling on Pahute Mesa Road past the intersection with Buckboard Mesa Road to RSM 20 P 130. The site is located at the end of the skid trail prior to U-20bc crater. This site consists of a small mud pit that could possibly be a mud puddle containing dried mud. The mud pit measures 6 by 4.5 m (20 by 15 ft) with all the mud being at the surface.

Soil samples were collected from the dried mud by BN on February 13, 2002. Samples were collected from the surface mud and analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. All samples show no COCs present above action levels (Table 1).

2.2.10 CAS 20-09-08, Mud Spill

CAS 20-09-08 is also located near the U-20aw fenced area, but on the southern end. This site consists of a large mud spill (white and gray in color) extending into a "Potential Crater Area." The mud spill measures approximately 68.5 by 27.4 m (225 by 90 ft) with a depth of 7.6 cm (3 in).

Soil samples were collected from the mud spill from the outside of potential crater fencing by BN on February 7, 2002. Samples were collected from the surface mud and analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. All samples show no COCs present above action levels (Table 1).

2.2.11 CAS 20-23-02, Postshot Cellar

CAS 20-23-02 is located off of Pahute Mesa Road in Area 20 at RSM 20 P 129, opposite the M Road turnoff and proceed to the U-20ae postshot cellar. This site consists of an open cellar that is 2.7 m (9 ft) deep, containing soil and drilling mud material at the bottom with a stand pipe protruding out the top of the cellar. The cellar is posted as "Underground Radioactive Material." Soil samples were collected from the bottom of the cellar by BN on April 23, 2002. Samples were collected at the bottom of the cellar floor, which contained a mixture of soil, organic material, and possible drilling mud. The samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. Sample results identified TPH as the only COC above action levels (Table 1). Lead was found in soil but at levels well below the EPA Region IX PRGs for Industrial Soils (Table 1) (EPA, 2002). No other chemical or radiological contaminants were present above action levels.

2.2.12 CAS 20-23-03, Cellar

CAS 20-23-03 is located at the end of a dirt road off of Pahute Mesa Road opposite the "UE-20 BH1" posting. This dirt road leads to the U-20az cellar containing dark soil, organic material, and possible drilling mud. The cellar is approximately 3.6 m (12 ft) deep and is posted as "Caution Cellar 20az." Soil samples were collected from the bottom of the cellar by BN on April 18, 2002. Samples were collected at the bottom of cellar floor, which contained a mixture of dark soil, organic material and possible drilling mud. The samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. Sample results identified COCs as TPH above action limits (Table 1). No other chemical or radiological contaminants were present above action levels.

2.2.13 CAS 20-23-04, Postshot Cellar

CAS 20-23-04 is located near a dirt road off of Pahute Mesa Road opposite the "UE-20 BH1" posting. The site is just off the right-hand side of the dirt road and consists of a postshot cellar that has been backfilled with gravel and soil. The approximate depth of the cellar is 4.4 m (14.5 ft) with a diameter of 2.7 m (9 ft). Protruding from the backfill is a metal posting identifying the cellar as "U-20am Postshot."

Composite soil samples were collected in the backfill material in the cellar from a depth range of 0 to 3.9 m (0 to 13 ft) by BN on March 27, 2002, and analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. All samples show no COCs present above action levels (Table 1).

2.2.14 CAS 20-23-05, Postshot Cellar

CAS 20-23-05 is located at the entrance of a dirt road with Pahute Mesa Road opposite of the "UE-20 BH1" posting. The postshot cellar is located to the east of the intersection approximately 137.2 m (450 ft) southwest of U-20ab. The cellar contains soil, organic material, and possible drilling mud along with a standpipe protruding from the top of the cellar. The cellar is 3 m (10 ft) deep and is posted as "Underground Radioactive Material." Debris in the area includes a ladder, wood, and scrap metal.

Soil samples were collected from the bottom of the cellar by BN on April 18, 2002. Samples were collected at the bottom of cellar floor, which contained a mixture of dark, moist soil, and organic material. The samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. Sample results identified COCs as TPH above action limits (Table 1). No other chemical or radiological contaminants were present above action levels.

2.2.15 CAS 20-23-06, Cellar

CAS 20-23-06 is located on a dirt road just past a large construction sump to the east of Pahute Mesa Road in Area 20. The cellar is located to the west of U-20ac. The cellar is open, approximately 2.7 m (9 ft) deep, and contains soil and small amounts of drilling mud or grout material at bottom along with a stand pipe located within the cellar. The cellar is posted as "Underground Radioactive Material."

Soil samples were collected from the bottom of the cellar by BN on April 18, 2002. Samples were collected at the bottom of the cellar floor, which contained a mixture of soil, organic material, and possible drilling mud. The samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. Sample results identified COCs as TPH above action limits (Table 1) and levels of lead above the regulatory levels for toxicity characteristic (EPA, 2001). The levels of lead found in soil were all well below the EPA Region IX PRGs for Industrial Soils (Table 1) (EPA, 2002). No other chemical or radiological contaminants were present above action levels.

2.2.16 CAS 20-37-01, Cellar & Mud Pit

CAS 20-37-01 can be located by traveling on Pahute Mesa Road to the Area 20 camp, turning at the southern-most dirt road at the camp and proceeding to RSM J 14. From this point, travel west on a dirt trail and the site will be located on the north side of the trail. The site is located 318 m (350 yds) northeast of U-20aa. This site consists of an open cellar and a backfilled mud pit forming a mound. The cellar is lined with metal casing and is approximately 2.7 m (9 ft) in depth containing some water (likely result of precipitation) and dark soil at the bottom. The backfilled mud pit measures approximately 19.8 by 9 m (65 by 30 ft). Both the cellar and mud pit are posted as "Underground Radioactive Material." The cellar is listed as being an active UGTA (Underground Test Area) monitoring well (DOE/NV, 2001b).

Soil samples were collected from the bottom of the cellar by BN on April 18, 2002. Samples were collected at the bottom of the cellar floor, which contained a mixture of dark, moist soil, and organic material. The samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. Sample results identified COCs as TPH above action limits (Table 1) and levels of lead above the regulatory levels for toxicity characteristic (EPA, 2001). The levels of lead found in soil were all well below the EPA Region IX PRGs for Industrial Soils (Table 1) (EPA, 2002).

In addition, soil samples were collected in the backfilled mud pit at a depth of 0.6 m (2 ft) by BN on April 17, 2002. The samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. No other chemical or radiological contaminants were

present above action levels. All samples from the mud pit showed no COCs present above action levels (Table 1).

2.2.17 CAS 20-37-05, Cellar

CAS 20-37-05 can be located by traveling on Buckboard Mesa Road and making a left on Pahute Mesa Road, proceeding to the fork in the road (turn south) and the site is located near the road. This site consists of an open cellar containing soil, organic material, and drilling mud at the bottom along with a stand pipe protruding out the top of the cellar. The cellar is approximately 3.6 m (12 ft) deep and is posted as "Underground Radioactive Material."

Soil samples were collected from the bottom of the cellar by BN on April 23, 2002, and contained a mixture of soil, organic material, and possibly drilling mud. The samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. Sample results identified COCs as TPH above action limits (Table 1). No other chemical or radiological contaminants were present above action levels.

2.3 PROCESS KNOWLEDGE

This information was generated by IT Industrial Sites PA group and compiled from interviews of personnel, review of historical records, and logs of field activities.

2.3.1 CAS 02-99-01, Oil Stained Dirt on Concrete

Historical information about CAS 02-99-01 is limited. The origin and chronological history of the magnetite and spill material are unknown. The concrete pad (where the magnetite is currently located), appears to have been a building/structure at one time with asphalt located near the south side of pad, which indicates that it may have been a storage facility.

2.3.2 CAS 03-22-33, Bucket; Spill; Debris

Historical information about CAS 03-22-33 is limited. The origin and chronological history of the magnetite is unknown; however, it is apparent that the magnetite was dumped after not being used during a previous activity in the area. The bucket no longer exists at the site, but there still remains debris consisting of cable, scrap metal, and wood.

2.3.3 CAS 03-99-04, Spill

Historical information about CAS 03-99-04 is limited. The origin and chronological history of the epoxy tar is unknown. It is apparent that the epoxy tar was dumped and abandoned after not being used during a previous activity in the area.

2.3.4 CAS 12-30-02, Drill Holes

CAS 12-30-02 drill holes are the result of pre- and postshot drilling in an area where underground nuclear testing was conducted. This site is associated with the drilling efforts

accomplished for the Rainier Test. The Rainier Test was conducted by Lawrence Livermore National Laboratory (LLNL) on September 19, 1957 (DOE/NV, 2000). The drill holes were designed as both instrumentation holes and exploration holes. Instrumentation holes were preshot holes drilled to place monitoring equipment into the test cavity to obtain predetermined data, while exploration holes were generally drilled for geologic inquiry (DOE/NV, 2001a). No drilling records were identified for these particular drill holes; therefore, the drilling media used to drill the holes remain unknown. It is also unknown if the drill cuttings/fill material came from the drilling of these holes or from another location (DOE/NV, 2001a). It was reported that the mound was created to contain leakage of radioactive gases (Butler, 2000). According to the *Underground Test Area Borehole Index* documentation, all the drill holes associated with CAS 12-30-02 are plugged and/or grouted and buried under 2.4 m (8 ft) of fill (DOE/NV, 2001b).

2.3.5 CASs associated with mud pit sites

There were 828 underground nuclear tests conducted at the NTS between November 1951 and September 1992 (DOE/NV, 2000). With each test several different types of holes were drilled into the ground. Holes were drilled for exploratory purposes, device emplacement, and instrumentation prior to the test event. Holes were drilled after the event to collect samples of the affected media. Regardless of the purpose of the borehole, mud pits were created throughout the NTS for the transfer and collection of drilling mud and other drilling fluids. Drilling mud is fluid used as a lubricant and stabilization medium during drilling operations. The drilling mud also served to suspend solids for subsequent removal from the drill hole. The main constituent of drilling mud was powdered clay mixed with water. Bentonite and sepiolite were the two types of powdered clay used at the NTS.

The majority of the drilling mud manufactured for sites on Pahute Mesa was mixed using a portable mud machine. Drilling mud COCs can include lead, chromium, diesel fuel, VOCs, SVOCs, and various radionuclides. The Mud Pit Strategy report (DOE/NV, 2001a) provides the details on why these COCs are possibly found in drilling mud.

A common practice during drilling operations on the NTS was to add diesel fuel to drilling muds when the drill bit got caught; this provided additional lubrication to get the drill bit moving again. Because the drilling mud was mostly in aqueous form when it was discarded, "diesel" having a specific gravity of less than one, floats to the top of the mud deposit (mud pit or mud spilled on the surface). For CASs in CAU 358 where TPH was identified, higher concentrations usually occurred at or near the surface of the deposit. This limits the ability of the hydrocarbons to migrate into the subsurface since it is concentrated on the top of a low permeability drilling mud/clay. As petroleum hydrocarbons disperse through soil, a fraction of the total hydrocarbon mass will remain attached to the soil particles via capillary forces. These hydrocarbons are immobile.

The maximum amount of hydrocarbon that can be retained by a soil is known as residual saturation capacity. By using the formula for calculating the number of cubic yards required to immobilize a volume of diesel and converting the volumes of soil and diesel to mass, an estimate of the amount of diesel in mg/kg that a soil can immobilize can be calculated (Dragun, 1988).

The formula for calculating the volume of soil required to immobilize a petroleum hydrocarbon is:

$$V_S = 0.2V_{HC} / P(RS)$$

where

V_s = Volume of soil required to obtain residual saturation
V_{HC} = Volume of discharged hydrocarbon
P = Soil porosity (approximately 0.4 for drilling mud)
RS = residual saturation capacity (for diesel it is 0.15)

Given the density of drilling mud at 1.5 g/cm^3 and the density of diesel at 0.85 g/cm^3 the amount of diesel which becomes immobile is 37,000 mg diesel per kg of soil. The highest concentration of TPH found in the CASs associated with CAU 358 was 5,330 mg/kg. This indicates that TPH is immobile at all of the sites within CAU 358.

The only other credible pathway by which TPH will become mobile is infiltrating precipitation. The following site characteristics limit the migration of petroleum hydrocarbons to the groundwater:

- The arid climate. The average annual precipitation are as follows: Area 2 and 3 - 16.4 cm (6.44 in), Area 18 - 22 cm (8.67 in), and Areas 19 and 20 - 20 cm (7.88 in).

- Depth to groundwater for the associated areas in CAU 358 range from 160 m (525 ft) to 1,067 m (3,500 ft).

- Low permeability volcanic tuff units above the water table limit fluid migration.

Data collected during the site characterization of CAU 417, The Central Nevada Test Area Surface, by IT and reported in Appendix D of the Corrective Action Decision Document (DOE/NV, 1998) supports the assertion that drilling muds, which are primarily clays, are effective at containing TPH, thus preventing TPH contamination from spreading into underlying native material. IT characterized the UC-1 Central Mud Pit (CAS 58-09-01) which is composed of primarily bentonite clay contaminated with TPH, by sampling in 1997. Boreholes were drilled through the drilling mud and into the underlying native material. For all boreholes, the drilling mud was contaminated with TPH at levels up to 2,560 mg/kg, while the underlying material showed no TPH contamination at levels greater than the Nevada State action level of 100 mg/kg. TPH levels were essentially zero (not detected at the laboratory reporting limit) at depths of 0.3 m (1 ft) or more below the bottom of the mud pit. Also, results for a borehole adjacent to and down gradient of the mud pit were all less than action levels, demonstrating that TPH did not migrate from the mud pit and that the drilling mud retained the TPH contamination.

Mud pit and cellar CASs in CAU 358 contain TPH contamination at levels comparable to those in the CAU 417 Central Mud Pit. Therefore, based on the results reported for CAU 417 (DOE/NV, 1998), it is not anticipated that TPH contamination will migrate from drilling muds at the CAU 358 CASs.

2.3.6 CASs associated with cellar sites

Cellars were constructed in a variety of configurations. They are associated with postshot drill holes to collect samples of media affected by underground testing. Cellars were created to house the Blow Out Preventor equipment (BOP). The BOP was a device located at the postshot drilling hole that could seal off the annular space between the drill pipe and walls of the containment stack to prevent an uncontrolled escape of radioactive gases or liquids. Most of the cellars within CAU 358 consist of a 3-m (10-ft) diameter corrugated metal pipe (CMP). This CMP lines an excavation in the ground and often has a concrete pad around the perimeter. The borehole was drilled through the bottom of the cellar. Cellars are anywhere from 2.4 to 4.6 m (8 to 15 ft) deep. Drilling muds were never disposed of in cellars; however, drilling equipment was washed over the cellars. Therefore, cellars may contain the same COCs found in drilling muds.

Because all of the CASs located in CAU 358 are located in areas of the NTS that are designated as nuclear test zones, it is unlikely that these lands will be turned over to the U.S. Bureau of Land Management for public use. Because of the unique nature of the historic activities performed at these sites, access will likely be further controlled from any use other than nuclear testing. Therefore, there will be no uncontrolled contact with these petroleum hydrocarbons by NTS personnel, thereby eliminating any risk associated with leaving the petroleum hydrocarbons in place with no further action.

2.4 CLOSURE STANDARDS

The clean-closure standards for the purposes of closure verification for this SAFER Plan are:

- EPA Region IX risk-based PRGs for industrial soils (EPA, 2002).
- Nevada State action level for petroleum hydrocarbons in soil (i.e., 100 mg/kg) as stated in NAC Section 445A.2272 (NAC, 2002a).
- The action levels for radionuclides are isotope-specific and defined as the maximum concentrations for that isotope found in samples from undisturbed background locations in the vicinity of the NTS (McArther and Miller, 1989).

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3.0 FIELD ACTIVITIES AND CLOSURE OBJECTIVES

This section provides the framework and rationale for characterization, removal, closure verification, site restoration, and waste disposal. The SAFER process is discussed in detail in the following subsections.

Before field activities begin, the following activities will have been completed:

- Development of an endangered species survey.
- Preparation of National Environmental Policy Act documentation.
- Preparation of a Site-Specific Health & Safety Plan.
- Cultural Resource Survey.
- Preparation of an NNSA/NSO Real Estate/Operations Permit.

3.1 CONTAMINANTS OF CONCERN

Based on site process knowledge and the analytical results for site characterization samples collected by BN personnel from February to April 2002, the COCs for each CAS are listed in Table 2.

3.2 REMEDIATION

3.2.1 Closure by No Further Action

Sample results for the following six CASs show no COCs present above action levels, and hence these sites will be closed by taking no further action:

- CAS 12-30-02, Drill Holes
- CAS 18-09-01, Mud Pit
- CAS 19-09-06, Mud Pit
- CAS 19-09-07, Mud Pit
- CAS 20-09-05, Mud Pit
- CAS 20-09-08, Mud Pit
- CAS 20-37-01, Cellar & Mud Pit (backfilled mud pit only)

At CAS 18-09-01 as a best management practice, debris (including a bucket, broken pieces of batteries, and approximately 1.5 m^3 (2 yd^3) of associated soil) will be removed and disposed of as hazardous waste. This includes TPH- and lead-impacted soil from beneath the bucket and mercury-impacted soil from the area of the broken batteries. The waste will be containerized and stored in a 90-day accumulation area prior to shipment to an approved offsite hazardous waste treatment and storage facility. One soil verification sample from the area of the bucket and two samples from the area of battery pieces will be collected and submitted for analysis.

TABLE 2 - CAU 358 CONTAMINANTS OF CONCERN

CAS	CHARACTERIZATION SAMPLE ANALYSIS[a]	CONTAMINANTS OF CONCERN (mg/kg)
02-99-01	**Magnetite** - RCRA metals[b], and gamma spectroscopy[c] **Hydrocarbon spill** - VOCs[d], SVOCs[e], TPH[f], PCBs[g], RCRA metals, gross alpha and beta, and gamma spectroscopy	**Magnetite** - None **Hydrocarbon spill** TPH 1,350 Lead 118
03-22-33	VOCs, SVOCs, TPH, PCBs, RCRA metals, TCLP-selenium[h], gross alpha and beta, and gamma spectroscopy	None
03-99-04	VOCs, SVOCs, TPH, PCBs, RCRA metals, gamma spectroscopy	TPH 3,510 SVOCs Benzo (a) anthracene 27 Benzo (b) fluoranthene 68 Benzo (k) fluoranthene 57 Benzo (a) pyrene 32 Dibenzo (a,h) anthracene 14 Indeno (1,2,3-c,d) pyrene 30
12-30-02	VOCs, SVOCs, TPH, PCBs, RCRA metals, gamma spectroscopy	None
18-09-01	**Mud Pit and Bucket** - VOCs, SVOCs, TPH, PCBs, RCRA metals, and gamma spectroscopy **Area containing broken pieces of batteries**- RCRA metals	**Mud pit** - None **Bucket** TPH 238,000 Lead 276 **Batteries** Mercury 7
19-09-05	VOCs, SVOCs, TPH, PCBs, RCRA metals, gamma spectroscopy	TPH 1,108
19-09-06	VOCs, SVOCs, TPH, PCBs, RCRA metals, gamma spectroscopy	None
19-09-07	VOCs, SVOCs, TPH, PCBs, RCRA metals, gamma spectroscopy	None
20-09-05	VOCs, SVOCs, TPH, PCBs, RCRA metals, gamma spectroscopy	None
20-09-08	VOCs, SVOCs, TPH, PCBs, RCRA metals, gamma spectroscopy	None
20-23-02	VOCs, SVOCs, TPH, PCBs, RCRA metals, gamma spectroscopy	TPH 2,880 Lead 231
20-23-03	VOCs, SVOCs, TPH, PCBs, RCRA metals, gamma spectroscopy	TPH 5,330
20-23-04	VOCs, SVOCs, TPH, PCBs, RCRA metals, gamma spectroscopy	None
20-23-05	VOCs, SVOCs, TPH, PCBs, RCRA metals, gamma spectroscopy	TPH 3,060
20-23-06	VOCs, SVOCs, TPH, PCBs, RCRA metals, gamma spectroscopy	TPH 230 Lead 329
20-37-01	VOCs, SVOCs, TPH, PCBs, RCRA metals, gamma spectroscopy	TPH 250 Lead 112
20-37-05	VOCs, SVOCs, TPH, PCBs, RCRA metals, gamma spectroscopy	TPH 3,700

Notes:

[a] All analyses were made by an offsite laboratory during 2001 using EPA *Test Method for Evaluating Waste*, 3rd Edition, Parts 1-4, SW-846 (EPA, 1996).

[b] Metals include arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver by method SW-846 6010 and 7471A (EPA, 1996).

[c] Radionuclides analyzed by gamma spectroscopy.

[d] Volatile organic compounds by SW-846 8260 (EPA, 1996).

[e] Semivolatile organic compounds by SW-846 8270 (EPA, 1996).

[f] Total petroleum hydrocarbons, full-scan, gasoline, diesel, and waste oil carbon ranges by SW-846 8015 modified (EPA, 1996).

[g] Polychlorinated biphenyls by SW-846 8082 (EPA, 1996).

[h] Toxicity Characteristic Leaching Procedure (TCLP), sample preparation method SW-846 1311 (EPA, 1996).

3.2.2 Clean-Closure by Excavation and Disposal

Based on sample analytical results and best management practices, the following three sites will be clean-closed by excavation/removal and disposal of the impacted soil/material:

- CAS 02-99-01, Oil Stained Dirt on Concrete
- CAS 03-22-33, Bucket; Spill; Debris
- CAS 03-99-04, Spill

The following three CASs will be clean-closed by excavation and disposal of impacted soil:

- **CAS 02-99-01, Oil Stained Dirt on Concrete.** Approximately 160.5 cubic meters (m^3) (210 cubic yards [yd^3]) of magnetite material (no COCs present) will be removed and disposed of in the Area 9 U10c Sanitary Landfill. In addition, approximately 3 m^3 (4 yd^3) of TPH-impacted soil will be excavated from the hydrocarbon spill site which measures approximately 3 by 3 by 0.3 m (10 by 10 by 1 ft). The TPH-impacted soil will be disposed of at the Area 6 Hydrocarbon Landfill. Five or fewer soil verification samples will be collected from the bottom of the TPH excavation and submitted for analysis. Once it is verified that TPH levels on site are less than the action level, the area of the excavation will be backfilled with clean material if necessary, and regraded to the approximate original site topography.

- **CAS 03-22-33, Bucket; Spill; Debris.** Approximately 90.2 m^3 (118 yd^3) of magnetite material/associated soil (no COCs present) will be excavated and disposed of in the Area 9 U10c Sanitary Landfill. No verification samples will be collected from this site. If necessary, the area will be regraded to the approximate original site topography.

- **CAS 03-99-04, Spill.** Approximately 46 m^3 (60 yd^3) of TPH- and SVOC-impacted soil/epoxy tar material will be excavated from an area measuring approximately 43.5 by 6.6 by 0.15 m (145 by 22 by 0.5 ft). The impacted soil will be disposed of in the Area 6 Hydrocarbon Landfill. Ten or fewer soil verification samples will be collected from the bottom of the shallow excavation and submitted for analysis. Once it is verified that TPH and SVOC levels on site are less than the action level, the area of the excavation will be regraded to the approximate original site topography.

The extent of the excavations will be determined by TPH field-screening results, using detection kits such as PetroFLAG® test kits. Excavation of soil will cease when field-screening results indicate that all soil with TPH levels greater than the action level (i.e., 100 mg/kg) has been removed. Analysis of all verification samples will be by standard EPA methods (EPA, 1996).

3.2.3 Closure In Place with Administrative Controls

Eight CASs will be closed in place with administrative controls, i.e., use restrictions implemented. The only COC present at these sites is total petroleum hydrocarbons as diesel/oil. Six of the eight sites are postshot cellars that are currently open, i.e., not backfilled. These cellars are associated with postshot boreholes that are identified to be plugged and abandoned by the Borehole Management Program. The scope of work under the Borehole Management

Program will also include clearing the cellars of any brush and debris to a degree necessary to expose the top of the wellhead. The casing will then be extended from the cellar to a point above the ground level, thus allowing access to the borehole for plugging in the future. After the casing has been extended, the cellars will be backfilled with native material. Currently these CASs pose very low risk to human health or the environment. This is supported by an "A through K" risk evaluation made for the sites following the NAC Section 445A.227 guidelines (NAC, 2002b) and presented in DQOs (Appendix A1). The following eight CASs will be closed in place with administrative controls:

- CAS 19-09-05, Mud Pit
- CAS 20-23-02, Postshot Cellar
- CAS 20-23-03, Cellar
- CAS 20-23-04, Postshot Cellar
- CAS 20-23-05, Postshot Cellar
- CAS 20-23-06, Cellar
- CAS 20-37-01, Cellar & Mud Pit [Cellar only]
- CAS 20-37-05, Cellar

Five of the eight CASs listed above are open cellars that are currently posted as "Underground Radioactive Material" areas due to the fact that, at each site, a borehole was drilled to access a cavity created by the detonation of a nuclear device. Analytical and survey results for samples collected from the bottom of the open cellars at these sites show no radioactivity present; the cellars are clean of radioactivity. As part of CAU 358 closure these CASs will be closed in place with use restrictions implemented. At a later date these sites will be closed as described above as part of the Borehole Management Program. Because the current radiological postings apply to areas beneath the cellars (the boreholes), these postings will remain in effect after site use restrictions are implemented, and after the cellars and boreholes are closed by the Borehole Management Program. All radiological postings currently in effect at these sites will remain in effect following site closure.

3.3 VERIFICATION

In order to assess the completeness of the remediation activities, biased soil samples will be collected to confirm that all materials exceeding the established clean-up criteria have been removed. The action level for TPH is 100 mg/kg (NAC, 2002a), 750 mg/kg for lead, 0 mg/kg for mercury, and several SVOCs are based on EPA Region IX PRGs for Industrial Soils (EPA, 2002). Soil verification samples will be collected from the bottom of the excavations. Additional samples may be required if the first set of verification samples indicates that COCs are still present. BN Organization Instruction OI-2152.108, "Soil Sampling," will be followed to collect all soil verification samples (BN, 2000). All samples will be labeled and sample jars will be sealed with custody tape, placed in individual Zip-lock bags, and placed on ice in a cooler for transport to the NTS Environmental Technical Services. Each verification sample will be submitted for laboratory analysis using standard EPA methods (EPA, 1996).

3.4 DATA QUALITY OBJECTIVES

DQOs are qualitative and quantitative statements that specify the quality of the data required to support potential closure alternatives for CAU 358. The DQOs were developed to clearly define the purposes for which environmental data will be used and to design a data-collection program that will satisfy these purposes. The formulation of a Conceptual Site Model (CSM) is an aid to the development of DQOs for the site.

Details of the DQO process are presented in Appendix A1. During the DQO discussions for CAU 358, data needed to resolve problem statements and decision statements were identified. Criteria for data collection and analysis were defined and agreed upon, and the appropriate quality assurance (QA)/quality control (QC) required for particular data collection activities was assigned. The analytical methods and reporting limits prescribed through the DQO process and the data quality indicators (DQIs) for laboratory analysis, such as precision and accuracy requirements, are provided in more detail in Section 6.0 of this SAFER Plan.

3.5 CLOSURE

The specific activities required to close each CAS that comprises CAU 358 have been detailed in Section 3.2. Hold points and conditions that are outside the assumptions of this plan may impact the requirements for closure. In general, the proposed activities for closure of CAU 358 include the following:

- For CASs that are to be clean-closed, removal of all housekeeping debris, sanitary waste, TPH-impacted soil, and mercury-impacted soil. The extent of soil with TPH concentrations greater than action levels will be determined in the field for each impacted CAS by field screening methods.

- All removed soil/material will be loaded and transported to the Area 9 U10c Sanitary Landfill, the NTS Area 6 Hydrocarbon Landfill or, if determined to be hazardous waste, transported to an approved permitted offsite hazardous waste treatment and storage facility.

- All excavations will be backfilled with clean fill, if necessary, and regraded to the approximate original site topography.

- For the CASs to be closed in place with administrative controls, the sites will be surveyed and a Use Restriction will be implemented.

- The preparation and submittal of a CR to the NDEP for approval.

3.6 DURATION

The schedule will require modifications if conditions exist that are outside the assumptions on which the schedule was developed. Flexibility has been placed in the project schedule to account for minor difficulties (e.g., weather, equipment breakdowns, personnel availability, NTS operational and security constraints). NNSA/NSO will keep the NDEP informed of any condition that may impact the project schedule. Figure 15 presents the proposed project schedule following submittal of the final SAFER Plan for CAU 358.

ACTIVITY DESCRIPTION	Completion Date
CAU 358: Areas 18, 19, 20 Cellars/Mud Pits	
SAFER Plan Finalization and Approval	December 31
Field Planning	June 1
Closure Activities in the Field	
Closure Activities	July 7
Closure Data Evaluation	September 18
Preparation of Closure Report	December 31

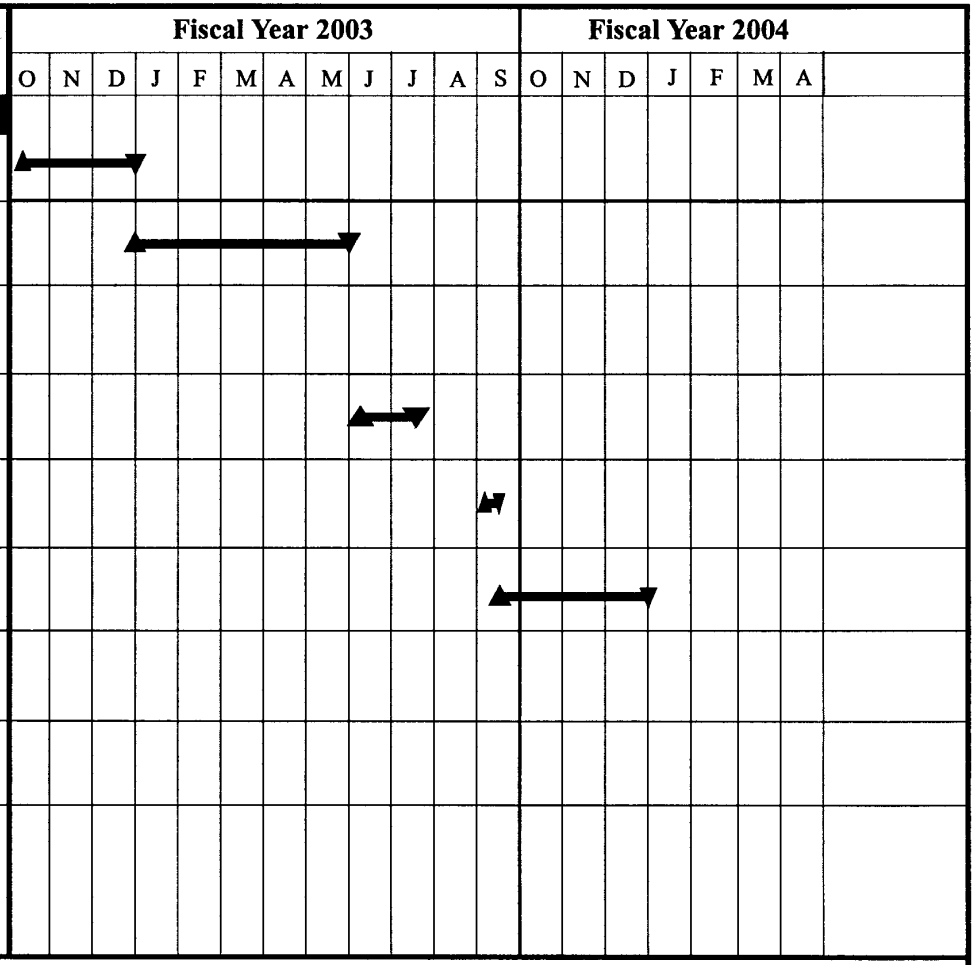

FIGURE 15
CAU 358 PROPOSED CLOSURE SCHEDULE

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4.0 REPORTS AND RECORDS AVAILABILITY

A daily report will be prepared when field activities have started. The report will summarize the daily activities, site visitors, health and safety issues, and any other relevant issues or problems. This report will be provided to the NNSA/NSO Task Manager for submittal to the NDEP.

Upon completion of closure activities, a CR will be prepared and will include the following sections and subsections:

- Introduction (Purpose and Scope)
- Closure Activities (Description of Corrective Action Activities, Deviation from the SAFER Plan as Approved, Corrective Action Schedule as Completed, and Site Plan/Survey Plan)
- Waste Disposition
- Closure Verification Results (Data Quality Assessment and Use Restrictions)
- Conclusions and Recommendations
- References
- Supporting Documentation (Analytical Results for Verification Samples, As-Built Documentation, Waste Disposition Documentation, and Modifications to the SAFER Plan)

The final CR will be submitted to NNSA/NSO and NDEP for review and approval. This SAFER Work Plan and the subsequent CR will be available in the NNSA/NSO Public Reading facilities in Las Vegas and Carson City, Nevada, or by contracting the NNSA/NSO Project Manager. The NDEP maintains the official administrative record for all activities conducted under the auspices of the FFACO (FFACO, 1996).

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5.0 INVESTIGATION/REMEDIATION WASTE MANAGEMENT

Waste from CAU 358 will be managed in accordance with all state and federal regulations, DOE orders, BN procedures, and the RCRA Operational Permit. Known waste types will include nonhazardous (e.g., sanitary/construction debris) waste, TPH-and SVOC-impacted soils, and hazardous waste.

5.1 WASTE MINIMIZATION

Waste generation will be minimized for the duration of the project, by site workers adhering to the principles of the BN Waste Minimization and Pollution Prevention Program. Care will be taken to segregate waste from non-waste materials, if at all possible, and avoid cross-contamination of waste streams.

5.2 POTENTIAL WASTE STREAMS

Table 3 shows the potential waste streams by CAS in CAU 358. No waste is expected to be generated at the CASs to be closed by taking no further action or closed in place with administrative controls.

5.2.1 Nonhazardous Waste

Nonhazardous waste (i.e., sanitary debris) will be generated during closure of CAU 358. Nonhazardous waste will consist primarily of used personal protective equipment (PPE) and housekeeping debris, such as scrap metal and wood. Where possible, this type of debris will be recycled. Non-recyclable materials will be disposed of in the NTS Sanitary Landfill.

5.2.2 TPH-Impacted Soil

TPH-impacted soil will be excavated from three CASs during closure of CAU 358. If no other COCs are present at concentrations greater than action limits, the removed soil will be transported and disposed of in the NTS Area 6 Hydrocarbon Landfill. If other COCs (e.g., lead or mercury) are present in the soil at concentrations greater than hazardous waste limits as set by RCRA (EPA, 2001), the soil will be treated as hazardous waste.

5.2.3 Hazardous Waste

Hazardous waste (e.g., spent methanol) will be produced by TPH field screening of soil during the closure of CAU 358. Spent methanol is classified by RCRA as a hazardous waste and will be managed as such. The waste will be transported to the NTS Area 23 Satellite Accumulation Area (SAA) Number NTS099. The SAA is registered and serviced by the BN Hazardous Waste Operations group. The accumulated waste is collected from the SAA periodically and

transported and disposed of offsite at an approved, permitted hazardous waste treatment, storage, and disposal facility.

TABLE 3 - POTENTIAL WASTE STREAMS BY CAS AT CAU 358

CAS	Sanitary	Hydrocarbon-Impacted Soil/Material	Hazardous
CAS 02-99-01	X	X	--
CAS 03-22-33	X	--	--
CAS 03-99-04	--	X	--
CAS 12-30-02	--	--	--
CAS 18-09-01	X	X	X (bucket of pipe dope, battery pieces, and soil beneath sites)
CAS 19-09-05	--	--	--
CAS 19-09-06	--	--	--
CAS 19-09-07	--	--	--
CAS 20-09-05	--	--	--
CAS 20-09-08	--	--	--
CAS 20-23-02	--	--	--
CAS 20-23-03	--	--	--
CAS 20-23-04	--	--	--
CAS 20-23-05	--	--	--
CAS 20-23-06	--	--	--
CAS 20-37-01	--	--	--
CAS 20-37-05	--	--	--

Note: Dashes indicate no waste generated; X indicates potential waste generation.

Excavated soil that contain RCRA metals at concentrations greater than RCRA hazardous waste levels (EPA, 2001) will be treated as hazardous waste. The waste will be placed in approved containers and stored in an established SAA only if the waste does not fill more than one 208-liter (55-gal) drum. If there is more than 55 gallons, the waste will be placed in a 90-day accumulation area or moved to the NTS Area 5 Hazardous Waste Storage Unit. BN Hazardous Waste Operations will oversee the transport of the waste to the Area 5 Hazardous Waste Storage

Unit and the shipment of the waste offsite to an approved hazardous waste treatment and storage facility for disposal.

5.3 CONTAINER MANAGEMENT

Some 208-liter (L) (55-gal) drums may be used during this project. All containers must be in good condition. If the container begins to leak, the contents must be transferred to a container that is in good condition without dents or significant rust. The containers must always be closed while stored unless waste is being added or removed. They must be handled in such a manner that will not jeopardize the integrity of the container.

Containers will not be filled above their specified weight capacity. Compactable waste will then be placed in 208-L (55-gal) drums. After a container has been filled, the container will be locked. If a container is not completely filled to capacity at the end of a workday, it will be locked and tamper-resistant tape will be placed over the container's hinge. Additional precautions will include not filling 208-L (55-gal) drums more than 7/8 full and not mixing waste types (e.g., PPE and decontamination water).

Because the majority of the waste produced during this project is anticipated to be soil and debris, secondary containment will not be required. If, however, free liquids, such as decontamination water, are placed in containers, the containers will be placed on spill containment pallets or within a plastic-lined bermed area. Appropriate labels and relevant information will be marked on each container with an indelible marker and must be legible and clearly visible for inspections. Pertinent data will be written on duct tape or a blank adhesive label that is applied to the side of the container. The following information will be included:

- Waste-tracking label
- Type of waste in the container (e.g., marked "Hazardous Waste")
- Location where waste was derived
- Date that accumulation begins/ends
- If sampling is required, an "Awaiting Analysis" sticker after sampling has been completed

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6.0 QUALITY ASSURANCE/QUALITY CONTROL

The overall objective of the closure activities described in this plan is to collect accurate and defensible data to support the selection of and to implement a closure alternative for each CAS in CAU 358. The following sections discuss the collection of required QC samples in the field and QA requirements for laboratory/analytical data to achieve closure.

6.1 PROPOSED FIELD SAMPLE COLLECTION ACTIVITIES

Field QC samples will be collected in accordance with established procedures (BN, 2000). Field QC samples are collected and analyzed to aid in determining the validity of sample results. The number of required QC samples depends on the type and number of environmental samples collected. The minimum frequency of collecting and analyzing QC samples for this investigation, as determined in the DQO process, include:

- Field duplicates (1 per 20 environmental samples or 1 if less than 20 are collected)
- Matrix spike/matrix spike duplicate (1 per 20 environmental samples or 1 if less than 20 are collected)

Additional QC samples may be substituted, based on site conditions at the discretion of the Technical Lead. Field QC samples will be analyzed using the same analytical procedures used for environmental samples. The results of the QC sample analysis will be included in the CR.

6.2 PROPOSED LABORATORY/ANALYTICAL DATA QUALITY INDICATORS

Criteria for site closure requires laboratory analysis of samples used to provide a quantitative measurement of any COCs present. Rigorous QA/QC will be implemented for all laboratory samples and will include documentation, data verification, validation of analytical results, and will meet the requirements of DQIs as they relate to laboratory analysis.

Data verification and validation will be performed in accordance with established procedures and with this SAFER Plan. All laboratory data from samples collected and analyzed will be evaluated for data quality according to EPA Functional Guidelines (EPA, 1994; 1999). The data will be reviewed to ensure that all critical samples were appropriately collected and analyzed and that the results passed data validation criteria. Validated data, whether estimated or not, will be assessed to determine whether they meet the DQOs of the investigation and the performance criteria for the DQIs. The results of this assessment will be documented in the CR. If the DQOs were not met, corrective actions will be evaluated, selected, and implemented (e.g., refine the CSM or resample to fill data gaps).

DQIs are qualitative and quantitative statements that specify the data requirements of a project and include precision, accuracy, representativeness, completeness, and comparability. In

addition, sensitivity has been included as a DQI for laboratory analysis. The performance criteria for each indicator has been selected based on the intended use of the data, current field and analytical procedures, and instrumentation. Precision and accuracy goals have been standardized for both organic and inorganic analytes for analytical laboratories under the EPA Contract Laboratory Program (EPA, 1988a; 1988b). Laboratory QC samples used to measure the precision and accuracy of analytical procedures will be analyzed using the same analytical procedures used for environmental samples.

Table 4 provides the established performance criteria for each of the DQIs and the impacts to the decision if the criteria are not met. Any deficiencies noted during the investigation that renders the data quality unacceptable will be documented in the CR.

TABLE 4 - LABORATORY/ANALYTICAL DATA QUALITY INDICATORS

DATA QUALITY INDICATOR	PERFORMANCE CRITERIA	IMPACT ON DECISION IF PERFORMANCE CRITERIA NOT MET
Precision	Variations between duplicates (field and lab) and original sample should not exceed analytical method-specific criteria listed in Table 5.	Estimated data within sample delivery group (SDG) will be evaluated for their usability. If data are determined to be unusable, data will not be used in decision and completeness criteria will be assessed.
Accuracy	Laboratory control sample results and matrix spike results should be within analytical method-specific criteria listed in Table 5.	Estimated data within SDG will be evaluated for its usability. If estimated data are biased high or conservative, the data may be used in decision. If estimated data are biased low and below the decision threshold, the data may not be used in decision and completeness criteria will be assessed.
Sensitivity	Detection limits of laboratory instruments must be less than action level for COC.	Cannot determine if COCs are present at levels of concern, thereby investigation objectives cannot be met.
Completeness	100% of samples submitted to laboratory 100% of requested analyses performed 100% of critical analytes to be valid[a] 80% of non-critical analytes to be valid	1. Decision of whether extent of contamination has been bounded cannot be determined. Impacts to decisions will be assessed. 2. Decision of whether COCs (TPH) above NAC level remain in soil cannot be determined. Impacts to decisions will be assessed.
Comparability	Equivalent samples analyzed using same analytical methods, same units of measurement, and detection limits must be used for like analyses.	Inability to use data collected.
Representa-tiveness	Correct analytical method performed for appropriate COC: valid data reflects appropriate target population.	Cannot identify COC or estimate concentration of COC; therefore, cannot make decision(s) on target population.

[a] Critical analytes are those analytes most likely present in the target population at COCs that have been identified through process knowledge of similar sites and historical documentation. Critical analytes for samples are TPH and TPH (lead and mercury).

TABLE 5 - LABORATORY ANALYTICAL PROCEDURES FOR CAU 358

PARA-METER OR ANALYTE	MEDIUM OR MATRIX	ANALY-TICAL METHOD	MINIMUM REPORTING LIMIT	REGULATORY LIMIT	RELATIVE PERCENT DIFFERENCE (RPD)[a]	PERCENT RECOVERY (%R)[b]
TPH	Soil Gasoline	8015B modified[c]	0.5 milligrams per kilogram (mg/kg)[d]	100 mg/kg[e]	Lab specific[f]	Lab specific[f]
	Soil Diesel		25 mg/kg[d]	100 mg/kg[e]		
SVOCs	Soil	8270C[c]	Analyte-specific estimated quantitation limits[d]	EPA Region 9 PRGs	Lab specific[f]	Lab specific[f]
VOCs	Soil	8260B[c]	Analyte-specific estimated quantitation limits[d]	EPA Region 9 PRGs	Lab specific[f]	Lab specific[f]
Total RCRA metal-lead	Soil	6010B[c]	2.5 mg/kg[d]	750 mg/kg	35[f]	Matrix Spike 75 - 125[f]
Total RCRA metal-mercury		7471A[c]	0.1 mg/kg[d]	62 mg/kg		Laboratory Control Sample 80 - 120[f]

[a] RPD is used to calculate precision. Precision is estimated from the RPD of the concentration measured for the MS/MSD analyses of unspiked field samples, or field duplicates of unspiked samples. It is calculated by: RPD = 100 x $\{(|C_1-C_2|)/[(C_1+C_2)/2]\}$, where C_1 = concentration of the analyte in the first aliquot, C_2 is the concentration of the analyte in the second sample aliquot.

[b] %R is used to calculate accuracy. Accuracy is assessed from the recovery of analytes spiked into a blank or sample matrix of interest, or from the recovery of surrogate compounds spiked into each sample. The recovery of each spiked analyte is calculated by: %R = 100 x (C_s-C_u/C_n), where C_s = concentration of the analyte in the spiked sample, C_u = the concentration of the analyte in the unspiked sample, and C_n = the concentration increase that should result from spiking the sample.

[c] U.S. Environmental Protection Agency's (EPA's) Test Methods for Evaluating Solid Waste, 3rd Edition, Parts 1-4, SW-846 (EPA, 1996)

[d] Industrial Sites Quality Assurance Project Plan (NNSA/NV, 2002).

[e] TPH regulatory limit set in Nevada Administrative Code, 445A.2272 (NAC, 2002a).

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

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APPENDIX A1

DATA QUALITY OBJECTIVES

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ACRONYMS AND ABBREVIATIONS

BN	Bechtel Nevada
CAS	Corrective Action Site
CAU	Corrective Action Unit
cm	centimeter(s)
COC	contaminant(s) of concern
COPC	contaminant(s) of potential concern
CR	Closure Report
CSM	conceptual site model
DNA	Defense Nuclear Agency
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FFACO	Federal Facility Agreement and Consent Order
ft	foot/feet
in	inch(es)
IT	International Technology Corporation
LLNL	Lawrence Livermore National Laboratory
m	meter(s)
mg/kg	milligram(s) per kilogram
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
NNSA/NV	U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office
NTS	Nevada Test Site
PCB	polychlorinated biphenyls
PRG	preliminary remediation goals
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
SAFER	Streamlined Approach for Environmental Restoration
SVOC	semi-volatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
TPH	total petroleum hydrocarbon
USGS	U.S. Geological Survey
VOC	volatile organic compound
%R	percent recovery

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APPENDIX A1
DATA QUALITY OBJECTIVES FOR CORRECTIVE ACTION UNIT 358: AREAS 18, 19, 20 CELLARS/MUD PITS

The information presented here is based on historical data generated from preliminary assessment activities for Corrective Action Unit (CAU) 358 at the Nevada Test Site (NTS). Data quality objective (DQO) worksheets follow the U.S. Environmental Protection Agency (EPA) DQO guidance outline (EPA, 2000). The steps systematically build on the data acquired during preliminary assessment work and background research. Copies of the preliminary assessment work are retained in the project files.

Members of the Scoping Team and Decision Teams are as follows:

1. Scoping Team
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1.0 PROBLEM STATEMENT

1.1 State the problem

Twenty-seven Corrective Action Sites (CASs) that comprise CAU 358, have been identified for closure. In order to properly close these sites, current data and existing information will be evaluated and used to develop conceptual site models (CSM). This data will also be used to develop closure alternatives. As currently listed in the Federal Facility Agreement and Consent Order (FFACO) of 1996, CAU 358 is comprised of 27 CASs. Ten of the CASs are located in crater or potential crater areas, and as such, pose a safety risks to personnel working at these sites. Therefore, a FFACO modification request that these ten CASs be removed from CAU 358 and placed in CAU 544 has been prepared and submitted for approval. Upon approval of this request, CAU 358 will consist of following 17 CASs. The DQOs presented in this Appendix have been prepared for the 17 CASs remaining in CAU 358:

- CAS 02-99-01, Oil Stained Dirt on Concrete
- CAS 03-22-33, Bucket; Spill; Debris
- CAS 03-99-04, Spill
- CAS 12-30-02, Drill Holes
- CAS 18-09-01, Mud Pit
- CAS 19-09-05, Mud Pit
- CAS 19-09-06, Mud Pit
- CAS 19-09-07, Mud Pit
- CAS 20-09-05, Mud Pit
- CAS 20-09-08, Mud Spill
- CAS 20-23-02, Postshot Cellar
- CAS 20-23-03, Cellar
- CAS 20-23-04, Postshot Cellar
- CAS 20-23-05, Postshot Cellar
- CAS 20-23-06, Cellar
- CAS 20-37-01, Cellar & Mud Pit
- CAS 20-37-05, Cellar

Upon approval of the FFACO modification request the following ten CASs currently in CAU 358 will be moved to CAU 544:

- CAS 19-09-01, Mud Pits (2)
- CAS 19-09-03, Mud Pit
- CAS 19-09-04, Mud Pit
- CAS 20-09-01, Mud Pits (2)
- CAS 20-09-02, Mud Pit
- CAS 20-09-03, Mud Pit
- CAS 20-09-04, Mud Pits (2)
- CAS 20-09-06, Mud Pit
- CAS 20-09-07, Mud Pit
- CAS 20-09-10, Mud Pit

1.2 Summarize the problem - combine the relevant background information into a concise description of the problem to be resolved and known or suspected sources of disposed waste.

1.2.1 CAS 02-99-01: Oil Stained Dirt on Concrete

This site is located on the south side of Road 2-05, just before the intersection with Road 2-03 on a concrete pad. There is no oil-stained dirt on the concrete pad as implied by the Federal Facility Agreement and Consent Order (FFACO) CAS title. During site visits made on June 7, 2001, and April 18, 2001, the oil-stained dirt on the concrete pad was determined to be a pile of magnetite. This was confirmed by process knowledge and testing with a magnet. Specific historical information about this site is limited. It is unknown where the magnetite came from; however, magnetite was used as shot emplacement hole plug back material during testing activities and excess material was commonly discarded. The site was likely misidentified because the mineral magnetite is dark in color and was mistaken for total petroleum hydrocarbon (TPH) contaminated soil. The dimensions of the magnetite pile measured approximately 13 by 14 meters (m) (42 by 45 feet [ft]) with a height of 1.8 m (6 ft). Samples of the magnetite were collected by Bechtel Nevada (BN) from two different locations on June 7, 2001, and analyzed for total Resource Conservation and Recovery Act (RCRA) metals, and gamma spectroscopy. The analytical results indicated that the magnetite did not contain any of the analyzed metals above the U.S. EPA Region IX Preliminary Remediation Goals (PRGs) (EPA, 2002) for industrial soils. The results also indicated that gamma emitting radionuclides are not above NTS background levels. A radiological field screening survey of the site was also conducted and the results showed levels of radiation to be at background. These sampling results are consistent with other CASs containing discarded magnetite from CAU 387.

In addition to the magnetite a small hydrocarbon spill, located southeast of the concrete pad, was identified. The discolored soil measured 3.4 by 3 m (11 by 10 ft). The vertical extent of TPH impacted soil is not known. Sampling was conducted by International Technology Corporation (IT) on November 25, 1998, on the oil-stained dirt. The samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH), polychlorinated biphenyls (PCBs), total RCRA metals, gross alpha and beta, and gamma spectroscopy. The results indicated that the only COPC was TPH in the diesel/oil range (1,350 milligrams per kilogram [mg/kg]).

1.2.2 CAS 03-22-33: Bucket; Spill; Debris

This CAS is located on a dirt road approximately 305 m (1,000 ft) north from the Road 3-03. The spill is located just east of the dirt road. The spilled material was determined to be magnetite material by process knowledge and testing with a magnet during a site visit. The spill covers an area 44 by 6.7 m (145 by 22 ft) with an average thickness of approximately 30.5 centimeters (cm) (12 inches [in]). The magnetite material was also found mixed with small dirt piles on the ground surface that is part of the total area. The previously reported bucket was not found during an IT site visit on July 19, 1999, or by BN during a site visit on June 8, 2001.

Sampling was conducted by IT on August 27, 1997, on the pile of magnetite material. The sample was analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, gross alpha

and beta, and gamma spectroscopy. The analytical results indicated that the magnetite contained no COPCs above regulatory levels or PRGs for industrial soils.

Soil samples were collected by BN from two different locations of the magnetite material on June 8, 2001, and analyzed for total RCRA metals, Toxicity Characteristic Leaching Procedure (TCLP)-selenium, and gamma spectroscopy. The results indicated that the magnetite material contained no COPCs above regulatory levels or PRGs for industrial soils. A radiological survey of the site was also conducted and the results indicated levels of radiation to be at background levels.

Historical information about this site is limited. It is unknown where the material came from; however, magnetite was used as emplacement hole plug back material during testing activities. No additional information is required from the site to establish a closure alternative.

1.2.3 CAS 03-99-04, Spill

This CAS is located on a skid trail off of the 3-07 Road (3B Road). The site can be found by traveling approximately 0.25 mile on a skid trail. From process knowledge of past sites containing similar material, it was determined that the spill is epoxy tar. Historical information about this site is limited. It is unknown where the epoxy tar came from; however, epoxy tar was known to be used as shot emplacement hole plug back material during testing activities. The spill covers a total area of approximately 38 by 15.2 m (125 by 50 ft).

Soil samples of the epoxy tar/associated soil were collected by BN on June 11, 2001, and analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. The results indicated that the COPCs were TPH-diesel/oil range (3,510 mg/kg) and several SVOCs above the PRGs (Table 1). All other analytical results of the epoxy tar spill were below regulatory levels and the PRGs for industrial soils. A radiological survey of the site was also conducted and the results indicated levels of radiation to be at background levels.

TABLE 1 - SVOCs IDENTIFIED AT CAS 03-99-04

SVOCs Identified	Analytical Method	Analytical Results (mg/kg)[a]	Minimum Reporting Limit (mg/kg)	Regulatory Limit-Preliminary Remediation Goals (mg/kg)
Benzo (a) anthracene	8270	27	6.6	2.9
Benzo (b) fluoranthene	8270	68	6.6	2.9
Benzo (k) fluoranthene	8270	57	6.6	29
Benzo (a) pyrene	8270	32	6.6	0.29
Dibenzo (a,h) anthracene	8270	14	6.6	0.29
Indeno (1,2,3-c,d) pyrene	8270	30	6.6	2.9

[a]mg/kg - milligrams per kilogram.

Sample results from the epoxy tar are consistent with results from other epoxy tar sites (CASs 02-99-02, 02-99-03, 03-99-01, 03-99-03, 03-99-06, 03-99-08, 07-99-03 closed in CAU 387). The extent of tar impacted soil is easily discerned with the naked eye; therefore, no samples are required. The SVOCs can leach from the epoxy tar into the soil. Previous verification sampling at the CASs within CAU 387 indicates that the SVOCs do not leach beyond the uppermost six inches of soil in contact with the epoxy tar. No additional information is required from the site to establish a closure alternative.

1.2.4 CAS 12-30-02, Drill Holes

This CAS is located near the P Road in Area 12 in association with the B Tunnel. The site consists of a large mound of possible drill cuttings/fill material on top of the Area 12 Mesa. The dimensions of the mound are approximately 46 by 26.5 m (151 by 87 ft) with a height of approximately 2.4 m (8 ft). It is reported that the mound was used to cover drill holes. There are two plugged drill holes that are protruding from the mound that measure approximately 7.6 cm (3 in) in diameter.

BN collected samples from two locations on April 24, 2002, from the mound at the surface. The samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. The analytical results indicated that the mound contained no COPCs above regulatory levels or PRGs for industrial soils. A radiological survey of the site was also conducted and the results indicated levels of radiation to be at background levels.

Based on past site visits, historical documentation, and interviews, the mound is covering nine plugged instrumentation drill holes and one plugged exploratory drill hole with miscellaneous housekeeping debris in the area. No drilling records were identified for these particular drill holes; therefore, the drilling media used to drill the holes remain unknown. It is also unknown if the drill cuttings/fill material came from the drilling of these holes or from another location (DOE/NV, 2001a). According to the *Underground Test Area Borehole Index* documentation, all the drill holes associated with CAS 12-30-02 are plugged and/or grouted under the 2.4 m (8 ft) of fill (DOE/NV, 2001b). An interviewee indicated that the mound was reportedly created to contain leakage of radioactive gases. In other words the mound was used to cover the drill holes as a means of secondary containment after the drill holes had been grouted closed. There is no reason to suspect that the mound is impacted with COPCs and previous sampling confirms it. No additional information is required from the site to establish a closure alternative.

1.2.5 CAS 18-09-01, Mud Pit

This CAS is located in Area 18 at the end of the 18-05 Road, approximately 2.5 miles southwest from Buckboard Mesa Road. The mud pit measures 36.5 by 21.3 m (120 by 70 ft) with an approximate depth of the drill mud at 30.5 cm (12 in). The drill mud is dry and light gray in color and the sides of the mud pit are covered with vegetation. Also located in the mud pit is a bucket containing an unknown material (possibly pipe dope) and a small area consisting of broken pieces of alkaline batteries.

Two sample locations were chosen within the mud pit and samples were collected from the surface mud and at depths of 0.3 m (1 ft) below surface at each location. The soil samples were

collected by BN at CAS 18-09-01 on February 7, 2002. The samples collected from the drill mud were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. The analytical results for the drilling mud indicate that the mud in the mud pits contain no COPCs above regulatory levels or the PRGs for industrial soils with the exception of TPH.

Two additional samples were collected from the drilling mud in the vicinity of the broken up pieces of alkaline batteries. Samples were analyzed for total RCRA metals to determine if the batteries had impacted the drilling mud. The analytical results indicated that the drilling mud in the vicinity of the broken pieces of batteries contained Mercury above the PRGs for industrial soils. The other sample was taken from the material inside the bucket of what is believed to be a lead-based pipe dope. Samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy. The analytical sample results of the material indicated a presence of TPH diesel/oil range (238,000 mg/kg). All other analytical results for samples collected were below regulatory limits and PRGs for industrial soils. It is not clear if the contents in the bucket have impacted the drilling mud in the vicinity of where the bucket is located.

Radiological surveys on the site were also conducted and the results indicated levels of radiation to be at background levels. No additional information is required from the site to establish a closure alternative. However, the drilling mud in the vicinity of the bucket should be sampled to verify that the bucket contents have not impacted the mud.

1.2.6 CAS 19-09-05, Mud Pit

This CAS is located in Area 19 on a dirt road approximately 0.8 mile off of Dead Horse Flats Road. The mud pit measures 29.5 by 24.6 m (97 by 81 ft) with the maximum depth of the drill mud at 30.5 cm (12 in). The drill mud is dry and cracked with a light gray color, and the sides of the mud pit are covered with vegetation.

Soil samples were collected by BN at CAS 19-09-05 on February 11, 2002. Samples were collected from the surface mud and from mud at depths of 15.2 cm (6 in) and 30.5 cm (12 in) at two locations. All samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy.

Analytical results indicated a presence of TPH diesel/oil range (1,108 mg/kg) for the surface sample and TPH oil range (150 mg/kg) at a 15.2-cm (6-in) depth at the first location. At the second location in the same mud pit, soil samples were also collected at the surface and at a depth of 30.5 cm (12 in). Analytical results indicated the presence of TPH oil range (170 mg/kg) in both the surface and the 30.5 cm (12 in) depth samples. All other analytical results were below regulatory limits. Radiological surveys on the site were also conducted and the results indicated levels of radiation to be at background levels. No additional information is required from the site to establish a closure alternative.

1.2.7 CASs 19-09-06, 19-09-07, 20-09-05, 20-09-08, and 20-37-01, Mud Pits and Mud Spill

These CASs are located throughout Areas 19 and 20. The surface areas of the mud pits range from approximately 50.3 by 48.8 m (165 by 160 ft) to 6 by 4.5 m (20 by 15 ft) with an assumed depth ranging from 2.54 cm (1 in) to 2.4 m (8 ft). One site, CAS 20-37-01, contains a mud pit that has been backfilled. Thickness of the mud spill at CAS 20-09-08 is 7.6 to 10 cm (3 to 4 in).

Soil samples were collected by BN at 19-09-06, 19-09-07, 20-09-05, 20-09-08, and 20-37-01 on February 7, 12 and 13, and April 17, 2002. Samples were collected from the surface mud and/or depths ranging from the surface down to 1 m (3 ft). All samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy.

The analytical results for these sites indicate that the mud in the mud pits and mud spill contains no COPCs above regulatory levels. A radiological survey of the sites was also conducted and the results indicated levels of radiation to be at background levels. No additional information is required from these site to establish a closure alternative.

1.2.8 CASs 20-23-02, 20-23-03, 20-23-04, 20-23-05, 20-23-06, 20-37-05, and 20-37-01, Cellars

These CASs are located throughout Area 20. All the cellars were open from the top with the exception of CAS 20-23-04, which was plugged and backfilled with soil/gravel on August 16, 1994, per the *Underground Test Area Borehole Index* (DOE/NV, 2001b). The cellars range from approximately 2.7 to 3.6 m (9 to 12 ft) in diameter with a depth range of approximately 2.7 to 4.5 m (9 to 15 ft). The cellar floors contain an unknown amount of soil with small amounts of organic material and possible drilling material. The walls of the cellars are lined with corrugated steel with the exception of CAS 20-37-01, which is lined with a square metal casing.

According to historical documentation and prior interviews, exploratory holes were drilled in order to determine a location suitable for underground testing. After a site was selected, holes were drilled for emplacement of the nuclear device and instrumentation. Prior to testing, a cellar was excavated and lined with corrugated metal pipe to house the containment equipment. The postshot hole was then drilled to approximately 30 to 36.6 m (100 to120 ft) below ground surface. The hole was filled with water and the abandonment valve installed and closed until after the test is completed. After a test was completed, postshot drilling was accomplished in order to reenter the test cavity to obtain gas samples and puddle glass (i.e., melted rock and materials which cooled and solidified at the bottom of the test cavity). Postshot drilling was also used to determine cavity size, chimney dimensions, the effects of the explosion on the surrounding material, and the distribution of radioactivity in the test area. Drilling muds were never disposed of in cellars; however, drilling equipment was washed over the cellar. Therefore, cellars can contain the same contaminants of concern (COCs) found in drilling muds. Additionally, leaded pipe dope was used to connect drill casing. This represents an additional source of lead within the cellar.

Soil samples were collected by BN at CASs 20-23-02, 20-23-03, 20-23-05, 20-23-06, 20-37-05, and 20-37-01 on April 18 and 23, 2002. Samples were collected from the bottom of each cellar

floor, which contained a mixture of soil and organic material, and some CASs contained small amounts of possible drilling mud. All samples were analyzed for VOCs, SVOCs, TPH full scan, PCBs, total RCRA metals, and gamma spectroscopy.

CAS 20-23-02; analytical results indicate a presence of TPH diesel/oil range (2,880 mg/kg).
CAS 20-23-03; analytical results indicate a presence of TPH diesel/oil range (5,330 mg/kg).
CAS 20-23-05; analytical results indicate a presence of TPH diesel/oil range (3,060 mg/kg).
CAS 20-23-06; analytical results indicate a presence of TPH oil range (230 mg/kg).
CAS 20-37-01; analytical results indicate a presence of TPH oil range (250 mg/kg).
CAS 20-37-05; analytical results indicate a presence of TPH oil range (3,700 mg/kg).

All other analytical results for samples collected at the CASs were below regulatory levels. Radiological surveys of all the sites were also conducted and the results indicated levels of radiation to be at NTS background levels.

CAS 20-23-04 is backfilled with soil/gravel. The sampling method for this cellar was different from the other cellars. BN personnel used a Geoprobe® to determine how deep the cellar was. Most cellars have a concrete bottom. The Geoprobe® cannot push the drive rod through concrete. Refusal occurred at a depth of 4 m (13 ft). On March 27, 2002, a composite sample was collected from the fill material in the cellar. The composite represented fill material taken from the ground surface and every foot thereafter to a depth of 4 m (13 ft). Results of samples collected from the cellar fill were below regulatory levels and PRGs for industrial soils. A radiological survey of the site was also conducted and the results indicated levels of radiation to be at background levels. Based on results from the other cellars it is highly likely that this cellar also contains TPH concentrations which exceed regulatory limits.

1.3 Develop and Refine the Conceptual Site Model

The Conceptual Site Models (CSMs) are considered the most probable scenarios for current conditions at the CAU 358 sites. Available information from which the CSMs are based were derived from process knowledge, related sites, site investigation, and environmental sampling analysis results. All of the sites are expected to fit the basic CSMs which pertain to that particular CAS with minor variations (Figures 2 through 9 in the main text of this plan).

An important element of a CSM is the expected fate and transport of contaminants as they move through site media and where they can be expected in the environment. The expected fate and transport is based on distinguishing physical characteristics of the contaminants and media, such as solubility of the COC, density, and particle size of the media. Ultimately migration of contaminants to groundwater is limited by the geophysical properties such as permeability, porosity, and hydrologic conductivity. Groundwater contamination is not considered a likely scenario at CAU 358 based on the following information.

1.3.1 Primary CSMs

Area 2 and Area 3: Area 2 and Area 3 of the NTS are located in the Yucca Flat which lies within a highly faulted intermountain basin, typical of the Basin and Range Physiographic Province. The basin is surrounded by upland cenozoic volcanic, mesozoic plutonic, and

paleozoic sedimentary rocks. The erosion of upland material fills the basin and has created a layer of alluvium with an average thickness of approximately 300 m (984 ft) and some areas can be as thick as 2,000 m (6,560 ft) (Lawrence Livermore National Laboratory [LLNL], date unknown). The alluvium is made up of poorly sorted sands and silts with varying degrees of calcareous cementation. The alluvium is underlain by layers of non- to moderately welded ash-flow tuff with intermittent layers of bedded tuff. The tuffs overlie a unit of crypto- to medium crystalline dolostone, which comprises the carbonate aquifer. Beneath the carbonate unit is a unit of quartzite, which forms the lower clastic confining layers (BN, 1999). In addition, extension of subsurface materials has created a series of steeply angled fault planes throughout the Yucca Flat (LLNL, date unknown).

Static water levels within the Yucca Flat range from 326 to 495 m (1,069 to 1,625 ft) beneath the ground surface (U.S. Geological Survey [USGS], 1996a); however, beneath the eastern two-thirds of the Yucca Flat the static water levels range from 457 to 574.5 m (1,500 to 1,885 ft) beneath the ground surface (Desert Research Institute, 1998). Within Area 2 the approximate depth to groundwater is 442 m (1,450 ft) below surface level within the alluvium (USGS, 1996a). Within Area 3 the approximate depth to groundwater is 491 m (1,610 ft) beneath the ground surface (Wuellner, 1994). Groundwater within the eastern area of the Nevada Test Site, including Yucca Flat, flows southward toward the Ash Meadows Discharge area (DOE/NV, 1996). The aquifers within the Yucca Flat are divided into upper and lower units within each lithology. These include the upper aquifer and lower aquitard within the tuff unit and the upper and lower carbonate aquifers within the dolostone. Beneath the carbonate aquifers are two clastic aquitards of Paleozoic age (USGS, 1996b).

Area 12: Tunnel U12b is located on the eastern edge of Rainier Mesa in Area 12. Stratigraphically, the mesa consists of Tertiary volcanic tuffs unconformable over Cambrian/Precambrian schist and quartzite, Paleozoic carbonates, or Cretaceous granitic rocks. The volcanic tuff sequence is approximately 610 to 1,524-m (2,000 to 5,000-ft) thick and consists of welded ash flow tuffs, friable vitric bedded-tuff, and zeolitized-bedded tuffs. Rainier Mesa is capped with a 30 to 122-m (100 to 400-ft) thick moderate to densely-welded, vitric, ash flow tuff called the Rainier Mesa Tuff overlying over 60 to 244 m (200 to 800 ft) of friable, vitric, ash flow, and bedded ash flow tuff that is Miocene in age. Beneath the vitric tuffs are approximately 183 to 914 (600 to 3,000 ft) of zeolitized bedded tuff with one or two thin, interbedded welded to nonwelded ash flow tuff units that are Miocene and Oligocene in age. The tunnels are mined into the zeolitized tuffs which are located approximately 259 to 427 m (850 to 1,400 ft) below the mesa surface (Defense Nuclear Agency [DNA], 1990; USGS, 1990).

The hydrology is controlled by the rock type. Groundwater flow through the welded, vitric ash flow tuffs is primarily through joints and fractures; whereas, flow through the vitric bedded tuffs is through the pore spaces. The zeolitized bedded tuff is a fractured aquitard with high porosity (approximately 30 percent) and low permeability. Due to the zeolitization, the interstitial permeability is zero. The fractures within this unit are not interconnected well. Groundwater migration within this unit is primarily downward along steeply dipping fractures and faults. Underlying the zeolitized tuffs is a far more permeable Paleozoic carbonate unit which is the main aquifer for the area and is where the regional water table resides. The older units below the Paleozoic carbonates act as another aquitard controlling the flow of water into and out of the regional water table. The depth to the groundwater table is approximately 914 to 1,067 m

(3,000 to 3,500 ft) beneath the mesa surface or 457 to 610 m (1,500 to 2,000 ft) below the tunnels. The Paleozoic carbonate unit eventually discharges into the Ash Meadows discharge basin (DNA, 1990).

Area 18: Area 18 lies within the northeastern part of the Timber Mountain caldera moat, which is made up of the Rainier Mesa Tuff and the Ammonia Tanks Member. The Rainier Mesa Tuff was erupted from vents above a magma chamber within Timber Mountain caldera. The eruption deposited the ash-flow tuff of the Rainier Mesa Tuff inside the caldera at a thickness of greater than 610 m (2,000 ft). The debris flows and breccia from the Rainier Mesa Tuff are a mixture of dense, hard rhyolite lava and welded tuff blocks in a matrix of porous, soft, ashy tuff, now altered largely to clay. The maximum known thickness is 259 m (850 ft).

The Ammonia Tanks Tuff is divided into two parts based on compositional and inferred cooling breaks. The lower part of the Ammonia Tanks Tuff is densely welded and very thick (e.g., more than 610 m (2,000 ft) on the Timber Mountain resurgent dome). The lower part is also greatly restricted outside the caldera. The upper part of the Ammonia Tanks Tuff is less densely welded, less than 244 m (800 ft) thick, and extends outside the caldera especially on Pahute Mesa. The ash-fall and non-welded tuff unit generally includes tuff between the Ammonia Tanks Tuff and the overlying gravel and tuffaceous sediments. A mass of ash-fall and non-welded tuff is also inferred to underlie Buckboard Mesa.

The trachybasalt lavas of Buckboard Mesa rest unconformably on a sloping, graded alluvial surface cut on the gravel and tuffaceous sediments. Two lava flows separated by scoria and cinders underlie most of Buckboard Mesa and have a maximum thickness of 76 m (250 ft). The northeastern part of the caldera moat has been undergoing erosion by Fortymile Canyon and its tributaries since the trachybasalt of Buckboard Mesa was extruded 2.8 million years ago (USGS, 1981). The static water level near CAS 18-09-01 is reported at 416 m (1,365 ft) beneath surface.

Areas 19 and 20: Areas 19 and 20 lie within the eastern part of Pahute Mesa, which is a volcanic plateau underlain by tuffs and lavas from the Timber Mountain Oasis Valley caldera complex and the Silent Canyon and Black mountain calderas north of Timber Mountain. A Miocene, rhyolitic, eruptive center produced this overlapping complex of fault-controlled calderas (DOE/NV, 1996). The major subsurface of Pahute Mesa is the Silent Canyon caldera, which is a deep structural depression. This caldera is comprised of different types of Tertiary volcanic rocks such as ash-flow and ash-fall tuffs. These tuffs are more than 3,962 m (13,000 ft) thick in some places (DOE/NV, 1988).

Inside the caldera the depth of the water table ranges from 594.4 to 716.3 m (1,950 to 2,350 ft). Outside of the caldera the depth decreases to around 259 m (850 ft) in the extreme northwest corner of the NTS. The permeability of the rock is generally low, and groundwater movement is primarily through fractures in the rock. The total flow of groundwater beneath Pahute Mesa is estimated to be about 8,000 acre-ft/year, of which 5,500 acre-ft enters the ground water system from Gold Flat and Kawich Valley to the north. Groundwater flow is generally south and southwest to the Oasis Valley, about 20 miles away (DOE/NV, 1988).

The sites are all located on the NTS which is one of the most arid regions of the country. There are no surface water features or expression of erosional activity at any of the CASs. Additionally, all of the mud pits are bermed and all of the cellars are below ground surface and lined with metal. Therefore, COCs will not likely be transmitted through the environment by surface water movement.

The CASs within CAU 358 are all located within Areas 2, 3, 12, 18, 19, and 20. Areas 2, 3, 12, 19 and 20 are all designated as weapons test zones. Area 18 has been used for nuclear tests in the past and is currently a reserved zone (DOE/NV, 1996). Because of the unique nature of the historic activities performed at these sites, access will likely be further controlled from any use other than nuclear testing or weapons testing. Therefore, there will be no uncontrolled contact with the CASs in CAU 358 by NTS personnel and no contact by members of the public.

1.3.2 CAS Specific Variations to the Primary CSMs

The proposed activities are based on the assumption that diesel- and oil- range petroleum hydrocarbons are the most prevalent COPCs at the sites. All of the sites are expected to fit the basic CSMs pertaining to that particular CAS with minor variations caused by site-specific preferential pathways, as identified below for each CAS:

- CAS 02-99-01, Oil Stained Dirt on Concrete: The primary CSM, based on sample analysis results, assumes that only petroleum hydrocarbons were released to the soil. There are no preferential pathways identified for this site based on the geohydrology previously described for Area 2 (See Figure 2 in main text of plan).

- CAS 03-22-33, Bucket; Spill; Debris: The primary CSM has been developed for this site even though sample analysis indicated that COCs are not present above regulatory levels. The spill (magnetite) is located on the surface and there are no preferential pathways identified for this site based on the geohydrology previously described for Area 3 (See Figure 3 in main text of plan).

- CAS 03-99-04, Spill: The primary CSM assumes that petroleum hydrocarbons and associated COCs (several SVOCs) were released to the soil and that the COCs did not extend beyond the limits of the immediate soil beneath the epoxy tar release. Past clean-up activities with epoxy tar sites did not contain COCs beyond an approximate depth of 15.2 cm (6 in) for subsurface soils. Sample analysis supports this model and indicates that petroleum hydrocarbons and SVOCs are limited to the pieces of epoxy tar/associated soils at approximately 15.2 cm (6 in) below ground surface. There are no preferential pathways identified for this site based on the geohydrology previously described for Area 3 (See Figure 4 in main text of plan).

- CAS 12-30-02, Drill Holes: A CSM has been developed for this site even though sample analysis from the mound indicated that COCs are not present above regulatory levels. There are no preferential pathways identified for this site based on the geohydrology previously described for Area 3 (See Figure 5 in main text of plan).

- CAS 18-09-01, Mud Pit: The primary CSM assumes that no petroleum hydrocarbons were released from the bucket. Also associated with this CAS is a small surface area containing broken pieces of alkaline batteries (Figure 6 of main text) which have released small amounts of mercury to the surface soil. The CSM assumes all released mercury is within 2.5 cm (1 in) of the surface.

- CAS 19-09-05, Mud Pit: The primary CSM assumes that only petroleum hydrocarbons were released in the mud. Sample analysis supports this CSM and indicates that the COCs extend to a maximum of 30.5 cm (12 in) in depth but are confined to the mud in the mud pit and pose no threat to human health or the environment. There are no preferential pathways identified for this site based on the geohydrology previously described for Area 19 (See Figure 7 main text of plan).

- CAS 19-09-06, Mud Pit: The CSM is that there are no COCs on this site. This is supported by the analytical data from the drilling mud. If COCs were present, there are no preferential pathways identified for this site based on the geohydrology previously described for Area 19.

- CAS 19-09-07, Mud Pit: The CSM is that there are no COCs on this site. This is supported by the analytical data from the drilling mud. If COCs were present, there are no preferential pathways identified for this site based on the geohydrology previously described for Area 19.

- CAS 20-09-08, Mud Spill: The CSM is that there are no COCs on this site. This is supported by the analytical data from the drilling mud. If COCs were present, there are no preferential pathways identified for this site based on the geohydrology previously described for Area 19.

- CAS 20-23-02, Postshot Cellar: The primary CSM assumes that petroleum hydrocarbons were released to the cellar floor. Sample analysis supports this CSM and indicates that the COCs (TPH diesel/oil range) are confined to the cellar floor and pose no threat to human health or the environment. There are no preferential pathways identified for this site based on the geohydrology previously described for Area 20 (See Figure 9 main text of plan).

- CAS 20-23-03, Cellar: The primary CSM assumes that petroleum hydrocarbons were released to the soil. Sample analysis supports this CSM and indicates that the COCs (TPH diesel/oil range) are confined to the cellar floor and pose no threat to human health or the environment. There are no preferential pathways identified for this site based on the geohydrology previously described for Area 20 (See Figure 9 main text of plan).

- CAS 20-23-04, Postshot Cellar: The primary CSM assumes that petroleum hydrocarbons were released to the cellar floor. Sample analysis did not confirm this assumption however, it is probable that the cellar floor is no different from the other cellars within CAU 358. A representative sample of the cellar floor could not be acquired without removing all of the clean fill from the cellar. COCs (TPH diesel/oil range) are confined

to the cellar floor and pose no threat to human health or the environment based on the geohydrology previously described for Area 20 (See Figure 8 main text of plan).

- CAS 20-23-05, Postshot Cellar: The primary CSM assumes that petroleum hydrocarbons were released to the cellar floor. Sample analysis supports this CSM and indicates that the COCs (TPH diesel/oil range) are confined to the cellar floor and pose no threat to human health or the environment. There are no preferential pathways identified for this site based on the geohydrology previously described for Area 20 (See Figure 9 main text of plan).

- CAS 20-23-06, Cellar: The primary CSM assumes that petroleum hydrocarbons were released to the cellar floor. Sample analysis supports this CSM and indicates that the COPCs (TPH oil range) are confined to the cellar floor and pose no threat to human health or the environment. There are no preferential pathways identified for this site based on the geohydrology previously described for Area 20 (See Figure 9 main text of plan).

- CAS 20-37-01, Cellar and Mud Pit: The primary CSM assumes that petroleum hydrocarbons were released to the cellar floor. Sample analysis supports this CSM and indicates that the COPCs (TPH oil range) are confined to the cellar floor and pose no threat to human health or the environment. There are no preferential pathways identified for this site based on the geohydrology previously described for Area 20 (See Figure 9 main text of plan).

- CAS 20-37-05, Cellar: The primary CSM assumes that petroleum hydrocarbons were released to the soil. Sample analysis supports this CSM and indicates that the COPCs (TPH oil range) are confined to the cellar floor and pose no threat to human health or the environment. There are no preferential pathways identified for this site based on the geohydrology previously described for Area 20 (See Figure 9 main text of plan).

1.3.3 Alternate CSMs

The conditions under the alternate CSM are considered less likely than conditions outlined in the primary CSMs.

- CAS 02-99-01, Oil Stained Dirt on Concrete: The alternate CSM provides for a more extensive petroleum hydrocarbon release than assumed in the primary CSM.

- CAS 03-22-33, Bucket; Spill; Debris: An alternate CSM is not necessary for this site because sample analysis indicated that COCs are not present above regulatory levels.

- CAS 03-99-04, Spill: The alternate CSM provides for a more extensive petroleum hydrocarbon and SVOC release than assumed in the primary CSM.

- CAS 12-30-02, Drill Holes: An alternate CSM is not necessary for this site because sample analysis indicated that COCs are not present above regulatory levels.

- CAS 18-09-01, Mud Pit: The alternate CSM provides for a more extensive petroleum hydrocarbon release that has impacted soil underneath the bucket of material, and/or a more extensive release of mercury to soil underneath the battery pieces than assumed in the primary CSM.

- CAS 19-09-05, Mud Pit: The alternate CSM provides for a more extensive petroleum hydrocarbon release than assumed in the primary CSM.

- CAS 19-09-06, Mud Pit: An alternate CSM is not necessary for this site because sample analysis indicated that COPCs are not present above regulatory levels.

- CAS 19-09-07, Mud Pit: An alternate CSM is not necessary for this site because sample analysis indicated that COPCs are not present above regulatory levels.

- CAS 20-09-05, Mud Pit: An alternate CSM is not necessary for this site because sample analysis indicated that COPCs are not present above regulatory levels.

- CAS 20-09-08, Mud Spill: An alternate CSM is not necessary for this site because sample analysis indicated that COPCs are not present above regulatory levels.

- CAS 20-23-02, Postshot Cellar: The alternate CSM provides for a more extensive petroleum hydrocarbon release than assumed in the primary CSM.

- CAS 20-23-03, Cellar: The alternate CSM provides for a more extensive petroleum hydrocarbon release than assumed in the primary CSM.

- CAS 20-23-04, Postshot Cellar: The alternate CSM provides for a more extensive petroleum hydrocarbon release than assumed in the primary CSM.

- CAS 20-23-05, Postshot Cellar: The alternate CSM provides for a more extensive petroleum hydrocarbon release than assumed in the primary CSM.

- CAS 20-23-06, Cellar: The alternate CSM provides for a more extensive petroleum hydrocarbon release than assumed in the primary CSM.

- CAS 20-37-01, Cellar and Mud Pit: The alternate CSM provides for a more extensive petroleum hydrocarbon release than assumed in the primary CSM.

- CAS 20-37-05, Cellar: The alternate CSM provides for a more extensive petroleum hydrocarbon release than assumed in the primary CSM.

2.0 IDENTIFY THE DECISION

In this step, the principal study question will be made into a decision statement that will address the problem as previously described.

2.1 Identify the Principal Study Question

The principal study question is, "Does any CAS within CAU 358 pose an unacceptable risk to human health/environment?"

2.2 Alternative Actions that Could Result from Resolving the Principal Study Question

The possible actions that may result include:

- Clean closure of the site based on unacceptable risk to human health or the environment.
- No further action with administrative controls based on unacceptable risk to human health for potential future site workers.
- No further action based on an acceptable risk to human health and the environment.

2.3 Decision Statement

Combining the principal study question with the alternative actions generates the following decision statement:

"Determine if the CASs within CAU 358 have a risk to human health or the environment and thus require some type of corrective action."

3.0 IDENTIFY THE INPUTS TO THE DECISION

3.1 Information Required to Resolve the Decision Statement

Relevant information that bears on the decision statement will be defined on a case by case basis. The relevant information will clarify the nature and extent of COCs at each site. This will include process knowledge, information from similar sites, and analytical sampling using an appropriate analytical method for potential COCs at each CAS. The future land use and potential receptors must be identified. Any missing data relevant to the decision statement must also be identified.

General information that applies to each CAS includes the U.S. EPA Region IX PRGs (EPA, 2002) for industrial soils to aid in the determination of risk to human health and the environment, and Nevada Administrative Code (NAC) Section 445A.2272 for action levels for petroleum hydrocarbons (NAC, 2002b).

3.2 List types of COCs and affected media.

The CASs and their associated COCs are listed below:

- CAS 02-99-01, Oil Stained Dirt on Concrete - TPH as diesel/oil range
- CAS 03-22-33, Bucket; Spill; Debris - No COPCs above action levels

- CAS 03-99-04, Spill - TPH as diesel/oil range, SVOCs
- CAS 12-30-02, Drill Holes - No COPCs above action levels
- CAS 18-09-01, Mud Pit - TPH as diesel/oil range (mercury-impacted material in mud pit only)
- CAS 19-09-05, Mud Pit - TPH as diesel/oil range
- CAS 19-09-06, Mud Pit - No COCs above action levels
- CAS 19-09-07, Mud Pit - No COCs above action levels
- CAS 20-09-05, Mud Pit - No COCs above action levels
- CAS 20-23-02, Postshot Cellar - TPH as diesel/oil range
- CAS 20-23-03, Cellar - TPH as diesel/oil range
- CAS 20-23-04, Postshot Cellar - No COCs above action levels
- CAS 20-23-05, Postshot Cellar - TPH as diesel/oil range
- CAS 20-23-06, Cellar - TPH as oil range
- CAS 20-37-01, Cellar and Mud Pit - TPH as oil range (cellar only)
- CAS 20-37-05, Cellar - TPH as oil range

For all of the CASs, the affected media is soil and/or drilling mud. Table 2 provides a summary of the sample analytical data.

3.3 Identify potential sampling approaches and appropriate analytical methods

3.3.1 CAS 02-99-01: Oil Stained Dirt on Concrete

Process knowledge coupled with a test for magnetism is adequate to determine the nature of the magnetite spill. No further information is required to adequately address the decision statement. There is a data gap that exists for the hydrocarbon spill. The nature of the spill is known, however the extent has not been determined. The extent can be determined using a field screening method developed by PetroFLAG®. This method has been used extensively on other CAS at the NTS and produces conservative results for the presence of petroleum hydrocarbons in soil. After the limits of the petroleum hydrocarbons have been identified, confirmatory samples collected and analyzed for TPH using analytical method 8015 modified (EPA, 1996) are adequate to confirm the PetroFLAG® results and verify that the impacted soils have been removed.

3.3.2 CAS 03-22-33: Bucket; Spill; Debris

Sampling was conducted by IT on August 27, 1997, on the pile of magnetite material. Additional soil samples were collected by BN from two different locations of the magnetite material on June 8, 2001. The results indicated that the magnetite material contained no COCs above regulatory levels (Table 2). A radiological survey of the site using field screening tools was also conducted and the results indicated levels of radiation to be at background levels.

Historical information about this site is limited. It is unknown where the material came from; however, magnetite was generally used as emplacement hole plug back material during testing activities. No additional samples are required to adequately address the decision statement.

TABLE 2 - CAU 358 SAMPLE ANALYTICAL RESULTS

SAMPLE IDENTIFICATION NUMBER	DIESEL (mg/kg)[a]	OIL (mg/kg)	GASOLINE (mg/kg)	TPH[b] (mg/kg)	VOCs[c] (µg/kg)[d]	SVOC[e] (µg/kg)	Total RCRA METALS (mg/kg)	PCBs[g] (µg/kg)	GAMMA SPECTROSCOPY (pCi/g)[h]
ACTION LEVEL	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**EPA PRGs**	**EPA PRGs**	**EPA PRGs**	**1 µg/kg**	**NTS Background**
CAS 02-99-01 (SDG[i] V1147) and (ERS 00049 [IT])									
029901-0-1	NS[j]	NS	NS	NS	NS	NS	< Action levels	NS	< Background levels
ERS00049	250	1,100	NS	1,350	< Action levels	< Action levels		< Action levels	
CAS 03-22-33 (SDG V1147 and V1212) and (ERS 00104 [IT])									
032233-0-1	NS	NS	NS	NS	NS	NS	< Action levels	NS	< Background levels
032233-0-2	NS	NS	NS	NS	NS	NS		NS	
032233-0-2A,B	NS	NS	NS	NS	NS	NS		NS	NS
ERS00104	25	42	NS	67	< Action levels	< Action levels		< Action levels	< Background levels
CAS 03-99-04 (SDG V1154 and V1155)									
039904-0-1	610	2,900	ND[k]	3,510	< Action levels	Six above action levels (See Table 1)	< Action levels	< Action levels	< Background levels
CAS 12-30-02 (SDG V1562 and V1563)									
123002-0-M1	ND	ND	ND	ND	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
123002-0-M2	ND	ND	ND	ND					

TABLE 2 - CAU 358 SAMPLE ANALYTICAL RESULTS (continued)

SAMPLE IDENTIFICATION NUMBER	DIESEL (mg/kg)[a]	OIL (mg/kg)	GASOLINE (mg/kg)	TPH[b] (mg/kg)	VOCs[c] (µg/kg)[d]	SVOC[e] (µg/kg)	(Total) RCRA METALS (mg/kg)	PCBs[g] (µg/kg)	GAMMA SPECTROSCOPY (pCi/g)[h]
ACTION LEVEL	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**EPA PRGs**	**EPA PRGs**	**EPA PRGs**	**1 µg/kg**	**NTS Background**
CAS 18-09-01 (SDG V1426 and V1427)									
180901-0-1MP	ND	15	ND	15	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
180901-1-1MP	ND	58	ND	58					
180901-0-2MP	ND	44	ND	44					
180901-1-2MP	ND	68	ND	68					
180901-0-3B	48,000	190,000	ND	238,000					
180901-0-4	NS	NS	NS	NS	NS	NS	Mercury - 7.0 All others < Action levels	NS	NS
CAS 19-09-05 (SDG V1431 and V1433)									
190905-0-1MP	138	970	ND	1,108	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
190905-6-1MP	17	150	3.5	170.5					
190905-0-2MP	15	170	3.2	188.2					
190905-1-2MP	22	170	ND	192					

TABLE 2 - CAU 358 SAMPLE ANALYTICAL RESULTS (continued)

SAMPLE IDENTIFICATION NUMBER	DIESEL (mg/kg)[a]	OIL (mg/kg)	GASOLINE (mg/kg)	TPH[b] (mg/kg)	VOCs[c] (µg/kg)[d]	SVOC[e] (µg/kg)	(Total) RCRA METALS (mg/kg)	PCBs[g] (µg/kg)	GAMMA SPECTROSCOPY (pCi/g)[h]
ACTION LEVEL	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**EPA PRGs**	**EPA PRGs**	**EPA PRGs**	**1 µg/kg**	**NTS Background**
CAS 19-09-06 (SDG V1439 and V1440)									
190906-0-1MP	ND	14	ND	14	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
190906-0-2MP	ND	ND	ND	ND					
190906-0-3MP	ND	ND	ND	ND					
190906-2-3MP	ND	ND	ND	ND					
190906-0-4MP	ND	ND	ND	ND					
190906-3-4MP	ND	ND	ND	ND					
CAS 19-09-07 (SDG V1433 and V1434)									
190907-0-1MP	ND	ND	ND	ND	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
190907-9-1MP	ND	ND	ND	ND					
190907-0-2MP	ND	ND	ND	ND					
190907-1-2MP	ND	ND	ND	ND					
190907-0-3M	ND	ND	ND	ND					
190907-0-4M	ND	ND	ND	ND					
190907-0-5M	ND	ND	ND	ND					
190907-0-0M	ND	ND	ND	ND					

TABLE 2 - CAU 358 SAMPLE ANALYTICAL RESULTS (continued)

SAMPLE IDENTIFICATION NUMBER	DIESEL (mg/kg)[a]	OIL (mg/kg)	GASOLINE (mg/kg)	TPH[b] (mg/kg)	VOCs[c] (µg/kg)[d]	SVOC[e] (µg/kg)	(Total) RCRA METALS (mg/kg)	PCBs[g] (µg/kg)	GAMMA SPECTROSCOPY (pCi/g)[h]
ACTION LEVEL	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**EPA PRGs**	**EPA PRGs**	**EPA PRGs**	**1 µg/kg**	**NTS Background**
CAS 20-09-05 (SDG V1439 and V1440)									
209005-0-1MP	ND	40	ND	40	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
CAS 20-09-08 (SDG V1426 and V1427)									
200908-0-0	ND	ND	ND	ND	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
200908-0-1	ND	ND	ND	ND					
209008-0-2	ND	23	ND	23					
CAS 20-23-02 (SDG V1559 and V1560)									
202302-9-C1	280	2,600	ND	2,880	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
CAS 20-23-03 (SDG V1550 and V1551)									
202303-12-C1	430	4,900	ND	5,330	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
CAS 20-23-04 (SDG V1508, V1509, and V1560)									
2304-(0-13)-C1	ND	17	ND	17	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels

TABLE 2 - CAU 358 SAMPLE ANALYTICAL RESULTS (continued)

SAMPLE IDENTIFICATION NUMBER	DIESEL (mg/kg)[a]	OIL (mg/kg)	GASOLINE (mg/kg)	TPH[b] (mg/kg)	VOCs[c] (µg/kg)[d]	SVOC[e] (µg/kg)	(Total) RCRA METALS (mg/kg)	PCBs[g] (µg/kg)	GAMMA SPECTROSCOPY (pCi/g)[h]
ACTION LEVEL	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**100 mg/kg**	**EPA PRGs**	**EPA PRGs**	**EPA PRGs**	**1 µg/kg**	**NTS Background**
CAS 20-23-05 (SDG V1550 and V1551)									
202305-10-C1	360	2,700	ND	3,000	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
CAS 20-23-06 (SDG V1550 and V1551)									
202306-9-C1	18	230	ND	248	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
CAS 20-37-01 (SDG V1541, V1542, V1550, and V1551)									
203701-9-C1	40	250	ND	290	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels
203701-2-M1	ND	ND	ND	ND					
203701-2-M2	ND	ND	ND	ND					
CAS 20-37-05 (SDG V1559 and V1560)									
203705-12-C1	35	3,700	0.11	3,735.1	< Action levels	< Action levels	< Action levels	< Action levels	< Background levels

[a]milligram(s) per kilogram
[b]total petroleum hydrocarbons
[c]volatile organic compoun
[d]microgram(s) per kilogram
[e]semivolatile organic compounds
[f]milligram(s) per liter
[g]polychlorinated biphynels.
[h]picoCurie(s) per gram
[i]sample delivery group
[j]not sampled
[k]not detected or less than detection limits

3.3.3 CAS 03-99-04, Spill

Soil samples of the epoxy tar/associated soil were collected by BN on June 11, 2001. The results indicated that the COPCs were TPH-diesel/oil range (3,510 mg/kg) and several SVOCs above the PRGs (Table 2). All other analytical results of the epoxy tar spill were below regulatory levels. A radiological survey of the site was also conducted and the results indicated levels of radiation to be at background levels.

Historical information about this site is limited. It is unknown where the epoxy tar came from; however, epoxy tar was used as emplacement hole plug back material during testing activities, similar to magnetite. Therefore, this epoxy tar is likely excess material that was discarded following plug back operations in Area 3. Sample results from the epoxy tar are consistent with results from other epoxy tar sites (CASs 02-99-02, 02-99-03, 03-99-01, 03-99-03, 03-99-06, 03-99-08, 07-99-03 closed in CAU 387). The extent of tar-impacted soil is easily discerned with the naked eye; therefore, no samples are required. The SVOCs can leach from the epoxy tar into the soil. Previous verification sampling at the CASs within CAU 387 indicates that the SVOCs do not leach beyond the uppermost six inches of soil in contact with the epoxy tar. No more samples are required to adequately address the decision statement. However, a data gap exists regarding the amount of SVOC-impacted soil affected by the epoxy tar. Confirmatory samples collected from beneath the epoxy tar spill and analyzed using analytical method 8270 (EPA, 1996) are adequate to determine the depth of SVOC-impacted soil if this is deemed necessary.

3.3.4 CAS 12-30-02, Drill Holes

BN collected samples from two locations on April 24, 2002, from the mound at the surface. The analytical results indicated that the mound contained no COCs above regulatory levels. A radiological survey of the site was also conducted and the results indicated levels of radiation to be at background levels.

Based on past site visits, historical documentation, and interviews, the mound is covering nine plugged instrumentation drill holes and one plugged exploratory drill hole with miscellaneous housekeeping debris in the area. An interviewee indicated that the mound was reportedly created to contain leakage of radioactive gases. According to the *Underground Test Area Borehole Index* documentation, all the drill holes associated with CAS 12-30-02 are plugged and/or grouted under the 2.4 m (8 ft) of fill (DOE/NV, 2001b). No further sampling is required to adequately address the decision statement.

3.3.5 CAS 18-09-01, Mud Pit

Drilling mud samples were collected by BN at CAS 18-09-01 on February 7, 2002. The analytical results for the drilling mud indicate that the mud in the mud pits contains no COCs above regulatory levels.

A sample was also collected from the drilling mud in the vicinity of broken up pieces of alkaline batteries. Analytical results indicated that the drilling muds in the vicinity of the broken pieces of batteries contained mercury at levels above the PRGs. After excavation of the drilling mud from the area of the broken battery pieces, two verification samples will be collected from the

excavated area and analyzed for mercury (method 7471A [EPA, 1996]). A final sample was taken from the material inside the bucket of what is believed to be a lead-based pipe dope. The analytical sample results of the material indicated a presence of TPH diesel/oil range (238,000 mg/kg). It is not clear if the contents in the bucket have impacted the drilling mud in the vicinity of where the bucket is located. Radiological surveys on the site were also conducted and the results indicated levels of radiation to be at background levels. The drilling mud in the vicinity of the bucket should be sampled (method 6010 [EPA, 1996]) to verify that the bucket contents have not impacted the mud.

3.3.6 CAS 19-09-05, Mud Pit

Soil samples were collected by BN at CAS 19-09-05 on February 11, 2002. Analytical results indicated a presence of TPH diesel/oil range (1,108 mg/kg) for surface and TPH oil range (150 mg/kg) at a 15-cm (6-in) depth at one location. At the second location in the same mud pit, soil samples were also collected at the surface and at a depth of 30.5 cm (12 in). Analytical results indicated a presence of TPH oil range (170 mg/kg) at both the surface and at a 30.5 cm (12 in) depth. All other analytical results for samples collected were below regulatory limits. Radiological surveys on the site were also conducted and the results indicated levels of radiation to be at background levels. No additional sampling is required to adequately address the decision statement. An A through K evaluation, pursuant to NAC Section 445A.227 (NAC, 2002a), is presented in Section 3.3.8 below to demonstrate the low risk associated with this mud pit.

3.3.7 CASs 19-09-06, 19-09-07, 20-09-05, 20-09-08, and 20-37-01, Mud Pits and Mud Spill

Soil samples were collected by BN at 19-09-06, 19-09-07, 20-09-05, 20-09-08 (mud spill), and 20-37-01 on February 7, 12 and 13, and April 17, 2002. Samples were collected from the surface mud and/or depths ranging from the surface down to 1 m (3 ft). The analytical results for these sites indicate that the mud in the mud pits and the mud spill contain no COCs above regulatory levels. Radiological surveys of the sites were also conducted, and the results indicated levels of radiation to be at background levels.

Drilling muds are recirculated as a borehole is drilled. Therefore, the drilling mud in the mud pits is relatively homogeneous. Sample results for the drilling mud indicates that within mud pits little to no variation exists between the samples. This supports the supposition of mud pit homogeneity. Calculating the standard deviation for chromium data and using a 95 percent confidence interval, the number of samples required to establish the average concentration of chromium for the mud pits is two (Sample size "n" was calculated from a 1-sample T test). All of the mud pits were sampled at least twice excluding one site, CAS 20-09-05. A test for equal variances indicates that the drilling mud populations within CAU 358 are not statistically different. Based on this test, mud pits can be considered as part of the same population. In theory, a total of two samples collected from the mud pits would be sufficient to characterize the all of these mud pit. To date, over ten times this number of sample have been collected and analyzed; implying the mud pits as a group have been well characterized. This finding makes sense given that drilling practices were established by a subcontractor, implying that the drilling materials and practices were consistent. No additional sampling is required to adequately address the decision statement.

3.3.8 CASs 20-23-02, 20-23-03, 20-23-04, 20-23-05, 20-23-06, 20-37-05, and 20-37-01, Cellars

Soil samples were collected by BN at CASs 20-23-02, 20-23-03, 20-23-05, 20-23-06, 20-37-05, and 20-37-01 on April 18 and 23, 2002. Samples were collected at the bottom of each cellar floor, which contained a mixture of soil, organic material, and some CASs contained small amounts of possible drilling mud. Sample analytical results indicate the following:

- CAS 20-23-02, analytical results indicate a presence of TPH diesel/oil range (2,880 mg/kg).
- CAS 20-23-03, analytical results indicate a presence of TPH diesel/oil range (5,330 mg/kg).
- CAS 20-23-05; analytical results indicate a presence of TPH diesel/oil range (3,060 mg/kg).
- CAS 20-23-06, analytical results indicate a presence of TPH oil range (230 mg/kg).
- CAS 20-37-01, analytical results indicate a presence of TPH oil range (250 mg/kg).
- CAS 20-37-05, analytical results indicate a presence of TPH oil range (3,700 mg/kg).

All other analytical results for samples collected at the CASs were below regulatory limits. Radiological surveys of all the sites were also conducted and the results indicated levels of radiation to be at background levels.

CAS 20-23-04 is backfilled with soil/gravel. On March 27, 2002, a composite sample was collected from the fill material in the cellar. Results of the sample collected from the cellar fill were below regulatory levels. However, it is assumed that this cellar also has elevated TPH within the range of the other cellars as previously described. A radiological survey of the site was also conducted and the results indicated levels of radiation to be at background levels. Based on results from the other cellars it is highly likely that this cellar also contains TPH concentrations which exceed regulatory limits.

Only one set of samples has been collected from each of the cellars. In order to prove statistical significance, at least two samples must be collected from a population. This presupposes each cellar should be considered as an independent population. There are only a few thousand parts per million variation in the sampling results for COCs which were above method detection limits. Both the lack of variation in the sample data and process knowledge indicate that the cellars are not independent and are in fact part of the same population. An A through K evaluation, pursuant to NAC 445A.227 (NAC, 2002a), is presented below to demonstrate the low risk associated with the cellar CASs and mud pit CAS 19-09-05.

Depth to Groundwater (A)
The depth to groundwater for each area has been previously described in Section 1.3.1. Depth to groundwater in Area 20, which contains all of the cellars within this CAU, ranges from 594 to 716 m (1,950 to 2,350 ft) below ground surface. The sites are all located within the Grouse Canyon and Area 20 Caldera (DOE/NV, 1988).

Distance to Irrigation or Drinking Water Wells (B)
The nearest water well to the Area 20 cellars and to CAS 19-09-05 mud pit is the U-20 water well. This well is a construction water well and does not supply water for potable uses. The depth to water in this well is 627 m (2,058 ft) below ground surface (USGS, 1996). Listed below are the CASs with COCs and their distance from U-20 water well:

CAS 19-09-05	10,217 m (33,521 ft)
CAS 20-23-02	4,227 m (13,870 ft)
CAS 20-23-03	2,685 m (8,809 ft)
CAS 20-23-04	2,418 m (7,932 ft)
CAS 20-23-05	2,950 m (9,680 ft)
CAS 20-23-06	491 m (1,612 ft)
CAS 20-37-01	7,769 m (25,488 ft)
CAS 20-37-05	5,323 m (17,463 ft)

Type of Soil (C)
The soil at the Area 20 cellars and at CAS 19-09-015 mud pit consists of eroded welded, vitric ash flow tuffs. These soils are underlain by the tuffs themselves.

Annual Precipitation (D)
The sites are all located on the NTS which is one of the most arid regions of the country. There are no surface water features or expression of erosional activity at any of the CASs. The annual average precipitation for Pahute Mesa is 20.02 cm (7.88 in) (Pahute Mesa 1 monitoring station). This station has been monitored since 1964.

Type of Regulated Substance Released (E)
Oil and diesel range petroleum hydrocarbons are the only regulated substances that have been detected above action levels.

Extent of Contamination (F)
The cellar bottoms are lined with concrete. The extent of contamination is confined to the cellars themselves. For CAS 19-09-05, the extent of contamination is confined to the mud pit which measures approximately 29.5 by 24.6 m (97 by 81 ft) and is 0.3 m (1 ft) deep.

Present and Potential Land Use (G)
Areas 19 and 20 are all designated weapons test zones as previously discussed. Because of the unique nature of the historic activities performed at these sites, access will likely be further controlled from any use other than nuclear testing or weapons testing. Therefore, there will be no uncontrolled contact with the CASs in CAU 358 by NTS personnel and no contact by members of the public.

Preferred Routes of Migration (and Exposure Pathways of Concern) (H)
The only credible pathway for TPH to become mobile is by infiltrating precipitation. Based on the conditions and limited precipitation in Areas 19 and 20, migration of hydrocarbons from the sites is expected to be minimal. The concrete bottoms of the cellars will act as a barrier to this migration. The low permeability of the drilling mud will also inhibit TPH mobility.

Location of Structures or Impediments (I)
For the cellar sites impacted soil is contained within the cellar, a metal-cased, concrete floored structure.

Potential for a Hazard Related to Fire, Vapor, or Explosion(J)
No potential.

Other Factors Specific to the Sites (K)
For CAS 19-09-05 an additional consideration is that petroleum hydrocarbons in drilling mud are essentially immobile. Data from other mud pit sites supports the conclusion that TPH contamination within drilling mud does not migrate significantly. Data collected during the site characterization of CAU 417, The Central Nevada Test Area Surface, by IT and reported in Appendix D of the Corrective Action Decision Document (DOE/NV, 1998) supports the assertion that drilling muds which are primarily clays are effective at containing TPH. This prevents TPH contamination from spreading into underlying native material. IT characterized the UC-1 Central Mud Pit (CAS 58-09-01) which is composed of primarily bentonite clay contaminated with TPH, by sampling in 1997. Boreholes were drilled through the drilling mud and into the underlying native material. For all boreholes, the drilling mud was contaminated with TPH at levels up to 2,560 mg/kg, while the underlying material showed no TPH contamination at levels greater than the Nevada State Action Level of 100 mg/kg. TPH levels were essentially zero (not detected at the laboratory reporting limit) at depths of 0.3 m (1 ft) or more below the bottom of the mud pit.

Additionally, for the cellars sites the impacted soil is present at the base of the cellars, at approximately 3 to 3.6 m (10 to 12 ft) below ground surface. These cellars will be backfilled with clean fill when the associated boreholes are closed as part of the Borehole Management Program, thus eliminating the potential for contact with the contamination.

Based on an evaluation of the A through K criteria and information provided previously, no additional sampling is required to adequately address the decision statement for these CASs.

4.0 DEFINE THE BOUNDARIES OF THE STUDY

4.1 Define the geographic areas of the field investigation.

4.1.1 Define the geographic area within which all decisions must apply (in some cases this may be defined by the CAU).

The geographic areas of the field investigation are those areas of each CAS which are impacted by COCs as identified by the CSM. Descriptions of each area are found in Section 1.2 of this report. The boundaries in all cases are limited to the FFACO CAS description. The mud pit site boundaries are limited to the mud pits or potential affected media in the vicinity. The cellar site includes only the cellars. The boreholes within the cellars are under the control of the NNSA/NV Borehole Management Project. The current primary objective of the Borehole Management Project is to plug and abandon NTS legacy boreholes for which there is no future use. Plugging of these boreholes is consistent with the intent of the Safe Drinking Water Act and

in accordance with the Nevada Department of Conservation and Natural Resources Division of Water Resources, regulations for water well and related drilling, NAC Chapter 534 (NAC, 1998).

4.1.2 Specify the characteristics that define the population of interest.

The population of interest is the concentration of COCs associated with each CAS and its associated risk to human health and the environment.

4.2 Define the time frame of the decision.

4.2.1 Determine the time frame to which the study data apply.

- The study data should be relevant to the length of time allowed by the SAFER process under the FFACO (FFACO, 1996).

- Migration (if occurring) is assumed to be imperceptibly slow. This is based on minimal surface water infiltration and the constraints of the CSM.

4.2.2 Determine when to collect data.

Field activities are scheduled to take place after approval of the final SAFER Plan. A date for field activities has not been formally determined. Field activities will be conducted at times that meet the security and safety constraints of the NTS.

4.2.3 Define relevant time constraints.

The FFACO deadline for delivery of the final SAFER Plan is December 2, 2002. The FFACO deadline of delivery for the final CR has not been formally determined.

4.3 Identify any practical constraints on data collection.

- Approval of the DQO process and the SAFER Plan by the NDEP
- Site operations - NTS operational and security constraints
- Equipment and personnel access
- Sever meteorological conditions
- Availability of heavy equipment
- Health and safety of workers

5.0 DEVELOP A DECISION RULE - DEFINE A LOGICAL BASIS FOR CHOOSING AMONG ALTERNATIVE ACTIONS

5.1 Specify the action level or preliminary action level for the decision.

The action level is 100 mg/kg for TPH based on NAC 445A.2272 (NAC, 2002b). Based on Preliminary Remediation Goals EPA Region IX for Industrial Soils, the action levels for several

different SVOCs can be located in Table 1, Section 1.2.3. The action level for mercury is 0 mg/kg based on the 2002 EPA Region IX PRGs (EPA, 2002).

5.2 Basis for Choosing Alternative Actions

Alternative actions will be based on whether a COC exceeds an action level as described in Section 5.1. If an action level is exceeded, then future land use and potential impact to human health and the environment will be considered. If COCs exceed action levels and future land use indicates that there is an exposure potential, then the action alternative will be clean closure. If COCs exceed action levels and future land use limits exposure, and there is limited risk to human health and the environment then closure in place will be recommended. If COCs are not present above action levels, then no further action will be required.

6.0 SPECIFY LIMITS ON THE DECISION ERRORS

6.1 Sources of Potential Decision Error

Measurement error is influenced by imperfections in the measurement and analysis system. Random and systematic measurement errors are introduced in the measurement process during physical sample collection, sample handling , sample preparation, sample analysis, and data reduction.

Errors introduced during sample collection and handling are minimized by developing a sampling and analysis plan. Bechtel Nevada Environmental Restoration sampling plans are compliant with approved operational instructions for sample collection, field documentation, and equipment decontamination. After samples are collected, the sample is identified with a unique number. A custody seal is placed on the container. The "Services Request & Chain of Custody Record" form is filled out and maintained.

Sample preparation and analysis errors are minimized by using an EPA-approved analytical method. Additionally quality control samples are added to maintain the following:

- Accuracy - Closeness of a measurement or the mean of a set of results to the true value. Accuracy is a measure of the bias of the measurement system. Indicators for measurement are based on the percent recoveries associated with the laboratory analytical control spikes, surrogate spikes, or matrix spikes.

- Comparability - A qualitative judgement which expresses the confidence with which one set can be compared to another. Items used to determine comparability include the analytical method and reporting units.

- Completeness - Indicators for this measurement are the amount of valid data obtained from a measurement system compared to the amount that was expected and needed to be obtained to meet the project data goals.

- Precision - A measurement which represents the repeatability of the analytical system. Indicators for measurement are based on the relative percent difference (RPD) between field duplicates, laboratory splits, or laboratory replicate analysis. It is usually expressed as the RPD or standard deviation.

- Representativeness - A qualitative judgement which refers to a sample or group of samples that reflect the characteristics of the media at the sampling point. It also includes how well the sampling point represents the actual parameter variations which are under study.

6.2 Limits on Decision Errors

Both previous and future sampling at CAU 358 have and will use a biased sampling approach. The biased sampling approach does not allow for the assessment of whether or not specific decision error rate limits have been attained. Therefore, for biased sampling a decision error rate cannot be established. Because an error rate cannot be established, the discussion of Type I (false rejection of the null hypothesis) and Type II (false acceptance of the null hypothesis) is not very meaningful. A valid null hypothesis for each CAS in CAU 358 would be that COCs pose an unacceptable risk to human health and the environment.

7.0 OPTIMIZE THE DESIGN - OUTLINE A SAMPLING DESIGN, SPECIFYING THE OPERATIONAL DETAILS OF THE SAMPLING PLAN WHICH FALLS WITHIN THE PROJECT'S CONSTRAINTS

7.1 Develop general sampling and analysis design alternatives.

Sampling will be conducted after clean up of appropriate sites are completed as specified in Section 4.3.

7.2 Select the most resource-effective design that satisfies all of the DQOs.

For those sites requiring clean closure by excavation and disposal, the impacted soil will be excavated. Verification samples will be collected to confirm that all soil impacted with COCs above action levels has been removed rather than characterize the extent of impacted soil in advance.

7.3 Document the operational details and theoretical assumptions of the selected design in the sampling and analysis plan.

Detailed documentation of sampling and analysis will be discussed in the SAFER Plan.

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APPENDIX A2

PROJECT ORGANIZATION

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PROJECT ORGANIZATION

The U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) Project Manager or Task Manager will serve as the primary point of contact for all activities conducted in this project. The NNSA/NSO Project Manager is responsible for seeing that all activities conducted during the project fulfill the obligations of NNSA/NSO as described in the Federal Facility Agreement and Consent Order of 1996 and the Nevada Division of Environmental Protection (NDEP) approved work plan. The NNSA/NSO Project Manager will plan, authorize, and control project work so that activities are completed in accordance with the work plan on schedule and within budget. The NNSA/NSO Project Manager will be the primary point of contact with the NDEP. The NNSA/NSO points of contact for this project are as follows:

Project Manager: Janet Appenzeller-Wing
Telephone Number: (702) 295-0461

Task Manager: Sabine Curtis
Telephone Number: (702) 295-0542

The identification of the project Health and Safety Officer and the Quality Assurance Officer can be found in both the Field Management Plan and the Site-Specific Health and Safety Plan. However, personnel are subject to change and it is suggested that the appropriate DOE Project Manager be contacted for further information. The Task Manager will be identified in the Federal Facility Agreement and Consent Order Biweekly Activity Report prior to the start of field activities.

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APPENDIX A3

NEVADA ENVIRONMENTAL RESTORATION PROJECT DOCUMENT REVIEW SHEET

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NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

1. Document Title/Number Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 358: Area 18, 19, 20 Cellars/Mud Pits, Nevada Test Site, Nevada
2. Document Date November 2002
3. Revision Number 0
4. Originator/Organization Bechtel Nevada
5. Responsible NNSA/NV ERP Project Mgr. Janet Appenzeller-Wing
6. Date Comments Received January 3, 2003
7. Review Criteria Federal Facility Agreement and Consent Order
8. Reviewer/Organization/Phone No. Clem Goewert/NDEP/(702) 486-2865
9. Reviewer's Signature _____

10. Comment Number/ Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept
1. General	M	The SAFER plan has not provided sufficient information on the location of the CAS's. The location maps and descriptions should contain enough detail or site coordinates that would allow the site to be found in the field.	A list of coordinates for each of the CAS's as provided by the IT Preliminary Assessment Group has been added to the beginning of Section 2.2. The coordinates are listed as Universal Transverse Mercator, Zone 11, in meters.	Yes
2. pg. 15, Sect. 2.2 and pg. 42, Sect. 3.2.3, last paragraph	M	Section 2.2 *Administrative Controls* on page 15 and the last paragraph of section 3.2.3 *Closure in Place with Administrative Controls* on page 42 notes that radiological postings are in place at the cellars. Nowhere are there any discussions of the significance of the postings. The SAFER Plan states that "radiological surveys of the CASs were conducted and the results indicated levels of radiation at or below background levels, indicating that no surface contamination exists at these sites". Please provide information on the significance of these postings.	The radiological postings apply to the postshot drill-back boreholes. The cellars at these 7 CASs contain no radiological COCs as determined by both sample collection and analysis and radiological site surveys. No reference is made to radiological postings on page 15 of the SAFER plan. The last paragraph in Section 3.2.3 on page 42 has been replaced with the following: "Five of the eight CASs listed above are open cellars that are currently posted as "Underground Radioactive Material" areas due to the fact that, at each site, a borehole was drilled to access a cavity created by the detonation of a nuclear device. Analytical and survey results for samples collected from the bottom of the open cellars at these sites show no radioactivity present; the cellars are clean of radioactivity. As part of CAU 358 closure these CASs will be closed in place with use	Yes

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

10. Comment Number/ Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept
			restrictions implemented. At a later date these sites will be closed as described above as part of the Borehole Management Program. Because the current radiological postings apply to areas beneath the cellars (the boreholes), these postings will remain in effect after site use restrictions are implemented, and after the cellars and boreholes are closed by the Borehole Management Program. All radiological postings currently in effect at these sites will remain in effect following site closure."	
3. pg 41	M	There are two sections numbered 3.2.3. The first section should be numbered 3.2.2.	Section numbers have been corrected as requested.	Yes
4. pg 41, Sect. 3.2.3	M	In section 3.23 Closure In Place with Administrative Controls, eight sites are listed for closure in place with land use restrictions. Six of these sites are cellars with an associated drill back casing in the cellar. The comment provided in the September 17, 2002 letter (Goewert to Wycoff) has not been fully addressed. The section still needs to address the closure measures for the cellars. As has been discussed between NDEP and the National Nuclear Security Administration Nevada Operations Office (NNSA/NV) staff, since the cellars have only hydrocarbon (diesel) contamination, NDEP will only require that the cellars be cleared of any debris and backfilled with native soils or other approved material. Also the casing from the drill back holes must be extended above the ground surface. The SAFER must describe the closure process. NDEP will address the plugging of the drill back holes through another program.	The following text describing how the open cellar sites will be closed by the Borehole Management Program has been added as the fifth paragraph on page xii and added to the first paragraph of Section 3.2.3 on page 41. "Eight CASs will be closed in place with administrative controls, i.e., use restrictions implemented. The only COC present at these sites is total petroleum hydrocarbons as diesel/oil. Six of the eight sites are postshot cellars that are currently open, i.e., not backfilled. These cellars are associated with postshot boreholes that are identified to be plugged and abandoned by the Borehole Management Program. The scope of work under the Borehole Management Program will also include clearing the cellars of any brush and debris to a degree necessary to expose the top of the wellhead. The casing will then be extended from the cellar to a point above the ground level, thus allowing access to the borehole for plugging in the future. After the casing has been extended, the cellars will be backfilled with native material."	Yes

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

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