Nevada
Environmental
Restoration
Project

DOE/NV--788

Corrective Action Investigation Plan for Corrective Action Unit 165: Areas 25 and 26 Dry Well and Washdown Areas, Nevada Test Site, Nevada

Controlled Copy No.: ____

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January 2002

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Environmental Restoration
Division

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

UNCONTROLLED

RECORD OF TECHNICAL CHANGE

Technical Change No. 3

Page 1 of 6

Project/Job No. 831841-02010005

Date June 14, 2002

Project/Job Name CAU 165: Areas 25 and 26 Dry Well and Washdown Areas, Nevada Test Site, Nevada

The following technical changes (including justification) are requested by:

Dustin R. Wilson

Task Manager

(Name)

(Title)

Justification: This Record of Technical Change (ROTC) is required to update the Corrective Action Investigation Plan based on actual site conditions. Investigation activities determined that an additional collection system pipe is connected to the dry well at Corrective Action Site (CAS) 25-20-01 and the disposal end point at CAS 25-51-02 is a surface outfall rather than a dry well. Additionally, this ROTC is necessary to clarify the maximum survey requirements of the transite awning at CAS 26-07-01.

Changes

Section 2.2.1.1, Paragraph 1:

Replace the second sentence with, "System components include a concrete dry well, a chemical waste line from Building 4125, and a waste line from an unknown source."

Add the following sentence before the last sentence in the paragraph: "Based on site observations, the other waste line is 60 ft of 6-in. VCP from a former, unknown source east of the dry well. The unknown source was probably one or more trailers with indeterminate activities."

Section 2.2.1.2

Replace the first paragraph with, "CAS 25-51-02, Dry Well, was originally thought to be a dry well for acid and caustic effluent from Building 3320 (Utility Equipment Building) at the Engineering Test Stand (ETS)-1 based on a water and sewer layout plan (REEC Co, 1984a). Attempts to locate the dry well via excavation and video survey have determined that the dry well was not constructed as planned. An acid and caustic drain line, 6-in. Duriron, was confirmed to be present as planned; however, the Duriron drain line connects to 6-in. VCP that ends at a surface outfall in a nearby wash. The outfall is east of Building 3220 and south of the location previously thought to be the dry well. The Duriron and VCP drain line is approximately 356 ft between the source, Building 3220, and the outfall as indicated on Figure 4-2."

Paragraph 3, Sentence 1: Replace "dry well" with outfall.

Paragraph 4: Replace each (four) "dry well" with "acid and caustic drain line."

Section 2.4, CAS 25-20-01, Lab Drain Dry Well

Add text to the end of the last sentence in the paragraph as follows: "... into the system from activities in Building 4215 (Alderson, 2001)."

Add the following sentences to the end of the paragraph: "An additional collection system pipe was found to be connected to the dry well from the east. No process knowledge has been identified that defines the process(es) that may have contributed effluent to the dry well via this pipe."

Section 3.1.1

Contaminant Sources

Add the following sentence after the third sentence: "Potential sources for the eastern collection system pipe have not been identified."

Release Mechanisms

Add the following sentences to the end of the paragraph: "Any contaminants at CAS 25-51-02 are expected to have concentrated near the outfall due to limited effluent flow; however, some surface migration may have occurred down the wash due to surface flow during rain events. Rain events should have reduced contaminant concentrations with distance from the outfall."

Migration Pathways

Add the following sentence after the first sentence: "Surface migration may have occurred at CAS 25-51-02 due to surface flow during rain events."

In the last sentence, replace "from the dry wells" with "from the outfall, dry well."

Exposure Points

Paragraph 1: Replace "All the CASs in this CSM" with "The dry well, cess pool, and leachfield." Move the last sentence to the end of the "Exposure Points" subsection as a stand-alone paragraph.

Paragraph 2: Move this sentence to the end of the Paragraph 1 and replace "any of the CASs" with "CASs 25-20-01, 25-59-01, and 26-59-01."

Add the following text as a new paragraph after Paragraph 1: "Any effluent at CAS 25-51-02 would have been discharged to the surface in limited volume over the life of the system. Therefore, surface and near-surface soil is the most likely exposure points to find soil contamination."

Section 4.2.2.1, Paragraph 2, Sentence 2

Replace "system pipe" with "system pipes."

Figure 4-1

Replace the figure with the attached revised Figure 4-1.

Section 4.2.2.2

Replace the first three paragraphs with the following two paragraphs:

"Phase I activities at this CAS will consist of confirming the system configuration and collecting biased surface (0 to 1 ft) and near-surface (2.5 to 3.5 ft) samples for laboratory analysis as indicated on Figure 4-2. Site preparation activities are minimal at this CAS and there is no surface debris.

The scoop and trowel method will be used to collect surface soil samples. Hand augering is the preferred method of collecting near-surface soil samples; however, excavation may also be used as appropriate."

Figure 4-2

Replace the figure with the attached revised Figure 4-2.

Section 4.2.2.7, Paragraph 3

Replace the first sentence with the following: "A radiological survey of the decontamination pad, interior walls of the transite awning (up to 10 ft vertically), and adjacent surface soil (out to 15 ft laterally) will be conducted to identify radiological hot spots."

Section 4.2.3.2

Replace the text in this section with the following:

"Phase II activities at this CAS will consist of collecting biased samples for laboratory analysis of the COC concentrations in soil at step-out locations around the Phase I locations found to contain COCs.

If COCs are identified in the Phase I samples, step-out locations will be established in a triangular pattern around those samples as indicated on Figure 4-2. If biasing factors indicate COCs extend beyond the proposed Phase II sample locations, further step-outs may be necessary. At each step-out location, samples will be collected at the depth(s) where COCs were encountered in Phase I samples, and at 5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest concentration as indicated by biasing factors. If necessary, additional samples will be collected at the Phase I locations to define the extent of COCs at that location.

The scoop and trowel method will be used to collect surface soil samples. Hand augering is the preferred method of collecting near-surface soil samples; however, excavation may also be used as appropriate. Drilling may be used if excavation does not provide adequate depth capability."

Technical Change No. 3

Page 4 of 6

Project/Job No. 831841-02010005

Date June 14, 2002

Project/Job Name CAU 165: Areas 25 and 26 Dry Well and Washdown Areas, Nevada Test Site, Nevada

The project time will be (Increased)(Decreased)(Unchanged) by approximately -0- days.

Applicable Project-Specific Document(s): *Corrective Action Investigation Plan for Corrective Action Unit 165: Areas 25 and 26 Dry Well and Washdown Areas, Nevada Test Site, Nevada, Rev. 0, DOE/NV--788.*

Approved By:

Sabine Curtis
for Janet Appenzeller-Wing, Project Manager
Industrial Sites Project

Date 6-19-02

Runore C. Wycoff
Runore C. Wycoff, Division Director
Environmental Restoration Division

Date 6-19-02

Client Notified Yes X No Date May 31, 2002

NDEP Concurrence: Date

Contract Change Order Required Yes No X

Contract Change Order No. Not applicable

Figure 4-1
 Sampling Locations at CAS 25-20-01, Lab Drain Dry Well

Figure 4-2
 Sampling Locations at CAS 25-51-02, Dry Well

RECORD OF TECHNICAL CHANGE

Technical Change No. 2

Page 1 of 2

Project/Job No. 831841-02010005

Date March 19, 2002

Project/Job Name CAU 165: Areas 25 and 26 Dry Well and Washdown Areas, Nevada Test Site, Nevada

The following technical changes (including justification) are requested by:

<u>Dustin R. Wilson</u>	<u>Task Manager</u>
(Name)	(Title)

Justification: Modification of the Waste Management Section 5.3 is required to address a comment provided by the Nevada Division of Environmental Protection (NDEP) in an approval letter dated February 20, 2002, titled "Approval of the Corrective Action Investigation Plan, Corrective Action Unit 165, Areas 25 and 26 Dry Well and Washdown Areas, Federal Facility Agreement and Consent Order." The comment is as follows: "The waste management plan Section 5.3.5 needs to be modified in accordance with the NDEP Investigative Derived Waste Position Paper sent to your office in a January 24, 2002 letter (Liebendorfer to Wycoff) or in accordance with RCRA 90-day storage (40 CFR 262.34)." The applicable changes, as indicated below, are in accordance with the requirements of *Resource Conservation and Recovery Act* (RCRA) and the agreements between U.S. Department of Energy National Nuclear Security Administration Nevada Operations Office (NNSA/NV) and NDEP.

Section 5.3.3.1 PPE/Equipment (first paragraph, last sentence)

Delete: "within 45 days from receipt of the final CAU analytical data package from the laboratory."

Insert: "where it will be managed and dispositioned according to the requirements of RCRA or subject to agreements between NNSA/NV and NDEP."

Section 5.3.3.2 Rinsate (first paragraph, last sentence)

Delete: "within 45 days from receipt of the final CAU analytical data package from the laboratory."

Insert: "where it will be managed and dispositioned according to the requirements of RCRA or subject to agreements between NNSA/NV and NDEP."

Section 5.3.5 Mixed Wastes (second paragraph, third sentence)

Delete: "within 45 days from receipt of the final CAU analytical data package from the laboratory,"

Insert: "it will be managed and dispositioned according to the requirements of RCRA or subject to agreements between NNSA/NV and NDEP,"

Technical Change No. 2

Page 2 of 2

Project/Job No. 831841-02010005

Date March 19, 2002

Project/Job Name CAU 165: Areas 25 and 26 Dry Well and Washdown Areas, Nevada Test Site, Nevada

The project time will be (Increased)(Decreased)(Unchanged) by approximately -0- days.

Applicable Project-Specific Document(s): *Corrective Action Investigation Plan for Corrective Action Unit 165: Areas 25 and 26 Dry Well and Washdown Areas, Nevada Test Site, Nevada, Rev. 0, DOE/NV-788.*

Approved By:

Janet Appenzeller-Wing
Janet Appenzeller-Wing, Project Manager
Industrial Sites Project

Date:

3/20/02

Robert M. Wycoff Jr.
for Robert M. Wycoff, Division Director
Environmental Restoration Division

Date:

3/20/02

Client Notified Yes X No Date

NDEP Concurrence:

Don Ebb Date 3/25/02

Contract Change Order Required Yes No X

Contract Change Order No. Not applicable

RECORD OF TECHNICAL CHANGE

Technical Change No. 1

Page 1 of 2

Project/Job No. 831841-02010005

Date January 18, 2002

Project/Job Name CAU 165: Areas 25 and 26 Dry Well and Washdown Areas, Nevada Test Site, Nevada

The following technical changes (including justification) are requested by:

Dustin R. Wilson

Task Manager

(Name)

(Title)

The wrong figure was used for Figure 4-2 on page 45. The existing Figure 4-2 must be replaced with the attached Figure 4-2.

The project time will be (Increased)(Decreased)(Unchanged) by approximately -0- days.

Applicable Project-Specific Document(s): *Corrective Action Investigation Plan for Corrective Action Unit 165: Areas 25 and 26 Dry Well and Washdown Areas, Nevada Test Site, Nevada, Rev. 0, DOE/NV-788.*

Approved By:

Sabine Curtis
for Janet Appenzeller-Wing, Project Manager
Industrial Sites Project

Date 1-18-02

Runore Wycoff

Date 1-18-02

Runore C. Wycoff, Division Director
Environmental Restoration Division

Client Notified Yes X No Date January 18, 2002

NDEP Concurrence Yes No Date N/A

Contract Change Order Required Yes No X

Contract Change Order No. Not applicable

Figure 4-2
Sampling Locations at CAS 25-51-02, Dry Well

Available for public sale, in paper, from:

U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Phone: 800.553.6847
Fax: 703.605.6900
Email: orders@ntis.fedworld.gov
Online ordering: <http://www.ntis.gov/ordering.htm>

Available electronically at <http://www.doe.gov/bridge>

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Fax: 865.576.5728
Email: reports@adonis.osti.gov

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**CORRECTIVE ACTION INVESTIGATION PLAN FOR
CORRECTIVE ACTION UNIT 165: AREAS 25 AND 26
DRY WELL AND WASHDOWN AREAS,
NEVADA TEST SITE, NEVADA**

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

Controlled Copy No.: ____

Revision No.: 0

January 2002

Approved for public release; further dissemination is unlimited.

**CORRECTIVE ACTION INVESTIGATION PLAN
FOR CORRECTIVE ACTION UNIT 165:
AREAS 25 AND 26 DRY WELL AND WASHDOWN AREAS,
NEVADA TEST SITE, NEVADA**

Approved by: _____ Date: _____

Janet Appenzeller-Wing, Project Manager
Industrial Sites Project

Approved by: _____ Date: _____

Runore C. Wycoff, Division Director
Environmental Restoration Project

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List of Acronyms and Abbreviations

ALARA	As-low-as-reasonably-achievable
Am	Americium
amsl	Above mean sea level
Ba	Barium
bgs	Below ground surface
BN	Bechtel Nevada
CADD	Corrective Action Decision Document
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CFR	<i>Code of Federal Regulations</i>
CLP	Contract Laboratory Program
Co	Cobalt
COC	Contaminant of Concern
COPC	Contaminant of Potential Concern
Cs	Cesium
CSM	Conceptual Site Model
Decon	Decontamination
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
dpm/100 cm ²	Disintegrations per minute per 100 square centimeters
DQI	Data quality indicator

List of Acronyms and Abbreviations (Continued)

DQO	Data quality objective(s)
DRO	Diesel-range organics
EM	Electromagnetic
E-MAD	Engine Maintenance, Assembly, and Disassembly
EPA	U.S. Environmental Protection Agency
ETSM	Engine Transport System Maintenance
ETS-1	Engine Test Stand-1
Eu	Europium
FFACO	<i>Federal Facility Agreement and Consent Order</i>
FSL	Field-screening level
FSR	Field-screening result
ft	Foot (feet)
ft ²	Square Foot (feet)
GPR	Ground-penetrating radar
HASP	Health and Safety Plan
HCIP	Heavy cast iron pipe
Hg	Mercury
HPGe	High Purity Germanium
HWAA	Hazardous Waste Accumulation Area
IDW	Investigation-derived waste
in.	Inch(es)
ISMS	Integrated Safety Management System
ITLV	IT Corporation, Las Vegas Office
LCS	Laboratory control sample

List of Acronyms and Abbreviations (Continued)

LLW	Low-level radioactive waste
LRL	Lawrence Radiation Laboratory
M&O	Management & Operations
MCC	Manned Control Car
MDA	Minimum detectable activities
mi	Mile
mg/kg	Milligram per kilogram
mR/h	Milliroentgen per hour
MRL	Minimum reporting limit
MS	Matrix spike
MSD	Matrix spike duplicate
Nb	Niobium
ND	Normalized difference
NDEP	Nevada Division of Environmental Protection
NEPA	<i>National Environmental Policy Act</i>
NERVA	Nuclear Engine for Rocket Vehicle Application
NNSA/NV	U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office
NRDS	Nuclear Rocket Development Station
NTS	Nevada Test Site
NTSWAC	<i>Nevada Test Site Waste Acceptance Criteria</i>
PAL	Preliminary action level
PCB	Polychlorinated biphenyl
PPE	Personal protective equipment

List of Acronyms and Abbreviations (Continued)

ppm	Part per million
PRG	Preliminary remediation goal
Pu	Plutonium
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
Ra	Radium
RCA	Radiological control area
RadCon	Radiological Control
RadSafe	Radiation safety
RCP	Reactor Control Point
RCRA	<i>Resource Conservation and Recovery Act</i>
RMA	Radioactive materials area
R-MAD	Reactor Maintenance, Assembly, and Disassembly
SAA	Satellite accumulation area
SDWS	Safe Drinking Water Standard
Sr	Strontium
SVOC	Semivolatile organic compound
TCA	Test Cell “A” Facility
TCC	Test Cell “C” Facility
TDA	Train decontamination area
TNT	Transient Nuclear Test
TPH	Total petroleum hydrocarbon
U	Uranium

List of Acronyms and Abbreviations (Continued)

VCP	Vitrified clay pipe
VOC	Volatile organic compound
Y	Yttrium
%	Percent recovery

Executive Summary

This Corrective Action Investigation Plan (CAIP) contains the project-specific information including facility descriptions, environmental sample collection objectives, and criteria for conducting site investigation activities at Corrective Action Unit (CAU) 165: Areas 25 and 26 Dry Well and Washdown Areas, Nevada Test Site (NTS), Nevada. The results of the field investigation will support a defensible evaluation of corrective action alternatives in the Corrective Action Decision Document.

Corrective Action Unit 165 is comprised of the following Corrective Action Sites (CASs):

- CAS 25-20-01, Lab Drain Dry Well
- CAS 25-51-02, Dry Well
- CAS 25-59-01, Septic System
- CAS 26-59-01, Septic System
- CAS 25-07-06, Train Decontamination Area
- CAS 25-07-07, Vehicle Washdown
- CAS 26-07-01, Vehicle Washdown Station
- CAS 25-47-01, Reservoir and French Drain

The eight CASs in CAU 165 are located at various facilities in Areas 25 and 26. The data quality objectives (DQO) process was used to identify and define the type and quality of data needed to complete the investigation phase of the CAU 165 corrective action process. A phased approach was developed to address the data needs during the investigation. The Phase I investigation will determine if contaminants of potential concern (COPCs) are present in concentrations exceeding preliminary action levels which define a contaminant of concern (COC). If laboratory data obtained from the Phase I investigation indicates the presence of COCs, the process will continue with a Phase II investigation. The process will continue based on the laboratory analytical results of the environmental samples and conclude once all the data required for selection of a corrective action are obtained. Corrective action alternatives of closure-in-place and clean closure will be evaluated for each CAS with COCs. Phase I data collection will be conducted at all CASs.

Based on process knowledge, COPCs for CAU 165 are primarily radionuclides. To address process knowledge uncertainty, the Phase I analytical program for most CASs will include volatile organic compounds, semivolatile organic compounds, *Resource Conservation and Recovery Act* metals, total

petroleum hydrocarbons, polychlorinated biphenyls, and radionuclides. Based on the results of Phase I sampling, the analytical program for Phase II investigation may be reduced.

In general, field activities will consist of collecting soil samples at biased locations by appropriate methods. Where necessary for Phase II investigation, soil samples will be collected from horizontal and vertical step-outs to bound the extent of contamination. The technical approach for investigation of CAU 165 will consist of the following activities:

- Remove and/or dispose of surface materials at CASs 25-07-06 and 25-07-07.
- Perform radiological surveys at CASs 25-07-06, 25-07-07, and 26-07-01.
- Collect environmental samples and submit for laboratory analysis to determine if COCs are present.
- Inspect portions of the collection system piping using a combination of visual, video, and/or radiological surveys, as appropriate. Collect sediment samples from the piping, if possible, and submit for laboratory analysis.
- Collect environmental samples at CASs with COCs and submit for laboratory analysis to define the lateral and vertical extent of COCs.
- Collect samples of investigation-derived waste, as needed, to ensure full characterization.
- Collect soil samples for laboratory analysis of geotechnical parameters, as needed.

This CAIP has been developed in accordance with the *Federal Facility Agreement and Consent Order* that was agreed to by the State of Nevada, the U.S. Department of Energy, and the U.S. Department of Defense. Under the FFACO, this CAIP will be submitted to the Nevada Division of Environmental Protection for approval. Field work will be conducted following approval of the plan.

1.0 Introduction

This Corrective Action Investigation Plan (CAIP) contains project-specific information including facility descriptions, environmental sample collection objectives, and criteria for conducting site investigation activities at Corrective Action Unit (CAU) 165: Areas 25 and 26 Dry Well and Washdown Areas, Nevada Test Site (NTS), Nevada.

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

The NTS is approximately 65 miles (mi) northwest of Las Vegas, Nevada ([Figure 1-1](#)). Corrective Action Unit 165 consists of eight corrective action sites (CASs) associated with various facilities that supported projects in Areas 25 and 26 of the NTS. [Table 1-1](#) lists the eight CASs that comprise CAU 165 and their facility locations. [Figure 1-2](#) shows the locations of the six CASs in Area 25 and [Figure 1-3](#) shows the location of the two CASs in Area 26.

1.1 Purpose

Corrective Action Unit 165 is being investigated because hazardous and/or radioactive constituents may be present at concentrations and locations that could potentially pose a threat to human health and the environment. The eight CASs at CAU 165 consist of dry wells, septic systems, decontamination (decon) pads, and a reservoir. The six CASs in Area 25 are associated with the Nuclear Rocket Development Station (NRDS) that operated from 1958 to 1973. Facilities in Area 26 were constructed for Project Pluto, a series of nuclear reactor tests conducted to develop a nuclear-powered ramjet engine. Project Pluto was active for a relatively limited duration from 1961 to 1964 (ERDA, 1977b). For operational reasons, the Project Pluto facilities were separated into three functional areas - control, testing, and disassembly. The two Area 26 CASs included in CAU 165 are located in the test and disassembly areas ([Figure 1-3](#)).

Figure 1-1
Nevada Test Site Location Map

Table 1-1
CAU 165 Corrective Action Sites

Located in Area	CAS Number	CAS Description ^a	Facility Association
25	25-20-01	Lab Drain Dry Well	Central Support Area
	25-51-02	Dry Well ^b	Engine Test Stand
	25-59-01	Septic System	E-MAD
26	26-59-01	Septic System	Pluto Facility
25	25-07-06	Train Decontamination Area	E-MAD
	25-07-07	Vehicle Washdown	Reactor Control Point
26	26-07-01	Vehicle Washdown Station	Pluto Facility
25	25-47-01	Reservoir and French Drain	Reactor Control Point

^aCAS Description from the FFACO (1996)

^bIn the FFACO, CAS 25-51-02 is designated as Drywell; throughout this document, it will be referred to as Dry Well.

E-MAD = Engine Maintenance, Assembly, and Disassembly Facility

R-MAD = Reactor Maintenance, Assembly, and Disassembly Facility

Existing information and process knowledge on the expected nature and extent of contamination are insufficient to select preferred corrective actions; therefore, additional information will be obtained by field investigation prior to choosing appropriate corrective actions for each CAS.

The sites will be investigated based on data quality objectives (DQOs) developed by representatives of NDEP and NNSA/NV. The DQOs are used to identify and define the type and quality of data needed to develop and evaluate appropriate corrective actions for CAU 165. This CAIP will describe the investigation developed to collect these data. A phased approach has been selected to generate the data needed to satisfy the DQOs. Phase I will determine if contaminants of potential concern (COPCs) are present in concentrations above preliminary action levels (PALs). If COPCs are present above PALs, Phase II will be implemented to determine the extent of contamination. The general purpose of the investigation is to:

- Identify the presence and nature of COPCs.
- Determine whether COPCs exceed PALs, thereby becoming contaminants of concern (COCs).

Figure 1-2
CAU 165: Area 25 Corrective Action Sites,
Nevada Test Site, Nye County, Nevada

Figure 1-3
CAU 165: Area 26 Corrective Action Sites,
Nevada Test Site, Nye County, Nevada

- Determine the vertical and lateral extent of COCs, if present.
- Ensure adequate data have been collected to close the sites under NDEP, *Resource Conservation and Recovery Act* (RCRA), and DOE requirements.

1.2 Scope

The scope of the investigation is to generate the information needed to resolve the decision statements identified in the Phase I and Phase II DQO processes. The Phase I decision statement is to determine if COCs are present. The Phase II decision statement is to determine the extent of COCs. All CASs will begin with a Phase I investigation. If COCs are identified, a Phase II investigation will be implemented.

The scope of the corrective action investigation for CAU 165 includes the following activities to address the decision statements:

- Remove and/or dispose of surface materials at CASs 25-07-06 and 25-07-07.
- Perform radiological surveys at CASs 25-07-06, 25-07-07, and 26-07-01.
- Collect environmental samples and submit for laboratory analysis to determine if COCs are present.
- Inspect portions of the collection system piping using a combination of visual, video, and/or radiological surveys, as appropriate. If possible, collect sediment samples from the piping and submit for laboratory analysis.
- At CASs with COCs, collect environmental samples and submit for laboratory analysis to define the lateral and vertical extent of COCs.
- Collect samples of investigation-derived waste (IDW), as needed, to ensure full characterization.
- Collect soil samples for laboratory analysis of geotechnical parameters, as needed.

1.3 CAIP Contents

The managerial aspects of this project are discussed in the *Project Management Plan* (DOE/NV,1994) and the site-specific Field Management Plan that will be developed prior to field activities. [Section 1.0](#) presents the purpose and scope of this CAIP, while [Section 2.0](#) provides

background information about the CAU. The objectives, including the conceptual site models, are presented in [Section 3.0](#). Field sampling activities are discussed in [Section 4.0](#), and waste management issues are discussed in [Section 5.0](#). General field and laboratory quality assurance (QA) and quality control (QC) issues (including collection of QC samples) are presented in [Section 6.0](#) of this CAIP and also in the *Industrial Sites Quality Assurance Project Plan* (QAPP) (DOE/NV, 1996b). The health and safety aspects of this project are documented in the IT Corporation, Las Vegas Office (ITLV), *Health and Safety Plan* (HASP) (IT, 2001), and will be supplemented with a site-specific health and safety plan written prior to the start of field work. Public involvement activities are documented in the “Public Involvement Plan,” Appendix V of the FFACO (1996). The project schedule and records-availability information for this document are discussed in [Section 7.0](#). [Section 8.0](#) provides a list of references. [Appendix A](#) provides a DQO summary, while [Appendix B](#) contains information on the project organization.

2.0 Facility Description

The CASs were grouped into CAU 165 based on their geographical location, technical similarities, and agency responsibility for closure.

2.1 Physical Setting

The following sections describe the general physical setting for Area 25 and Area 26. General background information pertaining to topography, geology, hydrogeology, and climatology are provided for these areas or the NTS region in the *Geologic Map of the Nevada Test Site, Southern Nevada*; USGS Map I-2046 (Frizzell and Shulters, 1990); *CERCLA Preliminary Assessment of DOE's Nevada Operations Office Nuclear Weapons Testing Areas* (DRI, 1988); the *Nevada Test Site Final Environmental Impact Statement* (ERDA, 1977b); and the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996a).

2.1.1 Area 25

Area 25 (Jackass Flats) is a valley bordered by highlands on all sides except for a large drainage outlet to the southwest. Elevations range from 3,400 to 5,600 feet (ft) above mean sea level (amsl). The dominant plant community is *Larrea-Ambrosia* associated with a transition zone between the Mojave and Great Basin Deserts (DOE, 1988b).

The Jackass Flats basin is underlain by alluvium, colluvium, and volcanic rocks of Cenozoic age. The alluvium and colluvium are above the saturated zone throughout most of Jackass Flats. Paleozoic sedimentary rocks, limestone, and dolomite, occur at greater depths. The Paleozoic rock formations are associated with productive aquifers throughout the region but locally are considered too deep (approximately 1,700 ft) to be an economic source of water. In western Jackass Flats, a highly-fractured welded-tuff (Topopah Spring Member) is associated with an aquifer. Groundwater flow for the region is generally to the south and southwest (DOE, 1988b). Depths to groundwater for the three water supply wells located within Area 25 are approximately 1,041; 928; and 740 ft below ground surface (bgs) (USGS, 1995b).

Surface water flow in Area 25 is ephemeral and is a function of variations in annual climate patterns. The climate in this area is affected by the rain shadow of the Sierra Nevada mountain range in California. The average annual precipitation for Jackass Flats is approximately 4 inches (in.). Most of the precipitation occurs between October and April as a result of storms originating in the Pacific Ocean. The remaining precipitation occurs in the summer months and is the result of convection of moist air brought on by southeasterly winds from the Gulf of Mexico, or cyclonic lows developed over the Great Basin. Summer showers are generally isolated and precipitation is variable. Occasionally, storms move directly northward from the Gulf of California, resulting in widespread heavy rain (DOE, 1988b). Potential evaporation rates for the NTS/Yucca Mountain region are approximately 66 in. per year (DOE/OCRWM, 1999).

Facility-specific infrastructure information for Area 25 is provided in the NRDS Master Plan (SNPO, 1970).

2.1.2 Area 26

Area 26 is generally bounded on the southwest by the low drainage divide between Wahmonie Flat and Jackass Flats, on the northwest by Lookout Peak, on the north and northeast by small rugged hills that are unnamed, and on the south by Skull Mountain. Area 26 is located midway between Jackass Flats and Frenchman Flat (Johnson and Ege, 1964).

The portion of Area 26 of concern to CAU 165 is a valley bordered by highlands on all sides except for a drainage outlet to the southwest and southeast. Area 26 is located in the transition zone between the northern edge of the Mojave Desert and the southern portion of the Great Basin Desert.

Elevations where Project Pluto facilities are present range from 4,200 to 4,400 ft amsl (AEC, 1961).

The Skull Mountain region is underlain by alluvium and colluvium, which ranges in age from Miocene to Holocene (Frizzel and Shulters, 1990). The alluvium and colluvium consist of unconsolidated to moderately cemented, locally deformed, alluvial fan, flood plain, streambed, talus, slope wash, and eolian deposits. The thickness is variable up to 1,970 ft thick (DRI, 1988). Nearby hills consist of Miocene-age Wahmonie and Salyer Formations which are rhyodactic and dacitic volcanic deposits (DRI, 1988).

The portion of Area 26 used for Project Pluto is covered by thin gravels capping a pediment that dips 3 to 6 degrees to the southeast. The pediment gravels merge with valley alluvium along Cane Springs Wash to the south. Where exposed, bedrock consists mostly of extrusive igneous rocks with some associated breccias of limited areal extent. A few thin beds of consolidated sedimentary rock are present between some of the extrusive rocks.

A perched water table occurs in a zone of the highly fractured rock. Static perched water levels range from 81 to 167 ft bgs (Johnson and Ege, 1964). The perched water may extend to depths exceeding 261 ft bgs before encountering rocks with a low-fracture permeability. The regional water table is assumed to be at a depth of approximately 1,700 ft bgs (DRI, 1988). The climate of Area 26 is similar to that of Area 25 ([Section 2.1.1](#)).

Facility-specific infrastructure information for Area 26 is provided in the *Environmental Survey Preliminary Report* (DOE, 1988a), *Background Information Project Pluto - Tory II-A* (Author Unknown, 1960), and the *Tory IIC Reactor Test Report* (AEC, 1964).

2.2 Operational History

The following subsections provide a description of the use and history of each of the CASs in CAU 165, that may have resulted in a potential release to the environment, beginning with a general discussion of each area, narrowing the discussion to a facility or landmark, and finally focusing on an individual CAS. The CAS-specific summaries are designed to illustrate any significant known waste-generating activity or release.

2.2.1 History of Area 25

In the early 1960s, the U.S. Atomic Energy Commission and the National Aeronautics and Space Administration negotiated an interagency agreement to establish and manage a test area known as the NRDS. The NRDS, located in Area 25, was used from the 1960s until 1973 to conduct full-scale testing of reactors, engines, and rocket stages to evaluate the feasibility of developing nuclear reactors for the United States space program.

When Project Rover was completed in 1973, NRDS activities were concluded, and the NRDS area was returned to NTS for closure. Following closure, the facilities were deactivated and

decommissioned for their potential transfer to other DOE programs. Since 1980, Area 25 has been primarily used for nonweapons research and development.

Within the Area 25 test area, several major installations were built to conduct and support NRDS activities. Collectively, these installations cover approximately 8,000 acres of land. The installations include the Reactor Control Point (RCP); Engine Maintenance, Assembly, and Disassembly (E-MAD) facility; Reactor Maintenance, Assembly, and Disassembly (R-MAD) facility; Test Cell A (TCA); and TCC (see [Figure 1-2](#)).

The E-MAD facility was used to assemble and prepare Nuclear Engine for Rocket Vehicle Application (NERVA) engines for testing. It was also used to refurbish NERVA engines for additional testing, and to disassemble and conduct detailed post-testing inspections of the engines and components. The E-MAD facility was built in 1965 and used from 1966 to 1973 (DRI, 1996).

The RCP facility was constructed to house support operations for the NRDS Project. Construction for the NRDS Project, including the RCP complex, began in 1958. The RCP area consisted of facilities required for the control and support of reactor tests performed at TCA and TCC at the NTS. The support facilities located within the RCP complex included the Administration Building, Control Point Building, Technical Operations Buildings, and the Technical Services Building. A cafeteria, warehouse, maintenance facility, and medical facilities were other buildings at the RCP complex. There were also trailers used as sleeping quarters and for radiation safety (RadSafe) activities. The NRDS Project ended in 1973.

The following sections provide historical information on individual facilities and CASs in Areas 25. [Figure 1-3](#) shows the locations of the CAU 165 CASs.

2.2.1.1 CAS 25-20-01, Lab Drain Dry Well

CAS 25-20-01, Lab Drain Dry Well, is located approximately 60 ft north of Building 4215 in the Central Support Area of Area 25 of the Nevada Test Site. System components include a concrete dry well and a chemical waste line. The Dry Well is a 4 x 8-ft precast concrete manhole ring with an open bottom and is filled with $\frac{3}{4}$ - to 1 $\frac{1}{2}$ -in. gravel to a minimum depth of 4 ft. The Dry Well is set to surface grade and a manhole cover is in place. The chemical waste line is 60 ft of 6-in. vitrified clay

pipe (VCP) from the north side of Building 4215 to the Dry Well (Norman Engineering Co., 1967b). [Figure 4-1](#) includes a sketch of CAS 25-20-01, Lab Drain Dry Well.

Building 4215, Technical Support Shop, was built in 1967 and included a photo shop, physical test shop, electronic shop, machine shop, mechanical equipment room, chemical analysis room, calibration shop, instrument repair shop, mechanical calibration laboratory, inspection and preparation room, and valve test and maintenance shop. In 1989, the building was converted to the Hydrologic Research Facility and the United States Geological Survey took possession. Currently, the facility is in use. The conversion included capping the chemical waste line drain. Thus, the system may have received effluent from 1967 through 1989. According to engineering drawings, source drains included three sinks associated with fume hoods and two floor drains. The sinks are located in the Chemical Analysis Room (207) and the Particulate Analysis Room (211). The floor drains are located in the Valve Test and Maintenance Shop Room (217) (Norman Engineering Co., 1967a).

2.2.1.2 CAS 25-51-02, Dry Well

CAS 25-51-02, Dry Well, is located east of Building 3320 (Utility Equipment Building) at the Engineering Test Stand (ETS)-1, approximately 65 ft east of the fence line. The site consists of an acid and caustic drain dry well connected to an inside floor drain and an outside drain by a 6-in. Duriron pipe. The pipe extends approximately 176 ft from Building 3320 to the Dry Well. Presently, there is no visible evidence of the dry well or piping which are entirely subsurface. The area in the vicinity of the dry well location appears depressed and is partially surrounded by a berm. [Figure 4-2](#) includes a sketch of CAS 25-51-02, Dry Well.

The ETS-1 facility was designed for testing of a downward-firing nuclear engine in a flight-simulated environment (ERDA, 1977b). Construction of the entire facility was completed in 1966, and operations were performed at ETS-1 until 1973 (SNPO, 1970; REEC Co, 1984c). Approximately 14 ground developmental tests of downward-firing NERVA-type engines were run from 1968 to 1969 (RSN, 1995). The facility includes a test stand connected to a control point building by a 1,150 ft underground tunnel, with associated offices and buildings, and the necessary electrical, water, heating, ventilation, air conditioning, and other support systems.

As-built engineering drawings indicate Building 3320 existed in 1963 (Aetron, 1963a); however, the construction date of the dry well has not been identified. Building 3320 consists of a boiler room, two mechanical rooms, an electrical equipment room, battery room, and restroom. Sulfuric acid and sodium hydroxide were used to clean the boiler by first shocking it with the acid and then neutralizing with the caustic.

The dry well was intended to collect leaks, spills, and overflow of acid and caustic effluent used in the building. On engineering drawings, the dry well was shown to receive acid and caustic effluent from a drain located by the east wall of the boiler room and from an outside drain just north of the charcoal adsorber furnace (Aetron, 1963b). An interview identified that the dry well possibly received effluent from the two 5,000-gallon capacity acid and caustic aboveground storage tanks once located northeast of Building 3320 (Garey, 2000). The interviewee estimated that 100 gallons of effluent might have been disposed of down the dry well over the life of the project (approximately from 1964 to 1970). The acid and caustic tanks (CAU 126, CAS 25-01-01) and the charcoal adsorber furnace (CAS 25-01-04) have since been removed but the tank concrete pad is still in place. Waste streams associated with these two CASs included friable asbestos-containing material on piping and sulfuric acid residue and impacted soil from an acid spill during tank removal.

2.2.1.3 CAS 25-59-01, Septic System

CAS 25-59-01, Septic System, is located in Area 25 of the NTS in the E-MAD facility. The gravity-fed system was designed for sanitary wastes and serviced two toilets, two urinals, and two sinks in the Engine Transport System Maintenance (ETSM) Building (Building 3901). The CAS consists of a cast iron cleanout riser, a 1,000-gallon capacity concrete septic tank (10.5 x 4.5 x 7 ft) with cast iron cleanout plugs on top, a perforated wall leaching cesspool (13 x 7 ft diameter) with a gravel leachbed, and associated piping. The piping includes 16 ft of 4-in. extra heavy cast iron pipe (HCIP) from the toilet facility to the septic tank and 10 ft of 4-in. HCIP from the septic tank to the cesspool. In addition to the septic system, engineering drawings show an outfall that is connected to the train service pit in the ETSM Building. The drain was installed underneath the train tracks in case of flooding. The outfall is not believed to be related to the sewage system. [Figure 4-3](#) includes a sketch of CAS 25-59-01, Septic System.

The ETSM Building, also known as the Train Shed, was designed to serve as the locomotive maintenance area for Area 25, with a railroad spur routed into the ETSM as an extension of the Railroad Transport System (RTS). The RTS connected the functional areas of the NRDS. The trains may have been contaminated because of their use in the NRDS program. The NRDS program ended in 1973.

The ETSM Building was designated as the TRUclean II test facility in 1986. The purpose of the program was volume reduction and activity removal of radioactively-contaminated soil to allow beneficial use of the treated soil. In 1987, a variety of contaminated soil matrices were shipped to Building 3901 for the TRUclean II testing program. There is no documentation indicating if any radiological contamination from this program entered the septic system. The building has not been used since 1987.

2.2.1.4 CAS 25-07-06, Train Decontamination Area

CAS 25-07-06, Train Decontamination Area (TDA), is located approximately 50 yards north of the E-MAD facility in Area 25 at the NTS. The site consists of a concrete decontamination pad (65 x 33 ft) with a 1-ft concrete berm, a 6-in. radioactive floor drain centered in the pad, 125 ft of 6-in. VCP (radioactive waste line) from the drain to an isolation valve, railroad tracks trending through the pad, and a hand railing partially surrounding the decon pad. The piping south of the isolation valve leading into the waste holdup tanks belongs to CAS 25-02-01 from CAU 135. The Manned Control Car (MCC) is currently parked on the decon pad but is not considered part of this CAS. Surface debris includes a pressure washer, a parts washer, a 55-gallon drum (unknown contents), lead bricks, hoses, wood, and other miscellaneous material. [Figure 4-5](#) includes a sketch of the CAS 25-07-06, TDA.

The TDA was constructed at the same time as the E-MAD facility. It was determined in an interview that the TDA was used between the late 1960s and early 1970s. The railroad tracks that extend through the TDA were part of the RTS that connected the functional areas of the NRDS. The TDA supported the E-MAD facility and was used to decontaminate the nuclear test engine equipment and components for inspection, maintenance, and/or disassembly. The MCC and railcars that transported these items from other buildings in Area 25 were also decontaminated in the TDA.

A report states that the TDA is contaminated with radiation with an approximate area of 669 meters squared (7,200 feet squared) (Sorom, 1992). Based on engineering drawings, the radioactive waste drain in the center of the pad is connected to a radioactive sewer line that terminates in a radioactive waste holdup pit formerly containing two tanks (CAU 135, CAS 25-02-01). The tanks received low-level radioactive liquid waste from all of the radioactive waste drains in the E-MAD Building (Building 3900). If radiation levels permitted, the stored liquid from the tanks was discharged to a radioactive leachfield (CAU 262, CAS 25-05-06) located southwest of Building 3900.

The specific contaminants, volume, and frequency of use of the TDA are unknown. The waste holdup tanks were previously sampled. The TDA was only one of many sources of effluent into the tanks and leachfield. It cannot be confirmed that the contaminants identified in CAS 25-02-01 were used in the TDA. The MCC utilized a spacer car to help prevent contamination. According to process knowledge, the MCC was deconned during operations. The MCC may have contained diesel fuel and hydraulic oils.

The TDA appeared as a contamination area on the *List of NTS Radiologically Controlled Areas* (REECo, 1995). In addition, the site is restricted due to radioactivity by a security fence and signs that read "Caution Radioactive Materials."

2.2.1.5 CAS 25-07-07, Vehicle Washdown

CAS 25-07-07, Vehicle Washdown, is located in Area 25 of the NTS, adjacent to the RCP facility. The vehicle washdown is located approximately 48 ft east of Road C at the junction of Road H. The vehicle washdown area consists of a decontamination pad (16 x 32 ft); a gravity-fed, gravel-lined sump (37 x 32 x 5 ft), trailer pads, three box hydrants and hose racks, and a utility pad drain connection. The utility pad is connected to the sump via 4-in. VCP (50 ft) and 30 ft of 4-in. Orangeburg piping. [Figure 4-6](#) includes a sketch of CAS 25-07-07, Vehicle Washdown.

The vehicle washdown area was used to decontaminate light vehicles returning from TCC and TCA. Technicians would drive to the test cells in the morning to perform daily maintenance on the reactors. The vehicles were then required to pass through a radiation checkpoint before returning to the RCP facility. If contamination was detected, the vehicles were sent to the decon pad. Plastic was placed underneath the vehicles to catch any runoff water. Blotter cloths were then used to wipe down any

contaminated areas. Wire brushes were used if necessary. Detergents were sometimes used in the decontamination operations. In addition, Freon-10 was occasionally used as a cleaner. The vehicles were then rinsed down with garden hoses. The technicians would also remove any protective clothing at the vehicle washdown area. All cloths, clothing, brushes, and plastic were disposed of properly.

Engineering drawings show that the wastewater generated on the decon pad would flow to the sump via grates and gravity. There are no drains or piping leading from the decon pad to the sump. The large trailer pads are 3 x 52.5 ft and the small pads are 3 x 18 ft. The pads were used to support RadSafe trailers. There is a large pit (80 x 200 x 6 ft) located just north of the site. No information was identified about this pit, but it is not believed to be associated with CAS 25-07-07.

In addition to decontamination effluent, it is also possible that sanitary wastes were disposed of in the sump based on the presence of the utility drain pad connection near the large trailer pads. The RadSafe trailers at the site were used as field offices for the radiation technicians and may have contained a restroom.

2.2.1.6 CAS 25-47-01, Reservoir and French Drain

CAS 25-47-01, Reservoir and French Drain, is located south of the RCP facilities in Area 25. Components include a backfilled reservoir (40 x 160 ft) and a backfilled L-shaped earthen drain (70 by 5 ft) from the CAU 271 (CAS 25-04-11) distribution box to the north end of the reservoir (dimensions are estimated from aerial photos). There is a slight depression and unconsolidated soil in an area where the reservoir may have been located. [Figure 4-8](#) includes a sketch of CAS 25-47-01, Reservoir and French Drain.

The exact use of the reservoir is unknown, although it is considered likely that the reservoir received effluent from a septic system servicing the cafeteria, the Technical Operations Building, and sleeping trailers in the RCP prior to and during construction of a leachfield (CAU 271, CAS 25-04-11). The septic system was operational from 1962 through 1983. It has been determined that the reservoir and earthen drain was constructed prior to a 1964 aerial photo (EG&G, 1964), but it is unknown when it was backfilled.

No previous sampling at this CAS has been identified. Analytical results from a 1995 REEC_o preliminary investigation of the potentially associated septic system identified the presence of the chemical and radiological COPCs (REEC_o, 1995). Radiological survey results for various facilities and structures at the RCP indicated background readings of 0.05 milliRoentgen per hour (mR/h) except for a few pieces of equipment and some isolated spots on floors and walls (REEC_o, 1984a).

2.2.2 History of Area 26

In 1958, the Lawrence Radiation Laboratory (LRL), predecessor of Lawrence Livermore and Lawrence Berkeley National Laboratories, was contracted to begin construction for Project Pluto in Area 26, formerly known as Area 401. Project Pluto was a joint program between the U.S. Atomic Energy Commission and DoD to demonstrate the feasibility of using a nuclear-powered ramjet engine to propel a supersonic, low-altitude missile (Author Unknown, 1960). Between 1961 and 1964, LRL conducted six experimental tests in Area 26 to develop the nuclear reactor for the ramjet. Four of the tests involved the Tory II-A nuclear reactor and the other two involved the Tory II-C reactor (DRI, 1988). The Tory reactors were air-cooled reactors fueled with highly enriched uranium dioxide homogeneously mixed with beryllium-oxide.

Several activities have taken place in Area 26 subsequent to the initial Project Pluto activities. From 1979 to 1983, the DoD and the DOE conducted three joint nuclear weapons accident training exercises (called NUWAX) at the Project Pluto control point and surrounding area. The exercises were designed to practice and evaluate planned emergency response to the scattering of radioactive material as a result of a nuclear weapons accident. In preparation for the exercises, short-lived radioisotopes (e.g., radium-223, mercury-197) were distributed on the ground surface to simulate contamination by weapons-grade plutonium (U.S. Army, 1989).

The facilities built to support Project Pluto were separated into three functional areas for operational reasons: control, testing, and disassembly areas. The two Area 26 CASs included in CAU 165 are located in the test and disassembly areas. Only the testing area will be discussed further in this CAIP.

2.2.2.1 Project Pluto Test Area

The testing area included the Test Bunker Building 2203 (Test Bunker), Building 2204 (Head House), and Building 2205 (Compressor House). Historical documentation reports that all three buildings were constructed in 1960, and were used from 1961 to 1964 during the Project Pluto activities (DRI, 1988). Personal interviews also indicate that the buildings may have been used sporadically after that time period for training exercises and other operations (Cebe, 1997). The nature of these activities are not known. Building 2203 is a facility of approximately 7,500 square feet (ft²) that served as the location to house equipment required to supply and control the air, heat, electrical power, and instrumentation necessary to the test the Tory reactors. The reactors were tested on a pad on the north side of the Building 2203. A remote-controlled railroad system (401 RR) was used to transport the reactors from the disassembly area to Building 2203 for testing. The status of Building 2203 is currently listed as active (BN, 2000b).

Building 2204 (Head House), measuring approximately 1,270 ft², housed the ventilation blowers and provided a sheltered entrance to the test bunker. A 392-ft long access tunnel connected the Head House to the Test Bunker. The status of Building 2204 is currently listed as active (BN, 2000b).

Building 2205 (Compressor House), measuring approximately 6,460 ft², housed water-cooled air compressors and all the air-drying equipment necessary to provide high-pressure air (3,600 pounds per square inch) for testing. The status of Building 2205 is currently listed as standby (BN, 2000b).

The following sections provide historical information on individual facilities and CASs in Area 26. [Figure 1-3](#) shows the locations of the CAU 165 CASs.

2.2.2.2 CAS 26-59-01, Septic System

CAS 26-59-01, Septic System, is located approximately 142 ft from the southwest corner of Building 2205 (Compressor House) in Area 26 of the NTS. The site consists of a septic tank (8 x 4 x 6 ft; 1,000-gallon capacity) with a manhole cover, leachfield, and piping that serviced Building 2205. The sanitary waste line is either 4- or 6-in. VCP approximately 172 ft from the Compressor House to the septic tank and 67 ft from the septic tank to the south end of the leachfield. There are five or six 30-ft long, 4-in. diameter VCP open joint lateral leach lines at 8-ft centers in the leachfield. A barbed wire fence presently surrounds the leachfield without signage. The ground is

slightly depressed, with normal vegetation and wood debris noted within the fenced area. [Figure 4-4](#) includes a sketch of CAS 26-59-01, Septic System.

Project Pluto began in 1961 and tested the feasibility of using a nuclear reactor for ramjet propulsion. Two Tory reactors were successfully tested. Construction of the facilities used during Project Pluto began in 1958. The Compressor House housed compressors and other equipment necessary for Project Pluto testing.

The exact date the septic system was in operation is unknown. The building was built in 1960 and Project Pluto was terminated in 1964, which is the last date the leachfield is assumed to have been used. Documentation and engineering drawings indicate that this system serviced Building 2205 in the capacity of a sewer system, and the building contained one rest room with a water closet, urinal, and a service sink, all of which drained into the septic system. Another drainage system, not associated with this CAS, existed to drain compressors and other equipment. This system is currently being evaluated for possible inclusion into Appendix II of the FFACO.

2.2.2.3 CAS 26-07-01, Vehicle Washdown Station

CAS 26-07-01, Vehicle Washdown Station, is located in Area 26, 150 yards east of Building 2201 (Maintenance, Assembly, and Disassembly Building). The site includes a bermed concrete pad (50 x 22 ft) and a metal support structure with a transite awning containing 10 sprayer heads. The pad drain is not part of this CAU; it is part of CAU 271 (CAS 26-05-01). There is a length of rubber hose in the lowered portion of the pad. [Figure 4-7](#) includes a sketch of CAS 25-07-01, Vehicle Washdown Station.

The Vehicle Washdown Station supported Project Pluto which tested Tory nuclear reactors for ramjet propulsion. The reactors were placed on a railroad test car and brought remotely to a test pad (east of the Vehicle Washdown) for each nuclear run. Initial decontamination of the reactors occurred on the railroad test cars at the Vehicle Washdown and then again at Building 2201.

2.3 Waste Inventory

Interviews with former site employees, review of procedures, and interpretations of aerial and ground photographs indicate that potential waste may include: miscellaneous debris, sanitary waste,

radiologically contaminated materials (primarily activation and fission products), radioactive effluent, and/or potentially hazardous wastes. In general, any of the CASs addressed by this CAU may have been used to dispose of material considered to be hazardous or radioactive waste by current standards. Available information was evaluated during the DQO process, and a list of potential contaminants was developed (described further in [Section 3.2](#)).

2.4 Release Information

The sources of potential contamination related to the CAU 165 CASs are varied, but are generally representative of each of the conceptual site model (CSM) elements developed during the DQO process. The CAS-specific release information, migration routes, exposure pathways, and affected media are discussed below, and additional information can be found in [Section A.1.1.3](#).

For CASs 25-20-01 (Lab Drain Dry Well), 25-51-02 (Dry Well), CAS 25-59-01 (Septic System), and CAS 26-59-01 (Septic System), effluent was discharged from source features (e.g., drains, lavatories) and routed through piping to an underground dispersion structure (i.e., dry well, cesspool, or leachfield), which allowed effluent to percolate into underlying soil for disposal. Contaminants may have been transported by system effluent, which would have served as the primary driving force for downward migration of any contaminants. The systems are no longer active. Infiltration from precipitation may be a minor mechanism since one of the dry wells and the leachfield are unconfined at the surface.

Potentially affected media includes system components (i.e., dry wells, septic tanks, cesspool, leachfield, leachrock, associated piping), content of septic tanks and residual material in pipes (if present), and subsurface soil surrounding system components.

CAS 25-20-01, Lab Drain Dry Well. Process knowledge indicates that the Dry Well may have received chemical effluent and was not part of a sanitary wastes system (Norman Engineering Co., 1967). Specific chemical compounds in the effluent are unknown. According to engineering drawings, source drains included three sinks associated with fume hoods and two floor drains. There is sufficient process knowledge to indicate that radiological COPCs were not introduced into the system (Alderson, 2001).

CAS 25-51-02, Dry Well. Potentially released materials include sulfuric acid and sodium hydroxide (Aetron, 1963). There is sufficient process knowledge to indicate that radiological COPCs were not introduced into the system (Alderson, 2001).

CAS 25-59-01, Septic System. No chemical or radiological COPCs have been confirmed for this CAS. The system was designed to receive sanitary wastes only. Although unlikely, there is a potential that some radiological and/or chemical compounds may have been introduced into the system through the sinks in the restroom.

CAS 26-59-01, Septic System. The system was designed to receive sanitary wastes only. Although unlikely, there is a potential that unidentified chemical COPCs may have been introduced into the system via the service sink. There is sufficient process knowledge to indicate that radiological COPCs were not introduced into the system (Alderson, 2001).

CASs 25-07-06 (Train Decontamination Area), 25-07-07 (Vehicle Washdown), and 26-07-01 (Vehicle Washdown Station). At each decontamination pad for CASs 25-07-06, 25-07-07, and 26-07-01, various equipment was washed and effluent was discharged to collection points via piping or direct surface flow. Unless discharged to another system, effluent would have percolated into nearby soil.

Potentially affected media includes concrete decontamination pads, waste lines, residual material in pipes, surrounding surface and subsurface soil, the awning and related hardware at CAS 26-07-01, and gravel sump at CAS 25-07-07. The discharge of effluent through the systems was the primary transport mechanism; however, the systems are no longer active. Infiltration from precipitation may be a minor mechanism, either by moving contaminants deeper into surrounding soil or by moving contaminants through open floor drains into associated collection or dispersion points. Runoff may be a minor transport mechanism, moving surface contamination to low-lying areas adjacent to the site.

CAS 25-07-06, Train Decontamination Area. Chemicals used include solvents (e.g., Freon-10), degreasers, alcohol, diluted acid, Turco decontamination solvent, unknown chemical cleaners, diesel fuel, polychlorinated biphenyls (PCBs), motor oil, and heavy metals (Garey, 1997 and 1999; LASL, 1970; Penwell, 1999). Radiological COPCs include cobalt-60 (Co-60); strontium-90 (Sr-90);

yttrium-90 (Y-90); niobium-94 (Nb-94); cesium-137 (Cs-137); barium-137m (Ba-137m); europium-152, -154, and -155 (Eu-152, Eu-154, and Eu-155); uranium-234, -235, -238 (U-234, U-235, U-238); plutonium-239/240 (Pu-239/240); and Americum-241 (Am-241) (Alderson, 2001).

CAS 25-07-07, Vehicle Washdown. Chemicals used include detergents and Freon-10 (Garey, 2000). Beryllium associated with the Transient Nuclear Test (TNT) excursion may also be present. Radiological COPCs include Co-60, Sr-90, Y-90, Nb-94, Cs-137, Ba-137m, Eu-152, Eu-154, Eu-155, U-234, U-235, U-238, Pu-238, Pu-239/240, and Am-241 (Alderson, 2001). COPCs associated with sanitary wastes may also be present due to the presence of the utility drain pad connection near one of the trailer pads.

CAS 26-07-01, Vehicle Washdown Station. Chemicals used include solvents and cleaning chemicals. Beryllium associated with the Tory Reactor may also be present. Radiological COPCs include Co-60, Sr-90, Y-90, Nb-94, Cs-137, Ba-137m, Eu-152, Eu-154, Eu-155, U-234, U-235, U-238, Pu-238, Pu-239/240, and Am-241 (Alderson, 2001).

CAS 25-47-01, Reservoir and French Drain. Effluent was apparently discharged to the reservoir via an unlined, earthen drain as overflow from or during construction of a nearby septic system (CAU 271, CAS 25-04-11). Contaminants may have percolated into underlying soil. There is uncertainty regarding COPCs due to the limited knowledge of the site. Chemical COPCs inferred from those identified in the nearby septic tank include barium, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total petroleum hydrocarbons (TPH) diesel-range organics (DRO), and PCBs (Nutley, 2000; REEC Co, 1995). Radiological COPCs may include Pu-238 and Pu-239/240 (Alderson, 2001). Affected media include soil within and surrounding the historical boundaries of the reservoir and earthen drain.

2.5 Investigative Background

No previous analytical sampling efforts have been identified for the CAU 165 CASs to date. Site investigation activities associated with CAU 165 have been identified and documented, in general, in the *Final Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996a).

The following subsections describe the known previous investigation activities that have taken place at the CAU 165 CASs.

In accordance with the NNSA/NV *National Environmental Policy Act* (NEPA) compliance program, a NEPA checklist will be completed prior to commencement of site investigation activities at CAU 165. This checklist compels NNSA/NV project personnel to evaluate their proposed project personnel against a list of several potential impacts which include, but are not limited to, air quality, chemical use, waste generation, noise level, and land use. Completion of the checklist results in a determination of the appropriate level of NEPA documentation by the NNSA/NV NEPA Compliance Officer.

2.5.1 Area 25 Radiological Survey and Cleanup Project

The *Nevada Test Site Area 25 Radiological Survey and Cleanup Project 1974-1983* (REECo, 1984b) report dated December 1984 gives a description of the RCP and details associated with cleanup activities. Additionally, this report provides details of a comprehensive radiological survey completed some time between 1974 to 1983. The surveys did not include leachfields or buried waste lines, thus CASs 25-07-07 and 25-47-01 were not surveyed. Except for a few isolated pieces of equipment which were moved to appropriate locations, and some isolated spots on floors and walls which were easily decontaminated, all portable instrument surveys indicated background readings of 0.05 mR/h. The facilities tested at the RCP were released for future use.

Radiological surveys were conducted at the ETS-1 Compound in 1973, 1978, and 1983 (REECo, 1984b); however, specific radiological surveys at the Dry Well (CAS 25-51-02) have not been identified. Swipe surveys for beta plus gamma and alpha did not indicate removable contamination with the exception of a maximum exposure rate of 30 mR/h on the center of the north shield.

Results from a 1978 radiological survey of Building 4215 (the source building for CAS 25-20-01) were below survey release limits. The release limits were 100 disintegrations per minute per 100 square centimeters dpm/100 cm² for removable alpha and 1,000 dpm/100 cm² for removable beta/gamma (REECo, 1984c).

2.5.2 1998 BN Radiological Surveys

CAS 25-07-06, Train Decontamination Area. A radiological survey of the E-MAD Train Decontamination Area was conducted June 23, 1998, by the Bechtel Nevada Demarcation Division (BN, 1998a). The survey was limited to six points along the perimeter of the pad and six points on the interior of the pad. The posting at the time of the survey was "Caution Radioactive Materials." This demarcation survey consisted of a radiological and geographic survey for determining if radiological posting and barricades are required at NTS sites that are potentially contaminated with radioactive material. The contamination levels from the field gross alpha measurements were above the Electra background reading of 0 dpm/100 cm² for 10 locations. The contamination levels from the field gross beta measurements were above the Electra background reading of 972 dpm/100 cm² at one location. The contamination levels from the final alpha measurements were above the Tennelec background reading of 2.6 dpm/100 cm² at one location. The contamination levels from the final beta measurements were not above the Tennelec background reading of 29.2 dpm/100 cm² at any location. The NE Electra used to collect beta surface contamination measurements was improperly calibrated. This calibration error was identified after the survey and the values stated in the report are low by factors ranging from two to three. However, the conclusions regarding whether or not the beta surface contamination exceeds background should still be correct. The levels from the FIDLER measurements indicated 11 locations that were positive. Of the readings that were elevated, one reading was significantly elevated (320 counts per second).

2.5.3 2001 ITLV Radiological Survey Report

In July 2001, ITLV personnel performed walkover radiological surface surveys at three CASs in CAU 165 (Speer, 2001). Scanning and static surveys were used to define the areas of elevated radioactivity. Results of the surveys and monitoring will be used to identify radiological health hazards and to provide safety information for protection of workers and environment.

2.5.4 2000 ITLV Surface Geophysical Survey Report

The report, *First Quarter 2000 Surface Geophysical Survey Report Potential Corrective Action Sites Area 25 EMAD and Test Cells C and A, Nye County, Nevada*, report geophysical investigations conducted on two CASs in CAU 165 (IT, 2000d). Results of the surveys will be used to confirm or

deny the existence of potentially buried materials and/or subsurface features. A combination of electromagnetic (EM-31), time domain metal detection (EM-61), and ground-penetrating radar (GPR) methods were used to complete the geophysical investigation. The geophysical field approach used at each CAS varied slightly depending on the intended objective and target(s) of the investigation.

This report includes the vehicle washdown area, CAS 25-07-07. The survey included EM-61 and GPR simultaneously. The survey was conducted to determine if there was a septic system associated with the utility drain pad connection. There was no evidence of a septic system being present at this site.

The report also includes the dry well (CAS 25-51-02) area east of Building 3320. The survey included EM-61 and GPR simultaneously. The EM-61 survey identified three small anomalies; however, the fence was too close and the data contained interference. The GPR survey identified an anomalous zone typical of reflections expected for a dry well. The top of the anomaly was identified at 4.5 ft bgs and its coordinates are assumed to coincide with the dry well (IT, 2000).

3.0 Objectives

This section presents an overview of the DQOs for CAU 165 and formulation of the CSMs. Also presented is information on the COPCs and PALs for the investigation.

3.1 Conceptual Site Models

The CSM describes the most probable scenario for current conditions at each site and defines the assumptions that are the basis for identifying appropriate sampling strategy and data collection methods. Three CSMs have been developed for CAU 165 using assumptions formulated from historical background information, knowledge from studies of similar sites, and data from previous sampling efforts presented in [Section 2.0](#). A discussion in [Section A.1.1.3](#) also provides information on the CSMs. The three CSMs include:

- Dry Well/Septic System
- Decontamination Pad
- Reservoir

The following elements are common to all three of the CSMs:

- Future land-use scenarios limit future uses to various nonresidential uses (DOE/NV, 1996a; BLM, 1990). Future use of the CASs are as follows: six CASs are located within the Research Test and Experiment Zone, and the remaining two CASs (25-59-01 and 25-07-06) are located within the Yucca Mountain Site Characterization Zone (DOE/NV, 1998). The Research Test and Experiment Zone is designated for small-scale research and development projects and demonstrations; pilot projects; outdoor tests; and experiments for development, quality assurance, or reliability of material and equipment under controlled conditions. This includes compatible nondefense research, development, and testing projects and activities. These land-use scenarios limit future use to industrial activities; therefore, residential land use is not considered.
- Exposure pathways to site workers include oral ingestion, inhalation, or dermal contact (absorption) of septage and soils due to disturbance of contaminated soils, debris, and/or structures. Solid media such as concrete and/or structures may only pose a potential radiological exposure risk to site workers. Surface radiological surveys of the solid media will be compared to the free-release criteria, as defined in the *NV/YMP Radiological Control Manual* (DOE/NV, 2000) (i.e., 1,000 dpm/100 cm² for removable surface contamination) to evaluate if COPCs are present at levels that may pose an unacceptable risk to human health and/or the environment.

- Groundwater is not expected to have been impacted because of its significant depth and because the environmental conditions (i.e., arid climate, relatively low permeability soils) are not conducive to downward migration. Depth to groundwater at Area 25 is approximately 1,040 ft bgs, as measured in Well #J-11 (USGS, 1993). A perched water table occurs throughout most of Area 26 with static water levels ranging from 81 to 167 ft bgs. The regional water table is assumed to be at 1,700 ft bgs in Area 26 (Johnson and Ege, 1964).

Temporal constraints due to weather conditions are not expected in Areas 25 and 26. However, rainfall and snow events will place constraints on sampling and surveying of radiologically contaminated soils because of the attenuating effect of moisture on alpha/beta-emitting radionuclides.

There are no time constraints on collecting samples as environmental conditions at all sites will not significantly change in the near future, and conditions would have stabilized over the years since last used. Additional information regarding area topography, geology, climatology, and hydrogeology can be found in [Section 2.0](#) of this document. If, during investigation activities, elements are identified that are outside the scope of the CSMs as presented, the situation will be reviewed and a recommendation will be made as to how best to proceed. In such cases, NDEP will be notified and given the opportunity to comment on, or concur with, the recommendation.

3.1.1 CSM for Dry Well/Septic System

[Figure A.1-1](#) in [Appendix A](#) shows a generalized representation of the CSM constructed for current site conditions at the Dry Well/Septic System sites which include CAS 25-20-01 (Lab Drain Dry Well), CAS 25-51-02 (Dry Well), CAS 25-59-01 (Septic System), and CAS 26-59-01 (Septic System). The following text relates information and assumptions that were used in developing the CSM.

Contaminant Sources

The Lab Drain Dry Well (CAS 25-20-01) engineering drawings indicate source drains included three sinks associated with fume hoods and two floor drains inside Building 4215 in the Central Support Area. The sinks are located in the Chemical Analysis Room (207) and the Particulate Analysis Room (211). The floor drains are located in the Valve Test and Maintenance Shop Room (217) (Norman Engineering Co., 1967a). At Dry Well (CAS 25-51-02) sources include an acid and caustic floor drain inside and one outside Building 3320 at the ETS. At Septic System (CAS 25-59-01) the sources

include two toilets, two urinals, and two sinks in the ETSM Building at E-MAD. At Septic System (CAS 26-59-01) the sources include one restroom with a water closet, urinal, and a service sink inside Building 2205, all of which drained into the septic system.

Release Mechanisms

Release mechanisms at these four CASs include the system components. Both dry wells and the cesspool are single, point-source releases. The leachfield at CAS 26-59-01 (Septic System) has multiple distribution lines. Any contaminants at these CASs, regardless of physical or chemical characteristics, are expected directly beneath these structures.

Migration Pathways

Migration pathways at the CASs are expected to be limited to typical vertical migration due to gravity. Contamination, if present, is expected to be contiguous to the site. Concentrations are expected to decrease with distance and depth from the dry wells, cesspool, and leachfield.

Exposure Points

All the CASs in this CSM have a leachrock/native soil interface which is the most likely exposure point to find soil contamination. The leachfield at CAS 26-59-01 (Septic System) has multiple distribution lines. If present, soluble contaminants are expected in the distal areas of the leachfield; insoluble and large-particle contaminants are expected in the proximal areas. Additionally, if contaminants were discharged to these systems, contaminants are likely to be present in the septic tanks of CASs 25-59-01 and 26-59-01. Any residual material remaining in piping may also contain contaminants.

All designed releases are subsurface and there is no evidence of surface soil staining at any of the CASs; therefore, surface contamination is not expected.

3.1.2 CSM for Decontamination Pad

Figure A.1-2 shows a generalized CSM constructed for current site conditions at the Decontamination Pad sites which include CASs 25-07-06 (Train Decontamination Area), 25-07-07

(Vehicle Washdown), and 26-07-01 (Vehicle Washdown Station). The following text relates information and assumptions that were used in developing the CSM:

Contaminant Sources

At CAS 25-07-06, TDA source consists of decontamination operations onto a concrete decontamination pad with a 1-ft concrete berm. CAS 25-07-07, Vehicle Washdown, sources consist of decontamination operations on a concrete pad and a drain from utility trailers to the sump. CAS 26-07-01, Vehicle Washdown Station, source includes decontamination operations onto a concrete decontamination pad, also with a berm.

Release Mechanisms

Release mechanisms at these three CASs include decon material (solvents) and removed contents (e.g., sprays, drips); overspray to surrounding soil and drains located on pad if present.

Migration Pathways

Migration pathways at the CASs are expected to be limited to typical vertical migration due to gravity. Contamination is expected to be mostly confined to the decontamination pads and adjacent soil or, in the case of CAS 25-07-07, to the gravel sump. Any contamination should be contiguous to the site, and concentrations are expected to decrease with distance and depth from the source.

Exposure Points

Exposure points include the decontamination pads at CAS 25-07-06 and CAS 26-07-01 which were constructed with concrete berms to contain effluent. As a result of these designs, contamination is expected to be minimal but an exposure point does exist in surrounding soils. Contamination may be scattered on the pad or may be concentrated around the floor drains. Additionally at both CASs, residual material in pipes is also an exposure point. The pad at CAS 25-07-07 does not have a floor drain and appears to be flat (i.e., no grade). Thus, exposure points are expected to be scattered and no biasing factors exist to concentrate contamination at any given location on the pad; however, if present, insoluble, heavy, and/or large-particle COPCs are expected in soil between the pad and the gravel sump. Contamination, if present, in the gravel sump is expected at the gravel/native soil

interface at the proximal end, closest to the decontamination pad, and under and within the perforated pipe in the sump.

3.1.3 CSM for Reservoir

Figure A.1-3 shows a generalized CSM constructed for current site conditions at CAS 25-47-01, Reservoir and French Drain. The following text relates information and assumptions that were used in developing the CSM:

Contaminant Sources

The Reservoir and French Drain source may include a 70-ft long, L-shaped earthen drain from the CAU 271 (CAS 25-04-11) distribution box.

Release Mechanisms

Release mechanisms at this CAS include any contents that the earthen drain may have transported to the reservoir.

Migration Pathways

Migration pathways at the CASs are expected to be limited to typical vertical migration due to gravity. In general, contamination is expected to be contiguous to the historical boundaries of the reservoir and earthen drain. There is no evidence that the reservoir overflowed its banks so contamination outside the physical boundary along the surface edges of the site is considered unlikely. If present, surface contamination concentrations are expected to decrease outward from the edges of the reservoir. Concentrations of contamination are expected to decrease with depth from the reservoir base/native soil interface.

Exposure Points

Exposure points are most likely in soil at the base of the reservoir and earthen drain at the native soil interface. It is possible that an organic or sludge layer may be present at or near the base of the reservoir. The reservoir has been backfilled so contamination is unlikely, although possible in the soil adjacent to and above the reservoir base. Any insoluble, heavy, and/or large-particle COPCs can

be expected at the proximal end of the earthen drain. Any soluble COPCs can be expected anywhere within the reservoir.

3.2 Contaminants of Potential Concern

Types of contaminants that might be present were identified through a review of site history documentation, process knowledge, personal interviews, past investigation efforts, and inferred activities associated with the CAU. [Table 3-1](#) provides a list of COPCs.

Laboratory analysis of environmental media (e.g., soil and septage) will provide the means for a quantitative measurement of the COPCs. To assure that laboratory analyses are sufficient to detect contamination in soil/septage samples at concentrations exceeding the minimum reporting limit (MRL), Phase I chemical and radiological parameters of interest have been selected for each CAS. Solid media (e.g., concrete) will be evaluated for radiological parameters by radiological surveys during Phase I. For each CAS, the Phase I chemical parameters for soil/septage include:

- Total VOCs
- Total SVOCs
- PCBs
- TPH (DRO and GRO)
- Total RCRA metals
- Beryllium (CASs 26-07-01 and 25-07-07 only)
- pH (CAS 25-51-02 only)

Phase I radiological parameters for each CAS include:

- Isotopic uranium
- Isotopic plutonium
- Strontium-90
- Gamma-emitting radionuclides

If the CAS advances to Phase II, parameters will be limited to COCs identified by Phase I analytical results, and the appropriate NNSA/NV and NDEP representatives will be notified.

3.3 Preliminary Action Levels

Laboratory analytical results for septage and soils will be compared to the following PALs to evaluate if COCs are present:

Table 3-1
Phase I Contaminants of Potential Concern

CAS	Chemical COPCs	Radiological COPCs	Source of Information
25-20-01	None identified	None identified	Alderson, 2001
25-51-02	None identified	None identified	Alderson, 2001
25-59-01	None identified	None identified	Alderson, 2001
26-59-01	None identified	None identified	Alderson, 2001
25-07-06	Solvents, degreasers, alcohol, diluted acid, turco decontamination solvent, diesel fuel, PCBs, motor oil, and heavy metals	Co-60, Sr-90, Y-90, Nb-94, Cs-137, Ba-137m, Eu-152, Eu-154, Eu-155, U-234, U-235, U-238, Pu-238, Pu-239/240, and Am-241	Garey, 1997 and 1999 LASL, 1970 Penwell, 1999 Alderson, 2001
25-07-07	Detergents, Freon-10 Beryllium	Co-60, Sr-90, Y-90, Nb-94, Cs-137, Ba-137m, Eu-152, Eu-154, Eu-155, U-234, U-235, U-238, Pu-238, Pu-239/240, and Am-241	Garey, 2000 Alderson, 2001
26-07-01	Solvent and cleaning chemicals, Beryllium	Co-60, Sr-90, Y-90, Nb-94, Cs-137, Ba-137m, Eu-152, Eu-154, Eu-155, U-234, U-235, U-238, Pu-238, Pu-239/240, and Am-241	REECO, 1986a Alderson, 2001
25-47-01	Nearby septic system septic tank included barium, VOCs, SVOCs, TPH-DRO, and PCBs	Pu-238, Pu-239/240	Alderson, 2001

- *EPA Region 9 Risk-Based Preliminary Remediation Goals (PRGs)* for chemical constituents in industrial soils (EPA, 2000)
- Background concentrations for RCRA metals will be used instead of PRGs when natural background exceeds the PRG, as is often the case with arsenic. Background is considered the mean plus two times the standard deviation of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nellis Air Force Range (NBMG, 1998; Moore, 1999).
- The TPH action limit of 100 ppm per the *Nevada Administrative Code (NAC)* 445A.2272 (NAC, 2000e).
- The action limit of $\text{pH} \leq 2$ or ≥ 12.5 per the *Nevada Administrative Code (NAC)* 444.843 (NAC, 2000f).

- The PALs for radionuclides are isotope-specific and defined as the maximum concentration for that isotope found in samples from undisturbed background locations in the vicinity of the NTS (McArthur and Miller, 1989; Atlan-Tech, 1992; Black and Townsend, 1996). The PAL is equal to the minimum detectable activity (MDA) for isotopes not reported in soil samples from undisturbed background locations or if the PAL is less than the MDA ([Table 3-3](#)).

For chemical COPCs without established PRGs, a similar protocol to that used by EPA Region 9 will be used in establishing an action level, if necessary.

Solid media such as concrete and/or structures may only pose a potential radiological exposure risk to site workers. Surface radiological surveys of the solid media will be compared to the free-release criteria, as defined in the *NV/YMP Radiological Control Manual* (DOE/NV, 2000a) (i.e., 1,000 dpm/100 cm² for removable surface contamination) to evaluate if COCs are present.

The comparison of laboratory results to PALs will be discussed in the Corrective Action Decision Document (CADD). Laboratory results above action levels indicate the presence of COCs at levels that may require corrective action. The evaluation of potential corrective actions and the justification for a preferred action will be included in the CADD based on the results of this field investigation. Proposed cleanup levels will be presented in the CADD.

3.3.1 Field-Screening Levels

Field screening may be instituted in the field to assist in providing additional semiquantitative measurements. These field-screening results (FSRs), along with other biasing factors, may help guide the selection of the most appropriate sampling location for collection of laboratory samples. The following action levels may be used for on-site field screening:

- Headspace field screening for volatile organic compound headspace screening levels at 20 parts per million (ppm) or 2.5 times background, whichever is greater
- TPH field-screening results greater than 100 ppm measured using an appropriate field-screening method (e.g., Hanby or other test kit)
- Asbestos-containing materials are defined as exceeding 1 percent by volume (CFR, 2001a)
- The radiological (alpha and beta/gamma) field-screening level (FSL) for soil samples is the mean background activity plus two times the standard deviation of the mean background activity (Adams, 1998)

Field-screening concentrations exceeding FSLs for radionuclides indicate potential contamination at that sample location. This information will be documented and the investigation will be continued to delineate the extent of the contamination. Additionally, this data may also be used to select discretionary samples to be submitted to the laboratory.

3.4 DQO Process Discussion

The DQOs are qualitative and quantitative statements that define the type, quantity, and quality of data required to support evaluations of potential closure alternatives for CAU 165. The DQOs were developed to identify data needs and clearly define the intended use of the environmental data, and to design a data collection program that will satisfy these purposes.

Details of the DQO process are presented in [Appendix A](#). During the DQO discussions for this CAU, the informational inputs or data needs to resolve problem statements and decision statements were documented. Criteria for data collection and analysis were defined and the appropriate QA/QC required for particular data collection activities were assigned. The analytical methods and reporting limits prescribed through the DQO process, as well as the data quality indicators (DQI) for laboratory analysis such as precision and accuracy requirements, are provided in more detail in [Section 6.0](#) of this CAIP. Resulting laboratory data will be assessed to confirm or refute the conceptual model and determine if the DQOs were met based on the DQIs of precision, accuracy, representativeness, completeness, and comparability. Other DQIs may be used, such as sensitivity.

The DQO decision flow process applied to the CAU 165 investigation is depicted in [Figure A.1-4](#). This decision process starts with a Phase I investigation for all CASs. If laboratory data obtained from the Phase I investigation indicates the presence of COCs, the process will continue with a Phase II investigation. The process ends with no further investigation of the site based on the laboratory analytical results of the environmental samples and having all the data required for selection of a corrective action. Corrective action alternatives of closure-in-place and clean closure will be evaluated for each CAS with COCs.

Analytical methods and MRLs for each chemical parameter are provided in [Table 3-2](#). The MRL is a practical reporting limit that ensures data generated by the laboratory will be usable by the investigation.

Table 3-2
Analytical Requirements for CAU 165
(Page 1 of 3)

Parameter	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision	Percent Recovery (%R) ^b
ORGANICS						
Total Volatile Organic Compounds (VOCs)	Water	8260B ^c	Parameter-specific estimated quantitation limits ^d	Not Applicable (NA)	Lab-specific ^e	Lab-specific ^e
	Soil					
Toxicity Characteristic Leaching Procedure (TCLP) VOCs						
Benzene	Aqueous	1311/8260B ^c	0.050 mg/L ^d	0.5 mg/L ^f	Lab-specific ^e	Lab-specific ^e
Carbon Tetrachloride			0.050 mg/L ^d	0.5 mg/L ^f		
Chlorobenzene			0.050 mg/L ^d	100 mg/L ^f		
Chloroform			0.050 mg/L ^d	6 mg/L ^f		
1,2-Dichloroethane			0.050 mg/L ^d	0.5 mg/L ^f		
1,1-Dichloroethene			0.050 mg/L ^d	0.7 mg/L ^f		
Methyl Ethyl Ketone			0.050 mg/L ^d	200 mg/L ^f		
Tetrachloroethene			0.050 mg/L ^d	0.7 mg/L ^f		
Trichloroethene			0.050 mg/L ^d	0.5 mg/L ^f		
Vinyl Chloride			0.050 mg/L ^d	0.2 mg/L ^f		
Total Semivolatile Organic Compounds (SVOCs)	Water	8270C ^c	Parameter-specific estimated quantitation limits ^d	NA	Lab-specific ^e	Lab-specific ^e
	Soil					
TCLP SVOCs						
o-Cresol	Aqueous	1311/8270C ^c	0.10 mg/L ^d	200 mg/L ^f	Lab-specific ^e	Lab-specific ^e
m-Cresol			0.10 mg/L ^d	200 mg/L ^f		
p-Cresol			0.10 mg/L ^d	200 mg/L ^f		
Cresol (total)			0.30 mg/L ^d	200 mg/L ^f		
1,4-Dichlorobenzene			0.10 mg/L ^d	7.5 mg/L ^f		
2,4-Dinitrotoluene			0.10 mg/L ^d	0.13 mg/L ^f		
Hexachlorobenzene			0.10 mg/L ^d	0.13 mg/L ^f		
Hexachlorobutadiene			0.10 mg/L ^d	0.5 mg/L ^f		
Hexachloroethane			0.10 mg/L ^d	3 mg/L ^f		
Nitrobenzene			0.10 mg/L ^d	2 mg/L ^f		
Pentachlorophenol			0.50 mg/L ^d	100 mg/L ^f		
Pyridine			0.10 mg/L ^d	5 mg/L ^f		
2,4,5-Trichlorophenol			0.10 mg/L ^d	400 mg/L ^f		
2,4,6-Trichlorophenol			0.10 mg/L ^d	2 mg/L ^f		

Table 3-2
Analytical Requirements for CAU 165
(Page 2 of 3)

Parameter	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision	Percent Recovery (%R) ^b
ORGANICS (continued)						
Polychlorinated Biphenyls (PCBs)	Water	8082 ^c	Parameter-specific (CRQL) ^g	NA	Lab-specific ^e	Lab-specific ^e
	Soil					
Total Petroleum Hydrocarbons (TPH)	Water Gasoline	8015B modified ^c	0.1 mg/L ^h	NA	Lab-specific ^e	Lab-specific ^e
	Soil Gasoline		0.5 mg/kg ^h			
	Water Diesel		0.5 mg/L ^h			
	Soil Diesel		25 mg/kg ^h			
INORGANICS						
Total Resource Conservation and Recovery Act (RCRA) Metals						
Arsenic	Water	6010B ^c	10 µg/L ^{h,i}	NA	20 ^{i,j}	Matrix Spike Recovery 75-125 ⁱ Laboratory Control Sample Recovery 80 - 100 ⁱ
	Soil	6010B ^c	1 mg/kg ^{h,i}		35 ^{i,j}	
Barium	Water	6010B ^c	200 µg/L ^{h,i}		20 ^{i,j}	
	Soil	6010B ^c	20 mg/kg ^{h,i}		35 ^{i,j}	
Beryllium	Water	6010B ^c	5 µg/L ^{h,i}		20 ^{i,j}	
	Soil	6010B ^c	0.5 mg/kg ^{h,i}		35 ^{i,j}	
Cadmium	Water	6010B ^c	5 µg/L ^{h,i}		20 ^{i,j}	
	Soil	6010B ^c	0.5 mg/kg ^{h,i}		35 ^{i,j}	
Chromium	Water	6010B ^c	10 µg/L ^{h,i}		20 ^{i,j}	
	Soil	6010B ^c	1 mg/kg ^{h,i}		35 ^{i,j}	
Lead	Water	6010B ^c	3 µg/L ^{h,i}		20 ^{i,j}	
	Soil	6010B ^c	0.3 mg/kg ^{h,i}		35 ^{i,j}	
Mercury	Water	7470A ^c	0.2 µg/L ^{h,i}		20 ^{i,j}	
	Soil	7471A ^c	0.1 mg/kg ^{h,i}		35 ^{i,j}	
Selenium	Water	6010B ^c	5 µg/L ^{h,i}		20 ^{i,j}	
	Soil	6010B ^c	0.5 mg/kg ^{h,i}		35 ^{i,j}	
Silver	Water	6010B ^c	10 µg/L ^{h,i}		20 ^{i,j}	
	Soil	6010B ^c	1 mg/kg ^{h,i}		35 ^{i,j}	
pH/corrosivity	Water	9040B	NA	pH>2 ^f	Lab-specific	Lab-specific
	Soil	9045C	NA	pH<12.5 ^f		
TCLP RCRA Metals						
Arsenic	Aqueous	1311/6010B ^c 1311/7470A ^c	0.10 mg/L ^{h,i}	5 mg/L ^f	20 ⁱ	Matrix Spike Recovery 75-125 ⁱ Laboratory Control Sample Recovery 80 - 100 ⁱ
Barium			2 mg/L ^{h,i}	100 mg/L ^f		
Cadmium			0.05 mg/L ^{h,i}	1 mg/L ^f		
Chromium			0.10 mg/L ^{h,i}	5 mg/L ^f		
Lead			0.03 mg/L ^{h,i}	5 mg/L ^f		
Mercury			0.002 mg/L ^{h,i}	0.2 mg/L ^f		
Selenium			0.05 mg/L ^{h,i}	1 mg/L ^f		
Silver			0.10 mg/L ^{h,i}	5 mg/L ^f		

Table 3-2
Analytical Requirements for CAU 165
(Page 3 of 3)

Parameter	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision	Percent Recovery (%R) ^b
RADIOCHEMISTRY						
Gamma-Emitting Radionuclides	Water	EPA 901.1 ^l	The Minimum Reporting Limits and Minimum Detectable Activities for Radionuclides are given in Table 3-3	NA	Relative Percent Difference (RPD) ^a 20% (Water) 35% (Soil) ⁱ	Laboratory Control Sample Recovery 80-120 ^e
	Soil	HASL-300 ^j		NA		Chemical Yield 30-105 ⁿ
Isotopic Uranium	Water	HASL-300 ^j ASTM D3972-97 ^m		NA	Normalized Difference (ND) -2<ND<2 ^k	Laboratory Control Sample Recovery 80-120 ^e
	Soil	HASL-300 ^j ASTM C1000-90 ^m		NA		
Isotopic Plutonium	Water	HASL-300 ^j ASTM D3865-97 ^m		NA		
	Soil	HASL-300 ^j		NA		
Strontium - 90	Water	ASTM D5811-95 ^m		NA		
	Soil	HASL-300 ^j		NA		

^a Relative percent difference (RPD) is used to calculate precision.

Precision is estimated from the relative percent difference of the concentrations measured for the matrix spike and matrix spike duplicate or of laboratory, or field duplicates of unspiked samples. It is calculated by: $RPD = 100 \times \{(|C_1 - C_2|) / [(C_1 + C_2) / 2]\}$, where C_1 = Concentration of the parameter in the first sample aliquot, C_2 = Concentration of the parameter in the second sample aliquot.

^b %R is used to calculate accuracy.

Accuracy is assessed from the recovery of parameters 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 parameter is calculated by: $\%R = 100 \times (C_s - C_u / C_n)$, where C_s = Concentration of the parameter in the spiked sample, C_u = Concentration of the parameter in the unspiked sample, C_n = Concentration increase that should result from spiking the sample

^c U.S. Environmental Protection Agency (EPA) *Test Methods for Evaluating Solid Waste*, 3rd Edition, Parts 1-4, SW-846 CD ROM, Washington, DC (EPA, 1996)

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

^e 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 to 20 samples of each matrix and calculating the mean %R for each parameter. The standard deviation (SD) of each %R is then calculated, and the warning and control limits for each parameter are established at ± 2 SD and ± 3 SD from the mean, respectively. If the warning limit is exceeded during the analysis of any sample delivery group (SDG), the laboratory institutes corrective action to bring the analytical system back into control. If the control limit is exceeded, the sample results for that SDG are considered unacceptable. These limits are reviewed after every quarter and are updated when necessary. 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.

^f Title 40 *Code of Federal Regulations* Part 261, "Identification and Listing of Hazardous Waste" (CFR, 2001a)

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

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

ⁱ EPA *Contract Laboratory Program Statement of Work for Inorganic Analysis* (EPA, 1988a; 1994b; and 1995)

^j *Prescribed Procedures for Measurements of Radioactivity in Drinking Water*, EPA-600/4-80-032 (EPA, 1980)

^k Normalized Difference is not RPD, it is another measure of precision used to evaluate duplicate analyses. The normalized difference is calculated as the difference between two results divided by the square root of the sum of the squares of their total propagated uncertainties. *Evaluation of Radiochemical Data Usability* (Paar and Porterfield, 1997)

^l *Manual of Environmental Measurements Laboratory Procedures*, HASL-300 (DOE, 1997)

^m American Society for Testing and Materials

ⁿ *General Radiochemistry and Routine Analytical Services Protocol (GRASP)* (EG&G Rocky Flats, 1991)

Definitions:

pCi/L = Picocuries per liter

mg/L = Milligrams per liter

pCi/g = Picocuries per gram

µg/kg = Micrograms per kilogram

mg/kg = Milligrams per kilogram

µg/L = Micrograms per liter

CRQL = Contract-required quantitation limits

Radiation minimum reporting limits were developed considering both the MDAs and the PALs (Adams and Dionne, 2000). The MDAs, PALs, and MRLs for radionuclides are provided in [Table 3-3](#). The MDA is the smallest amount of activity of a particular parameter that can be detected in a sample with an acceptable level of error. The MDAs listed in [Table 3-3](#) are typical default levels available for a commercial radioanalytical laboratory.

Table 3-3
Minimum Detectable Activities, Preliminary Action Levels,
and Minimum Reporting Limits for Radionuclides
in Samples Collected at CAU 165

Isotope	Soil and Sludge			Liquid		
	MDA ^a (pCi/g) ^d	PAL ^b (pCi/g) ^d	MRL ^c (pCi/g) ^d	MDA ^a (pCi/L) ^e	PAL ^b (pCi/L) ^e	MRL ^c (pCi/L) ^e
Cobalt-60	0.66 ^f	0.1	0.66	10	10	10
Strontium-90	0.41 ^f	1.17	0.41	1	0.37	1
Yttrium-90	0.41 ^f	1.17	0.41	1	0.37	1
Niobium-94	0.63 ^f	0.63	0.63	10	10	10
Cesium-137	0.43 ^f	7	2.14	10	10	10
Barium-137m	0.43 ^f	7	2.14	10	10	10
Europium-152	8.0	8.0	8.0	75	75	75
Europium-154	2.17 ^f	2.17	2.17	65	65	65
Europium-155	0.5	1.35	0.5	20	20	20
Uranium-234	0.08 ^f	3.47	0.38	0.07 ^f	8.92	0.37
Uranium-235	0.07 ^f	0.07	0.07	0.2 ^f	0.36	0.2
Uranium-238	0.07 ^f	0.32	0.07	0.2 ^f	9.39	1.0
Plutonium-238	0.05	0.05	0.05	0.1	0.16	0.1
Plutonium-239/240	0.05 ^f	0.106	0.05	0.1	9.0	0.1
Americium-241	0.7 ^f	0.05	0.7	50	<0.05	50

^a MDA is the minimum detectable activity; values are the default levels listed in Paragon Analytics, Inc.'s *Laboratory Quality Manual*, Revision 4, February 2000 (unless annotated otherwise) (Paragon, 2000).

^b PAL is the preliminary action level and is defined as the maximum concentration listed in the literature for a sample taken from an undisturbed background location (McArthur and Miller, 1989; Atlan-Tech, 1992; and DOE/NV, 1999). The PAL is equal to the MDA for isotopes not reported in soil samples from undisturbed background locations or if the PAL is less than the MDA.

^c MRL is the minimum reporting level. It is set equal to 5 times the MDA, or if 5 times the MDA is greater than the PAL, the MRL is set equal to the MDA.

^d pCi/g is picocuries per gram.

^e pCi/L is picocuries per liter.

^f MDA for this nuclide is based on the 95 percent Upper Confidence Level for the MDAs reported for soil samples collected by ITLV in Area 25 during site investigations in 1999 and 2000.

4.0 Field Investigation

This section of the CAIP contains the approach for investigating CAU 165.

4.1 Technical Approach

The technical approach for CAU 165 consists of the following activities:

- Remove and/or dispose of surface materials at CAS 25-07-06 and CAS 25-07-07.
- Perform surface radiological surveys (CAS 25-07-06, CAS 25-07-07, and CAS 26-59-01).
- Collect Phase I samples from biased locations and analyze samples as described in [Section 3.4](#).
- Collect required QC samples.
- Inspect and sample collection system pipes, as applicable.
- Collect Phase II samples to define extent of contamination, if necessary.
- Collect additional samples, as necessary, to estimate potential corrective action waste streams.
- Collect samples from native soils and analyze for geotechnical/hydrologic parameters, if necessary.
- Collect and analyze bioassessment samples at the discretion of the Site Supervisor (e.g., if VOCs exceed field-screening levels in a pattern that suggests that a VOC plume may be present).
- Stake or flag sample locations and record coordinates (in North American Datum 1927 coordinate system).

4.2 Field Activities

This section provides a description of the field activities for CAU 165. A phased approach has been chosen to address the data collection activities. Biased sampling will be conducted during Phase I and Phase II. Process knowledge indicates that contamination, if any, is confined to the spatial boundaries of the sites as defined in the DQO process and CSMs. If Phase I investigation determines that COCs are present at a CAS, that CAS will be addressed further by a Phase II investigation before

evaluating corrective action alternatives. Only COCs will be considered during Phase II. It is important to note that the target population(s) to be investigated in Phase I may be different than those in Phase II.

Modifications to the investigative strategy may be required should unexpected field conditions be encountered. Significant modifications will be justified in a Record of Technical Change (ROTC). NDEP concurrence with ROTC modifications is required prior to proceeding with investigation activities significantly different from those described in this document. If contamination is more extensive than anticipated, the maximum investigation depth will be limited by the capabilities of the equipment used to collect subsurface soil samples. If this occurs, the investigation will be rescoped.

Samples will be collected at biased sampling locations by hand augering, backhoe excavation, direct push, or drilling techniques, as appropriate. [Section 3.4](#) of the CAIP provides the analytical methods and laboratory requirements (i.e., detection limits, precision, and accuracy requirements) to be used when analyzing the COPCs. All sampling activities and quality control requirements for field and laboratory environmental sampling will be conducted in compliance with the Industrial Sites QAPP (DOE/NV, 1996b) and other applicable, approved procedures. Other governing documents include a current version of the ITLV HASP (IT, 2001) and an approved SSHASP prepared prior to the field effort.

As required by the DOE Integrated Safety Management System (ISMS) (DOE, 1997), these documents outline the requirements for protecting the health and safety of the workers and the public, and the procedures for protecting the environment. The ISMS program requires that site personnel will take every reasonable step to reduce or eliminate the possibility of injury, illness, or accidents, and to protect the environment during all project activities. The following safety issues will be taken into consideration when evaluating the hazards and associated control procedures for field activities discussed in the SSHASP:

- Potential hazards to site personnel and the public include, but are not limited to: radionuclides, chemicals (e.g., heavy metals, VOCs, SVOCs, and petroleum hydrocarbons), adverse and rapidly changing weather, remote location, and motor vehicle and heavy equipment operations.
- Proper training of all site personnel to recognize and mitigate the anticipated hazards.

- Work controls to reduce or eliminate the hazards including engineering controls, substitution of less hazardous materials, and personal protective equipment (PPE).
- Occupational exposure monitoring to prevent overexposures to hazards such as radionuclides, chemicals, and physical agents (e.g., heat, cold, and high wind).
- Radiological surveying for alpha/beta and gamma emitters to minimize and/or control personnel exposures. Use of the “as-low-as-reasonably-achievable” (ALARA) principle when dealing with radiological hazards.
- Emergency and contingency planning and communications to include medical care and evacuation, decontamination, and spill control measures, and appropriate notification of project management.

4.2.1 Site Preparation Activities

Site preparation activities will include removal of surface debris for proper disposal by the NTS M&O contractor prior to the investigation. The MCC at CAS 25-07-06, currently parked on the pad, is not considered part of this CAS and will be removed by the NTS M&O contractor prior to the investigation. [Section A.1.7](#) provides additional CAS-specific site preparation activities.

4.2.2 Phase I Activities

The objective of the Phase I investigation strategy is to determine if COCs are present. A comparison of laboratory analytical results from this phase against PALs will be used to confirm the presence or absence of COCs.

The Phase I sampling strategy targets locations and media most likely to be contaminated.

[Table A.1-3](#) in [Appendix A](#) lists the target populations for Phase I. [Section A.1.3.1](#) and [Table A.1-2](#) identifies the primary biasing factors and information needs in selecting sample locations for the Phase I investigation. See [Section 4.2.3.1](#) for proposed Phase II activities.

4.2.2.1 CAS 25-20-01, Lab Drain Dry Well

Phase I activities at this CAS will consist of collecting biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities are minimal at this CAS and there is no surface debris.

A soil sample will be collected from the Dry Well at the leachrock/native soil interface and at 2.5 ft below the interface. The contents of the collection system pipe will be sampled if appropriate, accessible, and adequate media is present. Sample locations may include any engineered access points (e.g., manholes) or excavations at the nominal midpoint of the pipe. Excavation is the preferred method of soil sample collection but drilling, direct push, or hand augering may also be used, as appropriate. [Figure 4-1](#) depicts Phase I sample locations.

4.2.2.2 CAS 25-51-02, Dry Well

Phase I activities at this CAS will consist of confirming the configuration of the Dry Well and associated piping and collecting biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities are minimal at this CAS and there is no surface debris.

A backhoe excavation will be made near the presumed location of the Dry Well based on coordinates from the geophysical survey and field observations. The excavation will attempt to locate the distal end of the collection system pipe and to confirm the presence of the Dry Well. If this excavation does not locate the end of the line, additional excavations will be made to locate the Dry Well. Once the Dry Well is located, soil samples will be collected at the leachrock/native soil interface and at 2.5 ft below the interface.

Excavation is the preferred method of soil sample collection but drilling, direct push, or hand augering may also be used, as appropriate.

The contents of the collection system pipes will be sampled if appropriate, accessible, and adequate media is present. Sample locations may include any engineered access points (e.g., manholes), or excavations at a nominal midpoint of the pipe.

A backhoe excavation will be made between the charcoal adsorber furnace pad and the main waste line to confirm the presence or absence of a waste line at that location, if necessary. [Figure 4-2](#) depicts Phase I sample locations.

Figure 4-1
Sampling Locations at CAS 25-20-01, Lab Drain Dry Well

Figure 4-2
Sampling Locations at CAS 25-51-02, Dry Well

4.2.2.3 CAS 25-59-01, Septic System

Phase I activities at this CAS will consist of collecting biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities are minimal at this CAS and there is no surface debris.

The septic tank manhole cover will be removed. Both chambers of the septic tank will be inspected for any contents. The contents will be sampled if appropriate, accessible, and adequate media is present. Soil samples will be collected beneath the septic tank inlet and outlet pipes at the base of the septic tanks as determined by engineering drawings. The contents of the collection system pipe will be sampled if appropriate, accessible, and adequate media is present. Sample locations may include any engineered access points (e.g., manholes) or excavations at a nominal midpoint of the pipe.

A soil sample will be collected from the cesspool at the interface of the leachrock/native soil interface and at 2.5 ft below the interface. Hand augering is the preferred soil sample collection method but drilling or direct push may be used, as appropriate. [Figure 4-3](#) depicts the Phase I sample locations.

4.2.2.4 CAS 26-59-01, Septic System

Phase I activities at this CAS will consist of locating the leachfield distribution pipes by excavation and collecting biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities are minimal at this CAS and there is limited surface debris (i.e., wood). Surface debris will be removed for proper disposal by the NTS M&O contractor prior to the investigation.

The septic tank manhole cover will be removed and the septic tank will be inspected for contents. The contents will be sampled if appropriate, accessible, and adequate media is present. Soil samples will be collected beneath the septic tank inlet and outlet pipes at the base of the septic tanks as determined by engineering drawings. The contents of the collection system pipe will be sampled if appropriate, accessible, and adequate media is present. Sample locations may include any engineered access points (e.g., manholes) or excavations at a nominal midpoint of the pipe.

Excavations and visual inspections will be made in the leachfield to locate the distribution pipes.

Figure 4-3
Sampling Locations at CAS 25-59-01, Septic System

Soil samples will be collected beneath the proximal end of the first identified designed release point (closest to the septic tank) and the distal end of the last identified distribution pipe (furthest from the septic tank). Samples will be collected at the leachrock/native soil interface and 2.5 ft below the interface at these locations. If a leachrock/native soil interface is not identified, samples will be collected directly beneath the distribution pipes and at 2.5 ft beneath the pipes. Excavation is the preferred soil sample collection method but direct push, drilling, or hand augering may be used, as appropriate. [Figure 4-4](#) depicts the Phase I sample locations.

4.2.2.5 CAS 25-07-06, Train Decontamination Area

The Phase I investigation at this CAS will consist of conducting a surface radiological survey and collecting data and/or biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities will include surface debris removal for proper disposal by the NTS M&O contractor prior to the investigation. The MCC, currently parked on the pad, is not considered part of this CAS and will be removed by the NTS M&O contractor prior to the investigation.

The design of this site focuses on decontamination of radiological-impacted media such as railroad cars using chemical cleaners; therefore, chemical COPCs are assumed to be incidental and collocated with radiation. As such, radiological surveys that detect radiological contamination are appropriate tools to locate any contaminants that may be present.

A radiological surface survey of the decontamination pad and adjacent surface soil (out to 15 ft laterally) will be conducted to identify radiological hotspots. A hotspot on the decontamination pad will be defined as any reading exceeding 1,000 dpm/100 cm² over background. If hotspots are identified on the pad, samples may be collected at those locations for waste determination purposes. The Site Supervisor has the discretion of selecting sample locations that best represent potential contamination.

If residual material is observed in pipes, it will be sampled if appropriate, accessible, and adequate media is present.

Figure 4-4
Sampling Locations at CAS 26-59-01, Septic System

Based on a recent surface radiological survey, a minimum of four surface soil samples will be collected around the decontamination pad at identified hotspots. The Site Supervisor has the discretion of modifying or replacing these locations based on results of the planned radiological walkover survey or other biasing factors. The scoop and trowel method will be used to collect soil samples. [Figure 4-5](#) depicts the Phase I sample locations.

4.2.2.6 CAS 25-07-07, Vehicle Washdown

The Phase I investigation at this CAS will consist of conducting a surface radiological survey, and collecting data and/or biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities are minimal at this CAS and there is limited surface debris. Surface debris will be removed for proper disposal by the NTS M&O contractor prior to the investigation.

A recent radiological walkover survey identified potential radiological activity above background in the borrow pit adjacent to the northeast corner of the site. However, the borrow pit is geographically distinct from the site, is not considered part of this CAS, and will not be investigated.

A radiological survey of the decontamination pad and adjacent surface soil (out to 15 ft laterally) will be conducted to identify radiological hotspots. A hotspot on the decontamination pad will be defined as any reading exceeding 1,000 dpm/100 cm² over background. If hotspots are identified on the pad, samples may be collected at those locations for waste determination purposes. The Site Supervisor has the discretion of selecting sample locations that best represent potential contamination.

A minimum of three surface soil samples will be collected adjacent to the edge of the decontamination pad (one sample from the east, west, and south sides). The Site Supervisor has the discretion of modifying or replacing these locations based on results of the planned radiological survey or other biasing factors.

Two surface soil samples will be collected from the north side of the decontamination pad between the pad and the sump at locations selected by the Site Supervisor.

An excavation will be made at the proximal side of the sump nearest the decontamination pad to locate the sewage distribution pipe and identify the base of the leachrock. A minimum of one sample

Figure 4-5
Sampling Locations at CAS 25-07-06, Train Decontamination Area

location will be selected in the vicinity of the pipe, and two discrete samples will be collected: one sample at the leachrock/native soil interface and one sample at 2.5 ft below the interface. If residual material is observed in the pipe, it will be sampled if appropriate, accessible, and adequate media is present.

Scoop and trowel and excavation are the preferred soil sample collection methods, but other methods may be used, as appropriate. [Figure 4-6](#) depicts the Phase I sample locations.

4.2.2.7 CAS 26-07-01, Vehicle Washdown Station

The Phase I investigation at this CAS will consist of conducting a surface radiological survey, and collecting biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities are minimal at this CAS and there is limited surface debris. Surface debris will be removed for proper disposal by the NTS M&O contractor prior to the investigation.

The awning over the east side of the decontamination pad will not be removed prior to or during the investigation. There may be limited access to this site; therefore, all investigative activities may be conducted by hand.

A radiological survey of the decontamination pad, interior walls of the transite awning, and adjacent surface soil (out to 15 ft laterally) will be conducted to identify radiological hotspots. A hotspot on the decontamination pad and awning will be defined as any reading exceeding 1,000 dpm/100 cm² over background. If hotspots are identified on the pad or awning, samples may be collected at those locations for waste determination purposes. The Site Supervisor has the discretion of selecting sample locations that best represent potential contamination.

A minimum of four surface soil samples will be collected around the decontamination pad, one sample per side adjacent to the edge of the pad. The Site Supervisor has the discretion of modifying or replacing these locations based on results of the planned radiological walkover survey. The scoop and trowel method will be used to collect soil samples. [Figure 4-7](#) depicts the Phase I sample locations.

Figure 4-6
Sampling Locations at CAS 25-07-07, Vehicle Washdown

Figure 4-7
Sampling Locations at CAS 26-07-01, Vehicle Washdown Station

4.2.2.8 CAS 25-47-01, Reservoir and French Drain

Phase I activities at this CAS will consist of collecting biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities are minimal at this CAS and there is no surface debris.

Excavation and visual inspection will be used in an attempt to identify the reservoir base/native soil interface at two locations, proximal and distal. If the reservoir base/native soil interface is identified, a sample will be collected directly below the interface and 2.5 ft below the interface. While excavating to the interface, samples will be collected at 2.5-ft intervals starting at 5 ft bgs. Maximum sampling depth will be limited to the capability of the excavator. The base of the reservoir is not expected to exceed 10 ft bgs.

Soil in the earthen drain will be sampled at the proximal end in the same manner. Sampling will begin at a depth equivalent to the bottom of the neighboring CAS (25-04-11) distribution box. The locations will be sited based on field observations and process knowledge.

Excavation is the preferred sample collection method, but other appropriate methods (e.g., drilling) may be used. [Figure 4-8](#) depicts the Phase I sample locations.

4.2.3 Phase II Activities

Phase II investigation efforts will consist of further characterizing sites where COCs have been confirmed to be present by Phase I activities. Data obtained from Phase II will be used to determine the extent of contamination. Only the COCs confirmed to be present by Phase I activities will be analyzed for during Phase II. This parameter selection process will be applied independently to each CAS and to each media investigated in a CAS as discussed in [Section A.2.4.4](#), Scale of Decision Making.

For all CASs in Phase II, the lateral and vertical extent of contamination will be bounded by a minimum of one laboratory analytical soil sample showing COC concentrations below PALs.

The spatial boundaries that apply to each CAS for Phase II are defined in [Table A.2-3](#). If the nature and/or extent of contamination is inconsistent with the CSMs or if contamination extends beyond the

Figure 4-8
Sampling Locations at CAS 25-47-01, Reservoir and French Drain

spatial boundaries identified in [Table A.2-3](#), work will be temporarily suspended, NDEP will be notified, and the investigation strategy will be reevaluated. As long as contamination is consistent with the CSM and is within the spatial boundaries, sampling will continue to define extent.

The potential Phase II investigation target populations for each CAS are shown in [Table A.2-2](#) in [Appendix A](#). Phase II target populations will be limited to those related to distinct Phase I target populations with COCs.

4.2.3.1 CAS 25-20-01, Lab Drain Dry Well

Phase II activities at this CAS will consist of collecting biased samples for laboratory analysis of the target population noted in [Table A.2-2](#).

If COCs are identified in the Dry Well, step-out sample locations will be established in a triangular pattern around the Dry Well. Each step out will be located approximately 15 ft from the Dry Well. If biasing factors indicate COCs to extend beyond the proposed Phase II sample locations, further step outs may be necessary. At each step-out location, samples will be collected at the depth(s) where COCs were encountered in Phase I samples from the Dry Well, and at 5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest concentration as indicated by biasing factors. If necessary, additional samples will be collected at the Dry Well to define the extent of COCs at that location.

Drilling is the preferred method of soil sample collection but excavation, direct push, or hand augering may also be used, as appropriate. [Figure 4-1](#) depicts proposed Phase II sample locations.

4.2.3.2 CAS 25-51-02, Dry Well

Phase II activities at this CAS will consist of confirming the presence and configuration of ancillary piping and collecting biased samples for laboratory analysis of the target populations noted in [Table A.2-2](#).

Step-out sample locations will be established in a triangular pattern around the Dry Well. Each step out will be located approximately 15 ft from the Dry Well. If biasing factors indicate COCs to extend

beyond the proposed Phase II sample locations, further stepouts may be necessary. At each stepout location, samples will be collected at the depth(s) where COCs were encountered in Phase I samples from the Dry Well, and at 5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest concentration as indicated by biasing factors. If necessary, additional samples will be collected at the Dry Well to define the extent of COCs at that location.

Drilling is the preferred method of soil sample collection but excavation, direct push, or hand augering may also be used, as appropriate. [Figure 4-2](#) depicts proposed Phase II sample locations.

4.2.3.3 CAS 25-59-01, Septic System

Phase II activities at this CAS will consist of collecting biased samples for laboratory analysis of the target populations noted in [Table A.2-2](#).

Step-out sample locations will be established in a triangular pattern around the cesspool and/or septic tank. Each step out will be located approximately 15 ft from the Phase I location. If biasing factors indicate COCs to extend beyond the proposed Phase II sample locations, further step outs may be necessary. At each stepout location, samples will be collected at the depth(s) where COCs were encountered in Phase I samples, and at 5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest concentration as indicated by biasing factors. If necessary, additional samples will be collected to define the extent of COCs at Phase I locations.

Drilling is the preferred method of soil sample collection but excavation, direct push, or hand augering may also be used, as appropriate. [Figure 4-3](#) depicts the proposed Phase II sample locations.

4.2.3.4 CAS 26-59-01, Septic System

Phase II activities at this CAS will consist of collecting biased samples for laboratory analysis of the target populations noted in [Table A.2-2](#).

If COCs are identified in any of the Phase I samples, step-out sample locations will be established. A triangular pattern will be used at the septic tank. Each step out will be located approximately 15 ft from the Phase I location. An existing Phase I sample location may be used as a step out if no COCs were identified. At the leachfield, a minimum of four sampling locations will be established approximately 15 ft outward from the corners of the leachfield. If biasing factors indicate COCs to extend beyond the proposed Phase II sample locations, further step outs may be necessary. At each Phase II location, soil samples will be collected at the depth(s) where COCs were encountered in Phase I samples, and at 5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest concentration as indicated by biasing factors. Additional samples will be collected to define extent of COCs, if necessary. If contamination is not identified in any of the Phase I samples collected beneath the distribution pipes, the leachfield will be considered uncontaminated and no further samples will be collected.

Drilling is the preferred method of soil sample collection but excavation, direct push, or hand augering may also be used, as appropriate. [Figure 4-4](#) depicts the proposed Phase II sample locations.

4.2.3.5 CAS 25-07-06, Train Decontamination Area

The Phase II investigation at this CAS will consist of collecting biased samples for laboratory analysis of the target population noted in [Table A.2-2](#).

Stepouts will be located approximately 15 ft outward (i.e., away from the pad) from Phase I sampling locations where COCs were identified in soil. If biasing factors indicate COCs to extend beyond the proposed Phase II sample locations, further step outs may be necessary. At each stepout location, samples will be collected at the depth(s) where COCs were encountered in Phase I samples, and at 2.5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest concentration as indicated by biasing factors. Additional samples will be collected to define the extent of COCs, if necessary.

Hand augering is the preferred method of soil sample collection but drilling, direct push, or excavation may also be used, as appropriate. [Figure 4-5](#) depicts the proposed Phase II sample locations.

4.2.3.6 CAS 25-07-07, Vehicle Washdown

The Phase II investigation at this CAS will consist of collecting biased samples for laboratory analysis of the target population noted in [Table A.2-2](#).

Soil surrounding the decontamination pad and sump will be sampled based on Phase I results. Step outs will be located approximately 15 ft outward (i.e., away from the pad or sump) from Phase I sampling locations where COCs were identified. If biasing factors indicate COCs to extend beyond the proposed Phase II sample locations, further step outs may be necessary. At each step-out location, samples will be collected at the depth(s) where COCs were encountered in Phase I samples, and at 2.5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest concentration as indicated by biasing factors. Additional samples will be collected to define the extent of COCs, if necessary.

Drilling and excavation are appropriate methods for soil sample collection but direct push or other methods may also be used. [Figure 4-6](#) depicts the proposed Phase II sample locations.

4.2.3.7 CAS 26-07-01, Vehicle Washdown Station

The Phase II investigation at this CAS will consist of collecting biased samples for laboratory analysis of the target population noted in [Table A.2-2](#).

Soil surrounding the decontamination pad will be sampled based on Phase I results. Step outs will be located approximately 15 ft outward (i.e. away from the pad) from Phase I sampling locations where COCs were identified. If biasing factors indicate COCs extend beyond the proposed Phase II sample locations, further step outs may be necessary. At each step-out location, samples will be collected at the depth(s) where COCs were encountered in Phase I samples, and at 2.5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest

concentration as indicated by biasing factors. Additional samples will be collected to define the extent of COCs, if necessary.

Hand augering is the preferred method of soil sample collection but drilling, direct push, or excavation may also be used, as appropriate. [Figure 4-7](#) depicts the proposed Phase II sample locations.

4.2.3.8 CAS 25-47-01, Reservoir and French Drain

Phase II activities at this CAS will consist of collecting biased samples for laboratory analysis of the target populations noted in [Table A.2-2](#).

Soil within the reservoir and earthen drain will be sampled to determine the vertical extent of COCs based on Phase I results. At each location, samples will be collected at the depth(s) where COCs were encountered in Phase I samples, and at 2.5 ft below the lowest depth where COCs were encountered.

Soil outside the reservoir and earthen drain will be sampled to determine the lateral extent of COCs. Step outs include one on each side of the reservoir and earthen drain and within 15 ft from the reservoir and earthen drain edges. If biasing factors indicate COCs to extend beyond the proposed Phase II sample locations, further step outs may be necessary. Samples will be collected at 2.5-ft intervals from the depth commensurate with the depth of COCs identified in Phase I plus 5 ft. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination and the sample with the highest concentration as indicated by biasing factors.

Drilling is the preferred sample collection method but other methods may be used as appropriate. [Figure 4-8](#) depicts the proposed Phase II sample locations.

4.2.4 Geotechnical/Hydrological Analysis and Bioassessment Tests

In some cases, it may be necessary to measure the geotechnical/hydrological and bioassessment parameters of a site. These samples will be collected within brass sleeves (or other containers, as appropriate) to maintain the natural physical characteristics of the soil. [Table 4-1](#) lists general

Table 4-1
General Geotechnical and Hydrological Analysis

Geotechnical Parameter	Methods
Initial moisture content	ASTM ^a D 2216-92
Dry bulk density	ASTM ^a D 2937-94
Calculated porosity	EM ^b -1110-2-1906 or MOSA ^c Chp. 18
Saturated hydraulic conductivity	ASTM ^a 2434-68(74) MOSA ^c Chp. 28
Unsaturated hydraulic conductivity	van Genuchten ^d
Particle-size distribution	ASTM ^a D 422-63(90)
Water-release (moisture retention) curve	MOSA ^c Chp. 26 ASTM ^a D 2325-68(94) MOSA ^c Chp. 24 Karanthanas and Hajek ^e

^aASTM, 1996

^bUSACE, 1970

^cMOSA (Soil Science Society of America, 1986)

^dvan Genuchten, 1980

^eKaranthanas and Hajek, 1982

geotechnical and hydrological parameters of interest. The testing methods shown are minimum standards and other equivalent or superior testing methods may be used. In some cases, bioassessment will also be performed on the sample material. Bioassessment is a series of tests designed to evaluate the physical, chemical, and microbiological characteristics of a site. Bioassessment tests include determinations of nutrient availability, pH, microbial population density, and the ability of the microbial population to grow under enhanced conditions. This type of analysis is most appropriate for hydrocarbon contamination sites where bioremediation is a potential corrective action. Bioassessment samples may be collected if biasing factors suggests a fuel or solvent plume may be present.

5.0 Waste Management

Management of IDW will be based on regulatory requirements, field observations, process knowledge, and the results of laboratory analysis of CAU 165 investigation samples. Disposable sampling equipment, PPE, and rinsate are considered potentially contaminated waste only by virtue of contact with potentially contaminated media (e.g., soil) or potentially contaminated debris (e.g., construction materials). Decontamination activities will be performed according to approved contractor procedures specified in the contractor field instructions and as appropriate for the COPCs likely to be identified at CAU 165.

Sanitary, hazardous, radioactive, and/or mixed waste, if generated, will be managed and disposed of in accordance with DOE Orders, U.S. Department of Transportation (DOT) regulations, RCRA regulations, *Nevada Revised Statutes*, and agreements and permits between the DOE and NDEP. Asbestos or PCB-containing materials will be managed and disposed of in accordance with appropriate regulations. Materials that are thought to potentially contain the hantavirus will be managed and disposed of in accordance with appropriate health and safety procedures.

All waste from CAU 165 will be evaluated against characteristic standards as no listed organic constituents have been identified. Process knowledge indicates that some CAU 165 locations may be contaminated with radioactive and hazardous constituents. To allow for the segregation of radioactive and “nonradioactive” waste and materials, radiological swipe and/or direct surveys may be conducted on reusable sampling equipment, PPE, and disposable sampling equipment waste streams exiting from within the controlled area. Removable contamination limits, as defined in Table 4-2 of the current DOE *NV/YMP Radiological Control (RadCon) Manual* (DOE/NV, 2000a), shall be used to determine if such materials may be declared “nonradioactive.”

Applicable waste management regulations and requirements are listed in [Table 5-1](#).

5.1 Waste Minimization

Corrective action investigation activities have been planned to minimize IDW generation. All IDW will be segregated to the greatest extent possible. Hazardous materials used at sites will be minimized

**Table 5-1
Waste Management Regulations and Requirements**

Waste Type	Federal Regulation	Additional Requirements
Solid (nonhazardous)	NA	NRS 444.440 - 444.620 ^a NAC 444.570 - 444.7499 ^b NTS Landfill Permit SW13.097.04 ^c NTS Landfill Permit SW13.097.03 ^d
Liquid/Rinsate (nonhazardous)	NA	NTS Waste Water Facility Permit GNEV93001, Rev. 3iii ^e
Hazardous	RCRA ^f	NRS 459.400 - 459.600 ^g NAC 444.850 - 444.8746 ^h POC ⁱ
Low-Level Radioactive	NA	DOE Orders and NTSWAC ^j
Mixed	RCRA ^f	NTSWAC ^j POC ⁱ
Hydrocarbon	NA	NAC 445A.2272(b) ^k NTS Landfill Permit SW13.097.02 ^l
Polychlorinated Biphenyls	TSCA ^m	NRS 459.400 - 459.600 ^g NAC 444.940 - 444.9555 ^o
Asbestos	TSCA ⁿ	NAC 444.965-444.976 ^p

^aNevada Revised Statutes (NRS, 1998a)

^bNevada Administrative Code (NAC, 2000a)

^cArea 23, Nevada Division of Environmental Protection (NDEP, 1997a)

^dU10c Crater located in Area 9, Nevada Division of Environmental Protection (NDEP, 1997c)

^eNevada Test Site Sewage Lagoons, Nevada Division of Environmental Protection (NDEP, 1999)

^fResource Conservation and Recovery Act (40 CFR 260-282, 2001c)

^gNevada Revised Statutes (NRS, 1998b)

^hNevada Administrative Code (NAC, 2000b)

ⁱPerformance Objective for the Certification of Nonradioactive Hazardous Waste (BN, 1995)

^jNevada Test Site Waste Acceptance Criteria, Revision 3 (DOE/NV, 2000b)

^kNevada Administrative Code (NAC, 2000c)

^lArea 6 Hydrocarbon Landfill, Nevada Division of Environmental Protection (NDEP, 1997b)

^mToxic Substance Control Act (40 CFR 761, CFR, 2001e)

ⁿToxic Substance Control Act (40 CFR 763, CFR, 2001f)

^oNevada Administrative Code (NAC, 2000d)

^pNevada Administrative Code (NAC, 2000e)

NA = Not applicable

to limit the unnecessary generation of hazardous and/or mixed wastes. Decontamination activities will be planned and executed to minimize the volume of rinsate.

5.2 Potential Waste Streams

Process/historical knowledge will be reviewed during the DQO process to identify COPCs that may have been released at a particular site and to identify waste types that may be generated during the investigation process. Depending on the anticipated COPCs at a particular site, the types of IDW that may be generated include low-level radioactive waste (LLW), mixed wastes (LLW and hazardous waste), radioactive/PCB waste, hydrocarbon waste, hazardous waste, PCB waste, and sanitary waste. Investigation-derived wastes typically generated during investigation activities may include one or more of the following:

- Media (e.g., soil)
- PPE and disposable sampling equipment (e.g., plastic, paper, sample containers, aluminum foil, spoons, bowls)
- Decontamination rinsate
- Field-screening waste (e.g., soil, spent solvent, rinsate, disposable sampling equipment, and PPE contaminated by field-screening activities)

Each waste stream generated will be segregated, and further segregation may occur within each waste stream. Waste will be traceable to its source and to associated media samples.

5.3 Investigation-Derived Waste Management

Process knowledge indicates that CASs within CAU 165 may be contaminated with potentially radioactive and hazardous constituents. Management requirements for sanitary, low-level, hazardous, or mixed wastes are discussed further in the following sections.

5.3.1 Sanitary Wastes

Sanitary waste will be contained in plastic bags or an appropriate receptacle and will be transported to a solid waste management unit. The IDW generated within the controlled area will be swiped and/or surveyed, as appropriate to determine if the removable contamination is under the limits defined in

Table 4-2 of the current *DOE/NV RadCon Manual* (DOE/NV, 2000a). The IDW will be characterized as radioactive or “nonradioactive” based on results.

5.3.2 Hydrocarbon

The action level for soil contaminated with hydrocarbons is 100 milligrams per kilogram (mg/kg) in the State of Nevada (NAC, 2000e). Soils and associated IDW with TPH levels above 100 mg/kg provided other regulated constituents below regulatory limits shall be managed as hydrocarbon waste and disposed of in accordance with all applicable regulations.

5.3.3 Hazardous Waste

This CAU will have hazardous waste accumulation areas (HWAAs) and/or satellite accumulation areas (SAAs) to accumulate waste that may be hazardous. HWAAs will be properly controlled for access and will be equipped with spill kits and appropriate spill containment. All containers in HWAAs will be managed consistent with the requirements of 40 CFR 265 Subpart I. A “Hazardous Waste Pending Analysis” (CFR, 2001c) marking will be placed on the containers of waste until such time that waste characterization is complete. Once the waste is characterized, containers of waste determined to be hazardous will be clearly marked or labeled with the words “Hazardous Waste.” HWAAs will be inspected weekly and will be covered under a site-specific emergency response plan until such time that the waste is determined to be nonhazardous or all containers of hazardous waste have been removed from the accumulation area.

SAAs, if established, will be managed in accordance with 40 CFR 262.34(c) (CFR, 2001d). SAAs may be employed to temporarily accumulate waste associated with field-screening methods (e.g., Hanby) or for IDW pending characterization. These waste management methods will be appropriate for the amount of waste being accumulated.

5.3.3.1 PPE/Equipment

Personal protective equipment, disposable sampling equipment, and debris will be visually inspected for gross contamination (e.g., clumps of soil/sludge) and will be segregated as it is generated. Grossly contaminated PPE/equipment will be managed as potentially “characteristic” hazardous waste. This segregated population of waste will either be (1) assigned the characterization of the

soil/sludge that was sampled, (2) sampled directly, or (3) undergo further evaluation using the soil/sludge sample results to determine how much soil/sludge would need to be present in the waste to exceed regulatory levels. Waste that is determined to be hazardous will be entered into an approved waste management system (i.e., any appropriate facility used for the storage, treatment, or disposal of hazardous IDW generated during FFACO site investigations) within 45 days from receipt of the final CAU analytical data package from the laboratory.

The PPE/equipment that is not visibly stained, discolored, or grossly contaminated will be managed as it is generated as nonhazardous waste and disposed of as sanitary or LLW depending on the concentration of radioactive contamination, if present.

5.3.3.2 Rinsate

Decontamination rinsate will initially be evaluated using analytical results for samples associated with the rinsate (i.e., soil sample results from borehole or sampling activities associated with the generation of rinsate). Decontamination rinsate at this site will not be considered hazardous waste unless there is evidence that the rinsate displays a RCRA characteristic. Evidence may include such things as hazardous constituents in associated samples, the presence of a visible sheen, pH, or association with equipment/materials used to respond to a release/spill of a hazardous waste/substance. The regulatory status of the rinsate will be determined through direct sampling. If determined to be hazardous, the rinsate will be entered into an approved waste management system within 45 days from receipt of the final CAU analytical data package from the laboratory.

The disposal of nonhazardous rinsate will be consistent with guidance established in current NNSA/NV Fluid Management Plans for the NTS as follows:

- Rinsate that is determined to be nonhazardous and contaminated to less than 5 times Safe Drinking Water Standards (SDWS) is not restricted as to disposal.
- Nonhazardous rinsate which is contaminated at 5 to 10 times SDWS, will be disposed of in an established infiltration basin or solidified and disposed of as sanitary or low-level waste depending on the concentration of radioactive contamination, if present.
- Nonhazardous rinsate which is contaminated at greater than 10 times SDWS will be disposed of in a lined basin or solidified and disposed of as sanitary or low-level waste depending on the concentration of radioactive contamination, if present.

5.3.3.3 Field-Screening Waste

The use of field test kits and/or instruments may result in the generation of small quantities of hazardous wastes. If hazardous waste is produced by field screening, it will be segregated from other IDW and managed as a separate waste stream.

5.3.3.4 Soil

This waste stream consists of soil produced during soil sampling, excavation, and/or drilling. This waste stream is considered to have the same COPCs as the material remaining in the ground. Regardless of the COPCs at the site (i.e., listed or not listed), the preferred method for managing this waste stream is to place the material back into the borehole/excavation in the approximate location from which it originated. If this cannot be accomplished, the material will either be managed on site by berming and covering next to the excavation, or by placement in a container(s). Material that is containerized at a site where hazardous constituents are COPCs will be marked "Hazardous Waste Pending Analysis." The disposition of containerized material may be deferred until implementation of corrective action at the site.

5.3.4 Low-Level Waste

Suspected low-level waste will be managed in accordance with the contractor-specific waste certification program plan, contractor-specific procedures, and the *Nevada Test Site Waste Acceptance Criteria* (NTSWAC) (DOE/NV, 2000b). The IDW will be staged at a designated Radiological Controlled Area (RCA) or Radioactive Materials Area (RMA) pending certification and disposal under NTSWAC requirements (DOE/NV, 2000b). Waste drums will be labeled "Radioactive Material Pending Analysis."

If radiological COPCs are expected at a leachfield CAU addressed by this plan, waste may be characterized incorporating the use of process knowledge, analytical results of direct or associated samples, visual examination, radiological surveys, and swipe results. Radiological swipe surveys and/or direct scan surveys may be conducted on reusable sampling equipment and the PPE and disposable sampling equipment waste streams exiting a radiologically controlled area. This allows for the immediate segregation of radioactive waste from waste that may be unrestricted regarding radiological release. Removable contamination limits, as defined in Table 4-2 of the current version

of the *NV/YMP Radiological Control Manual*, may be used to determine if such waste may be declared unrestricted regarding radiological release versus being declared radioactive waste. Direct sampling of the waste may be conducted to aid in determining if a particular waste unit (e.g., drum of soil) contains low-level radioactive waste, as necessary. Waste that is determined to be below the values of Table 4-2 by either direct radiological survey/swipe results or through process knowledge will not be managed as potential radioactive waste, but will be managed in accordance with the appropriate section of this plan. Wastes in excess of Table 4-2 values will be managed as potential radioactive waste and be managed in accordance with [Section 5.0](#) of this plan, the contractor-specific waste certification program plan, DOE Orders, and the requirements of the NTSWAC (DOE/NV, 2000b). Potential radioactive waste drums containing soil, PPE, disposable sampling equipment, and/or rinsate shall be staged at a designated RMA when full or at the end of an investigation phase. The waste drums will remain at the RMA pending certification and disposal under NTSWAC requirements (DOE/NV, 2000b).

5.3.5 Mixed Wastes

Mixed waste, if generated, shall be managed in accordance with RCRA (40 CFR 262) (CFR, 2001b) and State of Nevada requirements. These regulations, as well as DOE requirements for radioactive waste, are interpreted as follows. Where there is a conflict in regulations or requirements, the most stringent shall apply. For example, weekly inspections per RCRA regulations will be applied to mixed waste even though it is not required for radioactive waste.

In general, mixed waste shall be managed in the same manner as hazardous waste, with additional mandatory radioactive waste management program requirements. Pending characterization and confirmation of its regulatory status, suspected mixed waste will be managed in accordance with applicable regulations and requirements, and will be marked with the words “Hazardous Waste Pending Analysis.” However, within 45 days from receipt of the final CAU analytical data package from the laboratory, the mixed waste shall be transported via an approved hazardous waste transporter to the NTS transuranic waste storage pad for storage pending treatment or disposal. Mixed waste with hazardous waste constituents below land disposal restrictions may be disposed of at the NTS Area 5 Radioactive Waste Management Site, if the waste meets the requirements of the NTSWAC. Mixed waste not meeting land disposal restrictions will require development of a

treatment plan under the requirements of the *Mutual Consent Agreement* between DOE and the State of Nevada (NDEP, 1995).

5.3.6 PCB and Radioactive PCB Wastes

The management of PCBs is governed by the *Toxic Substances Control Act* and its implementing regulations in 40 CFR 761. PCB contamination may be found as a sole contaminant, or in combination with any of the types of waste discussed in this plan. For example, PCBs may be a co-contaminant in soil that contains a RCRA “listed” chemical constituent, resulting in a PCB/hazardous waste. PCBs may also be a co-contaminant in radioactive wastes (PCB/radioactive waste), in sanitary or hydrocarbon waste (PCB waste), in RCRA “characteristic” waste (PCB/hazardous waste), or even in mixed waste (PCB/radioactive/hazardous waste). The IDW will initially be evaluated using analytical results for media samples from the investigation. If any type of PCB waste is generated, it will be managed according to 40 CFR 761, as well as State of Nevada requirements, guidance, and agreements with NNSA/NV.

6.0 Quality Assurance/Quality Control

The overall objective of the characterization activities described in this CAIP is to collect accurate and defensible data to support the selection and implementation of a closure alternative for each CAS in CAU 165. The following two subsections ([Section 6.1](#) and [Section 6.2](#)) discuss the collection of required QC samples in the field and QA requirements for laboratory/analytical data to achieve closure. The last subsection ([Section 6.3](#)) provides QA/QC requirements for radiological survey data. Unless otherwise stated in this CAIP or required by the results of the DQO process (see [Appendix A](#)), this investigation will adhere to the Industrial Sites QAPP (DOE/NV, 1996b).

6.1 Quality Control Field Sampling Activities

Field QC samples will be collected in accordance with established procedures. 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 types 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:

- Trip blanks (1 per sample cooler containing VOC environmental samples)
- Equipment blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per lot of source material that contacts sampled media)
- Field duplicates (1 per 20 environmental samples or 1 per CAS per matrix, if less than 20 collected)
- Field blanks (1 per 20 environmental samples)
- Matrix spike (MS)/matrix spike duplicate (MSD) (1 per 20 environmental samples or 1 per CAS per matrix, if less than 20 collected)

Additional QC samples may be submitted based on site conditions at the discretion of the Site Supervisor. Field quality control samples shall be analyzed using the same analytical procedures implemented for associated environmental samples. Additional details regarding field QC samples are available in the Industrial Sites QAPP (DOE/NV, 1996b).

6.2 Laboratory/Analytical Quality Assurance

Criteria for Phase I and Phase II, as stated in the DQOs ([Appendix A](#)) and except where noted, require laboratory analytical quality data be used for making critical decisions. Rigorous QA/QC will be implemented for all laboratory samples including documentation, data verification and validation of analytical results, and an assessment of DQIs as they relate to laboratory analysis.

6.2.1 Data Validation

Data verification and validation will be performed in accordance with the Industrial Sites QAPP (DOE/NV, 1996b), except where otherwise stipulated in this CAIP. All nonradiological laboratory data from samples collected and analyzed will be evaluated for data quality according to *EPA Functional Guidelines* (EPA, 1994a and 1999). Radiological laboratory data from samples that are collected and analyzed will be evaluated for data quality according to company-specific procedures. The data will be reviewed to ensure that all critical samples were appropriately collected, analyzed, and the results passed data validation criteria. Validated data, including estimated data (i.e., J-qualified), will be assessed to determine if they meet the DQO requirements of the investigation and the performance criteria for the DQIs. The results of this assessment will be documented in the CADD. If the DQOs were not met, corrective actions will be evaluated, selected, and implemented (e.g., refine CSM or resample to fill data gaps).

6.2.2 Data Quality Indicators

Data quality indicators are qualitative and quantitative descriptors used in interpreting the degree of acceptability or utility of data. The principal DQIs are precision, accuracy, representativeness, comparability, and completeness. A sixth DQI, sensitivity, has also been included for the CAU 165 investigation. DQIs are used to evaluate the entire measurement system and laboratory measurement processes (i.e., analytical method performance) as well as to evaluate individual analytical results (i.e., parameter performance).

Precision and accuracy are quantitative measures used to assess overall analytical method and field sampling performance as well as to assess the need to “flag” (qualify) individual parameter results when corresponding QC sample results are not within established control limits. Therefore, performance metrics have been established for both analytical methods and individual analytical

results. Data qualified as estimated for reasons of precision or accuracy may be considered to meet the parameter performance criteria based on assessment of the data.

Representativeness and comparability are qualitative measures, and completeness is a combination of both quantitative and qualitative measures. Representativeness, comparability, and completeness are used to assess the measurement system performance. The DQI parameters are individually discussed in [Section 6.2.3](#) through [Section 6.2.8](#).

[Table 6-1](#) provides the established analytical method/measurement system performance criteria for each of the DQIs and the potential impacts to the decision if the criteria are not met. The Industrial Sites QAPP (DOE/NV, 1996b) documents the actions required to correct conditions that adversely affect data quality both in the field and the laboratory. All DQI performance criteria deficiencies will be evaluated for data usability and impacts to the DQO decisions. These evaluations will be discussed and documented in the data assessment section of the CADD. The following subsections discuss each of the DQIs that will be used to assess the quality of laboratory data.

6.2.3 Precision

Precision is used to assess the variability of sample handling, preservation, and storage along with the variability of the analysis process. It is used to evaluate the performance of analytical methods as well as to evaluate the usability of individual analytical results. Precision is a measure of agreement among a replicate set of measurements of the same property under similar conditions. This agreement is expressed as the relative percent difference (RPD) between duplicate measurements (DOE/NV, 1996b). The RPD is determined by dividing the difference between the replicate measurement values by the average measurement value and multiplying the result by 100, or:

$$RPD = \{|a1 - a2| / [(a1 + a2) / 2]\} \times 100$$

Where:

- a1 = The sample value, and
- a2 = The duplicate sample value.

Table 6-1
Laboratory/Analytical Data Quality Indicators

Data Quality Indicator	Performance Criteria	Potential Impact on Decision if Performance Criteria Not Met
Precision	Uncertainty associated with each measurement system is controlled sufficient to have confidence in comparison of analytical results to action levels.	Data that does not meet the performance criteria will be considered missing for purposes of evaluating completeness. Decisions may not be valid if analytical method performance criteria for precision are not met.
Accuracy	Uncertainty associated with each measurement system is controlled sufficient to have confidence in comparison of analytical results to action levels.	Data that does not meet the performance criteria will be considered missing for purposes of evaluating completeness. Decisions may not be valid if analytical method performance criteria for accuracy are not met.
Sensitivity	Detection limits of laboratory instruments must be less than respective PALs.	Cannot determine if COCs are present at levels of concern; therefore, the affected data will be assessed for usability and potential impacts on meeting site characterization objectives.
Phase I Completeness	100% of locations - identified in DQOs are sampled. 100% of analyses are required by CAIP. 100% of critical parameters are valid ^a . 80% of noncritical parameters are valid.	Cannot make decision on whether COCs are present above PALs with high confidence.
Phase II Completeness	100% of locations - identified in DQOs are sampled. 100% of analyses are required by CAIP. 100% of critical parameters are valid ^a . 80% of noncritical parameters are valid.	Decision of whether or not extent of contamination has been bounded cannot be determined.
Comparability	Consistent sampling, handling, preparation, analysis, reporting, and validation criteria will be used. Approved standard methods and procedures will be used to analyze and report the data.	Inability to compare results to established decision levels.
Representativeness	Correct analytical method performed for appropriate COPC; valid data reflects appropriate target population.	Cannot identify COC or estimate concentration of COC; therefore, cannot make decision(s) on target population.

^a Critical parameters specific to each CAS are discussed in [Table 6-2](#).

Determinations of precision will be made for field duplicate samples and laboratory duplicate samples. Field duplicate samples will be collected simultaneously with samples from the same source under similar conditions in separate containers. The duplicate sample is treated independently of the original sample in order to assess field impacts and laboratory performance on precision through a comparison of results. Laboratory precision is evaluated as part of the required laboratory internal QC program to assess performance of analytical procedures. The laboratory sample duplicates are an aliquot, or subset, of a field sample generated in the laboratory. They are not a separate sample but a split, or portion, of an existing sample. Typically, laboratory duplicate QC samples include MSD and laboratory control sample (LCS) duplicate samples for organic, inorganic, and radiological analyses.

6.2.3.1 Precision for Chemical Analysis

The relative percent difference (RPD) criteria to be used for assessment of precision are the parameter-specific criteria listed in [Table 3-2](#). The RPD criteria for precision are based on laboratory-specific control limits. Control limits are evaluated at the laboratory on a quarterly basis by monitoring the historical data and performance for each method. No review criteria for field duplicate RPD comparability have been established; therefore, the laboratory sample duplicate criteria will be applied to the review of field duplicates.

The assessment of precision will only be conducted for analytical results when either the sample or duplicate result is above the instrument detection limit or method detection limit, as applicable. Consequently, when both the sample and duplicate results are “nondetects” or analytical results are below the applicable limit of detection for the instrument or method, associated sample results are not included in the calculation of precision.

The parameter performance criteria for precision will be compared to RPD results of duplicate samples. This will be accomplished as part of the data validation process. Precision values for organic and inorganic analysis that are within the established control criteria indicate that analytical results for associated samples are valid. The RPD values that are outside the criteria for organic analysis do not necessarily result in the qualification of analytical data. It is only one factor in making an overall judgment about the quality of the reported analytical results. Inorganic laboratory sample duplicate RPD values outside the established control criteria do result in the qualification of

associated analytical results as estimated. Qualified data does not necessarily indicate that the data are not useful for the purpose intended; however, it is an indication that data precision should be considered for the overall assessment of the data quality and potential impact on data applicability in meeting site characterization objectives.

The criteria to evaluate analytical method performance for precision ([Table 6-1](#)) will be assessed based on the analytical method-specific (e.g., VOCs) precision measurements. The analytical method-specific precision measurement is calculated by taking the number of analyses meeting the RPD criteria, dividing that by the total number of analyses with detectable concentrations, and multiplying by 100. Each analytical method-specific precision measurement will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.3.2 Precision for Radiochemical Analysis

The parameter performance criteria for precision will be compared to the RPD or normalized difference (ND) results of duplicate samples. The criteria for assessment of the radiochemical precision are parameter-specific criteria (see [Table 3-2](#)). This assessment will be accomplished as part of the data validation process. Precision values that are within the established control criteria indicate that analytical results for associated samples are valid. Out of control RPD or ND values do not necessarily indicate that the data are not useful for the purpose intended; however, it is an indication that data precision should be considered for the overall assessment of the data quality and the potential impact on data applicability in meeting site characterization objectives.

If the RPD or ND criteria are exceeded, samples will be qualified. Field duplicates will be evaluated, but field samples will not be qualified based on their results. The MSD results outside of the control limits may not result in qualification of the data. An assessment of the entire analytical process, including the sample matrix, is conducted to determine if qualification is warranted.

The evaluation of precision based on duplicate RPD requires that both the sample and its duplicate have concentrations of the target radionuclide exceeding five times their MDA. This excludes many measurements because the samples contain nondetectable or low levels of the target radionuclide. However, the ND method may be used for evaluating duplicate data where the results are less than

five times their MDAs. This is based on the measurement uncertainty associated with low-level results. The ND test is calculated using the following formula:

$$\text{Normalized Difference} = \frac{S - D}{\sqrt{(TPU_s)^2 + (TPU_d)^2}}$$

Where:

- S = Sample Result
- D = Duplicate result
- TPU = Total Propagated Uncertainty
- TPUs = 2 sigma TPU of the sample
- TPUd = 2 sigma TPU of the duplicate

The control limit for the normalized difference is -1.96 to 1.96, which represents a confidence level of 95 percent.

The criteria to evaluate analytical method performance for precision ([Table 6-1](#)) will be based on the analytical method-specific (e.g., gamma spectrometry) precision measurements. Analytical method-specific precision measurement is calculated by taking the number of analyses meeting the RPD or ND criteria, dividing that by the total number of analyses, and multiplying by 100. Each analytical method-specific precision measurement will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.4 Accuracy

Accuracy is a measure of the closeness of an individual measurement or the average of a number of measurements to the true value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that result from sampling and analytical operations. It is used to assess the performance of laboratory measurement processes as well as to evaluate individual groups of analyses (i.e., sample delivery groups).

Accuracy is determined by analyzing a reference material of known parameter concentration or by reanalyzing a sample to which a material of known concentration or amount of parameter has been added (spiked). The measure of accuracy is expressed as the percent recovery (%R)

(DOE/NV, 1996b). This is calculated by dividing the measured sample concentration by the true concentration and multiplying the quotient by 100.

6.2.4.1 Accuracy for Chemical Analyses

The %R criteria to be used for assessment of accuracy are the parameter-specific criteria listed in [Table 3-2](#). Accuracy for chemical analyses will be evaluated based on results from three types of spiked samples: MS, LCS, and surrogates. Matrix spike samples are prepared by adding a known concentration of a target parameter to a specified amount of matrix sample for which an independent estimate of the target parameter concentration is available. Laboratory control samples are prepared by adding a known concentration of a target parameter to a “clean” sample matrix (does not contain the target parameter). Surrogate samples are prepared by adding known concentrations of specific organic compounds to each sample analyzed for organic analyses (including QC samples).

The %R criteria to be used will be based on laboratory-specific control limits. For organic analyses, laboratory control limits are reevaluated quarterly at the laboratory by monitoring the historical data and performance for each method. The acceptable control limits for inorganic analyses are established in the EPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, 1994a).

The %R parameter performance criteria for accuracy will be compared to %R results of spiked samples. This will be accomplished as part of the data validation process. Accuracy values for organic and inorganic analysis that are within the established control criteria indicate that analytical results for associated samples are valid. The %R values that are outside the criteria do not necessarily result in the qualification of analytical data. It is only one factor in making an overall judgment about the quality of the reported analytical results. Factors beyond the laboratory’s control, such as sample matrix effects, can cause the measured values to be outside of the established criteria. Therefore, the entire sampling and analytical process must be evaluated when determining the quality of the analytical data provided.

The criteria to evaluate analytical method performance for accuracy ([Table 6-1](#)) will be based on the analytical method-specific (e.g., VOCs) accuracy measurements. The analytical method-specific accuracy measurement is calculated by taking the number of analyses meeting the %R criteria,

dividing that by the total number of analyses, and multiplying by 100. Each analytical method-specific accuracy measurement will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.4.2 Accuracy for Radiochemical Analysis

Accuracy for radiochemical analyses will be evaluated based on results from LCS and MS samples. The LCS is prepared by adding a known concentration of the radionuclide being measured to a sample that does not contain radioactivity (i.e., distilled water). This sample is analyzed with the field samples using the same sample preparation, reagents, and analytical methods employed for the samples. One LCS is prepared with each batch of samples for analysis by a specific measurement.

The MS samples are prepared by adding a known concentration of a target parameter to a specified field sample with a measured concentration. The MS samples are analyzed to determine if the measurement accuracy is affected by the sample matrix. The MS samples are analyzed with sample batches when requested.

The %R criteria to be used for assessment of accuracy will be the control limits for radiochemical analyses listed in [Table 3-2](#). These criteria will be used to assess qualification of data associated with each spiked sample. This will be accomplished as part of the data validation process. Accuracy values that are within the established control criteria indicate that analytical results for associated samples are valid.

The criteria to evaluate analytical method performance for accuracy ([Table 6-1](#)) will be assessed based on the analytical method-specific (e.g., gamma spectrometry) accuracy measurements. The analytical method-specific accuracy measurement is calculated by taking the number of analyses meeting the %R criteria, dividing that by the total number of analyses, and multiplying by 100. Each analytical method-specific accuracy performance will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.5 Representativeness

Representativeness is a qualitative evaluation of measurement system performance. It is the degree to which sample data accurately and precisely represents a characteristic of a population, parameter

variations at a sampling point, or an environmental condition (EPA, 1987). Representativeness is assured by a carefully developed sampling strategy, collecting the specified number of samples from proper sampling locations, and analyzing them by the approved analytical methods.

Representativeness may be assured by reviewing field documentation, operating in accordance with approved procedures and plans, conducting field surveillances, and field-collected blank data. An evaluation of this qualitative criterion will be presented in the CADD.

6.2.6 Completeness

Completeness is a quantitative and qualitative evaluation of measurement system performance. The criterion for meeting completeness is defined as generating sufficient data of the appropriate quality to satisfy the data needs identified in the DQOs. The quantitative measurement to be used to evaluate completeness is presented in [Table 6-1](#) and is based on the percentage of measurements made that are judged to be valid. Percent completeness is determined by dividing the total number of valid analyses by the total number of analyses required to meet DQO data needs and multiplying by 100. Problems that may affect completeness include total number of samples sent to the laboratory but not analyzed due to problems with samples (e.g., broken bottles, insufficient quantity, insufficient preservation), and samples that were collected and sent but never received by the laboratory. If these criteria are not achieved, the dataset will be assessed for potential impacts on meeting site characterization objectives.

Critical parameters for CAU 165 Phase I are identified in [Table 6-2](#); they are defined as those parameters suspected to be present in the target population. Critical parameters have been identified through process knowledge and historical documentation.

Critical parameters for Phase II samples are the COCs identified based on Phase I analytical results.

The qualitative criterion for evaluation of measurement system performance is that sufficient data of the appropriate quality have been generated to satisfy the data needs identified in the DQOs. An evaluation of this qualitative criterion will be presented in the CADD.

Table 6-2
Critical Parameters by CAS

Phase	CAS	Critical Radiological Parameters	Critical Chemical Parameters
I ^a	25-20-01	None	None
	25-51-02	None	pH
	25-59-01	None	None
	26-59-01	None	None
	25-07-06	Sr-90, Y-90, Nb-94, Cs-137, Ba-137m, U-234, U-235, and U-238 Total and/or Removable Alpha Radiation ^b Total and/or Removable Beta/Gamma Radiation ^b	Volatiles associated with solvents, degreasers, Freon-10, alcohol, diluted acid, Turco decontamination solvent, TPH-DRO, PCBs
	25-07-07	Sr-90, Y-90, Nb-94, Cs-137, Ba-137m, U-234, U-235, and U-238 Total and/or Removable Alpha Radiation ^b Total and/or Removable Beta/Gamma Radiation ^b	Volatiles associated with solvents, degreasers, Freon-10, alcohol, diluted acid, Turco decontamination solvent, TPH-DRO, PCBs
	26-07-01	Sr-90, Y-90, Nb-94, Cs-137, Ba-137m, U-234, U-235, and U-238 Total and/or Removable Alpha Radiation ^b Total and/or Removable Beta/Gamma Radiation ^b	Volatiles associated with solvents and cleaning chemicals, beryllium
	25-47-01	Pu-238 and Pu-239/240	Nearby septic system septic tank include barium, VOCs, SVOCs, TPH-DRO, and PCBs

^aCritical parameters for Phase II will be determined based on Phase I analytical results

^bSemiquantitative data from radiological surveys and swipe collection and counting

6.2.7 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another (EPA, 1987). To ensure comparability, all samples will be subjected to the same sampling, handling, preparation, analysis, reporting, and validation criteria. Approved standard methods and procedures will also be used to analyze and report the data (e.g., Contract Laboratory Program [CLP] and/or CLP-like data packages). This approach ensures that the data from this project can be compared to other data sets. An evaluation of this qualitative criterion will be presented in the CADD.

6.2.8 Sensitivity

Sensitivity is a quantitative parameter that evaluates the capability of a method or instrument to measure parameter concentrations at or near decision levels. The evaluation criteria for this parameter will be that measurement sensitivity (detection limits) will be less than the corresponding PALs. If this criterion is not achieved, the affected data will be assessed for usability and potential impacts on meeting site characterization objectives.

6.3 Radiological Survey Quality Assurance

Radiological survey data used for making critical decisions will receive rigorous QA/QC scrutiny to determine if the data are of the right type, quality, and quantity to support a free-release determination. A review of survey documentation, data verification, and data validation will be performed for free-release radiological surveys as prescribed in the QAPP (DOE/NV, 1996b), except where otherwise stipulated in this CAIP. The DQIs of the radiological survey data will also be reviewed. The DQIs presented in this section are addressed specifically for radiological surveys used for free-release determinations.

The radiological survey data will be evaluated for consistency with the CSMs developed for the sites. If data are not consistent with the CSM, either the model will need to be reevaluated, or reasons for the differences and the effects of those differences on decisions will be documented. This will be performed by examining summary statistics and plots of the subsets of the data (e.g., histograms and quantile-quantile plots).

6.3.1 Data Validation

The radiological survey data will be evaluated to determine their validity. Individual data points within the context of the entire data set will be evaluated graphically and statistically to determine suspect data (e.g., outliers and anomalous values). A decision about how to treat the anomalous data (e.g., remove from the data set, censor, or leave data in data set without modification) will be made before proceeding with the data validation. Anomalies will be discussed in the data assessment section of the CADD.

The radiological survey data validation will examine:

- Completeness of Radiological Survey Forms
- Completeness of signatures, dates, and survey locations
- Proper field documentation of problems and deviations from procedures
- Scanning survey area coverage
- Scanning MDA
- Static survey MDA
- Quantity and spatial distribution of static survey results
- Detector system calibrated to National Institute of Standards and Technology-traceable sources
- Corrections made for geometry, self-absorption, backscatter, and daughter-product ingrowth
- Detector response to daily background and source checks

6.3.2 Data Quality Indicators

6.3.2.1 Precision

Precision is a quantitative measure of the variability in repeated measurements under a given set of conditions, compared to their mean value ([Section 6.2.3](#)). The degree of precision will be presented in terms of relative standard deviation (σ_r) of a set of measurements by the expression:

$$\sigma_r = \frac{\sigma}{\bar{X}} \times 100$$

Where

σ = standard deviation of the data set

$\bar{X}$ = mean of the data set

The lower the relative standard deviation, the more precise the data. Precision is assessed for radiological survey instruments by collecting a series of measurements of a known activity and determining the relative standard deviation of the measurements.

The degree of precision will be determined each day of instrument use and verified to be within 20 percent (ANSI, 1997). If the degree of precision for a survey instrument is determined to be outside this range, the instrument will be removed from use and replaced by an instrument that meets this performance standard.

6.3.2.2 Accuracy

Accuracy is a measure of the proximity of an individual measurement to the true value ([Section 6.2.4](#)). Accuracy is determined by taking measurements of a known quantity of radioactive material and determining the relative bias by the following formula:

$$\text{Relative Bias} = \left(\frac{x - y}{y} \right) \times 100$$

Where:

- y = The known true value
- x = The predicted value using the detection system

In field measurements, the accuracy error comes from the overall calibration factor, which relates the detector response (i.e., count rate) to physical quantities of interest (i.e., beta activity in disintegrations per 100 square centimeters). The major sources of error for the calibration factor in radiological survey instruments are:

- Backscatter of the radiation back into the detector
- Surface self-absorption of the radiation
- Distance of detector from surface under measurement
- Difference of radiation energy from the calibration standard energy
- Gamma radiation background

All of these major sources of errors are random errors because they vary with locations by chance; the accuracy error itself is given by the propagation of these errors to the final result. The greater the variability associated with these sources of error, the larger the accuracy error is for radiation measurement systems. Accuracy is assessed for radiological survey instruments by collecting a series of measurements of a known activity and determining the relative bias of the measurements.

Accuracy will be determined each day of instrument use and verified to be within 20 percent (ANSI, 1997). If the accuracy for a survey instrument is determined to be outside this range, the instrument will be removed from use and replaced by an instrument that meets this performance standard.

6.3.2.3 Representativeness

Representativeness expresses the degree to which measurement data accurately and precisely represent a characteristic of a population, parameter variations at a measurement location, or an environmental condition (Section 6.2.5). The representativeness criterion is best satisfied by making certain that measurement locations are selected properly and a sufficient number of measurements are collected. For this characterization project, where surveys are conducted, 100 percent surface scans will be performed in addition to systematic static measurements. This method allows one to survey a large area and bias static (point) measurements using the scanning data, ensuring that all survey measurements will be representative.

6.3.2.4 Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid measurements (Section 6.2.6). A high completeness level ensures that critical data points will be collected. Missing or unusable data can occur with any detection program. The pattern of missing or unusable data needs to be documented along with the operation to determine if a bias in statistical test could arise. To account for the likelihood of missing/unusable data during free-release radiological surveys, a repeated measurement will be taken when a data point is found to be suspect or invalid.

6.3.2.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another (Section 6.2.7 and EPA, 1987). The evaluation of data comparability can be conducted: (1) within the same survey plan, or (2) across different survey and sampling plans that have the same objectives and the same sampling and measurement environment. In the first case, data comparability can be achieved by using standard survey techniques to take radiological measurements and reporting radiological results in appropriate units. At a minimum, free-release survey data sets collected under the same survey plan, using the same survey methods, should be

comparable with one another and to the release criteria. In the second case, the validation of surface activity measurements using a building material sampling plan can be deemed as a data comparability evaluation that crosses different sampling and measurement programs. However, assumptions may have to be made (e.g., depth of contamination, radionuclide identity, and density) to allow for qualitative comparability of surface contamination activity to nuclide concentration. An evaluation of this qualitative criterion and all assumptions will be presented in the CADD.

6.3.2.6 Sensitivity

The sensitivity of a direct measurement system is a quantity of radioactive material that can be detected with a known level of confidence ([Section 6.2.8](#)). This quantity is a factor of both the instrumentation and the technique or procedure being used. The primary parameters that affect the sensitivity of radiological detection instruments are the background count rate, the detection efficiency, and the counting time interval. In performing free-release surveys, the sensitivity must be sufficiently low enough to ensure that levels below the release criteria can be detected with a high degree of confidence. In order to determine the needed sensitivity prior to performing the free-release surveys, the concept of the MDA is used. The MDA for radiological surveying is the minimum activity concentration on a surface that an instrument is expected to detect with a 95 percent confidence. The expression for MDA is given as:

$$\text{MDA} = \frac{3 + 4.65\sqrt{C_B}}{KT}$$

Where:

$$\text{MDA} = \text{dpm}/100 \text{ cm}^2$$

$$C_B = \text{background count in time } T$$

$$K = \text{proportionality constant that relates detector response to the activity level in a sample for a given set of measurement conditions}$$

The MDA depends on instrument characteristics (e.g., instrument efficiency, background, integration time) and the survey measurement process (e.g., surface type, source to detector geometry,

backscatter, and self-absorption) (NRC, 1997). These factors will be considered when planning characterization activities and will be documented in the CADD.

7.0 *Duration and Records Availability*

7.1 *Duration*

After the submittal of the CAIP to NDEP (FFACO milestone date of January 31, 2002), the following is a tentative schedule of activities (in calendar days):

- Day 0: Preparation for field work will begin.
- Day 116: The field work, including radiological surveys and sampling, will commence. Samples will be shipped to meet laboratory holding times.
- Day 193: The field investigation will be completed.
- Day 250: The quality-assured laboratory analytical data will be available for NDEP review.
- The FFACO date for the CADD is April 30, 2003.

7.2 *Records Availability*

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

8.0 References

- Adams, S.R., IT Corporation. 1998. Internal memorandum from S. Adams to R. McCall (Science Applications International Corporation) regarding methodology for determining action levels for CAU 407, the Roller Coaster RADSAFE Area, 16 June. Las Vegas, NV.
- Adams, S.R., and B.J. Dionne, IT Corporation. 2000. Memorandum to J.M. Moore (ITLV) entitled, "CAU 262 Proposed Minimum Reporting Levels (MRLs) for Radionuclides in Soil/Solids/Sludge and Water," 25 April. Las Vegas, NV.
- AEC, see U.S. Atomic Energy Commission.
- Aetron. 1963a. Engineering Drawing As-Built 3304-C12.2, "Test Cell 'D' Complex Test Stand & Process Systems Control Point Bldg. Area Site Grading," 19 July. Covina, CA.
- Aetron. 1963b. Engineering Drawing As-Built 3320-P2.2, "Test Cell 'D' Complex Test Stand & Process Systems Utility Equipment Building Piping Plan," 19 July. Covina, CA.
- Alderson, S.L., IT Corporation. 2001. Memorandum to J. Davis (ITLV) entitled, "Preliminary Action Levels and Minimum Reporting Limits for the Radiological Contaminants of Potential Concern Identified for Corrective Action Unit 165," 2 July. Las Vegas, NV.
- American National Standards Institute. 1997. *Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments*, ANSI N323A-1997. New York: Institute of Electrical and Electronics Engineers, Inc.
- American Society for Testing and Materials. 1996. Section 04.08 and 04.09, "Construction," *Annual Book of ASTM Standards*. Philadelphia, PA.
- ANSI, see American National Standards Institute.
- ASTM, see American Society for Testing and Materials.
- Author Unknown. 1960. *Background Information, Project Pluto - Tory II-A: Final Draft*, CIC 78665.
- Bechtel Nevada. 1995. *Nevada Test Site Performance Objective Criteria for Certification of Nonradioactive Hazardous Waste*, Rev. 0, G-E11/96.01. Las Vegas, NV.
- Bechtel Nevada. 2000a. Aerial photograph 10292-229, 2 February. Nellis Air Force Base, NV: BN, Remote Sensing Photo Laboratory.
- Bechtel Nevada. 2000b. *Nevada Test Site Occupancy Report*, 7 August. Las Vegas, NV.

BLM, see U.S. Department of Interior, Bureau of Land Management.

BN, see Bechtel Nevada.

Cebe, J., U.S. Department of Energy, Nevada Operations Office. 1997. Record of Telecon with D. Arnold (ITLV) regarding the Test Bunker facility, 18 December. Las Vegas, NV: IT Corporation.

CFR, see *Code of Federal Regulations*.

Code of Federal Regulations. 2001a. Title 40 CFR, "Protection of the Environment," Part 261, "Identification and Listing of Hazardous Waste." Washington, DC: U.S. Government Printing Office.

Code of Federal Regulations. 2001b. Title 40 CFR, "Protection of the Environment," Part 262, "Standards Applicable to Generators of Hazardous Waste." Washington, DC: U.S. Government Printing Office.

Code of Federal Regulations. 2001c. Title 40 CFR, "Protection of the Environment," Parts 260-282. Washington, DC: U.S. Government Printing Office.

Code of Federal Regulations. 2001d. Title 40 CFR, "Protection of the Environment," Part 262.34, "Standards Applicable to Generators of Hazardous Waste, Subpart C - Pre-Transport Requirements, Accumulation Time." Washington, DC: U.S. Government Printing Office.

Code of Federal Regulations. 2001e. Title 40 CFR, "Protection of the Environment," Part 761, "PCBs." Washington, DC: U.S. Government Printing Office.

Code of Federal Regulations. 2001f. Title 40 CFR, "Protection of the Environment," Part 763, "Asbestos." Washington, DC: U.S. Government Printing Office.

Desert Research Institute. 1988. *CERCLA Preliminary Assessment of DOE's Nevada Operations Office Nuclear Weapons Testing Areas*, Vol. 1. Las Vegas, NV.

Desert Research Institute. 1996. *Nevada Test Site Historic Structures Survey*. Prepared in conjunction with Carey & Co., Inc. for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV.

DOE, see U.S. Department of Energy.

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

DOE/OCRWM, see U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

DRI, see Desert Research Institute.

EG&G/EM, see EG&G Energy Measurements.

EG&G Energy Measurements. 1964. Aerial photograph 643-17-15, 13 March. Nellis Air Force Base, NV: Remote Sensing Laboratory Photo Library.

EG&G Rocky Flats, Environmental Management Department. 1991. *General Radiochemistry and Routine Analytical Services Protocol (GRASP)*, Version 2.1, July. Golden, Colorado: Nellis Air Force Base, NV: BN, Remote Sensing Laboratory Photo Laboratory, Rocky Flats Plant.

EPA, see U.S. Environmental Protection Agency.

ERDA, see U.S. Energy Research and Development Administration.

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

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

Frizzell, V.A., and J. Shulters. 1990. *Geologic Map of the Nevada Test Site, Southern Nevada*, USGS Map I-2046. Denver, CO: U.S. Geological Survey.

Garey, K., Peer Consultants. 1997. Record of Telecon with D. Filmeyer (IT) and A. O'Hagan (IT) regarding various E-MAD and R-MAD sites, 24 February. Las Vegas, NV.

Garey, K., Peer Consultants. 1999. Record of Telecon with B. Bailey (IT) regarding CAU 165, CAS 25-07-06, 6 May. Las Vegas, NV.

Garey, K., Peer Consultants. 2000. Record of Telecon with L. Shupp (ITLV) regarding CAU 165, CAS 25-51-02, 15 August. Las Vegas, NV.

H&N, see Holmes and Narver, Inc.

Holmes & Narver, Inc. Date Unknown. Engineering Drawing A26-4 entitled, "Nevada Test Site Area 26 Project Area Site Plan." Prepared for the U.S. Department of Energy, Nevada Operations Office. Mercury, NV: BN Archives and Records Center.

Holmes & Narver, Inc. 1989. As-Built Engineering Drawing JS-025-4215-C1, "Hydrologic Research Facility Site Plan," 10 March. Mercury, NV.

IT, see IT Corporation.

IT Corporation. 2000. *First Quarter 2000 Surface Geophysical Survey Report Potential Corrective Action Sites Area 25 EMAD and test Cells C and A, Nye County, Nevada*. Prepared by Science Applications International Corporation: Harrisburg, PA.

IT Corporation. 2001. *ITLV Health and Safety Plan*, March, ITLV/13052--105, Rev. 0.
Las Vegas, NV.

Johnson, R.B., and J.R. Ege. 1964. *Geology of the Pluto Site, Area 401, Nevada Test Site, Nye County, Nevada*, USGS-TEI-841. Denver, CO: U.S. Geological Survey.

Karathanasis, A.D., and B.F. Hajek. 1982. "Quantitative Evaluation of Water Adsorption on Soil Clays." In *Soil Science Society of America Journal*, 46: 1321-1325. Madison, WI.

Los Alamos Scientific Laboratory. 1970. *PEWEE Reactor, Safety Analysis Report*.
Los Alamos, NM.

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

NAC, see *Nevada Administrative Code*.

Nevada Administrative Code. 2000a. NAC 444.570 - 444.7499, "Solid Waste Disposal."
Carson City, NV.

Nevada Administrative Code. 2000b. NAC 444.850 - 444.8746, "Disposal of Hazardous Waste."
Carson City, NV.

Nevada Administrative Code. 2000c. NAC 444.940 - 444.9555, "Polychlorinated Biphenyl."
Carson City, NV.

Nevada Administrative Code. 2000d. NAC 444.965 - 444.976, "Disposal of Asbestos."
Carson City, NV.

Nevada Administrative Code. 2000e. NAC 445A.2272, "Contamination of Soil: Establishment of Action Levels." Carson City, NV.

Nevada Administrative Code. 2000f. NAC 444.843, "Hazardous Waste." Carson City, NV.

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

Nevada Division of Environmental Protection. 1997a. *Class II Solid Waste Disposal Site for Municipal and Industrial Solid Waste, Area 23 of the NTS*, Permit SW 13 097 04.
Carson City, NV.

Nevada Division of Environmental Protection. 1997b (as amended in August 2000). *Class III Solid Waste Disposal Site for Hydrocarbon Burdened Soils, Area 6 of the NTS*, Permit SW 13 097 02. Carson City, NV.

Nevada Division of Environmental Protection. 1997c (as amended in August 2000). *Class III Solid Waste Disposal Site; U10C, Area 9 of the NTS*, Permit SW 13 097 03. Carson City, NV.

Nevada Division of Environmental Protection. 1999. *State of Nevada Water Pollution Control General Permit*, No. GNEV93001. Carson City, NV.

Norman Engineering Company. 1961. Engineering Drawing 2202A-C-17, "Site Civil Plan VIII," 2 October. Los Angeles, CA.

Norman Engineering Co. 1967a. As-Built Engineering Drawing NRDS-SF-G/P.5 entitled, "Technical Shops Building Plumbing Plan – Area II," 16 February. Mercury, NV.

Norman Engineering Co. 1967b. As-Built Engineering Drawing NRDS-SF-G/C.2 entitled, "Technical Shops Building Plot Plan + Utilities Plan," 17 February. Mercury, NV.

Nutley, R., Space Nuclear Propulsion Office (retired). 2000. Record of Telecon with K. Willse (ITLV) regarding CAS 25-47-01, 18 September. Las Vegas, NV.

NRC, see U.S. Nuclear Regulatory Commission.

Paar, J.G., and Porterfield, D.R. 1997. *Evaluation of Radiochemical Data Usability*, April, ES/ER/MS-5.

PAI, see Paragon Analytics, Inc.

Paragon Analytics, Inc. 2000. *Laboratory Quality Manual*, Rev. 4. Fort Collins, CO.

Penwell, C., Reynolds Electrical & Engineering Company, Inc., retired. 1999. Record of Telecon with B. Bailey (IT) regarding CAU 165, CAS 25-07-06, 12 April. Las Vegas, NV.

Raytheon Services Nevada. 1995. *Radiological Effluents Released from Nuclear Rocket and Ramjet Engine Tests at the Nevada Test Site, 1959 through 1969, Fact Book*. Prepared for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV.

REECO, see Reynolds Electrical & Engineering Co., Inc.

Reynolds Electrical & Engineering Co., Inc. 1983a. Engineering Drawing 25-CP-C1.1 entitled, "Existing Water and Sewer Layout Control Point Area Plan," 21 March. Mercury, NV.

Reynolds Electrical & Engineering Co., Inc. 1983b. Engineering Drawing 25-E-MAD-C1.1 entitled, "Existing Water & Sewer Layout E-MAD Facility Plan," 28 July. Mercury, NV.

Reynolds Electrical & Engineering Co., Inc. 1984a. Engineering Drawing 25-ETS 1-C1 entitled, "Existing Water & Sewer Layout Engine Test Stand No. 1 (ETS#1) Plan," 14 February. Las Vegas, NV.

Reynolds Electrical & Engineering Co., Inc. 1984b. Engineering Drawing 25-E-MAD-C1.1 entitled, "Existing Water & Sewer Layout E- MAD Facility Plan," 06 January. Prepared for the U.S. Department of Energy. Mercury, NV: BN Archives and Records Center.

Reynolds Electrical & Engineering Co., Inc. 1984c. *Radiological Survey and Cleanup Project, 1974-1983*, Rev. 1, DOE/NV/103275. Prepared for the U.S. Department of Energy, Nevada Operations Office. Prepared by M.G. Miller. Las Vegas, NV.

Reynolds Electrical & Engineering Co., Inc. 1995. *Preliminary Characterization of Abandoned Septic Tank Systems*, Volume 1, December, DOE/NV/--414. Las Vegas, NV.

SNPO, see Space Nuclear Propulsion Office.

Soil Science Society of America. 1986. *Methods of Soil Analysis*, 2nd Edition, Part 1. Madison, WI.

Sorom, E., Reynolds Electrical & Engineering Company, Inc., retired. 1992. *Site Demarcation Program, Contaminated Areas Report*, 10 October. Las Vegas, NV.

Space Nuclear Propulsion Office. 1970. *NRDS Master Plan 1969-1970, Nuclear Rocket Development Station, Jackass Flats, Nevada*, CD:HFA:299. Las Vegas, NV: U.S. Atomic Energy Commission.

Speer, C.L., Science Applications International Corporation. 2001. Memorandum to R. McCall (SAIC) regarding radiological survey for CAU 165. Las Vegas, NV.

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

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

U.S. Army, see U.S. Army Laboratory Command.

U.S. Army Laboratory Command. 1989. *NUWAX-81: Army Radcon TEam Participation*, BRL-MR-3775. Ballistic Research Laboratory.

U.S. Atomic Energy Commission. 1961. *The Pluto Program*, UCRL-6398. Livermore, CA: University of California, Lawrence Radiation Laboratory.

U.S. Atomic Energy Commission. 1964. *Tory IIC Reactor Test Report*, UCRL-12069. Livermore, CA: University of California, Lawrence Radiation Laboratory.

USC, see *United States Code*.

U.S. Department of Energy. 1988a. *Environmental Survey Preliminary Report, Nevada Test Site, Mercury, Nevada*, DOE/EH/OEV-15-P. Washington, DC: Environment, Safety, and Health Office of Environmental Audit.

U.S. Department of Energy. 1988b. *Site Characterization Plan; Yucca Mountain Site, Nevada*, Vols. I-IX, DOE/RW-0199. Washington, DC.

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

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

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

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

U.S. Department of Energy, Nevada Operations Office. 1997. *Integrated Safety Management Policy*, DOE Order NV P 450.4. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1998. *Nevada Test Site Resource Management Plan*, DOE/NV-518. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1999. *Nevada Test Site Annual Site Environmental Report for Calender Year 1998*, DOE/NV-11718-361. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 2000a. *NV/YMP Radiological Control Manual*, Rev. 4, DOE/NV/11718-079, UC-702. Prepared by A.L. Gile of Bechtel Nevada. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 2000b. *Nevada Test Site Waste Acceptance Criteria*, DOE/NV-325, Rev. 3. Las Vegas, NV.

U.S. Department of Energy, Office of Civilian Radioactive Waste Management. 1999. *Draft Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada*, DOE/EIS-0250D. Las Vegas, NV.

- U.S. Department of Interior, Bureau of Land Management. 1990. *43 CFR Public Land Order 6802 Withdrawal of Public Land to Maintain the Physical Integrity of the Subsurface Environment, Yucca Mountain Project; Nevada*, 25 September, 55 FR 39152.
- U.S. Ecology and Atlan-Tech. 1991. *Environmental Monitoring Report for the Proposed Ward Valley, California, Low Level Radioactive Waste (LLRW) Facility*. Auburn, CA.
- U.S. Energy Research and Development Administration. 1977a. *Environmental Plutonium on Nevada Test Site and Environs, Interim Report of LFE Analytical Services for NAEG, NVO-171* (Page 275). Prepared by Major W. J., and Leventhal, L. for the U.S. Energy Research and Development Administration. Las Vegas, NV.
- U.S. Energy Research and Development Administration. 1977b. *Final Environmental Impact Statement, Nevada Test Site, Nye County, Nevada*, ERDA-1551. Washington, DC.
- U.S. Environmental Protection Agency. 1980. *Prescribed Procedures for Measurement of Radioactivity in Drinking Water*, EPA 600/4-80-032 (NTIS/PB80-224744; CD ROM; NEPIS/<http://www.epa.gov/cincl>). Washington, DC.
- U.S. Environmental Protection Agency. 1987. *Data Quality Objectives for Remedial Response Activities*, EPA/540/G-87/003. Washington, DC.
- U.S. Environmental Protection Agency. 1988a. *Contract Laboratory Program Statement of Work for Inorganic Analysis*, SOW No. 788, EPA/540/R-94/093. Washington, DC.
- U.S. Environmental Protection Agency. 1988b. *Contract Laboratory Program Statement of Work for Organic Analysis*, SOW No. 2/88, EPA/540/R-94/096. Washington, DC.
- U.S. Environmental Protection Agency. 1991. *Contract Laboratory Program Statement of Work for Organic Analysis*, OLMO 1.8, EPA/540/R-94/078. Washington, DC.
- U.S. Environmental Protection Agency. 1994a. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA/540/R-94/013. Washington, DC.
- U.S. Environmental Protection Agency. 1994b. *Contract Laboratory Program Statement of Work for Inorganic Analysis*, ILMO 3.0, EPA/540/R-94/076. Washington, DC.
- U.S. Environmental Protection Agency. 1994c. *Contract Laboratory Program Statement of Work for Organic Analysis*, OLMO 3.1, EPA/540/R-94/073. Washington, DC.
- U.S. Environmental Protection Agency. 1995. *Contract Laboratory Program Statement of Work for Inorganic Analysis*, ILMO 4.0, EPA/540/R-95/121. Washington, DC.

- U.S. Environmental Protection Agency. 1996. *Test Method for Evacuating Solid Waste Physical/Chemical Methods*, SW-846, 3rd Edition, CD-ROM PB97-501928GEI. Washington, DC.
- U.S. Environmental Protection Agency. 1997. *Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan) with Guidance*, Region IX. San Francisco, CA.
- U.S. Environmental Protection Agency. 1999. *Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA 540/R-99/008. Washington, DC.
- U.S. Environmental Protection Agency. 2000. Memorandum from S.J. Smucker to PRG table mailing list regarding *Region IX Preliminary Remediation Goals (PRGs)*, 1 August. San Francisco, CA.
- USGS, see U.S. Geological Survey.
- U.S. Geological Survey. 1993. *Water Levels in Continuously Monitored Wells in the Yucca Mountain Area, Nevada, 1985-88*, USGS-OFR-91-493. Prepared by R.R. Luckey, D.H. Lobmeyer, and D.J. Burkhardt.
- U.S. Geological Survey. 1995a. *Precipitation Data for Water Years 1992 and 1993 from a Network of Nonrecording Gages at Yucca Mountain, Nevada*, USGS-OFR-95-146. Prepared by D.S. Ambos, A.L. Flint, and J.A. Hevesi (U.S. Department of Energy, Nevada Operations Office).
- U.S. Geological Survey. 1995b. *Selected Ground-Water Data for Yucca Mountain Region, Southern Nevada and Eastern California, Calendar Year 1993*, USGS-OFR-95-158. Prepared by G.S. Hale, and C.L. Westenburg. Denver, CO.
- U.S. Nuclear Regulatory Commission. 1997. *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*, NUREG-1507. Washington, DC.
- van Genuchten, M. 1980. "A Closed Form Equation for Predicting the Hydraulic Conductivity of Unsaturated Soils." In *Soil Science Society of America Journal*, 44: 892-898. Madison, WI.

Appendix A

Data Quality Objectives

A.1.0 Seven-Step DQO Process for Phase I Investigations

The DQO process is a strategic planning approach based on the scientific method that is used to prepare for site characterization data collection. The DQOs are designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and technically defend potentially viable corrective actions (i.e., no further action, close in place, or clean closure). The CAU 165 investigation will be based on DQOs developed by representatives from NDEP and NNSA/NV.

Eight CASs comprise CAU 165. Six of the sites are located within Area 25 and two of the sites are located in Area 26 of the NTS. The eight CASs are:

- CAS 25-20-01, Lab Drain Dry Well
- CAS 25-51-02, Dry Well
- CAS 25-59-01, Septic System
- CAS 26-59-01, Septic System
- CAS 25-07-06, Train Decontamination Area
- CAS 25-07-07, Vehicle Washdown
- CAS 26-07-01, Vehicle Washdown Station
- CAS 25-47-01, Reservoir and French Drain

This section presents the seven-step DQO process for a Phase I investigation. All CASs will begin with a Phase I investigation. If a COPC is detected at concentrations above PALs, the COPC will be identified as a COC. If COCs are identified, the CAS containing that COC will undergo a Phase II investigation as presented in [Section A.2.0](#).

A.1.1 Step 1 - State the Problem

Step 1 defines the problem that has initiated the CAU 165 site investigation. This step identifies the DQO planning team members, describes the problem(s), and develops conceptual site models.

A.1.1.1 Planning Team Members

The DQO planning team consists of representatives from NDEP, NNSA/NV, ITLV, and Bechtel Nevada (BN). The primary decision makers include NNSA/NV and NDEP representatives.

Table A.1-1 lists the representatives from each organization in attendance for the August 22, 2001, DQO Kickoff meeting.

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

Participant	Affiliation	Meeting Held On
		08/22/2001
Steve Adams	ITLV	X
Stacey Alderson	ITLV	X
Jim Bolden	ITLV	X
Sabine Curtis	NNSA/NV	X
Syl Hersh	ITLV	X
Joe Hutchinson	ITLV	X
Brad Jackson	BN	X
R. Lynn Kidman	ITLV	X
Michael Kruzic	BN	X
Linda Linden	ITLV	X
Bob McCall	ITLV	X
Barbara Quinn	ITLV	X
Greg Raab	NDEP	X
Julie Snelling-Young	ITLV	X
Dustin Wilson	ITLV	X

BN - Bechtel Nevada
NNSA/NV - National Nuclear Security Administration Nevada Operations Office
ITLV - IT Corporation, Las Vegas Office
NDEP - Nevada Division of Environmental Protection
X - Denotes meeting attendance

A.1.1.2 Describe the Problem

Corrective Action Unit 165 is being investigated because hazardous and/or radioactive constituents may be present at concentrations and locations that could potentially pose a threat to human health and the environment.

A.1.1.3 Develop Conceptual Site Models

Conceptual Site Models describe the most probable scenario for current conditions at a site and define the assumptions that are the basis for identifying appropriate sampling strategy and data collection methods. An accurate CSM is important as it serves as the basis for all subsequent inputs and decisions throughout the DQO process.

An important element of a CSM is the expected fate and transport of contaminants which infer how contaminants move through site media and where they can be expected to be found in the environment. The expected fate and transport is based on distinguishing physical characteristics of the contaminants and media. Contaminant characteristics include solubility, density, and particle size. Media characteristics include permeability, saturation, sorting, chemical composition, and adsorption coefficients. In general, contaminants with low solubility and high density can be expected to be found relatively close to release points. Contaminants with high solubility and low density can be expected to be found further from release points or in areas where settling may occur.

Based on the following information, groundwater contamination is not considered a likely scenario at CAU 165. Depth to groundwater at Area 25 is approximately 1,040 ft bgs, as measured in Well #J-11 in 1993 (USGS, 1993). A perched water table occurs throughout most of Area 26 with static water levels ranging from 81 to 167 ft bgs. The regional water table, is assumed to be at 1,700 ft bgs in Area 26 (Johnson and Ege, 1964).

Three CSMs have been developed for CAU 165 using historical background information, knowledge from studies at similar sites, and data from previous sampling efforts. The three CSMs include:

- Dry Well/Septic System
- Decontamination Pad
- Reservoir

Sections [A.1.1.3.1](#) through [A.1.1.3.3](#) develop and discuss these three CSMs.

A.1.1.3.1 Dry Well/Septic System Conceptual Site Model

The following CASs are included in the Dry Well/Septic System CSM:

- CAS 25-20-01, Lab Drain Dry Well (located in the CSA)
- CAS 25-51-02, Dry Well (ETS-1)
- CAS 25-59-01, Septic System (E-MAD)
- CAS 26-59-01, Septic System (Pluto)

At each site, effluent was discharged from source features (e.g., drains, lavatories) and routed through piping to an underground dispersion structure (i.e., dry well, cesspool, or leachfield), which allowed effluent to percolate into underlying soil for disposal. The septic systems are consistent with the general CSM described in the *Work Plan for Leachfield Corrective Action Units: Nevada Test Site and Tonopah Test Range, Nevada* (DOE/NV, 1998). Significant differences include the lack of distribution boxes and the presence of a cesspool instead of a leachfield at CAS 25-59-01.

Figure A.1-1 shows a generalized representation of the Dry Well/Septic System CSM and the following text provides additional detail to supplement the model.

COPCs/Released Material

CAS 25-20-01, Lab Drain Dry Well: Process knowledge indicates that the Dry Well may have received chemical effluent and was not part of a domestic sewage system (Norman Engineering Co., 1967). Specific chemical compounds in the effluent are unknown. According to engineering drawings, sources included three sinks associated with fume hoods and two floor drains. The sinks are located in the Chemical Analysis Room (207) and the Particulate Analysis Room (211). The floor drains are located in the Valve Test and Maintenance Shop Room (217) (Norman Engineering Co., 1967). There is sufficient process knowledge to indicate that radiological COPCs were not introduced into the system (Alderson, 2001).

CAS 25-51-02, Dry Well: Potentially released materials include sulfuric acid and sodium hydroxide (Aetron, 1963). There is sufficient process knowledge to indicate that radiological COPCs were not introduced into the system (Alderson, 2001).

Figure A.1-1
Dry Well/Septic System Conceptual Model

CAS 25-59-01, Septic System: No chemical or radiological COPCs have been confirmed for this CAS. The system was designed to receive domestic sewage only. Although unlikely, there is a potential that some radiological and/or chemical compounds may have been introduced into the system through the sinks in the restroom.

CAS 26-59-01, Septic System: The system was designed to receive domestic sewage only. Although unlikely, there is a potential that unidentified chemical COPCs may have been introduced into the system via the service sink. There is sufficient process knowledge to indicate that radiological COPCs were not introduced into the system (Alderson, 2001).

Affected Media

Affected media includes system components (i.e., dry wells, septic tanks, cesspool, leachfield, leachrock, associated piping), content of septic tanks and residual material in pipes (if present), and subsurface soil surrounding system components.

Location of Contamination/Release

All the CASs in this CSM have a leachrock/native soil interface which is the most likely place to find soil contamination. Both dry wells and the cesspool are single, point-source releases. Any contaminants at these CASs, regardless of physical or chemical characteristics, are expected directly beneath these structures.

The leachfield has multiple distribution lines. If present, soluble contaminants are expected in the distal areas of the leachfield; insoluble and large-particle contaminants are expected in the proximal areas.

All designed releases are subsurface and there is no evidence of surface soil staining at any of the CASs; therefore, surface contamination is not expected.

If contaminants were discharged to these systems, contaminants may be present in the septic tanks of CASs 25-59-01 and 26-59-01. Any residual material remaining in piping may also contain contaminants.

Transport Mechanisms

Contaminants may have been transported by the release of effluent into the systems which served as the driving force for downward migration of contaminants; however, the systems are no longer active. Infiltration from precipitation may be a minor transport mechanism since one of the dry wells and the leachfield are unconfined at the surface.

Preferential Pathways

Preferential pathways at the CASs are expected to be limited to typical vertical migration due to gravity.

Lateral and Vertical Extent of Contamination

Contamination, if present, is expected to be contiguous to the site. Concentrations are expected to decrease with distance and depth from the dry wells, cesspool, and leachfield.

Groundwater contamination is not considered a likely scenario at CAU 165. A perched aquifer is postulated throughout Area 26 from 81 to 167 ft bgs (Johnson and Ege, 1964). Depth to groundwater at Area 25 is approximately 1,040 ft bgs, as measured in Well #J-11 in 1993 (USGS, 1993) and in Area 26, the regional water table is assumed to be at 1,700 ft bgs (Johnson and Ege, 1964).

A.1.1.3.2 Decontamination Pad Conceptual Site Model

The following CASs are included in the Decontamination Pad CSM:

- CAS 25-07-06, Train Decontamination Area (located at E-MAD)
- CAS 25-07-07, Vehicle Washdown (RCP)
- CAS 26-07-01, Vehicle Washdown Station (Pluto)

At each decontamination pad, various equipment was washed and effluent was discharged to collection points via piping or direct surface flow. Unless discharged to another system, effluent would have percolated into nearby soil.

Figure A.1-2 shows a generalized representation of the CSM, and the following text provides additional detail to supplement the model.

Figure A.1-2
Decontamination Pad Conceptual Model

COPCs/Released Material

CAS 25-07-06, Train Decontamination Area: Chemical COPCs include solvents, degreasers, Freon-10, alcohol, diluted acid, Turco decontamination solvent, unknown chemical cleaners, diesel fuel, PCBs, motor oil, and heavy metals (Garey, 1997 and 1999; LASL, 1970; Penwell, 1999). Radiological COPCs include: Co-60, Sr-90, Y-90, Nb-94, Cs-137, Ba-137m, Eu-152, Eu-154, Eu-155, U-234, U-235, U-238, Pu-238, Pu-239/240, and Am-241 (Alderson, 2001).

CAS 25-07-07, Vehicle Washdown: Chemical COPCs include detergents and Freon-10 (Garey, 2000). Beryllium associated with the TNT excursion may also be present. Radiological COPCs include: Co-60, Sr-90, Y-90, Nb-94, Cs-137, Ba-137m, Eu-152, Eu-154, Eu-155, U-234, U-235, U-238, Pu-238, Pu-239/240, and Am-241 (Alderson, 2001). Due to the presence of the utility drain pad connection near one of the trailer pads, COPCs associated with domestic sewage may also be present.

CAS 26-07-01, Vehicle Washdown Station: Chemical COPCs include unidentified solvents and cleaning chemicals. Beryllium associated with the Tory Reactor may also be present. Radiological COPCs include: Co-60, Sr-90, Y-90, Nb-94, Cs-137, Ba-137m, Eu-152, Eu-154, Eu-155, U-234, U-235, U-238, Pu-238, Pu-239/240, and Am-241 (Alderson, 2001).

Affected Media

Affected media includes concrete decontamination pads, waste lines, residual material in pipes, surrounding surface and subsurface soil, the awning and related hardware at CAS 26-07-01, and sump gravel at CAS 25-07-07.

Location of Contamination/Release

Contamination may be present on the decontamination pads, in surrounding surface and subsurface soil, in and on piping, and in the gravel sump at CAS 25-07-07.

Contamination on the decontamination pads at CAS 25-07-06 and CAS 26-07-01 may be scattered or may be concentrated around the floor drains. The pad at CAS 25-07-07 does not have a floor drain

and appears to be flat (i.e., no grade). Thus contamination, if present, is expected to be scattered and no biasing factors exist to concentrate contamination at any given location.

If present at CAS 25-07-07, insoluble, heavy, and/or large-particle COPCs are expected in the soil between the pad and the gravel sump. Contamination, if present, in the gravel sump is expected at the gravel/native soil interface at the proximal end, closest to the decontamination pad, and under the perforated pipe in the sump.

Transport Mechanisms

The discharge of effluent through the systems was the primary transport mechanism; however, the systems are no longer active. Infiltration from precipitation may be a minor mechanism, either by moving contaminants deeper into surrounding soil or by moving contaminants through open floor drains into associated collection or dispersion points. Runoff may be a minor transport mechanism, moving surface contamination to low-lying areas adjacent to the site.

Preferential Pathways

Preferential pathways at the CASs are expected to be limited to typical vertical migration due to gravity.

Lateral and Vertical Extent of Contamination

Contamination is expected to be mostly confined to the decontamination pads, adjacent soil, or in the case of CAS 25-07-07, to the gravel sump. Any contamination should be contiguous to the site, and concentrations are expected to decrease with distance and depth from the source.

The decontamination pads at CAS 25-07-06 and CAS 26-07-01 were constructed with concrete berms to contain effluent. As a result of these designs, contamination is expected to be minimal in surrounding soils. The decontamination pad at CAS 25-07-07 was constructed to direct effluent from the pad to the sump via surface flow; therefore, soil between the pad and the sump may be contaminated.

Groundwater contamination is not considered a likely scenario at CAU 165. A perched aquifer is postulated throughout Area 26 from 81 to 167 ft bgs (Johnson and Ege, 1964). Depth to groundwater at Area 25 is approximately 1,040 ft bgs, as measured in Well #J-11 in 1993 (USGS, 1993) and in Area 26, the regional water table is assumed to be at 1,700 ft bgs (Johnson and Ege, 1964).

A.1.1.3.3 Reservoir Conceptual Site Model

CAS 25-47-01, Reservoir and French Drain, is included in the Reservoir CSM.

Effluent was apparently discharged to the reservoir via an unlined, earthen drain as overflow from or during construction of a nearby septic system. Contaminants may have percolated into underlying soil.

Figure A.1-3 shows a generalized representation of the CSM and the following text provides additional detail to supplement the model.

COPCs/Released Material

There is uncertainty regarding COPCs due to the limited knowledge of the site. Chemical COPCs inferred from those identified in the nearby septic system septic tank include barium, VOCs, SVOCs, TPH-DRO, and PCBs (Nutley, 2000; REEC Co, 1995). Radiological COPCs may include Pu-238 and Pu-239/240 (Alderson, 2001).

Affected Media

Affected media include soil within and surrounding the historical boundaries of the reservoir and earthen drain.

Location of Contamination/Release

Contamination, if present, is most likely in soil at the base of the reservoir. It is possible that an organic or sludge layer may be present at or near the base of the reservoir.

Since the reservoir has been backfilled, contamination is unlikely. However, contamination is possible in the soil adjacent to and above the reservoir base. If present, insoluble, heavy, and/or

Figure A.1-3
Reservoir Conceptual Model

large-particle COPCs can be expected at the proximal end of the earthen drain. If present, any soluble COPCs can be expected anywhere within the reservoir.

Transport Mechanisms

The discharge of effluent into the reservoir and earthen drain was the primary transport mechanism; however, the reservoir has been backfilled. Infiltration from precipitation may be a minor transport mechanism moving contaminants deeper into surrounding soil.

Preferential Pathways

Preferential pathways at the CASs are expected to be limited to typical vertical migration due to gravity.

Lateral and Vertical Extent of Contamination

In general, contamination is expected to be contiguous to the historical boundaries of the reservoir and earthen drain. There is no evidence that the reservoir overflowed its banks; therefore, contamination outside the physical boundary along the surface edges of the site is considered unlikely. If present, surface contamination concentrations are expected to decrease outward from the edges of the reservoir. Concentrations of contamination are expected to decrease with depth from the reservoir base/native soil interface.

A.1.2 Step 2 - Identify the Decision

This step develops a decision statement and defines alternative actions. [Figure A.1-4](#) is a flow chart which identifies decisions and alternative actions appropriate for a Phase I investigation.

A.1.2.1 Develop a Decision Statement

The decision statement for a Phase I investigation is “Determine if a COC is present.”

Figure A.1-4
Decision Diagram for Investigation

A.1.2.2 Alternative Actions to the Decision

If a COC is not present, further assessment of the CAS is not required. If a COC is present, initiate a Phase II investigation.

A.1.3 Step 3 - Identify the Inputs to the Decision

This step identifies the information needed, determines sources for information, determines the basis for establishing the action level, and identifies sampling and analysis methods that can meet the data requirements.

A.1.3.1 Information Needs and Information Sources

In order to determine if a COC is present at a particular CAS, sample data must be collected and analyzed following these two criteria: (1) samples must be collected in areas most likely to be contaminated, and (2) the analytical suite selected must be sufficient to detect any contamination present in the samples. Biasing factors to support these criterion include:

- Documented process knowledge on source and location of release
- Field observations
- Radiological surveys
- Historical sample results
- Experience and data from investigations of similar sites
- Professional judgement

Table A.1-2 lists the information needs, the source of information for each need, and the proposed methods to collect the data. The last column addresses the QA/QC data type and associated metric. The data type is determined by the intended use of the resulting data in decision making. Data types are discussed below.

Quantitative Data

Quantitative data measures the quantity or amount of a characteristic or component within the population of interest. These data require the highest level of QA/QC in collection and measurement systems because the intended use of the data is to resolve primary decisions (i.e., rejecting or

**Table A.1-2
Information Needs to Resolve the Phase I Decision**

Information Need	Information Source	Collection Method	Data Type/Metric
Decision: Determine if a COC is present. Criteria 1: Samples will be collected in areas most likely to be contaminated.			
Source and location of release points	Process knowledge and previous investigations of similar sites	Information documented in CSM and public reports - no additional data needed	Qualitative - CSM has not been shown to be inaccurate
	Site visit and field observations	Conduct site visits and document field observations	Qualitative - CSM has not been shown to be inaccurate
	Radiological surveys	Perform radiological surveys using appropriate methods	Semiquantitative - Sampling based on biasing criteria stipulated in DQO Step 7
Decision: Determine if a COC is present. Criteria 2: Analyses must be sufficient to detect contamination in samples.			
Identification of all potential contaminants	Process knowledge and previous investigations of similar sites; a full suite of analyses will be utilized	Information documented in CSM and public reports - no additional data needed	Qualitative - CSM has not been shown to be inaccurate
Analytical results	Data packages of biased samples	Appropriate sampling techniques and approved analytical methods will be used	Quantitative - Validated analytical results will be compared to PALs

accepting the null hypothesis) and/or verifying closure standards have been met. Laboratory analytical data are generally considered quantitative.

Semiquantitative Data

Semiquantitative data indirectly measures the quantity or amount of a characteristic or component of interest. Inferences are drawn about the quantity or amount of a characteristic or component because a correlation has been shown to exist between the indirect measurement and the results from a quantitative measurement. The QA/QC requirements on semiquantitative collection and measurement systems are high but may not be as rigorous as a quantitative measurement system. Semiquantitative data contribute to decision making but are not used alone to resolve primary decisions. Field-screening data are generally considered semiquantitative.

Qualitative Data

Qualitative data identifies or describes the characteristics or components of the population of interest. The QA/QC requirements are the least rigorous on data collection methods and measurement systems. The intended use of the data is for information purposes, to refine conceptual models, and guide investigations rather than resolve primary decisions. This measurement of quality is typically assigned to historical information and data where QA/QC may be highly variable or not known. Professional judgement is often used to generate qualitative data.

Metrics provide a tool to determine if the collected data support decision making as intended. Metrics tend to be numerical for quantitative and semiquantitative data, and descriptive for qualitative data.

A.1.3.2 Determine the Basis for Preliminary Action Levels

Site workers may be exposed to contaminants through oral ingestion, inhalation, or dermal contact (absorption) of septage and soil during disturbance of these medias.

Laboratory analytical results for septage and soils will be compared to the following PALs to evaluate if COPCs are present at levels that may pose an unacceptable risk to human health and/or the environment:

- *EPA Region 9 Risk-Based Preliminary Remediation Goals for Industrial Soils* (EPA, 2000)
- Background concentrations for RCRA metals when natural background exceeds the PRG, as is often the case with arsenic; background is considered the mean plus two times the standard deviation of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nellis Air Force Range (NBMG, 1998; Moore, 1999)
- The TPH action limit of 100 ppm per the *Nevada Administrative Code* (NAC) 445A.2272 (NAC, 1999)
- The PALs for radionuclides are isotope-specific and defined as the maximum concentration for that isotope found in samples from undisturbed background locations in the vicinity of the NTS (McArthur and Miller, 1989; Atlan-Tech, 1992; Black and Townsend, 1996)

For COPCs without established PRGs, a similar protocol as EPA Region 9 will be used in establishing an action level, if necessary.

Solid media such as concrete and/or structures may only pose a potential radiological exposure risk to site workers. Surface radiological surveys of the solid media will be compared to the free-release criteria, as defined in the *NV/YMP Radiological Control Manual* (DOE/NV, 2000) (i.e., 1,000 dpm/100 cm² for removable surface contamination) to evaluate if COPCs are present at levels that may pose an unacceptable risk to human health and/or the environment.

A.1.3.3 Potential Sampling Techniques and Appropriate Analytical Methods

Excavation, drilling, direct push, scoop and trowel, or other appropriate sampling methods will be used. Sample collection and handling activities will follow standard procedures.

The Industrial Sites QAPP (DOE/NV, 1996), unless otherwise stipulated in the CAIP, provides analytical methods and laboratory requirements (e.g., detection limits, precision and accuracy requirements, minimum sample volume). Specific analyses required for the disposal of IDW are identified in [Section 5.0](#) of this CAIP.

To assure that laboratory analyses are sufficient to detect contamination in soil/septage samples at concentrations exceeding the MRL, Phase I chemical and radiological parameters of interest have been selected for each CAS. Solid media (i.e., concrete) will not be analyzed for chemical or radiological parameters by a laboratory during Phase I. For each CAS, the chemical parameters for soil/septage include:

- Total VOCs
- Total SVOCs
- PCBs
- TPH (DRO and GRO)
- Total RCRA metals
- Beryllium (CAS 26-07-01 and 25-07-07 only)
- pH (CAS 25-51-02 only)

Radiological parameters for each CAS include:

- Isotopic uranium
- Isotopic plutonium
- Strontium-90
- Gamma-emitting radionuclides

A.1.4 Step 4 - Define the Boundaries of the Study

The purpose of this step is to define the target population of interest, specify the spatial and temporal features of that population that are pertinent for decision making, determine practical constraints on data collection, and define the scale of decision making relevant to target populations.

A.1.4.1 Define the Target Population

The Phase I investigation target populations for each CAS are shown in [Table A.1-3](#). These target populations represent locations within the system that will encounter contamination, if present. Media containing rodent excreta will not be collected because it cannot be analyzed by the laboratory due to the potential for Hanta Virus exposure and is not representative of sediment associated with effluent discharge. Additional target populations may also be sampled during a Phase I investigation, at the discretion of the Site Supervisor. While these samples may not directly support Phase I decision making, they will be used if a CAS is elevated to a Phase II investigation.

A.1.4.2 Identify Spatial and Temporal Boundaries

The spatial boundaries that apply to each CAS in a Phase I investigation are the sample locations selected for Phase I sampling.

Temporal boundaries are those time constraints set up by weather conditions and project schedules. Weather conditions in Area 25 and Area 26 are generally tolerable year-round and will not significantly impact investigation activities. There are no time constraints on collecting samples as environmental conditions at all sites will not significantly change in the near future, and conditions would have stabilized over the years since the systems were last used.

A.1.4.3 Identify Practical Constraints

Activities on the NTS which are controlled may affect the ability to characterize this site, especially activities at the Reactor Control Point and Engine Test Stand where the investigation cannot be conducted from February through April. Underground utilities are expected to exist at some of the sites which may limit intrusive sampling locations, and adverse weather conditions may delay the investigation of this CAU. Access to CAS 26-07-01 is limited by lack of roads and may impact

**Table A.1-3
Target Populations for Phase I Investigations**

CAS	Target Population
25-20-01 Lab Drain Dry Well	COC concentrations in soil at leachrock/native soil interface in Dry Well COC concentrations in residual material in collection system pipe, if present
25-51-02 Dry Well	COC concentrations in soil at leachrock/native soil interface in Dry Well COC concentrations in residual material in collection system pipe, if present
25-59-01 Septic System	COC concentrations in soil at leachrock/native soil interface in cesspool COC concentrations in septic tank contents, if present COC concentrations in soil beneath the inlet and outlet pipes at septic tank base COC concentrations in residual material in collection system pipe, if present
26-59-01 Septic System	COC concentrations in soil at leachrock/native soil interface underlying distribution pipes at the proximal and distal ends of leachfield COC concentrations in septic tank contents, if present COC concentrations in soil beneath the inlet and outlet pipes at septic tank base COC concentrations in residual material in collection system pipe, if present
25-07-06 Train Decontamination Area	COC concentrations in surface concrete from decontamination pad COC concentrations in surface soil around the decontamination pad COC concentrations in residual material in pipe, if present
25-07-07 Vehicle Washdown	COC concentrations in surface soil between decontamination pad and sump COC concentrations in surface soil around the decontamination pad COC concentrations in soil at leachrock/native soil interface in sump COC concentrations in surface concrete from decontamination pad COC concentrations in residual material in pipe, if present
26-07-01 Vehicle Washdown Station	COC concentrations in surface concrete from decontamination pad COC concentrations in surface soil around the decontamination pad COC concentrations in interior side walls of transite awning
25-47-01 Reservoir and French Drain	COC concentrations in soil at reservoir and earthen drain base/native soil interface

investigation activities. The presence of the Manned Control Car in CAS 25-07-06 may hinder the investigation of that CAS. At CAS 25-59-01, the effluent chamber of the septic tank may have limited access minimizing the sample collection opportunities.

A.1.4.4 Define the Scale of Decision Making

The scale of decision making in a Phase I investigation is defined as the CAS.

A.1.5 Step 5 - Develop a Decision Rule

This step integrates outputs from previous steps with the inputs developed in this step into a decision rule (“*If...then...*”) statement. This rule describes the conditions under which possible alternative actions would be chosen.

A.1.5.1 Specify the Population Parameter

Because the sampling in Phase I is biased towards worst-case concentrations, the population parameter will be the maximum observed concentration of each COC within the target population(s).

A.1.5.2 Choose an Action Level

Action levels are defined in [Section A.1.3.2](#).

A.1.5.3 Measurement and Analysis Methods

The measurement and analysis methods in the Industrial Sites QAPP are capable of achieving the expected range of values. The detection limit of the measurement method to be used is less than the PAL for each COPC unless specified otherwise in the CAIP. See [Section A.1.3.3](#) for additional details.

A.1.5.4 Decision Rule

If the concentration of any COPC in a target population exceeds the PAL for that COPC, then that COPC is identified as a COC and a Phase II investigation will be conducted. If the COPC concentration is less than the PAL, then the decision will be no further corrective action.

A.1.6 Step 6 - Specify Tolerable Limits on Decision Errors

The sampling approach for the Phase I investigation relies on biased sampling locations such as knowing the location of contaminant release; therefore, random sample locations are not considered. Only validated analytical results (quantitative data) will be used to determine if COCs are present.

The baseline condition (i.e., null hypothesis) and alternative condition for the Phase I investigation are as follows:

- Baseline condition - A COC is present
- Alternative condition - A COC is not present

A.1.6.1 False Rejection Decision Error

The false rejection (alpha error) would mean deciding that a COC is not present when it really is, increasing risk to human health and the environment.

A false rejection decision error (where consequences are more severe) is controlled by meeting these criterion: (1) having a high degree of confidence that the sample locations selected will identify COCs if present anywhere within the CAS; and (2) having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.

To satisfy the first criteria, Phase I samples will be collected in areas most likely to be contaminated. To accomplish this, the following characteristics are considered:

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

These characteristics were considered during the development of the CSMs. The biasing factors listed in [Section A.1.3.1](#) will be used to further ensure that the first criteria is met.

To satisfy the second criteria, all Phase I samples will be analyzed for the chemical and radiological parameters listed in [Section A.1.3.3](#). Strict adherence to established procedures and QA/QC protocol protects against false negatives.

A.1.6.2 False Acceptance Decision Error

The false acceptance (beta error) would mean accepting that a COC is present when it is not, resulting in increased costs for unnecessary characterization.

The false acceptance decision error is controlled by protecting against false positive analytical results. False positive results are typically attributed to laboratory and/or sampling/handling errors. Quality assurance/quality control samples such as field blanks, trip blanks, laboratory control samples, and method blanks minimize the risk of a false positive analytical result. Other measures include proper decontamination of sampling equipment and using certified clean sample containers to avoid cross contamination.

A.1.6.3 Quality Assurance/Quality Control

Quality control samples will be collected as required by established procedures. The required QC samples include:

- Trip blanks (1 per sample cooler containing VOC environmental samples)
- Equipment blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per source lot per sampling event)
- Field duplicates (1 per matrix per 20 environmental samples)
- Matrix spike/matrix spike duplicate (1 per matrix per 20 environmental samples)
- Field blanks (1 per 20 environmental samples or 1 per sampling day, whichever best exemplifies field conditions)

Additional QC samples may be submitted based on site conditions.

Data quality indicators of precision, accuracy, comparability, completeness, and representativeness are defined in the Industrial Sites QAPP. In addition, sensitivity has been included as a DQI for laboratory analyses. Site-specific DQIs are discussed in detail in [Section 6.0](#) of the CAIP.

A.1.7 Step 7 - Optimize the Design for Obtaining Data

Biased sampling will be conducted at CAU 165 during Phase I investigations. Biased sampling locations are determined based on biasing factors listed in [Section A.1.3.1](#). The Site Supervisor has the discretion to modify these locations but only if the modified locations meet the decision needs and criteria stipulated in [Section A.1.3](#).

The following sections provide CAS-specific Phase I investigation activities.

A.1.7.1 CAS 25-20-01, Lab Drain Dry Well

Phase I activities at this CAS will consist of collecting biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities are minimal at this CAS and there is no surface debris.

A soil sample will be collected from the Dry Well at the leachrock/native soil interface and at 2.5 ft below the interface. The contents of the collection system pipe will be sampled if appropriate, accessible, and adequate media is present. Sample locations may include any engineered access points (e.g., manholes) or excavations at the nominal midpoint of the pipe. Excavation is the preferred method of soil sample collection but drilling, direct push, or hand augering may also be used, as appropriate.

A.1.7.2 CAS 25-51-02, Dry Well

Phase I activities at this CAS will consist of confirming the configuration of the Dry Well and associated piping and collecting biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities are minimal at this CAS and there is no surface debris.

A backhoe excavation will be made near the presumed location of the Dry Well based on coordinates from the geophysical survey and field observations. The excavation will attempt to locate the distal end of the collection system pipe and confirm the presence of the Dry Well. If this excavation does not locate the end of the line, additional excavations will be made to locate the Dry Well. Once the Dry Well is located, soil samples will be collected at the leachrock/native soil interface and at 2.5 ft below the interface.

Excavation is the preferred method of soil sample collection but drilling, direct push, or hand augering may also be used, as appropriate.

The contents of the collection system pipes will be sampled if appropriate, accessible, and adequate media is present. Sample locations may include any engineered access points (e.g., manholes) or excavations at the nominal midpoint of the pipe.

If necessary, a backhoe excavation will be made between the charcoal adsorber furnace pad and the main waste line to confirm the presence or absence of a waste line at that location.

A.1.7.3 CAS 25-59-01, Septic System

Phase I activities at this CAS will consist of collecting biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities are minimal at this CAS and there is no surface debris.

The septic tank manhole cover will be removed. Both chambers of the septic tank will be inspected for any contents. The contents will be sampled if appropriate, accessible, and adequate media is present. Soil samples will be collected beneath the septic tank inlet and outlet pipes at the base of the septic tanks as determined by engineering drawings. The contents of the collection system pipe will be sampled if appropriate, accessible, and adequate media is present. Sample locations may include any engineered access points (e.g., manholes) or excavations at a nominal midpoint of the pipe.

A soil sample will be collected from the cesspool at the interface of the leachrock/native soil interface and at 2.5 ft below the interface. Hand augering is the preferred soil sample collection method but drilling or direct push may be used, as appropriate.

A.1.7.4 CAS 26-59-01, Septic System

Phase I activities at this CAS will consist of locating the leachfield distribution pipes by excavation and collecting biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities are minimal at this CAS and there is minimal surface debris (i.e., wood). Surface debris will be removed for proper disposal by the NTS M&O contractor prior to the investigation.

The septic tank manhole cover will be removed and the septic tank will be inspected for contents. The contents will be sampled if appropriate, accessible, and adequate media is present. Soil samples will be collected beneath the septic tank inlet and outlet pipes at the base of the septic tanks as determined by engineering drawings. The contents of the collection system pipe will be sampled if appropriate, accessible, and adequate media is present. Sample locations may include any engineered access points (e.g., manholes) or excavations at a nominal midpoint of the pipe.

Excavations and visual inspections will be made in the leachfield to locate the distribution pipes.

Soil samples will be collected beneath the proximal end of the first identified designed release point (closest to the septic tank) and the distal end of the last identified distribution pipe (furthest from the septic tank). Samples will be collected at the leachrock/native soil interface and 2.5 ft below the interface at these locations. If a leachrock/native soil interface is not identified, samples will be collected directly beneath the distribution pipes and at 2.5 ft beneath the pipes. Excavation is the preferred soil sample collection method but direct push, drilling, or hand augering may be used, as appropriate.

A.1.7.5 CAS 25-07-06, Train Decontamination Area

The Phase I investigation at this CAS will consist of conducting a surface radiological survey and collecting data and/or biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities will include surface debris removal for proper disposal by the NTS M&O contractor prior to the investigation. The Manned Control Car, currently parked on the pad, is not considered part of this CAS and will be removed by the NTS M&O contractor prior to the investigation.

The design of this site focuses on decontamination of radiological-impacted media; therefore, chemical COPCs are assumed to be incidental and collocated with radiation. As such, radiological surveys that detect radiological contamination are appropriate tools to locate any contaminants that may be present.

A radiological surface survey of the decontamination pad and adjacent surface soil (out to 15 ft laterally) will be conducted to identify radiological hotspots. A hotspot on the decontamination pad will be defined as any reading exceeding 1,000 dpm/100 cm² over background. If hotspots are identified on the pad, samples may be collected at those locations for waste determination purposes. The Site Supervisor has the discretion of selecting sample locations that best represent potential contamination.

If residual material in pipes is observed, it will be sampled if appropriate, accessible, and adequate media is present.

Based on a recent surface radiological survey, a minimum of four surface soil samples will be collected around the decontamination pad at identified hotspots. The Site Supervisor has the discretion of modifying or replacing these locations based on results of the planned radiological walkover survey. The scoop and trowel method will be used to collect soil samples.

A.1.7.6 CAS 25-07-07, Vehicle Washdown

The Phase I investigation at this CAS will consist of conducting a surface radiological survey, and collecting data and/or biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities are minimal at this CAS and there is limited surface debris. Surface debris will be removed for proper disposal by the NTS M&O contractor prior to the investigation.

A recent radiological walkover survey identified potential radiological activity above background in the borrow pit adjacent to the northeast corner of the site. However, the borrow pit is geographically distinct from the site, is not considered part of this CAS, and will not be investigated.

A radiological survey of the decontamination pad and adjacent surface soil (out to 15 ft laterally) will be conducted to identify radiological hotspots. A hotspot on the decontamination pad will be defined as any reading exceeding 1,000 dpm/100 cm² over background. If hotspots are identified on the pad, samples may be collected at those locations for waste determination purposes. The Site Supervisor has the discretion of selecting sample locations that best represent potential contamination.

A minimum of three surface soil samples will be collected adjacent to the edge of the decontamination pad (one from the east, west, and south sides). The Site Supervisor has the discretion of modifying or replacing these locations based on results of the planned radiological survey.

Two surface soil samples will be collected from the north side of the decontamination pad between the pad and the sump at locations selected by the Site Supervisor.

An excavation will be made at the proximal side of the sump nearest the decontamination pad to locate the sewage distribution pipe and identify the base of the leachrock. A minimum of one sample location will be selected in the vicinity of the pipe and two discrete samples will be collected: one

sample at the leachrock/native soil interface and one sample at 2.5 ft below the interface. If residual material is observed in the pipe, it will be sampled if appropriate, accessible, and adequate media is present.

Scoop and trowel and excavation are the preferred soil sample collection methods, but other methods may be used, as appropriate.

A.1.7.7 CAS 26-07-01, Vehicle Washdown Station

The Phase I investigation at this CAS will consist of conducting a surface radiological survey, and collecting biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities are minimal at this CAS and there is limited surface debris. Surface debris will be removed for proper disposal by the NTS M&O contractor prior to the investigation.

The awning over the east side of the decontamination pad will not be removed. There may be limited access to this site; therefore, all investigative activities may be conducted by hand.

A radiological survey of the decontamination pad, interior walls of the transite awning, and adjacent surface soil (out to 15 ft laterally) will be conducted to identify radiological hotspots. A hotspot on the decontamination pad and awning will be defined as any reading exceeding 1,000 dpm/100 cm² over background. If hotspots are identified on the pad or awning, samples may be collected at those locations for waste determination purposes. The Site Supervisor has the discretion of selecting sample locations that best represent potential contamination.

A minimum of four surface soil samples will be collected around the decontamination pad, one sample per side adjacent to the edge of the pad. The Site Supervisor has the discretion of modifying or replacing these locations based on results of the planned radiological walkover survey. The scoop and trowel method will be used to collect soil samples.

A.1.7.8 CAS 25-47-01, Reservoir and French Drain

Phase I activities at this CAS will consist of collecting biased samples for laboratory analysis of the target populations noted in [Table A.1-3](#). Site preparation activities are minimal at this CAS and there is no surface debris.

Excavation and visual inspection will be used in an attempt to identify the reservoir base/native soil interface at two locations, proximal and distal. If the reservoir base/native soil interface is identified, a sample will be collected directly below the interface and 2.5 ft below the interface. While excavating to the interface, samples will be collected at 2.5-ft intervals starting at 5 ft bgs. Maximum sampling depth will be limited to the capability of the excavator. The base of the reservoir is not expected to exceed 10 ft bgs.

Soil in the earthen drain will be sampled at the proximal end in the same manner beginning at a depth equivalent to the bottom of the neighboring CAS (25-04-11, distribution box). The locations will be sited based on field observations and process knowledge.

Excavation is the preferred sample collection method, but other appropriate methods (e.g., drilling) may be used.

A.2.0 Seven-Step DQO Process for Phase II Investigations

This section discusses the DQO process for a Phase II investigation for any CAS that requires further assessment based on Phase I results. If COCs are identified, the CAS will proceed to a Phase II investigation.

A.2.1 Step 1 - State the Problem

Refer to [Section A.1.1](#) for information regarding Step 1.

A.2.2 Step 2 - Identify the Decision

This step develops a decision statement and defines alternative actions. [Figure A.1-4](#) is a flow chart that identifies decisions and alternative actions appropriate for a Phase II investigation.

A.2.2.1 Develop a Decision Statement

The decision statement for a Phase II investigation is “Determine the extent of a COC.”

A.2.2.2 Alternative Actions to the Decision

If extent of a COC is defined, further assessment of the CAS is not required. If extent is not defined, reevaluate site conditions and collect additional samples.

A.2.3 Step 3 - Identify the Inputs to the Decision

This step identifies the information needed, determines sources for information, determines the basis for establishing the action level, and identifies sampling and analysis methods that can meet the data requirements.

A.2.3.1 Information Needs and Information Sources

In order to determine the extent of a COC, samples must be collected at locations to bound lateral and vertical extent of COCs. Samples will only be analyzed for those parameters which exceeded PALs (i.e., COCs) in Phase I samples. Biasing factors to support these information needs may include:

- Documented process knowledge on source and location of release
- Field observations
- Field-screening results
- Radiological surveys
- Historical sample results
- Experience and data from investigations of similar sites
- Professional judgement
- Phase I sample results

Table A.2-1 lists the information inputs, the source of information for each input, and the proposed methods to collect the data. Additional information is provided in Section A.1.3.1.

Table A.2-1
Information Needs to Resolve the Phase II Decision

Information Need	Information Source	Collection Method	Data Type/Metric
Decision: Determine the extent of a COC			
Identification of applicable Phase II contaminants	Data packages of Phase I biased samples	Review Phase I analytical results to select Phase II COCs.	Quantitative - Only COCs identified in Phase I will be analyzed for in Phase II.
Extent of contamination	Field observations	Document field observations.	Qualitative - CSM has not been shown to be inaccurate.
	Field-screening results	Conduct field screening with appropriate instrumentation.	Semiquantitative - FSRs will be compared to FSLs.
	Phase II analytical results	Appropriate sampling techniques and approved analytical methods will be used to bound COCs.	Quantitative - Validated analytical results will be compared to PALs to determine COC extent.

A.2.3.2 Determine the Basis for Preliminary Action Levels

Laboratory analytical results will be compared to the PALs presented in Section A.1.3.2 to determine if COPCs are present at levels that may pose an unacceptable risk to human health and/or the environment (i.e., COCs).

A.2.3.3 Potential Sampling Techniques and Appropriate Analytical Methods

[Section A.1.3.3](#) provides details regarding potential sampling techniques. To assure that laboratory analyses are sufficient to detect contamination in samples, chemical and radiological parameters will be selected based on Phase I analytical data. Only those COCs identified during Phase I will be analyzed for during Phase II. This parameter selection process will be applied independently to each CAS and to each media investigated in a CAS, as discussed in [Section A.2.4.4](#), “Scale of Decision Making.”

A.2.4 Step 4 - Define the Boundaries of the Study

The purpose of this step is to define the target population of interest, specify the spatial and temporal features of that population that are pertinent for decision making, determine practical constraints on data collection, and define the scale of decision making relevant to target populations.

A.2.4.1 Define the Target Population

The potential Phase II investigation target populations for each CAS are shown in [Table A.2-2](#). Phase II target populations will be limited to those related to distinct Phase I target populations with COCs. For example, step-outs around the leachfield at CAS 26-59-01 will not be required if COCs are not identified in the Phase I leachfield samples; however, if COCs are identified in samples collected from soil underlying the inlet and outlet pipes of the septic tank, samples will be collected from soil around the locations with COCs. These target populations represent locations within the system that, when sampled, will provide sufficient data to address data needs discussed in [Section A.2.2](#).

A.2.4.2 Specify Spatial and Temporal Features

The spatial boundaries that apply to each CAS in a Phase II investigation are shown in [Table A.2-3](#). In general, geographic boundaries are defined by the structures that comprise the system components as well as impacted soil. Intrusive activities are not intended to extend into CASs not in CAU 165. Temporal boundaries are defined in [Section A.1.4.2](#).

Table A.2-2
Potential Target Populations for Phase II Investigations

CAS	Target Population
25-20-01, Lab Drain Dry Well	COC concentrations in soil at step-out locations around the Dry Well
25-51-02, Dry Well	COC concentrations in soil at step-out locations around the Dry Well
25-59-01, Septic System	COC concentrations in soil at step-out locations around the cesspool COC concentrations in soil at step-out locations around septic tank inlet and outlet pipes
26-59-01, Septic System	COC concentrations in soil at step-out locations around septic tank inlet and outlet pipes COC concentrations in soil at step-out locations around the leachfield
25-07-06, Train Decontamination Area	COC concentrations in soil at step-out locations around the decontamination pad
25-07-07, Vehicle Washdown	COC concentrations in soil at step-out locations around the pad and sump
26-07-01, Vehicle Washdown Station	COC concentrations in soil at step-out locations around the decontamination pad
25-47-01, Reservoir and French Drain	COC concentrations in soil outside the reservoir; COC concentrations in soil outside the earthen drain

Table A.2-3
Spatial Boundaries for Phase II Investigation Sites

Corrective Action Site	Spatial Boundary	
	Horizontal	Vertical
25-20-01, Lab Drain Dry Well	Area from Building 4215 foundation to the Dry Well and a 100-ft buffer around Dry Well	50 ft bgs
25-51-02, Dry Well	Area from Building 3320 foundation to the Dry Well berm and a 100-ft buffer around Dry Well	50 ft bgs
25-59-01, Septic System	Area from the ETMS Building foundation to the septic system, the septic system components, and a 100-ft buffer around the septic system components	50 ft bgs
26-59-01, Septic System	Area from the source building foundation to the septic system components and a 100-ft buffer around the leachfield and system components	50 ft bgs
25-07-06, Train Decontamination Area	Area from the decontamination pad to the isolation valve, the system components, and a 100-ft buffer	50 ft bgs
25-07-07, Vehicle Washdown	Area between the decontamination pad and the sump, system components, and a 100-ft buffer	50 ft bgs
26-07-01, Vehicle Washdown Station	Decontamination pad and a 100-ft buffer	50 ft bgs
25-47-01, Reservoir and French Drain	Former location of the reservoir and earthen drain and a 100-ft buffer	50 ft bgs

A.2.4.3 Identify Practical Constraints

Practical constraints are listed in [Section A.1.4.3](#).

A.2.4.4 Define the Scale of Decision Making

The scale of decision making in a Phase II investigation is defined as the extent of contamination in media from which characterization samples were collected.

A.2.5 Step 5 - Develop a Decision Rule

This step integrates outputs from previous steps with the inputs developed in this step into a decision rule (“*If...then...*”) statement. This rule describes the conditions under which possible alternative actions would be chosen.

A.2.5.1 Specify the Population Parameter

The population parameter will be the maximum observed concentration of each COC within the target population(s).

A.2.5.2 Choose an Action Level

Action levels are defined in [Section A.1.3.2](#).

A.2.5.3 Measurement and Analysis Methods

The measurement and analysis methods in the Industrial Sites QAPP are capable of achieving the expected range of values. The detection limit of the measurement method to be used is less than the PAL for each COPC unless specified otherwise in the CAIP. See [Section A.1.3.3](#) for additional details.

A.2.5.4 Decision Rule

If the maximum observed concentration of any COPC of a target population exceeds the PALs, then additional samples will be collected to define extent. If the observed maximum is less than PALs, then the decision will be no further sampling.

If contamination is inconsistent with the CSM or extends beyond the spatial boundaries identified in [Table A.2-3](#), then work will be suspended and the investigation strategy will be reevaluated. If contamination is consistent with the CSM and is within spatial boundaries, then the decision will be to continue sampling to define extent.

A.2.6 Step 6 - Specify Tolerable Limits on Decision Errors

The sampling approach for the Phase II investigation relies upon biased samples; therefore, statistical analysis is not appropriate. Only validated analytical results (quantitative data) will be used to determine COC extent.

The baseline condition (i.e., null hypothesis) and alternative condition for the Phase II investigation are as follows:

- Baseline condition - Extent of a COC has not been defined
- Alternative condition - Extent of a COC has been defined

A.2.6.1 False Rejection Decision Error

The false rejection (alpha error) would mean accepting that the extent of a COC has been defined when it has not, increasing risk to human health and the environment.

A false rejection decision error (where consequences are more severe) is controlled by meeting these criteria: (1) having a high degree of confidence that the sample locations selected will identify the extent of COCs; and (2) having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.

To satisfy that the first criteria is met, the Phase II data collection will sample areas that represent vertical and lateral extent of contamination by considering the following characteristics:

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

These characteristics were considered during the development of the CSMs. The biasing factors listed in [Section A.2.3.1](#) will be used to further ensure that the first criteria is met.

To meet the second criteria, Phase II samples will be analyzed for those chemical and radiological parameters that were identified as COCs in Phase I samples. Strict adherence to established procedures and QA/QC protocol protects against false negatives.

A.2.6.2 False Acceptance Decision Error

The false acceptance (beta error) would mean accepting that the extent of a COC has not been defined when it really has, resulting in increased costs for unnecessary remediation.

The false acceptance decision error is controlled by protecting against false positive analytical results. False positive results are typically attributed to laboratory errors and sampling/handling errors. Quality assurance/quality control samples such as field blanks, trip blanks, laboratory control samples, and method blanks minimize the risk of a false positive analytical result. Other measures include proper decontamination of sampling equipment and using certified clean sample containers to avoid cross contamination.

A.2.6.3 Quality Assurance/Quality Control

Quality assurance/quality control protocols are presented in [Section A.1.6.3](#).

A.2.7 Step 7 - Optimize the Design for Obtaining Data

Biased sampling will be conducted at CAU 165 during Phase II investigations. Biased sampling locations will be determined prior to the investigation based on process knowledge and analytical results from the Phase I investigation. As field data are generated (e.g., radiological surveys, field screening, and Phase I analytical results), the Site Supervisor has the discretion to modify these locations, but only if the modified locations meet the decision needs and criteria stipulated in [Section A.2.3](#).

The following sections provide CAS-specific Phase II investigation activities.

A.2.7.1 CAS 25-20-01, Lab Drain Dry Well

Phase II activities at this CAS will consist of collecting biased samples for laboratory analysis of the target populations noted in [Table A.2-2](#).

Step-out sample locations will be established in a triangular pattern around the Dry Well. Each step-out will be located approximately 15 ft from the Dry Well. If biasing factors indicate COCs extend beyond the proposed Phase II sample locations, further stepout may be necessary. At each step-out location, samples will be collected at the depth(s) where COCs were encountered in Phase I samples from the Dry Well, and at 5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest concentration as indicated by biasing factors. Additional samples will be collected at the Dry Well to define the extent of COCs at that location, if necessary.

Drilling is the preferred method of soil sample collection but excavation, direct push, or hand augering may also be used, as appropriate.

A.2.7.2 CAS 25-51-02, Dry Well

Phase II activities at this CAS will consist of confirming the presence and configuration of ancillary piping and collecting biased samples for laboratory analysis of the target populations noted in [Table A.2-2](#).

Step-out sample locations will be established in a triangular pattern around the Dry Well, each located approximately 15 ft from the Dry Well. If biasing factors indicate COCs extend beyond the proposed Phase II sample locations, further step-out may be necessary. At each step-out location, samples will be collected at the depth(s) where COCs were encountered in Phase I samples from the Dry Well, and at 5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest concentration as indicated by biasing factors. Additional samples will be collected at the Dry Well to define extent of COCs at that location, if necessary.

Drilling is the preferred method of soil sample collection but excavation, direct push, or hand augering may also be used, as appropriate.

A.2.7.3 CAS 25-59-01, Septic System

Phase II activities at this CAS will consist of collecting biased samples for laboratory analysis of the target populations noted in [Table A.2-2](#).

Step-out sample locations will be established in a triangular pattern around the cesspool and/or septic tank, each located approximately 15 ft from the Phase I location. If biasing factors indicate COCs extend beyond the proposed Phase II sample locations, further stepout may be necessary. At each step-out location, samples will be collected at the depth(s) where COCs were encountered in Phase I samples, and at 5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest concentration as indicated by biasing factors. Additional samples will be collected to define the extent of COCs at Phase I locations, if necessary.

Drilling is the preferred method of soil sample collection but excavation, direct push, or hand augering may also be used, as appropriate.

A.2.7.4 CAS 26-59-01, Septic System

Phase II activities at this CAS will consist of collecting biased samples for laboratory analysis of the target populations noted in [Table A.2-2](#).

If COCs are identified in any of the Phase I samples, step-out sample locations will be established. At the septic tank, a triangular pattern will be used, each located approximately 15 ft from the Phase I location. An existing Phase I sample location may be used as a step-out if no COCs were identified. At the leachfield, a minimum of four sampling locations will be established approximately 15 ft outward from the corners of the leachfield. If biasing factors indicate COCs to extend beyond the proposed Phase II sample locations, further step-out may be necessary. At each Phase II location, soil samples will be collected at the depth(s) where COCs were encountered in Phase I samples, and at 5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the

sample with the highest concentration as indicated by biasing factors. Additional samples will be collected to define extent of COCs, if necessary. If contamination is not identified in any of the Phase I samples collected beneath the distribution pipes, the leachfield will be considered uncontaminated and no further samples will be collected.

Drilling is the preferred method of soil sample collection but excavation, direct push, or hand augering may also be used, as appropriate.

A.2.7.5 CAS 25-07-06, Train Decontamination Area

The Phase II investigation at this CAS will consist of collecting biased samples for laboratory analysis of the target population noted in [Table A.2-2](#).

Step outs will be located approximately 15 ft outward (i.e., away from the pad) from Phase I sampling locations where COCs were identified in soil. If biasing factors indicate COCs extend beyond the proposed Phase II sample locations, further step-out may be necessary. At each step-out location, samples will be collected at the depth(s) where COCs were encountered in Phase I samples, and at 2.5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest concentration as indicated by biasing factors. Additional samples will be collected to define the extent of COCs, if necessary.

Hand augering is the preferred method of soil sample collection but drilling, direct push, or excavation may also be used, as appropriate.

A.2.7.6 CAS 25-07-07, Vehicle Washdown

The Phase II investigation at this CAS will consist of collecting biased samples for laboratory analysis of the target population noted in [Table A.2-2](#).

Soil surrounding the decontamination pad and sump will be sampled, based on Phase I results. Stepouts will be located approximately 15 ft outward (i.e., away from the pad or sump) from Phase I sampling locations where COCs were identified. If biasing factors indicate COCs extend beyond the proposed Phase II sample locations, further stepout may be necessary. At each step-out location,

samples will be collected at the depth(s) where COCs were encountered in Phase I samples, and at 2.5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest concentration as indicated by biasing factors. Additional samples will be collected to define the extent of COCs, if necessary.

Drilling and excavation are appropriate methods for soil sample collection, but direct push or other methods may also be used.

A.2.7.7 CAS 26-07-01, Vehicle Washdown Station

The Phase II investigation at this CAS will consist of collecting biased samples for laboratory analysis of the target population noted in [Table A.2-2](#).

Soil surrounding the decontamination pad will be sampled based on Phase I results. Step-outs will be located approximately 15 ft outward (i.e. away from the pad) from Phase I sampling locations where COCs were identified. If biasing factors indicate COCs extend beyond the proposed Phase II sample locations, further step out may be necessary. At each stepout location, samples will be collected at the depth(s) where COCs were encountered in Phase I samples, and at 2.5 ft below the lowest depth where COCs were encountered. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest concentration as indicated by biasing factors. Additional samples will be collected to define the extent of COCs, if necessary.

Hand augering is the preferred method of soil sample collection but drilling, direct push, or excavation may also be used, as appropriate.

A.2.7.8 CAS 25-47-01, Reservoir and French Drain

Phase II activities at this CAS will consist of collecting biased samples for laboratory analysis of the target populations noted in [Table A.2-2](#).

Soil within the reservoir and earthen drain will be sampled to determine the vertical extent of COCs based on Phase I results. At each location, samples will be collected at the depth(s) where COCs

were encountered in Phase I samples, and at 2.5 ft below the lowest depth where COCs were encountered.

Soil outside the reservoir and earthen drain will be sampled to determine the lateral extent of COCs. Step-outs will include one on each side of the reservoir and earthen drain. They will be located within 15 ft from the reservoir and earthen drain edges. If biasing factors indicate COCs extend beyond the proposed Phase II sample locations, further step-out may be necessary. Samples will be collected at 2.5-ft intervals from the depth commensurate with the depth of COCs identified in Phase I, plus 5 ft. In general, samples submitted for laboratory analysis will be those that define the uppermost and lowermost contamination, and the sample with the highest concentration as indicated by biasing factors.

Drilling is the preferred sample collection method, but other methods may be used, as appropriate.

A.3.0 References

- Aetron. 1963. Engineering Drawing As-Built 3320-P.2.2, Test Cell 'D' Complex Test Stand & Process Systems Utility Equipment Building Piping Plan, 19 July. Covina, CA.
- Alderson, S., IT Corporation, Las Vegas. 2001. Memo to J. Davis (IT) entitled, "Preliminary Action Levels (PALs) and Minimum Reporting Limits (MRLs) for the Radiological Contaminants of Potential Concern (COPC) Identified for Corrective Action Unit (CAU) 165," 2 July. Las Vegas, NV.
- Atlan-Tech. 1992. *Environmental Monitoring Report for the Proposed Ward Valley, California, Low Level Radioactive Waste (LLRW) Facility*. Rosewell, GA.
- Black, S.C., and Y.E. Townsend. 1996. *U.S. Department of Energy, Nevada Operations Office, Environmental Data Report for the Nevada Test Site - 1994*. Las Vegas, NV.
- DOE/NV, see U.S. Department of Energy, Nevada Operations Office.
- EPA, see U.S. Environmental Protection Agency.
- Garey, K., Peer Consultants. 1997. Record of telecon with D. Filmyer (IT) and A. O'Hagen (IT) regarding various E-MAD and R-MAD sites, 24 February. Las Vegas, NV.
- Garey, K., Peer Consultants. 1999. Record of telecon with B. Bailey (IT) regarding CAU 165, CAS 25-07-06, 6 May. Las Vegas, NV.
- Garey, K., Peer Consultants. 2000. Record of telecon with M. Yaun (IT) regarding CAS 25-07-07, 23 August. Las Vegas, NV.
- IT, see IT Corporation.
- Johnson, R.B., and J.R. Ege. 1964. *Geology of the Pluto Site, Area 401, Nevada Test Site, Nevada*, April, Report TEI-84. Washington, DC: U.S. Department of the Interior, U.S. Geological Survey.
- LASL, see Los Alamos Scientific Laboratory.
- Los Alamos Scientific Laboratory. 1970. *PEWEE Reactor, Safety Analysis Report*. Los Alamos, NM.
- McArthur, R.D., and F.L. Miller. 1989. *Off-Site Radiation Exposure Review Project (ORERP), Phase II Soil Program*, DOE/NV/10384-23, Publication No. 45064. Las Vegas, NV: Desert Research Institute.

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

NAC, see *Nevada Administrative Code*.

NBMG, see Nevada Bureau of Mines and Geology.

Nevada Administrative Code. 2000. NAC 445A.2272, "Contamination of Soil: Establishment of Action Levels." Carson City, NV: Nevada Division of Environmental Protection.

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

Norman Engineering Co. 1967. As-Built Engineering Drawing NRDS-SF-G/P.5, entitled, "Technical Shops Building Plumbing Plan - Area II," 16 February. Mercury, NV: BN Archives and Records Center.

Nutley, R., Space Nuclear Propulsion Office (retired). 2000. Record of telecon with K. Willse (IT) regarding CAS 25-47-01, 18 September. Las Vegas, NV.

Penwell, C., Reynolds Electrical & Engineering Co., Inc. (retired). 1999. Record of telecon with B. Bailey (IT) regarding CAU 165, CAS 25-07-06, 12 April. Las Vegas, NV.

REEC Co, see Reynolds Electrical & Engineering Co., Inc.

Reynolds Electrical & Engineering Co., Inc. 1995. *Preliminary Characterization of Abandoned Septic Tank Systems*, DOE/NV--414. Las Vegas, NV.

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

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

U.S. Department of Energy, Nevada Operations Office. 2000. *NV/YMP Radiological Control Manual*, DOE/NV/11718-079 UC-702, Rev. 4. Prepared by Bechtel Nevada. Las Vegas, NV.

U.S. Environmental Protection Agency. 2000. Memorandum from S.J. Smucker to PRG table users regarding *Region 9 PRGs*, 1 November. San Francisco, CA.

U.S. Geological Survey. 1993. *Water Levels in Continuously Monitored Wells in the Yucca Mountain Area, Nevada, 1985-88*, USGS-OFR-91-493. Prepared by R.R. Luckey, D.H. Lobbmeyer, and D.J. Burkhardt.

Appendix B

Project Organization

B.1.0 Project Organization

The NNSA/NV Project Manager is Janet Appenzeller-Wing, and her telephone number is (702) 295-0461. The NNSA/NV Task Manager assigned to CAU 165 is Sabine Curtis, and her telephone number is (702) 295-0542.

The names of the project Health and Safety Officer and the Quality Assurance Officer can be found in the appropriate NNSA/NV plan. However, personnel are subject to change, and it is suggested that the Project Manager be contacted for further information.

Appendix C

NDEP Comment Responses

NEVADA ENVIRONMENTAL RESTORATION PROJECT DOCUMENT REVIEW SHEET

1. Document Title/Number: Draft Corrective Action Investigation Plan for Corrective Action Unit 165: Areas 25 and 26 Dry Well and Washdown Areas, Nevada Test Site, Nevada			2. Document Date: October 2001	
3. Revision Number: 0			4. Originator/Organization: IT Corporation	
5. Responsible DOE/NV ERP Project Mgr.: Janet Appenzeller-Wing			6. Date Comments Due: November 26, 2001	
7. Review Criteria: Full				
8. Reviewer/Organization/Phone No.: NDEP			9. Reviewer's Signature:	

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
1)		NDEP reviewed the Draft Corrective Action Investigation Plan for Corrective Action Unit 165 and had no comments to this document.		

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

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

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