RECORD OF TECHNICAL CHANGE

Technical Change No. CAIP-1

Page 1 of 1

Project/Job No. IS05-580

Date 02/04/2005

Project/Job Name Industrial Sites, CAU 554 CAIP

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

Robert Boehlecke (Name)

SNJV, Industrial Sites, Task Manager (Title)

Description of Change:

Table A.1-5, page A-18 – change the vertical limit boundary from 250 ft to 500 ft.

Justification:

Field observations during drilling have indicated that contamination is likely to exceed 250 ft in depth. The source of contamination and the release mechanism as described in the conceptual site model remain the same.

The project time will Unchanged by approximately N/A days.

Applicable Project-Specific Document(s):

Corrective Action Investigation Plan for Corrective Action Unit 554: Area 23 Release Site, Nevada Test Site, Nevada

---

Approved By: Kevin Cabble Date 2-3-05

NNSA/NSO Project Manager

Robert M. Bangerter Jr. Date 2/3/05

NNSA/NSO Environmental Restoration Division Director

________________ Date ________

NDEP

RECORD OF TECHNICAL CHANGE

Technical Change No. CAIP-1 Page 1 of 1

Project/Job No. IS05-580 Date 02/04/2005

Project/Job Name Industrial Sites, CAU 554 CAIP

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

Robert Boehlecke (Name) SNJV, Industrial Sites, Task Manager (Title)

Description of Change:

Table A.1-5, page A-18 – change the vertical limit boundary from 250 ft to 500 ft.

Justification:

Field observations during drilling have indicated that contamination is likely to exceed 250 ft in depth. The source of contamination and the release mechanism as described in the conceptual site model remain the same.

The project time will Unchanged by approximately N/A days.

Applicable Project-Specific Document(s):

Corrective Action Investigation Plan for Corrective Action Unit 554: Area 23 Release Site, Nevada Test Site, Nevada

Approved By: [signature] Date 2-3-05
NNSA/NSO Project Manager

[signature] Date 2/3/05
NNSA/NSO Environmental Restoration Division Director

[signature] Date 2/4/05
NDEP

P:\IND-SITES\IS_COMMON\CAU_554\CAIP\ROTC_1.DOC

RECORD OF TECHNICAL CHANGE

Technical Change No. CAIP-2

Project/Job No. IS05-580 Date 3/15/05

Project/Job Name Industrial Sites, CAU 554 Corrective Action Investigation Plan

---

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

Grant Evenson	SNJV, Industrial Sites, Task Manager
(Name)	(Title)

Description of Change:

1) Table A.1-5, page A-19 – change the vertical limit boundary from 500 ft to 1200 below ground surface (bgs).

2) Section 4.2.3, Page 25, Replace the last paragraph to read;

Decision II sampling will consist of defining the extent of contamination where COCs have been confirmed. Sampling locations will be selected based on the CSM, biasing factors, FSRs, existing data, and the outer boundary sample locations where COCs were detected in the Decision I samples. In general, an initial set of step-out sample locations will be arranged in a triangular pattern around the Decision I locations at distances based on site conditions, COC concentrations, process knowledge, and biasing factors. If COCs extend beyond this initial set of step out locations, then additional Decision II samples will be collected from a single deep borehole (expected to be greater than 500 feet in depth) in the direction outward, and also in the inferred down gradient direction. This Decision II borehole will be positioned an adequate distance from the step-out location, and be advanced to a sufficient depth, in an effort to provide samples and profile COC concentrations through the upper and lower boundaries of detectable contamination. If this location does not intersect the plume, the primary decision makers will be notified and a decision made as to whether a second step-out is required.

If a depth of 1200 feet is reached and COCs are still present, groundwater is encountered, or if the Site Supervisor determines that extent sampling needs to be re-evaluated; work will be temporarily suspended, the primary decision makers will be notified, and the investigation strategy will be re-evaluated. A minimum of one analytical result less than the PAL from the vertical direction will be required to define the depth of COC contamination and the lateral extent of contamination may be defined by sample analysis or based on modeling. The vertical extent of COCs will only be established based on validated laboratory analytical results (i.e., not field screening). Contaminants determined not to be present in Decision I samples may be eliminated from Decision II analytical suites. Refer to Appendix A for specific sample locations.

3) Section A.1.8, Page A-26, Replace the second to the last paragraph to read;

The investigation to resolve Decision II will consist of completing boreholes at step-out locations (i.e., three boreholes each surrounding the two UST Decision I locations) only if the contamination is found to be relatively shallow, i.e. less than 250 feet in depth. If the vertical extent of the contamination is deeper than 250 feet, then a single step-out borehole in the inferred down gradient direction may be substituted for the three boreholes surrounding a given Decision I location. The depth of contamination identified during Decision I sampling will be used to guide field decisions and select specific step-out sample locations. Previous plume size estimates were calculated by REECO by using the 1990 carbon dioxide survey results. The results of this survey were used by REECO to estimate the areal extent of fuel contamination at CAS 23-02-08. In addition, REECO used Dragun's equation to estimate the vertical extent of contamination (Kendall, 1990). Assumptions were based on the reported material type and volume of release, soil porosity at the site, and the residual hydrocarbon saturation (Section A.1.1).

4) Section A.1.8, Page A-26, Replace the last paragraph to read;

If COCs extend beyond the initial step-out locations, then additional Decision II samples will be collected from one or more incremental step-outs. Potential Decision II sampling locations are shown in Figure A.1-4. Initial step-outs will be drilled attempting to exceed the vertical extent of contamination defined at the Decision I location(s). If any of the initial step-outs cannot practically reach depths to laterally bound Decision I COC concentrations, then knowledge of the lateral and vertical extent in the respective directions will be limited; and the decision makers will reach a consensus on the position, depth, and number of boreholes required to satisfy data needs. If the data needs can be satisfied with a single deep Decision II borehole, then this borehole will be advanced at least as deep as the vertical extent of contamination defined at the Decision I location(s). A clean sample (i.e., COCs less than PALs) collected from the deep Decision I and II boreholes will define the vertical extent of contamination at the respective locations. The contamination boundaries may need to be extrapolated to give an overall view of the lateral and vertical extent of COC concentrations at the site.

Justification:

1) Field observations during drilling have indicated that the bottom of the contamination is likely to exceed 500 ft in depth. A new technical plan has been discussed with the decision makers. This plan, when implemented, should satisfy data needs based on the current knowledge of site conditions. The source of contamination and the release mechanism as described in the conceptual site model remain the same.

2) The Decision II sampling approach has been modified and a technical plan developed based on the following information and from the below drilling and sampling summary.

- The only COC is TPH-diesel
- Contamination has been found from 14 ft to more than 400 ft bgs
- The bottom of the contamination has not been identified
- The primary direction of contaminant migration is down
- There appears to be a slight preference for the contamination to migrate to the NW

The Decision I borehole (A01) drilled where former UST 12-115-1 was located encountered diesel contamination starting at the bottom of the former tank excavation (about 15 ft) and continuing to more than 400 ft. This was the only Decision I borehole to encounter contamination. Four Decision II boreholes were drilled around borehole A01 at distances varying from 30 to 60 ft. Two of the boreholes were drilled to 100 ft (A03 45 ft to the SE and A04 30 ft to the NW) and two were drilled to 250 ft (A05 62 ft to the SW and A02 38 ft to the NE). Of these four boreholes contamination was only encountered in A04 located 30 ft to the NW or A01. Contamination was hit at a depth of 90 ft.

Due to the depth of the contamination, only one Decision II borehole will be drilled to total depth. This borehole will be located to the NW of holes A01 and A04 where it is likely to encounter contamination. The purpose of this borehole is to define the top and bottom of contamination at a step out location such that this information in conjunction with the information from boreholes A01 and A04 can be used to define the plume geometry and a reasonable contaminant boundary can be extrapolated. If groundwater is encountered and the borehole is still in contamination, work will be suspended, NDEP will be notified, and the investigation strategy will be reevaluated. In the event the borehole is drilled to 1200 ft without encountering contamination, a new Decision II location closer to borehole A01 will be selected and a borehole drilled to total depth.

3) The single deep Decision II step-out will not provide definitive information on lateral extent of the plume in three directions as was required in the CAIP. However, the plume geometry and the contamination profile, can be estimated based on the investigation information generated to date and the anticipated Decision I and II deep borehole analytical data to be collected. Previously, the CAIP had required drilling three step-out boreholes (Decision II) to total depths equal to the bottom clean sample vertically bounding the contamination at the Decision I location(s). The data provided if three deep boreholes were drilled would likely be limited to refining the plume geometry in a lateral direction with minimal impact to selection of closure alternatives. Drilling a second and a third borehole will provide a limited amount of information for the cost.

The project time will Unchanged by approximately 0 days.

Applicable Project-Specific Document(s):
Corrective Action Investigation Plan for Corrective Action Unit 554: Area 23 Release Site, Nevada Test Site, Nevada

Approved By: [signature] Date 3-28-05
for NNSA/NSO Project Manager

[signature: Robert M. Bangerter Jr.] Date 3/28/05
NNSA/NSO Environmental Restoration Division Director

[signature] Date 3/30/05
NDEP

RECORD OF TECHNICAL CHANGE

Technical Change No. CAIP-3 Page 1 of 2

Project/Job No. IS05-580 Date 05/26/2005

Project/Job Name CAIP for CAU 554: Area 23 Release Site, Nevada Test Site, Nevada, October 2004

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

Grant Evenson (Name) Task Manager – Industrial Sites (Title)

Description of Changes:

Section 3.3.3, Page 17, third row: Change text from, "scaled from 25 to 15 millirem…" to "based on 25 millirem…"

Table 3-1, Page 18: Change values of 5th column of the table (PAL) to reflect the 25 mrem/year dose constraint:

Americium-241: from "7.62 pCi/g" to "12.7 pCi/g"

Cesium-137: from "7.3 pCi/g" to "12.2 pCi/g"

Cobalt-60: from "1.61 pCi/g" to "2.7 pCi/g"

Table 3-1 Explanation, Page 18: In superscript "b" explanation, change text from "…scaled from 25 to 15 mrem/yr dose…" to "…based on 25 mrem/yr dose…".

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

Section A.1.4.2, Page A-15, last paragraph, third row: Change sentence to read, "Radiological PALs are based on the NCRP 25 mrem per year dose-based levels (NCRP, 1999) and the recommended levels for certain radionuclides in DOE Order 5400.5 Change 2 (DOE, 1993).

Justification:

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

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

Applicable Project-Specific Document(s):
Corrective Action Investigation Plan for Corrective Action Unit 554: Area 23 Release Site, Nevada Test Site, Nevada, October 2004

Approved By: [signature] Date 5/24/05
NNSA/NSO Project Manager

[signature] Date 5/25/05
NNSA/NSO Environmental Restoration Division Director

_______________ Date _______________
NDEP

Approved By: [signature] Date 5/24/05
NNSA/NSO Project Manager

[signature] Date 5/25/05
NNSA/NSO Environmental Restoration Division Director

[signature] Date 5/25/05
NDEP

Nevada
Environmental
Restoration
Project

DOE/NV--1010

National Nuclear Security Administration

Corrective Action Investigation Plan for Corrective Action Unit 554: Area 23 Release Site, Nevada Test Site, Nevada

Controlled Copy No.: ___
Revision No.: 0

October 2004

Environmental Restoration
Division

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

Available for public sale, in paper, from:

U.S. Department of Commerce
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Phone: 800.553.6847
Fax: 703.605.6900
Email: orders@ntis.gov
Online ordering: http://www.ntis.gov/ordering.htm

Available electronically at http://www.osti.gov/bridge

Available for a processing fee to U.S. Department of Energy and its contractors, in paper, from:

U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831-0062
Phone: 865.576.8401
Fax: 865.576.5728
Email: reports@adonis.osti.gov

Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

Printed on recycled paper

DOE/NV--1010

CORRECTIVE ACTION INVESTIGATION PLAN FOR CORRECTIVE ACTION UNIT 554: AREA 23 RELEASE SITE, NEVADA TEST SITE, NEVADA

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

Controlled Copy No.: ___

Revision No.: 0

October 2004

CORRECTIVE ACTION INVESTIGATION PLAN
FOR CORRECTIVE ACTION UNIT 554: AREA 23 RELEASE SITE,
NEVADA TEST SITE, NEVADA

Approved by: Signature Approved Date: 10/18/2004

Janet Appenzeller-Wing, Project Manager
Industrial Sites Project

Approved by: Signature Approved Date: 10/18/2004

Robert M. Bangerter, Acting Division Director
Environmental Restoration Division

Table of Contents

Table of Contents *(Continued)*

Table of Contents *(Continued)*

List of Figures

List of Tables

List of Acronyms and Abbreviations

ASTM	American Society of Testing and Materials
bgs	Below ground surface
BN	Bechtel Nevada
CADD	Corrective Action Decision Document
CAI	Corrective Action Investigation
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CO_2	Carbon dioxide
COC	Contaminant of concern
COPC	Contaminant of potential concern
CSM	Conceptual site model
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQI	Data quality indicator
DQO	Data quality objective
DRO	Diesel-range organics
EPA	U.S. Environmental Protection Agency
EQL	Estimated quantitation limit
FFACO	*Federal Facility Agreement and Consent Order*
FSL	Field-screening level

Acronyms and Abbreviations *(Continued)*

FSR	Field-screening results
ft	Foot (feet)
FWP	Field Work Permit
gal	Gallon
GRO	Gasoline-range organics
HASP	Health and Safety Plan
HWAA	Hazardous waste accumulation area
IDW	Investigation-derived waste
in.	Inch
in./yr	Inches per year
IRIS	Integrated Risk Information System
IS	Industrial Sites
ISMS	Integrated Safety Management System
LCS	Laboratory control sample
M&O	Management and Operating
MDC	Minimum detectable concentration
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mi	Mile
mrem/yr	Millirem per year
MRL	Minimum reporting limit
MS	Matrix spike
MSD	Matrix spike duplicate
NAC	*Nevada Administrative Code*

Acronyms and Abbreviations *(Continued)*

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*
NTS	Nevada Test Site
NTSWAC	Nevada Test Site Waste Acceptance Criteria
PAL	Preliminary action level
PCB	Polychlorinated biphenyls
pCi/g	Picocuries per gram
pCi/L	Picocuries per liter
POC	Performance Objective for the Certification of Nonradioactive Hazardous Waste
PPE	Personal protective equipment
ppm	Parts per million
PRG	Preliminary remediation goal
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RadCon	Radiological control
RCRA	*Resource Conservation and Recovery Act*
REECo	Reynolds Electrical & Engineering Co., Inc.
RMA	Radioactive materials area
RPD	Relative percent difference

Acronyms and Abbreviations *(Continued)*

SDWS	*Safe Drinking Water Standards*
SNJV	Stoller-Navarro Joint Venture
SVOC	Semivolatile organic compounds
TPH	Total petroleum hydrocarbon
TSCA	*Toxic Substance Control Act*
UST	Underground storage tank
VOC	Volatile organic compounds
WW-1	Water Well-1
yd^3	Cubic yards
%R	Percent recovery

Executive Summary

This Corrective Action Investigation Plan (CAIP) contains project-specific information for conducting site investigation activities at Corrective Action Unit (CAU) 554: Area 23 Release Site, Nevada Test Site, Nevada. Information presented in this CAIP includes facility descriptions, environmental sample collection objectives, and criteria for the selection and evaluation of environmental samples.

Corrective Action Unit 554 is located in Area 23 of the Nevada Test Site, which is 65 miles northwest of Las Vegas, Nevada. Corrective Action Unit 554 is comprised of one Corrective Action Site (CAS), which is:

- 23-02-08, USTs 23-115-1, 2, 3/Spill 530-90-002

This site consists of soil contamination resulting from a fuel release from underground storage tanks (USTs).

Corrective Action Site 23-02-08 is 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 prior to evaluating corrective action alternatives and selecting the appropriate corrective action for this 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 for CAU 554.

Corrective Action Site 23-02-08 will be investigated based on the data quality objectives (DQOs) developed on July 15, 2004, by representatives of the Nevada Division of Environmental Protection; U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office; and contractor personnel. 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 554.

Appendix A provides a detailed discussion of the DQO methodology and the DQOs specific to CAS 23-02-08.

The scope of the corrective action investigation for CAU 554 includes the following activities:

- Move surface debris and/or materials, as needed, to facilitate sampling.
- Perform field screening.
- Collect and submit environmental samples for laboratory analysis to determine if contaminants of concern are present.
- If contaminants of concern are present, collect additional step-out samples to define the extent of the contamination.
- Collect samples of investigation-derived waste, as needed, for waste management and minimization purposes.

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

1.0 Introduction

This Corrective Action Investigation Plan (CAIP) contains project-specific information including facility descriptions, environmental sample collection objectives, and criteria for conducting site investigation activities at Corrective Action Unit (CAU) 554: Area 23 Release Site, Nevada Test Site (NTS), Nevada. This CAIP has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) (1996) that was agreed to by the State of Nevada, the U.S. Department of Energy (DOE), and the U.S. Department of Defense (DoD). Corrective Action Unit 554 is located in Area 23 of the NTS, which is approximately 65 miles (mi) northwest of Las Vegas, Nevada (Figure 1-1). Area 23 is found immediately beyond the main gate to the NTS. Corrective Action Unit 554 is comprised of one Corrective Action Site (CAS), 23-02-08, USTs 23-115-1, 2, 3/Spill 530-90-002, which consists of one or more underground storage tank (UST) release(s). The corrective action investigation (CAI) will include field inspections and sampling of media, where appropriate. Data will also be obtained to support waste management decisions.

1.1 Purpose

Corrective Action Site 23-02-08 is being investigated because hazardous constituents may be present in concentrations that could potentially pose a threat to human health and/or the environment.

1.1.1 CAU History and Description

Corrective Action Site 23-02-08 consists of subsurface soil contamination from one or more release(s) of fuel oil from USTs 23-115-1, 23-115-2, and 23-115-3 that were formerly located at this site. The USTs were located off the northwest corner of the now demolished Building 115 (Steam Plant) in Area 23 of the NTS.

1.1.2 DQO Summary

Corrective Action Site 23-02-08 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); and contractor personnel. The DQOs are used to identify and define the type, amount, and quality of data needed to

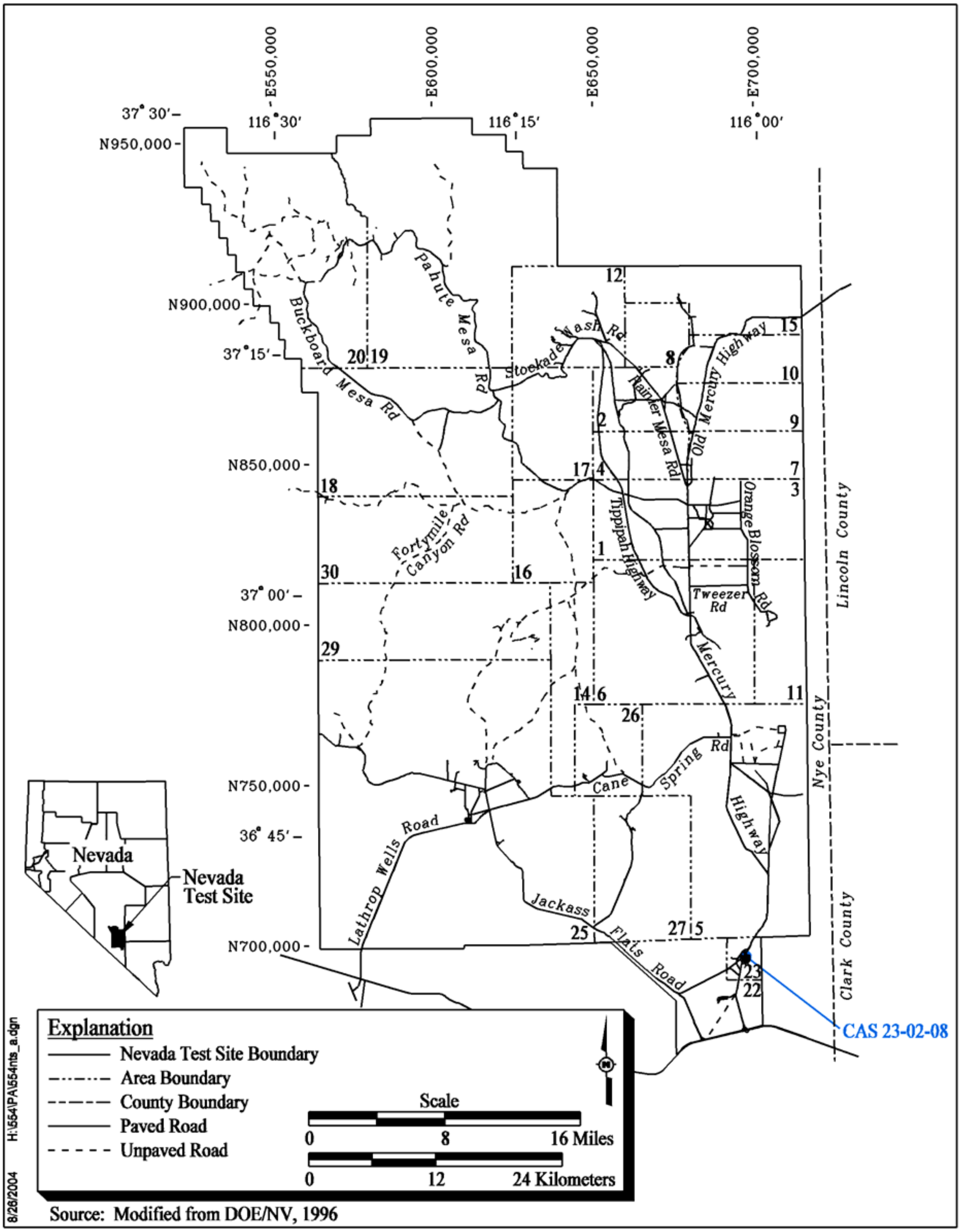

Figure 1-1
Nevada Test Site Map with CAU 554 CAS Location

develop and evaluate appropriate corrective actions for CAU 554. This CAIP will describe the investigation developed to collect the data needs identified in the DQO process. While a detailed discussion of the DQO methodology and the DQOs is presented in Appendix A of this document, a summary of the results of the DQO process is provided below.

The DQO problem statement for CAU 554 is: "Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives for CAS 23-02-08 in CAU 554." To address this question, the resolution of two decisions statements is required:

- Decision I: "Is any COPC present in environmental media within the CAS at a concentration exceeding its corresponding preliminary action level (PAL)?" Any contaminant associated with a CAS activity that is present at concentrations exceeding its corresponding PAL will be defined as a contaminant of concern (COC). If a COC is detected, then Decision II must be resolved. Otherwise, the investigation for that CAS is complete.
- Decision II: "If a COC is present, is sufficient information available to evaluate potential corrective action alternatives?" Sufficient information is defined to include:
  - The identification of the vertical and lateral extent of media containing any COC
  - The information needed to characterize investigation-derived waste (IDW) for disposal
  - The information needed to determine potential remediation waste types
  - The information needed to evaluate the feasibility of remediation alternatives (bioassessment if natural attenuation or biodegradation is considered and geotechnical data if construction or evaluation of barriers is considered)

The informational inputs and data needs to resolve the problem statement and the decision statements were generated as part of the DQO process for this CAU and are documented in Appendix A. The information necessary to resolve the DQO decisions will be generated for CAS 23-02-08 by collecting and analyzing samples generated during a field investigation. The presence and nature of contamination at this CAS will be determined by sampling locations that are determined to be the most probable to contain COCs if they are present anywhere within the CAS. If while defining the nature of contamination it is determined that COCs are present at CAS 23-02-08, this CAS will be further addressed by determining the extent of contamination before evaluating corrective action alternatives.

1.2 Scope

To generate information needed to resolve the decision statements identified in the DQO processes, the scope of the CAI for CAU 554 includes the following activities:

- Move surface debris and/or materials, as needed, to facilitate sampling.
- Perform field screening.
- Collect and submit environmental samples for laboratory analysis to determine if COCs are present.
- Collect additional step-out samples to define the extent of the contamination if COCs are present.
- Collect samples of IDW, as needed, for waste management and minimization purposes.
- Collect Quality Control (QC) samples.

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

1.3 CAIP Contents

Section 1.0 presents the purpose and scope of this CAIP, while Section 2.0 provides background information about CAU 554. 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) and QC requirements (including collection of QC samples) are presented in Section 6.0 and in the *Industrial Sites Quality Assurance Project Plan* (QAPP) (NNSA/NV, 2002). The project schedule and records availability are discussed in Section 7.0 and Section 8.0 provides a list of references.

Appendix A provides a detailed discussion of the DQO methodology and the DQOs specific to CAS 23-02-08, while Appendix B contains information on the project organization.

The health and safety aspects of this project are documented in the *Industrial Sites Project Health and Safety Plan* (SNJV, 2004) and will be supplemented with a site-specific field work plan (FWP) written prior to the start of field work.

Public involvement activities are documented in the "Public Involvement Plan" contained in Appendix V of the FFACO (1996). The managerial aspects of this project are discussed in the *Project Management Plan* (DOE/NV, 1994) and will be supplemented with a site-specific field management plan that will be developed prior to field activities.

2.0 Facility Description

Corrective Action Unit 554 is comprised of one CAS (23-02-08), which is located in Area 23 of the NTS. This CAS consists of one or more fuel oil release(s) from USTs 23-115-1, 23-115-2, and 23-115-3 that were formerly located at this site. The USTs were located to the west and northwest of the remaining concrete building pad for the demolished Building 115 (Steam Plant) in Area 23. The building pad and CAS 23-02-08 are located on a lot between Tumbler Avenue to the north and Ranger Avenue to the south and are bordered by a pedestrian sidewalk and Snapper Road to the west. Figure 2-1 shows a site sketch of CAS 23-02-08 before demolition of Building 115 in 2003.

2.1 Physical Setting

Corrective Action Site 554 is located in Mercury and lies within the Mercury Valley basin. General background information pertaining to topography, geology, hydrogeology, and climatology are provided for Mercury Valley 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); the *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).

Mercury Valley covers an area of approximately 70 square miles and ranges in elevation from 3,050 to 4,200 feet (ft). The valley is a transition zone between the northern edge of the Mojave Desert and the southern portion of the Great Basin Desert.

Groundwater beneath Mercury Valley occurs within valley-fill, 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 inches (in.) (DRI, 1985). Estimated potential evaporation rate at the NTS ranges from 60 to 80 inches per year (in./yr).

The nearest groundwater supply well to CAS 23-02-08 is Army Water Well-1 (WW-1), which is located approximately 5.4 mi southwest of the site (USGS, 1964). This well produces water from two bedrock zones. The combined static water level for these water producing zones in the well is

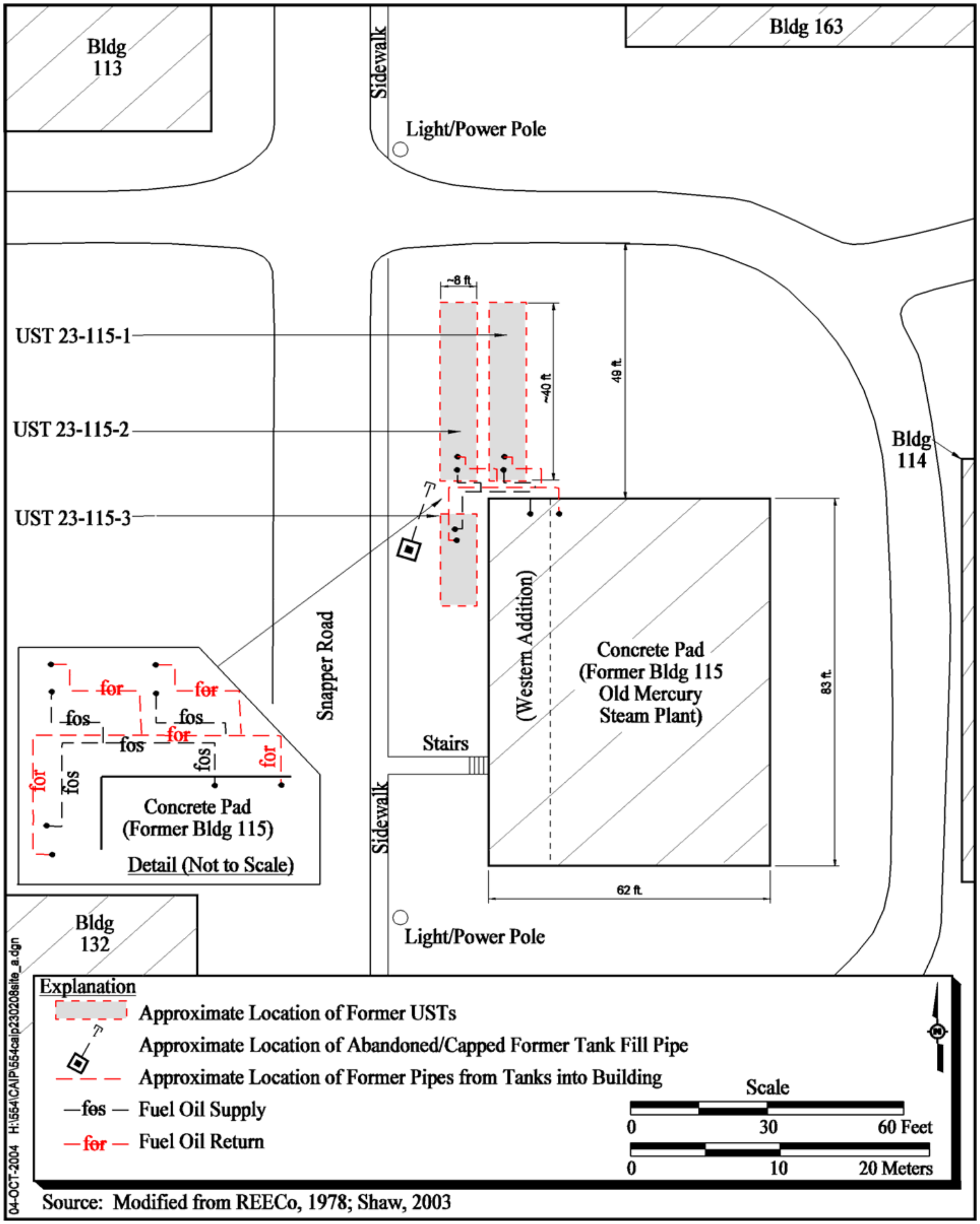

Figure 2-1
CAS 23-02-08, Site Map

786 ft below ground surface (bgs). The hydraulic gradient between the two water producing zones is vertically upward (USGS, 1964).

The closest well to the site is monitoring well SM-23-1, which is located about 1 mi west of Building 115. Depth to water in SM-23-1 is approximately 1,165 ft bgs. During drilling of SM-23-1, two perched water zones of varying thickness were encountered; the uppermost zone was approximately 1-ft thick and was found at 500 ft bgs; the lower zone is approximately 11-ft thick and was encountered at 1,080 ft bgs. Several caliche layers were also noted during drilling of SM-23-1 and were encountered at approximately 24 to 32 ft bgs (USGS, 1962).

Figure 2-1 shows the locations of the former structures. The lot has been regraded since demolition of Building 115 and slopes gently to the west where it is bordered by a pedestrian sidewalk and Snapper Road. Currently, several overhead and underground utility lines exist at the site. The concrete building pad for Building 115 remains and measures 62 by 83 ft (Figure 2-1).

2.2 Operational History

This section provides a description of the use and history of CAS 23-02-08. The following summary is designed to describe the current definition of CAS 23-02-08 and illustrate all significant, known activities at the CAS.

Corrective Action Site 23-02-08 is one or more fuel oil release(s) from former USTs to the ground surface and/or surrounding shallow subsurface soils. The USTs were located off the northwest corner of Building 115, which was the Mercury Steam Plant. Two of the three former USTs were 15,000-gallon (gal) capacity tanks and were installed in 1951 with the construction of the Steam Plant. These tanks were removed in December 1977 and replaced with similar sized tanks in January 1978. The third tank was a 10,000-gal capacity and was installed in 1965 during construction of the western addition to the Steam Plant. In 1983, all tank operations were discontinued at Building 115 when the Steam Plant was taken out of operation. All three tanks and associated piping were removed in December 1989 and the excavation was backfilled in March 1990. Building 115 and the surrounding components were demolished and removed in 2003. See Figure 2-2 for details on the piping configuration of the original USTs.

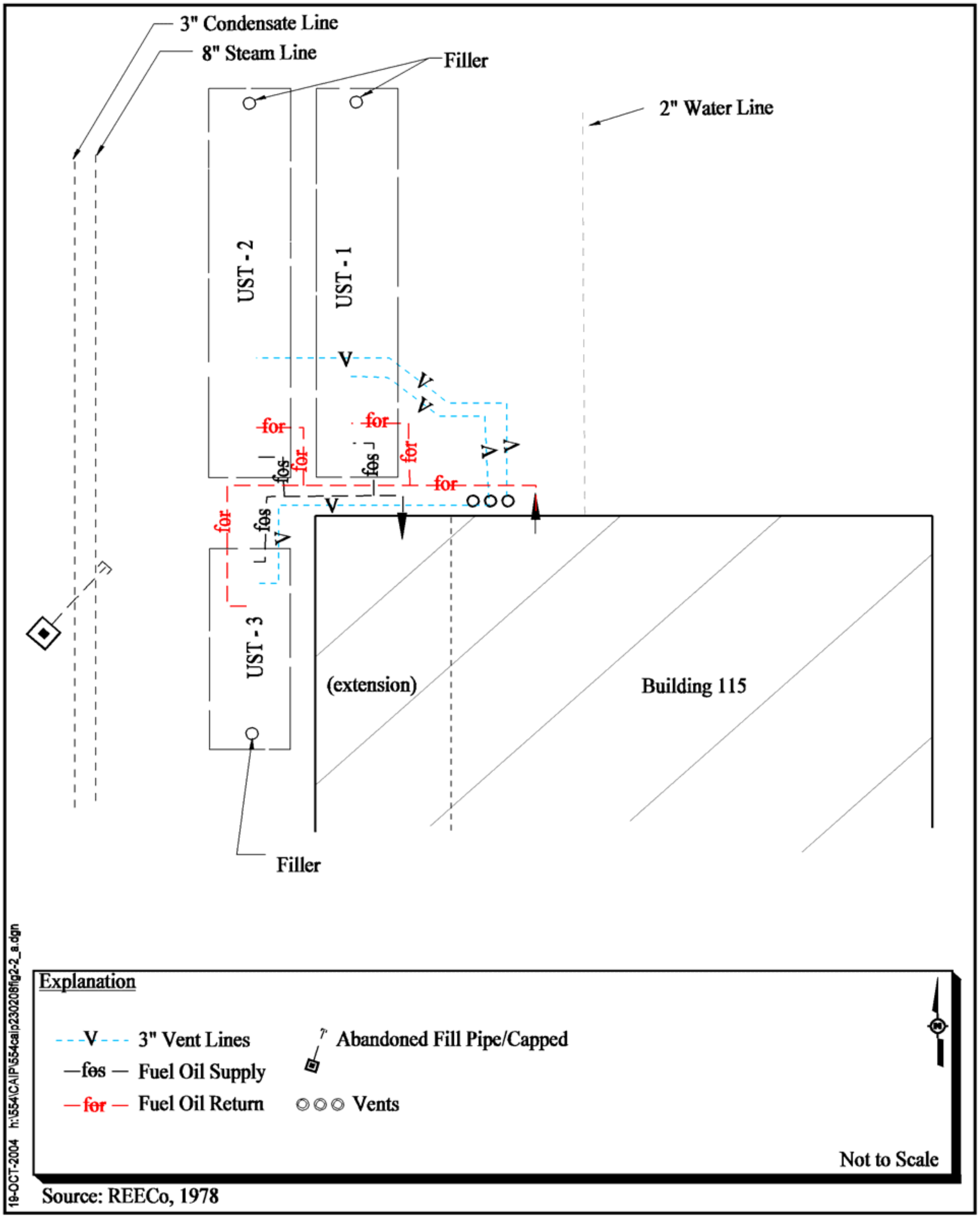

Figure 2-2
CAS 23-02-08, Piping Detail for USTs

Before Building 115 was demolished, asbestos abatement was conducted. Asbestos from the destroyed structure may be present in the soil at the site. Samples may be collected and analyzed for asbestos to aid in making health and safety and/or waste management related decisions during the investigation and/or subsequent corrective actions.

2.3 Waste Inventory

Available documentation, interviews with former site employees, process knowledge, and general historical NTS practices were used to identify wastes that may be present at CAS 23-02-08. Historical information and site visits indicate that the site may contain wastes such as construction materials, equipment, asbestos, and other miscellaneous debris.

Fuel oil released from the former UST(s) located at the site is potentially present in the surrounding shallow subsurface soil in the area to the northwest of the remaining Building 115 concrete pad. Waste types identified at this site include hydrocarbon waste and sanitary waste.

2.4 Release Information

This section contains descriptions of known or potential releases associated with CAS 23-02-08.

Number 2 fuel oil may have leaked from USTs 23-115-1 and/or 23-115-2 prior to their replacement (December 1977/March 1978), their ultimate removal (December 1989), and/or from UST 23-115-3 prior to its removal in December 1989. Other potential sources of releases are leaks from underground piping and/or surface releases during tank refilling. There is no indication that the remaining structure (concrete pad) is a source of potential contamination. There are no visible soil stains at the site surface. A volume estimate based on inventory reports indicates 100,000 gal of fuel oil may have been released in 1977 over a span of six months or more (Soong, 2003). A review of the UST removal records and analytical results indicate this may have been an over estimate. Contaminants are expected to be located in the soil within close proximity to former tank locations.

2.5 Investigative Background

This section summarizes the previous investigations conducted at CAS 23-02-08. More detailed discussions of these investigations are found in Appendix A.

Samples of stained soil encountered below the tank depths were analyzed for total petroleum hydrocarbons (TPH) at the time of tank removals in December 1989. Analytical results from soil beneath USTs 23-115-1 and -3 exceeded the regulatory threshold for TPH of 100 milligrams per kilogram (mg/kg). Reported soil sample results from the north (fill) ends of USTs 23-115-1 and -3 were 145 mg/kg and 123 mg/kg, respectively. Reported soil sample results from the south end at UST 23-115-3 were 706 mg/kg. A total of 8 cubic yards (yd^3) of contaminated soil was removed from the two tank locations and disposed at the 10c Industrial Waste Landfill at the NTS. Upon further excavation beneath UST 23-115-1, a hardened asphalt and soil mixture was encountered. An additional soil sample obtained from the fill end of this tank showed a TPH concentration of 920 mg/kg (Kendall, 1990).

The release was investigated in February 1990 and the excavations were backfilled in March 1990, per a verbal approval from NDEP (Youngs, 1990). Contamination at UST 23-115-1 was left in place because of the refusal encountered in the hardened asphalt/soil layer during excavation. Additional soil excavation and sampling was not performed at UST 23-115-3 due to the proximity of the excavation to Building 115. The lateral and vertical extents of contamination were estimated based on readings from a carbon dioxide (CO_2) survey performed at the site in February 1990. Two plume scenarios were estimated based on the results of this survey and an assumed volume release of 100,000 gal of diesel fuel, a soil porosity of 30 percent, and a residual hydrocarbon saturation of 15 percent (Kendall, 1990). The two plume scenarios were estimated by varying the lateral extent of contamination. Using a contamination radius of 20 ft, a plume depth was estimated at 210 ft bgs; while using a 35-ft radius of contamination, the plume depth was estimated at 70 ft bgs (Kendall, 1990).

The estimates on plume sizes are based on an estimated release of 100,000 gal of diesel fuel. This estimate is highly uncertain and is not supported by the relatively low levels of hydrocarbons identified directly under the tanks (i.e., the highest analytical result was 904 mg/kg under Tank 115-23-1). It could be that the release was much smaller than what was previously estimated. If this is the case, it can be expected that the plume size including depth of contamination and lateral extent of contamination is significantly smaller.

Closure documentation was not identified for any of the three USTs. Additional soil sampling will be performed at the former tank release site(s) to fully characterize the waste material.

2.5.1 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 554.

In accordance with the NNSA/NSO *National Environmental Policy Act* (NEPA) Compliance Program, a NEPA checklist will be completed prior to commencement of site investigation activities at CAU 554. This checklist requires NNSA/NSO project personnel to evaluate their proposed project activities against a list of potential impacts that include, but are not limited to: air quality, chemical use, waste generation, noise level, and land use. Completion of the checklist results in a determination of the appropriate level of NEPA documentation by the NNSA/NSO NEPA Compliance Officer.

3.0 Objectives

This section presents an overview of the DQOs for CAU 554 and formulation of the CSM for the site. Also presented is a summary listing of the contaminants reasonably suspected to be present at CAS 23-02-08, the contaminants of potential concern (COPCs), the PALs for the investigation, and the process used to move from PALs to final action levels. Additional details on the CSM are located in Appendix A.

3.1 Conceptual Site Model

The CSM describes the most probable scenario for current conditions at CAS 23-02-08 and defines the assumptions that are the basis for identifying appropriate sampling strategy and data collection methods. The CSM for CAU 554 has been developed using information from the physical setting, potential contaminant sources, knowledge from similar sites, release information, historical background information, and physical and chemical properties of the potentially affected media and COPCs. The CSM represents contamination of TPH-diesel-range organics (DRO) due to release(s) and describes potential contamination under or around the former USTs.

If evidence of potential contamination that is outside the scope of the presented CSM is identified during investigation activities, the situation will be reviewed and a recommendation will be made as to how best to proceed. In such cases, identified decision makers will be notified and given the opportunity to comment on and/or concur with the recommendation.

The following section discusses future land use and the identification of exposure pathways (i.e., combination of source, release, migration, exposure point, and receptor exposure route) for CAU 554.

3.1.1 Future Land Use

Corrective Action Site 23-02-08 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 DoD land-navigation exercises and training (DOE/NV, 1998).

The land-use zone where the CAU 554 CAS is located dictates that future land use will be limited to nonresidential (i.e., industrial) activities.

Corrective Action Site 23-02-08 is located in Mercury, Nevada. The nearby area includes office buildings, a cafeteria, training facilities, and dorm rooms. Visitors and personnel at the NTS for short duration training exercises could be exposed to potential contamination from this site. Applying the industrial site worker scenario to occasional visitors is conservative and will adequately account for such potential exposures.

3.1.2 Contaminant Sources

The CAS 23-02-08 contaminant source(s) are leaks and/or spills of Number 2 fuel oil from USTs and associated piping.

3.1.3 Release Mechanisms

There are two possible release mechanisms for CAS 23-02-08. The first is subsurface releases caused by leaks from the USTs and/or associated piping due to breaches in the system caused by corrosion. The second release mechanism is surface releases caused by spillage or overfilling of the USTs during filling operations.

3.1.4 Migration Pathways

Tank contents served as a potential driving force during a release from the USTs. This source has since been removed from the site; therefore, infiltration and percolation of precipitation is the only potential driving force for additional downward migration of contaminants. However, due to high evaporation and limited precipitation, percolation of infiltrated precipitation at the NTS does not provide a significant mechanism for vertical migration of contaminants to groundwater (DOE/NV, 1993). Annual potential evaporation at Area 23 of the NTS has been estimated between 60 to 80 in., while precipitation for Mercury is 5.59 in./yr (Winograd and Thordarson, 1975).

Spills or leaks at the ground surface may have had limited lateral migration prior to infiltration. Surface migration pathways are expected to be minor as CAS 23-02-08 has shallow surface slopes and the potential release site is not located in or near drainages.

The presence of relatively impermeable layers could modify transport pathways, both on the ground surface (e.g., concrete) and in the subsurface (e.g., caliche layers). Conversely, the presence of more permeable pathways such as utility corridors may provide preferential lateral pathways.

3.1.5 Exposure Points

Exposure points for the CSM are expected to be areas of surface contamination where visitors and site workers will come in contact with soil surface. Site workers also have a potential for contact with subsurface soils via excavation during construction/maintenance activities including work on underground utilities.

3.1.6 Exposure Routes

The potentially affected media for CAS 23-02-08 is shallow subsurface soil. Exposure routes to site workers include ingestion, inhalation, and/or dermal contact (absorption) from disturbance of, or direct contact with, contaminated soils.

3.1.7 Additional Information

Information concerning topography, geology, climatic conditions, hydrogeology, floodplains, and infrastructure at CAS 23-02-08 is presented in Sections 2.1 and 2.2 and Appendix A. This information has been addressed in the CSM and will be considered during the evaluation of corrective action alternatives, as applicable. Additional information on these topics may be required to complete the investigation and the evaluation of corrective action alternatives. However, climatic and site conditions (e.g., surface and subsurface soil descriptions) as well as specific structure descriptions will be observed and recorded during the CAI.

3.2 Contaminants of Potential Concern

A list of target analytes for CAU 554 were identified through a review of site history documentation, process knowledge information, personal interviews, past investigation efforts (where available), and inferred activities associated with CAS 23-02-08. Target analytes are those contaminants that may be reasonably suspected to be present at any CAS.

The only target analyte identified for CAS 23-02-08 is TPH-DRO.

Because complete information regarding activities performed at CAS 23-02-08 is unavailable, additional analytes have been included as COPCs. Chemical COPCs are defined as the analytes reported from analytical methods for which the State of Nevada has established action levels, or for which the U.S. Environmental Protection Agency (EPA) Region 9 has established Preliminary Remediation Goals (PRGs) (EPA, 2002a), or for which toxicity data are listed in the EPA *Integrated Risk Information System* (IRIS) database (EPA, 2001b). Analytical methods to be used for CAS 23-02-08 are:

- TPH-DRO
- TPH-Gasoline-Range Organics (GRO)
- Volatile Organic Compounds (VOCs)
- Semivolatile Organic Compounds (SVOCs)
- Polychlorinated Biphenyls (PCBs)
- Total *Resource Conservation and Recovery Act* (RCRA) Metals

Except for naturally occurring isotopes, radiological COPCs are defined as the radionuclides reported from the gamma sprectrometry analytical method. These include:

- americium (Am)-241, cesium (Cs)-137, and cobalt (Co)-60

Radiological COPCs are not suspected; however, Decision I samples will be analyzed for gamma-emitting isotopes to account for potential radiological contamination present due to general NTS activities and to meet waste acceptance criteria for IDW and potential remediation waste.

3.3 Preliminary Action Levels

The PALs presented in this section are to be used for site screening purposes. They are not intended to be used as cleanup or final action levels. However, they are useful in screening out analytes that are not present in sufficient concentrations to warrant further evaluation; therefore, they streamline the consideration of remedial alternatives. Each COPC that is detected in a sample at concentrations exceeding the corresponding PAL becomes a COC. The final action levels (along with the basis for their selection) will be defined in the investigation report where they will be compared to laboratory results in the evaluation of potential corrective actions.

3.3.1 Chemical PALs

Except as noted herein, the chemical PALs are defined as the EPA Region 9 Risk-Based PRGs for chemical constituents in industrial soils (EPA, 2002a). Background concentrations for RCRA metals will be used instead of PRGs when natural background exceeds the PRG, as is often the case with arsenic on the NTS. Background is considered the mean plus two standard deviations of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (formerly the Nellis Air Force Range) (NBMG, 1998; Moore, 1999). For detected chemical COPCs without established PRGs that are listed in the EPA IRIS database (EPA, 2001), the protocol used by the EPA Region 9 in establishing PRGs (or similar) will be used to establish these PALs. If this approach is used for the CAS 23-02-08 CAI, documentation will be provided in the investigation report.

3.3.2 Total Petroleum Hydrocarbon PAL

The PAL for TPH is 100 parts per million (ppm), as listed in the *Nevada Administrative Code* (NAC) 445A.2272 (NAC, 2003).

3.3.3 Radionuclide PALs

The PALs for radiological contaminants are based on the National Council on Radiation Protection and Measurements (NCRP) Report No. 129 recommended screening limits for construction, commercial, industrial land-use scenarios (NCRP, 1999) scaled from 25 to 15 millirems per year (mrem/yr) dose constraint (Appenzeller-Wing, 2004) and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993). These PALs are based on the construction, commercial, industrial land-use scenario provided in the guidance and are appropriate for the NTS based on future land-use scenarios as presented in Section 3.1.1. The specific radiological PALs for CAU 554 are listed in Table 3-1.

Solid media such as concrete and/or structures may pose a potential radiological exposure risk to site workers if contaminated. The radiological PAL for solid media will be defined as the

Table 3-1
Analytical Requirements for Radionuclides for CAU 554

Parameter/ Analyte	Matrix	Analytical Method	MDC[a]	PAL[b,c]	Laboratory Precision	Percent Recovery
Gamma Spectrometry						
Americium-241	Soil	HASL-300[d]	2.0 pCi/g[e]	7.62 pCi/g	RPD = 20% for water RPD = 35% for soil -2 < ND < 2[f]	Laboratory control sample recovery = 80 -120[g] %R
Cesium-137	Soil	HASL-300[d]	0.5 pCi/g[e]	7.3 pCi/g		
Cobalt-60	Soil	HASL-300[d]	0.5 pCi/g[e]	1.61 pCi/g		

[a]The MDC is the lowest concentration of a radionuclide, if present in a sample, that can be detected with a 95 percent confidence level.
[b]The PALs for soil are based on the *NCRP Report No. 129, Recommended Screening Limits for Contaminated Soil and Review of Factors Relevant to Site-Specific Studies* (NCRP, 1999) scaled from 25 to 15 mrem/yr dose and the guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993).
[c]PALs for liquids will be developed as needed.
[d]*The Procedures Manual of the Environmental Measurements Laboratory*, HASL-300 (DOE, 1997).
[e]MDCs vary depending on the presence of other gamma-emitting radionuclides in the sample and are relative to the MDC for cesium-137.
[f]ND is not RPD, it is another measure of precision used to evaluate duplicate analyses. The ND is calculated as the difference between two results divided by the square root of the sum of the squares of their total propagated uncertainties. *Evaluation of Radiochemical Data Usability* (Paar and Porterfield, 1997).
[g]EPA *Contract Laboratory Program Statement of Work for Inorganic Analysis* (EPA, 2004).

MDC = Minimum detectable concentration
PAL = Preliminary action level
pCi/g = Picocuries per gram
RPD = Relative percent difference
ND = Normalized difference
%R = Percent recovery

unrestricted-release criteria defined in the *NV/YMP Radiological Control* (RadCon) *Manual* (DOE/NV, 2000a).

3.4 DQO 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 used to prepare for site characterization data collection. The DQOs are designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and technically defend the recommendation of a viable corrective actions (e.g., no further action or closure in place).

The DQO strategy for CAU 554 was developed at a meeting on July 15, 2004. The DQO process identifies data needs, clearly defines the intended use of the environmental data, and designs a data collection program that will satisfy these purposes. During the DQO discussions for this CAU, the informational inputs or data needs to resolve problem statements and decision statements were documented.

The problem statement for CAU 554 is: "Existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives for the CAS 23-02-08 in CAU 554." To address this question, the resolution of two decisions statements is required:

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

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

  - The identification of the vertical and lateral extent of media containing any COC

  - The information needed to characterize IDW for disposal

  - The information needed to determine potential remediation waste types

  - The information needed to evaluate the feasibility of remediation alternatives (bioassessment if natural attenuation or biodegradation is considered and geotechnical data if construction or evaluation of barriers is considered)

Decision I samples from worst case locations (i.e., heaviest contamination based on biasing factors) at each Decision I location will be analyzed using the methods listed in Table 3-1 and Table 3-2. Additional samples from Decision I locations will be analyzed for only TPH-DRO unless biasing factors or analytical laboratory results indicate other contaminants are present. Decision II samples will be submitted for the analysis of all detected COCs. In addition, samples will be submitted for analyses as needed to support waste management or health and safety decisions.

The analytical methods needed to satisfy DQO data requirements as well as the DQIs for laboratory analysis are provided in more detail in Section 6.0. Laboratory data will be assessed in the investigation report to confirm or refute the CSM and determine if the DQO data needs were met.

The DQIs of precision, accuracy, representativeness, completeness, comparability, and sensitivity will also be assessed.

The analytical requirements for CAU 554 COPCs are listed in Table 3-1 and Table 3-2. To satisfy the DQI of sensitivity, the analytical methods must be sufficient to detect contamination that is present in the samples at PAL concentrations. Analytical methods and minimum reporting limits (MRLs) or minimum detectable concentrations (MDCs) for each parameter are also provided in Table 3-1 and Table 3-2. The MRL is the lowest concentration of a particular chemical parameter that can be detected in a sample within an acceptable level of error. The MDC is the lowest concentration of a particular radionuclide parameter that can be detected in a sample within an acceptable level of error.

Table 3-2
Analytical Requirements for Nonradiological Target Analytes and COPCs for CAU 554
(Page 1 of 2)

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

Table 3-2
Analytical Requirements for Nonradiological Target Analytes and COPCs for CAU 554
(Page 2 of 2)

[a] Relative percent difference (RPD) is used to calculate precision. Precision is estimated from the RPD of the concentrations measured for the matrix spike and matrix spike duplicate or of laboratory, or field duplicates of unspiked samples. It is calculated by: RPD = 100 x $\{(|A_1-A_2|)/[(A_1+A_2)/2]\}$, where A_1 = Concentration of the parameter in the initial sample aliquot, A_2 = Concentration of the parameter in the duplicate sample aliquot.
[b] The %R is used to calculate accuracy. Accuracy is assessed from the recovery of parameters spiked into a blank or sample matrix of interest, or from the recovery of surrogate compounds spiked into each sample. The recovery of each spiked parameter is calculated by: %R = 100 x (A_s-A_u/A_n), where A_s = Concentration of the parameter in the spiked sample, A_u = Concentration of the parameter in the unspiked sample, A_n = Concentration increase that should result from spiking the sample.
[c] *Test Method for Evaluating Solid Waste Physical/Chemical Methods*, 3rd Edition, Parts 1-4, (SW-846) CD ROM, Washington, DC (EPA,1996).
[d] Estimated Quantitation Limit as given in SW-846 (EPA, 1996).
[e] In-House Generated RPD and %R Performance Criteria. It is necessary for laboratories to develop in-house performance criteria and compare them to those in the methods. The laboratory begins by analyzing 15 to 20 samples of each matrix and calculating the mean %R for each parameter. The standard deviation (SD) of each %R is then calculated, and the warning and control limits for each parameter are established at ± 2 SD and ± 3 SD from the mean, respectively. If the warning limit is exceeded during the analysis of any sample delivery group (SDG), the laboratory institutes corrective action to bring the analytical system back into control. If the control limit is exceeded, the sample results for that SDG are considered unacceptable. These limits are reviewed after every quarter and are updated when necessary. The laboratory tracks trends in both performance and control limits by the use of control charts. The laboratory's compliance with these requirements is confirmed as part of an annual laboratory audit. Similar procedures are followed in order to generate acceptance criteria for precision measurements.
[f] *Industrial Sites Quality Assurance Project Plan* (NNSA/NV, 2002).
[g] *Contract Laboratory Program Statement of Work for Inorganic Analysis* (EPA, 2004).

Definitions:
EQLs = Estimated quantitation limits
mg/L = Milligrams per liter
mg/kg = Milligrams per kilogram
NA = Not applicable
RPD = Relative percent difference
%R = Percent recovery

4.0 Field Investigation

This section contains a description of activities to gather and document information from the CAU 554 (CAS 23-02-08) field investigation.

4.1 Technical Approach

The information necessary to satisfy the DQO data needs will be generated for CAS 23-02-08 by collecting and analyzing samples generated during a field investigation. The presence and nature of contamination at this CAS will be evaluated by collecting samples at biased locations that are determined to be most probable to contain COCs if they are present anywhere within the CAS. These locations will be determined based on their identification using the biasing factors listed in Section A.1.4.1 of Appendix A. If while defining the nature of contamination it is determined that COCs are present at CAS 23-02-08, this CAS will be further addressed by determining the extent of contamination before evaluating corrective action alternatives.

Sample locations may be changed based on site conditions, obvious staining of soils, field-screening results (FSRs), or professional judgment. The Site Supervisor has the discretion to modify the biased sample locations to best meet the DQO decision needs and criteria stipulated in Appendix A.

Since this CAIP only addresses contamination originating from CAU 554, it may be necessary to distinguish overlapping contamination originating from other sources. For example, TPH contaminants originating from asphalt pavings or oil from leaking vehicles, or dust suppression will not be addressed under CAU 554. To determine if contamination is from CAU 554 or from other sources, soil samples may be collected from background locations.

Modifications to the investigative strategy may be required should unexpected field conditions be encountered at CAS 23-02-08. Significant modifications shall be justified and documented on a Record of Technical Change prior to implementation. If an unexpected condition indicates that conditions are significantly different than the corresponding CSM, the activity will be restated and the identified decision makers will be notified.

4.2 Field Activities

Activities to be conducted at CAU 554 under this CAIP include site preparation, sample location selection, and sample collection. These investigation activities are discussed in the following subsections.

4.2.1 Site Preparation Activities

Site preparation will be conducted by the NTS Management and Operating (M&O) Contractor prior to the investigation. Site preparation may include, but not be limited to: relocation or removal of surface debris, equipment, and structures; the construction of hazardous waste accumulation areas (HWAAs), a decontamination pad/area, and site exclusion zones; providing sanitary facilities; and temporarily moving staged equipment.

Prior to mobilization for collecting investigation samples, the following preparatory activities will also be conducted:

- Perform visual surveys at CAS 23-02-08 to identify any staining, discoloration, disturbance of native soils, or any other indication of potential contamination.

4.2.2 Sample Location Selection

Biasing factors (including 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 presented in Appendix A.

As biasing factors are identified and used for selection of sampling locations, they will be documented in the appropriate field documents. The specific sampling strategy and the locations of the biased samples that were estimated for CAS 23-02-8 are presented in Appendix A.

4.2.3 Sample Collection

The sampling program for CAU 554 will consist of the following activities:

- Collect and analyze samples from locations as described in this section.

- Collect required QC samples.

- Collect waste management samples.
- Collect soil samples from background locations, if necessary.
- Collect and analyze bioassessment samples if appropriate (e.g., if VOC concentrations exceed field-screening levels (FSLs) in a pattern that suggests that a plume may be present).
- Perform radiological characterization surveys of construction materials and debris as necessary for disposal purposes.
- Stake or flag sample locations and record coordinates.

Decision I soil samples will be collected from selected locations based on the CSM, biasing factors, (FSRs), and existing data. Decision I subsurface soil samples will collected at depth intervals selected by the Site Supervisor based on biasing factors to a depth where the biasing factors are no longer present. Refer to Appendix A for specific locations.

Surface soil samples will be collected to show that the surface is not contaminated and that future use restriction for this site can be limited to the subsurface soils, if necessary.

Decision II sampling will consist of further defining the extent of contamination where COCs have been confirmed. Step-out (Decision II) sampling locations will be selected based on the CSM, biasing factors, FSRs, existing data, and the outer boundary sample locations where COCs were detected in the Decision I samples. In general, step-out sample locations will be arranged in a triangular pattern around the Decision I locations 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; work will be temporarily suspended, NDEP will be notified, and the investigation strategy will be reevaluated. The number, location, and spacing of step-outs may be modified by the Site Supervisor, as warranted by site conditions. A minimum of one analytical result less than the PAL 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). Contaminants determined not to be present in Decision I samples may be eliminated from Decision II analytical suites. Refer to Appendix A for specific sample locations.

Where sampling locations are modified by the Site Supervisor, the justification for these modifications will be documented in the field logbook. Section 3.4 provides the analytical methods and laboratory requirements (i.e., detection limits, precision, and accuracy requirements) to be used when analyzing the COPCs. The analytical program for CAS 23-02-08 is presented in Table 3-1 and Table 3-2. All sampling activities and quality control requirements for field and laboratory environmental sampling will be conducted in compliance with the Industrial Sites QAPP (NNSA/NV, 2002) and other applicable, approved procedures.

4.3 Geotechnical/Hydrological Analysis

Samples may be collected and submitted for geotechnical and hydrological analyses to generate additional information required for CAS 23-02-08, if needed. Samples to be analyzed for these parameters will be collected in brass sleeves (or other appropriate containers) to maintain the natural physical characteristics of the soil. Table 4-1 lists general geotechnical and hydrological parameters of interest. The testing methods shown are minimum standards, and other equivalent or superior testing methods may be used.

Table 4-1
General Geotechnical and Hydrological Analysis

Geotechnical Parameter	Methods
Initial moisture content	ASTM D 2216-92[a]
Dry bulk density	ASTM D 2937-94[a]
Calculated porosity	EM-1110-2-1906[b] or MOSA Chp. 18[c]
Saturated hydraulic conductivity	ASTM 2434-68(74)[a] or MOSA Chp. 28[c]
Unsaturated hydraulic conductivity	van Genuchten[d]
Particle-size distribution	ASTM D 422-63(90)[a]
Water-release (moisture retention) curve	MOSA Chp. 26[c] ASTM D 2325-68(94)[a] MOSA Chp. 24[c] Karanthanasis and Hajek[e]

[a] American Society of Testing and Materials (ASTM, 1996)
[b] U.S. Army Corps of Engineers (USACE), 1970
[c] Methods of Soil Analysis (MOSA) (SSSA, 1986)
[d] van Genuchten, 1980
[e] Karanthanasis and Hajek, 1982

4.4 Bioassessment Tests

Samples may be collected and submitted for bioassessment testing to generate information required to evaluate the potential for natural attenuation or biodegradation of TPH constituents at CAS 23-02-08. Bioassessment is a series of tests designed to evaluate the physical, chemical, and microbiological characteristics of a site. Bioassessment tests are used to determine nutrient availability, pH, microbial population density, and the ability of the microbial population to grow under enhanced conditions.

4.5 Safety

A current version of the Environmental Services Architect-Engineer Contractor's programmatic Health and Safety Plan (HASP) and Industrial Sites (IS) HASP will accompany the field documents. A Field Work Permit (FWP), or equivalent, will be prepared and approved prior to the field effort. As required by DOE's Integrated Safety Management System (ISMS) (DOE/NV, 1997), these documents outline the requirements for protecting the health and safety of the workers and the public, and the procedures for protecting the environment. The ISMS program requires that site personnel will reduce or eliminate the possibility of injury, illness, or accidents, and to protect the environment during all project activities. The following safety issues will be taken into consideration when evaluating the hazards and associated control procedures for field activities discussed in the IS HASP and FWP:

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

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

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

- Occupational exposure monitoring to prevent overexposures to hazards such as radionuclides, chemicals, and physical agents (e.g., heat, cold, and high wind).

- Radiological surveying for alpha/beta and gamma emitters to minimize and/or control personnel exposures; use of the "as-low-as-reasonably-achievable" principle when addressing radiological hazards.

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

- If potential asbestos-containing material is identified (CFR, 2003c; NAC, 2002d), it will be inspected and/or samples collected by trained personnel.

5.0 Waste Management

Management of IDW will be based on regulatory requirements, field observations, process knowledge, and laboratory results from CAU 554 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 several factors. These include the mass of the waste, the amount of contaminated media contained in the waste, and the maximum concentration of contamination found in the media. Direct samples of IDW may also be taken to support waste characterization.

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

5.1 Waste Minimization

Investigation activities are planned to minimize IDW generation. This will be accomplished by incorporating the use of process knowledge, visual examination, and/or radiological survey and swipe results. When possible, disturbed media (such as soil removed during trenching) or debris will be returned to its original location. Contained media (e.g., soil managed as waste) as well as other IDW will be segregated to the greatest extent possible to minimize generation of hazardous, radioactive, or mixed waste. Hazardous material used at the sites will be controlled in order to limit unnecessary generation of hazardous or mixed waste. Administrative controls, including decontamination procedures and waste characterization strategies, will minimize waste generated during the CAU 554 investigation.

5.2 Potential Waste Streams

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

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

5.3 Investigation-Derived Waste Management

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

Table 4-2 of the NV/YMP RadCon Manual (DOE/NV, 2000a) shall be used to determine if such materials may be declared nonradioactive. On-site IDW management requirements by waste type are detailed in the following sections. Applicable waste management regulations and requirements are listed in Table 5-1.

5.3.1 Sanitary Waste

Sanitary IDW generated during the CAU 554 investigation will be collected and disposed of in accordance with the permits for operation of the sanitary landfills at the NTS.

Table 5-1
Waste Management Regulations and Requirements

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

[a]*Nevada Revised Statutes* (NRS, 2003a, b, c)
[b]*Nevada Administrative Code* (NAC, 2002a, b, c, d)
[c]Area 23 Class II Solid Waste Disposal Site (NDEP, 1997a)
[d]Area 9 Class III Solid Waste Disposal Site (NDEP, 1997c)
[e]Nevada Test Site Sewage Lagoons (NDEP, 1999)
[f]*Resource Conservation and Recovery Act* (CFR, 2003a)
[g]*Nevada Test Site Performance Objective for the Certification of Nonradioactive Hazardous Waste* (BN, 1995)
[h]Nevada Test Site Waste Acceptance Criteria, Revision 5 (NNSA/NSO, 2003)
[i]Area 6 Class III Solid Waste Disposal Site for hydrocarbon waste (NDEP, 1997b)
[j]*Toxic Substance Control Act* (CFR, 2003b, c)

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

5.3.2 Special Sanitary Waste

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

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

5.3.3 Hazardous Waste

Suspected hazardous wastes will be placed in DOT-compliant containers. All containerized hazardous waste will be handled, inspected, and managed in accordance with Title 40 *Code of Federal Regulations* (CFR) 265, Subpart I (CFR, 2003a). These provisions include managing the waste in containers compatible with the waste type, and segregating incompatible waste types so that in the event of a spill, leak, or release, incompatible wastes shall not contact one another. Corrective Action Unit 554 will have waste storage areas established according to the needs of the project. Satellite accumulation areas and HWAAs will be managed consistent with the requirements of federal and state regulations (CFR, 2003a; NAC, 2002b). They will be properly controlled for access and equipped with spill kits and appropriate spill containment.

The HWAAs will be covered under a site-specific emergency response and contingency action plan until such time that the waste is determined to be nonhazardous or all containers of hazardous waste have been removed from the storage area. Hazardous wastes will be characterized in accordance with the requirements of Title 40 CFR 261 (CFR, 2003a). No RCRA “listed” wastes have been identified at CAU 554. Any waste determined to be hazardous will be transported in accordance with RCRA and DOT to a permitted treatment, storage, and disposal facility (CFR, 2003a).

5.3.3.1 Management of Personal Protective Equipment

All PPE and disposable sampling equipment will be visually inspected for stains, discoloration, and gross contamination as the waste is generated. Any IDW that meets this description will be segregated and managed as potentially "characteristic" hazardous waste. This segregated population of waste will either be (1) assigned the characterization of the soil/sludge that was sampled, (2) sampled directly, or (3) undergo further evaluation using the soil/sludge sample results to determine how much soil/sludge would need to be present in the waste to exceed regulatory levels. The PPE and equipment that is not visibly stained, discolored, or grossly contaminated and that is within radiological free-release criteria will be managed as nonhazardous sanitary waste.

5.3.3.2 Management of Decontamination Rinsate

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

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

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

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

5.3.3.3 Management of Soil

Soil is produced during soil sampling, excavation, and/or drilling. The preferred method for managing soil is to place the material back into the borehole/excavation in the same approximate location from which it originated. If this cannot be accomplished and the soil is determined to potentially contain COCs, the material will either be managed on site by berming and covering next to the excavation, or by placement in a container(s). This waste stream will be characterized based on laboratory analytical results from representative locations. The disposal of soil containing COCs may be deferred until implementation of corrective action at the site.

5.3.3.4 Management of Debris

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

5.3.3.5 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 (CFR, 2003a). On radiological sites, this may increase the potential to generate mixed waste; however, the generation of a mixed waste will be minimized as much as practicable. In the event a mixed waste is generated, the waste will be managed in accordance with Section 5.3.6 of this document.

5.3.4 Polychlorinated Biphenyls

The management of PCBs is governed by the *Toxic Substances Control Act* (TSCA) (USC, 1976) and its implementing regulations in 40 CFR 761 (CFR, 2003b). Polychlorinated biphenyls contamination may be found as a sole contaminant or in combination with any of the types of waste discussed in this document. For example, PCBs may be a co-contaminant in soil that contains a RCRA "characteristic" waste (PCB/hazardous waste), or in soil that contains radioactive wastes (PCB/radioactive waste), or even in mixed waste (PCB/radioactive/hazardous waste). The IDW will initially be evaluated using analytical results for media samples from the investigation. If any type of PCB waste is generated, it will be managed according to 40 CFR 761 (CFR, 2003b) as well as State of Nevada requirements (NAC, 2002c), and agreements with NNSA/NSO.

5.3.5 Low-Level Waste

Radiological swipe surveys and/or direct-scan surveys may be conducted on reusable sampling equipment and the PPE and disposable sampling equipment waste streams exiting a radiologically controlled area. This allows for the immediate segregation of radioactive waste from waste that may be unrestricted regarding radiological release. Removable contamination limits, as defined in Table 4-2 of the current version of the NV/YMP RadCon Manual (DOE/NV, 2000a), will be used to determine if such waste may be declared unrestricted regarding radiological release versus being declared radioactive waste. Direct sampling of the waste may be conducted to aid in determining if a particular waste unit (e.g., drum of soil) contains low-level radioactive waste, as necessary. Waste that is determined to be below the values of Table 4-2, by either direct radiological survey/swipe results or through process knowledge, will not be managed as potential radioactive waste but will be managed in accordance with the appropriate section of this document. Wastes in excess of Table 4-2 values will be managed as potential radioactive waste and be managed in accordance with this section and any other applicable sections of this document.

Low-level radioactive waste, if generated, will be managed in accordance with the contractor-specific waste certification program plan, DOE Orders, and the requirements of the current version of the

Nevada Test Site Waste Acceptance Criteria (NTSWAC) (NNSA/NSO, 2003). Potential radioactive waste drums containing soil, PPE, disposable sampling equipment, and/or rinsate may be staged at a designated radioactive materials area (RMA) or radiologically controlled area when full or at the end of an investigation phase. The waste drums will remain at the RMA pending certification and disposal under NTSWAC requirements (NNSA/NSO, 2003).

5.3.6 Mixed Waste

Mixed waste, if generated, shall be managed and dispositioned according to the requirements of RCRA (CFR, 2003a) or subject to agreements between NNSA/NSO and the State of Nevada, as well as DOE requirements for radioactive waste. The waste will be marked with the words "Hazardous Waste Pending Analysis and Radioactive Waste Pending Analysis." Waste characterized as mixed will not be stored for a period of time that exceeds the requirements of RCRA unless subject to agreements between NNSA/NSO and the State of Nevada. The mixed waste shall be transported via an approved hazardous waste/radioactive waste transporter to the NTS transuranic waste storage pad for storage pending treatment or disposal. Waste with hazardous waste constituent concentrations below land disposal restrictions may be disposed of at the NTS Area 5 Radioactive Waste Management Site if the waste meets the requirements of the NTSWAC (NNSA/NSO, 2003). Waste with hazardous waste constituent concentrations exceeding land disposal restrictions will require development of a treatment and disposal plan under the requirements of the Mutual Consent Agreement between DOE and the State of Nevada (NDEP, 1995).

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 CAS 23-02-08 in CAU 554. 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 Industrial Sites QAPP (NNSA/NV, 2002).

6.1 Quality Control Field Sampling Activities

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

- Trip blanks (one per sample cooler containing VOC environmental samples)
- Equipment blanks (one per sampling event for each type of decontamination procedure)
- Source blanks (one per lot of source material that contacts sampled media)
- Field duplicates (1 per 20 environmental samples or 1 per CAS per matrix, if less than 20 collected)
- Field blanks (1 per CAS or more if environmental conditions change)
- Matrix spike (MS)/matrix spike duplicate (MSD) (1 per 20 environmental samples or 1 per CAS per matrix, if less than 20 collected - not required for all radionuclide measurements)

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

6.2 Laboratory/Analytical Quality Assurance

Criteria for the investigation, as stated in the DQOs (Appendix A) 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 data quality indicators (DQIs) as they relate to laboratory analysis.

6.2.1 Data Validation

Data verification and validation will be performed in accordance with the Industrial Sites QAPP (NNSA/NV, 2002), except where otherwise stipulated in this CAIP. All nonradiological laboratory data from samples collected and analyzed will be evaluated for data quality according to EPA Functional Guidelines (EPA, 1999a and 2002b). 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 if they meet the DQO requirements of the investigation and the performance criteria for the DQIs. The results of this assessment will be documented in the corrective action decision document (CADD). If the DQOs were not met, corrective actions will be evaluated, selected, and implemented (e.g., refine CSM or resample to fill data gaps).

6.2.2 Data Quality Indicators

The data quality indicators are qualitative and quantitative descriptors used in interpreting the degree of acceptability or utility of data. Data quality indicators are used to evaluate the entire measurement system and laboratory measurement processes (i.e., analytical method performance) as well as to evaluate individual analytical results (i.e., parameter performance).

All DQO decisions as stated in Appendix A require laboratory analytical quality data. The quality and usability of this data will be assessed based on the following DQIs:

- Precision
- Accuracy/bias

- Representativeness
- Comparability
- Completeness
- Sensitivity

Table 6-1 provides the established analytical method/measurement system performance criteria for each of the DQIs and the potential impacts to the decision if the criteria are not met. The following subsections discuss each of the DQIs that will be used to assess the quality of laboratory data.

6.2.3 Precision

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

Determinations of precision will be made for field duplicate samples and laboratory duplicate samples. Field duplicate samples will be collected simultaneously with samples from the same source under similar conditions in separate containers. The duplicate sample will be treated independently of the original sample in order to assess field impacts and laboratory performance on precision through a comparison of results. Laboratory precision is evaluated as part of the required laboratory internal QC program to assess performance of analytical procedures. The laboratory sample duplicates are an aliquot, or subset, of a field sample generated in the laboratory. They are not a separate sample but a split, or portion, of an existing sample. Typically, laboratory duplicate QC samples include 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. Therefore, a performance matrix has been established for both analytical methods and individual analytical results (see Table 6-1).

Table 6-1
Laboratory and Analytical Performance Criteria for CAU 554 Data Quality Indicators

Data Quality Indicator	Performance Criteria	Potential Impact on Decision if Performance Criteria Not Met
Precision	Variations between laboratory duplicates should not exceed analytical method-specific criteria presented in Table 3-1 and Table 3-2. Variations between field duplicates should not exceed 20 percent.	Data that do not meet the performance criteria will not be used for decisions. Decisions may not be valid if analytical method performance criteria for precision are not met. Evaluate the effect on meeting the DQI of completeness.
Accuracy	Laboratory control sample, matrix spike, and surrogate results should be within the method-specific criteria presented in Table 3-1 and Table 3-2. Laboratory method blanks should be below the required detection limit.	Data that do not meet the performance criteria will not be used for decisions. Decisions may not be valid if analytical method performance criteria for accuracy are not met. Evaluate the effect on meeting the DQI of completeness.
Sensitivity	Laboratory detection limits must be less than or equal to respective PALs.	Cannot determine if COCs are present or migrating at levels of concern; therefore, the affected data will be assessed for usability and potential impacts on meeting the DQI of completeness.
Comparability	Sampling, handling, preparation, analysis, reporting, and data validation must be performed using approved 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	Decision I samples identify COCs if present anywhere within the CAS. Analyses will be sufficient to detect any COCs present in the samples. Decision II samples identify true extent of COCs.	Analytical results will not represent true site conditions. Inability to make appropriate DQO decisions.
Nature Completeness	80% of the CAS-specific COPC analytes have valid results. 100% of target analytes are valid.	Cannot make decision on whether COCs are present.
Extent Completeness	100% of target analytes used to define extent of COCs are valid.	Extent of contamination cannot be determined.
Clean Closure Completeness	100% of target analytes are valid.	Cannot determine if COCs remain in soil.

The RPD criteria to be used for assessment of precision for laboratory duplicates are the parameter-specific criteria listed in Table 3-1 and Table 3-2. The RPD criteria to be used for assessment of precision for field duplicates is less than 20 percent. The RPD values that are outside the criteria do not necessarily result in the qualification of analytical data. It is only one factor in making an overall judgment about the quality of the reported analytical results.

6.2.4 Accuracy

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). For organic analyses, laboratory control limits are used for evaluation of percent recovery. The acceptable control limits for organic analyses are established in the EPA *Contract Laboratory Program National Functional Guidelines for Organic Data Review* (EPA, 1999a). Accuracy for chemical analyses will be evaluated based on results from three types of spiked samples: MS, LCS, and surrogates. Accuracy for radiochemical analyses will be evaluated based on results from LCS and MS samples. 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.

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

The criteria for chemical analyses to be used for assessment of accuracy are the parameter-specific criteria listed in Table 3-2. The percent recovery criteria for radiochemical analyses to be used for assessment of accuracy will be the control limits listed in Table 3-1.

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

6.2.5 Representativeness

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

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

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

6.2.6 Completeness

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

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

6.2.7 Comparability

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

6.2.8 Sensitivity

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

7.0 Duration and Records Availability

7.1 Duration

Table 7-1 provides a tentative duration of activities (in calendar days) for the CAU 554 CAI activities.

Table 7-1
Tentative Activity Durations

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

7.2 Records Availability

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

8.0 References

ASTM, see American Society for Testing and Materials.

American Society for Testing and Materials. 1996. Section 04.08 and 04.09, "Construction," *Annual Book of ASTM Standards*. Philadelphia, PA.

Appenzeller-Wing, J., U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2004. Letter to T.A. Maize (NDEP) entitled, "Submittal of Proposed Radiological Preliminary Action Levels (PALs) for the Industrial Sites Project," 15 January. Las Vegas, NV.

BN, see Bechtel Nevada.

Bechtel Nevada. 1995. *Nevada Test Site Performance Objective for Certification of Nonradioactive Hazardous Waste*, Rev. 0, G-E11/96.01. Las Vegas, NV.

CFR, see *Code of Federal Regulations.*

Code of Federal Regulations. 2003a. Title 40 CFR Parts 260-282, "Hazardous Waste Management System: General." Washington, DC: U.S. Government Printing Office.

Code of Federal Regulations. 2003b. Title 40 CFR Part 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions." Washington, DC: U.S. Government Printing Office.

Code of Federal Regulations. 2003c. Title 40 CFR Part 763, "Asbestos." Washington, DC: U.S. Government Printing Office.

DOE, see U.S. Department of Energy.

DOE/NV, see U.S. Department of Energy, Nevada Operations Office.

DRI, see Desert Research Institute.

DRI and Carey & Co., see Desert Research Institute and Carey & Co., Inc.

Desert Research Institute. 1985. *Additional Intensity Duration Analyses and Design Hyetograph Parameters for Various Precipitation Stations on the Nevada Test Site, Nevada,* DOE/NV/10384-02. Prepared by R.H. French. Las Vegas, NV.

Desert Research Institute. 1988. *CERCLA Preliminary Assessments of DOE's Nevada Operations Office Nuclear Weapons Testing Areas,* April. Las Vegas, NV.

EPA, see U.S. Environmental Protection Agency.

ERDA, See U.S. Energy Research and Development Administration.

FFACO, see *Federal Facility Agreement and Consent Order.*

Federal Facility Agreement and Consent Order. 1996 (as amended). Agreed to by the State of Nevada, the U.S. Department of Energy, and the U.S. Department of Defense.

Karanthanasis, A.D., and B.F. Hajek. 1982. "Quantitative Evaluation of Water Adsorption on Soil Clays." In *Soil Science Society of America Journal,* 46: 1321-1325. Madison, WI.

Kendall, E.W., Reynolds Electrical & Engineering Co., Inc. 1990. Letter to R.E. Fredrichs (DOE/NV) entitled, "Results of the Carbon Dioxide Survey at Area 23, Building 115," 05 March. Las Vegas, NV: Defense Waste Management Department.

LLNL, see Lawrence Livermore National Laboratory.

Laczniak, R.J., J.C. Cole, D.A. Sawyer, and D.A. Trudeau. 1996. *Summary of Hydrogeologic Controls Ground-Water flow at the Nevada Test Site, Nye County, Nevada*. As accessed at http://water.usgs.geo/pubs/wri/wri964109/report.htm on 28 January, 2002.

Moore, J., Science Applications International Corporation. 1999. Memorandum to M. Todd (SAIC) entitled, "Background Concentrations for NTS and TTR Soil Samples," 3 February. Las Vegas, NV.

NAC, see *Nevada Administrative Code*.

NBMG, see Nevada Bureau of Mines and Geology.

NCRP, see National Council on Radiation Protection Measurements.

NDEP, see Nevada Division of Environmental Protection.

NNSA/NV, see U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office.

NOAA, see National Oceanic and Atmospheric Administration.

NRS, see *Nevada Revised Statutes*.

National Council on Radiation Protection and Measurements. 1999. *Recommended Screening Limits for Contaminated Surface Soils and Review of Factors Relevant to Site-Specific Studies*, Report No. 129. Washington, DC.

Nevada Administrative Code. 2002a. NAC 444.570 - 444.7499, "Solid Waste Disposal." Carson City, NV.

Nevada Administrative Code. 2002b. NAC 444.850 - 444.8746, "Disposal of Hazardous Waste." Carson City, NV.

Nevada Administrative Code. 2002c. NAC 444.940 - 444.9555, "Polychlorinated Biphenyl." Carson City, NV.

Nevada Administrative Code. 2002d. NAC 444.965 - 444.976, "Disposal of Asbestos." Carson City, NV.

Nevada Administrative Code. 2003. NAC 445A, "Water Controls." Carson City, NV.

Nevada Bureau of Mines and Geology. 1998. *Mineral and Energy Resource Assessment of the Nellis Air Force Range*, Open-File Report 98-1. Reno, NV.

Nevada Division of Environmental Protection. 1995. *Mutual Consent Agreement between the State of Nevada and the U.S. Department of Energy for the Storage of Low-Level Land Disposal Restricted Mixed Waste.* Carson City, NV.

Nevada Division of Environmental Protection. 1997a. *Class II Solid Waste Disposal Site for Municipal and Solid Waste, Area 23 of the NTS, Permit SW 13 097 04.* Carson City, NV.

Nevada Division of Environmental Protection. 1997b (as amended in August 2000). *Class III Solid Waste Disposal Site for Hydrocarbon Burdened Soils, Area 6 of the NTS*, Permit SW 13 097 02. Carson City, NV.

Nevada Division of Environmental Protection, 1997c (as amended in August 2000). *Class III solid Waste Disposal Site; UIOC, Area 9 of the NTS,* Permit SW 13 097 03. Carson City, NV.

Nevada Division of Environmental Protection. 1999. *State of Nevada Water Pollution Control General Permit*, No. GNEV93001. Carson City, NV.

Nevada Revised Statutes. 2003a. NRS 444.440 - 444.620, "Collection and Disposal of Solid Waste." Carson City, NV.

Nevada Revised Statutes. 2003b. NRS 459.400 - 459.600, "Disposal of Hazardous Waste." Carson City, NV.

Nevada Revised Statutes. 2003c. NRS 618.750-618.840 "Disposal of Hazardous Waste." Carson City, NV.

Paar, J.G., and D.R. Porterfield. 1997. *Evaluation of Radiochemical Data Usability*, April, ES/ER/MS-5. Oak Ridge, TN: U.S. Department of Energy.

REECo, see Reynolds Electrical & Engineering Co., Inc.

Reynolds Electrical & Engineering Co., Inc. 1978. Engineering Drawing 23-SP-M1 entitled "Building 115 Fuel Tank Replacement Mechanical Plan," 21 March. Las Vegas, NV.

Reynolds Electrical & Engineering Co., Inc. 1993. *Certification and Closure Report Area 23 Landfill Hazardous Waste Trenches*. Las Vegas, NV.

SNJV, see Stoller-Navarro Joint Venture.

SSSA, see Soil Science Society of America

Shaw Environmental, Inc. 2003. CAU 554 Project File. Las Vegas, NV.

Soil Science Society of America. 1986. *Methods of Soil Analysis*, 2nd Edition, Part 1. Madison, WI.

Soong, C., Bechtel Nevada. 2003. Record of Telecon with J. Zimoher (SAIC) regarding Building 115 USTs, 13 February. Las Vegas, NV.

Stoller-Navarro Joint Venture. 2004. *Industrial Sites Project Health and Safety Plan*, Rev. 0. July. Las Vegas, NV.

USACE, see U.S. Army Corps of Engineers.

USGS, see U.S. Geological Survey.

United States Code. 1976. 15 USC 2601 et seq., "*Toxic Substances Control Act*." Enacted by Public Law No. 94-469, as amended. Washington, DC: U.S. Government Printing Office.

U.S. Army Corps of Engineers. 1970. "Laboratory Soils Testing." In *Engineering Manual 1110-2-1906,* Appendix II. Washington, DC.

U.S. Department of Energy. 1993. DOE Order 5400.5, Change. 2, "Radiation Protection of the Public and the Environment." Washington, DC: U.S. Government Printing Office.

U.S. Department of Energy. 1997. *The Procedures Manual of the Environmental Measurements Laboratory*, HASL-300, 28th Ed., Vol. I. New York, NY.

U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office. 2002. *Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada*, Rev. 3, DOE/NV--372. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2003. *Nevada Test Site Waste Acceptance Criteria*, DOE/NV--325, Rev. 5. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1993. *Resource Conservation and Recovery Act Site Characterization Plan Area 23 Building 650 Leachfield,* DOE/NV/10972-37. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1994. *Project Management Plan,* Rev. 0. Las Vegas, NV.

U.S. Department of Energy, Nevada Operation Office. 1996. *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada*, DOE/EIS 0243. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1997. *Integrated Safety Management Policy*, DOE Order NV P 450.4. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1998. *Nevada Test Site Resource Management Plan,* DOE/NV--518. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 2000a. *NV/YMP Radiological Control Manual*, Rev. 4, DOE/NV/11718-079. Prepared by Bechtel Nevada. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 2000b. *Safety Management System Policy*, NV P 450.4. Las Vegas, NV.

U.S. Energy Research and Development Administration. 1977. *Final Environmental Impact Statement, Nevada Test Site, Nye County, Nevada,* ERDA-1551. Washington, DC.

U.S. Environmental Protection Agency. 1987. *Data Quality Objectives for Remedial Response Activities*, EPA/540/G-87/003. Washington, DC.

U.S. Environmental Protection Agency. 1996. *Test Method for Evaluating Solid Waste Physical/Chemical Methods*, SW-846, 3rd Edition. Washington, DC.

U.S. Environmental Protection Agency. 1999a. *Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA 540/R-99/008. Washington, DC.

U.S. Environmental Protection Agency. 1999b. *Contract Laboratory Program Statement of Work for Organic Analysis*, OLM 04.2, EPA/540/R-99/073**.** Washington, DC.

U.S. Environmental Protection Agency. 2001a. *Guidance on Data Quality Indicators*, EPA QA/G-5i, Washington, DC.

U.S. Environmental Protection Agency. 2001b. "Integrated Risk Information System (IRIS) Database." As accessed at http://www.epa.gov/iris/index.html on 11 February 2003.

U.S. Environmental Protection Agency. 2002a. *Region 9 Preliminary Remediation Goals (PRGs)*, Prepared by S.J. Smucker, 01 October. San Francisco, CA.

U.S. Environmental Protection Agency. 2002b. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA/540/R-01/008. Washington, DC.

U.S. Environmental Protection Agency. 2004. *Contract Laboratory Program Statement of Work for Inorganic Analysis*, ILM 05.3, EPA/540/R-03/121. Washington, DC.

U.S. Geological Survey. 1962. *Selected Logs and Drilling Records of Wells and Test Holes Drilled at the Nevada Test Site Prior to 1960*. Trace Elements Investigations Report, TEI-804. Prepared by J.E. Moore. Washington, DC.

U.S. Geological Survey. 1964. *Summary of Hydraulic Data Quality of Water, and Lithologic Log for Army Well 1, Mercury Valley, Nye County, Nevada*, Technical Letter NTS-71. Prepared by G.L. Meyer and R.E. Smith. Denver, CO.

U.S. Geological Survey. 1990. *Geologic Map of the Nevada Test Site, Southern Nevada,* USGS Map I-2046. Denver, CO.

van Genuchten, M. 1980. "A Closed Form Equation for Predicting the Hydraulic Conductivity of Unsaturated Soils." In *Soil Science Society of American Journal*, 44: 892-989. Madison, WI.

Winograd, I.J., and W. Thordarson. 1975. *Hydrology and Hydrochemical Framework, South-Central Great Basin, Nevada-California, with Special Reference to the Nevada Test Site,* USGS Professional Paper 712-C. Denver, CO.

Youngs, R.A., Reynolds Electrical & Engineering Co., Inc. 1990. Memorandum to D.L. Cox et al. (REECo) entitled, "Nonconformance Report (NCR) 530-90-002: Underground Storage Tank Removal for Building 115," 22 June. Las Vegas, NV.

Appendix A

Data Quality Objectives Process for Corrective Action Unit 554

A.1.0 Data Quality Objectives Process for CAU 554

The DQO process described in this appendix is a seven-step strategic planning approach based on the scientific method used to plan data collection activities and design performance criteria for the CAU 554, Area 23 Release Site. 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 CAS in CAU 554 is insufficient to evaluate and select preferred corrective actions at this time; therefore, a CAI will be conducted at this site.

The CAU 554 investigation will be based on the DQOs presented in this appendix as developed by representatives of NDEP, NNSA/NSO, and contractor personnel. The seven steps of the DQO process for CAU 554 are presented in Section A.1.2 through Section A.1.8 and were developed based on the CAS-specific information presented in Section A.1.1, and, in accordance with the EPA *Guidance for Quality Assurance Project Plans* (2002a) and EPA *Guidance for the Data Quality Objectives Process* (2000b).

This document identifies and references the associated EPA Quality System Documents for DQOs entitled *Data Quality Objectives Process for Hazardous Waste Site Investigations* (2000a) upon which the DQO process presented herein is based.

The DQO process presents a judgmental sampling approach in accordance with the EPA *DQOs for Hazardous Waste Site Investigations* (2000a) and *Guidance for Quality Assurance Project Plans* (2002a). In general, the procedures used in the DQO process provide:

- A scientific basis for making inferences about a site (or portion of a site) based on environmental data or process knowledge
- A basis for defining decision performance criteria and assessing the achieved decision quality of the data collection design
- Criteria for knowing when site investigators should stop data collection (i.e., when sufficient information is available to make decisions)

A.1.1 CAS-Specific Information

Corrective Action Unit 554 consists of one CAS (23-02-08) that is located in Area 23 of the NTS, as shown in Figure A.1-1. This CAS consists of a Number 2 fuel oil release(s) from USTs 23-115-1, 23-115-2, and 23-115-3 formerly located at this site. The USTs were located at the northwest corner of the now demolished Building 115 (Steam Plant) in Area 23. Figure A.1-2 shows a site sketch of CAS 23-02-08 before the demolition of Building 115 in 2003.

Physical Setting and Operational History - CAS 23-02-08 is located between Tumbler Avenue to the north and Ranger Avenue to the south and is bordered by a pedestrian sidewalk and Snapper Road to the west. The USTs were located to the west and northwest of the remaining building pad. Building 115 was the Mercury Steam Plant and was operational from 1951 until 1983. The Steam Plant produced steam using Number 2 fuel-oil fired boilers. The fuel oil was stored in the three USTs of CAS 23-02-08. The USTs were constructed of steel coated with asphalt, which was the corrosion treatment used at the time of construction. Two of the three USTs were 15,000-gal capacity and were originally installed in 1951 during the construction of Building 115. These tanks were removed in December 1977 and replaced with similar sized tanks in March 1978. The third tank was installed in 1965 during construction of the western addition to the building. In 1983, all tank operations were discontinued at Building 115. All three tanks and associated piping were removed in December 1989 and the excavation was backfilled in March 1990.

Building 115 was demolished in 2003. Asbestos from this destroyed structure may be present in the soil at the site. Samples may be collected and analyzed for asbestos to aid in making health and safety and/or waste management related decisions during the investigation and/or subsequent corrective actions.

Release Information - The UST(s) have been removed from the site; however, there was at least one documented release of fuel oil leaking from one or more tank to the surrounding soil. Other potential sources of releases are leaks from underground piping and surface releases during tank refilling. There is no indication that the remaining structure (concrete pad) is a source of potential contamination. There are no visible soil stains at the site surface. Based on inventory reports, an estimated 100,000 gal of fuel oil was released in 1977 over a span of six months or more (Soong, 2003).

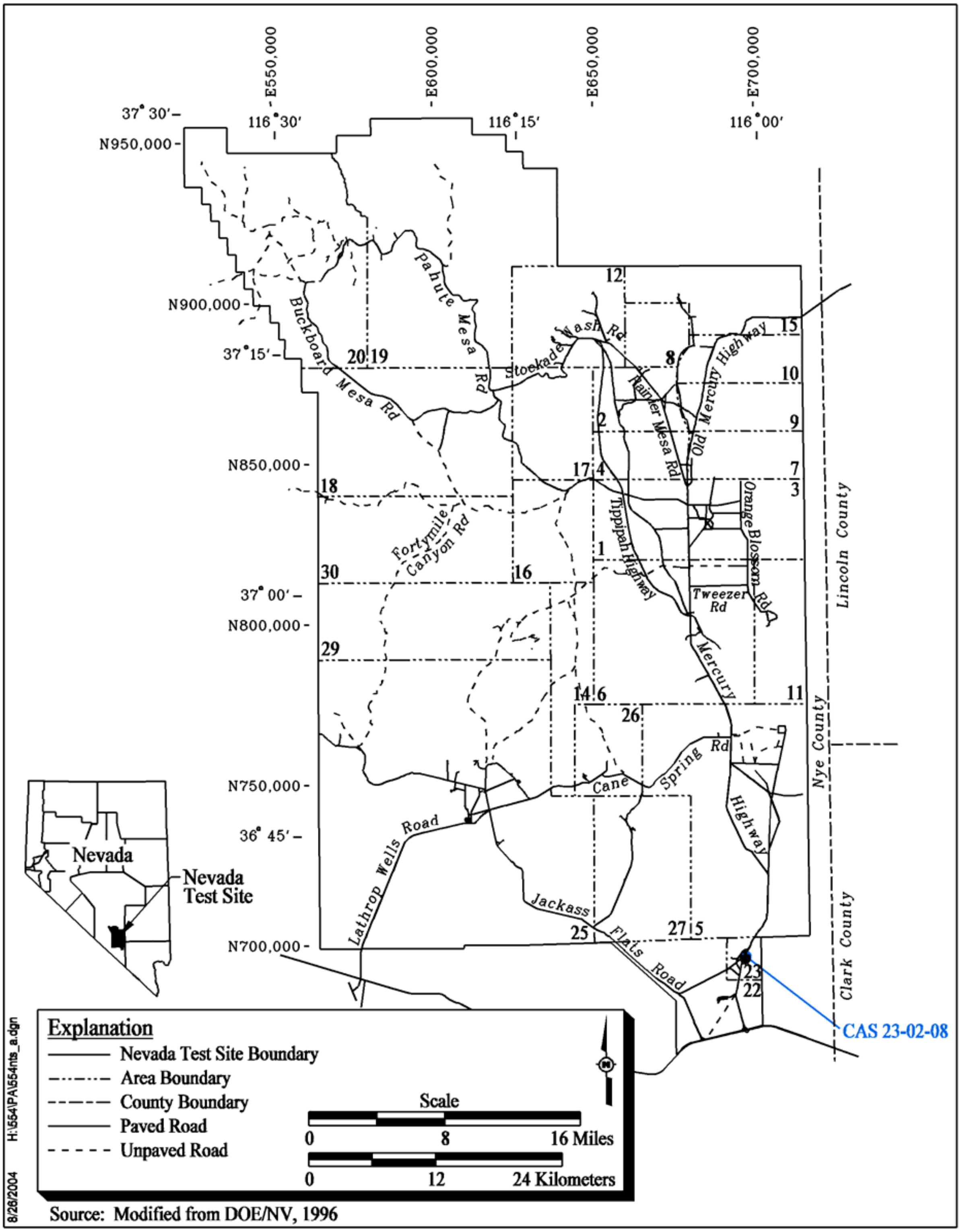

Figure A.1-1
CAU 554, CAS 23-02-08, Site Location Map

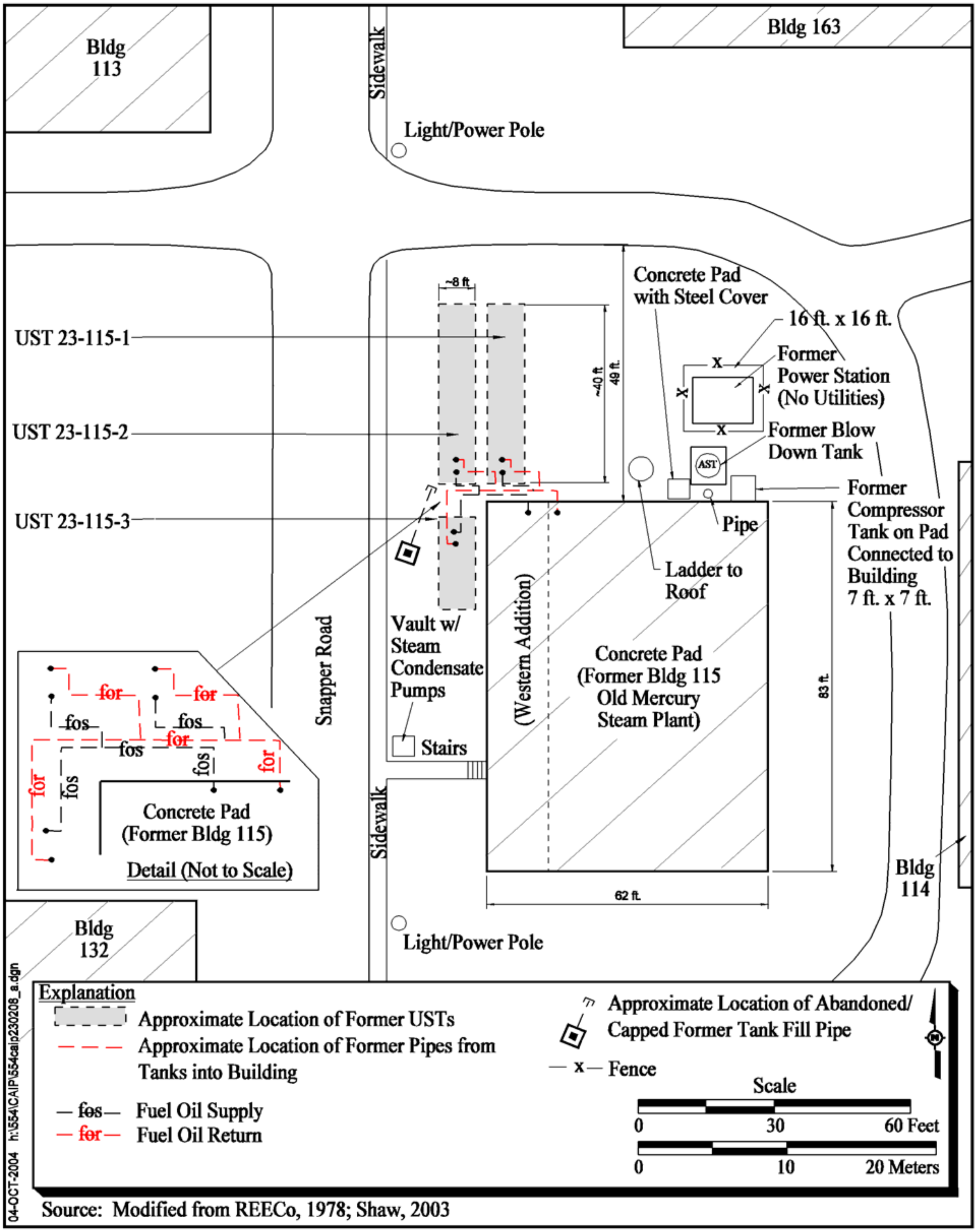

Figure A.1-2
CAS 23-02-08, Release Site Map

Previous Investigation Results - Soil sampling after tank removals in December 1989 revealed TPH concentrations greater than 100 ppm from soil under Tanks 23-115-1 and 23-115-3 locations. A total of 8 yd^3 of contaminated soil was removed from these former tank locations. No further sampling was performed at former Tank 23-115-3 location and the excavation was backfilled due to potential structural problems at Building 115 (Youngs,1990). Additional sampling at former Tank 23-115-3 location indicated TPH concentrations in the soil were still over 100 ppm. Further investigation identified the contamination under Tank 23-115-1 as a hardened asphalt/soil mixture and was attributed to the original tanks that were replaced in 1978. A soil gas survey was performed by Reynolds Electrical & Engineering Co., Inc. (REECo) in February 1990 to estimate the lateral extent of contamination. Report results indicated a CO_2 plume centered on the excavation area with a 20-ft radius; however, high readings also extended west of the tank excavations (Kendall, 1990). Two plume scenarios were estimated using Dragun's equation (Kendall, 1990) with a reported volume release assumption of 100,000 gal of diesel fuel, a soil porosity at the site of 30 percent, and a residual hydrocarbon saturation of 15 percent. The plume depths were estimated by REECo by varying the lateral extents of contamination. Using a contamination radius of 20 ft, the first plume depth was estimated at 210 ft bgs; while using a 35-ft radius of contamination, a second depth was estimated at 70 ft bgs (Kendall, 1990).

The estimates on plume sizes are based on an estimated release of 100,000 gal of diesel fuel. This estimate is highly uncertain and does not seem to be supported by the relatively low levels of hydrocarbons identified directly under the tanks (i.e., the highest analytical result was 904 mg/kg under Tank 23-115-1). It could be that much less product was released than has been previously estimated. If this is the case, it can be expected that the plume size including depth of contamination and lateral extent of contamination is significantly smaller.

Contaminants of Potential Concern - Target COPCs are defined as those contaminants that are known or reasonably expected to be present within the CAS based on previous sampling, process knowledge, geographic setting, and/or operational site history. Analyses for a broader range of COPCs that are not considered critical, assist in reducing the uncertainty concerning the history and potential release from the CAS and allows for an accurate evaluation of potential contamination. Further explanation of target versus non-target COPCs is provided in Section A.1.4.3.3. If any COPC is detected in any sample at a concentration above a PAL, the COPC will be identified as a COC.

The only target analyte identified for CAS 23-02-08 is TPH-DRO. Other suspect COPCs identified for this CAS include VOCs, SVOCs, RCRA metals, and PCBs.

A.1.2 Step 1 - State the Problem

This step describes the problem that has initiated the CAU 554 investigation, identifies the DQO planning team members, and presents the CSM for CAS 23-02-08.

Corrective Action Unit 23-02-08 is being investigated because contaminated soil may remain at this location due to an uncontrolled release of the TPH-DRO. As a result of this release, petroleum hydrocarbon constituents may be present at CAU 554 at concentrations that could potentially pose a threat to human health and the environment.

The problem statement for CAU 554 is: "Existing information on the nature of potential contaminants and, if present, the extent of contamination is insufficient to evaluate and recommend a corrective action alternative for CAS 23-02-08."

A.1.2.1 Planning Team Members

The DQO planning team consists of representatives from NDEP; NNSA/NSO; Stoller-Navarro Joint Venture (SNJV); and Bechtel Nevada (BN). The primary decision-makers are NDEP and NNSA/NSO representatives. Table A.1-1 lists representatives from each organization in attendance for the July 15, 2004, final DQO meeting.

A.1.2.2 Conceptual Site Model

The CSM for CAU 554 was developed using information from the physical setting, potential contaminant sources, knowledge from similar sites, release information, historical background information, and physical and chemical properties of the affected media and suspected COPC. Table A.1-2 provides information on CSM elements that will be used throughout the remaining steps of the DQO process. If additional elements are identified during the investigation that are outside the scope of the CSM, the situation will be reviewed and a recommendation will be made as to how to proceed. In such cases, decision makers will be notified and given the opportunity to comment on, or concur with, the recommendation.

Table A.1-1
Final DQO Meeting Participants for CAU 554
July 15, 2004

Participant	Affiliation
Jeff MacDougall	Nevada Division of Environmental Protection
Kevin Cabble	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
Brian Hoenes	Stoller-Navarro Joint Venture
Rob Boehlecke	Stoller-Navarro Joint Venture
Georgette Dimit	Stoller-Navarro Joint Venture
Barbara Ground	Stoller-Navarro Joint Venture
Allison Urbon	Bechtel Nevada

The CSM describes the most probable scenario for current conditions at CAS 23-02-08 and defines the assumptions that are the basis for identifying appropriate sampling strategy and data collection methods. The CSM is the basis for assessing how contaminants could reach receptors both in the present and future by addressing contaminant nature and extent, transport mechanisms and pathways, potential receptors, and potential exposures to those receptors. Accurate CSMs are important as they serve as the basis for all subsequent inputs and decisions throughout the DQO process.

The CSM consists of:

- The location(s) of the contaminant release(s) including areas subsequently affected and the process history at the site
- Contaminant source characteristics including contaminants present and contaminant-specific properties
- Site characteristics including physical, topographical, and meteorological information
- Migration pathways and transport mechanisms
- Exposure scenarios

Corrective Action Site 23-02-08 is the location of former leaking UST(s) that held fuel oil. The source of contamination is fuel that was released from UST(s) into the surrounding soil. Figure A.1-3

Table A.1-2
Conceptual Site Model
Description of Elements for CAS 23-02-08

CSM	UST Release
CAS Identifier	23-02-08
CAS Description	USTs 23-115-1, 2, 3/Spill 530-09-002
Site Status	Site has been abandoned - Building has been demolished and USTs and associated piping have been removed
Exposure Scenario	The potential for contamination exposure is limited to industrial and construction workers, and military personnel conducting training. These human receptors may be exposed to the COPCs through oral ingestion, inhalation, dermal contact (absorption) of soil and/or debris due to inadvertent disturbance of these materials.
Affected Media	Surface and shallow subsurface soil and possibly concrete pad
Sources of Potential Soil Contamination	Former USTs (fuel oil release)
Location of Contamination/ Release Point	From former leaking UST into shallow subsurface soil (12-15 ft bgs)
Transport Mechanisms	Percolation of precipitation through subsurface media serves as the primary driving force for vertical migration of contaminants. However, due to the arid environment of the NTS, infiltration of precipitation is very small and migration of contaminants is generally very limited. Evaporation potentials significantly exceed available soil moisture from precipitation (i.e., 3 to 10 in.) (USGS, 1995a). Previous studies have indicated vertical extent of up to 210 ft bgs.
Preferential Pathways	Vertical and possible lateral via buried utility lines
Lateral and Vertical Extent of Contamination	Unknown. 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. Depth to groundwater in Mercury (Area 23) near this site is approximately at 1,165 ft bgs (USGS, 1995b).
Amount Released	Estimated at 100,000 gal of fuel based on inventory records
Potentially Released Material	Contaminants released from USTs (fuel oil)
Existing Historical Data on COPCs	TPH-DRO was identified at the site at concentrations greater than 100 mg/kg

represents the CSM as it applies to CAS 23-02-08. Debris such as construction material may exist at this site (i.e., old buried utility lines or piping that may have been cut and capped off near the former USTs and/or the demolished structures).

The CSM development includes an evaluation of land use. The land-use description helps define exposure scenario. The land use is the basis for assessing how contaminants could reach potential receptors both in the present and the future. Currently, the potential for exposure to contamination at CAS 23-02-08 is limited to industrial site workers, construction and remediation workers, and military personnel. The land-use designation for this site is a "Reserved Zone" (DOE/NV, 1998). This zone includes land and facilities that provide widespread flexible support for diverse short-term testing and experimentation. The reserved zone is also used for short duration exercises and training such as nuclear emergency response and Federal Radiological Monitoring and Assessment Center training and DoD land-navigation exercises and training.

Corrective Action Site 23-02-08 is located in Mercury, Nevada. The nearby area includes office buildings, a cafeteria, training facilities, and dorm rooms. Visitors and personnel at the NTS for short duration training exercises could be exposed to potential contamination from this site. Applying the industrial site worker scenario to occassional visitors is conservative and will adequately account for such potential exposures.

A.1.3 Step 2 - Identify the Decisions

This step develops decision statements and defines alternative actions appropriate for Decision I and Decision II.

A.1.3.1 Decision Statements

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

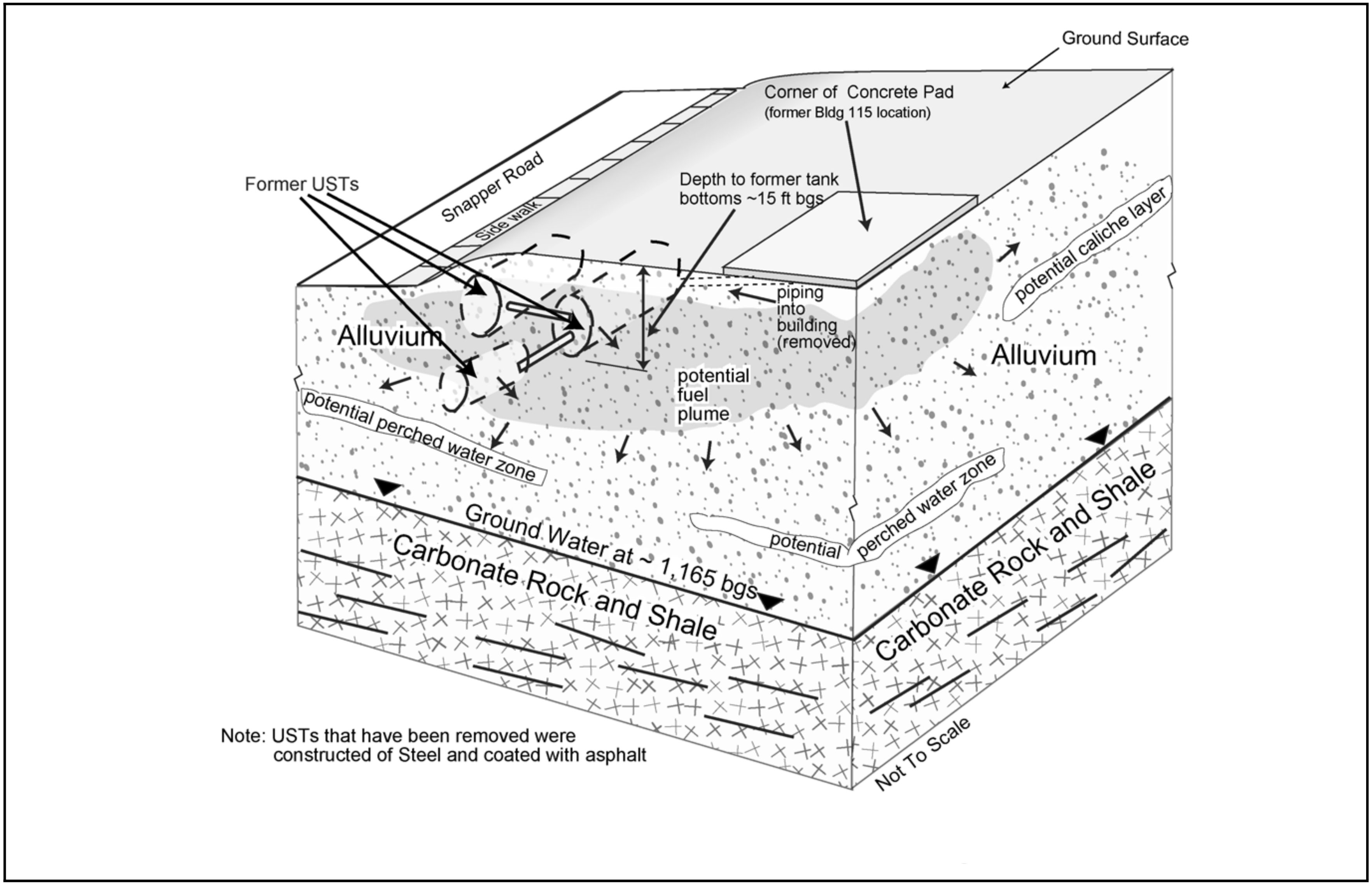

Figure A.1-3
UST Release CSM for CAS 23-02-08

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

- The identification of the vertical and lateral extent of media containing any COC
- The information needed to characterize IDW for disposal
- The information needed to determine potential remediation waste types
- The information needed to evaluate the feasibility of remediation alternatives (bioassessment if natural attenuation or biodegradation is considered and geotechnical data if construction or evaluation of barriers is considered)

A.1.3.2 Alternative Actions to the Decision

The alternative actions for Decision I are: “If no COCs are present, further assessment of the CAS is not required. If COCs are present, resolve Decision II.”

The alternative actions for Decision II are: “If the extent of COCs is defined in both the lateral and vertical directions, further assessment of the CAS is not required. If the extent of COCs is not defined, re-evaluate site conditions and collect additional samples.”

A.1.4 Step 3 - Inputs to the Decision

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

A.1.4.1 Information Needs and Information Sources

In order to determine if a COC is present at a given CAS, sample data must be collected and analyzed following these two criteria: (1) samples must be collected in areas most likely to contain a COC; and (2) the analytical suite selected must be sufficient to detect any COCs present in the samples. Biasing factors to support these criteria include:

- Documented process knowledge on source and location of release
- Visual evidence of discoloration, textural discontinuities, disturbance of native soils, or any other indication of potential contamination

- Presence of debris or equipment
- Field-screening results
- Previous sample or screening results
- Experience and data from investigations of similar sites

To determine the extent of a COC, Decision II sample data must be collected and analyzed at locations to bound the lateral and vertical extent of COCs. The data required to satisfy the information needed for Decision II for each COC is a sample result that is below the PAL. Step-out locations will be selected based on the CSM, biasing factors, and existing data. Biasing factors to support these information needs may include the factors previously listed plus Decision I analytical results.

Table A.1-3 lists the information needs, the source of information for each need, and the proposed methods to collect the data needed to resolve Decisions I and II. The last column addresses the QA/QC data type and associated metric. The data type is determined by the intended use of the data in decision making.

Data types are discussed in the following text. All data to be collected are classified into one of three measurement quality categories: quantitative, semiquantitative, and qualitative. The categories for measurement quality are defined in the following sections.

Quantitative Data

Quantitative data results from direct measurement of a characteristic or component within the population of interest. These data require the highest level of QA/QC in collection and measurement systems because the intended use of the data is to resolve primary decision (i.e., rejecting or accepting the null hypothesis) and/or verifying closure standards have been met. Laboratory analytical data are usually assigned as quantitative data.

Semiquantitative Data

Semiquantitative data is generated from a measurement system that indirectly measures the quantity or amount of a characteristic or component of interest. Inferences are drawn about the quantity or

Table A.1-3
Information Needs to Resolve Decision I and Decision II

Information Need	Information Source	Collection Method	Data Type/Metric
Decision I: Determine if a COC is present. Criteria I: Samples must be collected in areas most likely to contain a COC.			
Source and location of release points	Process knowledge compiled during the PA process and previous investigations of similar sites	Information documented in CSM and public reports – no additional data needed	Qualitative – CSM has not been shown to be inaccurate
	Site visit and field observations	Conduct site visits and document field observations	Qualitative - CSM has not been shown to be inaccurate
	Field screening	Review and interpret field-screening results	Semiquantitative - Sampling based on biasing criteria stipulated in DQO Step 3
	Biased Samples	Selection of locations utilizing technical expertise	Semiquantitative - Sampling based on process knowledge
Decision I: Determine if a COC is present. Criteria 2: Analyses must be sufficient to detect any COCs in samples.			
Identification of all potential contaminants	Process knowledge compiled during PA process and previous investigations of similar sites	Information documented in CSM and public reports - no additional data needed	Qualitative - CSM has not been shown to be inaccurate
Analytical results	Data packages of biased samples	Appropriate sampling techniques and approved analytical methods will be used	Quantitative - Detection limits will be less than PALs
Decision II: Determine the extent of a COC			
Identification of applicable Decision II contaminants	Data packages of prior samples	Review analytical results to select Decision II COCs	Quantitative – Only COCs previously identified will be analyzed in future sampling events.
Extent of Contamination	Field observations	Document field observations	Qualitative – CSM has not been shown to be inaccurate.
	Field screening	Conduct field screening with appropriate instrumentation	Semiquantitative – field screening results will be compared to FSLs.
	Decision II analytical results	Appropriate sampling techniques and approved analytical methods will be used to bound COCs	Quantitative - Validated analytical results will be compared to PALs to determine COC extent.

amount of a characteristic or component because a correlation has been shown to exist between results from the indirect measurement and the quantitative measurement. The QA/QC requirements on semiquantitative collection and measurement systems are high but may not be as rigorous as a quantitative measurement system. Semiquantitative data contribute to decision making, but are not generally used alone to resolve primary decisions. The data are often used to guide investigations toward quantitative data collection.

Qualitative Data

Qualitative data identifies or describes the characteristics or components of the population of interest. The QA/QC requirements for qualitative data are the least rigorous on data collection methods and measurement systems. Professional judgment is often used to generate qualitative data. The intended use of the data is for information purposes, to refine CSMs, and guide investigations rather than resolve primary decisions. This measurement of quality is typically associated with historical information and data where QA/QC may be highly variable or not known. Metrics provide a tool to determine if the collected data support decision making as intended. Metrics tend to be numerical for quantitative and semiquantitative data and descriptive for qualitative data.

A.1.4.2 Determine the Basis for the Preliminary Action Levels

Site workers and military personnel may be exposed to contaminants through oral ingestion, inhalation, external (radiological), or dermal contact (absorption) of soil during disturbance of environmental media. Laboratory analytical results for soils will be compared to the following PALs to evaluate if COPCs are present at levels that may pose an unacceptable risk to human health and/or the environment (i.e., COCs):

- EPA *Region 9 Risk-Based Preliminary Remediation Goals* for Industrial Soils (2002b).
- Background concentrations for RCRA metals will be evaluated when natural background exceeds the PAL, as is often the case with arsenic. Background is considered the mean plus two times the standard deviation of the mean based on data published in *Mineral and Energy Resource Assessment of the Nellis Air Force Range* (NBMG, 1998; Moore, 1999).
- TPH concentrations above the action level of 100 mg/kg per NAC 445A.2272 (NAC, 2003).

- For COPCs without established PRGs, a protocol similar to EPA Region 9 will be used to establish an action level; otherwise, an established PRG from another EPA region may be chosen.

- The PALs for material, equipment, and structures with residual surface contamination are the allowable total residual surface contamination values for unrestricted release of material and equipment listed in the DOE Order 5400.5 (DOE, 1993), which is also Table 4-2 of the NV/YMP Radcon Manual (DOE/NV, 2000).

- The PALs for radioactive contaminants are based on the NCRP Report No. 129 recommended screening limits for construction, commercial, industrial land-use scenarios (NCRP, 1999) scaled from 25 to 15 mrem/yr dose constraint (Appenzeller-Wing, 2004) and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993).

The selected PALs are based on the EPA Region 9 Industrial Land Use PRGs. The PRGs are risk-based tools for evaluating and cleaning up contaminated sites that estimate contaminant concentrations in environmental media (soil, air, and water) that EPA considers protective of humans (including sensitive groups) over a lifetime. The toxicity based PALs have been calculated for an industrial-use scenario. The industrial-use scenario is applicable to sites at the NTS based on future land-use scenarios as presented in Section A.1.2.2 and agreements between NDEP and NNSA/NSO.

The level of 100 mg/kg for TPH is based on a regulatory mandate from the State of Nevada.

Radiological COPCs are not suspected; however, the PALs for radiological contamination are listed here for completeness in the event that unforeseen conditions are encountered during the investigation. Radiochemistry PALs are based on a scaling of the NCRP 25 mrem/yr dose-based levels (NCRP, 1999) to a conservative 15 mrem/yr dose and the recommended levels for certain radionuclides in DOE Order 5400.5 (DOE, 1993). These PALs are based on the construction, commercial, industrial land-use scenario provided in the guidance, and are appropriate for the NTS based on future land-use scenarios as presented in Section A.1.2.2. These established PALs have been accepted by the regulatory agency for use.

A.1.4.3 Potential Sampling Techniques and Appropriate Analytical Methods

The following sections describe potential sampling and other investigative techniques. Additional detail is provided in Section A.1.8. Investigation of CAU 554 will include field screening, soil sampling, and laboratory analysis to determine the presence and extent of COCs.

A.1.4.3.1 Field Screening

Field screening may be conducted for TPH-DRO and VOCs. Field-screening techniques provide semiquantitative data that can be used to guide additional soil sampling activities. Field screening may also be used for health and safety monitoring and to assist in making certain health and safety decisions.

- TPH-DRO Screening. A gas chromatograph or equivalent instrument or method may be used to screen for weathered fuel oil or other heavier carbon chain compounds. The TPH-DRO FSL is established at 75 ppm.
- VOC Screening. A photoionization detector using the headspace method, or equivalent instrument or method may be used to screen for volatiles in soil. The VOC FSL is established as 20 ppm or 2.5 times background, whichever is greater.

A.1.4.3.2 Soil Sampling

Samples will be collected by grab sampling, hand auguring, direct push, backhoe excavation, drilling, or other appropriate sampling methods. Sample collection and handling activities will follow standard procedures. Specific analyses required for the disposal of IDW are identified in Section 5.0 of the CAIP.

A.1.4.3.3 Analytical Program

The analytes that have been identified as COPCs for CAU 554 are included within the analytical suites (e.g., VOC, SVOC, PCB, etc.) identified in Table A.1-4. To support the efficient decision-making activities, the COPCs for CAU 554 have been divided into target and nontarget categories. The target COPCs for Decision I sampling are constituents that are reasonably suspected to be present at the site based on documented use, previous analytical results, or process knowledge. Because information such as documented use or process knowledge exist for target analytes, these analytes are given greater importance in the decision-making process relative to other COPCs. For the target analytes more stringent performance criteria are specified during the data quality assessment (Section 6.0 of the CAIP). Nontarget COPCs include all the remaining analytes reported within an analytical method that have PALs. The nontarget COPCs also aid in reducing the uncertainty concerning the history and potential releases from the CAS and help in the accurate identification of potential contamination. The analytes reported for the various analytical methods proposed for the CAI are listed in Table A.1-4.

Section 3.0 and Section 6.0 of the CAIP provide the analytical methods and laboratory requirements (e.g., detection limits, precision, and accuracy) to be followed during this CAI. Sample volumes are laboratory- and method-specific and will be determined in accordance with laboratory requirements. Analytical requirements (e.g., methods, detection limits, precision, and accuracy) are specified in the Industrial Sites QAPP (NNSA/NV, 2002), unless superseded by the CAIP. These requirements will ensure that laboratory analyses are sufficient to detect contamination in samples at concentrations exceeding the MRL. Specific analyses, if any, required for the disposal of IDW are identified in Section 5.0 of the CAIP.

A.1.5 Step 4, Boundaries of the Study

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

A.1.5.1 Target Population

Decision I target populations represent locations within the CAS that contain COCs, if present. Decision II target populations are locations adjacent to the COC plume where COC concentrations are less than PALs.

A.1.5.2 Spatial and Temporal Boundaries

Spatial boundaries are the maximum lateral and vertical extent of expected contamination at each CAS, as shown in Table A.1-5. Contamination found beyond these boundaries may indicate a flaw in the CSM and would require re-evaluation of the CSM before the investigation could continue.

Temporal boundaries are those time constraints set up by weather conditions and project schedules. Significant temporal constraints due to weather conditions are not expected. Moist weather may place constraints on sampling and field screening contaminated soils because of the attenuating effect of moisture in samples (e.g., alpha-emitting radionuclides). There are no time constraints on

Table A.1-4
Reported Analytes for CAS 23-02-08

VOC	SVOC	TPH	PCB	Metals
1,1,1-Trichloroethane	1,2,4-Trichlorobenzene[a]	Total Petroleum	Aroclor-1016	Arsenic
1,1,1,2-Tetrachloroethane	1,2-Dichlorobenzene[a]	Hydrocarbons	Aroclor-1221	Barium
1,1,2,2-Tetrachloroethane	1,3-Dichlorobenzene[a]	(C^6 - C^{38})	Aroclor-1232	Cadmium
1,1,2-Trichloroethane	1,4-Dichlorobenzene[a]	DRO, GRO	Aroclor-1242	Chromium
1,1-Dichloroethane	2,4,5-Trichlorophenol		Aroclor-1248	Lead
1,1-Dichloroethene	2,4,6-Trichlorophenol		Aroclor-1254	Mercury
cis-1,2-Dichloroethene	2,4-Dichlorophenol		Aroclor-1260	Selenium
trans-1,2-Dichloroethene	2,4-Dimethylphenol			Silver
1,2-Dichloroethane	2,4-Dinitrophenol			
1,2-Dichloropropane	2,4-Dinitrotoluene			
1,2,3-Trichloropropane	2,6-Dinitrotoluene			
1,2,4-Trimethylbenzene	2-Chloronaphthalene			
1,2-Dibromo-3-chloropropane	2-Chlorophenol			
1,2-Dibromoethane	2-Methylphenol			
1,3,5-Trimethylbenzene	2-Nitroaniline			
cis-1,3-Dichloropropene	3,3'-Dichlorobenzidine			
trans-1,3-Dichloropropene	4-Bromophenyl phenyl ether			
2-Butanone	4-Chloroaniline			
2-Chlorotoluene	4-Methylphenol			
4-Methyl-2-pentanone	4-Nitrophenol			
Acetone	Acenaphthene			
Benzene	Acenaphthylene			
Bromobenzene	Aniline			
Bromochloromethane	Anthracene			
Bromodichloromethane	Benzo(a)anthracene			
Bromoform	Benzo(a)pyrene			
Bromomethane	Benzo(b)fluoranthene			
Carbon disulfide	Benzo(g,h,i)perylene			
Carbon tetrachloride	Benzo(k)fluoranthene			
Chlorobenzene	Benzoic Acid			
Chloroethane	Benzyl Alcohol			
Chloroform	Bis(2-chloroethoxy) methane			
Chloromethane	Bis(2-chloroethyl)ether			
Dibromochloromethane	Bis(2-chloroisopropyl)ether			
Dibromomethane	Bis(2-ethylhexyl) phthalate			
Dichlorodifluoromethane	Butyl benzyl phthalate			
Ethylbenzene	Carbazole			
Isopropylbenzene	Chrysene			
Iodomethane	Dibenzo(a,h)anthracene			
Methyl tertiary butyl ether	Dibenzofuran			
Methylene chloride	Diethyl Phthalate			
N-Butylbenzene	Dimethyl Phthalate			
N-Propylbenzene	Di-n-butyl Phthalate			
sec-Butylbenzene	Di-n-octyl Phthalate			
Styrene	Fluoranthene			
tert-Butylbenzene	Fluorene			
Tetrachloroethene	Hexachlorobenzene			
Toluene	Hexachlorobutadiene[a]			
Trichloroethene	Hexachlorocyclopentadiene			
Trichlorofluoromethane	Hexachloroethane			
Trichlorotrifluoroethane	Indeno(1,2,3-cd)pyrene			
Vinyl acetate	Isophorone			
Vinyl chloride	Naphthalene[a]			
Xylene	Nitrobenzene			
	N-Nitroso-di-n-propylamine			
	N-Nitrosodimethylamine			
	N-Nitrosodiphenylamine			
	Pentachlorophenol			
	Phenanthrene			
	Phenol			
	Pyrene			
	Pyridine			

[a]May be reported with VOCs

Table A.1-5
Spatial Boundaries of CAS 23-02-08

Corrective Action Site	Spatial Boundaries
23-02-08, USTs 23-115-1, 2, 3/Spill 530-90-002	The footprint of each UST and excavated area to 150 ft laterally, and vertically to 250 ft bgs.

collecting samples as environmental conditions at all sites will not significantly change in the near future and conditions would have stabilized over the years since the site was last used.

A.1.5.3 Practical Constraints

Practical constraints include nearby active buildings, underground and overhead utilities that may exist at the site, and may limit intrusive sampling locations. Other practical constraints may include topographical constraints (i.e., slopes) and access restrictions. Access restrictions include scheduling conflicts on the NTS with other entities, areas posted as contamination areas requiring appropriate work controls, physical barriers (e.g., fences, buildings, steep slopes), and areas requiring authorized access.

A.1.5.4 Scale of Decision Making

The scale of decision making in Decision I is defined as the CAS. The scale of decision making for Decision II is defined as contiguous areas contaminated with any COC originating from the CAS.

A.1.6 Step 5 - Develop a Decision Rule

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

A.1.6.1 Specify the Population Parameter

The population parameter for Decision I data collected from biased sample locations is the maximum observed concentration of each COC within the target population.

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

A.1.6.2 Choose an Action Level

Preliminary action levels are defined in Section A.1.4.2.

A.1.6.3 Measurement and Analysis Methods

The measurement and analysis methods in the Industrial Sites QAPP (NNSA/NV, 2002) are capable of achieving the expected range of values. The detection limit of the measurement method to be used is less than the PAL for each COPC, unless specified otherwise in the CAIP. See Section A.1.4.3 for additional details.

A.1.6.4 Decision Rule

The decision rule for Decision I is:

> "If the population parameter of any COPC in a target population exceeds the PAL for that COPC in a Decision I sample, then that COPC is identified as a COC and Decision II samples will be collected. If the Site Supervisor determines that an indicator (e.g., staining) is present, then Decision II sampling may be conducted prior to confirming contamination through analytical results. If all COPC concentrations are less than the corresponding PAL, then the decision will be no further action."

The decision rule for Decision II is:

> "If the observed concentration of any COC in a Decision II sample exceeds the PALs, then additional samples will be collected to complete the Decision II evaluation. If all observed COC population parameters are less than the PALs, then the decision will be that the extent of contamination has been defined in the lateral and/or vertical direction."

If contamination is inconsistent with the CSM or extends beyond the spatial boundaries identified in Table A.1-5, then work will be suspended and the investigation strategy will be reevaluated. If contamination is consistent with the CSM and is within spatial boundaries, then the decision will be to continue sampling to define the extent of the contamination.

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

The purpose of this step is to specify performance criteria for the decision rule. Setting tolerable limits on decision errors is neither obvious nor easy. It requires the planning team to weigh the relative effects of threat to human health and the environment, expenditure of resources, and consequences of an incorrect decision. Section 7.1 of the EPA QA/G-4HW guidance states that if judgmental sampling approaches are used, quantitative statements about data quality will be limited to measurement error. Measurement error is influenced by imperfections in the measurement and analysis system. Random and systematic measurement errors are introduced in the measurement process during physical sample collection, sample handling, sample preparation, sample analysis, and data reduction. If measurement errors are not controlled they may lead to errors in making the DQO decisions.

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

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

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

- The development of and concurrence of conceptual site models (based on process knowledge) by stakeholder participants during the DQO process

- Testing the validity of CSMs based on investigation results

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

A.1.7.1 False Negative Decision Error

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

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

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

To satisfy the first criterion, Decision I samples must be collected in areas most likely to be contaminated by COCs. Decision II samples must be collected in areas that represent the lateral and vertical extent of contamination. 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.1.4.3.1 will be used to further ensure that appropriate sampling locations are selected to meet these criteria. The investigation report will present an assessment on the DQI of representativeness that samples were collected from those locations that best represent the target populations as defined in Section A.1.5.1.

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

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

- Field duplicates (minimum of 1 per matrix per 20 environmental samples)
- Laboratory QC samples (minimum of 1 per matrix per 20 environmental samples)
- Matrix spike/matrix spike duplicate (1 per 20 environmental samples or 1 per CAS per matrix, if less than 20 collected, as required by the analytical methods)

A.1.7.2 False Positive Decision Error

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

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

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

A.1.8 Step 7 - Sampling and Analysis Design for Obtaining Data

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

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

All sample locations will be selected to satisfy the DQI of representativeness in that samples collected from selected locations will best represent the target populations as defined in Section A.1.5.1. To meet this criterion, a biased sampling strategy will be used for Decision I to target areas with the highest potential for contamination, if it is present anywhere in the CAS. Sample locations will be determined based on process knowledge, previously acquired data, or the field screening and biasing factors listed in Section A.1.4.1. If biasing factors are present in soils below locations where Decision I samples were removed, additional Decision I soil samples will be collected at depth intervals selected by the Site Supervisor based on biasing factors to a depth where the biasing factors are no longer present. The Site Supervisor has the discretion to modify the sample locations, but only if the modified locations meet the decision needs and criteria stipulated in this DQO.

To meet the DQI of representativeness for step-out (Decision II) samples (that Decision II sample locations represent the target population defined in Section A.1.5.1), sampling locations at CAS 23-02-08 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.1.4.1. In general, sample locations will be arranged in a triangular pattern around the Decision I locations at distances based on site conditions, process knowledge, and biasing factors.

Detailed Investigation Strategy - This section discusses the specific sampling and analysis design for CAS 23-02-08. Intrusive sampling for field-screening and laboratory analysis will be the primary investigative technique at this CAS. Biased locations will be determined based on biasing factors listed in Section A.1.4.1.

The investigation to resolve Decision I will consist of completing four boreholes. One borehole each will be located at the two former USTs suspected of leaking (i.e., Tanks 23-115-1 and 23-115-3) based on previous analytical results. A third borehole will be located at the approximate point where the pipes from the tanks entered at Building 115 and a fourth borehole will be located at the approximate location of the abandoned/capped former fill line for the former USTs 23-115-1 and -2 (see Figure A.1-4). Biasing factors will be used to determine sample collection depths. To confirm the nature of contamination Decision I samples from worse case locations (i.e., heaviest contamination based on biasing factors) at each Decision I location will be analyzed for the full analytical suite (see Analytical Program - Section A.1.4.3.3). Additional samples from Decision I locations will be analyzed for only TPH-DRO, unless biasing factors or analytical laboratory results indicate other contaminants are present. Decision II samples will be taken from a clean zone below the contamination to define the vertical extent of contamination.

Surface soil samples may be collected to show that the surface is not contaminated and that future use restriction for this site can be limited to the subsurface soils, if necessary.

The investigation to resolve Decision II, if necessary, will consist of completing approximately six boreholes at step-out locations (i.e., three boreholes each surrounding the two UST Decision I locations). If areas of contamination associated with both Tanks 23-115-1 and 23-115-3 are found to be contiguous, these step-out locations may be combined. The depth of contamination identified during Decision I sampling will be used to estimate the potential lateral extent of contamination and select specific step-out sample locations. For example, previous plume size estimates were calculated by REECo by using the 1990 CO_2 survey results. The results of this survey were used by REECo to estimate the areal extent of fuel contamination at CAS 23-02-08. In addition, REECo used Dragun's equation to estimate the vertical extent of contamination (Kendall, 1990). Assumptions were based on the reported material type and volume of release, soil porosity at the site, and the residual hydrocarbon saturation (Section A.1.1).

If COCs extend beyond the initial step-outs locations, Decision II samples will be collected from incremental step-outs. Initial step-outs will be located at least as deep as the vertical extent of contamination defined at the Decision I locations. The sample depth of incremental step-outs will be based on the deepest contamination observed at all locations. A clean sample (i.e., COCs less than PALs) 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. Potential Decision II sampling locations are shown in Figure A.1-4.

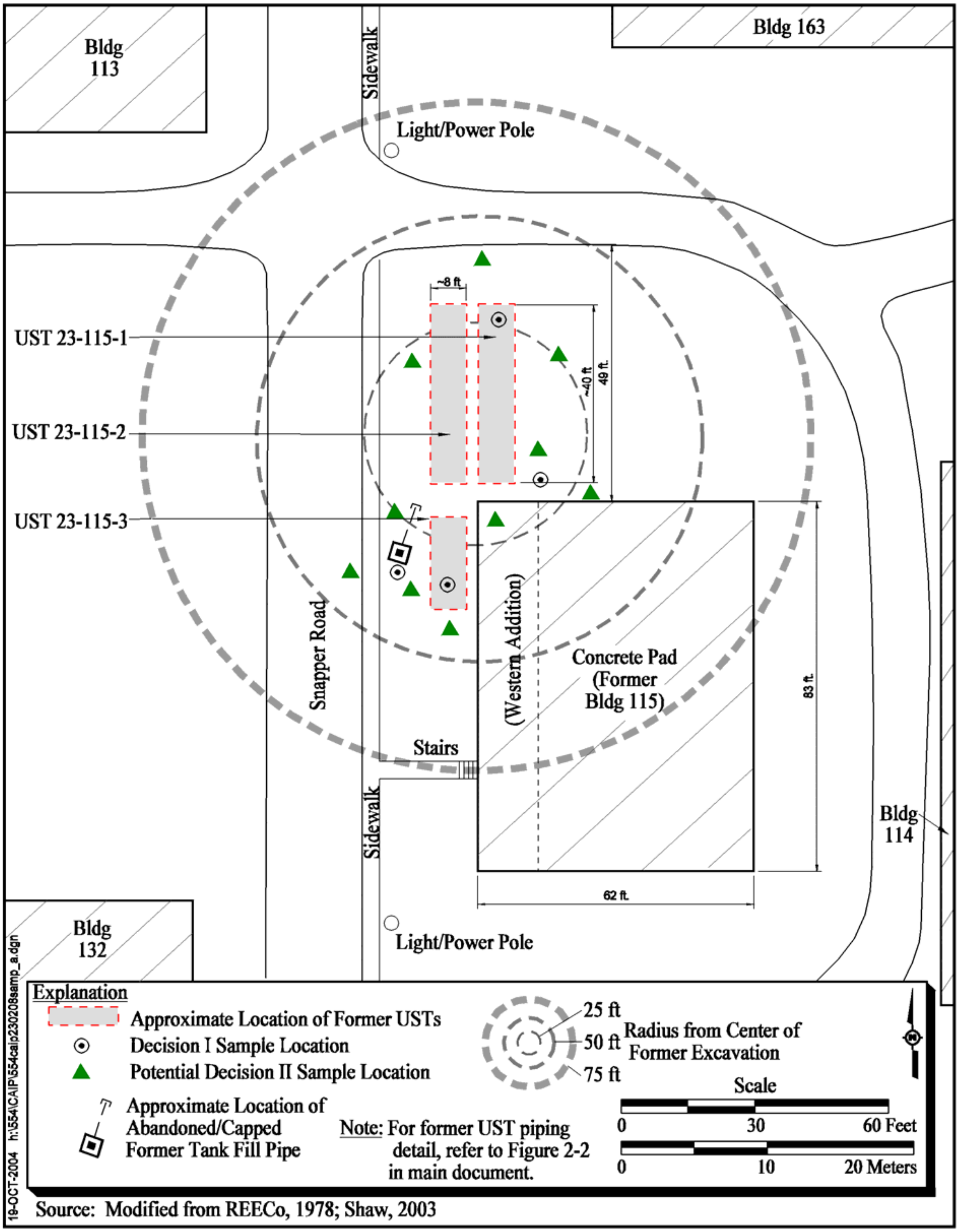

Figure A.1-4
Proposed Sampling Locations at CAS 23-02-08

A.2.0 References

Appenzeller-Wing, J., U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2004. Letter to T.A. Maize (NDEP) entitled, "Submittal of Proposed Radiological Preliminary Action Levels (PALs) for the Industrial Sites Project," 15 January. Las Vegas, NV.

DOE, see U.S. Department of Energy.

DOE/NV, see U.S. Department of Energy, Nevada Operations Office

EPA, see U.S. Environmental Protection Agency.

Kendall, E.W., Reynolds Electrical & Engineering Co., Inc. 1990. Letter to R.E. Fredrichs (U.S. Department of Energy, Nevada Operations Office), entitled, "Results of the Carbon Dioxide Survey at Area 23, Building 115." 05 March. Las Vegas, NV: Defense Waste Management Department.

Moore, J., Science Applications International Corporation. 1999. Memorandum to M. Todd (SAIC) entitled, "Background Concentrations for NTS and TTR Soil Samples," 03 February. Las Vegas, NV.

NAC, see *Nevada Administrative Code.*

NBMG, see Nevada Bureau of Mines and Geology.

NCRP, see National Council on Radiation Protection and Measurements.

NNSA/NV, see U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office.

National Council on Radiation Protection and Measurements. 1999. *Recommended Screening Limits for Contaminated Soils and Review of Factors Relevant to Site-Specific Studies,* Report No. 129. Washington, DC.

Nevada Administrative Code. 2003. NAC 445A, "Water Controls." Carson City, NV.

Nevada Bureau of Mines and Geology. 1998. *Mineral and Energy Resource Assessment of the Nellis Air Force Range*, Open-File Report 98-1. Reno, NV.

REECo, see Reynolds Electrical & Engineering Co., Inc.

Reynolds Electrical & Engineering Co., Inc. 1978. Engineering Drawing 23-SP-M1 entitled, "Building 115 Fuel Tank Replacement Mechanical Plan," 21 March. Las Vegas, NV.

Shaw Environmental, Inc. 2003. CAU 554 Project File. Las Vegas, NV.

Soong, C., Bechtel Nevada. 2003. Record of Telecon with J. Zimpfer (SAIC) regarding Building 115 USTs, 13 February. Las Vegas, NV.

U.S. Department of Energy. 1993. DOE Order 5400.5, Change 2, "Radiation Protection of the Public and the Environment," Washington, DC: U.S. Government Printing Office.

U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office. 2002. *Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada*, Rev. 3, DOE/NV--372. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1996. *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada,* DOE/EIS 0243. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1998. *Nevada Test Site Resource Management Plan*, DOE/NV--518. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 2000. *NV/YMP Radiological Control Manual*, Rev. 4, DOE/NV/11718-079. Prepared by Bechtel Nevada. Las Vegas, NV.

U.S. Environmental Protection Agency. 2000a. *Data Quality Objectives Process for Hazardous Waste Site Investigations,* EPA QA/G-4HW. Washington, DC.

U.S. Environmental Protection Agency. 2000b. *Guidance for the Data Quality Objectives Process*, EPA QA/G-4. Washington, DC.

U.S. Environmental Protection Agency. 2002a. *Guidance for Quality Assurance Project Plans,* EPA QA/G-5. Washington, DC.

U.S. Environmental Protection Agency. 2002b. *Region 9 Preliminary Remediation Goals (PRGs)*. Prepared by S.J. Smucker. 01 October. San Francisco, CA.

Youngs, R.A., Reynolds Electrical & Engineering Co., Inc. 1990. Memorandum to D.L. Cox, et al. (REECo) entitled "Nonconformance Report 530-90-002: Underground Storage Tank Removal for Building 115." 22 June. Las Vegas, NV.

Appendix B

Project Organization

B.1.0 Project Organization

The NNSA/NSO Project Manager is Janet Appenzeller-Wing and she can be contacted at (702) 295-0461. The NNSA/NSO Task Manager is Kevin Cabble and he can be contacted at (702) 295-5000.

The identification of the project Health and Safety Officer and the Quality Assurance Officer can be found in the appropriate plan. However, personnel are subject to change and it is suggested that the appropriate NNSA/NSO or Defense Threat Reduction Agency Project Manager be contacted for further information. The Task Manager(s) will be identified in the FFACO Monthly Activity Report Prior to the start of field activities.

Appendix C

NDEP Comment Responses

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

1. Document Title/Number Draft Corrective Action Investigation Plan for Corrective Action Unit 554: Area 23 Release Site, Nevada Test Site, Nevada
2. Document Date August 2004
3. Revision Number 0
4. Originator/Organization Stoller-Navarro
5. Responsible DOE/NV ERP Project Mgr. Janet Appenzeller-Wing
6. Date Comments Due October 1, 2004
7. Review Criteria Full
8. Reviewer/Organization/Phone No. NDEP
9. Reviewer's Signature

10. Comment Number/ Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept
1)		NDEP reviewed the Draft Corrective Action Investigation Plan for Corrective Action Unit 554 and had no comments to this document.		

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

Return Document Review Sheets to DOE/NV Environmental Restoration Division, Attn: QAC, M/S 505.

Library Distribution List

	Copies
U.S. Department of Energy National Nuclear Security Administration Nevada Site Office Technical Library P.O. Box 98518, M/S 505 Las Vegas, NV 89193-8518	1 (Uncontrolled)
U.S. Department of Energy Office of Scientific and Technical Information P.O. Box 62 Oak Ridge, TN 37831-0062	1 (Uncontrolled, electronic copy)
Southern Nevada Public Reading Facility c/o Nuclear Testing Archive P.O. Box 98521, M/S 400 Las Vegas, NV 89193-8521	1 (Controlled) 1 (Uncontrolled)
Manager, Northern Nevada FFACO Public Reading Facility c/o Nevada State Library & Archives Carson City, NV 89701-4285	1 (Uncontrolled)