Nevada
Environmental
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Project

DOE/NV--1278

National Nuclear Security Administration

Corrective Action Investigation Plan for Corrective Action Unit 561: Waste Disposal Areas Nevada Test Site, Nevada

Controlled Copy No.: ___
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July 2008

Environmental Restoration
Project

U.S. Department of Energy
National Nuclear Security Administration
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CORRECTIVE ACTION INVESTIGATION PLAN FOR CORRECTIVE ACTION UNIT 561: WASTE DISPOSAL AREAS 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 561:
WASTE DISPOSAL AREAS,
NEVADA TEST SITE, NEVADA

Approved by: /s/ Kevin Cabble Date: 7/15/2008

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Table of Contents

Table of Contents (Continued)

Table of Contents (Continued)

Table of Contents (Continued)

Appendix A - Data Quality Objectives

Table of Contents *(Continued)*

Table of Contents (Continued)

Appendix B - Project Organization

Appendix C - Determination of the Number and Location of Random Samples

Appendix D - Nevada Division of Environmental Protection Comment Responses

List of Figures

Number	Title	Page

List of Figures (Continued)

List of Tables

List of Tables *(Continued)*

List of Acronyms and Abbreviations

2,3,7,8 TCDD	2,3,7,8-tetrachloro-p-dibenzo-dioxin
Am	Americium
ASTM	American Society for Testing and Materials
bgs	Below ground surface
CAI	Corrective action investigation
CAIP	Corrective action investigation plan
CAS	Corrective action site
CAU	Corrective action unit
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act*
CFR	*Code of Federal Regulations*
COC	Contaminant of concern
COPC	Contaminant of potential concern
CPS	Counts per second
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
E-MAD	Engine Maintenance, Assembly, and Disassembly
EPA	U.S. Environmental Protection Agency
FAL	Final action level
FFACO	*Federal Facility Agreement and Consent Order*
FSR	Field-screening result

List of Acronyms and Abbreviations *(Continued)*

ft	Foot
gal	Gallon
GPS	Global Positioning System
HASL	Health and Safety Laboratory
HWAA	Hazardous waste accumulation area
IDW	Investigation-derived waste
in.	Inch
ISMS	Integrated Safety Management System
LCS	Laboratory control sample
LLW	Low-level waste
m^2	Square meter
MARSSIM	*Multi-Agency Radiation Survey and Site Investigation Manual*
MDC	Minimum detectable concentration
mg/kg	Milligrams per kilogram
mi	Mile
MLLW	Mixed low-level waste
mm/yr	Millimeters per year
mrem/yr	Millirem per year
MS	Matrix spike
MSD	Matrix spike duplicate
mV	Millivolt
N/A	Not applicable
NAC	*Nevada Administrative Code*
NAD	North American Datum

List of Acronyms and Abbreviations *(Continued)*

NCRP	National Council on Radiation Protection and Measurement
ND	Normalized difference
NDEP	Nevada Division of Environmental Protection
NEPA	*National Environmental Policy Act*
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NRS	*Nevada Revised Statutes*
NSI	Native soil interface
NSTec	National Security Technologies, LLC
NTS	Nevada Test Site
NTSWAC	*Nevada Test Site Waste Acceptance Criteria*
NV/YMP	Nevada Yucca Mountain Project
PAL	Preliminary action level
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzo dioxin
PCDF	Polychlorinated dibenzo furan
pCi/g	Picocuries per gram
POC	Performance Objective for the Certification of Nonradioactive Hazardous Waste
PPE	Personal protective equipment
PRG	Preliminary remediation goal
PSM	Potential source material
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RadCon	Radiological control

List of Acronyms and Abbreviations *(Continued)*

RBCA	Risk-based corrective action
RBSL	Risk-based screening level
RCA	Radiologically controlled area
RCP	Reactor Control Point
RCRA	*Resource Conservation and Recovery Act*
RESRAD	Residual Radioactive
RL	Reporting limit
RMA	Radioactive material area
R-MAD	Reactor Maintenance, Assembly, and Disassembly
RPD	Relative percent difference
SNJV	Stoller-Navarro Joint Venture
SSTL	Site-specific target level
SVOC	Semivolatile organic compound
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total petroleum hydrocarbons
TSCA	*Toxic Substances Control Act*
U	Uranium
UCL	Upper confidence limit
USGS	U.S. Geological Survey
UTM	Universal Transverse Mercator
VOC	Volatile organic compound
VSP	Visual Sample Plan
%R	Percent recovery

Executive Summary

Corrective Action Unit (CAU) 561 is located in Areas 1, 2, 3, 5, 12, 22, 23, and 25 of the Nevada Test Site, which is approximately 65 miles northwest of Las Vegas, Nevada. Corrective Action Unit 561 is comprised of the 10 corrective action sites (CASs) listed below:

- 01-19-01, Waste Dump
- 02-08-02, Waste Dump and Burn Area
- 03-19-02, Debris Pile
- 05-62-01, Radioactive Gravel Pile
- 12-23-09, Radioactive Waste Dump
- 22-19-06, Buried Waste Disposal Site
- 23-21-04, Waste Disposal Trenches
- 25-08-02, Waste Dump
- 25-23-21, Radioactive Waste Dump
- 25-25-19, Hydrocarbon Stains and Trench

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

The sites will be investigated based on the data quality objectives (DQOs) developed on April 28, 2008, by representatives of the Nevada Division of Environmental Protection; U.S. Department of Energy (DOE), National Nuclear Security Administration Nevada Site Office; Stoller-Navarro Joint Venture; and National Security Technologies, LLC. 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 561.

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

The scope of the Corrective Action Investigation for CAU 561 includes the following activities:

- Move surface debris and/or materials, as needed, to facilitate sampling.
- Conduct radiological surveys.
- Perform exploratory excavations.
- Perform field screening.
- Collect and submit environmental samples for laboratory analysis to determine the nature and extent of any contamination released by each CAS.
- Collect samples of source material to determine the potential for a release.
- Collect samples of potential remediation wastes.
- Collect quality control samples.

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; DOE, Environmental Management; U.S. Department of Defense; and DOE, Legacy Management (FFACO, 1996; as amended February 2008). 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. Fieldwork 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) 561: Waste Disposal Areas, Nevada Test Site (NTS), Nevada.

This CAIP has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the State of Nevada; U.S. Department of Energy (DOE), Environmental Management; U.S. Department of Defense; and DOE, Legacy Management (FFACO, 1996; as amended February 2008).

Corrective Action Unit 561 is located in Areas 1, 2, 3, 5, 12, 22, 23, and 25 of the NTS, which is approximately 65 miles (mi) northwest of Las Vegas, Nevada (Figure 1-1). Corrective Action Unit 561 contains the following corrective action sites (CASs):

- 01-19-01, Waste Dump
- 02-08-02, Waste Dump and Burn Area
- 03-19-02, Debris Pile
- 05-62-01, Radioactive Gravel Pile
- 12-23-09, Radioactive Waste Dump
- 22-19-06, Buried Waste Disposal Site
- 23-21-04, Waste Disposal Trenches
- 25-08-02, Waste Dump
- 25-23-21, Radioactive Waste Dump
- 25-25-19, Hydrocarbon Stains and Trench

The Corrective Action Investigation (CAI) will include field inspections, radiological 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.

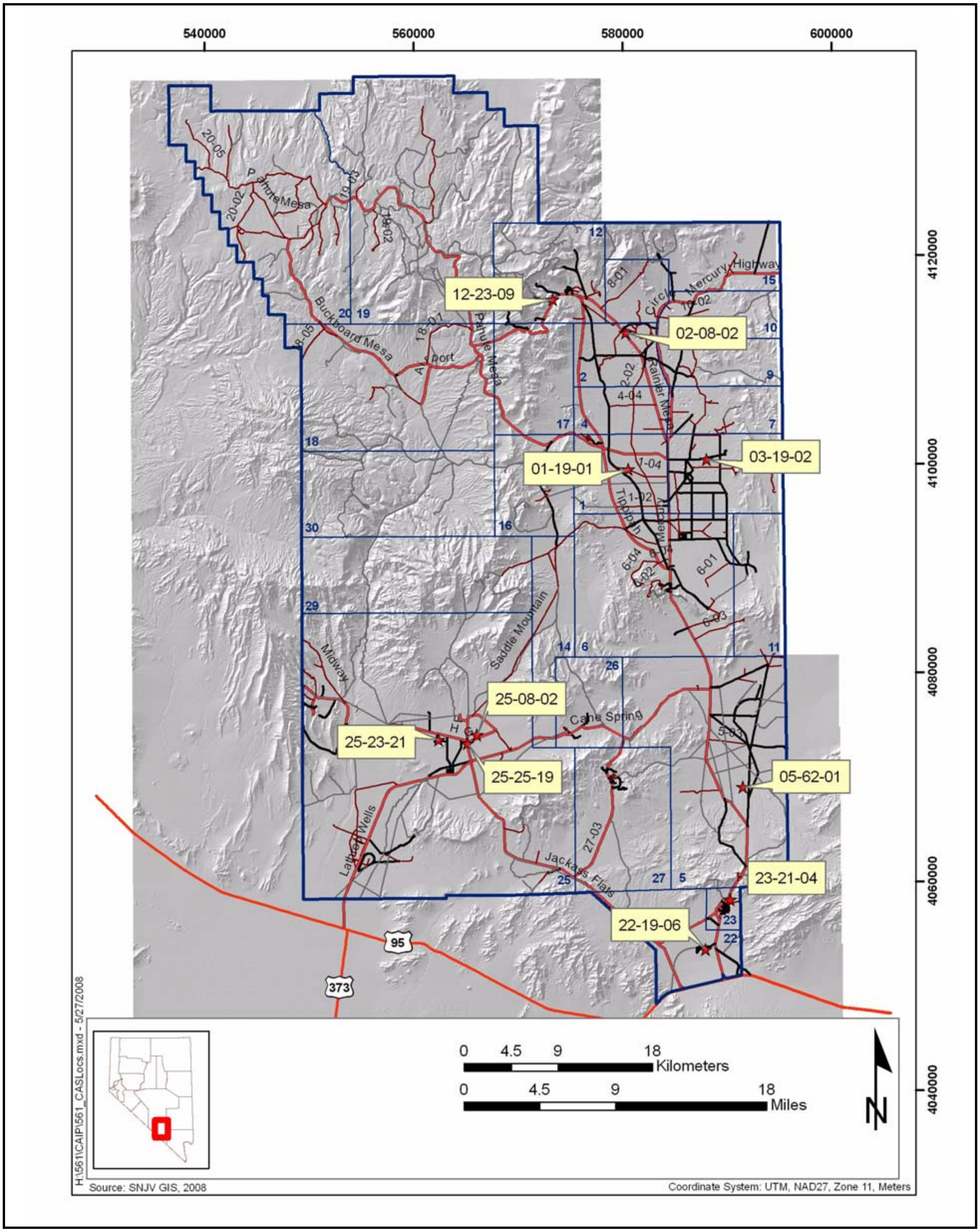

Figure 1-1
Nevada Test Site Map with CAU 561 CAS Locations

1.1 Purpose

The CASs in CAU 561 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 the CASs. Additional information will be generated by conducting a CAI before evaluating and selecting corrective action alternatives.

1.1.1 Corrective Action Unit 561 History and Description

Corrective Action Unit 561, Waste Disposal Areas, consists of 10 inactive sites located throughout the NTS. The 10 CAU 561 sites consist of waste dumps, a burn area, debris piles, radioactive waste dumps, radioactive gravel pile, waste disposal trenches, and a hydrocarbon stain and trench. The CAU 561 sites were all associated with nuclear testing activities conducted at the NTS from the 1950s through the 1980s. Operational histories for each CAU 561 CAS are detailed in Section 2.2.

1.1.2 Data Quality Objectives Summary

The sites will be investigated based on data quality objectives (DQOs) developed by representatives of the Nevada Division of Environmental Protection (NDEP); DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO); Stoller-Navarro Joint Venture (SNJV); and National Security Technologies, LLC (NSTec). 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 561. This CAIP describes the investigative approach developed to collect the data needs identified in the DQO process. While a detailed discussion of the DQO methodology and the DQOs specific to each CAS are presented in Appendix A, a summary of the DQO process is provided below.

The DQO problem statement for CAU 561 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 561." To address this statement, the resolution of two decision questions is required:

- Decision I: "Is any contaminant of potential concern (COPC) associated with the CAS present in environmental media at a concentration exceeding its corresponding final action level (FAL)?" For judgmental sampling, any contaminant associated with a CAS activity that is present at concentrations exceeding its corresponding FAL will be defined as a contaminant of concern (COC). For probabilistic sampling, any COPC for which 95 percent upper confidence limit (UCL) of the mean exceeds its corresponding FAL will be defined as a COC. A COC may also be defined as a contaminant that, in combination with other like contaminants, is determined to jointly pose an unacceptable risk based on a multiple constituent analysis (NNSA/NSO, 2006a). If a COC is detected, then Decision II must be resolved. If a COC is not detected, 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 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 questions 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 561 CAS by collecting and analyzing samples generated during a field investigation. The presence of contamination at each CAS will be determined by collecting and analyzing samples following these criteria:

- For judgmental sampling, samples must be collected in areas most likely to contain a COC.
- For probabilistic sampling, samples must be collected from random locations that represent contamination within the CAS.

1.2 Scope

To generate information needed to resolve the decision statements identified in the DQO processes, the scope of the CAI for CAU 561 includes the following activities:

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

- Collect and submit environmental samples for laboratory analysis to determine the nature and extent of any contamination released by each CAS.

- Collect samples of source material to determine the potential for a release.

- Collect samples of potential remediation wastes.

- Collect quality control (QC) samples.

Contamination of environmental media originating from activities not identified in the conceptual site model (CSM) of any CAS will not be considered as part of this CAU unless the CSM and the DQOs are modified to include the release. If not included in the CSM, contamination originating from these sources will not be considered for sample location selection, and/or will not be considered COCs. If such contamination is present, the contamination will be identified as part of another CAS (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 561. Objectives of the investigation, including CSMs, are presented in Section 3.0. Field investigation and sampling activities are discussed in Section 4.0, and waste management issues for this project are discussed in Section 5.0. General field and laboratory quality assurance (QA) (including collection of QA samples) are presented in Section 6.0 and in the Industrial Sites Quality Assurance Project Plan (QAPP) (NNSA/NV, 2002). The project schedule and records availability are discussed in Section 7.0. Section 8.0 provides a list of references.

Appendix A provides a detailed discussion of the DQO methodology and the DQOs specific to each CAS, Appendix B contains information on the project organization, and Appendix C provides the input parameters and calculations used for the probabilistic sampling design. Appendix D contains responses to NDEP comments on the draft version of this document.

2.0 Facility Description

Corrective Action Unit 561 is comprised of 10 CASs that were grouped together based on the technical similarities (waste disposal) and the agency responsible for closure. The 10 CASs are located in Areas 1, 2, 3, 5, 12, 22, 23, and 25.

2.1 Physical Setting

The following sections describe the general physical settings of Areas 1, 2, 3, 5, 12, 22, 23, and 25 of the NTS. General background information pertaining to topography, geology, hydrogeology, and climatology are provided for these specific areas of the NTS region in the *Geologic Map of the Nevada Test Site, Southern Nevada* (USGS, 1990); *CERCLA Preliminary Assessment of 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).

Geological and hydrological setting descriptions for each of the CASs are detailed in the following subsections based on the hydrogeographic area in which they are located.

2.1.1 Yucca Flat

Corrective Action Sites 01-19-01, 02-08-02, and 03-19-02 are located within the Yucca Flat Hydrographic Area of the NTS. Yucca Flat is a closed basin, which is slowly being filled with alluvial deposits eroding from the surrounding mountains (USGS, 1996).

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, 1996/2006). The average annual precipitation at Station UCC on the Yucca Flat dry lake is 6.62 inches (in.) (NOAA, 2002). The recharge rate to the Yucca Flat area is relatively low (1.76 millimeters per year [mm/yr]), and the thickness of the unsaturated zone extends to more than 600 feet (ft) below ground surface (bgs) (USGS, 1996).

The nearest groundwater well to CAS 01-19-01 is Water Well UE-3c #4, which is an active well located approximately 3.2 mi northeast of the site. The most recent recorded depth to the water table is approximately 2,300 ft bgs. The nearest groundwater well to CAS 02-08-02 is Water Well 2, which is an active well located less than 1 mi northeast of the site. The most recent recorded depth to the water table is approximately 2,051 ft bgs. The nearest active groundwater well to CAS 03-19-02 is Water Well U-3cn #5 located approximately 1.1 mi northwest of the site. The most recent recorded depth to the water table is approximately 1,620 ft bgs (USGS, 2006).

2.1.2 Frenchman Flat

Corrective Action Site 05-62-01 lies within the southern portion of the Frenchman Flat Hydrographic Area, a broad-lined closed basin surrounded by low lying mountains that separate this area from the Mercury Valley Hydrographic Area to the south and from the Yucca Flat Hydrographic Area to the north (USGS, 1996). Erosion of the surrounding mountains has resulted in the accumulation of more than 1,000 ft of alluvial deposits in some areas of Frenchman Flat. Volcanic rocks underlie the alluvium in the northern and western parts of Frenchman Flat and, where exposed, form the surrounding low lying mountains. Carbonate rocks primarily underlie the alluvium in the eastern and southeastern parts of Frenchman Flat and form much of the surrounding mountains in this area (DOE/NV, 1996).

Groundwater flow beneath the Frenchman Flat area occurs primarily within the carbonate-rock aquifer. Generally, the direction of groundwater flow in this region of the aquifer is from the northeast to southwest. Within the overlying alluvial and volcanic aquifers, lateral groundwater flow occurs from the margins to the center of the basin and downward into the carbonate-rock aquifer. The hydraulic gradient in most areas of the alluvial aquifer in Frenchman Flat is relatively flat (less than 1 ft per mile) except near active water wells and/or test wells (USGS, 2003). The average annual precipitation at station Well 5 B, which is located near Frenchman Flat, is 4.85 in. (ARL/SORD, 2006). The recharge rate to the Frenchman Flat area is relatively low (1.39 mm/yr) due to the thick unsaturated zone extending to more than 600 ft bgs (USGS, 2003).

The nearest groundwater well to CAS 05-62-01 is U-5a, an active well located approximately 3.9 mi north. The most recent recorded depth to the water table is approximately 628 ft bgs (USGS, 2006).

2.1.3 Area 12

Corrective Action Site 12-23-09 is located in Area 12 near the base of the eastern slope of Rainier Mesa close to the base of Dolomite Hill. It is near the surficial expression of the Tongue Wash Fault, a northeast-trending sinistral-reverse fault that dips approximately 45 degrees to the west (DRI, 1996).

The CAS located in Area 12 is within the Ash Meadows groundwater sub-basin. In the Rainier Mesa area, the boundary between the Ash Meadows and Alkali Flat/Furnace Creek sub-basins has been located on the basis of hydrography. It is unlikely that this groundwater sub-basin boundary coincides with the hydrographic divide. A more realistic scenario is the groundwater sub-basin boundary is defined by the relatively impermeable Eleana Formation. If this is true, groundwater may drain into the Alkali Flat/Furnace Creek sub-basin (via Timber Mountain) with flow ultimately discharging in Alkali Flat and Furnace Creek in Death Valley. If the current boundary is correct, then the ultimate discharge area for groundwater flow originating near the CAS would be the springs at Ash Meadows and perhaps Death Valley (via Yucca and Frenchman Flats) (DRI, 1996).

Surface water at CAS 12-23-09 drains into Tongue Wash, which eventually flows into other ephemeral channels draining east into Yucca Flat, a closed hydrographic basin (DRI, 1996).

The nearest groundwater well to CAS 12-23-09 is ER-12-1, an active well located approximately 0.6 mi west. The most recent recorded depth to the water table is approximately 1,520 ft bgs (USGS, 2006).

2.1.4 Mercury Valley

Corrective Action Sites 22-19-06 and 23-21-04 are located within the Mercury Valley basin. Mercury Valley covers an area of approximately 70 square miles and ranges in elevation from 3,050 to 4,200 ft. The valley is a transition zone between the northern edge of the Mojave Desert and the southern portion of the Great Basin Desert.

Groundwater beneath Mercury Valley occurs within alluvium and lower carbonate aquifers and within the upper clastic and lower clastic aquitards (DRI, 1988). Surface drainage and groundwater flow in the Mercury Valley is in the southwest direction. The average annual precipitation at the

Mercury Gauging Station is approximately 5.59 in. (NOAA, 2002). The nearest groundwater well to CAS 23-21-04 is U.S. Geological Survey (USGS) Well SM-23-1, an active well located approximately 1.7 mi southwest of the site. This is also the nearest well to CAS 22-19-06 and is 1.8 mi north. The most recent recorded depth to the water table is approximately 1,164 ft bgs (USGS, 2006). The recharge rate to the Mercury Valley area is relatively low (0.97 mm/yr) due to the thick unsaturated zone extending to more than 1,100 ft bgs (USGS, 2003).

2.1.5 Area 25, Jackass Flats

Corrective Action Sites 25-08-02, 25-23-21, and 25-25-19 are located in Area 25 within the Jackass Flats basin. The soil surrounding the sites are typical desert alluvium composed of mostly fine soil and loose rocks. Depth to bedrock and the existence of localized caliche is unknown in these areas. Area 25 (Jackass Flats) is an intermontane valley of the NTS bordered by highlands on all sides except for a large drainage outlet to the southwest. Elevations range from 3,400 to 5,600 ft above mean sea level. The Jackass Flats basin is underlain by alluvium, colluvium, and volcanic rocks of Cenozoic age. The alluvium and colluvium (with thickness of upwards to 1,000 ft) are above the saturated zone throughout most of Jackass Flats. Paleozoic age sedimentary rocks, limestones, and dolomites occur at greater depths (DRI, 1988; USGS, 1964). Depths to groundwater for the three water supply wells located within Area 25 are approximately 1,039 ft, 927 ft, and 740 ft bgs (USGS, 1993).

The nearest groundwater well to CASs 25-08-02, 25-23-21, and 25-25-19 is the J-11 Water Well, which is located 2.5 mi southwest, 2.0 mi southeast, and 1.8 mi southwest, respectively. The most recent recorded depth to the water table is approximately 1,164 ft bgs (USGS, 2006).

2.2 Operational History

The following subsections provide a description of the use and history of each CAS in CAU 561 that may have resulted in potential releases to the environment. The CAS-specific summaries are designed to describe the current definition of each CAS and illustrate all significant, known activities.

2.2.1 Corrective Action Site 01-19-01, Waste Dump

Corrective Action Site 01-19-01 consists of a fenced subsurface waste dump located east of Building 1-31.2e1 in Area 1. Visible debris at the surface consists of concrete chunks, rebar, red brick pieces, and wood. The waste dump is believed to contain construction debris from a former two-story brick house associated with the Apple II test. However, after a comprehensive review of available site information, the source of the construction debris is unknown. There is a potential for radiological contamination of the soil and debris at the fenced waste dump. Figure A.2-2 shows the locations of the waste dump and visible debris.

2.2.2 Corrective Action Site 02-08-02, Waste Dump and Burn Area

Corrective Action Site 02-08-02 consists of two components, a burn area as evidenced by soil staining, and a surface waste dump located at the southern end of Area 2 Camp in Area 2 of the NTS. After a comprehensive review of available site information, the source of the construction debris piles is unknown. The waste dump contains piles of dirt and boulders with scattered debris consisting of metal cables, wires, wooden planks, metal, a tire, pipes, sheet metal, and a 55-gallon (gal) rusted green metal drum. The piles were placed on the ground between 1983 and 1985, as determined by review of aerial photographs. The burn area, located northwest of the waste dump, contains visible debris including scattered nails, metal, wood, bits of charcoal, and previously molten lead and aluminum on the ground surface. There is a potential for hydrocarbon contamination of soil (because diesel or other fuels may have been used as an accelerant) as well as lead and aluminum contamination of the soil. Figure A.2-3 shows the locations of the waste dump and burn area.

2.2.3 Corrective Action Site 03-19-02, Debris Pile

Corrective Action Site 03-19-02 consists of a surface debris pile located in the north-central portion of Area 3 of the NTS. The debris pile consists of large items of rebar, concrete, and steel. There are “Caution Radioactive Materials” postings throughout the area. The boundary of the CAS is located around the postings. The site may be associated with the Pommard test, which was conducted on March 14, 1968. There is a potential for radiological contamination of the soil and debris at the site. Figure A.2-4 shows the locations of the debris pile.

2.2.4 Corrective Action Site 05-62-01, Radioactive Gravel Pile

Corrective Action Site 05-62-01 consists of a gravel pile with debris located approximately 1,000 ft west of CAS 05-23-01, Gravel Gertie, in Area 5 of the NTS. The gravel pile is present in a 1966 aerial photograph. The pile also contains what is believed to be concrete and metal debris from the Gravel Gertie. The CAS is located within a double-strand, yellow rope fence measuring 122 by 98 ft with “Caution Radioactive Material” postings. There is a potential for radiological contamination of the soil due to the gravel pile. Figure A.2-5 shows the locations of the radioactive gravel pile.

2.2.5 Corrective Action Site 12-23-09, Radioactive Waste Dump

Corrective Action Site 12-23-09 consists of two rectangular fenced areas (“north” and “south”) that include one area of potential subsurface debris and elevated radioactivity. The site was labeled as a radioactive waste dump on a topographic map; however, the site is believed to have been used as an electricians’ laydown yard based on interviews with personnel familiar with the site. The CAS is located approximately 150 ft northwest of the Stockade Wash Road, just north of E-Tunnel Road, in Area 12 of the NTS. There is a potential for radiological contamination of the soil at the site. Figure A.2-6 shows the locations of the radioactive waste dump.

2.2.6 Corrective Action Site 22-19-06, Buried Waste Disposal Site

Corrective Action Site 22-19-06 consists of a waste dump with buried debris identified by a geophysical survey. There is a potential for releases to surrounding soils associated with buried debris. The buried debris identified by the geophysical survey does not resemble tanks. After a comprehensive review of available site information, the source of the debris is unknown. A 1966 aerial photograph shows three aboveground tanks in the same area as the buried waste dump; however, these tanks were not present in a 1980 aerial photograph. Available records indicate the tanks (10,000 gallons each) were used for fuel at a former gas station (CAU 130, located adjacent to the waste dump) and were removed from the site before 1991 (USACE, 1994). There were no records found documenting how the tanks were removed or the exact date of removal. No surface soil staining was observed during a site visit conducted on April 11, 2008. The site is located at the southeast end of Camp Desert Rock in Area 22 of the NTS. Figure A.2-7 shows the locations of the buried waste disposal site located near the concrete foundation of Building T-951 (the former gas station), which is being included in the CAU 130 investigation.

2.2.7 Corrective Action Site 23-21-04, Waste Disposal Trenches

Corrective Action Site 23-21-04 consists of six trenches and one potential covered trench located approximately 1,500 ft northeast of Building 23-160 in Area 23 of the NTS. Three of the trenches contain debris (wood, metal, cables/wire, lead bricks, aerosol cans, nails, bolts, a metal water can, a drill bit, machine parts, and metal frame) and some stained soil. After a comprehensive review of available site information, the source of the construction debris piles is unknown. The other three trenches appear to be empty. The potential covered trench is located at the southern end of the site. There is a potential for lead contamination of the soil due to waste disposal of bricks in the trenches. Figure A.2-8 shows the locations of the buried waste disposal trenches.

2.2.8 Corrective Action Site 25-08-02, Waste Dump

Corrective Action Site 25-08-02 consists of a large waste dump located north of G Road between the Reactor Control Point (RCP) and Reactor Maintenance, Assembly, and Disassembly (R-MAD) Complex in Area 25 of the NTS. After a comprehensive review of available site information, the source of the construction debris piles is unknown. The waste dump contains piles of dirt, rock, and debris such as chunks of concrete, metal, wires, cinder blocks, a lead brick, asphalt pieces, wood, an empty cable spool, clay pipes, hoses, rusted cans, batteries (likely lead-acid type), 5-gal buckets, and bottles. There is also an area of unknown solidified, darker, rock-like material. There is a potential for lead and metals contamination of the soil from debris within the waste dump from bricks and batteries. Figure A.2-9 shows the locations of the waste dump.

2.2.9 Corrective Action Site 25-23-21, Radioactive Waste Dump

Corrective Action Site 25-23-21 consists of a radioactive waste dump located northeast of the Engine Maintenance, Assembly, and Disassembly (E-MAD) Facility in Area 25 of the NTS. The site also contains numerous scattered piles of debris north of the posted area along the Topopah Wash extending north to H Road and a second parcel of numerous scattered piles of debris north along the Topopah Wash extending north of H Road. After a comprehensive review of available site information, the source of the debris piles is unknown. The waste dump contains numerous dirt mounds and piles within a posted "Controlled Area" and also miscellaneous piles and some debris extending up the wash to H Road. There are two specific dirt mounds that are posted with "Caution Radioactive Material" signs. The debris within the dirt mounds and berms consists of wood, metal, pipes, cables, wires, and concrete chunks. The second parcel also contains concrete, asphalt, ballast, in addition to typical dump piles. There is a potential for radiological contamination of the soil and debris at the radioactive waste dump and the wash. Figure A.2-10 shows the locations of the radioactive waste dump, scattered piles in the extended area, and the second parcel. Figure A.2-11 shows the radioactive waste dump.

2.2.10 Corrective Action Site 25-25-19, Hydrocarbon Stains and Trench

Corrective Action Site 25-25-19 consists of several components including surface soil stains, a tar spill, trenches, concrete pads (one may contain a sump), debris, asphalt piles, rock and soil piles. The RCP facility is located just northwest of the CAS. Sources of the releases may include leaking vehicles and heavy equipment, maintenance and motor pool activities, surface debris, and potential buried debris. The CAS encompasses an approximately 8-acre area that is located southeast of the intersection of C Road (Jackass Flats Road) and G Road in Area 25 of the NTS. There is a potential for hydrocarbon contamination of the soil. Figure A.2-13 shows the locations of the hydrocarbon stains and the associated trenches.

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. Historical information and site visits indicate that the sites contain wastes such as construction materials, equipment, and other miscellaneous debris. Waste generated at all CASs may be comprised of debris, investigation-derived waste (IDW), decontamination liquids and soils. Potential waste types at all CASs include sanitary, hazardous, hydrocarbon waste, low-level radioactive waste (LLW), and mixed low-level radioactive waste (MLLW).

2.3.1 Corrective Action Site 01-19-01, Waste Dump

Waste items identified at CAS 01-19-01 include visible surface debris (concrete chunks, rebar, red brick pieces, and wood). Potential waste types may include LLW.

2.3.2 Corrective Action Site 02-08-02, Waste Dump and Burn Area

Waste items identified at CAS 02-08-02 includes scattered debris consisting of metal cables, wires, wooden planks, metal, a tire, pipes, sheet metal, and a 55-gal rusted green metal drum at the waste dump area. The burn area, located northwest of the waste dump, contains visible debris including scattered nails, metal, wood, bits of charcoal, and lead and aluminum hardened on the ground surface. Potential waste types include hydrocarbon waste and hazardous waste associated with the lead.

2.3.3 Corrective Action Site 03-19-02, Debris Pile

Solid waste items identified at CAS 03-19-02 include large pieces of concrete, rebar, and steel debris on the surface and partially buried. Potential waste types include LLW.

2.3.4 Corrective Action Site 05-62-01, Radioactive Gravel Pile

Solid waste items identified at CAS 05-62-01 include a gravel pile, metal mesh, and concrete, which is on the surface of the pile and also partially buried. Potential waste types include LLW.

2.3.5 Corrective Action Site 12-23-09, Radioactive Waste Dump

Solid waste items identified at CAS 12-23-09 include debris within a soil mound. There is no evidence of surface debris; however, geophysical surveys concluded that there is buried metallic debris present at soil mound. Potential waste types include LLW and polychlorinated biphenyl (PCB) waste from previous use as an elections laydown yard.

2.3.6 Corrective Action Site 22-19-06, Buried Waste Disposal Site

Solid waste items identified at CAS 22-19-06 include potentially hydrocarbon impacted soil and associated miscellaneous construction debris. Potential waste types include hydrocarbon waste.

2.3.7 Corrective Action Site 23-21-04, Waste Disposal Trenches

Solid waste items identified at CAS 23-21-04 include debris (wood, metal, cables/wire, lead bricks, aerosol cans, nails, bolts, a metal water can, a drill bit, machine parts, and a metal frame) and stained soil. Potential waste types include hydrocarbon waste, hazardous waste associated with aerosol cans, and hazardous or MLLW associated with lead.

2.3.8 Corrective Action Site 25-08-02, Waste Dump

Solid waste items identified at CAS 25-08-02 include numerous piles and a mound containing dirt, rock, and debris such as chunks of rock, broken concrete, metal, wires, cinder blocks, a lead brick, asphalt pieces, wood, an empty cable spool, clay pipes, hoses, rusted cans, batteries (possibly lead-acid), 5-gal buckets, and bottles. There is also an area of unknown solidified, darker, concrete-like material. Likely waste types include hydrocarbon waste and hazardous or MLLW associated with lead and batteries.

2.3.9 Corrective Action Site 25-23-21, Radioactive Waste Dump

Solid waste items identified at CAS 25-23-21 include debris within the dirt mounds and berms. Visible debris consists of wood, metal, pipes, cables, wires, and some concrete chunks. Potential waste types include LLW.

2.3.10 Corrective Action Site 25-25-19, Hydrocarbon Stains and Trench

Solid waste items identified at CAS 25-25-19 include a tar spill, debris, asphalt piles, and hydrocarbon impacted soil. Potential waste types include hydrocarbon waste.

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 561 CASs beyond a shallow layer of surface soil. Potentially affected media for all CASs include surface and shallow subsurface soil. 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 within close proximity of radiologically contaminated materials.

The following subsections contain CAS-specific descriptions of known or suspected releases associated with CAU 561.

2.4.1 Corrective Action Site 01-19-01, Waste Dump

Potential releases may have occurred when the waste was placed in the waste dump. Waste disposed of in the landfill may contain contaminants that leaked into the surrounding soils at the site. 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 debris.

2.4.2 Corrective Action Site 02-08-02, Waste Dump and Burn Area

Potential releases may have occurred when the waste piles were placed on the ground surface at the waste dump. Waste disposed of in and around the piles may contain contaminants that leaked into the surrounding soils at the site. 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 debris.

At the burn area, potential releases occurred when the wastes were placed on the ground surface and ignited. Waste in and around the burn area may contain contaminants that leaked into the surrounding soils at the site. If a release occurred, it is expected to be close to the surface and in proximity to the visibly burned areas of the site in the surface soils.

2.4.3 Corrective Action Site 03-19-02, Debris Pile

Potential releases may have occurred when the debris piles were placed on the ground surface. Waste disposed of in and around the piles may contain contaminants that leaked into the surrounding soils at the site. 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 debris.

2.4.4 Corrective Action Site 05-62-01, Radioactive Gravel Pile

Potential releases may have occurred when the gravel piles were placed on the ground surface. Waste disposed of in and around the piles may contain contaminants that leaked into the surrounding soils at the site. If a release occurred, contaminants are expected to be in the soils within proximity to the surface and subsurface soils beneath the gravel pile.

2.4.5 Corrective Action Site 12-23-09, Radioactive Waste Dump

Potential releases may have occurred when the waste was placed in the waste dump. Waste disposed of in the landfill may contain contaminants that leaked into the surrounding soils at the site. If a release occurred, it would be in the soils surrounding the buried debris.

2.4.6 Corrective Action Site 22-19-06, Buried Waste Disposal Site

Potential releases may have occurred when the wastes were placed in the landfill. Waste disposed of in and around the landfill may contain contaminants that leaked into the surrounding soils at the site. 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 landfill.

2.4.7 Corrective Action Site 23-21-04, Waste Disposal Trenches

Potential releases may have occurred when the waste piles were placed in the trenches. Waste disposed of in and around the trenches may contain contaminants that leaked into the surrounding soils at the site. Debris in the six open and one covered trench may have contamination that leaked into the surrounding soils. 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 trenches.

2.4.8 Corrective Action Site 25-08-02, Waste Dump

Potential releases may have occurred when the waste piles were placed on the ground surface at the waste dump. Waste disposed of in and around the piles may contain contaminants that leaked into the surrounding soils at the site. 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 debris.

2.4.9 Corrective Action Site 25-23-21, Radioactive Waste Dump

Potential releases may have occurred when the waste piles and mounds were placed on the ground surface at the waste dump. Waste disposed of in and around the piles may contain contaminants that leaked into the surrounding soils at the site. If a release occurred, contaminants would have been limited in volume and are expected to be located in the soil within close proximity to piles. Because the piles are located within the Topopah Wash, there is a potential for some contaminants to migrate down the wash.

2.4.10 Corrective Action Site 25-25-19, Hydrocarbon Stains and Trench

Potential releases may have occurred when the waste piles and spills were placed on the ground surface at the site. Waste disposed of in and around the trenches and spills may contain contaminants that leaked into the surrounding soils at the site. 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 waste piles and spills.

2.5 Investigative Background

The following subsections summarize all known investigations conducted at the CAU 561 sites. More detailed discussions of these investigations are found in Appendix A. No previous investigative analytical results have been identified for soils or materials currently present at any of the CAU 561 CASs.

2.5.1 Corrective Action Site 01-19-01, Waste Dump

In 2006, a gamma radiological walkover survey was performed within the fenced area. No areas of elevated radioactivity were identified as measured levels from the CAS area were not distinguishable from local background levels.

Geophysical surveys were performed in 2004 and identified buried metallic debris (Figure A.9-1) in the areas identified for this CAS (Fahringer, 2004b).

2.5.2 Corrective Action Site 02-08-02, Waste Dump and Burn Area

In 2006, a gamma radiological walkover survey was performed on the piles and, in 2008, a gamma radiological walkover survey was performed on the burn area. No areas of elevated radioactivity were identified because measured levels from the CAS area were not distinguishable from local background levels.

Geophysical surveys were performed at the burn area only (see Figure A.9-2) and identified surface and near-surface buried metallic debris (Fahringer, 2006a).

2.5.3 Corrective Action Site 03-19-02, Debris Pile

In 2007, a gamma radiological walkover survey was performed on the site. No areas of elevated radioactivity were identified because measured levels from the CAS area were not distinguishable from local background levels in the soil; however, two locations on the concrete debris were found to contain fixed readings above background. The gamma radiological walkover survey of the debris pile is shown in Figure A.9-4.

2.5.4 Corrective Action Site 05-62-01, Radioactive Gravel Pile

In 2006, a gamma radiological walkover survey for this CAS was performed. No areas of elevated radioactivity were identified because measured levels from the CAS area were not distinguishable from local background levels.

2.5.5 Corrective Action Site 12-23-09, Radioactive Waste Dump

In 2006, a gamma radiological walkover survey was performed for the north fenced area. The results of this survey identified an area of radioactivity from 2 to 5 times higher than background levels at the soil mound (see Figure A.9-7). A 2008 gamma radiological walkover survey was performed of the south fenced area. No areas of elevated radioactivity were identified as measured levels from the south fenced area were not distinguishable from local background levels.

Geophysical surveys were performed in the area of the soil mound (Fahringer, 2006b) and identified buried metallic debris (see Figure A.9-8). This is the same area (i.e., soil mound) where elevated radioactivity was identified.

2.5.6 Corrective Action Site 22-19-06, Buried Waste Disposal Site

There were no documented radiological surveys for this CAS. Geophysical surveys were performed in 2004 and identified buried metallic debris (see Figure A.9-10) in the area of the disposal trench (Fahringer, 2004a).

2.5.7 Corrective Action Site 23-21-04, Waste Disposal Trenches

There were no documented radiological surveys for this CAS. Geophysical surveys were performed in 2006 that did not identify buried metallic debris in the areas identified for this CAS (including the covered trench [Fahringer, 2006a]).

2.5.8 Corrective Action Site 25-08-02, Waste Dump

In 2006, a gamma radiological walkover survey was performed at this CAS. No areas of elevated radioactivity were identified because measured levels from the CAS area were not distinguishable from local background levels. No geophysical surveys were performed for this CAS.

2.5.9 Corrective Action Site 25-23-21, Radioactive Waste Dump

In 2005, a gamma radiological walkover survey was performed of the waste dump area. The results of this survey identified an area (outside the posted controlled area) of radioactivity from 2 to 5 times higher than background levels (see Figure A.2-12). During a 2008 site walk, partially buried pipes were observed inside the two posted radioactive material areas that exhibited surface contamination readings above background.

Geophysical surveys were performed and did not identify buried metallic debris in the areas identified for this CAS (Fahringer, 2005b).

2.5.10 Corrective Action Site 25-25-19, Hydrocarbon Stains and Trench

In 2008, a gamma radiological walkover for the area was performed at this CAS. No areas of elevated radioactivity were identified because measured levels from the CAS area were not distinguishable from local background levels.

Geophysical surveys were performed in 2007 and did not identify buried metallic debris in the areas identified for this CAS (Fahringer, 2007).

2.5.11 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 561.

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 561. 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 561 and formulation of the CSM. Also presented is a summary listing of the contaminants reasonably suspected to be present at each CAS (i.e., target contaminants), the COPCs, the preliminary action levels (PALs) for the investigation, and the process used to establish 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 561 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 flow chart representation of the conceptual pathways to receptors from CAU 561 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 evidence will be reviewed, the CSM revised, the DQOs reassessed, and a recommendation 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 561.

3.1.1 Land-Use and Exposure Scenarios

Corrective Action Sites 01-19-01, 02-08-02, 03-19-02, and 12-23-09 are located in the land-use zone described as the “Nuclear and High Explosives Test Zone,” which is designated for additional

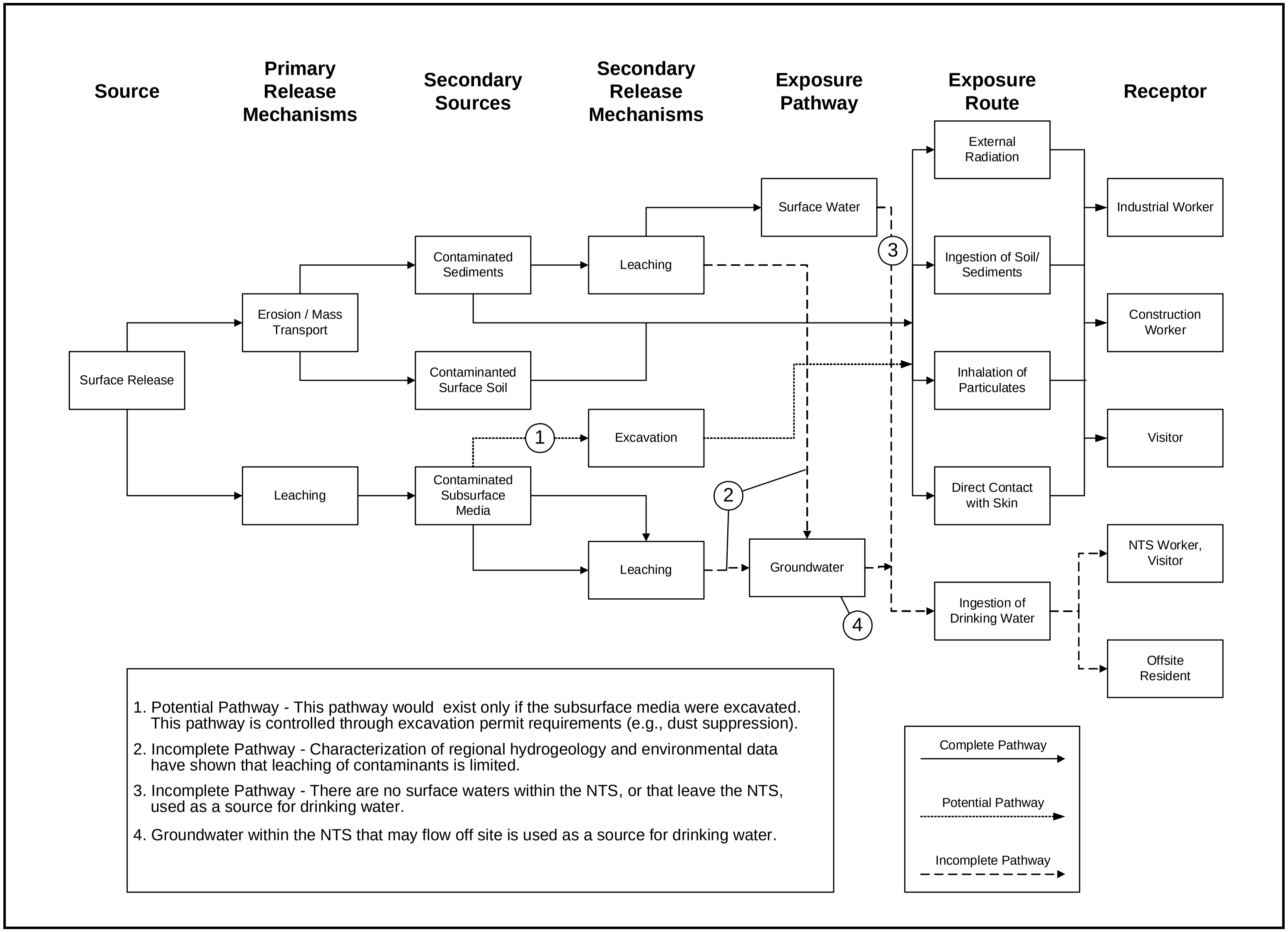

Figure 3-1
Conceptual Site Model Diagram

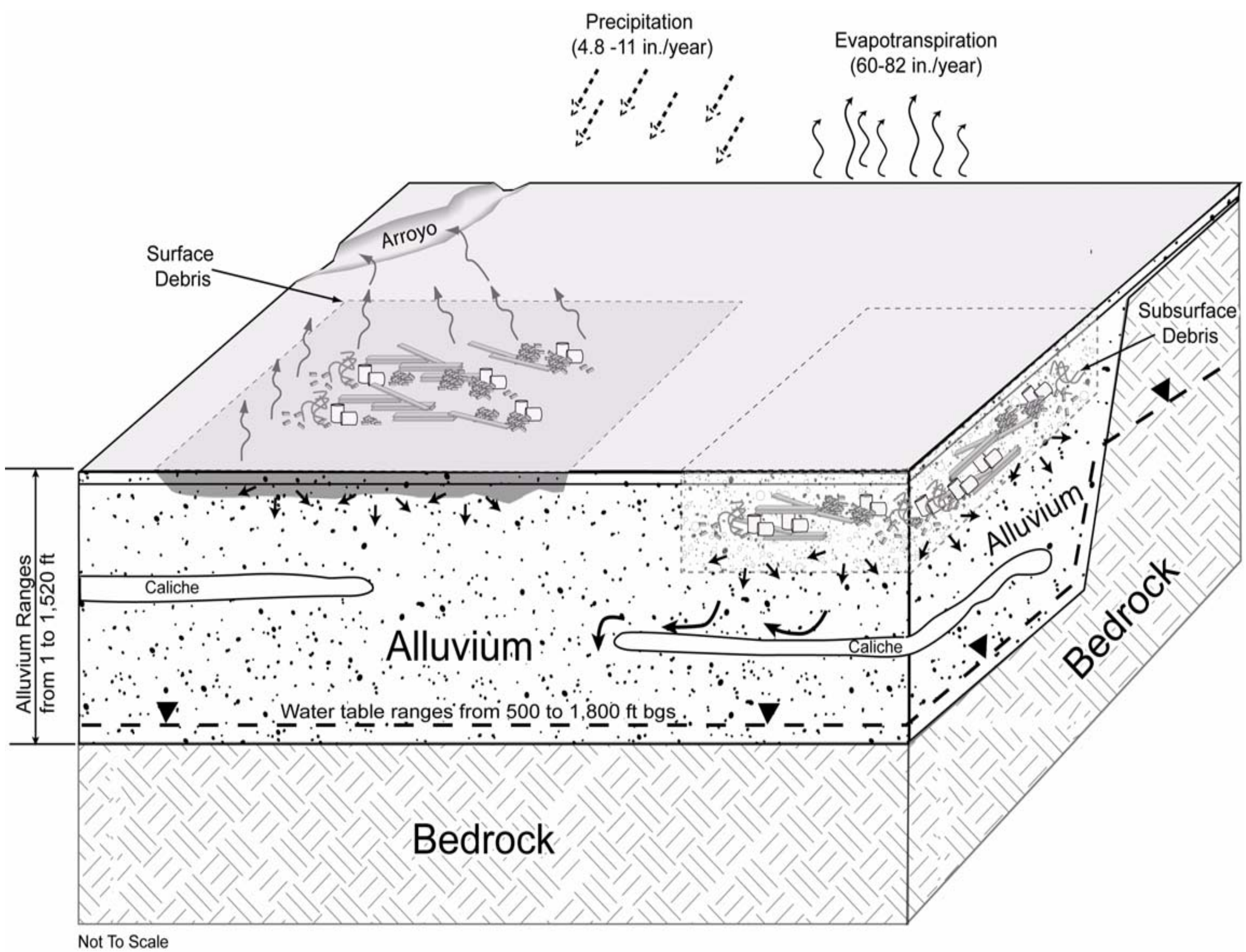

Figure 3-2
Corrective Action Unit 561 Conceptual Site Model

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

Corrective Action Site 22-19-06 is located in the land-use zone described as the "Solar Enterprise Zone." This area is designated for the development of a solar power generation facility, light industrial equipment, and commercial manufacturing capability.

Corrective Action Sites 05-62-01, 25-08-02, and 25-25-19 are located in the land-use zone described as the "Research, Test, and Experiment Zone." This area is designated for small-scale research and development projects and demonstrations; pilot projects; outdoor tests; and experiments for the development, quality assurance, or reliability of material and equipment under controlled conditions. This zone includes compatible defense and nondefense research, development, and testing projects and activities (DOE/NV, 1998).

Corrective Action Site 23-21-04 is located in the land-use zone described as "Reserved" within the NTS. This area includes land and facilities that provide widespread flexible support for diverse short-term testing and experimentation. The reserved zone is also used for short-duration exercises and training such as nuclear emergency response, Federal Radiological Monitoring and Assessment Center training, and U.S. Department of Defense land-navigation exercises and training (DOE/NV, 1998).

Corrective Action Site 25-23-21 is located in the "Yucca Mountain Site Characterization Zone." This area includes land and facilities that are dedicated to the management of nuclear wastes and, therefore, is not available for other uses (DOE/NV, 1998).

All land-use zones where the CAU 561 CASs are located dictate future land use and restrict current and future land use to nonresidential (i.e., industrial) activities.

The exposure scenario for all CAU 561 CASs have been categorized as an occasional use area based on current and projected future land use. This exposure scenario assumes exposure to industrial workers who are not assigned to the area as a regular worksite but may occasionally use the site for intermittent or short-term activities. A site worker under this scenario is assumed to be on the site for an equivalent of 8 hours per day, 10 days per year, for 5 years.

3.1.2 Contaminant Sources

The contamination sources for the CSM are surface and subsurface releases from wastes that are composed of or contain potentially hazardous chemicals or radioisotopes.

3.1.3 Release Mechanisms

Release mechanisms for the CSM are spills and leaks onto surface and subsurface soils from processes such as dumping of debris on the surface/pile and placement into a pit/trench/landfill, or erosion on the surface from formerly stored materials.

3.1.4 Migration Pathways

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

Surface migration pathways include the lateral migration of potential contaminants across surface soils/sediments and vertical migration of potential contaminants through subsurface soils. Contaminants released into the ephemeral streams/dry washes are subject to much higher transport mechanisms than contaminants released to other surface areas. For example, for CAS 25-23-21, the Topopah Wash is generally dry but is subject to infrequent, potentially intense, stormwater flows. These 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 force and the sediments drop out. These locations are readily identifiable by hydrologists as sedimentation areas. For CAS 02-08-02, the site is located in an unnamed dry wash. However, due to the location, the strategy for this CAS will account for the physical location in the dry wash and for potential migration during intermittent stormwater flow similar to CAS 25-23-21.

Migration is 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 up to 82 in. at other areas of the NTS, and limited precipitation for this region (4 to 11 in. [Winograd and Thordarson, 1975]), 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 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 excavation activities.

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. Site workers may also be exposed to radiological contamination by performing activities in proximity to radiologically contaminated materials.

3.1.7 Additional Information

Information concerning topography, geology, climatic conditions, hydrogeology, floodplains, and infrastructure at the CAU 561 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) as well as specific structure descriptions will be recorded during the

CAI. Areas of erosion and deposition within the wash will be qualitatively evaluated by a hydrologist to provide any additional information on potential offsite migration of contamination. Movement of the active stream channel in the last 40 years, may be identified based on a comparison of historical photographs and visual observations where erosion and deposition has occurred within the wash.

3.2 Contaminants of Potential Concern

The COPCs for CAU 561 are defined as the list of constituents represented by the analytical methods identified in Table 3-1 for Decision I environmental samples taken at each of the CASs. The constituents reported for each analytical method are listed in Table 3-2.

Table 3-1
Analytical Program[a]

Analyses	01-19-01	02-08-02	03-19-02	05-62-01	12-23-09	22-19-06	23-21-04	25-08-02	25-23-21	25-25-19
Organic Contaminants of Potential Concern (COPCs)										
Total Petroleum Hydrocarbons-Gasoline-Range Organics and Diesel-Range Organics	X	X	--	--	X	X	X	X	X	X
Polychlorinated Biphenyls	X	X	--	--	X	X	X	X	X	X
Semivolatile Organic Compounds	X	X	--	--	X	X	X	X	X	X
Volatile Organic Compounds	X	X	--	--	X	X	X	X	X	X
Dioxin	--	X[b]	--	--	--	--	--	--	--	--
Inorganic COPCs										
Resource Conservation and Recovery Act Metals	X	X	--	--	X	X	X	X	X	X
Beryllium	X	X	--	--	X	X	X	X	X	X
Radionuclide COPCs										
Gamma Spectroscopy[c]	X	X	X	X	X	X	X	X	X	X
Isotopic Uranium	--	--	--	X	--	--	--	--	--	--

[a]The COPCs are the constituents reported from the analytical methods listed
[b]The six samples from the burn area will also be analyzed for dioxin
[c]Results of gamma analysis will be used to determine whether further radioanalytical analysis (i.e., isotopic radionuclides) is warranted

X = Required analytical method
-- = Not required

Table 3-2
Constituents Reported by Analytical Methods

VOCs		SVOCs		PCBs	RCRA Metals	Isotopic Radionuclides
1,1,1-Trichloroethane	Chloroprene	2,3,4,6-Tetrachlorophenol	Dimethyl Phthalate	Aroclor 1016	Arsenic	Gross Alpha/Beta
1,1,1,2-Tetrachloroethane	Dibromochloromethane	2,4-Dimethylphenol	Di-n-butyl Phthalate	Aroclor 1221	Barium	Plutonium-238
1,1,2,2-Tetrachloroethane	Dichlorodifluoromethane	2,4-Dinitrotoluene	Di-n-octyl Phthalate	Aroclor 1232	Cadmium	Plutonium-239/240
1,1,2-Trichloroethane	Ethyl methacrylate	2,4,5-Trichlorophenol	Fluoranthene	Aroclor 1242	Chromium	Strontium-90
1,1-Dichloroethane	Ethylbenzene	2,4,6-Trichlorophenol	Fluorene	Aroclor 1248	Lead	Uranium-234
1,1-Dichloroethene	Isobutyl alcohol	2-Chlorophenol	Hexachlorobenzene	Aroclor 1254	Mercury	Uranium-235
cis-1,2-Dichloroethene	Isopropylbenzene	2-Methylnaphthalene	Hexachlorobutadiene	Aroclor 1260	Selenium	Uranium-238
1,2-Dichloroethane	m-Dichlorobenzene (1,3)	2-Methylphenol	Hexachloroethane	Aroclor 1268	Silver	Tritium
1,2-Dichloropropane	Methacrylonitrile	2-Nitrophenol	Indeno(1,2,3-cd)pyrene			**Gamma-emitting Radionuclides**
1,2,4-Trichlorobenzene	Methyl methacrylate	3-Methylphenol[a]	Naphthalene[b]			
1,2,4-Trimethylbenzene	Methylene chloride	4-Chloroaniline	Nitrobenzene			Actinium-228
1,2-Dibromo-3-chloropropane	N-Butylbenzene	4-Methylphenol[a]	N-Nitroso-di-n-propylamine			Americium-241
1,3,5-Trimethylbenzene	N-Propylbenzene	4-Nitrophenol	Pentachlorophenol			Cobalt-60
1,4-Dioxane	o-Dichlorobenzene (1,2)	Acenaphthene	Phenanthrene			Cesium-137
2-Butanone	p-Dichlorobenzene (1,4)	Acenaphthylene	Phenol			Europium-152
2-Chlorotoluene	p-isopropyltoluene	Aniline	Pyrene			Europium-154
2-Hexanone	sec-Butylbenzene	Anthracene	Pyridine			Europium-155
4-Methyl-2-pentanone	Styrene	Benzo(a)anthracene				Potassium-40
Acetone	tert-Butylbenzene	Benzo(a)pyrene				Niobium-94
Acetonitrile	Tetrachloroethene	Benzo(b)fluoranthene				Lead-212
Allyl chloride	Toluene	Benzo(g,h,i)perylene				Lead-214
Benzene	Total Xylenes	Benzo(k)fluoranthene				Thorium-234
Bromodichloromethane	Trichloroethene	Benzoic Acid				Thallium-208
Bromoform	Trichlorofluoromethane	Benzyl Alcohol				Uranium-235
Bromomethane	Vinyl acetate	Bis(2-ethylhexyl) phthalate				
Carbon disulfide	Vinyl chloride	Butyl benzyl phthalate				
Carbon tetrachloride		Carbazole				
Chlorobenzene		Chrysene				
Chloroethane		Dibenzo(a,h)anthracene				
Chloroform		Dibenzofuran				
Chloromethane		Diethyl Phthalate				

[a]May be reported as 3,4-methylpenohydrocarbons.
[b]May be reported with VOCs.

PCB = Polychlorinated biphenyl
RCRA = *Resource Conservation and Recovery Act*
SVOC = Semivolatile organic compound
VOC = Volatile organic compound

During the DQO meeting, CAS 02-08-02 discussions concerning the burning of construction debris at the burn area raised the question of potential dioxin contamination. To address this concern, dioxin was added to the analytical program for the six samples collected at the burn area.

The term dioxin is commonly used to refer to a family of toxic chemicals that all share a similar chemical structure and a common mechanism of toxic action. This family includes seven of the polychlorinated dibenzo dioxins (PCDDs), 10 of the polychlorinated dibenzo furans (PCDFs) and 12 of the polychlorinated biphenyls (PCBs). Polychlorinated dibenzo dioxins and PCDFs are not commercial chemical products, but are trace level unintentional by-products of most forms of combustion, and several industrial chemical processes. Dioxins and furans are found in the air, soil, and food, but are mainly distributed through the air. However, only a small percentage of exposure is from air, and the primary source of exposure is by eating contaminated food. Of all the dioxins and furans, 2,3,7,8-tetrachloro-p-dibenzo-dioxin (2,3,7,8 TCDD) is considered the most toxic (EPA, 2008). Also, of the 16 constituents reported from the dioxins/furans analysis, 2,3,7,8-TCDD is the only constituent that has an U.S. Environmental Protection Agency (EPA) Region 9 Preliminary Remediation Goal (PRG) of 0.000016 milligrams per kilogram (mg/kg) (EPA, 2004). Therefore, the evaluation of dioxins at CAS 02-08-02 will be based on the analytical analysis of 2,3,7,8 TCDD of the six burn area samples.

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 NTS sites were also included in the COPC list to reduce the uncertainty about potential contamination at the CASs because complete information is not available regarding activities performed at the CAU 561 sites.

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 and targeted analytical methods are required to meet a more stringent completeness criteria than other COPCs thus providing greater protection against a decision error (see Sections A.1.0 through A.7.0). Targeted contaminants for each CAU 561 CAS are identified in Table 3-3.

Table 3-3
Targeted Contaminants for CAU 561

CAS	Chemical	Radiological
01-19-01	--	--
02-08-02	Lead, TPH-DRO	--
03-19-02	--	Gamma Spectroscopy
05-62-01	--	U-234, U-235, U-238, Gamma Spectroscopy
12-23-09	--	Gamma Spectroscopy
22-19-06	--	--
23-21-04	Lead	--
25-08-02	Lead	--
25-23-21	--	Gamma Spectroscopy
25-25-19	TPH-DRO	--

DRO = Diesel-range organics
TPH = Total petroleum hydrocarbon
U = Uranium
-- = None identified

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 risk-based corrective action (RBCA) process used to establish FALs is described in the *Industrial Sites Project Establishment of Final Action Levels* (NNSA/NSO, 2006a). This process conforms with *Nevada Administrative Code* (NAC) Section 445A.227, which lists the requirements for sites with soil contamination (NAC, 2006b). For the evaluation of corrective actions, NAC Section 445A.22705 (NAC, 2006c) requires the use of American Society for Testing and Materials (ASTM) Method E 1739-95 (ASTM, 1995) to “conduct an evaluation of the site, based on the risk it poses to public health and the environment, to determine the necessary remediation standards (i.e., FALs) or to establish that corrective action is not necessary.”

This RBCA process, summarized in Figure 3-3, defines three tiers (or levels) of evaluation involving increasingly sophisticated analyses:

- Tier 1 Evaluation – Sample results from source areas (highest concentrations) are compared to action levels based on generic (non-site-specific) conditions (i.e., the PALs established in the CAIP). The FALs may then be established as the Tier 1 action levels or the FALs may be calculated using a Tier 2 evaluation.

- Tier 2 Evaluation – Conducted by calculating Tier 2 Site-Specific Target Levels (SSTLs) using site-specific information as inputs to the same or similar methodology used to calculate Tier 1 action levels. 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. The total petroleum hydrocarbons (TPH) concentrations will not be used for risk-based decisions under Tier 2 or Tier 3. Rather, the individual chemicals of concern will be compared to the SSTLs.

- Tier 3 Evaluation – Conducted by calculating Tier 3 SSTLs on the basis of more sophisticated risk analyses using methodologies described in Method E 1739-95 that consider site-, pathway-, and receptor-specific parameters.

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 FALs (along with the basis for 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 U.S. Environmental Protection Agency (EPA) *Region 9 Risk-Based Preliminary Remediation Goals (PRGs)* for contaminant constituents in industrial soils (EPA, 2004). Background concentrations for *Resource Conservation and Recovery Act* (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 for sediment samples collected by the Nevada Bureau of Mines and

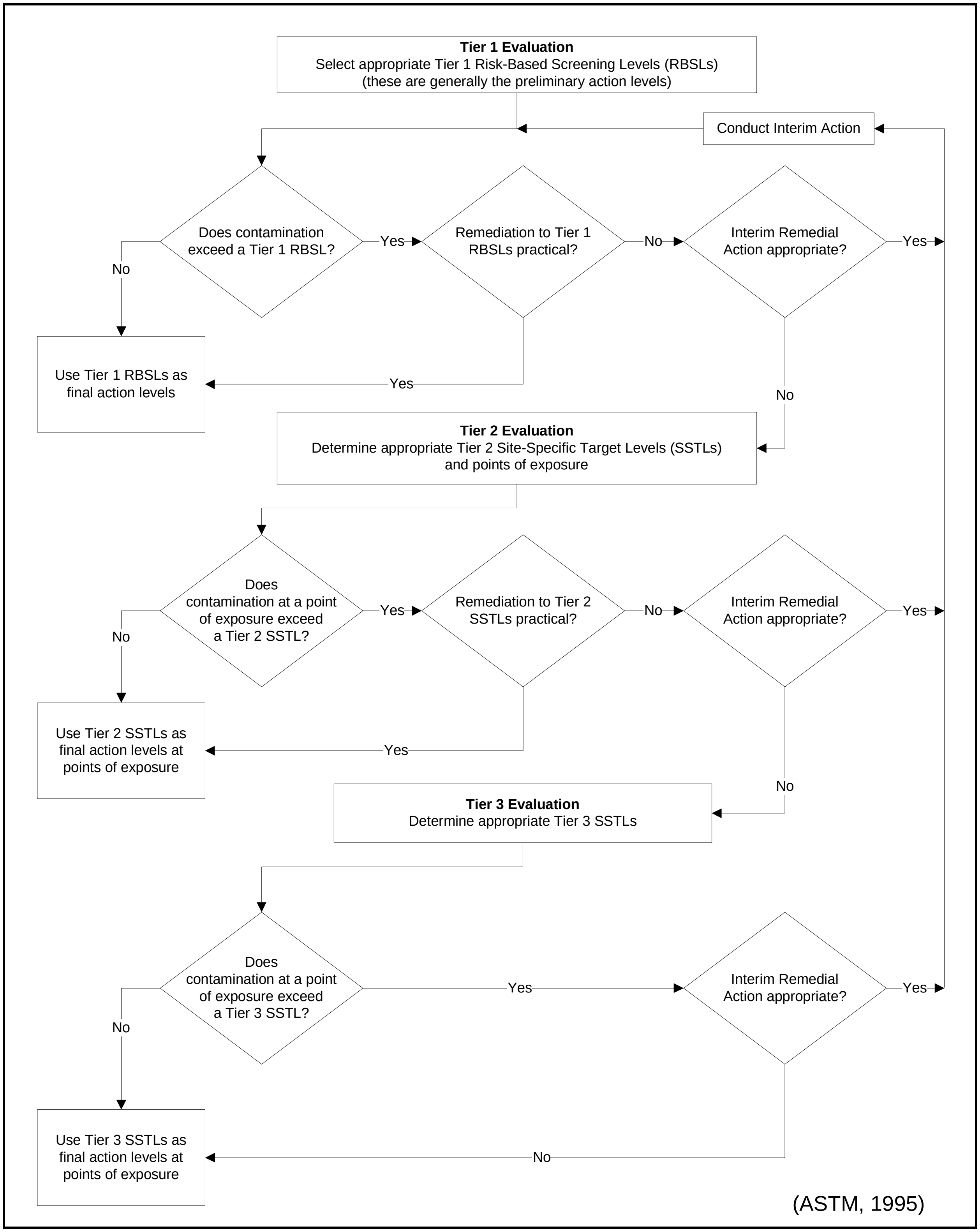

Figure 3-3
Risk-Based Corrective Action Decision Process

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, 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 mg/kg as listed in NAC 445A.2272 (NAC, 2006d).

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 millirem per year (mrem/yr) dose constraint (Murphy, 2004) and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993). National Council on Radiation Protection and Measurement 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.

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 561 was developed at a meeting on April 28, 2008. 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 CAU 561, the informational inputs or data needs to resolve problem statements and decision statements were documented.

The problem statement for CAU 561 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 561." To address this statement, the resolution of two decision questions is required:

- Decision I: "Is any COC present in environmental media within the CAS?" 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 determine potential remediation waste types.
  - The information needed to evaluate the feasibility of remediation alternatives (bioassessment if natural attenuation or biodegradation is considered and geotechnical data if construction or evaluation of barriers is considered).

The presence of a COC would require a corrective action. A corrective action may also be necessary if there is a potential for wastes that are present at a site to impose COCs into site environmental media if the wastes were to be released. To evaluate the potential for waste to result in the introduction of a COC to the surrounding environmental media, the following conservative assumptions were made:

- The containment would fail at some point, and the contents would be released to the surrounding media.
- The resulting concentration of contaminants in the surrounding media would be equal to the concentration of contaminants in the waste.
- Any liquid contaminant in the waste exceeding the RCRA toxicity characteristic concentration can result in introduction of a COC into the surrounding media.

Sludge containing a contaminant exceeding an equivalent FAL concentration would be considered to be potential source material (PSM) and would require a corrective action. Waste liquids with contaminant concentrations exceeding an equivalent toxicity characteristic action level would be considered PSM and, therefore, require corrective action.

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 less than or equal to the corresponding FALs. Analytical methods and target minimum detectable concentrations (MDCs) for each CAU 561 COPC are provided in Tables 3-4 and 3-5. The MDC is the lowest concentration of a chemical or radionuclide parameter that can be detected in a sample within an acceptable level of error. Due to changes in analytical methodology and changes in analytical laboratory contracts, information in Tables 3-4 and 3-5 that varies from corresponding information in the QAPP will supersede the QAPP (NNSA/NV, 2002).

Table 3-4
Analytical Requirements for Radionuclides for CAU 561

Analysis[a]	Matrix	Analytical Method	Minimum Detectable Concentration (MDC)[b]	Laboratory Precision	Laboratory Accuracy (%R)
Gamma-Emitting Radionuclides					
Gamma Spectroscopy	Aqueous	EPA 901.1[c]	< Preliminary Action Levels	RPD 35%[d] ND[e] -2<ND[e]<2	Laboratory Control Sample 80-120%R
	Nonaqueous	HASL-300[f]			
Other Radionuclides					
Uranium-234	All	HASL-300[f]	< Preliminary Action Levels	RPD 35%[d] ND[e] -2<ND[e]<2	Laboratory Control Sample 80-120%R Chemical Yield 30-105%R (not applicable for tritium and gross-alpha/beta) Matrix Spike Sample 61-140%R (tritium and gross alpha/beta only)
Uranium-235					
Uranium-238					

[a]Applicable constituents are listed in Table 3-2.
[b]The MDC is the lowest concentration of a radionuclide present in a sample and can be detected with a 95% confidence level.
[c]*Prescribed Procedures for Measurement of Radioactivity in Drinking Water* (EPA, 1980)
[d]*Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan) with Guidance* (EPA, 2000)
[e]ND is not RPD; rather, 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* (DOE, 1997a)
[f]*The Procedures Manual of the Environmental Measurements Laboratory*, HASL-300 (DOE, 1997b)

EPA = U.S. Environmental Protection Agency
HASL = Health and Safety Laboratory
ND = Normalized difference
RPD = Relative percent difference
%R = Percent recovery

Table 3-5
Analytical Requirements for Chemical COPCs for CAU 561

Analysis[a]	Matrix	Analytical Method (SW-846)[b]	Minimum Detectable Concentration (MDC)[c]	Laboratory Precision[d]	Laboratory Accuracy (%R)[d]
ORGANICS					
Total Volatile Organic Compounds	All	8260	< Preliminary Action Levels	Lab-specific	Lab-specific
Total Semivolatile Organic Compounds	All	8270	< Preliminary Action Levels	Lab-specific	Lab-specific
Polychlorinated Biphenyls	All	8082	< Preliminary Action Levels	Lab-specific	Lab-specific
Total Petroleum Hydrocarbons-Gasoline-Range Organics	All	8015 (modified)		Lab-specific	Lab-specific
Total Petroleum Hydrocarbons-Diesel-Range Organics	All	8015 (modified)		Lab-specific	Lab-specific
Dioxin	All	8280/8290	< Preliminary Action Levels	Lab-specific	Lab-specific
INORGANICS					
Metals	All	6010	< Preliminary Action Levels	RPD 35% (nonaqueous)[e] 20% (aqueous)[e] Absolute Difference[f] ±2x RL (nonaqueous)[f] ±1x RL (aqueous)[f]	Matrix Spike Sample 75-125%R[b] Laboratory Control Sample 80-120%R[f]
Mercury	Aqueous	7470			
	Nonaqueous	7471			

[a]Applicable constituents are listed in Table 3-2.
[b]*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846) (EPA, 1996)
[c]The MDC is the lowest concentration that can be reliably achieved within specified limits of accuracy and precision.
[d]RPD and %R performance criteria are developed by the analytical laboratory according to approved procedures.
[e]*Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan) with Guidance* (EPA, 2000)
[f]*USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, 1995)

RL = Reporting limit
RPD = Relative percent difference
%R = Percent recovery

4.0 Field Investigation

This section contains a description of the activities to be conducted to gather and document information from the CAU 561 field investigation.

4.1 Technical Approach

The information necessary to satisfy the DQO data needs will be generated for each CAS in CAU 561 by collecting and analyzing samples generated during a field investigation. The presence and nature of contamination at all CASs will be evaluated using a judgmental approach. Additionally, supplemental samples will be collected using a probabilistic sampling approach from random locations within CASs 02-08-02, 12-23-09, 25-08-02, and 25-23-21 because site information and biasing factors are not sufficient to adequately focus the investigation on specific locations.

If there is a waste present that has the potential to release significant contamination into site environmental media, then that waste will be sampled. If it is determined that a COC is present at any CAS, that CAS will be further addressed by determining the extent of contamination before evaluating corrective action alternatives.

Because this CAIP only addresses contamination originating from the CAU, it may be necessary to distinguish overlapping contamination originating from other sources. For example, widespread surface radiological contamination originating from atmospheric tests will not be addressed in the CAU 561 investigation. To determine whether contamination is from the CAU or from other sources, soil samples may be collected from locations outside the influence of releases from the CAS at selected CASs.

Modifications to the investigative strategy may be required should unexpected field conditions be encountered at any CAS. Significant modifications shall be justified and documented before implementation. If there is an unexpected indication that conditions are significantly different than the corresponding CSM, the activity will be rescoped and the decision-makers notified.

4.2 Field Activities

Field activities at CAU 561 include site preparation, sample location selection, and sample collection.

4.2.1 Site Preparation Activities

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

4.2.2 Sample Location Selection

At all CASs, biasing factors (including field-screening results [FSRs]) will be used to select the most appropriate samples from a particular location for submittal to the analytical laboratory. Biasing factors to be used for selection of sampling locations are listed in Section A.5.2.1. As biasing factors are identified and used for sampling location selection, they will be documented in the appropriate field documents.

Additionally, supplemental samples will be collected using a probabilistic sampling approach from random locations within CASs 02-08-02, 12-23-09, 25-08-02, and 25-23-21 determined using the Visual Sample Plan (VSP) software (PNNL, 2005). Examples of the selection of randomized sampling locations for each CAS and the use of the VSP software are described in Appendix C.

The CAS-specific sampling strategy and estimated locations of biased samples for each CAS are presented in Appendix A. 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 stipulated in Appendix A. Where sampling locations are modified by the Task Manager or Site Supervisor, the justification for these modifications will be documented in the field logbook.

4.2.3 Sample Collection

The CAU 561 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 locations outside the influence of releases from the CAS, if necessary.
- Perform radiological characterization surveys of construction materials and debris as necessary for disposal purposes.
- Record Global Positioning System (GPS) coordinates for each environmental sample location.

Decision I surface soil samples (0 to 0.5 ft bgs) and variable depth subsurface samples will be collected. Samples will be collected from the piles based on biasing factors (e.g., staining, odor, heterogeneous concentrated debris), if present. If no debris or biasing factors are present, then one sample will be collected from the center of the pile and submitted for laboratory analysis. 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 be 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, FSRs, existing data, and the outer boundary sample locations where COCs were detected. In general, step-out sample locations will be arranged in a triangular pattern around areas containing a COC at distances based on site conditions, COC concentrations, process knowledge, and biasing factors. If COCs extend beyond step-out locations, additional Decision II samples will be collected from locations further from the source. If a spatial boundary is reached, the CSM is shown to be inadequate, or the Site Supervisor determines that extent sampling needs to be re-evaluated, then work will be suspended temporarily, NDEP notified, and the investigation strategy 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).

4.2.4 Sample Management

The laboratory requirements (i.e., minimum detectable concentrations, precision, and accuracy requirements) to be used when analyzing the COPCs are presented in Tables 3-4 and 3-5. 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 QAPP (NNSA/NV, 2002) and other applicable, approved procedures.

4.3 Safety

A site-specific health and safety document will be prepared and approved before the field effort. As required by the DOE Integrated Safety Management System (ISMS) (DOE/NV, 1997), this document outlines the requirements for protecting the health and safety of the workers and the public. 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:

- Potential hazards to site personnel and the public include, but are not limited to: radionuclides, chemicals (e.g., heavy metals, volatile organic compounds [VOCs], semivolatile organic compounds [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, 2007c; NAC, 2006a), it will be inspected and/or samples collected by trained personnel.

4.4 Site Restoration

Following completion of the CAI and waste management activities, the following actions will be implemented before closure of the site REOP:

- Removal of all equipment, wastes, debris, and materials associated with the CAI.
- Removal of all signage and fencing (unless part of a corrective action).
- Grading of site to pre-investigation condition (unless changed condition is necessary under a corrective action).
- Site will be inspected and certified that restoration activities have been completed.

5.0 Waste Management

Management of IDW will be based on regulatory requirements, field observations, process knowledge, and laboratory results from CAU 561 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, hydrocarbon, radioactive, and/or mixed waste, if generated, will be managed and disposed of in accordance with applicable DOE orders, U.S. Department of Transportation (DOT) regulations, state and federal waste regulations, and agreements and permits between DOE and NDEP (DOE/NV, 1999; NDEP, 2005).

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 (e.g., soil removed during trenching, or decontamination) 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 to limit unnecessary generation of hazardous or mixed waste. Administrative controls, including decontamination procedures, recycle/reuse, and waste characterization strategies, will minimize waste generated during investigations.

5.2 Potential Waste Streams

Waste generated during the corrective action activities may 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)
- Remediation debris in investigation area (e.g., underground storage tank)
- Surface debris in investigation area (e.g., construction debris, scrap, lead brick)
- Field-screening waste (e.g., spent solvent, disposable sampling equipment, and/or PPE contaminated by field-screening activities)

The onsite management and ultimate disposition of wastes will be 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, waste generation process knowledge, field observations, field-monitoring results/FSRs, and/or radiological survey/swipe results.

Onsite IDW management requirements by waste type are detailed in the following sections. Applicable waste management regulations and requirements are listed in Table 5-1.

5.2.1 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).

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], Rev. 5 NTS Landfill Permit SW13.097.03[d], Rev. 7
Liquid/Rinsate (nonhazardous)	N/A	Water Pollution Control General Permit GNEV93001, Rev. iv[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], Rev. 7 NAC[b] 445A.82272
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, 2007a, b, and c)
[b]*Nevada Administrative Code* (NAC, 2006a and d)
[c]Area 23 Class II Solid Waste Disposal Site (NDEP, 2006a)
[d]Area 9 Class III Solid Waste Disposal Site (NDEP, 2006c)
[e]Nevada Test Site Sewage Lagoons (NDEP, 2005)
[f]*Resource Conservation and Recovery Act* (CFR, 2007a)
[g]*Nevada Test Site Performance Objective for the Certification of Nonradioactive Hazardous Waste* (BN, 1995)
[h]*Nevada Test Site Waste Acceptance Criteria,* Rev. 6-02 (NNSA/NSO, 2006b)
[i]Area 6 Class III Solid Waste Disposal Site for hydrocarbon waste (NDEP, 2006b)
[j]*Toxic Substances Control Act* (CFR, 2007b and c)

CFR = *Code of Federal Regulations*
DOE = U.S. Department of Energy
N/A = Not applicable
NAC = *Nevada Administrative Code*
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 Substances Control Act*

Industrial IDW generated at each CAS will be placed in a roll-off box located in Mercury, or other approved roll-off box location for ultimate disposal in the 10c Industrial Waste Landfill.

5.2.2 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 the current version of the NV/YMP RadCon Manual (NNSA/NSO, 2004), will be used to determine whether such waste may be declared unrestricted regarding radiological release versus being declared radioactive waste. Direct sampling of the waste may be conducted to aid in determining whether a particular waste unit (e.g., drum of soil) contains LLW, as necessary. Waste that is determined to be below the release values, by 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 (see Table 5-1). Wastes with values/release criteria in excess will be managed as potential radioactive waste in accordance with this section and any other applicable sections of this document (see Table 5-1).

If generated, LLW 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, 2006b). Potential radioactive waste drums containing soil, PPE, disposable sampling equipment, and/or rinsate may be staged and managed at a designated radioactive material area (RMA) or RCA when full or at the end of an investigation phase.

5.2.3 Hazardous Waste

The CAU will have waste accumulation 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 (see Table 5-1). The HWAAs will be properly controlled for access, and will be equipped with spill kits and appropriate spill containment. Wastes will be placed in DOT-compliant containers. All containerized hazardous waste will be handled, inspected, and managed in accordance with the hazardous waste regulations (see Table 5-1). These provisions include managing the waste in containers compatible with the waste type, and segregating incompatible waste types so that in the event of a spill, leak, or release, incompatible wastes shall not contact one another. The HWAAs will be covered under a site-specific emergency response and contingency action plan until such time that the waste is determined to be nonhazardous or all containers of hazardous waste have been removed from the storage area. Hazardous waste will be characterized, managed, and disposed of in accordance with federal requirements. *Resource Conservation and Recovery Act*-"listed" waste has not been identified at CAU 561.

5.2.4 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, an appropriate hydrocarbon waste management facility (e.g., recycling facility), or appropriate facility in accordance with State of Nevada regulations (see Table 5-1).

5.2.5 Mixed Low-Level Waste

Mixed waste, if generated, shall be managed and dispositioned according to the requirements of RCRA, or subject to agreements between NNSA/NSO and the State of Nevada, as well as DOE requirements for radioactive waste (see Table 5-1). Mixed waste that does not meet NTSWAC 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).

5.2.6 Polychlorinated Biphenyls

The management of PCBs is governed and implemented by *Toxic Substances Control Act* regulation (see Table 5-1). 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). If regulated PCB waste is generated, it will be managed according to federal and State of Nevada requirements, and agreements with NNSA/NSO.

5.3 Management of Specific Waste Streams

5.3.1 Personal Protective Equipment

Personal protective equipment and disposable sampling equipment will be inspected visually 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 can often be removed through decontamination methods, removal of gross contamination from small items, such as gloves or booties is not typically conducted. Any grossly contaminated IDW will be segregated and managed as potentially "characteristic" hazardous waste. This segregated population of waste will either: (1) be assigned the characterization of the soil/sludge that was sampled, (2) be sampled directly, or (3) undergo further evaluation using associated 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 (see Table 5-1). The PPE and equipment that is not visibly stained, discolored, or grossly contaminated and that is within the radiological free-release criteria will be managed as nonhazardous sanitary waste.

5.3.2 Management of Decontamination Rinsate

Rinsate waste may be generated from the decontamination of field sampling equipment and may be managed as RCRA-hazardous or nonhazardous waste, depending on process knowledge and associated analytical data. Depending on the radiological characterization of the rinsate waste, nonhazardous rinsate may be managed for disposal at the point of generation in accordance with an NNSA/NSO approved Fluid Management Plan, or disposed of elsewhere in accordance with the waste acceptance criteria of the receiving facility. Hazardous and/or radioactive rinsate wastes will be managed and disposed of in accordance with federal and state regulations, and the waste acceptance criteria of the appropriate waste disposal facility.

Wet or dry decontamination may be performed over the sampling site. In such cases, decontamination rinsate waste may be generated. If it is generated, it will be containerized, characterized and managed as noted above. When onsite equipment decontamination is performed, it will be done in such a manner as to introduce no new contaminants to the sampling site or to cause existing contaminants to migrate from the site.

5.3.3 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 be either managed onsite or containerized for transportation to an appropriate disposal site.

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

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

Note that soil placed back into an excavation in the same approximate location from which it originated is not considered waste.

5.3.4 Management of Debris

This waste stream can vary depending on site conditions. Debris that requires removal must be characterized for proper management and disposition. Historical site knowledge, waste generation process knowledge, field observations, field-monitoring results/FSRs, radiological survey/swipe results, and/or the analytical results of samples either directly or indirectly associated with the waste may be used to characterize the debris. Debris will be inspected visually for stains, discoloration, and gross contamination. Debris may be deemed reusable/recyclable, sanitary waste, hazardous waste, PCB waste, or LLW. 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 (see Table 5-1). Debris may be managed on site by berming and covering next to the excavation, by placing in a container(s), or by being left on the footprint of the CAS and its disposition deferred until implementation of corrective action at the site.

5.3.5 Field-Screening Waste

The use of field test kits and/or instruments may result in the generation of small quantities of hazardous wastes. If hazardous waste is produced by field screening, it will be segregated from other IDW and managed in accordance with the hazardous waste regulations. 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 5.2.5.

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 CAU 561 CAS. Sections 6.1 and 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 QAPP (NNSA/NV, 2002).

6.1 Quality Control Sampling Activities

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

- Trip blanks (1 per sample cooler containing VOC environmental samples)
- Equipment rinsate blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per lot of uncharacterized source material that contacts sampled media)
- Field duplicates (1 per 20 environmental samples or 1 per CAS per matrix, if less than 20 collected)
- Field blanks (1 per CAS depending on site conditions)
- 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 QAPP (NNSA/NV, 2002).

6.2 Laboratory/Analytical Quality Assurance

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

6.2.1 Data Validation

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

6.2.2 Data Quality Indicators

The DQIs are qualitative and quantitative descriptors used to interpret the degree of data acceptability or utility. The DQIs are used to evaluate the entire measurement system and laboratory measurement processes (i.e., analytical method performance) as well as to evaluate individual analytical results (i.e., parameter performance). 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 to be used to assess the quality of laboratory data. Due to changes in analytical methodology and analytical laboratory contracts, criteria for precision and accuracy in Tables 3-4 and 3-5 that vary from corresponding information in the QAPP will supersede the QAPP (NNSA/NV, 2002).

6.2.3 Precision

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

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. Sample duplications are not a separate sample but a split, or portion, of an existing sample. Typically, laboratory duplicate QC samples may include matrix spike duplicate (MSD) and laboratory control sample (LCS) duplicate samples for organic, inorganic, and radiological analyses.

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

The criteria used for the assessment of inorganic chemical precision when both results are greater than or equal to 5x reporting limit (RL) is 20 percent and 35 percent for aqueous and soil samples, respectively. When either result is less than 5x RL, a control limit of ±1x RL and ±2x RL for aqueous and soil samples, respectively, is applied to the absolute difference. The criteria used for the assessment of organic chemical precision is based on professional judgment using laboratory derived control limits.

Table 6-1
Laboratory and Analytical Performance Criteria for CAU 561 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 contaminant are not qualified for precision based on the criteria for each analytical method-specific and laboratory-specific criteria presented 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 contaminant are not qualified for accuracy based on the method-specific and laboratory-specific criteria presented 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 COPCs have valid results. 100% of CAS-specific targeted contaminants have valid results.	Cannot support/defend decision on whether COCs are present.
Extent Completeness	100% of COCs used to define extent have valid results.	Extent of contamination cannot be accurately determined.
Clean Closure Completeness	100% of targeted contaminants have valid results.	Cannot determine whether COCs remain in soil.

COC = Contaminant of concern
COPC = Contaminant of potential concern
DQO = Data quality objective
FAL = Final action level

The criteria used for the assessment of radiological precision when both results are greater than or equal to 5x MDC is 20 percent and 35 percent for aqueous and soil samples, respectively. When either result is less than 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 3-5.

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. 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.

6.2.4 Accuracy

Accuracy is a measure of the closeness of an individual measurement to the true value. It is used to assess the performance of laboratory measurement processes.

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

The criteria 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.

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 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 judgmental sampling, having a high degree of confidence that the sample locations selected will identify COCs if present anywhere within the CAS.
- For Decision I probabilistic sampling, having a high degree of confidence that the sample locations selected will represent contamination of 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.

For the judgmental sampling approach, the completeness goal for targeted contaminants and the remaining COPCs is 100 and 80 percent, respectively. If this goal is not achieved, the dataset will be assessed for potential impacts on making DQO decisions. For the probabilistic sampling approach, the completeness goal is a calculated minimum sample size required to produce a valid statistical comparison of the sample mean to the FAL. The methodology for determining minimum required sample size is described in Appendix C.

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. Additional samples will be collected if it is determined that the number of samples do not meet completeness criteria.

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 and documented in accordance with approved procedures that are in conformance with standard industry practices. Analytical methods and procedures approved by DOE will be used to analyze, report, and validate the data. These methods and procedures are in conformance with applicable methods used in industry and government practices. 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, 2002). 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 the CAI.

Table 7-1
Corrective Action Investigation Activity Durations

Duration (days)	Activity
10	Site Preparation
76	Fieldwork Preparation and Mobilization
55	Sampling
160	Data Assessment
180	Waste Management

7.2 Records Availability

Historical 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 Federal Sub-Project Director. This document is available in the DOE public reading rooms located in Las Vegas and Carson City, Nevada, or by contacting the DOE Federal Sub-Project Director. 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 used to plan data collection activities and define performance criteria for the CAU 561, Waste Disposal Areas 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 CASs in CAU 561 is insufficient to evaluate and select preferred corrective actions; therefore, a CAI will be conducted.

The CAU 561 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 Sections A.3.0 through A.9.0 were developed in accordance with *EPA Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006).

The DQO process presents a combination of probabilistic and judgmental sampling approaches. In general, the procedures used in the DQO process provide:

- A method to establish performance or acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of a study.
- Criteria that will be used to establish the final data collection design includes:
  - The nature of the problem that has initiated the study and a conceptual model of the environmental hazard to be investigated.
  - The decisions or estimates that need to be made and the order of priority for resolving them.
  - The type of data needed.
  - An analytic approach or decision rule that defines the logic for how the data will be used to draw conclusions from the study findings.

- Acceptable quantitative criteria on the quality and quantity of the data to be collected, relative to the ultimate use of the data.

- A data collection design that will generate data meeting the quantitative and qualitative criteria specified. A data collection design specifies the type, number, location, and physical quantity of samples and data, as well as the QA and QC activities that will ensure that the sampling design and measurement errors are managed sufficiently to meet the performance and acceptance criteria specified in the DQOs.

A.2.0 Background Information

The following 10 CASs that comprise CAU 561 are located in Areas 1, 2, 3, 5, 12, 22, 23, and 25 of the NTS, as shown in Figure A.2-1:

- 01-19-01, Waste Dump
- 02-08-02, Waste Dump and Burn Area
- 03-19-02, Debris Pile
- 05-62-01, Radioactive Gravel Pile
- 12-23-09, Radioactive Waste Dump
- 22-19-06, Buried Waste Disposal Site
- 23-21-04, Waste Disposal Trenches
- 25-08-02, Waste Dump
- 25-23-21, Radioactive Waste Dump
- 25-25-19, Hydrocarbon Stains and Trench

The following sections (Sections A.2.1 through A.2.3) provide a CAS description, physical setting and operational history, release information, and previous investigation results for each CAS in CAU 561. 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 01-19-01, Waste Dump

Corrective Action Site 01-19-01 consists of a fenced subsurface waste dump located east of Building 1-31.2e1 in Area 1. Visible debris at the surface consists of concrete chunks, rebar, red brick pieces, and wood. The waste dump is believed to contain construction debris from a former two-story brick house associated with the Apple II test. There is a potential for radiological contamination of the soil and debris at the fenced waste dump. Figure A.2-2 shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 01-19-01 is located on Yucca Flat Hydrographic Area of the NTS. Section 2.1 contains additional information on the physical setting. The original source of this debris is unknown. It may be associated with the Apple II test due to its proximity.

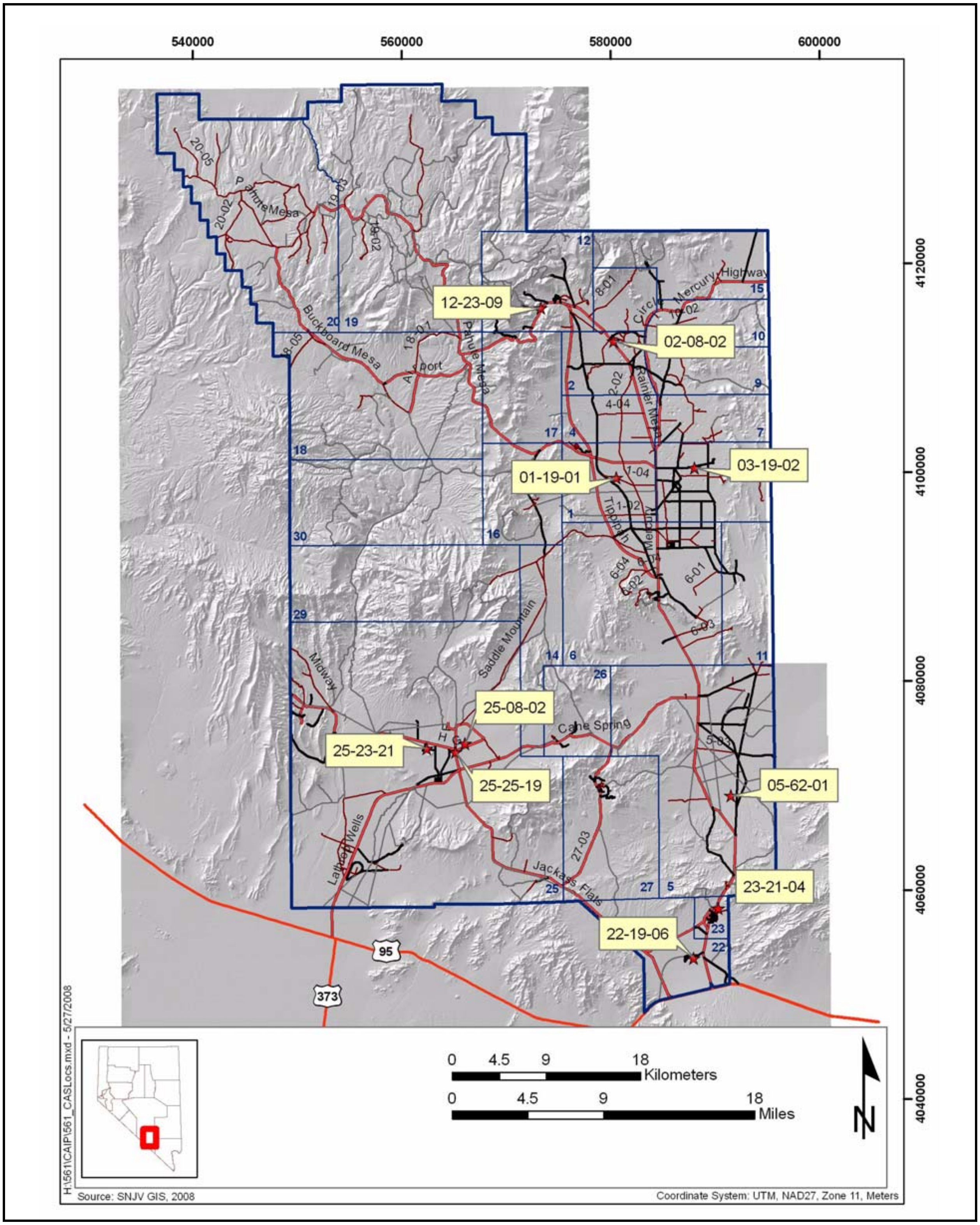

Figure A.2-1
Corrective Action Unit 561, CAS Location Map

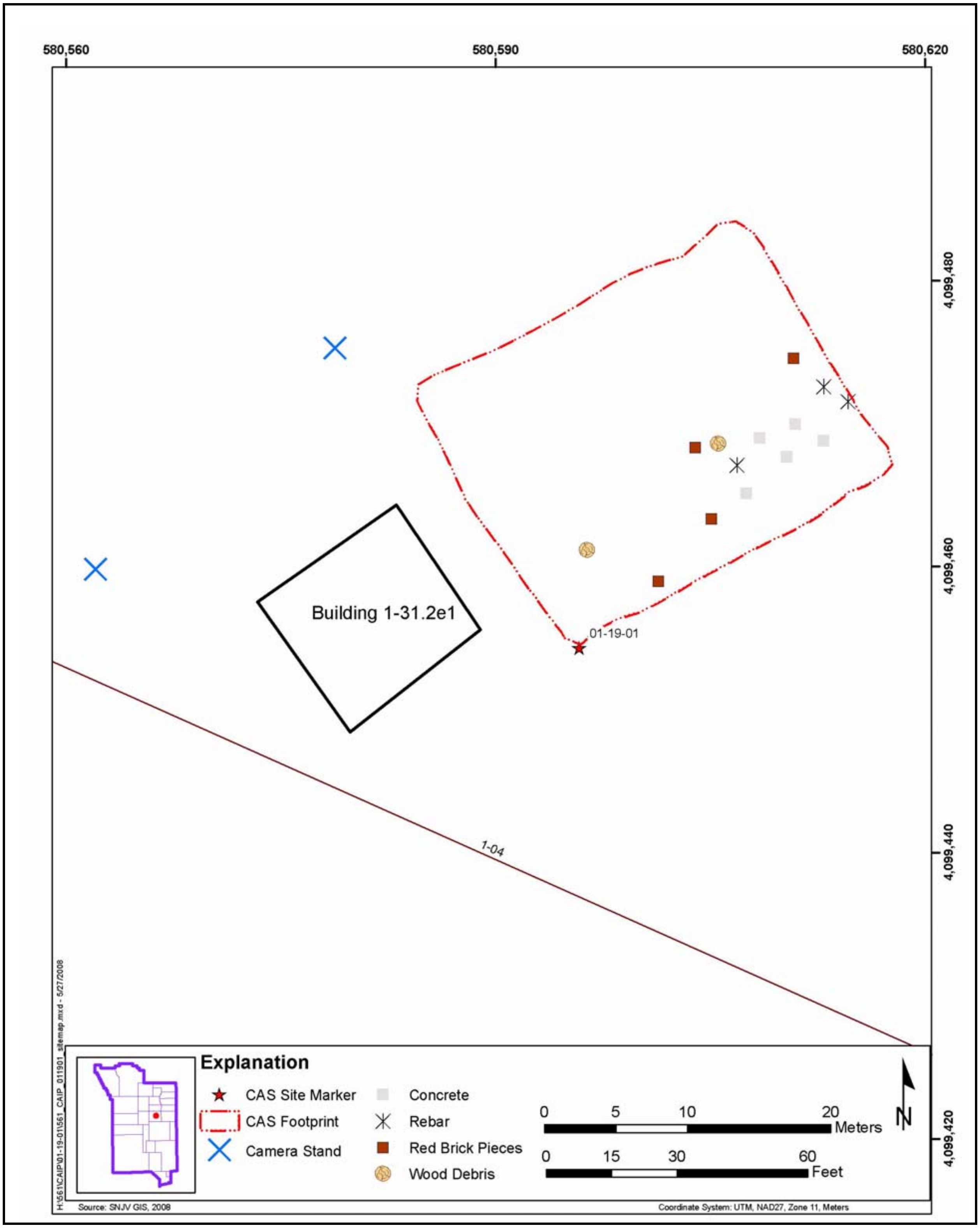

Figure A.2-2
Site Sketch of CAS 01-19-01, Waste Dump

Release Information – Potential releases may have occurred when the waste was placed into the waste dump. Waste disposed of in the waste dump may contain contaminants that leaked into the surrounding soils at the site. 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 debris.

Previous Investigation Results **–** In 2006, a gamma radiological walkover survey was performed of the fenced area. No areas of elevated radioactivity were identified because measured levels from the CAS area were not distinguishable from local background levels.

Geophysical surveys were performed in 2004 and identified buried metallic debris (see Figure A.9-1) in the areas identified for this CAS (Fahringer, 2004).

A.2.2 Corrective Action Site 02-08-02, Waste Dump and Burn Area

Corrective Action Site 02-08-02 consists of a burn area and waste dump located at the southern end of Area 2 Camp in Area 2 of the NTS. The waste dump contains piles of dirt and boulders with scattered debris consisting of metal cables, wires, wooden planks, metal, a tire, pipes, sheet metal, and a 55-gal rusted green metal drum. The CAS boundary was expanded to include several outlier piles that appear similar and from the same source area. The burn area, located northwest of the waste dump, contains visible debris including scattered nails, metal, wood, bits of charcoal, and lead and aluminum hardened on the ground surface. A third area consists of several outlying piles similar to the main dump area. The environmental concern at the site is believed to be diesel and lead contamination of the soil. Figure A.2-3 shows a site sketch of the CAS.

Physical Setting and Operational History **–** Corrective Action Site 02-08-02 is located on Yucca Flat Hydrographic Area of the NTS. Section 2.1 contains additional information on the physical setting. The waste dump is located adjacent to the former Area 2 Camp. There is no definitive information that this debris is associated with the Area 2 Camp other than location.

Release Information **–**Potential releases may have occurred when the waste piles were placed on the ground surface at the waste dump. Waste disposed of in and around the piles may contain contaminants that leaked into the surrounding soils at the site. If a release occurred, contaminants

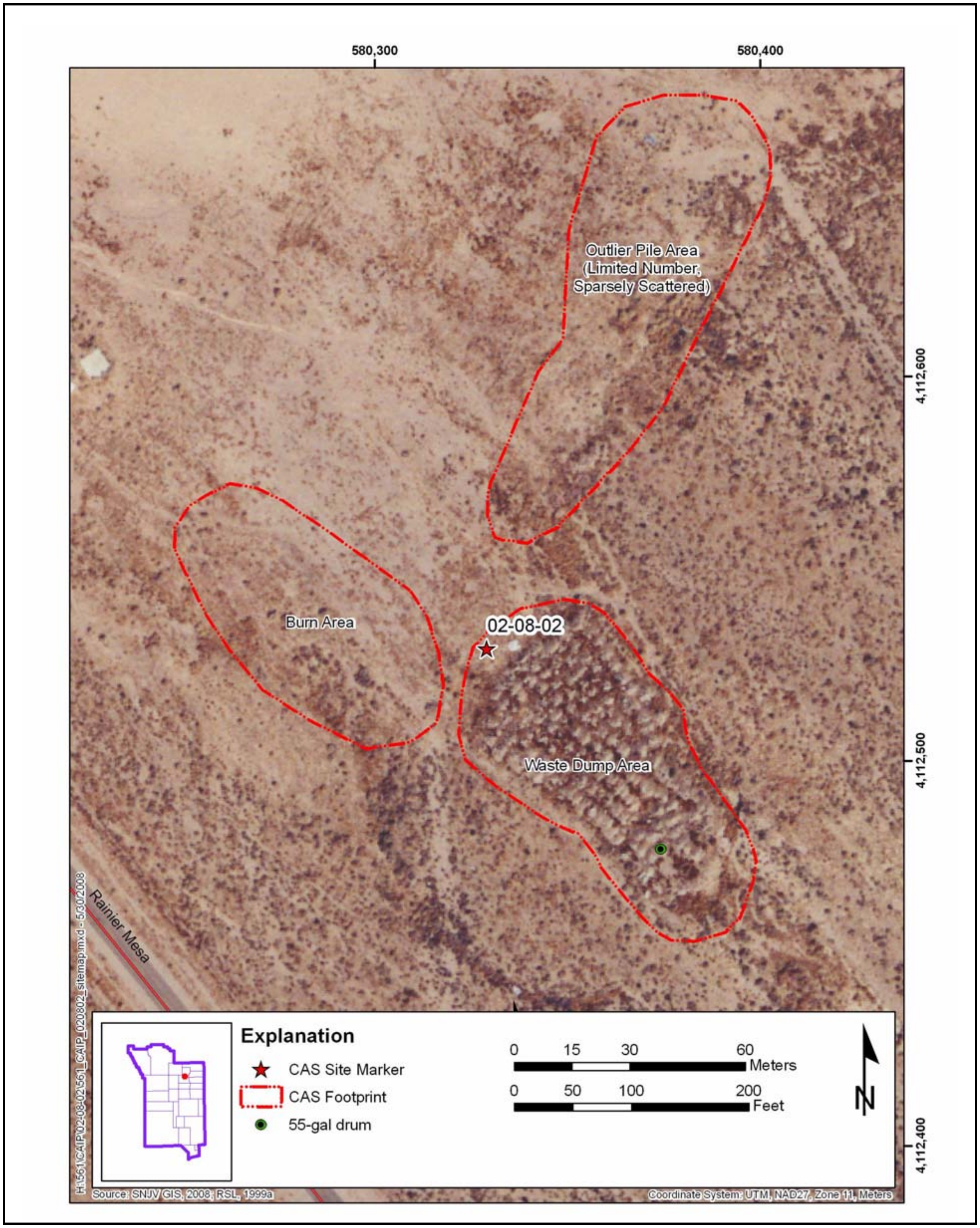

Figure A.2-3
Site Sketch of CAS 02-08-02, Waste Dump and Burn Area

would have been limited in volume and are expected to be located in the soil within close proximity to the debris.

At the burn area, the potential releases occurred when the wastes were placed on the ground surface and ignited. Waste in and around the burn area may contain contaminants that leaked into the surrounding soils at the site. If a release occurred, it is expected to be close to the surface and in proximity to the visibly burned areas of the site in the surface soils.

Previous Investigation Results **–** In 2006, a gamma radiological walkover survey was performed over the piles, and in 2008, a gamma radiological walkover survey was performed of the burn area. No areas of elevated radioactivity were identified because measured levels from the CAS area were not distinguishable from local background levels.

Geophysical surveys were performed at the burn area only (see Figure A.9-2) and identified surface and near-surface buried metallic debris (Fahringer, 2006).

A.2.3 Corrective Action Site 03-19-02, Debris Pile

Corrective Action Site 03-19-02 consists of a surface debris pile located in the north-central portion of Area 3 of the NTS. The debris pile consists of large items of rebar, concrete, and steel. There are "Caution Radioactive Materials" postings throughout the area. The boundary of the CAS is located around the postings. There is a potential for radiological contamination of the soil and debris at the site. Figure A.2-4 shows a site sketch of the CAS.

Physical Setting and Operational History **–** Corrective Action Site 03-19-02 is located on Yucca Flat Hydrographic Area of the NTS. Section 2.1 contains additional information on the physical setting. This site may be related to the Pommard test. There is no definitive information that indicates that this debris is associated to this test other than location.

Release Information **–** Potential releases may have occurred when the debris piles were placed on the ground surface. Waste disposed of in and around the piles may contain contaminants that leaked into the surrounding soils at the site. 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 debris.

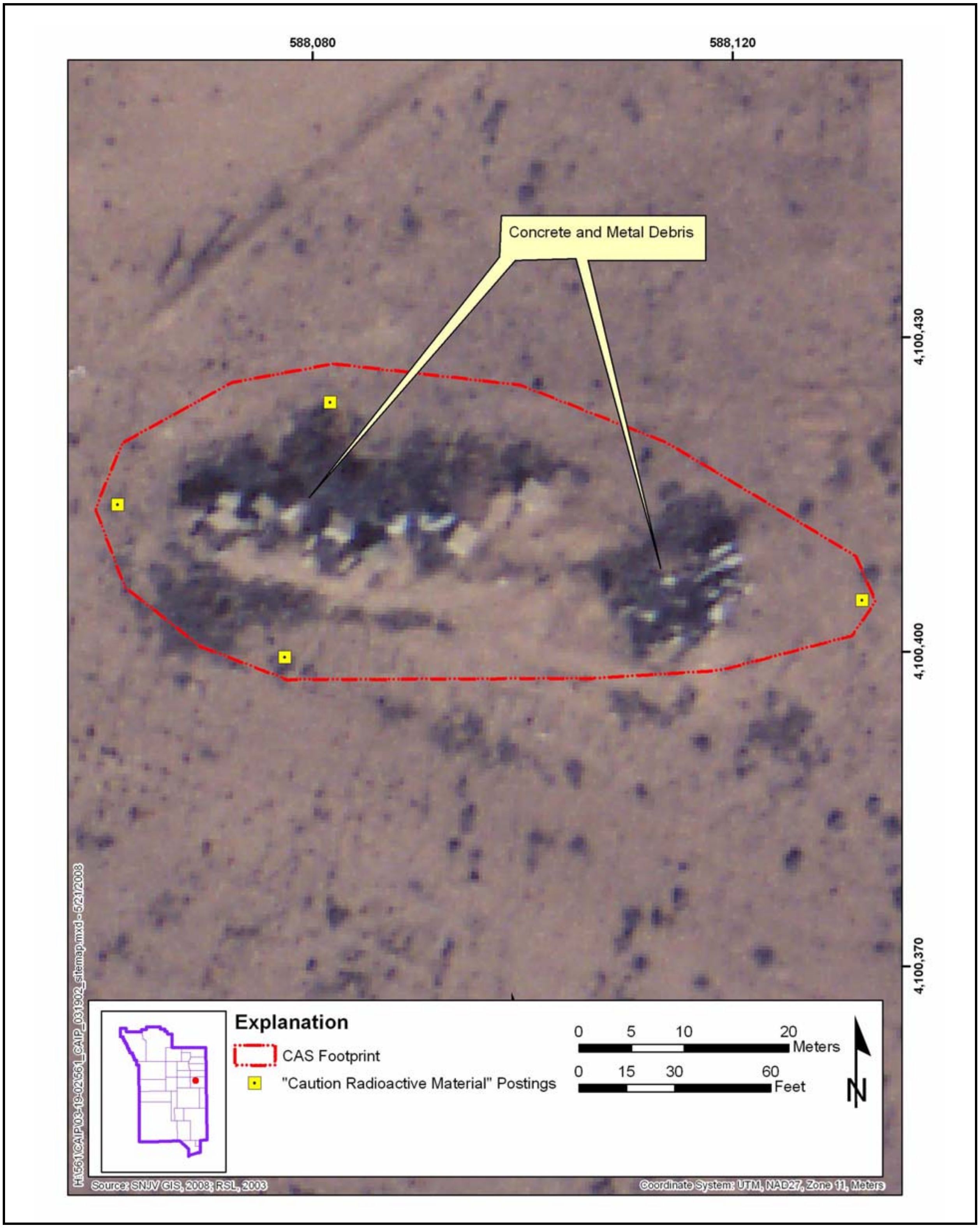

Figure A.2-4
Site Sketch of CAS 03-19-02, Debris Pile

Previous Investigation Results **–** In 2007, a gamma radiological walkover survey was performed of the site. No areas of elevated radioactivity were identified because measured levels from the CAS area were not distinguishable from local background levels in the soil; however, two locations on the concrete debris contained fixed readings above background. The gamma radiological walkover survey of the debris pile is shown in Figure A.9-4.

A.2.4 Corrective Action Site 05-62-01, Radioactive Gravel Pile

Corrective Action Site 05-62-01 consists of a radioactive gravel pile located approximately 1,000 ft west of CAS 05-23-01, Gravel Gertie, in Area 5 of the NTS. The site is located within a double strand yellow rope fence measuring 122 by 98 ft (0.27 acres) with "Caution Radioactive Material" postings. The environmental concern for the site is believed to consist of radionuclide contamination of the soil due to Gravel Gertie experiments and other atmospheric testing activities in Area 5 of the NTS. Figure A.2-5 shows a site sketch of the CAS.

Physical Setting and Operational History **–** Corrective Action Site 05-62-01 is located on Frenchman Flat in Area 5. Section 2.1 contains additional information on the physical setting. There is no definitive information that indicates that this gravel pile is associated to the Gravel Gertie tests other than location.

Release Information **–** Potential releases may have occurred when the gravel pile was placed on the ground surface. Waste disposed of in and around the pile may contain contaminants that leaked into the surrounding soils at the site. The release is expected to be in the soils within proximity to the surface and subsurface soils beneath the gravel pile.

Previous Investigation Results **–** In 2006, a gamma radiological walkover survey was performed at this CAS. No areas of elevated radioactivity were identified because measured levels from the CAS area were not distinguishable from local background levels.

A.2.5 Corrective Action Site 12-23-09, Radioactive Waste Dump

Corrective Action Site 12-23-09 consists of potential releases associated with a former radioactive waste dump, including remaining debris and an area of elevated radioactivity. The CAS is a fenced area, which includes two rectangular fenced areas ("north" and "south") that are adjoined by a

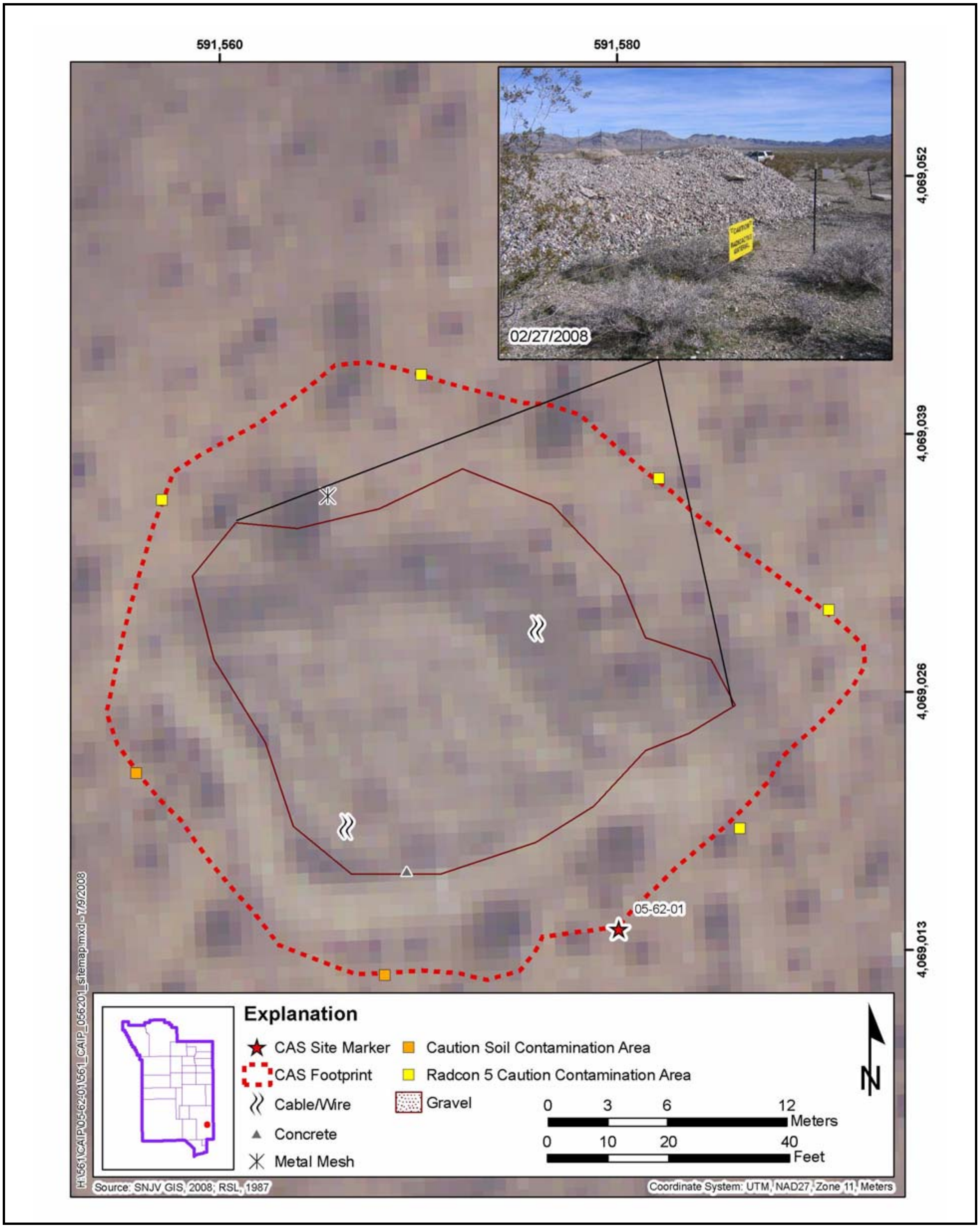

Figure A.2-5
Site Sketch of CAS 05-62-01, Radioactive Gravel Pile

common portion of the fence line. The CAS is located approximately 150 ft northwest of the Stockade Wash Road, just north of E-Tunnel Road in Area 12 of the NTS. The environmental concern for this CAS is the potential for radiological contamination of the soil. Figure A.2-6 shows a site sketch of the CAS.

***Physical Setting and Operational History* –** Corrective Action Site 12-23-09 is located on the base of the eastern slope of Rainier Mesa. Section 2.1 contains additional information on the physical setting. There is no definitive information that indicates that this site was used as a waste dump. The area is believed to have been used as an electricians' laydown yard.

***Release Information* –** Potential releases may have occurred when the waste was placed into the waste dump. Waste disposed of in the waste dump may contain contaminants that leaked into the surrounding soils at the site. It is expected that if a release occurred, it would be in the soils surrounding the buried debris.

***Previous Investigation Results* –** In 2006, a gamma radiological walkover survey was performed of the north fenced area. The results of this survey identified an area of radioactivity from 2 to 5 times higher than background levels at the soil mound (see Figure A.9-7). In 2008, a gamma radiological walkover survey was performed of the south fenced area. No areas of elevated radioactivity were identified as measured levels from the south fenced area were not distinguishable from local background levels.

Geophysical surveys were performed and identified buried metallic debris (see Figure A.9-8) in the area of the soil mound (Fahringer, 2006). This is the same area (soil mound) where elevated radioactivity was identified.

A.2.6 Corrective Action Site 22-19-06, Buried Waste Disposal Site

Corrective Action Site 22-19-06 consists of a waste dump with buried debris identified by a geophysical survey. There is a potential for releases to surrounding soils associated with buried debris. The site is located at the southeast end of Camp Desert Rock in Area 22 of the NTS. Figure A.2-7 shows a site sketch of the CAS.

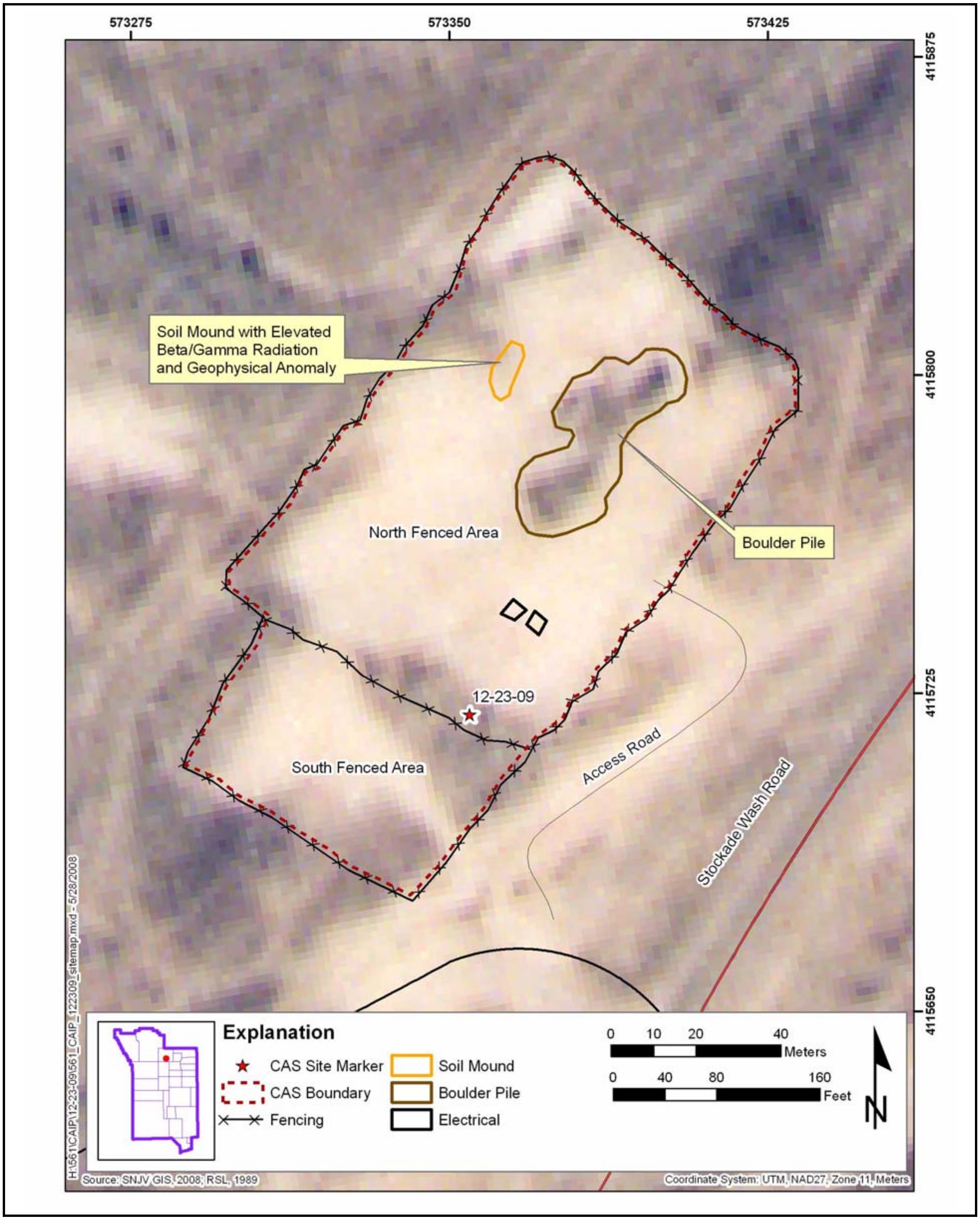

Figure A.2-6
Site Sketch of CAS 12-23-09, Radioactive Waste Dump

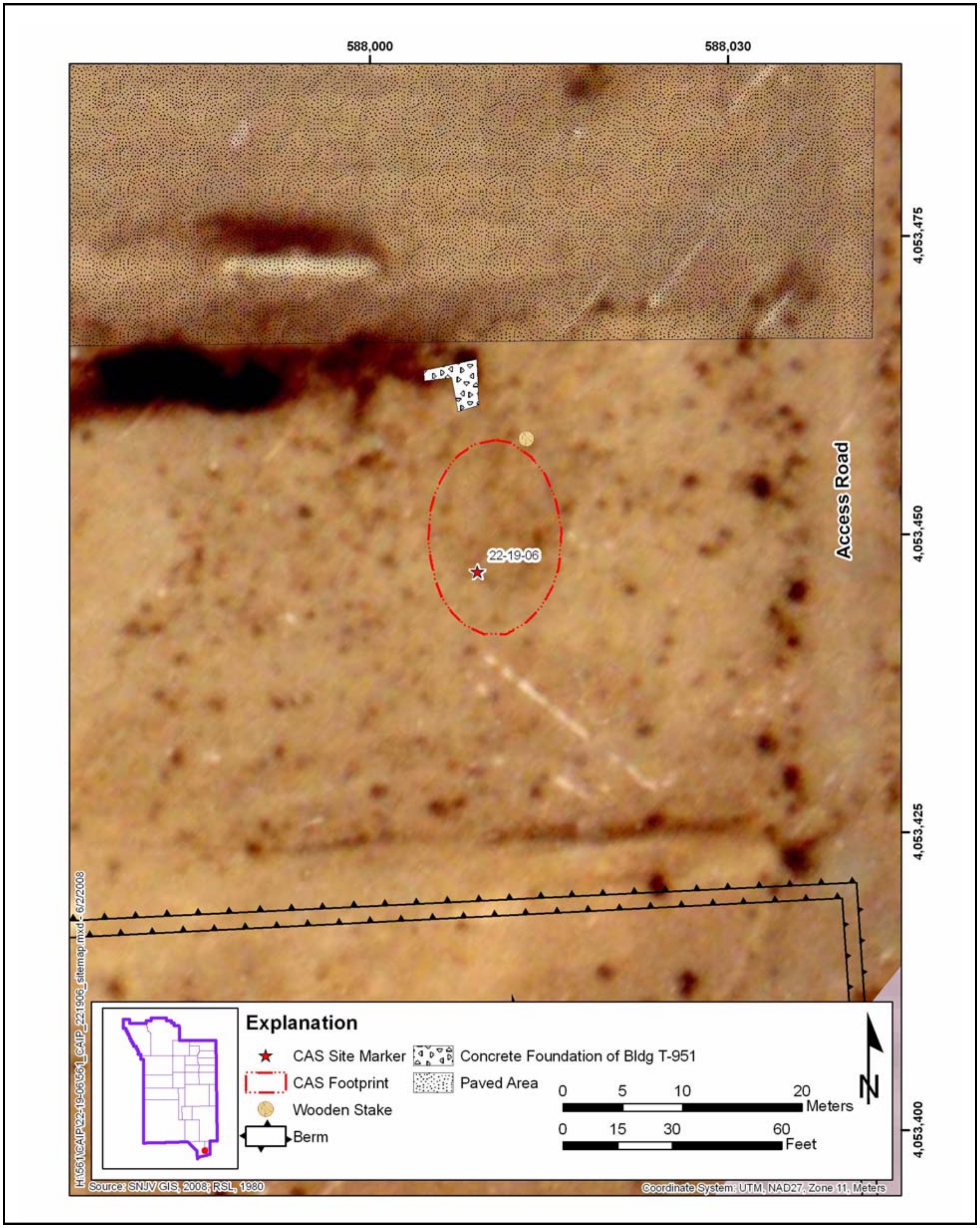

Figure A.2-7
Site Sketch of CAS 22-19-06, Buried Waste Disposal Site

Physical Setting and Operational History – Corrective Action Site 22-19-06 is located within the Mercury Valley basin. Section 2.1 contains additional information on the physical setting. There is no definitive information that indicates that this waste dump is associated with activities at Camp Desert Rock other than location.

Release Information – Potential releases may have occurred when the wastes were placed into the landfill. Waste disposed of in and around the landfill may contain contaminants that leaked into the surrounding soils at the site. 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 landfill.

Previous Investigation Results – There were no documented radiological surveys for this CAS. Geophysical surveys were performed in 2004 and identified buried metallic debris (see Figure A.9-10) in the area of the disposal trench (Fahringer, 2004).

A.2.7 Corrective Action Site 23-21-04, Waste Disposal Trenches

Corrective Action Site 23-21-04 consists of six waste disposal trenches and one potential covered trench located approximately 1,500 ft northeast of Building 23-160 in Area 23 of the NTS. Three of the trenches contain debris and some stained soil. The other three trenches appear to be empty. The potential covered trench is located at the southern end of the site. The environmental concern for the site is believed to be lead contamination of the soil due to waste disposal of bricks in the trenches. Figure A.2-8 shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 23-21-04 is located within the Mercury Valley basin. Section 2.1 contains additional information on the physical setting. There is no definitive information that indicates that the trenches are associated with activities at Mercury other than location.

Release Information – Potential releases may have occurred when the waste piles were placed into the trenches. Waste disposed of in and around the trenches may contain contaminants that leaked into the surrounding soils at the site. Debris in the six open and one covered trench may have contamination that leaked into the surrounding soils. If a release occurred, contaminants would have

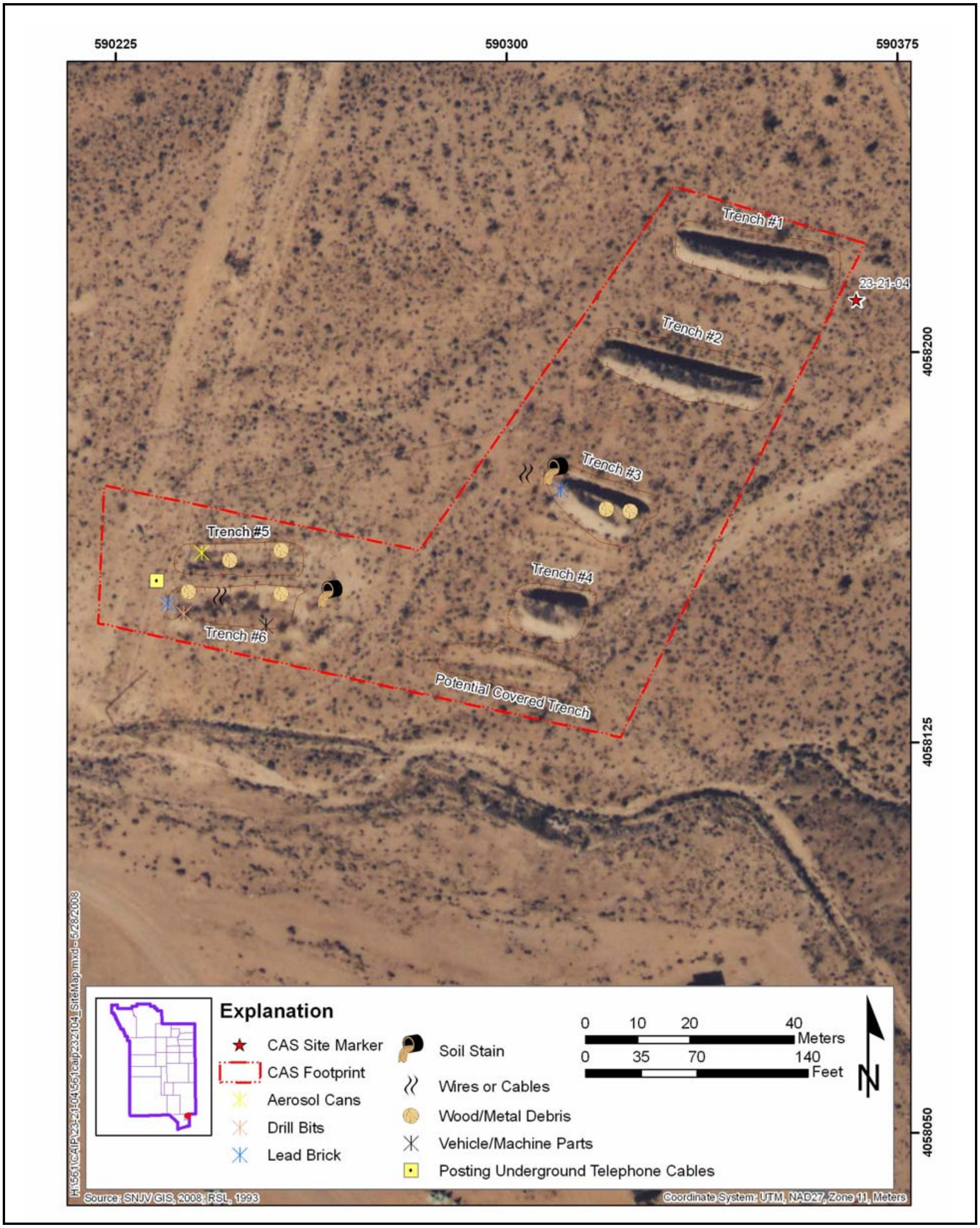

Figure A.2-8
Site Sketch of CAS 23-21-04, Waste Disposal Trenches

been limited in volume and are expected to be located in the soil within close proximity to the trenches.

Previous Investigation Results – There were no documented radiological surveys for this CAS. Geophysical surveys were performed in 2006 that did not identify buried metallic debris in the areas identified for this CAS (including the covered trench) (Fahringer, 2005).

A.2.8 Corrective Action Site 25-08-02, Waste Dump

Corrective Action Site 25-08-02 consists of a large waste dump located north of G Road between the RCP and R-MAD Complex in Area 25 of the NTS. The waste dump contains piles containing dirt, rock, and debris such as chunks of rock, broken concrete, metal, wires, cinder blocks, a lead brick, asphalt pieces, wood, an empty cable spool, clay pipes, hoses, rusted cans, batteries (possibly lead-acid type), 5-gal buckets, and bottles. There is also an area of unknown solidified, darker, rock-like material. There is a potential for lead and metals contamination of the soil from debris within the waste dump from bricks and batteries. Figure A.2-9 shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 25-08-02 is located in Area 25 within the Jackass Flats basin. Section 2.1 contains additional information on the physical setting. There is no definitive information that indicates that the piles are associated with Area 25 activities other than location.

Release Information – Potential releases may have occurred when the waste piles were placed on the ground surface at the waste dump. Waste disposed of in and around the piles may contain contaminants that leaked into the surrounding soils at the site. 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 debris.

Previous Investigation Results – In 2006, a gamma radiological walkover survey was performed at this CAS. No areas of elevated radioactivity were identified because measured levels from the CAS area were not distinguishable from local background levels. No geophysical surveys were performed for this CAS.

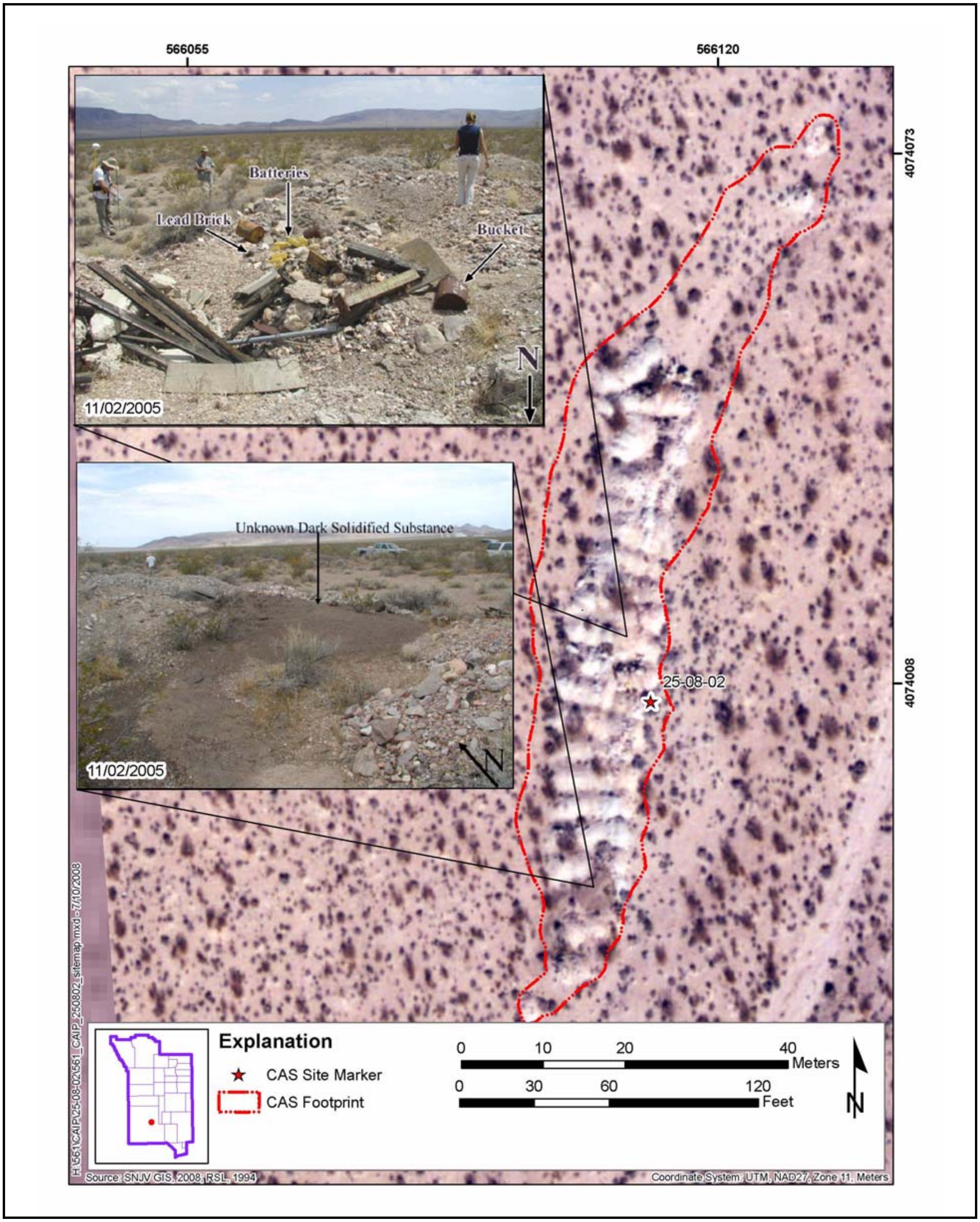

Figure A.2-9
Site Sketch of CAS 25-08-02, Waste Dump

A.2.9 Corrective Action Site 25-23-21, Radioactive Waste Dump

Corrective Action Site 25-23-21 consists of a radioactive waste dump located northeast of the E-MAD Facility in Area 25 of the NTS. The site also contains a second parcel of numerous scattered piles of debris along the Topopah Wash extending north of H Road. The waste dump contains numerous dirt mounds and piles within a posted “Controlled Area” and also miscellaneous piles and some debris extending up the wash to the H Road. There are two specific dirt mounds that are posted with “Caution Radioactive Material” signs. The debris within the dirt mounds and berms consists of wood, metal, pipes, cables, wires, and some concrete chunks. The second parcel also contains concrete, asphalt, and ballast in addition to more typical dump piles. There is a potential for radiological contamination of the soil and debris at the radioactive waste dump and the wash. Figure A.2-10 shows an expanded site sketch of the CAS including the second parcel. Figure A.2-11 shows a site sketch of the waste dump area.

Physical Setting and Operational History – Corrective Action Site 25-23-21 is located in Area 25 within the Jackass Flats basin. Section 2.1 contains additional information on the physical setting. There is no definitive information that indicates that the waste dump is associated with activities at E-MAD other than location.

Release Information – Potential releases may have occurred when the waste piles and mounds were placed on the ground surface at the waste dump. Waste disposed of in and around the piles may contain contaminants that leaked into the surrounding soils at the site. If a release occurred, contaminants would have been limited in volume and are expected to be located in the soil within close proximity to piles. Because the piles are located within the Topopah Wash, there is a potential for some contaminants to migrate down the wash.

Previous Investigation Results – In 2005, a gamma radiological walkover survey was performed of the waste dump area. The results of this survey identified an area (outside the posted controlled area) of radioactivity from 2 to 5 times higher than background levels (see Figure A.2-12). During a site walk, both pipes located inside of the two posted areas displayed readings above background.

Geophysical surveys were performed and did not identify buried metallic debris in the areas identified for this CAS (Fahringer, 2005).

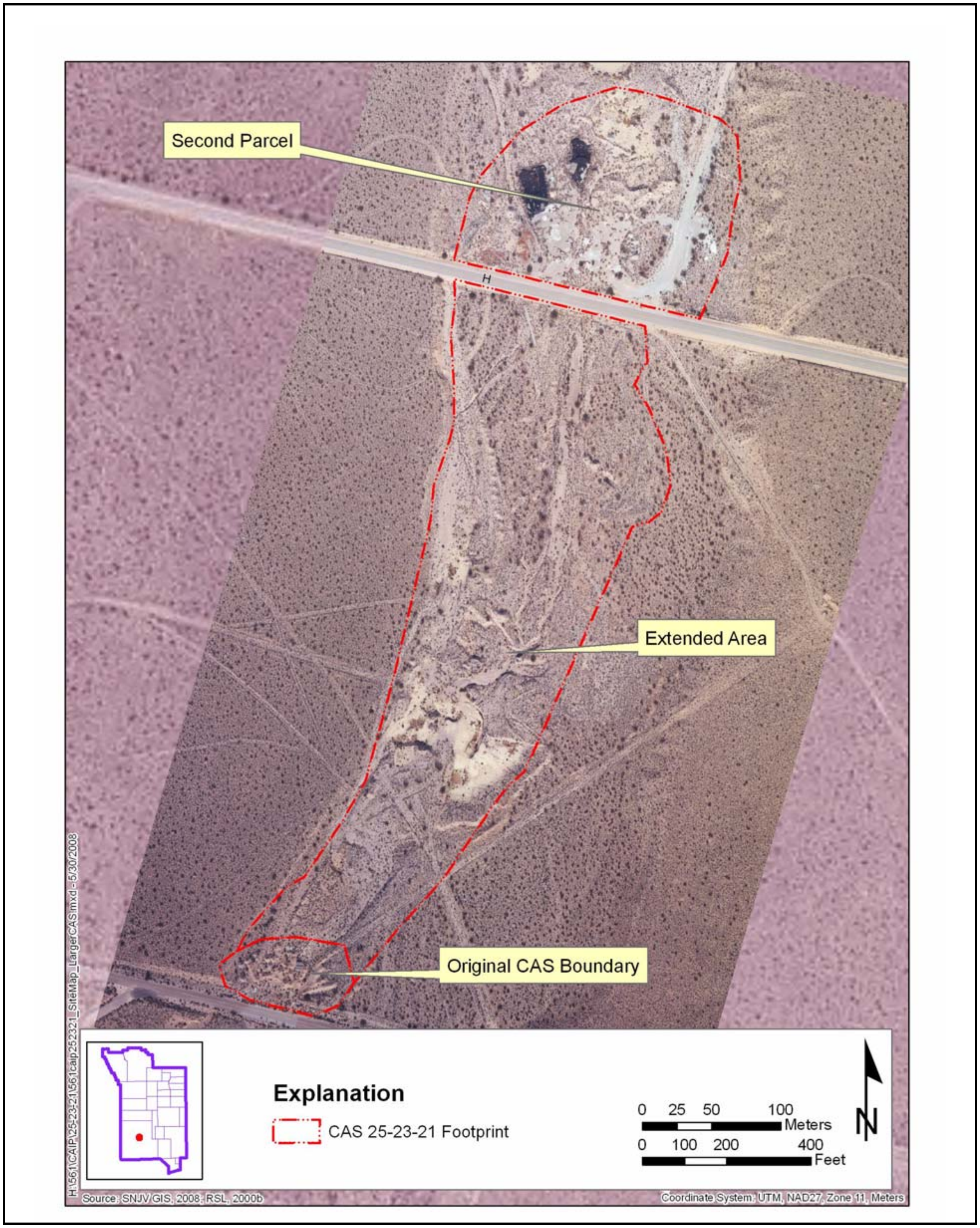

Figure A.2-10
Extended Site Sketch of CAS 25-23-21, Radioactive Waste Dump

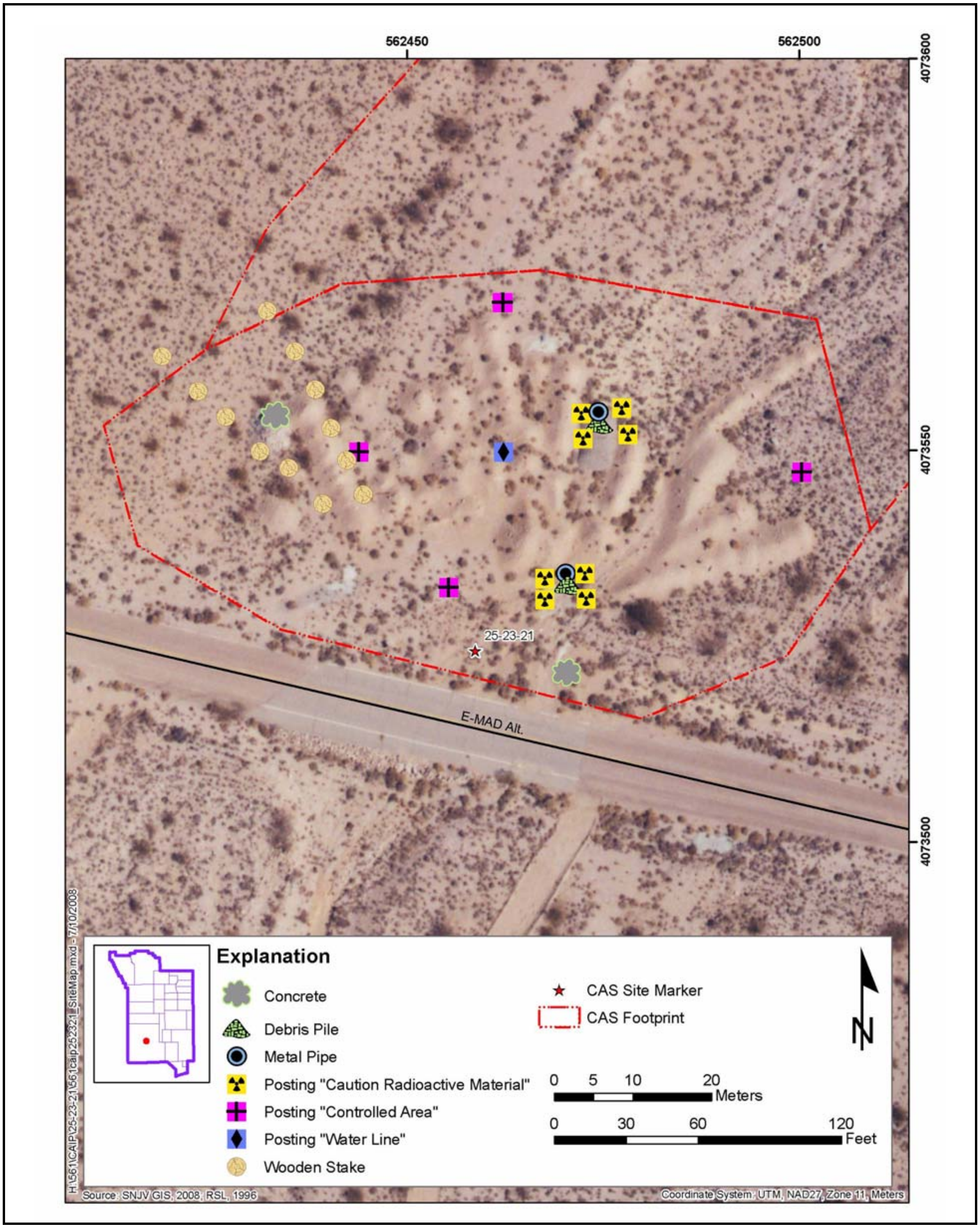

Figure A.2-11
Site Sketch of CAS 25-23-21, Radioactive Waste Dump

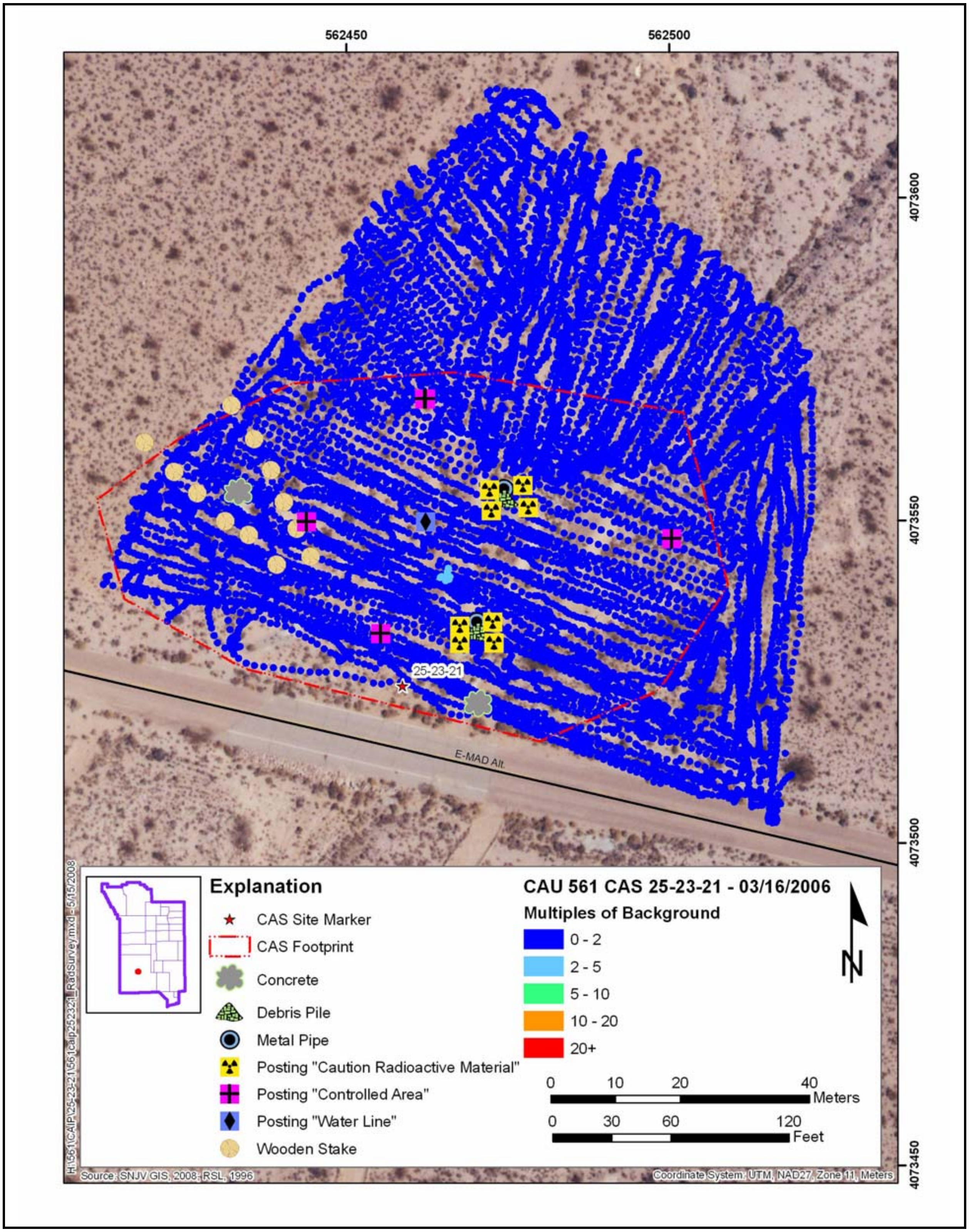

Figure A.2-12
Radiological Survey at CAS 25-23-21, Waste Dump

A.2.10 Corrective Action Site 25-25-19, Hydrocarbon Stains and Trench

Corrective Action Site 25-25-19 consists of surface soil stains, a tar spill, trenches, concrete pads (one with potential sump), debris, rock, and soil piles. The RCP facility is located just northwest of the CAS. Sources of the potential releases may include leaking vehicles and heavy equipment, maintenance and motor pool activities, surface debris, and potential buried debris. The CAS encompasses an approximately 8-acre area that is located southeast of the intersection of C Road (Jackass Flats Road) and G Road in Area 25 of the NTS. There is a potential for hydrocarbon contamination of the soil. Figure A.2-13 shows a site sketch of the CAS.

Physical Setting and Operational History – Corrective Action Site 25-25-19 is located in Area 25 within the Jackass Flats basin. Section 2.1 contains additional information on the physical setting. There is no definitive information that indicates that the stains or trenches are associated with activities at RCP other than location.

Release Information –Potential releases may have occurred when the waste piles and spills were placed on the ground surface at the site. Waste disposed of in and around the trenches and spills may contain contaminants that leaked into the surrounding soils at the site. If a release occurred, contaminants would have been limited in volume and are expected to be located in the soil within close proximity.

Previous Investigation Results – In 2008, a gamma radiological walkover of the area was performed. No areas of elevated radioactivity were identified because measured levels from the CAS area were not distinguishable from local background levels. Geophysical surveys were performed in 2007 and did not identify buried metallic debris in the areas identified for this CAS (Fahringer, 2007).

Figure A.2-13
Site Sketch of CAS 25-25-19, Hydrocarbon Stains and Trench

A.3.0 Step 1 - State the Problem

Step 1 of the DQO process defines the problem that requires study; identifies the planning team, and develops a conceptual model of the environmental hazards to be investigated.

The problem statement for CAU 561 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 561."

A.3.1 Planning Team Members

The DQO planning team consists of representatives from NDEP, NNSA/NSO, SNJV, and NSTec. The DQO planning team met on April 28, 2008, for the DQO meeting. The primary decision-makers are the NDEP and NNSA/NSO representatives.

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 561 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 made as to how to proceed. In such cases, NDEP and NNSA/NSO will be notified and given the opportunity to comment on, or concur with, the recommendation.

The applicability of the CSM to each CAS is summarized in Table A.3-1 and discussed below. Table A.3-1 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 the 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 surface and subsurface components (i.e., surface debris piles, buried waste) of the CSM. The CSM accounts for potential releases resulting from surface and subsurface spills. 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 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 561 sites is not available, contaminants detected at similar NTS sites were included in the

Table A.3-1
Conceptual Site Model
Description of Elements for Each CAS in CAU 561

<table>
<tr><th>CAS Identifier</th><th>01-19-01</th><th>02-08-02</th><th>03-19-02</th><th>05-62-01</th><th>12-23-09</th><th>22-19-06</th><th>23-21-04</th><th>25-08-02</th><th>25-23-21</th><th>25-25-19</th></tr>
<tr><td>CAS Description</td><td>Waste Dump</td><td>Waste Dump and Burn Area</td><td>Debris Pile</td><td>Radioactive Gravel Pile</td><td>Radioactive Waste Dump</td><td>Buried Waste Disposal Site</td><td>Waste DIsposal Trenches</td><td>Waste Dump</td><td>Radioactive Waste Dump</td><td>Hydrocarbon Stains and Trench</td></tr>
<tr><td>Site Status</td><td colspan="10">Sites are inactive and/or abandoned</td></tr>
<tr><td>Exposure Scenario</td><td colspan="10">Occasional</td></tr>
<tr><td>Sources of Potential Soil Contamination</td><td colspan="2">Surface and subsurface debris, stains, spills</td><td>Debris</td><td>Gravel</td><td colspan="6">Surface and subsurface debris, stains, spills</td></tr>
<tr><td>Location of Contamination/ Release Point</td><td colspan="10">Surface and subsurface soil at or near location(s) of stored waste/materials</td></tr>
<tr><td>Amount Released</td><td colspan="10">Unknown</td></tr>
<tr><td>Affected Media</td><td colspan="10">Surface and shallow subsurface soil; debris such as concrete, steel, and wood</td></tr>
<tr><td>Potential Contaminants</td><td>RAD</td><td>Lead, DRO</td><td>RAD</td><td>RAD</td><td>RAD</td><td>Unknown</td><td>Lead</td><td>Lead</td><td>RAD</td><td>DRO</td></tr>
<tr><td>Transport Mechanisms</td><td colspan="10">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.</td></tr>
<tr><td>Migration Pathways</td><td colspan="10">Vertical transport expected to dominate over lateral transport due to small surface gradients, except in washes.</td></tr>
<tr><td>Lateral and Vertical Extent of Contamination</td><td colspan="10">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 COC contamination is assumed to be within the spatial boundaries.</td></tr>
<tr><td>Exposure Pathways</td><td colspan="10">The potential for contamination exposure is limited to industrial and construction workers, and military personnel conducting training. These human receptors may be exposed to COPCs through oral ingestion, inhalation, dermal contact (absorption) of soil and/or debris due to inadvertent disturbance of these materials or irradiation by radioactive materials.</td></tr>
</table>

COC = Contaminant of concern
COPC = Contaminant of potential concern
DRO = Diesel-range organics
RAD = Radiological

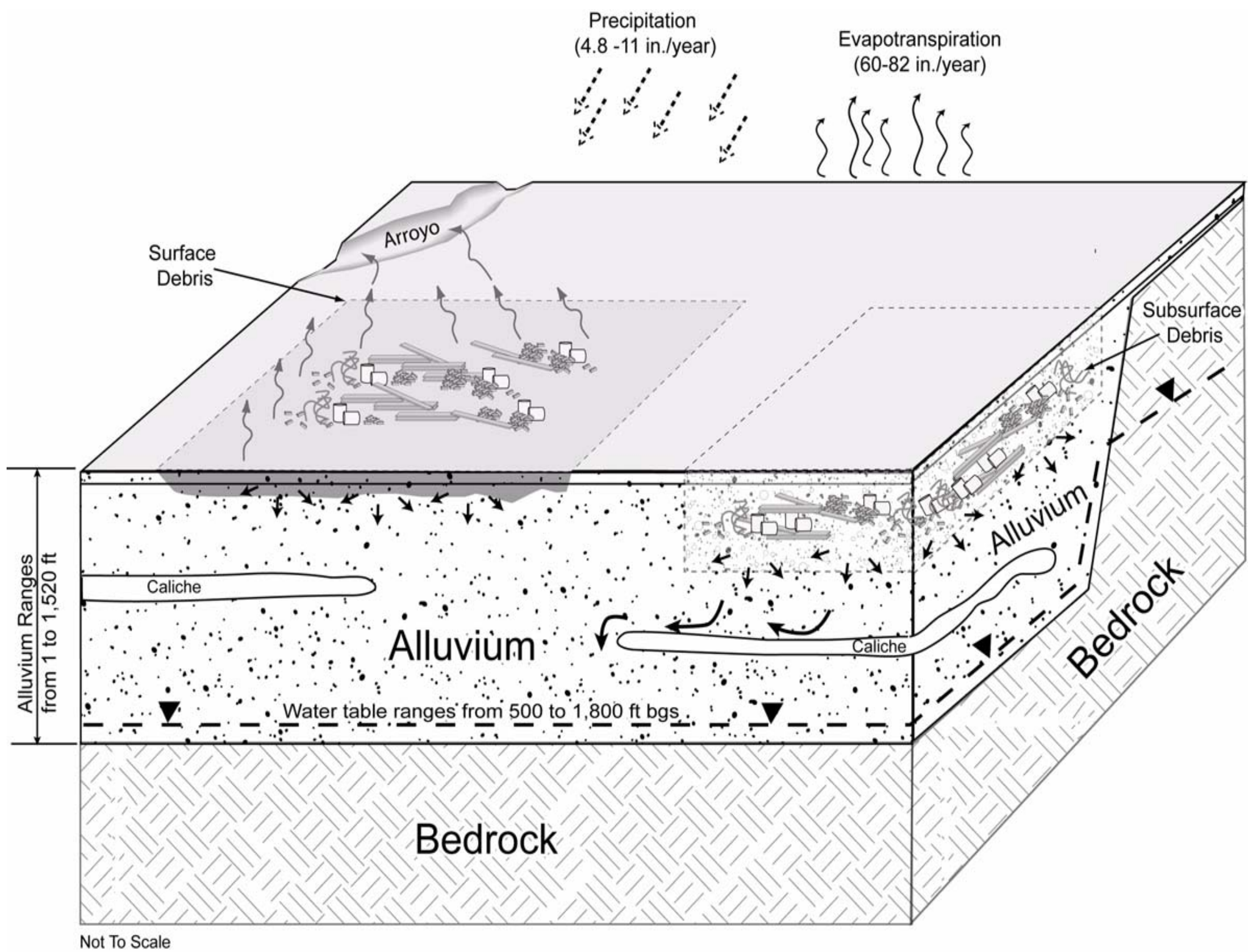

Figure A.3-1
Corrective Action Unit 561 Conceptual Site Model

contaminant lists to reduce uncertainty. The list of COPCs is intended to encompass all of the contaminants that could potentially be present at each CAS. The COPCs applicable to Decision I environmental samples from each of the CASs of CAU 561 are defined as the constituents reported from the analytical methods stipulated in Table A.3-2.

Table A.3-2
Analytical Program[a]

Analyses	01-19-01	02-08-02	03-19-02	05-62-01	12-23-09	22-19-06	23-21-04	25-08-02	25-23-21	25-25-19
Organic Contaminants of Potential Concern (COPCs)										
Total Petroleum Hydrocarbons-Gasoline-Range Organics and Diesel-Range Organics	X	X	--	--	X	X	X	X	X	X
Polychlorinated Biphenyls	X	X	--	--	X	X	X	X	X	X
Semivolatile Organic Compounds	X	X	--	--	X	X	X	X	X	X
Volatile Organic Compounds	X	X	--	--	X	X	X	X	X	X
Dioxin	--	X[b]	--	--	--	--	--	--	--	--
Inorganic COPCs										
Resource Conservation and Recovery Act Metals	X	X	--	--	X	X	X	X	X	X
Beryllium	X	X	--	--	X	X	X	X	X	X
Radionuclide COPCs										
Gamma Spectroscopy[c]	X	X	X	X	X	X	X	X	X	X
Isotopic Uranium	--	--	--	X	--	--	--	--	--	--

[a]The COPCs are the constituents reported from the analytical methods listed
[b]The six samples from the burn area will also be analyzed for dioxin
[c]Results of gamma analysis will be used to determine whether further radioanalytical analysis (i.e., isotopic radionuclides) is warranted

X = Required analytical method
-- = Not required

During the DQO meeting, CAS 02-08-02 discussions concerning the burning of construction debris at the burn area raised the question of potential dioxin contamination. To address this concern, dioxin was added to the analytical program for the six samples collected at the burn area.

The term dioxin is commonly used to refer to a family of toxic chemicals that all share a similar chemical structure and a common mechanism of toxic action. This family includes seven of the PCDDs, 10 of the PCDFs and 12 of the PCBs. Polychlorinated dibenzo dioxins and PCDFs are not commercial chemical products, but are trace level unintentional by-products of most forms of combustion, and several industrial chemical processes. Dioxins and furans are found in the air, soil, and food, but are mainly distributed through the air. However, only a small percentage of exposure is from air, and the primary source of exposure is by eating contaminated food. Of all the dioxins and furans, 2,3,7,8 TCDD is considered the most toxic (EPA, 2008). Also, of the 16 constituents reported from the dioxins/furans analysis, 2,3,7,8-TCDD is the only constituent that has an EPA Region 9 PRG of 0.000016 mg/kg (EPA, 2004). Therefore, the evaluation of dioxins at CAS 02-08-02 will be based on the analytical analysis of 2,3,7,8 TCDD of the six burn area samples.

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 providing greater protection against a decision error (see Section 6.2.6). Targeted analytes and targeted analytical methods for each CAU 561 CAS are identified in Table A.3-3.

Table A.3-3
Targeted Analytes and Analytical Methods for CAU 561

CAS	Chemical	Radiological
01-19-01	--	--
02-08-02	Lead, TPH-DRO	--
03-19-02	--	Gamma Spectroscopy
05-62-01	--	U-234, U-235, U-238, Gamma Spectroscopy
12-23-09	--	Gamma Spectroscopy
22-19-06	--	--
23-21-04	Lead	--
25-08-02	Lead	--
25-23-21	--	Gamma Spectroscopy
25-25-19	TPH-DRO	--

DRO = Diesel-range organics
TPH = Total petroleum hydrocarbons
U = Uranium
-- = Not required

A.3.2.3 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.3.2.4 Site Characteristics

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

A.3.2.5 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. Contaminants released into the Topopah Wash are subject to much higher transport mechanisms than contaminants released to other surface areas. Topopah Wash is generally dry but is subject to infrequent, potentially intense, stormwater flows. These 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 strength and the sediments drop out. Hydrologists readily identify these locations as sedimentation areas.

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 (4 in. per year [Winograd and Thordarson, 1975]), percolation of infiltrated precipitation at the NTS does not provide a significant mechanism for vertical migration of contaminants to groundwater (DOE/NV, 1992).

A.3.2.6 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 561 CASs are listed in Table A.3-4. These are based on NTS current and future land use. All of the CAU 561 CASs are in remote locations without any site improvements and where no regular work is performed. There is still the possibility, however, that site workers could occupy these locations on an occasional and temporary basis such as a military exercise. Therefore, these sites are classified as occasional work areas.

Table A.3-4
Land-Use and Exposure Scenarios

CAS	Record of Decision Land-Use Zone	Exposure Scenario
05-62-01, 25-08-02, and 25-25-19	**Research Test and Experiment Zone** This area is designated for small-scale research and development projects and demonstrations; pilot projects; outdoor tests; and experiments for the development, quality assurance, or reliability of material and equipment under controlled conditions. This zone includes compatible defense and nondefense research, development, and testing projects and 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.
01-19-01, 02-08-02, 03-19-02, and 12-23-09	**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.	
25-23-21	**Yucca Mountain Site Characterization Zone** This area includes land and facilities that are dedicated to the management of nuclear wastes and, therefore, is not available for other uses.	
22-19-06	**Solar Enterprise Zone** This area is designated for the development of a solar power generation facility, and light industrial equipment and commercial manufacturing capability.	
23-21-04	**Reserved** This area includes land and facilities that provide widespread flexible support for diverse short-term testing and experimentation. The reserved zone is also used for short-duration exercises and training such as nuclear emergency response, Federal Radiological Monitoring and Assessment Center training, and U.S. Department of Defense land-navigation exercises and training	

A.4.0 Step 2 - Identify the Goal of the Study

Step 2 of the DQO process states how environmental data will be used in meeting objectives and solving the problem, identifies study questions or decision statement(s), and considers alternative outcomes or actions that can occur upon answering the question(s).

A.4.1 Decision Statements

The Decision I statement is: “Is any COC present in environmental media within the CAS?” For judgmental sampling design, any analytical result for a COPC above the FAL will result in that COPC being designated as a COC. For probability (random) sampling design, any COPC that has a 95 percent UCL of the average concentration above the FAL will result in that COPC being designated as a COC. A COC may also be defined as a contaminant that, in combination with other like contaminants, is determined to jointly pose an unacceptable risk based on a multiple constituent analysis (NNSA/NSO, 2006). If a COC is detected, then Decision II must be resolved.

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

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

A corrective action will be determined for any site containing a COC. The evaluation of the need for corrective action will include the potential for wastes that are present at a site to cause the future contamination of site environmental media if the wastes were released.

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 Information Inputs

Step 3 of the DQO process 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:

- Samples must be either (a) be collected in areas most likely to contain a COC (judgmental sampling) or (b) properly represent contamination at the CAS (probabilistic sampling).
- 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 potential waste streams must provide sufficient information to determine potential remediation waste types and volumes.
- 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

Design of the sampling approaches for the CAU 561 CASs must ensure that the data collected are sufficient for selection of the corrective action alternatives (EPA, 2002). To meet this objective, the samples collected from each site should be either from locations that most likely contain a COC, if present (judgmental), or from sites that properly represent overall contamination at the CAS (probabilistic). These sample locations can, therefore, be selected by means of either (a) biasing factors used in judgmental sampling (e.g., a stain, likely containing a spilled substance) or (b) a probabilistic sampling design. Because the information available to develop judgmental sampling varies in scope among the CAU 561 CASs, both judgmental and probabilistic sampling approaches are used for the CAI. A judgmental sampling design has been developed for all CASs where appropriate and where biasing factors exist. A probabilistic sampling design has also been developed for portions of CASs 02-08-02, 12-23-09, 25-08-02, and 25-23-21.

The implementation of a judgmental approach for sample location selection, and of a probabilistic sampling approach, for CAU 561 are discussed in the following sections. Appendix C briefly reviews the methodology and computational approach for probabilistic sampling, and lists the sample size and locations as calculated by the VSP software program, including the values established as input for selecting random sample locations (PNNL, 2005).

A.5.2.1.1 Judgmental Approach for Sampling Location Selection

Decision I sample locations at all CASs will be determined based upon the likelihood of the soil containing a COC, if present at the CAS. 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.3-2.

Field-survey techniques may be used to select appropriate sampling locations. Field-screening techniques provide 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 561:

- Volatile organic compounds – A VOC detection instrument may be used to conduct headspace analysis because VOCs are a common concern at the NTS and have not been ruled out based upon process knowledge.
- Alpha and beta/gamma radiation – A radiological survey instrument will be used at all CASs.
- Gamma emitting radionuclides – A radiological dose rate measurement instrument may be used at 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 561:

- 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 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 evidence such as historical photographs, experience from previous investigations, or interviewee’s input, exists 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.

- 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.

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.5.2.1.2 Probabilistic Approach for Selection of Sample Size and Location

Resolution of the DQO Decision I associated with the probabilistic sampling design requires determining, with a specified degree of confidence, whether the true average contaminant concentrations at the site in question exceed their corresponding FALs. The averages from sample analytical results for each constituent are an estimation of the true average contaminant concentrations. Because the average contaminant concentrations from samples is only an estimate of the true (unknown) average contaminant concentrations, it is uncertain how well the sample averages represent the true averages. If an average contaminant concentration was directly compared to the FAL, a significant difference between the true average and the sample average could lead to making decision errors. To reduce the probability of making a false negative decision error, a conservative estimate of the true average is used to compare to the FAL. This conservative estimate (overestimation) of the true contaminant concentration averages will be calculated as the 95 percent UCLs of the respective sample contaminant concentration averages. By definition, there will be a 95 percent probability that the true average concentration is less than the 95 percent UCL of the sample average.

The calculation and comparison of UCLs to FALs will be conducted for all significant COPCs. A significant COPC is defined as any contaminant detected in any sample from the CAS at a concentration exceeding its corresponding PAL.

Computation of UCL

The computation of appropriate UCLs depends upon the data distribution, the number of samples, the variability of the dataset, and the skewness associated with the dataset. A statistical package will be used to determine the appropriate probability distribution (e.g., normal, lognormal, gamma) and/or a suitable nonparametric distribution-free method and then to compute appropriate UCLs. To ensure that the appropriate UCL computational method is used, the sample data will be tested for goodness-of-fit to all of the parametric and nonparametric UCL computation methods described in the EPA guidance document, *Calculating the Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites* (OSWER 9285.670) (OSWER, 2002).

Computation of an appropriate UCL for each of the significant COPCs requires that:

- A minimum number of samples be collected from random locations at each site.
- The data originate from a symmetric, but not necessarily normally distributed, population.
- The estimation of the variability is reasonable and representative of the population being sampled.
- The population values are not spatially correlated.

Computation of Minimum Sample Size

The minimum number of samples required to compute a UCL will be calculated from the actual investigation results for each of the significant COPCs to verify that sufficient samples were collected. The VSP software will be used to calculate minimum sample sizes (PNNL, 2005). This software was developed by Pacific Northwest National Laboratory for the DOE and the EPA to determine the minimum number of samples needed to characterize a site based on the type of test to be performed, the distribution and variability of the data, and the acceptable false positive and false negative error rates.

The input parameters to be used in calculating the minimum sample size are:

- A confidence level that a false negative error will not occur will be set at 95 percent.
- A confidence level that a false positive error will not occur will be set at 80 percent.
- A gray region width of 50 percent of each COPC action level.
- The average concentration or activity of the contaminant.
- The standard deviation of the contaminant average concentration or activity.

Estimation of Initial Sample Size

Because the minimum number of samples needed to perform the UCL comparison tests cannot be determined until after investigation results are obtained, the number of samples to be collected during the CAI must be estimated. Before the CAI, VSP software will be used to estimate the necessary minimum number of samples, based on data characteristic assumptions estimates will be generated as a result of the CAI (PNNL, 2005). The input parameters used to determine the estimated number of samples required to make DQO decisions are listed in Table A.5-1. Individual CAS probabilistic sampling and analysis designs are discussed in Section A.9.0 for CASs 02-08-02, 12-23-09, 25-08-02, and 25-23-21.

Table A.5-1
Parameter Values for Estimating Sample Size

Parameter	Initial Estimate	Final Determination[a]
Sampling Goal	Compare average to FAL	Compare average to FAL
Distribution	Data not assumed to be normally distributed	Best fit distribution determined based on actual data using ProUCL
Hypothesis	Assume site is dirty	Assume site is dirty
False Rejection Rate	5%	5%
False Acceptance Rate	15%	15%
Average	Because no data exist for this site, average was estimated	Determined based on actual data
Standard Deviation	Because no data exist for this site, standard deviation was estimated	Determined based on actual data

[a]Sample size will be calculated for each significant contaminant.

FAL = Final action level

These parameters were estimated because no data existed on which to base the sample size estimation. Therefore, the sufficiency of the number of samples collected will be evaluated following the CAI based on a recalculation of the sample size based on the actual data. For significant COPC analytical results reported as not detected, one-half of the detection limit values will be used to calculate statistical parameters (EPA, 1989). All calculations for the determination of sample size sufficiency will be provided in the investigation report.

Sample Locations

The location of initial CAI samples will be determined using a triangular grid pattern, based on a starting location chosen randomly. If additional samples need to be collected based on the determination of minimum sample size using actual sample results, additional sample locations will be determined using the same methodology (for five or more samples), or by randomly selecting each sample location (for less than five samples). The results of the initial, estimated sample size calculations and the placement of initial sample locations are presented in Appendix C.

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 Tables 3-4 and 3-5.

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

Step 4 of the DQO process defines the target population of interest and its relevant spatial boundaries, specifies temporal and other practical constraints associated with sample/data collection, and defines the sampling units on which decisions or estimates will be made.

A.6.1 Target Populations of Interest

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

- Each one of a set of locations bounding contamination in lateral and vertical directions.
- Potential 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

Practical constraints such as military activities at the NTS, weather (i.e., high winds, rain, lightning, extreme heat), utilities, threatened or endangered animal and plants, unstable or steep terrain, and/or access restrictions may affect the ability to investigate this site. The practical constraints associated with the investigation of the CAU 561 CASs are summarized in Table A.6-2.

Table A.6-1
Spatial Boundaries for CAU 561 CASs

Corrective Action Site	Spatial Boundaries
01-19-01	50 feet (ft) laterally, 15 ft vertically
02-08-02	50 ft laterally, 500 ft laterally downgradient in the wash, 15 ft vertically
03-19-02	50 ft laterally, 15 ft vertically
05-62-01	50 ft laterally, 15 ft vertically
12-23-09	50 ft laterally, 15 ft vertically
22-19-06	50 ft laterally, 15 ft vertically
23-21-04	50 ft laterally, 15 ft vertically
25-08-02	50 ft laterally, 15 ft vertically
25-23-21	50 ft laterally, 500 ft laterally downgradient in the wash, 15 ft vertically
25-25-19	50 ft laterally, 15 ft vertically

Table A.6-2
Practical Constraints for the CAU 561 Field Investigation

Corrective Action Site	Practical Constraints
01-19-01	Underground utilities
02-08-02	Underground utilities
03-19-02	Site access, military exercises, underground utilities
05-62-01	Site is underlain by bedrock, limiting excavation methods, underground utilities
12-23-09	Site access, military exercises, energized electrical lines, and communication lines
22-19-06	Site access, military exercises, underground utilities
23-21-04	Site access, military exercises, underground utilities
25-08-02	Site access, military exercises, underground utilities
25-23-21	Site access, military exercises, underground utilities
25-25-19	Site access, military exercises, underground utilities

A.6.4 Define the Sampling Units

The scale of decision-making in Decision I is defined as the CAS components. 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 the Analytic Approach

Step 5 of the DQO process specifies appropriate population parameters for making decisions, defines action levels, and generates an "If … then … else" decision rule that involves it.

A.7.1 Population Parameters

For judgmental sampling results, the population parameter is the observed concentration of each contaminant from each individual analytical sample. Each sample result will be compared to the FALs to determine the appropriate resolution to Decision I and Decision II. For Decision I, a single sample result for any contaminant exceeding a FAL would cause a determination that a COC is present within the CAS.

For probabilistic sampling results, the population parameter is the UCL of the sample population average concentration of each detected contaminant from all analytical samples from an individual contaminant release. The population parameter will be compared to the corresponding FALs to determine the appropriate resolution to Decision I and Decision II. For Decision I, a UCL of the average concentration for any contaminant exceeding a FAL would cause a determination that a COC is present within the CAS.

The Decision II population parameter is an individual analytical result from a bounding sample. For Decision II, a single bounding sample result for any contaminant exceeding a FAL would cause a determination that the contamination is not bounded.

A.7.2 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 RBCA process used to establish FALs is described in the *Industrial Sites Project Establishment of Final Action Levels* (NNSA/NSO, 2006). This process conforms with NAC Section 445A.227, which lists the requirements for sites with soil contamination (NAC, 2006a). For the evaluation of corrective actions, NAC Section 445A.22705 (NAC, 2006b) requires the use of ASTM Method E 1739-95 (ASTM, 1995) to "conduct an evaluation of the site, based on the risk it poses to public health and the environment, to determine the necessary remediation standards (i.e., FALs) or to establish that corrective action is not necessary."

This RBCA process defines three tiers (or levels) of evaluation involving increasingly sophisticated analyses:

- Tier 1 Evaluation – Sample results from source areas (highest concentrations) are compared to action levels based on generic (non-site-specific) conditions (i.e., the PALs established in the CAIP). The FALs may then be established as the Tier 1 action levels or the FALs may be calculated using a Tier 2 evaluation.

- Tier 2 Evaluation – Conducted by calculating Tier 2 SSTLs using site-specific information as inputs to the same or similar methodology used to calculate Tier 1 action levels. 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. The TPH concentrations will not be used for risk-based decisions under Tier 2 or Tier 3. Rather, the individual chemicals of concern will be compared to the SSTLs.

- Tier 3 Evaluation – Conducted by calculating Tier 3 SSTLs on the basis of more sophisticated risk analyses using methodologies described in Method E 1739-95 that consider site-, pathway-, and receptor-specific parameters.

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.7.2.1 Chemical PALs

Except as noted herein, the chemical PALs are defined as the EPA *Region 9 Risk-Based Preliminary Remediation Goals (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 average concentration plus two standard deviations 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, 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.7.2.2 Total Petroleum Hydrocarbon PALs

The PAL for TPH is 100 ppm as listed in NAC 445A.2272 (NAC, 2006c).

A.7.2.3 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). The NCRP 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 Underground Test Area Project limit of 400,000 picocuries per liter for discharge of water containing tritium (NNSA/NV, 2002b).

A.7.3 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, else the decision will be to continue sampling to define the extent.

The decision rules for Decision I are:

- If the population parameter 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, else no further investigation is needed for that COPC in that population.

- If a COC exists at any CAS, then a corrective action will be determined, else no further action will be necessary.

- If a waste is present that, if released, has the potential to cause the future contamination of site environmental media, then a corrective action will be determined, else no further action will be necessary.

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 in any bounding direction, then additional samples will be collected to complete the Decision II evaluation, else the extent of the COC contamination has been defined.

- 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 determine potential remediation waste types and evaluate the feasibility of remediation alternatives, else collect additional waste characterization samples.

A.8.0 Step 6 - Specify Performance or Acceptance Criteria

Step 6 of the DQO process defines the decision hypotheses, specifies controls against false rejection and false acceptance decision errors, examines consequences of making incorrect decisions from the test, and places acceptable limits on the likelihood of making decision errors.

A.8.1 Decision Hypotheses

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

- Validity testing of CSMs based on investigation results.

- Evaluation of the data quality based on DQI parameters.

A.8.2 False Negative Decision Error

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

A.8.2.1 False Negative Decision Error for Judgmental Sampling

In judgmental sampling, the selection of the number and location of samples is based on knowledge of the feature or condition under investigation and on professional judgment (EPA, 2002). Judgmental sampling conclusions about the target population depend upon the validity and accuracy of professional judgment.

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

- 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.
- Having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.
- Having a high degree of confidence that the dataset is of sufficient quality and completeness.

To satisfy the first criterion, 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 FALs). 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 QAPP (NNSA/NV, 2002a) and Section 6.2.2 of this document. 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 for 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. Site-specific DQIs are discussed in more detail in Section 6.2.2.

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 QAPP (NNSA/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.8.2.2 False Negative Decision Error for Probabilistic Sampling

The false negative error rate for CASs 02-08-02, 12-23-09, 25-08-02, and 25-23-21 was established by the DQO meeting participants at 0.05 (or 5 percent probability). Upon validation of the analytical results, statistical parameters will be calculated for each significant COPC as defined in Section A.5.2.1.2. Maintenance of a false negative error rate of 0.05 is contingent upon:

- Population distribution
- Sample size
- Actual variability
- Measurement error

Control of the false negative decision error, therefore, for probabilistic sampling designs is accomplished by ensuring that the following requirements are met for each of the significant COPCs:

- The population distributions fit the applied UCL determination method.
- A sufficient sample size was collected.
- The actual standard deviation is calculated.
- Analyses conducted were sufficient to detect contaminants exceeding FALs.

A.8.3 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.

False positive results are typically attributed to laboratory and/or sampling/handling errors that could cause cross contamination. To control against cross contamination, decontamination of sampling equipment will be conducted according to established and approved procedures and only clean sample containers will be used. To determine whether a false positive analytical result may have occurred, the following quality control samples will be collected as required by the QAPP (NNSA/NV, 2002a):

- Trip blanks (1 per sample cooler containing VOC environmental samples)
- Equipment blanks (1 per sampling event)
- Source blanks (1 per uncharacterized source lot)
- Field blanks (minimum of 1 per CAS, additional if field conditions change)

For probabilistic sampling, false positive decision error was established by the DQO meeting participants at 0.20 (or 20 percent probability). Protection against this decision error is also afforded by the controls listed in Section A.8.2.2 for probabilistic sampling designs.

A.9.0 Step 7 - Develop the Plan for Obtaining Data

Step 7 of the DQO process selects and documents a design that will yield data that will best achieve performance or acceptance criteria. Judgmental and probabilistic sampling schemes will be implemented to select sample locations and evaluate analytical results for CAU 561. Sections A.9.1 through A.9.3 contain general information about collecting Decision I and Decision II samples under judgmental and probabilistic sampling designs, while the subsequent sections provide CAS-specific sampling activities, including planned sample locations.

A.9.1 Judgmental Sampling

A judgmental sampling design will be implemented for all CASs in CAU 561. Because individual sample results, rather than an average concentration, will be used to compare to FALs at the CASs undergoing judgmental sampling, statistical methods to generate site characteristics will not be used. Adequate representativeness of the entire target population may not be a requirement to developing a sampling design. If good prior information is available on the target site of interest, then the sampling may be designed to collect samples only from areas known to have the highest concentration levels on the target site. If the observed concentrations from these samples are below the action level, then a decision can be made that the site contains safe levels of the contaminant without the samples being truly representative of the entire area (EPA, 2006).

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 for judgmentally sampled sites, 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.5.2.1.1. 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. Samples will be collected from the piles based on biasing factors (e.g., staining, odor, heterogeneous concentrated debris), if present. If no debris or biasing factors are present, then one sample will be collected from the center of the pile and submitted for laboratory analysis. The Site Supervisor has the discretion to modify the judgmental sample locations, but only if the modified locations meet the decision needs and criteria stipulated in this DQO.

For all of the CASs, the following activities will be conducted as a part of the investigation strategy for Decision I sampling:

- A visual survey will be conducted of all CASs at the surface and in any trenches/excavations.
- Potentially hazardous materials (e.g., lead, batteries, drums) will be identified and staged for removal.
- A soil sample will be collected beneath potentially hazardous materials removed from any CASs.
- All PSM (e.g., tar, radiologically elevated concrete, drum/bucket contents) will be sampled as PSM based on the analytical suite established in Section A.3.0 for each CAS.
- Judgmental sampling locations will be established based on field biasing factors (e.g., visible staining, odor, and geophysical and/or radiological surveys).

A.9.2 Probabilistic Sampling

A probabilistic sampling scheme will also be implemented to select sample locations and evaluate analytical results for CASs 02-08-02, 12-23-09, 25-08-02, and 25-23-21. The need for the probabilistic sampling data is to characterize a population similar features within a CAS. For probabilistically sampled sites, randomly selected sample locations will be chosen, with locations specified by the VSP software (PNNL, 2005). If a selected location cannot be sampled due to a physical barrier the Site Supervisor will re-establish the location at the nearest place that a sample can be collected. For any locations that do not fall on a pile, the nearest pile will be selected for sampling. During the investigation, if it is determined that the material being sampled is anomalous to the population being characterized (appears to be from a different source), then that material will be sampled according to the judgmental sampling approach.

A.9.3 Decision II Sampling

To meet the DQI of representativeness for Decision II samples (that Decision II sample locations represent the population of interest as defined in Section A.6.1), judgmental 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. 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.

A.9.4 General Sampling Strategy

This section discusses the sampling and analysis design applicable to all CAU 561 CASs.

All the CASs have similar features (waste disposal areas.) The sites consist of dumps, trenches, piles, burned materials, and stains. There are three sites that have been identified as radioactive and the remaining sites mainly consist of nonradioactive construction debris.

The general strategy for sampling will be applied to each of the CASs. Because certain sites are combining judgmental and probabilistic sampling strategies, the following sections provide detail on the sampling approach for each CAS.

A.9.4.1 Corrective Action Site 01-19-01, Waste Dump

Corrective Action Site 01-19-01 is contained within a fenced area. The CAS is approximately 20 ft to the east of Building 1-31-2.e1. Debris at the surface is visible within the barbed wire fence; however, according to geophysical surveys conducted in 2004, there is a larger area of buried metallic debris. Scattered debris at the surface includes concrete chunks, rebar, wood debris, and red brick pieces.

During Decision I judgmental sampling, the following features will be sampled:

- Two perpendicular (L-shaped) trenches are proposed to profile the buried metallic debris. Trench 1 will be orientated from the northeast end diagonally to the southwest through the area of the highest geophysical anomaly. The Trench 2 will be perpendicular to Trench 1 and cut through the approximate center of the fenced area.

- There will be a minimum of four samples collected from biased locations within each trench. One sample (at a minimum) will be collected from the native soil interface (NSI) below the most significant waste profile. If no biasing factors are present, then all four samples will be collected within the trench at different depths within a vertical profile. The top sample will be collected at 1 to 2 ft bgs, the bottom sample at the NSI, and two samples in between.

- Biasing factors within the trench may include soil staining, a concentrated heterogeneous profile, and/or the presence of waste.

Proposed Decision I trench locations are shown in Figure A.9-1.

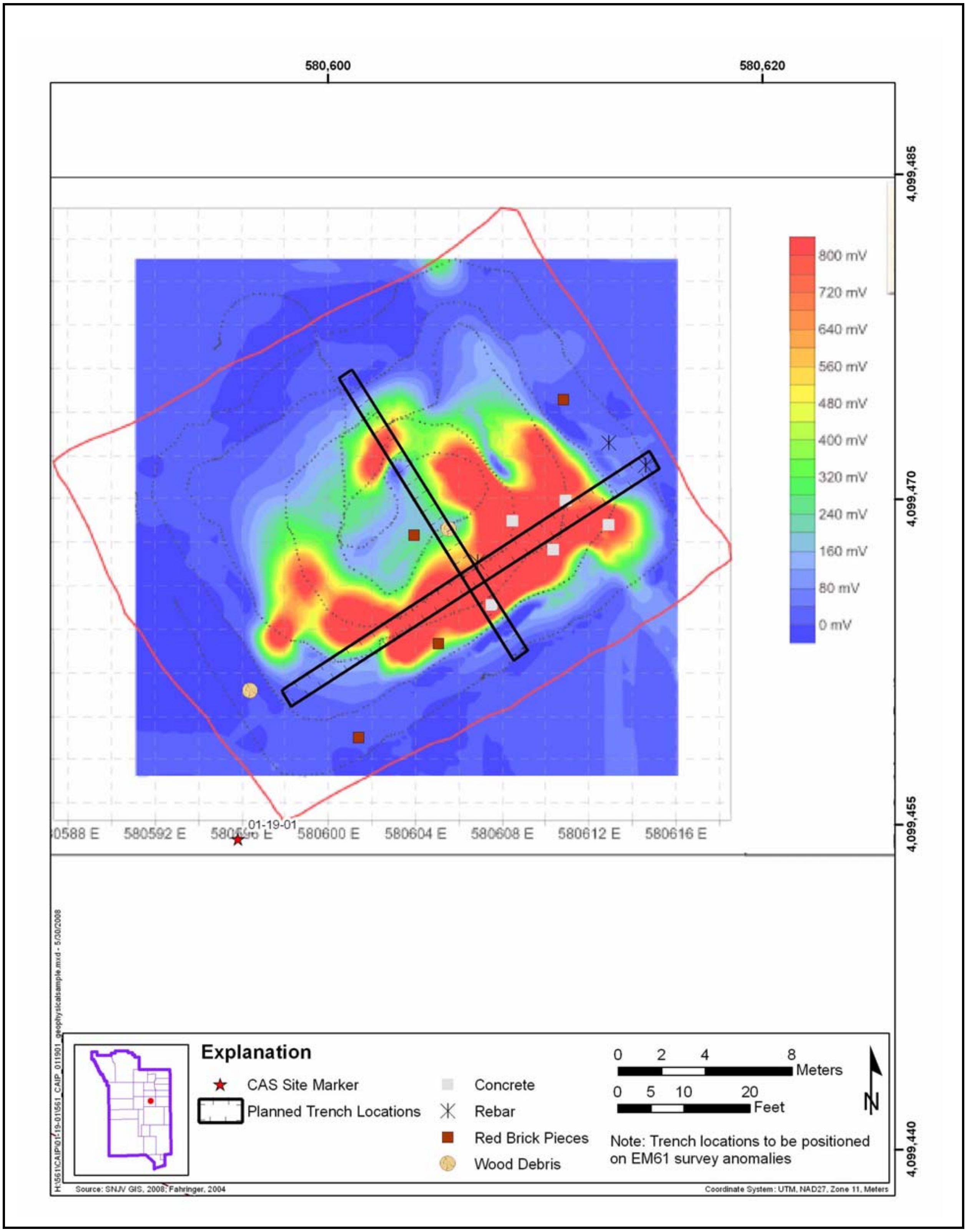

Figure A.9-1
Geophysical Survey with Planned Trench Locations at CAS 01-19-01

A.9.4.2 Corrective Action Site 02-08-02, Waste Dump and Burn Area

Corrective Action Site 02-08-02 has two CAS components; the waste dump and the burn area. The waste dump piles are located in the dry wash southeast of the Area 2 Camp. Several additional outlier piles to the northeast are also included in the CAS. There is currently no fencing surrounding the CAS features. There is visible debris at the surface which consists of dirt and large (1 to 7 ft diameter) boulders, cables, wire, wood planks, tires, pipes, and sheet metal. There was one 55-gal rusted drum identified during the field reconnaissance. The assumption is made that all piles came from the same source including the outlier piles located outside of the perimeter of the waste dump area and will be characterized as a single population using a probabilistic approach. If any piles are found that are anomalous to this population, those piles will be evaluated individually using a judgmental approach.

The burn area is located to the northwest of the waste dump piles. Within the burn area, there is mostly metallic debris (e.g., nails, hinges), wood, charcoal pieces, and solidified melted metal.

During Decision I judgmental sampling, the following features will be sampled:

- Six judgmental samples will be collected from the burn area at biased locations. These locations will be selected based on biasing factors such as melted metal, burned debris, or soil staining that may be the result of any materials that were burned.
- Two samples will be collected downgradient in the wash area.
- In the event that the material in the pile is not consistent with the other waste piles, additional samples will be collected from anomalous piles or wastes within the waste dump piles (e.g., drum).

During Decision I probabilistic sampling, the following will be sampled according to the following parameters set and calculated by the VSP software:

- Twelve location were randomly selected along the perimeter of the waste dump area using VSP. For any locations that do not fall on a pile, the nearest pile will be selected for sampling. Excavate through the pile with a backhoe. Samples will be collected from the piles based on biasing factors (e.g., staining, odor, heterogeneous concentrated debris), if present. If no debris or biasing factors are present, then one sample will be collected from the center of the pile and submitted for laboratory analysis.

- After the removal of potentially hazardous debris (e.g., lead bricks), samples will be collected from the soil beneath these items to ensure that there has been no contamination released onto surrounding soils.

The geophysical survey of the burn area that was used to bias the sampling locations are shown in Figure A.9-2.

Proposed Decision I sample locations are shown in Figure A.9-3.

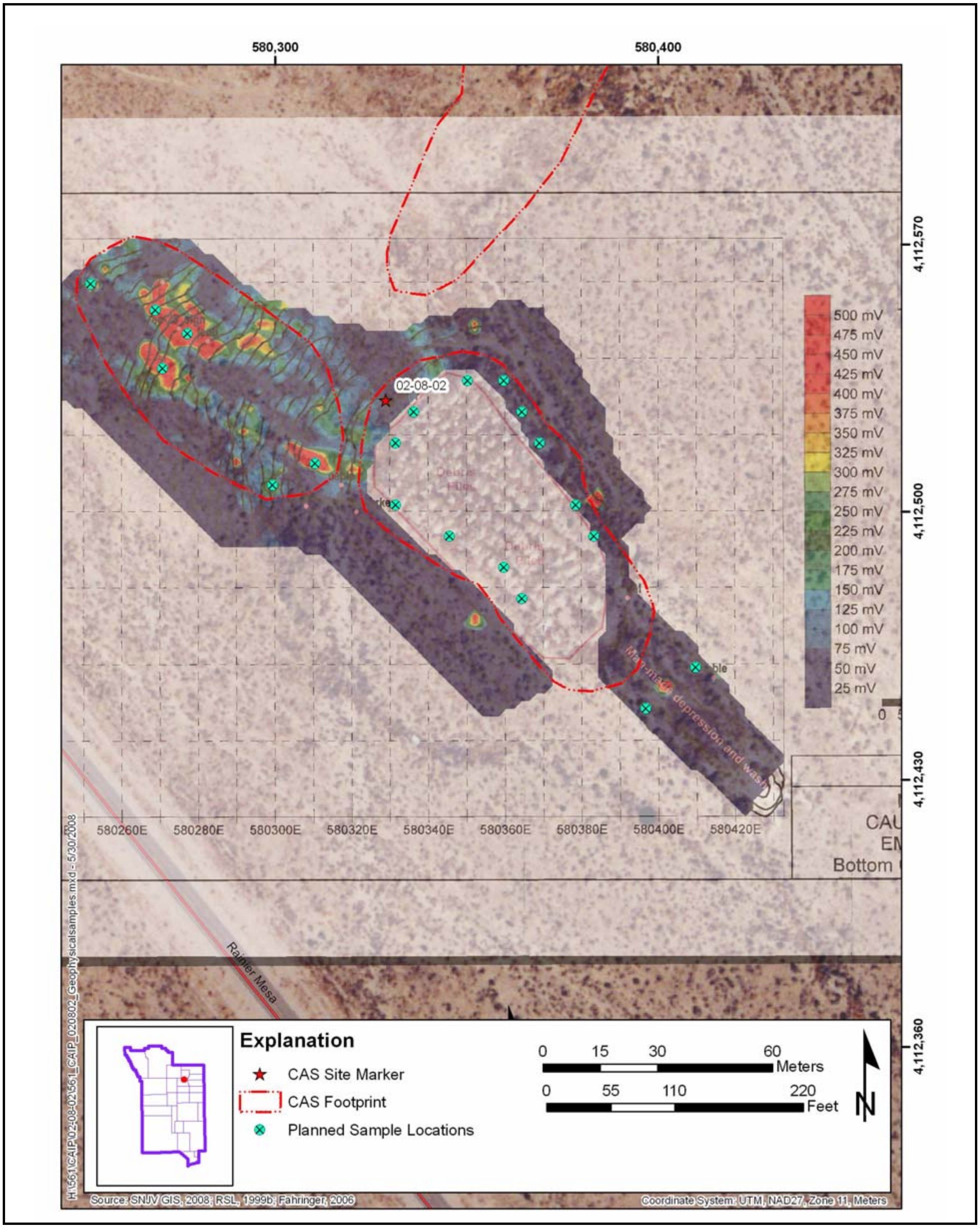

Figure A.9-2
Geophysical Survey of the Burn Area at CAS 02-08-02

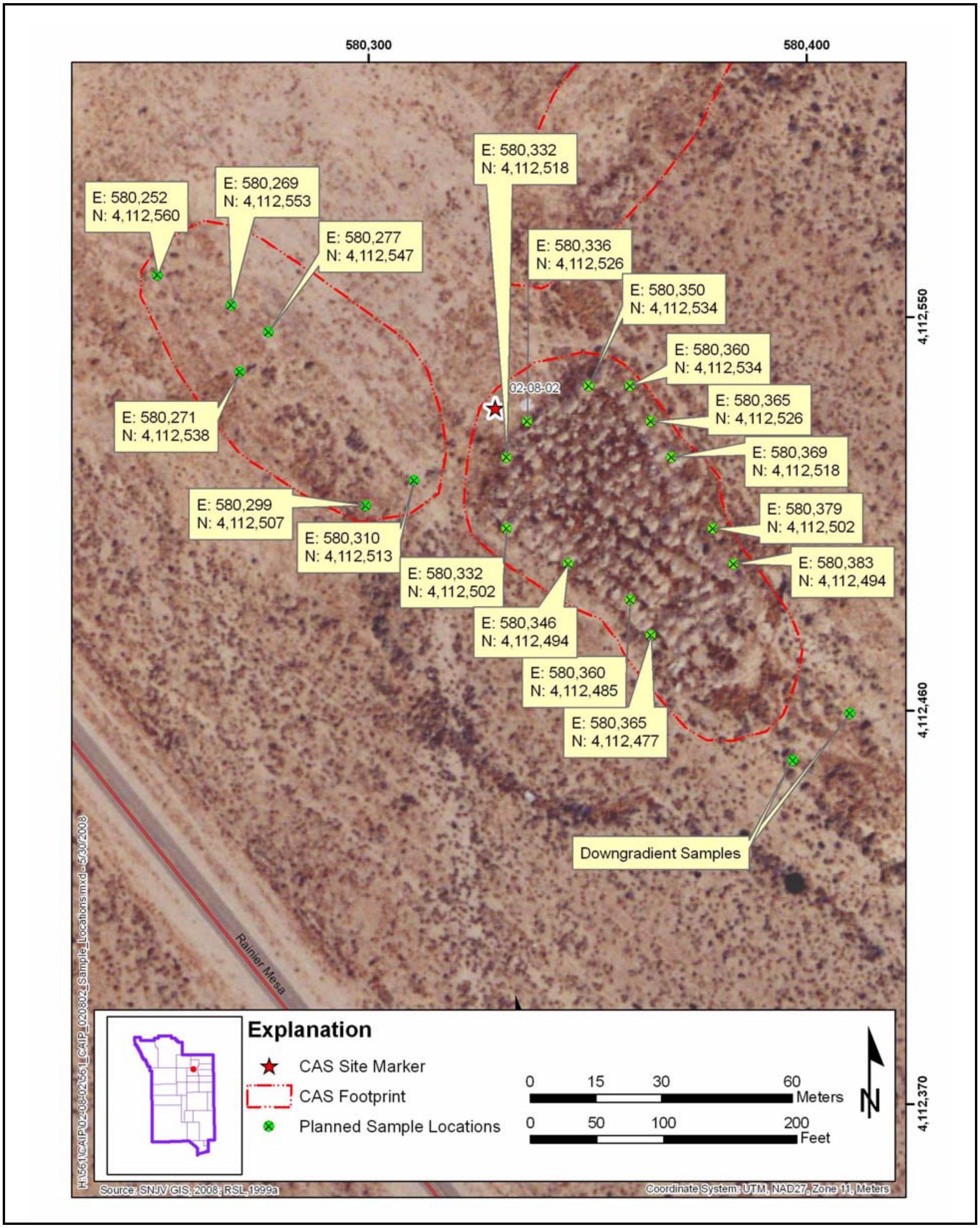

Figure A.9-3
Planned Sample Locations at CAS 02-08-02

A.9.4.3 Corrective Action Site 03-19-02, Debris Pile

Corrective Action Site 03-19-02 is surrounded by “Caution Radioactive Material” postings and is not fenced. The area contains debris believed to be associated with the Pommard test. Debris at the surface are visible within the posted area and include concrete slabs and chunks, rebar, and steel debris pieces that are partially buried.

During Decision I judgmental sampling, the following features will be sampled:

- One PSM sample will be collected from each of the two concrete locations that had the highest elevated radioactivity as identified during the 2007 gamma walkover survey.
- A biased surface soil sample will be collected from beneath each of the concrete PSM sample locations to determine contamination in the adjacent soils.

The gamma radiological walkover survey of the debris pile is shown in Figure A.9-4.

Proposed Decision I sample locations are shown in Figure A.9-5.

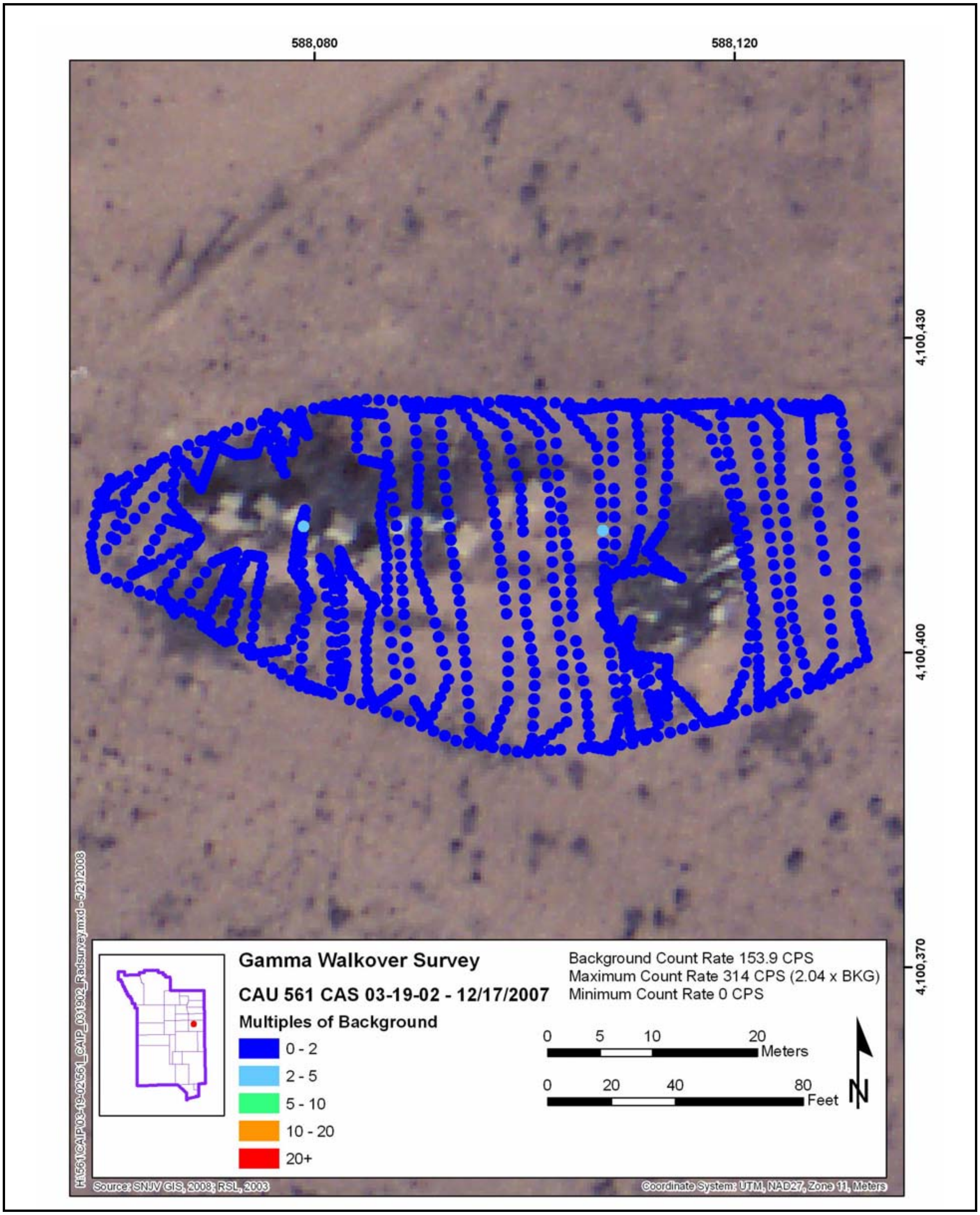

Figure A.9-4
Gamma Radiological Walkover Survey at CAS 03-19-02

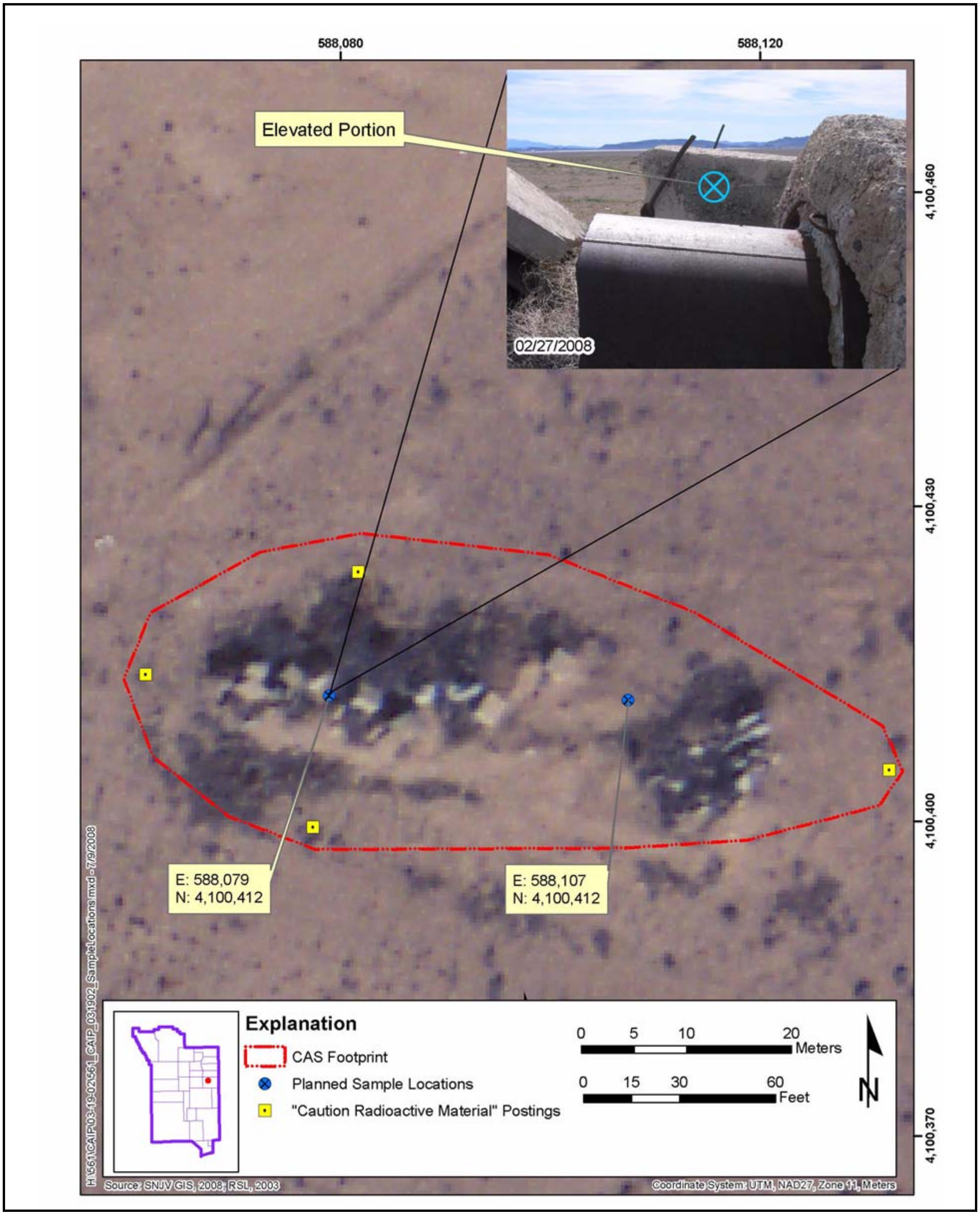

Figure A.9-5
Planned Sample Locations at CAS 03-19-02

A.9.4.4 Corrective Action Site 05-62-01, Radioactive Gravel Pile

Corrective Action Site 05-62-01 is surrounded by a fence with "Caution Radioactive Material" postings. The pile is approximately 5 ft high and has visible protruding concrete and metal debris. A gamma radiological walkover survey for this CAS was performed in 2006. No areas of elevated radioactivity were identified because measured levels from the CAS area were not distinguishable from local background levels.

During Decision I judgmental sampling, the following features will be sampled:

- A trench will be excavated through the lowest side of the pile with the length determined by the furthest reach of the backhoe.
- During the trenching, a sample will be collected and submitted of the pile material, based upon the highest FSR or other biasing factors.
- If there are no biasing factors, sample as close to the center of the pile as practical.
- Biasing factors within the excavation may include soil staining, a concentrated heterogeneous profile, and/or odor may be sampled if identified during the field investigation.
- One sample will be collected beneath the pile at the NSI will be submitted for laboratory analysis.
- Four surface soil samples will be collected within the fence area on each side of the gravel pile to determine whether potential contamination is migrating. These samples will be targeted at locations of erosion, if apparent.

Proposed trench and surface soil locations are shown in Figure A.9-6.

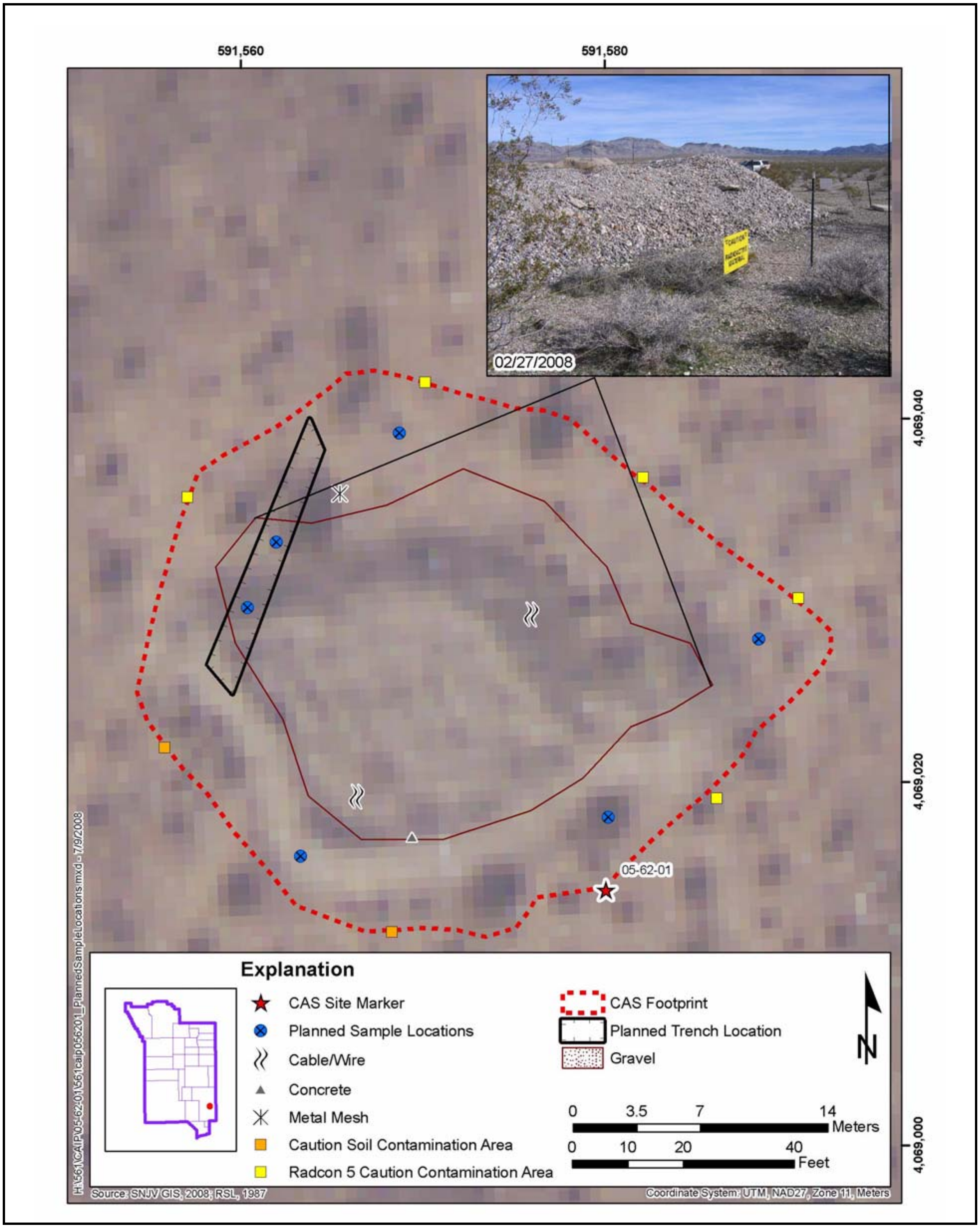

Figure A.9-6
Planned Sample Locations and Trench Location at CAS 05-62-01

A.9.4.5 Corrective Action Site 12-23-09, Radioactive Waste Dump

Corrective Action Site 12-23-09 has two separate fenced areas that comprise the CAS boundary: the north fenced area and the south fenced area. No debris is visible within the barbed-wire fence; however, according to geophysical surveys conducted in 2004, there is a larger area of buried metallic debris.

During Decision I judgmental sampling, the following features will be sampled:

- The soil mound in the north fenced area will be excavated and a minimum of one soil sample will be collected from the center of the mound.
- If biasing factors are noted during the excavation, then additional samples may be collected and submitted for laboratory analysis. Biasing factors may include radiologically elevated soil, stained soil, visible heterogeneous debris, and odor.

During Decision I probabilistic sampling, the following will be sampled:

- Six surface sample locations were selected randomly by the VSP software program within the north and south fenced areas combined.

The gamma radiological walkover survey identified areas of radioactivity from 2 to 5 times higher than background levels at the soil mound (Figure A.9-7). A gamma radiological walkover survey was performed of the south fenced area in 2008. No areas of elevated radioactivity were identified as measured levels from the south fenced area were not distinguishable from local background levels.

Geophysical surveys were performed and identified buried metallic debris (Figure A.9-8) in the area of the soil mound. This is the same area (soil mound) where elevated radioactivity was identified.

Proposed Decision I sample locations are shown in Figure A.9-9.

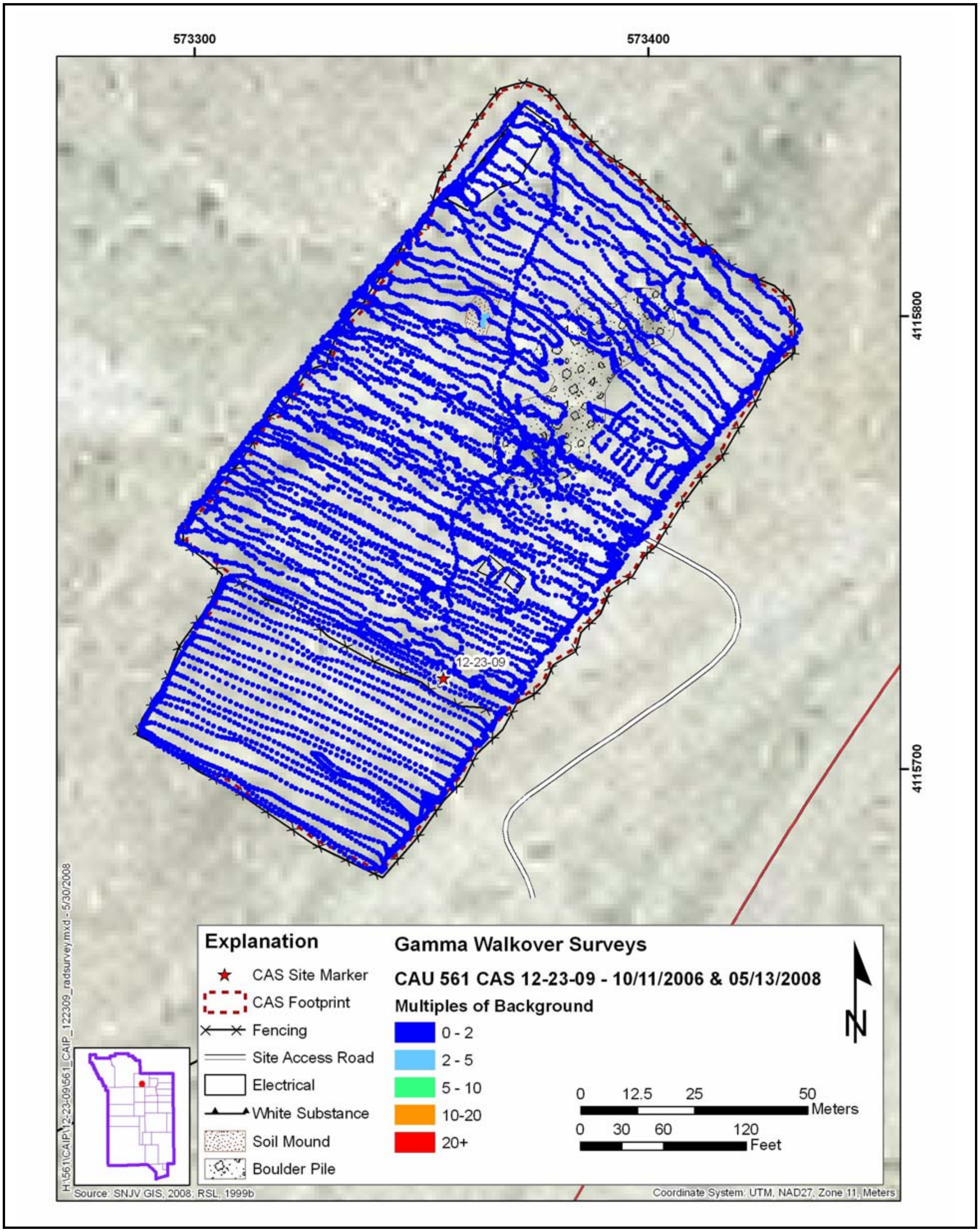

Figure A.9-7
Radiological Survey of the North Fenced Area at CAS 12-23-09

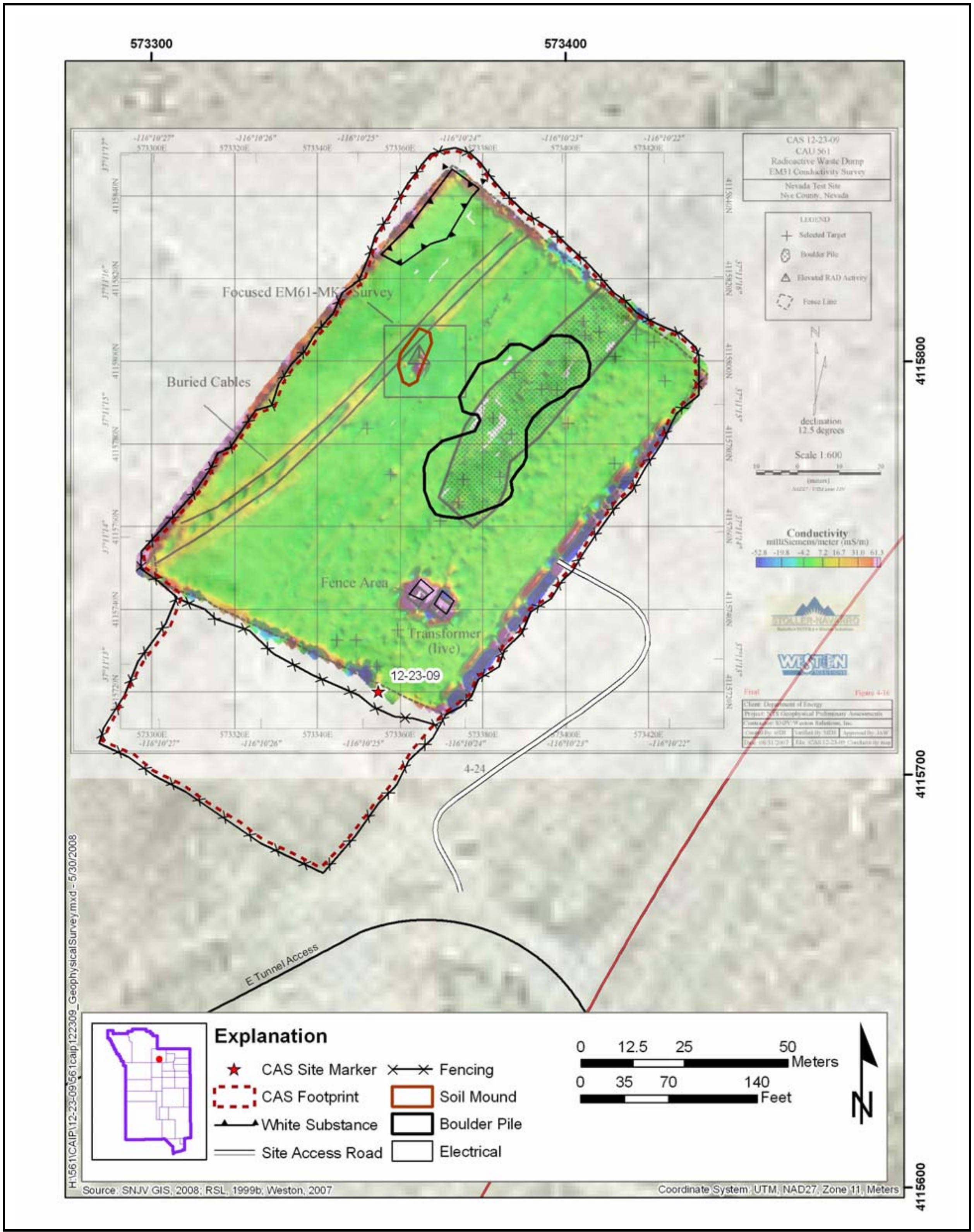

Figure A.9-8
Geophysical Survey of the North Fenced Area at CAS 12-23-09

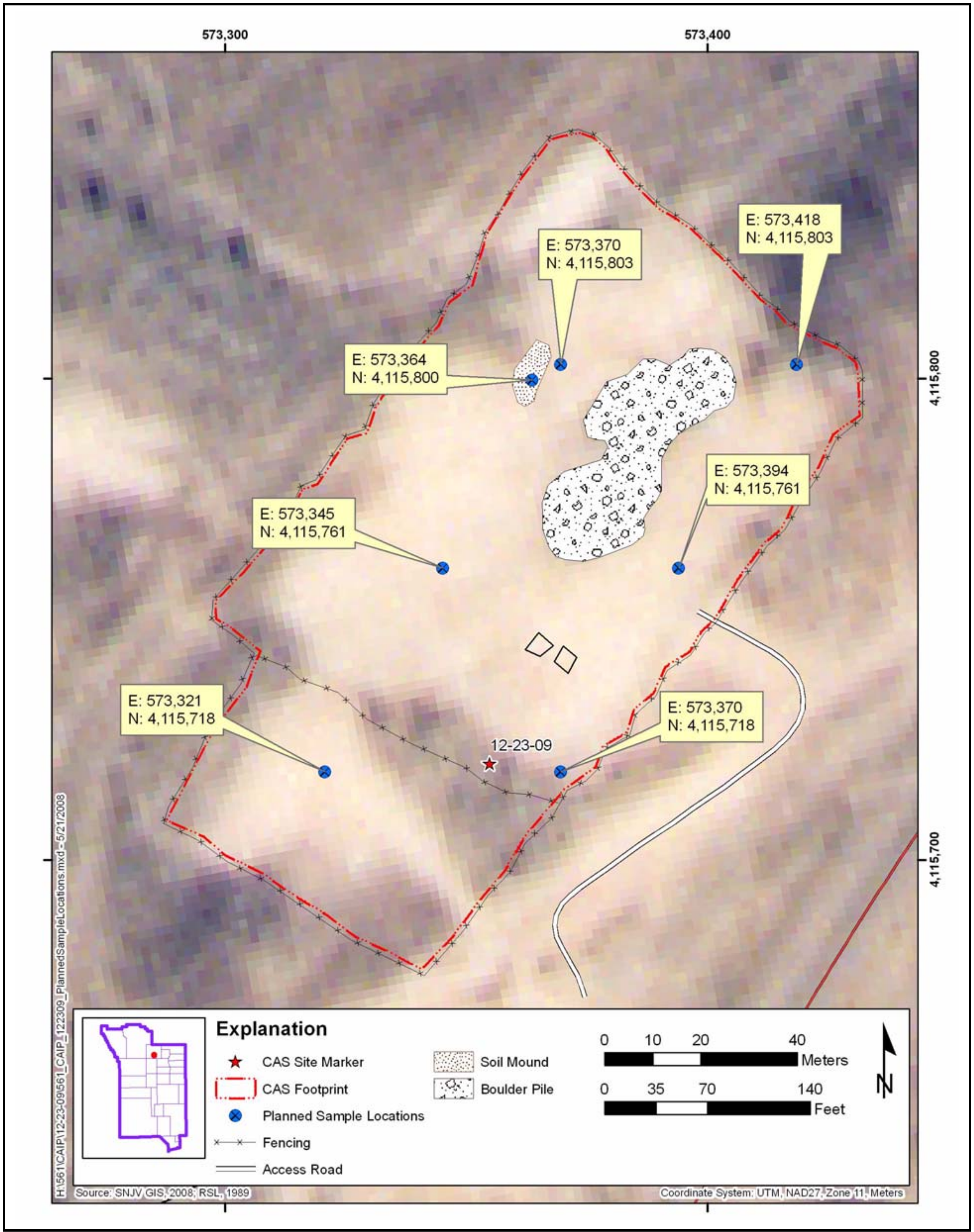

Figure A.9-9
Planned Sample Locations at CAS 12-23-09

A.9.4.6 Corrective Action Site 22-19-06, Buried Waste Disposal Site

Corrective Action Site 22-19-06 is located adjacent to the CAU 130, CAS 22-02-02 concrete foundation. Debris at the surface is not visible; however, according to geophysical surveys, there is an area of buried metallic debris.

During Decision I judgmental sampling, the following features will be sampled:

- One trench will be excavated to profile the buried metallic debris and potentially impacted soil. The trench will be orientated from the southwest end diagonally to cut across the geophysical anomaly.
- There will be a minimum of four samples collected from biased locations within the trench. Biasing factors within the trench may include soil staining, a concentrated heterogeneous profile, and/or the presence of waste. One sample will be collected from the NSI below the most significant waste profile.
- If no biasing factors are present, then all four samples will be collected within a vertical profile at the center of the trench. All samples will be generally spaced between the top sample at 1to 2 ft bgs and the bottom sample at the NSI.

The proposed Decision I trench location is shown in Figure A.9-10.

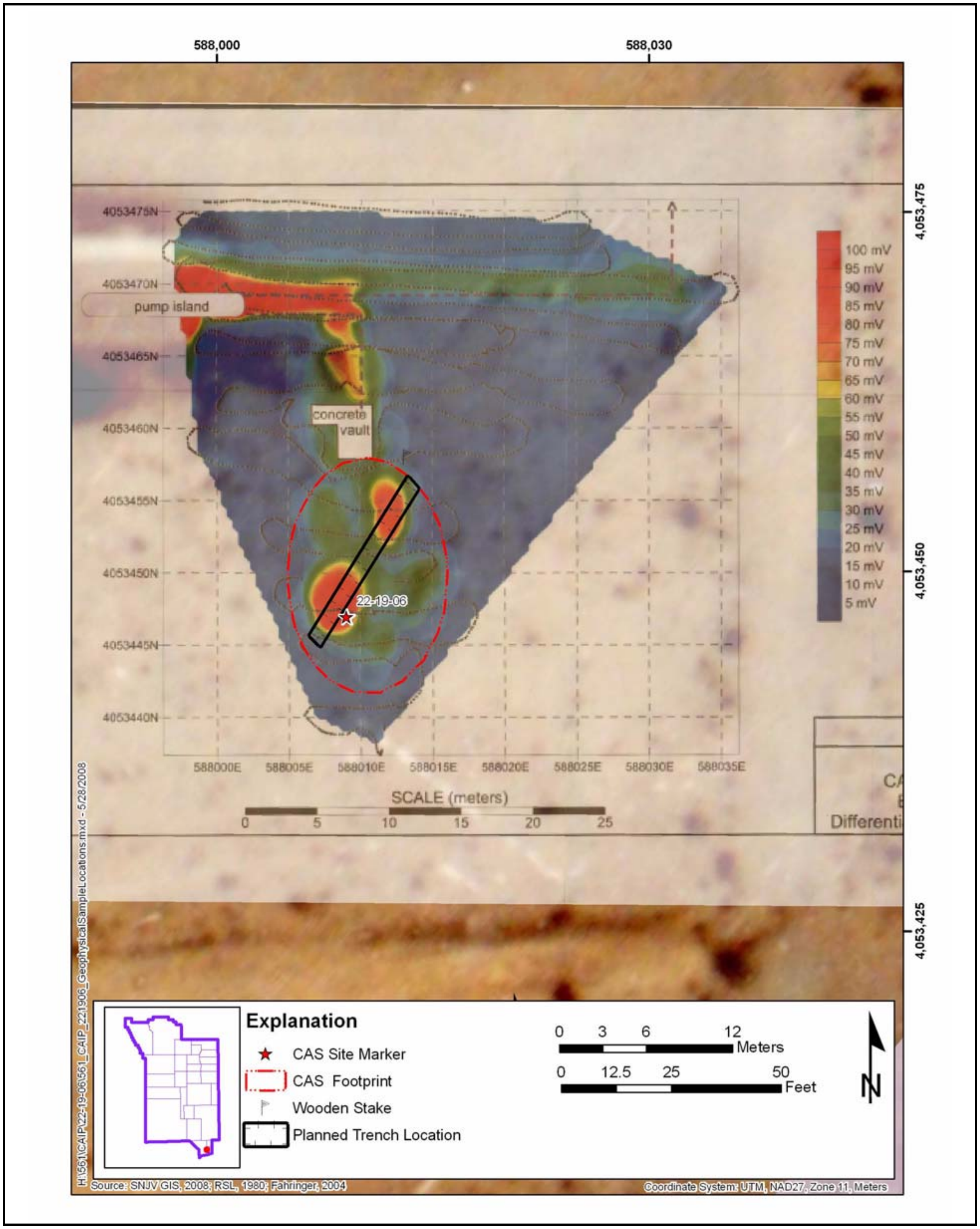

Figure A.9-10
Geophysical Survey with Planned Trench Location at CAS 22-19-06

A.9.4.7 Corrective Action Site 23-21-04, Waste Disposal Trenches

Corrective Action Site 23-21-04 is approximately 1,500 ft north of Building 23-160. The geophysical surveys performed in 2006 did not identify any anomalous areas around any of the six trenches or the covered trench. Debris at the surface is visible within and surrounding Trenches 3, 5, and 6. Scattered debris includes vehicle machine parts, wires and cables, aerosol cans, drill bits, and lead bricks. There are two locations of soil staining around Trenches 3 and 6. Trenches 1, 2, and 4 are open and empty.

During Decision I judgmental sampling a minimum of 12 samples will be collected. The following features will be sampled:

- Trenches/excavations will be performed at both ends and at a middle location of each of the trenches and the covered trench location. A minimum of three samples per trench will be collected from Trenches 3, 5, and 6.
- If there are biasing factors present at Trenches 1, 2, 4, and at the covered trench location, then samples may be collected based on biasing factors. Biasing factors within the trench may include soil staining, a concentrated heterogeneous profile, and/or odor. If no biasing factors are identified at these trenches, then no samples will be collected.
- A minimum of three samples per trench will be collected at Trenches 3, 5, and 6 beneath the identified PSM (two lead brick locations and stained soil locations).
- After the removal of potentially hazardous debris (e.g., lead bricks), samples will be collected from the soil beneath these items to ensure that there has been no contamination released onto surrounding soils.

Additional best management practices at this CAS include:

- Push the soil located along Trenches 1, 2, 3, and 4 back into the trenches following the investigation.

Proposed Decision I sample locations are shown in Figure A.9-11.

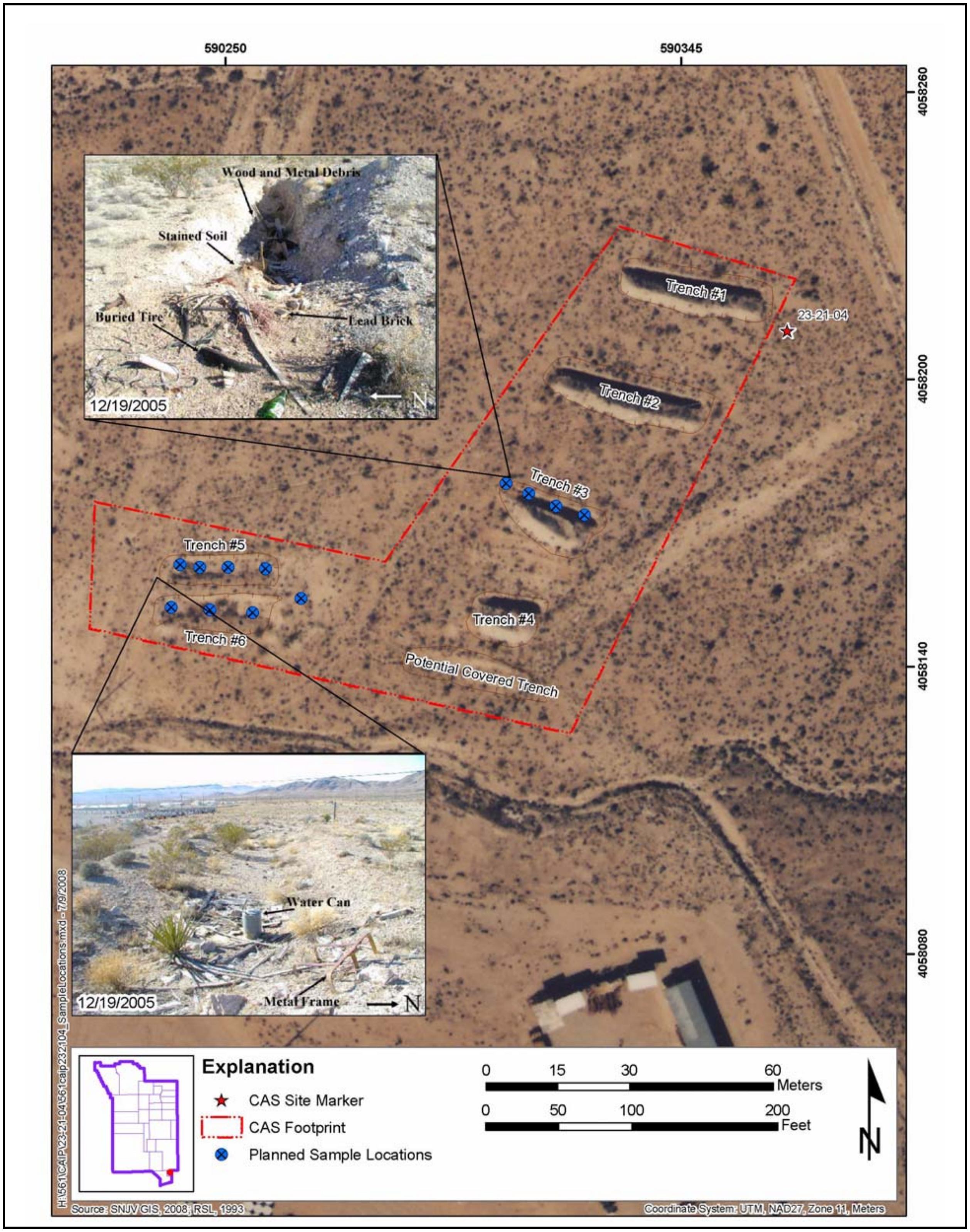

Figure A.9-11
Planned Sample Locations at CAS 23-21-04

A.9.4.8 Corrective Action Site 25-08-02, Waste Dump

Corrective Action Site 25-08-02 has no fencing surrounding the CAS features. Visible debris at the surface consists of rock, concrete, wire, cinder blocks, a lead brick, asphalt pieces, cable spools, clay pipe, hoses, rusted cans, batteries, 5-gal buckets, bottles, and an area of solidified, darker, rocky material. The debris is mainly on the surface, but is also protruding from the mounded piles. There are also two outlier piles containing debris at both ends of the main group of piles. The assumption is made that all piles came from the same source and will be characterized as a single population using a probabilistic approach. If any piles are found that are anomalous to this population, they will be evaluated individually using a judgmental approach.

During Decision I judgmental sampling, the following features will be sampled:

- Samples will be collected at four locations that have been identified as exhibiting biasing factors. The four locations include the outlier piles, the location of the solidified substance, and the pile with batteries.
- After the removal of potentially hazardous debris (e.g., lead bricks, batteries), samples will be collected from the soil beneath these items to ensure that there has been no contamination released onto surrounding soils.

During Decision I probabilistic sampling, the following will be sampled according to the following parameters set and calculated by the VSP software:

- Twelve location were randomly selected at the waste dump area using VSP. For any locations that do not fall on a pile, the nearest pile will be selected for sampling. Excavate through the pile with a backhoe. Samples will be collected from the piles based on biasing factors (e.g., staining, odor, heterogeneous concentrated debris), if present. If no debris or biasing factors are present, then one sample will be collected from the center of the pile and submitted for laboratory analysis.

Proposed Decision I sample locations are shown in Figure A.9-12.

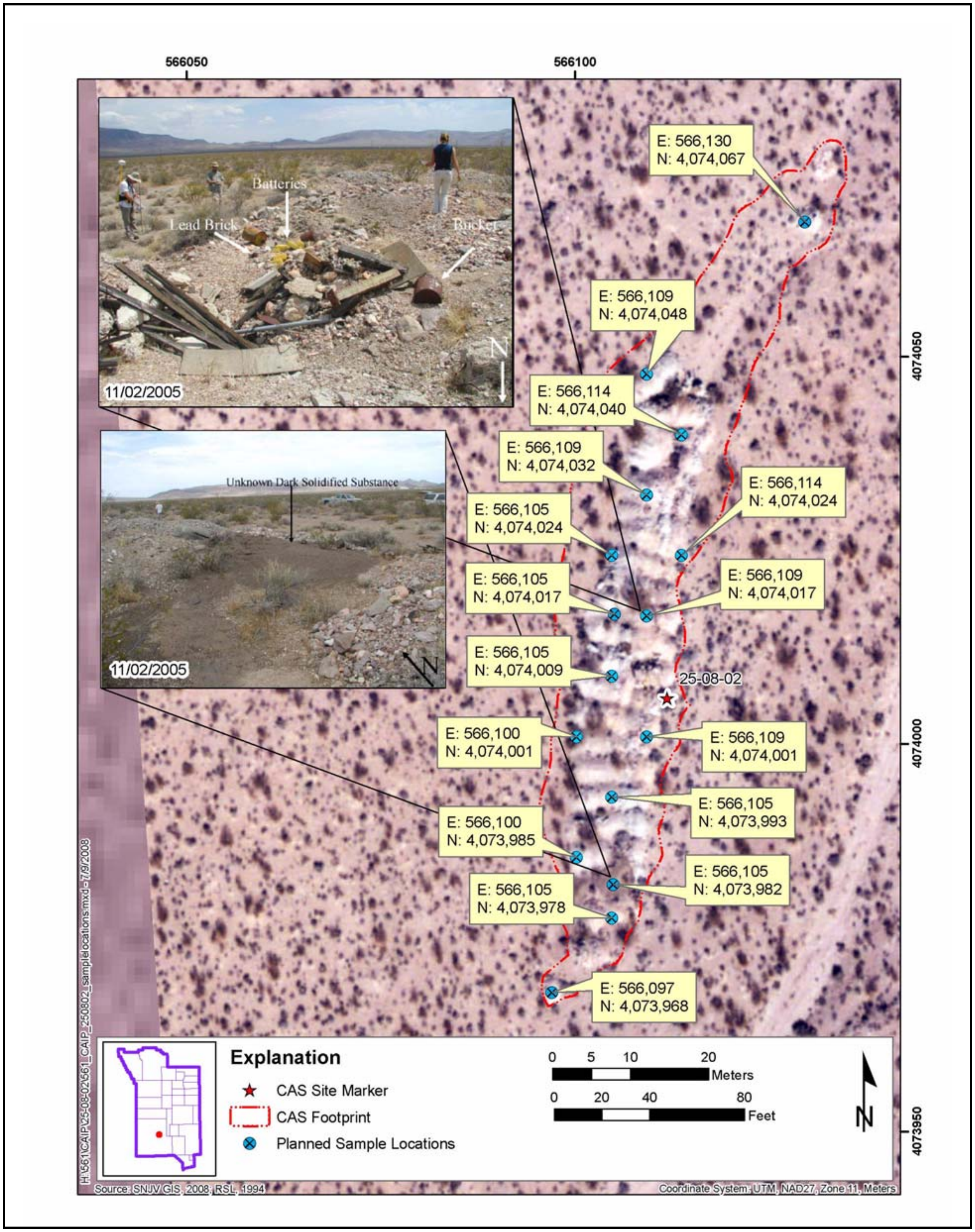

Figure A.9-12
Planned Sample Locations at CAS 25-08-02

A.9.4.9 Corrective Action Site 25-23-21, Radioactive Waste Dump

Corrective Action Site 25-23-21 consists of a radioactive waste dump located northeast of the E-MAD Facility in Area 25 of the NTS. The site also contains numerous scattered piles of debris north of the posted area along the Topopah Wash extending north to H Road and a second parcel of numerous scattered piles of debris north along the Topopah Wash extending north of H Road. After a comprehensive review of available site information, the source of the debris piles is unknown. The waste dump contains numerous dirt mounds and piles within a posted “Controlled Area” and also miscellaneous piles and some debris extending up the wash to the H Road. There are two specific dirt mounds that are posted with “Caution Radioactive Material” signs. The debris within the dirt mounds and berms consists of wood, metal, pipes, cables, wires, and some concrete chunks. The second parcel also contains concrete, asphalt, ballast, in addition to more typical dump piles. There is a potential for radiological contamination of the soil and debris at the radioactive waste dump and the wash. The assumption is made that all piles came from the same source and will be characterized as a single population using a probabilistic approach. If any piles are found that are anomalous to this population, they will be evaluated individually using a judgmental approach.

During Decision I judgmental sampling, the following features will be sampled:

Waste Dump

Three samples will be collected from biased locations that exhibited elevated readings in the radiological survey results. Samples will also be collected from any PSM or radiologically elevated debris (e.g., pipe) if possible. One surface sample will be collected downgradient of the waste dump in the wash.

Second Parcel

Based on visual survey, samples will be collected from any PSM or radiologically elevated debris and at locations identified to have biasing factors. Up to four additional judgmental samples also may be collected downgradient of the piles and/or at locations identified to have biasing factors based on the visual survey. Samples will also be collected from any PSM or radiologically elevated debris (e.g., pipe) if possible. During Decision I probabilistic sampling, the following will be sampled.

Waste Dump

Twelve locations were randomly selected at the waste dump area using VSP. For any locations that do not fall on a pile, the nearest pile will be selected for sampling. Excavate through the pile with a backhoe. Samples will be collected from the piles based on biasing factors (e.g., staining, odor, heterogeneous concentrated debris), if present. If no debris or biasing factors are present, then one sample will be collected from the center of the pile and submitted for laboratory analysis.

Proposed Decision I sample locations from the waste dump are shown in Figure A.9-13.

Second Parcel

Twelve locations were selected randomly at the second parcel area using VSP. For any locations that do not fall on a pile, the nearest pile will be selected for sampling. Samples will be collected from the piles based on biasing factors (e.g., staining, odor, heterogeneous concentrated debris), if present. If no debris or biasing factors are present, then one sample will be collected from the center of the pile and submitted for laboratory analysis.

Proposed Decision I sample locations from the second parcel north of H Road are shown in Figure A.9-14.

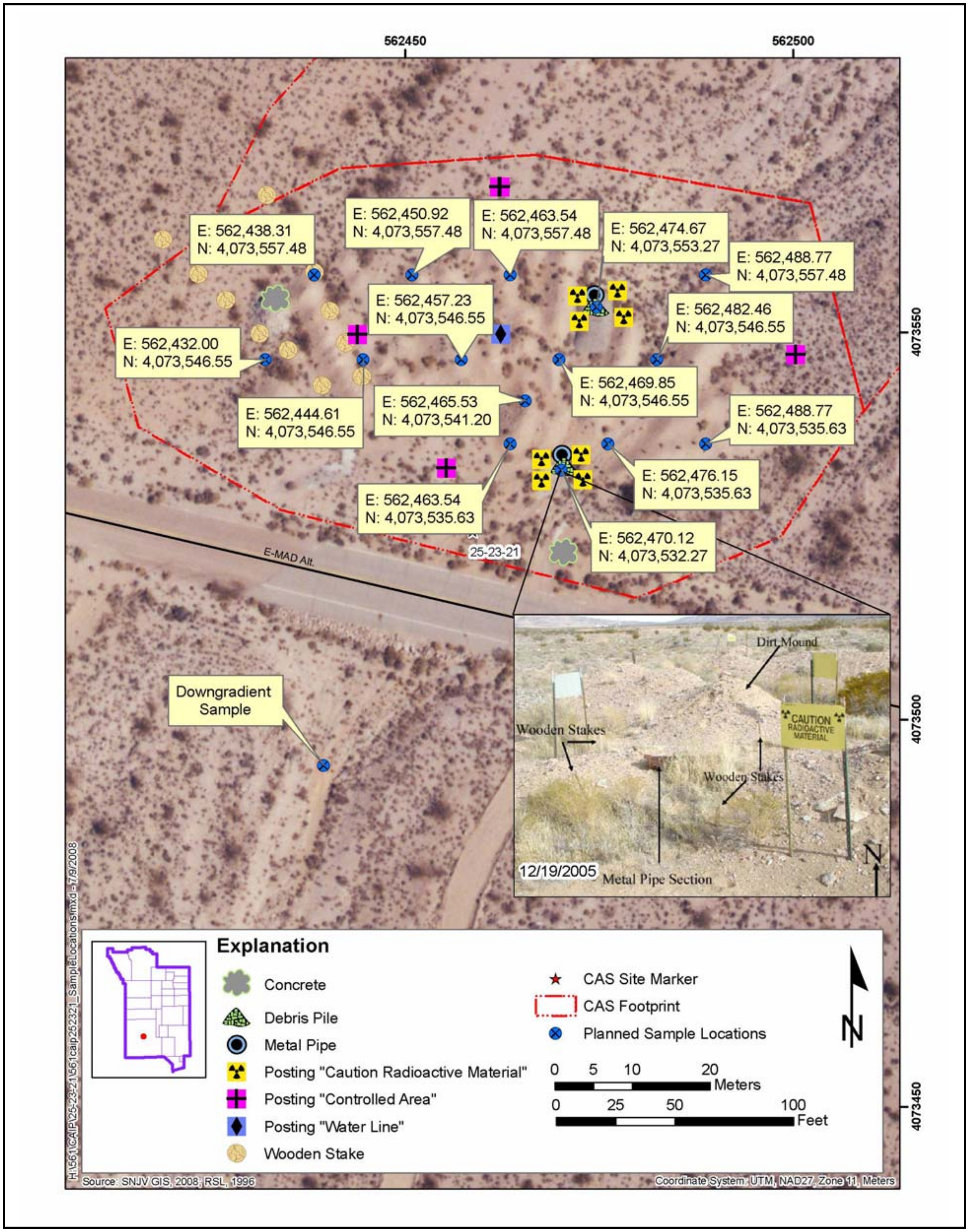

Figure A.9-13
Planned Sample Locations at CAS 25-23-21, Waste Dump

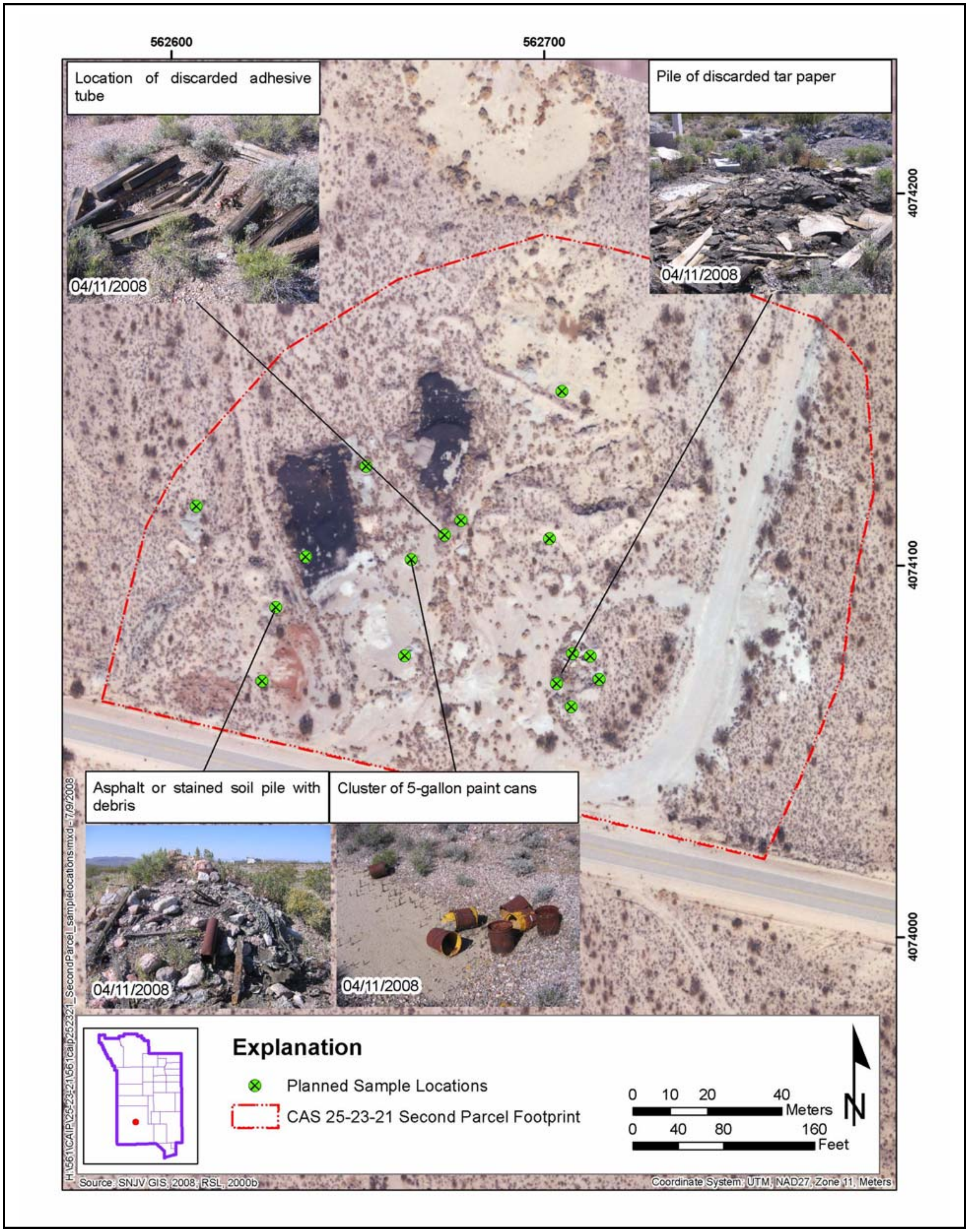

Figure A.9-14
Planned Sample Locations at CAS 25-23-21, Second Parcel

A.9.4.10 Corrective Action Site 25-25-19, Hydrocarbon Stains and Trench

Corrective Action Site 25-25-19 covers approximately 8 acres. The location is near the former RCP Complex. There are two trenches; the North Trench and the East Trench located at the site, and a location identified by historical photographs and process knowledge as the Motor Pool Area. In addition, there are several biased locations located within the boundary of the site that include; a stained soil mound, a soil mound with a white substance, two concrete pads, a tar spill, discolored soil, and a drainage location. Geophysical surveys were performed in 2007 that did not identify buried metallic debris in the areas identified for this CAS. A gamma radiological walkover of the area was performed in 2008. No areas of elevated radioactivity were identified because measured levels from the CAS area were not distinguishable from local background levels.

During Decision I judgmental sampling, the following features will be sampled:

- The two trenches (North Trench and East Trench) will be investigated by trenching across both ends and at a middle location of each of the trenches.

- There will be a minimum of four samples collected from biased locations within each trench. Biasing factors within the trench may include soil staining, a concentrated heterogeneous profile, and/or the presence of waste. One sample will be collected from the NSI below the most significant waste profile.

- If no biasing factors are present, then all four samples will be collected within a vertical profile at the center of the trench. All samples will be generally spaced between the top sample at 1 to 2 ft bgs and the bottom sample at the NSI.

- At the Motor Pool Area, just south of the concrete pads, a minimum of three samples will be collected from the stained surface soil areas at 0 to 1 ft bgs, and also deeper, if field conditions indicate that excessive staining is present.

- Samples will be collected from the biased locations located throughout the site from identified PSM (e.g., tar, white powder) and a sample will be collected beneath each PSM location.

- A sample will be collected from the south end of the site within the drainage channel just south of the tar spill.

Additional activities will be conducted at the site to determine whether there are features present that are not identified during process knowledge, historical documentation, or field visits:

- Metal plates present on one of the concrete pads will be moved to confirm that an underlying sump is not present. If a sump is identified, then consultation with the appropriate stakeholders will be required, and a sampling strategy will be presented and approved before any additional investigation.

Proposed Decision I sample locations are shown in Figure A.9-15.

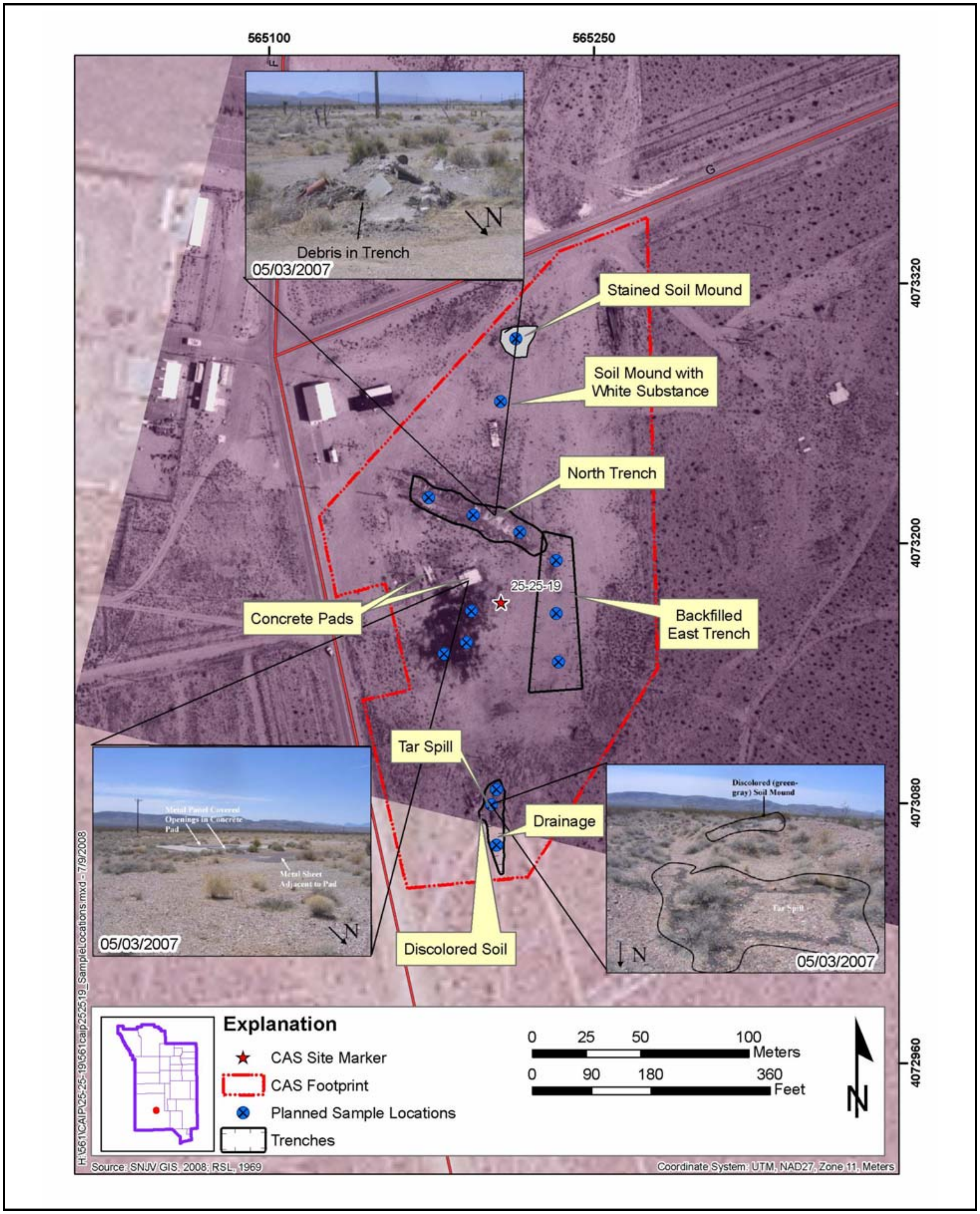

Figure A.9-15
Planned Sample Locations at CAS 25-25-19

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Appendix B

Project Organization

B.1.0 Project Organization

The NNSA/NSO Federal Sub-Project Director is Kevin Cabble. He can be contacted at (702) 295-5000. The NNSA/NSO Task Manager is also Kevin Cabble and can be contacted at the same number listed above.

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 DOE Federal Sub-Project Director 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

Determination of the Number and Location of Random Samples

C.1.0 Probabilistic Sampling Plan

C.1.1 Purpose

The DQO meeting participants specified a probabilistic (random) sampling design for CASs 02-08-02, 12-23-09, 25-08-02, and 25-23-21 at CAU 561. Contamination at these sites will be evaluated as a whole rather than individual locations within the sites. This appendix provides the methodology used to design the probabilistic sampling plan, the specific number and locations of samples to be collected, and the statistical tests to be applied to the data upon completion of the CAI.

C.1.2 Methodology

The objective of the probabilistic sampling design is to determine, with a specified degree of confidence, whether the true average contaminant concentrations at the site in question represent an unacceptable risk to human health and the environment. The averages from sample analytical results for each constituent are an estimation of the true average contaminant concentrations. The FALs represent site contaminant concentrations deemed to pose an unacceptable risk to human health and the environment.

Because the average contaminant concentrations from samples are only an estimate of the true (unknown) average contaminant concentrations, it is uncertain how well the sample averages represent the true averages. If an average contaminant concentration was directly compared to the FAL, a significant difference between the true average and the sample average could lead to making decision errors. To reduce the probability of making a false negative decision error, a conservative estimate of the true average is used to compare to the FAL. This conservative estimate (overestimation) of the true contaminant concentration averages will be calculated as the 95 percent UCLs of the respective sample contaminant concentration averages. By definition, there will be a 95 percent probability that the true average concentration is less than the 95 percent UCL of the sample average.

C.1.2.1 Computation of the Upper Confidence Limit

The computation of appropriate UCLs depends upon the data distribution, the number of samples, the variability of the dataset, and the skewness associated with the dataset. A statistical package will be used to determine the appropriate probability distribution (e.g., normal, lognormal, gamma) and/or a suitable nonparametric distribution-free method and then to compute appropriate UCLs. To ensure that the appropriate UCL computational method is used, the sample data will be tested for goodness-of-fit to all of the parametric and nonparametric UCL computation methods described in the EPA guidance document, *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites* (OSWER 9285.670) (OSWER, 2002).

A UCL will be calculated for each significant COPC. A significant COPC is defined to be a COPC that is detected in any sample at a concentration greater than the PAL. Computation of an appropriate UCL for each of the significant COPCs requires that a minimum number of samples be collected from random locations at each site and a basic assumption that:

- Data originate from a symmetric, but not necessarily normally distributed, population.
- Estimation of the variability is reasonable and representative of the population being sampled.
- Population values are not temporally or spatially correlated.

C.1.2.2 Sample Size

A minimum number of samples is required to compute a UCL. This number will be calculated from the actual investigation results for each of the significant COPCs to verify that sufficient samples were collected. The VSP software will be used to calculate minimum sample sizes (PNNL, 2005). This software was developed by Pacific Northwest National Laboratory for the DOE and EPA to determine the minimum number of samples needed to characterize a site based on the type of test to be performed, distribution of the data, variability of the data, and acceptable false positive and false negative error rates.

As agreed to by the DQO meeting participants on April 28, 2008, the input parameters to be used in calculating the minimum sample size are:

- A confidence level that a false negative error will not occur will be set at 95 percent.
- A confidence level that a false positive error will not occur will be set at 80 percent.
- A gray region width of 50 percent of the FAL.

Because the minimum number of samples needed to perform the UCL comparison tests cannot be determined until after investigation results are obtained, the number of samples to be collected during the CAI must be estimated. The VSP software will be used to estimate the minimum number of samples needed before the CAI based on estimates and assumptions about the characteristics of the data that will be generated as a result of the CAI. The following estimates shown in Tables C.1-1, C.1-4, C.1-7, and C.1-10, and assumptions are established for the CAI data:

- An appropriate 95th percentile UCL comparison test will be determined and used to compare to FALs (OSWER, 2002).
- The variability of the data was set at 60 percent of the PAL for reasonably expected target contaminants at the CASs where contaminated soil and debris are known to have been stored (CASs 02-08-02, 25-08-02, and 25-23-21), and at 40 percent of the PAL for a reasonably expected target contaminant where storage of contaminated debris and/or soil has not been confirmed at CAS 12-23-09.
- The initial action levels will be established at the PAL of a targeted analyte (i.e., 800 mg/kg for lead at CASs 02-08-02 and 25-08-02; 12.7 picocuries per gram for americium-241 at CASs 12-23-09 and 25-23-21).

C.1.2.3 Sample Location Selection

The location of initial CAI samples will be determined using a triangular grid pattern, based on a starting location that is chosen randomly. If it is determined that additional samples need to be collected based on the determination of minimum sample size using actual sample results, additional sample locations will be determined using the same methodology (for five or more samples) or by randomly selecting each sample location (for less than five samples).

C.1.3 Initial Sample Size and Sample Locations for CAS 02-08-02

The values used as input to VSP for determining the initial sample size and locations (Sections A.5.2.1.2 and C.1.2.2) for CAS 02-08-02 are compiled in Table C.1-1.

Additional values/settings used for the computation included:

- Sample placement set as systematic triangular grid with a random start location.
- Specified sampling area (calculated from GPS coordinates for site boundaries as 3,870 square meters (m^2).

Table C.1-1
Input Values for Visual Sample Plan, CAS 02-08-02

Parameter[a]	Value
Standard deviation	500 (60% of PAL)
Preliminary Action Level (Targeted Analyte)	800 mg/kg (lead)
Gray region width	400 (50% of PAL)
False negative error	5%
False positive error	20%

[a]Values in this table for the standard deviation and gray region width are for planning purposes only, and do not represent actual concentration values for a contaminant of potential concern.

mg/kg = Milligrams per kilogram
PAL = Preliminary action level

The DQO meeting participants agreed to use the results from sampling the accessible, outer set of debris piles to represent all debris piles (i.e., inner and outer). Therefore, the variability in the results from the outer set of debris piles is understood to apply to the full set of all debris piles in CAS 02-08-02.

The summary for the VSP output is compiled in Table C.1-2, and sample location coordinates are listed in Table C.1-3. The minimum required number of locations to sample at CAS 02-08-02 was estimated to be 12.

Table C.1-2
Summary of Sampling Design, CAS 02-08-02

Primary Objective of Design	Compare a Site Average to a Fixed Threshold
Type of sampling design	Nonparametric
Working (null) hypothesis	The average value at the site exceeds the threshold
Formula for calculating number of sampling locations	Sign test - MARSSIM version
Calculated total number of samples	12

MARSSIM = *Multi-Agency Radiation Survey and Site Investigation Manual*

Table C.1-3
Calculated Field Sampling Location Coordinates, CAS 02-08-02

Easting	Northing
580364.5	4112477.3
580359.8	4112485.4
580345.7	4112493.6
580383.4	4112493.6
580331.6	4112501.7
580378.6	4112501.7
580331.6	4112518.0
580369.2	4112518.0
580336.3	4112526.2
580364.5	4112526.2
580350.4	4112534.4
580359.8	4112534.4

Note: Sample location coordinates calculated by Visual Sample Plan software (PNNL, 2005) using input values listed in Table C.1-1 and settings listed in Table C.1-2.

C.1.4 Initial Sample Size and Sample Locations for CAS 12-23-09

The values used as input to VSP for determining the initial sample size and locations (Sections A.5.2.1.2 and C.1.2.2) for CAS 12-23-09 are compiled in Table C.1-4.

Additional values/settings used for the computation included:

- Sample placement set as systematic triangular grid with a random start location.
- Specified sampling area (calculated from GPS coordinates for site boundaries as 12,413 m^2.

Table C.1-4
Input Values for Visual Sample Plan, CAS 12-23-09

Parameter[a]	Value
Standard deviation	5 (40% of PAL)
Preliminary Action Level (Targeted Analyte)	12.7 pCi/g (Am-241)
Gray region width	6.35
False negative error	5%
False positive error	20%

[a]Values in this table for the standard deviation and gray region width are for planning purposes only, and do not represent actual concentration values for a contaminant of potential concern.

Am = Americium
pCi/g = Picocuries per gram
PAL = Preliminary action level

The summary for the VSP output is compiled in Table C.1-5, and sample location coordinates are listed in Table C.1-6. The minimum required number of locations to sample at CAS 12-23-09 was estimated to be 6.

Table C.1-5
Summary of Sampling Design, CAS 12-23-09

Primary Objective of Design	Compare a Site Average to a Fixed Threshold
Type of sampling design	Nonparametric
Working (null) hypothesis	The average value at the site exceeds the threshold
Formula for calculating number of sampling locations	Sign test - MARSSIM version
Calculated total number of samples	6

MARSSIM = *Multi-Agency Radiation Survey and Site Investigation Manual*

Table C.1-6
Calculated Field Sampling Location Coordinates, CAS 12-23-09

Easting	Northing
573320.75	4115718.29
573369.61	4115718.29
573345.18	4115760.61
573394.04	4115760.61
573369.61	4115802.92
573418.47	4115802.92

Note: Sample location coordinates calculated by Visual Sample Plan software (PNNL, 2005) using input values listed in Table C.1-4 and settings listed in Table C.1-5.

C.1.5 Initial Sample Size and Sample Locations for CAS 25-08-02

The values used as input to VSP for determining the initial sample size and locations (Sections A.5.2.1.2 and C.1.2.2) for CAS 25-08-02 are compiled in Table C.1-7.

Table C.1-7
Input Values for Visual Sample Plan, CAS 25-08-02

Parameter[a]	Value
Standard deviation	500 (60% of PAL)
Preliminary Action Level (Targeted Analyte)	800 mg/kg (lead)
Gray region width	400 (50% of PAL)
False negative error	5%
False positive error	20%

[a]Values in this table for the standard deviation and gray region width are for planning purposes only, and do not represent actual concentration values for a contaminant of potential concern.

mg/kg = Milligrams per kilogram
PAL = Preliminary action level

Additional values/settings used for the computation included:

- Sample placement set as systematic triangular grid with a random start location.
- Specified sampling area (calculated from GPS coordinates for site boundaries as 1,583 m^2.

The summary for the VSP output is compiled in Table C.1-8, and sample location coordinates are listed in Table C.1-9. The minimum required number of locations to sample at CAS 25-08-02 was calculated to be 12.

Table C.1-8
Summary of Sampling Design, CAS 25-08-02

Primary Objective of Design	Compare a Site Average to a Fixed Threshold
Type of sampling design	Nonparametric
Working (null) hypothesis	The average value at the site exceeds the threshold
Formula for calculating number of sampling locations	Sign test - MARSSIM version
Calculated total number of samples	12

MARSSIM = *Multi-Agency Radiation Survey and Site Investigation Manual*

Table C.1-9
Calculated Field Sampling Location Coordinates, CAS 25-08-02

Easting	Northing
566104.76	4073977.61
566100.27	4073985.40
566104.76	4073993.19
566100.27	4074000.97
566109.26	4074000.97
566104.76	4074008.76
566109.26	4074016.55
566104.76	4074024.34
566113.76	4074024.34
566109.26	4074032.13
566113.76	4074039.92
566109.26	4074047.71

Note: Sample location coordinates calculated by Visual Sample Plan software (PNNL, 2005) using input values listed in Table C.1-7 and settings listed in Table C.1-8.

C.1.6 Initial Sample Size and Sample Locations for CAS 25-23-21

The values used as input to VSP for determining the initial sample size and locations (Section A.5.2.1.2 and Section C.1.2.2) for CAS 25-23-21 are compiled in Table C.1-10.

Table C.1-10
Input Values for Visual Sample Plan, CAS 25-23-21

Parameter[a]	Value
Standard deviation	8 (60% of PAL)
Preliminary Action Level (Targeted Analyte)	12.7 pCi/g (Am-241)
Gray region width	6.35
False negative error	5%
False positive error	20%

[a]Values in this table for the standard deviation and gray region width are for planning purposes only, and do not represent actual concentration values for a contaminant of potential concern.

Am = Americium
PAL = Preliminary action level
pCi/g = Picocuries per gram

Additional values used for the computation included:

- Sample placement set as systematic triangular grid with a random start location.
- Specified sampling area (calculated from GPS coordinates for site boundaries as 4,093 m^2.

The summary for the VSP output is compiled in Table C.1-11, and sample location coordinates are listed in Table C.1-12. The minimum required number of locations to sample at CAS 25-23-21 was estimated to be 12.

Table C.1-11
Summary of Sampling Design, CAS 25-23-21

Primary Objective of Design	Compare a Site Average to a Fixed Threshold
Type of sampling design	Nonparametric
Working (null) hypothesis	The average value at the site exceeds the threshold
Formula for calculating number of sampling locations	Sign test - MARSSIM version
Calculated total number of samples	12

MARSSIM = *Multi-Agency Radiation Survey and Site Investigation Manual*

Table C.1-12
Calculated Field Sampling Location Coordinates, CAS 25-23-21
(Page 1 of 2)

Easting	Northing
Waste Dump	
562463.54	4073535.63
562476.15	4073535.63
562488.77	4073535.63
562432.00	4073546.55
562444.61	4073546.55
562457.23	4073546.55
562469.85	4073546.55
562482.46	4073546.55
562438.31	4073557.48
562450.92	4073557.48
562463.54	4073557.48
562488.77	4073557.48

Table C.1-12
Calculated Field Sampling Location Coordinates, CAS 25-23-21
(Page 2 of 2)

Easting	Northing
Second Parcel	
562606.62	4074115.96
562704.89	4074146.85
562662.58	4074075.71
562635.97	4074102.33
562714.88	4074069.44
562712.53	4074075.57
562652.25	4074126.71
562707.37	4074061.97
562701.53	4074107.26
562707.74	4074076.35
562677.84	4074112.12
562624.28	4074068.97

Note: Sample location coordinates calculated by Visual Sample Plan software (PNNL, 2005) using input values listed in Table C.1-10 and settings listed in Table C.1-11.

C.2.0 References

OSWER, see Office of Emergency and Remedial Response, U.S. Environmental Protection Agency.

Office of Emergency and Remedial Response, U.S. Environmental Protection Agency. 2002. *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*. December. Washington, DC.

PNNL, see Pacific Northwest National Laboratory.

Pacific Northwest National Laboratory. 2005. *Visual Sampling Plan Version 4.0, User's Guide*, PNNL-14002. Richland, WA.

Appendix D

Nevada Division of Environmental Protection Comment Responses

(2 Pages)

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

1. Document Title/Number Draft Corrective Action Investigation Plan for Corrective Action Unit 561: Waste Disposal Areas, Nevada Test Site, Nevada
2. Document Date June 2008
3. Revision Number 0
4. Originator/Organization Stoller-Navarro
5. Responsible DOE/NV ERP Subproject Director Kevin J. Cabble
6. Date Comments Due July 7, 2008
7. Review Criteria Full
8. Reviewer/Organization/Phone No. Jeff MacDougall and Dennis Nicodemus, NDEP, 486-2850
9. Reviewer's Signature

10. Comment Number/ Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept
1) Section 2.3, Page 13	M	Correct misspelling in fourth line.	This change was made as requested.	
2) Section 3.1, Page 21	M	Replace "tabular" with "flow chart".	This change was made as requested.	
3) Figure 3-2, Page 23	M	Conceptual Site Model does not show lateral migration as should be illustrated for seasonal flows in the Topopah Wash in CAS 25-23-21.	The Conceptual Site Model was modified by extending the arrows down the arroyo.	
4) Section 3.1.4, Page 26, 2nd Paragraph	M	Provide range values or +/-1 standard deviation for evapotranspiration and precipitation levels based on the whole test site versus just Area 3. The CASs in this CAU cover a wide range of area.	A range of values was added.	
5) Section A.3.2.2, Page A-29, 2nd Paragraph	M	Does research show that 2,3,7,8 TCDD specifically (not family) is a result of burning and not other chemical processes?	The following statement from NIOSH Publication number 84-104 shows that TCDD can result from burning. "The combustion of 2,4,5-T can result in its conversion to small amounts (0.6 ppt TCDD/1 ppm 2,495-T burned) of TCDD. Also, the burning or heating of commercial and purified chlorophenates and pyrolysis of polychlorinated biphenyls (PCBs) contaminated with trichlorobenzenes have resulted in the production of TCDD."	
6) Section A.8.3, Page A-51	M	Should referenced Section A.8.2 for controls, be section A.8.2.2?	This change was made as requested.	

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

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NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

Document Title/Number Draft Corrective Action Investigation Plan for Corrective Action Unit 561: Waste Disposal Areas, Nevada Test Site, Nevada

Revision Number 0

Reviewer/Organization Jeff MacDougall and Dennis Nicodemus, NDEP, 486-2850

10. Comment Number/ Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept
7) Section A.9.1, 2nd Paragraph	M	Paragraph references Section A.5.2.1; would Section A.5.2.1.1 be more appropriate?	This change was made as requested.	
8) Figure A.9-6	M	Figure doesn't show sample locations for the pile and underneath the pile.	Figure A.9-6 was modified to include the location of the trench and additional sample locations within the trench.	
9) Section A.9.4.10, Page A-79	M	Place this section on Page 81, thus all 3 figures associated with CAS 25-23-21 are together.	This change was made as requested.	

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

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