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JAN 19 2006

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SUBMITTAL OF THE ERRATA SHEET FOR THE FINAL CORRECTIVE ACTION INVESTIGATION PLAN FOR CORRECTIVE ACTION UNIT 555: SEPTIC SYSTEMS, NEVADA TEST SITE, NEVADA, REVISION 0, DECEMBER 2005

Enclosed for your records is one controlled copy of the Errata Sheet for the subject document.

Please direct comments and questions to Sabine T. Curtis, of my staff, at (702) 295-0542.

Janet L. Appenzeller-Wing, Acting Director
Environmental Restoration Division

ERD:1660.SC

Enclosure:
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ERRATA SHEET

The Following Corrections and Clarifications Apply to: Corrective Action Investigation Plan for Corrective Action Unit 555: Septic Systems, Nevada Test Site, Nevada, Revision 0, December 2005

DOE Document Number: DOE/NV--1097

Revision: 0

Original Document Issuance Date: December 2005

This errata sheet was issued under cover letter from DOE on: January 19, 2006

Remove and destroy page 6 of 59 and replace with the reissued corrected page attached. The word "four" was changed to "five" in the third line of the first paragraph.

2.0 Facility Description

Corrective Action Unit 555 is comprised of five CASs that were grouped together based on the geographical location of the sites, technical similarities, and the agency responsible for closure. The five CASs are located in Areas 1, 3, and 6 of the NTS and include the following domestic waste septic systems.

- CAS 01-59-01, Area 1 Camp Septic System
- CAS 03-59-03, Core Handling Building Septic System
- CAS 06-20-05, Birdwell Dry Well
- CAS 06-59-01, Birdwell Septic System
- CAS 06-59-02, National Cementers Septic System

Corrective Action Site 06-20-05 is a dry well that was discovered during the review of engineering drawings. Since the Birdwell Septic System (CAS 06-59-01) was installed to replace the dry well, both CASs will be investigated at the same time.

2.1 Physical Setting

The following sections describe the general physical settings of Areas 1, 3 and 6. General background information pertaining to topography, geology, hydrogeology, and climatology are provided for these specific areas of the NTS region in the *Geologic Map of the Nevada Test Site, Southern Nevada* (USGS, 1990); *CERCLA Preliminary Assessment for DOE's Nevada Operations Office Nuclear Weapons Testing Areas* (DRI, 1988); *Final Environmental Impact Statement, Nevada Test Site, Nye County, Nevada* (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).

Topographical and hydrological setting descriptions for four of the CASs located in Areas 3 and 6 are very similar, while the remaining CAS located in Area 1 covers a greater surface area and has a different topography and hydrology setting. All five sites are located in the Yucca Flat hydrographic area and have similar geology. Details for each CAS are provided in the following subsections.

Corrective Action Site 01-59-01, Area 1 Camp Septic System, is located in the northwest section of Area 1 at the Area 1 Subdock, west of Tippipah Highway and just north of Pahute Mesa Road (refer to Figure A.2-2). The septic system is situated in a gently sloping area that drains to the

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National Nuclear Security Administration

Corrective Action Investigation Plan for Corrective Action Unit 555: Septic Systems Nevada Test Site, Nevada

Controlled Copy No.: ___
Revision No.: 0

December 2005

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Division

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CORRECTIVE ACTION INVESTIGATION PLAN FOR FOR CORRECTIVE ACTION UNIT 555: SEPTIC SYSTEMS

NEVADA TEST SITE, NEVADA

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

Controlled Copy No.: ___

Revision No.: 0

December 2005

CORRECTIVE ACTION INVESTIGATION PLAN FOR
CORRECTIVE ACTION UNIT 555:
SEPTIC SYSTEMS
NEVADA TEST SITE, NEVADA

Approved by: Approved Signature Date: 12/21/2005

Kevin Cabble, Acting Project Manager
Industrial Sites Project

Approved by: Approved Signature Date: 12/21/2005

Janet Appenzeller-Wing, Acting Division Director
Environmental Restoration Division

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List of Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
bgs	Below ground surface
BN	Bechtel Nevada
CAI	Corrective Action Investigation
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CERCLA	*Comprehensive Environmental Resource Conservation and Liability Act*
CFR	*Code of Federal Regulations*
COC	Contaminant of concern
COPC	Contaminant of potential concern
CSM	Conceptual site model
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQI	Data quality indicator
DQO	Data quality objective
DRO	Diesel-range organics
EPA	U.S. Environmental Protection Agency
EQL	Estimated quantitation limit
FAL	Final action level
FFACO	*Federal Facility Agreement and Consent Order*
FSR	Field-screening result
ft	Foot
FWP	Field Work Permit

Acronyms and Abbreviations *(Continued)*

gal	Gallon
GRO	Gasoline-range organics
HASL	Health and Safety Laboratory
HWAA	Hazardous waste accumulation area
IDW	Investigation-derived waste
in.	Inch
IRIS	Integrated Risk Information System
IS HASP	Industrial Sites Health and Safety Plan
ISMS	Integrated Safety Management System
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
MDC	Minimum detectable concentration
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mi	Mile
mrem/yr	Millirem per year
MS	Matrix spike
MSD	Matrix spike duplicate
NA	Not applicable
NAC	*Nevada Administrative Code*
NCRP	National Council on Radiation Protection and Measurement
ND	Normalized difference
NDEP	Nevada Division of Environmental Protection
NEPA	*National Environmental Policy Act*

Acronyms and Abbreviations (Continued)

NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NRS	*Nevada Revised Statutes*
NTS	Nevada Test Site
NTSWAC	*Nevada Test Site Waste Acceptance Criteria*
NV/YMP	Nevada Yucca Mountain Project
PAL	Preliminary action level
PCB	Polychlorinated biphenyl
pCi/g	Picocuries per gram
pCi/L	Picocuries per liter
POC	Performance Objective for the Certification of Nonradioactive Hazardous Waste
PPE	Personal protective equipment
ppm	Parts per million
PRG	Preliminary remediation goal
PVC	Polyvinyl chloride
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RadCon	Radiological control
RBCA	Risk-based corrective action
RBSL	Risk-based screening level
RCA	Radiologically controlled area
RCRA	*Resource Conservation and Recovery Act*
RMA	Radioactive material area

Acronyms and Abbreviations (Continued)

RPD	Relative percent difference
SDWS	*Safe Drinking Water Standards*
SNJV	Stoller-Navarro Joint Venture
SS	Site Supervisor
SSTL	Site-specific target level
SVOC	Semivolatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total petroleum hydrocarbons
TM	Task Manager
TSCA	*Toxic Substance Control Act*
UGTA	Underground Test Area
USGS	U.S. Geological Survey
VOC	Volatile organic compound
%R	Percent recovery

Executive Summary

Corrective Action Unit (CAU) 555 is located in Areas 1, 3, and 6 of the Nevada Test Site, which is 65 miles northwest of Las Vegas, Nevada. Corrective Action Unit 555 is comprised of the five domestic waste corrective action sites (CASs) listed below:

- CAS 01-59-01, Area 1 Subdock Septic System
- CAS 03-59-03, Core Handling Building Septic System
- CAS 06-20-05, Birdwell Dry Well
- CAS 06-59-01, Birdwell Septic System
- CAS 06-59-02, National Cementers Septic System

These sites are being investigated because existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives. Additional information will be obtained by conducting a corrective action investigation (CAI) prior to evaluating corrective action alternatives and selecting the appropriate corrective action for each CAS. The results of the field investigation will support a defensible evaluation of viable corrective action alternatives that will be presented in the Corrective Action Decision Document.

The sites will be investigated based on the data quality objectives (DQOs) developed on August 23, 2005, by representatives of the Nevada Division of Environmental Protection; U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office; Stoller-Navarro Joint Venture; and Bechtel Nevada. The DQO process was used to identify and define the type, amount, and quality of data needed to develop and evaluate appropriate corrective actions for CAU 555.

Appendix A provides a detailed discussion of the DQO methodology and the DQOs specific to each CAS.

The scope of the CAI for CAU 555 includes, but is not limited to, the following activities:

- Move surface debris and/or materials, as needed, to facilitate sampling.
- Conduct radiological and geophysical surveys.
- Perform field screening.

- Collect and submit environmental samples for laboratory analysis to determine whether contaminants of concern are present.

- If contaminants of concern are present, collect additional step-out samples to define the extent of the contamination.

- Collect samples of investigation-derived waste, as needed, for waste management and minimization purposes.

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

1.0 Introduction

This Corrective Action Investigation Plan (CAIP) contains project-specific information including facility descriptions, environmental sample collection objectives, and criteria for conducting site investigation activities at Corrective Action Unit (CAU) 555: Septic Systems, 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 State of Nevada, the U.S. Department of Energy (DOE), and the U.S. Department of Defense.

Corrective Action Unit 555 is located in Areas 1, 3 and 6 of the NTS, which is approximately 65 miles (mi) northwest of Las Vegas, Nevada, and is comprised of the five corrective action sites (CASs) shown on Figure 1-1 and listed below:

- CAS 01-59-01, Area 1 Camp Septic System
- CAS 03-59-03, Core Handling Building Septic System
- CAS 06-20-05, Birdwell Dry Well
- CAS 06-59-01, Birdwell Septic System
- CAS 06-59-02, National Cementers Septic System

An FFACO modification was approved on December 14, 2005, to include CAS 06-20-05, Birdwell Dry Well, as part of the scope of CAU 555. The work scope was expanded in this document to include the investigation of CAS 06-20-05.

The Corrective Action Investigation (CAI) will include field inspections, radiological surveys, geophysical surveys, sampling of environmental media, analysis of samples, and assessment of investigation results, where appropriate. Data will be obtained to support corrective action alternative evaluations and waste management decisions.

1.1 Purpose

The CASs in CAU 555 are being investigated because hazardous and/or radioactive constituents may be present in concentrations that could potentially pose a threat to human health and the environment. Existing information on the nature and extent of potential contamination is insufficient to evaluate

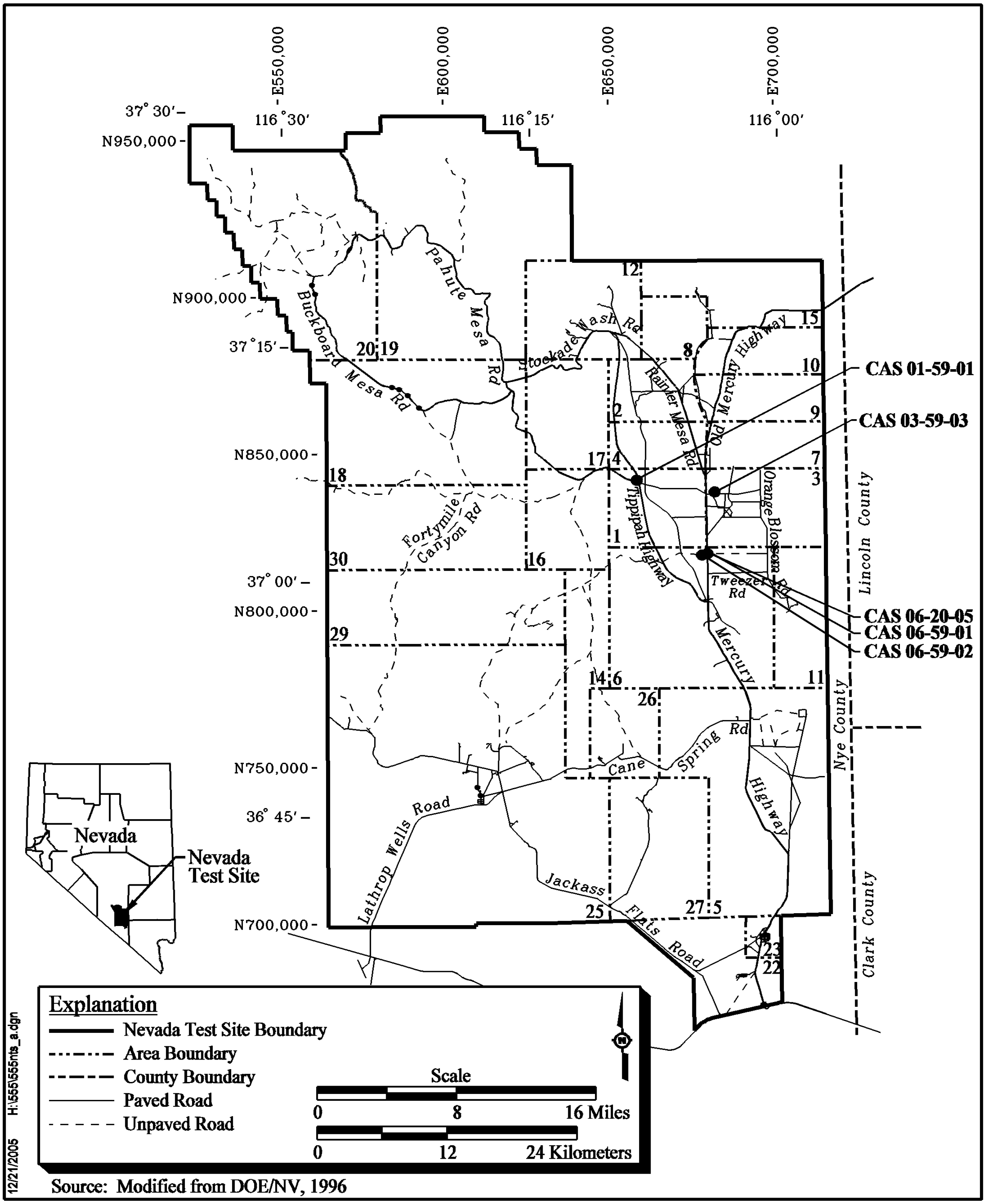

Figure 1-1
CAU 555 CAS Locations

and recommend corrective action alternatives for the CASs. Additional information will be generated by conducting a CAI before the evaluation and selection of corrective action alternatives.

1.1.1 Corrective Action Unit 555 History and Description

Corrective Action Unit 555, Septic Systems, consists of five inactive domestic waste sites located in Areas 1, 3, and 6 of the NTS. The CAU 555 sites were used to manage domestic waste from personnel who supported NTS activities in the Yucca Flat region from the mid-1960s through the mid-1990s. Operational histories for each of the CAU 555 CASs are detailed in Section 2.2.

1.1.2 Data Quality Objective Summary

The sites will be investigated based on data quality objectives (DQOs) developed by representatives of the Nevada Division of Environmental Protection (NDEP); DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO); Stoller-Navarro Joint Venture (SNJV); and Bechtel Nevada (BN). The DQOs are used to identify and define the type, amount, and quality of data needed to develop and evaluate appropriate corrective actions for CAU 555. This CAIP describes the investigative approach developed to satisfy the data needs identified in the DQO process. While a detailed discussion of the DQO methodology and the DQOs specific to each CAS are presented in Appendix A of this document, a summary of the DQO process is provided below.

The DQO problem statement for CAU 555 is: "Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives for the CASs in CAU 555." To address this question, the resolution of two decisions is required:

- Decision I: "Is any contaminant of potential concern (COPC) present in environmental media within the CAS at a concentration exceeding its corresponding final action level (FAL)?"
    - Any contaminant associated with a CAS activity that is present at concentrations exceeding its corresponding FAL will be defined as a contaminant of concern (COC).
    - If a COC is detected, then Decision II must be resolved. Otherwise, the investigation for that CAS is complete.

- Decision II: "If a COC is present, is sufficient information available to evaluate potential corrective action alternatives?" Sufficient information is defined to include:
  - Identifying the lateral and vertical extent of COC contamination in media.
  - The information needed to characterize investigation-derived waste (IDW) for disposal.
  - The information needed to determine potential remediation waste types.
  - The information needed to evaluate the feasibility of remediation alternatives.

The informational inputs and data needs to resolve the problem statement and the decision statements were generated as part of the DQO process for this CAU and are documented in Appendix A. The information necessary to resolve the DQO decisions will be generated for each CAU 555 CAS by collecting and analyzing samples generated during a field investigation. The presence and nature of contamination at each CAS will be determined by sampling locations that are identified as being the most probable to contain COCs if they are present anywhere within the CAS. If while defining the nature of contamination it is determined that COCs are present at a CAS, that CAS will be further addressed by determining the extent of contamination before evaluating corrective action alternatives.

1.2 Scope

To generate information needed to resolve the decision statements identified in the DQO processes, the scope of the CAI for CAU 555 includes the following activities:

- Move surface debris and/or materials, as needed, to facilitate sampling.
- Conduct radiological surveys.
- Perform field screening.
- Collect and submit environmental samples for laboratory analysis to determine whether COCs are present.
- If COCs are present, collect additional step-out samples to define the extent of the contamination.
- Collect samples of source material to determine the potential for a release.
- Collect samples of IDW, as needed, for waste management purposes.
- Collect Quality Control (QC) samples.

Contamination of environmental media originating from activities not identified in the conceptual site model (CSM) of any CAS will not be considered as part of this CAU, unless the CSM and the DQOs are modified to include the release. As such, contamination originating from these sources will not be considered for sample location selection, and/or will not be considered COCs for Decision II. If such contamination is present, the contamination will be identified as part of another CAS (either new or existing).

1.3 Corrective Action Investigation Plan Contents

Section 1.0 presents the purpose and scope of this CAIP, while Section 2.0 provides background information about CAU 555. Objectives of the investigation, including CSMs, are presented in Section 3.0. Field investigation and sampling activities are discussed in Section 4.0, and waste management issues for this project are discussed in Section 5.0. General field and laboratory quality assurance (QA) (including collection of QA samples) are presented in Section 6.0 and in the Industrial Sites Quality Assurance Project Plan (QAPP) (NNSA/NV, 2002). The project schedule and records availability are discussed in Section 7.0. Section 8.0 provides a list of references.

Appendix A provides a detailed discussion of the DQO methodology and the DQOs specific to each CAS, while Appendix B contains information on the project organization.

The health and safety aspects of this project are documented in the Industrial Sites Health and Safety Plan (IS HASP) (SNJV, 2004) and will be supplemented with a site-specific field work permit (FWP) to be developed before the start of field work. Public involvement activities are documented in the "Public Involvement Plan" contained in Appendix V of the FFACO (1996). The managerial aspects of this project are discussed in the Project Execution Plan (SNJV, 2005a) and will be supplemented with a site-specific field management plan that will be developed before field activities.

2.0 Facility Description

Corrective Action Unit 555 is comprised of five CASs that were grouped together based on the geographical location of the sites, technical similarities, and the agency responsible for closure. The four CASs are located in Areas 1, 3, and 6 of the NTS and include the following domestic waste septic systems.

- CAS 01-59-01, Area 1 Camp Septic System
- CAS 03-59-03, Core Handling Building Septic System
- CAS 06-20-05, Birdwell Dry Well
- CAS 06-59-01, Birdwell Septic System
- CAS 06-59-02, National Cementers Septic System

Corrective Action Site 06-20-05 is a dry well that was discovered during the review of engineering drawings. Since the Birdwell Septic System (CAS 06-59-01) was installed to replace the dry well, both CASs will be investigated at the same time.

2.1 Physical Setting

The following sections describe the general physical settings of Areas 1, 3 and 6. General background information pertaining to topography, geology, hydrogeology, and climatology are provided for these specific areas of the NTS region in the *Geologic Map of the Nevada Test Site, Southern Nevada* (USGS, 1990); *CERCLA Preliminary Assessment for DOE's Nevada Operations Office Nuclear Weapons Testing Areas* (DRI, 1988); *Final Environmental Impact Statement, Nevada Test Site, Nye County, Nevada* (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).

Topographical and hydrological setting descriptions for four of the CASs located in Areas 3 and 6 are very similar, while the remaining CAS located in Area 1 covers a greater surface area and has a different topography and hydrology setting. All five sites are located in the Yucca Flat hydrographic area and have similar geology. Details for each CAS are provided in the following subsections.

Corrective Action Site 01-59-01, Area 1 Camp Septic System, is located in the northwest section of Area 1 at the Area 1 Subdock, west of Tippipah Highway and just north of Pahute Mesa Road (refer to Figure A.2-2). The septic system is situated in a gently sloping area that drains to the southeast toward the leachfield. The subsurface piping continues downslope, passing through two material storage yards (CAS 01-42-01 and CAS 01-42-02, CAU 166). The easternmost yard is adjacent to the septic tank, distribution boxes and leachfield, and is posted with signage labeled "Caution Radioactive Material." A mound of gravel and soil mixture is present at the distal end of the leachfield.

Precipitation and runoff drain to the southeast following the natural slope of the land and can be seen as washes that are located on either side (to the north and south) of the leachfield. The washes continue to the southeast of the site toward the Yucca Flat dry lake bed.

Vegetation is abundant at the site and is scattered throughout and around the leachfield. The natural drainage channels and washes present at/near the CAS are generally clear of vegetation. Surface soil at the site is sandy with gravel and pebble-sized rocks. The soil in the washes is generally fine-grained and well-sorted sands and silts.

Corrective Action Site 03-59-03, Core Handling Building Septic System, is located in the northeast section of Area 3 at the Core Handling Building, just east of Mercury Highway and north of Road 3-03 (refer to Figure A.2-3). The septic system for this CAS is situated on relatively flat land, and reportedly accepted domestic effluent from the former CNC-11 building. The subsurface piping is shown on engineering drawings to pass through an adjacent CAS boundary (CAS 03-01-04, CAU 134), which is an above ground water tank and a buried water pump.

Vegetation at this site is generally low-lying, is scattered throughout the once-graded site, and is comprised of brush-type bushes. A large bush is growing adjacent to the water tank foundation on the southwest side near the water pump. Surface soil in the area of these CASs consists of light brown silty sand with gravel and pebble-sized rocks.

Corrective Action Sites 06-20-05, Birdwell Dry Well; 06-59-01, Birdwell Septic System; and 06-59-02, National Cementers Septic System, are located in Area 6 at the Well 3 Yard Complex, just east of Mercury Highway and just north of Road 6-09, (refer to Figures A.2-4 and A.2-5). The dry well and septic systems for these CASs are situated on relatively flat land.

Vegetation at these sites is scattered throughout the leach fields and over the sites, and is comprised of brush-type bushes. Several locations at CAS 06-20-05 and CAS 06-59-01 are somewhat covered with low brush (e.g., the former housing trailer spaces) and the grading has been disturbed. Surface soil in the area of these CASs consists of sandy silt with occasional gravel and pebble-sized rocks.

2.1.1 Yucca Flat

All four CASs are located within the Yucca Flat hydrographic area of the NTS. Yucca Flat is a closed basin, which is slowly being filled with alluvial deposits eroding from the surrounding mountains (USGS, 1996). Carbonate rocks primarily underlie the alluvium in parts of Yucca Flat and form much of the surrounding mountains in this area (DOE/NV, 1992).

Precipitation runs off the mountains surrounding Yucca Flat toward the Yucca Flat dry lake bed. The average annual precipitation near the CAU 555 sites, and at Station UCC on the Yucca Flat dry lake bed, ranges from 6.32 to 6.70 inches (in.) per year (Winograd and Thordarson, 1975; DRI, 1985; ARL/SORD, 2005).

The direction of groundwater flow in Yucca Flat generally is from the northeast to southwest. Within the overlying alluvial and volcanic aquifers, lateral groundwater flow occurs from the margins to the center of the basin and downward into the carbonate aquifer. In addition, the recharge rate to the Yucca Flat area is relatively low due to the thickness of the unsaturated zone extending to more than 600 feet (ft) below ground surface (bgs) (USGS, 1996).

The nearest well to CAS 01-59-01 is the DOE Test Well D, which is located approximately 2.4 mi northeast of the site. Depth to the water table recorded in this well is approximately 1,733 ft bgs (Thordarson, et al., 1962). The nearest active well to CAS 03-59-03 is the U.S. Geological Survey (USGS) Water Well A, which is located approximately 1 mi southeast of the site. Depth to the water table recorded in this well is approximately 1,610 ft bgs (USGS, 2004). The nearest water supply well to CASs 06-20-05, 06-59-01, and 06-59-02 is the DOE Water Well 3, which is located less than 1/2 mi and 1 mi west of the sites, respectively. Depth to the water table recorded in this well is approximately 1,533 ft bgs (USGS, 1996).

2.2 Operational History

The following subsections provide a description of the use and history of each CAS in CAU 555 that may have resulted in potential releases to the environment. The CAS-specific summaries are designed to describe the current definition of each CAS and illustrate all significant known activities.

2.2.1 Corrective Action Site 01-59-01, Area 1 Camp Septic System

The Area 1 Camp septic system was designed to manage domestic sewage and was constructed in 1985. The septic system reportedly received domestic effluent from the toilets, sinks, and/or showers in three buildings until the mid-1990s: the former Subdock Office (Building 1-101); the Drilling Operations (Building 1-102); and the "Bit Bay" (Building 1-103). The system components consist of a septic tank, two distribution boxes, a leachfield, and associated subsurface piping. Figure A.2-2 shows the location and layout of the Area 1 Camp septic system.

Historically, Buildings 1-101 and 1-102 were used as office buildings, and both contained rest rooms. Building 1-103 was used as a drill bit repair facility, and associated industrial wastewater was discharged to a separate septic system (Prothro, 2005). The two outside floor sinks/drains located outside of Building 1-103 were designed to collect and divert rainwater and condensate from the cooling systems to the septic system. According to historical documents, the septic system was overloaded with the addition of Building 1-102 in 1986. It was reported that the system did not function properly and had code violations, and the leachfield experienced frequent sewage backups.

The Area 1 Subdock is currently active; however, the septic system has been inactive and abandoned since the mid-1990s. Utilities have been shut off to Buildings 1-101, 1-102, and 1-103 and there are no current plans to reactivate the abandoned septic system (Ziehm, 2005). A new domestic waste septic system was installed just to the west of the Subdock and includes a small bathroom trailer that is periodically used by Building 1-101 and 1-102 personnel. Building 1-103 is currently used for DOE storage and is not connected to the new system. The outside floor sink drains at this building have not been plugged or capped; however, they are currently filled with sediment, and the immediate area ponds fill up with runoff water after rainfall events.

2.2.2 Corrective Action Site 03-59-03, Core Handling Building Septic System

The Core Handling Building (CNC-11) septic system was constructed in 1967 to manage domestic waste. The septic system received domestic effluent from the toilet, sink, and shower in the CNC-11 building until the early 1970s. The components for this system consisted of a septic tank, a leach pit, and associated subsurface piping. The CNC-11 building was used to process post-shot equipment. Metal scrapings of the equipment were submitted to an of-site laboratory for radiological analysis. After each test, the used equipment and all building sufaces were decontaminated and the effluent from these operations were discharged to a floor drain in the CNC-11 building that leads to an injection well (CAS 03-99-13, CAU 145), which is separate from the system that was connected to the rest room. Figure A.2-3 shows the location and layout of the Core Handling Building septic system.

The use of the CNC-11 domestic septic system is not known from the early 1970s to 1992. In 1994, a survey crew could not locate the septic tank or leaching pit, and listed the septic system as inactive and abandoned, requiring further investigation (REECo, 1994a and b). In addition, the septic tank or the associated subsurface piping could not be located by SNJV in 2004 using geophysical methods (Fahringer 2005b). The Core Complex is currently inactive and abandoned.

2.2.3 Corrective Action Sites 06-20-05, Birdwell Dry Well, and 06-59-01, Birdwell Septic System

The Birdwell septic system was constructed in 1981 to manage domestic waste. The septic system received domestic effluent until the early-1990s from the three housing trailers, a laundry room, a day room, and possibly from the restroom facilities in Building 6-63. The components of this system consist of two septic tanks, a distribution box, a leachfield, and associated subsurface piping. Multiple sinks, toilets, and showers were hooked up to this septic system from the housing area. Figure A.2-4 shows the location and layout of the Birdwell septic system and dry well.

Before construction of the septic system, a dry well was used from 1965 to 1981 to manage the wastewater from laundry operations. Wastewater from the sink(s) in the day room was discharged directly onto ground surface approximately 2 ft from the structure.

According to historical documents, a rest room in Building 6-63 was added to the system in 1985. Building 6-63 was used as offices for geophysical logging operations. The logging trucks were decontaminated in this building after use, and the wastewater was discharged to a separate system (CAS 06-23-03, CAU 335) from the one used to manage domestic waste (Naegle, 2005). Building 6-63 is currently used for equipment storage. The remainder of the site is inactive and abandoned.

2.2.4 Corrective Action Site 06-59-02, National Cementers Septic System

The National Cementers septic system was constructed in 1981 to manage domestic waste. The system reportedly received domestic effluent from at least two trailers through the early 1990s. An office trailer (No. 898834) was hooked up to the system in 1981, a second office trailer (No. 898823) was added to the system in 1984, and the third trailer's use (located south of concrete pad) and actual hookup date is unknown. Engineering drawings show the subsurface sewer piping to branch off to the south of the first trailer (No. 898834) and continue south for several feet to an unknown connection (Holmes & Narver, 1981a and b). No structure is currently present at this location, and it appears that the concrete pad has been resurfaced (SNJV, 2005b). According to engineering drawings, a water line was installed in this area in 1981 (Holmes & Narver, Inc., 1981a and b).

The system components include a septic tank, a distribution box, a leachfield, and associated subsurface piping. Figure A.2-5 shows the location and reported layout of the National Cementers septic system. The septic system and surrounding site was abandoned in the late 1990s and has since remained inactive.

2.3 Waste Inventory

Available documentation, interviews with former site employees, process knowledge, and general historical NTS practices were used to identify wastes that may be present. Potential waste types include sanitary waste, hydrocarbon waste, *Resource Conservation and Recovery Act* (RCRA) hazardous waste, PCB waste, radioactive waste, and mixed waste.

Solid waste items that may be present at these CASs include miscellaneous building material debris and wind-blown trash. At CAS 06-59-01, a basketball-sized mass of hardened resin-like substance was identified inside the leachfield boundary fencing near the septic tanks.

2.4 Release Information

Known or suspected releases from the CASs, including potential release mechanisms and migration routes associated with each of the CASs, are described in the following subsections. There has been no known migration of contamination at any CAU 555 CASs. Potentially affected environmental media for all CASs may include surface, near-surface, and shallow subsurface soils. Exposure routes to site workers include ingestion, inhalation, and/or dermal contact (absorption) from disturbance of potentially contaminated soils, debris, and/or structures. Site workers may also be exposed to external radiation by performing activities in proximity to radiologically contaminated materials.

Radiological soil contamination originating from nuclear testing is specifically excluded from the CAU 555 investigation. This contamination is not associated with a release from CAU 555 and will not be included in the subsequent evaluation of the CASs. If a concern is found at any of the CASs during the CAI, background surface soil samples will be obtained outside the respective CAS boundary, and the analytical results will be used for comparison to analytical results of soil samples obtained within the CAS boundary.

The following subsections contain CAS-specific descriptions of known or potential releases associated with CAU 555. There are no known documented releases associated with any of the CAU 555 CASs.

2.4.1 Corrective Action Site 01-59-01, Area 1 Camp Septic System

Other than normal operation of the septic system and leachfield overflow, there are no known documented releases associated with this CAS. No information exists suggesting that anything other than sanitary septic wastes were managed and discharged by this septic system.

If a release has occurred from any of the septic systems components, contaminants are expected to have been limited in volume and may be located in the soil within close proximity of the specific component breach, or in the soil beneath the leachrock at the bottom of the leachfield. However, it is possible that a release from the adjacent Radioactive Materials Area (RMA) Conditional Release Storage Yard-East (CAS 01-42-01, CAU 166) may have occurred from the equipment and runoff into the drainage channel routes (washes) at this site. The washes drain southeast through both material storage yards, toward and over the septic tank and distribution box manhole covers, and to the leachfield. Contaminants, if present, may have been transported in the washes from the adjacent RMA to the leachfield. Soil samples may be collected and analyzed from these areas to identify possible migration of contaminants, which will then be handled during the investigation of CAU 166.

2.4.2 Corrective Action Site 03-59-03, Core Handling Building Septic System

Other than normal operation of the septic system, there are no known documented releases associated with this CAS. No information exists suggesting that anything other than sanitary septic wastes were managed and discharged by this septic system.

Unknown system contents (if present) may have leaked from the CAS components subsequent to their removal at the site and/or during transport or handling.

If a release occurred from any of the septic system components, contaminants are expected to have been limited in volume and located in the soil within close proximity of the specific CAS component breach, or in the soil beneath the leachrock at the bottom of the former leach pit.

2.4.3 Corrective Action Sites 06-20-05, Birdwell Dry Well, and 06-59-01, Birdwell Septic System

Other than normal operation of the dry well septic systems, there are no known documented releases associated with these CASs. No information exists suggesting that anything other than laundry waste waters or sanitary septic wastes were managed and discharged to or by this dry well or septic system.

If a release occurred from any of the septic system components, contaminants are expected to have been limited in volume and located in the soil within close proximity to the specific CAS component breach.

2.4.4 Corrective Action Site 06-59-02, National Cementers Septic System

Other than normal operation of the septic system, there are no known documented releases associated with this CAS. No information exists suggesting that anything other than sanitary septic wastes were managed and discharged by this septic system.

If a release occurred from any of the septic system components, contaminants are expected to have been limited in volume and located in the soil within close proximity to the CAS component breach.

2.5 Investigative Background

The following subsections summarize the investigations conducted at the CAU 555 sites. More detailed discussions of these investigations are found in Appendix A. No previous analytical results have been identified for soils or materials currently present at any of the four CASs.

2.5.1 Corrective Action Site 01-59-01, Area 1 Camp Septic System

No known soil sampling has been conducted at this site.

A February 1992 inspection performed by BN of the active septic systems at CAS 01-59-01 reported the leachfield showed signs of system failure, which included moist ground and excessive vegetation on the west side. The excessive vegetation indicated sewage was not percolating into the subsurface and may be near the ground surface (Bingham, 1992). In April 1992, all vegetation was removed from the leachfield, and snow fencing was installed around the leachfield to prevent debris from blowing into the area.

An October 1995 inspection of the Area 1 Subdock septic system was conducted by BN, who reported the septic system did not contain an alternating dosing siphon (needed because total length of distribution line is greater than 1,000 ft). In addition, it was reported that Building 1-102 should remain unoccupied and secured until further notice (Sygitowicz, 1996a and b).

A geophysical survey was conducted in December 2004 by SNJV, which confirmed the presence and locations of the septic tank and distribution boxes (Fahringer, 2005a).

2.5.2 Corrective Action Site 03-59-03, Core Handling Building Septic System

No known soil sampling has been conducted at this site.

In 1994, a survey crew could not locate the septic tank or leaching pit and listed the septic system as inactive and abandoned requiring further investigation (REECo, 1994a and b). In addition, a geophysical survey performed by SNJV in 2004 did not detect the presence of the septic system (Fahringer, 2005b). It is not known whether any or all of these components have been removed.

2.5.3 Corrective Action Sites 06-20-05, Birdwell Dry Well, and 06-59-01, Birdwell Septic System

No known soil sampling has been conducted at this site.

No geophysical or radiological surveys have been conducted.

2.5.4 Corrective Action Site 06-59-02, National Cementers Septic System

No known soil sampling has been conducted at this site.

No geophysical or radiological surveys have been conducted.

2.5.5 National Environmental Policy Act

The *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996) includes site investigation activities such as those proposed for CAU 555.

In accordance with the NNSA/NSO *National Environmental Policy Act* (NEPA) Compliance Program, a NEPA checklist will be completed before beginning site investigation activities at CAU 555. This checklist requires NNSA/NSO project personnel to evaluate their proposed project activities against a list of potential impacts that 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/NSO NEPA Compliance Officer. This will be accomplished before mobilization for the field investigation.

3.0 Objectives

This section presents an overview of the DQOs for CAU 555 and formulation of the CSMs. Also presented is a summary listing of the contaminants reasonably suspected to be present at each CAS, the COPCs, the action levels for the investigation, and the process used to move from preliminary action levels (PALs) to FALs. Additional details and figures depicting the CSM are located in Appendix A.

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 the future land use, contaminant sources, release mechanisms, migration pathways, exposure points, and exposure routes. A CSM has been developed for CAU 555 using information from the physical setting, potential contaminant sources, release information, historical background information, knowledge from similar sites, and, physical and chemical properties of the potentially affected media and COPCs. Data collection methods and appropriate sampling strategies are also supported by the use of a CSM. Two forms of the CSM are displayed herein: Figure 3-1 presents a diagrammatic representation of the conceptual pathways to receptors from CAU 555 sources, while Figure 3-2 shows a graphical representation of the overall CSM. If evidence of contamination that is not consistent with the presented CSM is identified during investigation activities, the situation will be reviewed, the CSM will be revised, the DQOs will be reassessed, and a recommendation(s) will be made as how to best proceed with the CAI. In such cases, decision-makers listed in Section A.3.1 will be notified and given opportunity to comment and/or concur with the recommendation(s).

The following sections discuss future land use for the CAU 555 CASs and the identification of exposure pathways for these CASs (i.e., combination of source, release, migration, exposure point, and receptor exposure route).

3.1.1 Exposure Scenarios and Future Land Use

Corrective Action Sites 06-20-05, 06-59-01, and 06-59-02 are located in the land-use zone described as the "Nuclear Test Zone." This area is reserved for dynamic experiments, hydrodynamic tests, and

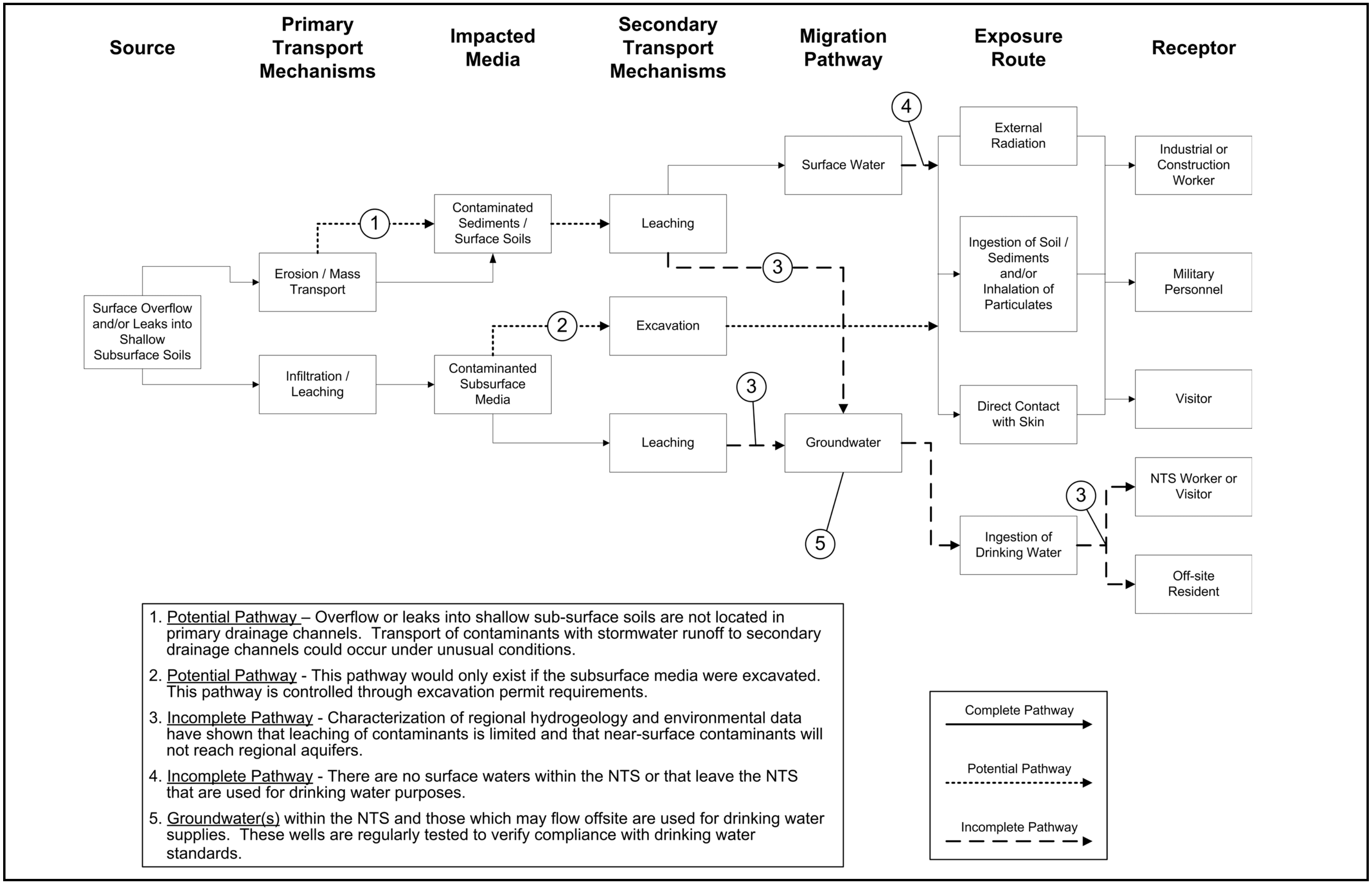

Figure 3-1
Conceptual Site Model Diagram for CAU 555: Septic Systems

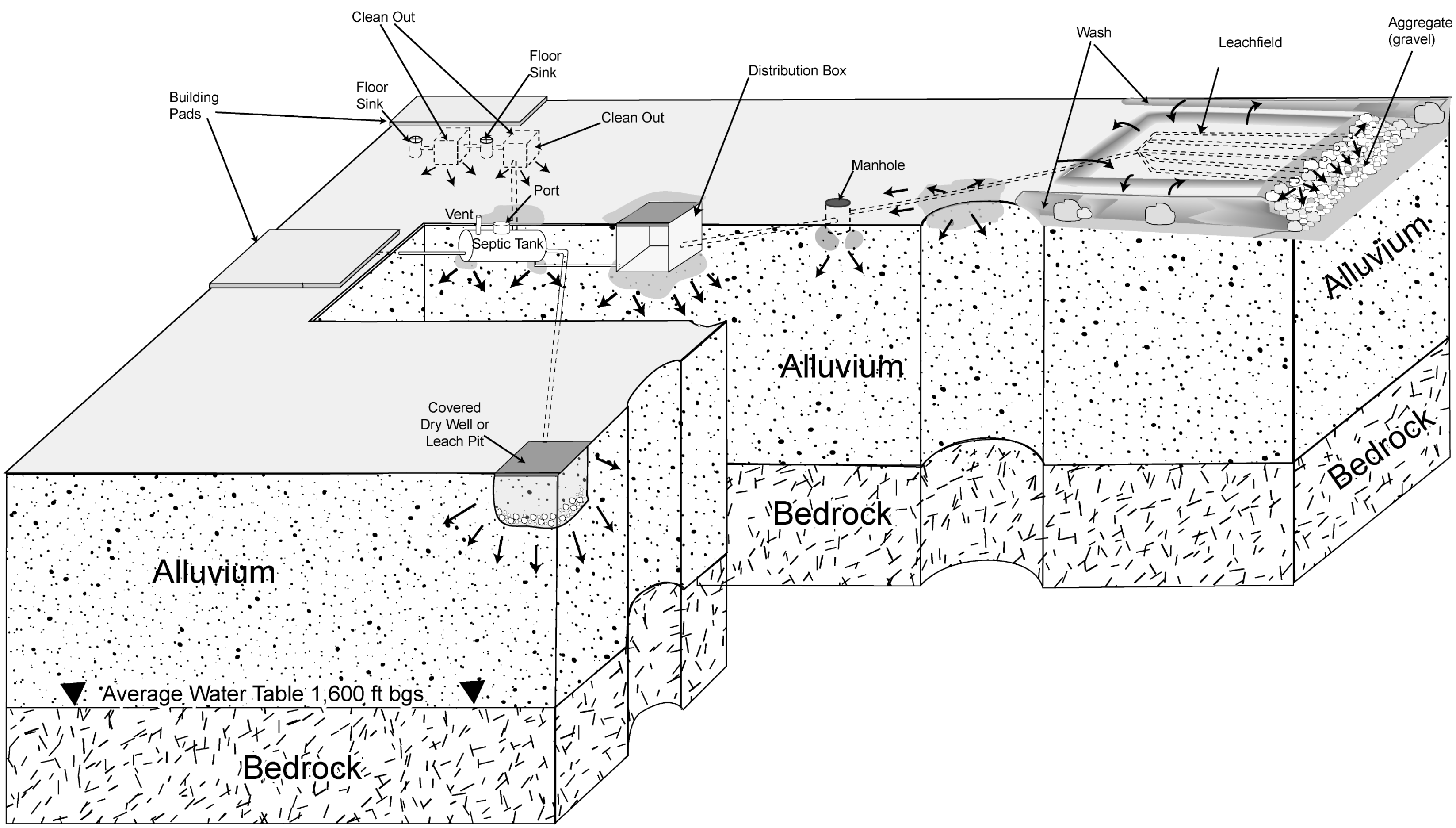

Figure 3-2
Conceptual Site Model for CAU 555: Septic Systems

underground nuclear weapons and nuclear effects tests. This zone includes compatible defense and nondefense research, development, and testing activities (DOE/NV, 1998).

Corrective Action Sites 01-59-01 and 03-59-03 are located in the land-use zone described as the "Nuclear and High Explosives Test Zone," which is designated within the "Nuclear Test Zone" for additional underground nuclear weapons and outdoor high explosives. This zone includes compatible defense and nondefense research, development, and testing activities (DOE/NV, 1998).

All land-use zones in which the CAU 555 CASs are located dictate that future land uses will be limited to nonresidential activities (i.e., limited use by industrial, construction/remediation and military personnel). The exposure scenario designation for the CAU 555 CASs is for a Remote Work Area. This scenario assumes that these sites are located in areas where the worker may regularly visit but is not an assigned work area where the worker may spend his or her entire day.

3.1.2 Contaminant Sources

The contamination sources for the Septic Systems CSM are:

- Septic tank and/or collection components (including piping)
- Leachfield, leach pit, or dry well components (including piping)

3.1.3 Release Mechanisms

Release mechanisms for the CSM are leaks onto the surface, and into near-surface and near-subsurface soils from breaches in subsurface piping, or discharges into and from the leachfield or leach pit, septic tank, or distribution box.

3.1.4 Migration Pathways

Subsurface migration pathways at the CASs are expected to be predominately vertical, although leaks below the ground surface (e.g., base of septic tank) may also have limited lateral migration before infiltration. The depth of infiltration will be dependent upon the type, volume, and duration of the discharge as well as the presence of relatively impermeable layers that could modify both vertical and horizontal transport pathways in the near surface (gravel trenches along pipelines) and in the shallow subsurface (e.g., caliche layers).

Surface migration is expected to be a minor pathway at all CASs, except possibly for CAS 01-59-01, because the septic systems were installed in relatively flat land and below the ground surface. The system at CAS 01-59-01 was installed in land that slopes toward the leachfield. In addition, except for CAS 01-59-01, the potential release sites at the CASs are not located in or near drainages. The leachfield at CAS 01-59-01 is located adjacent to and between two washes. The washes are generally dry but have been subject to infrequent, intense, storm water flows.

Migration pathways include the possible lateral migration of potential contaminants across the surface soils/sediments at CAS 01-59-01 and possible vertical migration of potential contaminants through subsurface soils at all the sites.

An important element of the CSM used in developing a sampling strategy is the expected fate and transport of contaminants (i.e., how contaminants migrate through media and where they can be expected to be found in the environment). Fate and transport of contaminants are presented in the CSM as the migration pathways and transport mechanism that could potentially move the contaminants through the various media. Fate and transport are influenced by physical and chemical characteristics of the contaminants and media. Contaminant characteristics include, but are not limited to, 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 affinity for media, and high density can be expected to be found relatively close to release points. Contaminants with high solubility, low affinity for media, and low density can be expected to be found further from release points. These factors affect the migration pathways and potential exposure points for the contaminants in the various media under consideration.

Infiltration and percolation of precipitation serves as a driving force for downward migration of contaminants. However, due to high potential evapotranspiration and limited precipitation for this region, percolation of infiltrated precipitation at the NTS does not provide a significant mechanism for vertical migration of contaminants to groundwater (USGS, 1996). In addition, the recharge rate to the Yucca Flat area is relatively low due to the thickness of the unsaturated zone extending to more than 600 ft bgs (USGS, 1996).

Annual potential evapotranspiration at the Area 3 Radiological Waste Management Site has been estimated at 62.6 in. per year (Shott et al., 1997). The average annual precipitation at the UCC Station on the Yucca Flat dry lake bed is 6.62 to 6.70 in. per year (Winograd and Thordarson, 1975; DRI, 1985; ARL/SORD, 2005).

3.1.5 Exposure Points

Exposure points for the CSM are expected to be areas of surface contamination where site workers (or visitors) will come in contact with soil surface. Subsurface exposure points may also exist if construction workers come in contact with contaminated media during excavation activities. Site workers may also be exposed to radiation while performing activities in proximity to radiologically contaminated materials.

3.1.6 Exposure Routes

Exposure routes to site workers include exposure to radiation fields, and ingestion, inhalation, and/or dermal contact (absorption) from disturbance of, or direct contact with, contaminated media.

3.1.7 Additional Information

Information concerning topography, geology, climatic conditions, hydrogeology, floodplains, and infrastructure at the CAU 555 CASs are available and presented in Section 2.1 as they pertain to the investigation. This information has been addressed in the CSM and will be considered during the evaluation of corrective action alternatives, as applicable. Climatic and site conditions (e.g., surface and subsurface soil descriptions) as well as specific structure descriptions will be recorded during the CAI.

3.2 Contaminants of Potential Concern

The COPCs for CAU 555 are defined as the list of constituents represented by the analytical methods identified in Table 3-1 for Decision I environmental samples taken at each of the sites. The list of COPCs is intended to encompass all of the contaminants that could potentially be present at each site. These COPCs were identified during the planning process through the review of site history, process knowledge, personal interviews, past investigation efforts (where available), and inferred activities associated with the CASs. Contaminants detected at other similar or other NTS sites were also included in the COPC list to reduce the uncertainty about potential contamination at the CASs, because complete information regarding activities performed at the CAU 555 sites is not available. Targeted analytes are those COPCs for which evidence in the available site and process information suggests that they may be reasonably suspected to be present at a given CAS. The targeted analytes are required to meet a more stringent completeness criteria than other COPCs, thus providing greater protection against a decision error (see Sections A.1.0 through A.8.0).

During the review of site history documentation, process knowledge information, personal interviews, past investigation efforts (where available), and inferred activities associated with the CASs, no COPCs were identified as targeted analytes at the CASs. In addition, no information was found suggesting hazardous constituents were introduced into any of the systems.

3.3 Preliminary Action Levels

The PALs presented in this section are to be used for site screening purposes. They are not necessarily intended to be used as cleanup action levels or FALs. However, they are useful in screening out analytes that are not present in sufficient concentrations to warrant further evaluation, therefore streamlining the consideration of remedial alternatives. The process that will be used to move from PALs to FALs is that specified by *Nevada Administrative Code* (NAC) 445A.2272 (NAC, 2004e). This regulation stipulates that determination of FALs shall be established by an evaluation of the site based on the risk to public health and the environment. This evaluation will be conducted using Method E 1739-95, adopted by the American Society for Testing and Materials (ASTM) (ASTM, 1995).

The ASTM's risk-based corrective action (RBCA) process, summarized in Figure 3-3, uses a tiered approach to data collection and analysis in supporting decisions on site assessment and response to contamination. This process includes a provision for conducting an interim remedial action if necessary and appropriate. The decision to conduct an interim action may be made at any time during the investigation and at any level (tier) of analysis. Concurrence of the decision-makers listed in Section A.3.1 will be obtained before any interim action is implemented. Evaluation of the DQO decisions will be based on conditions at the site following completion of any interim actions. Any interim actions conducted will be reported in the investigation report.

Table 3-1
Analytical Program for CAU 555

Analyses		CAS			
Parameter	**Soil/Liquid**	**01-59-01**	**03-59-03**	**06-20-05 and 06-59-01**	**06-59-02**
Organic Contaminants of Potential Concern (COPCs)					
Volatile Organic Compounds	SW-846 8260B[a]	X	X	X	X
Semivolatile Organic Compounds	SW-846 8270C[a]	X	X	X	X
Total Petroleum Hydrocarbons-Diesel-Range Organics	SW-846 8015B[a] (modified)	X	X	X	X
Total Petroleum Hydrocarbons-Gasoline-Range Organics		X	X	X	X
Polychlorinated Biphenyls	SW-846 8082[a]	X	X	X	X
Inorganic COPCs					
Total *Resource Conservation and Recovery Act* Metals[b]	SW-846 6010B[a] (Mercury-7470A[a])	X	X	X	X
Radionuclide COPCs					
Gamma Spectroscopy[c]	HASL-300[e] EPA Procedure 901.1[d]	X	X	X	X

[a]*EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, 3rd Edition, Parts 1-4, SW-846 (EPA, 1996).
[b]If sample is collected for waste management purposes, analysis may also include *Toxicity Characteristic Leaching Procedure* (TCLP).
[c]Results of gamma spectroscopy analysis for isotopic uranium, isotopic plutonium, and strontium-90 will be used to determine whether further radioanalytical analysis for americium-241, cesium-137, and cobalt-60 is warranted.
[d]*Prescribed Procedures for Measurements of Radioactivity in Drinking Water* (EPA, 1980).
[e]*The Procedures Manual of the Environmental Measurements Laboratory* (DOE, 1997).

X = Required analytical method

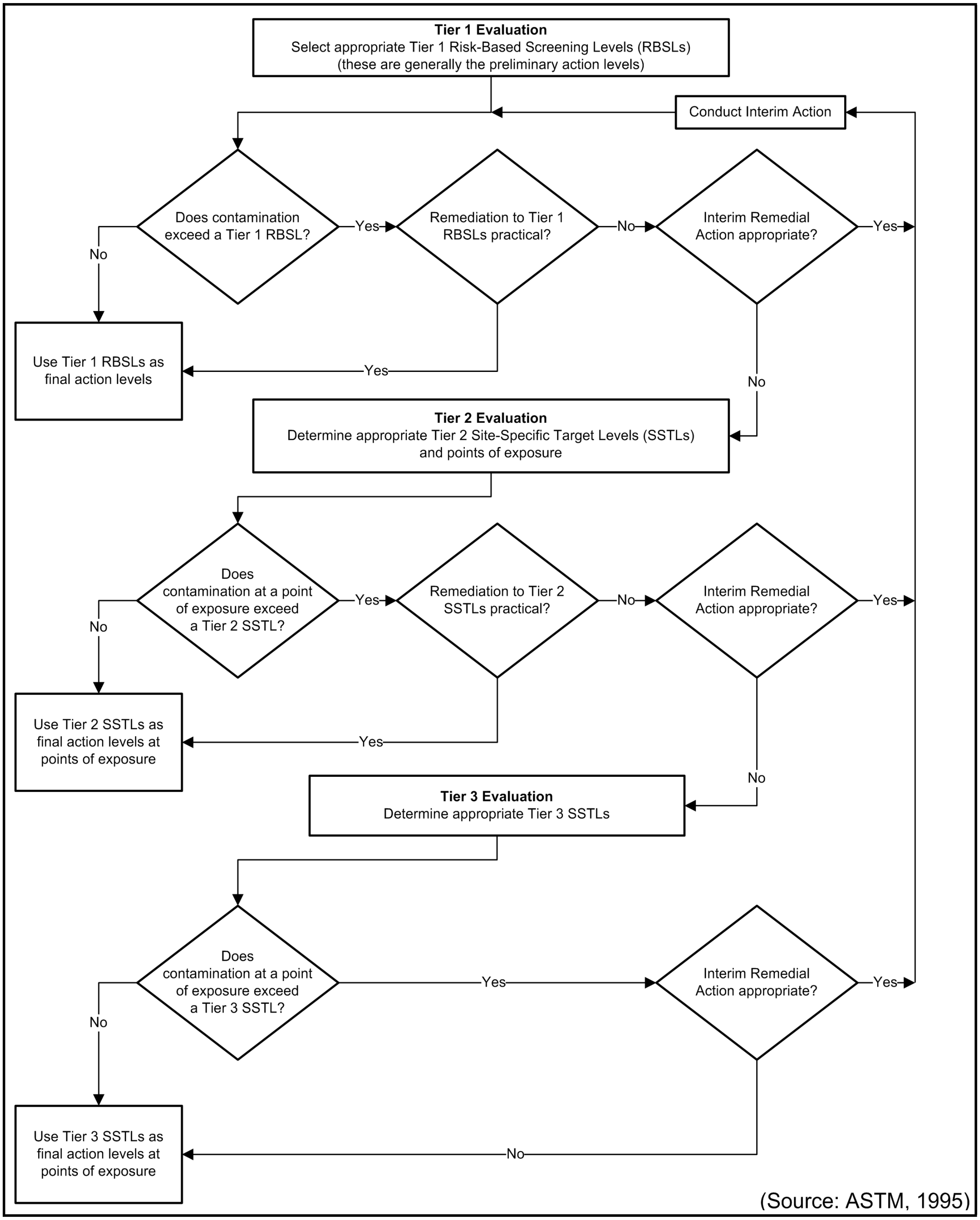

Figure 3-3
ASTM Method E 1739-95 Risk-Based Corrective Action Decision Process

The RBCA procedure defines three tiers or levels of evaluation involving increasingly sophisticated levels of analyses:

- Tier 1 – Sample results from source areas (highest concentrations) compared to risk-based screening levels (RBSLs) based on generic (non-site-specific) conditions.
- Tier 2 – Sample results from exposure points compared to site-specific target levels (SSTLs) calculated using site-specific inputs and Tier 1 formulas.
- Tier 3 – Sample results from exposure points compared to SSTLs and points of compliance calculated using chemical fate/transport and probabilistic modeling.

A Tier 1 evaluation will be conducted to determine whether contaminant levels satisfy the criteria for a quick regulatory closure or warrant a more site-specific assessment. This is accomplished by comparing individual source area contaminant concentration results to PALs. The PALs are a tabulation of chemical- and radioisotope-specific (but not site-specific) screening levels based on potential exposure pathways, media (i.e., soil, water, and air), and potential exposure scenarios using the U.S. Environmental Protection Agency (EPA) *Integrated Risk Information System* (IRIS) database (EPA, 2004a) or a dose constraint of 25 mrem per year (mrem/yr). If remediation to Tier 1 RBSLs (i.e., PALs) is not practicable, a Tier 2 evaluation may be conducted. Rationale and justification for using a Tier 2 evaluation will be presented in the investigation report.

If appropriate, a Tier 2 evaluation may be conducted by calculating Tier 2 SSTLs using site-specific information as inputs to the same or similar methodology used to calculate Tier 1 RBSLs. The Tier 2 SSTLs are then compared to individual sample results from reasonable points of exposure (as opposed to the source areas as is done in Tier 1) on a point-by-point basis. Total concentrations of total petroleum hydrocarbons (TPH) will not be used for risk-based decisions under Tier 2 or Tier 3. Rather, the individual COCs will be compared to the SSTLs, as per Sections 6.4.3 and X1.4 of the ASTM procedure (ASTM, 1995).

Alternatively, the Tier 2 RBCA process SSTLs may be compared to the predicted concentration or activity of the contaminant at the point of exposure based on attenuation of the COCs away from the source using relatively simplistic mathematical models. Points of exposure are defined as those locations at which an individual or population may come in contact with a COC originating from a CAS. If a Tier 2 evaluation is conducted, the calculations used to derive the SSTLs and the contaminant attenuation calculations will be provided as an appendix to the investigation report. If remediation to Tier 2 SSTLs is not practicable, a Tier 3 evaluation may be conducted. Rationale and justification for using a Tier 3 evaluation will be presented in the investigation report (see Figure 3-3).

If appropriate, a Tier 3 evaluation may be conducted by calculating Tier 3 SSTLs on the basis of more sophisticated risk analyses using methodologies described in Method E 1739-95 that consider site-, pathway-, and receptor-specific parameters. Tier 3 evaluation is much more complex than Tier 1 and Tier 2 evaluations because it may include additional site characterization, probabilistic evaluations, and sophisticated chemical fate/transport models. The Tier 3 SSTLs are then compared to the 95 percent upper confidence limit of the mean of sample results from reasonable point(s) of exposure (as opposed to individual sample results as is done in Tier 2). Contaminant concentrations exceeding Tier 3 SSTLs require corrective action. If a Tier 3 evaluation is conducted, the calculations used to derive the SSTLs and the upper confidence limit of the means will be provided as an appendix to the investigation report.

The FALs (along with the basis for their selection) will be proposed in the investigation report, where they will be compared to laboratory results in the evaluation of potential corrective actions.

3.3.1 Chemical PALs

Except as noted herein, the chemical PALs are defined as the *Region 9 Risk-Based Preliminary Remediation Goals (PRGs)* for chemical constituents in industrial soils (EPA, 2004b). Background concentrations for RCRA metals will be used instead of PRGs when natural background concentrations exceed the PRG, as is often the case with arsenic on the NTS. Background is considered the mean plus two standard deviations of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (formerly the Nellis Air Force Range) (NBMG, 1998; Moore, 1999). For detected chemical COPCs without established PRGs that have toxicity and carcinogenicity data listed in the EPA IRIS database (EPA, 2004a), the protocol used by the EPA Region 9 in establishing PRGs (or similar) will be used to establish PALs. If used, this process will be documented in the investigation report.

3.3.2 Total Petroleum Hydrocarbon PALs

The PAL for TPH is 100 parts per million (ppm) as listed in NAC 445A.2272 (NAC, 2004e).

3.3.3 Radionuclide PALs

The PALs for radiological contaminants (other than tritium) are based on the National Council on Radiation Protection and Measurement (NCRP) Report No. 129 recommended screening limits for construction, commercial, industrial land-use scenarios (NCRP, 1999) using a 25 mrem/yr dose constraint (Murphy, 2004) and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993). These PALs are based on the construction, commercial, and industrial land-use scenario provided in the guidance and are appropriate for the NTS based on future land use scenarios as presented in Section 3.1.1.

Solid media such as concrete and/or structures may pose a potential radiological exposure risk to site workers if contaminated. The radiological PAL for solid media will be defined as the unrestricted-release criteria defined in the *NV/YMP Radiological Control* (RadCon) *Manual* (NNSA/NSO, 2004).

3.4 Data Quality Objective Process Discussion

This section contains a summary of the DQO process that is presented in Appendix A. The DQO process is a strategic planning approach based on the scientific method that is designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and technically defend the recommendation of viable corrective actions (e.g., no further action, clean closure, or closure in place).

The DQO strategy for CAU 555 was developed at a meeting on August 23, 2005. The DQOs were developed to identify data needs, clearly define the intended use of the environmental data, and design a data collection program that will satisfy these purposes. During the DQO discussions for this CAU, the informational inputs or data needs to resolve problem statements and decision statements were documented.

The problem statement for CAU 555 is: "Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives for the CASs in CAU 555." To address this question, the resolution of two decisions statements is required:

- Decision I: "Is any COC present in environmental media within the CAS at a concentration exceeding its FAL?" If a COC is detected, then Decision II must be resolved. Otherwise, the investigation for that CAS is complete.
- Decision II: "If a COC is present, is sufficient information available to evaluate potential corrective action alternatives?" Sufficient information is defined to include:
  - Identifying the volume of media containing any COC bounded by analytical sample results in lateral and vertical directions.
  - The information needed to characterize IDW for disposal.
  - The information needed to determine potential remediation waste types.
  - The information needed to evaluate the feasibility of remediation alternatives (bioassessment if natural attenuation or biodegradation is considered and geotechnical data if construction or evaluation of barriers is considered).

Decision I samples will be submitted to analytical laboratories for the analyses listed in Table 3-1. Decision II samples will be submitted for the analysis of all unbounded COCs. In addition, samples will be submitted for analyses as needed to support waste management or health and safety decisions.

The data quality indicators (DQIs) of precision, accuracy, representativeness, completeness, comparability, and sensitivity needed to satisfy DQO requirements are discussed in Section 6.2. Laboratory data will be assessed in the investigation report to confirm or refute the CSM and determine whether the DQO data needs were met.

To satisfy the DQI of sensitivity (presented in Section 6.2.8), the analytical methods must be sufficient to detect contamination present in the samples at concentrations at least equal to the corresponding FALs. Analytical methods and minimum detectable concentrations (MDCs) for each COPC at the CAU 555 sites are provided in Tables 3-2 and 3-3. The MDC is the lowest concentration of any chemical or radionuclide parameter that can be detected in a sample within an acceptable level of error. Due to changes in analytical methodology and changes in analytical laboratory contracts, information in Tables 3-2 and 3-3 that varies from corresponding information in the QAPP will supersede that information in the QAPP (NNSA/NV, 2002).

Table 3-2
Analytical Requirements for Chemical COPCs for CAU 555
(Page 1 of 2)

Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Detectable Concentration (MDC)	Laboratory Precision (RPD)[a]	Percent Recovery (%R)[b]
ORGANICS					
Total Volatile Organic Compounds	Aqueous	8260B[c]	Parameter-specific EQLs[d]	Lab-specific[e]	Lab-specific[e]
	Soil				
Total Semivolatile Organic Compounds	Aqueous	8270C[c]	Parameter-specific EQLs[d]	Lab-specific[e]	Lab-specific[e]
	Soil				
Polychlorinated Biphenyls	Aqueous	8082[c]	Parameter-specific EQLs[f]	Lab-specific[e]	Lab-specific[e]
	Soil				
Total Petroleum Hydrocarbons-Gasoline-Range Organics	Aqueous	8015B modified[c]	0.5 mg/kg[g]	Lab-specific[e]	Lab-specific[e]
	Soil				
Total Petroleum Hydrocarbons-Diesel-Range Organics	Aqueous	8015B modified[c]	25 mg/kg[g]	Lab-specific[e]	Lab-specific[e]
	Soil				
INORGANICS Total RCRA Metals					
Arsenic	Aqueous	6010B[c]	0.01 mg/L[g, h]	20[h]	Matrix Spike Recovery at 75-125[h] Laboratory Control Sample Recovery at 80 - 120[h]
	Soil		1 mg/kg[g, h]	35[g]	
Barium	Aqueous	6010B[c]	0.20 mg/L[g, h]	20[h]	
	Soil		20 mg/kg[g, h]	35[g]	
Cadmium	Aqueous	6010B[c]	0.005 mg/L[g, h]	20[h]	
	Soil		0.5 mg/L[g, h]	35[g]	
Chromium	Aqueous	6010B[c]	0.01 mg/L[g, h]	20[h]	
	Soil		1 mg/kg[g, h]	35[g]	
Lead	Aqueous	6010B[c]	0.003 mg/L[g, h]	20[h]	
	Soil		0.3 mg/kg[g, h]	35[g]	
Mercury	Aqueous	7470A[c]	0.0002 mg/L[g, h]	20[h]	
	Soil	7471A[c]	0.1 mg/kg[g, h]	35[g]	
Selenium	Aqueous	6010B[c]	0.005 mg/L[g, h]	20[h]	
	Soil		0.5 mg/kg[g, h]	35[g]	
Silver	Aqueous	6010B[c]	0.01 mg/L[g, h]	20[h]	
	Soil		1 mg/kg[g, h]	35[g]	

Table 3-2
Analytical Requirements for Chemical COPCs for CAU 555
(Page 2 of 2)

Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Detectable Concentration (MDC)	Laboratory Precision (RPD)[a]	Percent Recovery (%R)[b]

Footnote:
1. See Table 3-3 for the analytical requirements for radionuclides.

[a]Precision is estimated from the relative percent difference (RPD) of the laboratory or field duplicates MSD and LCSD are spiked. It is calculated by: RPD = 100 x $(|A_1-A_2|)/[(A_1+A_2)/2]$, where A_1 = Concentration of the parameter in the initial sample aliquot, A_2 = Concentration of the parameter in the duplicate sample aliquot.
[b]Accuracy is assessed from the percent recovery (%R) 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 (A_s-A_u/A_n), where A_s = Concentration of the parameter in the spiked sample, A_u = Concentration of the parameter in the unspiked sample, A_n = Concentration increase that should result from spiking the sample.
[c]EPA *Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, 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]RPD and %R Performance Criteria are developed and generated in-house by the laboratory according to approved laboratory procedures.
[f]EPA *Contract Laboratory Program Statement of Work for Organic Analysis* (EPA, 2003).
[g]*Industrial Sites Quality Assurance Project Plan* (NNSA/NV, 2002a).
[h]EPA *Contract Laboratory Program Statement of Work for Inorganic Analysis* (EPA, 2000).

COPC = Contaminant of potential concern
EQL = Estimated quantitation limit
LCSD = Laboratory control sample duplicate
mg/L = Milligrams per liter
mg/kg = Milligrams per kilogram
MSD = Matrix spike duplicate
NA = Not applicable
RCRA = *Resource Conservation and Recovery Act*

Table 3-3
Analytical Requirements for Radionuclides for CAU 555

Parameter/Analyte	Matrix	Analytical Method	MDC[a]	PAL[b,c]	Laboratory Precision (RPD)	Percent Recovery (%R)
Gamma Spectrometry						
Americium-241	Soil	HASL-300[d]	2.0 pCi/g[e]	12.7 pCi/g	Relative Percent Difference (RPD) 35% Normalized Difference -2<ND<2[f]	Laboratory Control Sample Recovery 80-120[g] Percent Recovery (%R)
Cesium-137	Soil	HASL-300[d]	0.5 pCi/g[e]	12.2 pCi/g		
Cobalt-60	Soil	HASL-300[d]	0.5 pCi/g[e]	2.68 pCi/g		
Other Radionuclides						
Plutonium-238	Soil	ASTM C1001-00[h]	0.05 pCi/g	13.0 pCi/g	Relative Percent Difference (RPD) 35% Normalized Difference -2<ND<2[f]	Laboratory Control Sample Recovery 80-120[g] Percent Recovery (%R) Chemical Yield 30-105[i] %R
Plutonium-239/240	Soil			12.7 pCi/g		
Strontium-90	Soil	HASL 300[d]	0.5 pCi/g	838 pCi/g		
Uranium-234	Soil	ASTM C1000-02[j]	0.05 pCi/g	143 pCi/g		
Uranium-235	Soil			17.6 pCi/g		
Uranium-238	Soil			105 pCi/g		

Footnote:
1. See Table 3-2 for the analytical requirements for chemicals.

[a]The MDC is the lowest concentration of a radionuclide, if present in a sample, that can be detected with a 95 percent confidence level.
[b]The PALs for soil are based on the National Council for Radiation Protection and Measurement (NCRP) Report No. 129 Recommended Screening Limits for Contaminated Soil and Review of Factors Relevant to Site-Specific Studies (NCRP, 1999) scaled to 25 mrem/yr dose and the guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993).
[c]PALs for liquids will be developed as needed.
[d]*The Procedures Manual of the Environmental Measurements Laboratory*, HASL-300 (DOE, 1997).
[e]MDCs vary depending on the presence of other gamma-emitting radionuclides in the sample and are relative to the MDC for cesium-137.
[f] ND is not RPD, it is another measure of precision used to evaluate duplicate analyses. The ND 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).
[g]EPA *Contract Laboratory Program Statement of Work for Inorganic Analysis* (EPA, 2000).
[h]*Standard Test Method for Radiochemical Determination of Plutonium in Soil by Alpha Spectroscopy* (ASTM, 2002c).
[i]*General Radiochemistry and Routine Analytical Services Protocol* (GRASP) (EG&G Rocky Flats, 1991). The chemical yield only applies to plutonium, uranium, and strontium.
[j]*Standard Test Method for Radiochemical Determination of Uranium Isotopes in Soil by Alpha Spectrometry* (ASTM, 2000a).

ASTM = American Society for Testing and Materials
HASL = Health and Safety Laboratory
MDC = Minimum detectable concentration
mrem/yr = Millirem per year
ND = Normalized difference
PAL = Preliminary action level
pCi/g = Picocuries per gram
pCi/L = Picocuries per liter
UGTA = Underground Test Area

Use if analyses for quality assurance/waste characterization or waste management samples are of sludge, liquid and/or water
--*Standard Test Method for Isotopic Uranium in Water by Radiochemistry* (ASTM, 2002a).
--*Standard Test Method for Plutonium in Water* (ASTM, 2002b).
--*Standard Test Method for Strontium-90 in Water* (ASTM, 2000b).

4.0 Field Investigation

This section contains a description of the activities to be conducted to gather and document information from the CAU 555 field investigation.

4.1 Technical Approach

The information necessary to satisfy the DQO data needs will be generated for each CAS in CAU 555 by collecting and analyzing samples generated during a field investigation. The presence and nature of contamination at each CAS will be evaluated by collecting samples at biased locations that are determined to be most probable to contain COCs if they are present anywhere within the CAS. These locations will be determined based on their identification using the biasing factors listed in Section A.5.2.1 of Appendix A.

If while defining the nature of contamination it is determined that COCs are present at a CAS, that CAS will be further addressed by determining the extent of contamination before evaluating corrective action alternatives.

Because this CAIP only addresses contamination originating from the CAU, it may be necessary to distinguish overlapping contamination originating from other sources. For example, widespread surface radiological contamination originating from atmospheric tests will not be addressed in the CAU 555 investigation. If this is deemed necessary at any of the CASs, surface background soil samples will be obtained near the respective CAS, and the analytical results will be used for comparison.

Modifications to the investigative strategy may be required should unexpected field conditions be encountered at any CAS. Significant modifications shall be justified and documented on a Record of Technical Change before implementation. If an unexpected condition indicates that conditions are significantly different than the corresponding CSM, the activity will be rescoped and the identified decision-makers will be notified.

4.2 Field Activities

Field activities at CAU 555 include site preparation, sample location selection, and sample collection activities.

4.2.1 Site Preparation Activities

Site preparation will be conducted before starting investigation activities. Site preparation may include, but not be limited to: relocation or removal of surface debris, equipment, and structures; the construction of hazardous waste accumulation areas (HWAAs) and site exclusion zones; provision of sanitary facilities; the construction of decontamination pads/facilities; and the temporary movement of staged equipment.

Before collecting investigation samples, the following preparatory activities will also be conducted at the CAU 555 CASs:

- Radiological walkover surveys at CAS 01-59-01.
- Geophysical walkover surveys at CASs 01-59-01, 06-59-01, and 06-59-02, if necessary.
- Visual surveys at all CASs to identify any staining, discoloration, disturbance of native soils, or any other indication of potential contamination.
- Check for residual contents in septic tank, distribution boxes, and/or associated subsurface piping.
- Stake and/or flag sample locations and record coordinates.

4.2.2 Sample Location Selection

Biasing factors (including field-screening results [FSRs]) will be used to select the most appropriate samples from a particular location for submittal to the analytical laboratory. Biasing factors to be used for selection of sampling locations are listed in Section A.5.2.1 of Appendix A.

As biasing factors are identified and used for selection of sampling locations, they will be documented in the appropriate field documents. The CAS-specific sampling strategy and the estimated locations of biased samples for each CAS are presented in Appendix A.

The Site Supervisor (SS) or Task Manager (TM) designated for these sites has the discretion to modify the biased locations if the modified locations meet the DQO decision needs and criteria stipulated in Appendix A.

4.2.3 Sample Collection

The CAU 555 sampling program will consist of the following activities:

- Collect and analyze samples from locations as described in this section.
- Collect required QC samples.
- Collect additional samples (soil, liquid, and/or sludge), as necessary, to support the characterization of IDW and potential corrective action waste streams.
- Collect soil samples from background locations, if necessary.
- Perform field screening, as necessary.

Decision I soil samples will be collected from selected shallow locations based on the CSM, biasing factors, FSRs, and existing data. Any biasing factors identified and used for selection of sampling locations will be documented in the appropriate field documents. If biasing factors are present in soils beneath locations where Decision I samples were collected, subsurface Decision I soil samples will be collected by hand augering, backhoe excavation, direct-push, or drilling techniques, as appropriate. Decision I subsurface soil samples will be collected at depth intervals selected by the SS or TM, based on biasing factors, to a depth where the biasing factors are no longer present.

The content(s), if present, of the septic tanks, distribution boxes, and subsurface piping will be sampled to support investigation and waste management decisions. If multiphased residual material is present, it will be collected by appropriate method(s) to characterize the segregated phases (e.g., liquid, sludge, solid). Depending on analytical results of the sampled residual material, subsurface piping may be video-moled to identify breaches. If the video survey identifies breaches and/or conditions that may have provided a means for effluent to reach the surrounding soils, then samples will be collected at those locations for laboratory analysis. If residual material is present and of adequate volume, a sample will be collected for analysis. If no residual material or breaches are identified during the survey, sampling adjacent to and within the buried portions of the piping will not be necessary.

Decision II sampling will consist of further defining the extent of contamination where COCs have been confirmed. Step-out (Decision II) sampling locations at each CAS will be selected based on the CSM, biasing factors, FSRs, existing data, and the outer boundary sample locations where COCs were detected. In general, step-out sample locations will be arranged in a triangular pattern around areas containing a COC at distances based on site conditions, COC concentrations, process knowledge, and biasing factors. If COCs extend beyond step-out locations, additional Decision II samples will be collected from locations further from the source. If a spatial boundary is reached, the CSM is shown to be inadequate, or the SS determines that extent sampling needs to be re-evaluated, then work will be temporarily suspended, NDEP will be notified, and the investigation strategy will be re-evaluated. A minimum of one analytical result less than the action level from each lateral and vertical direction will be required to define the extent of COC contamination. The lateral and vertical extent of COCs will only be established based on validated laboratory analytical results (i.e., not field screening).

The number, location, and spacing of step-outs may be modified by the SS or TM, as warranted by site conditions to achieve DQO criteria. Where sampling locations are modified by the SS or TM, the justification for these modifications will be documented in the field logbook.

4.2.4 Sample Management

Section 3.4 discusses the analytical methods and laboratory requirements (i.e., detection limits, precision and accuracy requirements) to be used when analyzing the COPCs. The analytical program for each CAS is presented in Table 3-1. All sampling activities and QC requirements for field and laboratory environmental sampling will be conducted in compliance with the Industrial Sites QAPP (NNSA/NV, 2002) and other applicable, approved procedures.

4.3 Safety

A current version of the Environmental Services Architect-Engineer Contractor's programmatic health and safety plan and the IS HASP will accompany the field documents. An FWP, or equivalent, will be prepared and approved before 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 the procedures for protecting the environment. The ISMS program requires that site personnel will reduce or eliminate the possibility of injury, illness, or accidents, and will 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 Industrial Sites HASP and FWP:

- Potential hazards to site personnel and the public include, but are not limited to: chemicals (e.g., heavy metals, volatile organic compounds [VOCs], semivolatile organic compounds [SVOCs], and TPH), radionuclides, adverse and rapidly changing weather, remote location, and motor vehicle and heavy equipment operations.
- Occupational exposure monitoring to prevent overexposure to hazards such as chemicals, radionuclides, and physical agents (e.g., heat, cold, and high wind).
- 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 use of appropriate personal protective equipment (PPE).
- Radiological surveying for alpha/beta and gamma emitters to minimize and/or control personnel exposures; use of the "as-low-as-reasonably-achievable" principle when addressing radiological hazards.
- Emergency and contingency planning to include medical care and evacuation, decontamination, spill control measures, and appropriate notification of project management. The same principles apply to emergency communications.
- If presumed asbestos-containing material is identified (CFR, 2003c; NAC, 2004d), it will be inspected and/or samples collected by trained personnel.

5.0 Waste Management

Management of IDW will be based on regulatory requirements, field observations, process knowledge, and laboratory results from CAU 555 investigation samples.

Disposable sampling equipment, PPE, and rinsate are considered potentially contaminated waste only by virtue of contact with potentially contaminated media (e.g., soil) or potentially contaminated debris (e.g., construction materials). Therefore, sampling and analysis of IDW, separate from analyses of site investigation samples, may not be necessary for all IDW. However, if associated investigation samples are found to contain contaminants above regulatory levels, conservative estimates of total waste contaminant concentrations may be made based on the mass of the waste, the amount of contaminated media contained in the waste, and the maximum concentration of contamination found in the media. Direct samples of IDW may also be taken to support waste characterization.

Sanitary, hazardous, radioactive, and/or mixed waste, if generated, will be managed and disposed of in accordance with DOE orders, U.S. Department of Transportation (DOT) regulations, state and federal waste regulations, agreements and permits between DOE and NDEP, and the *Nevada Test Site Waste Acceptance Criteria* (NTSWAC).

5.1 Waste Minimization

Investigation activities are planned to minimize IDW generation. This will be accomplished by incorporating the use of process knowledge, visual examination, and/or radiological survey and swipe results. When possible, disturbed media (such as soil removed during trenching) or debris will be returned to its original location. Contained media (e.g., soil managed as waste) as well as other IDW will be segregated to the greatest extent possible to minimize generation of hazardous, radioactive, or mixed waste. Hazardous chemicals used at the sites (e.g., components of screening test kits) will be controlled in order to limit unnecessary generation of hazardous or mixed waste. Administrative controls, including decontamination procedures and waste characterization strategies, will minimize waste generated during investigations.

5.2 Potential Waste Streams

Waste generated during the investigation activities will include the following potential waste streams:

- Personal protective equipment and disposable sampling equipment (e.g., plastic, paper, sample containers, aluminum foil, spoons, bowls)
- Decontamination rinsate
- Environmental media (e.g., soil)
- Surface debris in investigation area
- Field-screening waste (e.g., fecal coliform)

5.3 Investigation-Derived Waste Management

The on-site management and ultimate disposition of IDW will be determined based on a determination of the waste type (e.g., sanitary, low-level, hazardous, hydrocarbon, mixed), or the combination of waste types. A determination of the waste type will be guided by several factors, including, but not limited to: the analytical results of samples either directly or indirectly associated with the waste, historical site knowledge, knowledge of the waste generation process, field observations, field-monitoring results, FSRs, and/or radiological survey/swipe results. Office trash and lunch waste will be sent to the sanitary landfill by placing the waste in a dumpster. Each waste stream generated will be reviewed and segregated to the greatest extent at the point of generation.

Table 4-2 of the NV/YMP RadCon Manual (NNSA/NSO, 2004) shall be used to determine whether such materials may be declared nonradioactive. On-site IDW management requirements by waste type are detailed in the following sections. Applicable waste management regulations and requirements are listed in Table 5-1.

5.3.1 Sanitary Waste

Sanitary IDW generated at each CAS will be collected, managed, and disposed of in accordance with the sanitary waste management regulations and the permits for operation of the NTS Area 9 U10c Industrial Waste Landfill.

Table 5-1
Waste Management Regulations and Requirements

Waste Type	Federal Regulation	Additional Requirements
Solid (nonhazardous)	NA	NRS[a] 444.440 - 444.620 NAC[b] 444.570 - 444.7499 NTS Landfill Permit SW13.097.04[c] NTS Landfill Permit SW13.097.03[d]
Liquid/Rinsate (nonhazardous)	NA	Water Pollution Control General Permit GNEV93001, Rev. 3iii[e]
Hazardous	RCRA[f], 40 CFR 260-282	NRS[a] 459.400 - 459.600 NAC[b] 444.850 - 444.8746 POC[g]
Low-Level Radioactive	NA	DOE Orders and NTSWAC[h]
Mixed	RCRA[f], 40 CFR 260-282	NTSWAC[h] POC[g]
Hydrocarbon	NA	NTS Landfill Permit SW13.097.02[i]
Polychlorinated Biphenyls	TSCA[j], 40 CFR 761	NRS[a] 459.400 - 459.600 NAC[b] 444.940 - 444.9555
Asbestos	TSCA[j], 40 CFR 763	NRS[a] 618.750-618.840 NAC[b] 444.965-444.976

[a]*Nevada Revised Statutes* (NRS, 2003a, b, c)
[b]*Nevada Administrative Code* (NAC, 2004a, b, c, d)
[c]Area 23 Class II Solid Waste Disposal Site (NDEP, 1997a)
[d]Area 9 Class III Solid Waste Disposal Site (NDEP, 1997c)
[e]Nevada Test Site Sewage Lagoons (NDEP, 1999)
[f]*Resource Conservation and Recovery Act* (CFR, 2003a)
[g]*Nevada Test Site Performance Objective for the Certification of Nonradioactive Hazardous Waste* (BN, 1995)
[h]*Nevada Test Site Waste Acceptance Criteria,* Revision 5 (NNSA/NSO, 2005)
[i]Area 6 Class III Solid Waste Disposal Site for Hydrocarbon Waste (NDEP, 1997b)
[j]*Toxic Substance Control Act* (CFR, 2003b)

CFR = *Code of Federal Regulations*
DOE = U.S. Department of Energy
NA = Not applicable
NAC = *Nevada Administrative Code*
NDEP = Nevada Division of Environmental Protection
NRS = *Nevada Revised Statutes*
NTS = Nevada Test Site
NTSWAC = *Nevada Test Site Waste Acceptance Criteria*
POC = Performance Objective for the Certification of Nonradioactive Hazardous Waste
RCRA = *Resource Conservation and Recovery Act*
TSCA = *Toxic Substance Control Act*

5.3.2 Low-Level Radioactive Waste

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 (RCA). 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 (NNSA/NSO, 2004), will be used to determine whether 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 whether a particular waste unit (e.g., drum of soil) contains low-level radioactive waste, as necessary. Waste that is determined to be below the values of Table 4-2, by either direct radiological survey/swipe results or through process knowledge, will not be managed as potential radioactive waste but will be managed in accordance with the appropriate section of this document. Wastes in excess of Table 4-2 values will be managed as potential radioactive waste and be managed in accordance with this section and any other applicable sections of this document.

Low-level radioactive waste, if generated, will be managed in accordance with the contractor-specific waste certification program plan, DOE orders, and the requirements of the current version of the NTSWAC (NNSA/NSO, 2005). Potential radioactive waste drums containing soil, PPE, disposable sampling equipment, and/or rinsate may be staged at a designated radioactive material area (RMA) or RCA when full or at the end of an investigation phase. The waste drums will remain at the RMA pending certification and disposal under NTSWAC requirements (NNSA/NSO, 2005).

5.3.3 Hazardous Waste

Suspected hazardous wastes will be placed in DOT-compliant containers. All containerized hazardous waste will be handled, inspected, and managed in accordance with 40 CFR 260-282, (CFR 2003a). These provisions include managing the waste in containers compatible with the waste type, and segregating incompatible waste types so that in the event of a spill, leak, or release, incompatible wastes shall not contact one another. Corrective Action Unit 555 will have waste storage areas established according to the needs of the project. Satellite accumulation areas and HWAAs will be managed consistent with the requirements of federal and state regulations (CFR, 2003a, and NAC, 2004b). They will be properly controlled for access and equipped with spill kits and appropriate spill containment.

Hazardous waste accumulation areas will be covered under a site-specific emergency response and contingency action plan until such time that the waste is determined to be nonhazardous or all containers of hazardous waste have been removed from the storage area. Hazardous wastes will be characterized in accordance with the requirements of Title 40 CFR 261 (CFR, 2003a). No RCRA "listed" wastes have been identified at CAU 555. Any waste determined to be hazardous will be transported in accordance with RCRA and DOT to a permitted treatment, storage, and disposal facility (CFR, 2003a).

5.3.4 Hydrocarbon Waste

Hydrocarbon soil waste containing more than 100 milligrams per kilogram (mg/kg) of TPH will be managed on site in a drum or other appropriate container until fully characterized. Hydrocarbon waste may be disposed of at a designated hydrocarbon landfill (NDEP, 1997b), an appropriate hydrocarbon waste management facility (e.g., recycling facility), or other method in accordance with Nevada regulations.

5.3.5 Mixed Waste

Mixed waste, if generated, shall be managed and dispositioned according to the requirements of RCRA (CFR, 2003a) or subject to agreements between NNSA/NSO and the State of Nevada, as well as DOE requirements for radioactive waste. The waste will be marked with the words "Hazardous Waste Pending Analysis," and "Caution Radioactive Material Pending Analysis." Waste characterized as mixed will not be stored for a period of time that exceeds the requirements of RCRA unless subject to agreements between NNSA/NSO and the State of Nevada. The mixed waste shall be transported via an approved hazardous waste/radioactive material transporter. Waste with hazardous waste constituent concentrations 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 (NNSA/NSO, 2005). Waste with hazardous waste constituent concentrations exceeding Land Disposal Restrictions will require development of a treatment and disposal plan under the requirements of the Mutual Consent Agreement between DOE and the State of Nevada (NDEP, 1995).

5.3.6 Polychlorinated Biphenyls

The management of PCBs is governed by the *Toxic Substances Control Act* (TSCA) (USC, 1976) and its implementing regulations at 40 CFR 761 (CFR, 2003b). Polychlorinated biphenyl contamination may be found as a sole contaminant or in combination with any of the types of waste discussed in this document. For example, PCBs may be a co-contaminant in soil that contains a RCRA "characteristic" waste (PCB/hazardous waste), or in soil that contains radioactive wastes (PCB/radioactive 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 (CFR, 2003b) as well as State of Nevada requirements, (NAC, 2004c) guidance, and agreements with NNSA/NSO.

5.4 Management of Specific Waste Streams

5.4.1 Personal Protective Equipment

Personal protective equipment and disposable sampling equipment will be visually inspected for stains, discoloration, and gross contamination as the waste is generated. Any IDW that meets this description will be segregated and 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. The PPE and equipment that is not visibly stained, discolored, or grossly contaminated and that is within radiological free-release criteria will be managed as sanitary waste.

5.4.2 Management of Decontamination Rinsate

Rinsate at CAU 555 will not be considered hazardous waste unless there is evidence that the rinsate may display a RCRA characteristic. Evidence may include such things as the presence of a visible sheen, pH, or association with equipment/materials used for sampling, or used to respond to a release/spill of a hazardous waste/substance. Decontamination rinsate that is potentially hazardous (using associated sample results and/or process knowledge) will be managed as characteristic hazardous waste (CFR, 2003a). The regulatory status of the potentially hazardous, or radiologically impacted rinsate will be determined through the application of associated sample results or through direct sampling. If the associated samples do not indicate the presence of hazardous, or radiologically impacted constituents, then the rinsate will be considered to be nonhazardous.

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

- Rinsate that is determined to be nonhazardous and contaminated to less than 5 times the *Safe Drinking Water Standards* (SDWS) is not restricted as to disposal. Nonhazardous rinsate that is contaminated at 5 to 10 times the SDWS will be disposed of in an established infiltration basin or solidified and disposed of as sanitary waste or low-level waste in accordance with the respective sections of this document.

- Nonhazardous rinsate which is contaminated at greater than 10 times SDWS will be disposed of in a lined basin or solidified and disposed of as sanitary waste or low-level waste in accordance with the respective sections of this document.

5.4.3 Management of Soil

This waste stream consists of soil removed for disposal during soil sampling, excavation, and/or drilling. This waste stream will be characterized based on laboratory analytical results from representative locations. If the soil is determined to potentially contain COCs, the material will either be managed on site or containerized for transportation to an appropriate disposal site.

On-site management of the waste soil will be allowed only if it is managed within an area of concern and it is appropriate to defer the management of the waste until the final remediation of the site. If this option is chosen, the waste soil shall be protected from run-on and runoff using appropriate protective measures based on the type of contaminant(s) (e.g., covered with plastic and bermed).

Management of soil waste for disposal consists of placing the waste in containers, labeling the containers, temporarily storing the containers until shipped, and shipping the waste to a disposal site. The containers, labels, management of stored waste, transport to the disposal site, and disposal shall be appropriate for the type of waste (e.g., hazardous, hydrocarbon, mixed).

Note that soils placed back into a borehole or excavation in the same approximate location from which it originated is not considered to be a waste.

5.4.4 Management of Debris

This waste stream can vary depending on site conditions. Debris that requires removal for the investigation activities (soil sampling, excavation, and/or drilling) must be characterized for proper management and disposition. Historical site knowledge, knowledge of the waste generation process, field observations, field-monitoring/screening results, radiological survey/swipe results and/or the analytical results of samples either directly or indirectly associated with the waste may be used to characterize the debris. Debris will be visually inspected for stains, discoloration, and gross contamination. Debris may be deemed reusable, recyclable, sanitary waste, hazardous waste, PCB waste, low-level waste, or any combination of the above. Waste that is not sanitary will be entered into an approved waste management system, where it will be managed and dispositioned according to federal, state requirements, and agreements between NNSA/NSO and the State of Nevada. The debris will either be managed on site by berming and covering next to the excavation, or by placement in a container(s). The disposal of debris may be deferred until implementation of corrective action at the site.

5.4.5 Field-Screening Waste

The use of field test kits and/or instruments may result in the generation of small quantities of hazardous wastes. If hazardous waste is produced by field screening, it will be segregated from other IDW and managed in accordance with the hazardous waste regulations (CFR, 2003a). On radiological sites, this may increase the potential to generate mixed waste; however, the generation of a mixed waste will be minimized as much as practicable. In the event a mixed waste is generated, the waste will be managed in accordance with Section 5.3.5 of this document.

6.0 Quality Assurance/Quality Control

The overall objective of the characterization activities described in this CAIP is to collect accurate and defensible data to support the selection and implementation of a closure alternative for each CAS in CAU 555. Section 6.1 and Section 6.2 discuss the collection of required QC samples in the field and QA requirements for laboratory/analytical data to achieve closure. Unless otherwise stated in this CAIP or required by the results of the DQO process (see Appendix A), this investigation will adhere to the Industrial Sites QAPP (NNSA/NV, 2002).

6.1 Quality Control Sampling Activities

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

- Trip blanks (1 per sample cooler containing VOC environmental samples)
- Equipment rinsate blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per lot of source material that contacts sampled media)
- Field duplicates (1 per 20 environmental samples, or if less than 20 collected, 1 per CAS per matrix)
- Field blanks (may be 1 per matrix per 20 environmental samples, 1 per day, or 1 per CAS depending on site conditions and agreement of DQO participants)
- Laboratory QC samples (1 per matrix per 20 environmental samples, or if less than 20 collected, 1 per CAS per matrix)

Additional QC samples may be submitted based on site conditions at the discretion of the SS or TM. 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 (NNSA/NV, 2002).

6.2 Laboratory/Analytical Quality Assurance

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

6.2.1 Data Validation

Data verification and validation will be performed in accordance with the Industrial Sites QAPP (NNSA/NV, 2002), except where otherwise stipulated in this CAIP. All chemical and radiological laboratory data from samples that are collected and analyzed will be evaluated for data quality according to company-specific procedures. The data will be reviewed to ensure that all suspected samples were appropriately collected, analyzed, and the results passed data validation criteria. Validated data, including estimated data (i.e., J-qualified), will be assessed to determine whether 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 Corrective Action Decision Document. If the DQOs were not met, corrective actions will be evaluated, selected, and implemented (e.g., refine CSM or resample to fill data gaps).

6.2.2 Data Quality Indicators

The DQIs are qualitative and quantitative descriptors used in interpreting the degree of acceptability or utility of data. Data quality indicators are used to evaluate the entire measurement system and laboratory measurement processes (i.e., analytical method performance) as well as to evaluate individual analytical results (i.e., parameter performance). The quality and usability of data used to make DQO decisions will be assessed based on the following DQIs:

- Precision
- Accuracy/bias
- Representativeness
- Comparability
- Completeness
- Sensitivity

Table 6-1 provides the established analytical method/measurement system performance criteria for each of the DQIs and the potential impacts to the decision whether the criteria are not met. The following subsections discuss each of the DQIs that will be used to assess the quality of laboratory data. Due to changes in analytical methodology and changes in analytical laboratory contracts, criteria for precision and accuracy in Tables 3-2 and 3-3 that vary from corresponding information in the QAPP will supersede that information in the QAPP (NNSA/NV, 2002a).

6.2.3 Precision

Precision is used to assess the variability between two equal samples. This is a measure of the repeatability of the analysis process from sample collection through analysis results. Precision is measured as the relative percent difference (RPD) or normalized difference (ND) of duplicate samples as presented in the Industrial Sites QAPP (NNSA/NV, 2002).

Determinations of precision will be made for field duplicate samples and laboratory duplicate samples. Field duplicate samples will be collected simultaneously with samples from the same source under similar conditions in separate containers. The duplicate sample will be 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 may include matrix spike duplicate (MSD) and laboratory control sample (LCS) duplicate samples for organic, inorganic, and radiological analyses.

Precision is a quantitative measure used to assess overall analytical method and field-sampling performance as well as to assess the need to “flag” (qualify) individual parameter results when corresponding QC sample results are not within established control limits.

The RPD and/or ND criteria to be used for assessment of precision for duplicates are the parameter-specific criteria listed in Table 3-2.

Table 6-1
Laboratory and Analytical Performance Criteria for CAU 555 Data Quality Indicators

Data Quality Indicator	Performance Metric	Potential Impact on Decision If Performance Metric Not Met
Precision	At least 80% of the sample results for each measured analyte are not qualified for precision based on the RPD or ND criteria for each analytical method-specific and laboratory-specific criteria presented in Tables 3-2 and 3-3.	If the performance metric is not met, the affected analytical results from each affected CAS will be assessed to determine whether there is sufficient confidence in analytical results to use the data in making DQO decisions.
Accuracy/Bias	At least 80% of the sample results for each measured analyte are not qualified for accuracy based on the method-specific and laboratory-specific criteria presented in Tables 3-2 and 3-3.	If the performance metric is not met, the affected analytical results from each affected CAS will be assessed to determine whether there is sufficient confidence in analytical results to use the data in making DQO decisions.
Sensitivity	Minimum detectable concentrations are less than or equal to respective FALs.	Cannot determine whether COCs are present or migrating at levels of concern.
Comparability	Sampling, handling, preparation, analysis, reporting, and data validation are performed using standard methods and procedures.	Inability to combine data with data obtained from other sources and/or inability to compare data to regulatory action levels.
Representativeness	Samples contain contaminants at concentrations present in the environmental media from which they were collected.	Analytical results will not represent true site conditions. Inability to make appropriate DQO decisions.
Completeness	80% of the CAS-specific COPC analytes have valid results. 100% of CAS-specific targeted analytes have valid results.	Cannot support/defend decision on whether COCs are present.
Extent Completeness	100% of COC analytes used to define extent have valid results.	Extent of contamination cannot be accurately determined.
Clean Closure Completeness	100% of targeted analytes have valid results.	Cannot determine whether COCs remain in soil.

CAS = Corrective action site
COC = Contaminant of concern
COPC = Contaminant of potential concern
DQO = Data quality objective
FAL = Final action level
ND = Normalized difference
RPD = Relative percent difference

The performance metric for assessing the DQI of precision on DQO decisions (see Table 6-1) is that at least 80 percent of sample results for each measured analyte are not qualified due to duplicates exceeding the RPD or ND criteria. If this performance is not met, an assessment will be conducted in the investigation report on the impacts to DQO decisions specific to affected analytes and CASs. Any

RPD or ND values outside the specified 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.

6.2.4 Accuracy/Bias

Accuracy is a measure of the closeness of an individual measurement or the average of a number of measurements to the true value. It is used to assess the performance of laboratory measurement processes as well as to evaluate individual groups of analyses (i.e., sample delivery groups).

Accuracy is determined by analyzing a reference material of known parameter concentration or by reanalyzing a sample to which a material of known concentration or amount of parameter has been added (spiked). Accuracy will be evaluated based on results from three types of spiked samples: matrix spike (MS), LCS, and surrogates (organics). The LCS sample is analyzed with the field samples using the same sample preparation, reagents, and analytical methods employed for the samples. One LCS will be prepared with each batch of samples for analysis by a specific measurement.

The criteria for chemical analyses to be used for assessment of accuracy are the parameter-specific criteria listed in Table 3-2. The percent recovery criteria for radiochemical analyses to be used for assessment of accuracy will be the control limits listed in Table 3-3.

The performance metric for assessing the DQI of accuracy on DQO decisions (see Table 6-1) is that at least 80 percent of the sample results for each measured analyte are not qualified for exceeding the percent recovery (%R) criteria. If this performance is not met, an assessment will be conducted in the investigation report on the impacts to DQO decisions specific to affected analytes and CASs. Any %R values outside the specified 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 laboratory 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 may be evaluated when determining the usability of the affected data.

6.2.5 Representativeness

Representativeness is the degree to which sample characteristics accurately and precisely represent a characteristics of a population or an environmental condition (EPA, 1987). Representativeness is assured by a carefully developing the sampling strategy during the DQO process such that false negative and false positive decision errors are minimized. The criteria listed in Step 6 of the DQOs - *Specify the Tolerable Limits on Decision Errors* are:

- For Decision I, having a high degree of confidence that the sample locations selected will identify COCs if present anywhere within the CAS.
- Having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.
- For Decision II, having a high degree of confidence that the sample locations selected will identify the extent of COCs.

These are qualitative measures that will be used to assess measurement system performance for representativeness. The assessment of this qualitative criterion will be presented in the investigation report.

6.2.6 Comparability

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another (EPA, 1987). The criteria for the evaluation of comparability will be that all sampling, handling, preparation, analysis, reporting, and data validation were performed using approved standard methods and procedures. This will ensure that data from this project can be compared to regulatory action levels that were developed based on data generated using the same or comparable methods and procedures. An evaluation of comparability will be presented in the investigation report.

6.2.7 Completeness

Completeness is defined as generating sufficient data of the appropriate quality to satisfy the data needs identified in the DQOs. For judgmental sampling, completeness will be evaluated using both a quantitative measure and a qualitative assessment. The quantitative measurement to be used to evaluate completeness is presented in Table 6-1 and is based on the percentage of measurements made that are judged to be valid. The completeness goal for targeted analytes and the remaining COPCs is 100 and 80 percent, respectively. If these criteria are not achieved, the dataset will be assessed for potential impacts on making DQO decisions.

The qualitative assessment of completeness is an evaluation of the sufficiency of information available to make DQO decisions. This assessment will be based on meeting the data needs identified in the DQOs and will be presented in the investigation report.

6.2.8 Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest (EPA, 2001). The evaluation criteria for this parameter will be that measurement sensitivity (detection limits) will be less than or equal to the corresponding FALs. If this criterion is not achieved, the affected data will be assessed for usability and potential impacts on meeting site characterization objectives. This assessment will be presented in the investigation report.

7.0 Duration and Records Availability

7.1 Duration

Table 7-1 is a tentative duration of activities (in calendar days) for corrective action investigation activities.

Table 7-1
Corrective Action Investigation Activity Durations

Duration (days)	Activity
10	Site Preparation
75	Field Work Preparation and Mobilization
60	Sampling
160	Data Assessment
180	Waste Management

7.2 Records Availability

Historic information and documents referenced in this plan are retained in the NNSA/NSO project files in Las Vegas, Nevada, and can be obtained through written request to the NNSA/NSO 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 for CAU 555

A.1.0 Introduction

The DQO process described in this appendix is a seven-step strategic systematic planning method based on the scientific method that was used to plan data collection and field investigation activities and define performance criteria for the CAU 555, Septic Sytems. The DQOs are designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and, technically defend recommended corrective actions (i.e., no further action, closure in place, or clean closure). Existing information about the nature and extent of contamination at the CASs in CAU 555 is insufficient to evaluate and select preferred corrective actions; therefore, a CAI will be conducted.

The CAU 555 investigation will be based on the DQOs presented in this appendix as developed by representatives of the NDEP and the NNSA/NSO. The seven steps of the DQO process presented in Section A.3.0 through Section A.9.0 were developed in accordance with the EPA *Guidance for the Data Quality Objectives Process* (EPA, 2000a) and the EPA *Guidance for Quality Assurance Project Plans* (EPA, 2002). The DQO process presented herein is based on the EPA Quality System Document for DQOs entitled *Data Quality Objectives Process for Hazardous Waste Site Investigations* (EPA, 2000b) and the CAS-specific information presented in Section A.2.0.

The DQO process presents a judgmental sampling approach. In general, the procedures used in the DQO process provide:

- A scientific basis for making inferences about a site (or portion of a site) based on environmental data or process knowledge;
- A basis for defining decision performance criteria and assessing the achieved decision quality of the data collection design;
- Criteria for knowing when site investigators should stop data collection (i.e., when sufficient information is available to support decisions); and,
- A basis for demonstrating an acceptable level of confidence in the sampling approach to generate the appropriate quantity and quality of information necessary to minimize the potential for making decision errors.

A.2.0 Background Information

The following CASs that comprise CAU 555 consist of domestic waste systems and are located in Areas 1, 3, and 6 of the NTS, as shown in Figure A.2-1.

- 01-59-01, Area 1 Camp Septic System
- 03-59-03, Core Handling Building Septic System
- 06-20-05, Birdwell Dry Well
- 06-59-01, Birdwell Septic System
- 06-59-02, National Cementers Septic System

Descriptions of each CAS and the CAS-specific COPCs are provided in the following sections. Descriptions include the physical setting and operational history, release information, and previous investigation results. The dimensions and the presence of CAS components were estimated based on review of engineering drawings, field reconnaissance, and geophysical survey data.

The scope of each CAS does not include floor drains within the buildings that are/were connected to the system, nor does it include subsurface piping beneath these building foundations or any foundation within the spatial boundaries of the CAS investigation. In addition, radioactive fallout contamination due to nuclear weapons testing is not included in the scope of each CAS. The scope of work at CAU 555 was expanded to include the investigation of CAS 06-20-05, Birdwell Dry Well.

Many of the COPCs are based on the process knowledge of activities conducted at the CAS, rather than specific knowledge of a release. Possible COPCs are defined as those contaminants that may be present within a CAS based on contaminants found at other NTS sites and the uncertainty concerning the history of potential releases. As a result, many of the Decision I COPCs for the CAI are considered the class of contaminants for a given analytical suite. Target analytes are defined as those contaminants that are known to be or reasonably suspected to be present within a CAS based on previous sampling results or process knowledge, geographic setting, and/or operational site history.

A.2.1 Corrective Action Site 01-59-01, Area 1 Camp Septic System

The Area 1 Camp septic system consists of a 3,000-gallon (gal) capacity septic tank, two outside floor sinks, two distribution boxes, a leachfield, and associated subsurface piping included in the CAS scope. Figure A.2-2 shows the configuration of the Area 1 Camp septic system.

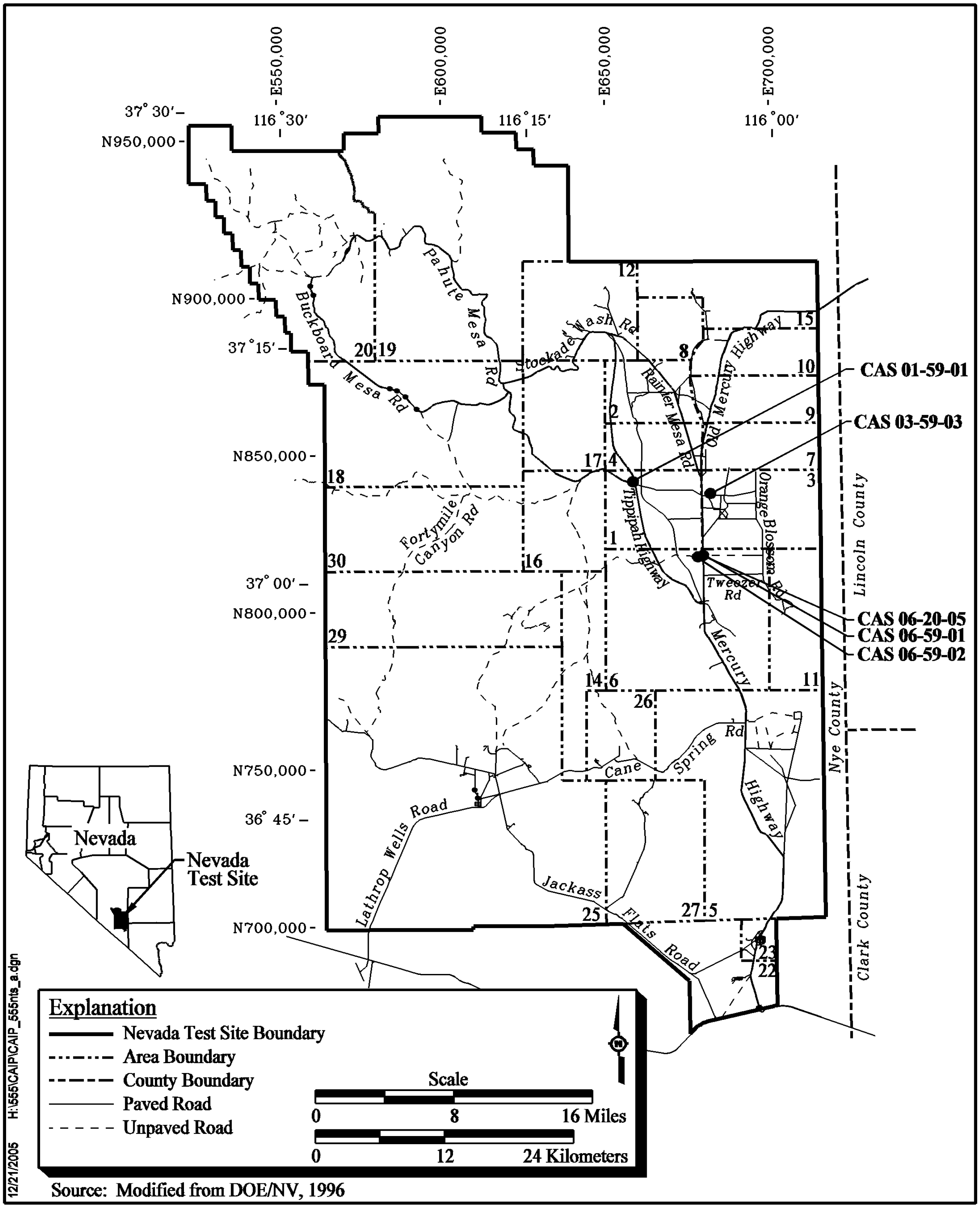


Figure A.2-1
CAU 555, CAS Location Map

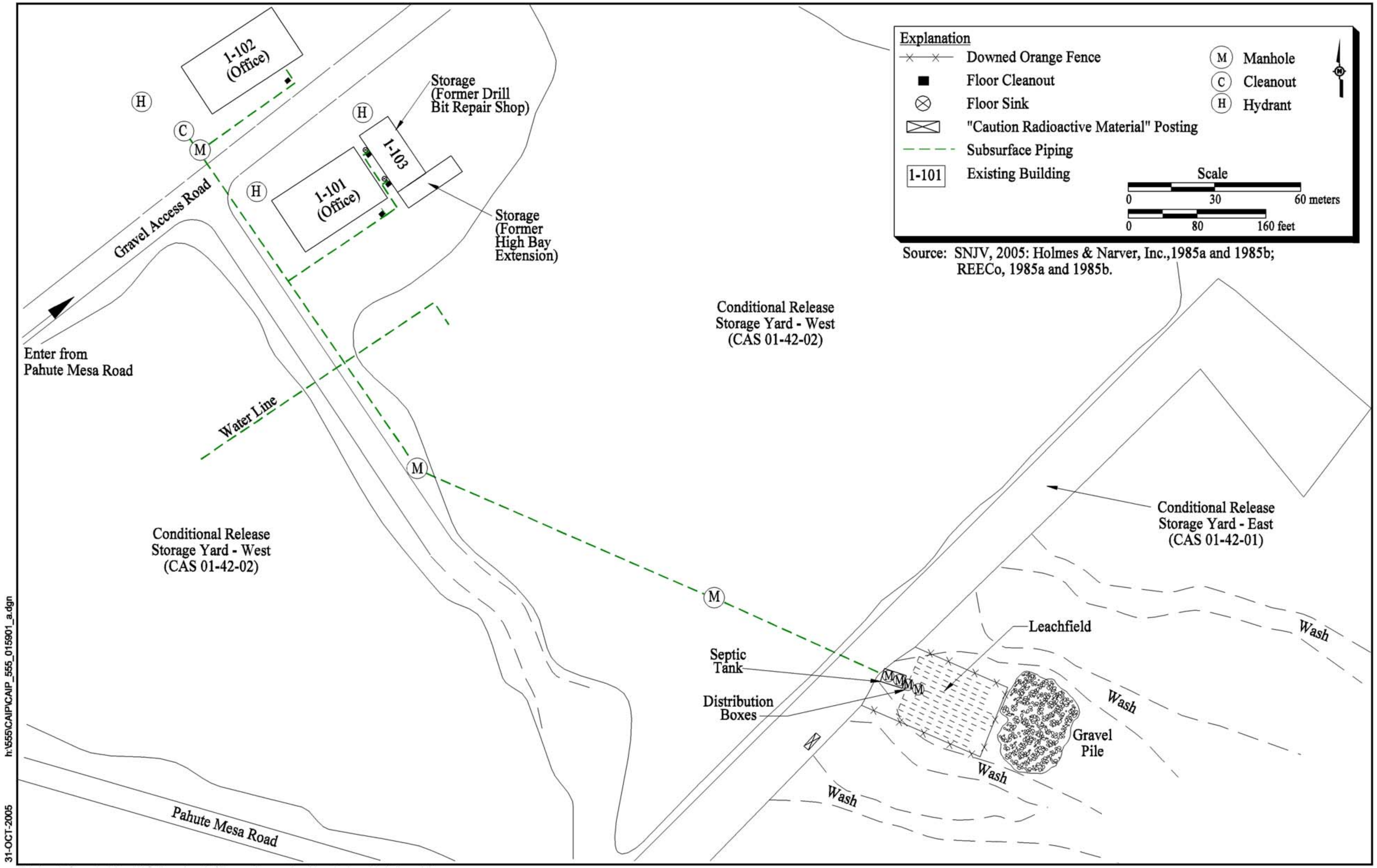


Figure A.2-2
CAU 555, CAS 01-59-01 Area 1 Camp Septic System Layout

The septic tank is composed of pre-cast, reinforced concrete that divided into two chambers. The first chamber (west end of tank) contains an inlet pipe, and the second chamber (east end) contains an outlet pipe that leads to the two distribution boxes. Between the two chambers is a vent pipe. Above each chamber of the septic tank is a manhole cover set flush with the ground surface. The tank itself measures 10 ft long by 5 ft wide and is 5 ft deep. The two distribution boxes are located approximately 2.5 ft east of the septic tank and lead to the leachfield. Each box measures 2 ft by 2 ft 9 in., is composed of pre-cast concrete, and has a manhole access point that is visible at the ground surface.

The two floor sinks are located outside of Building 1-103 and are connected to the subsurface piping leading to the leachfield. The sinks are located 3 ft from the southwest side of Building 1-103 at either end of the building and set in concrete flush to the ground surface. The base of each sink is equipped with an aluminum dome strainer consisting of a 4-in.-by-8-in. rectangular grate from which a 4-in. diameter pipe extends into the sink.

Subsurface sewer piping extends from the southeast side of Building 1-101, the southwest side of Building 1-103, and from the southeast side of Building 1-102. The 4-in.-diameter piping connects to a sewer line that extends to the southeast, makes a slight bend to the east (at sewer manhole), and continues toward the septic tank, distribution boxes and into the leachfield. The leachfield measures 100 ft long by 85 ft wide and is located to the east of the two distribution boxes. Engineering drawings indicate 12 linear trenches each measuring 100 ft long, by 2 ft deep by 3 ft wide with 1 ft of 3/4-in. gravel aggregate in the bottom. Each trench contains a 4-in.-diameter perforated pipe (clay, plastic or bituminous) overlying the gravel. The backfill on top of the trenches consists of native soil that is slightly mounded. The entire leachfield slopes toward the east-northeast. The east end of the leachfield is bound by a mixture of mounded soil and gravel.

Physical Setting and Operational History - Corrective Action Site 01-59-01, which is located within the Area 1 Subdock, was constructed in 1985 to manage domestic sewage and was used until the mid-1990s. The septic system is connected to the piping (e.g., floor drains) of three buildings. The buildings include the former Subdock Office (Building 1-101), the Drilling Operations (Building 1-102) and the "Bit Bay" (Building 1-103). Historically, Buildings 1-101 and 1-102 were used as office buildings, and both contained rest rooms. Building 1-103 was used as a drill bit repair facility, and associated industrial wastewater was discharged to a separate septic system (Prothro, 2005). According to historical documents, the septic system did not function properly and had code violations, and the leachfield experienced frequent sewage backups. The two outside floor sinks/drains located outside of Building 1-103 were designed to collect and divert rainwater and condensate from the cooling systems to the septic system. The sink drains have not been plugged or capped; however, they are currently filled with sediment, and the immediate area ponds up with runoff water after rainfall events.

The Area 1 Subdock is currently active; however, the septic system has been inactive and abandoned since the mid-1990s. Building 1-103 is currently used for DOE storage while Buildings 1-101 and 1-102 are used for periodic military training. Reportedly, utilities have been shut off to the three buildings, and there are no current plans to reactivate the abandoned septic system (Ziehm, 2005). A new domestic waste system has been constructed located just to the west of the Subdock Office and includes a small bathroom trailer that is used by Building 1-101 and 1-102 personnel.

Release Information - Other than normal operation of the septic system and leachfield overflow, there are no known documented releases associated with this CAS. No information exists suggesting that anything other than sanitary septic wastes were managed and discharged by this septic system.

Previous Investigation Results - No known soil sampling activities have occurred at this CAS. A February 1992 inspection performed by BN of the active septic systems at CAS 01-59-01 reported the leachfield showed signs of system failure, which included moist ground and excessive vegetation on the west side. The excessive vegetation indicated sewage was not percolating into the subsurface and maybe near the ground surface (Bingham, 1992). In April 1992, all vegetation was removed from the leachfield, and snow fencing was installed around the leachfield to prevent debris from blowing into the area (Bingham, 1992). An October 1995 survey of the Area 1 Subdock septic system was also conducted by BN, who reported the septic system did not contain an alternating dosing siphon (needed because total length of distribution line is greater than 1,000 ft). (Sygitowicz, 1996a and 1996b). In addition, it was reported that Building 1-102 should remain unoccupied and secured until further notice. A geophysical survey was conducted by SNJV in December 2004, which confirmed the presence and locations of the septic tank and distribution boxes (Fahringer, 2005a and b).

A.2.2 Corrective Action Site 03-59-03, Core Handling Building Septic System

The Core Handling Building (CNC-11) septic system was reported to consist of one septic tank, one leaching pit, and associated subsurface piping. In 1994, a survey crew could not locate the septic tank or leaching pit, and listed the septic system as inactive and abandoned requiring further investigation (REECo, 1994a and b). It is not known whether these CAS components were removed. Engineering drawings show the septic system connected to a floor drain, a sink, a water closet, and a cleanout in the rest room of the CNC-11 building. Figure A.2-3 shows the "as-built" configuration of the former septic system leading from Building CNC-11.

The septic tank is shown on "as-built" engineering drawings to be located approximately 70 ft east of the CNC-11 building. According to the drawing, the septic tank had a 750-gal capacity and was connected to the subsurface piping and the leaching pit. The piping was reported to have originated beneath the Building CNC-11 foundation at one shower drain, sink, and toilet of the rest room. The leaching pit location is shown to have been 20 ft east of the septic tank, was 5 ft wide, and extended 13 ft into the subsurface with an additional 1- to 2-ft layer of gravel aggregate at the base. The pit was shown on drawings to be topped by a concrete platform; however, this feature could not be located in the field.

Physical Setting and Operational History - Corrective Action Site 03-59-03, which is located at the Core Complex in Area 3, was constructed in 1967 to manage domestic waste and was used through the early 1970s. The CNC-11 Building is where Los Alamos National Laboratory conducted testing to identify alternatives for post-test drilling. After each test, the used equipment and all interior and exterior building sufaces were decontaminated, and the effluent from these operations were discharged to a floor drain that leads to an injection well (CAS 03-99-13, CAU 145), which is separate from the system that was connected to the rest room. The use of the CNC-11 Building or the septic system is not known from the early 1970s to 1992. The Core Complex is currently inactive and abandoned.

Release Information - Other than normal operation of the septic system, there are no known documented releases associated with this CAS. No information exists suggesting that anything other than sanitary septic wastes were managed and discharged by this septic system.

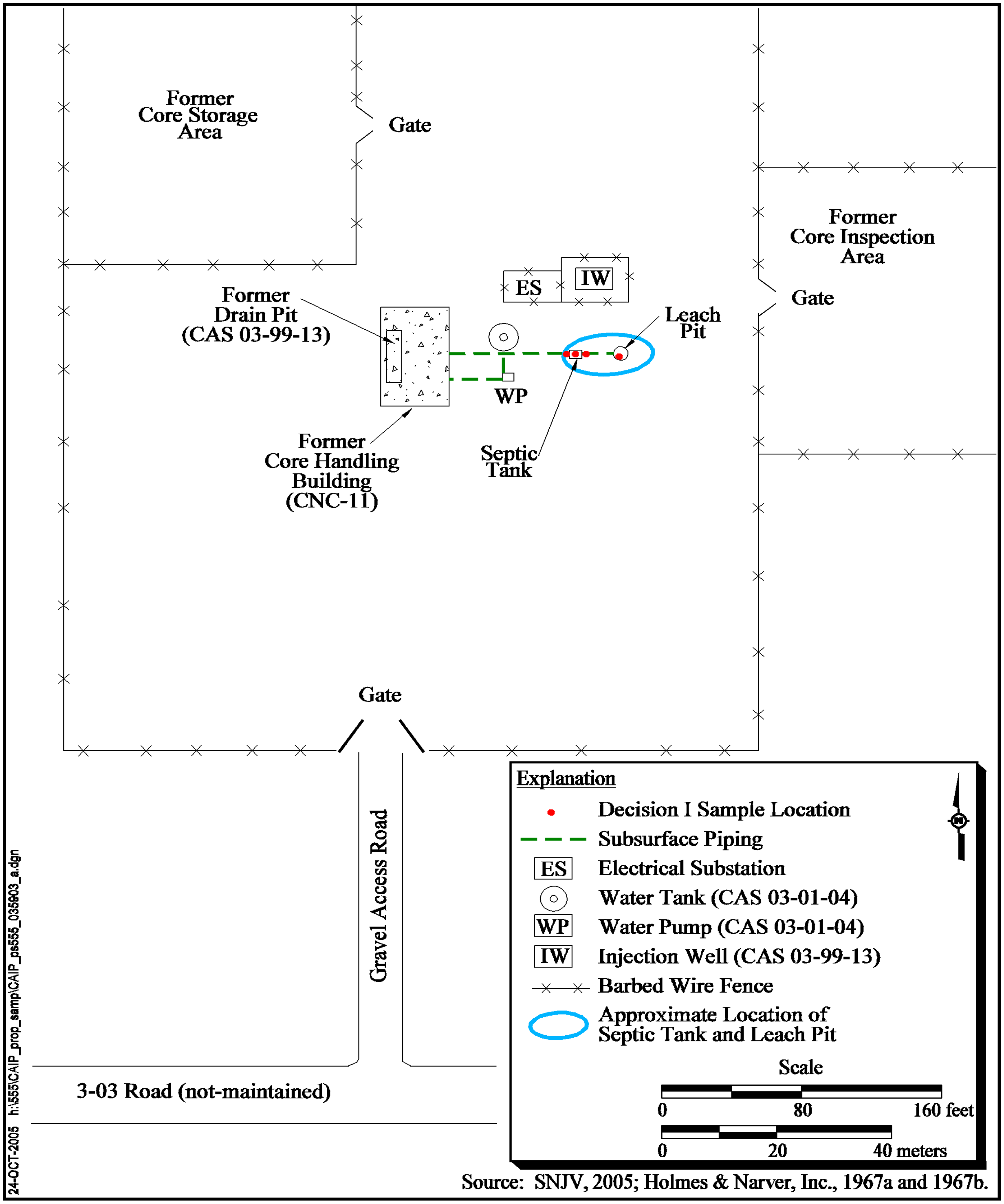


Figure A.2-3
CAS 03-59-03, Core Handling Building Septic System

Previous Investigation Results - No known soil sampling activities have occurred at this CAS.

In 1994, a survey crew could not locate the septic tank or leaching pit, and listed the septic system as inactive and abondoned, requiring further investigation (REECo, 1994a and b). In addition, a geophysical survey performed by SNJV in 2004 did not detect the presence of the septic system (Fahringer, 2005b). It is not known whether any or all of these components have been removed.

A.2.3 Corrective Action Sites 06-20-05, Birdwell Dry Well, and 06-59-01, Birdwell Septic System

The Birdwell septic system consists of two septic tanks, each having a 1,200-gal capacity; one distribution box; subsurface piping; and a leachfield. Also included in this CAS is a dry well that was used to collect effluent from the laundry room operations before installation of the septic system. Figure A.2-4 shows the septic system configuration at this site.

Engineering drawings show the leachfield to consist of three 100-ft-long, 4-in.-diameter, perforated polyvinyl chloride (PVC) drain lines that were set at a depth of 18 in. bgs, were spaced at 6-ft intervals, and overlay a bed of gravel to allow for downward percolation. The septic tanks are located 30 ft west of the distribution box, which is just north of and adjacent to the leachfield. The dry well is connected to the laundry room at the northeast corner of the building. Exact dimensions are unknown; however, a typical dry well detail is shown on engineering drawings for this site, which suggests the diameter to be 4 ft and the depth to be a minimum of 5 ft bgs with a base of washed 3/4-in. diameter aggregate. A 3-in.-diameter cast-iron drain line connects the drains in the laundry building to the dry well with a slope of 1/8 in. per 1 ft. The drain line enters the dry well into a 3-ft horizontal length of PVC perforated piping at a depth of 2 ft bgs (Holmes & Narver, Inc., 1981a and b). The horizontal pipe is covered by untreated building paper followed by a 6-in. layer of a soil and gravel mixture followed by an 18-in. layer of soil up to the ground surface.

Physical Setting and Operational History - Corrective Action Sites 06-20-05 and 06-59-01 are located in the northeast corner of the Well 3 Yard in Area 6. The dry well (CAS 06-20-05) was installed in 1965 and used until 1981 at which time the septic system was installed. Wastewater from the laundry operations was discharged to the adjacent dry well via a 3-in.-diameter cast-iron drain line at the northwest corner of the building (REECo, 1979). The septic system was installed in 1981 and

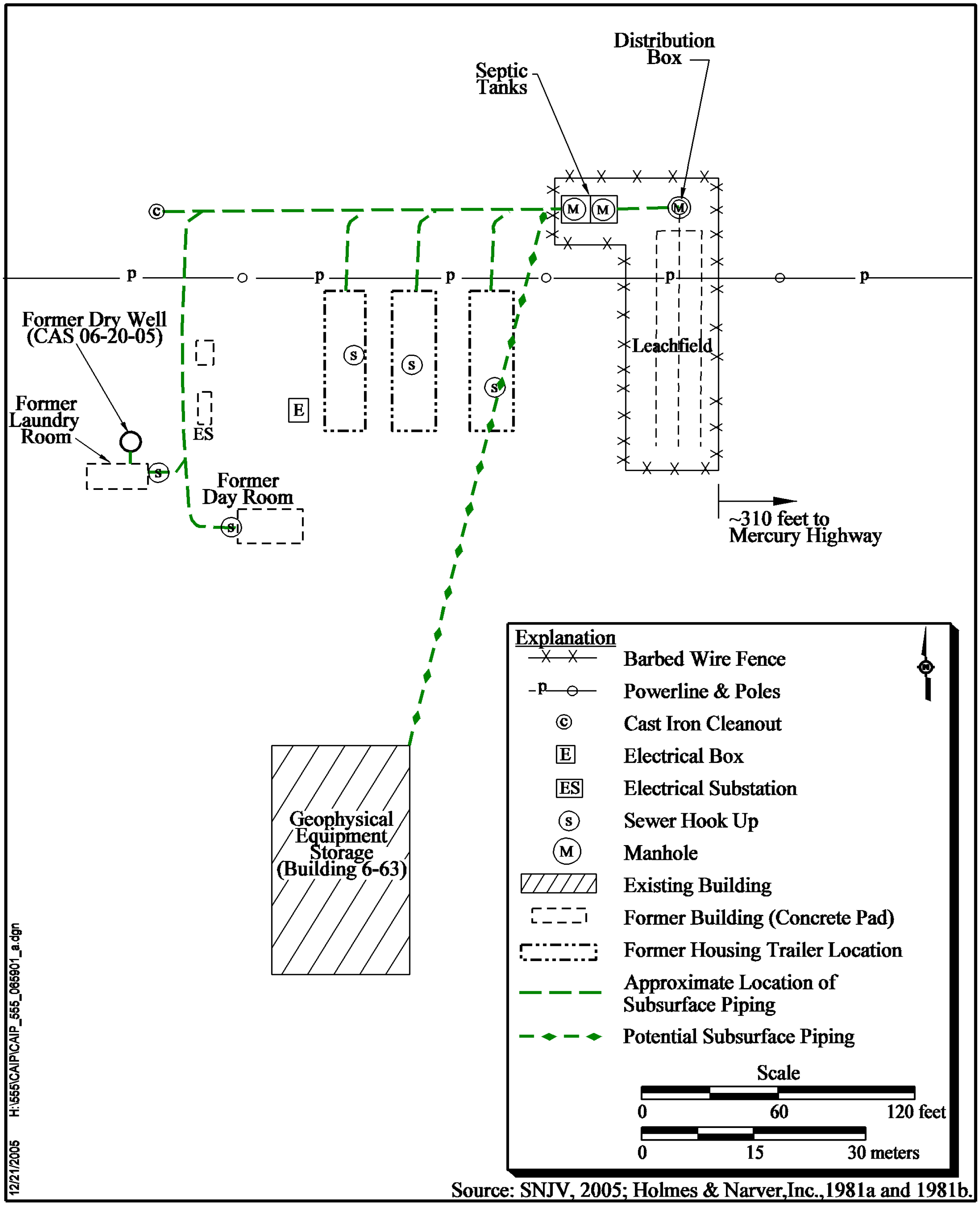


Figure A.2-4
CAS 06-20-05, Birdwell Dry Well, and
CAS 06-59-01, Birdwell Septic System

used through the early 1990s. It is not known how many sinks, toilets, or showers at this site were hooked up to this septic system. The subsurface piping connects the septic tanks to three housing trailers and cleanouts, a laundry facility, a day room (lounge), and possibly a restroom facilities within Building 6-63.

According to historical documents, a rest room in Building 6-63 was added to the system in 1985. Building 6-63 was used as offices for geophysical logging operations. The logging trucks were decontaminated in this building after use, and the wastewater (CAS 06-23-03, CAU 335) was discharged to a separate system than the one used to manage domestic waste (Naegle, 2005). Building 6-63 is currently used for equipment storage.

Release Information - Other than normal operation of the septic system, there are no known documented releases associated with this CAS. No information exists suggesting that anything other than sanitary septic wastes were managed and discharged by this septic system.

Previous Investigation Results - No previous investigation sampling or surveys have been conducted.

A.2.4 Corrective Action Site 06-59-02, National Cementers Septic System

The National Cementers septic system consists of one septic tank, one distribution box, subsurface piping, and a leachfield. The septic tank has a 1,000-gal capacity, and the leachfield is comprised of two 60-ft-long, 4-in.-diameter, perforated PVC drain lines that are each set in a trench within a bed of gravel. Figure A.2-5 shows the septic system configuration at this site.

Physical Setting and Operational History - Corrective Action Site 06-59-02 is located at the Well 3 Yard in Area 6. This septic system was designed for domestic waste usage, was constructed in 1981, and was used through the early 1990s. According to historical records, personnel from two office trailers utilized the system. The first trailer (No. 898834) was hooked up in 1981, and a second trailer (No. 898823) was added to the system in 1984. The surrounding site and septic system were abandoned in late 1990s and have since remained inactive. (During a site vist by SNJV in August 2005, the exact subsurface piping locations for this CAS could not be located [SNJV, 2005]). Engineering drawings show the subsurface sewer piping to branch off to the south of the first trailer

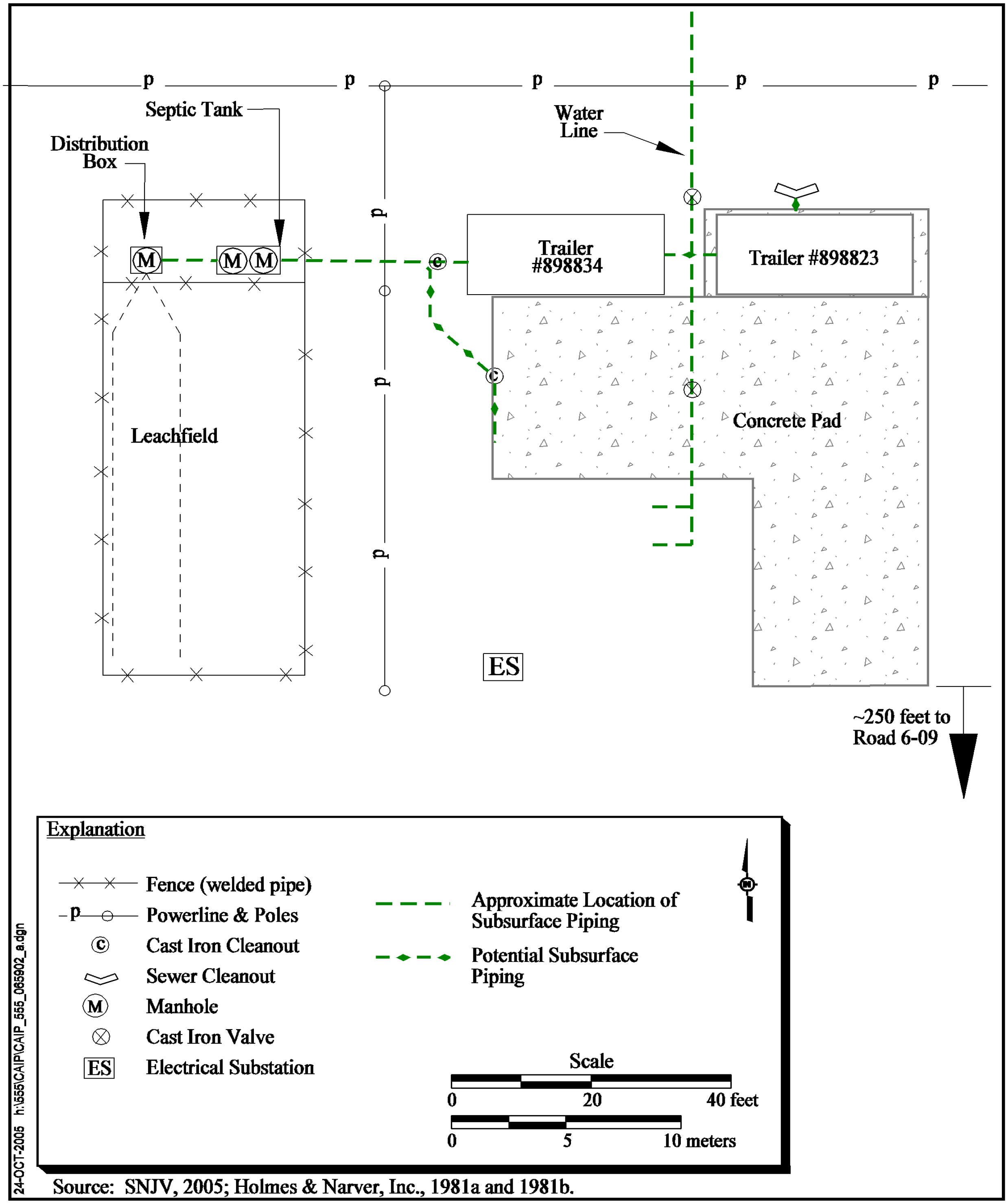


Figure A.2-5
CAS 06-59-02, National Cementers Septic System

(No. 898834) and continues south for several feet to an unknown connection (see Figure A.2-5). No structure is currently present at this location, and it appears that the concrete pad was resurfaced sometime after 1981, due to the cleanout being partially covered with concrete (SNJV, 2005). According to engineering drawings, a water line was installed in this area in 1981 (Holmes & Narver, Inc., 1981a and b).

Release Information - Other than normal operation of the septic system, there are no known documented releases associated with this CAS. No information exists suggesting that anything other than sanitary septic wastes were managed and discharged by this septic system.

Previous Investigation Results - No previous investigation sampling or surveys have been conducted.

A.3.0 Step 1 - State the Problem

This initial step of the DQO process identifies the planning team members and decision-makers, describes the problem that has initiated the CAU 555 investigation, and develops a CSM used in planning the investigation.

The problem statement for CAU 555 is: "Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives for the CASs in CAU 555."

A.3.1 Planning Team Members

The DQO planning team consists of representatives from NDEP, NNSA/NSO, SNJV, and BN. The primary decision-makers are the NDEP and NNSA/NSO representatives. Table A.3-1 lists representatives from each organization in attendance at the August 23, 2005, DQO meeting.

Table A.3-1
DQO Meeting Participants for CAU 555
August 23, 2005

Participant	Affiliation	Function
Jeff MacDougall	Nevada Division of Environmental Protection	Regulatory Representative and Oversight
Sabine Curtis	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office	Environmental Restoration Task Manager
Laura Pastor	Stoller-Navarro Joint Venture	Industrial Sites Task Manager
Georgette Dimit	Stoller-Navarro Joint Venture	Industrial Sites CAU Lead
Christian Palay	Stoller-Navarro Joint Venture	Quality Processes Representative
Dave Schrock	Stoller-Navarro Joint Venture	Waste Management Representative
David Nacht	Bechtel Nevada	Environmental Restoration Task Lead

A.3.2 Conceptual Site Model

The CSM is used to organize and communicate information about site characteristics. It reflects the best interpretation of available information at any point in time. The CSM is a primary vehicle for communicating assumptions about release mechanisms, potential migration pathways, or specific constraints. It provides a good summary of how and where contaminants are expected to move and what impacts such movement may have on the surrounding media. It is the basis for assessing how contaminants could reach receptors both in the present and future. 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.

The CSM has been developed for CAU 555 using information from the physical setting, potential contaminant sources, release information, historical background information, knowledge from similar sites, and physical and chemical properties of the potentially affected media and COPCs (see Figure A.3-1). The CSM represents the various components and configurations of septic systems at the CAU 555 CASs. The elements used in consideration for selecting and determining the CSM are in accordance with DOE's *Work Plan for the Leachfield Corrective Action Units*: *Nevada Test Site and Tonapah Test Range* (DOE/NV, 1998a) and are described below.

The graphical representation of the CSM shows potential contamination, release points, and possible migration routes from potential ruptured or failed septic systems that could be present in the soil under or around the septic system components, including the leachfield.

The CSM consists of:

- Potential contaminant releases including affected media.
- Release mechanisms (the conditions associated with the release).
- Potential contaminant source characteristics for contaminants suspected to be present.
- Site characteristics including physical, topographical, and meteorological information.
- Migration pathways and transport mechanisms that describe the potential for migration and where the contamination may be transported.
- The locations of points of exposure where individuals or populations may come in contact with a COC associated with a CAS.
- Routes of exposure where contaminants may enter the receptor.

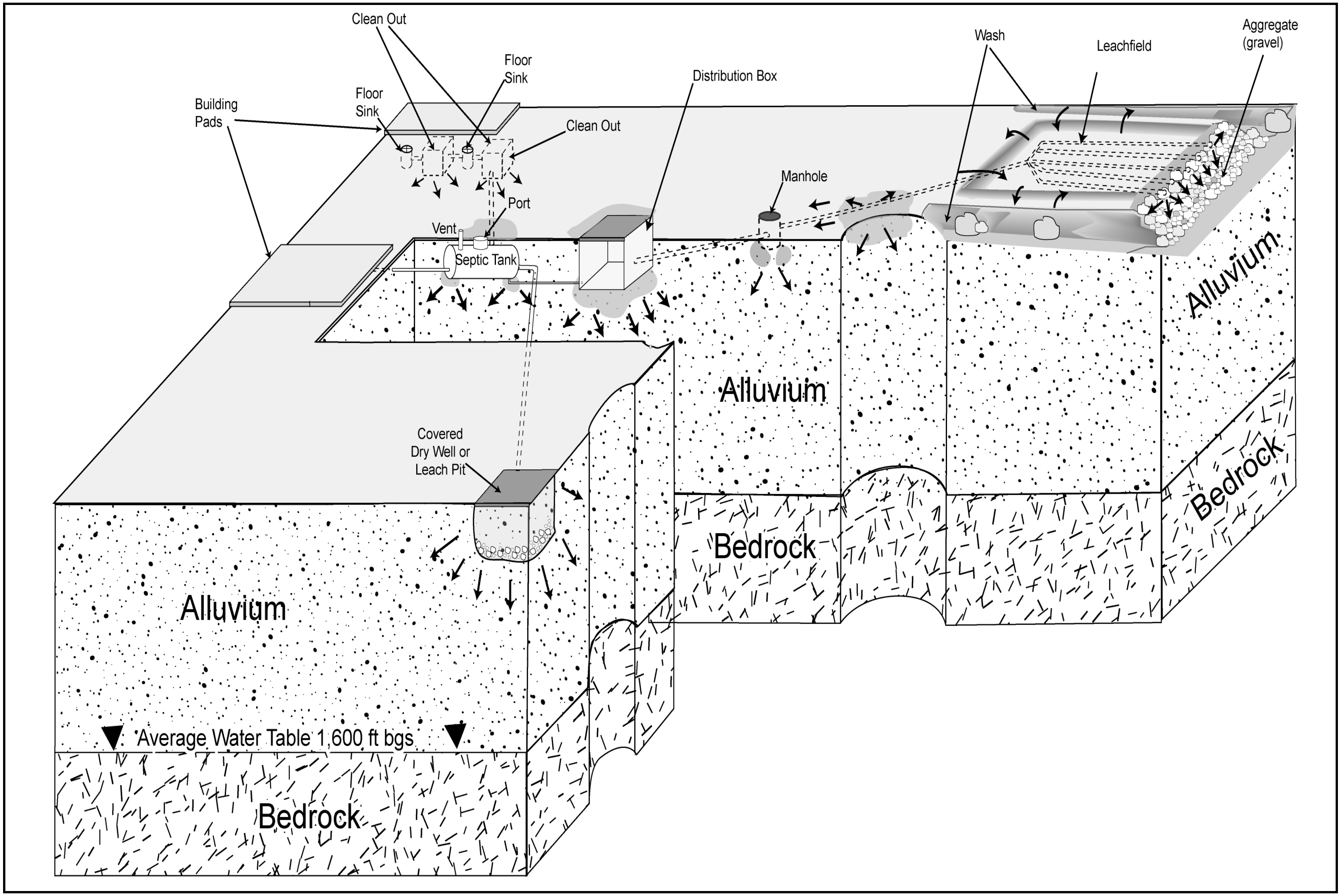


Figure A.3-1
Septic System CSM for CAU 555

If additional CSM elements are identified during the CAI that are outside the scope of the CSM, the situation will be reviewed and a recommendation will be made as to how to proceed. In such cases, NDEP and NNSA/NSO will be notified and given the opportunity to comment on, or concur with, the recommendation.

The applicability of the CSM to each CAS in CAU 555 is summarized in Table A.3-2 and discussed below. The information provided on the CSM elements provided in this table will be used throughout the remaining steps of the DQO process.

The CSM for septic systems applies to all four CASs in CAU 555. Each CAS is a unique septic system having various components where a release could possibly occur. At CAS 01-59-01 and CAS 03-59-03, building discharges were most likely limited to domestic sewage; however, it is possible that radionuclides and/or other industrial wastes were discharged to the septic system. At CAS 01-59-01, the system includes a large leachfield, has a history of failures (backups), and has been subject to overland flows (drainage). At CAS 03-59-03, the system included a leach pit. At CASs 06-59-01 and 06-59-02, discharges were most likely limited to domestic sewage. Both of these CASs include leachfields. At CAS 06-20-05, the laundry room effluent was discharged to a dry well before construction of the septic system. Figure A.3-1 represents typical site conditions applicable to this CSM.

A.3.2.1 Contaminant Release

Contamination, if present, is expected to be contiguous to the release points in the septic system. The native soil interface below and adjacent to these release points is the most likely location for soil contamination. The concentrations of the contaminants are expected to decrease with horizontal and vertical distance from the source. Any contaminants originating from CASs, regardless of physical or chemical characteristics, are expected to be in surface or subsurface soils adjacent to release points.

A.3.2.2 Potential Contaminants

The COPCs for CAU 555 are defined as the analytes reported from the Decision I analytical methods (defined in Section A.4.1). The analytical program for CAU 555 samples is identified in Table A.3-3. The analytes reported from these analytical methods are considered COPCs if these analytes have

Table A.3-2
Conceptual Site Model for CAU 555: Septic Systems Description of Elements for Each CAS
(Page 1 of 2)

CAS Identifier and Description	01-59-01, Area 1 Camp Septic System	03-59-03, Core Handling Building Septic System	06-20-05, Birdwell Dry Well and 06-59-01 Birdwell Septic Systems	06-59-02, National Cementers Septic System
Site Status	Septic system is inactive and abandoned; however, surrounding buildings may be occupied.	Septic system and surrounding area are inactive and abandoned; however, it is unknown whether system has been removed.	Dry well, septic system, and surrounding areas are inactive and abandoned.	
Future Land Use and Site Receptors	Nuclear and High Explosives Test Zone with limited use by industrial, construction, and/or military personnel.		Nuclear Test Zone with limited use by industrial, construction and/or military personnel.	
Sources of Potential Soil Contamination	Leaking septic system components and/or breaches in subsurface piping, including leachfield and leach pit. Surface runoff from other activities entering leachfield or leach pit.		Leaking dry well, septic system components, and/or breaches in subsurface piping, including leachfield.	
Location of Contamination/ Release Point	Surface and near-surface soil at overflow areas and system backup location(s). Near-surface and shallow subsurface soils at breached piping locations, or dry well or septic system component failure(s).			
Amount Released	Unknown			
Affected Media	Near-surface and shallow subsurface soils			
Potential Contaminants of Concern	Solvents, metals, petroleum hydrocarbons, PCBs, radionuclides			
Transport Mechanisms	Percolation of precipitation through subsurface media serves as the major driving force for migration of contaminants. However, due to the arid environment of the Nevada Test Site, percolation of precipitation is limited and migration of contaminants has been shown to be limited. Evaporation potentials significantly exceed available soil moisture from precipitation (Winograd and Thordarson, 1975). Surface water runoff may provide for the transportation of some contaminants within or outside of the footprints of the CAS.			
Migration Pathways	Gravel trenches along pipelines and within leachfields, leach pit or dry well, and overland flows from system backup.			

Table A.3-2
Conceptual Site Model for CAU 555: Septic Systems
Description of Elements for Each CAS
(Page 2 of 2)

CAS Identifier and Description	01-59-01, Area 1 Camp Septic System	03-59-03, Core Handling Building Septic System	06-20-05, Birdwell Dry Well and 06-59-01 Birdwell Septic Systems	06-59-02, National Cementers Septic System
Lateral and Vertical Extent of Contamination	Unknown. Contamination, if present, is expected to be contiguous to the release points, and not more than 15 feet (ft) laterally and up to 17 ft below ground surface (bgs). Concentrations are expected to decrease with distance and depth from the source. Groundwater contamination is not expected. Depth to groundwater near CAS 01-59-01 was measured in U.S. Geological Survey (USGS) Test Well D at 1,733 ft bgs (Thordarson et al., 1962). Depth to groundwater near CAS 03-59-03 was measured in USGS Test Well A at 1,610 ft bgs (USGS, 1961). Depth to groundwater near CASs 06-20-05, 06-59-01 and 06-59-02 was measured in Water Well 3 at a depth of 1,533 ft bgs (USGS, 1996). Surface migration may have occurred at one or all of these sites as a result of runoff.			
Exposure Scenario	The potential for contamination exposure is limited to industrial and construction workers, and to military personnel conducting training. These human receptors may be exposed to contaminants of potential concern through oral ingestion, inhalation, dermal contact (absorption) of soil and/or debris due to inadvertent disturbance of these materials or irradiation by radioactive materials.			

PRGs established by the EPA Region 9 (EPA, 2004a) or have toxicity and carcingenicity data listed in the EPA IRIS database (EPA, 2004b). Radiological COPCs are defined as the radionuclides reported above the MDC for the analytical methods listed in Table A.3-3.

The list of COPCs is intended to encompass all of the contaminants that could potentially cause an unacceptable risk at each CAS. Contaminants detected at other similar NTS sites were also included in the COPC list to reduce the uncertainty about potential contamination at the CASs, because complete information regarding activities performed at the CAU 555 sites is not available.

Targeted analytes are those COPCs for which evidence in the available site and process information suggests that they may be reasonably suspected to be present at a given CAS. The targeted analytes are required to meet a more stringent completeness criteria than other COPCs, thus providing greater protection against a decision error.

During review of the site history documentation, process knowledge information, personal interviews, review of available past investigation efforts, and inferred activities associated with the CASs, none of the COPCs were identified as targeted analytes at any of the CAU 555 CASs.

Table A.3-3
Analytical Program[a] for CAU 555
(Includes Waste Characterization Analyses)

Parameter[b]	CAS			
	01-59-01	03-59-03	06-20-05 and 06-59-01	06-59-02
Organic Contaminants of Potential Concern (COPC)s				
Volatile Organic Compounds[c]	X	X	X	X
Semivolatile Organic Compounds[c]	X	X	X	X
Total Petroleum Hydrocarbons (C_8 - C_{38})	X	X	X	X
Polychlorinated Biphenyls	X	X	X	X
Inorganic COPCs				
Total *Resource Conservation and Recovery Act* Metals[c]	X	X	X	X
Radionuclide COPCs				
Gamma Spectroscopy[d]	X[e]	X[e]	X[e]	X[f]
Isotopic Uranium	(x)	(x)	(x)	(x)
Isotopic Plutonium	(x)	(x)	(x)	(x)
Strontium-90	(x)	(x)	(x)	(x)

[a]The contaminants of potential concern are the analytes reported from the analytical methods listed.
[b]If the volume of material is limited, prioritization of the analyses will be necessary.
[c]If sample is collected for waste management purposes, analyses may also include *Toxicity Characteristic Leaching Procedure* (TCLP).
[d]Analytes to include americium-241, cesium-137, and cobalt-60.
[e] Results of on-site gamma analysis will be used to determine whether further radioanalytical analysis is warranted.

C_8 - C_{38} = Carbon-8 through carbon-38 (diesel-range and gasoline-range organics)
X = Required analytical method
(x) = Possible analytical method

A.3.2.3 Contaminant Characteristics

Contaminant characteristics include, but are not limited to: solubility, density, and adsorption potential. Contaminants with low solubility, high affinity for media, and high density can generally be expected to be found relatively close to release points. Contaminants with small particle size, high solubility, low density, and/or low affinity for media are found further from release points or in low areas where evaporation of ponding will concentrate dissolved constituents.

A.3.2.4 Site Characteristics

Site characteristics are defined by the interaction of physical, topographical, and meteorological attributes and properties. Physical properties include permeability, porosity, hydraulic conductivity, degree of saturation, sorting, chemical composition, and organic content. Topographical and meteorological properties and attributes include slope stability, precipitation frequency and amounts, precipitation runoff pathways and drainage channels (intermittant or ephemeral stream), and evapotranspiration potential.

A.3.2.5 Migration Pathways and Transport Mechanisms

Migration pathways at CAU 555 include the lateral migration of potential contaminants across surface soils/sediments and vertical migration of potential contaminants through near-subsurface soils. Primary transport mechanisms include erosion and/or mass transport or infiltration and/or leaching. Secondary transport mechanisms may include excavation.

An important element of the CSM in developing a sampling strategy is the expected fate and transport of contaminants (i.e., how contaminants migrate through media, and where they can be expected to migrate in the environment). Fate and transport of contaminants are presented in the CSM as the migration pathways and transport mechanism that could potentially move the contaminants throughout the various media. Fate and transport are influenced by physical and chemical characteristics of the contaminants and media described in Sections A.3.2.3 and A.3.2.4.

Based on the average depth to groundwater near the CAU 555 CASs, which is approximately 1,600 ft bgs, groundwater contamination is not considered to be a likely scenario. Surface migration may occur as a result of a system failure (i.e., backup in leachfield), or as runoff from precipitation. Preferential drainage routes are a biasing factor considered in the selection of sampling points and will be considered for CAS 01-59-01.

Infiltration and percolation of precipitation usually serves as a driving force for downward migration of contaminants; however, at the NTS, due to high potential evapotranspiration and limited precipitation for this region, percolation of infiltrated precipitation does not provide a significant mechanism for vertical migration of contaminants to groundwater (DOE/NV, 1992). In addition, the recharge rate to the Yucca Flat area is relatively low due to the thickness of the unsaturated zone extending to more than 600 ft bgs (USGS, 1996).

The average annual evapotranspiration for the area near the CAU 555 been estimated at approximately 62.6 in. per year (Shott et al., 1997). The average annual precipitation near the sites and at the UCC Station on the Yucca Flat dry lake bed ranges from 6.32 to 6.70 in. per year repectively (Winograd and Thordarson, 1975; DRI, 1985; ARL/SORD, 2005).

A.3.2.6 Exposure Scenarios

Human receptors may be exposed to COPCs through oral ingestion, inhalation, or dermal contact (absorption) of soil or debris due to inadvertent disturbance of these materials, or irradiation by radioactive materials. The exposure scenario for these CASs is for a Remote Work Area. These sites are located within the NTS boundaries and are limited by future land-use scenarios to site workers who may be exposed to COPCs. The future land-use scenarios at the NTS for CASs within CAU 555 include a Nuclear Test Zone within Area 6, and Nuclear and High Explosives Test Zones within Areas 1 and 3 (DOE/NV, 1998b). The potential for exposure to contamination at the CAU 555 CASs is limited to industrial and construction workers as well as military personnel conducting training. Descriptions of future land-use zones and exposure scenarios for these CASs are listed in Table A.3-4.

Table A.3-4
Exposure Scenarios and Future Land-Use Scenarios for CAU 555

CAS	Land-Use Zone	Human Receptor	Exposure Scenario
06-20-05, 06-59-01 and 06-59-02	Nuclear Test Zone The land in Area 6 of the NTS is reserved for dynamic experiments, hydrodynamic tests, and underground nuclear weapons and weapons effects tests. This zone includes compatible defense and nondefense research, development, and testing activities.	Industrial, Construction and Military Personnel	**Remote Work Area** This scenario assumes non-continuous work activities at a site where the worker regularly visits, but it is not an assigned work area where the worker spends his or her entire work day. The criteria for this exposure scenario are that powered site buildings with toilets are not present at the site, nor are any buildings anticipated to be built.
01-59-01 and 03-59-03	Nuclear and High Explosives Test Zone This land in Areas 1 and 3 area is designated within the Nuclear Test Zone for additional underground nuclear weapons and outdoor high explosives tests. This zone includes compatible defense and nondefense research, development, and testing activities.		

Source: DOE/NV, 1998b

A.4.0 Step 2 - Identify the Decisions

Step 2 of the DQO process identifies the decision statements and defines appropriate alternative actions that may be taken, depending on the answer to the decision statements.

A.4.1 Decision Statements

The Decision I statement is:

- "Is any COC present in environmental media within the CAS?"

Action levels for CAU 555 CAS contaminants are defined in Section A.7.3. Any contaminant (COPC) associated with a CAS activity that is present at concentrations exceeding its FAL will be defined as a COC and will become a target analyte. If a COC is detected, then Decision II must be resolved.

The Decision II statement is:

- "If a COC is present, is sufficient information available to evaluate potential corrective action alternatives?"

Sufficient information is defined to include the following:

- Identifying the volume of media containing any COC bounded by analytical sample results that are less than the action level in both the lateral and vertical directions.
- The information needed to characterize IDW for disposal.
- The information needed to determine potential remediation waste types.

If sufficient information is not available to evaluate potential corrective action alternatives then site conditions will be re-evaluated and additional samples will be collected (as long as the scope of the investigation is not exceeded and any CSM assumption has not been shown to be incorrect).

A.4.2 Alternative Actions to the Decisions

In this section, the actions that may be taken to solve the problem are identified depending on the possible outcomes of the investigation.

A.4.2.1 Alternative Actions to Decision I

If no COC associated with a release from the CAS is identified, then further assessment of the CAS is not required.

If a COC is identified, then the extent of the contamination will be determined and additional information required to evaluate potential correction action alternatives will be collected.

A.4.2.2 Alternative Actions to Decision II

If sufficient information is available to evaluate potential corrective action alternatives, then further assessment of the CAS is not required.

If sufficient information is not available, then an additional assessment will be required.

A.5.0 Step 3 - Identify the Inputs to the Decisions

This step identifies the information needed, determines sources for information, and identifies sampling and analysis methods that will allow reliable comparisons with FALs.

A.5.1 Information Needs

To resolve Decision I, a determination must be made whether a COC is present at a given CAS. Samples need to be collected and analyzed to meet following the following criteria:

- Samples must be collected in areas most likely to contain a COC.
- The analytical suite selected must be sufficient to identify any COCs present in the samples.

To resolve Decision II, a determination must be made whether sufficient information is available to evaluate potential corrective action alternatives at each CAS. Samples need to be collected and analyzed to meet the following criteria:

- Samples must be collected in areas contiguous to the contamination but where contaminant concentrations are below action levels.
- The analytical suites selected must be sufficient to detect contaminants at concentrations equal to or less than their corresponding FALs.
- Samples of the waste or environmental media must provide sufficient information to characterize the IDW for disposal.
- Samples of the waste or environmental media must provide sufficient information to determine potential remediation waste types.

A.5.2 Sources of Information

Information to satisfy Decision I and Decision II will be generated by collecting environmental samples using appropriate sampling methods (e.g., grab sampling, hand auguring, direct push, backhoe excavation, etc.). These samples will be submitted to analytical laboratories meeting the quality criteria stipulated in the Industrial Sites QAPP (NNSA/NV, 2002). Only validated data from analytical laboratories will be used to support DQO decisions. Sample collection and handling activities will follow standard procedures.

A.5.2.1 Sample Locations

Decision I samples are to be collected at locations most likely to contain a COC, if present. These locations will be selected based on field-screening techniques, biasing factors, the CSM, and existing information. Analytical suites for Decision I samples will include the COPCs identified in Table A.3-3.

Field-screening techniques may be used to select appropriate sampling locations by providing semiquantitative data that can be used to comparatively select samples to be submitted for laboratory analyses from several screening locations. Field screening may also be used for health and safety monitoring and to assist in making certain health and safety decisions. The following field-screening methods may be used to select analytical samples at CAU 555:

- Volatile organic compounds - A photoionization detector, or an equivalent instrument or method, may be used to conduct headspace analysis at all CASs.
- Total petroleum hydrocarbons - A gas chromatograph, or equivalent instrument/equipment or method, may be used to conduct screening for all CASs.
- Walkover surface area radiological surveys - A radiological survey instrument may be used over approximately 100 percent of the CAS boundaries, as permitted by terrain and field conditions, to detect hot spots of radiological contamination.
- Alpha and beta/gamma radiation - A hand-held radiological survey instrument may be used at all CASs.
- Gamma radiation - A radiological dose rate measurement instrument may be used at all CASs.

Biasing factors may also be used to select samples to be submitted for laboratory analyses based on existing site information and site conditions discovered during the investigation. The following factors will be considered in selecting locations for analytical samples at CAU 555:

- Documented process knowledge on source and location of release (e.g., volume of release)
- Experience and data from investigations of similar sites
- Visual indicators such as discoloration, textural discontinuities, disturbance of native soils, or any other indication of potential contamination

- Presence of debris, waste, or equipment
- Presence of odor

Decision II sample step-out locations will be selected based on the CSM, biasing factors, and existing data. Analytical suites will include those parameters that exceeded action levels (i.e., COCs) in prior samples. Biasing factors to support Decision II sample locations include Decision I biasing factors plus available analytical results.

A.5.2.2 Analytical Methods

Analytical methods are available to provide the data needed to resolve the decision statements. The analytical methods and laboratory requirements (e.g., detection limits, precision, and accuracy) are provided in Table 3-2 and Table 3-3. Table A.5-1 lists the analytes reported by the various analytical methods that are considered to be COPCs.

Table A.5-1
Analytes Reported by Specific Analytical Methods

Volatile Organic Compounds	Semivolatile Organic Compounds	Total Petroleum Hydrocarbons	Polychlorinated Biphenyls	Metals	Radionuclides
1,1,1-Trichloroethane 1,1,1,2-Tetrachloroethane 1,1,2,2-Tetrachloroethane 1,1,2-Trichloroethane 1,1-Dichloroethane 1,1-Dichloroethene cis-1,2-Dichloroethene trans-1,2-Dichloroethene 1,2-Dichloroethane 1,2-Dichloropropane 1,2,3-Trichloropropane 1,2,4-Trimethylbenzene 1,2-Dibromo-3-chloropropane 1,2-Dibromoethane 1,3,5-Trimethylbenzene cis-1,3-Dichloropropene trans-1,3-Dichloropropene 2-Butanone 2-Chlorotoluene 4-Methyl-2-pentanone Acetone Benzene Bromobenzene Bromochloromethane Bromodichloromethane Bromoform Bromomethane Carbon disulfide Carbon tetrachloride Chlorobenzene Chloroethane Chloroform Chloromethane Dibromochloromethane Dibromomethane Dichlorodifluoromethane Ethylbenzene Isopropylbenzene Iodomethane Methyl tertiary butyl ether Methylene chloride N-Butylbenzene N-Propylbenzene sec-Butylbenzene Styrene tert-Butylbenzene Tetrachloroethene Toluene Trichloroethene Trichlorofluoromethane Trichlorotrifluoroethane Vinyl acetate Vinyl chloride Xylene	1,2,4-Trichlorobenzene[a] 1,2-Dichlorobenzene[a] 1,3-Dichlorobenzene[a] 1,4-Dichlorobenzene[a] 2,4,5-Trichlorophenol 2,4,6-Trichlorophenol 2,4-Dichlorophenol 2,4-Dimethylphenol 2,4-Dinitrophenol 2,4-Dinitrotoluene 2,6-Dinitrotoluene 2-Chloronaphthalene 2-Chlorophenol 2-Methylphenol 2-Nitroaniline 3,3'-Dichlorobenzidine 4-Bromophenyl phenyl ether 4-Chloroaniline 4-Methylphenol 4-Nitrophenol Acenaphthene Acenaphthylene Aniline Anthracene Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(g,h,i)perylene Benzo(k)fluoranthene Benzoic Acid Benzyl Alcohol Bis(2-chloroethoxy) methane Bis(2-chloroethyl) ether Bis(2-chloroisopropyl) ether Bis(2-ethylhexyl) phthalate Butyl benzyl phthalate Carbazole Chrysene Dibenzo(a,h) anthracene Dibenzofuran Diethyl Phthalate Dimethyl Phthalate Di-n-butyl Phthalate Di-n-octyl Phthalate Fluoranthene Fluorene Hexachlorobenzene Hexachlorobutadiene[a] Hexachloro cyclopentadiene Hexachloroethane Indeno(1,2,3-cd)pyrene Isophorone Naphthalene[a] Nitrobenzene N-Nitroso-di-n-propylamine N-Nitrosodimethylamine N-Nitrosodiphenylamine Pentachlorophenol Phenanthrene Phenol Pyrene Pyridine	Total Petroleum Hydrocarbons Diesel-range organics Gasoline-range organics	Aroclor-1016 Aroclor-1221 Aroclor-1232 Aroclor-1242 Aroclor-1248 Aroclor-1254 Aroclor-1260	Arsenic Barium Cadmium Chromium Lead Mercury Selenium Silver	Gamma-emitting radionuclides: Americium-241 Cesium-137 Cobalt-60 Other parameters: Plutonium-238 Plutonium-239/240 Strontium-90 Uranium-234 Uranium-235 Uranium-238

[a]May be reported with volatile organic compounds.

A.6.0 Step 4 - Define the Boundaries of the Study

The purpose of this step is to define the population of interest, define the spatial boundaries, determine practical constraints on data collection, and define the scale of decision making.

A.6.1 Populations of Interest

The population of interest to resolve Decision I ("Is any COPC present in environmental media within the CAS at a concentration exceeding its corresponding action level?") is:

- Any single location within the site that is contaminated with any contaminant above an action level.

The populations of interest to resolve Decision II ("If a COC is present, is sufficient information available to evaluate potential corrective action alternatives?") are:

- Each one of a set of locations bounding contamination in lateral and vertical directions.
- Potential investigation derived or remediation waste.
- Environmental media where natural attenuation or biodegradation or construction/evaluation of barriers is considered.

A.6.2 Spatial Boundaries

Spatial boundaries are the maximum lateral and vertical extent of expected contamination at each CAS, as described in Table A.6-1. Contamination found beyond these boundaries may indicate an initial design flaw in the CSM and may require re-evaluation of the CSM before the investigation could continue. Each CAS is considered geographically independent, and intrusive activities are not intended to extend into the boundaries of neighboring CASs.

A.6.3 Practical Constraints

Other NTS activities may affect the ability to completely, effectively, or adequately investigate some or all of the CASs. Underground utilities also exist at these sites, which may limit intrusive sampling locations. Other practical constraints at each CAS may include rough terrain and access restrictions.

Table A.6-1
Spatial Boundaries at CAU 555 CASs

Corrective Action Site	Spatial Boundaries
CAS 01-59-01	The footprint of the septic system beginning at the outside edge of the building foundation(s) where the system originated and continuing along subsurface piping to the far outside edge of the leachfield, plus a lateral buffer of 50 feet (ft) to take into consideration the washes just to the north and south of the leachfield. (Contamination is not expected to be found greater than 15 ft from any CAS component.) A vertical boundary of up to 17 ft below ground surface (bgs) has been identified for this CAS.
CAS 03-59-03	The footprint of the septic system beginning at the outside edge of the building foundation(s) where the system originated and continuing along subsurface piping to the far outside edge of the leach pit, plus a lateral buffer of 25 ft. (Contamination is not expected to be found greater than 15 ft from any CAS component.) A vertical boundary of up to 17 ft bgs has been identified for this CAS.
CAS 06-20-05	The footprint of the dry well drain lines beginning at the outside edge of the building foundation where the drain lines originate and continuing along piping to the far outside edge of the dry well, plus a lateral buffer of 25 ft. (Contamination is not expected to be found greater than 15 ft from any CAS component.) A vertical boundary of up to 17 ft bgs has been identified for this CAS.
CAS 06-59-01	The footprint of the septic system beginning at the outside edge of the building foundation(s) where the system originated and continuing along subsurface piping to the far outside edge of the leachfield, plus a lateral buffer of 25 ft. (Contamination is not expected to be found greater than 15 ft from any CAS component.) A vertical boundary of up to 17 ft bgs has been identified for this CAS.
CAS 06-59-02	The footprint of the septic system beginning at the outside edge of the building foundation(s) where the system originated and continuing along subsurface piping to the outside edge of the leachfield, plus a lateral buffer of 25 ft. (Contamination is not expected to be found greater than 15 ft from any CAS component.) A vertical boundary of up to 17 ft bgs has been identified for this CAS.

Access restrictions include scheduling conflicts on the NTS with other entities, areas posted as contamination areas requiring appropriate work controls, physical barriers (e.g., fences, buildings, steep slopes), and areas requiring authorized access. Underground utilities surveys will be conducted at each CAS before the start of investigation activities to determine the presence and location of buried lines in the immediate area.

A.6.4 Define the Scale of Decision Making

The scale of decision making in Decision I is defined as the CAS. Any COC detected at any location within the CAS will cause the determination that the CAS is contaminated and needs further evaluation. The scale of decision making for Decision II is defined as a contiguous area contaminated with any COC originating from the CAS. Resolution of Decision II requires this contiguous area to be bounded laterally and vertically.

A.7.0 Step 5 - Develop a Decision Rule

This step develops a decision rule ("If..., then...") statement that defines the conditions under which possible alternative actions will be chosen. In this step, we specify the statistical parameters that characterizes the population of interest, specify the action levels, confirm that detection limits are capable of detecting action levels, and present decision rules.

A.7.1 Population Parameters

Each sample result representing each population of interest defined in Step 4 will be compared to the action levels to determine the appropriate resolution to Decision I and Decision II. For the Decision I population of interest, a single analytical sample result above FALs would cause a determination that a COC is present within the CAS. For the Decision II population of interest, a single analytical sample result above FALs would cause a determination that the contamination is not bounded in one direction.

Because this approach does not use a statistical average for comparison to the action levels, but rather a point-by-point comparison, the population parameter for both populations of interest is the observed concentration of each analyte from individual analytical sample results.

A.7.2 Decision Rules

The decision rules applicable to both Decision I and Decision II are:

- If COC contamination is inconsistent with the CSM or extends beyond the spatial boundaries identified in Section A.6.2, then work will be suspended and the investigation strategy will be reconsidered.
- If a COC is present, is consistent with the CSM, and is within spatial boundaries, then the decision will be to continue sampling to define the extent.

The decision rules for Decision I are:

- If the population parameter (the observed concentration of each analyte) of any COPC in the Decision I population of interest (defined in Step 4) exceeds the corresponding FAL, then that analyte is identified as a COC, and Decision II samples will be collected.

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

The decision rules for Decision II are:

- If the population parameter (the observed concentration of any COC) in the Decision II population of interest (defined in Step 4) exceeds the corresponding action level, then additional samples will be collected to complete the Decision II evaluation.
- If all bounding COC concentrations are less than the corresponding FALs, then the decision will be that the extent of contamination has been defined in the corresponding lateral and/or vertical direction.

If valid analytical results are available for the waste characterization samples defined in Section A.9.0, then the decision will be that sufficient information exists to characterize the IDW for disposal, determine potential remediation waste types, and to evaluate the feasibility of remediation alternatives.

A.7.3 Action Levels

The PALs presented in this section are to be used primarily for site screening purposes. They are not necessarily intended to be used as cleanup action levels or FALs. However, they are useful in screening out analytes that are not present in sufficient concentrations to support further evaluation, and therefore streamline the consideration of remedial alternatives. The process that will be used to move from PALs to FALs is that specified by NAC 445A.2272 (NAC, 2004). This regulation stipulates that determination of FALs shall be established by an evaluation of the site based on the risk it poses to public health and the environment. This evaluation will be conducted using Method E 1739-95, adopted by the ASTM (ASTM, 1995). The ASTM's RBCA process is summarized in Section 3.3. The Tier 1 action levels for Decision I and Decision II are the PALs defined below and in Section 3.3. If necessary, a Tier 2 or Tier 3 evaluation will be conducted by calculating site-specific target levels. If a Tier 2 or Tier 3 evaluation is conducted for TPH, the hazardous constituents of TPH will be compared to the SSTLs, as the general measure of TPH provides insufficient information about the amounts of individual COCs within the TPH measurement.

The comparison of laboratory results to FALs and the evaluation of potential corrective actions will be included in the investigation report. The FALs will be proposed (along with the basis for their selection) in the investigation report.

A.7.3.1 Chemical PALs

Except as noted herein, the chemical PALs are defined as the EPA Region 9 risk-based PRGs for chemical constituents in industrial soils (EPA, 2004a). Background concentrations for RCRA metals and zinc will be used instead of PRGs when natural background concentrations exceed the PRG, as is often the case with arsenic on the NTS. Background is considered the mean plus two standard deviations of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (formerly the Nellis Air Force Range) (NBMG, 1998; Moore, 1999). For detected chemical COPCs without established PRGs that have toxicity and carcinogenicity data listed in the EPA IRIS database (EPA, 2004b), the protocol used by the EPA Region 9 in establishing PRGs (or similar) will be used to establish PALs. If used, this process will be documented in the investigation report.

A.7.3.2 Total Petroleum Hydrocarbon PALs

The PAL for TPH is 100 ppm as listed in NAC 445A.2272 (NAC, 2004).

A.7.3.3 Radionuclide PALs

The PALs for radiological contaminants (other than tritium) are based on the NCRP Report No. 129 recommended screening limits for construction, commercial, industrial land-use scenarios (NCRP, 1999) scaled to 25 mrem/yr dose constraint (Murphy, 2004) and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993). These PALs are based on the construction, commercial, and industrial land-use scenario provided in the guidance and are appropriate for the NTS based on future land use scenarios as presented in Section A.3.2. The specific radiological PALs for CAU 555 are listed in Table 3-3. The radiological PAL for solid media will be defined as the unrestricted-release criteria defined in the NV/YMP RadCon Manual (NNSA/NSO, 2004). Solid media such as concrete and/or structures may pose a potential radiological exposure risk to site workers if contaminated.

A.7.4 Measurement and Analysis Sensitivity

The measurement and analysis methods listed in Section A.5.2.2 and in the *Industrial Sites QAPP* (NNSA/NV, 2002) are capable of measuring analyte concentrations at or below the corresponding FALs for each COPC. See Section 6.2.8 of this document for additional details.

A.8.0 Step 6 - Tolerable Limits on Decision Errors

The purpose of this step is to specify performance criteria for the decision rule. Setting tolerable limits on decision errors requires the planning team to weigh the relative effects of threat to human health and the environment, expenditure of resources, and consequences of an incorrect decision. Section 7.1 of the EPA's DQO guidelines states that if judgmental sampling approaches are used, quantitative statements about data quality will be limited to measurement error (EPA, 2000a). Measurement error is influenced by imperfections in the measurement and analysis system. Random and systematic measurement errors are introduced in the measurement process during physical sample collection, sample handling, sample preparation, sample analysis, and data reduction. If measurement errors are not controlled, they may lead to errors in making the DQO decisions.

This section provides an assessment of the possible outcomes of DQO decisions and the impact of those outcomes if the decisions are in error.

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

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

Decisions and/or criteria have false rejection (false negative) or false acceptance (false positive) errors associated with their determination. The impact of these decision errors and the methods that will be used to control these errors are discussed in the following subsections. In general terms, confidence in DQO decisions based on judgmental sampling results will be established qualitatively by:

- Developing CSMs (based on process knowledge) by stakeholder participants during the DQO process.

- Testing the validity of CSMs based on investigation results.

- Evaluating the quality of the data based on DQI parameters.

A.8.1 False Negative Decision Error

The false negative decision error would mean deciding that a COC is not present when it actually is (Decision I), or deciding that the extent of a COC has been defined when it has not (Decision II). In both cases the potential consequence is an increased risk to human health and environment.

The false negative decision error (where consequences are more severe) is controlled by meeting these criteria:

1. For Decision I, having a high degree of confidence that the sample locations selected will identify COCs if present anywhere within the CAS. For Decision II, having a high degree of confidence that the sample locations selected have identified the extent of COCs.

2. Having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.

3. Having a high degree of confidence that the dataset is of sufficient quality and completeness.

To satisfy the first criterion, Decision I samples must be collected in areas most likely to be contaminated by COCs (supplemented by random samples where appropriate). Decision II samples must be collected in areas that represent the lateral and vertical extent of contamination (above action levels). The following characteristics must be considered to control decision errors for the first criterion:

- 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 and selection of sampling locations. The field-screening methods and biasing factors listed in Section A.5.2.1 will be used to further ensure that appropriate sampling locations are selected to meet these criteria. Radiological survey instruments and field-screening equipment will be calibrated and checked in accordance with the manufacturer's instructions and approved procedures. The investigation report will present an assessment on the DQI of representativeness that samples were collected from those locations that best represent the populations of interest as defined in Section A.6.1.

To satisfy the second criterion, Decision I samples will be analyzed for the chemical and radiological parameters listed in Section 3.2 of the CAIP. Decision II samples will be analyzed for those chemical and radiological parameters that identified unbounded COCs. The DQI of sensitivity will be assessed for all analytical results to ensure that all sample analyses had measurement sensitivities (detection limits) that were less than or equal to the corresponding FALs. If this criterion is not achieved, the affected data will be assessed for usability and potential impacts on meeting site characterization objectives in the investigation report.

To satisfy the third criterion, the entire dataset, as well as individual sample results, will be assessed against the DQIs of precision, accuracy, comparability, and completeness as defined in the *Industrial Sites QAPP* (NNSA/NV, 2002) and in Section 6.2.2 of the CAIP. The DQIs of precision and accuracy will be used to assess overall analytical method performance as well as to assess the need to potentially "flag" (qualify) individual analyte results when corresponding QC sample results are not within the established control limits for precision and accuracy. Data qualified as estimated for reasons of precision or accuracy may be considered to meet the analyte performance criteria based on an assessment of the data. The DQI of completeness will be assessed to ensure that all data needs identified in the DQO have been met. The DQI of comparability will be assessed to ensure that all analytical methods used are equivalent to standard EPA methods so that results will be comparable to regulatory action levels that have been established using those procedures. Site-specific DQIs are discussed in more detail in Section 6.2.2 of the CAIP. Strict adherence to established procedures and QA/QC protocol protects against false negatives.

To provide information for the assessment of the DQIs of precision and accuracy, the following quality control samples will be collected as outlined by the *Industrial Sites QAPP* (NNSA/NV, 2002):

- Field duplicates (minimum of 1 per matrix per 20 environmental samples, per CAS)
- Laboratory QC samples (minimum of 1 per matrix per 20 environmental samples, or if less than 20 collected, 1 per CAS per matrix)

A.8.2 False Positive Decision Error

The false positive (beta) decision error would mean deciding that a COC is present when it is not, or deciding a COC is unbounded when it is not, resulting in increased costs for unnecessary sampling and analysis.

False positive results are typically attributed to laboratory and/or sampling/handling errors that could cause cross contamination. To control against cross contamination, decontamination of sampling equipment will be conducted according to established and approved procedures and only clean sample containers will be used.

To determine whether a false positive analytical result may have occurred, the following quality control samples will be collected as outlined by the *Industrial Sites QAPP* (NNSA/NV, 2002):

- Trip blanks (1 per sample cooler containing VOC environmental samples)
- Equipment rinsate blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per source lot per sampling event)
- Field blanks (minimum of 1 per CAS - additional if field conditions change)

A.9.0 Step 7 - Optimize the Design for Obtaining Data

This section provides the general approach for obtaining the information necessary to resolve Decision I and Decision II. A judgmental (nonprobabilistic) sampling scheme will be implemented to select sample locations and evaluate analytical results. Judgmental sampling allows the methodical selection of sample locations that target the populations of interest (defined in Step 4) rather than non-selective random locations. Random sample locations are used to generate average contaminant concentrations that estimate the true average ("characteristic") contaminant concentration of the site to some specified degree of confidence.

Because individual sample results, rather than an average concentration, will be used to compare to FALs, statistical methods to generate site characteristics will not be needed. Section 0.4.4 of the EPA *Data Quality Objectives Process for Hazardous Waste Site Investigations* (EPA, 2000b) guidance states that the use of statistical methods may not be warranted by program guidelines or site-specific sampling objectives. The need for statistical methods is dependent upon the decisions being made. Section 7.1 of the EPA's guidance state that a nonprobabilistic (judgmental) sampling design is developed when there is sufficient information on the contamination sources and history to develop a valid CSM and to select specific sampling locations. This design is used to confirm the existence of contamination at specific locations and provide information (such as extent of contamination) about specific areas of the site.

All sample locations will be selected to satisfy the DQI of representativeness in that samples collected from selected locations will best represent the populations of interest as defined in Section A.6.1. To meet this criterion, a judgmental sampling strategy will be used for Decision I to target areas with the highest potential for contamination, if it is present anywhere in the CAS. Sample locations will be determined based on process knowledge, previously acquired data, or the field-screening and biasing factors listed in Section A.5.2.1. If biasing factors are present in soils below locations where Decision I samples were removed, additional Decision I soil samples will be collected at depth intervals selected by project personnel until biasing factors are no longer present. Sample locations can be modified during the CAI, but only if the modified locations meet the decision needs and criteria stipulated in this DQO.

To meet the DQI of representativeness for step-out/Decision II samples (i.e., Decision II sample locations represent the population of interest as defined in Section A.6.1), sampling locations at each CAS will be selected based on the outer boundary sample locations where COCs were detected, the CSM, and other field-screening and biasing factors listed in Section A.5.2.1. In general, sample locations will be arranged in a triangular pattern around the Decision I location at distances based on site conditions, process knowledge, and biasing factors. If COCs extend beyond the initial step-outs, Decision II samples will be collected from incremental step-outs. Initial step-outs will be at least as deep as the vertical extent of contamination defined at the Decision I location and the depth of the incremental step-outs will be based on the deepest contamination observed at all locations. A clean sample (i.e., COCs less than FALs) collected from each step-out direction (lateral or vertical) will define extent of contamination in that direction. The number, location, and spacing of step-outs may be modified by the Site Supervisor, as warranted by site conditions.

The following sections discuss CAS-specific investigation activities, including proposed sample locations. As the sampling strategy for each CAS is developed, specific biasing factors will be described. In the absence of biasing factors, samples will be collected from the default sampling locations determined for each CAS, as described in the following sub-sections.

Sample locations selected will be biased to areas most likely to be impacted by contaminants, if present, and are based on the *Work Plan for the Leachfield Corrective Action Units: Nevada Test Site and Tonopah Test Range,* (DOE, 1998a). As discussed in Section A.2.0, radiological soil contamination at these sites originating from nuclear testing is specifically excluded from this investigation. If such contamination exists, it will be addressed by the Soils Program. In addition, the CAS scope does not include subsurface piping beneath existing building foundations or concrete pads.

A.9.1 Corrective Action Site 01-59-01, Area 1 Camp Septic System

Decision I sampling locations proposed for this site are identified on Figure A.9-1. These sample locations are biased to areas most likely to be impacted by contaminants, if present. The actual locations will be selected based on "as-built" engineering drawings, utility clearances, biasing factors (i.e., staining) and site conditions as documented during the initial visual inspection.

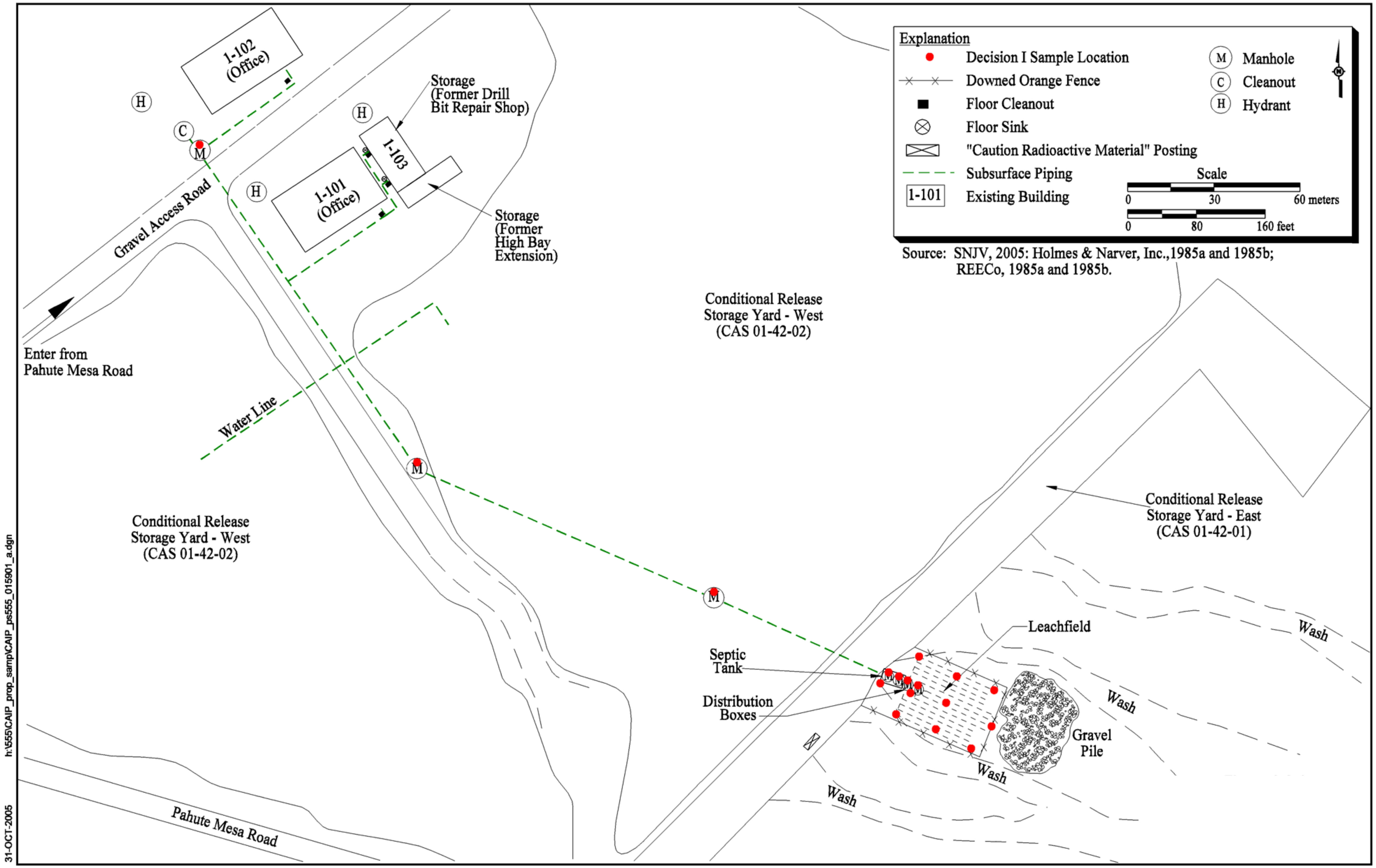


Figure A.9-1
CAU 555, CAS 01-59-01, Area 1 Camp Septic System Proposed Sample Locations

Manholes, the septic tank, and distribution boxes will be visually inspected for residual material. If residual material is present in an adequate volume, a sample will be collected for analysis to support environmental and waste management decisions. Depending on analytical results of the residual material, a video-mole survey may be conducted on the subsurface piping associated with the septic system to identify any breaches. If breaches in the piping are encountered, soil samples will be collected at a location directly below the respective breach. In addition, the soil horizon at the base and inlet/outlet piping of the manholes, septic tank and distribution boxes will be inspected for signs of failure. If stained soil is encountered at any of these locations, a minimum of one shallow subsurface soil samples will be collected and analyzed.

The leachfield at CAS 01-59-01 will be sampled in the following manner: A minimum of one shallow subsurface soil sample will be collected at each corner of the leachfield directly below the proximal ends (at the entrance of leachfield) and directly below the distal ends (at the exit of leachfield) of the leach lines. In addition, a minimum of one shallow subsurface soil sample each will be collected from beneath the selected leach line down the center of the leachfield at the proximal and distal ends. Additional samples will be collected at selected leach lines at the midpoint.

Based on Decision I sampling results for this CAS, Decision II samples may be collected at locations surrounding the Decision I sampling point.

A.9.2 Corrective Action Site 03-59-03, Core Handling Building Septic System

Decision I sample locations proposed for this site are identified on Figure A.9-2. These sample locations are biased to areas most likely to be impacted by contaminants, if present. The actual locations will be selected based on "as-built" engineering drawings, utility clearances, biasing factors (i.e., staining) and site conditions as documented during the initial visual inspection.

A minimum of one shallow subsurface soil sample will be collected at the former septic tank location. A minimum of one subsurface soil samples will be collected at the suspected former discharge point to the leach pit, and a minimum of one subsurface soil sample will be collected beneath the suspected bottom of the gravel that lined the leach pit.

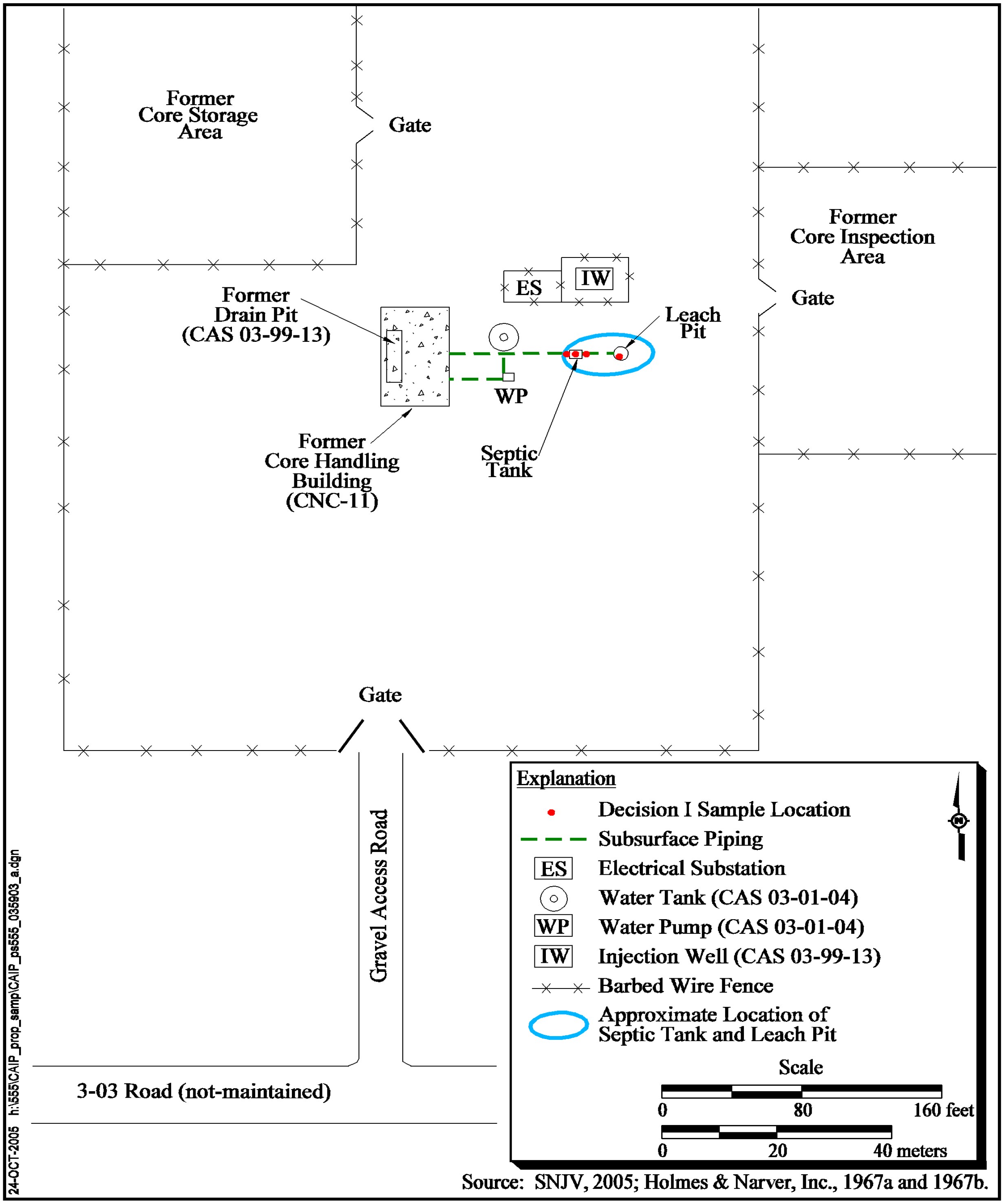


Figure A.9-2
CAS 03-59-03, Core Handling Building Septic System
Proposed Sampling Locations

Depending upon Decision I sampling results for this CAS, Decision II soil samples may be collected from locations surrounding the respective Decision I sampling point.

A.9.3 Corrective Action Sites 06-20-05 and 06-59-01, Birdwell Dry Well and Septic System

Decision I sample locations proposed for this site are identified on Figure A.9-3. These sample locations are biased to areas most likely to be impacted by contaminants, if present. The actual locations will be selected based on "as-built" engineering drawings, utility clearances, biasing factors (i.e., staining) and site conditions as documented during the initial visual inspection.

Manholes, the septic tank and distribution boxes will be visually inspected for residual material. If residual material is present in an adequate volume, a sample will be collected for analysis to support waste characterization. Depending on analytical results of the residual material, a video-mole survey may be conducted on the subsurface piping associated with the septic system. If breaches in the piping are encountered, a soil samples will be collected at a location directly below the respective breach. In addition, the soil horizon at the base and inlet/outlet piping of the manholes, septic tank and distribution boxes will be inspected for signs of failure. If stained soil is encountered at any of these locations, a minimum of one shallow subsurface soil samples will be collected and analyzed.

The leachfield will be sampled in the following manner: A minimum of one shallow subsurface soil sample will be collected at each corner of the leachfield directly below the proximal ends (at the entrance of leachfield) and directly below the distal ends (at the exit of leachfield) of the leach lines. In addition, a minimum of one shallow subsurface soil sample each will be collected from beneath the selected leach line down the center of the leachfield at the proximal midpoint and distal ends.

The dry well will be sampled in the following manner: A minimum of one shallow subsurface soil sample each will be collected directly beneath the pipe inlet and below the bottom-most aggregate layer in the native soil.

Based on the Decision I sampling results for this CAS, Decision II samples may be collected from locations surrounding the Decision I sampling point.

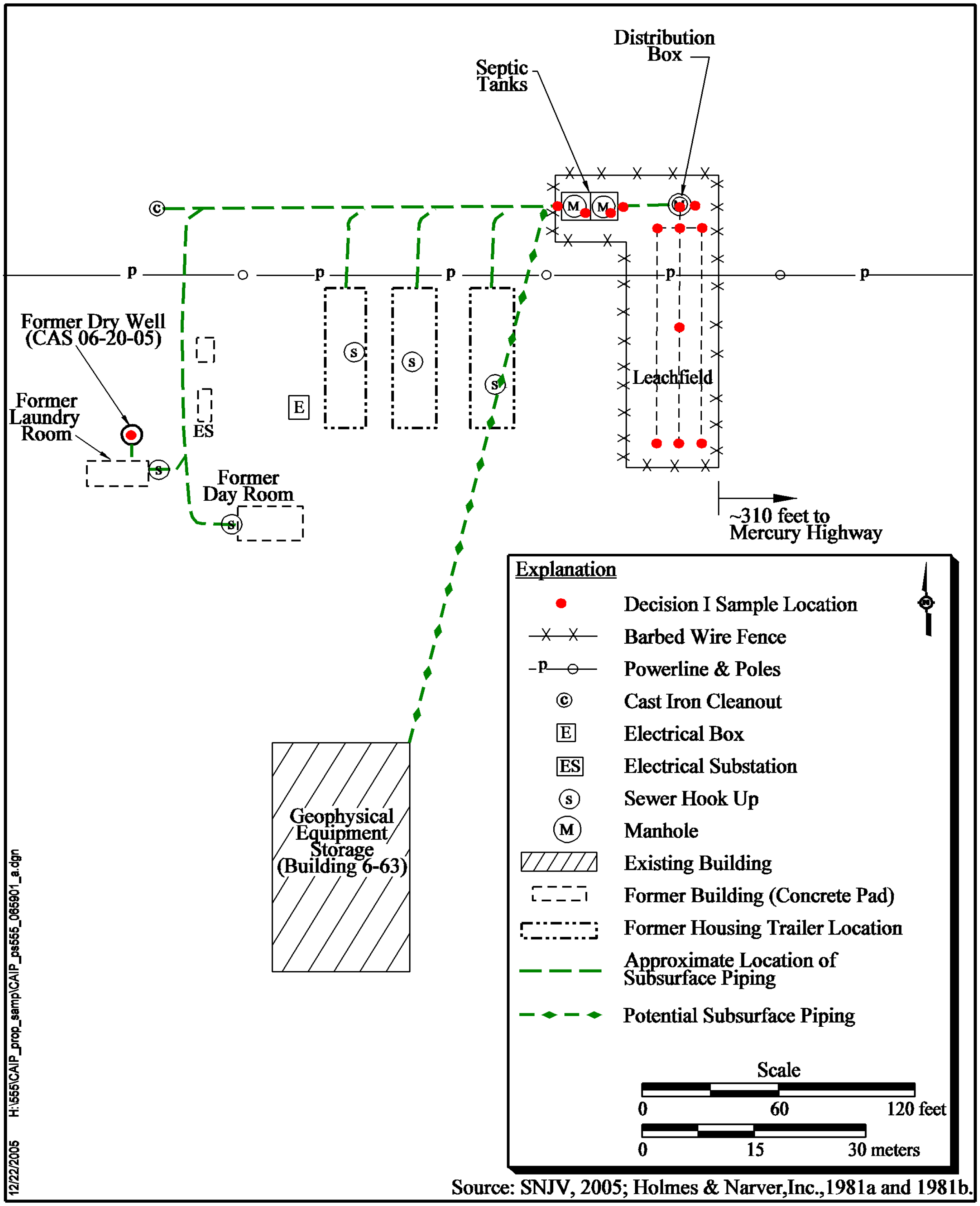


Figure A.9-3
CAS 06-20-05, Birdwell Dry Well, and
CAS 06-59-01, Birdwell Septic System

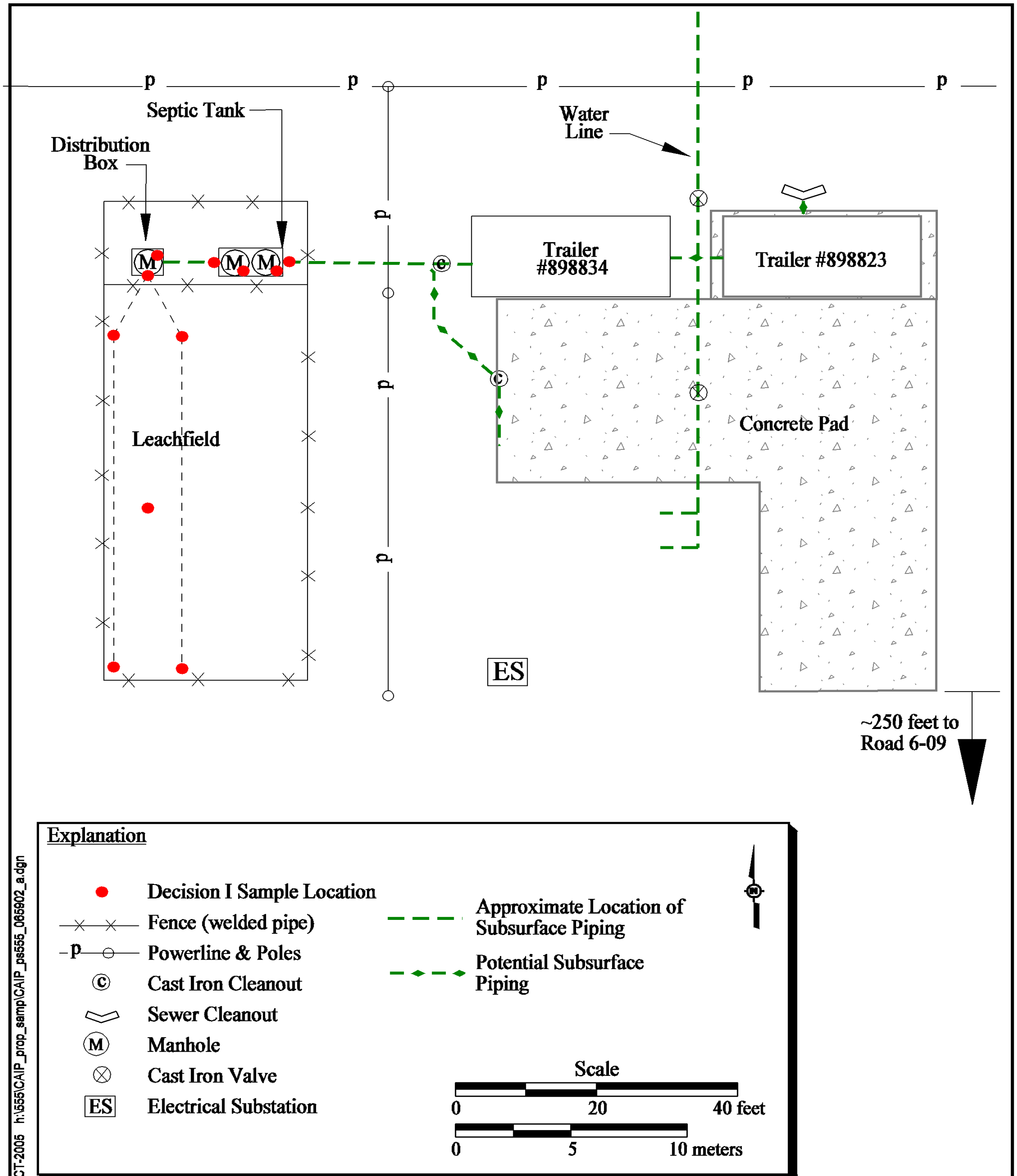
A.9.4 Corrective Action Site 06-59-02, National Cementers Septic System

Decision I sample locations proposed for this site are identified on Figure A.9-4. These sample locations are biased to areas most likely to be impacted by contaminants, if found. The actual locations will be selected based on "as-built" engineering drawings, utility clearances, biasing factors (i.e., staining) and site conditions as documented during the initial visual inspection.

Manholes, the septic tank and distribution boxes will be visually inspected for residual material. If residual material is present in an adequate volume, a sample will be collected for analysis to support waste characterization. Depending on analytical results of the residual material, a video-mole survey may be conducted on the subsurface piping associated with the septic system. If breaches in the piping are encountered, a soil samples will be collected at a location directly below the respective breach. In addition, the soil horizon at the base and inlet/outlet piping of the manholes, septic tank and distribution boxes will be inspected for signs of failure. If stained soil is encountered at any of these locations, a minimum of one shallow subsurface soil samples will be collected and analyzed.

The leachfield will be sampled in the following manner: A minimum of one shallow subsurface soil sample will be collected at each corner of the leachfield directly below the proximal ends (at the entrance of leachfield) and directly below the distal ends (at the exit of leachfield) of the leach lines. In addition, one sample will be collected from the center of the leachfield.

Based on the Decision I sampling results for this CAS, Decision II samples may be collected at locations surrounding the Decision I sampling point.



Source: SNJV, 2005; Holmes & Narver, Inc., 1981a and 1981b.

Figure A.9-4
CAS 06-59-02, National Cementers Septic System
Proposed Sample Locations

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Appendix B

Project Organization for CAU 555

B.1.0 Project Organization

The acting NNSA/NSO Project Manager is Kevin Cabble and he can be contacted at (702) 295-5000. The NNSA/NSO Task Manager is Sabine Curtis and she can be contacted at (702) 295-0542.

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 or Defense Threat Reduction Agency Project Manager be contacted for further information. The Task Manager will be identified in the FFACO Monthly Activity Report before the start of field activities.

Appendix C

Nevada Division of Environmental Protection Comments

NEVADA ENVIRONMENTAL RESTORATION PROJECT

DOCUMENT REVIEW SHEET

1. Document Title/Number: Draft Corrective Action Investigation Plan for Corrective Action Unit 555: Septic Systems, Nevada Test Site, Nevada	**2. Document Date:** 11/01/2005
3. Revision Number: 0	**4. Originator/Organization:** Stoller-Navarro
5. Responsible NNSA/NV ERP Project Manager: Kevin Cabble	**6. Date Comments Due:** 12/14/2005
7. Review Criteria: Full	
8. Reviewer/Organization/Phone No: Don Elle and Jeff MacDougall, NDEP, 486-2850	**9. Reviewer's Signature:**

10. Comment Number/Location	**11. Type***	**12. Comment**	**13. Comment Response**	**14. Accept**
1.) Section 3.3, Page 26 of 60, 3rd Paragraph	Mandatory	The last sentence states that the rationale and justification for using a Tier 3 evauation will be presented in the investigation report (see Figure 3-2). Figure 3-2 is currently the graphical representation of the conceptual site model. Figure 3-3 appears to be more appropriate reference for this statement. Please modify the sentence to address this ambiguity.	Agree. The referenced table has been correct to state Figure 3-3.	Yes
2.) Section 4.2.4, Page 36 of 60, 1st Paragraph	Mandatory	It states that Section 3.4 provides the analytical methods and laboratory requirements to be used when analyzing the COPCs. Actually Section 3.3 is a more appropriate reference. Please modify this sentence to address this ambiguity.	Section 3.4 does provide information on the analytical methods and laboratory requirements to be used when analyzing the COPCs. However, Table 3-2 was missplaced in Section 3.3 causing ambiquity. The table has been moved to Section 3.4.	Yes

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