Nevada
Environmental
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Project

DOE/NV--833

Corrective Action Investigation Plan for Corrective Action Unit 127: Areas 25 and 26 Storage Tanks Nevada Test Site, Nevada

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Environmental Restoration
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CORRECTIVE ACTION INVESTIGATION PLAN FOR CORRECTIVE ACTION UNIT 127: AREAS 25 AND 26 STORAGE TANKS NEVADA TEST SITE, NEVADA

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

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CORRECTIVE ACTION INVESTIGATION PLAN
FOR CORRECTIVE ACTION UNIT 127:
AREAS 25 AND 26 STORAGE TANKS
NEVADA TEST SITE, NEVADA

Approved by: Signature Approved Date: 8/27/02

Janet Appenzeller-Wing, Project Manager
Industrial Sites Project

Approved by: Signature Approved Date: 8-27-02

Runore C. Wycoff, Division Director
Environmental Restoration Division

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List of Acronyms and Abbreviations

Ac	Actinium
ACM	Asbestos-containing materials
AEC	U.S. Atomic Energy Commission
Am	Americium
amsl	Above mean sea level
AST	Aboveground storage tank
ASTM	American Society for Testing and Materials
bgs	Below ground surface
BN	Bechtel Nevada
°C	Degrees Celsius
CADD	Corrective Action Decision Document
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
Cd	Cadmium
CFR	*Code of Federal Regulations*
CLP	Contract Laboratory Program
COC	Contaminant of concern
COPC	Contaminant of potential concern
CRQL	Contract-required quantitation limit
Cs	Cesium
CSM	Conceptual site model
DNA	Defense Nuclear Agency
DoD	U.S. Department of Defense

List of Acronyms and Abbreviations *(Continued)*

DOE	U.S. Department of Energy
dpm/100 cm^2	Disintegrations per minute per 100 square centimeters
DQI	Data quality indicator
DQO	Data quality objective
DRI	Desert Research Institute
Du	Depleted uranium
EIS	Environmental impact statement
E-MAD	Engine Maintenance, Assembly, and Disassembly
EPA	U.S. Environmental Protection Agency
ETSM	Engine Transport System Maintenance
Eu	Europium
FFACO	*Federal Facility Agreement and Consent Order*
FSL	Field-screening level
FSR	Field-screening results
ft	Foot (feet)
ft^3	Cubic feet
gal	Gallon
GPS	Global positioning system
HASP	Health and safety plan
Hg	Mercury
HWAA	Hazardous waste accumulation area
IDW	Investigation-derived waste
in.	Inch(es)
IRIS	Integrated Risk Information System

List of Acronyms and Abbreviations *(Continued)*

ISMS	Integrated Safety Management System
ITLV	IT Corporation, Las Vegas Office
K	Potassium
LASL	Los Alamos Scientific Laboratory
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
LLW	Low-level radioactive waste
LRL	Lawrence Radiation Laboratory
MDC	Minimum detectable concentration
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
M&O	Management and Operating
mi	Mile
MOSA	Methods of soil analysis
mR/hr	Milliroentgen per hour
mRem	Millirem
MRL	Minimum reporting limit
MS/MSD	Matrix spike/matrix spike duplicate
NAC	*Nevada Administrative Code*
NASA	National Aeronautics & Space Administration
NBMG	Nevada Bureau of Mines and Geology
ND	Normalized difference
NDEP	Nevada Division of Environmental Protection

List of Acronyms and Abbreviations *(Continued)*

NEPA	*National Environmental Policy Act*
NNSA/NV	U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office
NRDS	Nuclear Rocket Development Station
NRS	*Nevada Revised Statutes*
NTS	Nevada Test Site
NTSWAC	Nevada Test Site Waste Acceptance Criteria
NUWAX	Nuclear Weapons Accident Exercise
PAL	Preliminary action level
PCB	Polychlorinated biphenyl
pCi/g	Picocuries per gram
pCi/L	Picocuries per liter
Pd	Palladium
PPE	Personal protective equipment
ppm	Parts per million
PRG	Preliminary remediation goal
Pu	Plutonium
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
Ra	Radium
RadCon	Radiological control
RCRA	*Resource Conservation and Recovery Act*
REECo	Reynolds Electrical & Engineering Co., Inc.

List of Acronyms and Abbreviations *(Continued)*

ROTC	Record of technical change
RPD	Relative percent difference
SAA	Satellite accumulation area
SAIC	Science Applications International Corporation
Sb	Antimony
SD	Standard deviation
SDG	Sample delivery group
SNPO	Space Nuclear Propulsion Office
Sr	Strontium
SSHASP	Site-specific health and safety plan
SVOC	Semivolatile organic compound
TCLP	Toxicity characteristic leaching procedure
Th	Thorium
TPH	Total petroleum hydrocarbon
U	Uranium
USGS	U.S. Geological Survey
UST	Underground storage tank
VOC	Volatile organic compound
WWTS	Wastewater Treatment System
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
% R	Percent recovery

Executive Summary

This Corrective Action Investigation Plan (CAIP) for Corrective Action Unit (CAU) 127: Areas 25 and 26 Storage Tanks has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the U.S. Department of Energy, the State of Nevada, and the U.S. Department of Defense. The general purpose of the investigation is to ensure that adequate data are collected to provide sufficient and reliable information to identify, evaluate, and technically defend potentially viable corrective actions.

Corrective Action Unit 127 is comprised of the following 12 Corrective Action Sites (CASs) in Areas 25 and 26:

- CAS 25-01-05, Aboveground Storage Tank (AST) [100,000 gallons (gal)]
- CAS 25-02-02, Underground Storage Tank (UST) (six 10,000-gal each)
- CAS 25-23-11, Contaminated Materials
- CAS 25-12-01, Boiler
- CAS 25-01-06, AST (1,000 gal)
- CAS 25-01-07, AST (1,000 gal)
- CAS 25-02-13, UST
- CAS 26-01-01, Filter Tank (Rad) and Piping (10,000-gal tank)
- CAS 26-01-02, Filter Tank (Rad) (5,000 gal)
- CAS 26-99-01, Radioactively Contaminated Filters
- CAS 26-02-01, UST (1,000 gal)
- CAS 26-23-01, Contaminated Liquids Spreader

This CAIP provides investigative details for CAU 127, whereas programmatic aspects of this project are discussed in the *Project Management Plan* (DOE/NV, 1994). General field and laboratory quality assurance and quality control issues are presented in the *Industrial Sites Quality Assurance Project Plan* (DOE/NV, 2002a). Health and safety aspects of the project are documented in the IT Corporation, Las Vegas Office, *Health and Safety Plan* (IT, 2001) and will be supplemented with a site-specific health and safety plan.

The CASs included in CAU 127 are located at Test Cell C; the Engine Maintenance, Assembly, and Disassembly (E-MAD) Facility; the X-Tunnel in Area 25; the Pluto Disassembly Facility; the Pluto Check Station; and the Port Gaston Training Facility in Area 26. Three of the Test Cell C CASs (25-01-05, 25-02-02, and 25-23-11) were part of the wastewater treatment system (WWTS) for the Nuclear Furnace effluent cleanup system. The WWTS was designed and operated to remove

radioactive contaminants from wastewater prior to discharging the wastewater in a leachfield. The other CAS at Test Cell C (25-12-01) consists of a boiler and ancillary features that were part of a borated water system that was used as a radiation shield. The E-MAD CASs (25-01-06 and 25-01-07) were aboveground storage tanks used to refuel locomotives and later used to heat the Engine Transport System Maintenance Building during the TRUclean II test series conducted in the late 1980s. The CAS in the X-Tunnel (25-02-13) was the former location of an underground storage tank used by the U.S. Army, sometime between 1985 and 1987, as a catch basin for fluid that may have run off a firing table. The tank was removed in 1996 during a cleanup of the experiment chamber.

In Area 26, the three CASs at the Pluto Disassembly Facility (26-01-01, 26-01-02, and 26-99-01) were part of a filter system, that was apparently associated with an unknown project or process conducted inside the Disassembly Building (Building 2201). These CASs were constructed subsequent to the cancellation of Project Pluto, but prior to 1986. Corrective Action Site 26-02-01 is located at the Pluto Check Station, Building 2105. This CAS was part of a system used to supply potable water to the building. The other CAS in Area 26 (CAS 26-23-01) is at the Port Gaston Training Area. This CAS was used to spread short-lived radiological contaminants over the ground in a specified area as part of an exercise intended to simulate a nuclear accident.

Based on site history, process knowledge, and previous field efforts, contaminants of potential concern for CAU 127 include radionuclides, metals, total petroleum hydrocarbons, volatile organic compounds, asbestos, and polychlorinated biphenyls. Additionally, beryllium may be present at some locations.

The general technical approach for investigation of CAU 127 consists of, but is not limited to, the following activities:

- Perform radiological walkover and/or screening surveys at nine CASs (25-01-05, 25-02-02, 25-23-11, 25-12-01, 25-02-13, 26-01-01, 26-01-02, 26-99-01, and 26-23-01)
- Perform field screening and collect Phase I soil samples from biased surface and subsurface locations and submit for laboratory analysis to define nature of contamination.
- Collect soil samples for geotechnical/hydrological parameters.

- Collect Phase II soil samples to define extent of contamination, if necessary.
- Collect required quality control samples.
- Collect waste characterization samples, as needed. This includes sampling the contents of tanks, where possible. If separate phases are present, each distinct phase will be sampled, when possible.
- Mark sample locations and collect coordinates.

Under the FFACO, the CAIP will be submitted to the Nevada Division of Environmental Protection for approval. Field work will be conducted following approval of the plan. The results of the field investigation will support a defensible evaluation of corrective action alternatives in the Corrective Action Decision Document.

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 investigations at Corrective Action Unit (CAU) 127: Areas 25 and 26 Storage Tanks, 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), the State of Nevada, and the U.S Department of Defense (DoD).

The NTS is approximately 65 miles (mi) northwest of Las Vegas, Nevada. Twelve Corrective Action Sites (CASs) comprise CAU 127 (Figure 1-1). The primary feature at each CASs was used for containing liquids, and all the CASs are now abandoned or inactive. The 12 CASs, located in Areas 25 and 26, are:

- CAS 25-01-05, Aboveground Storage Tank (AST) [100,000 gallons (gal)]
- CAS 25-02-02, Underground Storage Tank (UST) (six 10,000-gal)
- CAS 25-23-11, Contaminated Materials
- CAS 25-12-01, Boiler
- CAS 25-01-06, AST (1,000 gal)
- CAS 25-01-07, AST (1,000 gal)
- CAS 25-02-13, UST
- CAS 26-01-01, Filter Tank (Rad) and Piping (10,000-gal tank)
- CAS 26-01-02, Filter Tank (Rad) (5,000 gal)
- CAS 26-99-01, Radioactively Contaminated Filters
- CAS 26-02-01, UST (1,000 gal)
- CAS 26-23-01, Contaminated Liquids Spreader

1.1 Purpose

Corrective Action Unit 127 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.

It has been determined that existing information and process knowledge on the expected nature and extent of contamination are insufficient to select preferred corrective actions (i.e., clean closure, no

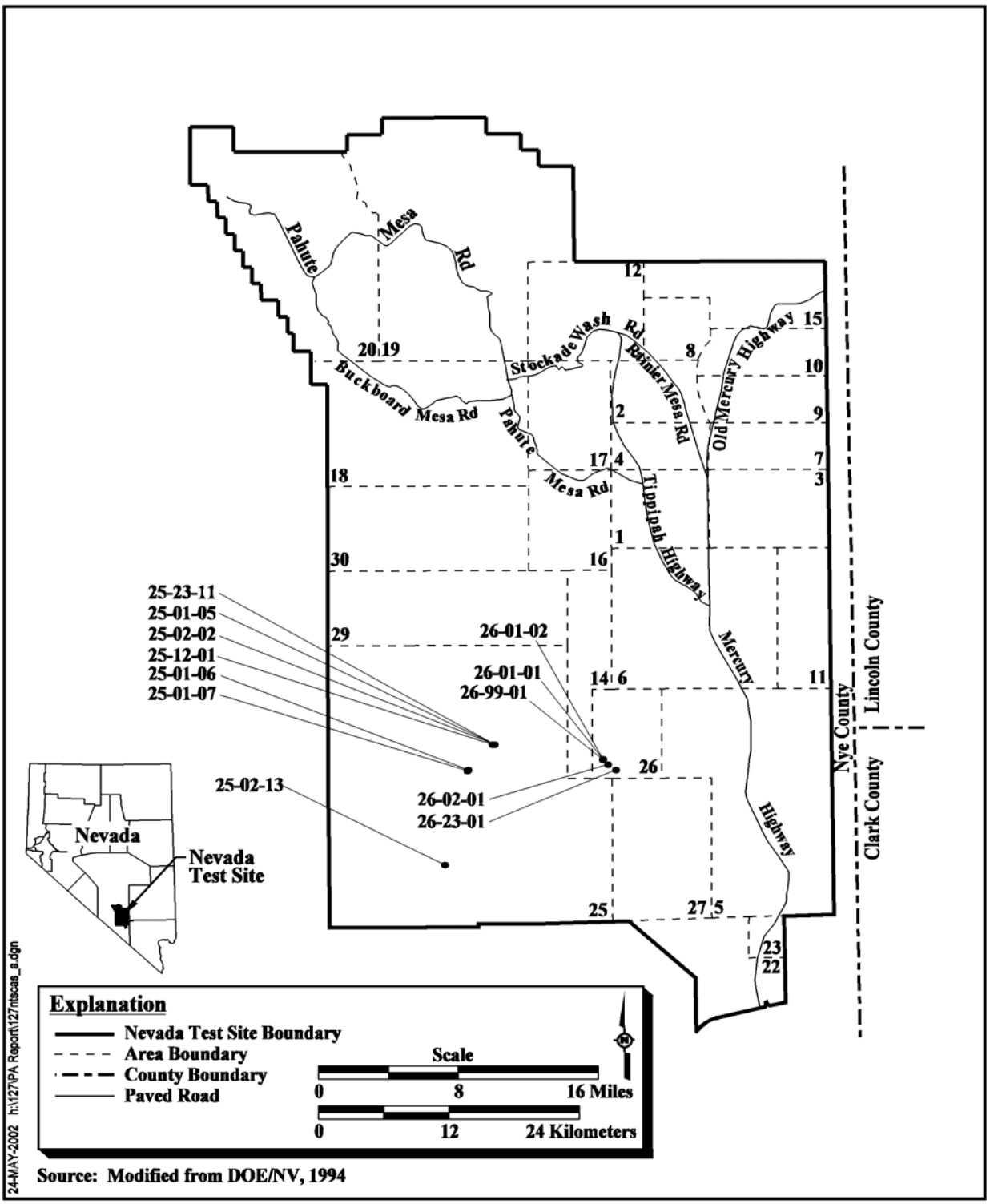


Figure 1-1
CAU 127 CAS Locations

further action, or close in place); therefore, additional information will be obtained by conducting a corrective action investigation at the CAU 127 CASs.

The CASs will be investigated based on data quality objectives (DQOs) developed by representatives of Nevada Division of Environmental Protection (NDEP) and the DOE, National Nuclear Security Administration Nevada Operations Office (NNSA/NV). The DQOs were used to identify and define the type and quality of data needed to develop and evaluate appropriate corrective actions for CAU 127. This CAIP describes the investigation developed to collect these data. The general purpose of the investigation is to ensure that adequate data are collected that provide sufficient and reliable information to identify, evaluate, and technically defend potentially viable corrective actions.

1.2 Scope

The scope of the CAU 127 investigation is to generate the information needed to resolve the decision statements identified in the DQO process. A two phased approach has been selected to organize and evaluate information needed to resolve the decision statements developed during the DQO process.

The Phase I decision statement is to determine if any contaminant of concern (COC) is present at each CAS. Contaminants of concern are defined as contaminants of potential concern (COPCs) that are present in samples at concentrations above preliminary action levels (PALs) defined in Section 3.3. If COCs are present, the nature of the contamination will be defined as the highest level of contamination present. If indicators are present that a COC has migrated, then the Phase II decision statement will be evaluated to determine the vertical and lateral extent of contamination. If sufficient evidence of contamination is present, the investigation will proceed directly to Phase II. For logistical reasons, at most CAU 127 CASs, both Phase I and Phase II (nature and extent) may be performed during a single field effort.

The scope of the corrective action investigation for CAU 127 includes the following activities to support Phase I and Phase II decision statements:

- Phase I - Perform radiological surveys at selected CASs to assist in the development of biased sampling locations.
- Phase I - Collect environmental samples for laboratory analyses to confirm the presence or absence of contaminants at concentrations exceeding PALs.

- Phase I - Collect tank content samples and perform radiological surveys to support waste characterization.

- Phase II - At CASs where a COC is identified, collect additional environmental samples and submit for laboratory analysis to define the vertical and lateral extent of contamination.

- Phase I and II - Collect Quality Control (QC) samples for laboratory analyses to ensure that the data generated from the analysis of investigation samples meet the requirements of the data quality indicators (DQIs).

- Phase I and II - To comply with regulatory requirements for waste disposal, collect samples of investigation-derived waste (IDW), as needed, and submit for laboratory analysis.

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, and Section 2.0 provides the background information for the CAU. The objectives, including the general conceptual site model (CSM), 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 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, 2002a). 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 (SSHASP) written prior to the start of field work. 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 the DQO summary and Appendix B contains information on the project organization. Public involvement activities are documented in the "Public Involvement Plan," Appendix V, of the FFACO (1996). Appendix C lists the responses to NDEP comments on the draft CAIP.

2.0 Facility Description

The CASs were grouped into CAU 127 based on their geographical location, technical similarities, and agency responsibility for closure. The 12 CASs consist of tanks, a boiler, and other storage containers.

2.1 Physical Setting

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

2.1.1 Area 25

Area 25 is located within Jackass Flats, which is surrounded on the southwest by a low-lying drainage divide, on the northwest by the southeastern slopes of Lookout Peak, on the north and northeast by small rugged hills, and on the south by the northern slopes of Skull Mountain (DRI, 1988). The erosion of the surrounding uplands has filled the basin and created a layer of alluvium and colluvium with a depth up to 1,025 feet (ft) (DOE, 1988; USGS, 1964a). The alluvium is underlain by welded and semi-welded ash-flow and ash-fall tuffs. Beneath the tuff layers lie the carbonate and clastic sediments with a depth up to 22,000 ft in some areas (SNPO, 1970).

Groundwater levels in Area 25 range from 2,388 ft to 2,469 ft above mean sea level (approximately 710 to 1,040 ft below ground surface [bgs]) (USGS, 1997). Area 25 lies within the Alkali Flat-Furnace Creek groundwater subbasin. In this subbasin, which includes most of the western half of the NTS, regional groundwater flow is generally from north to south, toward discharge areas at Alkali Flat and at Death Valley in the vicinity of Furnace Creek Ranch (USGS, 1996). The movement of groundwater within Jackass Flats is from north to south on the western side of the flats, and toward the southwest and west on the eastern side of the flats. The USGS (1996) reports that a

groundwater flow divide is present along the eastern side of Area 25. The divide is roughly located on the eastern edge of Skull Mountain, near the boundary of Areas 25 and 27, and near the boundary of Areas 14 and 25.

2.1.2 Area 26

A large portion of Area 26 consists of a thin gravel alluvium capping a pediment which dips 3 to 6 degrees to the southeast. Bedrock is exposed generally on steep embankments to the north and consists of extrusive igneous rocks, breccias, thin interbedded sedimentary rock, and small dikes. The extrusive rocks dip gently to the east and are highly fractured and faulted (USGS, 1964b).

Perched groundwater was found in some, but not all, wells located in Area 26. Static water levels range from 81 to 167 ft bgs. The perched water occurs in highly fractured and altered rock and may extend to a depth of 261 ft bgs before encountering a low-permeability confining layer. Additional perched groundwater lenses may exist between the known perched water table and the regional water table, which is assumed to be at 1,700 ft bgs (USGS, 1964b).

Perched ground water may be found locally throughout the NTS wherever aquitards compose ridges or hills that lie above the regional zone of saturation. However, the occurrence of such water is erratic and depends largely upon the interconnection of the fractures within the aquitard and, in turn, their connection with the underlying aquifers (USGS, 1975).

2.2 Operational History

The following subsections provide a description of the use and history of facilities associated with each of the CASs in CAU 127. The CAS-specific summaries are focused on any significant known waste-generating activities or release. Unless otherwise noted, all of the CASs are currently listed as inactive and/or abandoned and information was obtained from historical documentation, process knowledge, and/or interviews.

2.2.1 History of Area 25

From 1959 through 1973, the U.S. Atomic Energy Commission (AEC) (the predecessor to the DOE) participated jointly with the National Aeronautics & Space Administration (NASA) in the

development of nuclear rocket engines. The AEC and NASA formed the Space Nuclear Propulsion Office (SNPO) to oversee the project. The nuclear rocket engines were tested at the Nuclear Rocket Development Station (NRDS) (later renamed the Nevada Research and Development Area) located in Area 25 of the NTS.

Several facilities were built to support the testing program. Unknown additional activities may have been conducted at any of these facilities after NRDS operations were terminated in 1973.

2.2.1.1 CAS 25-01-05, Aboveground Storage Tank

The primary feature of this CAS is a 100,000-gal AST. This site is located within a posted underground radioactive material area located 300 ft east (outside) of the Test Cell C perimeter fence. This CAS consists of the 100,000-gal AST (diameter-27 ft, height-23 ft); associated piping, including two underground pipes leading to/from CAS 25-23-11 (Contaminated Materials); two wastewater transfer pumps; concrete pump pad; and the soil in contact with and potentially contaminated by the components of the CAS. The piping included in this CAS ends at the entrance to the CAS 25-23-11 pump vault.

The AST was originally located at Test Cell A and was moved to Test Cell C in early July 1972, where it was integrated into the existing Wastewater Treatment System (WWTS). The use of the AST at Test Cell A is unknown. At Test Cell C, its planned use was as a storage tank for the Nuclear Furnace-1 (NF-1) test series that was conducted during the summer of 1972. Process knowledge indicates that this tank was intended to be used as a backup to the six 10,000-gal USTs (CAS 25-02-02) that stored wastewater generated during the tests. It is not known if the AST ever actually contained wastewater. The WWTS was designed and operated to remove radioactive contaminants from wastewater prior to discharging the wastewater into a leachfield. Radiological surveys conducted in the vicinity of the AST indicates that the tank is a source of radiation; therefore, it is radiologically contaminated (Alderson, 2002).

2.2.1.2 CAS 25-02-02, Underground Storage Tank(s)

This CAS consists of six 10,000-gal USTs, the associated piping between the USTs and leading to the former location of CAS 25-23-12 (Filter Tanks), the concrete pad at the former location of the Filter

Tanks, and the surrounding soil. This site is located to the east of the Test Cell C Facility fence. Engineering drawings show that the underground piping connects the USTs to each other, a pipe leading to the ground surface ending with a pressure valve, and two pipes leading from the USTs to the former location of the filter tanks. Included in this CAS is a pipe that runs vertically from the southernmost UST, ending in a pump vault that is included in CAS 25-23-11 (Contaminated Materials). Also included is a pipe that runs from the pump vault to the previously removed Filter Tanks (CAU 198, CAS 25-23-12). These pipes are included in CAS 25-02-02 only up to the bottom of the pump vault, which is where CAS 25-23-11 begins. Any other underground piping that was associated with the former filter tanks is also included in this CAS.

This site was used as a part of the WWTS located east of the perimeter fence to the Test Cell C Facility. The system initially consisted of four USTs, and in late 1971, two more USTs were added for a total combined storage volume of 60,000 gal. The tanks were primarily used between May and July 1972 to store the wastewater that was produced during the NF-1 test series. Radiological surveys performed in the vicinity of the CAS 25-02-02 USTs indicates that the tanks are a source of radiation, and are radiologically contaminated (Alderson, 2002). This CAS is located within a posted underground radioactive material area.

2.2.1.3 CAS 25-23-11, Contaminated Materials

This CAS includes a concrete vault, heat shield/pump shed, pump, piping, and the potentially contaminated soil surrounding the piping and vault. The site is located immediately above the CAS 25-02-02 USTs, within a posted underground radioactive material area east of the Test Cell C Facility. The vault is approximately 80 cubic feet (ft^3), with 8-inch (in.) thick concrete walls. The bottom of the vault is open and is divided into two sections. The heat shield/pump shed is L-shaped, with two corrugated metal walls and a corrugated metal roof. It has been described as both a heat shield and a pump shed.

The wastewater transfer pump vault was part of the WWTS, constructed in 1971 to provide an efficient system for treating the effluents generated by the NF-1 Test. Wastewater flowed from Test Cell C into the six 10,000-gal USTs (CAS 25-02-02). Water flowed into each tank equally and was pumped from the southernmost UST. The transfer pump in the vault pumped the wastewater from this UST to the filter tanks (CAU 198, CAS 25-23-12) and into an 8-in. “radioactive” pipe, ultimately

discharging into a leachfield (CAU 262, CAS 25-05-08). During tests which required larger capacities, the wastewater may have been pumped into the aboveground 100,000-gal AST (CAU 127, CAS 25-01-05) prior to filtering. No information was provided concerning the use of this site subsequent to 1972, although it is known that activities at the NRDS were discontinued in 1973.

2.2.1.4 CAS 25-12-01, Boiler

This CAS consists of a 600,000 British Thermal Unit per hour boiler, the associated piping, a pump and a blower, and two separate, raised concrete pads. The site is located east of the Pumphouse Building (Building 3220), within a posted radioactive material area at the Test Cell C Facility. The CAS includes the pipes that run from the boiler to the Pumphouse Building and the pipes that run from the boiler to the ground. The piping within the building or below grade is not included in this CAS. The blower for the boiler is within the steel frame that supports the boiler, on the concrete pad where the boiler sits. The pump is located on a raised concrete pad near the Pumphouse. The boiler, installed in 1967, was part of a borated water system that was used as a radiation shield at Test Cell C. The boiler used propane to heat the borated water to keep the borate in solution (2 percent borate solution). The borated water system was a closed loop that was not in direct contact with radiological contamination from reactor testing.

2.2.1.5 CAS 25-01-06, Aboveground Storage Tank

This CAS consists of a 1,000-gal AST (diameter-4 ft, length-12 ft), associated piping that leads to the building, and a diesel fuel spill on the concrete pad and surrounding soil. The area of affected soil is estimated to be approximately 2 by 1 ft. The site is located at the northwest corner of the Engine Transport System Maintenance (ETSM) Building (Building 3901) in the Engine Maintenance, Assembly, and Disassembly (E-MAD) Facility. The piping included in this CAS terminates at the exterior of the building. The AST was originally used as a refueling tank for locomotives. The tank was later used to store heating fuel for the ETSM Building during the TRUclean II test series conducted in the late 1980s, when a decontamination pilot plant was set up at the ETSM. The facility was designed to develop and demonstrate a procedure for the removal of transuranics (primarily americium and plutonium) from contaminated soil (AWC, 1987b).

2.2.1.6 CAS 25-01-07, Aboveground Storage Tank

This CAS consists of the 1,000-gal AST (diameter-4 ft, length-12 ft), associated piping that leads to the building, and a diesel fuel spill on the concrete pad and surrounding soil. The site is located at the southeast corner of the ETSM Building (Building 3901) in the E-MAD Facility. The piping included in this CAS terminates at the exterior of the building. The AST was initially used as a refueling tank for locomotives. Eventually, the tank was used to store heating fuel for the ETSM Building during the TRUclean II test series conducted in the late 1980s, when a decontamination pilot plant was set up at the ETSM. The facility was designed to develop and demonstrate a procedure for the removal of transuranics (primarily americium and plutonium) from contaminated soil (AWC, 1987b).

2.2.1.7 CAS 25-02-13, Underground Storage Tank

This CAS consists of the location of a former tank and the gravel/soil surrounding the former tank location within the X-Tunnel (U25x). Information obtained by interviews and a May 2002 site visit by Bechtel Nevada (BN), NDEP, NNSA/NV, and ITLV personnel confirmed that the tank has been removed.

The X-Tunnel is located on the southwestern flank of Little Skull Mountain in Area 25. The main drift is 704-ft long. An experiment chamber, approximately 110-ft long, is located at the end of the tunnel. Several experiments have been conducted in the chamber, which is designed to contain high-pressure tests such as explosions. A side drift, perpendicular to the main drift, is located approximately 500 ft into the main drift. No moisture, seeps, or running water were observed in the tunnel during the May 2002 site visit.

This CAS was used by the U.S. Army, sometime between 1985 and 1987, as a catch basin for fluid that may have run off the firing table from a classified target. The tank was removed during a June 1996 cleanup of the site. Gravel from the tank location was also removed. The dimensions of the resulting pit were 8 by 10 by 8 ft. Both the tank and gravel were placed in transportainers and removed from the site. The cleanup effort was primarily carried out to remove depleted uranium that was dispersed in the target area as a result of a previous experiment. In preparation for subsequent activities, the pit where the tank was removed was filled and a concrete pad was constructed over approximately the back half of the experiment chamber.

The X-Tunnel is currently in a stand-by mode and all of the testing hardware is still in place and/or in storage. The support facilities are also in place. The X-Tunnel will be used again for testing by the DoD (Williams, 2002a).

2.2.2 History of Area 26

In 1958, the Lawrence Radiation Laboratory (LRL) was contracted to begin construction for Project Pluto in Area 26, alternatively known as Area 401. Project Pluto was a joint program between the AEC and DoD to demonstrate the feasibility of using a nuclear ramjet engine to propel a supersonic low altitude missile (Author Unknown, 1960). Between 1961 and 1964, LRL conducted six experimental tests to develop a nuclear reactor for the ramjet engine. Four of the tests involved the Tory II-A nuclear reactor and the other two involved the Tory II-C nuclear reactor (DRI, 1988).

The facilities built to support Project Pluto were separated into three functional areas for operational reasons: control, testing, and disassembly areas. The control area included the Control Room (Building 2101), Assembly Building (Building 2102), Data Reduction Building (Building 2107), Hot Critical Facility (Building 2103), and Check Station (Building 2105). The testing area included the Test Bunker (Building 2203), and the disassembly area consisted of the Disassembly Building (Building 2201) and the Railcar Washdown (Building 2202).

The Disassembly Building was constructed in 1959-60. It was used from 1961 to 1964 during Project Pluto to decontaminate the Tory II-A and Tory II-C reactors (LRL, 1960). Significant quantities of radioactive material were produced during the Tory reactor testing program, some of which was disposed in the disassembly area radioactive leachfield (CAU 271, CAS 26-05-01). In addition, process and sanitary effluents were generated and disposed of in separate septic systems associated with the facilities described above.

Building 2201 was used again in 1972 for repackaging operations (REECo, 1972). Solid fuel elements from the Project Pluto were repackaged for shipment from Area 26. Following 1972, classified experiments occurred in Building 2201; however, no information regarding these operations or potential impacts to the collection and disposal systems was identified. The building was administratively occupied by Sandia National Laboratories in 1997 (Parker, 1998).

Two other known activities occurred in Area 26 after the initial Project Pluto activities. In 1981 the DoD and the DOE conducted a joint accident nuclear weapons accident training exercise, Nuclear Weapons Accident Exercise (NUWAX)-81, at the NTS. The exercise was designed to put into action a planned emergency response to radioactive material scattered in the vicinity of a fictitious town named Wahmonie, California, as a result of the explosion of nuclear weapons. The Project Pluto control area and surrounding area supported NUWAX operations and served as the location for Wahmonie. The NUWAX-81 scenario involved a simulated crash of an U.S. Army helicopter transporting nuclear weapons to a storage site. The simulated helicopter crash site was the west bank of Wahmonie's water reservoir (now CAU 271, CAS 26-03-01). Aircraft parts and pieces of inert nuclear training weapons were prepositioned at the site. Short-lived radioisotopes, radium-223 (Ra-223) and mercury-197 (Hg-197), were distributed via an agricultural sprayer (possibly the one included in CAS 26-23-01) to a localized area to simulate contamination by weapons-grade plutonium (Pu) (U.S. Army, 1989).

In 1983, the joint venture between the DoD and DOE to train personnel for emergency response to nuclear weapons accidents was continued with the advent of NUWAX-83. The Federal Emergency Management Agency also participated in NUWAX-83. With the exception of a few details, a scenario similar to NUWAX-81 was conducted. Short-lived radioisotopes, Ra-223 and palladium-103 (Pd-103), were distributed during this exercise to simulate contamination with Pu and americium (Am). This accident simulated a crash in the mock city of Port Gaston, Virginia (DOE/NV, 1983). Short-lived radionuclides used in the exercise were distributed by the agricultural sprayer that is included in CAS 26-23-01.

Subsequent to Project Pluto and NUWAX operations, additional activities may have been conducted at the facilities in Area 26. The type of activities and the purpose are not known.

In the subsections that follow, the Area 26 CASs are organized according to their use.

2.2.2.1 CAS 26-01-01, Filter Tank (RAD) and Piping

This CAS consists of a 10,000-gal AST and three associated pipes. The site is located within the fence line of the Pluto Disassembly Facility, Building 2201. The AST is within a posted radioactive contamination area. Two of the pipes terminate at the adjacent filter shed, which contains the

radioactively contaminated filters (CAS 26-99-01), and the third pipe runs underground to the location of a former UST (CAU 418, CAS 26-02-04).

This CAS is part of a filter system, possibly a thin film evaporator system that was part of an unknown project or process conducted inside Building 2201. It is unknown when this AST was used; however, it is known that this system was constructed subsequent to the cancellation of Project Pluto. The Pluto Disassembly Facility was used for various other projects following the termination of Project Pluto. This CAS may have been used by one or more of those projects, as the filter system was installed after Project Pluto but before 1986, according to historical photographs. However, specifics of its installation and use are unclear. Based on the connection with the former UST (CAU 418, CAS 26-02-04) and data collected from the UST (Section 2.5.1), it is assumed that the filter system was used to remove radionuclides (specifically plutonium and americium) from a solution, prior to discharging the solution to the CAU 271, CAS 26-05-01 leachfield.

2.2.2.2 CAS 26-01-02, Filter Tank (RAD)

This CAS consists of a 5,000-gal AST and three associated pipes. The site is located within the fence line of the Pluto Disassembly Facility, Building 2201. The AST is within a posted radioactive contamination area. One of the pipes terminates at the adjacent filter shed, which contains the radioactively contaminated filters (CAS 26-99-01). The second pipe is connected to the tank and appears to be cut before reaching the filter shed. The third pipe runs into the ground on the north side of the tank. This line is connected to a manhole in the pipeline that connects Building 2201 with the radioactive leachfield (CAU 271, CAS 26-05-01), located southeast of Building 2201.

This CAS is part of a filter system, possibly a thin film evaporator system, that was part of an unknown project or process conducted inside Building 2201. It is unknown when this AST was used; however, it is known that this system was constructed subsequent to the cancellation of Project Pluto. The Pluto Disassembly Facility was used for various other projects following the Project Pluto cancellation. This CAS may have been used by one or more of those projects, since the filter system was installed after Project Pluto but before 1986, according to historical photographs. However, specifics of its installation and use are unclear. As discussed in Section 2.2.2.1, the filter system may have been used to remove radionuclides (specifically plutonium and americium) from solution.

2.2.2.3 CAS 26-99-01, Radioactively Contaminated Filters

This CAS consists of six metal filter tanks, a plywood shed, and the piping that connects the filters to each other within the shed. The shed is posted as a radioactive contamination area. The site is located within the fence of the Pluto Disassembly Facility, Building 2201. This CAS does not include the piping outside of the shed because the piping is included in CASs 26-01-01 and 26-01-02. Based on the presence of unused filter materials in a nearby shed, it appears that the filter media are paper elements and also some type of granular material.

This CAS is part of a filter system, possibly a thin film evaporator system, that was part of an unknown project or process conducted inside Building 2201. It is unknown when the filters were used; however, it is known that this system was constructed subsequent to the cancellation of Project Pluto. The Pluto Disassembly Facility was used for various other projects following the Project Pluto cancellation. This CAS may have been used by one or more of those projects, as the filter system was installed after Project Pluto but before 1986, according to historical photographs. However, specifics of its installation and use are unclear. As discussed in Section 2.2.2.1, the filter system may have been used to remove radionuclides (specifically plutonium and americium) from solution.

2.2.2.4 CAS 26-02-01, Underground Storage Tank

This CAS consists of a 1,000-gal water storage tank and associated piping. The site is located on the southeast corner of the former site of the Check Station, Building 2105. Features of this CAS are a 30-in. diameter access manhole on top of the tank, as well as three pipes that previously connected this tank to Building 2105. Building 2105 has been demolished, and these pipes were removed during the demolition, although the below-grade sections of the pipes may still be present.

This CAS was a water supply tank that was part of a hydropneumatic system associated with the Check Station. According to an interview, the tank received potable water that was trucked to the site. The potable water was then used for plumbing within Building 2105. The Check Station was used as a checkpoint for radiological safety personnel, and as an office and counting laboratory for LRL and Reynolds Electrical & Engineering Co., Inc. (REECo) health and safety staff during Project Pluto (REECo, 1961; LRL, date unknown). The building also appears to have been used as a decontamination area for personnel (REECo, 1961).

2.2.2.5 CAS 26-23-01, Contaminated Liquids Spreader

This CAS consists of a contaminated liquids spreader, which includes two tanks, the spreader bar, associated hoses, and the mobile rig that contains the unit. The site is located near the Port Gaston Training Area (Project Pluto Control Point). The spreader is in a posted radioactive material area and is also posted with fixed and/or inaccessible contamination signs.

In 1981, this spreader may have been used during the NUWAX-81 training exercise to spread a solution containing Ra-223, Hg-197, and possibly associated impurities throughout the exercise area. This spreader is known to have been used in 1983 during the NUWAX-83 exercise to spread a solution containing Ra-223, Pd-103, and possibly associated impurities throughout the exercise area.

2.3 Waste Inventory

Process knowledge, interviews with former NTS employees, and general historical practices indicate that the potential exists for release of hazardous and/or radiological constituents to the environment from these CASs. Available information was evaluated during the DQO process, and a list of potential contaminants was developed. The COPCs for CAU 127 are described further in Section 3.2.

The following subsections present information on COPCs, based on process knowledge and historical sources. The types of waste suspected to be present in each of the CASs is also summarized below.

CAS 25-01-05, Aboveground Storage Tank; CAS 25-02-02, Underground Storage Tank(s); and CAS 25-23-11, Contaminated Materials - Based upon process knowledge of these CASs, analytical results from the previously removed filter tanks (CAU 198, CAS 25-23-12), and analytical results from the previously investigated associated leachfield (CAU 262, CAS 25-05-08), it is expected that radiological wastes will be found at these sites. Specifically, strontium-90 (Sr-90) and cesium-137 (Cs-137) are the contaminants that are expected at these sites, although other common radionuclides associated with nuclear testing may also be present. Arsenic was found above the PAL (but within the range of natural background) in leachfield soil, and a solvent (specifically tricholoroethene) was reported to have been used in the decontamination of portions of Test Cell C. Asbestos-containing materials (ACM) may be present on some of the piping. Contaminated materials could be liquid

(water) and/or sediment in the tanks, soil surrounding and underlying the tanks/pipes, and pipe insulation. Lead bricks may also be present at these CASs.

CAS 25-12-01, Boiler - This boiler was used to heat borated water as part of a radiation shield. In addition to the boron within the boiler and the closed loop system, radionuclides may be present due to activation of elements present in the water solution and metals (e.g., aluminum and steel) from which system components are constructed. Contaminants are expected to be boron and activation products associated with the constituents within the boiler system. These activation products include chlorine-36 (Cl-36), cobalt-60 (Co-60), europium-154 (Eu-154), Eu-155, potassium-40 (K-40), and sodium-22 (Na-22). Contaminated materials could be liquid (water), sediment and/or scale in the boiler and piping, and pipe insulation.

CAS 25-01-06, Aboveground Storage Tank; and CAS 25-01-07, Aboveground Storage Tank - These tanks were used to store diesel fuel/heating oil. The sources of contamination are the contents leaking from the tanks. In addition to the waste fuel and potential sludge in the tank, contaminated materials include the concrete pads beneath the tanks and the soil adjacent to the pads.

CAS 25-02-13, Underground Storage Tank - The possible wastes at this site are petroleum hydrocarbons and depleted uranium contamination in the gravel/soil surrounding the previous location of the tank. However, available information indicates that the tank may never have contained these materials, there is no documented release from the tank, and the tank and surrounding gravel/soil have already been removed from the site.

CAS 26-01-01, Filter Tank (RAD) and Piping; CAS 26-01-02, Filter Tank (RAD); and CAS 26-99-01, Radioactively Contaminated Filters - Based upon the expected use of these CASs and analytical results from the previously removed associated UST (CAU 418, CAS 26-02-04) and the previously investigated associated leachfield (CAU 271, CAS 26-05-01), it is expected that radiological contaminants, metals (specifically lead), petroleum hydrocarbons, polychlorinated biphenyls (PCBs) and asbestos may be present. Contaminated materials could be liquid (water) and sediment in the tanks and filters, filter media, soil surrounding/below the tanks and pipes, and pipe insulation.

CAS 26-02-01, Underground Storage Tank - This CAS is only known to have contained potable water, for use in a hydropneumatic water supply system for Building 2105, Pluto Check Station. There are no contaminated materials expected to be encountered at this CAS.

CAS 26-23-01, Contaminated Liquids Spreader - This CAS includes an agricultural spreader used in at least one nuclear accident exercise. The radionuclides used were chosen because of their low levels of radiation and short half-lives. However, long-lived radioactive impurities may have been associated with the constituents used, and these contaminants may still be present in concentrations greater than background. The impurities may include Ra-226, actinium-227 (Ac-227), and its short-lived daughter, thorium-227 (Th-227). The contaminated materials may include the spreader and the soil underneath and adjacent to the spreader.

2.4 Release Information

The only documented releases within CAU 127 are hydrocarbon releases from ASTs at CASs 25-01-06 and 25-01-07. However, the potential for releases from the remaining CASs also exists based on the CSMs developed during the DQO process. The tanks, pipes, and miscellaneous containers are inactive and abandoned and no monitoring has taken place to determine if contaminants have/are migrating vertically or laterally. The only tank that has been removed is the tank in the X-Tunnel (CAS 25-02-13). Therefore, the potential exists for ongoing contaminant release and migration from residual material within the containers at the remaining CASs (except CAS 25-02-13). It is not known if any of the tanks, pipes, and other structures in this CAU contain any residual materials (e.g., sludge or liquid).

The sources of potential releases are varied, but are representative of the CSMs developed for this CAU. Contaminated liquids and sediments may be present in the tanks, pipes, etc. A release of contaminated liquids may have occurred, and may have migrated into and impacted soil below and surrounding the vessels. Additionally, at several CASs, asbestos or asbestos-containing materials may be present on the aboveground structures and may be friable. Exposure pathways are limited to ingestion, inhalation, and dermal contact (absorption) of soils/sediments or liquids, or inhalation of ACM by site workers due to disturbance of contaminated materials.

2.5 Investigative Background

No previous large-scale characterization or remediation information have been identified for the CAU 127 CASs. However, analytical data for some related CAS characterization/remediation efforts, as well as cursory-level radiological survey data for CAU 127 and related CASs are available. These data show levels of contamination above background at the Test Cell C WWTS and the Pluto Disassembly Facility. Constituents detected included radionuclides, PCBs, petroleum hydrocarbons, and metals.

The following subsections describe previous investigations that have been conducted at CASs within CAU 127 or adjacent/related to CAU 127 CASs. Specifically, investigations have been performed at locations within or near Test Cell C WWTS (CASs 25-01-05, 25-02-02, and 25-23-11), the X-Tunnel (CAS 25-02-13), Pluto Disassembly Facility (CASs 26-01-01, 26-01-02, and 26-99-01), and Port Gaston Training Area (CAS 26-23-01). Section 2.5.5 discusses *National Environmental Policy Act* (NEPA) documentation for CAU 127.

2.5.1 Test Cell C Wastewater Treatment System

There were five separate reports identified that contained investigation results for the CASs/area within the Test Cell C WWTS. Details of the reports are summarized below.

2.5.1.1 REECo Underground Contaminants Report

This REECo report, *Underground Contaminants*, dated August 1986, was a review of the various sources of underground contamination throughout the NTS. This is the earliest known investigation of potential contamination at the Test Cell C WWTS. REECo conducted a review of the underground contamination in the WWTS area, which included the CAU 262, CAS 25-05-08 leachfield; the CAU 198, CAS 25-23-12 filter tanks; the CAS 25-02-02 subsurface holding tanks; and the CAS 25-01-05 100,000-gal aboveground storage tank. The filter tanks measured 50 milliroentgen per hour (mR/hr) at contact with the top of the tank, whereas the 100,000-gal AST measured 5 mR/hr at contact with the side of the tank. Soil samples were taken within the leachfield at the ground surface, as well as below the leachfield laterals (between 7.5 and 11 feet bgs). Of the six surface soil samples, the average Cs-137 activity was 65 picocuries per gram (pCi/g), (with a maximum activity of 328 pCi/g), and naturally occurring levels of K-40 was detected along with relatively low levels of

Ra-226, Th-228, and Th-232. Cadmium-109 (Cd-109) was detected in one sample, at 5.85 pCi/g. Of the six subsurface soil samples, apparently intended to be taken below the laterals, a wide range of Cs-137 was detected, from 12.7 pCi/g to 735,000 pCi/g. Additionally, europium-155 was detected in two of the samples, at approximately 2 pCi/g; antimony-125 (Sb-125) was detected in three samples, with an average activity of 3.3 pCi/g; and Ra-226, Th-228 and Th-232 were each detected in two of the samples with concentrations less than 2 pCi/g. The samples were analyzed by gamma spectroscopy. Therefore, no direct measurements of plutonium or strontium were made; however, REECo (1986) made general inferences. The cesium to strontium ratio was assumed to be approximately 1 to 1 (REECo, 1986).

2.5.1.2 BN CAU 198 Radiation Survey Summary

A radiation survey was performed by BN (1998a) on the filter tanks and associated concrete pad and piping, included in CAU 198 CAS 25-23-12. The exposure rate at a distance of approximately 3 ft from the tanks was recorded as 5 mR/hr, and the maximum contact reading was 40 mR/hr on the top of the tanks. The maximum removable contamination was recorded as 969.50 disintegrations per minute per 100 square centimeter (dpm/100 cm^2) beta (BN, 1998a), whereas the maximum allowable removable contamination, based on Table 4-2 of the *NV/YMP Radiological Control (Radcon) Manual* for Sr-90 and Cs-137 is 200 dpm/100 cm^2 beta and 1,000 dpm/100 cm^2 beta/gamma radioactivity, respectively (DOE/NV, 2000).

2.5.1.3 BN CAU 198 Radiological Soil Sample Results

This report detailed the radio analytical results for two soil samples collected from CAS 25-23-12 in March 1998. The specific sample locations were listed as “soil surrounding pad” (CAU 198-1) and

"soil from north berm" (CAU 198-2). The samples were analyzed for gamma spectroscopy, gross alpha, and gross beta radioactivity (BN, 1998b). The results are listed in Table 2-1.

Table 2-1
Soil Sample Results for CAU 198, CAS 25-23-12

Sample ID	Isotope	Result (pCi/g)	Error% (2.0σ)
CAU 198-1	Gross Alpha	2.98	19.
	Gross Beta	17.5	5.8
	Cs-137	38.5	9.5
	K-40	29.3	18.
	Th-228	1.98	28.
	Th-232	1.38	41.

Sample ID	Isotope	Result (pCi/g)	Error% (2.0σ)
CAU 198-2	Gross Alpha	2.43	22.
	Gross Beta	2.9	25.
	Cs-137	0.268	45.
	K-40	27.1	19.
	Th-228	2.18	20.

BN, 1998b

Based on the Cs-137 and gross beta results, it appears that the soil surrounding the concrete pad is contaminated with radionuclides. It is not known if these results are for an area that was cleaned subsequent to sampling.

2.5.1.4 BN CAU 198 In Situ Gamma Spectroscopy Results

In situ gamma spectroscopy measurements were made on the two filter tanks and surrounding berms at the Test Cell C WWTS (CAU 198, CAS 25-23-12). This report shows substantial Cs-137 contamination on the tanks and the surrounding ground. No other radionuclides were found during the investigation. It was noted that there was a high count rate in the continuum of the spectral data, which suggests that radiation was being scattered before reaching the detector. The report further states that this would be expected from buried or shielded sources. (BN, 1998c)

2.5.1.5 CAU 262 Corrective Action Decision Document

This Corrective Action Decision Document (CADD) (DOE/NV, 2001) describes and summarizes the investigation activities for the subject sites. Included are the results for the corrective action investigation of the Test Cell C WWTS leachfield (CAS 25-05-08). Radioanalysis was performed on 84 subsurface soil samples. In 46 samples, the concentration of Cs-137 and/or Sr-90 exceeded PALs. Six of the nine surface soil samples collected had Cs-137 and Sr-90 concentrations exceeding PALs.

The PALs were not exceeded in soil samples for volatile organic compounds (VOCs) or semivolatile organic compounds (SVOCs), nor for *Resource Conservation and Recovery Act* (RCRA) metals (except for arsenic, which ranged from 1.3-3.4 milligrams per kilogram [mg/kg]). These arsenic concentrations are within the range of natural background in this area, and thus, these values do not imply contamination. Total petroleum hydrocarbons (TPH) did not exceed the *Nevada Administrative Code* (NAC) Action Level of 100 mg/kg (NAC, 2002e). The *NV/YMP RadCon Manual* unrestricted release criteria were exceeded at the distribution box and collection system piping (DOE/NV, 2001).

2.5.2 X-Tunnel

An experiment conducted at X-Tunnel contaminated the walls and floor of the test chamber and portions of the main drift with particles of depleted uranium. The *Final Radiological Report for X-Tunnel* (BN, 1996a) documented radiological surveys conducted during January 1996. In preparation for a subsequent experiment, a cleanup of X-Tunnel was performed in May through July 1996.

The BN (1996a) document states that based on the survey results, radioactively contaminated equipment and materials, including an underground tank and a large metal plate (firing table), were removed from the test chamber. It is assumed that CAS 25-02-13 is the former location of the underground tank mentioned in BN (1996a). The report also states that the back (ceiling) and ribs (walls) in the main tunnel and test chamber, from the side drift to the face (end of the tunnel) were cleaned and shot-creted to stabilize contamination. The invert (floor) of this same portion of the main tunnel and test chamber was removed.

The BN (1996a) document reports that subsequent to cleanup activities, the test chamber and main drift of the X-Tunnel were clean and available for access with no radiological restrictions or postings. The document also reports that the side drift, posted as a controlled area, contains ventilation piping with internal radioactive contamination and areas on the invert with radioactive contamination that has been fixed in place. These are not part of CAS 25-02-13.

2.5.3 Pluto Disassembly Facility

2.5.3.1 BN UST 26-2201-2 Waste Characterization Results

Upon removal of UST 26-2201-2 (CAU 418, CAS 26-02-04) from the Pluto Disassembly Facility (Building 2201), it was determined that an estimated 40 to 55 gallons of sludge remained in the tank. This sludge was sampled and the analytical results are listed in Table 2-2 (BN, 1996b).

Table 2-2
Sludge Sample Results for CAU 418, CAS 26-02-04 (UST 26-2201-2)

Sample ID	TCLP VOCs (mg/L)	TCLP SVOCs (mg/L)	TCLP Metals (mg/L)	TPH Diesel (mg/kg)	TPH Oil (mg/kg)	PCBs (mg/kg)	Flash Point (°C)	Gamma Scan (20 min) (pCi/g)	Gross Alpha (pCi/g)	Gross Beta (pCi/g)
26-2201-2 sludge	ND	ND	As 0.0123	<500	7,400	Aroclor-1254 26	>60	Am-241 4,290	6,860	2,810
			Ba 4.3					Pu-239 54,300		
			Cd 0.451					Ra-226 2.30		
			Cr 0.205					U-235 6.23		
			Pb 28							
			Se 0.456							
			Ag 0.022							

ND = Not detected
mg/L = Milligrams per liter
mg/kg = Milligrams per kilogram
pCi/g = Picocuries per gram
°C = Degrees Celsius
PCB = Polychlorinated biphenyl
SVOC = Semivolatile organic compound
TCLP = Toxicity characteristic leaching procedure
VOC = Volatile organic compound

Contaminants noted as elevated include the following:

- Lead--compared to the current regulatory Toxicity Characteristic Leaching Procedure (TCLP) level of 5.0 milligrams per liter (mg/L)
- TPH--compared to the NAC Action Level of 100 mg/kg
- PCBs--compared to the 40 CFR 761.125 regulatory level of 50 mg/kg (CFR, 2001d)
- Am-241 and Pu-239 (BN, 1996a)

This waste was classified as transuranic-mixed waste, and the tank was disposed of as low-level radioactive waste. As discussed in Section 2.2.2.1, UST 26-2201-2 was connected by a pipeline to the CAU 127 filter tank (CAS 26-01-01).

2.5.3.2 CAU 271 Field Investigation of CAS 26-05-01

Site visits and field work conducted in 2001 and 2002 have established a relationship between CAU 271 CAS 26-05-01 and CAU 127 CASs 26-01-01, 26-01-02, and 26-99-01. The filter system that comprises the three CAU 127 CASs apparently discharged effluent to the CAS 25-05-01 radioactive leachfield. In three subsurface soil samples collected from worst-case biased locations in the leachfield, Pu-239 (0.49 to 0.6 pCi/g), uranium-234 (4.8 pCi/g), and uranium-235 (0.26 pCi/g) were detected at concentrations above the CAU 271 PALs and statistically distinguishable from background (Hutchinson, 2002).

2.5.4 Port Gaston Training Area

2.5.4.1 NUWAX-81

Planning for NUWAX-81 is documented in Defense Nuclear Agency (DNA) (1980). It is unknown if the agricultural sprayer from CAS 26-23-01 is the same unit used in this exercise. This document discusses the purpose, scope, contaminants to be used, methods to be used, responsibilities, and similar topics. Additionally, a discussion of the impurities associated with the simulated contaminants, the half-lives, decay schemes, comparisons to background, and associated calculations are included. The simulated contaminants used were Hg-197 and Ra-223. The impurities associated with Ra-223 are Ra-226, Ac-227, and Th-227. The impurities associated with Hg-197 are Hg-197m and Hg-203. The simulated contaminant solution also contained stable mercury isotopes. The DNA (1980) report concluded that the amounts of Ra-226, Ac-227, Th-227, Hg-197m, and Hg-203, as well as the amount of stable mercury added to the soil will be considerably less than background levels.

2.5.4.2 NUWAX-83

Planning for NUWAX-83 is presented in DNA (1982). This document describes the purpose, scope, contaminants to be used, a discussion of the methods, and similar topics. Additionally, a discussion of the impurities associated with the simulated contaminants, the half-lives, etc. is included. The two

simulated contaminants to be used were Ra-223 and Pd-103. Although the impurities for Ra-223 are listed as Ra-226 and Ac-227 (no mention was made of Th-227), Th-227 should also be considered an impurity because it is a daughter of Ac-227. The impurities associated with Pd-103 are listed as silver-110m and iridium-192. However, the half lives of these two impurities are 270 and 74 days, respectively. Therefore, no residual contamination is expected to exist from Pd-103 impurities. (DNA, 1982)

2.5.5 NEPA Documentation

In accordance with the NNSA/NV NEPA Compliance Program, a NEPA checklist will be completed prior to commencement of site investigation activities at CAU 127. This checklist is used by NNSA/NV project personnel to evaluate their proposed projects 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.

3.0 Objectives

This section presents an overview of the DQOs for CAU 127 and the development of the general CSM. Also presented are the COPCs and PALs for the investigation.

3.1 Conceptual Site Model

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. Two CSMs were developed for CAU 127 using assumptions formulated from historical background information, knowledge from studies of similar sites and site visits, and data from previous sampling efforts presented in Section 2.0. The CAU 127 CSMs are aboveground tank/piping (CSM #1) and underground tank/piping/structure (CSM #2). A discussion in Section A.1.1.3 provides additional information on the CSMs. Generalized illustrations of CSM #1 and CSM #2 are shown in Figure A.1-1 and Figure A.1-2, respectively.

3.1.1 Future Land Use

Future land-use scenarios limit subsequent uses of the CASs to various nonresidential (i.e., industrial) activities. Exposure scenarios for sites located within the NTS boundaries are limited by the future land-use scenarios to site workers who may be exposed to COPCs through oral ingestion, inhalation, or dermal contact (absorption) of soils and/or debris (e.g., equipment, concrete) due to inadvertent disturbance of these materials. Site workers may also be exposed to radiation by performing activities in proximity to radiological COPCs. Alternative 3, *Expanded Use*, from the NTS Environmental Impact Statement (EIS) is used to consider future land-use scenarios at the NTS. These scenarios include all currently planned and proposed projects; all ongoing NNSA/NV and interagency programs and operations described in Alternative 1, *Continue Current Operations (No Action Alternative)*; and potential project activities resulting from other DOE EISs (DOE/NV, 1996).

The CAU 127 CASs are within the following future land-use zones:

- Research, Test, and Experiment Zone - CASs 25-01-05; 25-02-02; 25-23-11; 25-02-13; 25-12-01; 26-01-01; 26-01-02; 26-99-01; 26-02-01; and 26-23-01. (DOE/NV, 1998c)

- Yucca Mountain Site Characterization - CASs 25-01-06 and 25-01-07 (DOE/NV, 1998c)

3.1.2 Contaminant Sources

The source of contamination at most of the CASs is a storage tank or tanks, also possibly associated piping and pump systems, and migration to domestic water supplies through groundwater. Additional source information for individual CASs is discussed in Section 2.2.

3.1.3 Exposure Pathways

Potential exposure pathways to site workers include oral ingestion, inhalation, and dermal contact (absorption) of soils due to disturbance of contaminated soils, and migration to domestic water supplies through groundwater. Site workers may also be exposed to radiation by performing activities in proximity to radiologically contaminated materials.

However, groundwater is not expected to be impacted because of its significant depth and because the environmental conditions (i.e., low precipitation and high evapotranspiration rates, Section 3.1.4) are not conducive to downward migration. Therefore, groundwater is not a viable exposure pathway to a receptor.

3.1.4 Release Mechanisms

An important element of the CSM is the expected fate and transport of contaminants, which infer how contaminants move through media and where they can be expected in the environment. Fate and transport are influenced by distinguishing physical and chemical characteristics of the contaminants and media. Contaminant characteristics include solubility, density, and adsorption potential. Media characteristics include permeability, porosity, water saturation, sorting, chemical composition, and organic content. In general, contaminants with low solubility, high adsorption, and high density can be expected to be found relatively close to release points. Contaminants with high solubility, low adsorption, and low density can be expected to be found further from release points.

Contaminants could be transported into the subsurface by infiltration of precipitation that serves as a driving force for downward migration of contaminants. However, potential evapotranspiration (the evaporative capacity of the atmosphere at the soil surface) at the NTS is significantly greater than

precipitation, thus limiting vertical migration of contaminants. The annual average precipitation for this region is only 3 to 6 in. per year (USGS, 1975). The total potential evapotranspiration at the Area 3 Radiological Waste Management Site has been estimated at 62.6 in. (Shott, et al., 1997). The potential annual evapotranspiration is approximately 10 times greater than the annual precipitation. These data indicate that evaporation is the dominant factor influencing the movement of water in the upper unsaturated zone. Therefore, recharge to groundwater from precipitation is not significant at the NTS and does not provide a significant mechanism for migration of contaminants to groundwater.

Contaminants may also have been transported to the environment by the release of liquids in the tanks.

3.1.5 Migration Pathways

Migration pathways at the CASs are expected to be generally limited to vertical migration due to gravity. However, for spills or leaks aboveground, the contaminants may have migrated laterally prior to infiltration. Additionally, the presence of relatively impermeable layers could modify transport pathways, both on the ground surface (e.g., concrete pads) and in the subsurface (e.g., caliche layers). Contamination, if present, is expected to be contiguous to the site, except where multiple sites are adjacent. In these cases, migration from one site may have impacted the immediately adjacent site. For both CAU 127 CSMs, concentrations of contaminants are expected to decrease with horizontal and vertical distance from the location of the release.

3.1.6 Exposure Points

Exposure points for the aboveground leaks/spills (CSM #1) would be soil at the ground surface, below the release. For subsurface leaks/spills (CSM #2), the exposure point would be the interface of the pipe/tank bedding and the underlying native soil.

3.1.7 Additional Information

Additional topographic information for CAU 127 will be limited to the vicinity of the CASs. The information to be gathered primarily consists of drainage patterns, and potential migration pathways.

General surface and subsurface soil descriptions will be observed and recorded during the corrective action investigation. If bedrock is contacted during the investigation, then the stratigraphy and lithology will be recorded as well.

Climatic conditions for the CAU are well documented and have been addressed in the CSM (Section 3.1.4 and Appendix A). No further information is required.

Groundwater data for the CAU is known and has been addressed in the CSM (Section 2.1, Section 3.1.3, and Appendix A). No further information is required.

Existing floodplain studies are available and will be considered during corrective action, as necessary. No further information is required.

The presence of infrastructures is known. No further information is required.

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, and inferred activities associated with the various CASs. These COPCs are listed in Table 3-1. The COPCs are also discussed in Section A.1.1.3.2 of Appendix A.

The chemical and radiological parameters of interest have been selected for each CAS, based upon the above sources of information. Due to the uncertainty of this information, additional constituents have been added to the analytical program for CAU 127. The analytical program is shown in Table A.1-6 in Appendix A. Laboratory analysis of environmental soil samples will provide the means for quantitative measurement of the COPCs. The laboratory analyses and methods have been determined to be sufficient to detect contamination in soil samples at concentrations exceeding the minimum reporting limit (MRL). If an additional or follow-up field effort is required, the sampling and analytical parameters will be limited to COCs identified by previous analytical results.

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 meet sensitivity requirements.

Table 3-1
Documented Contaminants of Potential Concern for CAU 127

CAS	Chemical COPCs[a]	Source of Information	Radiological COPCs[a]	Source of Information
25-01-05, 25-02-02, 25-23-11	Asbestos Beryllium Trichloroethene	DRI, 1988 IT, 1996 Patton, 1992 Site Reconnaissance	Americium-241 Barium-137m Cesium-137 Cobalt-60 Europium-152 Europium-154 Europium-155 Niobium-94 Plutonium-238, 239/240 Radium-226 Strontium-90 Tritium Uranium-234, 235, 238 Yttrium-90	AEC/NASA, 1971 Alderson, 2001 DOE, 1988 DOE/NV, 1998a DOE/NV, 1998b DOE/NV, 2001 DRI, 1988 Proctor, 1998 REECo, 1986
25-12-01	Asbestos Beryllium Boron	LASL, 1970 Patton, 1992 Site Reconnaissance	Chlorine-36 Cobalt-60 Europium-154, 155 Potassium-40 Sodium-22	Adams, 2001 Henderson, 2001
25-01-06, 25-01-07	Diesel Fuel	Garey, 2000 REECo, 1991 Site Reconnaissance	In adjacent soil: Americium-241 Plutonium-238 Plutonium-239/240 Radium Thorium	AWC, 1987a AWC, 1987b Bliss, 1992
25-02-13	Hydraulic fluid	Bastian, 1996; Williams, 2001	Depleted uranium	Bastian, 1996; Williams, 2001
26-01-01, 26-01-02, 26-99-01	Asbestos Beryllium Lead PCBs TCLP metals TPH (gasoline) TPH (oil)	Bonn, 1996a Bonn, 1996b DOE/NV, 1993 NDEP, 1998 REECo, 1972 Site Reconnaissance Ullrich, 2001	Americium-241 Plutonium-238 Plutonium-239/240 Uranium	Alderson, 2001 Bonn, 1996b DOE/NV, 1993
26-02-01	Beryllium	Process Knowledge	None	None
26-23-01	None	None	Radium-226 Actinium-227	Alderson, 2001; DNA, 1982

[a]These constituents are the critical analytes for the investigation.

Table 3-2
Analytical Requirements for CAU 127
(Page 1 of 3)

Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision[a]	Percent Recovery (%R)[b]
ORGANICS						
Total Volatile Organic Compounds (VOCs)	Water Soil	8260B[c]	Parameter-specific estimated quantitation limits[d]	Not Applicable (NA)	Lab-specific[e]	Lab-specific[e]
Toxicity Characteristic Leaching Procedure (TCLP) VOCs[p]						
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 Soil	8270C[c]	Parameter-specific estimated quantitation limits[d]	NA	Lab-specific[e]	Lab-specific[e]
TCLP SVOCs[p]						
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]		
Polychlorinated Biphenyls (PCBs)	Water Soil	8082[c]	Parameter-specific (CRQL)[g]	NA	Lab-specific[e]	Lab-specific[e]

Table 3-2
Analytical Requirements for CAU 127
(Page 2 of 3)

Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision[a]	Percent Recovery (%R)[b]
Total Petroleum Hydrocarbons (TPH)	Water GRO (C6-C10)	8015B modified[c]	0.1 mg/L[h]	NA	Lab-specific[e]	Lab-specific[e]
	Soil GRO (C6-C10)		0.5 mg/kg[h]			
	Water DRO (C10-C38)		0.5 mg/L[h]			
	Soil DRO (C10-C38)		25 mg/kg[h]			
Total Metals						
Arsenic	Water	6010B[c]	10 µg/L[h, i]	NA	20[i]	Matrix Spike Recovery 75-125[i] Laboratory Control Sample Recovery 80 - 120[i]
	Soil	6010B[c]	1 mg/kg[h, i]		35[o]	
Barium	Water	6010B[c]	200 µg/L[h, i]		20[i]	
	Soil	6010B[c]	20 mg/kg[h, i]		35[o]	
Beryllium	Water	6010B[c]	5 µg/L[h, i]		20[i]	
	Soil	6010B[c]	0.5 mg/kg[h, i]		35[o]	
Boron	Water	6010B[c]	100 µg/L[h]		20[i]	
	Solid	6010B[c]	10 mg/kg[h]		35[o]	
Cadmium	Water	6010B[c]	5 µg/L[h, i]		20[i,]	
	Soil	6010B[c]	0.5 mg/kg[h, i]		35[o]	
Chromium	Water	6010B[c]	10 µg/L[h, i]		20[i,]	
	Soil	6010B[c]	1 mg/kg[h, i]		35[o]	
Lead	Water	6010B[c]	3 µg/L[h, i]		20[i,]	
	Soil	6010B[c]	0.3 mg/kg[h, i]		35[o]	
Mercury	Water	7470A[c]	0.2 µg/L[h, i]		20[i]	
	Soil	7471A[c]	0.1 mg/kg[h, i]		35[o]	
Selenium	Water	6010B[c]	5 µg/L[h, i]		20[i,]	
	Soil	6010B[c]	0.5 mg/kg[h, i]		35[o]	
Silver	Water	6010B[c]	10 µg/L[h, i]		20[i]	
	Soil	6010B[c]	1 mg/kg[h, i]		35[o]	
TCLP RCRA Metals[p]						
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 - 120[i]
Barium			2 mg/L[h, i]	100 mg/L[f]		
Cadmium			0.05 mg/L[h, i]	1 mg/L[f]		
Chromium			0.1 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			0.1 mg/L[h, i]	5 mg/L[f]		
Other[p]						
Asbestos	Solid	NIOSH 9002	<1%		Lab-Specific[e]	Lab-Specific[e]
RADIOCHEMISTRY						

Table 3-2
Analytical Requirements for CAU 127
(Page 3 of 3)

Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision[a]	Percent Recovery (%R)[b]
Gamma-Emitting Radionuclides	Water	EPA 901.1[j]	The Minimum Reporting Limits and Minimum Detectable Activities for Radionuclides are given in Table 3-3	NA	Relative Percent Difference (RPD[a]) 20% (Water)[h] 35% (Soil)[h,o] Normalized Difference (ND) -2<ND<2[k]	Laboratory Control Sample Recovery 80-120[e]
	Soil	HASL-300[l]				
Isotopic Uranium	Water	HASL-300[l] ASTM D3972-02[m]		NA		Chemical Yield 30-105[n] Laboratory Control Sample Recovery 80-120[i]
	Soil	HASL-300[l] ASTM C1000-00[m]				
Tritium	Water	EPA 906.0[j]		NA		Laboratory Control Sample Recovery 80-120[e]
	Soil	EERF[q]				
Isotopic Plutonium	Water	ASTM D3865-02[m]		NA		Chemical Yield 30-105[n] Laboratory Control Sample Recovery 80-120[i]
	Soil	HASL-300[l]				
Strontium - 90	Water	ASTM D5811-00[m]		NA		
	Soil	HASL-300[l]				

[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 x $\{(|C_1-C_2|)/[(C_1+C_2)/2]\}$, 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 x (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 261.24, "Toxicity Characteristic" (CFR, 2001b)

[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, 2002a)

[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)

[o] *Sampling and Analysis Plan (Field Sampling and Quality Assurance Project Plan) with Guidance EPA Region IX* (EPA, 1997)

[p] Although not intended to be included as part of the sampling program, these analyses have been included as a contingency for waste management.

[q] EERF - EPA Eastern Environmental Radiation Facility (or laboratory-specific method such as Paragon Analytics, Inc. Method 754/704).

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
DRO = Diesel-range organics
GRO = Gasoline-range organics

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

Table 3-3
Minimum Detectable Concentrations, Preliminary Action Levels, and Minimum Reporting Limits for Radionuclides in Samples Collected at CAU 127

Isotope	Soil and Sludge			Liquid		
	MDC[a] (pCi/g)[d]	PAL[b] (pCi/g)[d]	MRL[c] (pCi/g)[d]	MDC[a] (pCi/L)[e]	PAL[b] (pCi/L)[e]	MRL[c] (pCi/L)[e]
Americium-241 (by Gamma spectroscopy)	2.0[f]	2.0	2.0	50	50	50
Cesium-137	0.5[f]	7	2.5	10	10	10
Cobalt-60	0.5[f]	0.5	0.5	10[f]	10	10
Europium-152	4.0[f]	4.0	4.0	75	75	75
Europium-154	2.5[f]	2.5	2.5	65	65	65
Europium-155	1.0[f]	1.35	1.0	20	20	20
Radium-226	1.0	3.47	1.0	20	25.9	20
Strontium-90	0.5	1.17	0.5	1.0	1.0	1.0
Thorium-227 (equal to Actinium-227)[g]	5.0[f]	5.0	5.0	50	50	50
Uranium-234	0.05	3.47	0.25	0.1[f]	8.92	0.5
Uranium-235	0.05	0.07	0.05	0.1[f]	0.36	0.1
Uranium-238	0.05	3.47	0.25	0.1[f]	9.39	0.5
Plutonium-238	0.05	0.05	0.05	0.1	0.16	0.1
Plutonium-239/240	0.05	0.106	0.05	0.1	9.0	0.5

[a] MDC is the minimum detectable concentration: detection limits required for the measurement of ITLV samples.
[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; US Ecology and Atlan-Tech, 1992; and DOE/NV, 1999). The PAL is equal to the MDC for isotopes not reported in soil samples from undisturbed background locations or if the PAL is less than the MDC.
[c] MRL is the minimum reporting level. It is set equal to 5 times the MDC, or if 5 times the MDC is greater than the PAL, the MRL is set equal to the MDC.
[d] pCi/g is picocuries per gram.
[e] pCi/L is picocuries per liter.
[f] MDC for gamma-emitting radionuclides is relative to Cs-137.
[g] Ac-227 will be determined from Th-227. Due to its short half-life, Th-227 will be in equilibrium with its parent, Ac-227, and the Ac-227 will have the same activity as the Th-227.

3.3 Preliminary Action Levels

Laboratory analytical results for soil samples will be compared to the following PALs to evaluate if COCs are present:

- *EPA Region 9 Risk-Based Preliminary Remediation Goals* (PRGs) for chemical constituents in industrial soils (EPA, 2000).
- Background concentrations for 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 parts per million (ppm) per the NAC 445A.2272 (NAC, 2002e).
- 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; US Ecology and Atlan-Tech, 1992; DOE/NV, 1999). The PAL is equal to the MDC for isotopes not reported in soil samples from undisturbed background locations or if the PAL is less than the MDC (see Table 3-3).

For detected chemical COPCs without established PRGs, if necessary, a similar protocol to that used by EPA Region 9 will be used in establishing an action level for those COPCs listed in the Integrated Risk Information System (IRIS) Database (EPA, 2002).

The comparison of laboratory results to PALs will be discussed in the CADD. Laboratory results above action levels indicate the presence of COCs at levels that may require further investigation or 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 provide real-time semiquantitative measurements of certain COPCs. The field-screening results (FSRs), along with other biasing factors, can guide the selection of the most appropriate sampling locations for collection of laboratory samples. The

following action levels, known as field-screening levels (FSLs) may be used for on-site field screening:

- Headspace field screening for VOCs at 20 ppm or 2.5 times background, whichever is greater.
- TPH field-screening results greater than 75 ppm measure using an appropriate field-screening method (e.g., Handby or an equivalent method).
- Asbestos-containing materials are defined as exceeding 1 percent by volume (CFR, 2001e).
- The radiological (alpha and beta/gamma) 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 indicate potential contamination at that sample location. This information will be documented and the investigation will be continued in order to delineate the extent of contamination. Additionally, these data may also be used to select discretionary samples to be submitted for laboratory analysis. At sites with external radiation fields (i.e., "shine") that could interfere with radiological screening, measures will be taken (e.g., shielding) to reduce or eliminate the ambient radiation.

3.4 DQO Process Discussion

The DQOs are qualitative, semiquantitative, and quantitative statements that define the type, quantity, and quality of data required to support evaluations of potential closure alternatives for CAU 127. 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 development process with NNSA/NV and NDEP for this CAU, the informational inputs or data needs to resolve problem statements and decision statements were documented. Criteria for data collection activities were assigned. The analytical methods and reporting limits prescribed through the DQO process, as well as the DQIs for laboratory analysis such as precision and accuracy requirements, are provided in more detail in Section 6.0 of this CAIP. 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, comparability, and sensitivity.

The DQO decision flow process applied to the CAU 127 investigation is depicted in Figure 3-1. This decision process starts with a definition of the nature of contamination for all CASs. If laboratory data indicates the presence of COCs, the process will continue to define the extent of contamination. The process ends with no further investigation of the site based on the acquisition of laboratory analytical results for environmental samples and acquisition of all other data required for selection of a corrective action.

For CAS 25-02-13, a walkover radiological survey of the tunnel floor will be performed at the former location of the underground tank. This survey is planned to confirm the absence of radiological contamination (Figure 3-1). As discussed in Section 2.2.1.7, CAS 25-02-13 is located inside a tunnel in Little Skull Mountain, and it is at least 1,000 ft above the regional groundwater table. The tank and underlying gravel were removed in 1996, and the location is currently covered with an approximately 12-in. thick layer of concrete.

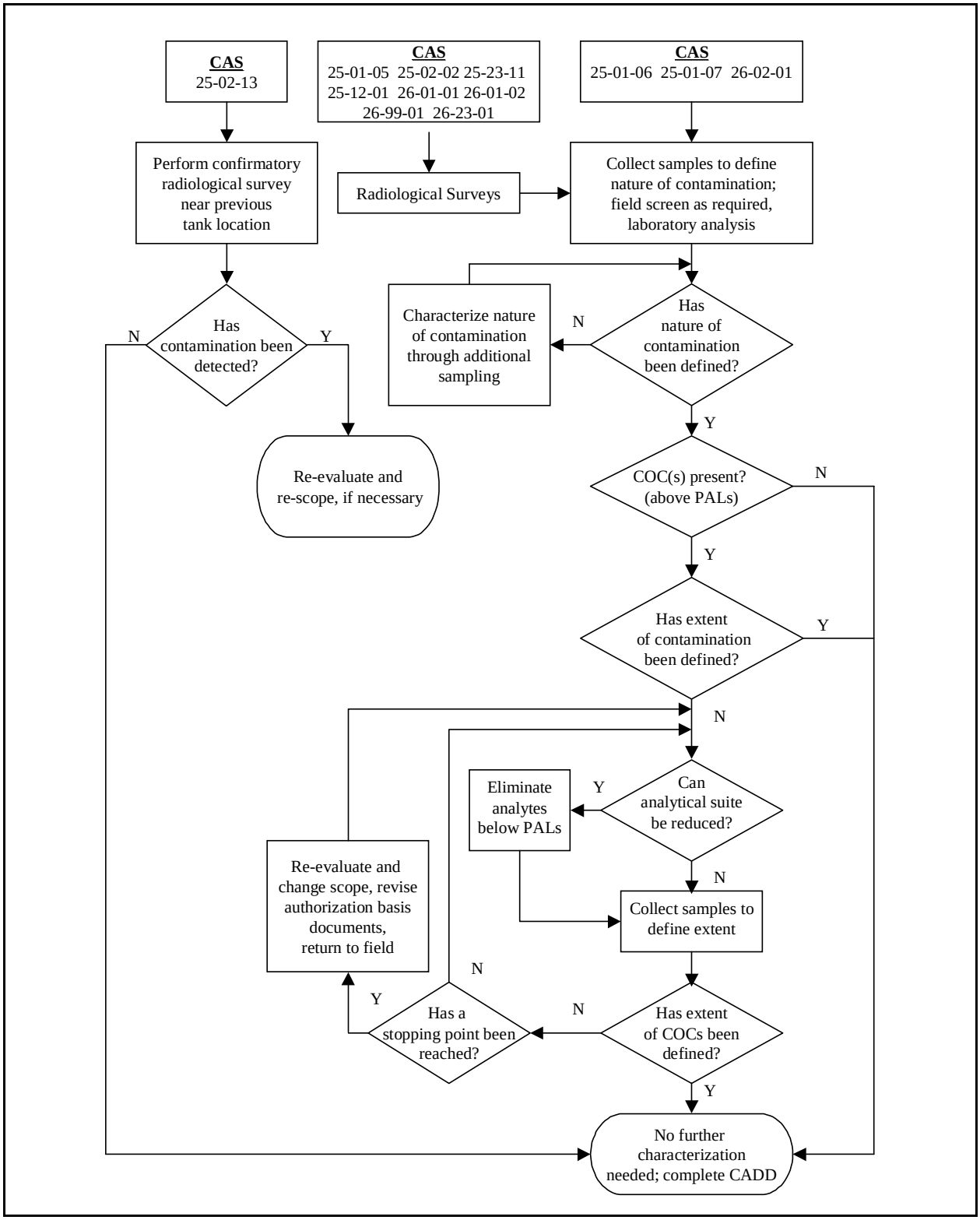


Figure 3-1
Data Quality Objective Decision Flow

4.0 Field Investigation

This section of the CAIP contains the approach for investigating CAU 127.

4.1 Technical Approach

The technical approach for CAU 127 consists of, but is not limited to, the following activities:

- Perform radiological surveys at nine CASs (25-01-05, 25-02-02, 25-23-11, 25-12-01, 25-02-13, 26-01-01, 26-01-02, 26-99-01, and 26-23-01).
- Perform field screening and collect Phase I soil samples from biased locations and submit for laboratory analysis to define nature of contamination.
- Collect soil samples for geotechnical/hydrological parameters.
- Collect Phase II soil samples to define extent of contamination, if necessary.
- Collect required QC samples.
- Collect waste characterization samples, as needed. This includes sampling the contents of tanks, where possible. If separate phases are present, each distinct phase will be sampled, when possible.
- Mark sample locations and collect coordinates in Universal Transverse Mercator, Zone 11, North American Datum 1927, meters coordinate system.

These activities may be conducted at any point during the investigation as deemed most efficient and appropriate by the Site Supervisor. Collection and analysis of soil samples are not planned for CASs 25-02-13 (UST) and 25-12-01 (Boiler).

4.2 Field Activities

This section provides a description of the field activities for CAU 127. A phased approach to DQO decision-making has been chosen to address the data collection activities. Biased sampling will be conducted during the investigation to address both Phase I and Phase II data needs. Process knowledge indicates that contamination, if any, is generally confined to the spatial boundaries of the sites as defined in the DQO process and the CSMs. On adjacent CASs, the possibility exists that one CAS has impacted the adjoining CAS. If Phase I determines that COCs are present at a CAS, the

extent of contamination will be determined (Phase II) before evaluating corrective action alternative requirements. In most cases, for logistical reasons, samples to determine both nature and extent will be collected during a single field effort. Where laboratory analytical data are available to support the determination of COCs, only COCs will be considered during subsequent sampling to determine the extent of contamination.

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) to this CAIP. The NDEP's concurrence with the ROTC 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. Spatial boundaries for the field investigation are listed in Appendix A.

Samples will be collected at biased sampling locations by rotary sonic drilling, hollow stem auger drilling, direct-push, handheld auger, hand sampling, and/or excavation, as appropriate. Table 3-2 provides the analytical methods and laboratory requirements (i.e., detection limits, precision, and accuracy requirements) to be used when analyzing for the COPCs. The analytical program for each CAS is presented in Appendix A, Table A.1-6. All sampling activities and QA/QC requirements for field and laboratory environmental sampling will be conducted in compliance with the Industrial Sites QAPP (DOE/NV, 2002a) and other applicable 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/NV, 1997), these documents outline the requirements for protecting the health and safety of the workers and the public and 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).

- 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 may be required by the NTS Management and Operating (M&O) Contractor prior to the investigation. Site preparation may include, but not be limited to: providing site access, construction of hazardous waste accumulation areas and site exclusion zones, removal and proper disposal of surface debris, and temporarily moving staged equipment.

4.2.2 Phase I Activities

The objective of Phase I is to determine the nature of contamination, which includes identifying both the contaminants that are present above the PALs and the maximum concentration of these contaminants. In order to accomplish this, radiological surveys, field screening, and biased sampling will be conducted.

Radiological surveys will be conducted at nine CASs. At eight of these nine sites (CAS 25-02-13 not included, see Section 4.2.2.1) the surveys will be performed to estimate the lateral extent of contamination, and/or identify hot spots for subsequent sampling or swiping. Additional biasing factors for sample collection include process knowledge, field observations, field screening, historical sample results, experience at similar sites, and professional judgement.

Sample locations will be based upon these biasing factors. Figures 4-1 to 4-8 show the potential sample locations for the CAU 127 CASs. These locations and the number of samples submitted for laboratory analyses may be modified in the field, but only if the decision needs and criteria stipulated in Section A.1.3 are satisfied.

The Phase I sampling strategy targets locations and media most likely to be contaminated by migrating COCs. Appendix A, Table A.1-10, lists the target populations for Phase I. Section A.1.3.1 and Table A.1-4 identify the primary biasing factors and information needs for selecting data collection locations to determine the extent of contamination. The following subsections provide additional information on Phase I field activities.

4.2.2.1 Radiological Surveys

Radiological surveys will be conducted at eight of the CAU 127 CASs in an attempt to define the lateral extent of surficial contamination and/or to locate hot spots for subsequent sampling or swiping. The CASs are 25-01-05, 25-02-02, 25-23-11, 25-12-01, 26-01-01, 26-01-02, 26-99-01, and 26-23-01. Walk-over surveys using handheld instruments will be performed on those portions of the CASs that are accessible. The walk-over surveys will be conducted on each CAS in such a manner as to ascertain if radiological contamination is present and is decreasing as the distance from the tanks/piping/etc. increases, as CSM #1 would predict. Additionally, if elevated ground surface readings are encountered, an effort will be made through *in situ* screening techniques to identify the source term as being either a surface/shallow subsurface source term or a subsurface source term. An NE Technology Electra, Eberline E-600, TSA-PRM-470B and Bicron millirems (mRem) or equivalent instruments will be used in the appropriate capacity as the handheld instruments.

A confirmatory walk-over radiological survey of the X-Tunnel floor will be conducted at the former location of the CAS 25-02-13 underground tank.

Some radiological screening, surveying, and swipe collection will take place for waste characterization purposes. These activities will assess the amount of fixed and removable contamination on the surfaces of pipes, tanks, concrete, and possibly other objects. When necessary, detectors or probes on extended cables will be lowered into structures to collect measurements, and

swipes will be affixed to extension poles or fish tapes to obtain data from the interior of structures or objects.

Additional equipment and software used in the radiological data collection and processing include a global positioning system (GPS) receiver, such as Trimble, and associated laptop computers to log and process the walkover radiological data. Mapping programs such as Surfer will be used to plot data on site maps or aerial photographs.

4.2.2.2 Intrusive Investigation

Intrusive investigation activities such as drilling, excavation, or other appropriate methods will be used to collect biased surface and subsurface soil samples.

Rotary sonic drilling, hollow stem auger drilling, direct-push, handheld augering, hand sampling, excavation, or other appropriate methods will be used to access sample intervals for field screening and laboratory analysis to determine if a COC is present. The frequency of sample locations will be based on biasing factors, but the anticipated number of samples per feature is detailed Table A.1-13, and discussed in Section 4.2.2.3. Two CASs, 25-01-06 and 25-01-07, will proceed directly to Phase II. They are discussed in Section 4.2.3.

Sample intervals (depth intervals) will be selected from the biased locations. Sample intervals will focus on surface soils (for aboveground features) and soils at the base and deeper (for subsurface features). The estimated depth of subsurface features will be determined by engineering drawings and other historical documentation. For subsurface features, the first sample interval will begin at the base of the feature. Soil samples will be collected at biased locations, according to the quantities listed in Table A.1-13. Both surface and subsurface sampling strategies may be required where both surface and subsurface features are present, such as CAS 25-01-05. The sampling frequency may be increased or decreased, based on biasing factors that support minor changes in the proposed sampling strategy. This includes sampling depth intervals where biasing factors (e.g., FSRs) indicate maximum concentrations of contaminants are present. Sampling to define extent is described in Section 4.2.3.

Select samples will be submitted for laboratory analysis of the Phase I chemical and radiological parameters identified for each CAS in Section 3.2. The analytical program is given in Table A.1-6 and analytical requirements are listed in Table 3-2. Quality assurance and QC requirements for sample collection are discussed in Section 6.0.

At selected CASs, the contents of tanks will be sampled to support waste characterization. If sufficient material is present and accessible, tank contents samples will be collected at CASs 25-01-05, 25-02-02, 25-12-01 (boiler will be sampled), 26-01-01, 26-01-02, 26-99-01, 26-02-01, and 26-23-01. If separate phases are identified (e.g., sludge and liquid), each phase will be sampled separately, if possible. At CAS 26-99-01, the filter media will be sampled, if possible. The analytical program for waste characterization sampling is presented in Appendix A, Table A.1-6. Where necessary, in addition to totals, the analytical program will include TCLP analyses. At CASs 25-01-05, 25-02-02, 25-23-11, 25-12-01, 26-01-01, 26-01-02, and 26-99-01 samples of suspected ACM will be analyzed for asbestos.

4.2.2.3 CAS-Specific Phase I Activities

Sampling locations shown on Figures 4-1 through 4-8 are for illustrative purposes only, and may be modified based upon biasing factors, and for Phase II, previous analytical results.

4.2.2.3.1 CAS 25-01-05, Aboveground Storage Tank

Perform a radiological survey of the tank and surrounding area. The area will not include the footprint of the CAS 25-05-08 leachfield that was previously investigated as part of CAU 262. The survey will also include the underground pipes (10 ft on either side) that connect this tank to CAS 25-23-11. A pump pad/vault was shown near the northwest end of pipes, near CAS 25-23-11, although it may have been removed. If present, a radiological characterization of the pumps and the pad/vault will be performed. As discussed in Section 4.2.2.2, the contents of the AST will be sampled, if possible. If separate phases are identified, and if possible, a sample of each phase will be collected for analysis.

After the radiological survey and characterization results have been analyzed, a minimum of two surface soil samples from near the base of the tank will be collected based on biasing factors.

Additionally, two subsurface soil samples will be collected using angle boring from under footprint of tank. A minimum of three subsurface soil samples will be collected along the length of the two underground pipes connected to CAS 25-23-11. The sample locations will be selected based on biasing factors. The previously mentioned pump pad/vault is included in this area. The sample interval (sample depth) will begin at the base of the pipe. Refer to Figure 4-1 for potential Phase I and Phase II sample locations.

4.2.2.3.2 CAS 25-02-02, Underground Storage Tank(s)

Perform a radiological survey of the ground surface within 20 ft of the approximated outline of tanks, and within 10 ft along either side of the piping that runs to the former location of the Filter Tanks (CAS 25-23-12, CAU 198). Perform a radiological survey around, over, and within Filter Tank bermed area, extending 20 ft beyond the outer toe of the berms. This survey will also include the area of CAS 25-23-11, and will be used for biasing the sample locations for CAS 25-23-11. Conduct a downhole radiological survey of at least one tank interior if access is available (e.g., through vent risers) and if tank contents are not sufficient to allow a sample to be collected. As discussed in Section 4.2.2.2, the contents of the tanks will be sampled and analyzed, if possible. If separate phases are identified, and if possible, a sample of each phase will be collected for analysis.

After the radiological survey results have been analyzed, collect a minimum of one surface soil sample, next to aboveground piping over USTs. The sample location(s) will be selected based upon biasing factors.

A minimum of six soil sample locations (surface and subsurface) will be selected on the soil berms around the filter tank area (outside, top, and inside berm surfaces). These sample locations will be based upon biasing factors. Any locations selected on the top of berm will be surface soil sample locations only. A minimum of one subsurface soil sample will be collected within the bermed area, immediately off the concrete pad. A minimum of two subsurface soil samples will be collected adjacent to the pump vault. Again, these sample locations will be selected based upon biasing factors. Sample intervals will be below the base of CAS 25-23-11 pump vault, as the soil above the vault base is addressed in the investigation of CAS 25-23-11. Collect a minimum of one subsurface soil sample below the underground pipe running to CAS 25-23-11. This sample interval will begin at the base of the pipe. Collect subsurface soil samples as near as possible to the tanks (beginning at the base of the

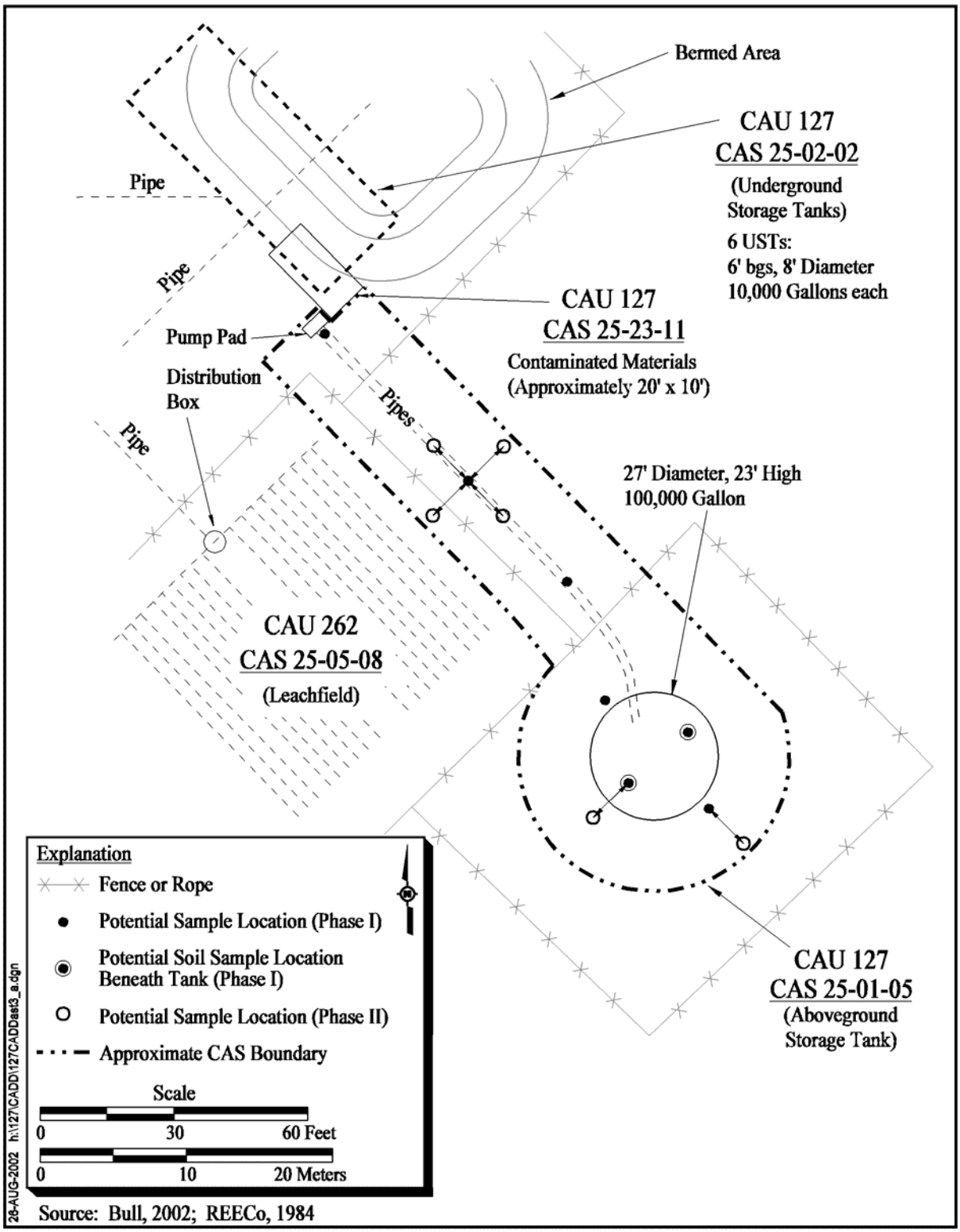


Figure 4-1
Test Cell C, CAS 25-01-05

tanks) at a minimum of four sample locations, based upon biasing factors. Samples on the northeast side of the tanks will be obtained by extending the depths of the sample locations on the inside of the bermed area. Refer to Figure 4-2 and Figure 4-3 for potential Phase I and Phase II sample locations.

4.2.2.3.3 CAS 25-23-11, Contaminated Materials

As described in Section 4.2.2.3.2, CAS 25-02-02, perform a radiological survey in the area around the pump vault. Specifically, this survey will cover the area within 20 ft of pump vault. In addition to the survey of the ground surface around the pump vault, perform a limited radiological characterization of exterior and accessible interior surfaces of pump and pipes within the vault, the concrete vault, and the aboveground heat shield, as appropriate. No suspected ACM will be disturbed to access surfaces for this effort.

After the radiological survey and characterization results have been analyzed, a minimum of two surface soil samples will be collected, the locations of which will be based upon biasing factors, as well as accessibility, due to conflicts with the piping and the heat shield. (Note: Soil below the bottom of the pump vault is addressed in the investigation of CAS 25-01-05 or CAS 25-02-02. Refer to Figure 4-2 and Figure 4-3 for potential Phase I and Phase II sample locations).

4.2.2.3.4 CAS 25-12-01, Boiler

A radiological survey of the concrete will be performed within 20 ft of the boiler, and within 10 ft of the other features (e.g., piping, pump pad) included in this CAS. A limited radiological characterization of exterior and accessible interior surfaces of the boiler and the other features included in this CAS will be performed, as appropriate (suspected ACM will not be disturbed to access surfaces). It is expected that the access door on the south end of the boiler can be used to provide access to the interior surfaces of the boiler. If material is present and accessible in the boiler, it will be sampled and analyzed. Refer to Figure 4-4 for the layout of the CAS and the surrounding area.

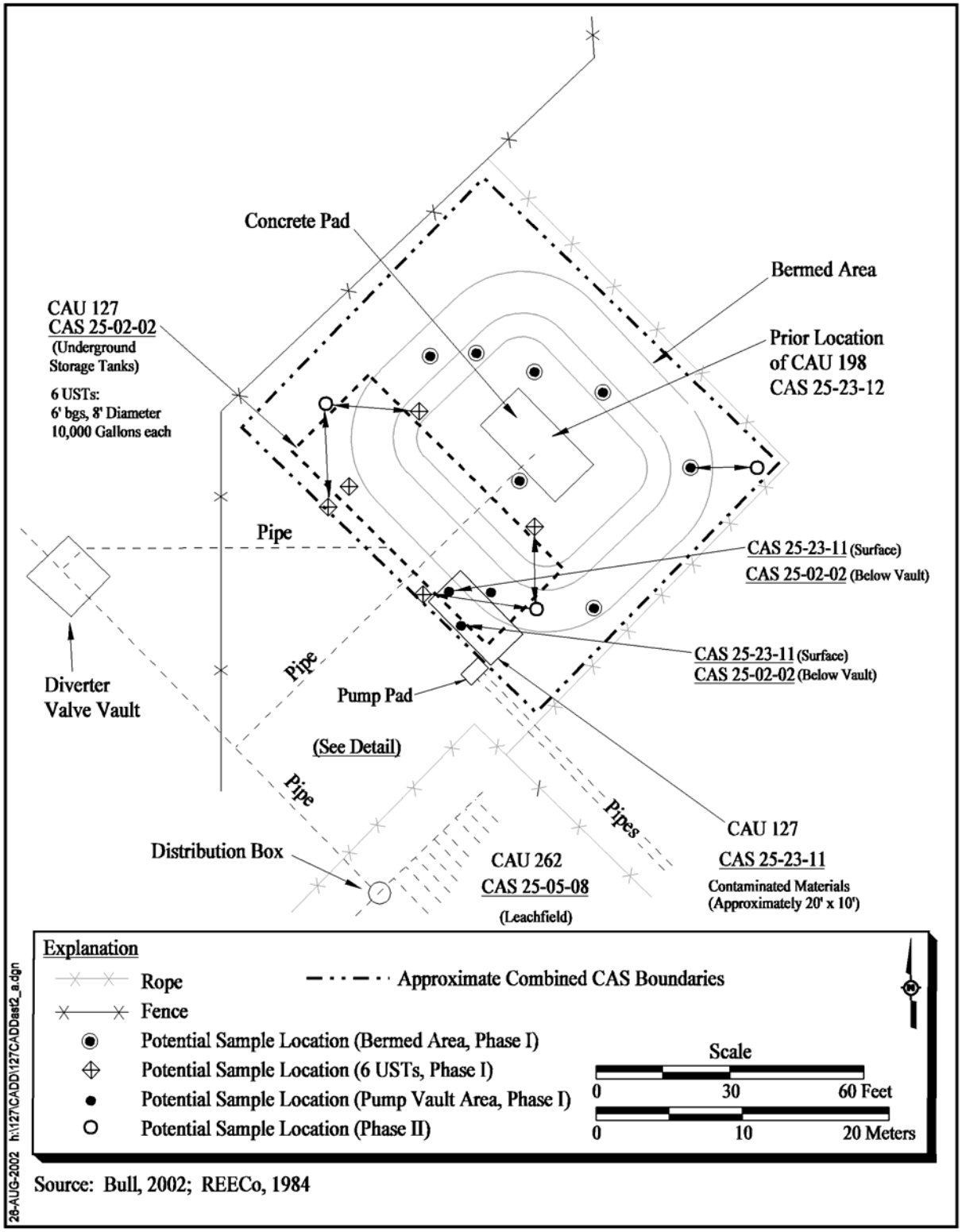
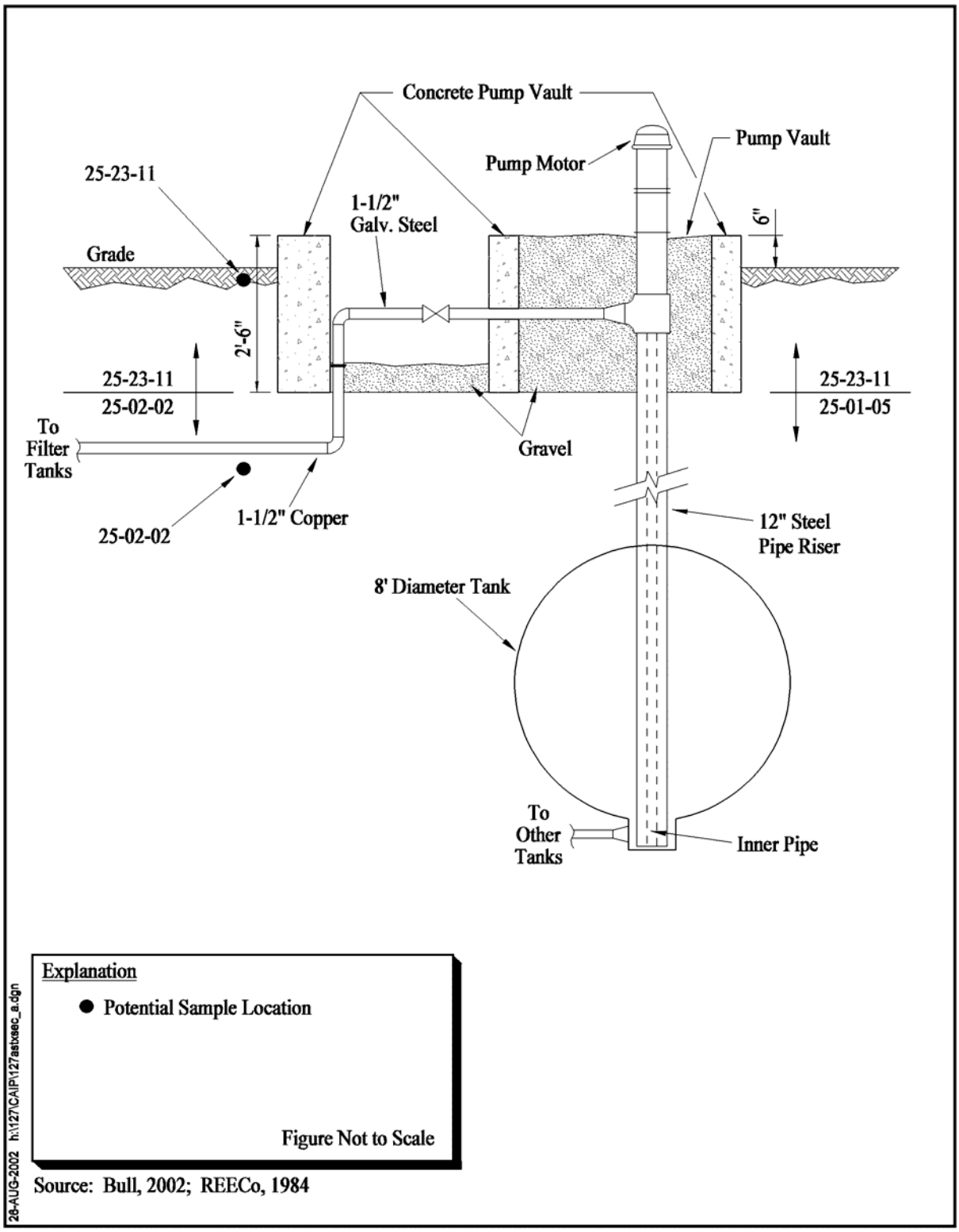


Figure 4-2
Test Cell C, CAS 25-02-02 and CAS 25-23-11



Source: Bull, 2002; REECo, 1984

Figure 4-3
Test Cell C Wastewater Treatment System Cross-Section, Interface Between CASs

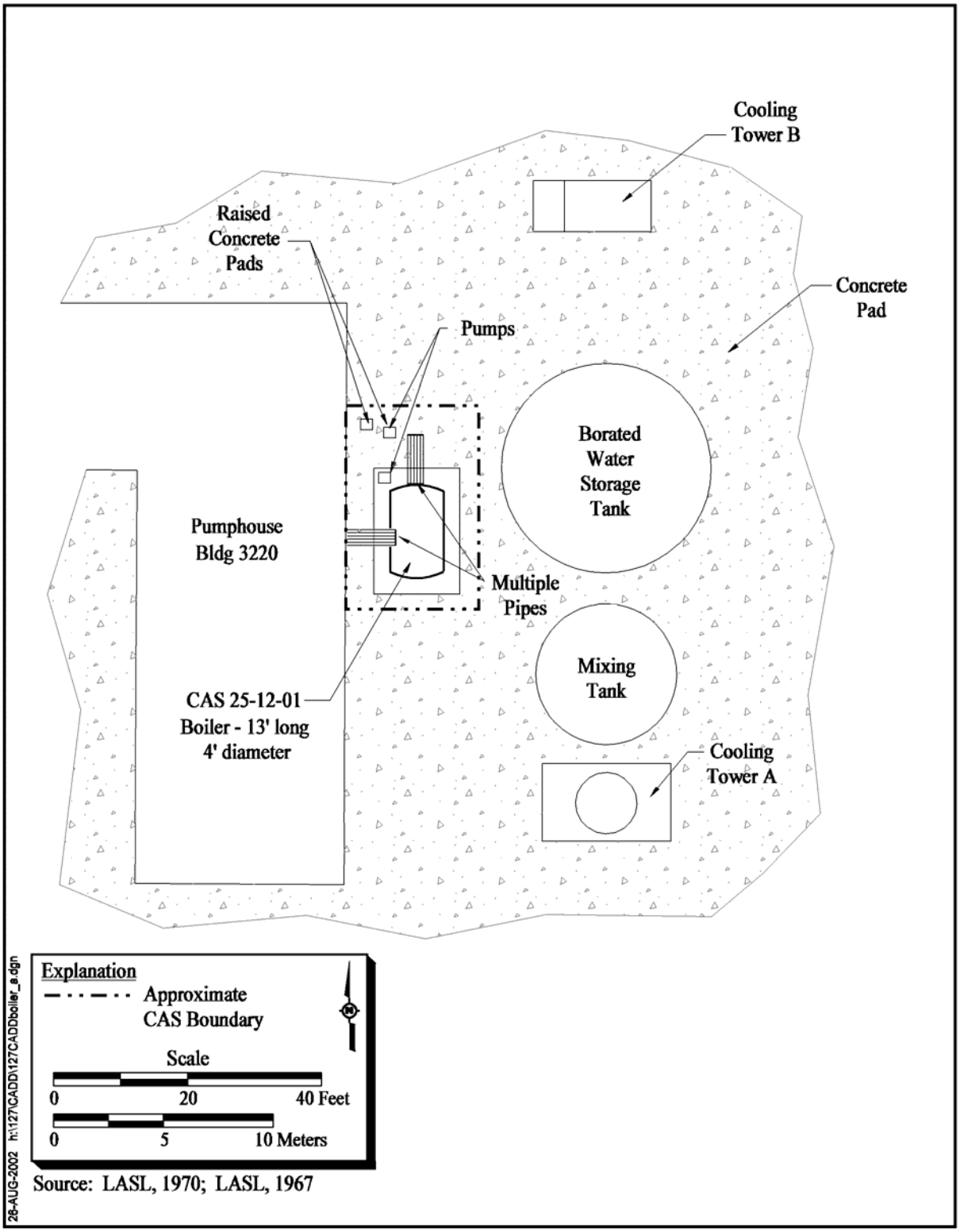


Figure 4-4
Test Cell C Boiler, CAS 25-12-01

4.2.2.3.5 CAS 25-02-13, Underground Storage Tank

A confirmatory walkover radiological survey of the X-Tunnel floor at the former location of the UST will be performed. The planned area of the survey is approximately 20 ft by 20 ft, as shown on Figure 4-5.

4.2.2.3.6 CAS 26-01-01, Filter Tank (Rad) and Piping; CAS 26-01-02, Filter Tank (Rad)

A radiological survey of the ground within 20 ft of each tank will be performed. This survey will incorporate the area underneath the aboveground pipes connected to the tanks. Additionally, a radiological survey along the path (10 ft either side) of the underground pipe that connected CAS 26-01-01 to the UST at CAS 26-02-04 (CAU 418) will be performed. A limited radiological characterization will be performed of the exterior and accessible interior surfaces of tanks and aboveground pipes, as appropriate (suspected ACM will not be disturbed to access surfaces). As discussed in Section 4.2.2.2, the contents of the tanks will be sampled and analyzed, if possible. If separate phases are identified, and if possible, a sample of each phase will be collected for analysis.

After the radiological survey and characterization results have been analyzed, a minimum of four surface and subsurface soil samples will be collected at locations beneath and immediately adjacent to each CAS (tank and aboveground piping), based upon biasing factors. Along the length of the underground pipe running from CAS 26-01-01 to the previous location of the CAS 26-02-04 UST (CAU 418), collect a minimum of three subsurface soil samples will be collected. Locations will be based upon biasing factors, and sample intervals (sample depths) will begin at the base of the pipe. Refer to Figure 4-6 for potential Phase I and Phase II sample locations.

4.2.2.3.7 CAS 26-99-01, Radioactively Contaminated Filters

A radiological survey will be performed of the ground surface within 20 ft of the Filter Shed, and underneath, as possible. A limited radiological characterization will also be performed of exterior and accessible interior surfaces of filter tanks, aboveground pipes within the shed, and shed (structure), as appropriate (suspected ACM will not be disturbed to access surfaces). After the radiological survey and characterization results have been analyzed, soil samples will be collected from a minimum of three surface and subsurface locations beneath and immediately adjacent to the

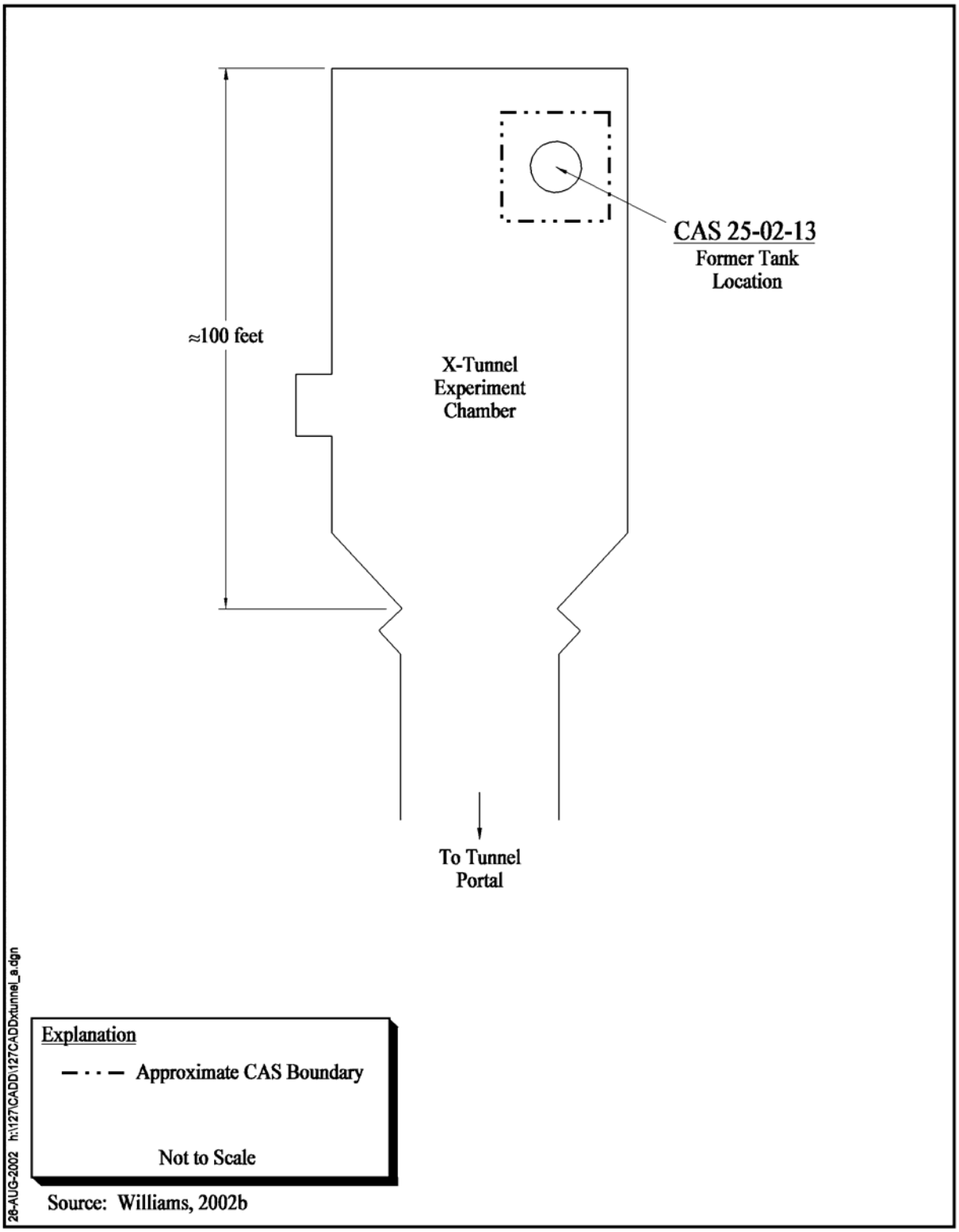


Figure 4-5
X-Tunnel Former Location of Underground Storage Tank, CAS 25-02-13

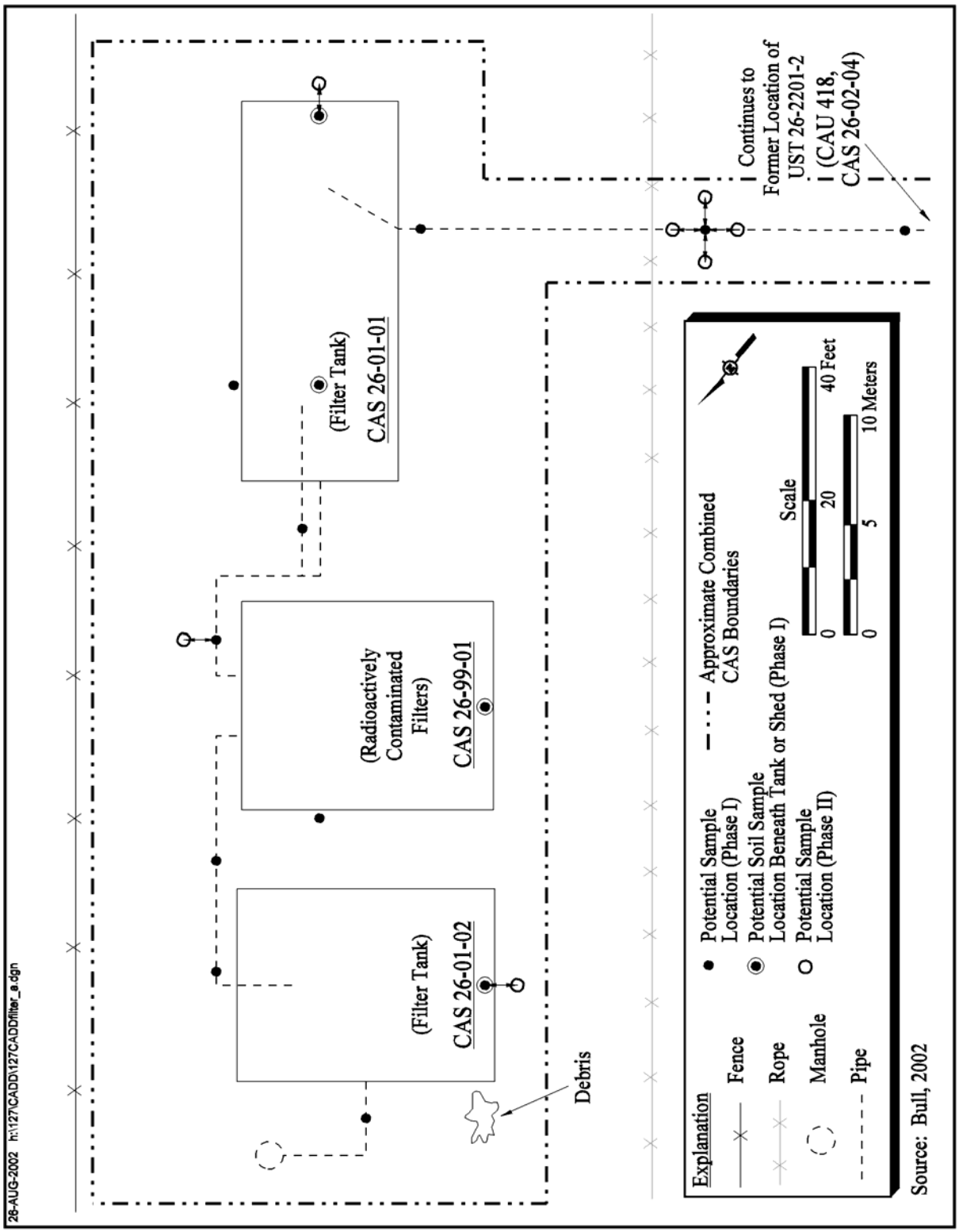


Figure 4-6
Pluto Disassembly Facility,
CASs 26-01-01, 26-01-02, and 26-99-01

building, based upon biasing factors. Refer to Figure 4-6 for potential Phase I and Phase II sample locations. Also, the filter media will be sampled and analyzed, if possible.

4.2.2.3.8 CAS 26-02-01, Underground Storage Tank

Soil samples will be collected from two subsurface locations, immediately adjacent to the tank, based upon biasing factors. The sample interval (sample depth) will begin at the base of the tank. Refer to Figure 4-7 for potential Phase I and Phase II sample locations. As discussed in Section 4.2.2.2, the contents of the tanks will be sampled and analyzed, if possible. If separate phases are identified, and if possible, a sample of each phase will be collected for analysis.

4.2.2.3.9 CAS 26-23-01, Contaminated Liquids Spreader

A limited radiological characterization of the exterior and accessible interior surfaces of tanks, hoses, pipes, wheels, frames, etc. will be performed, as appropriate. A walk-over radiological survey of the ground within 20 ft of the spreader will also be conducted.

After the radiological survey and characterization results have been analyzed, a minimum of three surface soil samples will be collected beneath or immediately adjacent to the spreader, locations based upon biasing factors. Refer to Figure 4-8 for potential Phase I and Phase II sample locations. The contents of each tank on the spreader will be sampled and analyzed, if possible. If separate phases are identified, and if possible, a sample of each phase will be collected for analysis.

4.2.3 Phase II Activities

Phase II efforts will consist of further characterizing sites to define the extent of contamination where COCs have been confirmed or are suspected to be present. For all CASs to undergo Phase II sampling, the extent of contamination will be bounded by a minimum of one soil sample with laboratory analytical results showing COC concentrations below PALs (in both lateral and vertical directions).

The spatial boundaries that apply to each CAS for Phase II are defined in Table A.1-11. If the nature and/or extent of contamination is inconsistent with the CSM or if contamination extends beyond the spatial boundaries identified in Table A.1-11, work will be temporarily suspended, NDEP will be

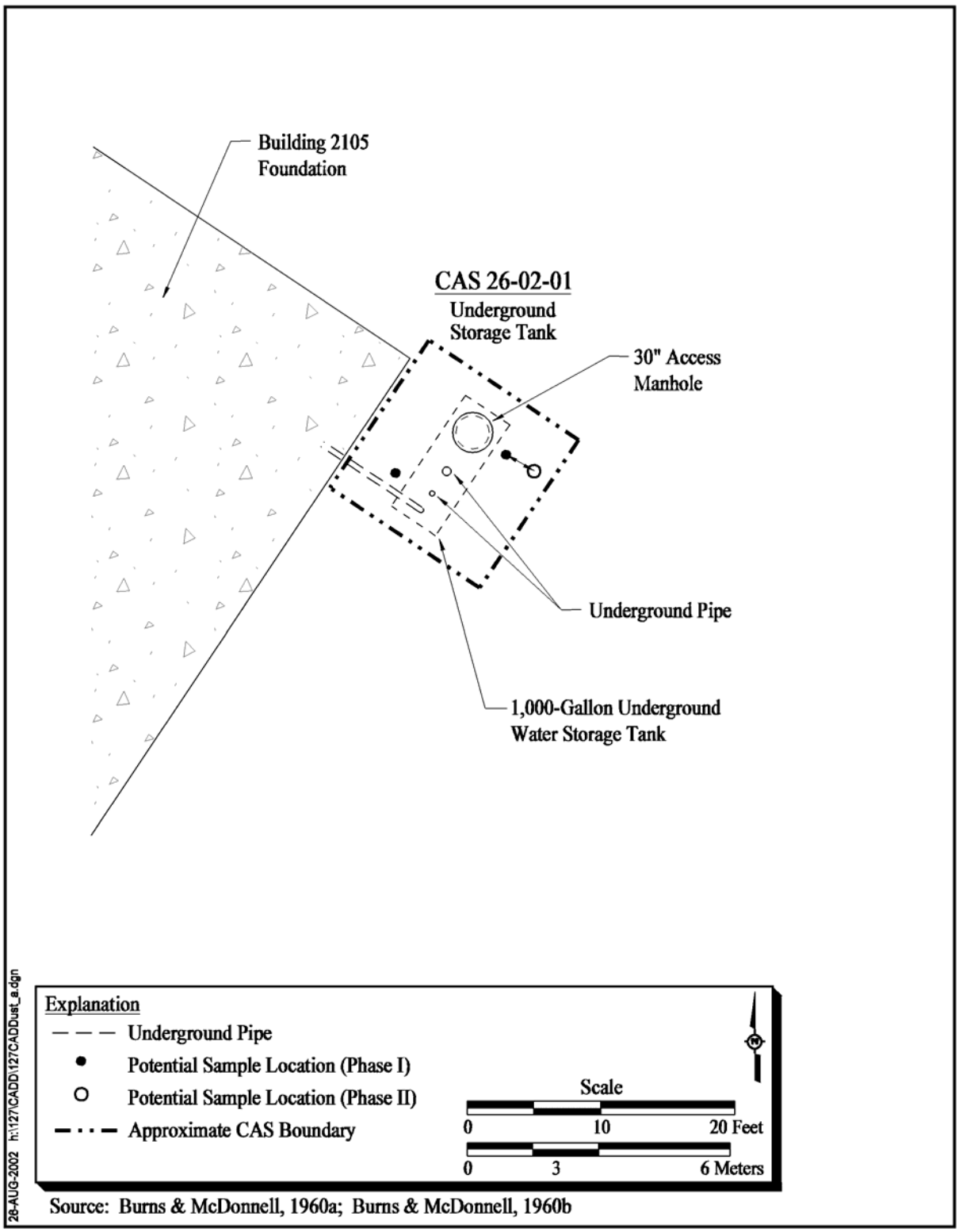


Figure 4-7
Pluto Check Station, CAS 26-02-01

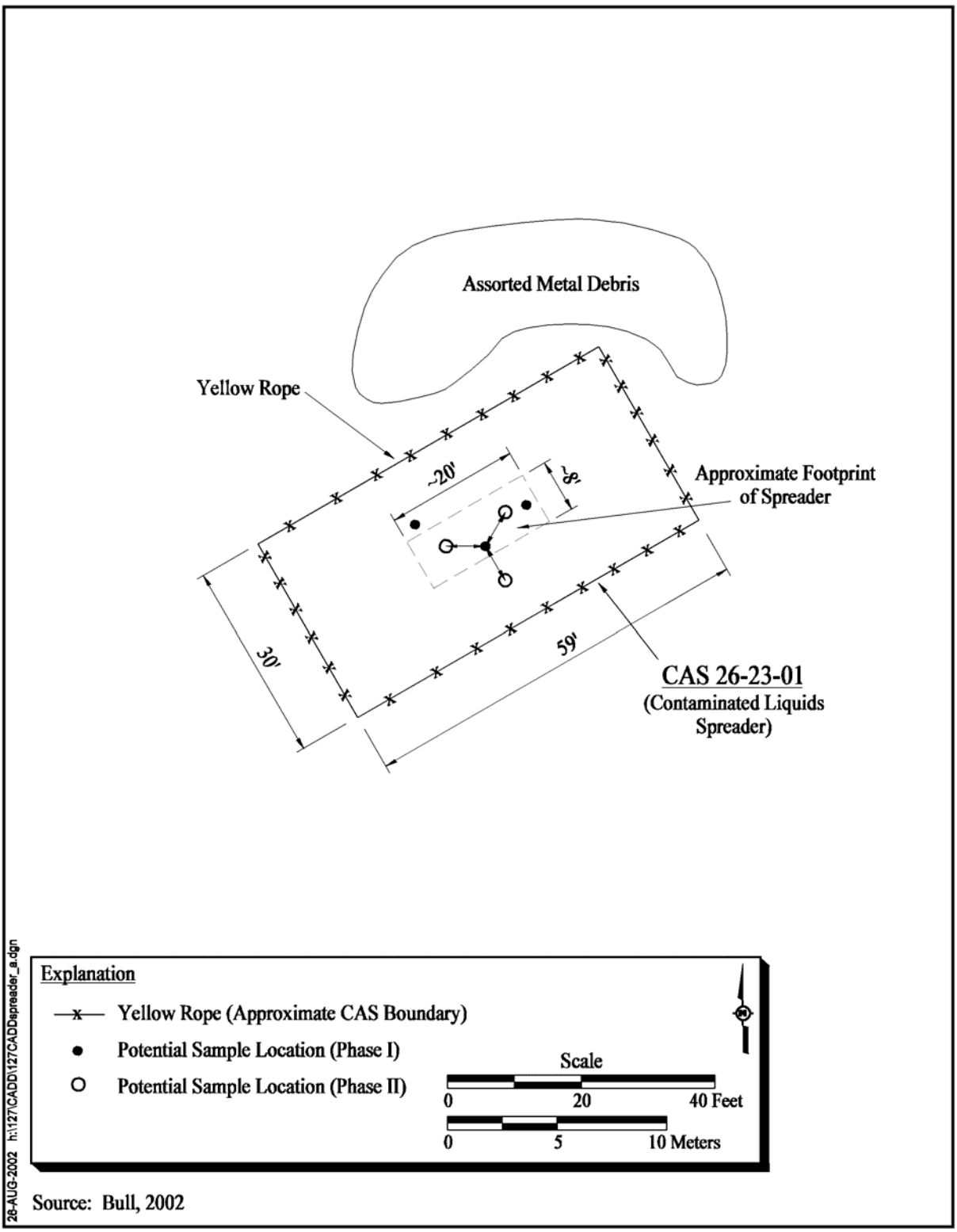


Figure 4-8
Port Gaston Training Facility,
CAS 26-23-01

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 target populations are discussed in Section A.1.4.1 in Appendix A. Phase II target populations will be limited to COC concentrations at step-out locations, and below the contaminant plume. CASs with multiple features in close proximity to each other (e.g., 25-02-02 and 25-23-11) will be treated as one area of concern. In these situations, sample locations to define the extent of contamination will be selected adjacent to the boundaries of the outer features with limited locations between features.

Biased soil samples will be collected from step-out locations during the Phase II investigation, where necessary. The step-out sample locations will be determined prior to Phase II sampling based on process knowledge, site observations, field screening data, and analytical results from Phase I or earlier Phase II sampling (if multiple Phase II rounds are required).

Schematic Phase II sampling locations are shown in Figures 4-1 to 4-8 for the CASs discussed in Section 4.2.2 (Phase I Activities). Step-out sample locations will be placed at a maximum of 15 ft from previous phase sample locations where COCs were detected. If biasing factors indicate COCs may extend beyond the proposed Phase II sample locations, further step-out locations may be necessary. As field data are generated, these locations may be modified, but only if the modified locations meet the decision needs and criteria stipulated in Section A.1.3. At each Phase II location, soil samples will be collected at the depth(s) and from two intervals below the lowest depth where COCs were encountered. These samples will be screened, and if the results are not greater than FSLs, one of these samples (typically, the uppermost) will be submitted to the laboratory for analysis, as laboratory analysis is the only acceptable verification that extent has been determined. In general, samples submitted for laboratory analysis will be those that define the lateral and vertical extent of COCs.

The field investigation of CASs 25-01-06 and 25-01-07 will proceed directly to Phase II since the presence of contamination greater than the PALs is suspected at these CASs. Figure 4-9 shows potential sampling locations for CASs 25-01-06 and 25-01-07. A minimum of one surface soil and one shallow subsurface soil sample will be collected within the stained area at each of these CASs. Analysis of these samples should establish the nature of contamination. To define the extent of

contamination at CASs 25-01-06 and 25-01-07, a minimum of one surface and one subsurface soil sample will be collected to the north, east, and west, approximately three feet beyond the visibly stained surface soil (Figure 4-9). The exact sample locations and depth intervals will be based upon biasing factors. If FSLs or other biasing factors indicate contamination extends beyond these locations, step-out locations at additional distances and/or depths will be sampled, as necessary. Analysis of samples that do not exceed FSLs will confirm the delineation of contamination extent at CASs 25-01-06 and 25-01-07.

4.2.4 Geotechnical/Hydrological Analysis

For purposes of collecting uncontaminated soil for geotechnical/hydrological analysis, samples will be collected from native, undisturbed soil near the CASs. These samples will be collected from depths and horizons similar to those sampled at the respective CASs. Although this sampling will be performed at each site, the samples will be analyzed only if necessary for purposes of providing additional information required for site closure. In general, those analyses are only required at sites where remedial actions will take place. As required by the analysis methods, these samples will be collected within brass sleeves (or other appropriate container) to maintain the natural physical characteristics of the soil. Table 4-1 lists general geotechnical and hydrological parameters of interest. The testing methods shown are minimum standards. Other equivalent or superior testing methods may be used.

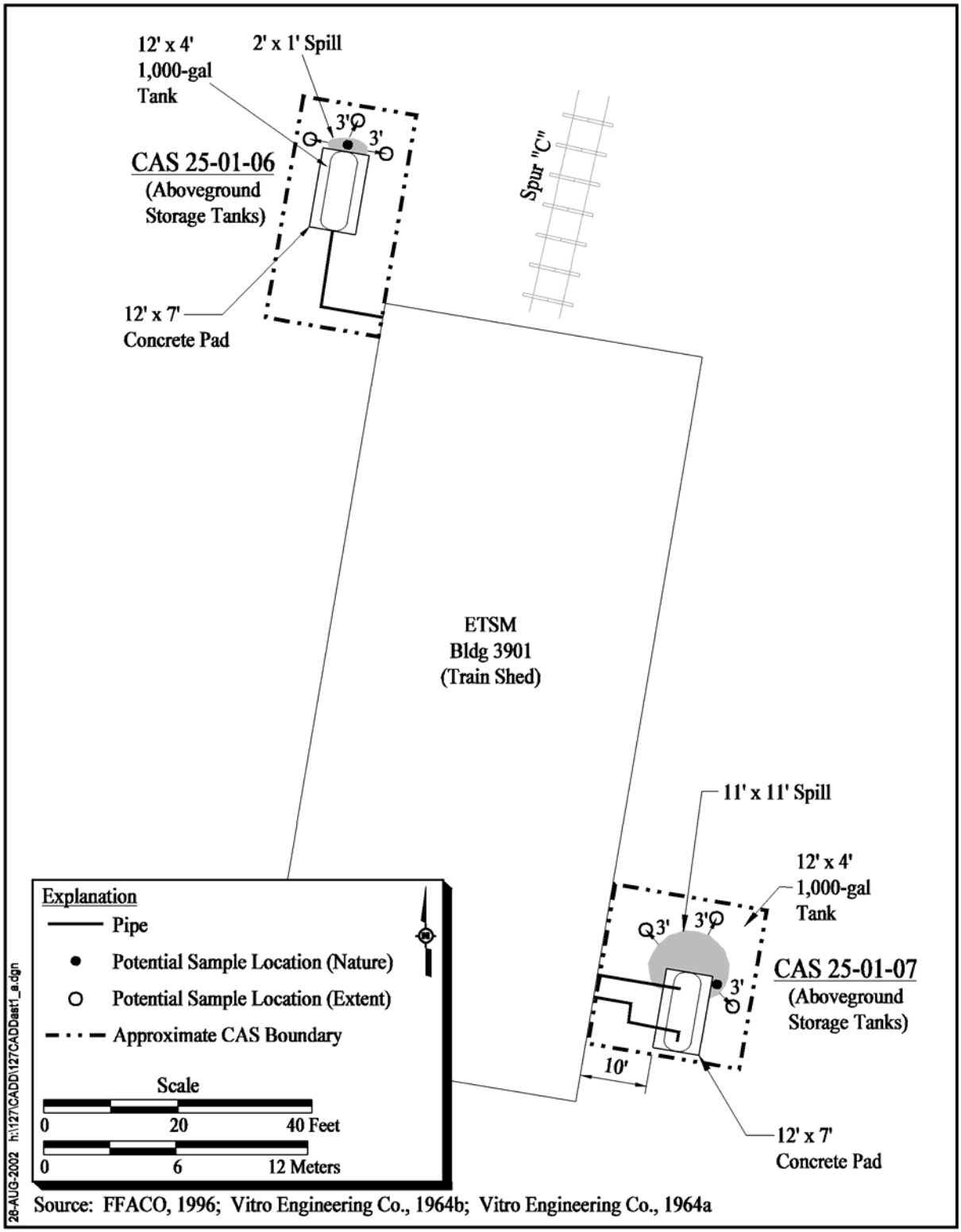


Figure 4-9
E-MAD, CASs 25-01-06 and 25-01-07

Table 4-1
General Geotechnical and Hydrological Analysis for CAU 127

Geotechnical Parameter	Methods
Moisture content	ASTM[a] D 2216-98/D 4643-00
Bulk density[b]	ASTM[a] D 2937-00; MOSA[c] Chapter 13
Calculated total porosity[b]	MOSA[c] Chapter 18
Saturated hydraulic conductivity	ASTM[a] D 2434-68(2000); MOSA[c] Chapter 28
Calculated unsaturated hydraulic conductivity	van Genuchten[d]
Particle-size analysis/soil classification	ASTM[a] D 422-63(1998)
Moisture characteristics	ASTM[a] D 2325-68(2000); MOSA[c] Chapter 26

[a]Annual Book of ASTM Standards: "Volume 04.08, "Soil and Rock (I)" (ASTM, 2002)
[b]Analysis can only be conducted on samples collected using a method able to collect samples in 2.5- by 6-in. brass sleeves (Smith, 2001).
[c]*Methods of Soil Analysis* (Soil Science Society of America, 1986)
[d]Van Genuchten, M., *Soil Science Society of America Journal*, "A Closed Form Equation for Predicting the Hydraulic Conductivity of Unsaturated Soils" (1980)

MOSA = Methods of Soil Analysis

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 127 investigation samples. 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 regulations, RCRA regulations, applicable state regulations, and agreements and permits between the DOE and NDEP. Polychlorinated biphenyls or ACM 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. 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 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 was 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 COPC 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)

Table 5-1
Waste Management Regulations and Requirements

Waste Type	Federal Regulation	Additional Requirements
Solid (nonhazardous) NTS Landfill Permit SW13.097.04[c] NTS Landfill Permit SW13.097.03[d]	NA	NRS 444.440 - 444.645[a] NAC 444.570 - 444.7499[b]
Liquid/Rinsate (nonhazardous)	NA	NTS Wastewater Facility Permit GNEV93001, Rev. iii[e]
Hazardous	RCRA[f]	NRS 459.400 - 459.600[a] NAC 444.850 - 444.8746[b] POC[g]
Low-Level Radioactive	NA	DOE Orders and NTSWAC[h]
Mixed	RCRA[f]	NTSWAC[h] POC[g]
Hydrocarbon\	NA	NAC 445A.2272(b)[b] Landfill Permit SW13.097.02 [i]
Polychlorinated Biphenyls	TSCA[j]	NRS 459.400 - 459.600[a] NAC 444.940 - 444.9555[b]
Asbestos	TSCA[j]	NRS 459.400 - 459.600 & 618.775[a] NAC 444.965-444.976[b]

[a] *Nevada Revised Statues* (NRS, 1998a, b, c, d)
[b] *Nevada Administrative Code* (NAC, 2002a, b, c, d, e)
[c] *Nevada Test Site, Area 23, Nevada Division of Environmental Protection* (NDEP, 1997a)
[d] *Nevada Test Site, U10c Crater Located in Area 9, Nevada Division of Environmental Protection* (NDEP, 2001)
[e] *Nevada Test Site Sewage Lagoons, Nevada Division of Environmental Protection* (NDEP, 1999)
[f] *Resource Conservation and Recovery Act* (40 CFR 260-282) (CFR, 2001a)
[g] *Performance Objective for the Certification of Nonradioactive Hazardous Waste* (BN, 1995)
[h] *Nevada Test Site Waste Acceptance Criteria* (NTSWAC), Revision 4 (DOE/NV, 2002b)
[i] *Nevada Test Site, Area 6 Hydrocarbon Landfill, Nevada Division of Environmental Protection* (NDEP, 1997b)
[j] *Toxic Substance Control Act*, 40 CFR 761-763 (CFR, 2001d, e)

NA = Not applicable

- Decontamination rinsate
- Field-screening waste (e.g., soil, spent solvent, rinsate, disposable sampling equipment, and PPE contaminated by field-screening activities)

All waste from CAU 127 will be evaluated against characteristic standards as no RCRA-listed constituents have been identified. Each waste stream generated will be segregated to the greatest extent possible. Waste will be traceable to its source and to associated media samples.

5.3 Investigation-Derived Waste Management

Process knowledge indicates that the CASs within CAU 127 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 *NV/YMP RadCon Manual* (DOE/NV, 2000), shall be used to determine if such materials may be declared "nonradioactive." 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 packaged in plastic bags or an appropriate receptacle and will be transported to a solid waste management unit. The IDW generated within a radioactive 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 *NV/YMP RadCon Manua*l (DOE/NV, 2000). The IDW will be characterized as radioactive or "nonradioactive" based on these results.

5.3.2 Hydrocarbon

The action level for soil contaminated with hydrocarbons is 100 mg/kg in the State of Nevada (NAC, 2002e). Soils and associated IDW with TPH levels above 100 mg/kg, provided other regulated constituents are below regulatory limits, shall be managed as hydrocarbon waste and disposed of in accordance with all applicable regulations.

5.3.3 Hazardous Waste

Hazardous waste accumulation areas (HWAAs) and/or satellite accumulation areas (SAAs) will be established to accumulate waste that may be hazardous. The 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 (48 CFR, 1996). A "Hazardous Waste Pending Analysis" 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.” The 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. The SAAs, if established, will be managed in accordance with 40 CFR 262.34(c) (CFR, 2001c). The 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 Personal Protective Equipment/Equipment

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

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 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 127. 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 may also be determined through direct sampling. If determined to be hazardous, the rinsate will be entered into an approved waste management system where it will be managed and dispositioned according to the requirements of RCRA or subject to agreements between NNSA/NV and NDEP.

5.3.3.3 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). If containerized soil is determined to be hazardous, it will be managed and dispositioned according to the requirements of RCRA or subject to agreements between NNSA/NV and NDEP.

5.3.4 Low-Level Waste

Investigation-derived 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 RadCon Manual* (DOE/NV, 2000), 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 LLW, as necessary. Waste that is determined to be below the values of the RadCon Manual, 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 the field instruction. Waste in excess of *NV/YMP RadCon Manual*, Table 4-2, values will be managed as a potential radioactive waste. Suspected LLW 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, 2002b). The IDW will be staged at a designated Radiological Controlled Area or Radioactive Materials Area pending certification and disposal under NTSWAC requirements (DOE/NV, 2002b). Waste drums will be labeled "Radioactive Material Pending Analysis."

5.3.5 Mixed Wastes

Mixed waste, if generated, shall be managed in accordance with RCRA (CFR, 2001a) 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. Mixed waste shall be transported via an approved 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 requirements (DOE/NV 2002b). 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 (CFR, 2001d). The PCB contamination may be found as a sole contaminant, or in combination with any of the types of waste discussed in this section. For example,

PCBs may be a cocontaminant in soil that contains a RCRA "characteristic" chemical constituent such as lead, resulting in a PCB/hazardous waste. The PCBs may also be a cocontaminant 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, or subject to agreements between NNSA/NV and NDEP.

6.0 Quality Assurance and Quality Control

The primary objective of the corrective action investigation 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 127. The following two subsections (Section 6.1 and Section 6.2) discuss the QA and QC of the field sampling performance, including the collection of field QC samples, and the QA/QC requirements for laboratory performance and data quality (i.e., acceptability and usability) for use in the decision-making process to achieve closure. Data collected during the corrective action investigation will be evaluated against DQI-specific performance criteria to verify that the DQOs established during the DQO process (Appendix A) have been satisfied.

Unless otherwise stated in this CAIP or required by the results of the DQO process (Appendix A), this investigation will adhere to the QA/QC requirements in the Industrial Sites QAPP (DOE/NV, 2002a).

The discussion of the DQIs, including the datasets, will be provided in the CAU 127 CADD to be developed at the completion of the corrective action investigation.

6.1 Quality Control Field Sampling Activities

Field QC samples will be collected in accordance with approved 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 investigation (i.e., environmental and waste characterization) samples collected. The minimum frequency of collecting and analyzing QC samples established for this investigation include:

- Trip blanks (one per sample cooler containing VOC investigation samples)
- Equipment rinsate blanks (one per sampling event for each type of decontamination procedure performed)
- Source blanks (one per lot of source material that contacts sampled media)
- Field duplicates (A minimum of 1 per CAS per matrix and 1 per 20 environmental samples, if more than 20 samples are collected)

- Field blanks (1 per 20 environmental samples either per day or at the discretion of the Site Supervisor)

- Matrix spike/matrix spike duplicate (MS/MSD) (A minimum of 1 per CAS per matrix and 1 per 20 environmental samples, if more than 20 samples are collected). Some radioanalytical measurements (e.g., gamma spectrometry) do not require MS/MSD analysis.

Additional QC samples may be submitted based on site conditions at the discretion of the Site Supervisor. Field QC 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, 2002a).

6.2 Laboratory and Analytical Quality Assurance

Criteria for Phase I and Phase II, as stated in the DQOs (Appendix A) and except where noted, require laboratory and 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, 2002a), except where otherwise stipulated in this CAIP. Asbestos samples will not be validated, although all other organic and inorganic laboratory data from samples collected and analyzed will be evaluated for data quality according to *EPA Contract Laboratory Program National Functional Guidelines* (EPA, 1994a and 1999). Radiological laboratory data from samples that are collected and analyzed will be evaluated for data quality according to approved procedures. The data will be reviewed to ensure that all critical samples were appropriately collected and analyzed, and the results met 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 CAU 127 CADD. If the DQOs are not met, impact to the corrective action alternatives for closure will be evaluated. Based on the evaluation, the appropriate corrective action will be selected and implemented (e.g., refine CSM or resample) to fill data gaps.

6.2.2 Data Quality Indicators

Data quality indicators are quantitative and qualitative descriptors used in determining the degree of acceptability or usability of data. The DQIs established to evaluate the quality of CAU 127 data are precision, accuracy, representativeness, comparability, completeness, and sensitivity. Data quality indicators are used to evaluate the entire measurement system, the laboratory measurement processes (i.e., analytical method performance), and individual analytical results (i.e., parameter performance).

Precision, accuracy, and sensitivity are quantitative measures used to assess the overall analytical method and field-sampling performance as well as to assess the need to qualify the usability of 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. Based on an assessment of the data, data qualified as estimated for reasons of precision or accuracy may also be considered to meet the parameter performance criteria.

Representativeness and comparability are qualitative measures, and completeness is a quantitative measure. Representativeness, comparability, and completeness are used to assess the overall measurement system performance.

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, 2002a) requires conditions (i.e., nonconformances) that adversely affect data quality, both in the field and the laboratory, be documented. Corrective action required to mitigate adverse field conditions are tracked to verify its successful implementation. 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 CAU 127 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 defined in the Industrial Sites QAPP (DOE/NV, 2002a). The QAPP also presents the method generally used to quantify precision. A method that is specific to radiological analyses is presented in Section 6.2.3.2.

Table 6-1
Laboratory and Analytical Performance Criteria for CAU 127 Data Quality Indicators

Data Quality Indicator	Performance Criteria	Potential Impact on Decision if Performance Criteria Not Met
Precision	Variations between duplicates (field and laboratory) and original sample should not exceed analytical method-specific criteria listed in Table 3-2[a].	Estimated data within sample delivery group (SDG) will be evaluated for its usability. If data determined not usable, then data will not be used in decision, and completeness criteria will be re-evaluated.
Accuracy	Laboratory control sample results and matrix spike results should be within analytical method-specific criteria listed in Table 3-2.	Estimated data within SDG will be evaluated for its usability. If estimated data are biased high or conservative, the data may be used in decision. If estimated data are biased low and below the decision threshold, the data may not be used in decision and completeness criteria will be re-evaluated.
Sensitivity	Detection limits of laboratory instruments must be less than or equal to 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.
Comparability	Equivalent samples analyzed using same analytical methods, the same units of measurement and detection limits must be used for like analyses.	Inability to combine data with data obtained from other sources and/or inability to compare data to decision criteria (e.g., PRGs).
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.
Phase I Completeness	100% of requested analyses to be conducted. 80% of laboratory data should be valid.	Cannot make decision on whether COCs are present above PALs with high confidence.
Phase II Completeness	100% of requested analyses to be conducted. 80% of laboratory data to be valid.	Decision of whether or not extent of contamination has been bounded cannot be determined.

[a]Criteria may not be attainable for soil samples and analyte concentrations near the detection limit.

Determinations of precision will be made for field duplicate samples and/or 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; laboratory control sample duplicates (LCSDs) 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 chemical analysis 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 as a guideline.

The assessment of precision will only be conducted for analytical results when both the sample and duplicate results are 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. However, 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 the DQOs.

The criteria to evaluate analytical method performance for precision (Table 6-1 and Table 3-2) 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 the DQOs, and results of the assessment will be documented in the CADD.

6.2.3.2 Precision for Radiological 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 radiological precision are parameter-specific criteria (see Table 3-2). This assessment will be accomplished as part of the data validation process. Precision values within the established control limit indicate that analytical results for associated samples are valid. The RPD control limit for radiological measurements has been set at 35 percent for soil and 20 percent for water. 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 MDC. 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 MDCs. This is based on the measurement uncertainty associated with low-level results. The ND test is calculated using the following formula:

Normalized Difference = $$S - D / \sqrt{(TPU_S)^2 + (TPU_D)^2}$$

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 ND 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 the DQOs, and results of the assessment will be documented in the CADD.

6.2.4 Accuracy

Accuracy is defined in the Industrial Sites QAPP (DOE/NV, 2002a). The QAPP also presents the method generally used to quantify accuracy.

6.2.4.1 Accuracy for Chemical Analyses

The percent recovery (%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, laboratory control sample (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, e.g., deionized water). 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 and Table 3-2) 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.

6.2.4.2 Accuracy for Radiological Analysis

Accuracy for radiological analyses will be evaluated based on results from LCS and MS samples. The LCS is analyzed with 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 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 radiological 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 limit 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.

6.2.5 Representativeness

Representativeness is the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition (EPA, 1987). 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.

6.2.6 Completeness

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 sample locations sampled and percentage of samples analyzed and on the measurements made that are judged to be valid. Percent completeness for measurement usability (not rejected) 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 DQOs.

Critical parameters for CAU 127 Phase I are identified in Table 3-1; they are defined as those parameters suspected to be present in the target population. Critical parameters have been identified through process knowledge and by reviewing historical documentation. For critical parameters, 80 percent of the analytes must have valid results to meet completeness objectives.

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

6.2.7 Comparability

Comparability is a qualitative term expressing the confidence with which one dataset can be compared to another (EPA, 1987). This is important to ensure that project data can be compared to quantitative decision criteria (e.g., PALs). To ensure comparability, all samples will be subjected to the same sampling, handling, preparation, and validation criteria in accordance with approved procedures. 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). An evaluation of this qualitative criterion will be presented in the CAU 127 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) is lower 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.

7.0 Duration and Records Availability

7.1 Duration

After the submittal of the CAIP to NDEP (FFACO milestone date of August 30, 2002), the following is a tentative schedule of activities (in calendar days):

- Day 0: Preparation for field work will begin (at submittal of Draft CAIP).
- Day 149: The field work, including sample collection activities, will commence. Samples will be shipped to meet laboratory holding times.
- Day 275: The field investigation will be completed.
- Day 335: The quality-assured laboratory analytical data will be available for NDEP review.
- The FFACO date established for the CADD is September 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 appropriate DOE Project Manager. The NDEP maintains the official Administrative Record for all activities conducted under the auspices of the FFACO.

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Appendix A

Data Quality Objectives

A.1.0 Seven-Step DQO Process for CAU 127 Investigation

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 127 investigation will be based on DQOs developed by representatives of the NDEP and the NNSA/NV.

Twelve CASs comprise CAU 127. Seven CASs are in Area 25, and five CASs are in Area 26. The CAS descriptions are:

- CAS 25-01-05, AST (100,000 gal)
- CAS 25-01-06, AST (1,000 gal)
- CAS 25-01-07, AST (1,000 gal)
- CAS 25-02-02, UST (six 10,000-gal each)
- CAS 25-02-13, UST
- CAS 25-12-01, Boiler
- CAS 25-23-11, Contaminated Materials
- CAS 26-01-01, Filter Tank (Rad) and Piping (10,000-gal tank)
- CAS 26-01-02, Filter Tank (Rad) (5,000 gal)
- CAS 26-02-01, UST (1,000 gal)
- CAS 26-23-01, Contaminated Liquids Spreader
- CAS 26-99-01, Radioactively Contaminated Filters

The investigation at all CASs will begin with Phase I activities to determine the nature of potential contamination. If a COPC is detected in any sample at concentrations above PALs, the COPC will be identified as a COC. If a COC is identified, the CAS containing that COC will undergo additional investigation during Phase II to determine the extent of contamination. Field conditions (e.g., elevated field-screening results) may warrant a Phase II investigation prior to confirmation of the presence of COCs.

A.1.1 Step 1 - State the Problem

Step 1 defines the problem that has initiated the CAU 127 investigation. This step identifies the DQO planning team members, describes the problem, and develops the CSMs.

A.1.1.1 Planning Team Members

The DQO planning team consists of representatives from NDEP, NNSA/NV, BN, and ITLV. The primary decision-makers include NDEP and NNSA/NV representatives. Table A.1-1 lists representatives from each organization in attendance for the April 18, 2002, DQO meeting.

Table A.1-1
DQO Meeting Participants

Participant	Affiliation
Tom Fitzmaurice	BN
Michael Foley	ITLV
John Forbes	BN
John Fowler	ITLV
Clem Goewert	NDEP
Bridget Iverson	ITLV
Lynn Kidman	ITLV
Sean Kosinski	NNSA/NV
William Nicosia	ITLV
Kurt Schmidt	ITLV
David Schrock	ITLV
Robert Sobocinski	ITLV
Thomas Thiele	ITLV
Daniel Tobiason	BN
Jeanne Wightman	ITLV

BN – Bechtel Nevada
ITLV – IT Corporation, Las Vegas Office
NDEP – Nevada Division of Environmental Protection
NNSA/NV – DOE, National Nuclear Security Administration Nevada Operations Office

A.1.1.2 Describe the Problem

The overall problem statement for CAU 127 is: "Does sufficient information exist about the nature and extent of contamination at the 12 CASs to evaluate and select preferred corrective actions?" A preliminary assessment has indicated that existing information and data are insufficient, and a corrective action investigation is necessary.

Corrective Action Unit 127 is being investigated because:

- The CASs are abandoned sites that were not properly closed, and may not comply with the requirements of future land use.
- 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 Model

The CSMs describe the most probable scenarios for current conditions at specific sites and define the assumptions that are the basis for identifying the appropriate sampling strategy and data collection methods. Accurate CSMs are important as they serve as the basis for all subsequent inputs and decisions throughout the DQO process.

If additional elements are identified during the investigation that are outside of the scope of the CSMs as presented in this section, the situation will be reviewed and a recommendation will be made as to how to proceed. If this occurs, NDEP will be notified and given the opportunity to comment on, or concur with, the recommendation.

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 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, high sorption, and high density can be expected to be found relatively close to release points. Contaminants with high solubility, low sorption, and low density can be expected to be found further from release points.

Future land-use scenarios limit future uses of the CAU 127 CASs to various nonresidential (i.e., industrial) uses (DOE/NV, 1998). The future land-use scenarios for CAU 127 are presented in Table A.1-2. Exposure scenarios for sites located within the NTS boundaries are limited by the future land-use scenarios to site workers who may be exposed via dermal contact (adsorption), oral ingestion, or inhalation of COCs associated with soils and/or objects (e.g., tanks, concrete) due to inadvertent disturbance of these materials. An additional exposure pathway for workers is through

external exposure to gamma radiation at sites containing potential radiological contamination (e.g., CASs associated with Test Cell C).

Table A.1-2
Future Land-Use Scenarios for CASs Within CAU 127

CAS	Land Use Zone	Zone Description
25-01-05 25-02-02 25-02-13 25-12-01 25-23-11 26-01-01 26-01-02 26-02-01 26-23-01 26-99-01	Research, Test, and Experiment	Designated for small-scale research and development projects; demonstrations; pilot projects; outdoor tests; and experiments for the development, quality assurance, or reliability of material and equipment under controlled conditions. Includes compatible defense and nondefense research, development, and testing projects and activities (DOE/NV, 1998).
25-01-06 25-01-07	Yucca Mountain Site Characterization	This area is reserved for support of the characterization of the Yucca Mountain Repository. The Land Use Management Policy under a Memorandum of Agreement with the NTS gives the Yucca Mountain Project technical responsibility independent of, but in coordination with the agreement (DOE, 2002).

A.1.1.3.1 Conceptual Site Models for CAU 127

Two CSMs have been developed for CAU 127 using historical background information, knowledge from studies at similar sites, and data from previous sampling efforts. The CSMs are termed Aboveground Tank/Piping (CSM#1) and Underground Tank/Piping/Structure (CSM#2). The applicability of the CSMs to each CAS is summarized in Table A.1-3. As shown in Table A.1-3, both CSMs apply to several of the CAU 127 CASs.

Table A.1-3
CSMs and Associated CASs

Conceptual Site Model (CSM)	25-01-05	25-02-02	25-23-11	25-12-01	25-01-06	25-01-07	25-02-13	26-01-01	26-01-02	26-99-01	26-02-01	26-23-01
Aboveground Tank/Piping	X	X	X	X	X	X	X	X	X	X		X
Underground Tank/Piping/Structure	X	X	X				X	X	X		X	

X - The CSM applies to this CAS.

Aboveground Tank/Piping Conceptual Site Model (CSM #1)

Eleven CASs are included in the Aboveground Tank/Piping CSM developed for CAU 127 (Table A.1-3). Figure A.1-1 shows a generalized representation of CSM#1. Tanks or other containment vessels have been used at all but one of the CASs within this CAU. If a spill or surface release occurred at one of these sites, the liquid containing COPCs would likely seep into the ground. Lateral migration is possible on the ground surface; however, in subsurface soils, contaminants would be expected to migrate primarily downward, and to a lesser degree horizontally. Concrete or a hardpan layer (i.e., caliche), if present, would limit vertical migration of contaminants or would modify the location, if any, where vertical migration could occur. In the case of a concrete pad, liquid contaminants would have a proclivity to run off, if the concrete was sloped, or would migrate through cracks into the subsurface. Precipitation could accelerate contaminant migration laterally as runoff and vertically as percolation. However, percolation should be limited, due to low precipitation rates and high evapotranspiration rates. This CSM predicts that the concentration of the contaminants would be highest in the immediate vicinity of a release (at the ground surface), and would decrease with distance, both horizontally and vertically. However, due to volatilization and/or weathering, the level of contamination may actually increase with depth in the near-surface soils (less than 6 in. bgs). Since vertical migration is expected to be limited, it is unlikely that any contamination would reach groundwater.

At CASs with insulated aboveground piping, ACM may be present, and the potential exists for friable asbestos. If friable asbestos is present, the asbestos could become airborne. The CASs with observed ACM or the potential for ACM are 25-01-05, 25-02-02, 25-23-11, 25-12-01, 26-01-01, 26-01-02, and 26-99-01.

Underground Tank/Piping/Structure conceptual Site Model (CSM #2)

Seven CAU 127 CASs are included in the Underground Tank/Piping/Structure CSM (Table A.1-3). Figure A.1-2 shows a generalized representation of CSM#2. This CSM is similar to CSM#1 except that lateral migration of contaminants in runoff is not a transport mechanism for CSM#2.

If a release or leak from an underground structure occurred, the liquid containing COPCs would migrate away from the release point, primarily downward, and to a lesser degree horizontally. Capillary action may cause some secondary migration upward, but this would be minimal. Migration

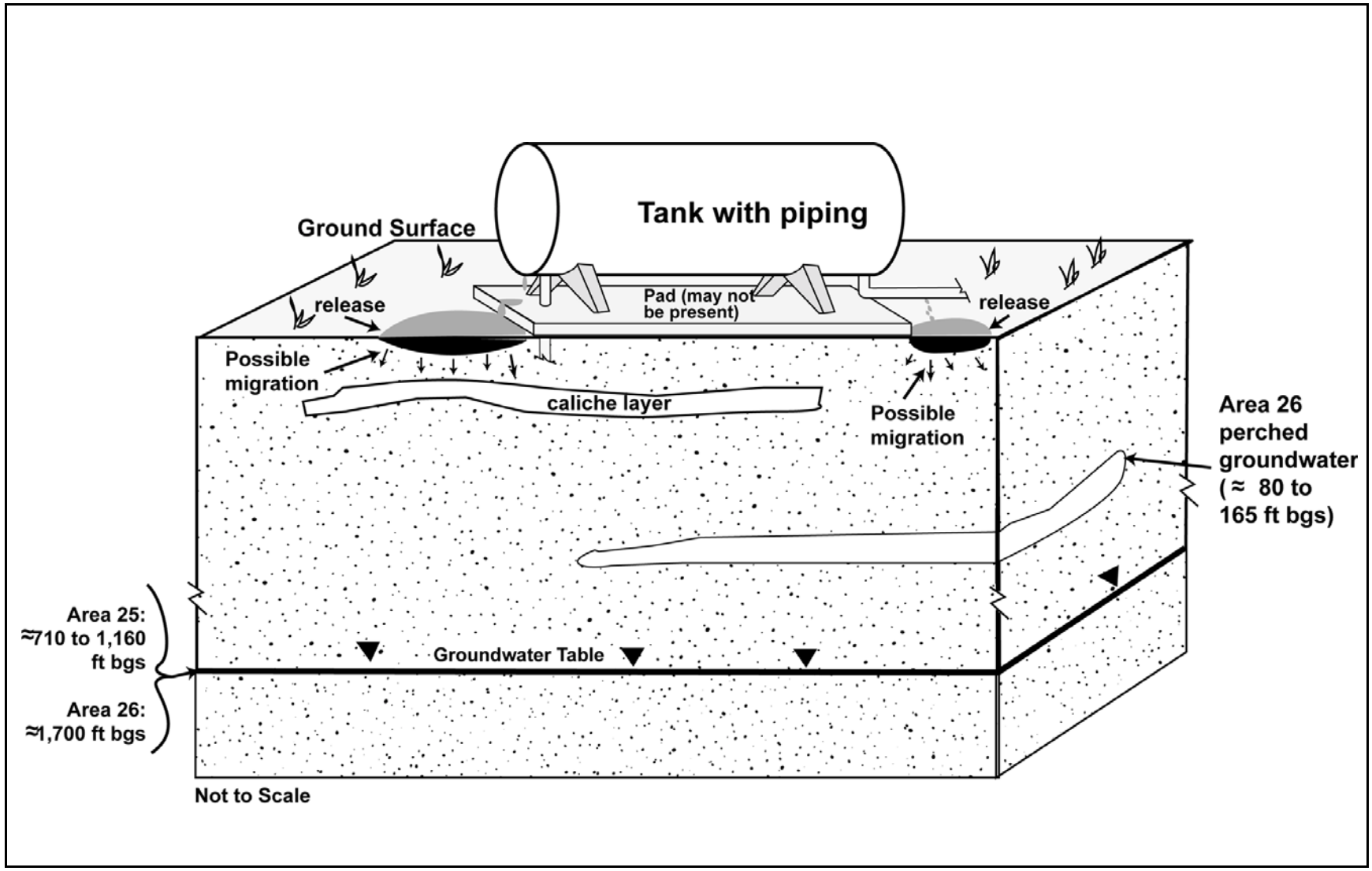

Figure A.1-1
Aboveground Tank/Piping Conceptual Site Model (CSM #1)

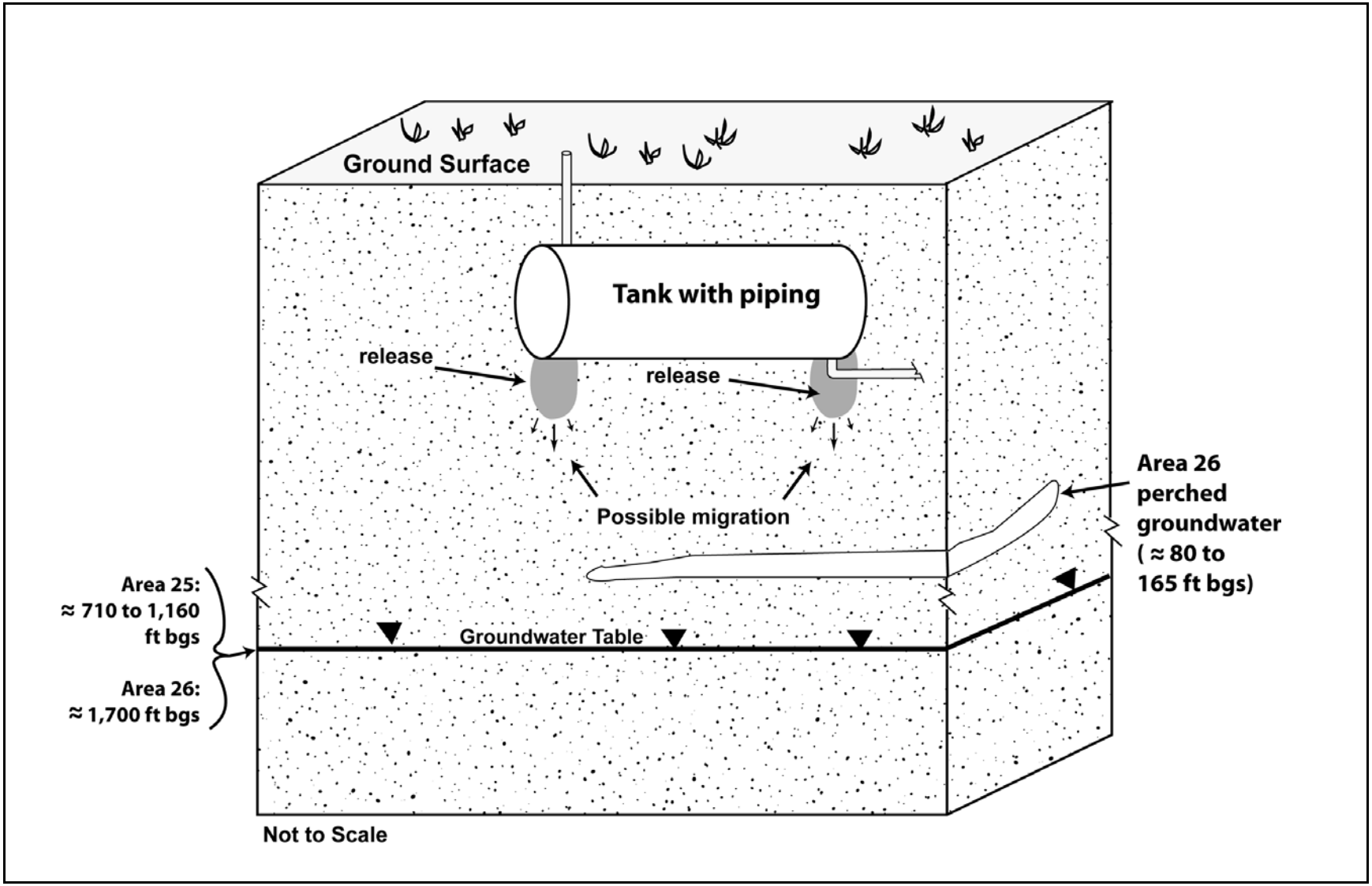

Figure A.1-2
Underground Tank/Piping/Structure Conceptual Site Model (CSM #21)

is predicted to be similar to the subsurface migration discussed in CSM #1. This CSM predicts that the concentration of contaminants would be highest in the immediate vicinity of a subsurface release location, and would decrease with distance, both horizontally and vertically.

The following sections provide additional information on elements of the CSMs.

Affected Media

For CSM #1, Aboveground Tank/Piping, the potentially affected media are surface and subsurface soils. Where ACMs are present, the air may contain asbestos if the materials are disturbed. For CSM #2, Underground Tank/Piping/Structure, the potentially affected medium is subsurface soil.

Any contamination found at these CASs would be attributable to direct release to the surface or subsurface. Insufficient records are available for many of these areas; therefore, much of the information related to COPCs is based upon limited historical information, interviews with current/former site employees, and site visits performed during preliminary assessments of the CASs.

Location of Contamination/Release

Where at- or above-grade features are present (CSM #1), contamination may be found in surface soils, as well as subsurface soils. Where the features are below-grade (CSM #2), surface soil contamination is not expected. Migration of contamination for both CSMs would be expected to be primarily downward, with horizontal migration to a lesser extent. For both CSMs, the presence of relatively impermeable layers (e.g., concrete, bedrock, or caliche) may influence both lateral and vertical migration.

Transport Mechanisms

The degree of contaminant migration at these sites is unknown, but it is assumed to be minimal based on low precipitation and high evapotranspiration rates. Runoff could cause lateral migration of contaminants over the ground surface for CSM #1. Contaminants may also have been transported by infiltration and percolation of precipitation through soil, which would serve as a driving force for downward migration. See “Lateral and Vertical Extent of Contamination” for additional information. Friable asbestos could become airborne, and transported by wind to become an air and surface soil contaminant.

Preferential Pathways

Preferential pathways for contaminant migration are not expected for the CAU 127 CASs. As discussed previously, the presence of relatively impermeable layers could modify transport pathways both on the ground surface (e.g., concrete pads) and in the subsurface (e.g., caliche layers). The potential effect of these layers will be considered in the development of sampling schemes and sampling contingencies discussed in the CAIP.

Lateral and Vertical Extent of Contamination

Contamination, if present, is expected to be generally confined to the site. However, where multiple sites are adjacent, migration from one site may have impacted the immediately adjacent site. For example, the piping for the CAS 26-01-01 tank ends at the filter tank shed (CAS 26-99-01). Lateral migration from one CAS may have contaminated the soil below the adjacent CAS in such a situation. It is expected that lateral contamination will be confined to the CAS and adjacent CAS, if applicable. However, the potential exists for surface soil contamination due to a source unrelated to the CAS under investigation. This may be the case for the CASs located at Test Cell C, where widespread radiological contamination of the ground surface may be present.

Surface migration may occur as a result of a spill or leak and subsequently as runoff of precipitation. Surface migration is a biasing factor considered in the selection of sampling points.

Downward contaminant transport is expected to be very limited due to low precipitation and high evapotranspiration rates. Average annual precipitation is only 3 to 6 in. on valleys and less than 10 in. on ridges and mesas in this region (USGS, 1975), while the potential evaporation rate is almost 66 in. per year (DOE, 2002). Subsurface migration will be influenced by the geophysical properties of the soil, such as permeability, porosity, and conductivity. The presence of a hardpan layer (i.e., caliche) could limit vertical migration of contaminants and enhance lateral migration in some cases. The vertical migration of contaminants is expected to be limited due to the lack of a driving force (minimal infiltration). Migration of certain constituents (i.e., metals, radionuclides) will also be controlled to varying degrees by geochemical processes, such as adsorption, ion exchange, and precipitation of solids from solution.

Groundwater contamination is not considered a likely scenario at CAU 127. The groundwater depth varies between areas from approximately 2,390 to 2,470 ft above mean sea level (amsl) (approximately 710 to 1,040 ft bgs) in Area 25 (USGS, 1995) to approximately 2,700 ft amsl (1,700 ft bgs) in Area 26 (DRI, 1988). A perched water table is present throughout most of Area 26 at depths ranging from approximately 80 to165 ft bgs (USGS, 1964). Additional perched groundwater lenses may exist between the known perched water table and the regional water table.

Contaminant transport by the downward movement of precipitation through the unsaturated zone is not a viable transport mechanism for CAS 25-02-13 at the X-Tunnel. X-Tunnel is located on the southwest flank of Little Skull Mountain at an elevation of approximately 3,540 ft amsl. The unsaturated zone is therefore over 1,000-ft thick at X-Tunnel. Also, no water drainage is reported at X-Tunnel, implying that X-Tunnel does not intersect any water-transmitting faults or fractures, or perched water-bearing units.

A.1.1.3.2 Contaminants of Potential Concern

The CAS-specific list of COPCs was developed based upon process knowledge of the CASs, review of historic documents, past investigations at related CASs, and interviews with former site employees. The COPCs based on existing information are summarized below, with supporting information about how the COPCs were developed for each CAS. Due to uncertainty regarding the existing COPC information, additional constituents have been included as COPCs for the investigation of CAU 127. These COPCs are listed in Section A.1.3.3.

CAS 25-01-05–Aboveground Storage Tank; 25-02-02–Underground Storage Tank(s); 25-23-11–Contaminated Materials: These CASs are part of the WWTS at Test Cell C that was used for the NF-1 test series in 1972. The 100,000-gallon tank was used as back-up to the six 10,000-gallon USTs to store water generated during this series of tests. The water was processed through two filter tanks, which were previously removed, and then discharged to an on-site leachfield. Corrective Action Site 25-23-11 consists of a concrete vault, heat shield, pump, and piping. Historical documentation reports the use of VOCs during previous site remediation activities. Based upon historical information, the COPCs for these three CASs are VOCs, RCRA metals, asbestos (on piping), gamma-emitting radionuclides, Sr-90, plutonium, tritium, and uranium.

Analytical results from previous investigations at the WWTS indicate the presence of Cs-137, Sr-90, U-235, Eu-155, Cd-109, and Sb-125.

CAS 25-12-01–Boiler: This boiler is adjacent to the Test Cell C pumphouse building. The boiler was part of a borated water system that was used as a radiation shield. The boiler ran on propane. According to historical documents, the COPCs are radioisotopes that may have been present (through activation) in the boiler water (Cl-36, Co-60, Eu-154, Eu-155, and K-40). Potential asbestos pipe coverings are also present.

CAS 25-01-06–Aboveground Storage Tank; CAS 25-01-07–Aboveground Storage Tank: These CASs were installed in 1965 and originally contained diesel fuel used to refuel locomotives at the ETSM Building 3901 within the E-MAD Facility. After 1986, these tanks were used to supply fuel to heat the Building 3901. Visible petroleum staining on the ground at the north end of each tank was observed during a site visit conducted as part of the preliminary assessment of the CASs. The COPCs are petroleum hydrocarbons, specifically, diesel and heating oil.

There is a concern that radiological contamination may be present in the soil at this site, although this contamination is not a result of activities at these CASs. Therefore, radiological constituents will be added to the list of analytes.

CAS 25-02-13–Underground Storage Tank: This CAS is located in the X-Tunnel and is the previous location of an underground tank. The tank and gravel from the tank location were removed from the X-Tunnel experiment chamber in June 1996. The site was used by the U.S. Army, sometime between 1985 and 1987, as a catch basin to collect and contain hydraulic fluid from the firing table of a classified project. According to a radiological report for the X-Tunnel, depleted uranium (DU) was used in the tunnel prior to removal of the tank; therefore, it may also be a COPC (Bastian, 1996). The tank was reported to have been left in place until the X-Tunnel remediation was nearly completed, in order to catch any runoff generated during the process. The COPCs for this CAS are DU and hydraulic fluid (petroleum hydrocarbons).

CAS 26-01-01–Filter Tank (RAD) and Piping; CAS 26-01-02–Filter Tank (RAD); CAS 26-99-01–Radioactively Contaminated Filters: These CASs comprised a filter system that may have been used as part of a thin film evaporator system at the Project Pluto Disassembly Facility.

This system may have been used to recover and solidify radioactive wastes from liquid decontamination streams. Based upon a preliminary assessment of the filter system, the COPCs are beryllium, lead, uranium, RCRA metals, PCBs, petroleum hydrocarbons (gasoline and oil), Am-241, Pu-238, Pu-239/240, and asbestos.

CAS 26-02-01–Underground Storage Tank: This CAS was a water supply tank at the Project Pluto Check Station. It is unknown how long the tank was used or if it was used for any other purpose. As there is no information regarding any other use, there are no COPCs identified for this CAS.

CAS 26-23-01–Contaminated Liquids Spreader: The spreader was used to spray liquid intentionally contaminated with short-lived radionuclides throughout the associated exercise area at the Port Gaston Training Area. Two exercises were conducted, one in 1981 and the other in 1983, in which the liquids spreader was used to spray radiologically contaminated water to simulate a nuclear weapon accident. Materials reported to have been used were Ra-223 and Hg-197 in 1981, and Ra-223 and Pd-103 in 1983. Due to their short half-lives, these constituents are not COPCs. However, additional radiological constituents may have been present as impurities in the material used. The COPCs expected to be present include Ra-226, Ac-227, and Th-227. Other impurities may also be present.

A.1.2 Step 2 - Identify the Decision

This step develops the Phase I and Phase II decision statements and defines alternative actions.

A.1.2.1 Develop Decision Statement

Two decision statements are required for this investigation. The decision statement for Phase I of the investigation is: "Determine if a COC is present." The decision statement for Phase II is: "Determine the lateral and vertical extent of a COC."

A.1.2.2 Alternative Actions to the Decisions

If a COC is not present, further assessment of the CAS is not required. If a COC is present and its extent is defined in both the lateral and vertical directions, further assessment of the CAS is not required. If extent is not defined, reevaluate site conditions and collect additional samples.

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. To determine if a COC is present, each sample result is compared to the PAL (Section A.1.3.2). If any sample result is greater than the PAL, then the applicable CAS is advanced to a Phase II investigation for that analyte. This approach does not use a statistical mean/average for comparison to the PAL, but rather the individual result, to identify COCs.

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 contain a COC and (2) the analytical suite selected must be sufficient to detect any COCs present in the samples.

Biasing factors to support these criteria include:

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

In order to determine the extent of a COC, samples must be collected at locations to bound the lateral and vertical extent of COCs. The data required to satisfy the information need for each COC is a sample result that is below the PAL. Three lateral step-out samples and one vertical sample will be collected around and/or below each CAS identified as having exceeded the PAL for one or more COCs. The lateral samples will be located a maximum of 15 ft from the previous location, while the vertical samples will begin 2 ft below the previous location depth with COCs. The lateral step-out distance will generally be based upon the size of the already determined contaminated area. The step-outs for small areas will be just a few feet from the previous contaminated locations, whereas on large contaminated areas, the step-outs will increase to as much as 15 ft. When indicators or biasing factors indicate that the COC concentration at the step-out location may still exceed the PAL, then an

additional step-out distance may be used to collect the analytical sample. If the location where the PAL is exceeded is surrounded by clean locations, then lateral step-outs may not be necessary. In that case, sampling may consist only of sampling from deeper intervals at or near the original location to determine the vertical extent of contamination. Step-out locations may be moved due to access or safety issues; however, the modified locations must meet the decision needs and criteria for Phase II decisions.

Phase II samples will only be analyzed for those parameters that exceeded PALs (i.e., COCs) in Phase I samples. Biasing factors to support selection of Phase II sampling locations may include:

- Geophysical and/or radiological surveys
- Documented process knowledge on source and location of release
- Field observations
- Field-screening results
- Historical sample results
- Experience and data from investigations of similar sites
- Professional judgement
- Previous sample results

Table A.1-4 (Phase I) and Table A.1-5 (Phase II) 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 in the following text.

Quantitative Data

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

Semiquantitative Data

Semiquantitative data indirectly measure the quantity or amount of a characteristic or component. 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

Table A.1-4
Information Needs to Resolve the Phase I Decision
(Page 1 of 2)

Information Need	Information Source	Collection Method	Biasing Factors to Consider	Data Type/Metric
Decision: Determine if a COC is present. Criteria 1: Samples will be collected in areas most likely to contain a COC.				
Source and location of release points	Process knowledge compiled during the Preliminary Assessment process and previous investigations of similar sites	Information documented in CSM and public reports – no additional data needed	None	Qualitative – CSM has not been shown to be inaccurate
	Site visit and field observations	Conduct site visits and document field observations	View caps, joints, connections of pipes, tanks, etc. and surface soil for potential leaks, spills	Qualitative – CSM has not been shown to be inaccurate
	Radiological surveys	Perform radiological surveys using appropriate methods	Bias locations based upon areas of visible or likely surface spills/leaks	Semiquantitative – Locations based on biasing criteria stipulated in DQO Step 7
	Field screening	Collect soil samples from stained areas, or areas of likely spills/leaks	Bias locations based upon results of process info and field observations	Semiquantitative– Sampling locations based on visual or process knowledge
	Biased samples	Generate sampling points based on results of radiological surveys and field screening	Send samples with highest survey/screening results to laboratory	Semiquantitative – Sampling based on survey and screening results.
	Biased samples	Additional points will be located near CAS features	Bias locations along/around features.	Semiquantitative – Sampling based on CAS features.
Decision: Determine if a COC is present. Criteria 2: Analyses must be sufficient to detect any COCs in samples above action limits.				
Identification of all potential contaminants	Process knowledge compiled during PA process and previous investigations of similar sites	Information documented in CSM and public reports – no additional data needed	None	Qualitative – CSM has not been shown to be inaccurate

Table A.1-4
Information Needs to Resolve the Phase I Decision
(Page 2 of 2)

Information Need	Information Source	Collection Method	Biasing Factors to Consider	Data Type/Metric
Decision: Determine if a COC is present. Criteria 2: Analyses must be sufficient to detect any COCs in samples above action limits.				
Analytical results	Data packages of biased samples	Appropriate sampling techniques and approved analytical methods will be used. MDLs and MDAs are sufficient to provide quantitative results for comparison to PALs	None	Quantitative – Validated analytical results will be compared to PALs
Decision: Determine if sufficient information exists to characterize waste. Criteria: Analyses must be sufficient to allow disposal options to be accurately identified and estimated.				
Radiological data for comparison to Free Release Criteria	Radiological surveys	Perform radiological surveys using appropriate methods	Bias locations based upon areas of visible or likely surface spills/leaks. Areas of accumulation	Semiquantitative – Locations based on biasing criteria stipulated in DQO Step 7
Analytical results	Data packages of tank content samples	Appropriate sampling techniques and approved analytical methods will be used. MDLs and MDAs are sufficient to provide quantitative results for comparison to disposal requirements	Sufficient material must be available for analysis	Quantitative – Validated analytical results will be compared to disposal criteria

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. The data are often used to guide investigations toward quantitative data collection.

Qualitative Data

Qualitative data identify or describe 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

Table A.1-5
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 Contaminants	Sample data packages	Review analytical results to select COCs.	Quantitative – Only COCs identified will be analyzed in subsequent samples.
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.
	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.

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 the Preliminary Action Levels

Site workers may be exposed to contaminants through oral ingestion, inhalation, or dermal contact (absorption) of soil during disturbance of this medium. Laboratory analytical results for 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, 2002).
- Background concentrations for 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).

- TPH action limit of 100 mg/kg, per the NAC 445A.2272 (NAC, 2002).
- 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; US Ecology Atlan-Tech, 1992; DOE/NV, 1996).

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), 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

Radiological Surveys

Radiological surveys will be used to determine presence/lateral extent of contamination. Radiological surveys will follow standard procedures. Further information is provided in Section A.1.7.1.

Sampling

Augering, direct-push, excavation, drilling, or other appropriate sampling methods will be used to collect soil samples. Sample collection and handling activities will follow standard procedures. The Industrial Sites QAPP (DOE/NV, 2002), unless otherwise stipulated in the CAIP, provides analytical methods and laboratory requirements (e.g., detection limits, precision, and accuracy). Sample volumes are laboratory- and method-specific and will be determined in accordance with laboratory requirements.

At all CASs within CAU 127, both site characterization and waste characterization efforts are proposed. Site characterization sampling and analysis are the focus of the DQO process. However, waste characterization sampling and analysis has been addressed to support the decision-making process for waste management, and also to ensure an efficient field program.

Samples of tank contents, filter medium, or other material may be collected, as appropriate, and submitted for analysis. These samples will assist in profiling media for waste characterization

purposes. Solid media (e.g., concrete or tank walls) will not be analyzed by a laboratory for chemical or radiological parameters. Specific analyses required for the disposal of IDW are identified in Section 5.0 of the CAIP.

Analytical Program

To ensure that laboratory analyses are sufficient to detect contamination in samples at concentrations exceeding the MRL, Phase I chemical and/or radiological parameters of interest have been selected for each CAS. The parameters for each CAS are identified in Table A.1-6. The Phase I analytical program was developed based on the historical COPC information presented in Section A.1.1.3.2. The analytical program also includes other constituents that have been added as COPCs due to uncertainty in existing documentation for the CASs. Analytical methods are specified in the Industrial Sites QAPP (DOE/NV, 2002), unless superseded by the CAIP.

The analytes of interest for the investigation of PCBs, are listed in Table A.1-7. The SVOC and VOC compounds expected to be analyzed for the investigation are included in Table A.1-8 and Table A.1-9, respectively.

Only those COCs identified during Phase I sampling will be analyzed during Phase II, provided that the Phase I analytical results are available. If Phase I results are not available, Phase II samples will be analyzed for all the parameters listed in Table A.1-6 for a given CAS.

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 the 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 target populations are dependent upon the CSM(s) applicable to the CAS. Phase I sampling target populations are identified in Table A.1-10. These target populations represent locations within the CAS that will contain COCs, if present. If it is determined to be necessary to sample additional target populations, they may also be sampled during Phase I of the investigation. While the

Table A.1-6
Analytical Program
(Includes Site and Waste Characterization Analyses)

Analyses[a]	25-01-05	25-02-02	25-23-11	25-12-01	25-01-06	25-01-07	25-02-13	26-01-01	26-01-02	26-99-01	26-02-01	26-23-01
Organics												
TPH (Diesel- and Gasoline- Range Organics, unless specified)	●	●	●	●	●	●	●	●[b]	●[b]	●[b]	●	●
PCBs	●	●	●	●	●	●		●	●	●	●	●
SVOCs	●	●	●	●	●	●		●	●	●	●	●
VOCs	●	●	●	●	●	●		●	●	●	●	●
Metals												
Total RCRA Metals[c]	●	●	●	●	●	●		●	●	●	●	●
Total Beryllium	●	●	●	●				●	●	●	●	●
Total Boron				●								
Asbestos	●	●	●	●				●	●	●		
Radionuclides												
Gamma Spectrometry	●	●	●	●	●	●		●[d]	●[d]	●[d]	●	●
Gross Beta				●								
Isotopic Uranium	●	●	●	●	●	●	●	●	●	●	●	
Tritium	●	●	●									
Isotopic Plutonium	●	●	●	●	●	●		●	●	●	●	
Strontium-90	●	●	●	●	●	●		●	●	●	●	

[a]In addition to the specified samples shown for soils, liquid, sludge, or solid material present in tank, piping, or other container may also be analyzed for the same constituents, with the exclusion of asbestos. If the volume of material is limited, prioritization of the analyses will be necessary.
[b]Add oil-range TPH.
[c]May also include TCLP metals if sample is collected for waste management purposes.
[d]Analysis for isotopic americium may be required for waste management purposes.

Table A.1-7
Proposed PCB Compounds for Analysis

PCB
Aroclor-1016
Aroclor-1221
Aroclor-1232
Aroclor-1242
Aroclor-1248
Aroclor-1254
Aroclor-1260

Table A.1-8
Proposed SVOCs for Analysis

Semivolatile Organic Compounds		
1,2,4-Trichlorobenzene	4-Chloro-3-methylphenol	Dibenzofuran
1,2-Dichlorobenzene	4-Chloroaniline	Diethyl Phthalate
1,3-Dichlorobenzene	4-Chlorophenyl phenyl ether	Dimethyl Phthalate
1,4-Dichlorobenzene	4-Methylphenol	Di-n-butyl Phthalate
2,4,5-Trichlorophenol	4-Nitroaniline	Di-n-octyl Phthalate
2,4,6-Trichlorophenol	4-Nitrophenol	Fluoranthene
2,4-Dichlorophenol	Acenaphthene	Fluorene
2,4-Dimethylphenol	Acenaphthylene	Hexachlorobenzene
2,4-Dinitrophenol	Anthracene	Hexachlorobutadiene
2,4-Dinitrotoluene	Benzo(a)anthracene	Hexachlorocyclopentadiene
2,6-Dinitrotoluene	Benzo(a)pyrene	Hexachloroethane
2-Chloronaphthalene	Benzo(b)fluoranthene	Indeno(1,2,3-cd)pyrene
2-Chlorophenol	Benzo(g,h,i)perylene	Isophorone
2-Methylnaphthalene	Benzo(k)fluoranthene	Naphthalene
2-Methylphenol	Bis(2-chloroethoxy) methane	Nitrobenzene
2-Nitroaniline	Bis(2-chloroethyl)ether	N-nitroso-di-n-propylamine
2-Nitrophenol	Bis(2-ethylhexyl) phthalate	N-nitrosodiphenylamine
3,3'-Dichlorobenzidine	Butyl benzyl phthalate	Pentachlorophenol
3-Nitroaniline	Carbazole	Phenanthrene
4,6-Dinitro-2-methylphenol	Chrysene	Phenol
4-Bromophenyl phenyl ether	Dibenzo(a,h)anthracene	Pyrene

Table A.1-9
Proposed VOCs for Analysis

Volatile Organic Compounds		
1,1,1,2-Tetrachloroethane	2-Hexanone	Dibromomethane
1,1,1-Trichloroethane	4-Methyl-2-pentanone	Dichlorodifluoromethane
1,1,2,2-Tetrachloroethane	Acetone	Ethylbenzene
1,1,2-Trichloroethane	Benzene	Iodomethane
1,1-Dichloroethane	Bromoform	Methylene chloride
1,1-Dichloroethene	Bromomethane	Styrene
1,2,3-Trichloropropane	Carbon disulfide|	Tetrachloroethene
1,2-Dibromo-3-chloropropane	Carbon tetrachloride	Toluene
1,2-Dibromoethane	Chlorobenzene	Trichloroethene
1,2-Dichloroethane	Chloroethane	Trichlorofluoromethane
1,2-Dichloropropane	Chloroform	Vinyl acetate
1,4-Dichlorobenzene	Chloromethane	Vinyl chloride
2-Butanone	Dibromochloromethane	

additional samples may not directly support Phase I decision-making, they will be used if a CAS is elevated to Phase II to define contamination extent.

The potential Phase II sampling target populations for each CAS are:

- COC concentrations in soil at step-out locations
- COC concentrations in soil below the contaminant plume(s)

Phase II target populations will be limited to those related to distinct Phase I target populations with COCs. These target populations represent locations within the system that, when sampled, will provide sufficient data to address the Phase II data needs discussed in Section A.1.3.

A.1.4.2 Identify the Spatial and Temporal Boundaries

The spatial boundaries that apply to each CAS in Phase I are the survey and sample locations selected for Phase I. The spatial boundaries that apply to each CAS for Phase II are shown in Table A.1-11. In general, geographic boundaries are defined by the impacted soil. Intrusive activities are not intended to extend into CASs not in CAU 127.

Temporal boundaries are time constraints due to time-related phenomena, such as weather conditions, seasons, activity patterns, etc. Significant temporal constraints due to weather conditions are not expected. Moist weather may place constraints on sampling and field-screening contaminated soils

Table A.1-10
Target Populations for the Phase I Investigations

CAS	Target Population
25-01-05	COC concentrations in surface soil near tank, especially near overflow pipe. COC concentrations in subsurface soil below tank and below piping running between tank and USTs (CAS 25-02-02). COC concentrations in tank contents for waste characterization.
25-02-02	COC concentrations in surface soil near the aboveground pressure valve and the aboveground piping above the USTs; COC concentrations in subsurface soil at the these locations, as well as soil adjacent to USTs, under piping between USTs and former filter tanks, and adjacent to piping from USTs to pump vault (CAS 25-23-11). COC concentrations in surface and subsurface soil at the former location of the filter tanks (includes berms around location). COC concentrations in tank contents for waste characterization.
25-23-11	COC concentrations in surface and subsurface soil near heat shield and pump vault. COC concentrations of materials in pump vault. Radiological characterization of surfaces of accessible pipes, concrete, pump, and debris for waste characterization.
25-12-01	COC concentrations in materials within boiler for waste characterization. Radiological characterization of surfaces of accessible pipes, pumps, concrete pad, and boiler for waste characterization.
25-01-06	COC concentrations in surface and subsurface soil on north side of concrete pad under tank.
25-01-07	COC concentrations in surface and subsurface soil on north side of concrete pad under tank.
25-02-13	COC concentrations on gravel/soil on the floor of the X-Tunnel experiment chamber over the former location of the underground tank.
26-01-01	COC concentrations in surface and subsurface soil under/adjacent to tank and piping. Radiological characterization of surfaces of pipes and tank for waste characterization. COC concentrations in tank contents for waste characterization.
26-01-02	COC concentrations in surface and subsurface soil under/adjacent to tank and piping. Radiological characterization of surfaces of pipes and tank for waste characterization. COC concentrations in tank contents for waste characterization.
26-99-01	COC concentrations in the surface and subsurface soil under the shed housing the radioactively contaminated filters. Radiological characterization of surfaces of pipes, filter tanks, and shed for waste characterization. COC concentrations in filter media for waste characterization.
26-02-01	COC concentrations in subsurface soil under base of tank. COC concentrations in tank contents for waste characterization.
26-23-01	COC concentrations in surface and possibly shallow subsurface soil from area below and immediately adjacent to spreader. Radiological characterization of inside and outside surfaces of spreader for waste characterization. COC concentrations in tank contents for waste characterization.

Table A.1-11
Spatial Boundaries for Phase II Investigation

CAS	Spatial Boundary	
	Horizontal	Vertical
25-01-05	50-ft buffer around the CAS	30 ft bgs
25-02-02	50-ft buffer around the CAS	50 ft bgs
25-23-11	50-ft buffer around the CAS	30 ft bgs
25-12-01	30-ft buffer around the CAS	0 ft bgs
25-01-06	50-ft buffer around the CAS	30 ft bgs
25-01-07	50-ft buffer around the CAS	30 ft bgs
26-01-01	50-ft buffer around the CAS	30 ft bgs
26-01-02	50-ft buffer around the CAS	30 ft bgs
26-99-01	50-ft buffer around the CAS	30 ft bgs
26-02-01	50-ft buffer around the CAS	30 ft bgs
26-23-01	30-ft buffer around the CAS	10 ft bgs

because of the attenuating effect of moisture in samples. 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 sites were last used.

A.1.4.3 Identify Practical Constraints

Nevada Test Site-controlled activities may affect the ability to characterize these CASs, although the sites are generally abandoned, without any ongoing activity. The exception to this is the X-Tunnel, location of CAS 25-02-13, which is inactive not abandoned. Also, CAS 26-02-01, the Check Station, has recently been demolished. The aboveground piping associated with this site has been removed, which would have disturbed the nearby surface soils, and impacted the representativeness of data from surface soil samples. Table A.1-12 indicates other practical constraints that may be encountered at each CAS.

Table A.1-12
Practical Constraints Identified for CAU 127

CAS	Utilities Likely to be Encountered[a]	Topography/Site Conditions Likely to Affect Planned Activities	Structures (Tanks/Pipes/Bldgs) Likely to Affect Planned Activities	Area Subject to Access Restrictions[b]	Confined Space, Health & Safety, Structural Integrity Issues
25-01-05	None known	No	No	Yes	Yes
25-02-02	None known	No	No	Yes	Yes
25-23-11	None known	No	Yes	Yes	Yes
25-12-01	None known	No	Yes	Yes	Yes
25-01-06	None known	No	No	Yes	No
25-01-07	None known	No	No	Yes	No
25-02-13	None known	Yes	Yes	Yes	Yes
26-01-01	None known	No	Yes	Yes	Yes
26-01-02	None known	No	Yes	Yes	Yes
26-99-01	None known	No	Yes	Yes	Yes
26-02-01	None known	No	No	No	No
26-23-01	None known	No	No	Yes	No

Source: Site visits.
[a]Utility constraints are subject to change as detailed information is collected prior to commencement of investigation activities and will be appropriately documented. All CASs will be surveyed for utilities prior to field activities in accordance with the SSHASP. Does not include underground piping that is included as part of the CAS.
[b]Access restrictions include both scheduling conflicts on the NTS with other entities and areas posted as contamination areas requiring appropriate work controls, and areas requiring authorized access.

A.1.4.4 Define the Scale of Decision Making

The scale of decision making in Phase I is defined as the CAS. The scale of decision making in Phase II is defined as the maximum extent of COC contamination. The scale of decision making for an unrestricted release determination is the entire object/structure (e.g., tank, pipe) surveyed.

A.1.5 Step 5 - Develop a Decision Rule

This step integrates outputs from the 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

The maximum observed concentration of each COC will be the population parameter. If radiological surveys are performed, radiological sampling results will supersede radiological survey results.

A.1.5.2 Choose an Action Level

Action levels are defined in Section A.1.1.3.2.

A.1.5.3 Measurement and Analysis Methods

The analyses identified in Section A.1.3.3 for each CAS will be used to identify the presence, location, and extent of COCs in the investigation. Indicators (e.g., field conditions, process knowledge) may also be used to identify the presence and location of COCs. At selected CASs, radiological surveys will also be used to identify the presence and location of COCs.

The measurement and analysis methods in the Industrial Sites QAPP (DOE/NV, 2002) are capable of achieving the expected range of values to resolve the Phase I and II decisions. The detection limit of the measurement method to be used is less than the PAL for each COPC, unless specified otherwise in the CAIP.

A.1.5.4 Decision Rule

Phase I Decision: 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 it is determined that sufficient indicators are present, then Phase I can be terminated and a Phase II investigation initiated. If the COPC concentration is less than the PAL, then the decision will be no further action.

Phase II Decision: If the maximum observed concentration of any COC of a target population exceeds the PALs, then additional samples will be collected to define extent. If the observed concentration is less than the PAL, then the decision will be that the extent of contamination has been defined in the vertical and/or horizontal direction.

If contamination is inconsistent with the CSM or extends beyond the spatial boundaries identified in Table A.1-11, 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.1.6 Step 6 - Specify the Tolerable Limits on Decision Errors

The sampling approach for the CAU 127 investigation relies on biased sampling locations. 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 Phase I are:

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

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

- Baseline condition – The extent of a COC has not been defined.
- Alternative condition – Extent of a COC has been defined.

Decisions and/or criteria have an alpha (false negative) or beta (false positive) error associated with their determination (discussed in the following subsections). Since quantitative data are individually compared to action levels, statistical evaluations of the data such as averages or confidence intervals are not appropriate.

A.1.6.1 False Negative Decision Error

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

A false negative 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 COCs if present anywhere within the CAS or that the locations 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 the first criterion, Phase I samples will be collected in areas most likely to be contaminated by any COCs and Phase II samples will be collected in areas that represent the lateral and vertical extent of contamination. 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 criterion is met.

To satisfy the second criterion, all Phase I samples and Phase II samples (when Phase I data are not yet available) will be analyzed for the chemical and radiological parameters listed in Section A.1.3.3 using analytical methods that are capable of producing quantitative data to concentrations below or equal to PALs (unless stated otherwise in the CAIP). For Phase II samples, when Phase I data are available, samples will be analyzed for only those chemical and radiological parameters that have been identified as COCs in the Phase I samples. Strict adherence to established procedures and QA/QC protocol protects against false negatives.

A.1.6.2 False Positive Decision Error

The false positive (acceptance or beta) decision error would mean deciding that a COC is present when it is not, or accepting that the extent of a COC has not been defined when it really has, resulting in increased costs for unnecessary characterization.

The false positive 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

Radiological survey instruments will be calibrated in accordance with manufacturer's instructions and periodic calibrations will be performed in accordance with approved procedures. Quality control samples will be collected as required by established procedures. The required QC samples include:

- Trip blanks (one per sample cooler containing VOC environmental samples)
- Equipment blanks (one per sampling event for each type of decontamination procedure)
- Source blanks (one per source lot per sampling event)
- Field duplicates (minimum of 1 per matrix per 20 environmental samples or 1 per CAS if less than 20 collected)
- Field blanks (minimum of per one CAS)
- Matrix spike/matrix spike duplicate (minimum of 1 per matrix per 20 environmental samples or 1 per CAS if less than 20 collected). The MS/MSD is not needed for some radioanalytical measurements (e.g., gamma spectrometry).

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 (DOE/NV, 2002). In addition, sensitivity has been included as a DQI for laboratory analyses. Site-specific DQIs are discussed in more detail in Section 6.0 of the CAIP.

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

Radiological surveys and intrusive sampling will be conducted at CAU 127 during Phase I. Radiological surveys will be conducted at eight of the CASs to estimate the lateral extent of contamination and/or identify hot spots for subsequent sampling or swiping. A radiological survey of X-Tunnel floor will be performed at the former location of the CAS 25-02-13 underground tank to confirm the absence of contamination.

Soil sampling locations will be determined based on the results of the surveys and other biasing factors listed in Section A.1.3.1. These locations may be modified, but only if the modified locations

meet the decision needs and criteria stipulated in Section A.1.3. As noted in Section A.1.3.3 and Section A.1.4.1, some sampling will be performed for waste characterization purposes. Section A.1.7.1 and Section A.1.7.2 provide information on general investigation activities. Section A.1.7.3 provides the planned Phase I sampling strategy for each CAS in CAU 127 except CASs 25-01-06 and 25-01-07. The investigation of these two CASs will proceed directly to Phase II, since soil contamination is known to be present. The Phase II strategy is presented in Section A.1.7.4.

A.1.7.1 Radiological Survey Methodologies and Instruments

Radiological surveys will be conducted at eight CASs to define the lateral extent of surficial contamination and/or to locate hot spots for subsequent sampling or swiping. Walk-over surveys using handheld instruments will be performed on those portions of the CASs that are accessible. The walk-over surveys will be conducted on each CAS in such a manner as to ascertain if radiological contamination is present and is decreasing as the distance from the tanks/piping/etc. increases, as CSM #1 would predict. Additionally, if elevated surface readings are encountered, an effort will be made through *in situ* screening techniques to identify the source term as being either a surface/shallow subsurface source term or a subsurface source term. The NE Technology Electra, Eberline E-600, TSA-PRM-470B and Bicron mRem or equivalent instruments will be used in the appropriate capacity as the handheld instruments. As discussed above, a confirmatory walk-over radiological survey of the tunnel floor will be conducted at the former location of the CAS 25-02-13 underground tank.

Some radiological screening, surveying, and swipe collection will take place for waste characterization purposes. These activities will assess the amount of fixed and removable contamination on the surfaces of pipes, tanks, concrete, and possibly other objects. When necessary, detectors or probes on extended cables will be lowered into structures to collect measurements, and swipes will be affixed to extension poles or fish tapes to obtain data from the interior of structures or objects.

Additional equipment and software used in the radiological data collection and processing include a GPS receiver, such as Trimble or Motorola, and associated laptop computers to log and process the

walk-over radiological data. Mapping programs such as ArcView, Surfer, and EarthVision will be used to plot data on site maps or aerial photographs.

A.1.7.2 Intrusive Investigation

Intrusive investigations will be conducted at 10 of the CASs to determine if a COC is present. An intrusive investigation is not planned for the boiler and associated features at Test Cell C (CAS 25-12-01) or the former UST location in the X-Tunnel (CAS 25-02-13). Samples from each of the 10 sites will be collected from biased locations. The sampling locations will be determined based on the results of the radiological surveys and other biasing factors listed in Section A.1.3.1.

Rotary sonic drilling, hollow-stem auger drilling, direct-push, handheld augers, or excavation will be used to access sample intervals for laboratory analysis at select locations to determine if a COC is present. Due to the potentially dangerous nature of buried features (i.e., tanks, piping, utilities, asbestos), sample locations may be biased adjacent to any buried feature, based upon the review of engineering drawings, and information obtained during site walkovers. The locations may also be biased, based upon specific site conditions encountered. Surface soil samples (<0.5 ft bgs) will be collected by hand according to approved procedures.

A.1.7.3 Phase I Sampling Strategy

The planned Phase I sampling strategy for each CAS is listed in Table A.1-13. The biasing factors listed in Section A.1.3.1 will be used to determine sampling locations. Where soil sampling is proposed in Table A.1-13, if FSRs above FSLs or other biasing factors indicate the presence of contamination at levels above the PALs, a Phase II investigation will be instituted.

The collection of samples of tank contents for waste characterization are dependent on the accessibility and availability of the contents. The determination that tank contents can be sampled will be made in the field. If distinct phases are identified, if possible, a sample of each phase will be collected for analysis. If there is evidence of leakage from any of the CAU tanks/piping, any liquids remaining in the tanks will be removed as soon as possible.

Table A.1-13
Planned Phase I Sampling Strategy
(Page 1 of 3)

CAS	Sampling Strategy[a]
25-01-05 Test Cell C 100,000-gal AST	Sample and analyze contents of tank, if sufficient material is present. Perform radiological survey of ground within a 20-ft perimeter of tank and along the length of piping (10 ft either side). Pump pad/vault may still be present at northwest end of pipes. If present, perform radiological survey of pumps and pad/vault. Minimum of two surface soil samples around the base of the tank, locations based on biasing factors. Two subsurface soil samples, using angle boring, under footprint of tank. Minimum of three subsurface soil samples, locations based on biasing factors, along the length of the underground pipe running to CAS 25-23-11. Include pump pad/vault in this area. Sample interval will begin at the base of the pipe. Minimum of one sample of suspected ACM on pipes.
25-02-02 Test Cell C six 10,000-gal USTs	Sample and analyze contents of tanks, if sufficient material is present. Perform radiological survey of ground within 20 ft of approximated outline of tanks, and along the length of piping (10 ft either side). Perform radiological survey around, over, and within bermed area that previously held filter tanks (extend 20 ft beyond outer toe of berms). This survey will also be used for CAS 25-23-11. Conduct downhole radiological survey of tank interior(s) if access is available (e.g., through vent risers) and if tank contents are not sampled. Minimum of one surface soil sample, next to aboveground piping over USTs, locations based upon biasing factors. Minimum of six soil sample locations (surface and subsurface) in soil berms around the filter tank area (outside, top, and inside berm surfaces), locations based upon biasing factors. Locations at top of berm will be surface soil sample locations only. Minimum of one subsurface soil sample within the bermed area, immediately off the concrete pad, location based upon biasing factors. Minimum of two subsurface soil samples adjacent to pump vault, location based upon biasing factors. Sample intervals will be below the base of CAS 25-23-11 pump vault. (Note: Soil above base of vault is addressed in investigation of CAS 25-23-11). Minimum of one subsurface soil sample, below the underground pipe running to CAS 25-23-11, sample interval will begin at the base of the pipe. Subsurface soil samples as near as possible to tanks, minimum of four sample locations, based upon biasing factors. Samples on the northeast side of the tanks will be obtained by extending the depths of the sampling locations inside of the bermed area. Minimum of one sample of suspected ACM on pipes.

Table A.1-13
Planned Phase I Sampling Strategy
(Page 2 of 3)

CAS	Sampling Strategy[a]
25-23-11 Test Cell C Contaminated Materials	Perform radiological survey within 20 ft of pump vault. Perform limited radiological characterization of exterior and accessible interior surfaces of pump, pipes, concrete vault, and heat shield, as appropriate (suspected ACM will not be disturbed to access surfaces). Minimum of two surface soil samples, locations based upon biasing factors. Exact locations will be based upon accessibility, due to piping and heat shield conflict. (Note: subsurface soil at these locations will be addressed by the investigation of CAS 25-02-02.) Minimum of one sample of suspected ACM on pipes.
25-12-01 Test Cell C Boiler	Sample and analyze contents of boiler, if sufficient material is present. Perform radiological survey of ground within 20 ft of boiler, and within 10 ft of other features included in CAS. Perform limited radiological characterization of exterior and accessible interior surfaces of boiler and other features included in CAS, as appropriate (suspected ACM will not be disturbed to access surfaces). Minimum of one sample of suspected ACM on boiler and/or pipes.
25-02-13 X-Tunnel UST	Perform a confirmatory radiological survey of the tunnel experiment chamber floor at the former location of the underground tank. The excavation associated with the tank removal was approximately 10 ft by 8 ft. Due to uncertainty in the precise location of the excavation, the radiological survey will include an area of at least 20 ft by 20 ft.
25-01-06 E-MAD 1,000-gal AST	Proceed to Phase II sampling.
25-01-07 E-MAD 1,000-gal AST	Proceed to Phase II sampling.
26-01-01 Project Pluto Disassembly Facility 10,000-gal Filter Tank (RAD) and Piping	Sample and analyze contents of tank, if sufficient material is present. Perform radiological survey of ground within 20 ft of tank and along the length of piping (5 ft on either side). Perform limited radiological characterization of exterior and accessible interior surfaces of tank and aboveground pipes, as appropriate (suspected ACM will not be disturbed to access surfaces). Minimum of four surface and subsurface soil sample locations beneath and immediately adjacent to the tank and aboveground piping, based upon biasing factors. Minimum of three subsurface soil samples along the length of the underground pipe running from CAS 26-01-01 to the previous location of the CAS 26-02-04 UST. Locations will be based upon biasing factors, and sample intervals will begin at the base of the pipe. Minimum of one sample of suspected ACM on pipes.

Table A.1-13
Planned Phase I Sampling Strategy
(Page 3 of 3)

CAS	Sampling Strategy[a]
26-01-02 Project Pluto Disassembly Facility 5,000-gal Filter Tank	Sample and analyze contents of tank, if sufficient material is present. Perform radiological survey of ground within 20 ft of tank, and along the length of piping (5 ft either side). Perform limited radiological characterization of exterior and accessible interior surfaces of tank and aboveground pipes, as appropriate (suspected ACM will not be disturbed to access surfaces). Minimum of four surface and subsurface soil locations beneath and immediately adjacent to the tank and aboveground piping, based upon biasing factors. Minimum of one sample of suspected ACM on pipes.
26-99-01 Project Pluto Disassembly Facility Radioactively Contaminated Filters	Sample and analyze contents of tanks/filters, if sufficient material is present. Perform radiological survey of ground within 20 ft of shed. Perform limited radiological characterization of exterior and accessible interior surfaces of filter tanks, aboveground pipes, and shed, as appropriate (suspected ACM will not be disturbed to access surfaces). Minimum of three surface and subsurface soil sample locations beneath and immediately adjacent to the building, based upon biasing factors. Minimum of one sample of suspected ACMs on pipes and/or other features.
26-02-01 Project Pluto Check Station 1,000-gal UST	Sample and analyze contents of tank, if sufficient material is present. Two subsurface soil samples, immediately adjacent to the tank, locations based upon biasing factors. Sample interval will begin at the base of the tank.
26-23-01 Port Gaston Contaminated Liquids Spreader	Sample and analyze contents of two tanks (it is suspected tanks are dry). Perform limited radiological characterization of exterior and accessible interior of surfaces of tanks, hoses, pipes, wheels, frames, etc., as appropriate. Perform radiological survey of area within 20 ft radius of spreader. Minimum of three surface soil samples beneath or immediately adjacent to the spreader, locations based upon biasing factors.

[a]The sampling locations may be altered based upon additional information.

A.1.7.4 Phase II Sampling Strategy

Biased soil sampling for laboratory analysis will be conducted at CAU 127 during Phase II. Biased sampling locations will be estimated prior to Phase II, based on process knowledge and analytical results from Phase I, if available. As field data are generated (e.g., radiological surveys, field-screening, and Phase I analytical results), the Phase II locations may be modified as long as they meet the decision needs and criteria stipulated in Section A.1.3.

Lateral step-out sample points will be located a maximum of 15 ft from outer boundary sample locations where COCs were detected. If biasing factors indicate COCs extend beyond the proposed Phase II sample locations, further step-out locations may be necessary. At each Phase II lateral step-out location, soil samples will be collected at the depth(s) where COCs were encountered and at 2-ft intervals below the lowest depth where COCs were encountered. Phase II sampling to define the vertical extent of contamination will begin 2 ft below the depth where COCs were detected. In general, samples submitted for laboratory analysis would be those that define the lateral and vertical extent of COCs. Additional samples may be collected to define the extent of COCs if necessary.

At each sample location, sampling will continue until two consecutive soils samples with screening results below FSLs are collected or a hold point (Table A.1-11) is reached. In addition to screening results below FSLs, these two consecutive sample intervals will also be characterized by the absence of other indicators of contamination (e.g., odors or staining). The extent of contamination will be defined by submitting one of these below-FSL samples (generally, the uppermost sample) for laboratory analysis to confirm the absence of COCs. If the analyzed sample is below PALs, then extent will be considered to be determined. Accordingly, not every interval that is collected for field screening will be submitted for laboratory analysis; the protocol is discussed in the CAIP.

Based on current site conditions, the investigations of CASs 25-01-06 and 25-01-07 will proceed directly to Phase II. The sampling strategy for these CASs is listed in Table A.1-14.

Table A.1-14
Planned Phase II Sampling Strategy

CAS	Sampling Strategy[a]
25-01-06 E-MAD 1,000-gal AST	Minimum of two soil samples within the stained soil area–one surface and one shallow subsurface. Minimum of one surface and one subsurface soil sample in each direction (north, east, and west), approximately 3 ft beyond the visibly stained surface soil. Final sample locations and sample depths will be based upon biasing factors. Analyze samples that do not exceed FSLs in order to confirm delineation of contamination extent. If contamination extends beyond these limits, step-out locations at additional distance and/or depth, as necessary, will be sampled.
25-01-07 E-MAD 1,000-gal AST	Minimum of two soil samples within the stained soil area–one surface and one shallow subsurface. Minimum of one surface and one subsurface soil sample in each direction (north, east, and west), approximately 3 ft beyond the visibly stained surface soil. Final sample locations and sample depths will be based upon biasing factors. Analyze samples that do not exceed FSLs in order to confirm delineation of contamination extent. If contamination extends beyond these limits, step-out locations at additional distance and/or depth, as necessary, will be sampled.

[a]The sampling locations may be altered based upon additional information.

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

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 127: Areas 25 and 26, Storage Tanks Nevada Test Site, Nevada	2. Document Date: June 2002
3. Revision Number: 0	4. Originator/Organization: IT Corporation
5. Responsible NNSA/NV ERP Project Mgr.: Janet Appenzeller-Wing	6. Date Comments Due: July 19, 2002
7. Review Criteria: Full	
8. Reviewer/Organization/Phone No.: Clemens Goewert, NDEP, 486-2865	9. Reviewer's Signature:

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
1) 1st Paragraph Page A-1	M	In the first paragraph on Page A-1, it is discussed that CAS 25-02-13 Underground Storage Tank Location has sufficient information, and will go through an "A through K" evaluation to allow an Administrative Closure. There are 2 main issues with this discussion. 1) an A through K evaluation will not be acceptable for an administrative closure if DU is still present at the tank location. If the DU has been removed, and only hydrocarbons are remaining then an administrative closure is possible. 2) The second issue is that this is not the location to present this type of discussion. Discussion on closure options should be presented in the main body of the CAIP and not the DQOs. The outcome of the DQO process should identify what questions need to be answered and what data is needed from the site. The main body of the CAIP needs to identify how the site data will be collected to meet the data needs at this site. Discussion of this site must be presented both in the DQOs and the CAIP.	1. A confirmatory radiological survey of the X-Tunnel floor at the former location of the CAS 25-02-13 Underground Storage Tank has been added to investigation. This survey will be performed to confirm the absence of depleted uranium contamination at this location and potentially allow an Administrative Closure of CAS 25-02-13. 2. The discussion of an "A through K" Administrative Closure of CAS 25-02-13 has been deleted from Appendix A.	Yes
2) Appendix A	M	Appendix A is intended to establish the Data Quality Objectives for Corrective Action Unit 127. This appendix mixes the development of the CAIP into the DQO process. This section needs to be totally revised, and only focus on the DQOs. The CAIP is then presented in the Main Body of the plan. Figure A.1-3, Data Quality Objective Decision Flow, does not allow the 7 Step Data Quality Objective Process. This figure would better fit in the main body of the CAIP.	Appendix A was revised into one seven-step DQO process. Figure A.1-3 was moved to the main body of the CAIP.	Yes

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

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