Nevada
Environmental
Restoration
Project

DOE/NV--1114

National Nuclear Security Administration

Corrective Action Investigation Plan for Corrective Action Unit 139: Waste Disposal Sites Nevada Test Site, Nevada

Controlled Copy No.: ___
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April 2006

Environmental Restoration
Division

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

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CORRECTIVE ACTION INVESTIGATION PLAN FOR
FOR CORRECTIVE ACTION UNIT 139:
WASTE DISPOSAL SITES
NEVADA TEST SITE, NEVADA

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

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CORRECTIVE ACTION INVESTIGATION PLAN FOR
CORRECTIVE ACTION UNIT 139:
WASTE DISPOSAL SITES
NEVADA TEST SITE, NEVADA

Approved by: APPROVED SIGNATURE Date: 4/5/06

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List of Acronyms and Abbreviations

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

Acronyms and Abbreviations *(Continued)*

FWP	Field Work Permit
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
Iso-Pu	Isotopic plutonium
Iso-U	Isotopic uranium
kg	Kilogram
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
MDC	Minimum detectable concentration
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mi	Mile
mrem/yr	Millirem per year
MS	Matrix spike
MSD	Matrix spike duplicate
N/A	Not applicable
NAC	*Nevada Administrative Code*
NCRP	National Council on Radiation Protection and Measurement
ND	Normalized difference

Acronyms and Abbreviations *(Continued)*

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
NRS	*Nevada Revised Statutes*
NTS	Nevada Test Site
NTSWAC	Nevada Test Site Waste Acceptance Criteria
NV/YMP	Nevada Yucca Mountain Project
PAL	Preliminary action level
PBX	Plastic-bonded explosives
PCB	Polychlorinated biphenyl
pCi/g	Picocuries per gram
pCi/L	Picocuries per liter
POC	Performance Objective for the Certification of Nonradioactive Hazardous Waste
PPE	Personal protective equipment
ppm	Parts per million
PRG	Preliminary remediation goal
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RadCon	Radiological Control
RBCA	Risk-based corrective action
RBSL	Risk-based screening level
RCA	Radiologically controlled area

Acronyms and Abbreviations *(Continued)*

RCRA	*Resource Conservation and Recovery Act*
RESRAD	Residual Radioactive computer code
RL	Reporting limit
RMA	Radioactive material area
RPD	Relative percent difference
SDWS	*Safe Drinking Water Standards*
SNJV	Stoller-Navarro Joint Venture
Sr	Strontium
SSTL	Site-specific target level
SVOC	Semivolatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total petroleum hydrocarbons
TSCA	*Toxic Substance Control Act*
UGTA	Underground Test Area
USGS	U.S. Geological Survey
UST	Underground storage tank
VOC	Volatile organic compound
%R	Percent recovery

Executive Summary

Corrective Action Unit (CAU) 139 is located in Areas 3, 4, 6, and 9 of the Nevada Test Site, which is 65 miles northwest of Las Vegas, Nevada. Corrective Action Unit 139 is comprised of the seven corrective action sites (CASs) listed below:

- 03-35-01, Burn Pit
- 04-08-02, Waste Disposal Site
- 04-99-01, Contaminated Surface Debris
- 06-19-02, Waste Disposal Site/Burn Pit
- 06-19-03, Waste Disposal Trenches
- 09-23-01, Area 9 Gravel Gertie
- 09-34-01, Underground Detection Station

These sites are being investigated because existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives with the exception of CASs 09-23-01 and 09-34-01. Regarding these two CASs, CAS 09-23-01 is a gravel gertie where a zero-yield test was conducted with all contamination confined to below ground within the area of the structure, and CAS 09-34-01 is an underground detection station where no contaminants are present. Additional information will be obtained by conducting a corrective action investigation (CAI) before evaluating corrective action alternatives and selecting the appropriate corrective action for the other five CASs where information is insufficient. The results of the field investigation will support a defensible evaluation of viable corrective action alternatives that will be presented in the Corrective Action Decision Document.

The sites will be investigated based on the data quality objectives (DQOs) developed on January 4, 2006, by representatives of the Nevada Division of Environmental Protection; U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office; Stoller-Navarro Joint Venture; and Bechtel Nevada. The DQO process was used to identify and define the type, amount, and quality of data needed to develop and evaluate appropriate corrective actions for CAU 139.

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

The scope of the CAI for CAU 139 includes the following activities:

- Move surface debris and/or materials, as needed, to facilitate sampling.
- Conduct radiological surveys.
- Conduct an additional geophysical survey at CAS 06-19-03.
- Perform field screening.
- Collect and submit environmental samples for laboratory analysis to determine whether contaminants of concern are present.
- If contaminants of concern are present, collect additional step-out samples to define the extent of the contamination.
- Collect samples of investigation-derived waste, as needed, for waste management and minimization purposes.

This Corrective Action Investigation Plan has been developed in accordance with the *Federal Facility Agreement and Consent Order* that was agreed to by the State of Nevada, the U.S. Department of Energy, and the U.S. Department of Defense. Under the *Federal Facility Agreement and Consent Order*, this 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.

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) 139: Waste Disposal Sites, Nevada Test Site (NTS), Nevada.

This CAIP has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) (1996) that was agreed to by the State of Nevada, the U.S. Department of Energy (DOE), and the U.S. Department of Defense.

Corrective Action Unit 139 is located in Areas 3, 4, 6, and 9 of the NTS, which is approximately 65 miles (mi) northwest of Las Vegas, Nevada (Figure 1-1). Corrective Action Unit 139 is comprised of the seven corrective action sites (CASs) shown on Figure 1-1 and listed below:

- 03-35-01, Burn Pit
- 04-08-02, Waste Disposal Site
- 04-99-01, Contaminated Surface Debris
- 06-19-02, Waste Disposal Site/Burn Pit
- 06-19-03, Waste Disposal Trenches
- 09-23-01, Area 9 Gravel Gertie
- 09-34-01, Underground Detection Station

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

1.1 Purpose

The CASs in Areas 3, 4, and 6 are being investigated because hazardous and/or radioactive constituents may be present in concentrations that could potentially pose a threat to human health and the environment. Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives for five of the seven CASs. Additional information will be generated by conducting a CAI before evaluating and selecting

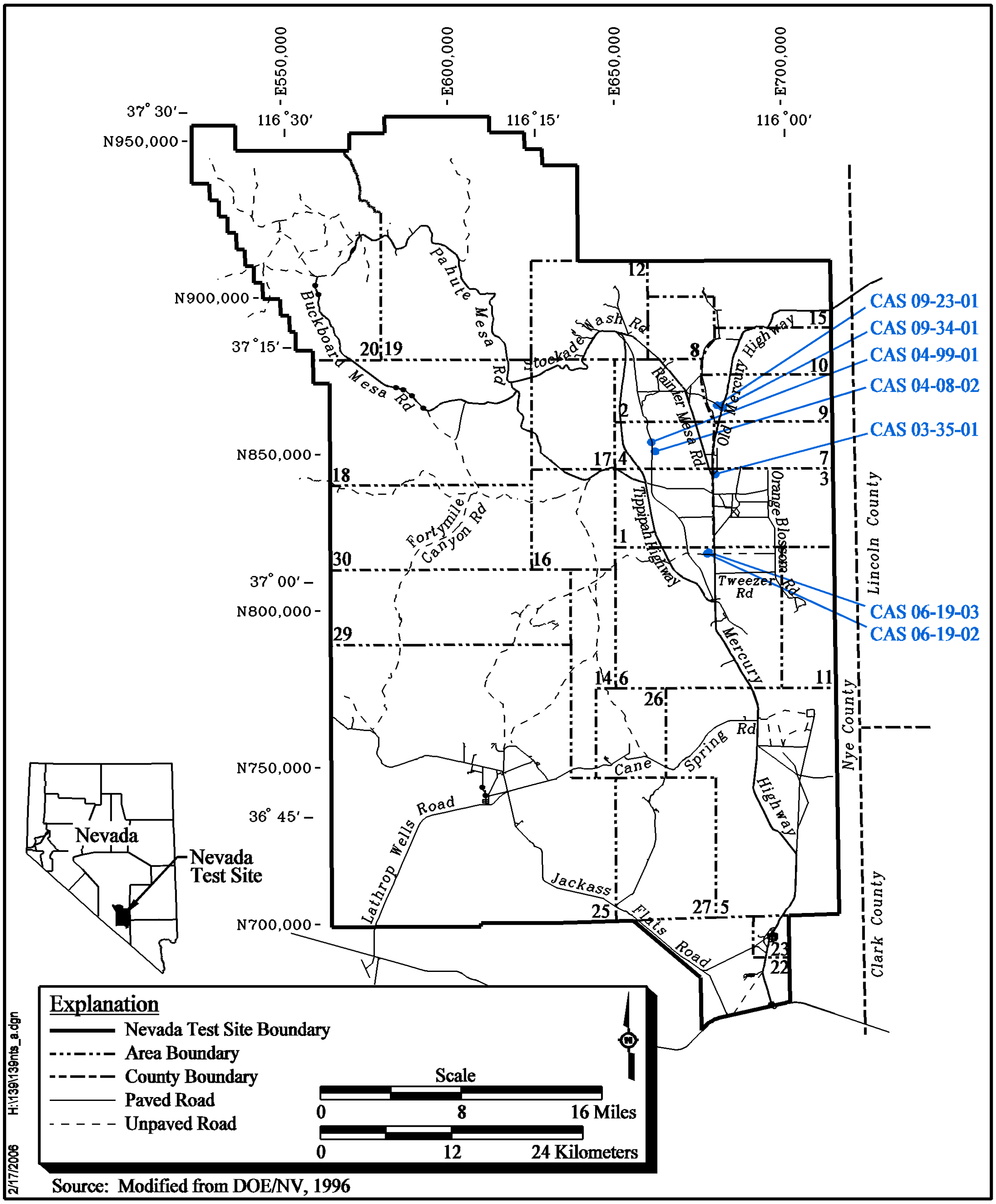

Figure 1-1
Nevada Test Site Map with CAU 139 CAS Locations

corrective action alternatives. Sufficient information is available for the remaining two CASs, to recommend corrective action alternatives.

Corrective Action Site 09-23-01, Area 9 Gravel Gertie, is a gravel structure located in Area 9 that housed a safety experiment. This contaminated the ground below the structure with uranium and plastic-bonded explosives (PBX). Because the contaminants released during the test are known and the extent of contamination is confined to the gravel gertie and subsurface soil, the corrective action alternative to be pursued for CAS 09-23-01 is closure in place with use restrictions to prohibit unauthorized intrusive activities.

Corrective Action Site 09-34-01, Underground Detection Station, is a monitoring station that was used to collect data during nuclear tests. Because the processes in the building were limited to the operation of monitoring equipment and are not believed to involve the release of contaminants or wastes, the corrective action alternative to be pursued for CAS 09-34-01 is no further action. As a best management practice, a 6-ft cyclone fence will be erected around the ramp to the bunker elevator and a “Do Not Enter” sign posted to restrict access to the bunker.

Additional background information and justification to recommend these alternatives is included in the main body of this CAIP. Because information is adequate to recommend the alternatives for CASs 09-23-01 and 09-34-01 and resolve the data quality needs, no CAI is required for these two CASs.

1.1.1 Corrective Action Unit 139 History and Description

Corrective Action Unit 139, Waste Disposal Sites, consists of seven inactive sites located in Areas 3, 4, 6, and 9 of the NTS. The five CAU 139 sites to be investigated consist of surface debris, shallow subsurface debris, a waste trench, and storage areas. The CAU 139 sites were all used to support nuclear testing conducted in the Yucca Flat area from the 1950s through the 1970s or to support cleanup operations in the 1980s. Operational histories for each CAU 139 CAS are detailed in Section 2.2.

1.1.2 Data Quality Objective Summary

The five sites will be investigated based on data quality objectives (DQOs) developed by representatives of the Nevada Division of Environmental Protection (NDEP); DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO); Stoller-Navarro Joint Venture (SNJV); and Bechtel Nevada (BN). The DQOs are used to identify and define the type, amount, and quality of data needed to develop and evaluate appropriate corrective actions for CAU 139. This CAIP describes the investigative approach developed to collect the data identified in the DQO process. While a detailed discussion of the DQO methodology and the DQOs specific to each CAS are presented in Appendix A of this document, a summary of the DQO process is provided below.

The DQO problem statement for CAU 139 is: "Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives for the CASs in CAU 139." To address this question, the resolution of two decisions statements is required:

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

- Decision II: "If a COC is present, is sufficient information available to evaluate potential corrective action alternatives?" Sufficient information is defined to include:

  - Identifying the lateral and vertical extent of COC contamination in media.
  - The information needed to characterize investigation-derived waste (IDW) for disposal.
  - The information needed to determine potential remediation waste types.
  - The information needed to evaluate the feasibility of remediation alternatives.

The informational inputs and data needs to resolve the problem statement and the decision statements were generated as part of the DQO process for this CAU and are documented in Appendix A. The information necessary to resolve the DQO decisions will be generated for each CAU 139 CAS by collecting and analyzing samples generated during a field investigation. The presence of contamination at each of the five CASs will be determined by sampling locations that are identified as being the most probable to contain COCs if they are present anywhere within the CAS. If, while defining the nature of contamination, it is determined that COCs are present at a CAS, that CAS will be further addressed by determining the extent of contamination before evaluating corrective action alternatives.

1.2 Scope

To generate information needed to resolve the decision statements identified in the DQO processes, the scope of the CAI for CAU 139 includes the following activities:

- Remove surface debris and/or materials, as needed, to facilitate sampling.
- Perform field screening.
- Conduct visual surveys to identify biasing factors that may include staining, discoloration, disturbance of native soil, or any other indication of potential contamination.
- Conduct radiological surveys at CASs 03-35-01, 06-19-02, and 06-19-03.
- Conduct an expanded geophysical survey at CAS 06-19-03.
- Collect and submit environmental samples for laboratory analysis to determine whether COCs are present.
- If COCs are present, collect additional step-out samples to define the extent of the contamination.
- Record the coordinates of sample location through global positioning system surveying.
- Collect quality control (QC) samples.
- Collect and analyze IDW samples and conduct inspections and surveys.

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

1.3 Corrective Action Investigation Plan Contents

Section 1.0 presents the purpose and scope of this CAIP, while Section 2.0 provides background information about CAU 139. Objectives of the investigation, including CSMs, are presented in Section 3.0. Field investigation and sampling activities are discussed in Section 4.0, and waste management issues for this project are discussed in Section 5.0. General field and laboratory quality assurance (QA) (including collection of QA samples) are presented in Section 6.0 and in the *Industrial Sites Quality Assurance Project Plan* (QAPP) (NNSA/NV, 2002a). The project schedule and records availability are discussed in Section 7.0. Section 8.0 provides a list of references.

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

The health and safety aspects of this project are documented in the *Industrial Sites Health and Safety Plan* (SNJV, 2004) and will be supplemented with a site-specific Field Work Permit (FWP) developed before the start of field work.

Public involvement activities are documented in the "Public Involvement Plan" contained in Appendix V of the FFACO (1996). The managerial aspects of this project are discussed in the *Project Execution Plan* (SNJV, 2005a) and will be supplemented with a site-specific field management plan that will be developed before field activities.

2.0 Facility Description

Corrective Action Unit 139 is comprised of seven CASs that were grouped together based on the geographical location of the sites, technical similarities (potential waste disposal sites), and the agency responsible for closure.

2.1 Physical Setting

The following sections describe the general physical settings of the CAU 139 CASs. These CASs are all located within the Yucca Flats sub-basin. Corrective Action Sites 03-35-01, 04-08-02, 04-99-01, 06-19-02, 06-19-03, 09-23-01, and 09-34-01 are located within the Yucca Flat Hydrographic Area of the NTS. General background information pertaining to topography, geology, hydrogeology, and climatology is provided in the *Geologic Map of the Nevada Test Site, Southern Nevada* (USGS, 1990); *CERCLA Preliminary Assessment for DOE's Nevada Operations Office Nuclear Weapons Testing Areas* (DRI, 1988); *Final Environmental Impact Statement, Nevada Test Site, Nye County, Nevada* (ERDA, 1977); and the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996).

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

The NTS lies within the Death Valley groundwater flow system. The Death Valley flow system covers an approximate area of 15,800 square miles of the southern Great Basin. The flow system consists of volcanic rock in the west and carbonate rock in the east and is estimated to transmit more than 70,000 acre-feet of groundwater annually. The region is characterized by low rainfall; intermittent streams; internal surface drainages; and large, sparsely-distributed springs (ERDA, 1977). The geologic and hydrologic settings, as they relate to the investigation of each CAS, are provided in the following sections according to the hydrogeographic area in which they are located.

The direction of groundwater flow in Yucca Flat generally is from the northeast to southwest. Within the overlying alluvial and volcanic aquifers, lateral groundwater flow occurs from the margins to the center of the basin and downward into the carbonate aquifer (USGS, 1996). The average annual precipitation at Station UCC on the Yucca Flat dry lake is 6.70 inches (in.) (ARL/SORD, 2005). The recharge rate to the Yucca Flat area is relatively low due to the thickness of the unsaturated zone extending to more than 600 ft below ground surface (bgs) (USGS, 1996).

Corrective Action Sites 04-08-02 and 04-99-01 are located on the slopes of the Yucca Valley, but the slopes are very gradual and have no protuberances; therefore, erosion or other characteristics of the physical setting will not affect the investigation. The remaining CASs are located on the valley floor and lie in flat areas that exhibit adequate runoff characteristics; therefore, erosion, ponding, or other characteristics of the physical setting are not anticipated to have any adverse affect upon the investigation.

The depth to groundwater at CAS 03-35-01 is approximately 1,580 ft. This estimate is based on the depth to groundwater at UE-3e#4, which is the nearest well to CAS 03-35-01. This well is currently active (USGS and DOE, 2005).

The depth to groundwater at CASs 04-08-02 and 04-99-01 is approximately 1,720 ft. This estimate is based on the depth to groundwater at Well TW-D, which is the nearest well to CASs 04-08-02 and 04-99-01. The water from this well is currently unused (USGS and DOE, 2005).

The depth to groundwater at CASs 06-19-02 and 06-19-03 is approximately 1,530 ft. This estimate is based on the depth to groundwater at Water Well 3, which is the nearest well to CASs 06-19-02 and 06-19-03. This well is currently inactive and abandoned (USGS and DOE, 2005).

The depth to groundwater at CASs 09-23-01 and 09-34-01 is approximately 2,460 ft. This estimate is based on the depth to groundwater at a monitoring well, which is the nearest well to CASs 09-23-01 and 09-34-01. This well is currently active (USGS and DOE, 2005).

2.2 Operational History

The following subsections provide a description of the use and history of each CAS in CAU 139 that may have resulted in potential releases to the environment. The CAS-specific summaries are designed to describe the current definition of each CAS and illustrate all significant, known activities.

2.2.1 Corrective Action Site 03-35-01, Burn Pit

Corrective Action Site 03-35-01 consists of the potential releases of contaminants from undocumented disposal activities that may have taken place over 40 or more years. This site was identified as a CAS when small debris items were found in the area, but no historical documentation indicates that a pit exists or burning occurred. The CAS is adjacent to the U-3gg crater, former Building 3-51, the old balloon launchpad, the Area 3 burn pit (CAS 03-08-01), and arsenic-contaminated soil piles (CAS 03-99-01). The debris at this site may have originated from activities related to these various operations or structures. Miscellaneous debris such as cinder blocks, small piles of concrete, and rusted and empty cans are strewn throughout the area of the CAS.

2.2.2 Corrective Action Site 04-08-02, Waste Disposal Site

Corrective Action Sites 04-08-02 consists of the potential release of contaminants from debris stored at sites associated with a project with operations described in the NTS Long Range Radioactive Waste Consolidation Plan (REECo, 1982). Radioactive debris from various activities at the NTS was consolidated and stored at this location for an undetermined length of time. No other documented activities have taken place at these locations, so any contamination detected at this site is assumed to be associated with these storage activities. The area of the CAS is defined by the historical footprint with fencing still present, a leveled area, and operations apparently impacted the ground surface (soil) as evidenced by elevated readings noted during a radiological survey.

2.2.3 Corrective Action Site 04-99-01, Contaminated Surface Debris

Corrective Action Site 04-99-01 consists of the potential release of contaminants from debris stored at sites associated with a project with operations described in the NTS Long Range Radioactive Waste Consolidation Plan (REECo, 1982). Radioactive debris from various activities at the NTS was consolidated and stored at this location for an undetermined length of time. No other documented activities have taken place at this location, so any contamination detected at this site is assumed to be associated with these storage activities. The area of CAS is defined by four corner posts, and there is little indication of much usage.

2.2.4 Corrective Action Site 06-19-02, Waste Disposal Site/Burn Pit

Corrective Action Site 06-19-02 consists of the potential release of contaminants associated with the operation of the Area 6 U.S. Environmental Protection Agency (EPA) Farm. The CAS consists of an animal pen where animals were kept and a fenced area where a wood shed once stood, which now shows charred wood on the surface and is referred to as a burn pit. Additionally, an area referred to as a waste disposal site lies adjacent to the burn pit, although there is no record of this area being associated with any EPA Farm activities. There is no documentation available indicating what was burned in the burn pit or what if anything was disposed in the waste disposal site. The animals that were kept at this facility were exposed to radiation and were then evaluated. Due to the location and the site's proximity to other facilities, EPA activities were suspended at this location and moved to Area 15 in the mid-1970s. The Area 6 EPA facility was operational from 1964 until 1973 when appropriate facilities became available at the Area 15 Experimental Farm.

2.2.5 Corrective Action Site 06-19-03, Waste Disposal Trenches

Corrective Action Site 06-19-03 consists of the potential release of contaminants from the buried remains of EPA Farm animals and associated wastes from operation of the EPA Farm. Historical documents indicate that the livestock was fed radioisotopes and dosed with radioactive solution, then slaughtered; the parts were containerized and potentially buried somewhere at the Area 6 EPA Farm. No documentation is available regarding the burial of these wastes. However, during the installation of a water line in 2004, wastes were discovered when a disposal trench was intercepted. During the water line installation, the existence of at least one disposal trench was established. The period of use of the trench is assumed to be during the operational period of the Area 6 EPA Farm (1964 to 1973).

2.2.6 Corrective Action Site 09-23-01, Area 9 Gravel Gertie

Corrective Action Site 09-23-01 consists of the potential subsurface release of contaminants generated during the Ganymede safety experiment, which involved the zero-yield detonation of four devices comprised of uranium and PBX within a gravel structure (DOE/NV, 2000). The gravel gertie was designed to function so that the gravel structure would expand during detonation and then settle to near its original shape while retaining the contaminated particles within the gravel (Sandia, 1964).

Within the boundaries of the CAS are the gravel gertie with a caved-in entrance located on the north side with what appears to be steel poles protruding from the top, a large gravel pile located directly to the east of the gertie, a concrete vault with a lid constructed of heavy timbers, and a circular vault that contains the remains of communication cables assumed to have been used to monitor the experiment. A berm running from a detection station (Bunker 9-300) extends into and terminates within the area of the CAS. Engineering drawings indicate this berm housed the communication and power cables necessary to conduct testing. Evidence of a trench that runs between the gravel gertie and the concrete vault is also still apparent.

The area of the CAS is approximately 350 ft by 600 ft and is fenced and posted with signs that read, “Underground Radioactive Material.”

An atmospheric nuclear detonation (Tesla [tower test], T9b) was conducted at this location on March 1, 1955. Any contaminants associated with a surface release from the detonation within the gravel gertie will not be distinguished from the surface release associated with the tower test; therefore, surface contamination in this area will be addressed as part of the CAS 09-23-11 Soils investigation.

2.2.7 Corrective Action Site 09-34-01, Underground Detection Station

Corrective Action Site 09-34-01 was created to account for the potential release of contaminants generated as a result of facility operations monitoring nuclear tests in the area. This underground detection station, known as both Bunker 9-300 and Bunker Z-900, is located on the northeast corner of the 9-01 Road and Old Mercury Highway intersection approximately 15 ft bgs. Bunker 9-300 is a bunker with a floor, ceiling, and walls constructed of concrete approximately 28 in. thick. The only known access to this bunker, as shown in an engineering diagram was via a vertical elevator that ran from the floor elevation of the bunker (approximately 23 ft bgs) to ground level. There is no evidence that any testing was conducted at this location, but tests throughout the area were monitored and data gathered at this location. No information exists suggesting that any releases have occurred from this bunker, and there is no indication of spills or staining in the area surrounding the CAS footprint.

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 at each CAS. Historical information and site visits indicate that the sites contain wastes such as rusted items, construction materials, animal remains, animal pen contents, and radioactively contaminated soil.

2.3.1 Corrective Action Site 03-35-01, Burn Pit

Solid waste items identified at CAS 03-35-01 include a small amount of miscellaneous building material debris such as cinder blocks and unfinished piles of concrete; a few scattered rusted items such as empty oil and punctured aerosol cans and wire cable; and a few pieces of wood, some charred at the edges.

2.3.2 Corrective Action Site 04-08-02, Waste Disposal Site

Documentation identifies that this site stored radioactive waste collected as part of the Long Range Radioactive Waste Consolidation Plan (REECo, 1982). The exact inventory, condition, or storage duration of the waste is unknown. The contamination on the soil is assumed to have originated from the radiological waste that was stored at the site. The debris from the stored waste is no longer present at the site, but removable radiological contaminants are assumed to remain in the soil based on the results of radiological surveys. Solid waste items identified at this CAS include a few rusted metal items such as stakes, wire, cable, a sheet metal sign, and grating; a wooden frame; and soil.

2.3.3 Corrective Action Site 04-99-01, Contaminated Surface Debris

Documentation identifies CAS 04-99-01 as a location used to store radioactive waste collected as part of the Long Range Radioactive Waste Consolidation Plan (REECo, 1982). An inventory of materials stored on site is not available, and the condition and storage duration of any materials or waste on site is unknown. Any debris that may be related to waste storage operations (and any waste itself) is no longer present at the site. Solid waste items identified at this CAS include a few rusted metal items such as steel stakes and old cans.

2.3.4 Corrective Action Site 06-19-02, Waste Disposal Site/Burn Pit

Urine and feces excreted by the animals while in the pen may have potentially contaminated the soil within the pen. An area located adjacent to the animal pen, referred to as a burn pit, contains the remnants of charred wood and various metal debris such as automobile engine parts. An area adjacent to the burn pit, referred to as a waste disposal site, contains the remains of weather-disintegrated fabric buried in sand that has built up against the fence separating the burn pit from the waste disposal site. Solid waste items in addition to those identified above include soil that may have become contaminated as a result of activities conducted at this location.

2.3.5 Corrective Action Site 06-19-03, Waste Disposal Trenches

Animal carcasses were disposed of in trenches located north of the farm. The contents of one of the waste trenches was unintentionally exposed during the installation of a water line running from Well 3 to the U1a site. Items excavated include a cow carcass, liquid samples contained in plastic jugs, and multiple animal bones. These items, with the exception of the full carcass, were all packaged and sealed in plastic bags or containers that showed no signs of leakage. Waste items identified at CAS 06-19-03 are the animal remains in the sealed containers or bags. Even though the waste trench could have potentially been used to dispose of other Area 6 EPA Farm wastes, there is no documentation to indicate that anything other than animal remains were disposed.

2.3.6 Corrective Action Site 09-23-01, Area 9 Gravel Gertie

Contamination from the T9b tower test resulted in large-scale surface contamination that is not being considered in this investigation but will be addressed in the Soils CAS 09-23-11. Uranium used in the safety experiment conducted in the gravel gertie remains in the soil beneath the structure. Solid waste items visible from the surface at CAS 09-23-01 include a two metal culverts, communication cable lying on the surface, the subsurface soil, and miscellaneous wood debris.

2.3.7 Corrective Action Site 09-34-01, Underground Detection Station

Corrective Action Site 09-34-01 is an underground bunker that was used for monitoring nuclear tests in the area. There is no evidence to indicate that any waste is present in the bunker.

2.4 Release Information

Known or suspected releases from the CASs, including potential release mechanisms, and migration routes associated with each of the CASs are described in the following subsections. There has been no known migration of contamination at any CAU 139 CASs. Potentially affected media for all CASs except CAS 06-19-03 include surface and shallow subsurface soil. Potentially affected media for CAS 06-19-03 include subsurface soil only. Exposure routes to site workers 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.

At CASs 09-23-01 and 09-34-01, surface soils have been impacted by contamination associated with atmospheric nuclear testing. This contamination is not associated with a release from CAU 139 and will not be included in the subsequent evaluation of the site. This surface contamination will likely be addressed by Soils CAS 09-23-11.

2.4.1 Corrective Action Site 03-35-01, Burn Pit

The primary source of any potential release originates from unknown contaminants that may have leaked from debris subsequent to its placement at the site and/or during transport or handling, the remnants of items burned there, and the potential for the presence of propellants or accelerants. If a release occurred, contaminants are expected to be limited in volume based on the size of the potential contaminant source debris and the lack of soil stains, and are expected to be located in the soil within close proximity to the debris, which is assumed to be incidental construction debris or sanitary waste.

2.4.2 Corrective Action Site 04-08-02, Waste Disposal Site

The primary source of potential releases originates from radioactivity that may have leached from radioactive waste subsequent to its placement at the site and/or during transport or handling. If a release occurred, contaminants would have been limited in volume and are expected to be located in the soil within close proximity to where the waste was consolidated and temporarily stored.

2.4.3 Corrective Action Site 04-99-01, Contaminated Surface Debris

The primary source of potential release originates from unknown contaminants that may have leached from stored items subsequent to their placement at the site and/or during transport or handling. Two small soil berms and two shallow depressions have been identified at this site but are not associated with any known activity. If a release occurred, contaminants would have been limited in volume and are expected to be located in the soil within close proximity to the berms and depressions.

2.4.4 Corrective Action Site 06-19-02, Waste Disposal Site/Burn Pit

The source of the potential release is assumed to originate from remnants generated as a result of the housing and caring for animals at the Area 6 EPA Farm. The livestock was fed radioisotopes that may have been excreted and could possibly have been deposited on the soil. If a release occurred, contaminants would have been limited in volume due to the confinement of the animals to the pens and are expected to be located in the soil within close proximity to the animal pens or support areas.

The source of release in the burn pit is assumed to originate from the remnants of items burned there and the potential for the presence of propellants or accelerants. Because of the presence of animals and any food stored on site (e.g., grain, hay) that is necessary for their support, it is assumed that pesticides may have been used throughout the area to reduce or limit the number of pests. The use of pesticides was common at the NTS to control pest populations.

2.4.5 Corrective Action Site 06-19-03, Waste Disposal Trenches

The primary source of potential release originates from buried remains or other waste that may have leaked from their packaging subsequent to their placement in the trench(es) and/or during transport or handling. If a release occurred, contaminants would have been limited in volume and are expected to be located in the soil within close proximity to the trench(es).

At least one disposal trench has been identified at this site. The buried wastes are assumed to be associated with Area 6 EPA Farm activities.

2.4.6 Corrective Action Site 09-23-01, Area 9 Gravel Gertie

Process knowledge from similar investigations indicates that underground radioactive material, in the form of radiologically contaminated soil, is known to be present at this CAS. The release is associated with the activities of the Ganymede safety experiment in which PBX was detonated in the presence of nuclear material (uranium) in a gravel-covered structure. This site was also ground zero for the Tesla tower test, which was an atmospheric nuclear detonation. Soils contaminated as a result of atmospheric nuclear testing are not included in this CAS, but are included in the Soils CAS 09-23-11.

2.4.7 Corrective Action Site 09-34-01, Underground Detection Station

A review of process knowledge and historical information indicates that there is no reason to suspect that any equipment, materials, or operations associated with this CAS released any contamination.

2.5 Investigative Background

The following subsections summarize the investigations conducted at the CAU 139 sites. More detailed discussions of these investigations are found in Appendix A. No previous investigative sampling results have been identified for soils or materials currently present at CASs 03-35-01, 04-08-02, 04-99-01, 06-19-02, 09-23-01, and 09-34-01.

2.5.1 Corrective Action Site 03-35-01, Burn Pit

In September 2004, a geophysical survey was performed within the footprint of the CAS. The survey did not find any anomalies that can definitively be attributed to a burn pit (Fahringer, 2004). The results of the geophysical survey revealed the presence of anomalies that were assumed to be construction materials.

2.5.2 Corrective Action Site 04-08-02, Waste Disposal Site

In August 2002, a geophysical survey of the CAS footprint was performed. The site was characterized by a dirt surface with intermittent surface metal debris and bordered by a metal fence on the west side. There are four anomalies that are not associated with surface debris (Shaw, 2002).

In July 2002, a radiological survey of the area of the CAS was performed. It was concluded the maximum gamma radiation emission rate is approximately 10 times mean background. The elevated gamma radiation emission rate is attributed to residual radiological contamination (Alderson, 2002).

2.5.3 Corrective Action Site 04-99-01, Contaminated Surface Debris

In August 2002, a geophysical survey of the area of the CAS was performed. The site was characterized by a dirt surface with two north-south elongate berms, approximately 2 ft high and 6.5 ft apart with numerous metal cans and metal debris between the berms. There are some anomalies attributed to small, buried metal objects (Shaw, 2002).

In July 2002, a radiological survey of the area of the CAS was performed. It was concluded that the maximum gamma radiation emission rate is not significantly greater than the mean background (Alderson, 2002).

2.5.4 Corrective Action Site 06-19-02, Waste Disposal Site/Burn Pit

In March 2005, a geophysical survey of the CAS was conducted to investigate possible buried objects. No anomalies were identified, but the survey was inconclusive due to interference caused by the proximity to a chain-link fence and other metal at the surface (Fahringer, 2005a).

In July 2002, a radiological survey was performed of the area of the CAS. It was concluded that the maximum gamma radiation emission rate was not significantly greater than the mean background (Alderson, 2002).

2.5.5 Corrective Action Site 06-19-03, Waste Disposal Trenches

During the installation of a water line in 2004, the contents of a disposal trench were uncovered. The trench contents included a cow carcass and liquid remains sealed in plastic containers. During the week of June 4, 2004, two liquid samples, four soil samples, and two sludge samples were collected and analyzed.

The liquid samples were analyzed for total *Resource Conservation and Recovery Act (*RCRA) metals, beryllium (Be), polychlorinated biphenyls (PCBs), total volatile organic compounds (VOCs), strontium (Sr)-90, tritium, gamma spectroscopy, isotopic uranium (Iso-U), and isotopic plutonium (Iso-Pu). Analytical results did not exceed the current regulatory thresholds for any of the constituents (NNSA/NSO, 2004b).

The soil samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), RCRA metals, Be, PCBs, total petroleum hydrocarbons (TPH)-diesel-range organics (DRO), TPH-gasoline-range organics (GRO), total pesticides, total herbicides, Iso-U, Iso-Pu, Sr-90, gamma spectroscopy, Toxicity Characteristic Leaching Procedure (TCLP) VOCs, TCLP SVOCs, TCLP RCRA metals, TCLP total herbicides, and TCLP total pesticides. Analytical results did not exceed the current regulatory thresholds for any of the constituents (SNJV, 2005b).

The sludge samples were analyzed for TCLP VOCs, TCLP SVOCs, and TCLP metals. Analytical results did not exceed the current regulatory thresholds for disposal in a sanitary landfill (SNJV, 2005b).

In March 2005, a geophysical survey was conducted of the area of the CAS to identify the presence of anomalies. According to survey results, subsurface metal was detected only in the western portion of the survey area and the depth to the subsurface metal varies from approximately 6 in. to 6 ft bgs (Fahringer, 2005b).

In November 2001, a radiological survey was performed by IT Corporation of the area of the CAS. It was concluded that the maximum gamma radiation emission rate is not significantly greater than the mean background (IT, 2001).

2.5.6 Corrective Action Site 09-23-01, Area 9 Gravel Gertie

Radiological surveys were performed in 1958, 1966, and 1971. Knowledge of the 1958 radiological survey is limited to the following statement within a 1973 report: "Gravel gertie type, very little venting. 10,000 cpm alpha within a few hundred ft of GZ (ground zero)" (Author Unknown, 1973). The 1966 survey reported 150,000 cpm at the filled entranceway to the mound (Author Unknown, 1973). The 1971 survey reported 25,000 cpm 400 ft north of the mound (Author Unknown, 1973). In addition, no radiological contamination outside the gravel gertie was detected after the Ganymede experiment (DOE/NV, 2000).

2.5.7 National Environmental Policy Act

The *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996) includes site investigation activities such as those proposed for CAU 139.

In accordance with the NNSA/NSO *National Environmental Policy Act* (NEPA) Compliance Program, a NEPA checklist will be completed before beginning site investigation activities at CAU 139. This checklist requires NNSA/NSO project personnel to evaluate their proposed project activities against a list of potential impacts that include, but are not limited to: air quality, chemical use, waste generation, noise level, and land use. Completion of the checklist results in a determination of the appropriate level of NEPA documentation by the NNSA/NSO NEPA Compliance Officer. This will be accomplished before mobilization for the field investigation.

3.0 Objectives

This section presents an overview of the DQOs for CAU 139 and formulation of the CSM. Also presented is a summary listing of the contaminants reasonably suspected to be present at each CAS, the COPCs, the preliminary action levels (PALs) for the investigation, and the process used to move from PALs to FALs. Additional details and figures depicting the CSM are located in Appendix A.

3.1 Conceptual Site Model

The CSM describes the most probable scenario for current conditions at each site and defines the assumptions that are the basis for identifying the future land use, contaminant sources, release mechanisms, migration pathways, exposure points, and exposure routes. The CSM is also used to support appropriate sampling strategies and data collection methods. The CSM has been developed for CAU 139 using information from the physical setting, potential contaminant sources, release information, historical background information, knowledge from similar sites, and physical and chemical properties of the potentially affected media and COPCs. Figure 3-1 depicts a tabular representation of the conceptual pathways to receptors from CAU 139 sources. Figure 3-2 depicts a graphical representation of the CSM. If evidence of contamination that is not consistent with the presented CSM is identified during investigation activities, the situation will be reviewed, the CSM will be revised, the DQOs will be reassessed, and a recommendation will be made as to how best to proceed. In such cases, decision makers listed in Section A.3.1 will be notified and given the opportunity to comment on and/or concur with the recommendation.

The following sections discuss future land use and the identification of exposure pathways (i.e., combination of source, release, migration, exposure point, and receptor exposure route) for CAU 139.

3.1.1 Future Land Use

Corrective Action Sites 03-35-01, 04-08-02, and 04-99-01 are located in the land-use zone described as the “Nuclear and High Explosive Test Zone.” This area is designated within the Nuclear Test Zone for additional underground nuclear weapons tests and outdoor high-explosive tests. This

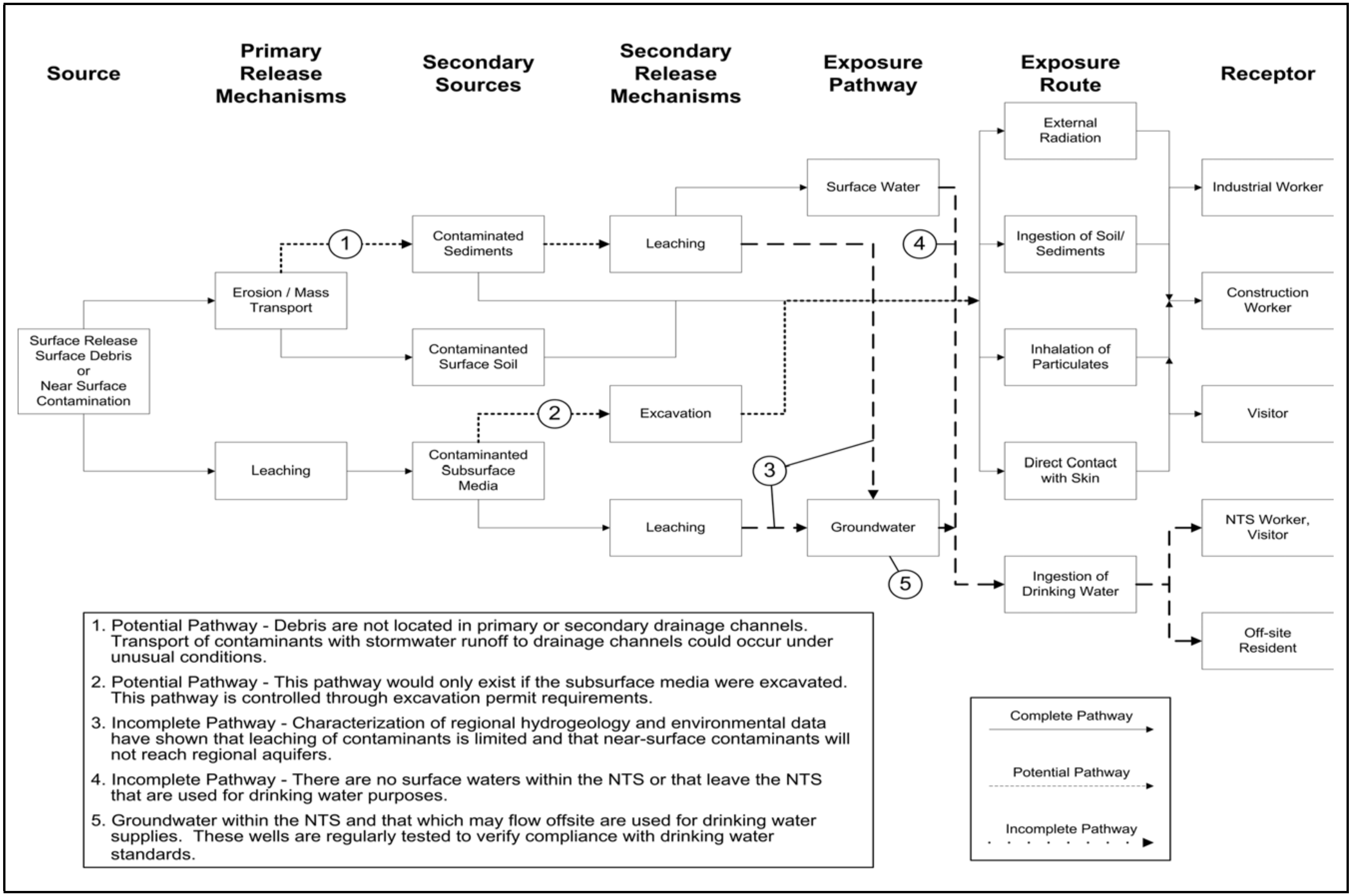

Figure 3-1
Conceptual Site Model Diagram

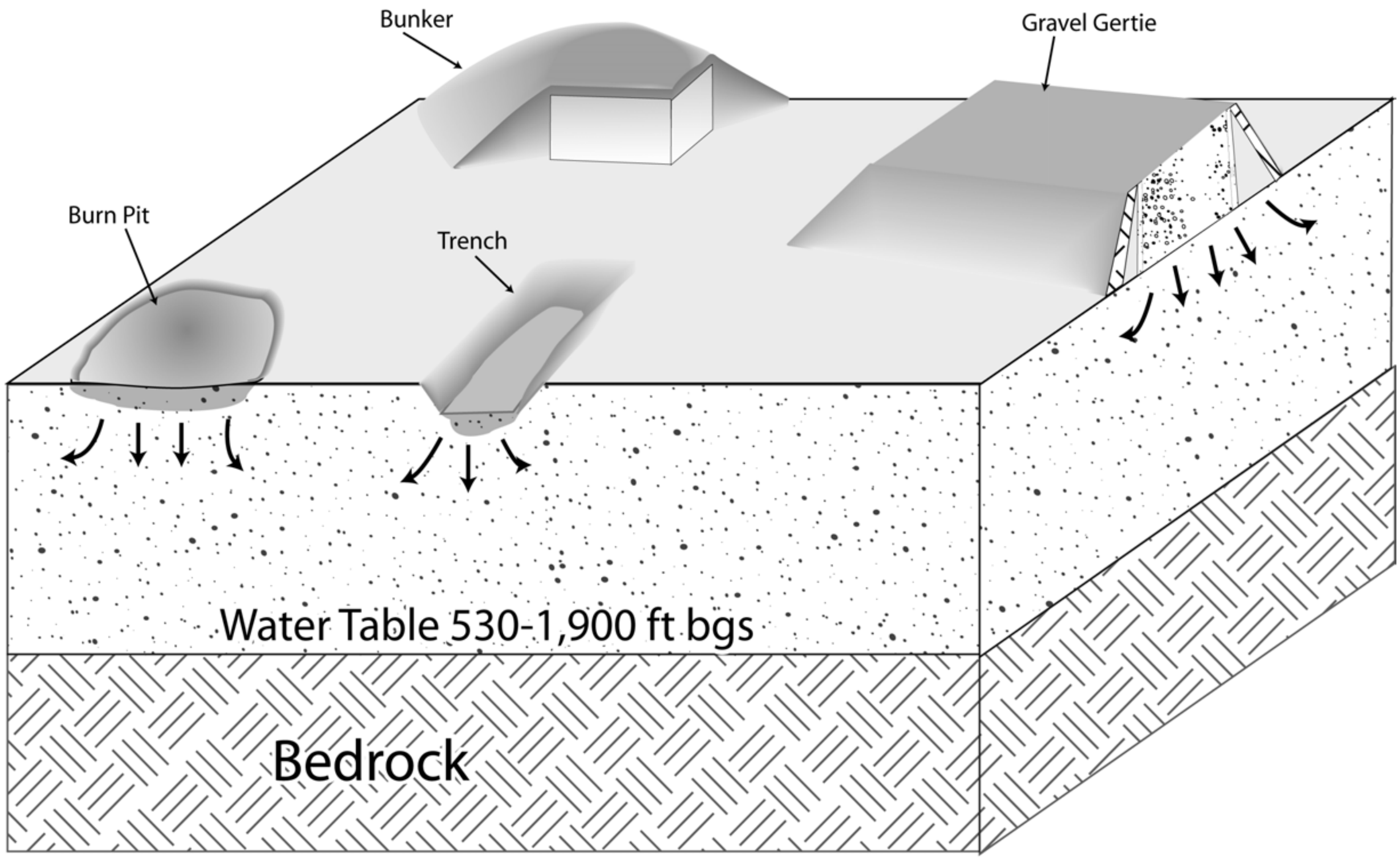

Figure 3-2
Corrective Action Unit 139 Conceptual Site Model

zone includes compatible defense and nondefense research, development, and testing activities (DOE/NV, 1998).

Corrective Action Sites 06-19-02, 06-19-03, 09-23-01, and 09-34-01 are located in the land-use zone described as the "Nuclear Test Zone." This area is reserved for dynamic experiments, hydrodynamic tests, and underground nuclear weapons and weapons effects tests. This zone includes compatible defense and nondefense research, development, and testing activities (DOE/NV, 1998).

All land-use zones where the CAU 139 CASs are located dictate that future land uses will be limited to nonresidential (i.e., industrial) activities.

All CASs in CAU 139 are identified as occasional use areas, which are defined as areas where workers may be exposed to the site occasionally (up to 80 hours per year for 5 years). Site structures are not present for shelter and comfort of the worker.

3.1.2 Contaminant Sources

The contamination sources identified during the development of the CSM for CAU 139 are:

- The surface releases associated with the storage of equipment, materials, and waste debris
- The subsurface releases associated with buried remains
- The subsurface releases associated with detonation of devices in a gravel covered structure

The underground detection station was evaluated for containing a potential contaminant source. Although little is known of the contents of this station, engineering drawings indicate that an elevator is present. If the elevator was operated with hydraulics, the hydraulic fluid could be considered to be potential source material that, if released to environmental media, could cause contamination at levels of concern.

3.1.3 Release Mechanisms

Release mechanisms for the conceptual site model are: spills, leaks, or movement of removable contamination onto surface and shallow subsurface soils from debris and buried or stored materials; or direct release from munitions detonation. Buried materials that were isolated from the environment by being wrapped in plastic bags or stored in containers may have leaked or have been spilled.

If the underground detection station contained hydraulic fluid, and if the hydraulic fluid leaked from the hydraulic system, it would be contained by the 28-inch thick, reinforced concrete walls and floor of the building. There is no reason to believe that any hydraulic fluid (if present) could be released to the environmental media around the building. Therefore, a release mechanism does not exist for the underground detection station.

3.1.4 Migration Pathways

Subsurface migration pathways at the CASs are expected to be predominately vertical, although spills or leaks at the ground surface may also have limited lateral migration before infiltration. The depth of infiltration will be dependant upon the type, volume, and duration of the discharge as well as the presence of relatively impermeable layers that could modify vertical or horizontal transport pathways, both on the ground surface (e.g., concrete) and in the subsurface (e.g., caliche layers).

Surface migration pathways at the CASs are expected to be minor as all the CASs have shallow surface slopes and the potential release sites are not located in or near drainages.

Migration pathways include the lateral migration of potential contaminants across surface soils/sediments and vertical migration of potential contaminants through subsurface soils. Stormwater flow events provide an intermittent mechanism for both vertical and horizontal transport of contaminants. Contaminated sediments entrained by these stormwater events would be carried by the streamflow to locations where the flowing water loses energy and the sediments drop out. These locations are readily identifiable as sedimentation areas. Surface water from throughout the Yucca Flat flows toward the Yucca Lake where the water evaporates or percolates to groundwater.

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 through the various media. Fate and transport are influenced by physical and chemical characteristics of the contaminants and media. Contaminant characteristics include, but are not limited to: solubility, density, and adsorption potential. Media characteristics include permeability, porosity, water saturation, sorting, chemical composition, and organic content. In general, contaminants with low solubility, high affinity for media, and high density can be expected to be found relatively close to release points. Contaminants with high solubility, low affinity for media, and low density can be expected to be found further from release points. These factors affect the migration pathways and potential exposure points for the contaminants in the various media under consideration.

Infiltration and percolation of precipitation serves as a driving force for downward migration of contaminants. However, due to high potential evapotranspiration (annual potential evapotranspiration at the Area 3 Radiological Waste Management Site has been estimated at 62.6 in. (Shott et al., 1997) and limited precipitation for this region (6.70 in. [ARL/SORD, 2005]), percolation of infiltrated precipitation at the NTS does not provide a significant mechanism for vertical migration of contaminants to groundwater (DOE/NV, 1992).

3.1.5 Exposure Points

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

There are no exposure points for the underground detection station as there is no release mechanism. If a release mechanism did exist for the underground detection station, the contamination would be released to the environmental media below the underground building where there is no potential exposure to site workers.

3.1.6 Exposure Routes

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

3.1.7 Additional Information

Information concerning topography, geology, climatic conditions, hydrogeology, floodplains, and infrastructure at the CAU 139 CASs are available and are presented in Section 2.1 as they pertain to the investigation. This information has been addressed in the CSM and will be considered during the evaluation of corrective action alternatives, as applicable. Climatic and site conditions (e.g., surface and subsurface soil descriptions) will be recorded during the CAI.

3.2 Contaminants of Potential Concern

The COPCs for CAU 139 are defined as the list of constituents reported by the analytical methods identified in Table 3-1 for Decision I environmental samples taken at each of the CASs. The list of COPCs is intended to encompass all of the contaminants that could potentially be present at each CAS. These COPCs were identified during the planning process through the review of site history, process knowledge, personal interviews, past investigation efforts (where available), and inferred activities associated with the CASs. Contaminants detected at other similar or other NTS sites were also included in the COPC list to reduce the uncertainty about potential contamination at the CASs because complete information regarding activities performed at the CAU 139 sites is not available.

During the review of site history documentation, process knowledge information, personal interviews, past investigation efforts, and inferred activities associated with the CASs, some of the COPCs were identified as targeted contaminants at specific CASs. Targeted contaminants are those COPCs for which evidence in the available site and process information suggests that they may be reasonably suspected to be present at a given CAS. The targeted contaminants are required to meet a more stringent completeness criteria than other COPCs thus providing greater protection against a decision error (see Section A.1.0 through Section A.7.0).

Because no investigation will be conducted at CASs 09-23-01 and 09-34-01, the COPCs expected to be found at each CAS need to be identified to ensure anticipated closure plans are sufficient. The COPCs anticipated at CAS 09-23-01 include uranium and its daughter products. There are no COPCs anticipated at CAS 09-34-01.

Table 3-1
Analytical Program[a]
(Includes Waste Characterization Analyses)

Analyses[b]	03-35-01	04-08-02	04-99-01	06-19-02	06-19-03
Organic Contaminants of Potential Concern (COPCs)					
Volatile Organic Compounds[c]	X	N/A	X	X	X
Semivolatile Organic Compounds[c]	X	N/A	X	X	X
Total Petroleum Hydrocarbons (Diesel-Range Organics)	X	N/A	X	X	X
Polychlorinated Biphenyls	X	X	X	X	X
Pesticides[c]	N/A	N/A	N/A	X	N/A
Inorganic COPCs					
Total *Resource Conservation and Recovery Act* Metals, Beryllium[c]	X	N/A	X	X	X
Radionuclide COPCs					
Gamma Spectroscopy[d]	X	X	X	X	X
Isotopic Uranium, Isotopic Plutonium, Strontium-90	N/A	X	X	N/A	X
Tritium	N/A	N/A	N/A	N/A	X

X = Required analytical method
N/A = Not applicable

[a]The contaminants of potential concern are the analytes reported from the analytical methods listed.
[b]If the volume of material is limited, prioritization of the analyses will be necessary.
[c]May also include Toxicity Characteristic Leaching Procedure analytes if any total results or field-screening results exceed action levels, or if samples are collected for waste management purposes.
[d]Results of gamma analysis will be used to determine whether further radioanalytical analysis is warranted.

3.3 Preliminary Action Levels

The PALs presented in this section are to be used for site screening purposes. They are not necessarily intended to be used as cleanup action levels or FALs. However, they are useful in screening out contaminants that are not present in sufficient concentrations to warrant further evaluation, therefore streamlining the consideration of remedial alternatives. The process that will be used to move from PALs to FALs is that specified by *Nevada Administrative Code* (NAC) 445A.22705 (NAC, 2004b). This regulation stipulates that determination of FALs shall be established by an evaluation of the site based on the risk to public health and the environment. This evaluation will be conducted using Method E1739-95, adopted by the American Society for Testing and Materials (ASTM, 1995).

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

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

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

A Tier 1 evaluation will be conducted to determine whether contaminant levels satisfy the criteria for a quick regulatory closure or warrant a more site-specific assessment. This is accomplished by comparing individual source area contaminant concentration results to PALs. The PALs are a tabulation of chemical- and radioisotope-specific (but not site-specific) screening levels based on potential exposure pathways, media (i.e., soil, water, and air), and potential exposure scenarios using risk information derived from the *Integrated Risk Information System* (IRIS) database (EPA, 2005) or a dose constraint of 25 millirem per year (mrem/yr). If remediation to Tier 1 RBSLs (i.e., PALs) is not practicable, a Tier 2 evaluation may be conducted. Rationale and justification for using a Tier 2 evaluation will be presented in the investigation report.

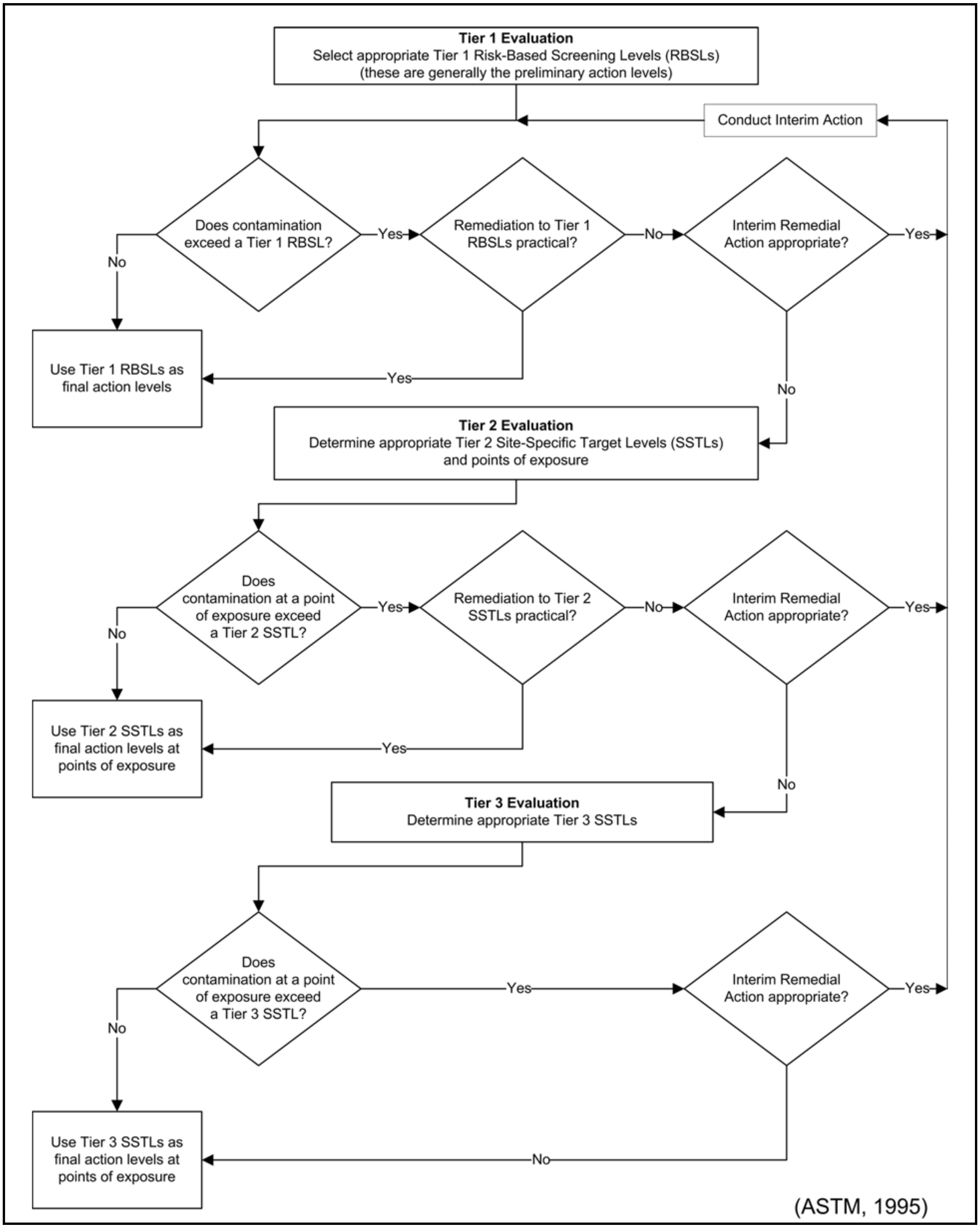

Figure 3-3
ASTM Method E1739-95 Risk-Based Corrective Action Decision Process

If appropriate, a Tier 2 evaluation may be conducted by calculating Tier 2 SSTLs using site-specific information as inputs to the same or similar methodology used to calculate Tier 1 RBSLs (for radionuclides, the Tier 2 SSTL will be calculated using Residual Radioactive (RESRAD) computer code. The Tier 2 SSTLs are then compared to individual sample results from reasonable points of exposure (as opposed to the source areas as is done in Tier 1) on a point-by-point basis. Total TPH concentrations will not be used for risk-based decisions under Tier 2 or Tier 3. Rather, the individual COCs will be compared to the SSTLs (ASTM, 1995).

Alternatively, the Tier 2 RBCA process SSTLs may be compared to the predicted concentration or activity of the contaminant at the point of exposure based on attenuation of the COCs away from the source using relatively simplistic mathematical models. Points of exposure are defined as those locations at which an individual or population may come in contact with a COC originating from a CAS. If a Tier 2 evaluation is conducted, the calculations used to derive the SSTLs and the contaminant attenuation calculations will be provided as an appendix to the investigation report. If remediation to Tier 2 SSTLs is not practicable, a Tier 3 evaluation may be conducted. Rationale and justification for using a Tier 3 evaluation will be presented in the investigation report (Figure 3-1).

If appropriate, a Tier 3 evaluation may be conducted by calculating Tier 3 SSTLs on the basis of more sophisticated risk analyses using methodologies described in Method E1739-95 that consider site-, pathway-, and receptor-specific parameters. Tier 3 evaluation is much more complex than Tiers 1 and 2 because it may include additional site characterization, probabilistic evaluations, and sophisticated chemical fate/transport models. The Tier 3 SSTLs are then compared to the 95 percent upper confidence limit of the mean of sample results from reasonable point(s) of exposure (as opposed to individual sample results as is done in Tier 2). Contaminant concentrations exceeding Tier 3 SSTLs require corrective action. If a Tier 3 evaluation is conducted, the calculations used to derive the SSTLs and the upper confidence limit of the means will be provided as an appendix to the investigation report.

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

3.3.1 Chemical PALs

Except as noted herein, the chemical PALs are defined as the EPA *Region 9 Risk-Based Preliminary Remediation Goals (PRGs)* for contaminant constituents in industrial soils (EPA, 2004). Background concentrations for RCRA metals will be used instead of PRGs when natural background concentrations exceed the PRG, as is often the case with arsenic on the NTS. Background is considered the mean plus two standard deviations of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (formerly the Nellis Air Force Range) (NBMG, 1998; Moore, 1999). For detected chemical COPCs without established PRGs that have toxicity and carcinogenicity data listed in the EPA IRIS database (EPA, 2005), the protocol used by the EPA Region 9 in establishing PRGs (or similar) will be used to establish PALs. If used, this process will be documented in the investigation report.

3.3.2 Total Petroleum Hydrocarbon PALs

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

3.3.3 Radionuclide PALs

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

The PAL for tritium is based on the Underground Test Area (UGTA) Project limit of 400,000 picocuries per liter (pCi/L) for discharge of water containing tritium (NNSA/NV, 2002b). The activity of tritium in the soil moisture of soil samples will be reported in units of pCi/L for comparison to this PAL.

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

3.4 Data Quality Objective Process Discussion

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

The DQO strategy for CAU 139 was developed at a meeting on January 4, 2006. The DQOs were developed 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.

The problem statement for CAU 139 is: “Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives for the CASs in CAU 139.” To address this question for the CASs, the resolution of two decisions statements is required:

- Decision I: “Is any COPC present in environmental media within the CAS at a concentration exceeding its corresponding action level?” Any analytical result for a COPC above the FAL will result in that COPC being designated as a COC. If a COC is detected, then Decision II must be resolved. Otherwise, the investigation for that CAS is complete.

- Decision II: “If a COC is present, is sufficient information available to evaluate potential corrective action alternatives?” Sufficient information is defined to include:

  - Identifying the volume of media containing any COC bounded by analytical sample results in lateral and vertical directions.

  - The information needed to characterize IDW for disposal.

  - The information needed to determine potential remediation waste types.

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

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

To satisfy the DQI of sensitivity (presented in Section 6.2.8), the analytical methods must be sufficient to detect contamination that is present in the samples at concentrations equal to the corresponding FALs. Analytical methods and minimum detectable concentrations (MDCs) for each CAU 139 COPC are provided in Table 3-2 and Table 3-3. The MDC is the lowest concentration of any chemical or radionuclide parameter that can be detected in a sample within an acceptable level of error. Due to changes in analytical methodology and changes in analytical laboratory contracts, information in Table 3-2 and Table 3-3 that varies from corresponding information in the QAPP will supersede that information in the QAPP (NNSA/NV, 2002a).

Table 3-2
Analytical Requirements for Radionuclides for CAU 139

Parameter/ Analyte	Matrix	Analytical Method	MDC[a]	PAL[b,c]	Laboratory Precision (RPD)	Percent Recovery (%R)
Gamma Spectroscopy						
Americium-241	Soil	HASL-300[d]	2.0 pCi/g[e]	12.7 pCi/g	Relative Percent Difference (RPD) 35% Normalized Difference -2<ND<2[f]	Laboratory Control Sample Recovery 80-120[g] Percent Recovery (%R)
Cesium-137	Soil	HASL-300[d]	0.5 pCi/g[e]	12.2 pCi/g		
Cobalt-60	Soil	HASL-300[d]	0.5 pCi/g[e]	2.68 pCi/g		

[a]The MDC is the lowest concentration of a radionuclide, if present in a sample, that can be detected with a 95 percent confidence level.
[b]The PALs for soil are based on the National Council for Radiation Protection and Measurement (NCRP) Report No. 129 Recommended Screening Limits for Contaminated Soil and Review of Factors Relevant to Site-Specific Studies (NCRP, 1999) scaled to 25 mrem/yr dose and the guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993).
[c]PALs for liquids will be developed as needed.
[d]MDCs vary depending on the presence of other gamma-emitting radionuclides in the sample and are relative to the MDC for cesium-137.
[e]*The Procedures Manual of the Environmental Measurements Laboratory*, HASL-300 (DOE, 1997).
[f] ND is not RPD, it is another measure of precision used to evaluate duplicate analyses. The ND is calculated as the difference between two results divided by the square root of the sum of the squares of their total propagated uncertainties. *Evaluation of Radiochemical Data Usability* (Paar and Porterfield, 1997).
[g]EPA *Contract Laboratory Program Statement of Work for Inorganic Analysis* (EPA, 1988; 1994, and 1995).

EPA = U.S. Environmental Protection Agency
MDC = Minimum detectable concentration
mrem/yr = Millirem per year
PAL = Preliminary action level
pCi/g = Picocuries per gram
ND = Normalized difference

Table 3-3
Analytical Requirements for Chemical COPCs for CAU 139
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Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Detectable Concentration (MDC)	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD)[a]	Percent Recovery (%R)[b]
ORGANICS						
Total Volatile Organic Compounds (VOCs)	Aqueous Soil	8260B[c]	Parameter-specific EQLs[d]	N/A	Lab-specific[e]	Lab-specific[e]
Toxicity Characteristic Leaching Procedure (TCLP) VOCs						

Table 3-3
Analytical Requirements for Chemical COPCs for CAU 139
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Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Detectable Concentration (MDC)	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD)[a]	Percent Recovery (%R)[b]
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 Soil	8270C[c]	Parameter-specific EQLs[d]	N/A	Lab-specific[e]	Lab-specific[e]
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]		
o-Cresol			0.10 mg/L[d]	200 mg/L[f]		
Cresol (total)			0.10 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]		
Hexachoroethane	Aqueous	1311/8270C[c]	0.10 mg/L[d]	3 mg/L[f]	Lab-specific[e]	Lab-specific[e]
Nitrobenzene			0.10 mg/L[d]	2 mg/L[f]		
Pentachlorophenol			0.10 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]		
Total Petroleum Hydrocarbons-Diesel-Range Organics	Soil	8015B modified[c]	25 mg/kg[h]	N/A	Lab-specific[e]	Lab-specific[e]
Total Pesticides	Water Soil	8081A[c]	Parameter-specific estimated quantitation limits[g]	N/A	Lab-specific[e]	Lab-specific[e]
TCLP Pesticides						

Table 3-3
Analytical Requirements for Chemical COPCs for CAU 139
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Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Detectable Concentration (MDC)	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD)[a]	Percent Recovery (%R)[b]
Alpha Chlordane	Aqueous	1311/8081A[c]	0.0005 mg/L [g]	0.03 mg/L[f]	Lab-specific[e]	Lab-specific[e]
Gamma Chlorodane			0.0005 mg/L [g]	0.03 mg/L[f]		
Endrin			0.0005 mg/L [g]	0.02 mg/L[f]		
Heptachlor			0.0005 mg/L [g]	0.008 mg/L[f]		
Heptachlor Epoxide			0.0005 mg/L [g]	0.008 mg/L[f]		
Lindane (Gamma-BCH)			0.0005 mg/L [g]	0.4 mg/L[f]		
Methoxychlor			0.0005 mg/L [g]	10.0 mg/L[f]		
Toxaphene			0.0005 mg/L [g]	0.5 mg/L[f]		
INORGANICS						
Total RCRA Metals, plus Beryllium						
Arsenic	Aqueous	6010B[c]	0.01 mg/L [g, h]	N/A	20[g]	Matrix Spike Recovery at 75-125[g] Laboratory Control Sample Recovery at 80 - 120[g]
	Soil	6010B[c]	1 mg/kg [g, h]		35[h]	
Barium	Aqueous	6010B[c]	0.20 mg/L [g, h]		20[g]	
	Soil	6010B[c]	20 mg/kg [g, h]		35[h]	
Beryllium	Aqueous	6010B[c]	0.005 mg/L [g,h]		20[g]	
	Soil	6010B[c]	0.5 mg/kg [g, h]		35[h]	
Cadmium	Aqueous	6010B[c]	0.005 mg/L [g, h]		20[g]	
	Soil	6010B[c]	0.5 mg/L [g, h]		35[h]	
Chromium	Aqueous	6010B[c]	0.01 mg/L [g, h]		20[g]	
	Soil	6010B[c]	1 mg/kg [g,h]		35[h]	
Lead	Aqueous	6010B[c]	0.003 mg/L [g, h]		20[g]	
	Soil	6010B[c]	0.3 mg/kg [g, h]		35[h]	
Mercury	Aqueous	7470A[c]	0.0002 mg/L [g, h]		20[g]	
	Soil	7471A[c]	0.1 mg/kg [g, h]		35[h]	
Selenium	Aqueous	6010B[c]	0.005 mg/L [g, h]		20[g]	
	Soil	6010B[c]	0.5 mg/kg [g, h]		35[h]	
Silver	Aqueous	6010B[c]	0.01 mg/L [g, h]		20[g]	
	Soil	6010B[c]	1 mg/kg [g, h]		35[h]	
TCLP RCRA Metals						

Table 3-3
Analytical Requirements for Chemical COPCs for CAU 139
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Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Detectable Concentration (MDC)	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD)[a]	Percent Recovery (%R)[b]
Arsenic	Aqueous	1311/6010B[c] 1311/7470A[c]	0.10 mg/L [g, h]	5 mg/L[f]	20[i]	Matrix Spike Recovery at 75-125[g] Laboratory Control Sample Recovery at 80 - 120[g]
Barium			2 mg/L [g, h]	100 mg/L[f]		
Cadmium			0.05 mg/L [g, h]	1 mg/L[f]		
Chromium			0.1 mg/L [g, h]	5 mg/L[f]		
Lead			0.03 mg/L [g, h]	5 mg/L[f]		
Mercury			0.002 mg/L [g, h]	0.2 mg/L[f]		
Selenium			0.05 mg/L [g, h]	1 mg/L[f]		
Silver			0.1 mg/L [g, h]	5 mg/L[f]		

Footnotes:
1. See Table 3-2 for the analytical requirements for radionuclides.

[a]Precision is estimated from the relative percent difference (RPD) of the laboratory or field duplicates MSD and LCSD are spiked. It is calculated by: RPD = 100 x ($|A_1-A_2|$)/[(A_1+A_2)/2], where A_1 = Concentration of the parameter in the initial sample aliquot, A_2 = Concentration of the parameter in the duplicate sample aliquot
[b]Accuracy is assessed from the percent recovery (%R) of parameters spiked into a blank or sample matrix of interest, or from the recovery of surrogate compounds spiked into each sample. The recovery of each spiked parameter is calculated by: %R = 100 x (A_s-A_u/A_n), where A_s = Concentration of the parameter in the spiked sample, A_u = Concentration of the parameter in the unspiked sample, A_n = Concentration increase that should result from spiking the sample
[c]*Test Methods for Evaluating Solid Waste Physical/Chemical Methods*, 3rd Edition, Parts 1-4, (SW-846) CD ROM, Washington, DC (EPA,1996)
[d]Estimated Quantitation Limit as given in SW-846 (EPA, 1996)
[e]RPD and %R Performance Criteria are developed and generated in-house by the laboratory according to approved laboratory procedures.
[f]Title 40 *Code of Federal Regulations* (CFR) Part 261, "*Identification and Listing of Hazardous Waste*" (CFR, 2001b)
[g]*Contract Laboratory Program Statement of Work for Inorganic Analysis* (EPA, 1995)
[h]*Industrial Sites Quality Assurance Project Plan* (NNSA/NV, 2002a)

EQL = Estimated quantitation limit
LCSD = Laboratory control sample duplicate
mg/L = Milligrams per liter
mg/kg = Milligrams per kilogram
MSD = Matrix spike duplicate
N/A = Not applicable
RCRA = *Resource Conservation and Recovery Act*
RPD = Relative percent difference

4.0 Field Investigation

This section contains a description of the activities to be conducted to gather and document information from the CAU 139 field investigation.

4.1 Technical Approach

The information necessary to satisfy the DQO data needs will be generated for each CAU 139 CAS by collecting and analyzing samples generated during a field investigation. The presence and nature of contamination at each CAS will be evaluated using a judgmental approach by collecting samples at biased locations that are determined to be most probable to contain COCs if they are present anywhere within the CAS. These locations will be determined based on their identification using the biasing factors listed in Section A.5.2.1 of Appendix A. If while defining the nature of contamination it is determined that COCs are present at a CAS, that CAS will be further addressed by determining the extent of contamination before evaluating corrective action alternatives.

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

4.2 Field Activities

Field activities at CAU 139 include site preparation, sample location selection, and sample collection activities.

4.2.1 Site Preparation Activities

Site preparation will be conducted by the NTS Management and Operating Contractor before the investigation. Site preparation may include, but not be limited to: relocating or removing surface debris, equipment, and structures; constructing hazardous waste accumulation areas (HWAAs) and site exclusion zones; providing sanitary facilities; constructing decontamination facilities; and temporarily moving staged equipment.

Before mobilization for collecting investigation samples, the following preparatory activities will also be performed:

- Radiological survey of CAS 03-35-01.
- Geophysical survey of CAS 06-19-03 beyond current survey to determine if other trenches are present.
- Visual surveys at all CASs within CAU 139 to identify any staining, discoloration, disturbance of native soils, or any other indication of potential contamination.

4.2.2 Sample Location Selection

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

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

The Task Manager or Site Supervisor has the discretion to modify the biased locations if the modified locations meet the DQO decision needs and criteria stipulated in Appendix A.

4.2.3 Sample Collection

The CAU 139 sampling program will consist of the following activities:

- Collect and analyze samples from locations as described in this section.
- Collect required QC samples.
- Collect waste management samples.
- Collect soil samples from background locations, if necessary.

- Perform radiological characterization surveys of construction materials and debris as necessary for disposal purposes.

- Record global positioning system coordinates for each environmental sample location.

Decision I surface soil samples (0 to 0.5 ft bgs) will be collected from selected locations based on the CSM, biasing factors, field-screening results, and existing data. If biasing factors are present in soils below locations where Decision I samples were collected, subsurface Decision I soil samples will also be collected by hand augering, backhoe excavation, direct-push, or drilling techniques, as appropriate. Decision I subsurface soil samples will collected at depth intervals selected by the Task Manager or Site Supervisor based on biasing factors to a depth where the biasing factors are no longer present.

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

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

4.2.4 Sample Management

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

4.3 Safety

A current version of the Environmental Services Architect-Engineer Contractor's programmatic Health and Safety Plan (HASP) and Industrial Sites HASP will accompany the field documents. An FWP, or equivalent, will be prepared and approved before the field effort. As required by the DOE Integrated Safety Management System (ISMS) (DOE/NV, 1997), these documents outline the requirements for protecting the health and safety of the workers and the public, and the procedures for protecting the environment. The ISMS program requires that site personnel will reduce or eliminate the possibility of injury, illness, or accidents, and 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 Industrial Sites HASP and FWP:

- Potential hazards to site personnel and the public include, but are not limited to: radionuclides, chemicals (e.g., heavy metals, VOCs, SVOCs, and petroleum hydrocarbons), adverse and rapidly changing weather, remote location, and motor vehicle and heavy equipment operations.
- Proper training of all site personnel to recognize and mitigate the anticipated hazards.
- Work controls to reduce or eliminate the hazards including engineering controls, substitution of less hazardous materials, and use of appropriate personal protective equipment (PPE).
- Occupational exposure monitoring to prevent overexposures to hazards such as radionuclides, chemicals, and physical agents (e.g., heat, cold, and high wind).
- Radiological surveying for alpha/beta and gamma emitters to minimize and/or control personnel exposures; use of the "as-low-as-reasonably-achievable" principle when addressing radiological hazards.

- Emergency and contingency planning to include medical care and evacuation, decontamination, spill control measures, and appropriate notification of project management. The same principles apply to emergency communications.

- If presumed asbestos-containing material is identified (CFR, 2003c; NAC, 2004a), it will be inspected and/or samples collected by trained personnel.

5.0 Waste Management

Management of IDW will be based on regulatory requirements, field observations, process knowledge, and laboratory results from CAU 139 investigation samples.

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

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

5.1 Waste Minimization

Investigation activities are planned to minimize IDW generation. This will be accomplished by incorporating the use of process knowledge, visual examination, and/or radiological survey and swipe results. When possible, disturbed media (such as soil removed during trenching) or debris will be returned to its original location. Contained media (e.g., soil managed as waste) as well as other IDW will be segregated to the greatest extent possible to minimize generation of hazardous, radioactive, or mixed waste. Hazardous 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

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

- Personal protective equipment and disposable sampling equipment (e.g., plastic, paper, sample containers, aluminum foil, spoons, bowls)
- Decontamination rinsate
- Environmental media (e.g., soil)
- Surface debris in investigation area (e.g., metallic and/or construction debris)
- Field-screening waste (e.g., spent solvent, disposable sampling equipment, and/or PPE contaminated by field-screening activities)

5.3 Investigation-Derived Waste Management

The on-site management and ultimate disposition of IDW will be determined based on a determination of the waste type (e.g., sanitary, low-level, hazardous, hydrocarbon, mixed), or the combination of waste types. A determination of the waste type will be guided by several factors, including, but not limited to: the analytical results of samples either directly or indirectly associated with the waste, historical site knowledge, knowledge of the waste generation process, field observations, field-monitoring/screening results, and/or radiological survey/swipe results.

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

5.3.1 Sanitary Waste

Sanitary IDW generated at each CAS will be collected, managed, and disposed of in accordance with the sanitary waste management regulations and the permits for operation of the NTS 10c Industrial Waste Landfill.

Table 5-1
Waste Management Regulations and Requirements

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

[a]*Nevada Revised Statutes* (NRS, 2003a, b, c)
[b]*Nevada Administrative Code* (NAC, 2004a)
[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 6 (NNSA/NSO, 2005)
[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
N/A = Not applicable
NAC = *Nevada Administrative Code*
NDEP = Nevada Division of Environmental Protection
NRS = *Nevada Revised Statutes*
NTS = Nevada Test Site
NTSWAC = Nevada Test Site Waste Acceptance Criteria
POC = Performance Objective for the Certification of Nonradioactive Hazardous Waste
RCRA = *Resource Conservation and Recovery Act*
TSCA = *Toxic Substance Control Act*

Office trash and lunch waste will be sent to the sanitary landfill by placing the waste in a dumpster. Each waste stream generated will be reviewed and segregated to the greatest extent at the point of generation.

5.3.2 Low-Level Radioactive Waste

Radiological swipe surveys and/or direct-scan surveys may be conducted on reusable sampling equipment and the PPE and disposable sampling equipment waste streams exiting a radiologically controlled area (RCA). This allows for the immediate segregation of radioactive waste from waste that may be unrestricted regarding radiological release. Removable contamination limits, as defined in Table 4-2 of the current version of the NV/YMP RadCon Manual (NNSA/NSO, 2004a), will be used to determine whether such waste may be declared unrestricted regarding radiological release versus being declared radioactive waste. Direct sampling of the waste may be conducted to aid in determining whether a particular waste unit (e.g., drum of soil) contains low-level radioactive waste, as necessary. Waste that is determined to be below the values of Table 4-2, by either direct radiological survey/swipe results or through process knowledge, will not be managed as potential radioactive waste, but will be managed in accordance with the appropriate section of this document. Wastes in excess of Table 4-2 values will be managed as potential radioactive waste and be managed in accordance with this section and any other applicable sections of this document.

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

5.3.3 Hazardous Waste

Suspected hazardous wastes will be placed in DOT-compliant containers. All containerized hazardous waste will be handled, inspected, and managed in accordance with 40 *Code of Federal Regulations* (CFR) 265, Subpart I (CFR, 2003a). These provisions include managing the waste in containers compatible with the waste type, and segregating incompatible waste types so that in the event of a spill, leak, or release, incompatible wastes shall not contact one another. Corrective Action Unit 139 will have waste storage areas established according to the needs of the project. Satellite accumulation areas and HWAAs will be managed consistent with the requirements of Federal and State regulations (CFR, 2003a; NAC, 2004a). They will be properly controlled for access and equipped with spill kits and appropriate spill containment.

Hazardous waste accumulation areas will be covered under a site-specific emergency response and contingency action plan until such time that the waste is determined to be nonhazardous or all containers of hazardous waste have been removed from the storage area. Hazardous wastes will be characterized in accordance with the requirements of Title 40 CFR 261 (CFR, 2003a). No RCRA "listed" wastes have been identified at CAU 139. Any waste determined to be hazardous will be transported in accordance with RCRA and DOT to a permitted treatment, storage, and disposal facility (CFR, 2003a).

5.3.4 Hydrocarbon Waste

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

5.3.5 Mixed Low-Level Waste

Mixed waste, if generated, shall be managed and dispositioned according to the requirements of RCRA (CFR, 2003a) or subject to agreements between NNSA/NSO and the State of Nevada, as well as DOE requirements for radioactive waste. The waste will be marked with the words "Hazardous Waste Pending Analysis" and "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 constituent concentrations below Land Disposal Restrictions may be disposed of at the NTS Area 5 Radioactive

Waste Management Site if the waste meets the requirements of the NTSWAC (NNSA/NSO, 2005). 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).

5.3.6 Polychlorinated Biphenyls

The management of PCBs is governed by the *Toxic Substances Control Act* (TSCA) (USC, 1976) and its implementing regulations at 40 CFR 761 (CFR, 2003b). Polychlorinated biphenyl contamination may be found as a sole contaminant or in combination with any of the types of waste discussed in this document. For example, PCBs may be a co-contaminant in soil that contains a RCRA "characteristic" waste (PCB/hazardous waste), or in soil that contains radioactive wastes (PCB/radioactive waste), or even in mixed waste (PCB/radioactive/hazardous waste). The IDW will initially be evaluated using analytical results for media samples from the investigation. If any type of PCB waste is generated, it will be managed according to 40 CFR 761 (CFR, 2003b) as well as State of Nevada requirements, (NAC, 2004a) guidance, and agreements with NNSA/NSO.

5.4 Management of Specific Waste Streams

5.4.1 Personal Protective Equipment

Personal protective equipment and disposable sampling equipment will be visually inspected for stains, discoloration, and gross contamination as the waste is generated and also evaluated for radiological contamination. Staining and discoloration will be assumed to be the result of contact with potentially contaminated media such as soil, sludge, or liquid. Gross contamination is the visible contamination of an item (e.g., clumps of soil/sludge on a sampling spoon or free liquid smeared on a glove). While gross contamination often can be removed through decontamination methods, removal of gross contamination from small items, such as gloves or booties is not typically conducted. Any IDW that meets this description will be segregated and managed as potentially "characteristic" hazardous waste. This segregated population of waste will either be: (1) assigned the characterization of the soil/sludge that was sampled, (2) sampled directly, or (3) undergo further evaluation using the soil/sludge sample results to determine how much soil/sludge would need to be present in the waste to exceed regulatory levels. 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. The PPE and equipment that is not visibly stained, discolored, or grossly contaminated will be managed as nonhazardous sanitary waste.

5.4.2 Management of Decontamination Rinsate

Rinsate at CAU 139 will not be considered hazardous waste unless there is evidence that the rinsate may display a RCRA characteristic. Evidence may include such things as the presence of a visible sheen, pH, or association with equipment/materials used to respond to a release/spill of a hazardous waste/substance. Decontamination rinsate that is potentially hazardous (using associated sample results and/or process knowledge) will be managed as characteristic hazardous waste (CFR, 2003a). The regulatory status of the potentially hazardous rinsate will be determined through the application of associated sample results or through direct sampling. If the associated samples do not indicate the presence of hazardous 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 that 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 that 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.

5.4.3 Management of Soil

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

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

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

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

5.4.4 Management of Debris

This waste stream can vary depending on site conditions. Debris that requires removal for the investigation activities (soil sampling, excavation, and/or drilling) must be characterized for proper management and disposition. Historical site knowledge, knowledge of the waste generation process, field observations, field-monitoring/screening results, radiological survey/swipe results and/or the analytical results of samples either directly or indirectly associated with the waste may be used to 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 low-level waste. 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, by placement in a container(s), or left on the footprint of the CAS and its disposition deferred until implementation of corrective action at the site.

5.4.5 Field Screening Waste

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

IDW and managed in accordance with the hazardous waste regulations (CFR, 2003a). For sites where field-screening samples contain radioactivity above background levels, field-screening methods that have the potential to generate hazardous waste will not be used, thus avoiding the potential to generate mixed waste. In the event a mixed waste is generated, the waste will be managed in accordance with Section 5.3.5 of this document.

6.0 Quality Assurance/Quality Control

The overall objective of the characterization activities described in this CAIP is to collect accurate and defensible data to support the selection and implementation of a closure alternative for each CAS in CAU 139. Section 6.1 and Section 6.2 discuss the collection of required QC samples in the field and QA requirements for laboratory/analytical data to achieve closure. Unless otherwise stated in this CAIP or required by the results of the DQO process (see Appendix A), this investigation will adhere to the Industrial Sites QAPP (NNSA/NV, 2002a).

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 environmental sample results. The number of required QC samples depends on the types and number of environmental samples collected. The minimum frequency of collecting and analyzing QC samples for this investigation, as determined in the DQO process, include:

- Trip blanks (1 per sample cooler containing VOC environmental samples)
- Equipment rinsate blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per lot of source material that contacts sampled media)
- Field duplicates (1 per 20 environmental samples or 1 per CAS per matrix, if less than 20 collected)
- Field blanks (minimum of 1 per CAS, additional if field conditions change)
- Laboratory QC samples (1 per 20 environmental samples or 1 per CAS per matrix, if less than 20 collected)

Additional QC samples may be submitted based on site conditions at the discretion of the Task Manager or 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, 2002a).

6.2 Laboratory/Analytical Quality Assurance

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

6.2.1 Data Validation

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

6.2.2 Data Quality Indicators

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

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

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

6.2.3 Precision

Precision is used to assess the variability between two equal samples. This is a measure of the repeatability of the analysis process from sample collection through analysis results.

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

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

The criteria used for the assessment of chemical precision when both results are ≥ 5x reporting limit (RL) is 20 percent and 35 percent for aqueous and soil samples, respectively. When either result is < 5x RL, a control limit of ± 2x RL for aqueous and soil samples, respectively, is applied to the absolute difference.

Table 6-1
Laboratory and Analytical Performance Criteria for CAU 139 Data Quality Indicators

Data Quality Indicator	Performance Metric	Potential Impact on Decision If Performance Metric Not Met
Precision	At least 80% of the sample results for each measured analyte are not qualified for precision based on the RPD criteria as discussed in Section 6.2.3.	If the performance metric is not met, the affected analytical results from each affected CAS will be assessed to determine whether there is sufficient confidence in analytical results to use the data in making DQO decisions.
Accuracy	At least 80% of the sample results for each measured analyte are not qualified for accuracy based on the criteria discussed in Section 6.2.4.	If the performance metric is not met, the affected analytical results from each affected CAS will be assessed to determine whether there is sufficient confidence in analytical results to use the data in making DQO decisions.
Sensitivity	Minimum detectable concentrations are less than or equal to respective FALs.	Cannot determine whether COCs are present or migrating at levels of concern.
Comparability	Sampling, handling, preparation, analysis, reporting, and data validation are performed using standard methods and procedures.	Inability to combine data with data obtained from other sources and/or inability to compare data to regulatory action levels.
Representativeness	Samples contain contaminants at concentrations present in the environmental media from which they were collected.	Analytical results will not represent true site conditions. Inability to make appropriate DQO decisions.
Completeness	80% of the CAS-specific COPC analytes have valid results. 100% of CAS-specific targeted analytes have valid results.	Cannot support/defend decision on whether COCs are present.
Extent Completeness	100% of COC analytes used to define extent have valid results.	Extent of contamination cannot be accurately determined.

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

The criteria used for the assessment of radiological precision when both results are 5x MDC is 20 percent and 35 percent for aqueous and soil samples, respectively. When either result is < 5x MDC, the normalized difference should be between -2 and +2 for aqueous and soil samples. The parameters to be used for assessment of precision for duplicates are listed in Table 3-3.

The performance metric for assessing the DQI of precision on DQO decisions (see Table 6-1) is that at least 80 percent of sample results for each measured contaminant are not qualified due to duplicates exceeding the criteria. If this performance is not met, an assessment will be conducted in the investigation report on the impacts to DQO decisions specific to affected contaminants and CASs. Any values outside the specified criteria do not necessarily result in the qualification of analytical data. It is only one factor in making an overall judgment about the quality of the reported analytical results.

6.2.4 Accuracy

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

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

The criteria used for the assessment of inorganic chemical accuracy are 75 to 125 percent for MS recoveries and 80 to 120 percent for LCS recoveries. For organic chemical accuracy, MS and LCS laboratory specific percent recovery criteria developed and generated in-house by the laboratory according to approved laboratory procedures are applied. The criteria used for the assessment of radiochemical accuracy are 80 to 120 percent for LCS and MS recoveries.

The parameters for chemical analyses to be used for assessment of accuracy are listed in Table 6-1. The parameters for radiochemical analyses to be used for assessment of accuracy will be the control limits listed in Table 3-3. Any values outside the specified criteria do not necessarily result in the qualification of analytical data. It is only one factor in making an overall judgment about the quality of the reported analytical results. Factors beyond laboratory control, such as sample matrix effects, can cause the measured values to be outside of the established criteria. Therefore, the entire sampling and analytical process may be evaluated when determining the usability of the affected data.

The performance metric for assessing the DQI of accuracy on DQO decisions (see Table 6-1) is that at least 80 percent of the sample results for each measured contaminant are not qualified for accuracy. If this performance is not met, an assessment will be conducted in the investigation report on the impacts to DQO decisions specific to affected contaminants and CASs.

6.2.5 Representativeness

Representativeness is the degree to which sample characteristics accurately and precisely represent a characteristics of a population or an environmental condition (EPA, 2002). Representativeness is assured by a carefully developing the sampling strategy during the DQO process such that false negative and false positive decision errors are minimized. The criteria listed in DQO Step 6 – Specify the Tolerable Limits on Decision Errors are:

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

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

6.2.6 Completeness

Completeness is defined as generating sufficient data of the appropriate quality to satisfy the data needs identified in the DQOs. For judgmental sampling, completeness will be evaluated using both a quantitative measure and a qualitative assessment. The quantitative measurement to be used to evaluate completeness is presented in Table 6-1 and is based on the percentage of measurements made that are judged to be valid. The completeness goal for targeted analytes and the remaining

COPCs is 100 and 80 percent, respectively. If these criteria are not achieved, the dataset will be assessed for potential impacts on making DQO decisions.

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

6.2.7 Comparability

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another (EPA, 2002). The criteria for the evaluation of comparability will be that all sampling, handling, preparation, analysis, reporting, and data validation were performed using approved standard methods and procedures. This will ensure that data from this project can be compared to regulatory action levels that were developed based on data generated using the same or comparable methods and procedures. An evaluation of comparability will be presented in the investigation report.

6.2.8 Sensitivity

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

7.0 Duration and Records Availability

7.1 Duration

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

Table 7-1
Corrective Action Investigation Activity Durations

Duration (days)	Activity
50	Site Preparation
86	Field Work Preparation and Mobilization
24	Sampling
160	Data Assessment
180	Waste Management

7.2 Records Availability

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

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Appendix A

Data Quality Objectives

A.1.0 Introduction

The DQO process described in this appendix is a seven-step strategic systematic planning method based on the scientific method that was used to plan data collection activities and define performance criteria for the CAU 139, Waste Disposal Sites, field investigation. The DQOs are designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and technically defend recommended corrective actions (i.e., no further action, closure in place, or clean closure). Existing information about the nature and extent of contamination at the majority of the CASs in CAU 139 is insufficient to evaluate and select preferred corrective actions; therefore, a CAI will be conducted.

The CAU 139 investigation will be based on the DQOs presented in this appendix as developed by representatives of the NDEP and the NNSA/NSO. The seven steps of the DQO process presented in Section A.3.0 through Section A.9.0 were developed in accordance with EPA *Guidance for the Data Quality Objectives Process* (EPA, 2000b) *and Guidance for Quality Assurance Project Plans* (EPA, 2002). The DQO process presented herein is based on the EPA Quality System Document for DQOs entitled *Data Quality Objectives Process for Hazardous Waste Site Investigations*, (EPA, 2000a) and the CAS-specific information presented in Section A.2.0.

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

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

A.2.0 Background Information

The following seven CASs that comprise CAU 139 are located in Areas 3, 4, 6, and 9 of the NTS, as shown in Figure A.2-1:

- CAS 03-35-01, Burn Pit
- CAS 04-08-02, Waste Disposal Site
- CAS 04-99-01, Contaminated Surface Debris
- CAS 06-19-02, Waste Disposal Site/Burn Pit
- CAS 06-19-03, Waste Disposal Trenches
- CAS 09-23-01, Area 9 Gravel Gertie
- CAS 09-34-01, Underground Detection Station

The following sections (Section A.2.1 through Section A.2.7) provide a CAS description, physical setting and operational history, release information, and previous investigation results for each CAS in CAU 139. The CAS-specific COPCs are provided in the following sections. Many of the COPCs are based on a conservative evaluation of possible site activities considering the incomplete site histories of the CASs and considering contaminants found at similar NTS sites. Targeted contaminants are defined as those contaminants that are known or that could be reasonably suspected to be present within the CAS based on previous sampling or process knowledge.

A.2.1 Corrective Action Site 03-35-01, Burn Pit

Corrective Action Site 03-35-01 consists of the soil and release within the area located northeast of the Buster Jangle Wye (BJY) intersection in Area 3 of the NTS. Debris such as metal cans, wood, cable, concrete, cinder blocks, and other scrap is present throughout the site. Figure A.2-2 shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 03-35-01 is located near the BJY intersection in Area 3 of the NTS. Documentation originally used to include this CAS in the FFACO is believed to actually be discussing CAS 03-08-01, located several hundred feet to the south. A small area containing a few rusted cans and minimal metal debris and building materials (i.e., cinder blocks and chunks of concrete) is the current basis of this CAS. The ground has been disturbed recently with the cleanup of CAS 03-99-11. The area is flat with gravel ranging in size from 0.5 in. to

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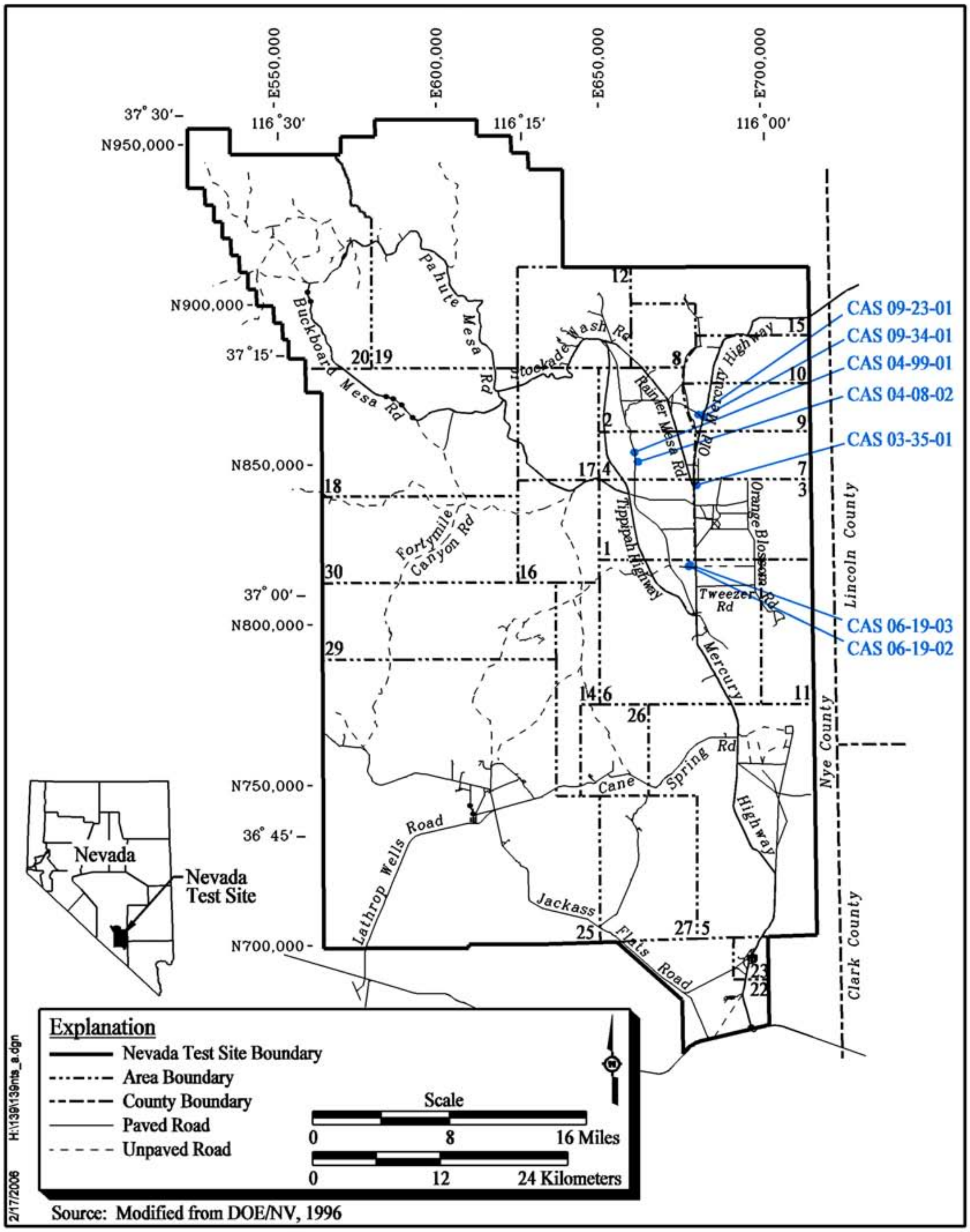

Figure A.2-1
Corrective Action Unit 139, CAS Location Map

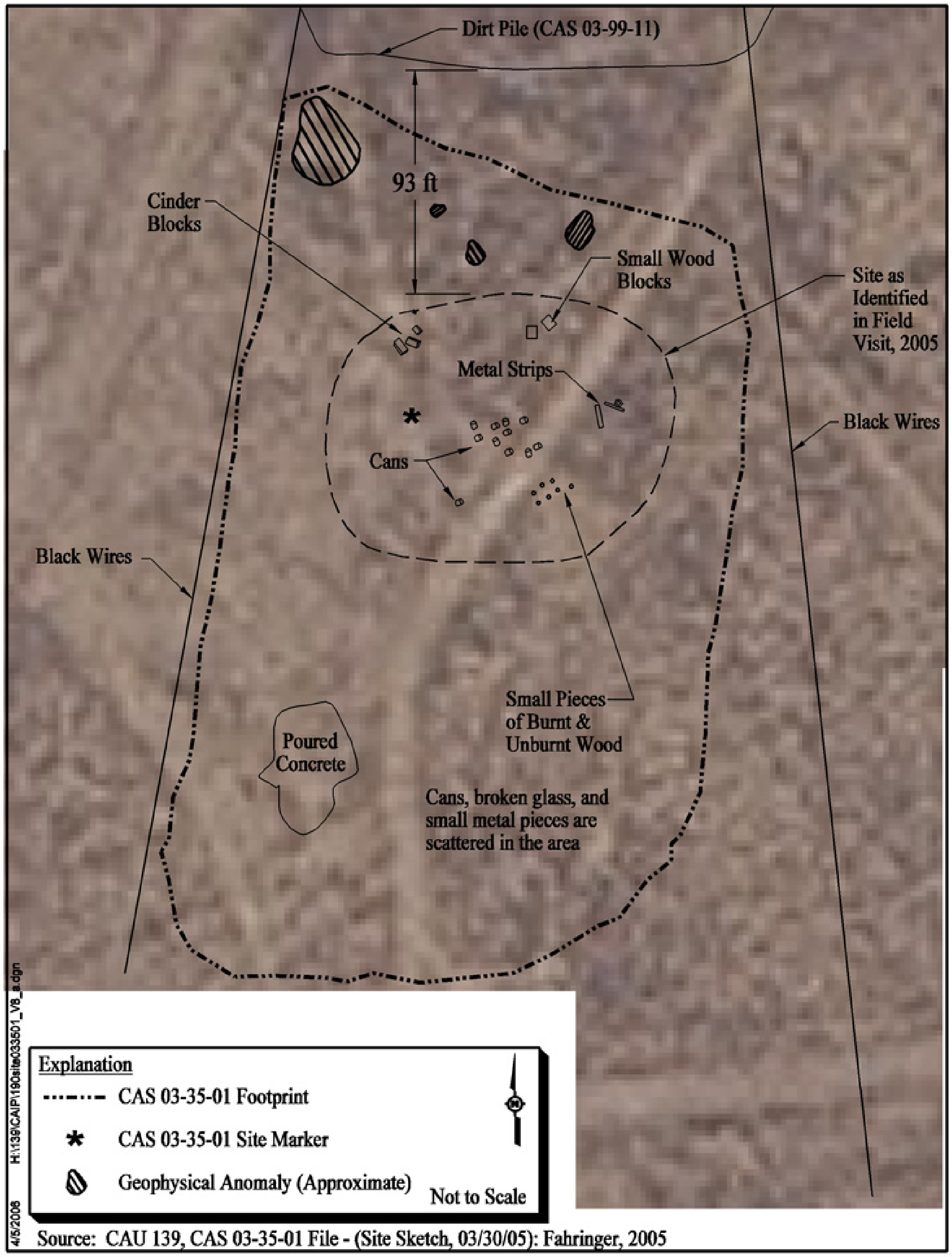

Figure A.2-2
Site Sketch of CAS 03-35-01, Burn Pit

6 in. The area is grown over with vegetation. Water flows from northwest towards the southeast. The area is bordered on the west by a dirt road. There is no documented operational history for this area.

Release Information **–** There is no documented release information available. The source of any release is assumed to be the debris and any sources from the burning of debris.

Previous Investigation Results **–** Geophysical surveys using EM31 and EM61-MKII equipment were conducted and a number of subsurface anomalies were identified within the area of the CAS (Fahringer, 2005). Neither radiological survey data nor previous sampling data have been gathered.

A.2.2 Corrective Action Site 04-08-02, Waste Disposal Site

Corrective Action Site 04-08-02 consists of potential releases from within the area located south of the intersection of 4-04 Road and Orange Road. Debris such as a metal grate, cable, spindle, metal stakes, and chicken wire is present at the site. The only standing structure within the CAS is a wire fence that partially surrounds the area. Figure A.2-3 shows a site sketch of the CAS.

Physical Setting and Operational History **–** Corrective Action Site 04-08-02 is located in Area 4 of the NTS. The site is generally flat with gravel ranging in size from 0.5 in. to 6 in. The area is partially fenced and has a natural wash running along the south side of the site, with soil deposited at one location to apparently dam any incoming water or divert flow. A large portion of the area of the CAS has been leveled and a natural wash has developed from the leveled area out of the CAS. The only operational history for this location is a reference in the Long Range Radioactive Waste Consolidation Plan. The area is currently inactive and abandoned.

Release Information **–** There is no documented release information available. The source of any release is assumed to be the items once stored at this location associated with the Long Range Radioactive Waste Consolidation Plan (REECo, 1982).

Previous Investigation Results **–** A radiological survey conducted in 2002 shows the maximum gamma radioactivity emission rate to be approximately 10 times the mean background (Alderson, 2002). The contaminated area appears to be confined to the outline of a former pad or laydown area.

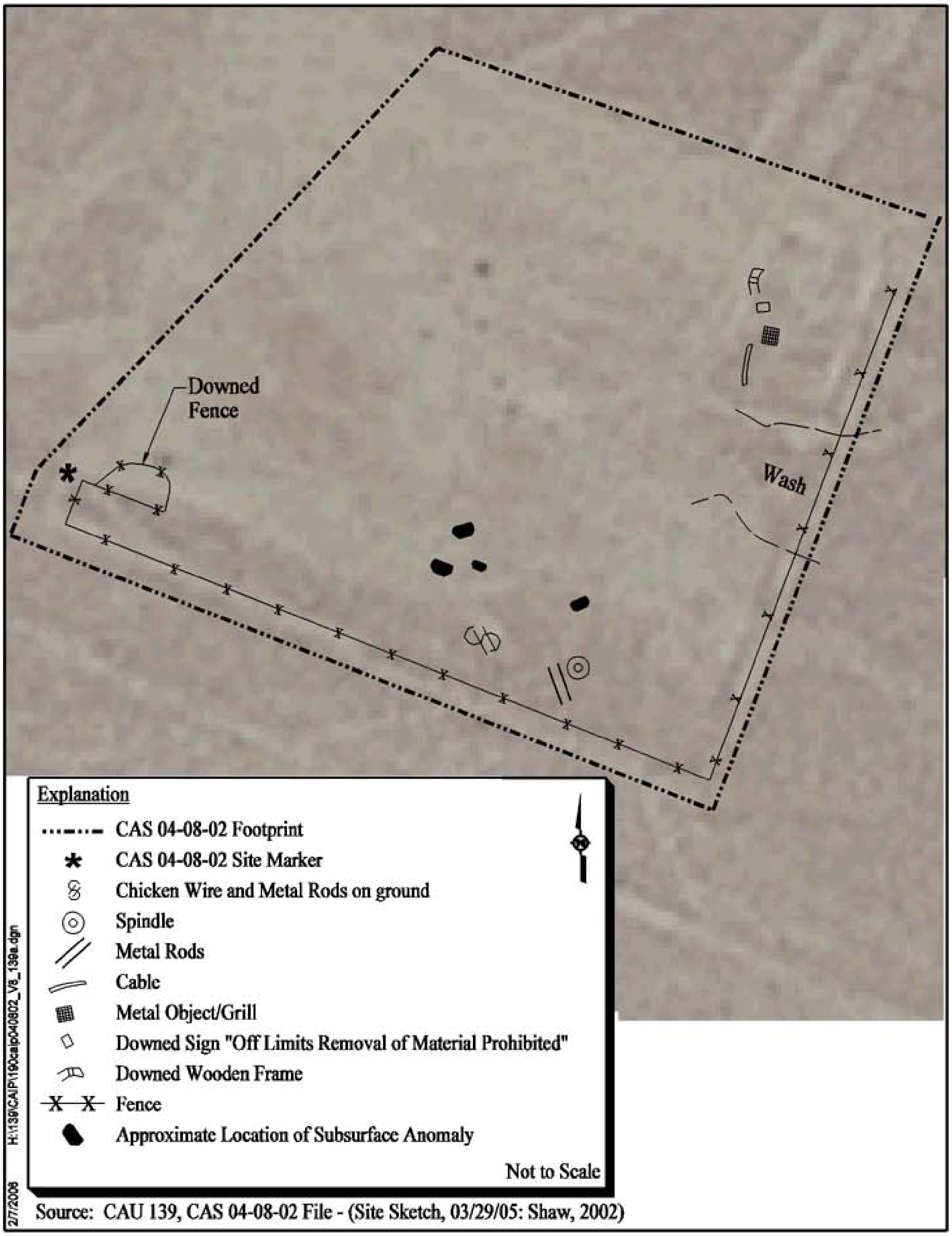

Figure A.2-3
Site Sketch of CAS 04-08-02, Waste Disposal Site

Geophysical surveys using EM31 and EM61-MKII equipment were conducted and a few subsurface anomalies were identified within the area of the CAS (Shaw, 2002). No samples have been collected or analyzed.

A.2.3 Corrective Action Site 04-99-01, Contaminated Surface Debris

Corrective Action Site 04-99-01 consists of the soil and release within the area located approximately 75 ft west of the intersection of the 4-04 Road and Orange Road. Debris such as rusted metal cans and rusted metal stakes are present at the site. Figure A.2-4 shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 04-99-01 is located in Area 4 of the NTS. The site slopes west to east toward the valley floor with gravel ranging in size from 0.5 in. to 6 in. The area has small berms and shallow depressions running the width of the area, parallel to the road (approximately 60 ft by 5 ft) exhibiting no apparent effect on water flow through the area. Four t-posts are standing at the corners of the CAS with four metal stakes driven into the ground along one of two shallow depressions. The only operational history for this location is a reference in the Long Range Radioactive Waste Consolidation Plan as a temporary storage area (REECo, 1982). The area is currently inactive and abandoned.

Release Information – There is no documented release information available. The source of any release is assumed to be the debris currently present at the site and any items once stored at this location associated with the Long Range Radioactive Waste Consolidation Plan (REECo, 1982).

Previous Investigation Results – A radiological survey conducted in 2002 shows the maximum gamma radioactivity emission rate to not be significantly different than the mean background (Alderson, 2002). Geophysical surveys using EM31 and EM61-MKII equipment were conducted and a few subsurface anomalies were identified within the area of the CAS (Shaw, 2002).

A.2.4 Corrective Action Site 06-19-02, Waste Disposal Site/Burn Pit

Corrective Action Site 06-19-02 consists of the soil and release within the area located adjacent to Building 6-660 near Well 3 in Area 6 of the NTS. Debris such as scrap metal, wood, and decaying

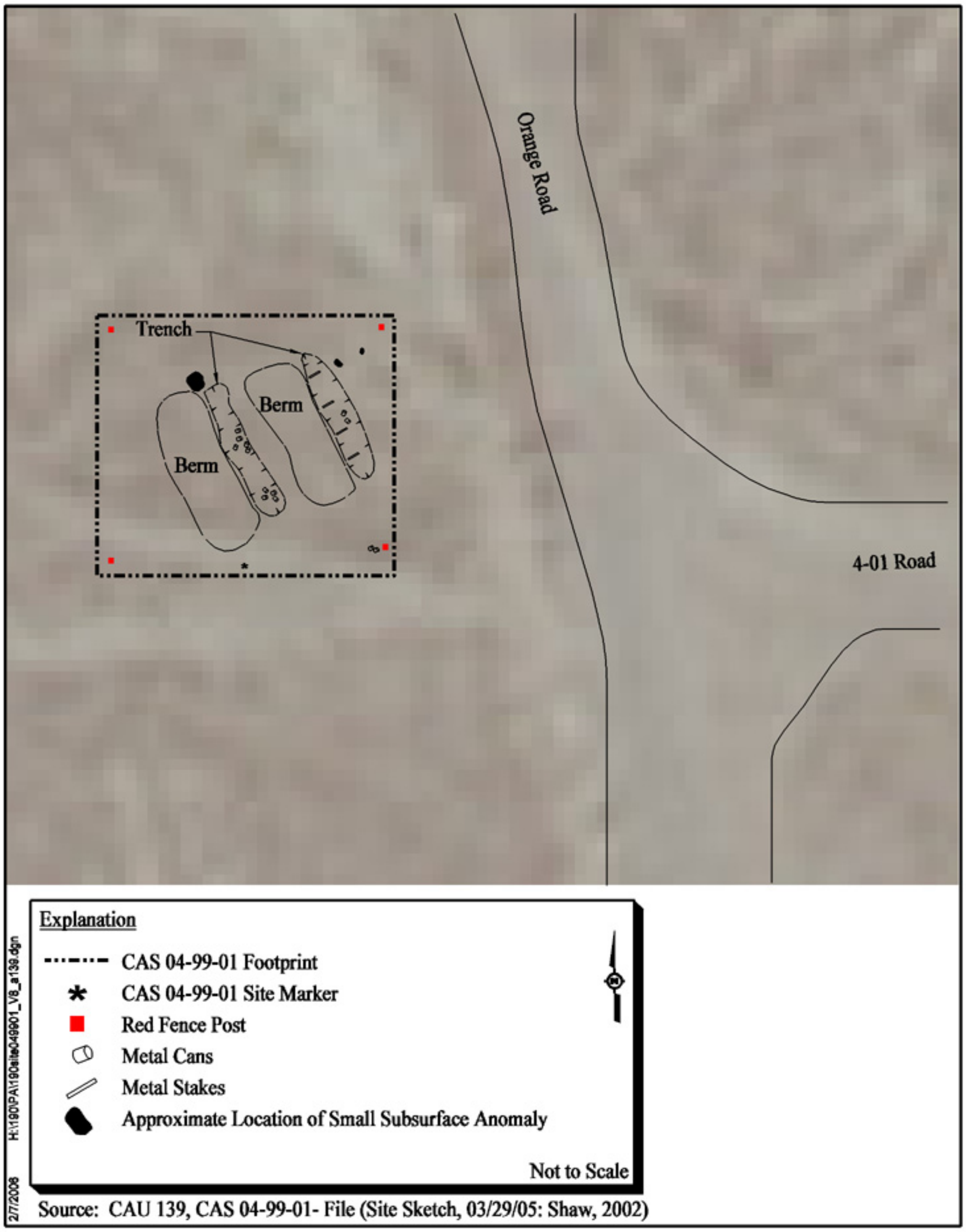

Figure A.2-4
Site Sketch of CAS 04-99-01, Contaminated Surface Debris

fabric partially buried by drift sand are present at the site. Figure A.2-5 shows a site sketch of the CAS.

Physical Setting and Operation History – Corrective Action Site 06-19-02 is located in Area 6 of the NTS, approximately 200 ft northwest of Well 3. The site is generally flat with gravel at the surface. Vegetation exists throughout the area. A dirt road circles to the south of the CAS and provides access to the fill spout at Well 3. A chain-link fence establishes the perimeter of the burn pit and a wire fence establishes the perimeter of an old animal pen.

The animal pen was part of a group of animal holding pens, but the history of the waste disposal area and fenced burn pit area is uncertain. It is believed that the sites provided support for the U.S. Public Health Service Animal Investigation Program. The area is currently inactive and abandoned.

Release Information – There is no documented release information available. The source of any release is assumed to be the waste products from the animals once held in these pens. The animals ingested radioactive feed as part of the experiments. The excrement from the animals has the potential to contain radioactivity. In the area identified as the burn pit, charred wood and other surface debris is present.

Previous Investigation Results – A radiological survey conducted in 2002 shows the maximum gamma radioactivity emission rate to not be significantly different than the mean background (Alderson, 2002). Geophysical surveys using EM31 and EM61-MKII equipment were conducted identifying no buried items within the area of the CAS (Shaw, 2002).

A.2.5 Corrective Action Site 06-19-03, Waste Disposal Trenches

Corrective Action Site 06-19-03 consists of one known and other potential waste disposal trenches located north of former Building 6-660. The waste buried in the trench(es) include the remains of animals dissected and analyzed as part of the EPA Farm activities as well as other wastes that were generated as part of the activities such as a complete carcass and animal fluids. Figure A.2-6 shows a site sketch of the CAS.

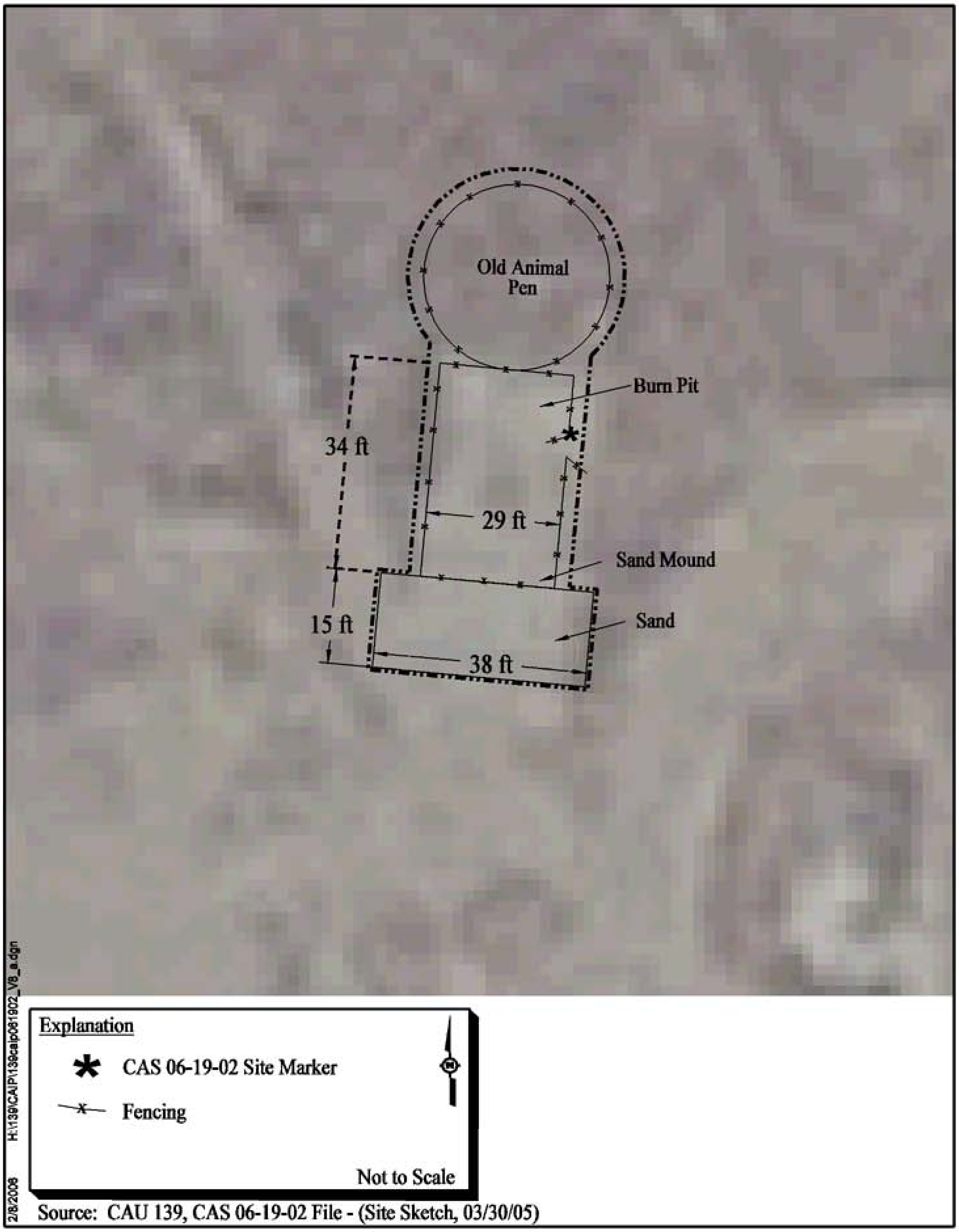

Figure A.2-5
Site Sketch of CAS 06-19-02, Waste Disposal Site/Burn Pit

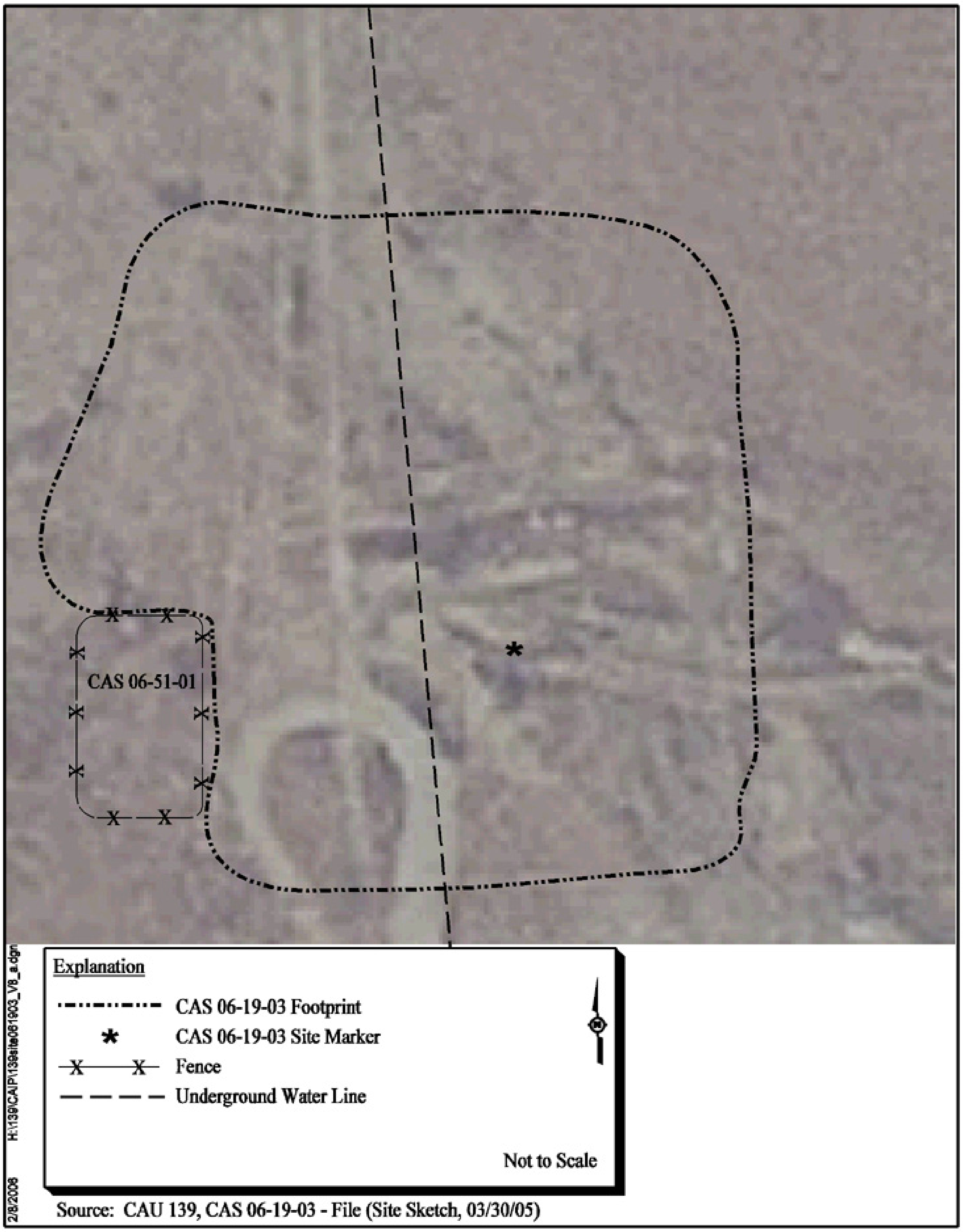

Figure A.2-6
Site Sketch of CAS 06-19-03, Waste Disposal Trenches

Physical Setting and Operation History – Corrective Action Site 06-19-03 is located in Area 6 of the NTS approximately 700 ft north of Well 3. The site is generally flat with gravel at the surface. Vegetation exists throughout the area. An underground water line was installed in 2004 that bisects the area. An aboveground water line is present just west of the site. An unused dirt road runs parallel to the water line through the CAS.

During excavation activities for an underground water line in 2004, a waste trench was uncovered revealing buried remains of animals and small plastic containers that appeared to be filled with biological samples. The trench appears to run perpendicular to the water line from east to west. The water line project was completed and the excavation backfilled after four days of site investigation in which the waste from the trench was sampled and analyzed. The area is currently inactive and abandoned.

Release Information – There is no documented release information available. The source of any release is assumed to be the buried items. Some of the animal remains buried in the trench were found secured in sealed plastic bags and containers while others, such as the carcass of a cow, was found buried without containment.

Previous Investigation Results – A radiological survey conducted in 2001 shows the maximum gamma radioactivity emission rate to be not significantly different than the mean background (IT, 2001). Geophysical surveys using EM31 and EM61-MKII equipment were conducted, and an area assumed to be the trench where the animal remains were buried was identified (Fahringer, 2005). Samples collected during the 2004 water line excavation of the buried remains and surrounding soil revealed no contamination exceeding action levels (NNSA/NSO, 2004). Samples of soil from the trench walls, IDW, and of soil waste directly sampled were analyzed for a variety of constituents including VOCs, SVOCs, PCBs, TPH-DRO, TPH-GRO, RCRA metals, Be, herbicides, pesticides, gamma spectroscopy, Iso-U, Iso-Pu, and Sr-90. No other sampling information is available.

A.2.6 Corrective Action Site 09-23-01, Area 9 Gravel Gertie

Corrective Action Site 09-23-01 consists of the soil and release within the area located along the 9-01 Road between the old Mercury Highway and Circle Road. Debris such as wood, various cables, and metal culverts are present throughout the site. Figure A.2-7 shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 09-23-01 is located in Area 9 of the NTS. The CAS consists of structures within an area posted with "Underground Radioactive Material" signs that include: a gravel gertie (a small concrete room with a ceiling comprised of approximately 20 ft of gravel); a second smaller gravel mound; one concrete vault approximately 10 ft by 5 ft covered with wood with two large culverts protruding from the sides at the surface; and one circular vault approximately 4 ft in diameter and approximately 15 ft deep with rungs designed as steps and handholds allowing entry down one side with communication cabling lying on the bottom; in addition to minimal surface debris lying throughout the area.

This area was ground zero for the Tesla test (T9b) of Operation Teapot, an atmospheric nuclear test conducted in 1955, which resulted in large-scale surface contamination that is not being considered in this investigation. The Ganymede test of Operation Hardtack, II, was a zero-yield safety experiment that was detonated inside the Area 9 Gravel Gertie in 1958. The experiment conducted in the gravel-covered bunker was described as a successful containment of four devices comprised of uranium and PBX. Access to the area is restricted with two fences and posted with signs identifying underground radioactive material. There is a large amount of Trinity glass dispersed throughout the site. The toe of a berm extends into the fenced area and houses cables previously used to facilitate testing. The area is currently inactive and abandoned.

Release Information – No radiological contamination outside the gravel gertie was detected after the Ganymede experiment (DOE/NV, 2000). Process knowledge and operational history are the bases for determining that no hazardous contamination is present.

Previous Investigation Results – Aerial data and ground surveys confirmed the lack of alpha activity around the bunker area, but fission products and soil activation products were detectable at this site (DOE/NV, 2000a). An investigation conducted at a similar site (CAS 05-23-01, Gravel Gertie)

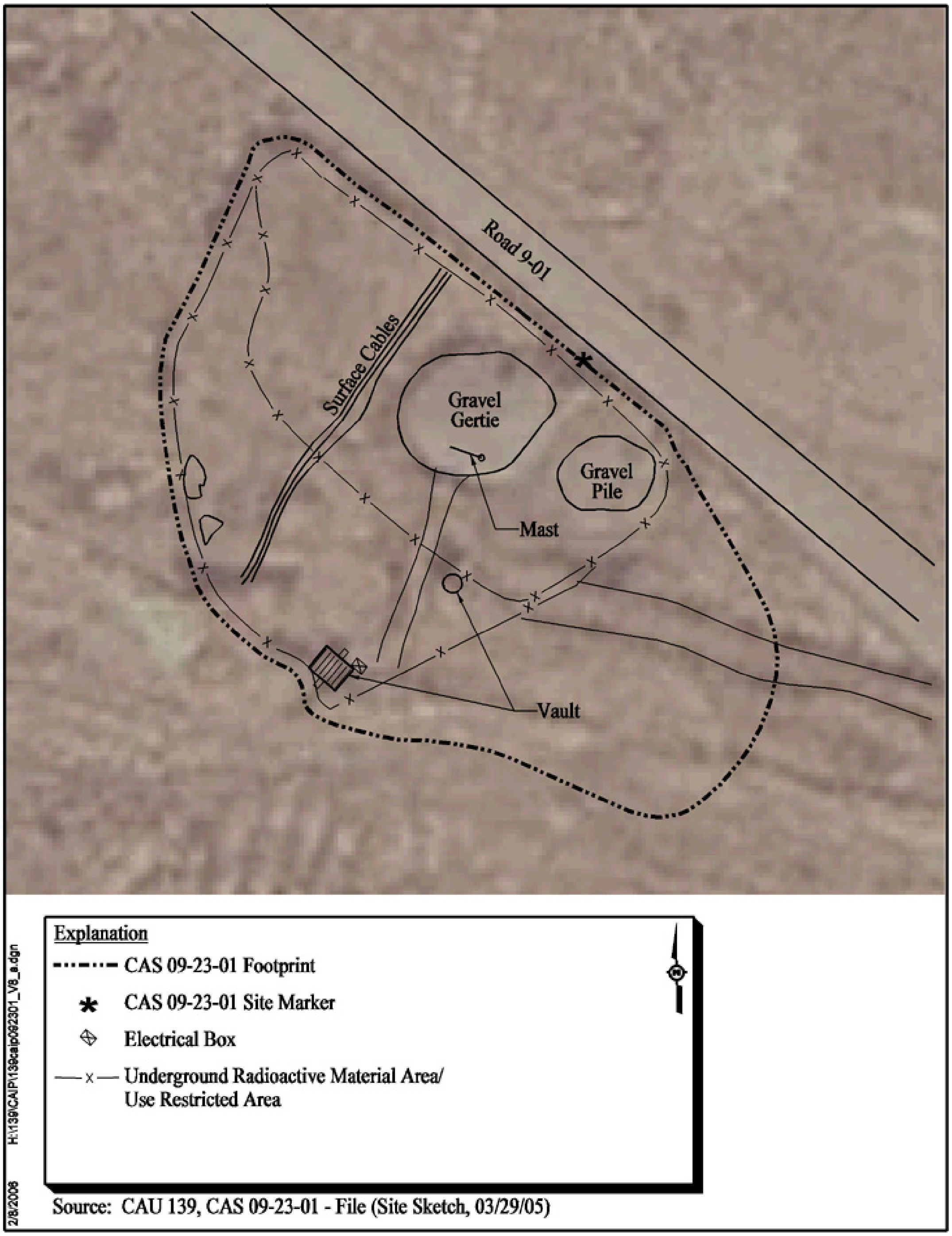

Figure A.2-7
Site Sketch of CAS 09-23-01, Area 9 Gravel Gertie

determined that uranium contamination is present within the internal structure and that it is not practical to collect samples from inside the gravel gertie.

A.2.7 Corrective Action Site 09-34-01, Underground Detection Station

Corrective Action Site 09-34-01 consists of a station identified as Bunker 9-300 located at the northeast corner of the interesection of the old Mercury Highway and 9-01 Road. Figure A.2-8 shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 09-34-01, identified as Bunker 9-300, is located in Area 9 of the NTS. The bunker is a underground facility buried approximately 15 ft bgs. A soil mound is present over the bunker location.

Bunker 9-300 (also referred to as Bunker Z-900) was used to house detection equipment for monitoring the several nuclear tests that were detonated throughout the immediate area. The bunker is only accessible via an elevator that is assumed to have not been operational for approximately 30 to 40 years. It is not considered safe to enter the bunker. The area is currently inactive and abandoned.

Release Information – There is no documented release information available.

Previous Investigation Results – No previous investigation results from Bunker 9-300 are available. Investigations in the immediate area of Bunker 9-300 include CAU 380 and CAU 464. Corrective Action Unit 380 included a transformer west of Station 9-63 determined to be non-PCB. No soil staining was observed. Corrective Action Unit 464, CAS 09-02-01, included a 1,000-gallon diesel fuel tank, located on the east side of Station 9-63, which provided fuel to the generators formerly housed in Station 9-63. The CAU was clean closed after 15 cubic yards of soil was removed, verification soil samples were collected, and analysis for contaminants were determined to be below action levels.

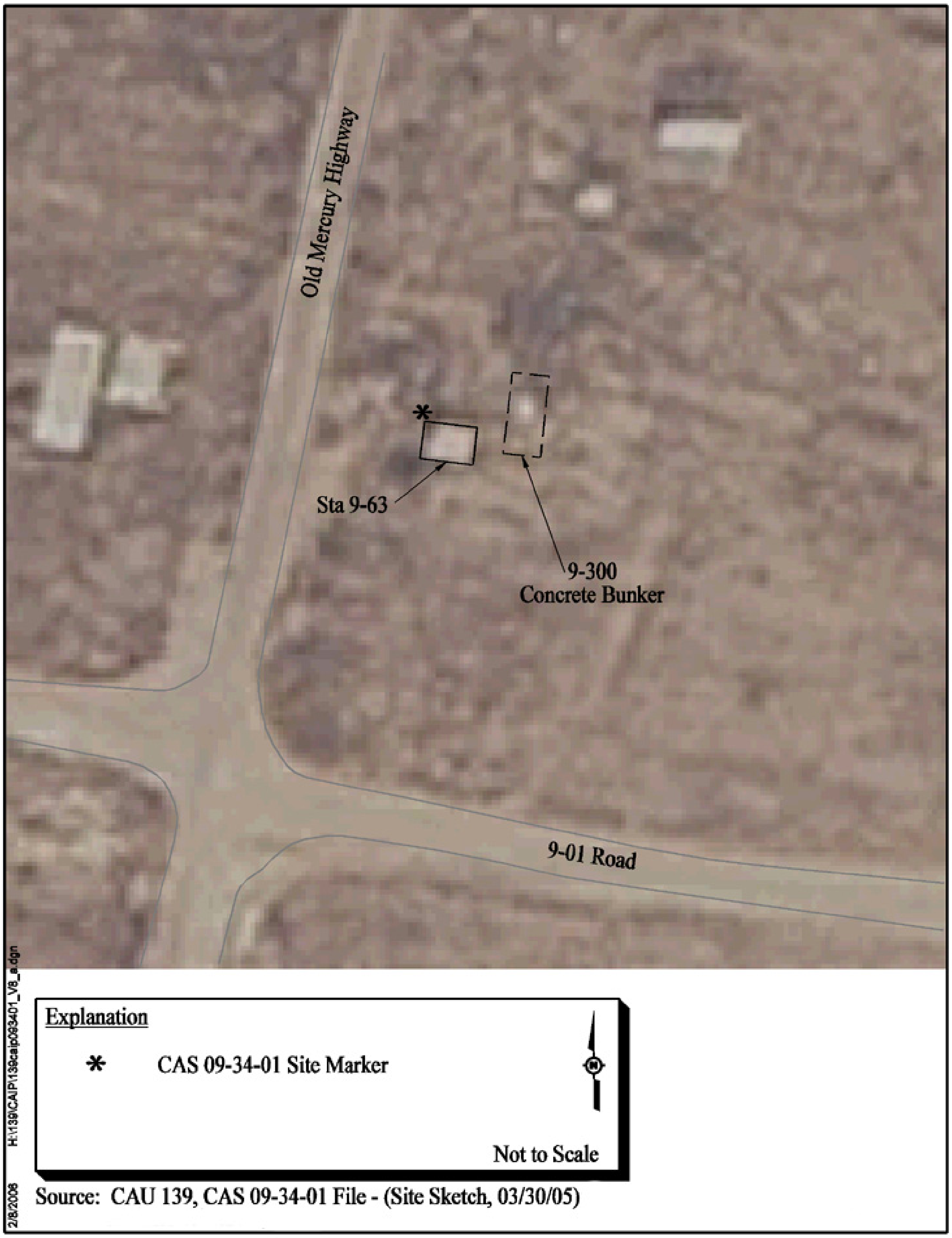

Figure A.2-8
Site Sketch of CAS 09-34-01, Underground Detection Station

A.3.0 Step 1 – State the Problem

The problem statement for CAU 139 is: "Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives for the CASs in CAU 139" with the exception of CASs 09-23-01 and 09-34-01. Because no additional information is required to evaluate and recommend corrective actions for CASs 09-23-01 and 09-34-01, DQOs (to control the type, quantity, and quality of data to be gathered during the CAI) for these CASs will not be developed.

A.3.1 Planning Team Members

The DQO planning team consists of representatives from NDEP, NNSA/NSO, SNJV, and BN. The primary decision makers are the NDEP and NNSA/NSO representatives. Table A.3-1 lists representatives from each organization in attendance for the January 4, 2006, DQO meeting.

Table A.3-1
Final DQO Meeting Participants for CAU 139
January 4, 2006

Participant	Affiliation
Ted Zaferatos	Nevada Division of Environmental Protection
Sabine Curtis	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
David Nacht	Bechtel Nevada
Tom Thiele	Bechtel Nevada
Robert Boehlecke	Stoller-Navarro Joint Venture
Grant Evenson	Stoller-Navarro Joint Venture
Steve Felton	Stoller-Navarro Joint Venture
Christian Palay	Stoller-Navarro Joint Venture
Jeff Kirkwood	Stoller-Navarro Joint Venture
C.-H. Tung	Stoller-Navarro Joint Venture
Joe Hutchinson	Stoller-Navarro Joint Venture
Arno Gomez	Stoller-Navarro Joint Venture
Joe Peters	Stoller-Navarro Joint Venture

A.3.2 Conceptual Site Model

The CSM is used to organize and communicate information about site characteristics. It reflects the best interpretation of available information at any point in time. The CSM is a primary vehicle for communicating assumptions about release mechanisms, potential migration pathways, or specific constraints. It provides a good summary of how and where contaminants are expected to move and what impacts such movement may have. It is the basis for assessing how contaminants could reach receptors both in the present and future. The CSM describes the most probable scenario for current conditions at each site and define the assumptions that are the basis for identifying appropriate sampling strategy and data collection methods. Accurate CSMs are important as they serve as the basis for all subsequent inputs and decisions throughout the DQO process.

The CSM was developed for CAU 139 using information from the physical setting, potential contaminant sources, release information, historical background information, knowledge from similar sites, and physical and chemical properties of the potentially affected media and COPCs.

The CSM consists of:

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

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

The applicability of the CSM as it applies to each CAS is summarized in Table A.3-2 and discussed below. Table A.3-2 provides information on CSM elements that will be used throughout the remaining steps of the DQO process. Figure A.3-1 represents site conditions applicable to this CSM.

A.3.2.1 Contaminant Release

The most likely locations of the contamination and releases to the environment are the soils directly below or adjacent to the CSM's surface and subsurface source components (e.g.., burnpits, waste storage sites, waste trenches, etc.). The CSM accounts for potential releases resulting from the placement of wastes or contamination of environmental media from operational sources. Any contaminants migrating from CASs, regardless of physical or chemical characteristics, are expected to exist at interfaces, and in the soil adjacent to disposal features in lateral and vertical directions.

A.3.2.2 Potential Contaminants

The COPCs applicable to Decision I environmental samples from each of the CASs of CAU 139 are defined as the analytes reported from the analytical methods stipulated in Table A.3-3. The list of COPCs is intended to encompass all of the contaminants that could potentially be present at each CAS. These contaminants were identified during the planning process through the review of site history, process knowledge, personal interviews, past investigation efforts (where available), and inferred activities associated with the CASs. Because complete information regarding activities performed at the CAU 139 sites is not available, contaminants detected at similar NTS sites were included in the contaminant lists to reduce the uncertainty.

During the review of site history documentation, process knowledge information, personal interviews, past investigation efforts (where available), and inferred activities associated with the CASs, some of the COPCs were identified as targeted contaminants at specific CASs. Targeted contaminants are those COPCs for which evidence in the available site and process information suggests that they may be reasonably suspected to be present at a given CAS. The targeted contaminants are required to meet a more stringent completeness criteria than other COPCs thus

Table A.3-2
Conceptual Site Model
Description of Elements for Each CAS in CAU 139

CAS Identifier	03-35-01	04-08-02	04-99-01	06-19-02	06-19-03	09-23-01	09-34-01
CAS Description	Burn Pit	Waste Disposal Site	Contaminated Surface Debris	Waste Disposal Site/Burn Pit	Waste Disposal Trenches	Area 9 Gravel Gertie	Under-ground Detection Station
Site Status	Sites are inactive and/or abandoned						
Future Land Use	Occasional Use Area - 80 hours (10 days) per year						
Sources of Potential Soil Contamination	Accelerants, debris	Surface debris		Accelerants, debris	Buried wastes	Conventional explosives	None
Location of Contamination/ Release Point	Land surface				Base of trench(es)	Gravel gertie	None
Amount Released	Unknown					Not Available	None
Affected Media	Soil						
Potential Contaminants	VOCs, SVOCs, TPH-DRO, PCBs, RCRA metals, beryllium, radionuclides	Radionuclides, PCBs		VOCs, SVOCs, TPH-DRO, PCBs, pesticides, RCRA metals, beryllium, radionuclides	VOCs, SVOCs, TPH-DRO, PCBs, RCRA metals, beryllium, radionuclides	Uranium and daughter products	None
Transport Mechanisms	Percolation of precipitation through subsurface media serves as the major driving force for migration of contaminants. Surface water runoff may provide for the transportation of some contaminants within or outside of the footprints of the CASs.						None
Migration Pathways	Vertical transport expected to dominate over lateral transport due to small surface gradients.						None
Lateral and Vertical Extent of Contamination	Contamination, if present, is expected to be contiguous to the release points. Concentrations are expected to decrease with distance and depth from the source. Groundwater contamination is not expected. Lateral and vertical extent of contaminant of concern contamination is assumed to be within the spatial boundaries.						N/A
Exposure Scenario	The potential for contamination exposure is limited to industrial workers, construction workers, and military personnel conducting training. These human receptors may be exposed to contaminants of potential concern through oral ingestion, inhalation, dermal contact (absorption) of soil and/or debris due to inadvertent disturbance of these materials or irradiation by radioactive materials.						

DRO = Diesel-range organics
kg = Kilogram
N/A = Not applicable
PCBs = Polychlorinated biphenyls
RCRA = *Resource Conservation and Recovery Act*
SVOC = Semivolatile organic compound
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compound

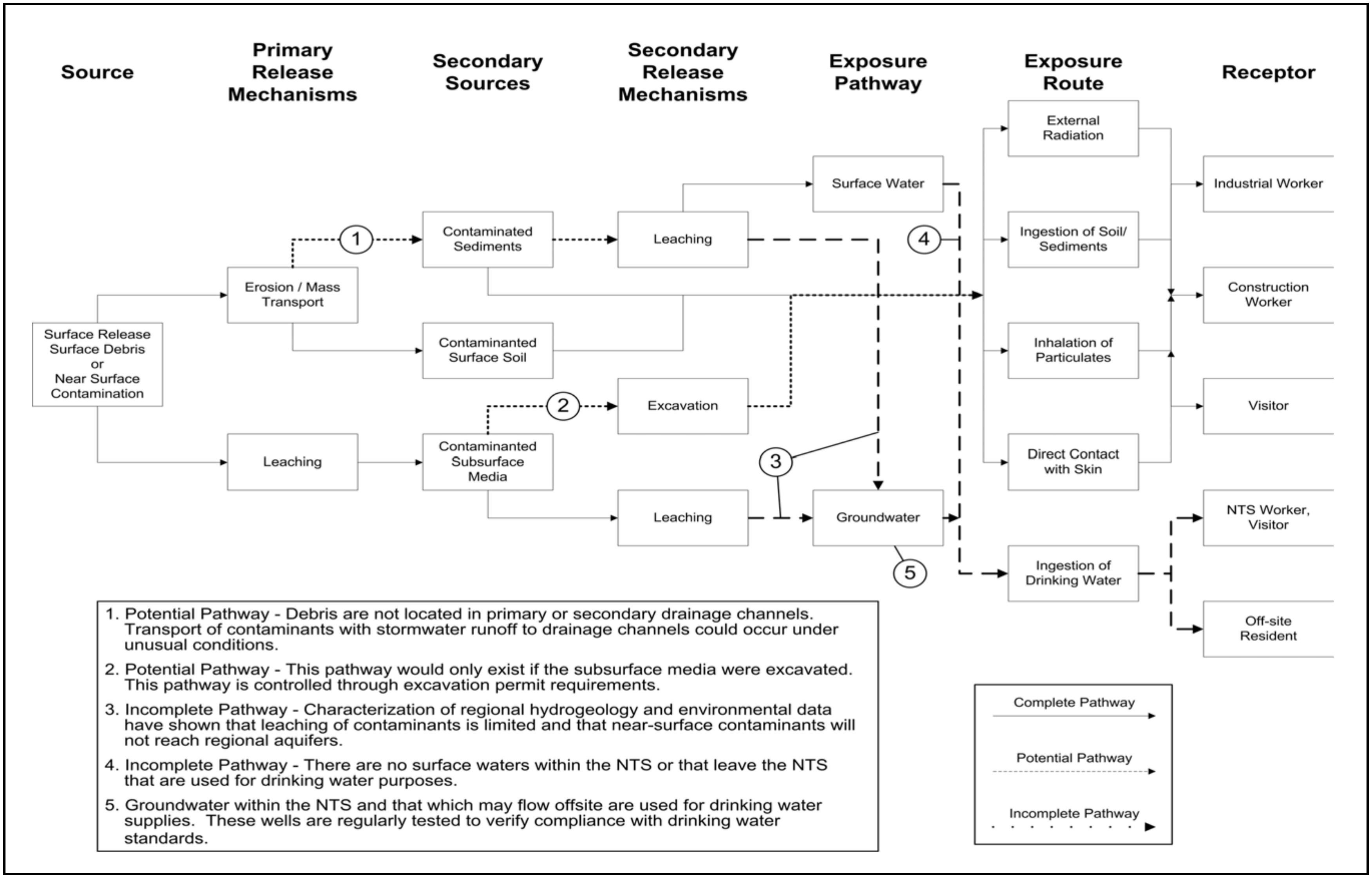

Figure A.3-1
Corrective Action Unit 139 Conceptual Site Model

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

Analyses[b]	03-35-01	04-08-02	04-99-01	06-19-02	06-19-03
Organic Contaminants of Potential Concern (COPCs)					
Volatile Organic Compounds[c]	X	N/A	X	X	X
Semivolatile Organic Compounds[c]	X	N/A	X	X	X
Total Petroleum Hydrocarbons-Diesel-Range Organics	X	N/A	X	X	X
Polychlorinated Biphenyls	X	X	X	X	X
Pesticides	N/A	N/A	N/A	X	N/A
Inorganic COPCs					
Total *Resource Conservation and Recovery Act* Metals, Beryllium[c]	X	N/A	X	X	X
Radionuclide COPCs					
Gamma Spectroscopy[d]	X	X	X	X	X
Isotopic Uranium, Isotopic Plutonium, Strontium-90	N/A	X	X	N/A	X
Tritium	N/A	N/A	N/A	N/A	X

X = Required analytical method
N/A = Not applicable

[a]The contaminants of potential concern are the analytes reported from the analytical methods listed.
[b]If the volume of material is limited, prioritization of the analyses will be necessary.
[c]May also include Toxicity Characteristic Leaching Procedure analytes if sample is collected for waste management purposes.
[d]Results of gamma analysis will be used to determine whether further radioanalytical analysis is warranted.

providing greater protection against a decision error (see Section A.3.2). Corrective action unit 139 CASs with targeted analytes are listed in Table A.3-4. Corrective action site 04-08-02 is the only CAS with a targeted analyte based on process knowledge.

Table A.3-4
Targeted Analytes for CAU 139

CAS	Chemical Targeted Analyte(s)	Radiological Targeted Analyte(s)
04-08-02	N/A	Cesium-137

N/A = Not applicable

A.3.2.3 Contaminants of Concern at Area 9 CASs

Corrective Action Sites 09-23-01 and 09-34-01 will not be investigated because sufficient information has already been collected to make a decision regarding closure alternatives. The COCs at CAS 09-23-01 were generated as a result of the Ganymede safety experiment detonated within the gravel gertie. The safety experiment was a zero-yield test that dispersed uranium and daughter isotopes into the soil. It is assumed that subsurface radionuclide contamination exists in soils below the gravel gertie.

Corrective Action Site 09-34-01 is an underground bunker/monitoring station where data from surrounding testing were collected. The only access to the bunker is by a vertical elevator shaft. Due to the layout as determined by engineering drawings, along with the lack of soil staining around the elevator shaft exit, it was determined that no COCs are present at this CAS.

A.3.2.4 Contaminant Characteristics

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

A.3.2.5 Site Characteristics

Site characteristics are defined by the interaction of physical, topographical, and meteorological attributes and properties. Physical properties include permeability, porosity, hydraulic conductivity, degree of saturation, sorting, chemical composition, and organic content. Topographical and meteorological properties and attributes include slope stability, precipitation frequency and amounts, precipitation runoff pathways, drainage channels and ephemeral streams, and evapotranspiration potential. The site characteristics for the CASs are as follows:

- CAS 03-35-01 is located near the intersection of the Mercury Highway and the 7-01 Road (known as the BJY). The northern area of the site has been disturbed by vehicular activity. The site is flat and the area not affected by traffic is well vegetated.

- CASs 04-08-02 and 04-99-01 are located on the western slopes of the Yucca Valley. The sites slope gently to the east with gravel at the surface. Vegetation typical of the area is present at both sites.

- CASs 06-19-02 and 06-19-03 are located on the floor of the Yucca Valley. The sites are flat with very little vegetation. The surface at CAS 06-19-02 is sandy and fences are present. The surface at CAS 06-19-03 is compacted sand and gravel with a water pipe running along the western edge.

- CAS 09-23-01 is located along the 9-01 Road on the floor of the Yucca Valley. The site is flat with two large piles of gravel and the toe of a berm extending into it. The surface is sandy with little vegetation. A scar from a trench that runs from the north to the south within the site is also present.

- CAS 09-34-01 is located at the northeast corner of the 9-01 Road and old Mercury Highway intersection. A large berm with a concrete station built into the side is present but is not part of the CAS. The surface beyond the berm is compacted sand and gravel with little vegetation.

A.3.2.6 Migration Pathways And Transport Mechanisms

Migration pathways include the lateral migration of potential contaminants across surface soils/sediments and vertical migration of potential contaminants through subsurface soils. Stormwater flow events provide an intermittent mechanism for both vertical and horizontal transport of contaminants. Contaminated sediments entrained by these stormwater events would be carried by the streamflow to locations where the flowing water loses energy and the sediments drop out. These locations are readily identifiable by hydrologists as sedimentation areas. The sites within the Yucca Flat slope gently toward the valley floor. Surface waters with entrained sediments congregate in arroyos and deposit sediments in the Yucca Flat.

Infiltration and percolation of precipitation serves as a driving force for downward migration of contaminants. However, due to high potential evapotranspiration (annual potential evapotranspiration at the Area 3 Radiological Waste Management Site has been estimated at 62.6 in. [Shott et al., 1997]) and limited precipitation for this region (6.7 in. per year [ARL/SORD, 2005]), percolation of infiltrated precipitation at the NTS does not provide a significant mechanism for vertical migration of contaminants to groundwater (DOE/NV, 1992).

A.3.2.7 Exposure Scenarios

Human receptors may be exposed to COPCs through oral ingestion, inhalation, dermal contact (absorption) of soil or debris due to inadvertent disturbance of these materials or irradiation by radioactive materials. The land use and exposure scenarios for the CAU 139 CASs are listed in Table A.3-5. These are based on NTS current and future land use. Although CAS 06-19-02 and CAS 06-19-03 are located within 1 mi of a currently active area, no facilities are present that would allow these to be used as an assigned work station for NTS site personnel. However, as site personnel may periodically perform work at these sites, they are considered to be occasional use areas. Corrective Action Sites 03-35-01, 04-08-02, 04-99-01, and 09-23-01 are at remote locations without any site improvements and where no regular work is performed. There is no exposure scenario for CAS 09-34-01 because no contamination is believed to be present. There is still the possibility, however, that site workers could occupy these locations on an occasional and temporary basis. Therefore, these sites are also classified as occasional use areas.

The future land-use scenarios for the CASs in CAU 139 of Nuclear Test Zone and Nuclear and High Explosives Test Zone (DOE/NV, 1998) support these exposure scenarios. The nature of these future land-use zones (nuclear and explosives testing) ensures that future land use will be consistent with current land uses as described in Table A.3-5.

Table A.3-5
Land-Use and Exposure Scenarios

Corrective Action Site	Record of Decision Land-Use Zone	Exposure Scenario
03-35-01, 04-08-02, 04-99-01	Nuclear and High Explosives Test This 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.	Occasional Use Area Worker will be exposed to the site occasionally (up to 80 hours per year for 5 years). Site structures are not present for shelter and comfort of the worker.
06-19-02, 06-19-03, 09-23-01, 09-34-01	Nuclear Test This area is reserved for dynamic experiments, hydrodynamic tests, and underground nuclear weapons and weapons effects tests. This zone includes compatible defense and nondefense research, development and testing activities.	Occasional Use Area Worker will be exposed to the site occasionally (up to 80 hours per year for 5 years). Site structures are not present for shelter and comfort of the workers.

A.4.0 Step 2 – Identify the Decisions

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

A.4.1 Decision Statements

The Decision I statement is: "Is any COC present in environmental media within the CAS?" Any analytical result for a COPC above the FAL will result in that COPC being designated as a COC. If a COC is detected, then Decision II must be resolved.

The Decision II statement is: "If a COPC is present, is sufficient information available to evaluate potential corrective action alternatives?" Sufficient information is defined to include:

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

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

A.4.2 Alternative Actions to the Decisions

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

A.4.2.1 Alternative Actions to Decision I

If no COC associated with a release from the CAS is detected, then further assessment of the CAS is not required. If a COC associated with a release from the CAS is detected, then the extent of COC contamination will be determined and additional information required to evaluate potential corrective action alternatives will be collected.

A.4.2.2 Alternative Actions to Decision II

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

A.5.0 Step 3 – Identify the Inputs to the Decision

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

A.5.1 Information Needs

To resolve Decision I (determine whether a COC is present at a given CAS), samples need to be collected and analyzed following these two criteria: (1) samples must be collected in areas most likely to contain a COC; and (2) the analytical suite selected must be sufficient to identify any COCs present in the samples.

To resolve Decision II (determine whether sufficient information is available to evaluate potential corrective action alternatives at each CAS), samples need to be collected and analyzed to meet the following criteria:

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

A.5.2 Sources of Information

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

A.5.2.1 Sample Locations

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

Field-screening techniques may be used to select appropriate sampling locations by providing semiquantitative data that can be used to comparatively select samples to be submitted for laboratory analyses from several screening locations. Field screening may also be used for health and safety monitoring and to assist in making certain health and safety decisions. The following field-screening methods may be used to select analytical samples at CAU 139:

- Volatile organic compounds – A photoionization detector, or an equivalent instrument or method, will be used to conduct headspace analysis at CASs 03-35-01, 04-99-01, 06-19-02, and 06-19-03.
- Walkover surface area radiological surveys – A plastic scintillator has been or will be used over approximately 100 percent of the CAS boundaries, as permitted by terrain and field conditions to detect radiologically elevated areas.
- Alpha and beta/gamma radiation – An NT Technology Electra, or equivalent instrument or method, will be used at all CASs

Biasing factors may also be used to select samples to be submitted for laboratory analyses based on existing site information and site conditions discovered during the investigation. The following factors will also be considered in selecting locations for analytical samples at CAU 139:

- Documented process knowledge on source and location of release (e.g., volume of release)
- Stains: Any spot or area on the soil surface that may indicate the presence of a potentially hazardous liquid. Typically, stains indicate an organic liquid such as an oil has reached the soil, and may have spread out vertically and horizontally.
- Elevated radiation: Any location identified during radiological surveys that had alpha/beta/gamma levels significantly higher than surrounding background soil.

- Geophysical anomalies: Any location identified during geophysical surveys that had results indicating surface or subsurface materials existed, and were not consistent with the natural surroundings (e.g., buried concrete or metal, surface metallic objects).

- Drums, containers, equipment or debris: Materials of interest that may have been used at, or added to, a location and that may have contained or come in contact with hazardous or radioactive substances at some point during their use.

- Lithology: Locations where variations in lithology (soil or rock) indicate that different conditions or materials exist.

- Preselected areas based on process knowledge of the site: Locations for which information from historical photographs, experience from previous investigations, or interviews suggest that a release of hazardous or radioactive substances may have occurred.

- Preselected areas based on process knowledge of the contaminant(s): Locations that may reasonably have received contamination, selected on the basis of the chemical and/or physical properties of the contaminant(s) in that environmental setting.

- Previous sample results: Locations that may reasonably have been contaminated based upon the results of previous field investigations.

- Experience and data from investigations of similar sites

- Visual indicators such as discoloration, textural discontinuities, disturbance of native soils, or any other indication of potential contamination

- Presence of debris, waste, or equipment

- Odor

- Physical and chemical characteristics of contaminants

- Other biasing factors: Factors not previously defined for the CAI, but become evident once the investigation of the site is under way. Previous sample or screening results

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

A.5.2.2 Analytical Methods

Analytical methods are available to provide the data needed to resolve the decision statements. The analytical methods and laboratory requirements (e.g., detection limits, precision, and accuracy) are provided in Table 3-2 and Table 3-3 along with specific analyses required for the disposal of IDW.

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

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

A.6.1 Populations of Interest

The population of interest to resolve Decision I ("Is any COC present in environmental media within the CAS?") is any location within the site that is contaminated with any contaminant above a FAL. The populations of interest to resolve Decision II ("If a COC is present, is sufficient information available to evaluate potential corrective action alternatives?") are:

- Each one of a set of locations bounding contamination in lateral and vertical directions.
- IDW or environmental media that must be characterized for disposal.
- Potential remediation waste.
- Environmental media where natural attenuation or biodegradation or construction/evaluation of barriers is considered.

A.6.2 Spatial Boundaries

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

A.6.3 Practical Constraints

Other NTS activities may affect the ability to investigate this site. Underground utilities may exist at the site, which may limit intrusive sampling locations. Other practical constraints include rough terrain and access restrictions. Access restrictions include scheduling conflicts active on the NTS with other entities, areas posted as contamination areas requiring appropriate work controls, the

Table A.6-1
Spatial Boundaries of CAU 139 CASs

Corrective Action Site	Spatial Boundaries
03-35-01	200 ft laterally, 17 ft vertically from debris or anomaly
04-08-02	200 ft laterally outside of CAS boundary, 17 ft vertically
04-99-01	200 ft laterally outside of CAS boundary, 17 ft vertically
06-19-02	200 ft laterally outside of CAS boundary, 17 ft vertically
06-19-03	200 ft laterally beyond trench boundary, area between trenches, 17 ft vertically

water line at CAS 06-19-03, physical barriers (e.g., fences, buildings, steep slopes), and areas requiring authorized access. Additionally, if the CAS 06-19-03 geophysical survey results detect additional trenches, the spacing between adjacent trenches may limit the scope of excavation sampling. Underground utilities surveys will be conducted at each CAS before the start of investigation activities to determine whether utilities exist, and, if so, determine the limit of spatial boundaries for intrusive activities.

A.6.4 Define the Scale of Decision Making

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

A.7.0 Step 5 – Develop a Decision Rule

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

A.7.1 Population Parameters

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

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

A.7.2 Decision Rules

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

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

The decision rules for Decision I are:

If the population parameter (the observed concentration of each analyte) of any COPC in the Decision I population of interest (defined in Step 4) exceeds the corresponding FAL, then that contaminant is identified as a COC, and Decision II samples will be collected. If all COPC concentrations are less than the corresponding FALs, then the decision will be no further action.

The decision rules for Decision II are:

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

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

A.7.3 Action Levels

The PALs presented in this section are to be used for site screening purposes. They are not necessarily intended to be used as cleanup action levels or FALs. However, they are useful in screening out contaminants that are not present in sufficient concentrations to warrant further evaluation and, therefore, streamline the consideration of remedial alternatives. The process that will be used to move from PALs to FALs is that specified by NAC 445A (NAC, 2004). This regulation stipulates that determination of FALs shall be established by an evaluation of the site based on the risk it poses to public health and the environment. This evaluation will be conducted using Method E1739-95, adopted by the ASTM (ASTM, 1995). The ASTM's RBCA process is summarized in Section 3.3. The Tier I action levels for Decision I and Decision II are the PALs defined below and in Section 3.3. If necessary, a Tier 2 or Tier 3 evaluation will be conducted by calculating SSTLs. If a Tier 2 or Tier 3 evaluation is conducted for TPH, the hazardous constituents of TPH will be compared to the SSTLs, as the general measure of TPH provides insufficient information about the amounts of individual COCs within the TPH measurement.

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

A.7.3.1 Chemical PALs

Except as noted herein, the chemical PALs are defined as the EPA Region 9 PRGs for chemical contaminants in industrial soils (EPA, 2004). Background concentrations for RCRA metals and zinc will be used instead of PRGs when natural background concentrations exceed the PRG, as is often the case with arsenic on the NTS. Background is considered the mean plus two standard deviations of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (formerly the Nellis Air Force Range) (NBMG, 1998; Moore, 1999). For detected chemical COPCs without established PRGs that have toxicity and carcinogenicity data listed in the EPA IRIS database (EPA, 2005), the protocol used by the EPA Region 9 in establishing PRGs (or similar) will be used to establish PALs. If used, this process will be documented in the investigation report.

A.7.3.2 Total Petroleum Hydrocarbon PALs

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

A.7.3.3 Radionuclide PALs

The PALs for radiological contaminants (other than tritium) are based on the NCRP Report No. 129 recommended screening limits for construction, commercial, industrial land-use scenarios (NCRP, 1999) scaled to 25 mrem/yr dose constraint (Murphy, 2004) and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993). These PALs are based on the construction, commercial, and industrial land-use scenario provided in the guidance and are appropriate for the NTS based on future land use scenarios as presented in Section A.3.2. The PAL for tritium is based on the UGTA Project limit of 400,000 pCi/L for discharge of water containing tritium to an infiltration basin/area (NNSA/NV, 2002b).

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

A.7.4 Measurement and Analysis Sensitivity

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

A.8.0 Step 6 – Tolerable Limits on Decision Errors

The purpose of this step is to specify performance criteria for the decision rule. Setting tolerable limits on decision errors requires the planning team to weigh the relative effects of threat to human health and the environment, expenditure of resources, and consequences of an incorrect decision. Section 7.1 of the EPA QA/G-4HW guidance states that if judgmental sampling approaches are used, quantitative statements about data quality will be limited to measurement error (EPA, 2000a). Measurement error is influenced by imperfections in the measurement and analysis system. Random and systematic measurement errors are introduced in the measurement process during physical sample collection, sample handling, sample preparation, sample analysis, and data reduction. If measurement errors are not controlled they may lead to errors in making the DQO decisions.

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

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

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

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

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

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

- The development of and concurrence of CSMs (based on process knowledge) by stakeholder participants during the DQO process.

- Testing the validity of conceptual site models based on investigation results.
- Evaluating the quality of the data based on DQI parameters.

A.8.1 False Negative Decision Error

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

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

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

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

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

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

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

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

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

A.8.2 False Positive Decision Error

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

The false positive decision error is controlled by implementing all the controls that protect against false negative decision errors. False positive results are typically attributed to laboratory and/or sampling/handling errors that could cause cross contamination. To control against cross contamination, decontamination of sampling equipment will be conducted according to established and approved procedures and only clean sample containers will be used. To determine whether a false positive analytical result may have occurred, the following QC samples will be collected as required by the Industrial Sites QAPP (DOE/NV, 2002a):

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

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

This section provides the general approach for obtaining the information necessary to resolve Decision I and Decision II. A judgmental (nonprobabilistic) sampling scheme will be implemented to select sample locations and evaluate analytical results. Judgmental sampling allows the methodical selection of sample locations that target the populations of interest (defined in Step 4) rather than non-selective random locations.

Because individual sample results, rather than an average concentration, will be used to compare to FALs, statistical methods to generate site characteristics will not be necessary. Section 0.4.4 of the EPA *Data Quality Objectives Process for Hazardous Waste Site Investigations* (EPA, 2000a) guidance states that the use of statistical methods may not be warranted by program guidelines or site-specific sampling objectives. The need for statistical methods is dependent upon the decisions being made. Section 7.1 of the EPA QA/G-4HW guidance states that a nonprobabilistic (judgmental) sampling design is developed when there is sufficient information on the contamination sources and history to develop a valid CSM and to select specific sampling locations. This design is used to confirm the existence of contamination at specific locations and provide information (such as extent of contamination) about specific areas of the site.

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

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

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

A.9.1 Corrective Action Site 03-35-01, Burn Pit

Corrective Action Site 03-35-01 anomalies revealed during the geophysical survey will be (Figure A.2-2) exposed with a backhoe and investigated to identify or rule out the presence of biasing factors around and beneath the anomalies. The scope of the Decision I investigation, including the investigation to expose the geophysical anomalies, will be limited to a 50-ft radius from the site marker and the finished concrete slab to the south.

The soil beneath and surrounding debris (including debris causing a geophysical anomaly) within this area will be inspected and soil samples will be collected if biasing factors are present. One biased location has been identified for sampling based on the presence of burnt debris. This location can be found in the field as a small scorched area approximately 18 in. in diameter. A minimum of one surface soil sample will be collected from 0 to 0.5 ft bgs at this location. All samples will be analyzed to determine whether COCs are present in the soil resulting from point-source contamination.

A.9.2 Corrective Action Site 04-08-02, Waste Disposal Site

A biased sampling strategy will be applied to CAS 04-08-02 to target the surface soil areas with the highest potential for contamination (i.e., radiologically elevated areas) resulting from stored material during past operations. Two soil samples will be collected from each of three areas defined by the highest radiological survey results. The three areas are shown in Figure A.9-1. These areas will be field screened for further definition and sample selection based on elevated beta/gamma readings. Proposed locations for collecting Decision I samples are provided on Figure A.9-2.

A minimum of two Decision I soil samples will be collected within each of the three elevated reading locations (shown as polygons based on the Figure A.9-1 radiologically elevated areas). The two samples will be collected from 0 to 0.5 ft bgs. A screening sample will be collected below each sample and submitted for analysis to determine that the biasing factor is decreasing or absent. If a screening sample is not collected, then an additional soil sample will be submitted for analysis from that depth interval.

A.9.3 Corrective Action Site 04-99-01, Contaminated Surface Debris

The geophysical anomalies at CAS 04-99-01 will be exposed using a backhoe or handtools and investigated to identify or rule out the presence of biasing factors around and beneath the anomalies. Soil samples will be collected at locations where biasing factors are present.

Additionally, the investigation will include excavating a trench perpendicular to the two small mounds and depressions to determine the presence of any debris or biasing factors. This biased sampling strategy targets the areas most likely to encounter any buried debris that may have released COCs into the surrounding soil. A minimum of one sample will be collected from the trench within each mound/depression based on any biasing factors. A screening sample will be collected below each sample submitted for analysis to determine that the biasing factor is decreasing or absent. If a screening sample is not collected, then an additional soil sample will be submitted for analysis from that depth interval. If biasing factors are absent, then sample selection will be from beneath each mound at the interface with undisturbed native material. If the interface with the underlying native soil cannot be discerned, then the sample will be collected at a depth of 0 to 1 ft bgs. The trench will be excavated to a minimum a depth of 1 ft bgs.

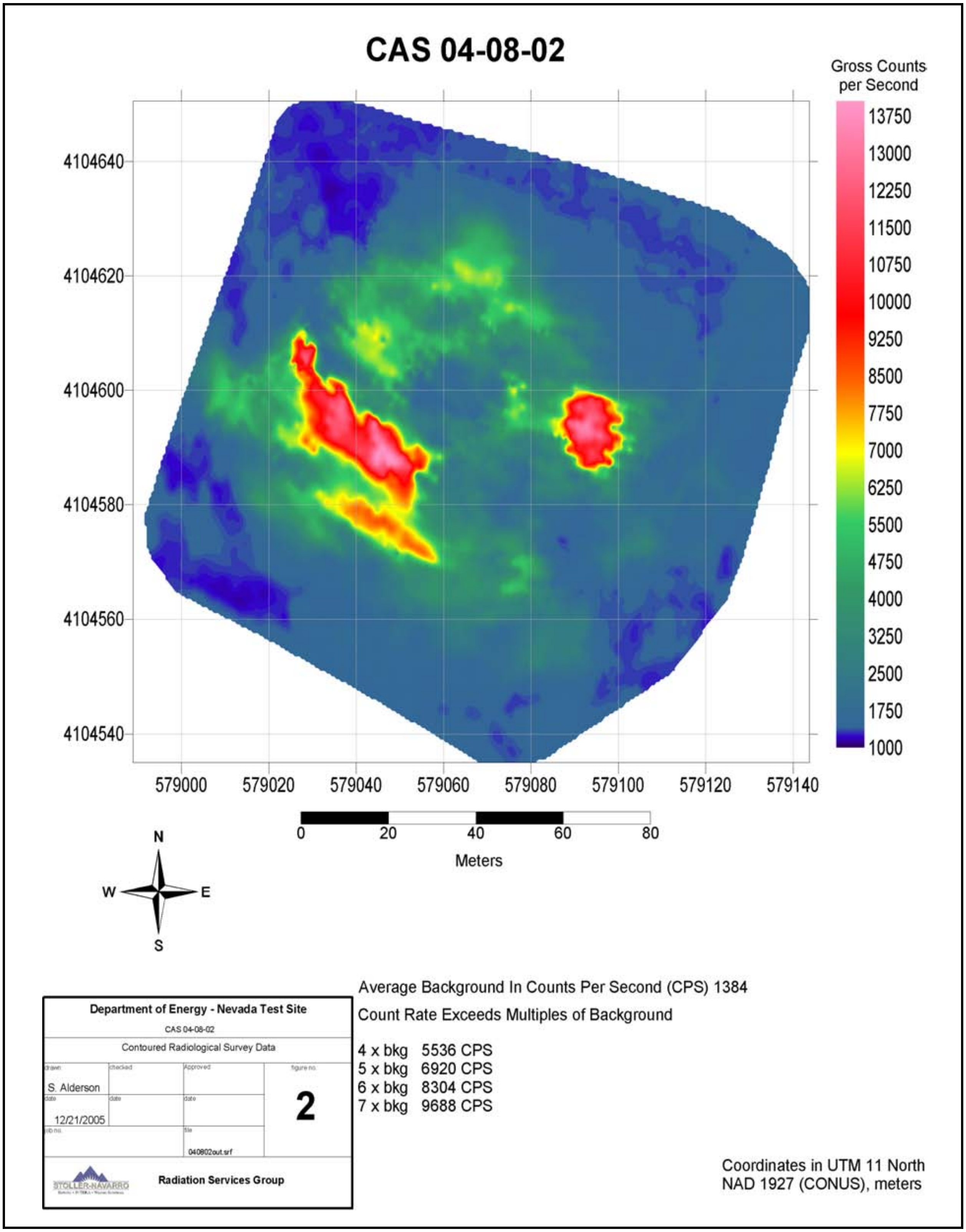

Figure A.9-1
Radiological Survey Results from CAS 04-08-02

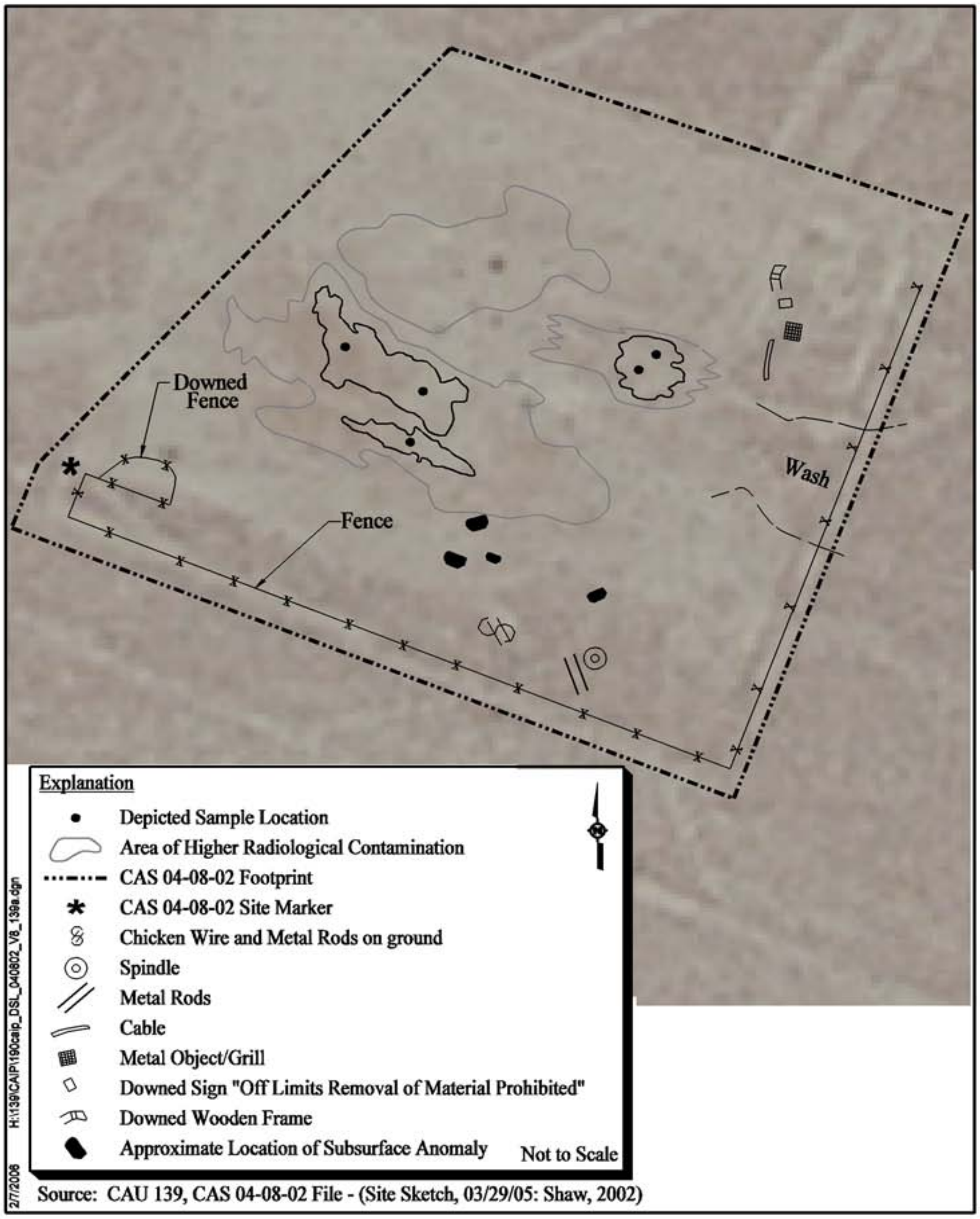

Figure A.9-2
Proposed Sample Locations at CAS 04-08-02

The cans (surface debris) within this area will also be investigated to determine whether COCs are present within the surface soil resulting from residue deposition that may contribute to point-source contamination. A minimum of one surface sample will be collected from 0 to 0.5 ft bgs of the soil beneath the rusted cans. Additional soil samples will be collected from beneath the cans if biasing factors are present. The proposed sample locations are shown in Figure A.9-3.

A.9.4 Corrective Action Site 06-19-02, Waste Disposal Site/Burn Pit

A biased sampling strategy will be applied at CAS 06-19-02 in order to target points with the highest potential for contamination in the surface and subsurface soil at three areas within the CAS footprint. The three areas are identified as the round animal pen, the burn pit, and the waste disposal area. These general areas are shown in Figure A.9-4, and a detailed sampling strategy discussion for each area is provided in this section A minimum of two samples from two locations in the round animal pen will be sampled to investigate the potential that COCs may be in the surface soil due to past livestock activity. A minimum of two soil samples will be collected from locations from within a trench excavated to investigate the presence of any debris or burnt residue and to look for the presence of biasing factors. A minimum of two sample locations from beneath the sand at the waste disposal area. The biased sampling strategy targets the areas most likely to encounter any buried debris that may have leaked COCs into the surrounding soil. Soil samples from the trench to be excavated in the waste disposal area may also be collected based upon field observations.

The surface soil in the round animal pen will be investigated to look for biasing factors. Surface soil samples from depths of 0 to 0.5 ft bgs and 1.0 to 1.5 bgs will be collected at two locations exhibiting biasing factors. A minimum of four soil samples will be collected. The proposed sample locations are shown in Figure A.9-4. If no biasing factors are present, the samples will be collected from the center of the animal pen and from a location 2 ft from the perimeter closest to the burn pit.

The investigation at the burn pit will include excavating a trench east to west across the burn pit area. The location of the trench will be determined in the field, and a minimum of one sample will be collected from the trench material beneath each biasing factor. The investigation and trenching will continue to a minimum depth of 5 ft or to a depth where biasing factors are no longer present, whichever is greater. If there is no evidence of past burial activities (i.e., debris) or biasing factors, a

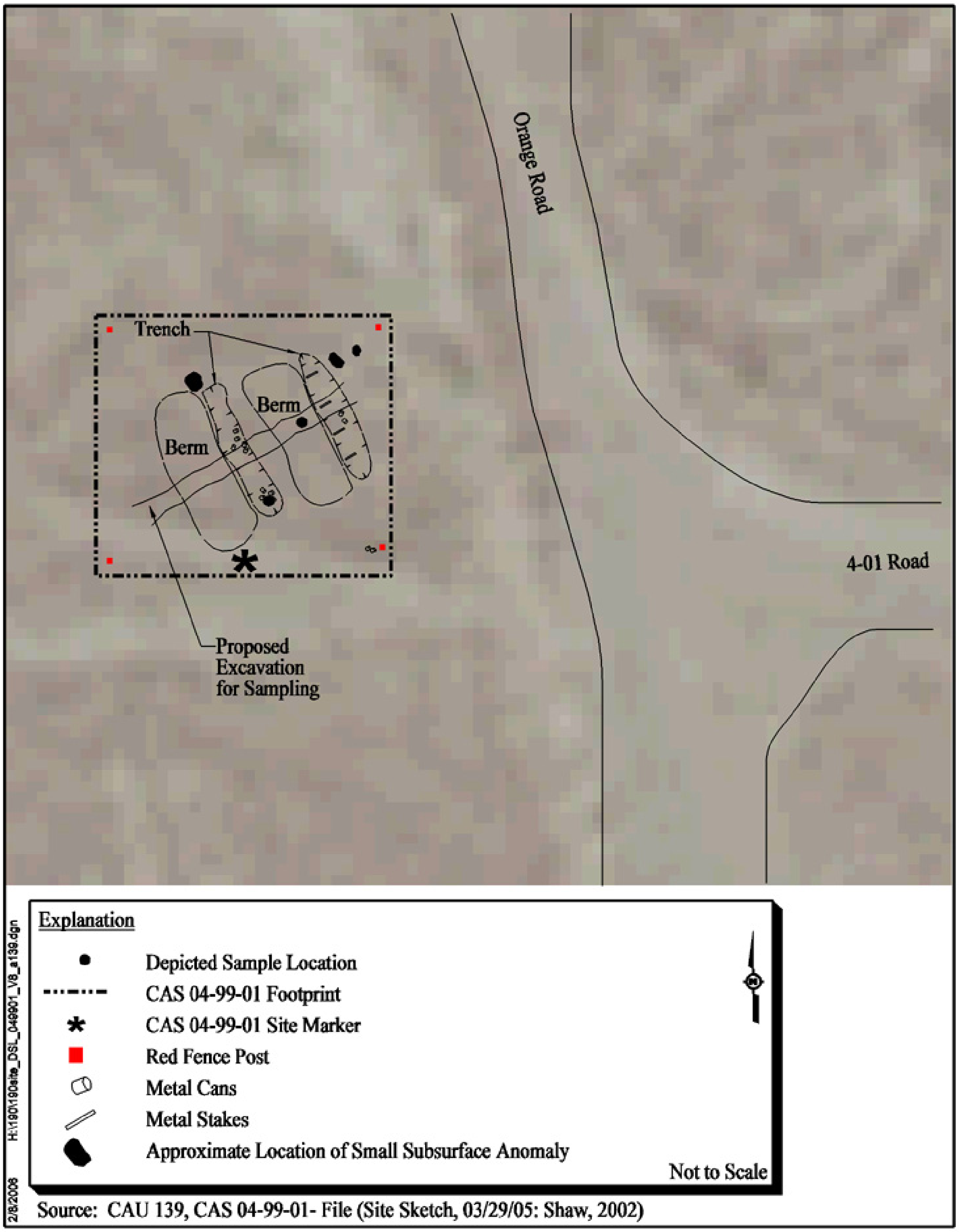

Figure A.9-3
Proposed Sample Locations at CAS 04-99-01

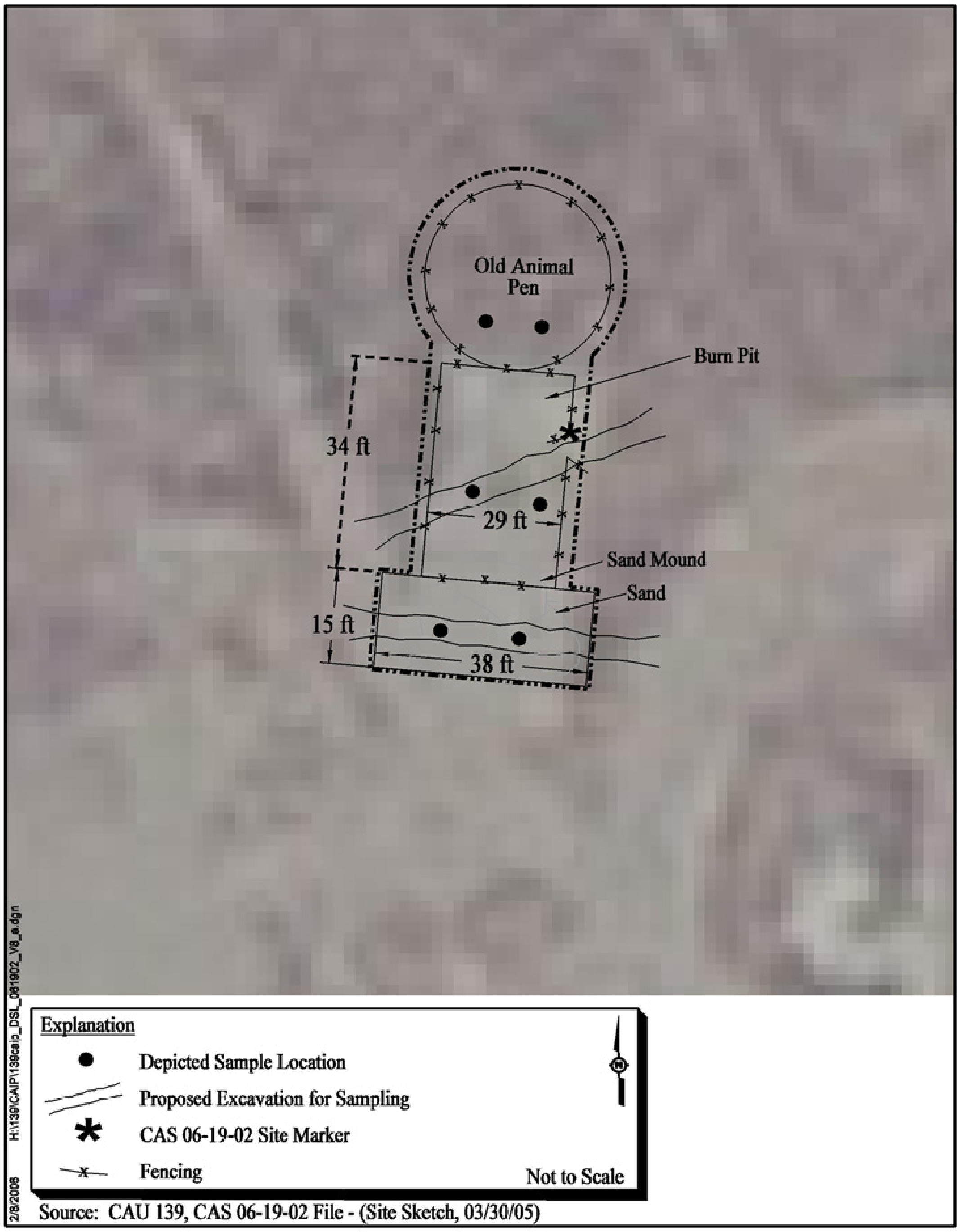

Figure A.9-4
Proposed Sample Locations at CAS 06-19-02

minimum of two soil samples will be collected from a depth of 2.5 to 3.0 ft bgs from within the trench as shown in Figure A.9-4.

The investigation at the waste disposal area will begin by moving the sand aside to expose the native/historical ground surface beneath the sand. If cannot be discerned, then the interface will be assumed to be at surface grade with the surrounding area. Two soil samples will be collected at an interval from the interface depth to 0.5 ft below it, at locations exhibiting biasing factors, if present. Additionally, the investigation will include excavating a trench across the waste disposal area to a minimum depth of 5 ft below the sand/historical surface interface. A minimum of one sample will be collected from within the trench beneath each potential biasing factor or evidence of debris. The excavation and potential sampling will continue to a depth where biasing factors or debris are no longer present. If there is no evidence of past burial activities (i.e., debris) or biasing factors, a minimum of two soil samples will be collected from the proposed samples locations illustrated in Figure A.9-4.

A.9.5 Corrective Action Site 06-19-03, Waste Disposal Trenches

Figure A.9-5 provides a map of the past geophysical survey results and shows a distinct anomaly that is assumed to be associated with the burial trenches. This anomaly and the 2004 trench excavation are the only evidence of subsurface burial. A geophysical survey of all scarred areas surrounding the current survey area will be conducted in an effort to identify or rule out the existence of other trenches in the area. This is shown as a blank area in the upper right corner of Figure A.9-5.

If no additional potential trench anomalies are discovered by conducting this expanded geophysical survey, then a minimum of eighteen soil samples will be collected from six sample locations 5 to 10 ft laterally outside the assumed trench perimeter. Figure A.9-6 shows these six proposed sample locations relative to the assumed trench perimeter based on the known anomaly. This set of six locations will function as Decision I locations to bound the perimeter of the CAS trench, or multiple trenches if more trench anomalies are found. If the field investigation determines that other trenches may be present, then other locations in addition to the set of six will be sampled. Sample collection from locations between trenches will be conducted only if the separation is great enough to allow excavation without encroaching on the existing trenches. A generalized sampling approach as it relates to depth is provided in the follow paragraph.

In general, three samples will be collected from each sample location: one sample collected from a depth of 2.5 to 3.0 ft bgs, a second sample collected from a depth of 7.5 to 8.0 ft bgs, and a third sample collected from a depth of 12.5 to 13.0 ft bgs. Biasing factors are not expected, but if identified (with the exception of buried waste itself), additional soil samples may be collected. All sampling will remain outside of the boundaries of the trenches. If buried material is encountered, it will not be sampled but placed back into the trench, and a new location will be selected further away from the trench(es).

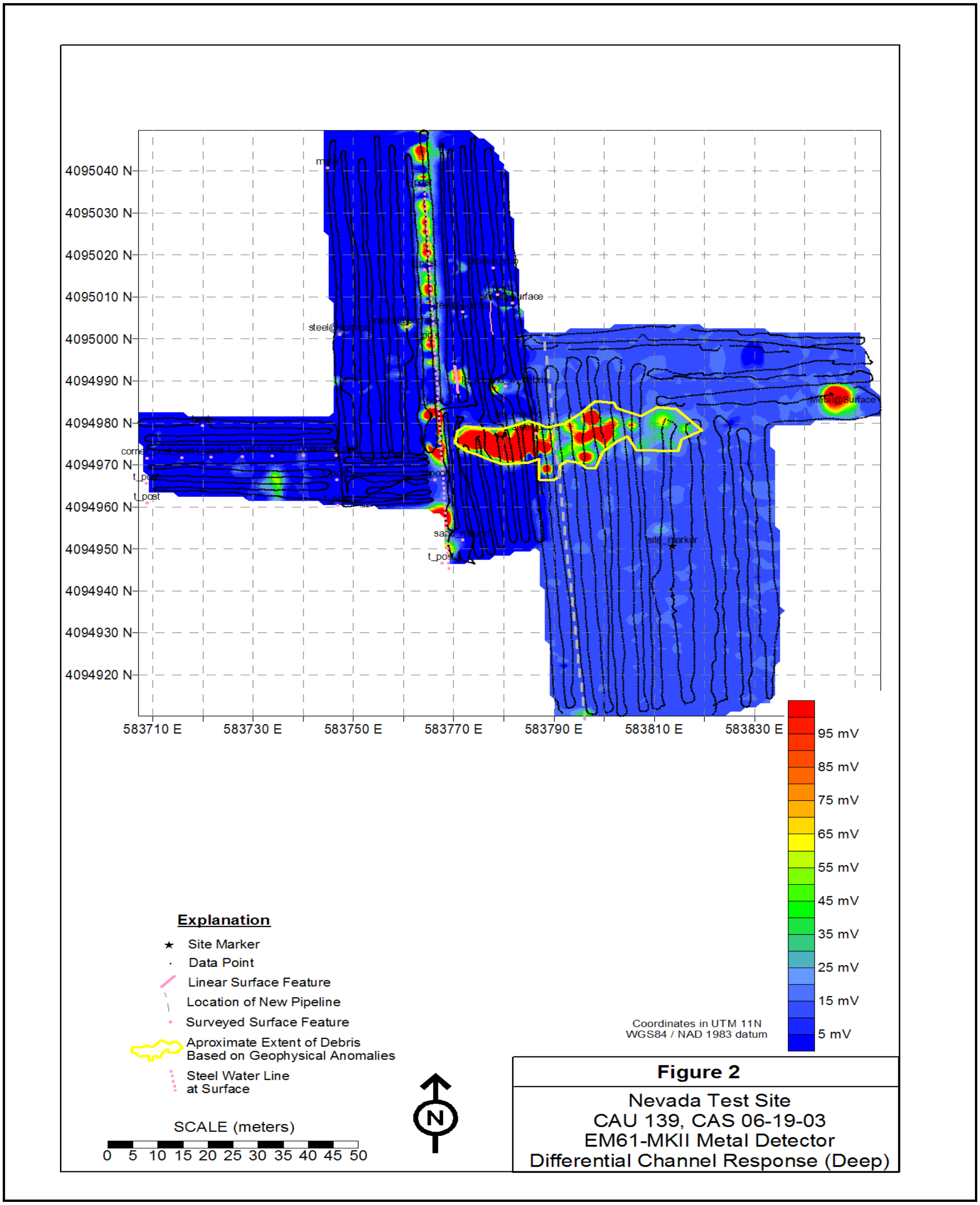

Figure A.9-5
Geophysical Survey from CAS 06-19-03

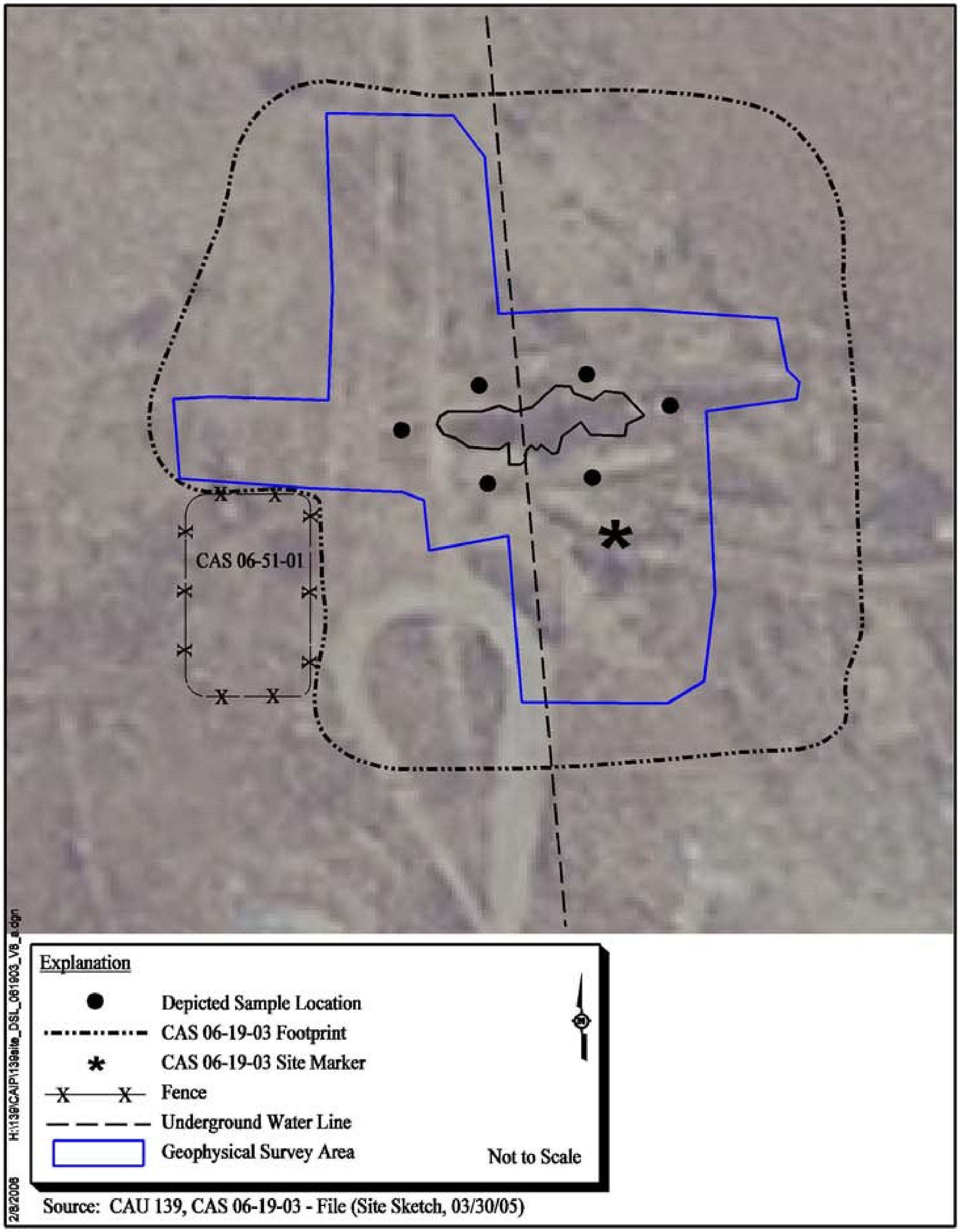

Figure A.9-6
Proposed Sample Locations at CAS 06-19-03

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Appendix B

Project Organization

B.1.0 Project Organization

The NNSA/NSO Acting Sub-Project Director of Industrial Sites and Task Manager is Sabine Curtis. She can be contacted at (702) 295-0542.

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

Appendix C

Nevada Environmental Restoration Project Comments

NEVADA ENVIRONMENTAL RESTORATION PROJECT

DOCUMENT REVIEW SHEET

1. Document Title/Number: Draft Corrective Action Investigation Plan for Corrective Action Unit 139: Waste Disposal Sites, Nevada Test Site, Nevada	**2. Document Date:** 03/15/2006
3. Revision Number: 0	**4. Originator/Organization:** Stoller-Navarro
5. Responsible NNSA/NV ERP Project Manager: Sabine T. Curtis	**6. Date Comments Due:** 03/15/2006
7. Review Criteria: Full	
8. Reviewer/Organization/Phone No: Donald R. Elle, NDEP, 486-2850	**9. Reviewer's Signature:**

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
1.) Section 1.1, Purpose, Page 3	Mandatory	Although no further action is planned for CAS 09-34-01, it would be appropriate to mention the intent to take measures to prevent access.	The following sentence will be included at the end of the paragraph addressing CAS 09-34-01, "As a best management practice, a six ft cyclone fence will be erected around the ramp to the bunker elevator and a "Do Not Enter" sign posted to restrict access to the bunker."	Yes
2.) Appendix A, Table A.3-4	Mandatory	This table appears incomplete. Only one CAS is listed.	The last sentence of Section A.3.2.2 (page A-22) will be changed to read ..."Targeted contaminates for CAU 139 CASs with targeted analytes are listed in Table A.3-4." "Corrective Action Site 04-08-02 is the only CAS with targeted analytes." No changes to Table A.3-4.	Yes

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