RECORD OF TECHNICAL CHANGE

Technical Change No. CAIP - 1 | Page 1 of 2

Project/Job No. IS05-140 | Date MAY 1 6 2005

Project/Job Name Industrial Sites / CAU 224 CAIP

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

David Strand (Name) | Project Task Manager (Title)

Description of Change:

Page 25. Table 3-2, Analytical Requirements for CAU 224. Remove the analytical parameter of sulfide from the table.

Page 28 Table 3-3, Contaminants of Potential Concern for CAU 224. Remove the COPCs of methanol and sulfide from the table.

Page A-5. Table A.1-1. Decision I Contaminants of Potential Concern Per CAS. Remove the COPCs methanol and sulfide from the table.

Page A-19, Section A.1.1.5, Third Paragraph, Second Line. Remove "(including methanol)."

Page A-24. Remove "sulfide," from the last sentence.

Page A-25. Remove "sulfide," from the 4th paragraph.

Page A-41. Table A.1-6. Analytical Methods for Laboratory Analysis. Remove the analytical parameters of methanol and sulfide from the table.

Justifications: The fate of methanol in water, surface and subsurface soils is expected to be complete degradation within one year or less. Methanol rapidly evaporates from dry surfaces. Methanol should be removed from the list of analyses in the 224 CAIP due to the number of years since it was last used and the fact that any residual methanol in CASs 06-05-01, 06-17-04, and 06-23-01 would be completely evaporated or degraded and, therefore non-detectable in any samples collected. *Soil and Fertilizers and Fertility (4th Edition),* Tisdale et al, 1985.

Sulfide was mistakenly identified as a COPC in the 224 CAIP for CAS 23-25-02 based on documentation that indicated hydrogen sulfide and sulfuric acid were once used in the lab that the leachfield serviced. Neither of these can produce sulfide in soil or water. Sulfide, if it were to have existed in the CAS soils, would immediately oxidize into sulfate, which is abundant in soils and poses no threat to human health or the environment. *National Library of Medicine Website*

Page A-5, Table A.1-1. Insert superscript "c" at bottom of page with the following text:

"Only 25% of samples submitted will be analyzed for the radionuclides listed except CASs 06-05-01, 06-17-04, 06-23-01, and 23-05-02 where 100% of samples submitted for analysis will analyzed for the listed radionuclides."

Justification:

This is standard practice to submit only 25% of samples for rad analysis at CASs that are not suspected to have or have no history of containing radiological contaminants. All samples are field screened prior to collection. This statement was inadvertently left off of Table A.1-1.

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

Applicable Project-Specific Document(s): ***Corrective Action Investigation Plan for Corrective Action Unit 224: Decon Pad and Septic Systems Nevada Test Site, Nevada, Revision 0, April 2004.***

CC:

Approved By: Sabine Curtis Date 3-1-05
Sabine T. Curtis, Acting Project Manager
Industrial Sites Project

Janet Appenzeller-Wing Date 3-1-05
Janet Appenzeller-Wing, Acting Division Director
Environmental Restoration Division

NDEP Concurrence Yes X No ___ Date ___________
NDEP Signature ___________
Contract Change Order Required Yes___ No ___
Contract Change Order No. ___________

RECORD OF TECHNICAL CHANGE

Technical Change No. CAIP-2 Page 1 of 1

Project/Job No. IS05-160 Date MAY 16 2005

Project/Job Name CAIP for CAU 224: Decon Pad and Septic Systems, Rev. 0, April 2004

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

David Strand	Task Manager – Industrial Sites
(Name)	(Title)

Description of Changes:

Section 3.3, Page 29, fourth bullet: Change text from, "scaled from 25 to 15 millirem…" to "based on 25 millirem…"

Section A.1.4.2, Page A-37, fourth bullet: Change text from, "scaled from 25 to 15 mrem…" to "based on 25 mrem…"

Section A.1.4.2, Page A-38, first sentence: Change sentence to read, "As indicated above, the radiochemistry PALs are based on the NCRP 25 mrem per year dose-based levels (NCRP, 1999) and the recommended levels for certain radionuclides in DOE Order 5400.5 Change 2 (DOE, 1993).

Justification:

The Preliminary Action Levels (PALs) values for radiological isotopes in the environment are calculated based on 25 mrem per year exposure level, not 15 mrem per year, as agreed between NNSA/NSO, NDEP and SNJV for the Industrial Sites project.

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

Applicable Project-Specific Document(s):
Corrective Action Investigation Plan for Corrective Action Unit 224: Decon Pad and Septic Systems, Rev.0, April 2004

Approved By: Sabine Curtis Date 5-11-05
NNSA/NSO Project Manager

Robert M. Bangerter Jr. Date 5/11/05
NNSA/NSO Environmental Restoration Division Director

[signature] Date 5/12/05
NDEP

Nevada
Environmental
Restoration
Project

DOE/NV--965

National Nuclear Security Administration

Corrective Action Investigation Plan for Corrective Action Unit 224: Decon Pad and Septic Systems Nevada Test Site, Nevada

Controlled Copy No.: ___
Revision No.: 0

April 2004

Environmental Restoration
Division

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

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DOE/NV--965

CORRECTIVE ACTION INVESTIGATION PLAN FOR CORRECTIVE ACTION UNIT 224: DECON PAD AND 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

April 2004

CORRECTIVE ACTION INVESTIGATION PLAN FOR CORRECTIVE ACTION UNIT 224: DECON PAD AND SEPTIC SYSTEMS NEVADA TEST SITE, NEVADA

Approved by: Signature Approved Date: 4-15-04

Kevin Cabble, Acting Project Manager
Industrial Sites Project

Approved by: Signature Approved Date: 4-19-04

Janet Appenzeller-Wing, Acting Division Director
Environmental Restoration Division

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List of Acronyms and Abbreviations

bgs	Below ground surface
BN	Bechtel Nevada
CADD	Corrective Action Decision Document
CAI	Corrective action investigation
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CFR	*Code of Federal Regulations*
CI	Cast iron
CLP	Contract Laboratory Program
COC	Contaminant of concern
COPC	Contaminant of potential concern
CRDL	Contract-required detection limit
CSM	Conceptual site model
DoD	U.S. Department of Defense
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
FFACO	*Federal Facility Agreement and Consent Order*
FSL	Field-screening level
FSR	Field-screening result

List of Acronyms and Abbreviations *(Continued)*

ft	Foot (feet)
ft/mi	Feet per mile
gal	Gallon
GRO	Gasoline-range organics
HASP	Health and Safety Plan
HWAA	Hazardous waste accumulation area
IDW	Investigation-derived waste
in.	Inch
IRIS	Integrated Risk Information System
ISMS	Integrated Safety Management System
LANL	Los Alamos National Laboratory
LCS	Laboratory control sample
LLW	Low-level radioactive waste
LLNL	Lawrence Livermore National Laboratory
MDC	Minimum detectable concentration
mg/kg	Milligram per kilogram
mi	Mile
M&O	Management and Operating
mrem	Millirem
MRL	Minimum reporting limit
MS	Matrix spike
MSD	Matrix spike duplicate
MWF	Metal working fluid
NAC	*Nevada Administrative Code*

List of Acronyms and Abbreviations *(Continued)*

NCRP	National Council on Radiation Protection and Measurement
ND	Normalized difference
NDEP	Nevada Division of Environmental Protection
NEPA	*National Environmental Policy Act*
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NTS	Nevada Test Site
NTSWAC	*Nevada Test Site Waste Acceptance Criteria*
PA	Preliminary assessment
PAH	Polynuclear aromatic hydrocarbons
PAL	Preliminary action level
PCB	Polychlorinated biphenyl
pCi/g	Picocuries per gram
PID	Photoionization detector
PPE	Personal protective equipment
ppm	Parts per million
PRG	Preliminary remediation goal
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RCRA	*Resource Conservation and Recovery Act*
REECo	Reynolds Electric & Engineering Co., Inc.
RMA	Radioactive materials area
ROTC	Record of Technical Change
RPD	Relative percent difference

List of Acronyms and Abbreviations *(Continued)*

SDWS	*Safe Drinking Water Standard*
SNJV	Stoller-Navarro Joint Venture
SSHASP	Site-specific health and safety plan
SVOC	Semivolatile organic compound
TaDD	Tactical Demilitarization Development
TPH	Total petroleum hydrocarbon
TSCA	*Toxic Substance Control Act*
USGS	U.S. Geological Survey
VCP	Vitrified Clay Pipe
VOC	Volatile organic compound
%R	Percent recovery
µCi/mL	Microcuries per milliliter
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter

Executive Summary

This Corrective Action Investigation Plan for Corrective Action Unit (CAU) 224, Decon Pad and Septic Systems, Nevada Test Site, Nevada, 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. The general purpose of the investigation is to ensure adequate data are collected to provide sufficient and reliable information to identify, evaluate, and select viable corrective actions.

This Corrective Action Investigation Plan provides investigative details for CAU 224, whereas programmatic aspects of this project are discussed in the *Project Management Plan* (DOE/NV, 1994). General field and laboratory quality assurance and quality control issues are presented in the *Industrial Sites Quality Assurance Project Plan* (NNSA/NV, 2002). Health and safety aspects of the project are documented in the current version of the Environmental Architect-Engineer Services Contractor's Health and Safety Plan and will be supplemented with a site-specific health and safety plan.

Corrective Action Unit 224 is comprised of the following nine corrective action sites (CASs) in Nevada Test Site areas 2, 3, 5, 6, 11, and 23:

- 02-04-01, Septic Tank (Buried)
- 03-05-01, Leachfield
- 05-04-01, Septic Tanks (4)/Discharge Area
- 06-03-01, Sewage Lagoons (3)
- 06-05-01, Leachfield
- 06-17-04, Decon Pad and Wastewater Catch
- 06-23-01, Decon Pad Discharge Piping
- 11-04-01, Sewage Lagoon
- 23-05-02, Leachfield

Corrective Action Sites 06-05-01, 06-23-01, and 23-05-02 were identified in the 1991 Reynolds Electrical & Engineering Co., Inc. Inventory (REECo, 1991). The remaining six sites were identified during reviews of various historical documents. For the purposes of this document the nine sites have been divided into four categories by the components present at each site. The components include the septic and/or collection component, the leachfield component, the lagoon/leachpit/outfall component, and the decontamination component.

The data quality objective (DQO) process was used to identify and define the type, quantity, and quality of data needed to complete the investigation phase of the corrective action process. The DQOs address the primary problem that sufficient information is not available to determine the appropriate corrective action for the CASs.

Corrective action closure alternatives (i.e., no further action, close in place, or clean closure) will be recommended for CAU 224 based on an evaluation of all the DQO-required data.

Under the *Federal Facility Agreement and Consent Order*, the Corrective Action Investigation Plan will be submitted to the Nevada Division of Environmental Protection for approval. Field work will be conducted following approval of the plan. The results of the field investigation will support a defensible evaluation of corrective action alternatives that will be presented in the Corrective Action Decision Document.

1.0 Introduction

This Corrective Action Investigation Plan (CAIP) contains project-specific information including facility descriptions, environmental sample collection objectives, and criteria for conducting site investigation activities at Corrective Action Unit (CAU) 224: Decon Pad and 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 (DoD).

The NTS is approximately 65 miles (mi) northwest of Las Vegas, Nevada (Figure 1-1). Corrective Action Unit 224 is comprised of the nine Corrective Action Sites (CASs) listed below:

- 02-04-01, Septic Tank (Buried)
- 03-05-01, Leachfield
- 05-04-01, Septic Tanks (4)/Discharge Area
- 06-03-01, Sewage Lagoons (3)
- 06-05-01, Leachfield
- 06-17-04, Decon Pad and Wastewater Catch
- 06-23-01, Decon Pad Discharge Piping
- 11-04-01, Sewage Lagoon
- 23-05-02, Leachfield

Corrective Action Sites 06-05-01, 06-23-01, and 23-05-02 were identified in the 1991 Reynolds Electrical & Engineering Co., Inc. (REECo) inventory (1991). The remaining sites were identified during review of various historical documents. Additional information will be obtained by conducting a corrective action investigation (CAI) prior to evaluating and selecting a corrective action alternative for each CAS. The CAI will include field inspections, radiological and geological surveys, and sample collection. Data will also be obtained to support investigation-derived waste (IDW) disposal and potential future waste management decisions.

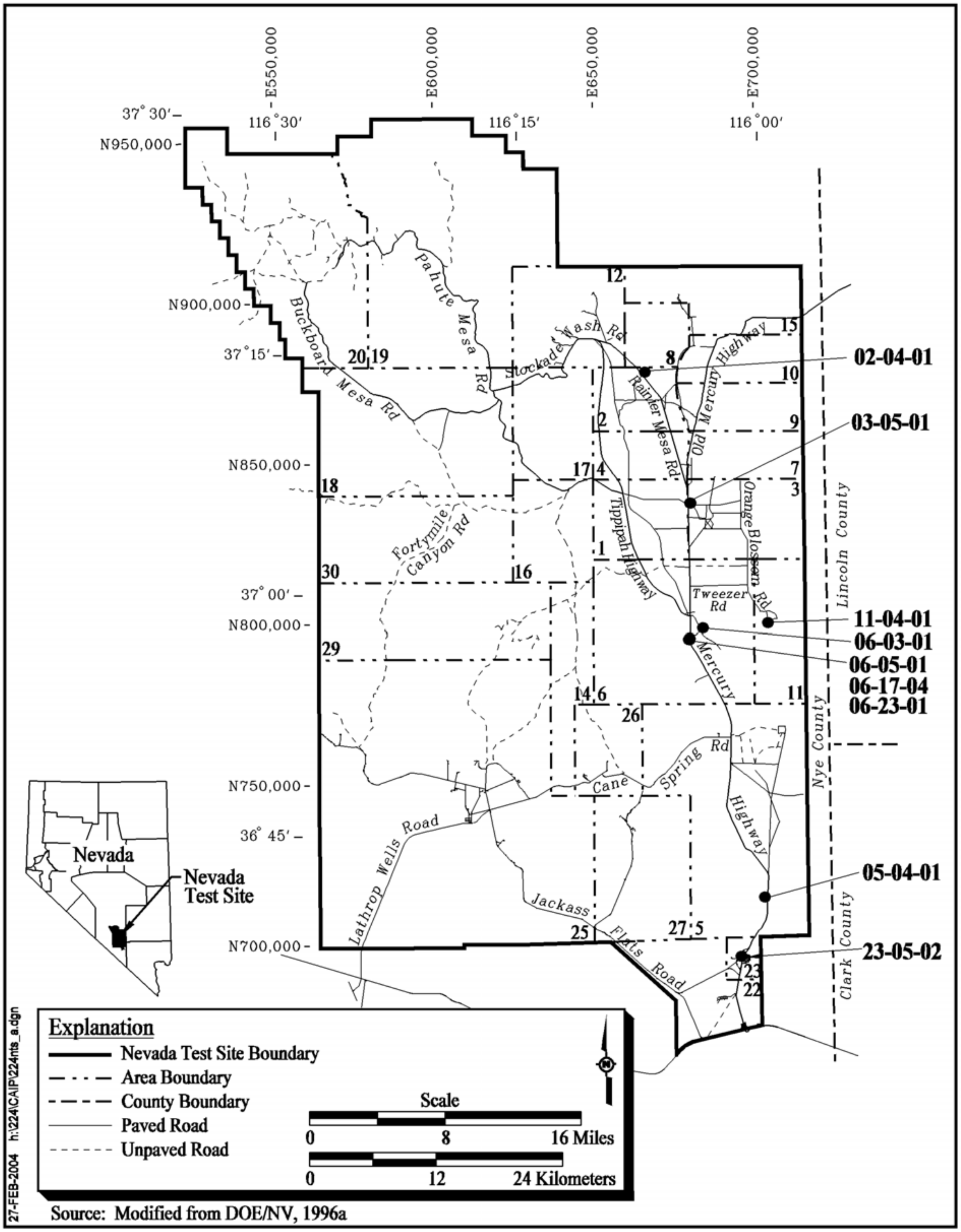

Figure 1-1
CAU 224 CAS Location Map

1.1 Purpose

The CASs in CAU 224 are being investigated because hazardous and/or radioactive constituents, may be present in concentrations that could potentially pose an unacceptable risk to human health and/or the environment.

The CAI will be conducted in accordance with the data quality objectives (DQOs) developed by the Nevada Division of Environmental Protection (NDEP) and the DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO).

The general purpose of the investigation is to collect sufficient data to support the selection of a corrective action compliant with all NDEP, *Resource Conservation and Recovery Act* (RCRA), *Toxic Substance Control Act* (TSCA), and DOE requirements.

1.1.1 CAS Descriptions

The CASs are located in six areas of the NTS as shown in Figure 1-1. Of the nine CASs, three (CASs 06-05-01, 06-17-04, and 06-23-01) have been combined for discussion purposes because each represents a component of the same system. Site maps for each of the nine CASs can be found in Appendix A.1, as Figure A.1-2 through Figure A.1-8.

1.1.1.1 CAS 02-04-01, Septic Tank (Buried)

Corrective Action Site 02-04-01 consists of a buried septic tank and its associated piping located along side of the 2-07 Road in the Area 2 Support Facility (Figure A.1-2). Four former facilities (Area 9 Drilling Operations Office, EG&G Support Yard, Lawrence Livermore National Laboratory (LLNL) Post Shot Containment Shop, and potential pipe cleaning platform) have been identified that could have potentially been associated with the tank. The septic tank is estimated to be approximately 24 by 13 feet (ft) and has a main vent line protruding from the tank.

1.1.1.2 CAS 03-05-01, Leachfield

Corrective Action Site 03-05-01 consists of a leach pit within the Area 3 Subdock Complex (Figure A.1-3). The complex was primarily used for the cleaning and repair of drilling equipment. The leachfield is believed to have received waste from the nearby Bit Sharpening Shop. The estimated dimensions of the leachfield are 60- by 60- by 2-ft, and it is currently located in a shallow depression that appears to have been leveled or graded.

1.1.1.3 CAS 05-04-01, Septic Tanks(4)/Discharge Area

Corrective Action Site 05-04-01 is located approximately 1,180 ft northwest of a former Area 5 trailer park (Figure A.1-4), and was used as the septic system for the associated structures. The trailer park consisted of a kitchen, recreation hall, and residential complex, and accommodated approximately 600 people. The CAS consists of four 7,500-gallon (gal) septic tanks encompassing a 34- by 18-ft area and the associated piping; a 7- by 5-ft distribution box; and the desert wash that potentially received overflow from the septic tanks.

1.1.1.4 CAS 06-03-01, Sewage Lagoons (3)

Corrective Action Site 06-03-01 consists of the former Yucca Lake sewage lagoon systems in Area 6 of the NTS (Figure A.1-5). The CAS includes Sewage Lagoons I and II and distribution box, the Domestic Lagoons, and the associated piping, and was used to contain domestic and potentially industrial waste from buildings 6-620, 6-621, 6-623, and 6-624. The combined area for Sewage Lagoons I and II is 135 by 90 ft and includes a distribution box located in the center. Dimensions for the Domestic Lagoons are 148 by 96 ft.

1.1.1.5 CASs 06-05-01, Leachfield; 06-17-04, Decon Pad and Wastewater Catch; and 06-23-01, Decon Pad Discharge Piping

Corrective Action Sites 06-05-01, 06-17-04, and 06-23-01 comprise a system that includes a decontamination pad, wastewater catch, associated piping, leachfield, drainage ditch, lagoons, and potential outfall (Figure A.1-6). These components received wastewater from Buildings CP-2 (laundry facility) and CP-6 (shower/decon facility) in Area 6 of the NTS. The CAS 06-05-01 leachfield measures approximately 120 by 62 ft, the drainage ditch (also part of CAS 06-05-01) is approximately 430-ft long and 10-ft wide; the lagoons (CAS 06-05-01) measure 197 by 75 ft; the outfall area (06-05-01) is of an unknown size; the decontamination pad (CAS 06-17-04) measures 160 by 60 ft; the wastewater catch (06-17-04) is 4 by 4 by 4 ft; the length of the piping (CAS 06-23-01) is estimated at approximately 450 ft.

1.1.1.6 CAS 11-04-01, Sewage Lagoon

Corrective Action Site 11-04-01 consists of a covered former sewage lagoon and associated discharge piping in Area 11 of the NTS at the Technical Facilities Complex, which is referred to as the Tactical Demilitarization Development (TaDD) Facility and the Los Alamos National Laboratory (LANL) Technical Facility (Figure A.1-7). The nearby facility included a Device Assembly Building, machine shop, and photography shop. The CAS also includes a two-compartment septic tank and distribution box with removable covers, and an evapotranspiration bed. The site is believed to have received only domestic waste from the Technical Facilities Complex. The portion of the sewage system leading to the evapotranspiration bed is currently inactive, but remains operable.

1.1.1.7 CAS 23-05-02, Leachfield

Corrective Action Site 23-05-02 consists of a leachfield and the associated discharge piping located in Area 23 of the NTS, which serviced former Building 155 in Mercury (Figure A.1-8). The leachfield received wastewater from the Radiological Safety and Industrial Hygiene laboratories (Building 155). The estimated dimensions of the leachfield are 20 by 33 ft with an unknown depth. There is approximately 130 ft of associated piping leading from Building 155 to the leachfield.

1.1.2 DQO Summary

The DQO process was used to identify and define the type, quantity, and quality of information needed to identify, evaluate, and recommend potentially viable corrective actions for CAU 224. For more detail on the DQO process, see Appendix A.1.

The primary problem statement for the investigation is: "Existing information on the nature of potential contaminants and, if present, the extent of contamination is insufficient to evaluate and recommend corrective action alternatives for CASs 02-04-01, 03-05-01, 05-04-01, 06-03-01, 06-05-01, 06-17-04, 06-23-01, 11-04-01, and 23-05-02." To address this problem statement, the resolution of the following two decisions statements is required:

- Decision I: "Is a COPC present at a concentration that could pose an unacceptable risk to human health and the environment?" Any contaminant analytically detected at a CAS at a concentration exceeding the corresponding preliminary action level (PAL), as defined in

Section A.1.4.2, will be considered a contaminant of concern (COC) for that CAS. Samples used to resolve the decision are referred to as Decision I samples.

- Decision II: "If a COC is present, is sufficient information available to evaluate appropriate corrective action alternatives?" Sufficient information is defined as the data needs identified in the DQOs to include the lateral and vertical extent of all COCs associated with a CAS. Samples used to resolve the decision are identified as Decision II samples.

An iterative approach has been selected to generate the data needed to satisfy the DQOs. Decision I data will be generated and evaluated to determine the presence of COCs. Decision II data will be generated and evaluated to define the extent of COCs.

1.2 Scope

To generate information needed to resolve the decision statements identified in the DQO processes, the scope of the CAI for CAU 224 includes the following activities:

- Conduct land radiological and geophysical surveys as necessary to provide information and identify potential biased sampling locations.
- Conduct Decision I sampling for hazardous and radiological parameters using laboratory analyses to determine the presence and nature of contamination.
- If COCs are identified in Decision I samples, collect Decision II samples to define the horizontal and vertical extent of the contamination.
- Collect quality control (QC) samples for laboratory analyses to evaluate the performance of measurement systems and controls based on the requirements of the data quality indicators (DQIs).
- Comply with regulatory requirements for waste disposal through the collection and analysis of IDW samples, as needed. Collect samples of IDW and conduct inspections and surveys, as needed, to support waste management decisions.
- Collect soil samples for laboratory analysis of geotechnical parameters and/or bioassessment, as needed to support potential closure decisions.

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

1.3 CAIP Contents

Section 1.0 presents the purpose and scope of this CAIP, while Section 2.0 provides background information about the CAU. The objectives and the CSM are presented in Section 3.0. Field sampling activities are discussed in Section 4.0, and waste management for this project is discussed in Section 5.0. General field and laboratory quality assurance (QA) and QC requirements (including collection of QC 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.1, Section A.1 provides detailed information on the DQO process for this project, while Section A.2 contains information on the project organization, and Appendix A.3 contains NDEP comments. The health and safety aspects of this project are documented in a site-specific health and safety plan (SSHASP), or equivalent written prior to 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 Management Plan* (DOE/NV, 1994) and will be supplemented with a site-specific field management plan that will be developed prior to field activities.

2.0 Facility Description

Corrective Action Unit 224 includes nine CASs that were grouped together based on technical similarities (releases from septic systems and discharge points), and agency responsibility (Environmental Restoration) for closure. The following sections provide information on the physical setting, operational history, waste inventory, release information, and investigative background of each site.

2.1 Physical Setting

The CAU 224 CASs are located within Areas 2, 3, 5, 6, 11, and 23 of the NTS. The following sections provide a general overview of the topography, geology, and hydrogeology for specific areas of the NTS region as described in the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996). The location of the CASs on the NTS are shown in Figure 1-1. Seven of the nine CASs are located within the Yucca Flat Hydrographic Area of the NTS. Corrective Action Site 05-04-01 is located within the Frenchman Flat Hydrographic Area, and CAS 23-05-01 is within the Mercury Valley basin.

2.1.1 Yucca Flat

Corrective action sites 02-04-01, 03-04-01, 06-03-01, 06-05-01, 06-17-04, 06-23-01, and 11-04-01 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). Paleozoic carbonate rocks primarily underlie the quaternary age alluvium in parts of Yucca Flat and form much of the surrounding mountains in this area. The soil classes present in the Yucca Flat area include stony, cobbly soils with moderately low available water-holding capacity (DOE/NV, 1996).

The direction of groundwater flow in Yucca Flat is generally 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 (USGS, 1996). The average annual precipitation at station UCC on the Yucca Flat dry lake is 6.62 inches (in.) (ARL/SORD, 2003). No rain gauge station was identified locally for any of the CASs in CAU 224. The recharge rate to the

Yucca Flat area is relatively low due to the thickness of the unsaturated zone occurring to more than 600 ft below ground surface (bgs) (USGS, 1996).

The nearest groundwater well to CAS 02-04-01 is Water Well WW-2, an active well located approximately 0.6 mi northeast of the site. The latest recorded depth to the water table is approximately 2,053 ft bgs (USGS and DOE, 2004a). The nearest well to CAS 03-05-01 is U.S. Geological Survey (USGS) water well WW-A, an active well located approximately 1 mi southeast of the site. The latest recorded depth to the water table is approximately 1,600 ft bgs (USGS and DOE, 2004b). The nearest active well to CASs 06-03-01, 06-05-01, 06-17-04, and 06-23-01 is USGS water well ER6-2, located approximately 2.3 to 2.4 mi northwest of the sites. The latest recorded depth to the water table is approximately 1,784 ft bgs (USGS and DOE, 2004c). The nearest well to CAS 11-04-01 is USGS water well ER6-1, an active well located approximately 2.9 mi northwest of the site. The latest recorded depth to the water table is approximately 1,547 ft bgs (USGS and DOE, 2004d).

2.1.2 Frenchman Flat

Corrective Action Site 05-04-01 lies within the southern portion of the Frenchman Flat Hydrographic Area, a broad-lined closed basin surrounded by low-lying mountains that, to the south, separates this area from the Mercury Valley Hydrographic Area and, to the north, separates it from the Yucca Flat Hydrographic Area (USGS, 1996). Erosion of the surrounding mountains has resulted in the accumulation of more than a thousand feet of alluvial deposits in some areas of Frenchman Flat. Volcanic rocks underlie the alluvium in the northern and western parts of Frenchman Flat and, where exposed, form some of the surrounding low-lying mountains. Carbonate rocks primarily underlie the alluvium in the eastern and southeastern parts of Frenchman Flat and also form some of the surrounding mountains in this area (DOE/NV, 1996).

Groundwater flow beneath the Frenchman Flat area primarily occurs within the carbonate-rock aquifer. Generally, the direction of groundwater flow in region of the aquifer 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-rock aquifer. The hydraulic gradient in most areas of the alluvial aquifer in Frenchman Flat is relatively flat (less than 1 foot per mile [ft/mi]) except near water supply and/or test wells (USGS, 1996). The average annual precipitation at station Well 5 B, which is located near Frenchman Flat is 4.85 in. (ARL/SORD, 2003). No rain gauge station was identified locally for CAS 05-04-01. The recharge rate to the Frenchman Flat area is relatively low due to the thick unsaturated zone occurring to more than 600 ft bgs (USGS, 1996).

The nearest groundwater well to CAS 05-04-01 is Water Well WW-5a, an active well located approximately 4.5 mi northeast of CAS 05-04-01. The latest recorded depth to the water table is approximately 710 ft bgs (USGS and DOE, 2004e).

2.1.3 Mercury Valley

Corrective Action Site 23-05-02 is located within the Mercury Valley basin. Mercury Valley covers an area of approximately 70 square miles and ranges in elevation from 3,050 to 4,200 ft. The valley is a transition zone between the northern edge of the Mojave Desert and the southern portion of the Great Basin Desert.

Groundwater beneath Mercury Valley occurs within valley-fill, and lower carbonate aquifers, and within the upper clastic and lower clastic aquitards (DRI, 1988). Surface drainage and groundwater flow in the Mercury Valley is in the southwest direction. The average annual precipitation at the Mercury gauging station is approximately 5.59 in. (DRI, 1985). The nearest groundwater well to CAS 23-05-02 is USGS Well SM-23-1, an active well located approximately 1.5 mi southwest of the site. The latest recorded depth to the water table is approximately 1,164 ft bgs (USGS and DOE, 2004f).

2.2 Operational History

The following subsections provide a description of the use and operational history of the nine CASs within CAU 224. This summary is intended to illustrate the significant activities known to have been conducted at or near each site that may have released contamination to the environment.

2.2.1 CAS 02-04-01, Septic Tank (Buried)

The Area 2 Support Facility was operational from the 1960s to the 1990s when the facility was closed. The surrounding buildings have since been demolished and/or removed. Historical or operational information has not been located that could identify which facilities may have been directly associated with the septic tank. Therefore, it is assumed that four former facilities may have been associated with the septic tank through subsurface piping systems. The Area 9 Drilling Operations Office was located east of the tank and was used as an office. The EG&G Support Yard was located northwest of the tank and it consisted of a machine shop, skid structures, brock houses, a substation, trailers, and sheds. The facility was used for maintenance and repair of drill rigs and drilling-related equipment. The LLNL Post Shot Containment Shop (Building T-151) was located to the north/northwest of the septic tank and was used to repair and clean drilling-related equipment. Between the LLNL Post Shot Containment Shop and the Area 9 Drilling Operations Office was a pipe cleaning platform, likely used for steam cleaning and degreasing drilling pipe. Trailers may have been associated with the pipe cleaning platform. Figure A.1-2 shows the locations of the former structures, the septic tank, and potential associated piping.

2.2.2 CAS 03-05-01, Leachfield

The Area 3 Subdock Complex operated from the 1970s to 1985 primarily for cleaning and repairing worn drill bits and bent drilling rods. Contaminants from the nearby Bit Sharpening Shop, located west of the leach pit, may have been dumped into the leachfield. Activities in the shop primarily included degreasing and cooling the drill bits undergoing repair.

2.2.3 CAS 05-04-01, Septic Tanks(4)/Discharge Area

The site consists of four abandoned septic tanks and associated piping that received waste from the former Area 5 trailer park. The trailer park consisted of a kitchen, recreation hall, and residential complex. In 1995, a characterization was conducted to support closure of the septic tank and overflow/outfall area. Based on the analytical results, it was recommended that the tanks be closed as a domestic sewer system under Nevada State Health Division guidelines (REECo, 1995). Documentation has not been found to verify closure of the system.

2.2.4 CAS 06-03-01, Sewage Lagoons (3)

The date of construction and operation of the Domestic Lagoons and Sewage Lagoons I and II was estimated as 1972 and 1974, respectively. Operations of both lagoon systems continued until they were replaced in 1989 by the current Area 6 Yucca Lake Lagoons. Sewage Lagoons I and II serviced

Building 6-623, the Machine and Welding Shop. Based on general process knowledge, industrial (shop) wastes from these activities may have been discharged to the system. The Domestic Lagoons serviced Buildings 6-620, 6-621, 6-624 and an administrative trailer complex. Activities in these various facilities included generator and hydraulic repair, welding, and drilling repair. Currently, both lagoon systems are covered to grade and marked with four monuments that state, "Closed Sewage Lagoons." Signage placed in the middle of the Domestic Lagoons indicates a closure date of August 29, 1989.

2.2.5 CASs 06-05-01, Leachfield; 06-17-04, Decon Pad and Wastewater Catch; and 06-23-01, Decon Pad Discharge Piping

This system received wastes from Buildings CP-2 and CP-6. Building CP-2 was used for the decontamination of potentially radioactively contaminated laundry. Building CP-6 was a radioactive decontamination facility, which had an equipment decontamination pad located to the east of the facility. Radioactively contaminated equipment was decontaminated at the CP-6 decontamination pad using high pressure water and various solvents, degreasers, and detergents. Additionally, Building CP-6 was used as a shower area for workers exposed to surface contamination. The CP-2 Leachfield operated from 1951 to 1971 and it is believed that the leachfield, waste lagoons, drainage ditch, and potential outfall area were all in operation simultaneously until the late 1960s or early 1970s.

2.2.6 CAS 11-04-01, Sewage Lagoon

The former sewage lagoon, now covered, received wastes from buildings within the TaDD Facility. The buildings connected to the system include Building 102, the LANL Assembly Building, used for device assembly, maintenance, and repair; and Building 103, the LANL Shop and Photo Lab, which included a machine shop, a darkroom, and other various equipment storage rooms. The darkroom contains a developing tank equipped with a faucet potentially used to develop radiographics and film. The sewage lagoon became inactive in the late 1980s and was backfilled by 1990.

2.2.7 CAS 23-05-02, Leachfield

The leachfield was operational between 1959 and 1973, and is currently completely covered by asphalt and gravel and serves as the motor pool parking lot. It received wastewater from the

Radiological Safety and Industrial Hygiene laboratories (Building 155) in Mercury. Building 155 was used as the radiological safety laboratory until 1964. In 1964, the laboratory was relocated to trailers near Building 155. The trailers were connected to the same leachfield as Building 155. Building 155 continued in operation as the Industrial Hygiene laboratory until 1973. The facility housed a hot, cold, and standards laboratory as well as a darkroom. Engineering drawings indicate that the rest rooms were serviced by a separate sewage system.

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. Based on this information, domestic, industrial, chemical, and radiological wastes are expected at CAU 224. There is no known information that indicates hazardous wastes were disposed of at CAU 224 sites. Available information was evaluated during the DQO process, and a list of potential contaminants was developed and is provided in Table 3-2.

Radiological analysis may be required to support waste management decisions and IDW disposal. Where potential mixed waste exists, these areas will be identified and delineated to the extent necessary to properly manage the IDW and address future waste management issues.

2.4 Release Information

The CAS-specific release information, migration routes, exposure pathways, and affected media are discussed below, and additional information can be found in Section A.1.1. Based on historical information and process knowledge the primary sources of potential environmental contaminants released to soil within CAU 224 include:

- Industrial wastes that may have been discharged into the septic tank and associated piping at CAS 02-04-01 from activities conducted at the EG&G Support Yard, LLNL Post Shot Containment Shop, and potential pipe cleaning platform. Effluent may have included metal working fluids (MWFs), oil, grease, petroleum-based products, solvents, degreasers, and cleaning fluids.

- Industrial waste from the Bit Sharpening Shop that may have been discharged into the leachpit at CAS 03-05-01. Standard drilling lubricants, oils, greases, solvents, petroleum-based products, degreasing agents, and are associated with the Bit Sharpening Shop.

- Contaminants associated with domestic wastes from the Area 5 Trailer Park may be present in the septic tanks and associated piping at CAS 05-04-01.

- Industrial wastes that may have been discharged into the lagoons at CAS 06-03-01 from activities conducted from several buildings in Area 6. Effluent may have included MWFs, various metals, solvents, degreasers, petroleum-based products, hydraulic fluids and oils. Contaminants associated with domestic waste from the buildings may be present.

- Radiological and chemical wastes discharged to the decontamination pad, wastewater catch, associated piping, leachfield, setting basin, lagoons, and potential outfall. Effluent was associated with decontamination activities at Buildings CP-2 and CP-6 (CASs 06-05-01, 06-17-04, and 06-23-01) and may have included the use of various acids, caustics, solvents, and detergents.

- Industrial and chemical wastes discharged into the sewage lagoon, septic tank, distribution box, associated piping, and evapotranspiration bed at CAS 11-04-01 from activities conducted at the LANL Assembly Building and LANL shop and photo lab. Effluent may have included photoprocessing chemicals (e.g., developers and fixers), MWFs, and solvents.

- Chemical and radiological wastes discharged into the leachfield at CAS 23-05-02 associated with the Building 155 laboratories. Effluent may have included acids, caustics, solvents, reactive chemicals including oxidizers, radioactive materials, gases/halogens, and other miscellaneous chemicals.

Potential release mechanisms at CAU 224 CASs are spills and/or breaches, infiltration/percolation, or run-off of contaminants.

The primary migration routes for contaminants of potential concern (COPCs) at the CAU 224 CASs are represented in the CSM (Figure 3-1). No known migration of contamination has occurred at CAU 224 CASs and potential migration routes are expected to be primarily vertical due to gravity with limited horizontal migration depending on the nature of the release. For example, if any of the underground pipes or tanks breached, contaminants may migrate laterally to a limited extent prior to infiltration/ percolation. Additionally, the presence of relatively impermeable layers (e.g., caliche), either at the surface or subsurface could limit vertical migration and modify migration laterally.

Precipitation is minimal at the NTS and does not provide a significant mechanism for migration of contaminants to groundwater. Contaminant migration is expected to be limited due to overland flow,

low precipitation, and high potential evapotranspiration in the arid environment. Additional information on migration is presented in Section 3.1.3 and in Appendix A.1, Section A.1.2.3.

Potentially affected media for CAU 224 include surface and subsurface soils. Additional affected media information is given in Appendix A.1, Section A.1.2.3.

2.4.1 Exposure Pathways

Site workers, industrial and construction personnel, as well as military personnel conducting training may be exposed to potentially contaminated soil at CAU 224 (DOE/NV, 1998b). Exposure pathways include ingestion, inhalation of dust, and/or dermal contact (absorption) from disturbance of contaminated soils, debris, and/or structures. These exposure pathways are considered unlikely to result in significant exposure to potential receptors from contaminated soil from the site because of the expected limited use and the restricted access to the NTS and the CAU 224 areas.

2.5 Investigative Background

Previous site investigation activities associated with CAU 224 were identified during the preliminary assessment. Details of these investigations are provided in Section A.1.1. The following paragraphs summarize all known investigation results conducted at each CAS.

CAS 02-04-01 - No previous investigation results are available for CAS 02-04-01.

CAS 03-05-01 - A geophysical survey was conducted at CAS 03-05-01 in 2003 indicating piping heading west and southeast of the leachpit. It is unknown where the piping leads (Shaw, 2003). The survey results will be re-evaluated based on current geophysical data when complete.

CAS 05-04-01 - A preliminary characterization was conducted by REECo in 1995 to support closure of the septic tank and overflow/outfall area of the CAS. Four liquid samples were collected (one from each tank), as well as one soil sample below the effluent discharge pipe, and one background soil sample. Barium was detected in both the liquid and soil at levels below regulatory concern. Di-n-butylphthalate and di-n-octylphthalate were also detected, but are attributable to laboratory contamination (REECo, 1995).

CAS 06-03-01 - Three effluent samples were collected from the Yucca Lake Sewage Lagoon System in the first quarter of 1989. Cyanide and pyrene were detected in the northwest system (Sewage Lagoons I and II) at 160 and 13 microgram per liter (µg/L), respectively, and are below regulatory concerns. The analytical method used for cyanide is unknown. A combined result for 1,2-dichlorobenzene and 1,4-dichlorobenzene was reported at 21 µg/L. The combined concentrations of 1,2-dichlorobenzene and 1,4-dichlorabenzene was reported as 14.0 µg/L for the southwest system (Domestic Lagoons). Liquid radiological samples were collected at an Area 6 sewage lagoon in 1989; however, it is indeterminate from the documentation which lagoon effluent was sampled. The ranges of activities observed were: -5.4×10^{-11} to 5.5×10^{-11} microcuries per milliliter (µCi/mL) for plutonium-238; -4.9×10^{-12} to 1.0×10^{-12} µCi/mL for plutonium-239/-240; 1.0×10^{-8} to 6.1×10^{-8} µCi/mL for gross beta; and -1.0×10^{-7} to 3.0×10^{-7} µCi/mL for tritium. Further radiological sampling was conducted at an Area 6 sewage lagoon in 1990; however, again it is indeterminate from the documentation which lagoon effluent was sampled. The ranges of activities observed were: 1.3×10^{-10} µCi/mL for strontium-90; -2.1×10^{-11} to 3.3×10^{-11} µCi/mL for plutonium-238; -3.6×10^{-12} to 5.1×10^{-12} µCi/mL for plutonium-239/-240; 3.5×10^{-8} to 5.2×10^{-8} µCi/mL for gross beta; and -1.1×10^{-7} to 2.5×10^{-7} µCi/mL for tritium (Haworth, 1989).

CASs 06-05-01, 06-17-04, and 06-23-01 - Radiological surveys were conducted for the purposes of radiological area posting at the Area 6 Old Decon Pad, Old Leach Pond, and Decon Pad Pond in 1998. The results indicate that subsurface soils contain unknown levels of radionuclide activity but the surface soils removable activity is below 10 *Code of Federal Regulations* (CFR) Part 835 guidelines (1999) for all radionuclide categories (DOE/NV, 2000a). The CP-2 Leachfield was sampled in 1986 with cadmium and silver concentrations detected below regulatory limits in the EP Toxicity extract. Cesium-137, potassium-40, radium-226, thorium-228, and thorium-232 were detected at activities below background levels (REECo, 1986; DRI, 1988; Adams, 2002).

CAS 11-04-01 - No previous investigation results are available for CAU 224, CAS 11-04-01.

CAS 23-05-02 - Recent geophysical survey results for CAS 23-05-02, indicated a variety of features; however, none typified a leachfield (SAIC, 2003). As noted in the operational history, the radiological component of the Building 155 laboratory relocated to Building 650. Characterization sampling of the Building 650 leachfield indicated a maximum plutonium-239/240 activity of

77.1 picocuries per gram (pCi/g), exceeding the PAL of 7.62 pCi/g. The study also identified total petroleum hydrocarbon (TPH) in one sample at 570 milligrams per kilogram (mg/kg) (PAL is 100 mg/kg) and polychlorinated biphenyls (PCBs) at a maximum concentration of 155 micrograms per kilogram (µg/kg) (PAL is 70 µg/kg) (DOE/NV, 1998a).

2.5.1 National Environmental Policy Act

In accordance with the NNSA/NSO's *National Environmental Policy Act* (NEPA) Compliance Program, a NEPA checklist will be completed prior to commencement of site investigation activities at CAU 224. 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.

3.0 Objectives

This section presents an overview of the DQOs for CAU 224 and formulation of the CSM. Information on the COPCs and corresponding PALs is also presented. The DQO process is detailed in Appendix A.1.

3.1 Conceptual Site Model

The CSM demonstrates the most probable scenario for current conditions at CAU 224 and defines the assumptions that are the basis for selection of an appropriate sampling strategy and data collection methods. A CSM has been developed for CAU 224 using assumptions formulated from physical setting, potential contaminant sources/release mechanisms, process knowledge, historical background information, knowledge from studies of similar sites, and data from previous sampling efforts. Appendix A.1, Section A.1.2.3 provides more detailed information on the CSM as presented for DQO formulation. Figure 3-1 illustrates the CSM developed for current site conditions at CAU 224. The CSM identifies site features, possible sources of COPCs, as well as the potential contaminant migration pathways.

If evidence of potential contamination outside the scope of the CSM is identified during investigation activities, the situation will be reviewed and recommendations made as to the path forward. In such cases, NNSA/NSO and NDEP will be notified prior to proceeding.

3.1.1 Future Land Use

The future land-use scenarios for CAU 224 are limited to industrial use (nonresidential and controlled access) and include defense and nondefense research, development, and testing activities. The areas are nonresidential and access to the NTS is controlled. The nine CASs within CAU 224 are located in areas designated as either “nuclear and high explosive test zone,” “defense industrial zone,” or “reserved zone” (DOE/NV, 1998b). Table 3-1 provides descriptions of each zone and identifies the CAU 224 CASs within each zone.

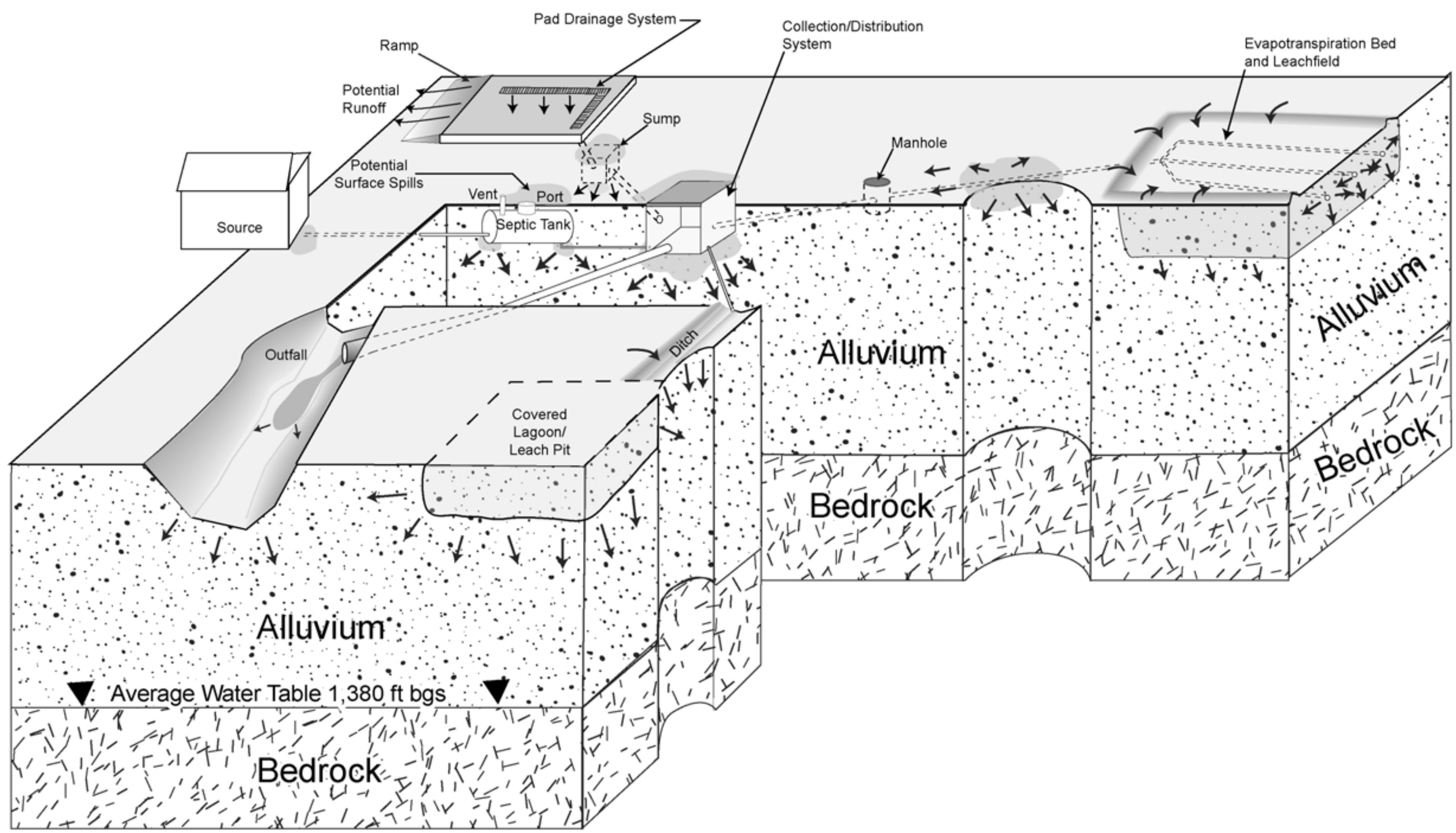

Figure 3-1
Conceptual Site Model for CAU 224

Table 3-1
Land Use

Land-Use Designation	Land-Use Description	CASs
Nuclear and High Explosive Test Zone	The area is designated within the Nuclear Test Zone for additional underground nuclear weapons tests and outdoor high explosive tests. This zone includes compatible defense and nondefense research, development, and testing activities.	02-04-01 and 03-05-01
Defense Industrial Zone	This area is designated for stockpile management of weapons, including production, assembly, disassembly or modification, staging, repair, retrofit, and surveillance. Also included in this zone are permanent facilities for stockpile stewardship operations involving equipment and activities such as radiography, lasers, material processing, and pulsed power.	06-03-01, 06-05-01, 06-17-04, and 06-23-01
Reserved Zone	This area includes land and facilities that provide widespread flexible support for diverse short-term testing and experimentation. The reserved zone is also used for short duration exercises and training such as nuclear emergency response and Federal Radiological Monitoring and Assessment Central training and U.S. Department of Defense land-navigation exercises and training.	11-04-01, 05-04-01, and 23-05-02

3.1.2 Contaminant Sources and Release Mechanisms

The primary contaminant sources are discussed in detail in Section 2.4 and Section A.1.2.3 and include industrial, chemical, and radiological wastes potentially managed in four identified systems or components. They include:

- Septic and/or collection component
- Leachfield component
- Lagoon/leach pit component
- Decontamination pad component

The primary surface and subsurface release mechanisms of COPCs at CAU 224 CASs are spills, breaches, infiltration/percolation, and run-off from the various components and their elements.

3.1.3 Migration Pathways and Transport Mechanisms

An important element of the CSM in developing a sampling strategy is the expected fate and transport of contaminants (how contaminants migrate through media and where they can be expected 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. 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.

The degree of contaminant migration at CAU 224 is largely unknown but is expected to be minimal based on the affinity of the COPCs for soil particles, and the low precipitation and high evapotranspiration rates typical of the NTS environment. Contaminants may have been transported by infiltration and percolation of precipitation through soil, which serves as the primary driving force for downward migration. Mixing of the surface soil as a result of grading or construction activities (e.g., abandonment of sewage lagoons) could also have moved contaminants into deeper intervals. The migration of organic constituents (e.g., TPH, semivolatile organic compounds [SVOCs], and PCBs) will be controlled by their respective affinity for adsorption to organic material present in the soil. However, the lack of organic material in the desert soil will reduce the effectiveness of this process. Migration of inorganic constituents (e.g., metals in waste oil) is controlled by geochemical processes, such as adsorption, soil pH, and precipitation of solids from solution.

Because of the low volatility of the suspected contaminants, an airborne release subsequent to the initial contaminant release is not considered a significant release pathway. The main process of migration through the air would be through windblown dust. If VOCs, SVOCs, metals, or petroleum hydrocarbons adsorbed to the fine soil particles, a small amount of migration could be expected via the airborne pathway. For subsurface mechanisms, it would be expected that contaminant levels decrease with horizontal and vertical distance from the point of release (except with construction activities).

Preferential pathways for contaminant migration at CAU 224 are expected not to be present or have only had a minor impact on contaminant migration. The presence of relatively impermeable layers (e.g., caliche layers, concrete pads) modify transport pathways both on the ground surface and in the subsurface. Small gullies and washes, if present, could channelize run-off and increase lateral transport prior to infiltration.

Contaminants could be transported into the subsurface and eventually to the groundwater by percolation of precipitation. Evapotranspiration (total water loss) at the NTS is significantly greater than precipitation, thus limiting the potential for vertical migration of contaminants. The annual average precipitation for the CASs within CAU 224 is approximately 5 to 7 in. per year (DRI, 1985; ARL/SORD, 2003). The total evapotranspiration at the Area 3 Radiological Waste Management Site (a central NTS location relative to the CASs in CAU 224) has been estimated at 62.6 in. (Shott et al., 1997). Thus, the annual evapotranspiration is approximately 10 times greater than the annual precipitation. These data indicate that evaporation is the dominant factor influencing the movement of water in the upper unsaturated zone. Therefore, groundwater recharge from precipitation does not provide a significant mechanism for the movement of contaminants to groundwater.

3.1.4 Exposure Points

Exposure points within CAU 224 are the locations where visitors, site workers, or military personnel will come in contact with potential contaminants within the CAS boundaries. The exposure points at CAU 224 would be the surface and shallow subsurface at locations where contamination is present.

3.1.5 Exposure Routes

Exposure routes to visitors, site workers, or military personnel include ingestion, inhalation, and/or dermal contact (absorption) from disturbance of contaminated soils, debris, and/or structures. Site workers may also be exposed to radiation by performing activities in proximity to radiologically contaminated materials.

3.1.6 Additional Information

Additional topographic information for CAU 224 will not be necessary because the data available is adequate to make determinations about the sites.

General surface and subsurface soil descriptions will be observed and recorded during the CAI.

Climatic conditions for the CAU are well documented for these areas of the NTS and have been addressed in the DQO process and reflected in the CSM. No further information is required.

Groundwater data for the CAU is known and has been addressed in the CSM. The CAS-specific depth to groundwater data are presented in Section 2.1. No further information is required.

Floodplain study results are not applicable to CAU 224.

Specific structure descriptions will be observed and recorded during the CAI. The structures include various buildings and utilities. The CAI will not compromise the integrity of structures, with the possible exception of the parking lot, which currently covers the abandoned leach pit at CAS 23-05-02.

3.2 Contaminants of Potential Concern

Contaminants of Potential Concern for CAU 224 were identified through a review of site history, process knowledge, personal interviews, past investigations, and inferred activities associated with the CASs. Types of contaminants suspected to be present at CAU 224 include:

- Unspecified solvents
- Degreasers
- Petroleum based products
- Metal working fluids
- Hydraulic fluids and oils
- Detergents
- Photoprocessing chemicals
- Radioactive materials

Since complete information regarding activities performed at CAU 224, as well as throughout the NTS, is unavailable, some uncertainty as to the list of potential contaminants exists. Due to this uncertainty, constituents (in addition to the suspected contaminants) have been included in the Decision I analytical program to define the nature of contamination for the CAU 224 investigation. The Decision I analytical program for CAU 224 is listed in Table 3-2. These suspected contaminants are considered COPCs and defined as the analytes reported from the analytical methods listed in Table 3-2 for which the U.S. Environmental Protection Agency (EPA) Region IX has established preliminary remediation goals (PRGs) (EPA, 2002a) or for which toxicity data are listed in the

EPA Integrated Risk Information System (IRIS) database (EPA, 2002b). Radiological COPCs are defined as the radionuclides reported from the analytical methods also listed in Table 3-2. Potassium-40 is not considered a COPC due to its predominance in the environment. The only mechanism for Potassium-40 to be a contaminant is through concentration; there are no reported activities at the NTS that would have concentrated Potassium-40 or released it as a contaminant. The CAI will not be expanded to delineate the extent of Potassium-40, nor will Potassium-40 be evaluated in the corrective action decision document (CADD).

Based on process knowledge for the activities conducted at the various CASs within CAU 224 certain analytes are suspected to be present. These suspected contaminants are referred to as critical analytes to define the nature of contamination (Decision I) and also are identified in Table 3-3. Critical analytes are defined as the chemical contaminants and/or radionuclides that are suspected to be preset at the CAU based on the information used to identify suspected contaminants. Because information such as documented use or process knowledge exist for critical analytes, these analytes are given greater importance in the decision-making process relative to other COPCs. For the critical analytes more stringent performance criteria are specified during the data quality assessment (Section 6.0). If COPCs are detected in the Decision I sampling at a concentration that exceeds the respective PAL, whether critical or noncritical it will become a COC and the extent will be determined using a 90 percent completeness goal.

Each COPC that is detected in a sample at concentrations exceeding the corresponding PAL becomes a COC for subsequent sampling to define the extent of contamination (Decision II). These step-out samples will be collected and analyzed for the COCs identified by the Decision I sampling. However, if Decision II samples are collected prior to nature-of-contamination data becoming available, then the step-out samples will be analyzed for the full list of parameters specified in Table 3-2.

The radionuclides resulting from the atmospheric nuclear testing are not intended to drive the nature and extent determinations under this investigation. For CAU 224, source characterization is the focus of the sampling and analysis. Radiological analyses will be included in the analytical suite to determine if site-specific processes released radioactive constituent to the environment and to support the disposal of IDW and potential waste management decisions.

Table 3-2
Analytical Requirements for CAU 224
(Page 1 of 3)

Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD)[a]	Percent Recovery (%R)[b]
ORGANICS						
Total Volatile Organic Compounds (VOCs)	Aqueous	8260B[c]	Parameter-specific estimated quantitation limits[d]	Not applicable (NA)	Lab-specific[e]	Lab-specific[e]
	Soil					
Toxicity Characteristic Leaching Procedure (TCLP) VOCs						
Benzene	Aqueous	1311/8260B[c]	0.050 mg/L[d]	0.5 mg/L[f]	Lab-specific[e]	Lab-specific[e]
Carbon Tetrachloride			0.050 mg/L[d]	0.5 mg/L[f]		
Chlorobenzene			0.050 mg/L[d]	100 mg/L[f]		
Chloroform			0.050 mg/L[d]	6 mg/L[f]		
1,2-Dichloroethane			0.050 mg/L[d]	0.5 mg/L[f]		
1,1-Dichloroethene			0.050 mg/L[d]	0.7 mg/L[f]		
Methyl Ethyl Ketone			0.050 mg/L[d]	200 mg/L[f]		
Tetrachloroethene			0.050 mg/L[d]	0.7 mg/L[f]		
Trichloroethene			0.050 mg/L[d]	0.5 mg/L[f]		
Vinyl chloride			0.050 mg/L[d]	0.2 mg/L[f]		
Total Semivolatile Organic Compounds (SVOCs)	Aqueous	8270C[c]	Parameter-specific estimated quantitation limits[d]	NA	Lab-specific[e]	Lab-specific[e]
	Soil					
TCLP SVOCs						
o-Cresol	Aqueous	1311/8270C[c]	0.10 mg/L[d]	200 mg/L[f]	Lab-specific[e]	Lab-specific[e]
m-Cresol			0.10 mg/L[d]	200 mg/L[f]		
p-Cresol			0.10 mg/L[d]	200 mg/L[f]		
Cresol (total)			0.30 mg/L[d]	200 mg/L[f]		
1,4-Dichlorobenzene			0.10 mg/L[d]	7.5 mg/L[f]		
2,4-Dinitrotoluene			0.10 mg/L[d]	0.13 mg/L[f]		
Hexachlorobenzene			0.10 mg/L[d]	0.13 mg/L[f]		
Hexachlorobutadiene			0.10 mg/L[d]	0.5 mg/L[f]		
Hexachloroethane			0.10 mg/L[d]	3 mg/L[f]		
Nitrobenzene			0.10 mg/L[d]	2 mg/L[f]		
Pentachlorophenol			0.50 mg/L[d]	100 mg/L[f]		
Pyridine			0.10 mg/L[d]	5 mg/L[f]		
2,4,5-Trichlorophenol			0.10 mg/L[d]	400 mg/L[f]		
2,4,6-Trichlorophenol			0.10 mg/L[d]	2 mg/L[f]		
Polychlorinated Biphenyls (PCBs)	Aqueous	8082[c]	Parameter-specific (CRQL)[g]	NA	Lab-specific[e]	Lab-specific[e]
	Soil					
Total Petroleum Hydrocarbons (TPH) (C_6-C_{38})	Aqueous GRO	8015B modified[c]	0.1 mg/L[h]	NA	Lab-specific[e]	Lab-specific[e]
	Soil GRO		0.5 mg/kg[h]			
	Aqueous DRO		0.5 mg/L[h]			
	Soil DRO		25 mg/kg[h]			
Cyanide	Aqueous	9010	10 µg/L	NA	Lab-specific[e]	Lab-specific[e]
	Soil		1 mg/kg			
Sulfide	Aqueous	9030B	500 µg/L			
	Soil		50 mg/kg			

Table 3-2
Analytical Requirements for CAU 224
(Page 2 of 3)

Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD)[a]	Percent Recovery (%R)[b]
INORGANICS						
Total Metals						
Antimony	Aqueous	6010B[c]	60 µg/L[h, i]	NA	20[i]	Matrix Spike Recovery 75-125[i]; Laboratory Control Sample Recovery 80 - 120[i]
	Soil		6 mg/kg[h, i]		35[h]	
Arsenic	Aqueous	6010B[c]	10 µg/L[h, i]		20[i]	
	Soil		1 mg/kg[h, i]		35[h]	
Barium	Aqueous	6010B[c]	200 µg/L[h, i]		20[i]	
	Soil		20 mg/kg[h, i]		35[h]	
Beryllium	Aqueous	6010B[c]	5 µg/L[h, i]		20[i]	
	Soil		0.5 mg/kg[h, i]		35[h]	
Cadmium	Aqueous	6010B[c]	5 µg/L[h, i]		20[i]	
	Soil		0.5 mg/kg[h, i]		35[h]	
Chromium	Aqueous	6010B[c]	10 µg/L[h, i]		20[i]	
	Soil		1 mg/kg[h, i]		35[h]	
Copper	Aqueous	6010B[c]	25 µg/L[h, i]		20[i]	
	Soil		2.5 mg/kg[h, i]		35[h]	
Lead	Aqueous	6010B[c]	3 µg/L[h, i]		20[i]	
	Soil		0.3 mg/kg[h, i]		35[h]	
Manganese	Aqueous	6010B[c]	15 µg/L[h, i]		20[i]	
	Soil		1.5 mg/kg[h, i]		35[h]	
Mercury	Aqueous	7470A[c]	0.2 µg/L[h, i]		20[i]	
	Soil	7471A[c]	0.1 mg/kg[h, i]		35[h]	
Molybdenum	Aqueous	6010B[c]	10 µg/L[h, i]		20[i]	
	Soil		1 mg/kg[h, i]		35[h]	
Nickel	Aqueous	6010B[c]	40 µg/L[h, i]		20[i]	
	Soil		4 mg/kg[h, i]		35[h]	
Selenium	Aqueous	6010B[c]	5 µg/L[h, i]		20[i]	
	Soil		0.5 mg/kg[h, i]		35[h]	
Silver	Aqueous	6010B[c]	10 µg/L[h, i]		20[i]	
	Soil		1 mg/kg[h, i]		35[h]	
Zinc	Aqueous	6010B[c]	20 µg/L[h, i]		20[i]	
	Soil		2 mg/kg[h, i]		35[h]	
TCLP RCRA Metals						
Arsenic	Aqueous	1311/6010B[c] 1311/7470A[c]	0.10 mg/L[h, i]	5 mg/L[f]	20[i]	Matrix Spike Recovery 75-125[i]; Laboratory Control Sample Recovery 80 - 120[i]
Barium			2 mg/L[h, i]	100 mg/L[f]		
Cadmium			0.05 mg/L[h, i]	1 mg/L[f]		
Chromium			0.10 mg/L[h, i]	5 mg/L[f]		
Lead			0.03 mg/L[h, i]	5 mg/L[f]		
Mercury			0.002 mg/L[h, i]	0.2 mg/L[f]		
Selenium			0.05 mg/L[h, i]	1 mg/L[f]		
Silver			0.10 mg/L[h, i]	5 mg/L[f]		

Table 3-2
Analytical Requirements for CAU 224
(Page 3 of 3)

Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD)[a]	Percent Recovery (%R)[b]
RADIOCHEMISTRY						
Gamma-Emitting Radionuclides	Aqueous	EPA 901.1[j]	10 pCi/L (Cs-137)	NA	Relative Percent Difference (RPD[a]) 20% (Water)[h] 35% (Soil)[h] Normalized Difference (ND) -2<ND<2[k]	Laboratory Control Sample Recovery 80-120[i]
	Soil	HASL-300[l]	0.5 pCi/L (Cs-137)			
Isotopic Uranium	Aqueous	HASL-300[l] ASTM D3972-02[m]	0.1 pCi/L	NA		Chemical Yield 30-105[n] Laboratory Control Sample Recovery 80-120[i]
	Soil	HASL-300[l] ASTM C1000-00[m]	0.05 pCi/g			
Isotopic Plutonium	Aqueous	ASTM D3865-02[m]	0.07 pCi/L	NA		
	Soil	ASTM HASL-300[l]	0.05 pCi/g			
Strontium - 90	Aqueous	ASTM D5811-00[m]	1.0 pCi/L	NA		
	Soil	HASL-300[l]	0.5 pCi/g			

[a] Relative percent difference (RPD) is used to calculate precision.
Precision is estimated from the relative percent difference of the concentrations measured for the matrix spike and matrix spike duplicate or of laboratory, or field duplicates of unspiked samples. It is calculated by: RPD = 100 x $\{(|C_1-C_2|)/[(C_1+C_2)/2]\}$, where C_1 = Concentration of the parameter in the first sample aliquot,
C_2 = Concentration of the parameter in the second sample aliquot.
[b] %R is used to calculate accuracy.
Accuracy is assessed from the recovery of parameters spiked into a blank or sample matrix of interest, or from the recovery of surrogate compounds spiked into each sample. The recovery of each spiked parameter is calculated by: percent recovery (%R) = 100 x (C_s-C_u/C_n), where C_s = Concentration of the parameter in the spiked sample,
C_u = Concentration of the parameter in the unspiked sample, C_n = Concentration increase that should result from spiking the sample
[c] U.S. Environmental Protection Agency (EPA) *Test Methods for Evaluating Solid Wast*e, 3rd Edition, Parts 1-4, SW-846 CD ROM, Washington, DC (EPA,1996)
[d] Estimated Quantitation Limit as given in SW-846 (EPA, 1996)
[e] In-House Generated RPD and %R Performance Criteria
It is necessary for laboratories to develop in-house performance criteria and compare them to those in the methods. The laboratory begins by analyzing 15 to 20 samples of each matrix and calculating the mean %R for each parameter. The standard deviation (SD) of each %R is then calculated, and the warning and control limits for each parameter are established at ± 2 SD and ± 3 SD from the mean, respectively. If the warning limit is exceeded during the analysis of any sample delivery group (SDG), the laboratory institutes corrective action to bring the analytical system back into control. If the control limit is exceeded, the sample results for that SDG are considered unacceptable. These limits are reviewed after every quarter and are updated when necessary. The laboratory tracks trends in both performance and control limits by the use of control charts. The laboratory's compliance with these requirements is confirmed as part of an annual laboratory audit. Similar procedures are followed in order to generate acceptance criteria for precision measurements.
[f] Title 40 *Code of Federal Regulations* Part 261, "Identification and Listing of Hazardous Waste" (CFR, 2003)
[g] EPA *Contract Laboratory Program Statement of Work for Organic Analysis* (EPA, 1988b; 1991; and 1994c)
[h] *Industrial Sites Quality Assurance Project Plan* (NNSA/NV, 2002)
[i] EPA *Contract Laboratory Program Statement of Work for Inorganic Analysis* (EPA, 1988a; 1994b; and 1995)
[j] *Prescribed Procedures for Measurements of Radioactivity in Drinking Water*, EPA-600/4-80-032 (EPA, 1980)
[k] Normalized Difference is not RPD, it is another measure of precision used to evaluate duplicate analyses. The normalized difference is calculated as the difference between two results divided by the square root of the sum of the squares of their total propagated uncertainties. *Evaluation of Radiochemical Data Usability* (Paar and Porterfield, 1997)
[l] *The Procedures Manual of the Environmental Measurements Laboratory*, HASL-300 (DOE, 1997)
[m] American Society for Testing and Materials (ASTM, 2000b, 2002a, b, c)
[n] *General Radiochemistry and Routine Analytical Services Protocol (GRASP)* (EG&G Rocky Flats, 1991)

Definitions:
Cs = Cesium
EQLS = Estimated quantitation limits
mg/L = Milligrams per liter
mg/kg = Milligrams per kilogram
NA = Not applicable
µg/L = Micrograms per liter;

Table 3-3
Contaminants of Potential Concern for CAU 224

Chemical		Radiological	
COPCs	**Critical Analytes**	**COPCs**	**Critical Analytes**
Total Petroleum Hydrocarbons	TPH-DRO	Gamma Spectrometry	Americium-241 Cesium-137 Cobalt-60
Semivolatile Organic Compounds	Dichlorobenzene Ethyl Benzene Chrysene Fluorene Napthalene	Isotopic Uranium	None
Volatile Organic Compounds	Tetrachlorethylene Carbon Tetrachloride 1,1,1 Trichloroethane 1,2 Dichloroethane Methylene chloride Tetrachloroethene Trichlorethylene Toluene Xylene Benzene	Isotopic Plutonium	None
PCBs	None		
RCRA Metals	Silver Barium		
Metals	Aluminum Antimony Beryllium Cobalt Copper Manganese Molybdenum Nickel Zinc	Strontium-90	None
Cyanide	Cyanide		
Hydroquinone	Hydroquinone		
Methanol	Methanol		
Sulfide	Sulfide		

3.3 Preliminary Action Levels

Laboratory analytical results for COPCs in soil samples will be compared to the following PALs to evaluate the presence of COCs:

- EPA *Region 9 Risk-Based Preliminary Remediation Goals* for chemical constituents in industrial soils (EPA, 2002a).

- Background concentrations for RCRA metals will be used instead of PRGs when natural background exceeds 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).

- The TPH action limit of 100 parts per million (ppm) per the *Nevada Administrative Code* (NAC) 445A (NAC, 2003).

- The PALs for radiological contaminants 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) scaled from 25 to 15 millirem (mrem) per year dose and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993).

- For detected chemical COPCs without established PRGs, a similar protocol to that used by the EPA Region 9 will be used in establishing a preliminary action level for those COPCs listed in the EPA IRIS database (EPA, 2002b).

Solid media such as concrete may pose a potential radiological exposure risk to site workers if contaminated. The radiological PAL for the surface of solid media will be defined as the unrestricted-release criteria defined in the *NV/YMP Radiological Control (RadCon) Manual* (DOE/NV, 2000b).

The comparison of laboratory results to PALs will be discussed in the CADD. Laboratory results above PALs indicate the presence of COCs that will require further evaluation. The evaluation of potential corrective actions and the justification for a preferred action will be included in the CADD based on the results of this field investigation. Proposed cleanup levels will be presented in the CADD, if applicable.

3.4 DQO Process Discussion

The DQO strategy for CAU 224 was developed at a meeting on February 10, 2003, to identify data needs, clearly define the intended use of the environmental data, and to 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. A CSM has been developed for the nine CASs using historical background information, knowledge from studies at similar sites, and data from previous sampling efforts. The CSM includes potential contamination sources, release mechanisms, and migration pathways.

Details of the DQO process are presented in Appendix A.1. Criteria for data collection activities were assigned. The analytical methods and reporting limits prescribed through the DQO process, as well as the DQIs for laboratory analysis such as precision and accuracy requirements, are provided in Section 6.0 of this CAIP. Laboratory data will be assessed to determine if the DQOs were met based on the DQIs of precision, accuracy, representativeness, completeness, and comparability. Other DQIs, such as sensitivity, also may be used.

Laboratory analysis of environmental soil samples will provide the means for quantitative measurement of the COPCs. Table 3-2 includes the analytical methods for CAU 224, minimum reporting limits (MRLs), and precision and accuracy requirements for each method. The analytical methods are capable of generating data that meet the project needs determined through the DQO process. Specifically, the MRLs are set so that laboratory analyses will generate data with the necessary resolution for comparison to PALs. The MRLs for radiological analytes have been developed considering both the minimum detectable concentrations (MDCs) and PALs.

4.0 Field Investigation

This section of the CAIP contains the approach for investigating CAU 224.

4.1 Technical Approach

The information necessary to resolve the DQO decisions will be generated for each CAS 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 COPCs if they are present anywhere within the CAS. These locations will be determined based on the identification of biasing factors. 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.

Sample locations may be changed based on site conditions, obvious debris or staining of soils, field-screening results, or professional judgement. The Site Supervisor has the discretion to modify the biased locations, but only if the modified locations meet the DQO decision needs and criteria stipulated in Appendix A.1.

Since 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 under CAU 244. To determine if contamination is from the CAU or from other sources, soil samples may be collected from background locations at selected CASs.

Modifications to the investigative strategy may be required should unexpected field conditions be encountered at any CAS. Significant modifications shall be justified, approved and documented on a Record of Technical Change prior to 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 for the CAU 224 CAI includes the following:

- Conduct the radiological land-area surveys to identify potential biased sampling locations and to document the radiological condition of the site.
- Conduct video mole surveys of discharge and outfall lines in order to identify potential contamination release points, and provide biased sampling locations. Piping that is currently in use will not be subject to video surveys.
- Excavate subsurface features, if necessary to gain additional access for inspection or sampling, or to introduce the video mole system.
- Collect and analyze samples from biased locations as described in this section.
- Collect additional samples as necessary to resolve Decision II.
- Collect required QC samples.
- Collect additional samples, as necessary, to support the characterization of potential corrective action waste streams.
- Collect samples from native soils and analyze for geotechnical/hydrologic parameters and bioassessment, if necessary.
- Stake or flag sample locations and record coordinates.

4.2.1 Site Preparation Activities

Site preparation will be conducted by the NTS Management and Operating (M&O) contractor prior to the investigation. Site preparation may include, but not be limited to: removal and proper disposal of surface debris (e.g., surface metal, wood debris, and concrete) that may interfere with sampling as well as providing access to sample points (e.g., fence removal).

4.2.2 Decision I Activities

The objective of the Decision I strategy is to determine if COCs are present within the CAS boundaries. Decision I sampling strategy targets locations and media most likely to be contaminated with COCs. The initial activities planned for CAU 224 will include site radiological surveys, video mole surveys and biased soil sampling. The results of the radiological surveys for CAU 224 will be used to determine biased sampling locations, identify potential areas of elevated radiological activity, and provide information to protect workers and the environment from radiological hazards during the CAI at CAU 224.

The presence of COCs will be determined by biased sampling and laboratory analyses. A comparison of laboratory analytical results from Decision I samples against PALs will be used to confirm the presence or absence of COCs.

Sampling activities at CAS 05-04-01 will be limited to tank contents, if present, as well as surface/near-surface soil beneath the overflow piping for each tank and two samples in the wash. The samples collected will be analyzed to confirm conclusions from 1995 that indicated the contents were nonhazardous. If analytical results indicate COCs are present then residual materials in manholes and associated piping will be collected, if present.

Biased sampling locations at all other CASs will be determined based on the results of surveys and other biasing factors. The Site Supervisor has the ability to modify these locations and minimize samples submitted for laboratory analyses, but only if the decision needs and criteria stipulated in Appendix A.1, Section A.1.3, are satisfied.

Appendix A.1 lists the target populations for Decision I and identifies information needs in selecting data collection locations for Decision I samples. The following are the biasing factors that currently have been identified for consideration in the selection of the surface soil sample locations:

- Aerial photograph review and evaluation
- Walk-over and drive-over radiological surveys
- Visual indicators (e.g., staining, topography, areas of preferential surface run-off)
- Existing site-specific analytical data (e.g., CAS 05-04-01 closure sampling data)
- Known or suspected sources and locations of release
- Process knowledge and experience at similar sites
- Geologic and/or hydrologic conditions
- Physical and chemical characteristics of suspected contaminants.

Contaminants determined not to be present in Decision I samples may be eliminated from Decision II analytical suites. However, the initial surface soil samples will be analyzed for the full suite of parameters identified in Table 3-2.

4.2.3 Field-Screening Levels

Field screening, along with other biasing factors, may help guide the selection of the most appropriate sampling locations for collection of laboratory samples. The following field screening levels (FSLs) may be used for on-site field screening:

- The radiological (alpha and beta/gamma) FSL of the mean background activity plus two times the standard deviation of the mean background activity collected from undisturbed locations within the vicinity of the site (Adams, 1998).
- The VOC FSL is established as 20 ppm or 2.5 times background, whichever is greater.
- The TPH FSL is established as 75 ppm.

Field-screening concentrations exceeding FSLs indicate potential contamination at that sample location. This information will be documented and the investigation will collect additional samples to delineate the extent of the contamination. Additionally, these data may be used to select confirmatory samples for submission to the laboratory.

4.2.4 Decision II Activities

Decision II (step-out) sampling locations at CAU 224 will be selected based on the outer boundary sample locations where a COC is detected in Decision I samples. Sample locations may be changed based on current site conditions, obvious debris or staining of soils, field-screening results, or professional judgement. Decision II locations will also be selected based on pertinent features of the CSM and the other biasing factors. If biasing factors indicate a COC potentially extends beyond planned Decision II sample locations, locations may be modified or additional Decision II samples may be collected from incremental step-out locations. Both surface and subsurface soil samples may be collected and analyzed to determine the extent of a COC.

Also due to the nature of buried features possibly present (e.g., structures, buried debris, and utilities), sample locations may be relocated, based upon the review of engineering drawings, and information obtained during the site visit. However, the new locations will meet the decision needs and criteria stipulated in Section A.1.4.1.

Decision II subsurface soil samples will be collected at biased locations by hand augering, direct-push, excavation, or drilling techniques, as appropriate. Subsurface soil sample depth intervals will be selected based on biasing factors. Section 3.0 provides the analytical methods and laboratory requirements (i.e., detection limits, precision, and accuracy requirements) to be used when analyzing the COPCs.

If the nature and/or extent of contamination is inconsistent with the CSM, or if contamination extends beyond the spatial boundaries identified in Appendix A.1, Section A.1.5.2, identified decision makers will be notified and the investigation strategy will be reevaluated. As long as contamination is consistent with the CSM and is within spatial boundaries, sampling will continue to define extent.

4.3 Sampling Strategy

The CASs in CAU 224 have been divided for investigation purposes based on the function of the system components and the varying potential for contamination. The four components (septic and/or collection component, leachfield component, lagoon/leachpit component, and decontamination pad component) are graphically represented in the CSM (Figure 3-1), providing a basis for the sampling strategies described in the following sections. Table A.1-7 defines Decision I and II target populations, and provides the spatial boundaries for sampling.

4.3.1 Septic and/or Collection Component Activities

Piping is common in all the CAU 224 CASs with the exception of CAS 06-05-01. Sampling activities at these CASs will consist of video mole surveys of abandoned piping to identify breaches or residual material, excavating to locate the piping, and collecting Decision I and II samples for laboratory analysis as necessary. Manhole access to piping is also present for CASs 06-03-01 and 11-04-01. Residual material in manholes will also be sampled, if present.

Each of the CASs 02-04-01, 05-04-01, and 11-04-01 has at least one septic tank. Intrusive activities at CAS 02-04-01 may be necessary to locate the tank. Activities at CAS 02-04-01, 05-04-01, and 11-04-01 include visual inspection of the inside of the septic tank and collecting Decision I samples for laboratory analysis from each matrix of the tank residual if present. Decision I soil samples will be collected for CASs 02-04-01 and 11-04-01 beneath the inlet and outlet end pipes, in the soil horizon underlying the base of the septic tanks, and in areas of potential overflow. Decision II samples in the area encompassing the tanks will be collected as detailed on Table A.1-7.

Corrective Action Sites 06-23-01 and 11-04-01 each have a covered distribution box that directed effluent to the leachfield and evapotranspiration bed, respectively. Decision I activities at these CASs will consist of excavating (as appropriate) to locate the distribution box, inspecting inside the distribution box, and collecting Decision I samples for laboratory analysis of residual contents in the distribution boxes (if present). Decision I soil samples will be collected beneath the inlet and outlet piping of the distribution boxes if breaches are suspected and the soil horizon underlying the base of the box. As detailed in Table A.1-7, Decision II samples vertically from the base will be collected based on FSL exceedances and at additional locations encompassing the distribution box. There is presumably a distribution box associated with CAS 06-03-01 within the covered Sewage Lagoon I and II. Samples will be collected if the box can be located.

4.3.2 Leachfield Component Activities

Corrective Action Sites 06-05-01 and 23-05-02 each have a leachfield and 11-04-01 has an evapotranspiration bed constructed very similar to a leachfield. Decision I activities at these CASs will consist of excavating or other intrusive method to locate the boundaries of each leachfield, exposing the proximal and distal ends of the associated perforated distribution pipes, and collection of Decision I samples of residuals in the distribution piping at the proximal, midpoint, and distal ends. Decision I samples will also be collected from soil above and below the distribution pipes at the proximal, midpoint, and distal ends. Native soil beneath the leachfield at the proximal, midpoint, and distal ends of the distribution pipes will also be sampled. If the interface cannot be identified, then samples will be collected directly beneath the distribution pipes. Decision II samples will be collected vertically at Decision I locations if FSLs are exceeded and until FSRs are less than FSLs and at locations encompassing the CAS as described in Table A.1-7.

4.3.3 Lagoon/Leach Pit Component Activities

Corrective Action Sites 03-05-01, 06-03-01, 06-05-01, and 11-04-01 each have a lagoon or lagoon like (i.e., the leach pit) component. Decision I activities at these CASs will consist of locating the distribution pipe or discharge area for each lagoon and collecting Decision I samples of lagoon sediments and in soil beneath the lagoon at the native soil interface at the proximal, midpoint, and distal ends. As indicated in Table A.1-7, Decision II samples will be collected vertically at Decision I locations if FSLs are exceeded and until FSRs are less than FSLs and at locations encompassing the CAS. Decision II samples will also be collected at the perimeter locations of the lagoons.

4.3.4 Decontamination Pad Component Activities

Corrective Action Site 06-17-04 includes a decontamination pad, drain, and wastewater catch, and CAS 03-05-01 potentially has a sump associated with it. Activities at these CASs will consist of collecting Decision I samples at the pad/native soil interface (i.e., under the pad); surface soil adjacent to the edges of the decontamination pad; soil beneath the concrete trench leading from the pad to the sump; and soil at the base of the sump. Decision II samples will be collected vertically at Decision I locations if FSLs are exceeded and until FSRs are less than FSLs and at locations encompassing the CAS.

The CAS-specific proposed sampling locations are presented in Figure A.1-10 through Figure A.1-16 in Appendix A.1 of this CAIP.

4.4 Geotechnical/Hydrological Analysis and Bioassessment Tests

It may be necessary to measure the geotechnical/hydrological parameters of the CAS. Bioassessment samples may be collected if biasing factors suggests a petroleum plume may be present. Samples to be analyzed for these parameters will be collected within brass sleeves (or other containers, as appropriate) to maintain the natural physical characteristics of the soil. The testing methods shown are minimum standards, and other equivalent or superior testing methods may be used. In some cases, bioassessment will also be performed on the sample material. Bioassessment is a series of tests designed to evaluate the physical, chemical, and microbiological characteristics of a site. Bioassessment tests include determinants of nutrient availability, pH, microbial population density, and the ability of the microbial population to grow under enhanced conditions. This type of analysis is most appropriate for hydrocarbon contamination sites where bioremediation is a potential corrective action.

4.5 Safety

A current version of the Environmental Architect-Engineer Services Contractor's Health and Safety Plan (HASP) will accompany the field documents, and a site-specific health and safety plan (SSHASP), or equivalent will be prepared and approved prior to the field effort. As required by the DOE Integrated Safety Management System (ISMS) (DOE/NV, 1997), these documents outline the requirements for protecting the health and safety of the workers and the public, and 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 to protect the environment during all project activities. The following safety issues will be taken into consideration when evaluating the hazards and associated control procedures for field activities discussed in the safety basis document:

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

- Proper training of all site personnel to recognize and mitigate the anticipated hazards

- Work controls to reduce or eliminate the hazards including engineering controls, substitution of less hazardous materials, administrative controls, and use of appropriate personal protective equipment (PPE)

- Occupational exposure monitoring to prevent overexposures to hazards such as radionuclides, chemicals, and physical agents (e.g., thermal stress, adverse weather)

- 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 dealing with radiological hazards

- Emergency communications and contingency planning, including medical care and evacuation, decontamination, spill control measures, and appropriate notification of project management

5.0 Waste Management

Management of IDW will be based on regulatory requirements, field observations, process knowledge, and the results of laboratory analysis of CAU 224 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 analysis of site investigation samples, may not be necessary. However, if associated investigation samples are found to contain contaminants above regulatory levels, direct samples of IDW may 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, and agreements and permits between DOE and NDEP.

In summary, all waste from CAU 224 will be evaluated as potentially characteristic, as no listed wastes have been identified. Waste generated will be characterized and disposed of using process knowledge, field observations, and analytical results, in accordance with regulatory requirements.

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 excavation) 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 material used at the sites 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

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

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

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

5.3 Investigation-Derived Waste Management

The on-site management and ultimate disposition of IDW may 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/screening results, and/or radiological survey/swipe results. Table 4-2 of the NV/YMP RadCon Control Manual (DOE/NV, 2000b) shall be used to determine if 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.

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 260-268	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 260-268	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] 444.965-444.970

[a]*Nevada Revised Statutes* (NRS, 2003a, b, c)
[b]*Nevada Administrative Code* (NAC, 2002a, 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/NV, 2003)
[i]Area 6 Class III Solid Waste Disposal Site for hydrocarbon waste (NDEP, 1997b)
[j]*Toxic Substance Control Act* (CFR, 2003b, c)

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 = Nevada Test Site Performance Objective for the Certification of Nonradioactive Hazardous Waste
RCRA = Resource Conservation and Recovery Act
TSCA = Toxic Substance Control Act

5.3.1 Sanitary Waste

Office trash and lunch waste will be sent to the sanitary land fill by disposal in a dumpster.

5.3.1.1 Special Sanitary Waste

Hydrocarbon waste is defined as waste containing more than 100 mg/kg of TPH contamination (NAC, 2003). Hydrocarbon waste 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.

Asbestos-containing materials that may be encountered or generated during this investigation will be managed and disposed of in accordance with appropriate federal (CFR, 2003) and State of Nevada (NAC, 2002b) regulations.

5.3.2 Hazardous Waste

Corrective Action Unit 224 will have waste storage areas established according to the needs of the project. Satellite accumulation areas and hazardous waste accumulation areas (HWAAs) will be managed consistent with the requirements of federal and state regulations (CFR, 2003; NAC, 2002b). The HWAAs will be properly controlled for access and equipped with spill kits and appropriate spill containment. Suspected hazardous wastes will be placed in DOT-compliant containers, and marked "Hazardous Waste Pending Analysis." All containerized waste will be handled, inspected, and managed in accordance with Title 40 CFR 265, Subpart I (CFR, 2003). 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.

The HWAAs 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. *Resource Conservation and Recovery Act* "listed" waste has not been identified at CAU 224. Any waste determined to be hazardous will be managed and transported in accordance with RCRA and DOT to a permitted treatment, storage, and disposal facility (CFR, 2003).

Management of Personal Protective Equipment - PPE and disposable sampling equipment will be visually inspected for stains, discoloration, and gross contamination as the waste is generated, to determine if the waste is potentially contaminated. The PPE/equipment that is not visibly stained, discolored, or grossly contaminated will be managed as nonhazardous sanitary waste. At the discretion of the Site Supervisor and Site-Safety Officer, any IDW that is determined to be potentially contaminated will be segregated and managed as potentially "characteristic" hazardous waste. This segregated population of waste will either be (1) assigned the characterization of the environmental media that was sampled, (2) sampled directly, or (3) undergo further evaluation using the environmental media sample results to determine how much of the media would need to be present in the waste to exceed regulatory levels. Waste that is determined to be hazardous will be entered into an approved waste management system, where it will be managed and dispositioned according to RCRA requirements or subject to agreements between NNSA/NSO and the State of Nevada.

Management of Decontamination Rinsate - Rinsate at this CAU will not be considered hazardous waste unless there is evidence that the rinsate would display a RCRA characteristic. Evidence may include such things as the presence of a visible sheen, pH, or association with equipment/materials 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, 2003). The regulatory status of the potentially hazardous rinsate will be determined through the application of associated sample results or through direct sampling. If determined to be hazardous, the rinsate will be entered into an approved waste management system, where it will be managed and dispositioned according to RCRA requirements or subject to agreements between NNSA/NSO and the State of Nevada. If the associated samples do not indicate the presence of hazardous 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 5x *Safe Drinking Water Standards* (SDWS) is not restricted as to disposal. Nonhazardous rinsate which is contaminated at 5x to 10x 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 10x 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.

Management of Soil - This waste stream consists of soil produced during soil sampling, excavation, and/or drilling. This waste stream is considered to have the same COPCs as the material remaining in the ground. The preferred method for managing this waste stream is to place the material back into the borehole/excavation in the same approximate location from which it originated. If this cannot be accomplished, the material will either be managed within the area of concern by berming and covering next to the excavation, or by placement in a container(s). Containerized soil determined to be hazardous will be subject to RCRA and associated storage time requirements.

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 will be used to characterized 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, or LLW. Debris determined to be hazardous will be subject to RCRA and associated storage time requirements. 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).

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, 2003). 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.

5.3.3 Polychlorinated Biphenyls

The management of PCBs is governed by the TSCA and its implementing regulations at 40 CFR 761 (CFR, 2003). Polychlorinated biphenyls 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, 2003) as well as State of Nevada requirements (NAC, 2002b), guidance, and agreements with NNSA/NSO.

5.3.4 Low-Level 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. This allows for the immediate segregation of radioactive waste from waste that may be unrestricted regarding radiological release. Removable contamination limits, as defined in Table 4-2 of the current version of the NV/YMP RadCon Manual (DOE/NV, 2000b), will be used to determine if such waste may be declared unrestricted regarding radiological release versus being declared radioactive waste. Direct sampling of the waste may be conducted to aid in determining if a particular waste unit (e.g., drum of soil) contains LLW, as necessary. Waste that is determined to be below the values of 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 *Nevada Test Site Waste Acceptance Criteria* (NTSWAC) (NNSA/NV, 2003). Potential radioactive waste drums will be marked "Radioactive Waste Pending Analysis," and may contain soil, PPE, disposable sampling equipment, and/or rinsate may be staged at a designated radioactive materials area (RMA) when full or at the end of an investigation phase. The waste drums will remain at the RMA pending certification and disposal under NTSWAC requirements (NNSA/NV, 2003).

5.3.5 Mixed Waste

Mixed waste, if generated, shall be managed and dispositioned according to the requirements of RCRA (CFR, 2003) 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 "Hazardous Waste Pending Analysis" and "Radioactive Waste 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 waste transporter to the NTS transuranic waste storage pad for storage pending treatment or disposal. Mixed waste with hazardous waste constituents below Land Disposal Restrictions may be disposed of at the NTS Area 5 RWMS if the waste meets the requirements of the NTSWAC (NNSA/NV, 2003). Mixed waste not meeting 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).

6.0 Quality Assurance/Quality Control

The primary objective of the corrective action investigation described in this CAIP is to collect accurate and defensible data to support the selection and implementation of a closure alternative for the CASs within CAU 224. 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. Section 6.2.9 provides QA/QC requirements for radiological survey data. Data collected during the corrective action investigation will be evaluated against DQI-specific performance criteria to verify that the DQOs established during the DQO process (Appendix A.1) have been satisfied.

Unless otherwise stated in this CAIP or required by the results of the DQO process (Appendix A.1), this investigation will adhere to the Industrial Sites QAPP (NNSA/NV, 2002).

The discussion of the DQIs, including the data sets, will be provided in the CAU 224 CADD to be developed at the completion of the corrective action investigation.

6.1 Quality Control Field Sampling Activities

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

- Trip blanks (1 per sample cooler containing volatile organic compound [VOC] environmental samples)
- Equipment blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per source lot per sampling event)
- Field duplicates (minimum of 1 per matrix per 20 environmental samples or 1 per CAS if event if less than 20 collected)
- Field blanks (minimum of 1 per 20 environmental samples or 1 per CAS if less than 20 collected or change in field conditions)

- Matrix spike (MS)/matrix spike duplicate (MSD), (minimum of 1 per matrix per 20 environmental samples or 1 per CAS if less than 20 collected as required by the analytical method)

Additional QC samples may be submitted based on site conditions at the discretion of the Site Supervisor. Field QC samples shall be analyzed using the same analytical procedures implemented for associated environmental samples. Additional details regarding field QC samples are available in the Industrial Sites QAPP (NNSA/NV, 2002).

6.2 Laboratory/Analytical Quality Assurance

Criteria for the investigation, as stated in the DQOs (Appendix A.1) 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 nonradiological laboratory data from samples collected and analyzed will be evaluated for data quality according to *EPA Functional Guidelines* (EPA, 1994a and 1999). Radiological laboratory data from samples that are collected and analyzed will be evaluated for data quality according to company-specific procedures. The data will be reviewed to ensure that all critical samples were appropriately collected, analyzed, and the results passed data validation criteria. Validated data, including estimated data (i.e., J-qualified), will be assessed to determine if they meet the DQO requirements of the investigation and the performance criteria for the DQIs. The results of this assessment will be documented in the CADD. If the DQOs were not met, corrective actions will be evaluated, selected, and implemented (e.g., refine CSM or resample to fill data gaps).

6.2.2 Data Quality Indicators

Data quality indicators are qualitative and quantitative descriptors used in interpreting the degree of acceptability or utility of data. The principal DQIs are precision, accuracy, representativeness, comparability, and completeness. A sixth DQI, sensitivity, has also been included for the CAU 224 investigation. 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).

Precision and accuracy are quantitative measures used to assess overall analytical method and field sampling performance as well as to assess the need to “flag” (qualify) individual parameter results when corresponding QC sample results are not within established control limits. Therefore, performance metrics have been established for both analytical methods and individual analytical results. Data qualified as estimated for reasons of precision or accuracy may be considered to meet the parameter performance criteria based on assessment of the data.

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

Table 6-1 provides the established analytical method/measurement system performance criteria for each of the DQIs and the potential impacts to the decision if the criteria are not met. The Industrial Sites QAPP (NNSA/NV, 2002) documents the actions required to correct conditions that adversely affect data quality both in the field and the laboratory. All DQI performance criteria deficiencies will be evaluated for data usability and impacts to the DQO decisions. These evaluations will be discussed and documented in the data assessment section of the CADD. The following subsections discuss each of the DQIs that will be used to assess the quality of laboratory data.

6.2.3 Precision

Precision is used to assess the variability of a population of measurements with the variability of the analysis process. It is used to evaluate the performance of analytical methods as well as to evaluate the usability of individual analytical results. Precision is a measure of agreement among a replicate set of measurements of the same property under similar conditions. This agreement is expressed as the relative percent difference (RPD) between duplicate measurements. The method used to calculate RPD is presented in the Industrial Sites QAPP (NNSA/NV, 2002).

Table 6-1
Laboratory and Analytical Performance Criteria for CAU 224 Data Quality Indicators

Data Quality Indicator	Performance Criteria	Potential Impact on Decision if Performance Criteria Not Met
Precision	Variations between duplicates (laboratory and field) and original sample should not exceed analytical method-specific criteria discussed in Section 6.2.3.	Data that do not meet the performance criteria will be evaluated for purposes of completeness. Decisions may not be valid if analytical method performance criteria for precision are not met.
Accuracy	Laboratory control sample results, matrix spike results, and surrogate results should be within specified acceptance windows.	Data that do not meet the performance criteria will be evaluated for purposes of completeness. Decisions may not be valid if analytical method performance criteria for accuracy are not met.
Sensitivity	Detection limits of laboratory instruments must be less than or equal to respective PALs.	Cannot determine if COCs are present or migrating at levels of concern; therefore, the affected data will be assessed for usability and potential impacts on meeting site characterization objectives.
Comparability	Equivalent samples analyzed using same analytical methods, the same units of measurement and detection limits must be used for like analyses.	Inability to combine data with data obtained from other sources and/or inability to compare data to regulatory action levels.
Representativeness	Correct analytical method performed for appropriate COPC; valid data reflects appropriate target population.	Cannot identify COC or estimate concentration of COC; therefore, cannot make decision(s) on target population.
Nature Completeness	80% of the CAS-specific possible analytes identified in the CAIP have valid results. 90% of critical analytes are valid.	Cannot make decision on whether COCs are present.
Extent Completeness	90% of suspected analytes used to define extent of COCs are valid.	Extent of contamination cannot be determined.
Clean Closure Completeness	90% of suspected analytes are valid.	Cannot determine if COCs remain in soil.

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

6.2.3.1 Precision for Chemical Analysis

The RPD criteria to be used for assessment of precision are the parameter-specific criteria listed in Table 6-1. When laboratory-specific control limits are indicated, they are based on the evaluation at the laboratory on a quarterly basis by monitoring the historical data and performance for each method. No review criteria for field duplicate RPD comparability have been established; therefore, the laboratory sample duplicate criteria will be applied to the review of field duplicates.

The parameter performance criteria for precision will be compared to RPD results of duplicate samples. This will be accomplished as part of the data validation process. Precision values for organic and inorganic analyses that are within the established control criteria indicate that analytical results for associated samples are valid. The RPD values that are outside the criteria for organic analysis do not necessarily result in the qualification of analytical data. It is only one factor in making an overall judgment about the quality of the reported analytical results. For the purpose of data validation of inorganic analyses, precision is measured in two ways. The RPD is calculated when the sample and its duplicate results are greater than five times the contract-required detection limit (CRDL). The absolute difference is calculated and applied to the CRDL when the results are less than five times the CRDL. Inorganic laboratory sample duplicate RPD values outside the established control criteria result in the qualification of associated analytical results as estimated; however, qualified data does not necessarily indicate that the data are not useful for the purpose intended. This qualification is an indication that data precision should be considered for the overall assessment of the data quality and potential impact on data applicability in meeting site characterization objectives.

The criteria to evaluate analytical method performance for precision (Table 3-2) will be assessed based on the analytical method-specific (e.g., VOCs) precision measurements. The analytical method-specific precision measurement is calculated by taking the number of analyses meeting the RPD criteria, dividing that by the total number of analyses with detectable concentrations, and multiplying by 100. Each analytical method-specific precision measurement will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.3.2 Precision for Radiochemical Analysis

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

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

The evaluation of precision based on duplicate RPD requires that both the sample and its duplicate have concentrations of the target radionuclide exceeding five times their MDC. This excludes many measurements because the samples contain nondetectable or low levels of the target radionuclide. However, the ND method may be used for evaluating duplicate data where the results are less than five times their MDCs. This is based on the measurement uncertainty associated with low-level results. The ND test is calculated using the following formula:

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

where:

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

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

The criteria to evaluate analytical method performance for precision (Table 3-2) will be based on the analytical method-specific (e.g., gamma spectrometry) precision measurements. Analytical method-specific precision measurement is calculated by taking the number of analyses meeting the RPD or ND criteria, dividing that by the total number of analyses, and multiplying by 100. Each analytical method-specific precision measurement will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.4 Accuracy/Bias

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

Accuracy is determined by analyzing a reference material of known parameter concentration or by reanalyzing a sample to which a material of known concentration or amount of parameter has been added (spiked). The measure of accuracy is expressed as the percent recovery (%R) (NNSA/NV, 2002). This is calculated by dividing the measured sample concentration by the true concentration and multiplying the quotient by 100.

6.2.4.1 Accuracy for Chemical Analyses

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

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

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

The criteria to evaluate analytical method performance for accuracy (Table 3-2) will be based on the analytical method-specific (e.g., VOCs) accuracy measurements. The analytical method-specific accuracy measurement is calculated by taking the number of analyses meeting the %R criteria, dividing that by the total number of analyses, and multiplying by 100. Each analytical method-specific accuracy measurement will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.4.2 Accuracy for Radiochemical Analysis

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

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

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

The criteria to evaluate analytical method performance for accuracy (Table 3-2) will be assessed based on the analytical method-specific (e.g., gamma spectrometry) accuracy measurements. The analytical method-specific accuracy measurement is calculated by taking the number of analyses meeting the %R criteria, dividing that by the total number of analyses, and multiplying by 100. Each analytical method-specific accuracy performance will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.5 Representativeness

Representativeness is a qualitative evaluation of measurement system performance. It is the degree to which sample data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition (EPA, 1987). Representativeness is assured by a carefully developed sampling strategy, collecting the specified number of samples from proper sampling locations, and analyzing them by the approved analytical methods. An evaluation of this qualitative criterion will be presented in the CADD.

6.2.6 Completeness

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

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

6.2.7 Comparability

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

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 PALs. To ensure that the MRLs are consistent with the corresponding PALs, the MRLs from requested analytical methods for each COPC are compared to the EPA Region 9 PRGs. Equally, the MDC from radiochemistry analytical methods are compared with the accepted established PALs based on NCRP (1999) and DOE (1993) established levels. If this criterion is not achieved, the affected data will be assessed for usability and potential impacts on meeting site characterization objectives.

6.2.9 Radiological Survey Quality Assurance

Radiological surveys will be performed and data collected in accordance with approved procedures.

7.0 Duration and Records Availability

7.1 Duration

After the submittal of the CAIP to NDEP (FFACO milestone has not been established), the following is a tentative schedule of activities (in calendar days):

- Day 0: Preparation for field work will begin.
- Day 120: The field work will commence. Samples will be shipped to meet laboratory holding times.
- Day 200: The field investigation will be completed.
- Day 260: The quality-assured laboratory analytical data will be available for NDEP review.
- The FFACO date for the CADD has not been determined.

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 DOE Project Manager. The NDEP maintains the official Administrative Record for all activities conducted under the auspices of the FFACO.

8.0 References

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Appendix A.1

Data Quality Objectives

A.1 Seven-Step DQO Process for CAU 224 Investigation

The Data Quality Objective process described in this appendix is a seven-step strategic planning approach based on the scientific method that is used to plan data collection activities at CAU 224, Decon Pad and Septic Systems. The DQOs are designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and technically defend the recommended corrective actions (i.e., no further action, closure in place, or clean closure). Existing information about the nature and extent of contamination at each CAS in CAU 224 is insufficient to evaluate and select preferred corrective actions; therefore, a CAI will be conducted.

The CAU 224 investigation will be based on the DQOs presented in this appendix as developed by representatives of the NDEP and NNSA/NSO. The seven steps of the DQO process for CAU 224 are presented in Section A.1.2 through Section A.1.8 and developed based on the CAS-specific information presented in Section A.1.1. This document identifies and references the associated EPA Quality System Documents entitled *Guidance for Quality Assurance Project Plans EPA QA/G-5* (EPA, 2002a), *Data Quality Objectives for Hazardous Waste Site Investigation EPA QA/G-4HW* (EPA, 2000) and *Guidance on Choosing a Sampling Design for Environmental Data Collection EPA QA/G-5S* (EPA, 2002b) upon which the DQO process presented herein is based.

A.1.1 CAS-Specific Information

Corrective Action Unit 224, Decon Pad and Septic Systems, consists of the following nine CASs:

- 02-04-01, Septic Tank (Buried)
- 03-05-01, Leachfield
- 05-04-01, Septic Tanks (4)/Discharge Area
- 06-03-01, Sewage Lagoons (3)
- 06-05-01, Leachfield
- 06-17-04, Decon Pad and Wastewater Catch
- 06-23-01, Decon Pad Discharge Piping
- 11-04-01, Sewage Lagoon
- 23-05-02, Leachfield

The CASs are located in six areas of the NTS as shown in Figure A.1-1. The following sections present CAS-specific information on the physical setting, operational history, sources of potential

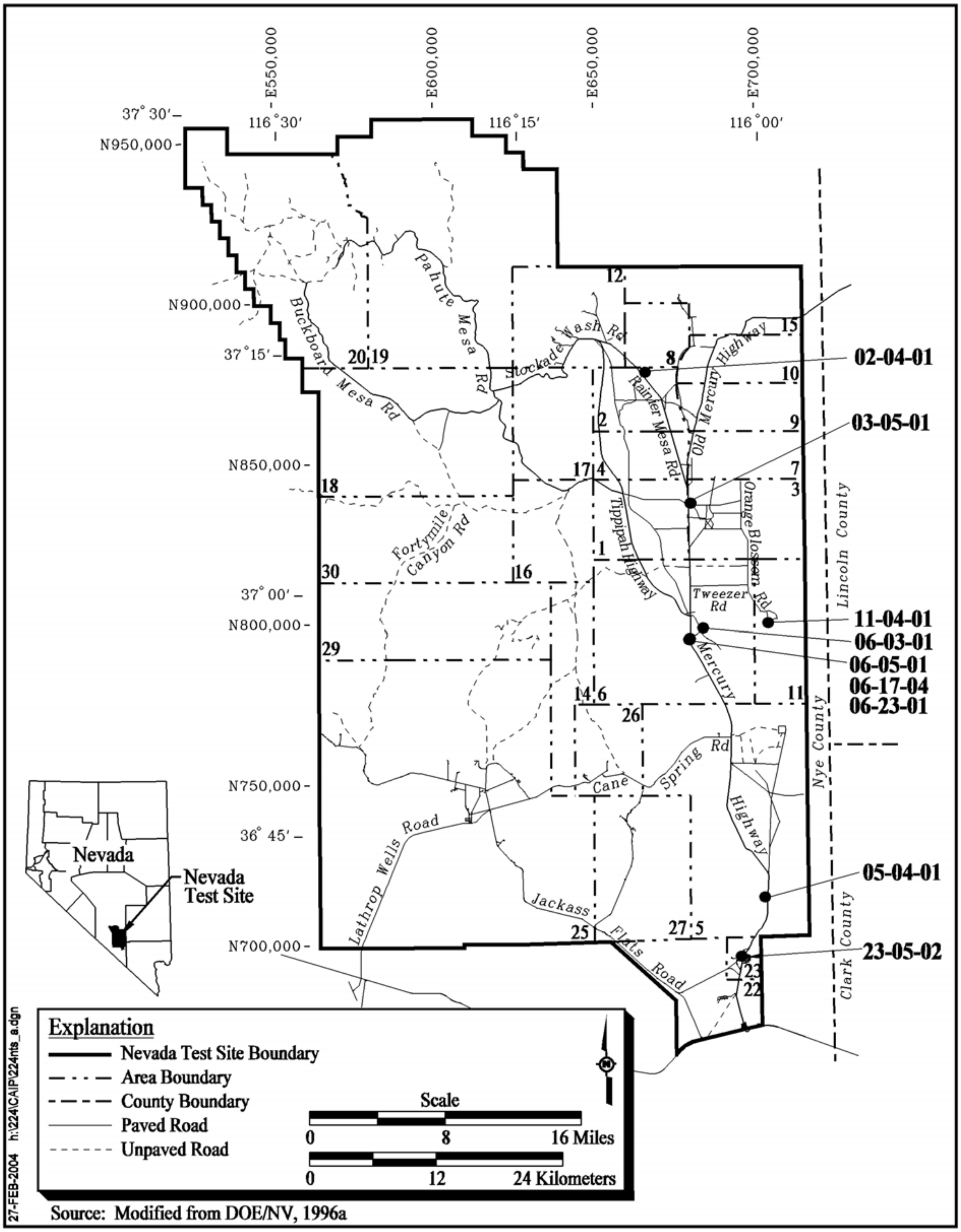

Figure A.1-1
CAU 224 Location Map

contamination, previous investigation results, and COPCs. Of the nine CAU 224 CASs listed above, three (CASs 06-05-01, 06-17-04, and 06-23-01) have been combined for discussion purposes because each represents a component of the same system. Septic tank contents and residuals will be characterized for waste disposal purposes.

Previous investigation data for the CAU 224 CASs are limited. Additionally, many of the COPCs are based on knowledge of activities conducted rather than specific knowledge of a release. As a result, all of the analytes reported by each of the analytical methods requested are considered to be COPCs. Polychlorinated biphenyls and beryllium, and the radionuclides uranium-234, uranium-235, uranium-238, americium-241, cesium-137, strontium-90, plutonium-238, and plutonium-239/-240 are included as COPCs for all CASs because of common concerns for the NTS. Other COPCs (e.g., aluminum and cobalt) have been identified in the following subsections if they were specifically mentioned in the operational history documentation. Table A.1-1 lists the COPCs per CAS.

A.1.1.1 Corrective Action Site 02-04-01, Septic Tank (Buried)

Physical Setting and Operational History - Corrective Action Site 02-04-01 consists of a buried septic tank and its associated piping located along side of 2-07 Road in the Area 2 Support Facility (Figure A.1-2). The septic tank is estimated to be approximately 24 by 13 ft and has a main vent line protruding from the tank. There are six yellow, traffic barrier poles with a posted sign reading "Caution - Buried Septic Tank." Based on site reconnaissance activities, there is no evidence of an associated leachfield or lagoon nearby. Two small-diameter pipes located northeast of the tank were identified and could potentially be connected to the tank. The exact nature, extent, and layout of subsurface piping, if present, is unknown.

The Area 2 Support Facility was constructed in the 1960s to support drilling operations in the Yucca Flat testing basin. The Area 2 Facility was closed in the 1990s. The surrounding buildings and concrete slabs have been demolished and/or removed since the closure of the facility. Historical or operational information has not been located that could identify which facilities may have been directly associated with the septic tank. As a consequence, the associated facility waste streams

discharged to the septic tank are unknown. Four surrounding facilities have been identified that could potentially be associated with the septic tank through subsurface piping systems. These facilities are

Table A.1-1
Decision I Contaminants of Potential Concern Per CAS[a]

COPC	CAS 02-04-01	CAS 03-05-01	CAS 05-04-01	CAS 06-03-01	CASs 06-05-01, 06-17-04, 06-23-01	CAS 11-04-01	CAS 23-05-02
Organics							
VOCs[a]	X	X	X	X	X	X	X
SVOCs[a]	X	X	X	X	x	X	X
PCBs[a]	X	X	X	X	X	X	X
Total Petroleum Hydrocarbons [C_6 - C_{10}]	X	X	X	X	X	X	X
Total Petroleum Hydrocarbons [C_{10} - C_{38}]	X	X	X	X	X	X	X
Methanol[b]					X		
Hydroquinone						X	X
Metals							
RCRA metals[a]	X	X	X	X	X	X	X
Antimony							X
Aluminum[b]	X			X		X	X
Beryllium	X	X	X	X	X	X	X
Cobalt	X			X		X	
Copper							X
Manganese	X			X		X	
Molybdenum							X
Nickel	X			X		X	
Zinc[b]	X			X		X	
Other Parameters							
Cyanide				X			X
Sulfide							X
Radionuclides							
Gamma Emitting to include:							
Americium-241	X	X	X	X	X	X	X
Cesium-137	X	X	X	X	X	X	X
Cobalt-60							X
Strontium-90	X	X	X	X	X	X	X
Plutonium-238 and -239/240	X	X	X	X	X	X	X
Uranium-234, -235, -238	X	X	X	X	X	X	X

[a]For those COPCs identified that include multiple parameters, the parameters with Preliminary Action Levels will be evaluated using EPA *Region IX Risk-Based Preliminary Remediation Goals (PRGs)* for chemical contaminants in industrial soils (EPA, 2002c)
[b]The PRG for this COPC is a non-risk based maximum (EPA, 2002c)

X = COPCs

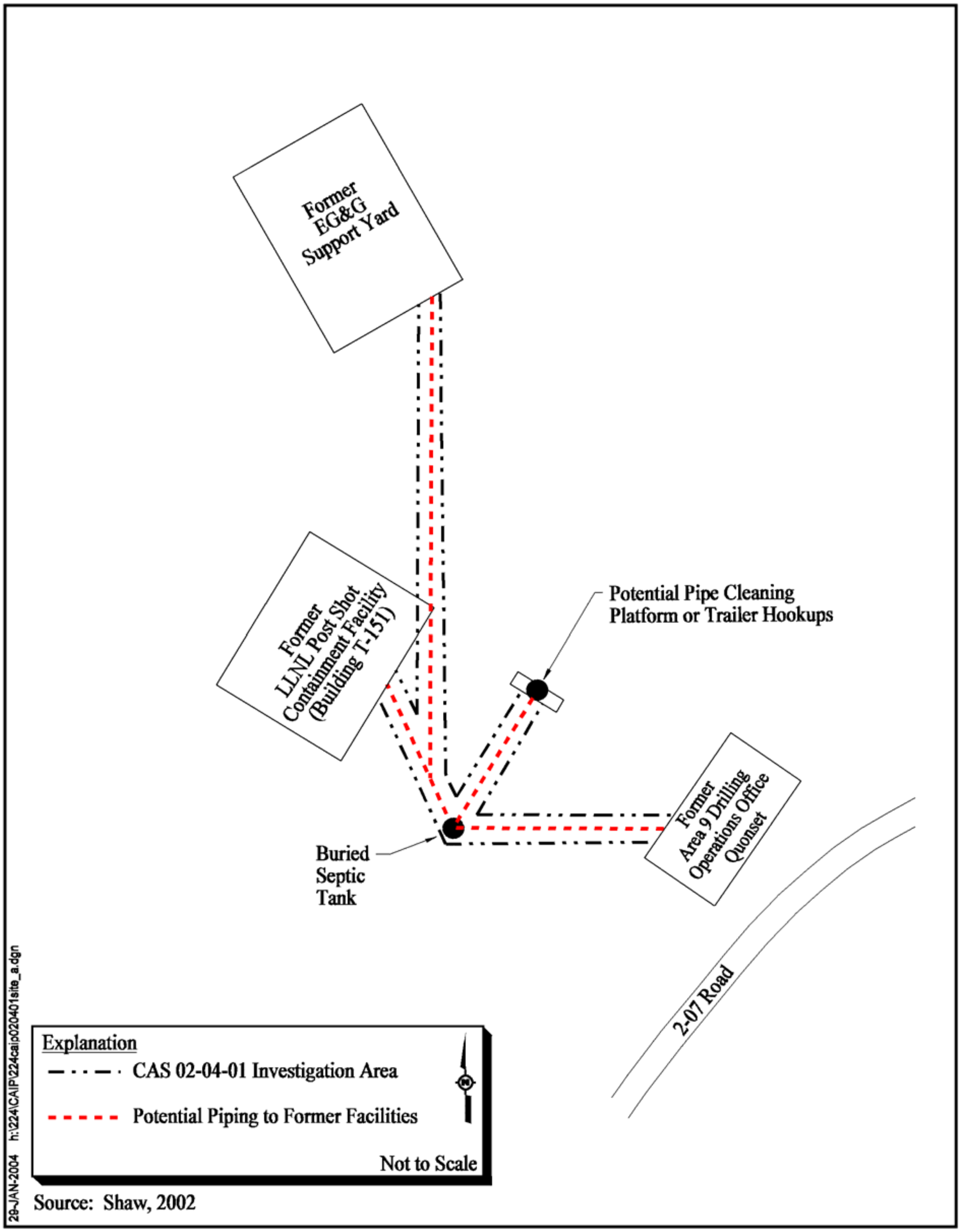

Figure A.1-2
CAU 224, CAS 02-04-01 Site Map

the Area 9 Drilling Operations Office Quonset; the EG&G Support Yard; the LLNL Post Shot Containment Shop (Building T-151); a pipe cleaning platform; and unidentified trailers. Figure A.1-2 shows the facility locations in relation to the tank and how these facilities may possibly be linked through subsurface piping.

Sources of Potential Contamination - The sources of potential contamination at CAS 02-04-01 are based on the assumption that subsurface piping connected drains, sumps, and/or lines from the former surrounding facilities to the buried septic tank. A geophysical survey is proposed to provide additional information. Pending the geophysical survey results, the operational activities at these facilities are considered sources of potential contamination in the event contaminants were disposed down the facility drains. The sources include the following:

- The Area 9 Drilling Operations Office was located east of the tank and was used as an office. It is expected only domestic waste was generated within this facility. The COPCs associated with domestic waste (People for Puget Sound, 2001) should be detected by the following analyses: VOCs, SVOCs, TPH, and RCRA metals.

- The EG&G Support Yard was a 100- by 250-ft fenced area located northwest of the tank. The Yard consisted of a machine shop, skid structures, brock houses, a substation, trailers, and sheds. Historical documentation states the yard and associated structures were used for maintenance and repairing drill rigs and drilling-related equipment where typical wastes such as MWFs (e.g., coolants, cutting oils, lubricants, and machining fluid), metals, petroleum products, solvents, cleaning fluids, and polynuclear aromatic hydrocarbons [PAHs] may have been generated. The PCBs from the storage yard substation may be present based on process knowledge. Machine shop metals could include aluminum, zinc, manganese, chromium, lead, nickel, cadmium, beryllium, and cobalt. (HHS, 1998; Haz-Map, 2002). If subsurface piping leading to the septic tank is identified during the geophysical survey, COPCs from these operations should be detected by the following analyses: VOCs, SVOCs, TPH, PCBs, and RCRA metals (i.e., chromium, lead, and cadmium. Additional metals include aluminum, beryllium, zinc, manganese, nickel, and cobalt).

- The LLNL Post Shot Containment Shop was located to the north/northwest of the septic tank and was used to repair and clean drilling-related equipment. This facility had a sump and injection well located inside the building that was used to capture steam cleaning rinsate and other fluids generated by facility maintenance and cleaning operations. Closure activities performed on the sump and injection well in 1996 consisted of removing liquid and sludge waste from the well, backfilling the well casing with grout, and capping the well with concrete. Closure activities described in the RCRA Closure Report Area 2 Bitcutter and Postshot Containment Shops Injection Wells, Corrective Action Unit 90 (DOE/NV, 1996b) do not suggest any extraneous subsurface piping or drains present between the injection well system and the septic tank. Samples taken from materials removed during closure activities were analyzed for VOCs, SVOCs, TPH, RCRA metals, and gamma spectroscopy. Analytical results show TPH was present above NDEP action levels with values ranging from 16,300 to 303,000 mg/kg. If subsurface piping leading to the septic tank is identified during the geophysical survey, TPH from these operation would be the COPC, which is consistent with the COCs identified at well closure.

- The pipe cleaning platform was located between the LLNL Postshot Containment Shop and the Area 9 Drilling Operations Office. The platform was likely used for steam cleaning and degreasing drilling pipe. It is unknown if the platform floor contained a french drain or sump for capturing rinsate. The platform location may be the same location as the two protruding, small-diameter pipes identified during a site visit. The two pipes may be remnants of the former platform or trailer hookups. Typical wastes generated from similar operations would include oil, grease, lead, solvents, degreasers, and radionuclides (REECo, 1983). Domestic waste would have been associated with the trailer complex if the trailers were connected to the system (Haworth, 2003). If subsurface piping leading to the septic tank is identified during the geophysical survey, COPCs from these operations should be detected by the following analyses VOCs, SVOCs, TPH, RCRA metals, and radionuclides.

Previous Investigation Results - No previous investigation results are available for CAU 224, CAS 02-04-01.

Potential Contamination - The COPCs for CAS 02-04-01 based on assumed connections to the surrounding facilities, the operations conducted therein, and common NTS concerns are:

- VOCs, SVOCs, PCBs, TPH (gasoline-range organics [GRO] and diesel-range organics [DRO]), RCRA metals, aluminum, zinc, manganese, nickel, beryllium, cobalt, and radionuclides.

Residual tank contents will also be analyzed for fecal coliform bacteria for health and safety purposes.

A.1.1.2 Corrective Action Site 03-05-01, Leachfield

Physical Setting and Operational History - Corrective Action Site 03-05-01 consists of a leach pit within the Area 3 Subdock Complex (Figure A.1-3). The Area 3 Subdock Complex operated from the 1970s to 1985 primarily for cleaning and repairing worn drill bits and bent drilling rods. Site reconnaissance activities and historical document/aerial photograph review indicate the leach pit is located in a shallow depression and appears to have been leveled or graded. The estimated dimensions are 60 by 60 by 2 ft.

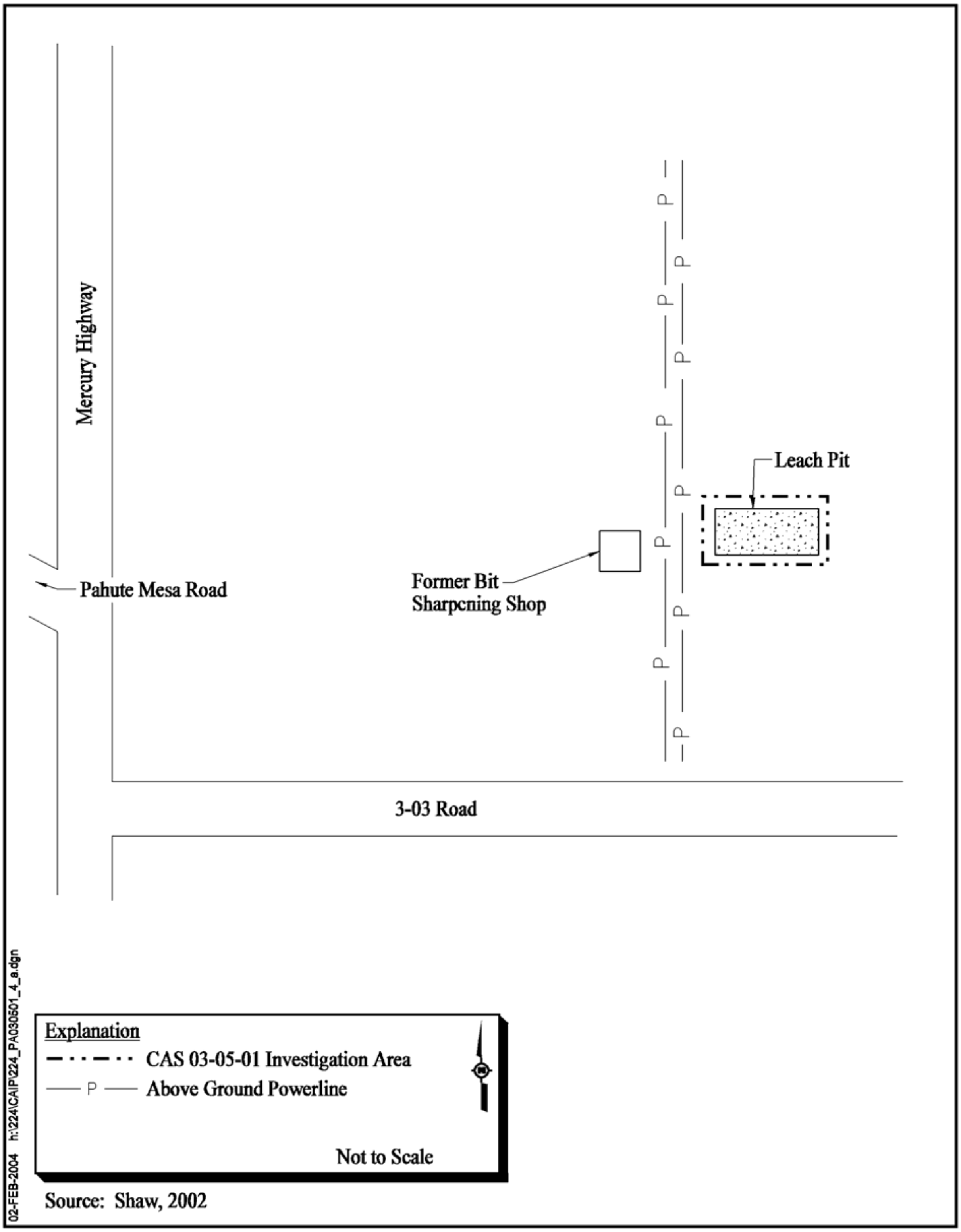

Figure A.1-3
CAU 224, CAS 03-05-01 Site Map

Sources of Potential Contamination - The sources of potential contamination at CAS 03-05-01 include bit retipping activities associated with the Bit Sharpening Shop. The former Bit Sharpening Shop was located west of the leach pit. Results of the geophysical survey (Shaw, 2003) indicates there is no piping leading from the foundation of the shop to the leach pit; however, based on interviews, contamination associated with activities conducted in the Bit Sharpening Shop is expected in the leach pit. Activities in the shop primarily included degreasing and cooling the drill bits undergoing repair. Interviews indicated that waste entering the leach pit would not have been via a drain but possibly "dumped" directly. Materials used for retipping include standard drilling lubricants, oils, greases, solvents, petroleum hydrocarbons, and degreasing agents. Other suspected contaminants include metals, tungsten carbide used in cutting, drilling mud, diesel fuel, and transmission fluid associated with generators (McNeil, 2003; Haworth, 2003; McGlothin, 2003). Based on the interviews, suspected COPCs from these activities should be detected by analyses for VOCs, SVOCs, TPH, and RCRA metals. There is no PRG (EPA, 2002c) for tungsten or tungsten carbide.

Additionally, it is unknown if the leach pit received domestic waste; however, the possibility of such disposal is noted in Fiore (1992). The COPCs associated with domestic waste (People for Puget Sound, 2001) should be detected by analyses for VOCs, SVOCs, TPH, and RCRA metals.

Previous Investigation Results - The previous investigation for CAS 03-05-01 includes a geophysical survey indicating piping heading west and southeast of the leachfield. It is unknown where the piping leads (Shaw, 2003). The survey results will be modified based on the 2004 survey results when interpretation is complete.

Potential Contamination - Based on the information provided by the interviewees (McNeil, 2003; Haworth, 2003; McGlothin, 2003) and common concerns for the NTS, the COPCs for 03-05-01 include VOCs, SVOCs, TPH (GRO and DRO), PCBs, RCRA metals plus beryllium, and radionuclides.

Tungsten is considered for health and safety purposes.

A.1.1.3 Corrective Action Site 05-04-01, Septic Tanks (4)/Discharge Area

Physical Setting and Operational History - Corrective Action Site 05-04-01 is located approximately 1,180 ft northwest of a former trailer park in Area 5 of the NTS (Figure A.1-4). The CAS consists of four 7,500-gal septic tanks encompassing a 34- by 18-ft area, the associated piping, a 7- by 5-ft distribution box, and the desert wash that potentially received overflow from the septic tanks. The site is an abandoned septic system that serviced a former trailer park. The trailer park consisted of a kitchen, recreation hall, and residential complex. Review of drawings indicate there were 35 sewer connections within the complex. The sewer lines were constructed of 6-in. vitrified clay pipe (VCP). Four manholes are present along the length of the connection from the former trailer complex to a distribution box and four septic tanks.

Sources of Potential Contamination - The sources of potential contamination at CAS 05-04-01 include activities conducted in the kitchen, recreation hall, and residential complex.

Previous Investigation Results - A preliminary characterization was conducted in 1995 to support closure of the septic tank and overflow/outfall area of the CAS. The results are summarized in *Preliminary Characterization of Abandoned Septic Tank Systems* (REECo, 1995). In 1995 approximately 3,600 gal of clear liquid was present in each tank with a minimal amount of sediment. The samples that were collected included four liquids (one from each tank), one soil 1 ft bgs from below the effluent discharge pipe, and one soil (designated as background) from an area approximately 60 ft southeast of the septic tanks. The liquid samples were analyzed for TPH, VOCs, SVOCs, RCRA metals, pH, PCBs, oil and grease, and radionuclides. The soil samples were analyzed for TPH, pH, PCBs, oil and grease, and radionuclides. The soil samples were also extracted and the extract analyzed for VOCs, SVOCs, and RCRA metals. The approach to the characterization appears to be consistent with the requirements for *Closure Plan for Recently Abandoned and/or Inactive Septic Tank/Holding Tank Systems* (Kendall, 1995). Barium was detected in both the liquid and soil at levels below regulatory concern. Di-n-butylphthalate and di-n-octylphthalate were also detected, but are attributable to laboratory contamination. Based on the analytical results, it was recommended that the tanks be closed as a domestic sewer system under Nevada State Health Division guidelines (REECo, 1995). Documentation has not been found to verify closure of the system.

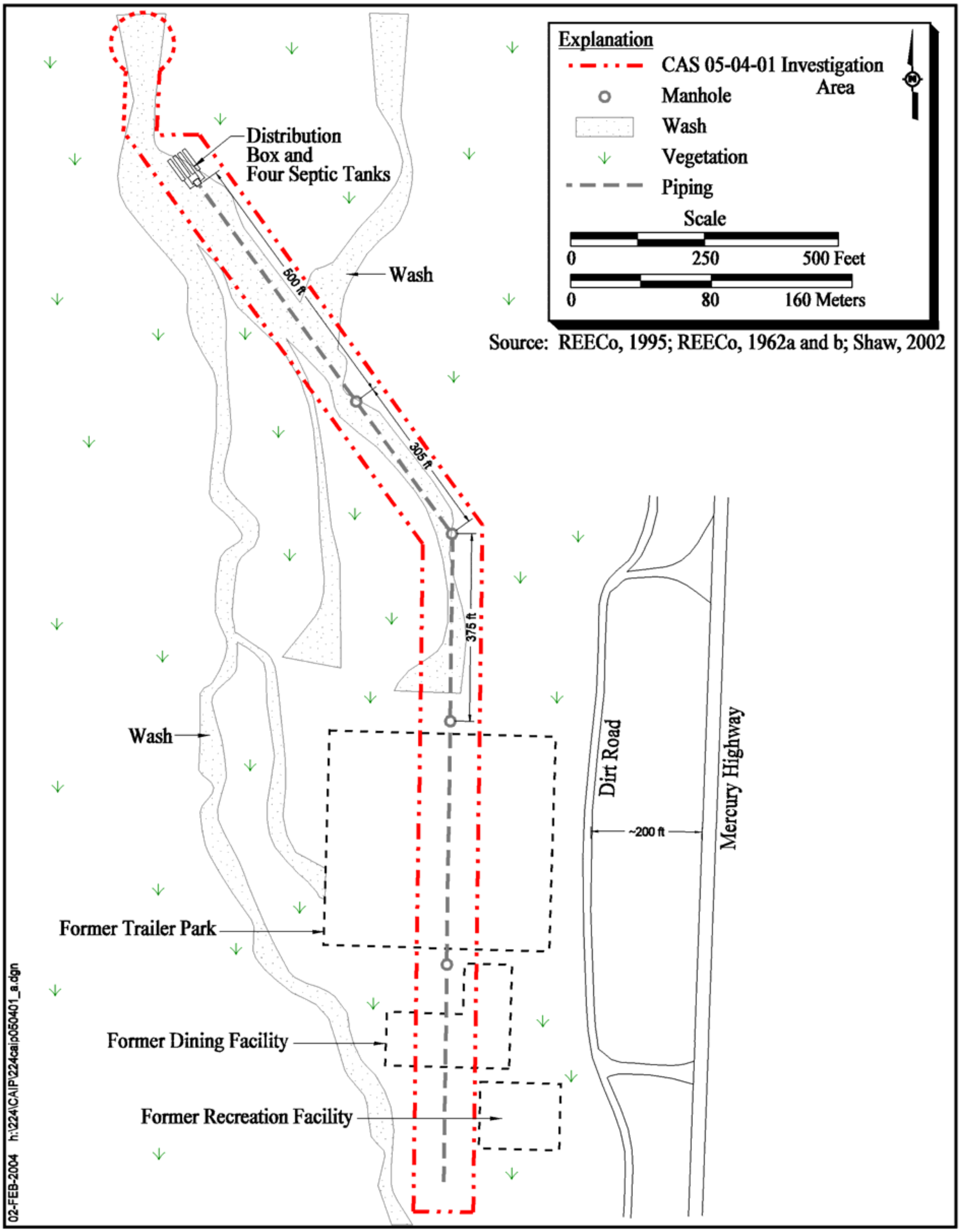

Figure A.1-4
CAU 224, CAS 05-04-01 Site Map

Potential Contamination - Based on the 1995 characterization results, there are no COPCs for the septic tank contents and overflow area of the CAS. Residual liquid present in the tanks in 1995 and soil collected from immediately below the tank overflow/discharge area showed no contamination above regulatory thresholds. The residual tank contents, if present, and soil in the overflow/discharge area will be characterized to confirm the previous findings. Manholes will be inspected and residual, if present, will also be characterized. The COPCs considered are associated with domestic waste (People for Puget Sound, 2001). The COPCs, if present, should be detected by the analyses for VOCs, SVOCs, TPH (GRO and DRO), PCBs, RCRA metals, and radionuclides.

Fecal coliform bacteria analysis will be conducted for health and safety purposes and the contents characterized for waste disposal purposes.

A.1.1.4 Corrective Action Site 06-03-01, Sewage Lagoons (3)

Physical Setting and Operational History - Corrective Action Site 06-03-01 consists of the former Yucca Lake sewage lagoon systems in Area 6 of the NTS. The CAS includes Sewage Lagoons I and II and distribution box, the Domestic Lagoons, and the associated piping (Figure A.1-5). The dates of construction and operation of the Domestic Lagoons and Sewage Lagoons I and II were estimated as 1972 and 1974, respectively, from engineering drawings. According to the *Nevada Operations Office First Quarterly Compliance Action Report* (DOE/NV, 1990) the Area 6 lagoons were dug out and backfilled. Both lagoon systems are covered to grade and marked with four monuments that state, "Closed Sewage Lagoons." Signage placed in the middle of the Domestic Lagoons indicates a closure date of August 29, 1989. The combined area for Sewage Lagoons I and II is 135 by 90 ft and a distribution box was in the center. Dimensions for the Domestic Lagoons are 148 by 96 ft.

Sources of Potential Contamination - There is no documentation that indicates sources of potential contamination at CAS 06-03-01 other than domestic waste. However, based on engineering drawings, the piping leading to each lagoon system contains asbestos. Sources of potential contamination to the systems is based on possible releases from activities conducted in the facilities serviced by the two lagoon systems as described below:

- Sewage Lagoons I and II serviced Building 6-623, the Machine and Welding Shop. Based on general process knowledge, shop wastes from these activities may have been discharged to the system containing including solvents, MWFs, degreasers, petroleum hydrocarbons, hydraulic

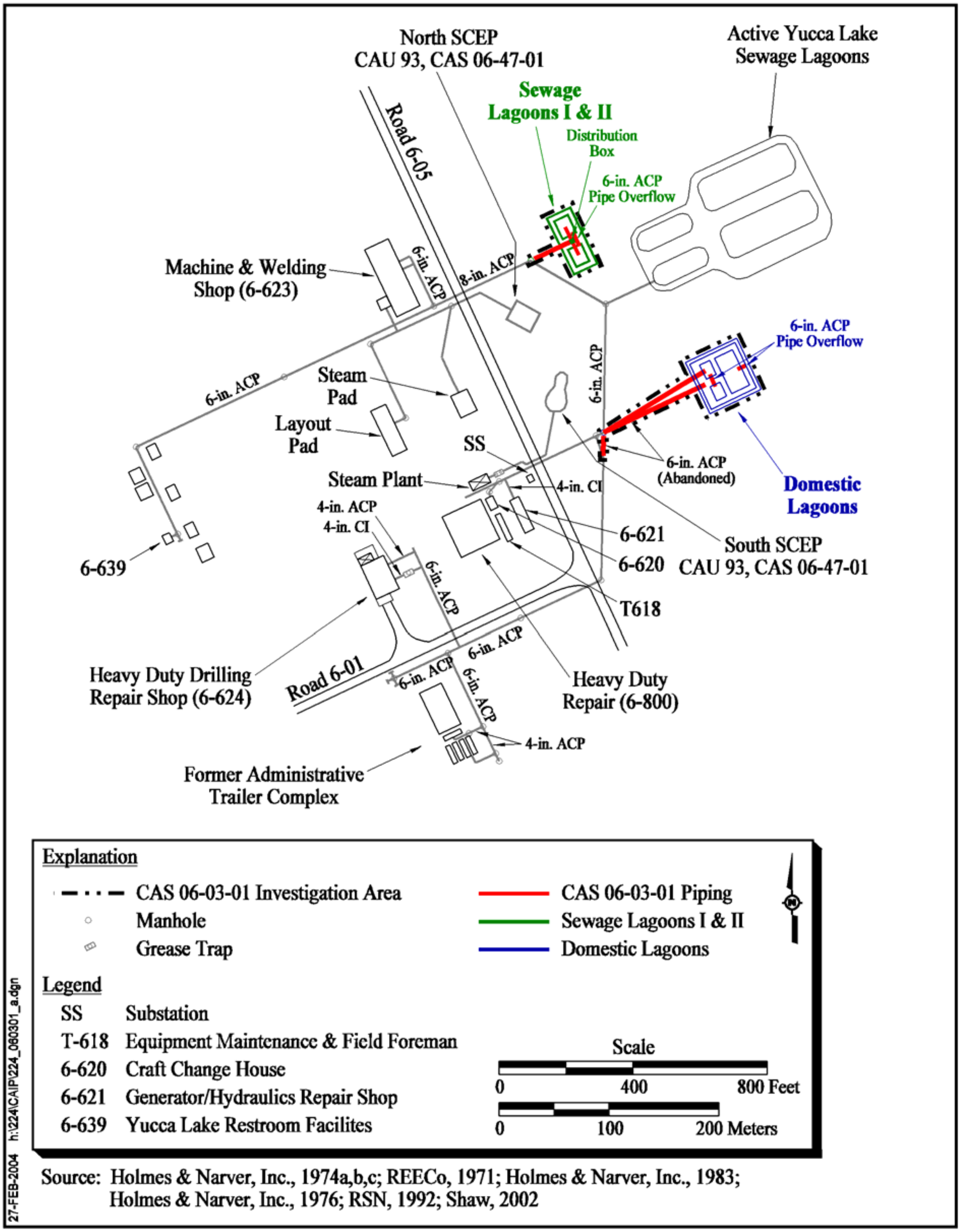

Figure A.1-5
CAU 224, CAS 06-03-01 Site Map

fluids and oils, various metals including aluminum, zinc, manganese, chromium, lead, nickel, cadmium, beryllium, and cobalt, and oils (HHS, 1998; Haz-Map, 2002).

- The Domestic Lagoons serviced Buildings 6-620, 6-621, 6-624 and an administrative trailer complex. Activities in these various facilities included generator and hydraulic repair, welding, and drilling repair. Similar to Sewage Lagoons I and II, wastes containing various contaminants may have been discharged to the system including solvents, MWFs, degreasers, petroleum hydrocarbons, hydraulic fluids and oils which could potentially be PCB contaminated, various metals, and oils (HHS, 1998; Haz-Map, 2002).

Asbestos is associated with the piping leading to both lagoon systems.

Previous Investigation Results - Three liquid samples were collected from the Yucca Lake Sewage Lagoon System in the first quarter of 1989. Data from one sample from the Northwest System (assumed to be Sewage Lagoon I and II) and two samples from the Southeast System (assumed to be the Domestic Lagoons) were summarized by Haworth (1989). Cyanide and pyrene were detected in the Northwest System at 160 and 13 μg/L, respectively. Also, a combined result for 1,2-dichlorobenzene and 1,4-dichlorobenzene was reported at 21 μg/L. For the Southeast System, the combined result for 1,2-dichlorobenzene and 1,4-dichlorobenzene was 14.0 μg/L.

Radiological samples were collected at an Area 6 sewage lagoon in 1989; however, it is indeterminate from the documentation which lagoon effluent was sampled. Samples were analyzed for plutonium-238 and -239/-240, gross beta, and tritium in water. The results were presented in NTS Annual Site Environmental Report - 1989 (REECo, 1990). The range of activities observed were as follows:

- plutonium-238: -5.4×10^{-11} to 5.5×10^{-11} microcuries per milliliter (μCi/mL)
- plutonium-239/-240: -4.9×10^{-12} to 1.0×10^{-12} μCi/mL
- gross beta: 1.0×10^{-8} to 6.1×10^{-8} μCi/mL
- tritium: -1.0×10^{-7} to 3.0×10^{-7} μCi/mL

Radiological samples were also collected at an Area 6 sewage lagoon in 1990; however, it is indeterminate from the documentation which lagoon effluent was sampled. Samples were analyzed for strontium-90, plutonium-238 and plutonium-239/-240, gross beta, and tritium in water. Results were presented in NTS Annual Site Environmental Report - 1990 (REECo, 1991) as follows:

- strontium-90: 1.3×10^{-10} μCi/mL

- plutonium-238: -2.1×10^{-11} to 3.3×10^{-11} µCi/mL
- plutonium-239/-240: -3.6×10^{-12} to 5.1×10^{-12} µCi/mL
- gross beta: 3.5×10^{-8} to 5.2×10^{-8} µCi/mL
- tritium: -1.1×10^{-7} to 2.5×10^{-7} µCi/mL

***Potential Contamination* -** Based on general process knowledge, low levels of contamination identified in effluent samples, and common concern for the NTS, the COPCs for CAS 06-03-01 include:

- VOCs, SVOCs, TPH (GRO and DRO), PCBs, RCRA metals plus aluminum, zinc, manganese, nickel, beryllium, and cobalt, cyanide, and radionuclides.

Asbestos is associated with the lagoon system piping and considered for health and safety purposes. Sewage sludge, if encountered in the piping, will also be analyzed for fecal coliform bacteria for health and safety purposes.

A.1.1.5 Corrective Action Sites 06-05-01, Leachfield; 06-17-04, Decon Pad and Wastewater Catch; and 06-23-01, Decon Pad Discharge Piping

***Physical Setting and Operational History* -** Corrective Action Sites 06-05-01, 06-17-04, and 06-23-01 comprise a system that received wastewater from Buildings CP-2 and CP-6 (Figure A.1-6). Building CP-2 was used for the decontamination of potentially radioactive contaminated laundry. Building CP-6 was a radioactive decontamination facility, which had an equipment decontamination pad located to the east. Radioactively contaminated equipment was decontaminated at the CP-6 decontamination pad using high-pressure water and various solvents, degreasers, and detergents. Additionally, Building CP-6 was used as a shower area for workers exposed to surface contamination. The CP-2 Leachfield operated from 1951 to 1971 and it is believed that the waste lagoons, drainage ditch, outfall area, and leachfield were all in operation simultaneously until the late 1960s or early 1970s.

Operationally, the Building CP-2 laundry facilities discharged wastewater to a buried 6-in. VCP (CAS 06-23-01). The Building CP-6 decontamination pad discharged wastewater to a 4- by 4- by 4-ft wastewater catch located at the southeastern end of the decontamination pad. Wastewater discharged to this wastewater catch eventually discharged to buried 6-in. VCP (CAS 06-23-01). The buried 6-in. VCPs from CP-2 and CP-6 are connected to a common distribution box. This wastewater travelled

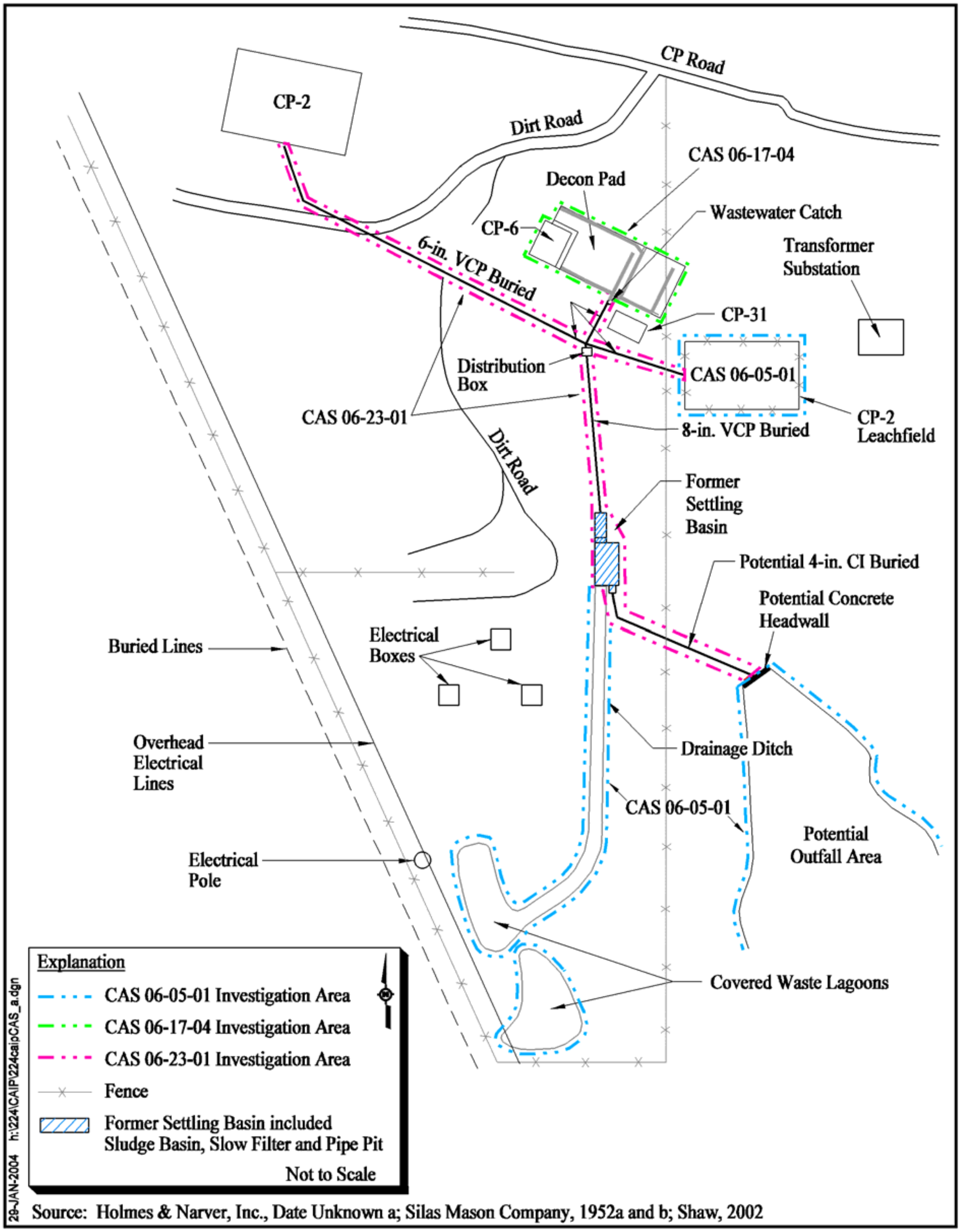

Figure A.1-6
CAU 224, CAS 06-05-01, CAS 06-17-04 and CAS 06-23-01 Site Map

from this distribution box to either the CP-2 Leachfield (CAS 06-05-01) via buried 6-in. VCP; or to a settling basin, sludge basin, slow filter, and pipe pit (settling basin) (CAS 06-17-04) via buried 8-in. VCP. Wastewater from the settling basin (CAS 06-17-04) travelled to the potential outfall area (CAS 06-05-01) via buried 4-in. cast-iron (CI) pipe; or to the waste lagoons (now covered [CAS 06-05-01]) via a drainage ditch (CAS 06-05-01).

Sources of Potential Contamination - The source of potential contamination at CASs 06-05-01, 06-17-04, and 06-23-01 include laundry decontamination activities conducted at CP-2 and the equipment decontamination activities conducted at CP-6. In addition to radionuclides, various other contaminants or materials have the potential to impact this site based on their relationship to activities in Buildings CP-2, CP-6, and/or the decontamination pad. Based on process knowledge and assumed similarities between the CP-2 and CP-6 decontamination processes, the potential contaminants for the site are those identified by Shugart (1985), including:

- Acids - Hydrochloric acid, sulfuric acid, Keecham-215 Rust Remover
- Caustics - Sodium hydroxide (Alk Rust), 152A Cherokee Chemical, Laundry Soap
- Solvents - 182 Degreaser Cherokee, Stoddard solvent (petroleum distillate), trichloroethane, acetone, ILD-1 Laundry Degreaser
- Alcohols - Isopropanol, methanol
- Miscellaneous - Sodium hypochlorite (Clorox), fabric softener, freon, and San Del Technical Cleaner

The composition of the cited tradename chemicals was not identified other than the category as listed above. In addition, the potential hazardous components associated with acids, caustics, and sodium hypochlorite are assumed to be negligible under the present environmental condition. Methanol and isopropanol are not routinely reported; however, the output for these will be requested along with the VOC analytical suite. The PRG for methanol in soil is 100,000 mg/kg which is a non-risk based maximum. Isopropanol does not have a PRG (EPA, 2002c).

Previous Investigation Results - The *Nevada Test Site Contaminated Land Areas Report* (DOE/NV, 2000) presents posting information for the Area 6 Old Decon Pad, Old Leach Pond, and Decon Pad Pond. The requirements were based on a radiological survey conducted in 1998. The radiological information presented indicates that subsurface soils contain unknown levels of radionuclide activity but the surface soils removable activity is below CFR (1999) guidelines for all radionuclide categories (DOE/NV, 2000).

The CP-2 Leachfield sampling results were reported in the *Hazardous Waste Installation Assessment Report* (REECo, 1986). Cadmium and silver were detected in the EP Toxicity extract at 0.04 and 0.05 mg/L, respectively. The values are below RCRA regulatory limits of 1 and 5 mg/L for these metals. Cesium-137 results were also summarized and activities reported ranged from 0.34 to 1.07 picocuries per gram (pCi/g). The cesium-137 activities are below the present PAL of 7.3 pCi/g. The *CERCLA Preliminary Assessment of DOE's Nevada Operations Office Nuclear Weapons Testing Areas* (DRI, 1988) elaborated on the results presenting the cesium-137 results from REECo (1986) along with the observed activities for potassium-40, radium-226, thorium-228, thorium-232. Data for a total of nine samples from 0 to 122 cm deep were presented. Further review of these data by Adams (2002) indicated that the activities of the radionuclides observed were not above background; however, a detailed radiological land area survey will be performed.

Potential Contamination - Based on the process knowledge and common NTS concerns, the COPCs for 06-05-01, 06-17-04, and 06-23-01 include VOCs (including methanol), SVOCs, TPH (GRO and DRO), PCBs, RCRA metals plus beryllium, and radionuclides. Isopropanol is considered for health and safety purposes.

A.1.1.6 Corrective Action Unit 11-04-01, Sewage Lagoon

Physical Setting and Operational History - Corrective Action Site 11-04-01 consists of a former sewage lagoon and associated discharge piping (Figure A.1-7). A two-compartment septic tank and distribution box with removable covers leading to an evapotranspiration bed is also a component of the CAS. The sewage system is located in Area 11 at the Technical Facilities Complex, currently referred to as the TaDD Facility and the Los Alamos National Laboratory (LANL) Technical Facility. The portion of the sewage system leading to the evapotranspiration bed is currently inactive, but remains operable.

Documentation indicates that CAS 11-04-01 contains two sewage systems. The older sewage system contained a sewage lagoon that became inactive sometime in the late 1980s and is currently covered.

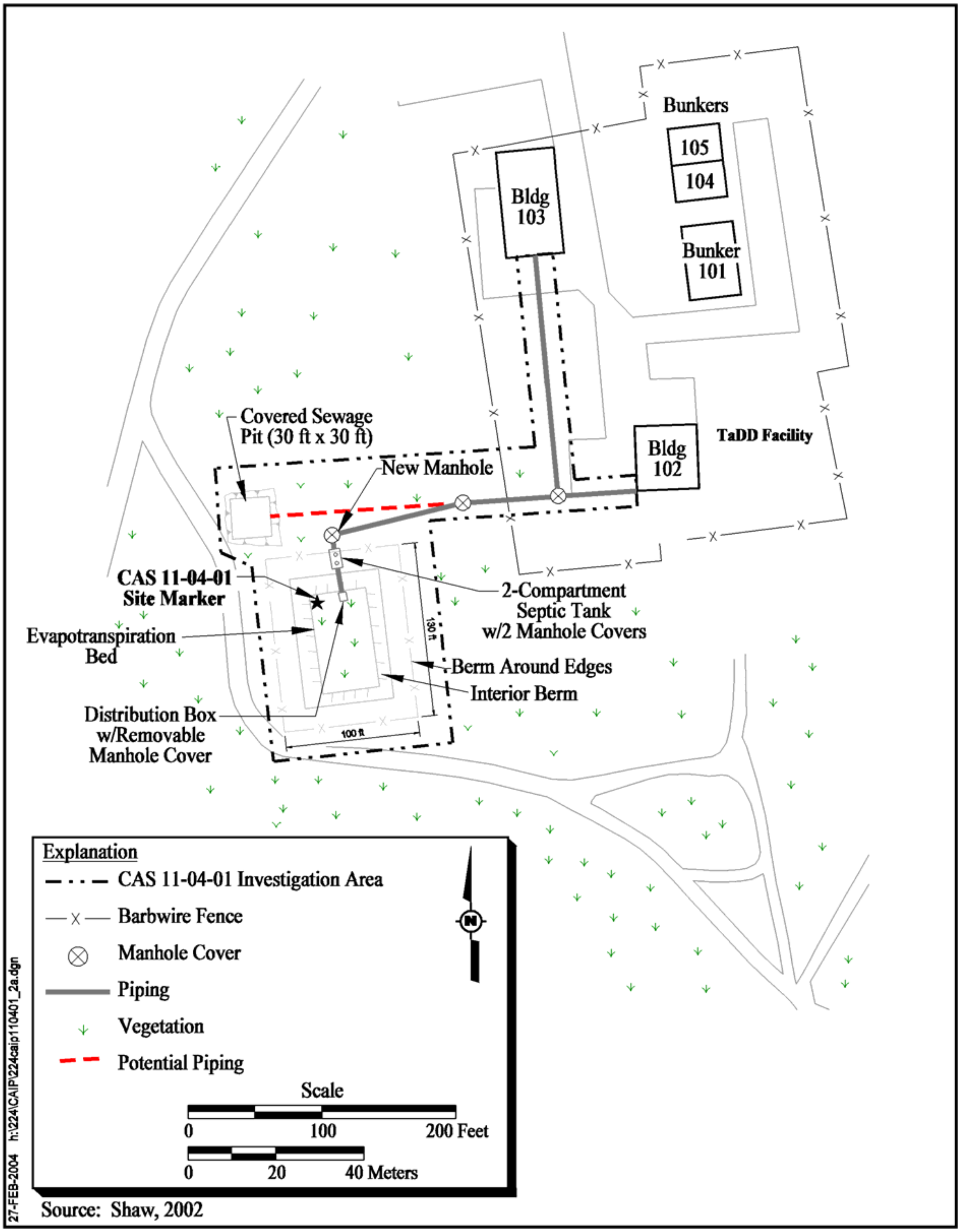

Figure A.1-7
CAU 224, CAS 11-04-01 Site Map

A review of engineering drawings indicate that the lagoon measured approximately 30 by 30 ft and was 3 ft deep. The old sewage lagoon was backfilled by 1990 and the replacement system used a portion of the original discharge piping connected to a new sewer manhole. At this manhole, new discharge piping was angled south to the new evapotranspiration bed. Also, a two-compartment septic tank and distribution box with removable access cover was installed. The evapotranspiration bed is approximately 130 by 100 ft and 28 in. deep. Engineering drawings of the evapotranspiration bed show that the bed is not lined.

Sources of Potential Contamination - The source of potential contamination to CAS 11-04-01 is domestic sewage from the surrounding facilities. There is no documentation that indicates sources of potential contamination to CAS 11-04-01 other than domestic waste; however, based on activities conducted in the facilities serviced by the two lagoon systems, it is possible that releases of contamination to the system occurred. The facilities connected to the system include Building 102, the LANL Assembly Building (used for device assembly, maintenance, and repair) and Building 103, the LANL Shop and Photo Lab (which included a machine shop, a darkroom, and other various equipment storage rooms). The darkroom contains a developing tank equipped with a faucet potentially used to develop radiographics and film, based on the facility activities possible contaminants include photoprocessing chemicals (e.g., developers and fixers containing hydroquinone, aluminum, silver, chromium), MWFs, and solvents (HHS, 1998; Haz-Map, 2002).

Previous Investigation Results - No Previous Investigation Results are available for CAU 224, CAS 11-04-01.

Potential Contamination - Based on process knowledge for activities in the facilities serviced by the system and general concerns for the NTS, the COPCs for CAS 11-04-01 include VOCs, SVOCs including hydroquinone, PCBs, TPH (GRO and DRO), RCRA metals, aluminum, zinc, manganese, nickel, beryllium, cobalt, and radionuclides.

Sewage sludge, if encountered, will be analyzed for fecal coliform bacteria for health and safety purposes.

A.1.1.7 Corrective Action Site 23-05-02, Leachfield

Physical Setting and Operational History - Corrective Action Site 23-05-02 consists of a leachfield and the associated discharge piping (Figure A.1-8). The leachfield serviced former Building 155 located in Area 23 in Mercury. The leachfield is now completely covered by asphalt and gravel and is a motor pool parking lot. The estimated dimensions are 20 by 33 ft and the depth is unknown (DRI, 1988). Based on engineering drawings, a CI and an orangeburg pipe lead 130 ft from Building 155 northeast to the leachfield (REECo, 1968).

The leachfield was operational between 1959 and 1973 and received wastewater from the Radiological Safety and Industrial Hygiene laboratories (Building 155). Building 155 was built in 1959 and was used as the radiological safety laboratory until 1964. In 1964, the laboratory was relocated to trailers near Building 155. The trailers were connected to the same leachfield as Building 155. In 1965, the laboratory was relocated to Building 650, which was serviced by a separate sewage system. Building 155 continued in operation as the Industrial Hygiene laboratory until 1973. The leachfield became inactive at that time. However, one sink remained operable and drained to the leachfield until discovered in 1983 and disconnected. The leachfield was completely covered by the Mercury motor pool parking lot in the 1980s.

The facility housed a hot, cold, and standards laboratory as well as a darkroom. Engineering drawings indicate that the rest rooms were serviced by a separate sewage system.

Sources of Potential Contamination - The sources of potential contamination at CAS 23-05-02 include chemicals and waste generated by activities conducted in Building 155 laboratories. Photoprocessing chemicals such as developers and fixers may have introduced contaminants such as hydroquinone, aluminum, silver, and chromium into the system. Review of *Analytical Procedures of the Radiological Safety Laboratory* (REECo, 1961) provided insight into the chemicals that were likely used in the course of operation as well as the waste handling/disposal practices. These chemicals include the following:

- Acids- acetic acid, hydrocyanic acid, hydrofluoric acid, hydrochloric acid, chromic acid, nitric acid, oxalic acid, perchloric acid, phosphoric acid, sulfuric acid
- Caustics- ammonium hydroxide, potassium hydroxide, sodium hydroxide

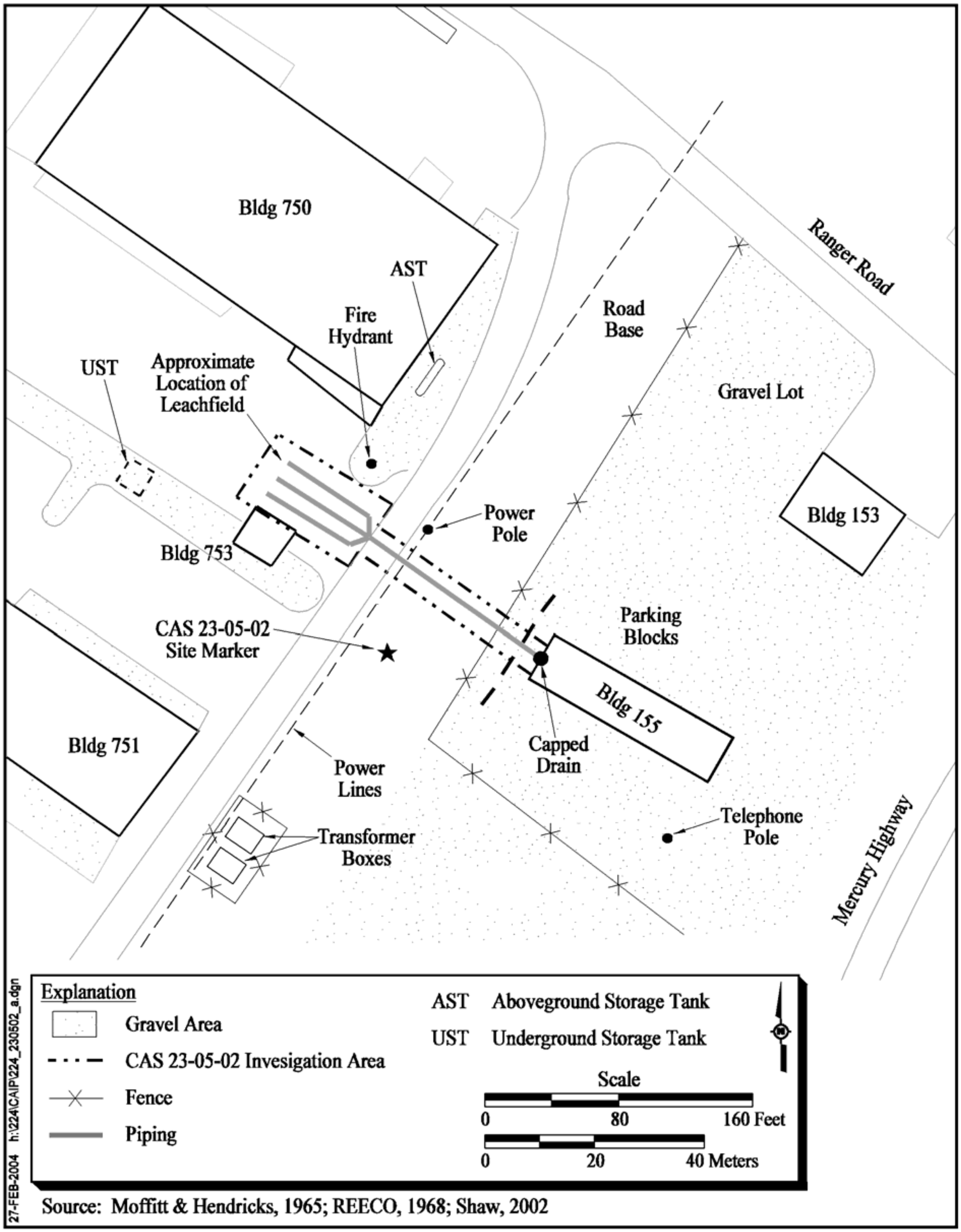

Figure A.1-8
CAU 224, CAS 23-05-02 Site Map

- Metals- arsenic, arsenic compounds, antimony, antimony compounds, barium compounds, cadmium, copper, lead, molybdenum, beryllium, potassium, mercury

- Solvents- benzene, chloroform, ethers, methanol, methyl ethyl ketone, tetrachloroethylene, toluene, trichloroethylene, carbon tetrachloride

- Reactive/Oxidizers- carbon disulfide, chlorates, perchlorates, chromates, cyanide, hydrogen peroxide, other peroxides, sodium hydrosulfide

- Radioactive materials (analysis of bioassay and environmental samples)- plutonium, enriched uranium, fission products (i.e, cesium-137, strontium-90), activation products (cobalt-60), strontium-89/-90, strontium-90

- Gases/Halogens- carbon monoxide, hydrogen sulfide, ozone, sulfur dioxide, chlorine, fluorine;

- Miscellaneous- amino compounds, liquid bromine, flourides, iodine, silver nitrate, ethyl acetate

Chemical handling and disposal practices procedurally controlled for the laboratories indicate that acids and caustics were diluted prior to disposal down the facility drains, flammable and volatiles (e.g., ether, methylethyl ketone) were air evaporated or disposed of in a designated waste solvent container, and volatile solvents that were immiscible in water were retained in a designated waste solvent container as well. The procedure also indicated that carbon tetrachloride was not permitted for use on the NTS without approval, and chlorates and perchlorates were limited to special authorization use. However, according to REECo (1961), materials capable of liberating poisonous or flammable gases were to be handled in a ventilation hood and not to be emptied down the drain. Interviewees stated it was not uncommon to dispose of acids and bases down the facility drains. Silver and carbon tetrachloride were specifically mentioned (Friedrichs, 1999; Hatcher, 1999).

The gases listed are assumed not to have impacted the leachfield. The potential hazardous components associated with acids, caustics, and peroxides are assumed to be negligible under the present environmental condition. However, the potential degradation of the bituminous orangeburg pipe by exposure to the chemicals and solvents identified may have introduced SVOCs into the leachfield system. The COPCs for CAS 23-05-02 should be detected by the analyses for VOCs, SVOCs, RCRA metals, antimony, copper, molybdenum, beryllium, cyanide, sulfide, and radionuclides including cobalt-60.

As noted in the operational history, the radiological component of the Building 155 laboratory relocated to Building 650 in 1965. The results reported in the *Characterization Report for Area 23, Building 650 Leachfield* (DOE/NV, 1998a) were reviewed and are summarized below. The maximum radionuclide activities observed were:

- Cobalt-60: 1.57 pCi/g
- Strontium-89/-90: 2.75 pCi/g
- Plutonium-238: 4.26 pCi/g
- Plutonium- 239/-240: 77.1 pCi/g.

The results were from samples at the base of the distribution box located 9 ft bgs to a depth of 22 ft. Contamination within the leachfield contamination was observed to a depth of 11 ft bgs which is approximately 2 ft below the leachfield distribution lines. Total petroleum hydrocarbons were detected in one sample at 570 mg/kg and PCBs were observed in samples near the distribution box at 91 to 155 μg/kg. Acetone was also observed at approximately 10 μg/kg.

Previous Investigation Results - Geophysical survey results for CAU 224, CAS 23-05-02 were reported in *Surface Geophysical Survey Final Report Corrective Action Units Nevada Test Site* (SAIC, 2003). Conclusions from the survey indicated a variety of features; however, none typified a leachfield.

Potential Contamination - Based on the process knowledge and common concerns for the NTS, the COPCs for CAS 23-05-02 include VOCs, SVOCs including hydroquinone, PCBs, TPH (GRO and DRO), RCRA metals, aluminum, antimony, copper, molybdenum, beryllium, cyanide, sulfide, and radionuclides including cobalt-60.

A.1.2 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 224 CAI, and develops the CSM.

A.1.2.1 Planning Team Members

The DQO planning team consists of representatives from NDEP, NNSA/NSO, Stoller-Navarro Joint Venture (SNJV), and Bechtel Nevada (BN). The primary decision-makers include NDEP and

NNSA/NSO representatives. Table A.1-2 lists representatives from each organization in attendance at the January 29, 2004, DQO planning meeting.

Table A.1-2
DQO Meeting Participants

Participant	Affiliation
Sabine Curtis	NNSA/NSO
Jack Ellis	SNJV
John Fowler	SNJV
Brian Hoenes	SNJV
Joe Hutchinson	SNJV
Lynn Kidman	SNJV
Laura Pastor	SNJV
Barbara Quinn	SNJV
Marko Suput	SNJV
Glen Richardson	BN
Jeanne Wightman	SNJV
Greg Raab	NDEP

BN – Bechtel Nevada
SNJV – Stoller-Navarro Joint Venture
NDEP – Nevada Division of Environmental Protection
NNSA/NSO – U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office

A.1.2.2 Describe the Problem

Corrective Action Unit 224, Decon Pad and Septic Systems, is being investigated because effluent potentially contaminated with hazardous and/or radioactive constituents may have discharged to the various systems which comprise the unit. Designed releases to leachfields and lagoons could have resulted in contamination of the native soils associated with the CASs. Additionally, accidental releases caused by breaches in distribution system or potential spills could result in surface or subsurface soils contamination. The problem statement for CAU 224 is:

"Existing information on the nature of potential contaminants and, if present, the extent of contamination is insufficient to evaluate and recommend corrective action alternatives for CASs 02-04-01, 03-05-01, 05-04-01, 06-03-01, 06-05-01, 06-17-04, 06-23-01, 11-04-01, and 23-05-02."

A.1.2.3 Develop A Conceptual Site Model

The CSMs are used to describe the most probable scenario for current conditions at a CAS and define the assumptions that are the basis for identifying appropriate sampling strategy and data collection methods.

The graphical CSM for CAU 224, Figure A.1-9, is consistent with the general model presented in the Leachfield Work Plan (DOE/NV, 1998c) and captures the commonalities of the CASs. The graphical CSM is based on process knowledge potential contaminant release mechanisms gained from investigations of similar systems on the NTS. The CAU 224 CASs are divided based on the function of the system components and the varying potential for contamination. As shown in Table A.1-3, the general components of the CAU 224 CASs are septic and/or collection, leachfields, lagoons/leach pits and decontamination pad.

The septic and/or collection component of the CSM applies to all the CASs within CAU 224 with the exception of CAS 06-05-01. The component includes elements such as the tank itself, sumps, distribution boxes, settling basins, and associated piping. Within the component of the CSM, the effluent, (upon release from the source [e.g., floor drain]), travels through discharge lines and is routed into the various system elements (e.g., septic tank).

The leachfield component of the CSM applies to CASs 06-05-01, 11-04-01, and 23-05-02. Effluent was dispersed throughout the leachfield or evapotranspiration bed by way of distribution pipes located in the subsurface. The general configuration of the distribution pipes for CASs 11-04-01 and 23-05-02 is shown on engineering drawings; however, the exact configuration of distribution piping for 06-05-01 is unknown. Leachfields were designed to disperse effluent within the leachfield and allow liquid to percolate down into the underlying native soil.

The lagoon/leach pit component of the CSM applies to CASs 03-05-01, 05-04-01, 06-03-01, and 06-05-01 and shows conceptually that effluent is released to a lagoon, leach pit, or an outfall or via a

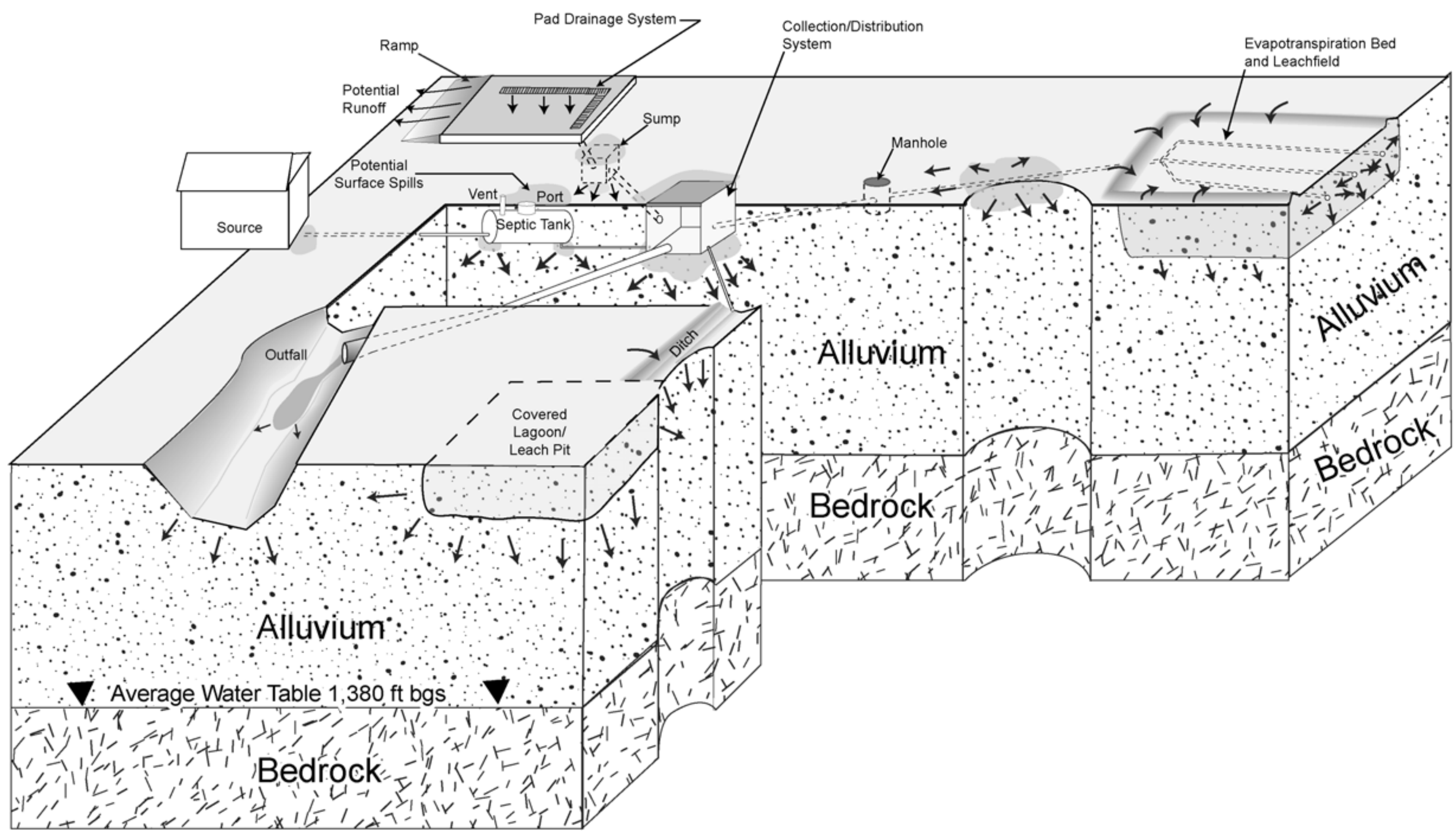

Figure A.1-9
Conceptual Site Model for CAU 224

Table A.1-3
Conceptual Site Model Components, Elements, and Applicable CASs

CSM Component	Elements	02-04-01	03-05-01	05-04-01	06-03-01	06-05-01	06-17-04	06-23-01	11-04-01	23-05-02
Septic and/or Collection	Piping	X	X	X	X			X	X	
	Manhole			X	X				X	
	Septic Tank	X		X					X	
	Distribution Box			X	X				X	
	Sump		X							
Leachfield	Distribution Piping									X
	Leachfield					X				X
Lagoon/Leach Pit/Outfall	Leach Pit		X							
	Lagoons				X	X				
	Outfall			X						
Decontamination Pad	Wastewater Catch						X			
	Concrete Trench						X			

drainage ditch or piping directed to the lagoon. These systems were designed to release effluent to the lagoon and allow liquid to evaporate as well as percolate down into the underlying native soil.

The decontamination pad component of the CSM applies to CAS 06-17-04 illustrates that effluent, upon release from the source activities, travels through the drains in the pad and is collected in a trench that discharges to a wastewater catch.

If components are identified during the CAI that are not covered by the CSM or if the investigation extends beyond the spacial boundaries for the CAS(s), the planned approach will be evaluated against the CSM strategy and revised as appropriate. The DQOs will be reviewed and any significant deviations and corrective recommendations will be presented to the decision makers for approval.

Affected media - For the septic and/or collection component of the CSM, the affected media are the residual sludge and/or liquid in the underground storage tank, associated piping, and tank/box contents which came in direct contact with the effluent. The subsurface soil beneath these structures may be impacted if a breach or rupture of the system occurred. Surface soils adjacent to the tank or distribution box structure may be impacted if an overflow or accidental spill occurred. Affected media associated with the leachfield component are subsurface soil beneath the distribution lines and the soil covering the lines. Affected media for the lagoon/leach pit component are subsurface soil immediately beneath the effluent pipe or discharge point and the extent of the affected area (e.g., lagoon bottom, outfall). Berms and/or the surface soil adjacent to the lagoon may have been impacted if an overflow of the lagoon occurred. It is not known if the soil covers placed over the lagoons are affected. Affected media for the decontamination pad component includes the concrete structures, drain and sump components that directly contacted the effluent, soil beneath the pad drains, trench, or sump if a breach in the system occurred. Surface soil adjacent to the pad may have been impacted if an overflow occurred (e.g., if a pad drain were accidently blocked or from runoff).

Location of Contamination/Release Points - For the CAU 224 CASs, the presence of COPCs in soils may have resulted from designed or accidental releases as previously discussed and depicted on the CSM (Figure A.1-9). The location of contamination at the CAU 224 CASs is unknown and potential release points are assumed consistent with the CSM.

Transport Mechanisms - An important element of a CSM is the expected fate and transport of contaminants in the environment, which infers how contaminants move through site media and where they can be expected in the environment. The expected fate and transport is based on distinguishing physical and chemical characteristics of the suspected contaminants and media. Contaminant characteristics include biodegradation potential, solubility, density, and affinity for nonmobile particles (adsorption). Media characteristics include permeability, porosity, hydraulic conductivity, total organic carbon content, and adsorption coefficients. In general, contaminants with low solubility and high density can be expected to be found relatively close to release points. Contaminants with high solubility and low density are more susceptible to factors that can move them through various media; therefore, can be expected to be found further from release points.

Migration of potential contamination is assumed to be minimal based on the affinity of the COPCs for soil particles, and the low precipitation and high evapotranspiration rates typical of the NTS environment. Runoff could cause lateral migration of contaminants over the ground surface for the release scenarios described. Contaminants may also have been transported by infiltration and percolation of precipitation through soil, which would serve as the primary driving force for downward migration. Mixing of the surface soil as a result of grading or construction activities could also move the COPCs into deeper intervals (e.g., the lagoons within CAS 06-05-01). The migration of organic constituents (e.g., petroleum hydrocarbons, PCBs) can be controlled to some extent by their affinity for organic material present in soil. However, this mechanism is considered insignificant because of the lack of organic carbon in the desert soil. Migration of certain inorganic constituents (e.g., metals in waste oil) is controlled by geochemical processes, such as adsorption, ion exchange, and precipitation of solids from solution.

It is assumed that groundwater is not impacted because of its significant depth at the NTS. The groundwater level for CAU 224 ranges from approximately 700 ft bgs in Area 5 to 2,053 ft in Area 2 and the average annual precipitation is 6.62 in. Also, the environmental conditions at the NTS (i.e., arid climate, relatively low permeability soils) are not conducive to significant downward migration.

Airborne release subsequent to the initial contaminant release is not considered a significant release pathway. The main process of migration through the air would be through windblown dust. The COPCs adsorbed to the fine soil particles and migration could occur via the airborne pathway and this process could result in the deposition of contaminants beyond the CAS boundaries. For all transport mechanisms, it would be expected that contaminant levels decrease with distance from the point of release and distributed consistent with the prevailing wind direction.

Preferential Pathways - Preferential pathways for contaminant migration at the CAU 224 CASs are not expected to be present or have only had a minor impact on contaminant migration. The presence of relatively impermeable layers (e.g., caliche layers, concrete pads) may modify transport pathways both on the ground surface and in the shallow subsurface. Small gullies, if present, could channelize runoff and increase lateral transport prior to infiltration. Rain may wash COPCs off the concrete pad onto the surrounding soil (CAS 06-17-04). When the systems were operational, a breach in distribution piping may have allowed liquids to contaminate soils preferentially along the pipeline due to the disturbed nature of the subsurface soils. Contamination could travel laterally to a small degree under these scenarios. Although the preferential pathways for contaminant migration will be considered in the development of sampling strategies and sampling contingencies discussed in the CAIP, primary consideration will be given to the release and transport mechanisms.

Lateral and Vertical Extent of Contamination - If contamination is present at a CAS, it is expected to be confined to the surface and shallow subsurface at the site. Concentrations of contaminants are expected to decrease with distance (both horizontally and vertically) from the release point(s). For releases at the surface, migration may occur as a result of storm events when precipitation rates exceed infiltration (stormwater runoff). However, these events are infrequent. Also, for CAS 06-17-04, Decontamination Pad, overflow of the drain system caused by blockage or from a stormwater event may have moved contamination laterally off the concrete pad to soils adjacent to the entrance to pad. Surface migration is a biasing factor considered in the selection of sampling locations. As stated previously, downward contaminant transport is expected to be limited but is unknown because the quantities of hazardous material released is unknown.

Potential Receptors - The CSM development includes an evaluation of land use. The land-use description helps define exposure scenarios. Table A.1-4 summarizes the land-use designations and associated descriptions for the CAU 224 CASs (DOE/NV, 1998b). The land use is the basis for assessing how contaminants could reach potential receptors both in the present and future. Based on the land use, current and future receptors are industrial and construction workers and military personnel in training.

A.1.3 Step 2 – Identify the Decision

Step 2 of the DQO process identifies the decisions statements and defines alternative actions. Also presented is this section is the decision logic for the entire process.

Table A.1-4
Land Use

Land-Use Designation	Land-Use Description	CASs
Nuclear and High Explosive Test Zone	The area is designated within the Nuclear Test Zone for additional underground nuclear weapons tests and outdoor high explosive tests. This zone includes compatible defense and nondefense research, development, and testing activities.	02-04-01 and 03-05-01
Defense Industrial Zone	This area is designated for stockpile management of weapons, including production, assembly, disassembly or modification, staging, repair, retrofit, and surveillance. Also included in this zone are permanent facilities for stockpile stewardship operations involving equipment and activities such as radiography, lasers, material processing, and pulsed power.	06-03-01, 06-05-01, 06-17-04, and 06-23-01
Reserved Zone	This area includes land and facilities that provide widespread flexible support for diverse short-term testing and experimentation. The reserved zone is also used for short duration exercises and training such as nuclear emergency response and Federal Radiological Monitoring and Assessment Central Training and U.S. Department of Defense land-navigation exercises and training.	11-04-01, 05-04-01, and 23-05-02

A.1.3.1 Develop Decision Statements

The primary problem statement is: "Existing information on the nature of potential contaminants and, if present, the extent of contamination is insufficient to evaluate and recommend corrective action alternatives for CAS (s)."

Therefore, the following two decision statements have been established as criteria for determining the adequacy of the data collected during the CAI to resolve the problem statement.

Decision I: "Is a COPC present at a concentration that could pose an unacceptable risk to human health and the environment?" Any contaminant analytically detected at a CAS at a concentration exceeding the corresponding PAL, as defined in Section A.1.4.2, will be considered a COC for that CAS. Samples used to resolve Decision I are referred to as Decision I samples.

Decision II: "If a COC is present, is sufficient information available to evaluate appropriate corrective action alternatives?" Sufficient information is defined as the data needs identified in this

DQO to include the lateral and vertical extent all COCs associated with a CAS. Samples used to resolve the decision are identified as Decision II samples.

A.1.3.2 Alternative Actions to the Decisions

For each decision identified in the previous section there is an alternate action.

Alternate action for Decision I: If a COC is not present, further assessment of the CAS is not required. If a COC is present, resolve Decision II.

Alternate action for Decision II: If the extent of the COC is defined in both the lateral and vertical direction, further characterization of the CAS is not required. If the extent of a COC is not defined, re-evaluate site conditions and collect additional samples.

A.1.4 Step 3 – Identify the Inputs to the Decisions

The objectives of Step 3 are to identify the information needed, determine sources for information, determine the basis for establishing action levels, and identify sampling and analysis methods that can meet the data requirements.

A.1.4.1 Information Needs and Information Sources

Table A.1-5 lists the information needs, the source of information for each need, and the proposed methods to collect the data needed to resolve Decisions I and II, as well as the QA/QC data type. The data type is determined by the intended use of the resulting data in decision making. Data types are discussed in the *Industrial Sites Quality Assurance Project Plan* (NNSA/NV, 2002). All data to be collected are classified into one of three measurement quality categories: quantitative, semiquantitative, and qualitative. Additionally, the status of obtaining the data needed is presented in the last column of Table A.1-5.

In order to determine if a COC is present, the Decision I samples must be collected and analyzed following these criteria: (1) samples must be collected in areas most likely to be contaminated, and (2) the analytical suites selected and associated method detection limits must be sufficient to detect a COC below its corresponding PAL. In order to determine the extent of contamination for a COC,

Table A.1-5
Information Needs and Status to Resolve Decisions I and II
(Page 1 of 2)

Information Need	Information Source	Collection Method	Data Type/Metric	Status
Decision I: Determine if a COC is present. Criterion 1: Samples must be collected in areas most likely to contain a COC.				
Source and location of release points	Process knowledge compiled during the Preliminary Assessment process and previous investigations of similar sites	Information documented in CSM and public reports. Complete for all CASs with the exception of CASs 06-03-01 and 11-04-01.	Qualitative – At present, CSM is assumed to be accurate	CAS 06-03-01: Information or data documenting the closure of Sewage Lagoon I and II and the Domestic Lagoons is presently being researched. CAS 11-04-01: Confirmation of CAS boundary/components is needed. In addition to the former sewage lagoon and piping, CAS boundaries include the septic tanks and evapotranspiration bed (installed in 1990 and presently operational). At present, the TaDD facility is on operational standby. Findings from the research has the potential to affect the sampling strategy for both CASs.
	Site visit and field observations	Conduct site visits and document field observations	Qualitative - At present, CSM is assumed to be accurate	Complete with the following exceptions: CASs 02-04-01, 03-05-01, and 23-05-02.
	Aerial photographs	Review and interpret aerial photographs	Semiquantitative	Complete
	Radiological Survey	Review and interpret radiological surveys	Semiquantitative	Complete with the exception of review and interpretation of data.
	Geophysical Survey	Review and interpret survey results	Semiquantitative	Complete with the exception of review and interpretation of data.
	Video Mole Survey	Review and interpret to identify breaches in the systems	Semiquantitative	CAIP Implementation. At present assuming 100% coverage of abandoned lines. Piping currently in use will not be surveyed.
	Field screening during sampling	Review and interpret field-screening results	Semiquantitative	CAIP Implementation
Decision I: Determine if a COC is present. Criterion 2: Analyses must be sufficient to detect any COCs in samples.				
Identification of all potential contaminants	Process knowledge compiled during PA process and previous investigations of similar sites	Information reported in CSM and public reports - no additional data needed	Qualitative -At present, CSM is assumed to be accurate	Complete
Analytical results	Data packages	Appropriate sampling techniques and approved analytical methods will be used	Quantitative - Detection limits will be less than PALs	Post-CAIP Implementation

Table A.1-5
Information Needs and Status to Resolve Decisions I and II
(Page 2 of 2)

Information Need	Information Source	Collection Method	Data Type/Metric	Status
Decision II: Determine the extent of a COC.				
Identification of applicable COCs	Data packages	Review analytical results to select COCs	Quantitative	Post-CAIP Implementation
Extent of Contamination	Field observations	Document field observations	Qualitative – At present, CSM is assumed to be accurate	CAIP Implementation
	Field screening	Conduct field screening with appropriate instrumentation	Semiquantitative – FSRs will be compared to FSLs	CAIP Implementation
	Decision I analytical results	Appropriate sampling techniques and approved analytical methods will be used to bound COCs	Quantitative - Validated analytical results will be compared to PALs to determine COC extent	Post-CAIP Implementation

Decision II samples will be collected to assess the lateral and vertical extent. The data required to satisfy the information needs for Decision II for each COC is a sample concentration that is below the corresponding PAL.

Both Decision I and Decision II sample locations will be selected based on the CSM and biasing factors. Biasing factors for sample collection include the following:

- Previous sample results, if available
- Documented process knowledge on source and location of release
- Experience and data from investigations of similar sites
- Field observations
- Aerial photograph review
- Radiological survey results
- Geophysical survey results
- Field-screening data including VOC, TPH, and radiological (Section A.1.4.3.2)
- Professional judgement

When field-screening results (FSRs) or other biasing factors suggest that the COC concentrations at step-out location(s) may still exceed the PAL, additional step-out distances will be used to define the lateral extent of contamination. If a location where the PAL is exceeded is surrounded by clean locations, lateral step outs may not be necessary. In that case, sampling may consist only of sampling from deeper intervals at or near the original location to determine the vertical extent of contamination.

Vertical extent samples will be collected from depth intervals that will meet DQOs and in a manner that will conserve resources during possible remediation. Biasing factors to support depth interval sampling will primarily based on FSRs and professional judgement. Sampling locations may be moved due to access problems, underground utilities, or safety issues; however, the modified locations must meet the decision requirements and criteria necessary to fulfill the information needs.

A.1.4.2 Determine the Basis for the Preliminary Action Levels

Industrial Sites staff, construction/remediation workers, and military personnel (i.e., ground troops) may be exposed to contaminants through ingestion, inhalation, external exposure, or dermal contact with contaminated soil. Laboratory analytical results for soil will be compared to the following PALs to determine if COCs are present:

- EPA Region 9 Risk-Based PRGs for chemical constituents in industrial soils (EPA, 2002c).
- Background concentrations for RCRA metals will be used instead of PRGs when natural background exceeds the PRG, as is often the case with arsenic on the NTS. Background is considered the mean plus two times the standard deviation of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (NBMG, 1998; Moore, 1999).
- The TPH action limit of 100 ppm per the *Nevada Administrative Code* (NAC) 445A.2272 (NAC, 2002).
- The PALs for radionuclides are derived from the NCRP recommended screening limits for construction, commercial, and industrial land use (NCRP, 1999) scaled from 25 to 15 mrem per year dose and the generic guidelines for residual concentrations of radionuclides in DOE Order 5400.5 Change 2 (DOE, 1993).

The selected PALs are based on the EPA Region 9 Industrial Land Use PRGs. In general, the PRGs are risk-based screening tools for evaluating and cleaning up contaminated sites. The values are estimates of contaminant concentrations in environmental media that EPA considers protective of humans over a lifetime. The toxicity-based PALs for Industrial Soils are calculated based on soil ingestion for and outdoor worker. The selected PALs are applicable to sites at the NTS based on future land-use scenarios as presented in Table A.1-3 and agreements between NDEP and NNSA.

The conservative level of 100 ppm for TPH is based on a regulatory mandate from the State of Nevada and is used as a “clean-up” level.

As indicated above, the radiochemistry PALs are based on a scaling of the NCRP 25 mrem per year dose-based levels (NCRP, 1999) to a conservative 15 mrem per year and the recommended levels for certain radionuclides in DOE Order 5400.5 Change 2 (DOE, 1993). These PALs are based on the Construction, Commercial, Industrial land-use scenario provided in the guidance and are appropriate for the NTS based on future Land-Use scenarios as presented in Table A.1-3.

A.1.4.3 Potential Sampling Techniques and Appropriate Analytical Methods

As discussed in Section A.1.4.1, the collection, measurement, and analytical methods are selected so the results will be generated for all potential contaminants at CAU 224. Sampling and analysis of residual materials such as hold-up in piping and tank contents are is included to support the decision-making process for waste management and to ensure an efficient field program. Tank distribution box and/or residuals will be analyzed for the full suite of analytes to ensure full characterization for future waste disposal.

A.1.4.3.1 Video Mole Survey

A video mole survey of discharge and outfall lines may be conducted to inspect the current physical condition and layout of the CAS distribution systems, as necessary. Video mole surveys allow a visual assessment of the system's integrity and can be used to identify breaches which may have resulted in a release. Subsurface features may be excavated to gain additional access for inspection or sampling or to introduce the video system. Piping that is currently in use will not be subject to video mole surveys.

A.1.4.3.2 Field Screening

Field-screening activities will be conducted for the following analytes and/or parameters:

- Alpha and Beta/Gamma Radiation - a handheld radiological survey instrument or method will be used based on the possibility that radiologically contaminated or elevated measurements (i.e., hot spots) are present in soil, concrete, or other materials. If determined appropriate, on-site gamma spectrometry or an equivalent instrument or method, may also be used to screen samples. The FSL for samples is the mean background activity plus two times the standard deviation of the mean background activity.

- VOCs - a photoionization detector (PID), or equivalent instrument or method, will be used for headspace analysis of subsurface samples because VOCs have not been ruled as COPCs for the CAU 224 CASs. The FSL for the headspace analysis is 20 ppm or 2.5 times background, whichever is greater.

- TPH - a gas chromatograph, or equivalent equipment or method, may be used at all the CASs because TPH is representative of general characteristics of sewage and may be in decontamination rinsate. The FSL for TPH is 75 ppm.

The techniques and FSLs are based on the applications for other CAU investigations and common NTS practices. These field-screening techniques will provide semiquantitative data that can be used to guide confirmatory soil sampling activities and waste management decisions.

A.1.4.3.3 Sampling Methods

Based on the results of the video mole survey, piping will be excavated at points of suspected residual hold-up or breaches and visually inspected. Samples will be collected if an adequate volume of residual material is present and accessible. Soil beneath detectable breaches will also be sampled.

Liquid and solid material in septic tanks will be sampled using an appropriate sampling technique that includes a bailer, bacon bomb sampler, or similar device. An attempt will be made to collect a column sample that represents the entire depth of the liquid phase. A separate column sample representing the entire depth of the solid phase will also be collected, if possible. In the event that the tank contents are dry, a long-handled tool such as a rake or shovel may be used. Contents in distribution boxes will be sampled in a similar manner. Sumps will be sampled at the lowest point.

Hand sampling, augering, direct-push, excavation, drilling, or other appropriate sampling methods will be used to collect soil samples. Sample collection and handling activities will only be conducted in accordance with approved Standard Quality Practices. It may be appropriate to use excavation in selected areas to determine if contaminated soil has been covered with clean fill.

For waste management purposes, the concrete structure of the decontamination pad and wastewater catch (CAS 06-17-04) will be sampled by coring or other appropriate method.

A.1.4.3.4 Analytical Methods

The analytical program for CAU 224 CASs shown in Table A.1-6 has been developed based on the COPC information presented in Section A.1.1 and summarized in Table A.1-1. Section 3.0 and Section 6.0 of the CAIP provide the analytical methods and laboratory requirements (e.g., detection limits, precision, and accuracy) to be followed during this CAI. Sample volumes are laboratory- and method-specific and will be determined in accordance with laboratory requirements. Analytical requirements (e.g., methods, detection limits, precision, and accuracy) are specified in the Industrial Sites QAPP (NNSA/NV, 2002), unless superseded by the CAIP. These requirements will ensure that laboratory analyses are sufficient to detect contamination in samples at concentrations exceeding the MRL.

A.1.5 Step 4 - Define the Study Boundaries

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

A.1.5.1 Define the Target Population

Decision I target populations represent locations that are most likely to contain COCs and residual materials in piping, tanks, and other structures for waste management. The target population for Decision II step-out locations are COC concentrations in samples adjacent to contaminated areas that are less than PALs. Table A.1-7 summarizes the target populations for the CASs based on the CSM and the spatial boundaries (Section A.1.5.2).

A.1.5.2 Identify the Spatial and Temporal Boundaries

The spatial boundaries (geographic) boundaries are defined as the vertical or horizontal extent of impacted soil beyond which the investigation will be rescoped. Intrusive sampling activities are not intended to extend into the boundaries of neighboring areas of environmental concern (e.g., other CASs). The horizontal boundaries at each CAS reflect the investigation area (i.e., the suspected

Table A.1-6
Analytical Methods for Laboratory Analysis

Analytical Parameter	Analytical Method	
	Liquid	Soil/Sediment/Sludge
Volatile Organic Compounds	SW-846 8260B[a]	SW-846 8260B[a]
Semivolatile Organic Compounds	SW-846 8270C[a]	SW-846 8270C[a]
RCRA Metals plus antimony, aluminum, beryllium, cobalt, copper, manganese, molybdenum, nickel, zinc	SW-846 6010B[a] (mercury - 7470A[a])	SW-846 6010B[a] (mercury - 7471A[a])
Polychlorinated Biphenyls	SW-846 8082[a]	SW-846 8082[a]
Total Petroleum Hydrocarbons (C_6 - C_{38})	SW-846 8015B[a] (modified)	SW-846 8015B[a] (modified)
Methanol	SW-846 8260B[a]	SW-846 8260B[a]
Hydroquinone	SW 846-8270C[a]	SW-846 8270C[a]
Cyanide	SW-846 9010	SW-846 9010
Sulfide	SW-846 9030B	SW-846 9030B
Asbestos	NA	Visual Inspection of Piping
Gamma Spectrometry (to include Cesium-137, Americium-241, Cobalt-60)	EPA Procedure 901.1[b]	HASL-300[c]
Strontium-90	ASTM D5811-00[d]	HASL-300[c]
Isotopic Plutonium	ASTM D3865-02[e]	ASTM C1001-00[f]
Isotopic Uranium	ASTM D3972-02[g]	ASTM E1000-02[h]

ASTM = American Society of Testing and Materials
RCRA = *Resource Conservation and Recovery Act*
SW = Solid Waste

[a]*EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 3rd Edition, Parts 1-4, SW-846* (EPA, 1996)
[b]*Prescribed Procedure for Measurements of Radioactivity in Drinking Water* (EPA, 1980)
[c]*The Procedures Manual of the Environmental Measurements Laboratory* (DOE, 1997)
[d]*Standard Test Method for Strontium-90 in Water* (ASTM, 2000a)
[e]*Standard Test Method for Plutonium in Water* (ASTM, 2002a)
[f]*Standard Test Method for Radiochemical Determination of Plutonium in Soil by Alpha Spectroscopy* (ASTM, 2000b)
[g]*Standard Test Method for Isotopic Uranium in Water by Radiochemistry* (ASTM, 2002b)
[h]*Standard Test Method for Radiochemical Determination of Uranium Isotopes in Soil by Alpha Spectrometry* (ASTM, 2002c)

Table A.1-7
Decision I and II Target Populations and Spatial Boundaries
(Page 1 of 6)

<table>
<tr><th rowspan="2">CSM Component - CSM Element</th><th rowspan="2">CAU 224 CAS</th><th rowspan="2">Decision I Target Populations</th><th rowspan="2">Decision II Target Populations</th><th colspan="2">Spatial Boundaries for Decision II</th></tr>
<tr><th>Horizontal</th><th>Vertical</th></tr>
<tr><td rowspan="7">Septic and/or Collection - Piping</td><td>CAS 02-04-01</td><td rowspan="2">(1) Residual materials in piping
(2) Soil beneath detectable breaches in piping</td><td rowspan="2">Decision II soil samples to vertically and laterally define extent of suspected contamination at detected breaches based on visual observations, FSL exceedances, and other biasing factors.</td><td rowspan="4">Maximum of 30 ft in any direction to encompass a detected breach.</td><td>Maximum of 25 ft bgs from the base of the piping. Depth of the piping is unknown.</td></tr>
<tr><td>CAS 03-05-01</td><td>Maximum of 25 ft bgs from the base of the piping. Depth is approximately 2 ft based on a cited depth of the leach pit of 2 ft.</td></tr>
<tr><td>CAS 05-04-01</td><td colspan="2">None based on process knowledge. If the results of the residual tank content samples are inconsistent with the 1995 characterization results, Decision I and II Target Populations consistent with the other CASs will apply along with the spatial boundaries indicated.</td><td>Maximum of 25 ft bgs from the base of the piping. Depth to piping likely varies. Inlet piping to the distribution box is approximately 10 ft bgs.</td></tr>
<tr><td>CAS 06-03-01</td><td rowspan="4">(1)Residualmaterialsinpiping
(2) Soil beneath detectable breaches in piping</td><td rowspan="4">Decision II soil samples to vertically and laterally define extent of suspected contamination at detected breaches based on visual observations, FSL exceedances, and other biasing factors.</td><td>Maximum of 25 ft bgs from the base of the piping. Depth of the piping is unknown.</td></tr>
<tr><td>CAS 06-23-01</td><td>Maximum of 30 ft in any direction to encompass a detected breach with the following exception. The spatial boundary for piping leading from CP-2 and the decontamination pad sump to the distribution box and from the distribution box to the leachfield is limited to the north by CAS 06-17-04 and east by the leachfield portion of CAS 06-05-01.</td><td>Maximum of 25 ft bgs from the base of the piping. Depth to piping is unknown.</td></tr>
<tr><td>CAS 11-04-01</td><td>Maximum of 30 ft in any direction around a detected breach with the following exception. The spatial boundary is limited to the south by the evapotranspiration bed and the east by the facility fence/boundary.</td><td>Maximum of 25 ft bgs from the base of the piping. Depth to inlet piping appears to be approximately 3 to 4 ft bgs at the manhole/septic tank and outlet piping to the leachfield is 1 ft bgs.</td></tr>
<tr><td>CAS 23-05-02</td><td>Maximum of 30 ft in any direction to encompass a detected breach.</td><td>Maximum of 25 ft bgs from the base of the piping. Depth to piping is unknown.</td></tr>
</table>

Table A.1-7
Decision I and II Target Populations and Spatial Boundaries
(Page 2 of 6)

CSM Component - CSM Element	CAU 224 CAS	Decision I Target Populations	Decision II Target Populations		Spatial Boundaries for Decision II	
					Horizontal	Vertical
Septic and/or Collection - Piping with manhole access	CAS 05-04-01	(1) Residual materials in manhole	None based on process knowledge. If the results of the residual material analysis are inconsistent with the 1995 characterization results, Decision I and II Target Populations consistent with the other CASs will apply.		Not applicable unless a breach is detected at the manhole. If so, guidance for the Piping Element applies.	
	CAS 06-03-01	(1) Residual materials in manhole/piping	Decision II soil samples to vertically and laterally define extent of suspected contamination at detected breaches based on visual observations, FSL exceedances, and other biasing factors.			
	CAS 11-04-01					
Septic and/or Collection - Septic Tank	CAS 02-04-01	(1) Residual Tank Contents (2) Soil horizon at the base of the tank and inlet piping (3) Surface/shallow subsurface soil beneath the outlet ends and/or overflow piping	Decision II samples to vertically and laterally define extent of suspected contamination at Decision I sample locations based on visual observations, FSL exceedances, and other biasing factors.	(1) Decision II sample locations oriented around the tank and approximately 15 ft from Decision I sample locations. (2) Additional step-out locations if biasing factors indicate COCs extend beyond the proposed Decision II sample locations.	Maximum of 45 ft in any direction to encompass the tank.	Maximum of 25 ft bgs from the base of the tank. Depth to the base of the tank is unknown.
	CAS 05-04-01	(1) Residual Tank Contents	None based on process knowledge. If the results of the residual tank content samples are inconsistent with 1995 characterization results, Decision I and II Target Populations consistent with the other CASs will apply along with the spatial boundaries indicated.			
	CAS 11-04-01	(1) Residual Tank Contents (2) Soil horizon at the base of the tank and inlet piping (3) Surface/shallow subsurface soil beneath the outlet ends and/or overflow piping	Decision II samples to vertically and laterally define extent of suspected contamination at Decision I sample locations based on visual observations, FSL exceedances, and other biasing factors.	(1) Decision II sample locations oriented around the tank and approximately 15 ft from Decision I sample locations not to encroach upon the leachfield portion of the CAS. (2) Additional step-out locations if biasing factors indicate COCs extend beyond the proposed Decision II sample locations.	Maximum of 45 ft encompassing the tank to the north, east and west. The spatial boundary is limited to the south by the evapotranspiration bed.	Maximum of 25 ft bgs from the base of the tank. Depth to the base of the tank is 4 ft bgs.

Table A.1-7
Decision I and II Target Populations and Spatial Boundaries
(Page 3 of 6)

CSM Component - CSM Element	CAU 224 CAS	Decision I Target Populations	Decision II Target Populations		Spatial Boundaries for Decision II: Horizontal	Spatial Boundaries for Decision II: Vertical
Septic and/or Collection - Distribution Box	CAS 05-04-01	None based on process knowledge. If the results of the residual tank content samples are inconsistent with the 1995 characterization results, Decision I and II Target Populations consistent with the other CASs will apply along with the spatial boundaries indicated.			Maximum of 45 ft to encompass the distribution box. The spatial boundary is limited to the north by the septic tanks.	Maximum of 25 ft bgs from the base of the distribution box. Depth to the base of the distribution box is 7 ft bgs.
	CAS 06-03-01			Additional Decision II sample locations specific to the distribution box will not be collected. Potential contamination from the distribution box will be captured by the Decision II sampling for the sewage lagoons. See Lagoons/Leach Pit/Outwash CSM component.	Not applicable. Spatial boundaries associated with the distribution box are included in the Lagoon/Leach Pit/Outfall CSM Component	
	CAS 06-23-01	(1) Residual material in distribution box (2) Soil horizon at the base of the distribution box and inlet/outlet piping	Decision II samples to vertically and laterally define extent of suspected contamination at Decision I sample locations based on visual observations, FSL exceedances, and other biasing factors.	(1) Decision II sample location oriented around the distribution box approximately 15 ft from Decision I sample locations. Decision II sample locations may also support Decision II for the decontamination pad (06-17-04) and leachfield (06-05-01). (2) Additional step-out locations if biasing factors indicate COCs extend beyond the proposed Decision II sample locations will be limited in a manner that does not encroach upon the decontamination pad and leachfield CASs.	Maximum of 45 ft in any direction to encompass the distribution box with the following exception. The spatial boundary for the distribution box and from the distribution box to the leachfield is limited to the north by CAS 06-17-04 and east by the leachfield portion of CAS 06-05-01.	Maximum of 25 ft bgs from the base of the distribution box. Depth to the base of the distribution box is unknown.
	CAS 11-04-01			Decision II sample locations specific to the distribution box will not be collected. Potential contamination from the distribution box will be captured by the Decision II sampling for the evapotranspiration bed. See Leachfield CSM component below.	Not applicable. Spatial boundaries associated with the distribution box are included in the Leachfield CSM Component	
Septic and/or Collection Sump	CAS 03-05-01	(1) Residual material/sediment at lowest point (2) Soil horizon at the base of the sump	Decision II samples to vertically and laterally define extent of suspected contamination at Decision I sample locations based on visual observations, FSL exceedances, and other biasing factors.	(1) Decision II sample locations oriented around the sump approximately 15 ft from Decision I sample location. (2) Additional step-out locations if biasing factors indicate COCs extend beyond the proposed Decision II sample locations.	Maximum of 45 ft in any direction to encompass the sump.	Maximum of 25 ft bgs from the base of the sump. Depth to the base of the sump is 1.5 ft bgs.

Table A.1-7
Decision I and II Target Populations and Spatial Boundaries
(Page 4 of 6)

CSM Component - CSM Element	CAU 224 CAS	Decision I Target Populations	Decision II Target Populations		Spatial Boundaries for Decision II	
					Horizontal	Vertical
Leachfield - Distribution Piping	CAS 06-05-01 CAS 11-04-01 CAS 23-05-02	(1) Residual material at the midpoint and proximal and distal ends	Decision II sample locations specific to the leachfield distribution piping are not planned. Potential contamination of the leachfield will be captured by the Decision II sampling for each CAS. See Leachfield CSM component below.		Not applicable.	
Leachfield	CAS 06-05-01	(1) Soil/cover material above distribution piping at the midpoint, proximal and distal ends (2) Soil/cover material below distribution piping at the midpoint, proximal and distal ends (3) Native soil at the leachrock/ native soil interface below distribution piping at the midpoint, proximal and distal ends	Decision II samples to vertically and laterally define extent of suspected contamination at Decision I sample locations based on visual observations, FSL exceedances, and other biasing factors.	(1) Decision II sample locations oriented on the leachfield perimeter. (2) Additional step-out locations if biasing factors indicate COCs extend beyond the proposed Decision II sample locations.	Maximum of 45 ft in any direction to encompass the leachfield with the following considerations. The spatial boundary to the northwest of the leachfield is limited by CAS 06-17-04, to the east by a transformer pad, and to the southeast by CP-72.	Maximum of 25-ft bgs from the leachrock/native soil interface. Depth to the interface is not known.
	CAS 11-04-01			(1) Decision II sample locations oriented on the evapotranspiration bed perimeter. (2) Additional step-out locations if biasing factors indicate COCs extend beyond the proposed Decision II sample locations.	Maximum of 45 ft encompassing the evapotranspiration bed. The spatial boundary is limited to the east by the facility fence/boundary.	Maximum of 25 ft bgs from the leachrock/native soil interface. Depth to the interface is appears to be 2.5 ft.
	CAS 23-05-02			(1) Decision II sample locations oriented on the leachfield perimeter. (2) Additional step-out locations if biasing factors indicate COCs extend beyond the proposed Decision II sample locations.	Maximum of 45 ft in any direction to encompass the leachfield. The spatial boundary may be limited to the southwest by Building 753.	Maximum of 25 ft bgs from the leachrock/native soil interface. Depth to the interface is not known.

Table A.1-7
Decision I and II Target Populations and Spatial Boundaries
(Page 5 of 6)

CSM Component - CSM Element	CAU 224 CAS	Decision I Target Populations	Decision II Target Populations		Spatial Boundaries for Decision II	
					Horizontal	Vertical
Lagoon/Leach Pit/Outfall	CAS 03-05-01	(1) Sediment deemed representative of the lagoon or leach pit bottom if discernible (2) Native soil at the lagoon bottom/native soil interface at the point of discharge, midpoint and end	Decision II samples to vertically and laterally define extent of suspected contamination at Decision I sample locations based on visual observations, FSL exceedances, and other biasing factors.	(1) Decision II sample locations oriented on the leach pit perimeter. (2) Additional step-out locations if biasing factors indicate COCs extend beyond the proposed Decision II sample locations.	Maximum of 45 ft in any direction encompassing the leach pit.	Maximum of 25 ft bgs from the leachpit sediment/native soil interface. Depth to the interface is 2 ft.
	CAS 05-04-01	(1) Surface/Near Surface Soil in outfall		None based on process knowledge. If the results of the outfall samples are inconsistent with 1995 characterization results, Decision II Target Populations consistent with the other CASs will apply along with the spatial boundaries indicated		
	CAS 06-03-01	(1) Sediment deemed representative of the lagoon or leach pit bottom if discernible (2) Native soil at the lagoon bottom/native soil interface at the point of discharge, midpoint and end		(1) Decision II sample locations oriented on the perimeter for each of the sewage lagoonsystems. (2) Additional step-out locations if biasing factors indicate COCs extend beyond the proposed Decision II sample locations.	Maximum of 45 ft in any direction encompassing each of the sewage lagoon systems.	Maximum of 25 ft bgs from the lagoon bottom/native soil interface if discernible. Depth to the interface is unknown. The lagoons have potentially been dug-out and closed.
	CAS 06-05-01	(1) Surface/Near Surface Soil in potential outfall		(1) Decision II sample locations oriented onthelagoonperimeters. (2) Additional step-out locations if biasing factors indicate COCs extend beyond the proposed Decision II sample locations.	Maximum of 45 ft in any direction to encompass the lagoons and the potential outfall.	Maximum of 25 ft bgs from the lagoon bottom/native soil interface if discernible. depth to the interface is unknown. With respect to the potential outfall, maximum of 25 ft bgs.
	CAS 11-04-01	(1) Sediment deemed representative of the lagoon or leach pit bottom if discernible (2) Native soil at the lagoon bottom/native soil interface at the point of discharge, midpoint and end		(1) Decision II sample locations oriented onthelagoonperimeter. (2) Additional step-out locations if biasing factors indicate COCs extend beyond the proposed Decision II sample locations.	Maximum of 45 ft in any direction to encompass the lagoon.	Maximum of 25 ft bgs from the lagoon bottom/native soil interface if discernible. Depth to the interface is 3 ft. The lagoon has potentially been dug-out.

Table A.1-7
Decision I and II Target Populations and Spatial Boundaries
(Page 6 of 6)

CSM Component - CSM Element	CAU 224 CAS	Decision I Target Populations	Decision II Target Populations		Spatial Boundaries for Decision II	
					Horizontal	Vertical
Decontamination Pad	CAS 06-17-04	(1) Concrete samples for waste characterization (2) Soil underlying the pad at the pad/soil interface (3) Soil adjacent to the pad	Decision II samples to vertically and laterally define extent of suspected contamination at Decision I sample locations based on visual observations, FSL exceedances, and other biasing factors.	(1) Decision II sample locations oriented on the decontamination pad perimeter. (2) Additional step-out locations if biasing factors indicate COCs extend beyond the proposed Decision II sample locations.	Maximum of 45 ft in any direction around the pad with the following considerations. The spatial boundary to the southeast of the decontamination pad is limited by the leachfield portion of CAS 06-05-01 and south by the piping leading from CP-2 to the distribution box and from the distribution box to the leachfield.	25 ft bgs from the pad/native soil interface. With respect to soil samples on the perimeter of the pad, 25 ft bgs.
Wastewater Catch		(1) Residual material/sediment at the lowest point (2) Soil horizon at the base of the wastewater catch		Additional Decision II sample locations specific to the wastewater catch are not planned. Potential contamination from the wastewater catch will be captured by the Decision II sampling for the decontamination pad element. See above.	Not applicable. Spatial boundaries associated with the wastewater catch and concrete trench are included in the Decontamination Pad CSM Component	
Concrete Trench		(1) Concrete samples for waste characterization (2) Soil underlying the concrete trench (3) Soil adjacent to the concrete trench				

lateral extent of contamination) where COCs potentially exist. The spatial boundaries as presented in Table A.1-7 may be further refined based on visual inspection of the CASs.

Temporal boundaries are time constraints due to time-related phenomena, such as weather conditions, seasons, and activity patterns. Significant temporal constraints due to weather conditions are not expected; however, snow events may affect site activities during winter months. Moist weather may place constraints on sampling and field screening of contaminated soils because of the attenuating effect of moisture in samples. There are no time constraints on collecting samples.

A.1.5.3 Identify Practical Constraints

The primary practical constraints anticipated at the CASs are the presence of underground utilities, posted contamination area requirements, physical barriers (e.g., fences) and areas requiring access authorization. Utility surveys will be conducted at each CAS prior to the start of investigation activities to determine if utilities exist and, if so, determine the limit of spatial boundaries for intrusive activities. Additionally, piping that is still in use will not be video surveyed or sampled. No other practical constraints have been identified.

A.1.5.4 Define the Scale of Decision Making

For CAU 224, the scale of decision making for Decision I is defined as each CAS. The scale of decision making for Decision II is defined as the extent of COC contamination originating from individual CASs.

A.1.6 Step 5 – Develop a Decision Rule

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

A.1.6.1 Specify the Population Parameter

The population parameter for Decision I data collected from biased sample locations is the maximum observed concentration of each COPC within the target population. For radiological surveys, the maximum observed activity of each COPC is considered the population parameter. If radiological sampling and analysis is performed to support the radiological survey results, the maximum observed activity of each COPC identified in the sample will be the population parameter. Radiological sampling and analysis will supersede radiological survey results.

The population parameter for Decision II data is the observed concentration of each unbounded COC in any sample.

A.1.6.2 Choose an Action Level

Action levels are defined as the PALs, which are specified in Section A.1.4.2.

A.1.6.3 Decision Rule

If the concentration of any COPC in a target population exceeds the corresponding PAL in a Decision I or Decision II sample, that COPC is identified as a COC. If all COPC concentrations are less than the corresponding PALs, then the decision will be no further action.

If the observed population parameter of any COC in a Decision II sample exceeds the PALs, samples will be collected to define the extent of contamination. If all observed COC population parameters are less than PALs, the decision will be that the extent of contamination has been defined in the lateral and vertical directions.

If contamination is inconsistent with the CSM or extends beyond the identified spatial boundaries, work will be suspended and the investigation strategy will be reevaluated. If contamination is consistent with the CSM and is within spatial boundaries, the decision will be to continue sampling to define extent.

A.1.7 Step 6 – Specify the Tolerable Limits on Decision Errors

The sampling approach for the investigation relies on biased sampling locations (judgemental data collection); therefore, statistical analysis is not appropriate. Only validated analytical results (quantitative data) will be used to determine if COCs are present (Decision I) or the extent of a COC (Decision II), unless otherwise stated. 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:

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

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

A.1.7.1 False Negative (Rejection) Decision Error

The false negative (rejection of the null hypothesis) decision error would mean:

- Decision I: Deciding that a COC is not present when it actually is.
- Decision II: Deciding that the extent of a COC has been defined when it actually has not.

In both cases, this would result in an increased risk to human health and environment.

For Decision I, a false negative decision error (where the consequences are more severe) is controlled by meeting the following criteria:

- Having a high degree of confidence that the Decision I sample locations selected will identify COCs if present anywhere within a CAS.

- Having a high degree of confidence that Decision I analyses selected (both field screening and confirmatory laboratory) will be sufficient to detect any COCs present in the sampled media and that the detection limits are adequate to ensure an accurate quantification of the COCs.

For Decision II, the false negative decision error is reduced by:

- Having a high degree of confidence that the Decision II sample locations selected will identify the extent of COCs.

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

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

To satisfy the first criterion for both decisions, Decision I samples will be collected in areas most likely to be contaminated by COPCs and Decision II samples will be collected in areas that potentially represent the lateral and vertical extent of COCs. The following characteristics are considered to accomplish the first criterion:

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

These characteristics were considered during the development of the CSM. The biasing factors listed in Section A.1.4.1 will be used to further ensure that these criteria are met.

To satisfy the second criterion, all samples used to define the nature and extent of contamination will be analyzed for the parameters listed in Section A.1.4.3.4 using analytical methods that are capable of producing quantitative data at concentrations equal to or below PALs.

To satisfy the third criterion for Decision II, the entire dataset, as well as individual sample results, will be assessed against the DQIs of precision, accuracy, comparability, completeness, and representativeness defined in the Industrial Sites QAPP (NNSA/NV, 2002). Consistent with the QAPP, the goal for the completeness DQI is that 80 percent of the COPC results are valid for every sample. The COPCs are defined as those contaminants that may realistically be present within a CAS (Section A.1.4.3.4). In addition, sensitivity has been included as a DQI for laboratory analyses. Site-specific DQIs are discussed in more detail in Section 6.0 of the CAIP. Strict adherence to established procedures and QA/QC protocols also protects against false negatives.

A.1.7.2 False Positive Decision Error

The false positive (acceptance of the null hypothesis or beta) decision error would mean:

- Deciding that a COC is present when it actually is not (Decision I)
- Accepting that the extent of a COC has not been defined when it really has (Decision II)

These errors result in increased costs for unnecessary characterization or corrective actions.

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

A.1.7.3 Quality Assurance/Quality Control

Field-screening equipment will be calibrated and checked in accordance with the manufacturer's instructions or approved procedures.

Quality control samples will be collected as required by the Industrial Site QAPP (NNSA/NV, 2002) and in accordance with established procedures. The required QC field samples include:

- Trip blanks (1 per sample cooler containing environmental VOC samples)
- Equipment blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per source lot per sampling event)
- Field duplicates (minimum of 1 per matrix per 20 environmental samples or 1 per CAS if event if less than 20 collected)
- Field blanks (1 per CAS if less than 20 collected or change in field conditions)
- Matrix spike/matrix spike duplicate (minimum of 1 per matrix per 20 environmental samples or 1 per CAS if less than 20 collected as required by the analytical method)

Additional QC samples may be submitted based on site-specific conditions.

A.1.8 Step 7 – Optimize the Design for Obtaining Data

This section presents an overview of the resource-effective strategy planned to obtain the data required to meet the project DQOs. As additional data or information is obtained (identified as inputs to the decision in Table A.1-5) this step will be reevaluated and refined, as necessary, to reduce uncertainty and increase the confidence that the nature and extent is accurately defined.

A.1.8.1 General Investigation Strategy

Intrusive soil sampling for field-screening and laboratory analysis will be conducted at the CAU 224 CASs with the exception of CAS 05-04-01. The Decision I locations are determined based on biasing factors listed in Section A.1.4.1, the CSM, and the target populations as detailed in Section A.1.5. The selected biased locations may be modified during the CAI, but only if the modified locations meet the decision needs and criteria stipulated in Section A.1.4.1.

Decision II sampling locations at each CAS are based on an assumed perimeter of the CAS. If biasing factors indicate COCs extend beyond the proposed Decision II sample locations, further incremental step out locations will be selected and samples may be collected without support of analytical results. In the event that step out locations from different components or elements in a CAS approach each other, the area will be considered as one area and samples would be collected only in an outward direction.

With respect to CAS 05-04-01, the tank contents along with residual material in manholes will be sampled and analyzed to confirm conclusions from 1995 that indicated the contents were nonhazardous. Surface/near surface soil beneath the overflow piping for each tank and two samples in the wash will be collected to confirm the previous characterization results.

A.1.8.2 Detailed Investigation Strategy

The following sections discuss the approach for obtaining the information necessary to resolve the DQOs. The strategy may be further revised based on upcoming field inspections and interpretation of geophysical and radiological survey results. Target populations to be sampled are detailed in Table A.1-7. The proposed sampling locations are illustrated for each CAS in Figure A.1-10 through Figure A.1-16, located at the end of the section.

A.1.8.2.1 Septic and/or Collection

Piping is common in all the CASs with the exception of CAS 06-05-01. Sampling activities at these CASs will consist of video mole survey of abandoned piping to identify breaches or residual material, excavating to locate the piping, and collecting Decision I and II samples for laboratory analysis as

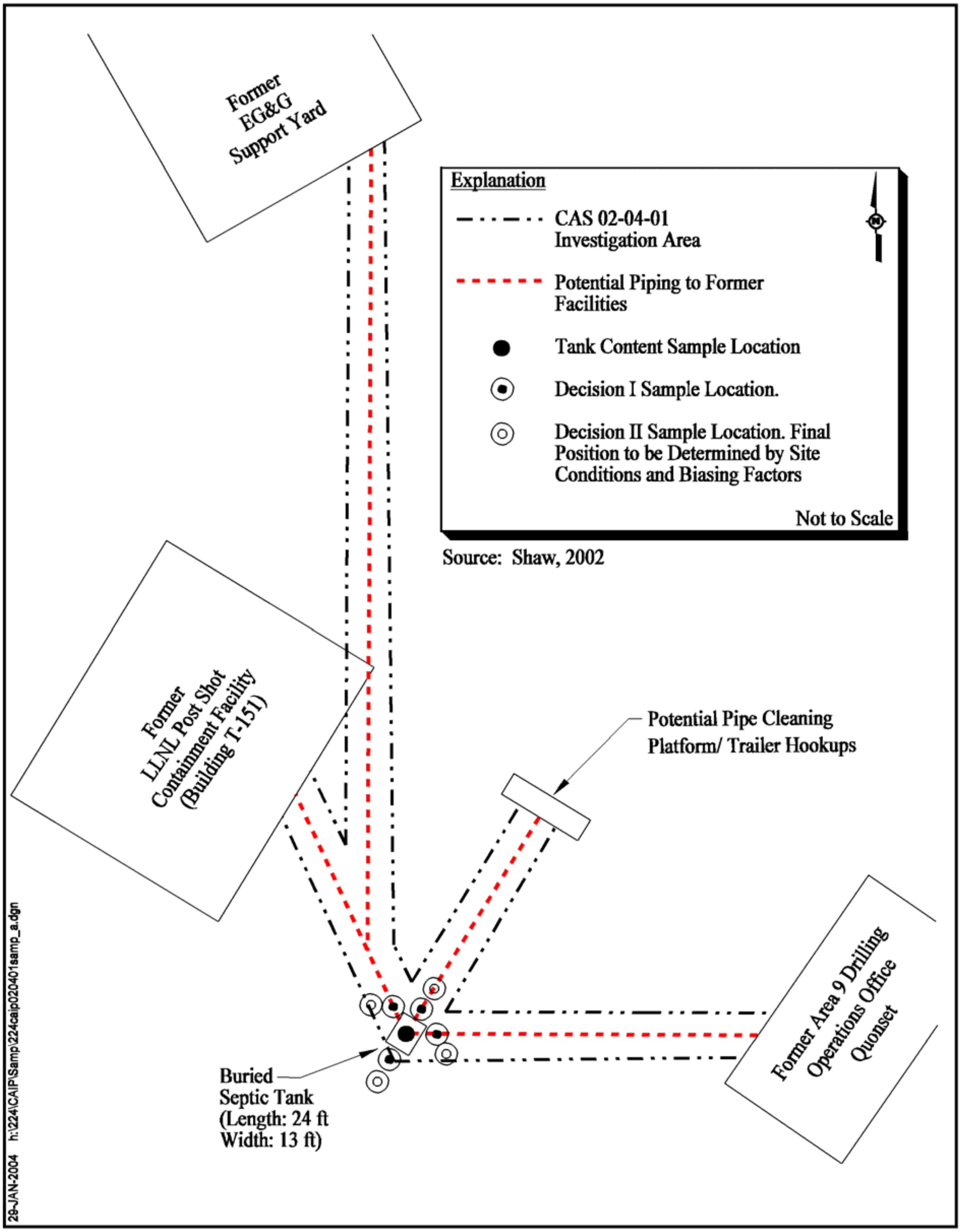

Figure A.1-10
CAU 224, CAS 02-04-01 Sample Locations

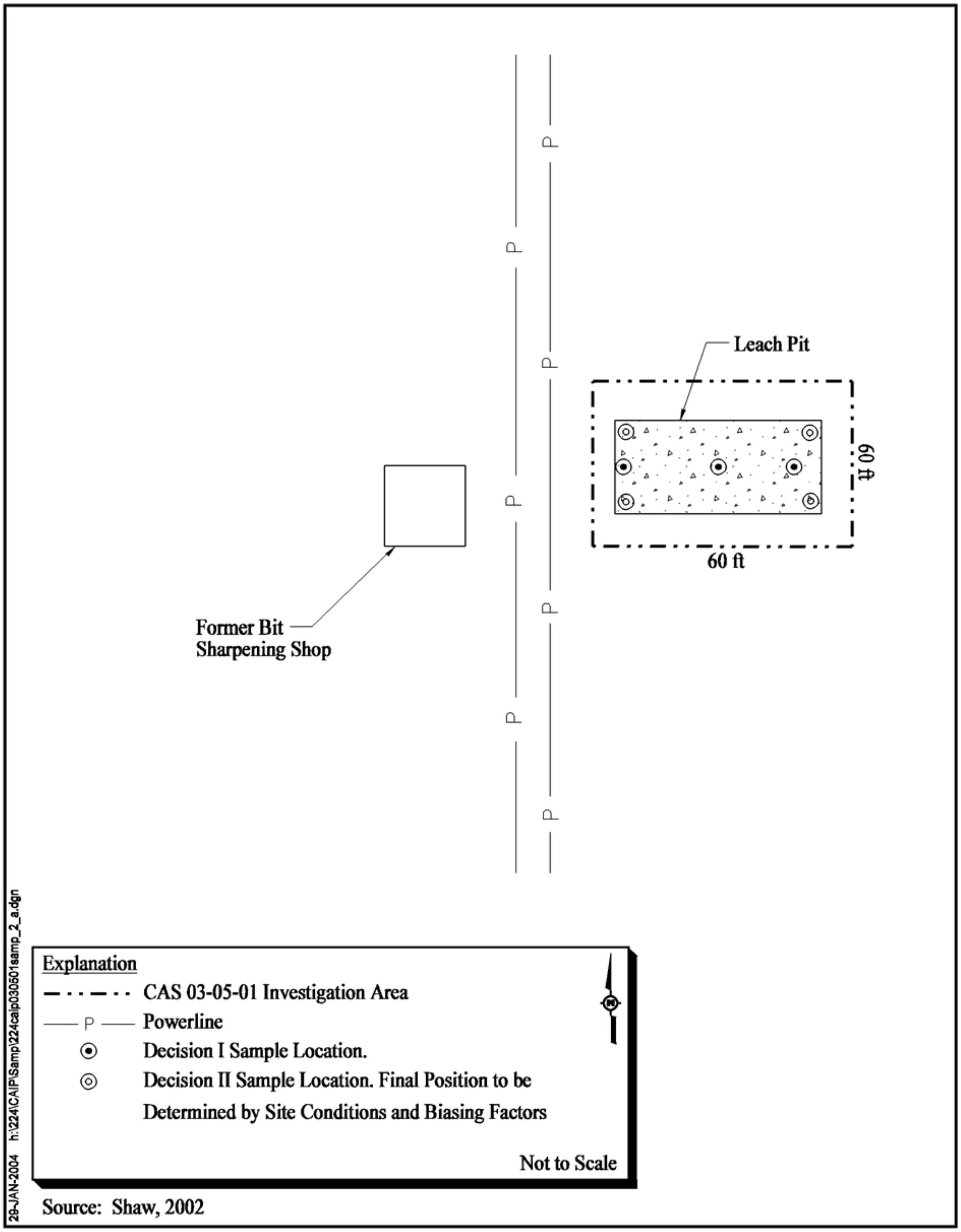

Figure A.1-11
CAU 224, CAS 03-05-01 Sample Locations

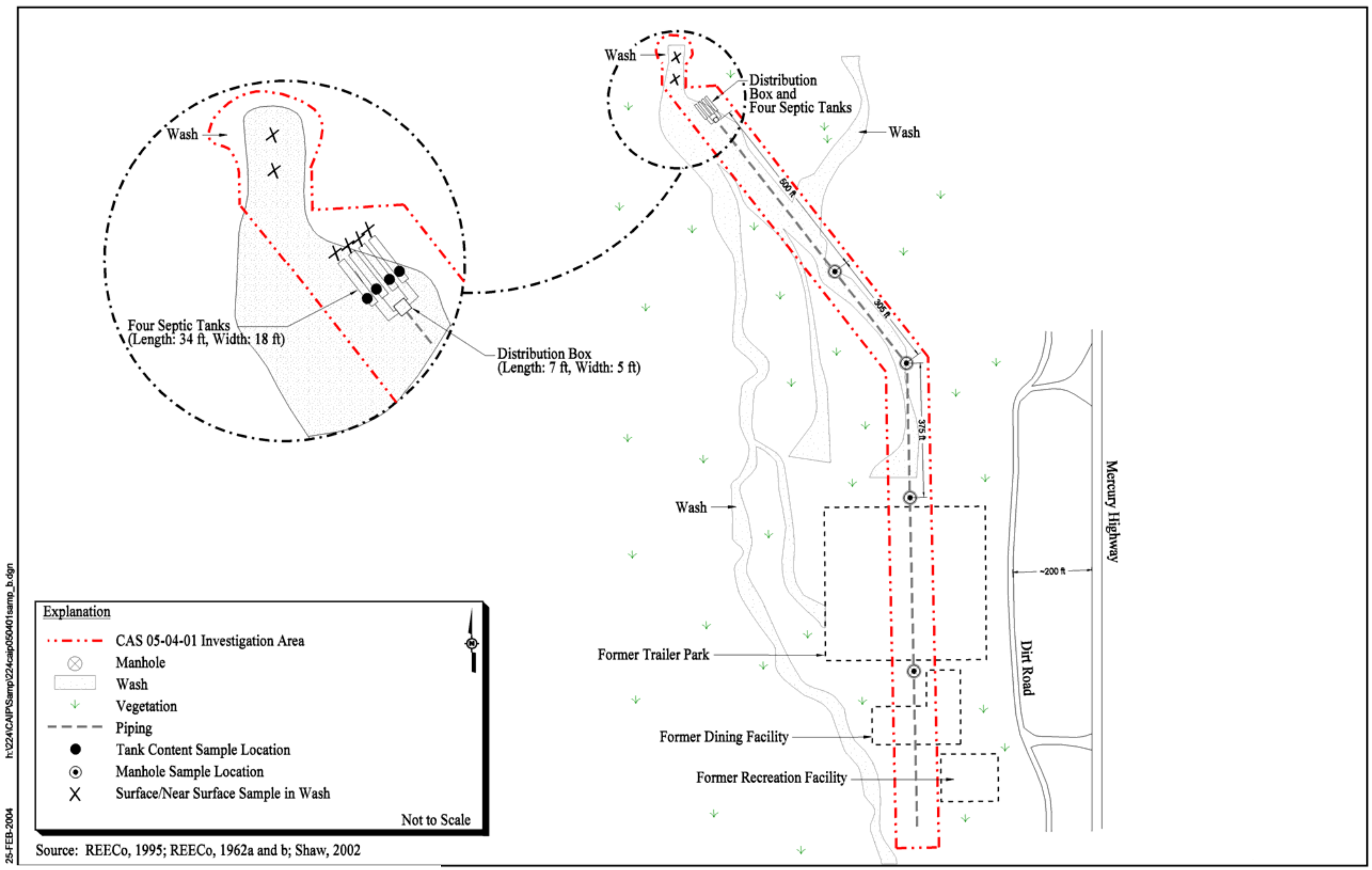

Figure A.1-12
CAU 224, CAS 05-04-01 Sample Locations

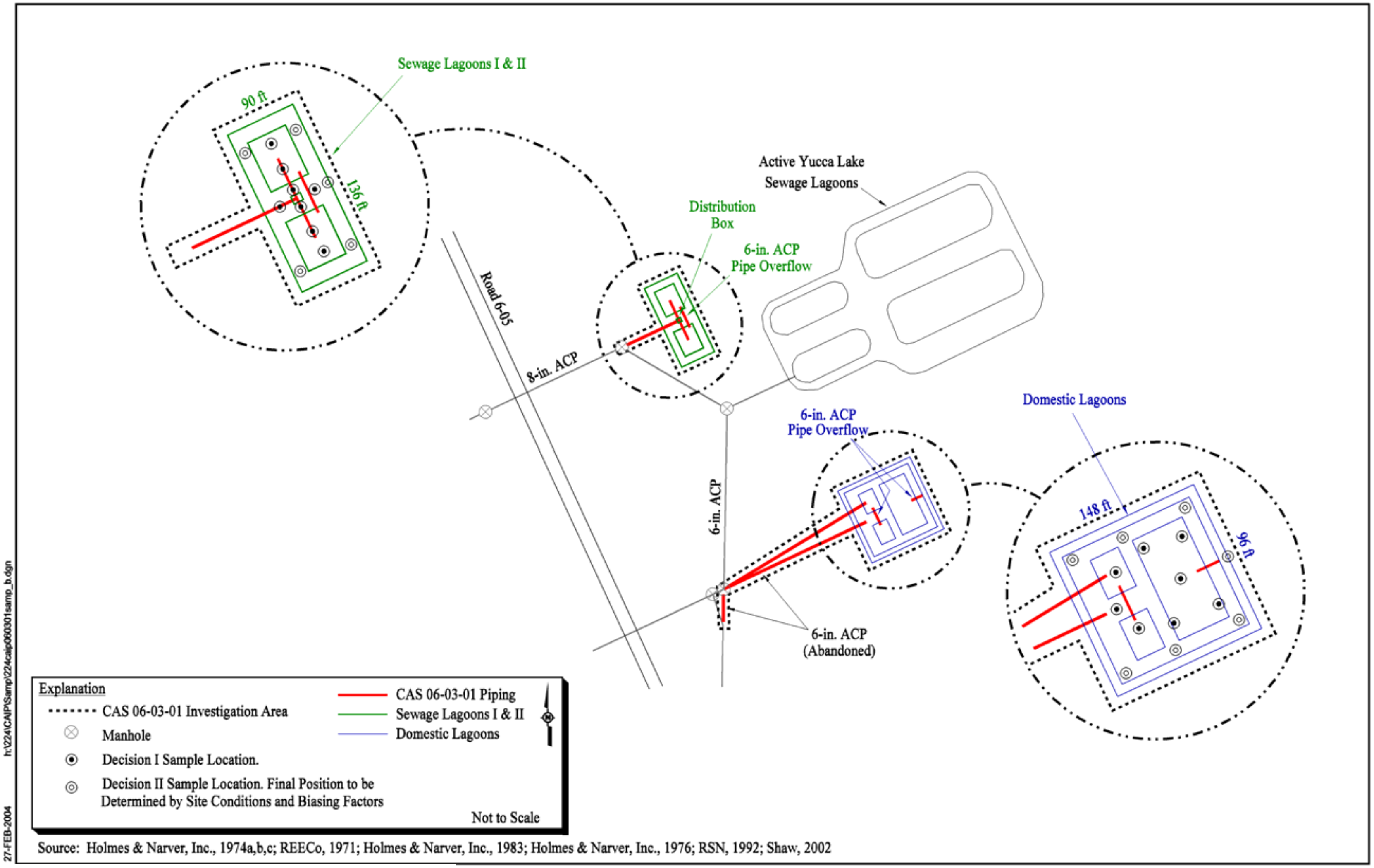

Figure A.1-13
CAU 224, CAS 06-03-01 Sample Locations

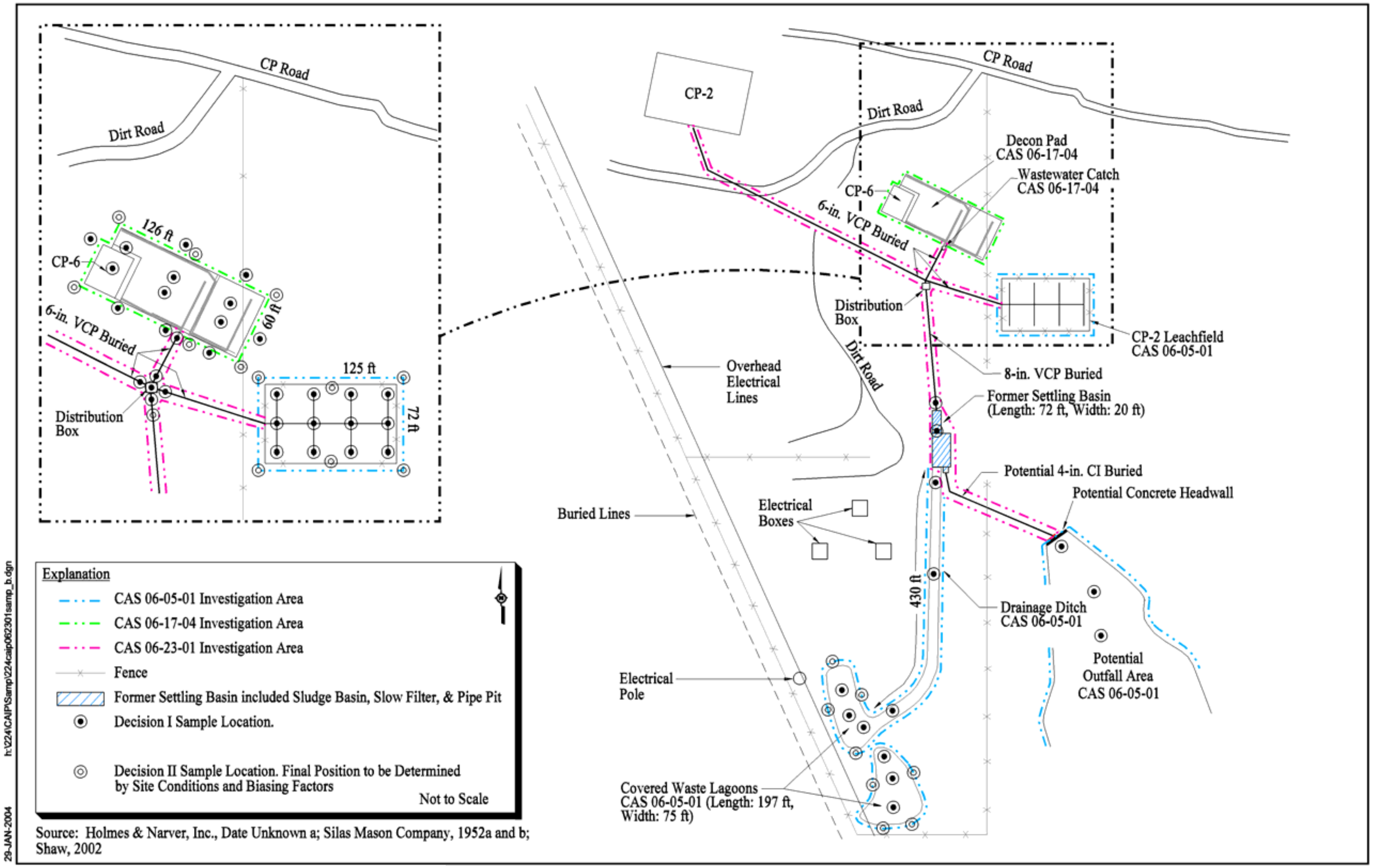

Figure A.1-14
CAU 224, CAS 06-05-01, CAS 06-17-04 and CAS 06-23-01 Sample Locations

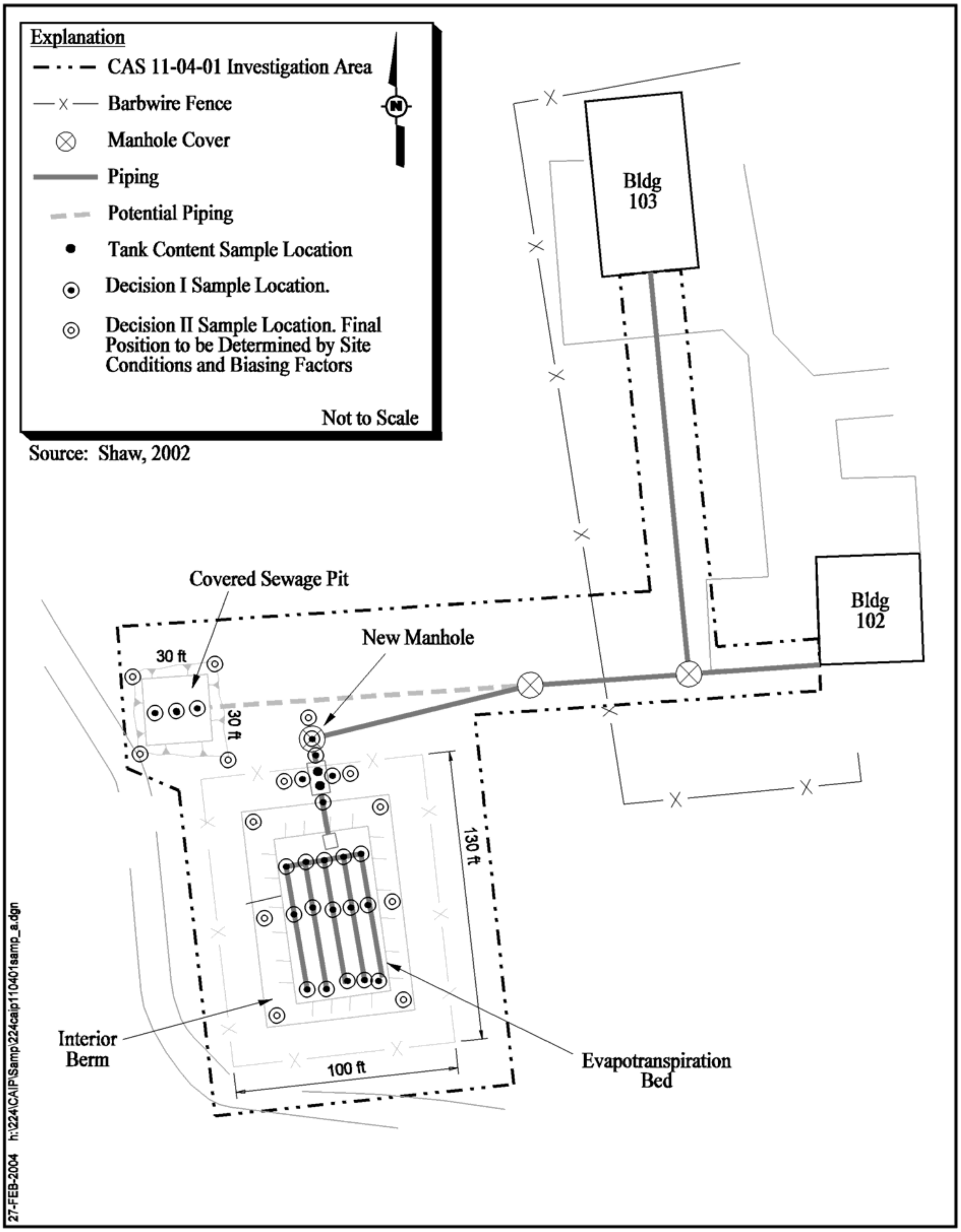

Figure A.1-15
CAU 224, CAS 11-04-01 Sample Locations

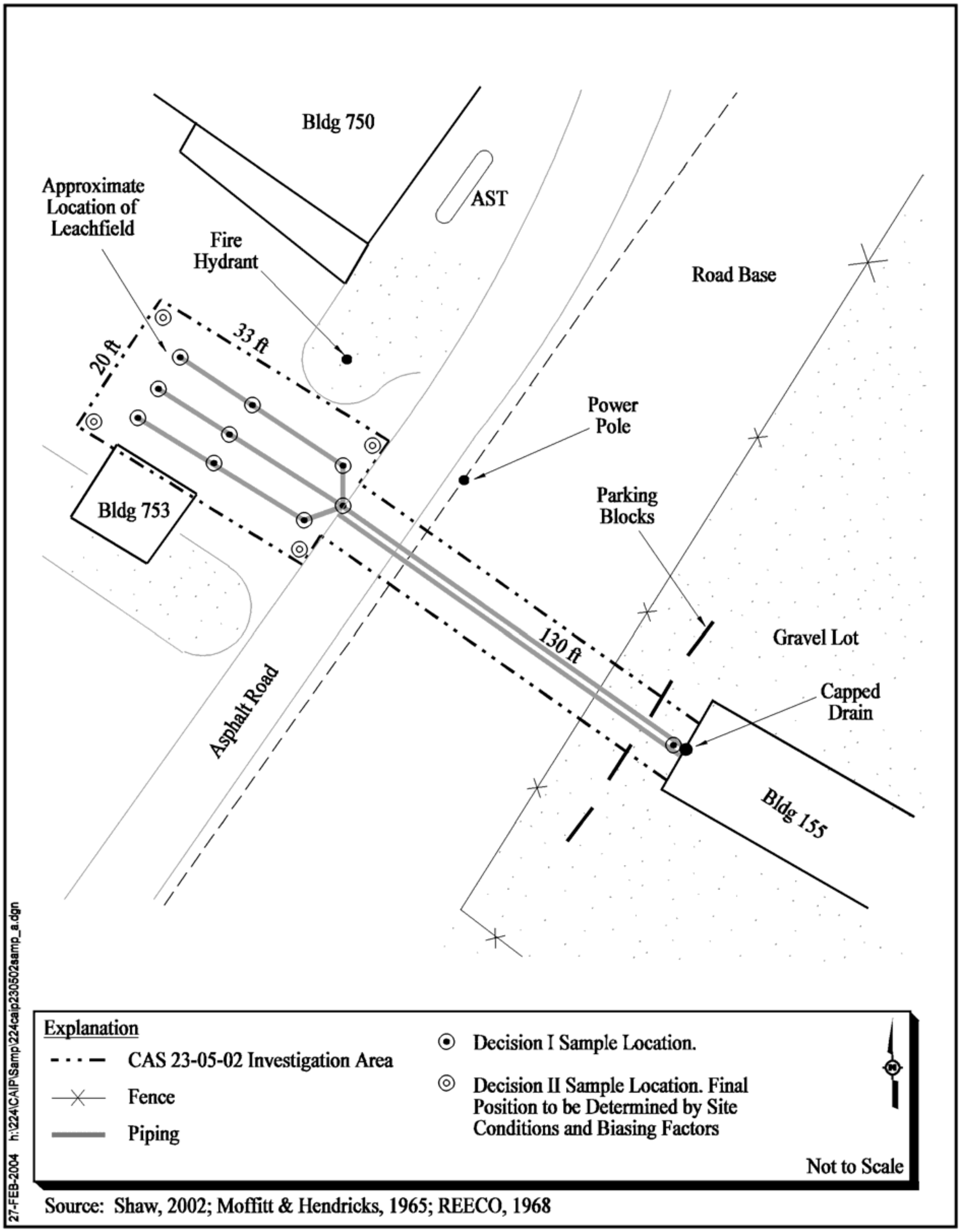

Figure A.1-16
CAU 224, CAS 23-05-02 Sample Locations

necessary. Manhole access to piping is also present for CASs 06-03-01 and 11-04-01. Residual material in manholes will also be sampled, if present.

Each of the CASs 02-04-01, 05-04-01, and 11-04-01 has at least one septic tank. Intrusive activities at CAS 02-04-01 may be necessary to locate the tank. Activities at CAS 02-04-01, 05-04-01, and 11-04-01 include visual inspection of the inside of the septic tank and collecting Decision I samples for laboratory analysis from each matrix the tank residual if present. Decision I soil samples will be collected for CASs 02-04-01 and 11-04-01 beneath the inlet and outlet end pipes, in the soil horizon underlying the base of the septic tanks, and in areas of potential overflow. Decision II samples in the area encompassing the tanks will be collected as detailed on Table A.1-7.

Corrective Action Sites 06-23-01 and 11-04-01 each have a covered distribution box that directed effluent to the leachfield and evapotranspiration bed, respectively. Decision I activities at these CASs will consist of excavating (as appropriate) to locate the distribution box, inspecting inside the distribution box, and collecting Decision I samples for laboratory analysis of residual contents in the distribution boxes (if present). Decision I soil samples will be collected beneath the inlet and outlet piping of the distribution boxes if breaches are suspected and the soil horizon underlying the base of the box. As detailed in Table A.1-7, Decision II samples vertically from the base will be collected based on FSL exceedances and at additional locations encompassing the distribution box. There is presumably a distribution box associated with CAS 06-03-01 within covered Sewage Lagoons I and II. Samples will be collected if the box can be located.

A.1.8.2.2 Leachfield

Corrective Action Sites 06-05-01 and 23-05-02 each have a leachfield and CAS 11-04-01 has an evapotranspiration bed constructed very similar to a leachfield. Decision I activities at these CASs will consist of excavating or other intrusive method to locate the boundaries of each leachfield, exposing the proximal and distal ends of the associated perforated distribution pipes, and collection of Decision I samples of residuals in the distribution piping at the proximal, midpoint, and distal ends. Decision I samples will be collected from soil above and below the distribution pipes at the proximal, midpoint and distal ends. Native soil beneath the leachfield at the proximal, midpoint, and distal ends of the distribution pipes will also be sampled. If the interface cannot be identified, samples will be collected directly beneath the distribution pipes. Decision II samples will be collected vertically at

Decision I locations if FSLs are exceeded. This process will continue until FSRs are less than FSLs and at locations encompassing the CAS as described in Table A.1-7.

A.1.8.2.3 Lagoons/Leach Pit

Corrective Action Sites 03-05-01, 06-03-01, 06-05-01, and 11-04-01 each have a lagoon or lagoon like component (i.e., the leach pit). Decision I activities at these CASs will consist of locating the distribution pipe or discharge area for each lagoon and collecting Decision I samples of lagoon sediments and in soil beneath the lagoon at the native soil interface at the proximal, midpoint, and distal ends. As indicated in Table A.1-7, Decision II samples will be collected vertically at Decision I locations if FSLs are exceeded and until FSRs are less than FSLs and at locations encompassing the CAS. Decision II samples will also be collected at the perimeter locations of the lagoons.

A.1.8.2.4 Decontamination Pad

Corrective Action Site 06-17-04 includes a decontamination pad, drain, and wastewater catch. CAS 03-05-01 potentially has a sump associated with the CAS. Activities at these CASs will consist of collecting Decision I samples at the pad/native soil interface (i.e., under the pad); surface soil adjacent to the edges of the decontamination pad; soil beneath the concrete trench leading from the pad to the sump; and soil at the base of the sump. Decision II samples will be collected vertically at Decision I locations if FSLs are exceeded and until FSRs are less than FSLs and at locations encompassing the CAS.

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Appendix A.2

Project Organization

A.2 Project Organization

The NNSA/NSO Project Manager is Janet Appenzeller-Wing, and her telephone number is (702) 295-0461. The NNSA/NSO Task Manager for CAU 224 will be identified in the FFACO Biweekly Activity Report prior to the start of field activities.

The names of the project Health and Safety Officer and the Quality Assurance Officer can be found in the appropriate NNSA/NSO plan. However, personnel are subject to change, and it is suggested that the NNSA/NSO Project Manager be contacted for further information.

Appendix A.3

Response to NDEP Comments

04-05-04 12:31pm From-NSF ENVIRONMENTAL MGMNT 702 2955300 T-242 P.002/003 F-576

ALLEN BIAGGI, *Administrator*

Administration
Water Pollution Control
Air Quality
(702) 486-2850

STATE OF NEVADA
KENNY C. GUINN
Governor

R. MICHAEL TURNIPSEED, *Director*

Federal Facilities
Corrective Actions
Waste Management
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DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

DIVISION OF ENVIRONMENTAL PROTECTION

(Las Vegas Office)
1771 E. Flamingo Road, Suite 121-A
Las Vegas, Nevada 89119-0837

March 24, 2004

Ms. Janet Appenzeller-Wing
Acting Director, Environmental Restoration Division
Nevada Nuclear Security Administration
Nevada Site Office
P. O. Box 98518
Las Vegas, NV 89193-8518

ACTION	
INFO	ERD ESHD TD LVHD NSO/MGR
NSO/MGR	✓
AMEM	✓
AMNS	
AMSO	
AMSSP	✓

RE: Review of the draft Corrective Action Investigation Plan for the Corrective Action Unit 224, Decon Pad and Septic Systems, Nevada Test Site, Nevada

Dear Ms. Appenzeller-Wing:

The Nevada Division of Environmental Protection staff, Bureau of Federal Facilities (NDEP) has received and reviewed the draft Corrective Action Investigation Plan (CAIP) for the Corrective Action Unit 224, Decon Pad and Septic Systems provided by the Nevada Nuclear Security Administration/Nevada Site Office. NDEP has no comments related to the draft CAIP.

Address any questions regarding this matter to either Greg Raab at (702) 486-2867, or me at (702) 486-2874.

Sincerely,

Don Elle, Ph.D.
Supervisor, Las Vegas
Bureau of Federal Facilities

NSPO Rev. 8-02) (O) 1969

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