Nevada
Environmental
Restoration
Project

DOE/NV--827

Corrective Action Investigation Plan For Corrective Action Unit 410: Waste Disposal Trenches Tonopah Test Range, Nevada

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Environmental Restoration
Division

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

IT CORPORATION

NNSA/NV ERD Industrial Sites Project
RECORD OF TECHNICAL CHANGE

Technical Change No. 1

Project/Job No. 840224 Date February 19, 2003

Project/Job Name CAU 410: Waste Disposal Trenches, Tonopah Test Range, Nevada

Phase/Task CAIP/DQO Process

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

George W. Petersen, Jr. — Task Manager

(Name) (Title)

Justification: This Record of Technical Change (ROTC) is required to update the *Corrective Action Investigation Plan (CAIP) for Corrective Action Unit (CAU) 410: Waste Disposal Trenches, Tonopah Test Range (TTR), Nevada*, and allow for the proposed removal of contaminated soil from Corrective Action Site (CAS) 03-19-001, Waste Disposal Site. It is proposed that the work be completed as supplemental field activities to the CAIP/Data Quality Objectives (DQO) process and will focus on the excavation, segregation, and separation of soil, debris, and stained soil. It is anticipated that the remaining area of the CAS will be free of contamination greater than preliminary action level (PAL) concentrations and preclude the need for additional corrective actions at CAS 03-19-001. Therefore, a Corrective Action Decision Document /Closure Report (CADD/CR) will replace the planned CADD.

<u>Changes</u>

Section 2.1.5 CAS 03-19-001, Waste Disposal Site, Paragraph 1

Replace the third and fourth sentences with:

"TPH diesel-range organic (DRO) contamination was identified above the PAL concentration at the sample location and appeared to be limited to the 4.5- to 5-ft interval. In addition, the excavation encountered refusal in a deposit of hardpan/caliche at a depth of between 9- to 9.5-ft bgs."

Please Note: The above replaced sentences do not diminish the original agreed upon scope of work as presented in the CAU 410 CAIP. Instead, these sentences add additional information gathered during the initial phase of the investigation at CAS 03-19-001.

Section 2.5.5 CAS 03-19-001, Waste Disposal Site

Insert second paragraph:

"During the CAU 410 investigation activities in November 2002, undisturbed soil deposits were encountered in a trench excavation located approximately 12- to 15-ft south of the original SWS-4 sample location. Neither debris nor stained soil were observed in the sides and/or bottom of the trench and none of the five samples collected from the trench indicated the presence of TPH.

Based on the available data, TPH contamination exists within the central portion of CAS 03-19-001 and appears to be centered at the SWS-4 sample location. The contamination appears to be limited to a depth of between 4.5- to 5-ft bgs and covers and area of approximately 30 ft^2."

Section 4.2.5 CAS 03-19-001, Waste Disposal Site

Add the following paragraphs:

"Based on available data, the contamination appears to be limited to a depth of 4.5- to 5-ft bgs where FSLs were exceeded for TPH DRO. The estimated volume of the TPH contaminated soil is approximately 12 cubic yards (yd^3) and covers an area of approximately 30 ft^2.

Supplemental field activities at this CAS include defining the site boundaries based on available data and sample locations identified during the previous investigative actions for CAUs 405 and 410. Corrective Action Site 03-19-001 is bounded by sample No. ss4st03 in the northeast corner, No. 41003006 in the southeast corner, No. 41003003 in the southwest corner, and sample Nos. ss4lf06 and ss4lf05 in the northwest corner.

During the proposed supplemental field activities at CAS 03-09-001, the bounded area will be excavated to define the vertical limits of the TPH DRO. The anticipated depth of the excavation is approximately 5-ft or below the debris and stained soil.

If Field Screening Results (FSRs) exceed Field Screening Levels (FSLs) at the 5-ft depth, the excavation will be extended and additional samples will be collected to define the vertical extent. In addition, samples will be collected from the sidewalls to define the horizontal extent of the TPH DRO

Technical Change No. 1

Project/Job No. 840224 Date February 19, 2003

Project/Job Name CAU 410: Waste Disposal Trenches, Tonopah Test Range, Nevada

Phase/Task CAIP/DQO Process

contamination. If FSRs are below FSLs at the exterior sidewall and bottom sample locations, the TPH contamination will be deemed bounded and no more samples will be collected.

The excavated soil from CAS 03-19-001 will be disposed by the Management and Operating (M&O) contractor with the CAU 490 hydrocarbon waste. The excavation will be backfilled with clean granular material."

The project time will be (~~Increased~~)(Decreased)(Unchanged) by approximately -59- days.

Applicable Project-Specific Document(s): *Corrective Action Investigation Plan for Corrective Action Unit 410: Waste Disposal Trenches, Tonopah Test Range, Nevada*, Rev. 0, DOE/NV-827.

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for Robert M. [signature] Date 2/25/03
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NDEP Concurrence Yes X No ___ Date 2/27/03
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Contract Change Order Required Yes___ No ___
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NNSA/NV ERD Industrial Sites Project
RECORD OF TECHNICAL CHANGE

Technical Change No. 2

Project/Job No. 840224 Date February 19, 2003

Project/Job Name CAU 410: Waste Disposal Trenches, Tonopah Test Range, Nevada

Phase/Task CAIP/DQO Process

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

George W. Petersen, Jr.	Task Manager
(Name)	(Title)

Justification: This Record of Technical Change (ROTC) is required to update the *Corrective Action Investigation Plan (CAIP) for Corrective Action Unit (CAU) 410: Waste Disposal Trenches, Tonopah Test Range (TTR), Nevada,* and allow for the proposed removal of contaminated soil and debris from Corrective Action Site (CAS) TA-19-002-TAB2, Debris Mound, and the removal of debris from CAS TA-21-002-TAAL, Disposal Trench (i.e., SW Antelope Lake). It is proposed that the work be completed as supplemental field activities to the CAIP/Data Quality Objectives (DQO) process and will focus on the excavation, segregation, and separation of soil, debris, and unexploded ordnance (UXO). In addition, at CAS TA-19-002-TAB2, Debris Mound, depleted uranium (DU) material will be screened, segregated, packaged, and certified to ensure it meets the requirements of the NTS Waste Acceptance Criteria (NTSWAC).

It is anticipated that the remaining area of each CAS will be free of contamination greater than preliminary action level (PAL) concentrations and preclude the need for additional corrective actions at CASs TA-19-002-TAB2 and TA-21-002-TAAL. Therefore, a Corrective Action Decision Document/Closure Report (CADD/CR) will replace the planned CADD.

Technical Change No. 2

Project/Job No. 840224 Date February 19, 2003

Project/Job Name CAU 410: Waste Disposal Trenches, Tonopah Test Range, Nevada

Phase/Task CAIP/DQO Process

Changes

Section 2.1.1 CAS TA-19-002-TAB2, Debris Mound

Insert a fourth paragraph:

"During the CAU investigation activities in November 2002, the initial excavation at the site confirmed the presence of subsurface debris at the mound area. The buried debris material appeared to be confined to the mound area and within the limits of a buried pan-shaped metal object approximately 10- by 15-ft. The metal pan has an open top and a height of approximately 12- to 18-inches (in.). Vertical extend of the debris and potentially contaminated material could not be determined due to the size of the metal pan and inability to move the pan-shaped metal object. In addition, depleted uranium (DU) material was identified on the debris and appeared to be mixed with the soil at the CAS."

Section 2.1.3 CAS TA-21-002-TAAL, Disposal Trench

Insert a third paragraph:

"During the CAU investigation activities in November 2002, the initial excavation at the site confirmed the presence of subsurface debris in the area of the geophysical survey. Excavation activities did not define the horizontal and vertical extent of the debris due to the nature of the materials and capability of the equipment."

Section 2.2.1 CAS TA-19-002-TAB2, Debris Mound

Add a second paragraph:

"Source of the DU material is uncertain at CAS TA-19-002-TAB2. The initial investigation activities confirmed the presence of buried debris material piled/buried on top of a 10- by 15-ft open-top, pan-shaped metal object in the area of the mound."

Section 2.2.3 CAS TA-21-002-TAAL, Disposal Trench

Add a second paragraph:

"Initial explorations at CAS TA-21-002-TAAL uncovered a variety of buried debris (e.g., metallic debris, UXO and steel wire) within the CAS. However, the initial explorations were limited due to the nature of the debris and waste materials and capacity of the equipment. The extent and quantity of the buried materials could not be fully determined. The horizontal limits of the debris appeared to extend beyond the area identified during the geophysical survey and the vertical extent appeared to be greater than 10 ft in the northern portion of the CAS."

Section 4.2.1 CAS TA-19-002-TAB2, Debris Mound

Add the following paragraphs:

"Supplemental field activities will focus on removing, packaging, and certifying the DU-contaminated soil and debris identified during the initial site investigation.

During the proposed supplemental field activities at CAS TA-19-002-TAB2, the DU, debris and waste material will be containerized in open-top cargo containers. The DU-contaminated waste will be properly packaged and certified the meet the requirements of the NTS Waste Acceptance Criteria (NTSWAC). DU-contaminated waste will be disposed by the Management and Operating (M&O) contractor through the approved Low-Level Waste (LLW) Certification Program

If Field Screening Results (FSRs) exceed Field Screening Levels (FSLs) at the interface between the bottom of the 10- by 15-ft metal pan-shaped object and the underlying soil, the excavation will be extended and additional samples will be collected to define the vertical extent. Samples will be collected to define the horizontal extent, as necessary. The anticipated depth of the excavation is approximately 18- to 24-in. bgs. If FSRs are below FSLs at the exterior sidewall and bottom sample locations, the CAS will be deemed bounded and no more samples will be collected.

Unexploded ordnance materials will be segregated and placed in a bermed area at the edge of the CAS."

Section 4.2.3 CAS TA-21-002-TAAL, Disposal Trench

Add the following paragraphs:

"Supplemental field activities at this CAS include defining the site boundaries based on available data collected during the initial field investigative activities and additional samples collected during the proposed supplemental field activities.

During the proposed supplemental field activities at CAS TA-21-002-TAAL, additional excavation and sample collection will be performed. The average depth of the excavations is approximately 5-ft bgs or below the buried debris based on observed site conditions during the initial field activities. The excavation will extend between 10- to 12-ft bgs in the northern portion of the CAS.

If FSRs exceed FSLs at the interface of the buried material and native soil, the excavation will be extended and additional samples will be collected to define the vertical extent. In addition, samples will be collected to define the horizontal extent, if necessary. If FSRs are below FSLs at the exterior sidewall and bottom sample locations, the CAS will be deemed bounded and no more samples will be collected.

Debris will be separated and placed in the existing bermed area pending disposal by U.S. Air Force (USAF). The UXO materials will be segregated and placed in the existing bermed area established during the initial field investigation activities."

Technical Change No. 2

Project/Job No. 840224 Date February 19, 2003

Project/Job Name CAU 410: Waste Disposal Trenches, Tonopah Test Range, Nevada

Phase/Task CAIP/DQO Process

The project time will be (Increased)(Decreased)(Unchanged) by approximately -59- days.

Applicable Project-Specific Document(s): *Corrective Action Investigation Plan for Corrective Action Unit 410: Waste Disposal Trenches, Tonopah Test Range, Nevada*, Rev. 0, DOE/NV-827.

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for [signature] Date 3/06/03
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NDEP Concurrence Yes X No __ Date ______
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RECORD OF TECHNICAL CHANGE

Technical Change No. 3 | Page 1 of 3

Project/Job No. 840224 | Date March 10, 2003

Project/Job Name CAU 410: Waste Disposal Trenches, Tonopah Test Range, Nevada

Phase/Task CAIP/Data Quality Objective process

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

George W. Petersen, Jr. | Task Manager
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Justification: This Record of Technical Change (ROTC) is required to update the *Corrective Action Investigation Plan (CAIP) for Corrective Action Unit (CAU) 410: Waste Disposal Trenches, Tonopah Test Range (TTR), Nevada,* and allow for the proposed removal of contaminated soil from Corrective Action Site (CAS) 03-19-001, Waste Disposal Site. It is proposed that the work be completed as supplemental field activities to the CAIP/Data Quality Objectives (DQO) process and will focus on the excavation, segregation, and separation of soil, debris, and stained soil. It is anticipated that the remaining area of the CAS will be free of contamination greater than preliminary action level (PAL) concentrations and preclude the need for additional corrective actions at CAS 03-19-001. Therefore, a Corrective Action Decision Document /Closure Report (CADD/CR) will replace the planned CADD.

Changes

Section 4.2.5 CAS 03-19-001, Waste Disposal Site

Delete paragraphs added in ROTC No. 1 for this section and replace with the following paragraphs:

"Based on available analytical data from CAU 405 and previous investigation results for CAU 410, the contamination appears to extend to a depth of 9-ft bgs where FSLs were exceeded for TPH DRO.

Supplemental field activities at this CAS include defining the site boundaries based on available data and sample locations identified during the previous investigation results for CAUs 405 and 410. Corrective Action Site 03-19-001 is bounded by sample No. ss4lf06 in the northwest corner, No. 41003006 in the southeast corner, and No. 41003003 in the southwest corner. The northeast boundary has not been defined.

During the proposed supplemental field activities at CAS 03-09-001, the area of concern will be excavated to define the horizontal and vertical limits of the TPH DRO. The anticipated depth of the excavation is anticipated to be approximately 9-ft or below the debris and stained soil.

If FSRs exceed FSLs at the interface below the debris and stained soil, the excavation will be extended and additional samples will be collected to define the vertical extent. In addition, samples will be collected from the sidewalls to define the horizontal extent of the TPH DRO contamination.

If FSRs are below FSLs at the exterior sidewall and bottom sample locations, the TPH contamination will be deemed bounded and no more samples will be collected.

The excavated soil from CAS 03-19-001 will be placed in roll-off containers or stockpiled on-site pending analytical results for characterization. ITLV will prepare a waste determination based on the analytical sample results.

Assuming only hydrocarbon contamination, debris and contaminated soil will be loaded directly into roll-off containers or trucks. Any other waste will be properly managed according to federal and state regulations.

The excavation will be backfilled with clean granular material. This may include previously excavated clean soil."

The project time will be increased by approximately 59 days.

Applicable Project-Specific Document(s): *Corrective Action Investigation Plan for Corrective Action Unit 410: Waste Disposal Trenches, Tonopah Test Range, Nevada*, Rev. 0, DOE/NV–827.

Technical Change No. 3
Project/Job No. 840224
Project/Job Name CAU 410: Waste Disposal Trenches, Tonopah Test Range, Nevada
Phase/Task CAIP/DQO Process

Page 3 of 3
Date March 10, 2003

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DOE/NV--827

CORRECTIVE ACTION INVESTIGATION PLAN FOR CORRECTIVE ACTION UNIT 410: WASTE DISPOSAL TRENCHES TONOPAH TEST RANGE, NEVADA

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

Controlled Copy No.: ____

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July 2002

CORRECTIVE ACTION INVESTIGATION PLAN
FOR CORRECTIVE ACTION UNIT 410:
WASTE DISPOSAL TRENCHES
TONOPAH TEST RANGE, NEVADA

Approved by: Signature Approved Date: 7-16-02

Janet Appenzeller-Wing, Project Manager
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Approved by: Signature Approved Date: 7/16/02

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Table of Contents

List of Figures v
List of Tables vi
List of Acronyms and Abbreviations vii
Executive Summary ES-1

1.0 Introduction 1
1.1 Purpose 1
1.1.1 CAS TA-19-002-TAB2, Debris Mound 4
1.1.2 CAS TA-21-003-TANL, Disposal Trench 5
1.1.3 CAS TA-21-002-TAAL, Disposal Trench 5
1.1.4 CAS 09-21-001-TA09, Disposal Trenches 5
1.1.5 CAS 03-19-001, Waste Disposal Site 5
1.2 Scope 6
1.3 CAIP Contents 6

2.0 Facility Description 8
2.1 Physical Setting 8
2.1.1 CAS TA-19-002-TAB2, Debris Mound 8
2.1.2 CAS TA-21-003-TANL, Disposal Trench 9
2.1.3 CAS TA-21-002-TAAL, Disposal Trench 12
2.1.4 CAS 09-21-001-TA09, Disposal Trenches 12
2.1.5 CAS 03-19-001, Waste Disposal Site 12
2.2 Operational History 15
2.2.1 CAS TA-19-002-TAB2, Debris Mound 15
2.2.2 CAS TA-21-003-TANL, Disposal Trench 17
2.2.3 CAS TA-21-002-TAAL, Disposal Trench 17
2.2.4 CAS 09-21-001-TA09, Disposal Trenches 18
2.2.5 CAS 03-19-001, Waste Disposal Site 18
2.3 Waste Inventory 18
2.4 Release Information 19
2.5 Investigative Background 20
2.5.1 CAS TA-19-002-TAB2, Debris Mound 20
2.5.2 CAS TA-21-003-TANL, Disposal Trench 20
2.5.3 CAS TA-21-002-TAAL, Disposal Trench 21
2.5.4 CAS 09-21-001-TA09, Disposal Trenches 21
2.5.5 CAS 03-19-001, Waste Disposal Site 21
2.5.6 *National Environmental Policy Act* 22

3.0 Objectives 23
3.1 Conceptual Site Model 23

Table of Contents (Continued)

3.1.1 Future Land Use 23
3.1.2 Contaminant Sources 23
3.1.3 Release Mechanisms. 25
3.1.4 Migration Pathways 25
3.1.5 Exposure Pathways. 26
3.1.6 Additional Information 26
3.2 Contaminants of Potential Concern 26
3.2.1 CAS TA-19-002-TAB2, Debris Mound. 27
3.2.2 CAS TA-21-003-TANL, Disposal Trench 27
3.2.3 CAS TA-21-002-TAAL, DIsposal Trench 27
3.2.4 CAS 09-21-001-TA09, Disposal Trenches. 28
3.2.5 CAS 03-19-001, Waste Disposal Site. 28
3.3 Preliminary Action Levels 28
3.4 DQO Process Discussion 29
3.4.1 Analytical Requirements 29
3.4.2 Geotechnical/Hydrological Analysis and Bioassessment Tests 34

4.0 Field Investigation 36

4.1 Technical Approach 36
4.2 Field Activities 36
4.2.1 CAS TA 19-002-TAB2, Debris Mound 37
4.2.2 CAS TA 21-003-TANL, Disposal Trench 38
4.2.3 CAS TA 21-002-TAAL, Disposal Trench 38
4.2.4 CAS 09 21-001-TA09, Disposal Trenches. 38
4.2.5 CAS 03-19-001, Waste Disposal Site. 43
4.3 Field-Screening Levels 43
4.4 Safety 45

5.0 Waste Management. 47

5.1 Waste Minimization 47
5.2 Potential Waste Streams 49
5.3 Investigation-Derived Waste Management 49
5.3.1 Sanitary Waste 50
5.3.2 Hydrocarbon Waste 50
5.3.3 Hazardous Waste 50
5.3.3.1 PPE/Equipment 51
5.3.3.2 Rinsate 51
5.3.3.3 Field-Screening Waste 52
5.3.3.4 Soil 52
5.3.4 Low-Level Waste 52
5.3.5 Mixed Wastes 53

Table of Contents (Continued)

6.0 Quality Assurance/Quality Control 55
6.1 Quality Control Field Sampling Activities 55
6.2 Laboratory/Analytical Quality Assurance 56
6.2.1 Data Validation 56
6.2.2 Data Quality Indicators 56
6.2.3 Precision 57
6.2.3.1 Precision for Chemical Analysis 59
6.2.3.2 Precision for Radiochemical Analysis 60
6.2.4 Accuracy 61
6.2.4.1 Accuracy for Chemical Analyses 61
6.2.4.2 Accuracy for Radiochemical Analysis 62
6.2.5 Representativeness 63
6.2.6 Completeness 63
6.2.7 Comparability 64
6.2.8 Sensitivity 64
6.3 Radiological Survey Quality Assurance 64
7.0 Duration and Records Availability 65
7.1 Duration 65
7.2 Records Availability 65
8.0 References 66

Appendix A - Data Quality Objectives

A.1.0 Seven-Step DQO Process for CAU 410 Investigations A-1
A.1.1 Step 1 - State the Problem A-1
A.1.1.1 Planning Team Members A-1
A.1.1.2 Describe the Problem A-2
A.1.1.3 Develop Conceptual Site Model A-2
A.1.1.3.1 CAS TA-19-002-TAB2, Debris Mound A-4
A.1.1.3.2 CAS TA-21-003-TANL, Disposal Trench A-4
A.1.1.3.3 CAS TA-21-002-TAAL, Disposal Trench A-7
A.1.1.3.4 CAS 09-21-001-TA09, Disposal Trenches A-7
A.1.1.3.5 CAS 03-19-001, Waste Disposal Site A-8
A.1.2 Step 2 - Identify the Decision A-11
A.1.2.1 Develop a Decision Statement A-11
A.1.2.2 Alternative Actions to the Decision A-11
A.1.3 Step 3 - Identify the Inputs to the Decision A-11
A.1.3.1 Information Needs and Information Sources A-11

Table of Contents *(Continued)*

A.1.3.2 Determine the Basis for the Preliminary Action Levels A-16
A.1.3.3 Potential Sampling Techniques and Appropriate Analytical Methods A-17
A.1.4 Step 4 - Define the Boundaries of the Study A-18
A.1.4.1 Define the Target Population A-18
A.1.4.2 Identify the Spatial and Temporal Boundaries A-19
A.1.4.3 Identify Practical Constraints A-20
A.1.4.4 Define the Scale of Decision Making A-20
A.1.5 Step 5 - Develop a Decision Rule A-20
A.1.5.1 Specify the Population Parameter A-21
A.1.5.2 Choose an Action Level A-21
A.1.5.3 Measurement and Analysis Methods A-21
A.1.5.4 Decision Rule A-21
A.1.6 Step 6 - Specify the Tolerable Limits on Decision Errors A-22
A.1.6.1 False Negative Decision Error A-22
A.1.6.2 False Positive Decision Error A-23
A.1.6.3 Quality Assurance/Quality Control A-24
A.1.7 Step 7 - Optimize the Design for Obtaining Data A-24
A.1.7.1 Geophysical Surveys A-25
A.1.7.2 Intrusive Investigation A-25
A.1.7.2.1 Investigation Strategy for CASs TA-19-002-TAB2, TA-21-003-TANL, and TA 21-002-TAAL A-26
A.1.7.2.2 Investigation Strategy for CAS 09-21-001-TA09 . . . . . . A-26
A.1.7.2.3 Investigation Strategy for CAS 03-19-001 . . . . A-26

A.2.0 References A-28

Appendix B - Project Organization

B.1.0 Project Organization B-1

Appendix C - NDEP Comment Responses

List of Figures

Number	Title	Page
1-1	Tonopah Test Range Location Map	2
1-2	TTR CAU 410 CAS Location Map	3
2-1	Location Map for CAS TA-19-002-TAB2, Debris Mound	10
2-2	Location Map for the NEDS Lake Trench, CAU 410, CAS TA-21-003-TANL	11
2-3	Location Map of SW Antelope Lake Trench, CAU 410, CAS TA-21-002-TAAL	13
2-4	Location Map and Site Layout for CAU 410, CAS 09-21-001-TA09	14
2-5	Location Map and Site Layout for CAU 410, CAS 03-09-01	16
3-1	CAU 410 General Conceptual Site Model	24
4-1	Sample Location Map for CAS TA-19-002-TAB2, Debris Mound	39
4-2	Sample Location Map for the NEDS Lake Trench, CAU 410, CAS TA-21-003-TANL	40
4-3	Sample Location Map of SW Antelope Lake Trench, CAU 410, CAS TA-21-002-TAAL	41
4-4	Sample Location Map and Site Layout for CAU 410, CAS 09-21-001-TA09	42
4-5	Sample Location Map and Site Layout for CAU 410, CAS 03-09-01	44
A.1-1	CAU 410 General Conceptual Site Model	A-5
A.1-2	Decision Flow Chart	A-12

List of Tables

Number	Title	Page
3-1	Analytical Requirements for CAU 410	30
3-2	Minimum Detectable Concentrations, Preliminary Action Levels, and Minimum Reporting Limits for Radionuclides in Samples Collected at CAU 410	34
3-3	General Geotechnical and Hydrological Analysis	35
5-1	Waste Management Regulations and Requirements	48
6-1	Laboratory and Analytical Performance Criteria for CAU 410 Data Quality Indicators	58
A.1-1	DQO Meeting Participants	A-2
A.1-2	Past Use and Physical Description	A-6
A.1-3	Future Land-Use Scenarios for CASs Within CAU 410	A-8
A.1-4	Analytical Methods for CAU 410	A-10
A.1-5	Information Needs to Resolve Decision I	A-15
A.1-6	Information Needs to Resolve Decision II	A-16
A.1-7	Spatial and Temporal Boundaries for CAU 410	A-19
A.1-8	Practical Constraints Identified for CAU 410	A-20

List of Acronyms and Abbreviations

ALARA	As-low-as-reasonably-achievable
bgs	Below ground surface
BN	Bechtel Nevada
CADD	Corrective action decision document
CAI	Corrective action investigation
CAIP	Corrective action investigation plan
CAI	Corrective action investigation
CAS	Corrective action site
CAU	Corrective action unit
CFR	*Code of Federal Regulations*
CLP	Contract laboratory program
COC	Contaminant of concern
COPC	Contaminant of potential concern
CRDL	Contract-required detection limit
Cs	Cesium
CSM	Conceptual site model
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
dpm/100 cm^2	Disintegrations per minute per 100 square centimeters
DQI	Data quality indicator
DQO	Data quality objective
DRO	Diesel-range organics

List of Acronyms and Abbreviations *(Continued)*

DU	Depleted uranium
EM	Electromagnetic
EPA	U.S. Environmental Protection Agency
FFACO	*Federal Facility Agreement and Consent Order*
FSL	Field-screening level
FSR	Field-screening result
ft	Foot (feet)
GRO	Gasoline-range organics
HASP	Health and Safety Plan
HE	High explosives
HWAA	Hazardous waste accumulation area
IDW	Investigation-derived waste
IRIS	Integrated Risk Information System
ISMS	Integrated Safety Management System
ITLV	IT Corporation, Las Vegas Office
LCS	Laboratory control sample
LLNL	Lawrence Livermore National Laboratory
LLW	Low-level radioactive waste
MDA	Minimum detectable activity
MDC	Minimum detectable concentration
mi	Mile
mg/kg	Milligram per kilogram
MRL	Minimum reporting limit
MS	Matrix spike

List of Acronyms and Abbreviations *(Continued)*

MSD	Matrix spike duplicate
NAC	*Nevada Administrative Code*
ND	Normalized difference
NDEP	Nevada Division of Environmental Protection
NEDS	Nonexplosive Destruct System
NEPA	*National Environmental Policy Act*
NNSA/NV	U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office
NRS	*Nevada Revised Statutes*
NTS	Nevada Test Site
NTSWAC	*Nevada Test Site Waste Acceptance Criteria*
PAL	Preliminary action level
PCB	Polychlorinated biphenyl
pCi/g	Picocuries per gram
PPE	Personal protective equipment
ppm	Part per million
PRG	Preliminary remediation goal
Pu	Plutonium
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RCA	Radiological control area
RCRA	*Resource Conservation and Recovery Act*
RMA	Radioactive materials area

List of Acronyms and Abbreviations *(Continued)*

ROTC	Record of technical change
RPD	Relative percent difference
SAA	Satellite accumulation area
SDWS	*Safe Drinking Water Standards*
SNL	Sandia National Laboratories
SSHASP	Site-specific health and safety plan
SVOC	Semivolatile organic compound
TPH	Total petroleum hydrocarbon
TTR	Tonopah Test Range
U	Uranium
UXO	Unexploded ordnance
VOC	Volatile organic compound
%R	Percent recovery

Executive Summary

This Corrective Action Investigation Plan contains the project-specific information including facility descriptions, environmental sample collection objectives, and criteria for conducting site investigation activities at Corrective Action Unit (CAU) 410: Waste Disposal Trenches, Tonopah Test Range, Nevada. The results of the field investigation will support a defensible evaluation of corrective action alternatives in the Corrective Action Decision Document.

Corrective Action Unit 410 is comprised of the following Corrective Action Sites (CASs):

- TA-19-002-TAB2, Debris Mound
- TA-21-003-TANL, Disposal Trench
- TA-21-002-TAAL, Disposal Trench
- 09-21-001-TA09, Disposal Trenches
- 03-19-001, Waste Disposal Site

The CASs are located throughout the Tonopah Test Range. The data quality objectives process was used to identify and define the type and quality of data needed to complete the investigation for the CAU 410 corrective action process. An investigation strategy was developed to address the data needs during the investigation. The investigation will determine if contaminants are present in concentrations exceeding preliminary action levels which define a contaminant of concern (COC). By identifying the COCs, the nature of the contamination is defined. If the investigation indicates the presence of COCs, the lateral and vertical extent of contamination will be defined. Corrective action alternatives of closure-in-place and clean closure will then be evaluated for each CAS with COCs.

Based on process knowledge, contaminants of potential concern for CAU 410 are primarily radionuclides, high explosives, and total petroleum hydrocarbons. To address process knowledge uncertainty, the analytical program for all CAS locations, with the exception of CAS 03-19-001, will include the analytes specific to the location plus volatile organic compounds, semivolatile organic compounds, and *Resource Conservation and Recovery Act* metals. In general, field activities will consist of geophysical and radiological surveys, and collecting soil samples at biased locations by appropriate methods. The technical approach for investigation of CAU 410 will consist of the following activities:

- Remove metal structure at CAS TA 21-003-TANL (completed).

- Perform surface radiological surveys (completed).

- Perform geophysical surveys at all CAS locations to identify any subsurface metal debris (completed).
- Collect and analyze samples from biased locations.
- Perform field screening for applicable contaminants of potential concern corresponding to each CAS.
- Collect required quality control samples.
- Collect additional samples, as necessary, to estimate potential waste streams.
- Collect samples from native soils and analyze for geotechnical/hydrologic parameters, if necessary.
- Collect and analyze bioassessment samples as appropriate (e.g., if volatile organic compounds exceed field-screening levels in a pattern that suggests a plume may be present).
- Perform radiological surveys of debris identified during the investigation including the structure at CAS TA-21-003-TANL.
- Stake or flag sample locations and record coordinates (in North American Datum 1927 coordinate system).

This Corrective Action Investigation Plan has been developed in accordance with the *Federal Facility Agreement and Consent Order* that was agreed to by the State of Nevada, the U.S. Department of Energy, and the U.S. Department of Defense. Under this agreement, 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) 410: Waste Disposal Trenches, Tonopah Test Range (TTR), Nevada.

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

The TTR, which is included in the Nevada Test and Training Range (formerly called the Nellis Air Force Range), is approximately 140 miles (mi) northwest of Las Vegas, Nevada (Figure 1-1). Corrective Action Unit 410 is comprised of the five corrective action sites (CASs). Figure 1-2 shows the locations of the five CASs within TTR.

Corrective Action Unit 410 is comprised of the following CASs:

- TA-19-002-TAB2, Debris Mound
- TA-21-003-TANL, Disposal Trench
- TA-21-002-TAAL, Disposal Trench
- 09-21-001-TA09, Disposal Trenches
- 03-19-001, Waste Disposal Site

1.1 Purpose

The five CASs in CAU 410 are being investigated because contaminants may be present in concentrations that could potentially pose a threat to human health and the environment, and waste may have been disposed of without appropriate controls.

Existing information and process knowledge on the expected nature and extent of contamination are insufficient to select preferred corrective actions; therefore, additional information will be obtained by field investigation prior to evaluating appropriate corrective actions specific to each CAS.

The sites will be investigated based on data quality objectives (DQOs) developed by representatives of the Nevada Division of Environmental Protection (NDEP) and the DOE National Nuclear Security

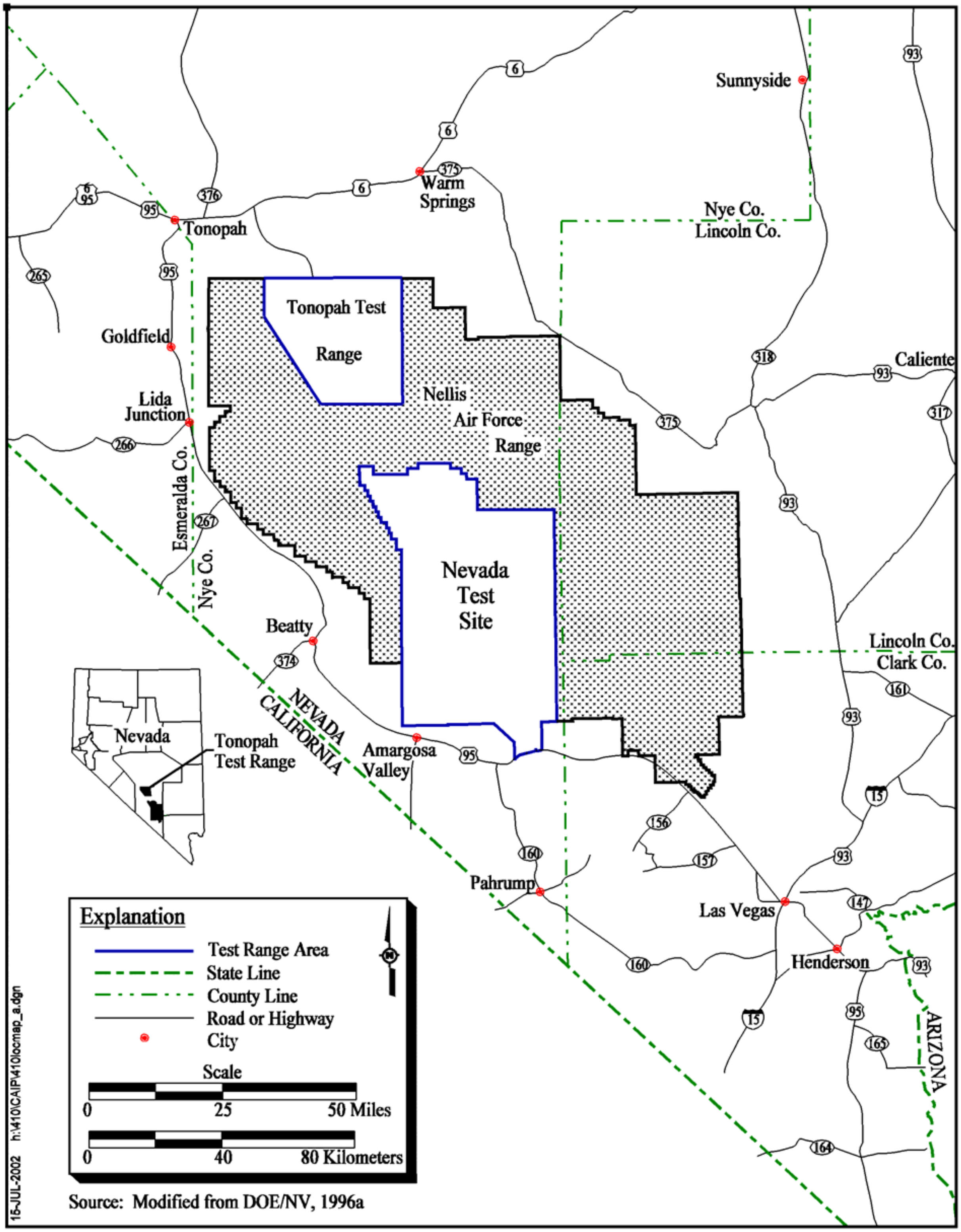

Figure 1-1
Tonopah Test Range Location Map

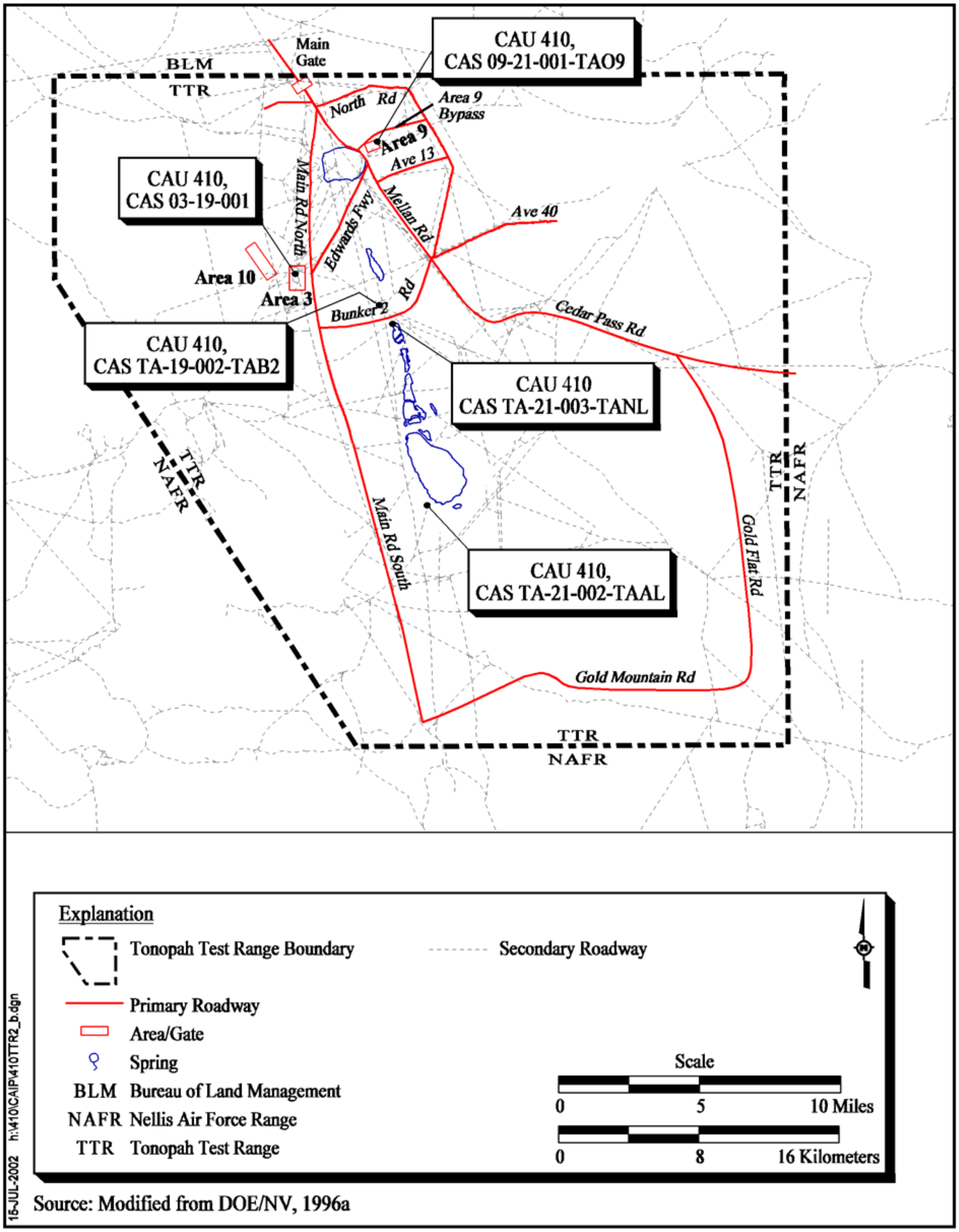

Figure 1-2
TTR CAU 410 CAS Location Map

Administration Nevada Operations Office (NNSA/NV). The DQOs are used to identify and define the type, amount, and quality of data needed to develop and evaluate appropriate corrective actions for CAU 410. The DQO strategy for CAU 410 is as follows:

- Decision I for CAU 410 is to "Define the nature of contamination at a location" by identifying any contamination above preliminary action levels (PALs). Data must be collected in areas most likely to contain disposed waste, and samples must be collected from areas most likely to be contaminated. If PALs are not exceeded, then the investigation is complete. If PALs are exceeded, then Decision II must be resolved.

- Decision II for CAU 410 is to "Determine the extent of contamination identified above PALs." This will be achieved by the data collection must be adequate to detect contaminants of concern (COCs) in samples.

This CAIP describes the strategy to collect sufficient data to evaluate appropriate corrective actions. Most of the data will be generated from analytical results of environmental samples collected during the corrective action investigation (CAI). The general purpose of the investigation is to:

- Identify the presence and nature of contaminants of potential concern (COPCs).

- Determine whether COPCs exceed PALs, thereby becoming COCs.

- Determine the vertical and lateral extent of COCs, if present.

- Ensure that all NDEP, *Resource Conservation and Recovery Act* (RCRA), and DOE closure requirements have been met.

The five CASs in CAU 410 are described in the following sections.

1.1.1 CAS TA-19-002-TAB2, Debris Mound

This CAS is described as a debris mound and is located in the north Nonexplosive Destruct System (NEDS) Lake area near Bunker 2. This CAS is a mounded area approximately 15 x 20 feet (ft) in diameter in a disturbed area approximately 110 x 120 ft. The site contains metal and possible ordnance as well as metal and parachute debris protruding from the surface of the mound. Geophysical surveys identified metallic subsurface debris consistent with the debris identified at the surface.

1.1.2 CAS TA-21-003-TANL, Disposal Trench

This CAS location is a disposal trench located in the north NEDS Lake area near the dry lake bed. The site consists of one trench that was covered by an arched structure composed of metal and wood. The trench is approximately 20 x 50 ft and there is an obvious depression where the trench is located. This site was used for a series of tests conducted in the 1960s and 1970s called the “suitcase tests” and for containment capability tests. The CAS may contain beryllium, radiological constituents, total petroleum hydrocarbons (TPH), explosives, and rocket propellant. There is no surface metal or debris visible; however, geophysical surveys identified subsurface metallic debris at the east end of the trench.

1.1.3 CAS TA-21-002-TAAL, Disposal Trench

This CAS is classified as a disposal trench and is located in a disturbed area with a circumference of approximately 883 ft. There is no obvious trench configuration visible from the surface, but there is partially buried and surface debris visible at the surface. Geophysical surveys identified four areas of subsurface metallic debris consistent with trenches in the disturbed area.

1.1.4 CAS 09-21-001-TA09, Disposal Trenches

This CAS consists of two open trenches in a perpendicular configuration. The trenches are approximately 198 x 90 ft (east-west trench) and 56 x 268 ft (north-south trench). The site is documented to have provided fill material for the covers of nearby bunkers and as a possible construction materials dump. There is no obvious staining; however, there is limited construction debris throughout the site. Geophysical surveys did not identify any subsurface metallic debris at the location.

1.1.5 CAS 03-19-001, Waste Disposal Site

This location was identified as a Waste Disposal Site as a result of the CAU 405 investigation. There was debris found at the 4.5- to 5-ft interval, and TPH was identified above the PALs. Bechtel Nevada (BN) field screened additional locations to identify the plume. This site borders a current use restriction for the a landfill in CAU 424. There is no debris present at the surface and no subsurface metallic debris was identified during the geophysical surveys.

1.2 Scope

The scope of the investigation is to generate information needed to resolve the decision statements identified in the DQO processes. The DQO decision statements are:

- Define nature by identifying presence or absence of COCs at a location.
- Determine extent of contamination by establishing lateral and vertical boundaries of identified COCs.

To address the decision statements, the scope of the corrective action investigation for CAU 410 includes the following activities :

- Conduct radiological surveys at all CAS locations, except CAS 03-19-001 (completed).
- Remove the structure over the trench at CAS TA-21-003-TANL (completed).
- Conduct geophysical surveys at all CAS locations (completed).
- Collect environmental samples and submit for laboratory analysis to determine if COCs are present.
- Collect samples of investigation-derived waste (IDW), as needed, for waste management and minimization purposes.
- Collect soil samples for laboratory analysis of geotechnical parameters, as needed.

1.3 CAIP Contents

The managerial aspects of this project are discussed in the *Project Management Plan* (DOE/NV, 1994a) and will be supplemented with a site-specific field management plan that will be developed prior to field activities. Section 1.0 presents the purpose and scope of this CAIP, while Section 2.0 provides background information about the CAU. The objectives, including the conceptual site models, are presented in Section 3.0. Field sampling activities are discussed in Section 4.0, and waste management for this project is discussed in Section 5.0. General field and laboratory quality assurance (QA) and quality control (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, 2002b). The project schedule and records availability are discussed in Section 7.0. Section 8.0 provides a list of references. Appendix A provides a DQO summary, while Appendix B contains information on the project organization. Appendix C provides response to NDEP comments on the Draft CAIP. The health and safety aspects of this project are documented in the IT Corporation, Las Vegas (ITLV) *Health and Safety Plan* (HASP) (IT, 2001a), and will be supplemented with a site-specific health and safety plan 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).

2.0 Facility Description

Corrective Action Unit 410 is comprised of five CASs, which were grouped together for site closure based on the similarity of the sites (waste disposal sites and trenches), and because they are all located at the TTR. All five of these CASs are the result of weapons testing and disposal activities.

2.1 Physical Setting

The following sections describe the general physical setting of the TTR. General background information pertaining to topography, geology, hydrogeology, and climatology are provided for these specific areas of the TTR region as described in the *Geology of Northern Nellis Air Force Base Bombing and Gunnery Range, Nye County, Nevada* (USGS, 1971); *Resource Conservation and Recovery Act Facility Investigation Work Plan* (DOE/NV, 1994b) the *Environmental Assessment, Tonopah Test Range* (ERDA, 1975); and the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996b).

Most of TTR, including Area 9, Area 3, Main Lake, NEDS Lake, and Antelope Lake where these CASs are located, is located in Cactus Flat. Cactus Flat is an intermontane basin, typical of the Basin and Range Physiographic Province, surrounded by the Cactus Range to the southwest, the northern portion of Kawich Range to the east, and the Monitor Range to the north. Cactus Flat is made up of Quarternary-aged alluvium eroded from the surrounding volcanic highlands. The alluvium can be divided into local landslide and talus, fan alluvium, valley-filled alluvium, and lake and shoreline deposits; each division differs in grain size, locality, and/or degree of compaction and cementation (DOE/NV, 1994b; USGS, 1971).

2.1.1 CAS TA-19-002-TAB2, Debris Mound

This CAS is located on the north end of NEDS Lake. This specific area of NEDS Lake is a dry, flat lake bed or playa containing sparse vegetation. The surface of the lake bed is smooth with large dessication cracks. The geology of the NEDS area consists of a moderately thick soil layer. Under the soil layer there is likely to be playa deposits underlain by a thick sequence of valley-fill alluvium consisting of brown gravel and course sand. Well EH-4, which is approximately 6 mi west of the NEDS site, penetrated a thick sequence of sand and gravel overlying a thick (150 ft) clay sequence at approximately 250 ft (DOE/NV, 1994b). The depth of the alluvium is unknown, but exploratory drilling at Well EH-4 discovered the thickness to exceed 1,000 ft (DOE/NV, 1996a). The alluvium layer is underlain by genetically related tufts and lavas of the Thirsty Canyon Tuff unit, which can have a thickness of up to 500 ft. Beneath the Thirsty Canyon Tuff unit lies the rhyolitic tuffs of the Timber Mountain tuff unit and the rhyolitic ash-fall of the Paintbrush Tuff unit. The Paintbrush Tuff unit is underlain by various layers of Miocene-aged volcanic lavas and tuffs and various-aged limestone and dolomite layers. (USGS, 1971)

The water level at Well EH-4 is approximately 315 ft below ground surface (bgs) (USGS, 2001). From Cactus Flat, groundwater flows northwest between Cactus Peak and Monitor Hills and then southwest into Stonewall Flat and Gold Flat at a discharge rate of 4.2×10^7 cubic ft per year. Ultimately, the groundwater discharges into Death Valley (DOE/NV, 1994b; DOE/NV, 1996b).

The site consists of a disturbed mounded area with very little vegetation. The debris mound is approximately 15 x 20 ft and 0.5-ft high with several small depressions throughout the area. Debris exposed on the mound consist of a broken sandbag, rusted metal pieces, a harness, a rusted metal box, wire, wood, small pieces of potential ordnance, and small ammunition casings that appear to be spent. According to the geophysical surveys subsurface debris identified is confined to the mound area (Shaw E & I, 2002). Figure 2-1 represents the current site conditions of the CAS.

2.1.2 CAS TA-21-003-TANL, Disposal Trench

The groundwater flow and geology are similar to that stated for CAS TA-19-002-TAB2. This site is also located at the northern end of NEDS Lake.

The Disposal Trench contains a few pieces of metal scrap and wood, and there is an arched steel and wood-plank structure which covers the trench. The site is approximately 48 x 18 x 3 ft. The site is posted within a soil contamination area and contains possible spent munitions. Miscellaneous debris is located in and around the trench. According to the geophysical surveys, the subsurface debris is confined to the eastern edge of the trench (Shaw E & I, 2002). Figure 2-2 represents the current site conditions of the CAS.

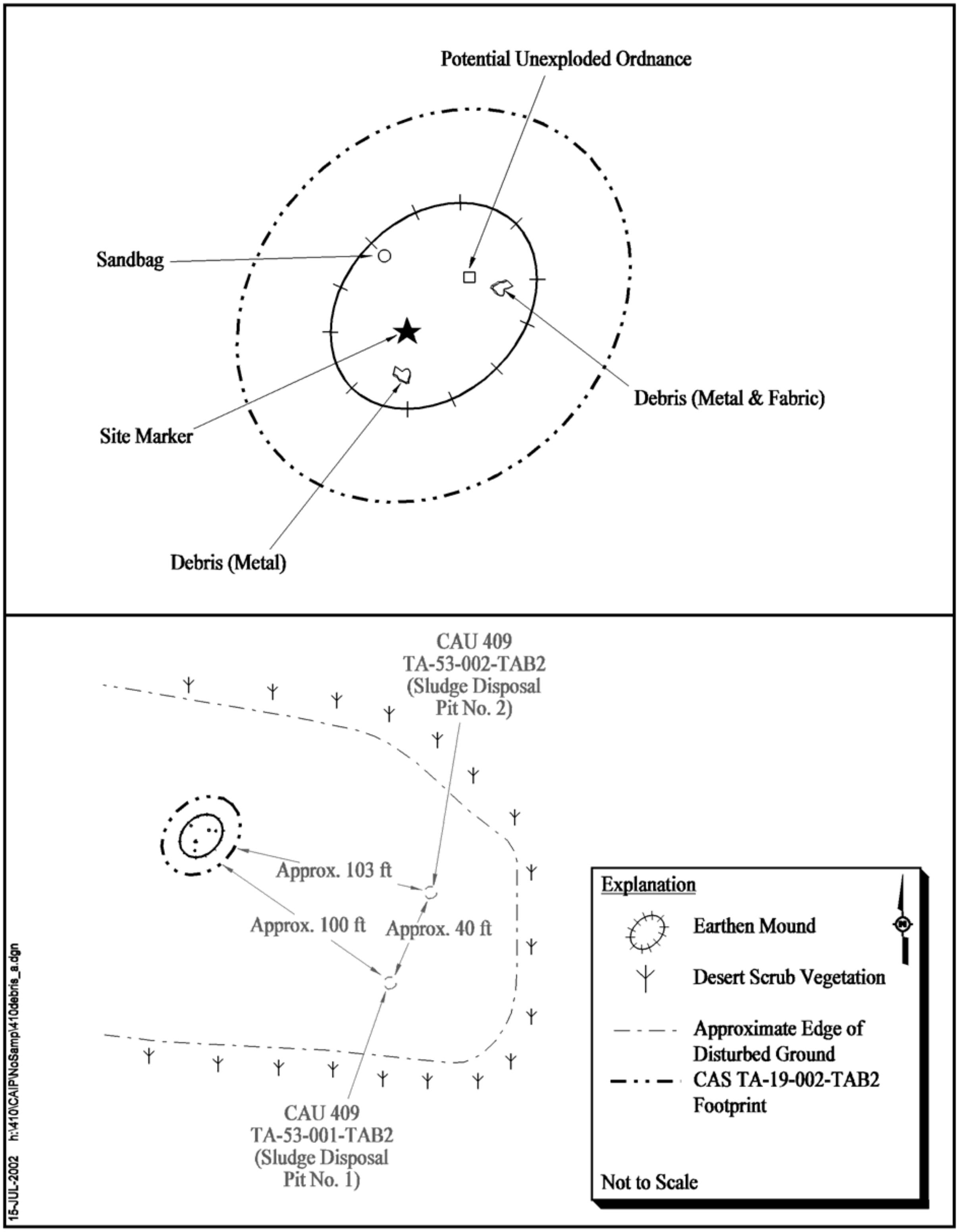

Figure 2-1
Location Map for CAS TA-19-002-TAB2, Debris Mound

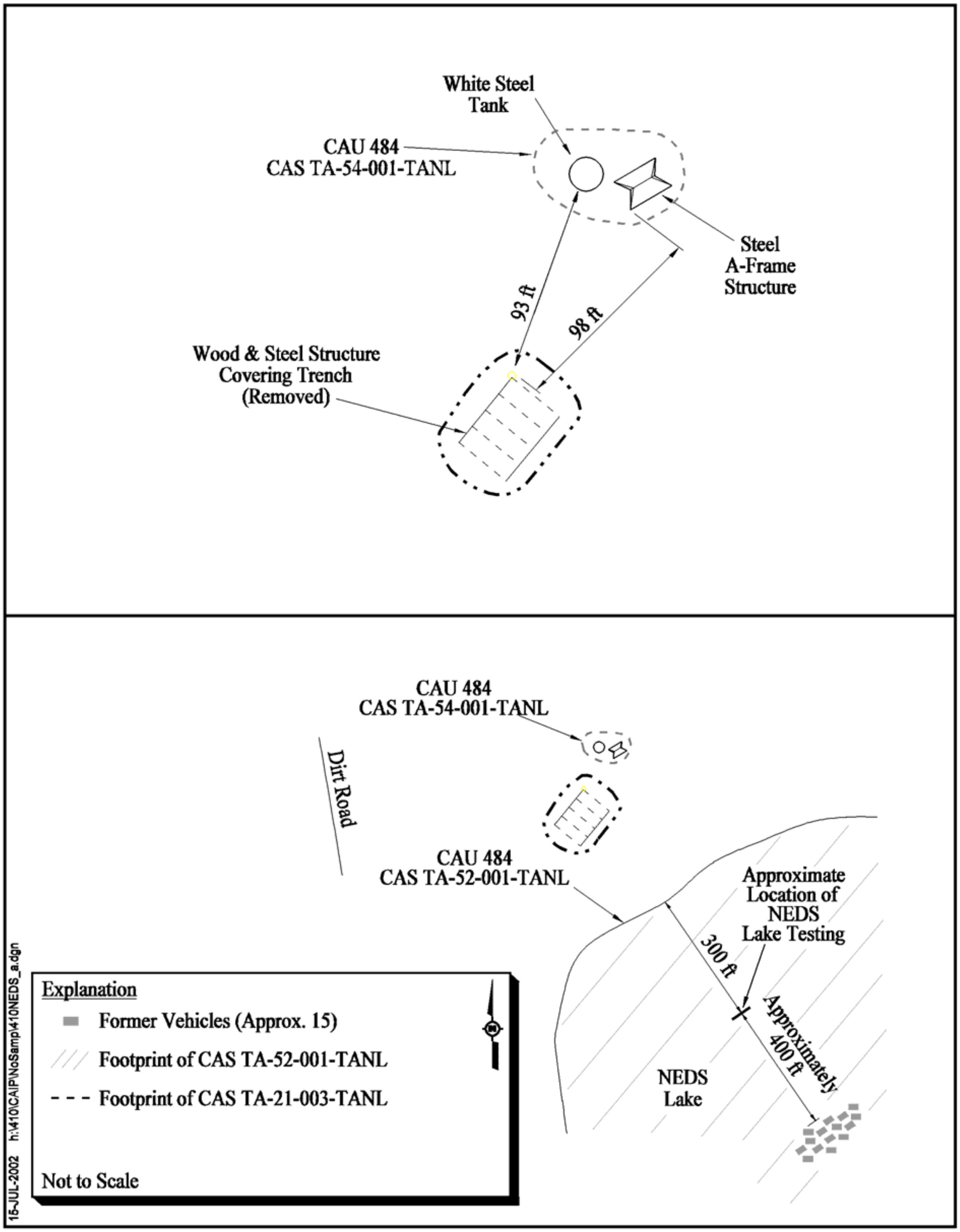

Figure 2-2
Location Map for the NEDS Lake Trench, CAU 410, CAS TA-21-003-TANL

2.1.3 CAS TA-21-002-TAAL, Disposal Trench

The groundwater flow and geology are similar to that stated for CAU TA-19-002-TAB2. This site is located at the south end of Antelope Lake.

There is no surface expression of a trench in the area; however, the area is disturbed. The disturbed surface has a circumference of approximately 883 ft. There is little or no vegetation at the CAS and the northeast corner was bulldozed into a mound. There is surface debris scattered throughout the area consisting of metal pieces, rusted shrapnel, wood, and cable. A geophysical survey conducted in 2002 identified subsurface debris in four trench/burial pit areas. Two anomalous locations in the northern area of the sites may contain large buried debris. The southern two areas exhibit the traits of smaller or not densely distributed debris (Shaw E & I, 2002). The southern portion of the mound appears to have eroded and washed away. Figure 2-3 represents the current site conditions of the CAS.

2.1.4 CAS 09-21-001-TA09, Disposal Trenches

The geology for this CAS is the same as the Cactus Flats Region described in Section 2.1. A well, TTR Sandia 5, is located in the vicinity of the CAS south of the Main Lake, and is an active Environmental Restoration well. The water level at TTR Sandia 5 is approximately 156 ft bgs (USGS, 2001).

Vegetation is sparse on the sloping edges of the trenches and there is concrete and visible surface debris contained in both; however, material does not appear to be buried. The north-south trench is 288 x 56 x 4 ft and the east-west trench is 498 x 90 x 5 ft.

Geophysical surveys did not identify any subsurface anomalies. The only anomalies identified were consistent with existing surface metallic debris (Shaw E & I, 2002). Figure 2-4 represents the current site conditions of the CAS.

2.1.5 CAS 03-19-001, Waste Disposal Site

This CAS was identified during the CAU 405, Area 3 Septic Systems, characterization activities. During the CAU 405 investigation, debris and staining were identified outside of the boundaries of

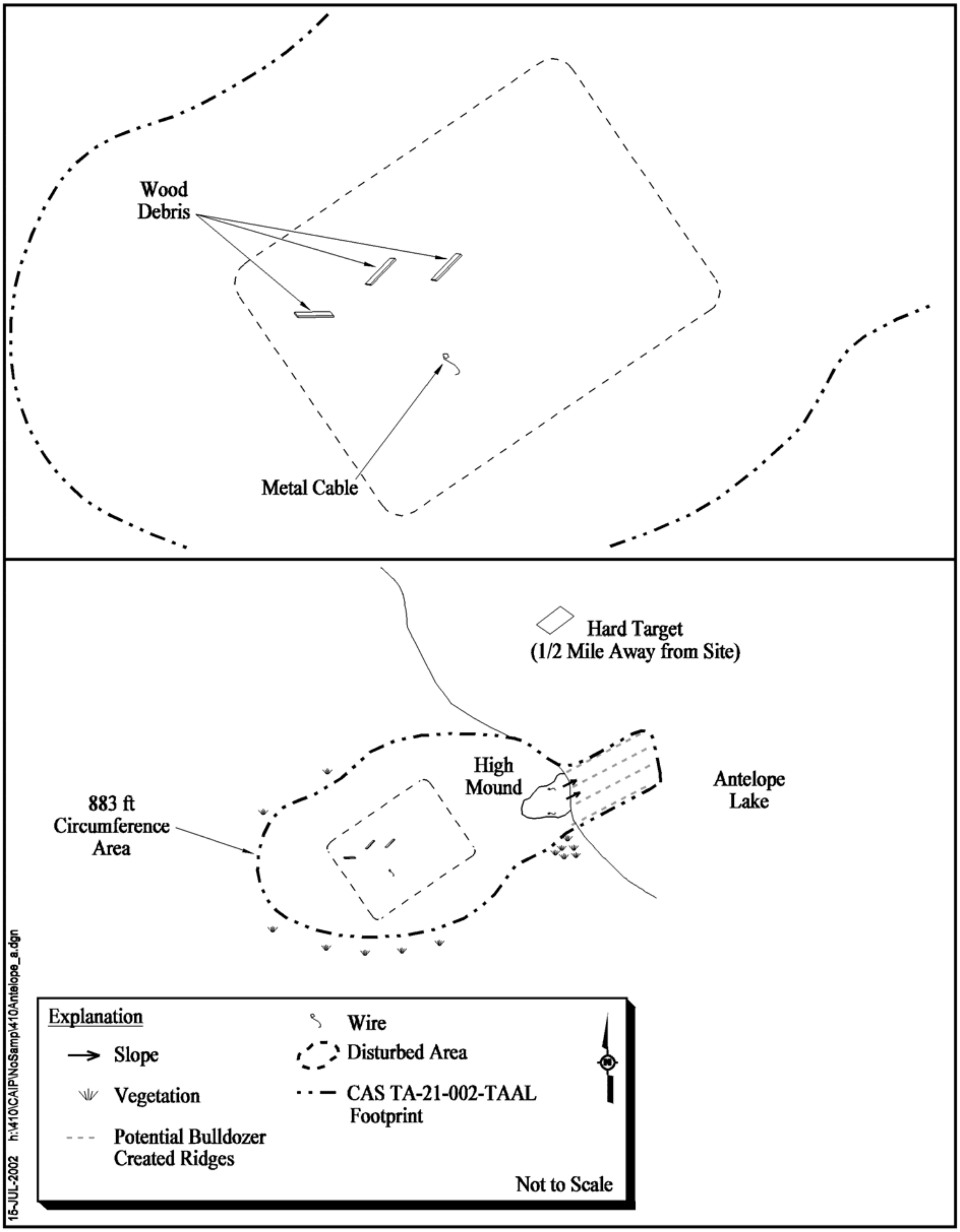

Figure 2-3
Location Map of SW Antelope Lake Trench, CAU 410, CAS TA-21-002-TAAL

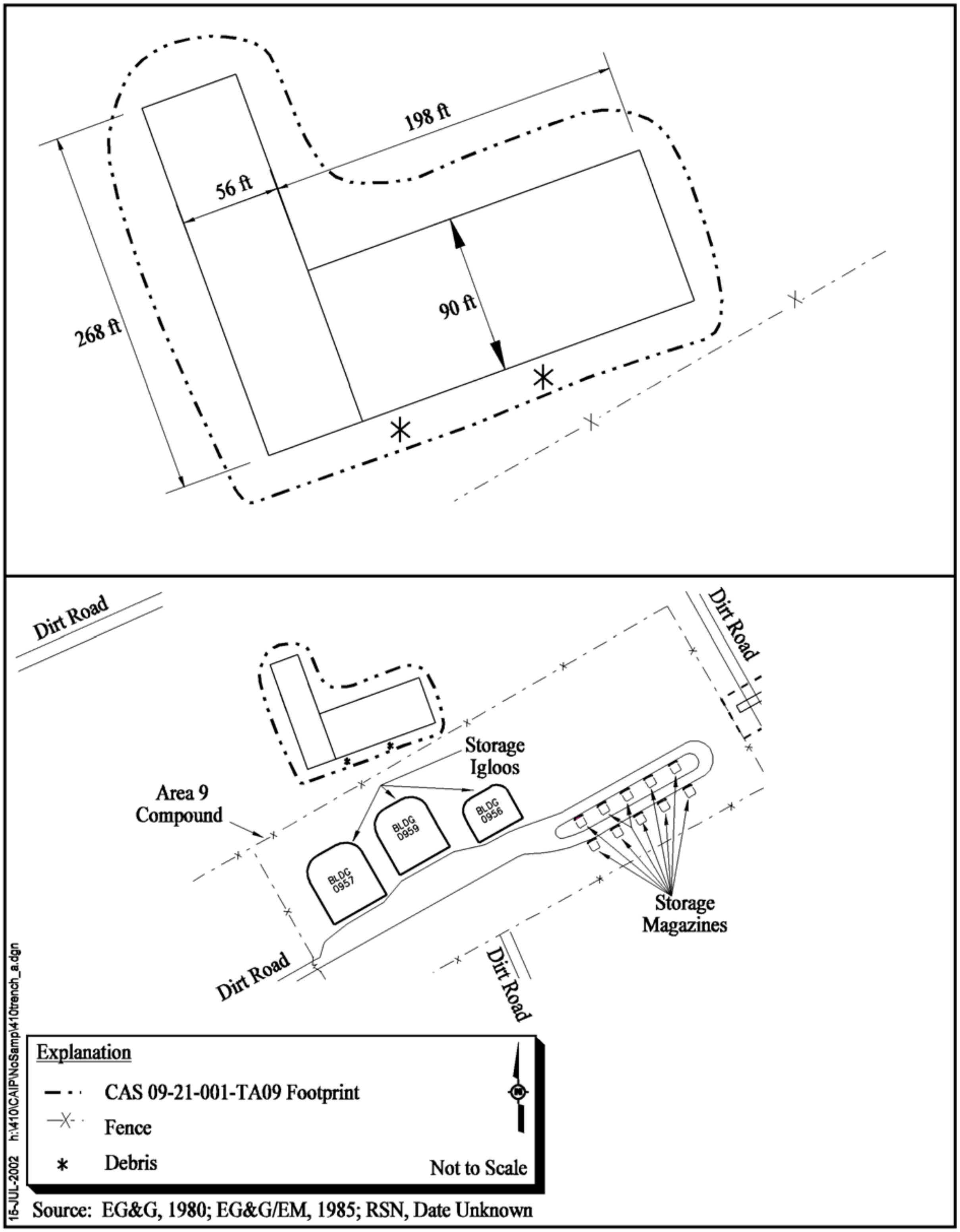

Figure 2-4
Location Map and Site Layout for CAU 410, CAS 09-21-001-TA09

the original CAS at the SWS-4 location. The TPH diesel-range organics (DRO) contamination existing at CAS 03-19-001 is limited to the 4.5- to 5-ft interval. During the CAU 405 excavation at that location, hardpan/caliche at the 9- to 9.5-ft interval resulted in refusal in the area.

Bechtel Nevada results from the Petroflag TPH screening indicated results below the 100 parts per million (ppm) action level for all locations except for the sample directly to the west of the original sample location identified during the CAU 405 investigation. The sample to the west had a reading of 194 ppm for TPH.

This CAS is located in Area 3 of the TTR. Surface materials around the site consists of pavement, sand, gravel, and cobbles with little or no vegetation. The topography around Area 3 slopes in all directions and surface drainage flows northwest. Depth to groundwater beneath Area 3 is estimated at 361 to 394 ft bgs. The groundwater flow direction is generally to the north-northwest. (DOE/NV, 1996b).

Currently, a use restriction is in place on CAU 424, Area 3 Landfill Complex; CAS 03-08-002-A303, Landfill Cell A3-3 located approximately 80 ft southwest of the identified location. Debris identified at this location includes wire, glass, burned material, asphalt, and soil with rust residue at the 4.5- to 5-ft interval. Geophysical surveys did not identify any subsurface debris at this location (Shaw E & I, 2002). Figure 2-5 represents the current site conditions of the CAS.

2.2 Operational History

The following subsections provide a description of the use and history of each of the CASs in CAU 410 that may have resulted in a potential release to the environment. The CAS-specific summaries are designed to illustrate all significant, known activities.

2.2.1 CAS TA-19-002-TAB2, Debris Mound

The disposal mound was discovered east of Bunker 2 on July 24, 1993. The origin and purpose of the debris mound is uncertain; however, it has been suggested that the debris is remnant of parachute retard airdrop tests or NEDS Lake tests conducted at the TTR (Dubiskas, 1998). Figure 2-1 is a site sketch of CAS TA-19-002-TAB2, Debris Mound.

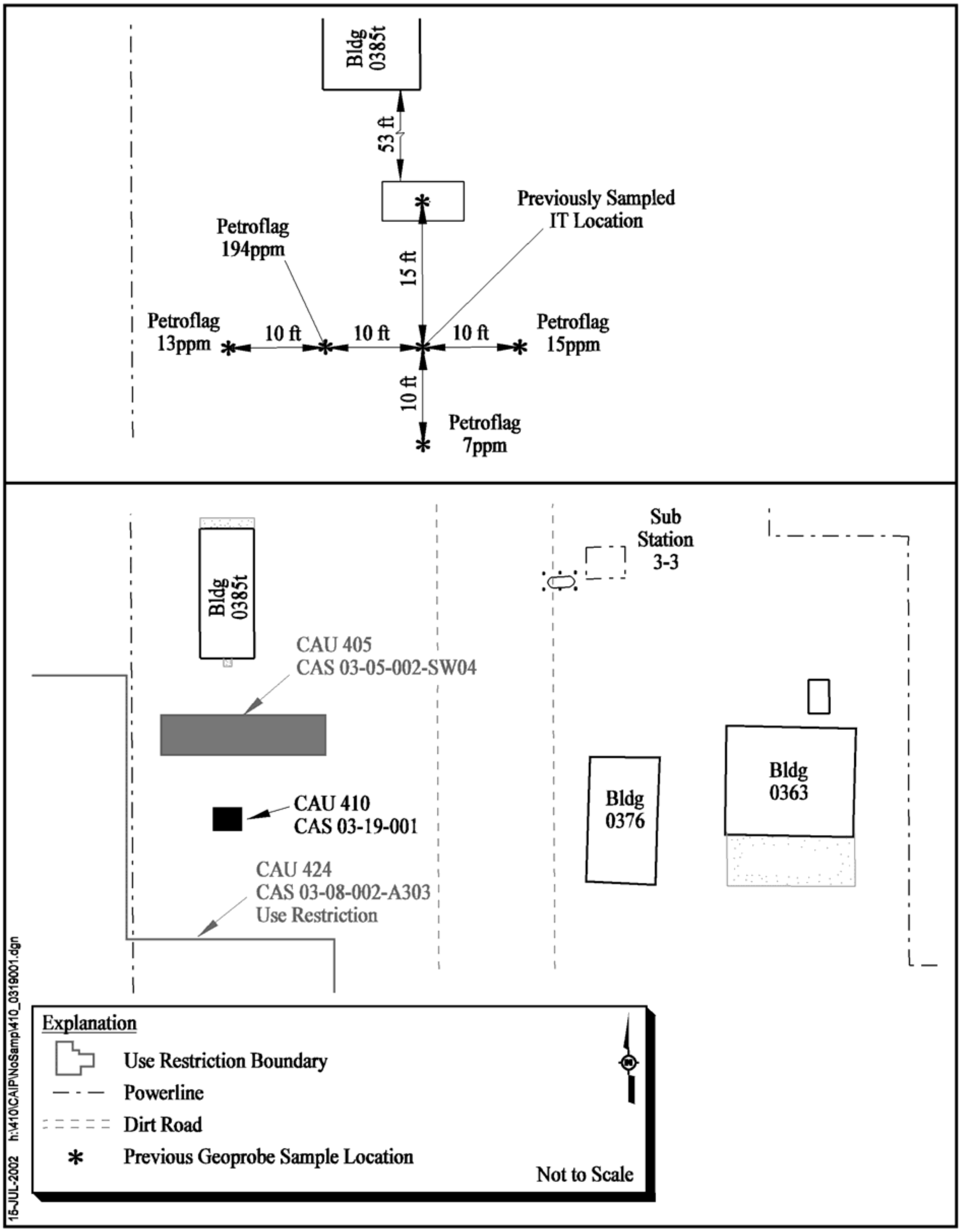

Figure 2-5
Location Map and Site Layout for CAU 410, CAS 03-09-01

2.2.2 CAS TA-21-003-TANL, Disposal Trench

During 1974, Lawrence Livermore National Laboratory (LLNL) performed a series of tests on the NEDS Lake. These NEDS tests were conducted in an attempt to create and test a transportable containment system for shrapnel and gaseous products. Depleted uranium (DU) and beryllium were dispersed during the tests (Galvin, Quas, and Statler, 1993). This CAS was used as shelter from the detonations; however, it is unknown specifically what was being sheltered during the NEDS tests. According to historical documentation, all of the test materials used in the NEDS tests were taken back to LLNL. In 1975, Sandia National Laboratories (SNL) performed a sweep of the test area and removed DU and beryllium for disposal at the Nevada Test Site (NTS) (E&E, 1989). Figure 2-2 is a site sketch of CAS TA-21-003-TANL, Disposal Trench.

It is also believed that from the late 1960s to the mid-1970s, the trench and the wood and metal structure covering it were used to contain explosives from other tests. These were referred to as the suitcase tests. Historical information indicates that DU was used in at least one of these tests. Lawrence Livermore National Laboratory may have participated in these tests (Kluesner, 2001).

2.2.3 CAS TA-21-002-TAAL, Disposal Trench

This CAS is located in an active target area referred to as Antelope Lake. Interviews suggest that materials resulting from activities conducted in the area, were disposed of in the former trench starting in the 1960s and continuing again in the 1980s through 1990s. Based on interviews with past and present TTR personnel, the site may have been excavated to provide soil used to fill holes that were created by the Plowshare Project. It is uncertain as to what specific materials and quantities were disposed in the trench (Galvin, 2001). The tests that took place on Antelope Lake include the 1962 Dispersal Test, 1970 Test, W79 Test, W33 Gun Round testing, Joint Test Assembly Tests, LLNL Metal Particle Dispersion Tests, and the Plowshare Project. The disturbed area of the site may have been the result of a recovery effort for a penetrator that landed in the area in 1992 (Dubiskas, 1997). In addition, TTR personnel performed a clean-up effort on Antelope Lake during 1982 to remove rocket motor debris using front-end loaders and may have also potentially disposed of recovered material in the trench. According to an interview, material was no longer buried in disposal trenches after 1985 (Elliston, 1998). Figure 2-3 is a site sketch of CAS TA-21-002- TAAL, Disposal Trench.

2.2.4 CAS 09-21-001-TA09, Disposal Trenches

The buildings, or bunkers, in the fenced compound in Area 9 are constructed with earthen material covering the exterior and are used for storage. According to interviews and engineering drawings, the trenches were dug in order to supply the bunkers with their earthen coverings (Galvin, 2001). The trenches were not present in black and white aerial photographs dated between 1961 and 1963. However, an engineering drawing from Building 09-57 dated 1965, has an arrow pointing toward the current trench location which reads "Borrow Area 1,000 ft," indicating that the trenches were probably excavated around this time.

In addition to being used as a source for borrow material, interviews have indicated that the trenches were also used for disposal of excess concrete or rinsate. In the early to mid-1970s, the Tornado series of tests were conducted in Area 9 to simulate flying debris colliding with nuclear test reactor containment structures. The concrete trucks used for these tests may have used these trenches to dispose of residual concrete (Kluesner, 2001). Another possible use of the trenches, was as temporary storage for explosive mounts. Figure 2-4 is a site sketch of the CAS 09-21-001-TA09, Disposal Trench.

2.2.5 CAS 03-19-001, Waste Disposal Site

No historical documentation has been identified to suggest the time frame or reason why there is buried debris at the location identified. Figure 2-5 is a site sketch of CAS 03-19-001, Waste Disposal Site.

2.3 Waste Inventory

In general, any of the CASs addressed by this CAU may have been used to dispose of material considered to be hazardous or radioactive waste by current standards. Interviews with former site employees, review of procedures, and interpretations of aerial and ground photographs indicate that potential waste may include miscellaneous debris, radiologically contaminated materials (primarily DU), unexploded ordnance (UXO), and/or potentially hazardous wastes.

2.4 Release Information

The sources of potential contamination related to the CAU 410 CASs are varied, but are generally representative of each of the conceptual site model (CSM) elements developed during the DQO process. The CAS-specific release information, migration routes, exposure pathways, and affected media are discussed below, and additional information can be found in Section A.1.1.3.

- CAS TA-19-002-TAB2 has a documented release of high explosives (HE) and radiological constituents to the surface and subsurface soils.
- CAS TA-21-003-TANL identified DU, beryllium, TPH, HE, and rocket propellant to the subsurface soils confined to within the boundary of the trench.
- CAS TA-21-002-TAAL identified asbestos, total RCRA metals, beryllium, radiological constituents, HE, and TPH as being possibly released to the subsurface soils.
- CAS 09-21-001-TA09 identified HE as being possibly released to the subsurface soils at this location.
- CAS 03-19-001 has a documented release of TPH DRO to the subsurface soils at this site.

Potentially affected media for all CASs includes surface and subsurface soil. Exposure points for all CAU 410 CASs are the disturbed soils found between the native-soil interface and the ground surface. Exposure pathways to site workers include oral ingestion, inhalation, and dermal contact (absorption) of soils due to disturbance of contaminated soils. Vertical and lateral migration routes are possible for all CASs as determined by historical documentation and process knowledge. Migration may have occurred by contaminants being transported by infiltration of precipitation through surface soil which serves as a driving force for downward migration of contaminants.

Adjacent CAS locations have been identified for the following sites:

- CAS TA-19-002-TAB2 has two sites that have been identified east of the site: CAS TA-53-001-TAB2 and CAS TA-53-002-TAB2 (CAU 409). There are no documented releases from these sites that are expected to impact this site.
- CAS TA-21-003-TANL has two CASs that are located to the north and east of this: CAS location: CAS TA-54-001-TANL and CAS TA-52-001-TANL (CAU 484). There are no documented releases from these sites that are expected to impact this site.
- CAS TA-21-002-TAAL does not have any other CAS locations in the vicinity.

- CAS 09-21-001-TA09 does not have any other CAS locations in the vicinity.
- CAS 03-19-001 is located near two CASs. The site that identified this location, CAS 03-05-002-SW04 (CAU 405). Additionally, CAS 03-08-002-A303 (CAU 424) is located to the south and west of the site. Neither of these CASs are expected to have releases associated with this site.

2.5 Investigative Background

Site investigation activities associated with CAU 410 have been identified and generally documented in the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996b). Previous analytical sampling efforts have been identified for two locations; CAS 03-19-001, Waste Disposal Site, and CAS TA-21-002-TAAL, Disposal Trench. Geophysical and/or radiological surveys have been conducted at all CASs within CAU 410. The following text identifies and describes all known investigation activities conducted at CAU 410 sites.

2.5.1 CAS TA-19-002-TAB2, Debris Mound

Radiological readings were taken from the north and south sides of CAS TA-19-002-TAB2 using an NE Technology Electra alpha, beta/gamma survey meter. Total alpha and beta radiation were elevated above background readings, but no definite areas of concern were identified (IT, 2001b and c). The radiological surveys performed in 2002 did not identify any areas with higher count rates that would require further investigation (IT, 2002). Geophysical surveys conducted in 2002 identified isolated areas consistent with surface or near-subsurface metallic debris in the area of the mound (Shaw E & I, 2002).

2.5.2 CAS TA-21-003-TANL, Disposal Trench

Residual DU and beryllium may be present at CAS TA-21-003-TANL as a result of dispersion from a series of tests conducted at the NEDS Lake in 1974. The radiological surveys performed in 2002 did not identify any areas with count rates that would require further investigation (IT, 2002). Geophysical surveys conducted in 2002 identified isolated areas consistent with subsurface or near-subsurface metallic debris (Shaw E & I, 2002).

2.5.3 CAS TA-21-002-TAAL, Disposal Trench

This CAS is in an area of Antelope Lake where limited soil sampling activities were performed by SNL during October 1992. A total of 14 samples were collected and analyzed for gross alpha, gross beta, total uranium, gamma spectroscopy, and percent moisture. The purpose of these samples was to provide a baseline of potential contamination concentrations within the soil. The results indicated that gross alpha and beta and uranium are within the area's natural levels. Cesium (Cs)-137 concentrations were consistent with fallout concentrations in the area, and americium-241 concentrations were not greater than detection levels (SNL, 1993). The radiological surveys performed in 2002 did not identify any areas with count rates that would require further investigation (IT, 2002). Geophysical surveys conducted in 2002 identified isolated areas consistent with subsurface metallic debris (Shaw E & I, 2002).

2.5.4 CAS 09-21-001-TA09, Disposal Trenches

The radiological survey performed at CAS 09-21-001-TA09 did not identify any areas of elevated radiological contamination (i.e., greater than background) (IT, 2001c). The radiological surveys performed in 2002 did not identify any areas with count rates that would require further investigation (IT, 2002). Geophysical surveys conducted in 2002 identified isolated areas consistent with surface metallic debris (Shaw E & I, 2002).

2.5.5 CAS 03-19-001, Waste Disposal Site

Samples collected during the CAU 405 investigation exceeded the regulatory limits for TPH DRO at the 4.5- to 5-ft interval. Samples collected from the 6.5- to 7-ft and the 8.5- to 9.5-ft intervals did not exceed the regulatory limit. The lateral extent of the contamination was not investigated during the CAU 405 field investigation (NNSA/NV, 2002a). It was determined that the contamination was not related to the CAU 405 investigation and the site became CAS 03-19-001 in CAU 410. Bechtel Nevada collected lateral step-out samples at this CAS and screened the samples for TPH using Petroflag. The results and locations of the Petroflag samples are detailed on Figure 2-5. Geophysical surveys conducted in 2002 did not identify subsurface metallic debris in the area of the CAS (Shaw E & I, 2002).

2.5.6 National Environmental Policy Act

In accordance with the NNSA/NV *National Environmental Policy Act* (NEPA) compliance program, a NEPA checklist will be completed prior to commencement of site investigation activities at CAU 410. This checklist compels NNSA/NV project personnel to evaluate their proposed project activities against a list of potential impacts which 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/NV NEPA Compliance Officer.

3.0 Objectives

This section presents an overview of the DQOs for CAU 410 and formulation of the CSMs. Also presented is information on the COPCs and PALs for the investigation.

3.1 Conceptual Site Model

The CSM describes the most probable scenario for current conditions at each site and defines the assumptions that are the basis for identifying appropriate sampling strategy and data collection methods. A single CSM has been developed for CAU 410 using assumptions formulated from historical background information, knowledge from studies of similar sites, and data from previous sampling efforts. The CSM depicts scenarios where there is presence of buried debris in the disposal features. Section A.1.1.3 also provides information on the CSM as presented for DQO formulation.

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

Figure 3-1 shows a generalized representation of the CSM constructed for current site conditions at the CAU 410, Waste Disposal Trenches.

3.1.1 Future Land Use

All of the CASs, except CAS 03-19-001, are located in areas of the TTR where passive tests, impact tests, and chemical tests may have been conducted. Corrective Action Site 03-19-001 is located in an administrative area. Land-use scenarios limit future use of these areas to industrial activities (DOE/NV, 1996b).

3.1.2 Contaminant Sources

Three waste disposal trenches, one waste disposal site, and one debris mound comprise CAU 410. The trenches in CAU 410 have varying configurations. Documentation suggests that there were

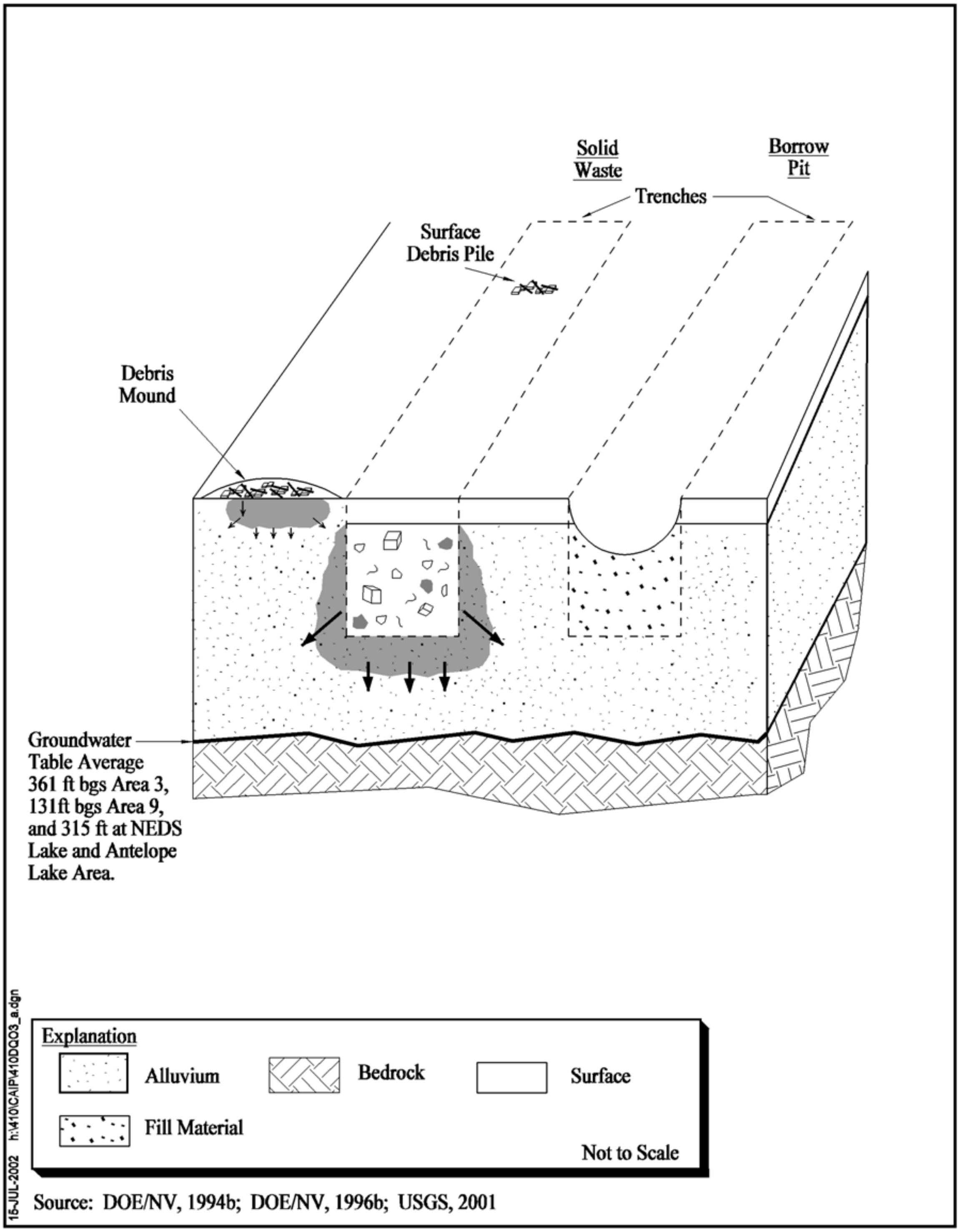

Figure 3-1
CAU 410 General Conceptual Site Model

possible release of hazardous, nonhazardous, and/or radiological contaminants at the CAU 410 locations due to disposal activities associated with tests conducted at the TTR.

3.1.3 Release Mechanisms

Subsurface soils are potentially affected from leachable solid and/or liquid waste. Any contamination would be attributable to direct release to the surface and/or subsurface from solid waste, erosion of various contaminants off the surface of solid materials, and leaching of contaminants. Any contaminants at these CASs, regardless of physical or chemical characteristics, are expected directly beneath the debris and/or trench configuration. No disposal records were identified for these sites; therefore, materials disposal is based on visual observations and process knowledge from similar, previously investigated sites.

3.1.4 Migration Pathways

Migration pathways at the CASs are expected to be limited to typical vertical migration due to percolation of infiltrated stormwater. If present, contamination is expected to be contiguous to the site. Concentrations are expected to decrease with distance and depth from the disposal feature.

The amount of percolation in the areas of the CAU 410 sites is unknown, but is assumed to be minimal based on the area's low precipitation and high evapotranspiration rates. Evaporation potentials significantly exceed available soil moisture from precipitation. The average annual precipitation at the TTR ranges from 3 to less than 10 inches per year. The annual potential evaporation ranges from 60 to 82 inches per year, or roughly 5 to 25 times the annual precipitation. (Winograd and Thordarson, 1975) Subsurface lateral migration is governed by the geophysical properties such as permeability, porosity, and hydrologic conductivity. The presence of a hardpan layer (i.e., caliche) at some of the CASs would retard vertical migration of contaminants. Surface lateral migration is not a concern because contaminants are subsurface.

Groundwater contamination is not considered a likely scenario at CAU 410. The depth to groundwater varies for each CAS as detailed in Section 2.0.

3.1.5 Exposure Pathways

Exposure pathway to site workers include oral ingestion, inhalation, or dermal contact (absorption) from disturbance of contaminated soils, debris, and/or structures. Solid media such as concrete and/or structures may pose a potential radiological exposure risk to site workers.

3.1.6 Additional Information

Additional topographic information for CAU 410 will not be necessary because the data available is adequate to make determinations about the sites.

General surface and subsurface soil descriptions will be observed and recorded during the corrective action investigation.

Climatic conditions for the CAU are well documented and have been addressed in the CSM. No further information is required.

Groundwater data for the CAU is known and has been addressed in the CSM. No further information is required.

Existing floodplain studies are available and will be considered during corrective action, as necessary. No further information is required.

The presence of infrastructures is known; however; the investigation of the CAU 410 sites will not impact any existing structures or utilities in proximity to the sites.

3.2 Contaminants of Potential Concern

Types of contaminants that might be present were identified through a review of site history documentation; process knowledge from similar, previously investigated sites; personal interviews; past investigation efforts; and inferred activities associated with CAU 410. The critical analytes and COPCs for each CAS are discussed in the following sections. Additional analyses are listed for each site to identify any additional releases that may have occurred at the CAS locations. The COPCs are defined as the analytes reported from the analytical methods listed in Table A.1-3 for CAU 410 with the *Region IX Preliminary Remediation Goals* (EPA, 2000).

Table A.1-4 provides a list of analyses to be performed at the CAU 410 locations that include additional analyses (e.g., volatile organic compounds [VOCs], semivolatile organic compounds [SVOCs], and total RCRA metals). The additional analyses have been identified for the investigation as confirmatory samples to obtain data on the sites to support decisions about the sites based on the results of the characterization.

Laboratory analysis of environmental media (e.g., soil) will provide the means for a quantitative measurement of the COPCs. To assure that laboratory analyses are sufficient to detect contamination in soil samples at concentrations exceeding the minimum reporting limit (MRL), chemical and radiological parameters of interest have been selected for each CAS. Solid debris (e.g., concrete, wood, or metal) will be evaluated for radiological parameters through radiological surveys conducted during the investigation.

3.2.1 CAS TA-19-002-TAB2, Debris Mound

According to historical information and field observations, the only critical analyte for this site is HE (Dubiskas, 1998; IT, 2002). Radiological constituents were also identified as suspect contaminants. Specific radiological constituents could not be identified; therefore, a samples will be collected for gamma spectroscopy and submitted for laboratory analysis. Additional analyses will be completed for VOCs, SVOCs, and total RCRA metals to identify any additional releases for this CAS.

3.2.2 CAS TA-21-003-TANL, Disposal Trench

Critical analytes for this CAS include beryllium, TPH gasoline-range organics [GRO], TPH, DRO, rocket propellant, HE, DU, uranium [U]-234, U-235, U-236, plutonium [Pu]-238, Pu-239/240, and Cs-137. These analytes are based on historical information and process knowledge for this location (DOE, 1993). Additional analyses will be performed on samples for VOCs, SVOCs, and total RCRA metals to identify any additional releases at this site.

3.2.3 CAS TA-21-002-TAAL, DIsposal Trench

Critical analytes for this CAS are the same as TA-21-003-TANL with the exception of beryllium. These analytes were based on the process knowledge of the tests conducted in the vicinity of this location (Elliston, 1998; Galvin, 2001). Based on the geophysical surveys, metallic debris has been identified in the subsurface. Therefore, additional analyses will be performed on samples for VOCs, SVOCs, and total RCRA metals to identify any additional releases at this site from the materials.

3.2.4 CAS 09-21-001-TA09, Disposal Trenches

The critical analyte for this CAS is HE. However, based on the process knowledge of the activities in this area, gamma spectroscopy samples will be collected for additional analyses (Kluesner, 2001). Samples will be submitted to the laboratory for analyses for VOCs, SVOCs, and total RCRA metals to identify any additional releases at this CAS.

3.2.5 CAS 03-19-001, Waste Disposal Site

The critical analyte for this CAS is TPH DRO. There will be no additional analyses performed at this CAS because there is sufficient data from other projects to identify additional contaminants.

3.3 Preliminary Action Levels

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

- *EPA Region 9 Risk-Based Preliminary Remediation Goals* for chemical constituents in industrial soils (EPA, 2000)
- 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 TTR. Background is considered the mean plus two standard deviation of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nellis Air Force Range (NBMG, 1998; Moore, 1999).
- The TPH action limit of 100 ppm per the *Nevada Administrative Code* (NAC) 445A.2272 (NAC, 2000e).
- The PALs for radionuclides are isotope-specific and defined as the maximum concentration for that isotope found in samples from undisturbed background locations in the vicinity of the Nevada Test Site (NTS) (McArthur and Miller, 1989; Atlan-Tech, 1992; BN, 1996). The PAL is equal to the minimum detectable concentrations (MDC) for isotopes not reported in soil samples from undisturbed background locations or if the PAL is less than the MDC (Table 3-2).

- For detected chemical COPCs without established PRGs, a similar protocol to that used by U.S. Environmental Protection Agency (EPA) Region 9 will be used in establishing an action level for those COPCs listed in IRIS Database (EPA, 2001)

Solid media such as concrete and/or structures may only pose a potential radiological exposure risk to site workers if contaminated. The radiological PAL for solid media will be defined as the free-release criteria defined in the *NV/YMP Radiological Control Manual* (DOE/NV, 2000) (i.e., 1,000 disintegrations per minute per 100 square centimeters [dpm/100 cm^2] for removable surface contamination).

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

3.4 DQO Process Discussion

The DQO strategy was developed at a meeting on April 18, 2002. The DQOs were developed to identify data needs and clearly define the intended use of the environmental data, and to design a data collection program that will satisfy these purposes. Details of the DQO process are presented in Appendix A.

During the DQO discussions for this CAU, the informational inputs or data needs to resolve problem statements and decision statements were documented. Criteria for data collection and analysis were defined and the appropriate QA/QC required for particular data collection activities were assigned. Resulting laboratory data will be assessed to confirm or refute the conceptual model and determine if the DQOs were met. The following sections identify the analytical requirements and the parameters for bioassessment and geotechnical/hydrological analysis.

3.4.1 Analytical Requirements

Analytical methods and MRLs for each chemical parameter are provided in Table 3-1. The MRL is a practical reporting limit that ensures data generated by the laboratory will be usable by the investigation.

Table 3-1
Analytical Requirements for CAU 410
(Page 1 of 4)

Parameter	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD)[a]	Percent Recovery (%R)[b]
ORGANICS						
Total Volatile Organic Compounds (VOCs)	Water Soil	8260B[c]	Parameter-specific estimated quantitation limits[d]	Not Applicable (NA)	Lab-specific[e]	Lab-specific[e]
Toxicity Characteristic Leaching Procedure (TCLP) VOCs						
Benzene	Aqueous	1311/8260B[c]	0.050 mg/L[d]	0.5 mg/L[f]	Lab-specific[e]	Lab-specific[e]
Carbon Tetrachloride			0.050 mg/L[d]	0.5 mg/L[f]		
Chlorobenzene			0.050 mg/L[d]	100 mg/L[f]		
Chloroform			0.050 mg/L[d]	6 mg/L[f]		
1,2-Dichloroethane			0.050 mg/L[d]	0.5 mg/L[f]		
1,1-Dichloroethene			0.050 mg/L[d]	0.7 mg/L[f]		
Methyl Ethyl Ketone			0.050 mg/L[d]	200 mg/L[f]		
Tetrachloroethene			0.050 mg/L[d]	0.7 mg/L[f]		
Trichloroethene			0.050 mg/L[d]	0.5 mg/L[f]		
Vinyl Chloride			0.050 mg/L[d]	0.2 mg/L[f]		
Total Semivolatile Organic Compounds (SVOCs)	Water Soil	8270C[c]	Parameter-specific estimated quantitation limits[d]	NA	Lab-specific[e]	Lab-specific[e]
TCLP SVOCs						
ORGANICS (continued)						
o-Cresol	Aqueous	1311/8270C[c]	0.10 mg/L[d]	200 mg/L[f]	Lab-specific[e]	Lab-specific[e]
m-Cresol			0.10 mg/L[d]	200 mg/L[f]		
p-Cresol			0.10 mg/L[d]	200 mg/L[f]		
Cresol (total)			0.30 mg/L[d]	200 mg/L[f]		
1,4-Dichlorobenzene			0.10 mg/L[d]	7.5 mg/L[f]		
2,4-Dinitrotoluene			0.10 mg/L[d]	0.13 mg/L[f]		
Hexachlorobenzene			0.10 mg/L[d]	0.13 mg/L[f]		
Hexachlorobutadiene			0.10 mg/L[d]	0.5 mg/L[f]		
Hexachloroethane			0.10 mg/L[d]	3 mg/L[f]		
Nitrobenzene			0.10 mg/L[d]	2 mg/L[f]		
Pentachlorophenol			0.50 mg/L[d]	100 mg/L[f]		
Pyridine			0.10 mg/L[d]	5 mg/L[f]		
2,4,5-Trichlorophenol			0.10 mg/L[d]	400 mg/L[f]		
2,4,6-Trichlorophenol			0.10 mg/L[d]	2 mg/L[f]		
Polychlorinated Biphenyls (PCBs)	Water Soil	8082[c]	Parameter-specific (CRQL)[g]	NA	Lab-specific[e]	Lab-specific[e]

Table 3-1
Analytical Requirements for CAU 410
(Page 2 of 4)

Parameter	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD)[a]	Percent Recovery (%R)[b]
Total Petroleum Hydrocarbons (TPH)	Water Gasoline	8015B modified[c]	0.1 mg/L[h]	NA	Lab-specific[e]	Lab-specific[e]
	Soil Gasoline		0.5 mg/kg[h]			
	Water Diesel		0.5 mg/L[h]			
	Soil Diesel		25 mg/kg[h]			
Explosives	Water	8330[c]	14 mg/L[c]	NA	Lab-specific[e]	Lab-specific[e]
	Soil		2.2 mg/kg[c]			
INORGANICS						
Total *Resource Conservation and Recovery Act* (RCRA) Metals						
Arsenic	Water	6010B[c]	10 µg/L[h, i]	NA	20[i]	Matrix Spike Recovery 75-125[i] Laboratory Control Sample Recovery 80 - 120[i]
	Soil	6010B[c]	1 mg/kg[h, i]		35[i,o]	
Barium	Water	6010B[c]	200 µg/L[h, i]		20[i]	
	Soil	6010B[c]	20 mg/kg[h, i]		35[i,o]	
Beryllium	Water	6010B[c]	5 µg/L[h, i]		20[i]	
	Soil	6010B[c]	0.5 mg/kg[h, i]		35[i,o]	
Cadmium	Water	6010B[c]	5 µg/L[h, i]		20[i]	
	Soil	6010B[c]	0.5 mg/kg[h, i]		35[i,o]	
Chromium	Water	6010B[c]	10 µg/L[h, i]		20[i]	
	Soil	6010B[c]	1 mg/kg[h, i]		35[i,o]	
Lead	Water	6010B[c]	3 µg/L[h, i]		20[i]	
	Soil	6010B[c]	0.3 mg/kg[h, i]		35[i,o]	
Mercury	Water	7470A[c]	0.2 µg/L[h, i]		20[i]	
	Soil	7471A[c]	0.1 mg/kg[h, i]		35[i,o]	
Selenium	Water	6010B[c]	5 µg/L[h, i]		20[i]	
	Soil	6010B[c]	0.5 mg/kg[h, i]		35[i,o]	
Silver	Water	6010B[c]	10 µg/L[h, i]		20[i]	
	Soil	6010B[c]	1 mg/kg[h, i]		35[i,o]	
pH/corrosivity	Water	9040B	NA	pH>2[f]	Lab-specific	Lab-specific
	Soil	9045C	NA	pH<12.5[f]		
TCLP RCRA Metals						

Table 3-1
Analytical Requirements for CAU 410
(Page 3 of 4)

Parameter	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD)[a]	Percent Recovery (%R)[b]
Arsenic	Aqueous	1311/6010B[c] 1311/7470A[c]	0.10 mg/L[h, i]	5 mg/L[f]	20[i]	Matrix Spike Recovery 75-125[i] Laboratory Control Sample Recovery 80 - 120[i]
Barium			2 mg/L[h, i]	100 mg/L[f]		
Cadmium			0.05 mg/L[h, i]	1 mg/L[f]		
Chromium			0.10 mg/L[h, i]	5 mg/L[f]		
Lead			0.03 mg/L[h, i]	5 mg/L[f]		
Mercury			0.002 mg/L[h, i]	0.2 mg/L[f]		
Selenium			0.05 mg/L[h, i]	1 mg/L[f]		
Silver			0.10 mg/L[h, i]	5 mg/L[f]		
RADIOCHEMISTRY						
Gamma-Emitting Radionuclides	Water	EPA 901.1[j]	The Minimum Reporting Limits and Minimum Detectable Activities for Radionuclides are given in Table 3-2	NA	Relative Percent Difference (RPD[a]) 20% (Water)[h] 35% (Soil)[h] Normalized Difference (ND) -2<ND<2[k]	Laboratory Control Sample Recovery 80-120[i]
	Soil	HASL-300[l]				
Isotopic Uranium	Water	HASL-300[l] ASTM D3972-97[m]		NA		Chemical Yield 30-105[n] Laboratory Control Sample Recovery 80-120[i]
	Soil	HASL-300[l] ASTM C1000-90[m]				
Isotopic Plutonium	Water	HASL-300[l] ASTM D3865-97[m]		NA		
	Soil					
Strontium - 90	Water	ASTM D5811-95[m]		NA		
	Soil	HASL-300[l]				

Table 3-1
Analytical Requirements for CAU 410
(Page 4 of 4)

Parameter	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD)[a]	Percent Recovery (%R)[b]

[a] Relative percent difference (RPD) is used to calculate precision.
Precision is estimated from the relative percent difference of the concentrations measured for the matrix spike and matrix spike duplicate or of laboratory, or field duplicates of unspiked samples. It is calculated by: RPD = 100 x $\{(|C_1-C_2|)/[(C_1+C_2)/2]\}$, where C_1 = Concentration of the parameter in the first sample aliquot, C_2 = Concentration of the parameter in the second sample aliquot.
[b] %R is used to calculate accuracy.
Accuracy is assessed from the recovery of parameters spiked into a blank or sample matrix of interest, or from the recovery of surrogate compounds spiked into each sample. The recovery of each spiked parameter is calculated by: %R = 100 x (C_s-C_u/C_n), where C_s = Concentration of the parameter in the spiked sample, C_u = Concentration of the parameter in the unspiked sample, C_n = Concentration increase that should result from spiking the sample
[c] U.S. Environmental Protection Agency (EPA) *Test Methods for Evaluating Solid Wast*e, 3rd Edition, Parts 1-4, SW-846 CD ROM, Washington, DC (EPA,1996)
[d] Estimated Quantitation Limit as given in SW-846 (EPA, 1996)
[e] In-House Generated RPD and %R Performance Criteria
It is necessary for laboratories to develop in-house performance criteria and compare them to those in the methods. The laboratory begins by analyzing 15 to 20 samples of each matrix and calculating the mean %R for each parameter. The standard deviation (SD) of each %R is then calculated, and the warning and control limits for each parameter are established at ± 2 SD and ± 3 SD from the mean, respectively. If the warning limit is exceeded during the analysis of any sample delivery group (SDG), the laboratory institutes corrective action to bring the analytical system back into control. If the control limit is exceeded, the sample results for that SDG are considered unacceptable. These limits are reviewed after every quarter and are updated when necessary. The laboratory tracks trends in both performance and control limits by the use of control charts. The laboratory's compliance with these requirements is confirmed as part of an annual laboratory audit. Similar procedures are followed in order to generate acceptance criteria for precision measurements.
[f] Title 40 *Code of Federal Regulations* Part 261, "Identification and Listing of Hazardous Waste" (CFR, 2001b)
[g] EPA *Contract Laboratory Program Statement of Work for Organic Analysis* (EPA, 1988b; 1991; and 1994c)
[h] *Industrial Sites Quality Assurance Project Plan* (NNSA/NV, 2002b)
[i] EPA *Contract Laboratory Program Statement of Work for Inorganic Analysis* (EPA, 1988a; 1994b; and 1995)
[j] *Prescribed Procedures for Measurements of Radioactivity in Drinking Water*, EPA-600/4-80-032 (EPA, 1980)
[k]Normalized Difference is not RPD, it is another measure of precision used to evaluate duplicate analyses. The normalized difference is calculated as the difference between two results divided by the square root of the sum of the squares of their total propagated uncertainties. *Evaluation of Radiochemical Data Usability* (Paar and Porterfield, 1997)
[l] *Manual of Environmental Measurements Laboratory Procedures*, HASL-300 (DOE, 1997)
[m] American Society for Testing and Materials
[n] *General Radiochemistry and Routine Analytical Services Protocol (GRASP)* (EG&G Rocky Flats, 1991)
Definitions:
pCi/L = Picocuries per liter
mg/L = Milligrams per liter
pCi/g = Picocuries per gram
µg/kg = Micrograms per kilogram
mg/kg = Milligrams per kilogram
µg/L = Micrograms per liter;
CRQL = Contract-required quantitation limits

The MRLs for radiological activity concentration picocuries per gram (pCi/g) MRLs were developed considering both the MDCs and the PALs (Adams and Dionne, 2000). The MDCs, PALs, and MRLs for radionuclides are provided in Table 3-2. The MDC is the smallest amount of activity of a particular parameter that can be detected in a sample with an acceptable level of error. The MDCs listed in Table 3-2 are typical default levels available for a commercial radioanalytical laboratory.

The DQO decision flow process applied to the CAU 410 investigation is depicted in Figure A.1-2. This decision process starts with defining the nature of contamination for all CASs. If COCs are present, the process will continue by determining the extent of contamination identified. The process

Table 3-2
Minimum Detectable Concentrations, Preliminary Action Levels, and Minimum Reporting Limits for Radionuclides in Samples Collected at CAU 410

Isotope	Soil			Liquid		
	MDC[a] (pCi/g)[d]	PAL[b] (pCi/g)[d]	MRL[c] (pCi/g)[d]	MDC[a] (pCi/L)[e]	PAL[b] (pCi/L)[e]	MRL[c] (pCi/L)[e]
Cesium-137	0.5[f]	7	2.5	10	10	10
Uranium-234	0.05[f]	3.47	0.25	0.1[f]	8.92	0.5
Uranium-235	0.05[f]	0.07	0.05	0.1[f]	0.36	0.1
Uranium-238	0.05[f]	3.47	0.25	0.1[f]	9.39	0.5
Plutonium-238	0.05	0.05	0.05	0.1	0.16	0.1
Plutonium-239/240	0.05[f]	0.106	0.05	0.1	9.0	0.5

[a] MDC is the minimum detectable concentration: detection limits required for the measurement of ITLV samples
[b] PAL is defined as the maximum concentration listed in the literature for a sample taken from an undisturbed background location (McArthur and Miller, 1989; Atlan-Tech, 1992; and DOE/NV, 1999); the PAL is equal to the MDC for isotopes not reported in soil samples from undisturbed background locations or if the PAL is less than the MDC
[c] MRL is the minimum reporting level; it is set equal to 5 times the MDC or if 5 times the MDC is greater than the PAL, the MRL is set equal to the MDC
[d] Picocuries per gram
[e] Picocuries per liter
[f] MDC for gamma-emitting radionuclides in relative to Cs-137.

ends with no further investigation of the site based on the nature and extent of contamination at the CAS being defined. Corrective action alternatives of closure-in-place and clean closure will be evaluated for each CAS with COCs.

3.4.2 Geotechnical/Hydrological Analysis and Bioassessment Tests

It may be necessary to measure the geotechnical/hydrological parameters of a site. These samples will be collected within brass sleeves (or other containers, as appropriate) to maintain the natural physical characteristics of the soil. Table 3-3 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. In some cases, bioassessment will also be performed on the sample material. Bioassessment is a series of tests designed to evaluate the physical, chemical, and microbiological characteristics of a site. Bioassessment tests include determinants of nutrient

Table 3-3
General Geotechnical and Hydrological Analysis

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

[a]ASTM, 1996
[b]USACE, 1970
[c]Methods of Soil Analysis (MOSA) (Soil Science Society of America, 1986)
[d]van Genuchten, 1980
[e]Karathanasis and Hajek, 1982

availability, pH, microbial population density, and the ability of the microbial population to grow under enhanced conditions. This type of analysis is most appropriate for hydrocarbon contamination sites where bioremediation is a potential corrective action. Bioassessment samples may be collected if biasing factors suggests a fuel or solvent plume may be present.

4.0 Field Investigation

This section of the CAIP contains the approach for investigating CAU 410.

4.1 Technical Approach

The technical approach for CAU 410 consists of the following activities:

- Remove metal structure at CAS TA 21-003-TANL (completed).
- Perform surface radiological surveys (completed).
- Perform geophysical surveys at all CAS locations to identify any subsurface metal debris (completed).
- Collect and analyze samples from biased locations as described in this section.
- Perform field screening for applicable COPCs corresponding to each CAS.
- Collect required QC samples.
- Collect additional samples, as necessary, to estimate potential corrective action waste streams.
- Collect samples from native soils and analyze for geotechnical/hydrologic parameters, if necessary.
- Collect and analyze bioassessment samples if appropriate (e.g., if VOCs exceed field-screening levels in a pattern that suggests that a plume may be present).
- Perform radiological surveys of debris identified during the investigation including the structure at CAS TA-21-003-TANL.
- Stake or flag sample locations and record coordinates (in North American Datum 1927 coordinate system).

4.2 Field Activities

This section provides a description of the field activities for all CASs at CAU 410. Process knowledge indicates that if contamination is identified, it will be found within the spatial boundaries of the sites as defined in the DQO process and CSMs. If while defining the nature of contamination, the investigation determines that COCs are present at a CAS, that CAS will be further addressed by determining the extent of contamination before evaluating corrective action alternatives.

Modifications to the investigative strategy may be required should unexpected field conditions be encountered. Significant modifications will be justified in a Record of Technical Change (ROTC). Concurrence from NDEP is required on ROTC modifications prior to proceeding with investigation activities significantly different from those described in this document. The investigation will be rescoped if contamination is more extensive than anticipated, and the maximum investigation depth is limited by the capabilities of the equipment used to collect subsurface soil samples.

Samples will be collected at biased locations by hand augering, backhoe excavation, direct-push, or drilling techniques, as appropriate. Sample locations may be changed based on current site conditions, obvious debris or staining of soils, field-screening results (FSRs), or professional judgement. Section 3.0 provides the analytical methods and laboratory requirements (i.e., detection limits, precision, and accuracy requirements) to be used when analyzing the COPCs. 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, 2002b) and other applicable, approved procedures.

4.2.1 CAS TA 19-002-TAB2, Debris Mound

A minimum of two samples will be collected from the native-soil interface below identified debris to define the nature of COPCs identified for this location. One additional soil sample will be collected down gradient from the mound to determine the extent of contamination identified. A minimum of four additional step-out samples will be collected based on FSRs from outside of the trench to determine the lateral extent of identified contamination. If FSRs exceed field-screening levels (FSLs) at the native soil interface, additional vertical samples will be collected to define vertical extent of identified contamination. Excavation is the preferred method of soil sample collection but drilling, direct-push, or hand augering may also be used, as appropriate. Figure 4-1 depicts proposed sample locations. Identified surface and subsurface debris will be removed for disposal during investigation activities.

Samples will be submitted for the laboratory analysis listed in Table A.1-4.

4.2.2 CAS TA 21-003-TANL, Disposal Trench

Samples will be collected from a minimum of two locations at the native-soil interface within the trench. Based on FSRs within the trench, the nature and extent of contamination will be defined. A minimum of four additional step-out samples will be collected based on FSRs from outside of the trench to determine the lateral extent of identified contamination. If FSRs exceed FSLs at the native soil interface, additional vertical samples will be collected to define vertical extent of identified contamination. Excavation is the preferred method of soil sample collection but drilling, direct-push, or hand augering may also be used, as appropriate. Figure 4-2 depicts the proposed sample locations for the CAS.

Samples will be submitted for the laboratory analysis listed in Table A.1-4.

4.2.3 CAS TA 21-002-TAAL, Disposal Trench

Excavation is the preferred soil sample collection method; however, drilling or direct-push may be used, as appropriate. Geophysical surveys revealed four areas of buried debris at this CAS. The debris will be excavated to identify the extent, a minimum of two samples will be collected from the native-soil interface below the debris to determine the nature of contamination. Step-out samples will be collected if the soil samples collected exceed FSLs and if debris is present to determine the lateral extent of contamination. If FSRs exceed FSLs at the native soil interface, additional vertical samples will be collected to define vertical extent of identified contamination. Figure 4-3 depicts the proposed sample locations.

Samples will be submitted for the laboratory analysis listed in Table A.1-4.

4.2.4 CAS 09 21-001-TA09, Disposal Trenches

Geophysical surveys did not indicate any subsurface buried debris; therefore, a surface sample will be collected from two low spots within this CAS. If FSRs exceed FSLs at either low spot sample locations, additional lateral and vertical samples will be collected to define lateral and vertical extent of contamination identified. Excavation is the preferred soil sample collection method; however, direct-push, drilling, or hand augering may be used, as appropriate. Figure 4-4 depicts the sample locations.

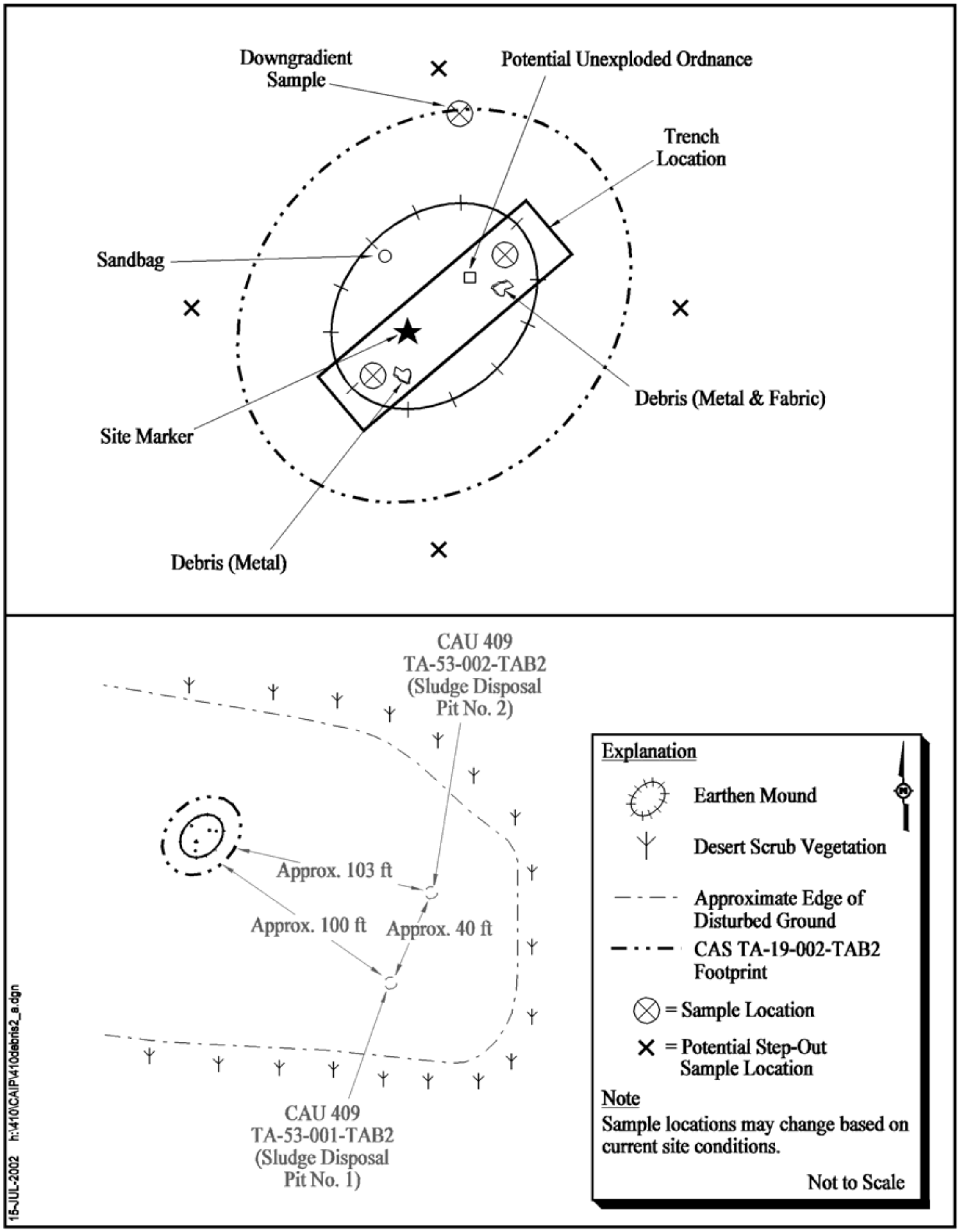

Figure 4-1
Sample Location Map for CAS TA-19-002-TAB2, Debris Mound

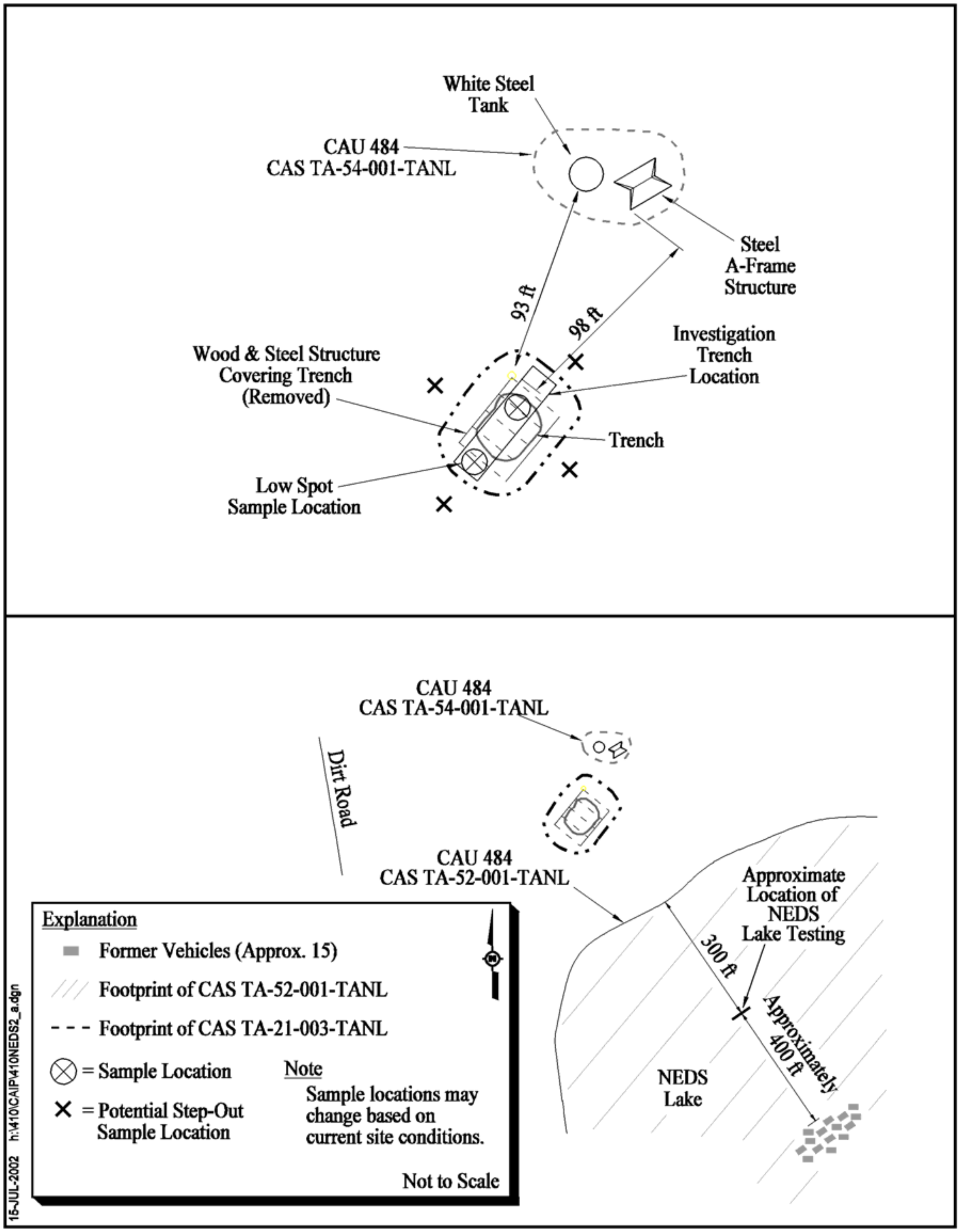

Figure 4-2
Sample Location Map for the NEDS Lake Trench, CAU 410, CAS TA-21-003-TANL

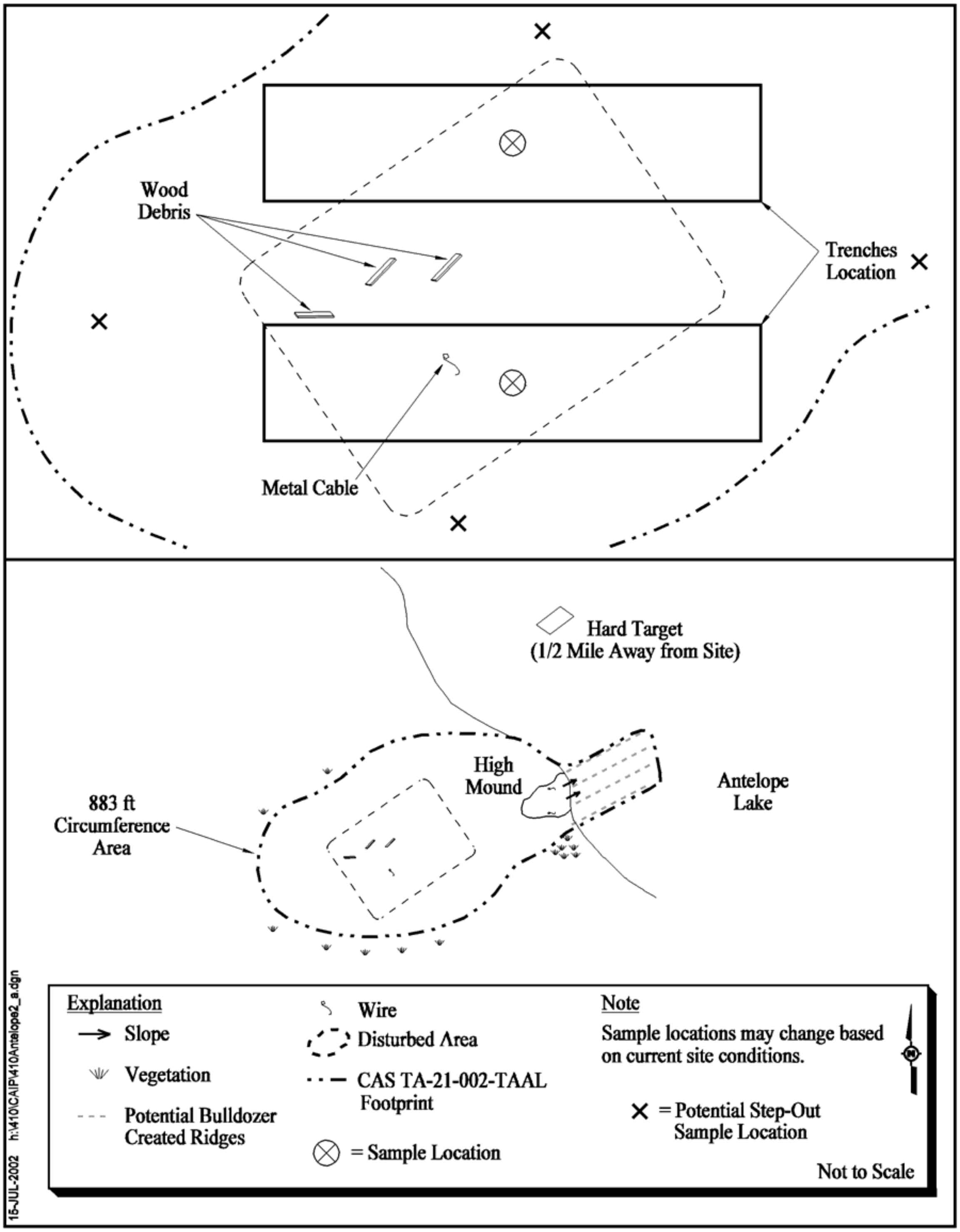

Figure 4-3
Sample Location Map of SW Antelope Lake Trench, CAU 410, CAS TA-21-002-TAAL

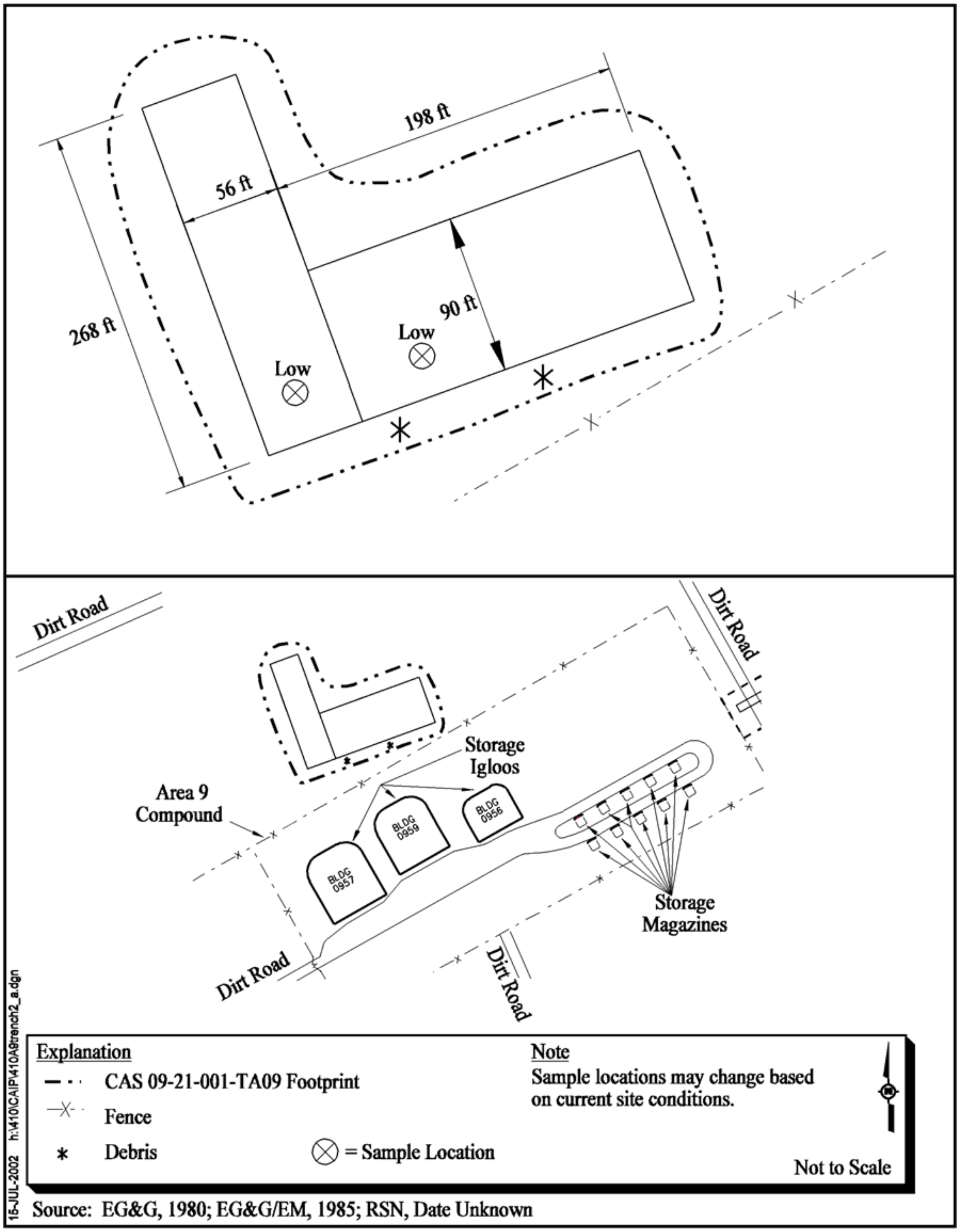

Figure 4-4
Sample Location Map and Site Layout for CAU 410, CAS 09-21-001-TA09

Samples will be submitted for the laboratory analysis listed in Table A.1-4.

4.2.5 CAS 03-19-001, Waste Disposal Site

The investigation for the Waste Disposal Site will be based on current site conditions and the geophysical results collected prior to the project. The sample points for the investigation will be the previously sampled location from the CAU 405 investigation and the Petroflag sample to the west of the CAU 405 location that exceeded the action levels. According to the previously collected analytical data, the interval of 4.5 to 5-ft bgs is the interval where FSLs were exceeded for TPH DRO. If FSRs exceed FSLs at the 4.5- to 5-ft interval at the step-out locations, additional vertical samples will be collected to define vertical extent of contamination identified. During the CAU 405 investigation, samples were collected from the 6.5 to 7.5-ft bgs and 9 to 9.5-ft bgs intervals which did not exceed PALs. If step-out samples are necessary, then the first step-out samples will be collected from the BN Petroflag locations as identified on Figure 4-5. Lateral step-out samples will then continue at 5-ft intervals at the same depths until FSRs do not exceed FSLs for TPH. Use restrictions will not be entered if step-out sampling is guided toward the boundaries. Additional samples may be collected based on site conditions, for waste determination purposes, and/or other identified data needs. Figure 4-5 depicts the proposed sample locations.

Samples will be submitted for the laboratory analysis listed in Table A.1-4.

4.3 Field-Screening Levels

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

- Headspace field screening for VOCs levels is 20 ppm or 2.5 times background, whichever is greater
- TPH field-screening level is 75 ppm measured using an appropriate field-screening method (e.g., Hanby or other test kit)
- The radiological (alpha and beta/gamma) FSL for soil samples is the mean background activity plus two times the standard deviation of the mean background activity collected from undisturbed locations within the vicinity of the site (Adams, 1998)

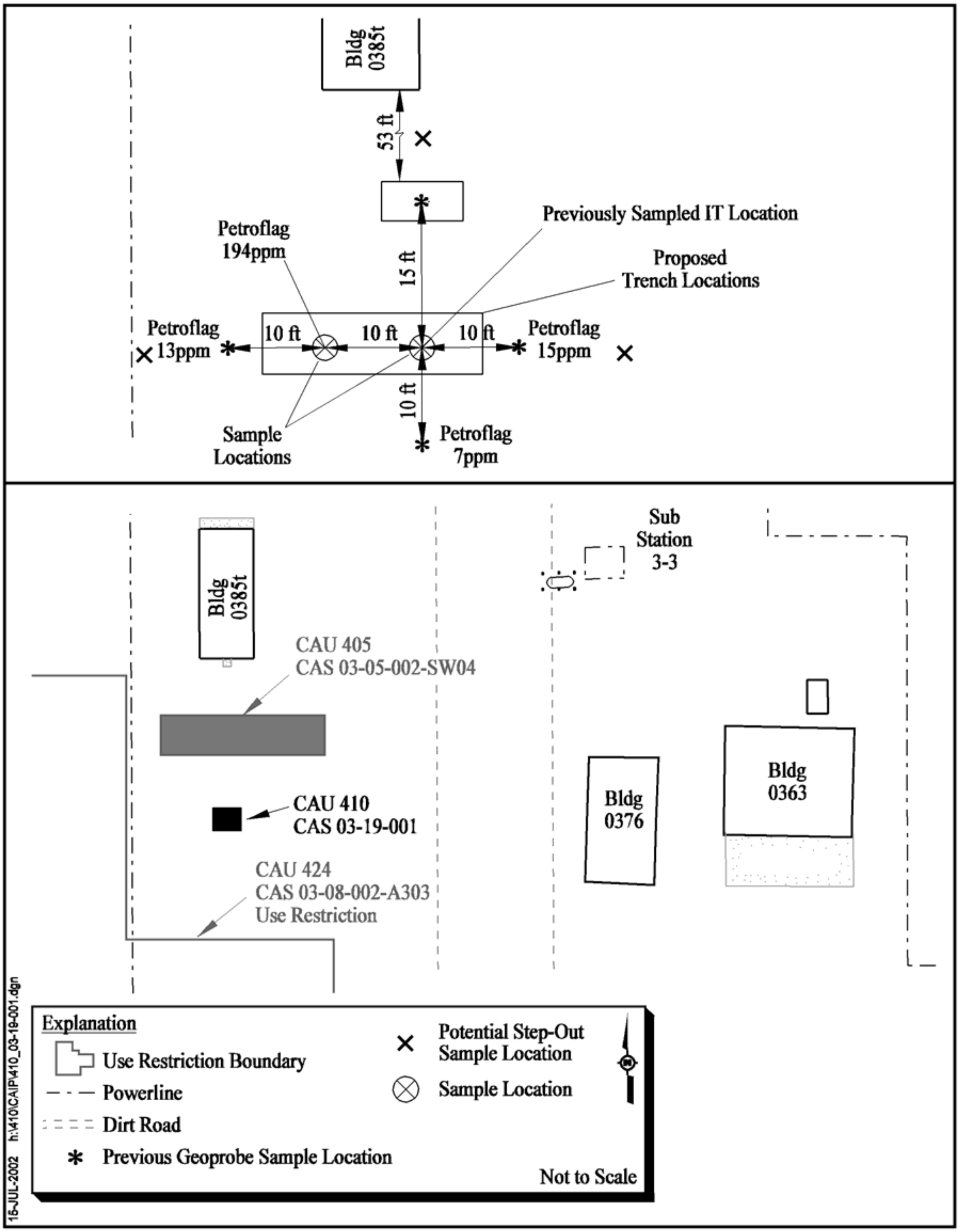

Figure 4-5
Sample Location Map and Site Layout for CAU 410, CAS 03-09-01

- High explosives FSLs for soil samples is 10 ppm as measured by the appropriate field-screening tests.

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

4.4 Safety

A current version of the ITLV HASP (IT, 2001a) will accompany the field documents and a site-specific health and safety plan (SSHASP) will be prepared and approved prior to the field effort. As required by the DOE Integrated Safety Management System (ISMS) (DOE/NV, 1997), these documents outline the requirements for protecting the health and safety of the workers and the public, and the procedures for protecting the environment. The ISMS program requires that site personnel will take every reasonable step to 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 SSHASP:

- Potential hazards to site personnel and the public include, but are not limited to: radionuclides, chemicals (e.g., heavy metals, VOCs, SVOCs, HE, 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” (ALARA) principle when dealing with radiological hazards

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

- If asbestos-containing materials are identified (CFR, 2001f; NAC, 2002e), they will be inspected and/or samples by trained personnel

5.0 Waste Management

Management of IDW will be based on regulatory requirements, field observations, process knowledge, and the results of laboratory analysis of CAU 410 investigation samples. Disposable sampling equipment, PPE, and rinsate are considered potentially contaminated waste by virtue of contact with potentially contaminated media (e.g., soil) or potentially contaminated debris (e.g., construction materials). Decontamination activities will be performed according to approved procedures and as appropriate for the COPCs likely to be identified at CAU 410.

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, RCRA regulations, *Nevada Revised Statutes*, and agreements and permits between the DOE and NDEP. Asbestos-containing materials will be managed and disposed of in accordance with appropriate regulations. Materials that are thought to potentially contain the hantavirus will be managed and disposed of in accordance with appropriate health and safety procedures.

All waste from CAU 410 will be evaluated against characteristic standards as no listed organic constituents have been identified. Process knowledge indicates that some CAU 410 locations may be contaminated with radioactive and hazardous constituents. To allow for the segregation of radioactive and nonradioactive waste and materials, radiological swipe and/or direct surveys may be conducted on reusable sampling equipment, PPE, and disposable sampling equipment waste streams exiting the controlled area. Removable contamination limits, as defined in Table 4-2 of the current *NV/YMP Radiological Control Manual* (DOE/NV, 2000), shall be used to determine the release status of such materials.

Applicable waste management regulations and requirements are listed in Table 5-1.

5.1 Waste Minimization

Corrective action investigation activities have been planned to minimize IDW generation. All IDW will be segregated to the greatest extent possible. Hazardous materials used at sites will be minimized to limit the unnecessary generation of hazardous and/or mixed wastes. Decontamination activities will be planned and executed to minimize the volume of rinsate.

Table 5-1
Waste Management Regulations and Requirements

Waste Type	Federal Regulation	Additional Requirements
Solid (nonhazardous)	NA	NRS 444.440 - 444.620[a] NAC 444.570 - 444.7499[b] State of Nevada Solid Waste Disposal Site Permit SW1309802 NTS Landfill Permit SW13.097.02[i]
Liquid/Rinsate (nonhazardous)	NA	NTS Waste Water Facility Permit GNEV93001, Rev. 3iii[c]
Hazardous	RCRA[d]	NRS 459.400 - 459.600[e] NAC 444.850 - 444.8746[f] POC[g]
Low-Level Radioactive	NA	DOE Orders and NTSWAC[h]
Mixed	RCRA[d]	NTSWAC[h] POC[g]
Polychlorinated Biphenyls	TSCA[j]	NRS 459.400 - 459.600[e] NAC 444.940 - 444.9555[l]
Asbestos	TSCA[k]	NAC 444.965-444.976[m]

[a]*Nevada Revised Statues* (NRS, 1998a)
[b]*Nevada Administrative Code* (NAC, 2002a)
[c]Nevada Test Site Sewage Lagoons, Nevada Division of Environmental Protection (NDEP, 1999)
[d]*Resource Conservation and Recovery Act* (CFR, 2001a)
[e]*Nevada Revised Statues* (NRS, 1998b)
[f]*Nevada Administrative Code* (NAC, 2002b)
[g]*Performance Objective for the Certification of Nonradioactive Hazardous Waste* (BN, 1995)
[h]Nevada Test Site Waste Acceptance Criteria, Revision 4 (NNSA/NV, 2002c)
[i]Area 6 Hydrocarbon Landfill, Nevada Division of Environmental Protection (NDEP, 1997b)
[j]*Toxic Substance Control Act* (40 CFR 761) (CFR, 2001e)
[k]*Toxic Substance Control Act* (40 CFR 763) (CFR, 2001f)
[l]*Nevada Administrative Code* (NAC, 2002c)
[m]*Nevada Administrative Code* (NAC, 2002d)

NA = Not applicable

5.2 Potential Waste Streams

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

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

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

5.3 Investigation-Derived Waste Management

The on-site management and ultimate disposition of IDW may be guided by several factors, but not limited to: the analytical results of samples either directly or indirectly associated with the waste, historical site knowledge, knowledge of the waste generation process, field observations, field monitoring/screening results, and/or radiological survey/swipe results. Table 4-2 of the current *NV/YMP Radiological Control Manual* (DOE/NV, 2000) shall be used to determine if such materials may be declared nonradioactive. The IDW will be characterized as radioactive or “nonradioactive” based on results. Management requirements for sanitary, low-level, hazardous, or mixed wastes are discussed in the following sections.

5.3.1 Sanitary Waste

Sanitary waste will be contained in plastic bags or an appropriate receptacle and will be transported to a solid waste management unit. The IDW generated within the controlled area will be swiped and/or surveyed, as appropriate to determine if the removable contamination is under the limits defined in Table 4-2 of the current *NV/YMP Radiological Control Manual* (DOE/NV, 2000). The IDW will be characterized as radioactive or "nonradioactive" based on results.

5.3.2 Hydrocarbon Waste

The action level for soil contaminated with hydrocarbons is 100 milligrams per kilogram (mg/kg) in the State of Nevada (NAC, 2002e). Soils and associated IDW with TPH levels above 100 mg/kg, provided that other regulated constituents are below regulatory limits, shall be managed as hydrocarbon waste and disposed of in accordance with all applicable regulations.

5.3.3 Hazardous Waste

This CAU will have hazardous waste accumulation areas (HWAAs) and/or satellite accumulation areas (SAAs) to accumulate waste that potentially is classified as hazardous. The HWAAs will be properly controlled for access and will be equipped with spill kits and appropriate spill containment. All containers in HWAAs will be managed consistent with the requirements of 40 CFR 265 Subpart I. A "Hazardous Waste Pending Analysis" (CFR, 2001a) marking will be placed on the containers of waste until such time that waste characterization is complete. Once the waste is characterized, containers of waste determined to be hazardous will be clearly marked or labeled with the words "Hazardous Waste." The HWAAs will be inspected weekly and 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 accumulation area.

If SAAs are established, they will be managed in accordance with 40 CFR 262.34(c) (CFR, 2001d). The SAAs may be employed to temporarily accumulate small quantities of waste classified as potentially hazardous.

5.3.3.1 PPE/Equipment

Personal protective equipment, disposable sampling equipment, and debris will be visually inspected for gross contamination (e.g., clumps of soil) and segregated as it is generated. Grossly contaminated PPE/equipment will be managed as potentially "characteristic" hazardous waste. This segregated population of waste will either be (1) assigned characterization based on analysis of the soil that was sampled, (2) sampled directly, or (3) undergo further evaluation using the soil sample results to determine how much soil would need to be present in the waste to exceed regulatory levels. Waste that is determined to be hazardous will be entered into an approved waste management system (i.e., any appropriate facility used for the storage, treatment, or disposal of hazardous IDW generated during FFACO site investigations) where it will be managed and dispositioned according to the requirements of RCRA or subject to agreements between NNSA/NV and NDEP.

The PPE/equipment that is not visibly stained, discolored, or grossly contaminated will be managed as it is generated as nonhazardous waste and disposed of as sanitary or LLW depending on the concentration of radioactive contamination, if present.

5.3.3.2 Rinsate

Decontamination rinsate will initially be evaluated using analytical results for samples associated with the rinsate (i.e., soil sample results from excavation or sampling activities associated with the generation of rinsate). Decontamination rinsate at this site will not be considered hazardous waste unless there is evidence that the rinsate displays a RCRA characteristic. Evidence may include such things as hazardous constituents in associated samples, the presence of a visible sheen, pH, or association with equipment/materials used to respond to a release/spill of a hazardous waste/substance. The regulatory status of the rinsate may also be determined through direct sampling. If determined to be hazardous, the rinsate will be entered into an approved waste management system where it will be managed and dispositioned according to the requirements of RCRA or subject to agreements between NNSA/NV and NDEP.

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

- Rinsate that is determined to be nonhazardous and contaminated to less than 5 times *Safe Drinking Water Standards* (SDWS) is not restricted as to disposal.
- Nonhazardous rinsate which is contaminated at 5 to 10 times SDWS, will be disposed of in an established infiltration basin or solidified and disposed of as sanitary or low-level waste depending on the concentration of radioactive contamination, if present.
- Nonhazardous rinsate which is contaminated at greater than 10 times SDWS will be disposed of in a lined basin or solidified and disposed of as sanitary or low-level waste depending on the concentration of radioactive contamination, if present.

5.3.3.3 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 as a separate waste stream.

5.3.3.4 Soil

This waste stream consists of soil produced during soil sampling, excavation, and/or drilling. This waste stream is considered to have the same COPCs as the material remaining in the ground. Regardless of the COPCs at the site (i.e., listed or not listed), the preferred method for managing this waste stream is to place the material back into the borehole/excavation in the approximate location from which it originated. If this cannot be accomplished, the material will either be managed on site by placement next to the excavation with berming and covering, or by placement in a container(s). Material that is containerized at a site where hazardous constituents are COPCs will be marked “Hazardous Waste Pending Analysis.” The disposition of containerized material may be deferred until implementation of corrective action at the site.

5.3.4 Low-Level Waste

Suspected low-level waste will be managed in accordance with the contractor-specific waste certification program plan, contractor-specific procedures, and the *Nevada Test Site Waste Acceptance Criteria* (NTSWAC) (NNSA/NV, 2002c). The IDW will be staged at a designated radiological controlled area (RCA) or radioactive materials area (RMA) pending certification and disposal under NTSWAC requirements (NNSA/NV, 2002c). Waste drums will be labeled "Radioactive Material Pending Analysis."

If radiological COPCs are expected at any CAS addressed by this plan, waste may be characterized by incorporating the use of process knowledge, analytical results of direct or associated samples, visual examination, radiological surveys, and swipe results. Radiological swipe surveys and/or direct scan surveys may be conducted on reusable sampling equipment, 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 with regard to radiological release. Removable contamination limits, as defined in Table 4-2 of the current version of the *NV/YMP Radiological Control Manual* (DOE/NV, 2000), may be used to determine if such waste may be declared unrestricted regarding radiological release versus being declared radioactive waste. Direct sampling of the waste may be conducted to aid in determining if a particular waste unit (e.g., drum of soil) contains LLW, as necessary. Waste that is determined to be below the values of Table 4-2 of the current version of the *NV/YMP Radiological Control Manual* (DOE/NV, 2000), 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 plan. Wastes in excess of Table 4-2 of the current version of the *NV/YMP Radiological Control Manual* (DOE/NV, 2000) values will be managed as potential radioactive waste and be managed in accordance with Section 5.0 of this plan, the contractor-specific waste certification program plan, DOE Orders, and the requirements of the NTSWAC (NNSA/NV, 2002c). Potential radioactive waste drums containing soil, PPE, disposable sampling equipment, and/or rinsate shall be staged at a designated RMA when full or at the end of an investigation phase. The waste drums will remain at the RMA pending certification and disposal under NTSWAC requirements (NNSA/NV, 2002c).

5.3.5 Mixed Wastes

Mixed waste, if generated, shall be managed in accordance with RCRA (40 CFR 262) (CFR, 2001c) and State of Nevada requirements. These regulations, as well as NNSA/NV requirements for radioactive waste, are interpreted as follows. Where there is a conflict in regulations or requirements, the most stringent shall apply. For example, weekly inspections per RCRA regulations will be applied to mixed waste even though it is not required for radioactive waste.

In general, mixed waste shall be managed in the same manner as hazardous waste, with additional mandatory radioactive waste management program requirements. Pending characterization and confirmation of its regulatory status, suspected mixed waste will be managed in accordance with applicable regulations and requirements, and will be marked with the words “Hazardous Waste Pending Analysis.” The potentially mixed waste will be managed and dispositioned according to the requirements of RCRA or subject to agreements between NNSA/NV and NDEP, and shall be transported via an approved hazardous waste transporter to the NTS transuranic waste storage pad for storage pending treatment or disposal. Mixed waste with hazardous waste constituents below land disposal restrictions may be disposed of at the NTS Area 5 Radioactive Waste Management Site, if the waste meets the requirements of the NTSWAC. Mixed waste not meeting land disposal restrictions will require development of a treatment and disposal plan under the requirements of the *Mutual Consent Agreement* between DOE and the State of Nevada (NDEP, 1995).

6.0 Quality Assurance/Quality Control

The overall objective of the characterization activities described in this CAIP is to collect accurate and defensible data to support the selection and implementation of a closure alternative for each CAS in CAU 410. Section 6.1 and Section 6.2 discuss the collection of required QC samples in the field and QA requirements for laboratory/analytical data to achieve closure. Section 6.3 provides QA/QC requirements for radiological survey data. 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, 2002b).

6.1 Quality Control Field Sampling Activities

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

- Trip blanks (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 20 environmental samples)
- 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 quality control 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, 2002b).

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, 2002b), except where otherwise stipulated in this CAIP. All nonradiological laboratory data from samples collected and analyzed will be evaluated for data quality according to *EPA Functional Guidelines* (EPA, 1994a and 1999). Radiological laboratory data from samples that are collected and analyzed will be evaluated for data quality according to company-specific procedures. The data will be reviewed to ensure that all critical samples were appropriately collected, analyzed, and the results passed data validation criteria. Validated data, including estimated data (i.e., J-qualified), will be assessed to determine if they meet the DQO requirements of the investigation and the performance criteria for the DQIs. The results of this assessment will be documented in the CADD. If the DQOs were not met, corrective actions will be evaluated, selected, and implemented (e.g., refine CSM or resample to fill data gaps).

6.2.2 Data Quality Indicators

Data quality indicators are qualitative and quantitative descriptors used in interpreting the degree of acceptability or utility of data. The principal DQIs are precision, accuracy, representativeness, comparability, and completeness. A sixth DQI, sensitivity, has also been included for the CAU 410 investigation. DQIs are used to evaluate the entire measurement system and laboratory measurement processes (i.e., analytical method performance) as well as to evaluate individual analytical results (i.e., parameter performance).

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

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

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

6.2.3 Precision

Precision is used to assess the variability of a population of measurements with the variability of the analysis process. It is used to evaluate the performance of analytical methods as well as to evaluate the usability of individual analytical results. Precision is a measure of agreement among a replicate set of measurements of the same property under similar conditions. This agreement is expressed as the relative percent difference (RPD) between duplicate measurements (NNSA/NV, 2002b). The RPD is determined by dividing the difference between the replicate measurement values by the average measurement value and multiplying the result by 100, or:

$$RPD = \{|a1 - a2|/[(a1 + a2)/ 2]\} \times 100$$

Where:

a1 = concentration of the parameter in the initial sample aliquot
a2 = concentration of the parameter in the duplicate sample aliquot

Table 6-1
Laboratory and Analytical Performance Criteria for CAU 410 Data Quality Indicators

Data Quality Indicator	Performance Criteria	Potential Impact on Decision if Performance Criteria Not Met
Precision	Variations between duplicates (laboratory and field) and original sample should not exceed analytical method-specific criteria discussed in Section 6.2.3.	Data that do not meet the performance criteria will be evaluated for purposes of completeness. Decisions may not be valid if analytical method performance criteria for precision are not met.
Accuracy	Laboratory control sample results and matrix spike results should be within Section 6.2.4.	Data that do not meet the performance criteria will be evaluated for purposes of completeness. Decisions may not be valid if analytical method performance criteria for accuracy are not met.
Sensitivity	Detection limits of laboratory instruments must be less than or equal to respective PALs.	Cannot determine if COCs are present or migrating at levels of concern; therefore, the affected data will be assessed for usability and potential impacts on meeting site characterization objectives.
Comparability	Equivalent samples analyzed using same analytical methods, the same units of measurement and detection limits must be used for like analyses.	Inability to combine data with data obtained from other sources and/or inability to compare data to regulatory action levels.
Representativeness	Correct analytical method performed for appropriate COPC; valid data reflects appropriate target population.	Cannot identify COC or estimate concentration of COC; therefore, cannot make decision(s) on target population.
Nature Completeness	80% of the CAS-specific noncritical samples and analyses identified in the CAIP have valid results. 100% of critical parameters are valid.	Cannot make decision on whether COCs are present or migrating.
Extent Completeness	100% of the CAS-specific samples and critical analyses used to define extent of COCs.	Extent of contamination cannot be determined.
Clean Closure Completeness	100% of the CAS-specific samples and critical parameters are valid.	Decision of whether or not COCs remain in soil cannot be determined.

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

6.2.3.1 Precision for Chemical Analysis

The RPD criteria to be used for assessment of precision are the parameter-specific criteria listed in Table 3-1. When laboratory-specific control limits are indicated, they are based on the evaluation at the laboratory on a quarterly basis by monitoring the historical data and performance for each method. No review criteria for field duplicate RPD comparability have been established; therefore, the laboratory sample duplicate criteria will be applied to the review of field duplicates.

The parameter performance criteria for precision will be compared to RPD results of duplicate samples. This will be accomplished as part of the data validation process. Precision values for organic and inorganic analyses that are within the established control criteria indicate that analytical results for associated samples are valid. The RPD values that are outside the criteria for organic analysis do not necessarily result in the qualification of analytical data. It is only one factor in making an overall judgment about the quality of the reported analytical results. For the purpose of data validation of inorganic analyses, precision is measured in two ways. The RPD is calculated when the sample and its duplicate results are greater than 5 times the contract-required detection limit (CRDL). The absolute difference is calculated and applied to the CRDL when the results are less than 5 times the CRDL. Inorganic laboratory sample duplicate RPD values outside the established control criteria result in the qualification of associated analytical results as estimated; however, qualified data does not necessarily indicate that the data are not useful for the purpose intended. This qualification is an indication that data precision should be considered for the overall assessment of the data quality and potential impact on data applicability in meeting site characterization objectives.

The criteria to evaluate analytical method performance for precision (Table 6-1) will be assessed based on the analytical method-specific (e.g., VOCs) precision measurements. The analytical method-specific precision measurement is calculated by taking the number of analyses meeting the RPD criteria, dividing that by the total number of analyses with detectable concentrations, and multiplying by 100. Each analytical method-specific precision measurement will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.3.2 Precision for Radiochemical Analysis

The parameter performance criteria for precision will be compared to the RPD or normalized difference (ND) results of duplicate samples. The criteria for assessment of the radiochemical precision are parameter-specific criteria (see Table 3-1). This assessment will be accomplished as part of the data validation process. Precision values that are within the established control criteria indicate that analytical results for associated samples are valid. Out of control RPD or ND values do not necessarily indicate that the data are not useful for the purpose intended; however, it is an indication that data precision should be considered for the overall assessment of the data quality and the potential impact on data applicability in meeting site characterization objectives.

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

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

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

Where:

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

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

The criteria to evaluate analytical method performance for precision (Table 6-1) will be based on the analytical method-specific (e.g., gamma spectrometry) precision measurements. Analytical method-specific precision measurement is calculated by taking the number of analyses meeting the RPD or ND criteria, dividing that by the total number of analyses, and multiplying by 100. Each analytical method-specific precision measurement will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.4 Accuracy

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

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

6.2.4.1 Accuracy for Chemical Analyses

The %R criteria to be used for assessment of accuracy are the parameter-specific criteria listed in Table 3-1. Accuracy for chemical analyses will be evaluated based on results from three types of spiked samples: MS, LCS, and surrogates. Matrix spike samples are prepared by adding a known concentration of a target parameter to a specified amount of matrix sample for which an independent estimate of the target parameter concentration is available. Laboratory control samples are prepared by adding a known concentration of a target parameter to a "clean" sample matrix (does not contain the target parameter). Surrogate samples are prepared by adding known concentrations of specific organic compounds to each sample analyzed for organic analyses (including QC samples).

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

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

The criteria to evaluate analytical method performance for accuracy (Table 6-1) will be based on the analytical method-specific (e.g., VOCs) accuracy measurements. The analytical method-specific accuracy measurement is calculated by taking the number of analyses meeting the %R criteria, dividing that by the total number of analyses, and multiplying by 100. Each analytical method-specific accuracy measurement will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.4.2 Accuracy for Radiochemical Analysis

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

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

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

The criteria to evaluate analytical method performance for accuracy (Table 6-1) will be assessed based on the analytical method-specific (e.g., gamma spectrometry) accuracy measurements. The analytical method-specific accuracy measurement is calculated by taking the number of analyses meeting the %R criteria, dividing that by the total number of analyses, and multiplying by 100. Each analytical method-specific accuracy performance will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.5 Representativeness

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

6.2.6 Completeness

Completeness is a quantitative and qualitative evaluation of measurement system performance. The criterion for meeting completeness is defined as generating sufficient data of the appropriate quality to satisfy the data needs identified in the DQOs. The quantitative measurement to be used to evaluate completeness is presented in Table 6-1 and is based on the percentage of measurements made that are judged to be valid. Percent completeness is determined by dividing the total number of valid analyses by the total number of analyses required to meet DQO data needs and multiplying by 100. Problems that may affect completeness include total number of samples sent to the laboratory but not analyzed due to problems with samples (e.g., broken bottles, insufficient quantity, insufficient preservation), samples that were collected and sent but never received by the laboratory and rejected data. If these criteria are not achieved, the dataset will be assessed for potential impacts on meeting site characterization objectives.

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

6.2.7 Comparability

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

6.2.8 Sensitivity

Sensitivity is a quantitative parameter that evaluates the capability of a method or instrument to measure parameter concentrations at or near decision levels. The evaluation criteria for this parameter will be that measurement sensitivity (detection limits) will be less than 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.

6.3 Radiological Survey Quality Assurance

Radiological surveys will be performed and data collected in accordance with approved standard quality practices (SQPs).

7.0 Duration and Records Availability

7.1 Duration

After the submittal of the CAIP to NDEP (FFACO milestone date of December 31, 2002), the following is a tentative schedule of activities (in calendar days):

- Day 0: Preparation for field work will begin.
- Day 116: The field work will commence. Samples will be shipped to meet laboratory holding times.
- Day 193: The field investigation will be completed.
- Day 250: The quality-assured laboratory analytical data will be available for NDEP review.
- The FFACO date for the CADD will be established in fiscal year 2003.

7.2 Records Availability

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

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Appendix A

Data Quality Objectives

A.1.0 Seven-Step DQO Process for CAU 410 Investigations

The DQO process is a strategic planning approach based on the scientific method 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 potentially viable corrective actions (i.e., no further action or close in place). The existing information about the nature and extent of contamination at the five CASs in CAU 410 is insufficient to evaluate and select preferred corrective actions. The CAU 410 investigation will be based on DQOs developed by representatives of NDEP and NNSA/NV.

Corrective Action Unit 410 is comprised of the following CASs:

- TA-19-002-TAB2, Debris Mound
- TA-21-003-TANL, Disposal Trench
- TA-21-002-TAAL, Disposal Trench
- 09-21-001-TA09, Disposal Trenches
- 03-19-001, Waste Disposal Site

This section presents the seven-step DQO process for the investigation. All CASs had geophysical surveys performed to identify boundaries of the CAS based on anomalies of buried debris or disturbed soil. Identified subsurface materials will be excavated for investigation and possible disposal. Sites without identifiable surface or subsurface debris will have confirmatory sampling performed to define the nature and extent of the CAS.

A.1.1 Step 1 - State the Problem

Step 1 defines the problem that has initiated the CAU 410 site investigation. This step identifies the DQO planning team members, describes the problem, and develops a conceptual site model.

A.1.1.1 Planning Team Members

The DQO planning team consists of representatives from NDEP, NNSA/NV, ITLV, and Bechtel Nevada (BN). The primary decision-makers include NDEP and NNSA/NV representatives. Table A.1-1 lists representatives from each organization in attendance for the April 18, 2002, DQO meeting.

Table A.1-1
DQO Meeting Participants

Participant	Affiliation	Meeting Held On April 18, 2002
Kevin Cabble	NNSA/NV	✗
Jill Dale	ITLV	✗
Angela Dudley	ITLV	✗
John Fowler	ITLV	✗
Clem Goewert	NDEP	✗
Joe Hutchinson	ITLV	✗
Jeff Johnson	ITLV	✗
Lynn Kidman	ITLV	✗
William Nicosia	ITLV	✗
Dan Tobiason	BN	✗
Jeanne Wightman	ITLV	✗
John Wong	NDEP	✗

BN = Bechtel Nevada
NNSA/NV = U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office
ITLV = IT Corporation, Las Vegas Office
NDEP = Nevada Division of Environmental Protection
X = Denotes meeting attendance

A.1.1.2 Describe the Problem

Corrective Action Unit 410 is being investigated because:

- Disposed waste may be present without appropriate controls (i.e., use restrictions).
- Ordnance, fuel, nonhazardous, hazardous, and/or radiological constituents may be present in concentrations at the CAS locations that could potentially pose a threat to human health and the environment.

A.1.1.3 Develop Conceptual Site Model

The CSM describes the most probable scenario for current conditions at a site and defines the assumptions that are the basis for identifying appropriate sampling strategy and data collection methods. An accurate CSM is important as it serves as the basis for all subsequent inputs and decisions throughout the DQO process.

An important element of a CSM is the expected fate and transport of contaminants, which infer how contaminants move through site media and where they can be expected in the environment. The expected fate and transport is based on distinguishing physical characteristics of the contaminants and media. Contaminant characteristics include solubility, density, and affinity to nonmobile particles. Media characteristics include permeability, porosity, hydraulic conductivity, and degree of saturation. In general, contaminants with low solubility, high density, and high affinity can be expected to be found relatively close to release points. Contaminants with high solubility, low density, and low affinity can be expected to be found further from release points or in areas where settling may occur.

Percolation of precipitation through subsurface media and vapor phase diffusion serve as the major driving forces for migration of contaminants. However, due to the arid environment, percolation of precipitation at the TTR is very small and migration of contaminants has been shown to be very limited. Evaporation potentials significantly exceed available soil moisture from precipitation. The average annual precipitation at the TTR ranges from 3 to less than 10 inches per year. The annual potential evaporation ranges from 60 to 82 inches per year, or roughly 5 to 25 times the annual precipitation. (Winograd and Thordarson, 1975)

Vapor phase diffusion is limited by the vapor pressure of the contaminant and is expected to be limited to relatively short distances from the contaminant source. Migration attributed to each of these driving forces under conditions found at the TTR would result in contaminant concentrations that decrease with distance from the contaminant source.

According to historical documentation and interviews, the CAU 410 sites, with the exception of CAS 03-19-001, are classified as waste disposal trenches, sites, and mounds from high explosives and ordnance-related tests. The trenches vary in configuration and process knowledge, and range in use from borrow pits to backfill holes. Documentation suggests the possible disposal of ordnance, fuel, nonhazardous material, hazardous material, and/or radiological material at CAU 410 locations. Subsurface soils are the media potentially affected from leachable solid and/or liquid waste. Any contamination would be attributable to direct release to the surface and/or subsurface from solid waste, erosion of various contaminants off the surface of solid materials, and leaching of contaminants from materials. No disposal records were identified for these sites; therefore, material disposal is based on process knowledge and visual observations.

During the CAU 405 investigation, debris and staining were identified outside of the scope of the original CAS at the SWS-4 location. This location has been identified as CAS 03-19-001 and added to CAU 410. No disposal records were identified for this site; therefore, materials disposal is based on process knowledge and interviews.

All five CASs are included in the general CSM developed for CAU 410. Figure A.1-1 shows a representation of the general CSM, while additional details to supplement the model are provided in the following text. The current physical description for each CAS was used to develop the CSM and is presented in the following subsections. Table A.1-2 summarizes the past use of each CAS and was used to develop the CSM.

A.1.1.3.1 CAS TA-19-002-TAB2, Debris Mound

This CAS is described as a debris mound and is located in the north NEDS Lake area near Bunker 2. This CAS is a mounded area approximately 15 x 20 ft in diameter in a disturbed area approximately 110 x 120 ft. The site contains metal and possible ordnance, and there is metal and parachute debris protruding from the surface of the mound. Geophysical surveys identified metallic subsurface debris consistent with the debris identified at the surface.

A.1.1.3.2 CAS TA-21-003-TANL, Disposal Trench

This CAS location is a disposal trench located in the north NEDS Lake area near the dry lake bed. The site consists of one trench that was covered by an arched structure composed of metal and wood. The trench is approximately 20 x 50 ft and has an obvious depression where the trench is located. This site was used for a series of tests conducted in the 1960s and 1970s called the “suitcase tests” and for containment capability tests. The CAS may contain beryllium, radiological constituents, TPH, explosives, and rocket propellant. There is no surface metal or debris visible; however, geophysical surveys identified subsurface metallic debris at the east end of the trench.

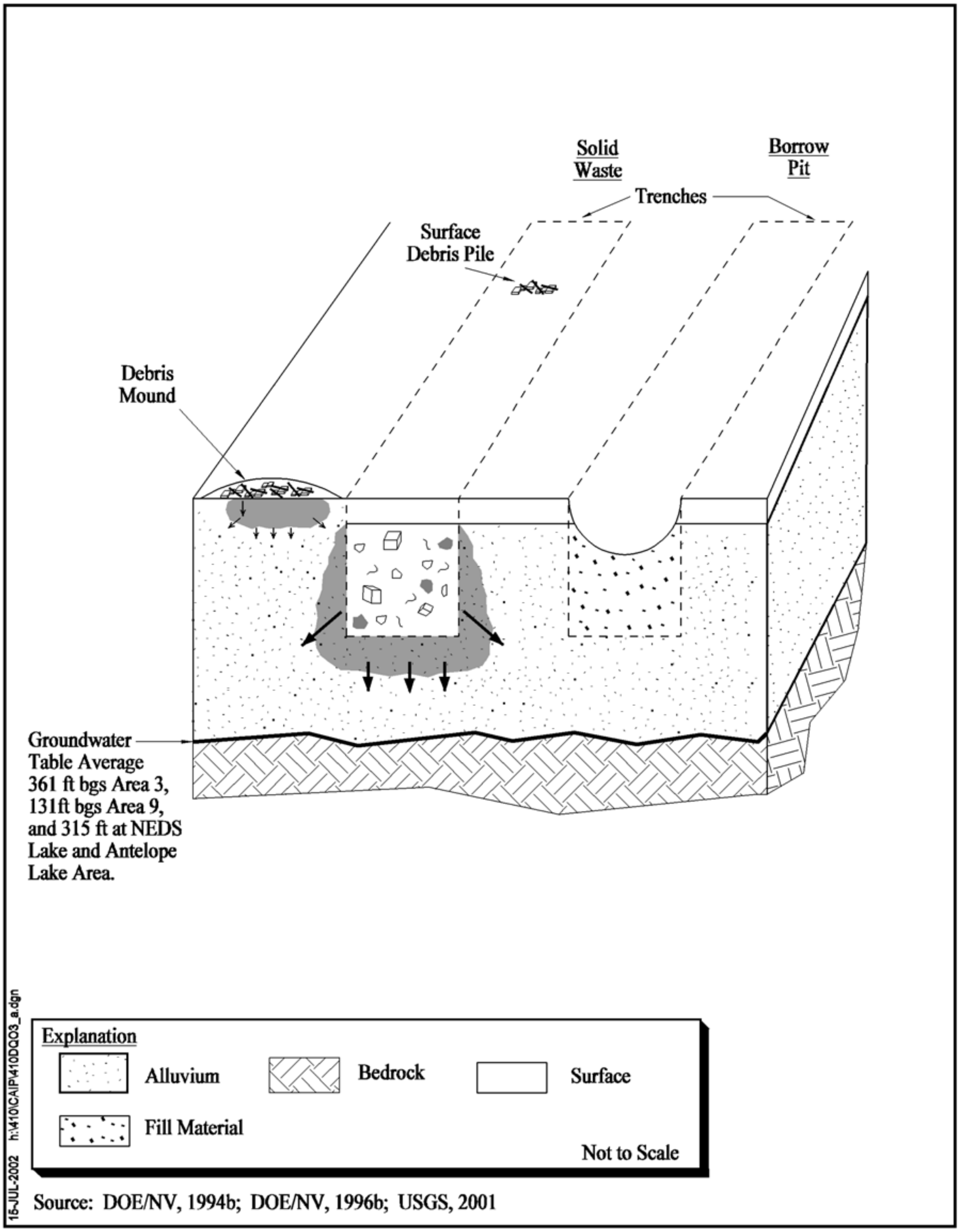

Figure A.1-1
CAU 410 General Conceptual Site Model

Table A.1-2
Past Use and Physical Description
(Page 1 of 2)

CAS	Past Use	Suspect Contaminants
Debris Mound TA-19-002-TAB2 (Debris Mound)	Interviews suggest that this site may have been associated with the parachute tube ejection tests. The area of the debris is 15 x 20 ft, yet the entire disturbed area is 110 x 120 ft. This debris mound may contain metal scrap and ordnance in addition to the visible debris which is currently protruding from the surface (Dubiskas, 1998). It is possible that the waste that may exhibit hazardous and sanitary characteristics. During a field visit in 2001, radiation exceeded established background levels (IT, 2001a); however, radiological surveys conducted in the area determined that the area did not have surface radiological contamination (IT, 2002). Geophysical surveys identified surface and possible subsurface debris consistent with the area of the mound (Shaw E & I, 2002).	HE, radiological constituents
Disposal Trench TA-21-003-TANL (NEDS Lake Trench)	This disposal trench is believed to have been used during a series of tests conducted in the late 1960s to the mid-1970s (referred to as the suitcase tests (Kluesner, 2001). Sandia National Laboratories also conducted activities at this location using artillery rounds to test containment capabilities (Dubiskas, 1997). As a result of these containment tests, it is necessary to survey the area for DU. Due to the type of tests conducted during the time associated with this site, it is also assumed that beryllium is a COPC due to the common association with DU (DOE, 1993). The size of this trench is approximately 20 x 50 ft. Subsurface debris was identified during geophysical surveys at the eastern end of the trench (Shaw E & I, 2002). During a recent survey, there was no surface radiological contamination at the trench location (IT, 2002). Additional interviews and historical information about this site suggest that the arched structure over the trench was used during the tests described above. A report on specific RCRA facilities identified this CAS as a location where burn tests for rocket propellant were performed (DOE/NV, 1994).	beryllium, DU, TPH, HE, rocket propellant
Disposal Trench TA-21-002-TAAL (Antelope Lake Trench)	This disposal trench is within a large disturbed area and consists of one or multiple trenches. There is visible surface debris and disturbed surface soils at the CAS location. Historical documentation indicates that the site may have been a source of fill material for holes generated as a part of the Plowshare Project (Galvin, 2001). Antelope Lake is an active target and materials from activities may have been buried in the trenches. In 1982, there was a cleanup effort on Antelope Lake to remove rocket motor debris. It is possible that debris collected as part of the cleanup effort may have been disposed of in these trenches (Elliston, 1998). There is no surface expression of a trench; however, there is an area with an approximate circumference of 883 ft which is disturbed. Surface debris in the area consists of wire, metal fragments, rusted shrapnel, wood, and cable (IT, 2001b). Four areas of subsurface metallic debris were identified during the geophysical surveys (Shaw E & I, 2002). There was no radiological contamination above background identified during the radiological surveys conducted in 2002 (IT, 2002).	asbestos, total RCRA metals, beryllium, radiological constituents, HE, TPH

Table A.1-2
Past Use and Physical Description
(Page 2 of 2)

CAS	Past Use	Suspect Contaminants
Disposal Trenches 09-21-001-TA09 (Area 9 Trenches)	The CAS consists of two open trenches in a perpendicular configuration. The size of the trenches are 198 x 90 ft for the east-west trench and the 56 X 268 ft for the north-south trench. Historical information indicates that the trenches were used as borrow pits to construct igloos in the area with earthen covers (Galvin, 2001). Additional information suggests that the trenches were also used for disposal of excess concrete and rinsate from construction activities and served as temporary storage for explosive mounts (Kluesner, 2001). The types of explosive mounts stored in the trenches are unknown. There was no subsurface metallic debris identified during the geophysical surveys in 2002 (Shaw E & I, 2002). No surface radiological contamination was identified during drive-over surveys (IT, 2002).	HE
Waste Disposal Site, CAS 03-19-001 (Area 3 TPH Contamination)	Miscellaneous buried debris includes wire, glass, burned material, and rust residue. The lateral extent of the debris is unknown. The debris found during the CAU 405 investigation was identified at the 4.5- to 5-ft interval. Historical documentation does not exist for this location. A use restriction from the CAU 424 landfill exists approximately 80 ft to the south and to the west of CAS 03-19-001. No subsurface metallic debris was identified for this location during the geophysical surveys (Shaw E & I, 2002).	TPH DRO

A.1.1.3.3 CAS TA-21-002-TAAL, Disposal Trench

This CAS is classified as a disposal trench and is located in a disturbed area with a circumference of approximately 883 ft. There is no obvious trench configuration visible from the surface, but there is partially buried and surface debris. Geophysical surveys identified four areas of subsurface metallic debris consistent with trenches in the disturbed area.

A.1.1.3.4 CAS 09-21-001-TA09, Disposal Trenches

This CAS consists of two open trenches in a perpendicular configuration. The trenches are approximately 198 x 90 ft (east-west trench) and 56 x 268 ft (north-south trench). The site is documented to have provided fill material for the covers of nearby bunkers and as a possible construction materials dump. There is no obvious staining; however, there is limited construction debris throughout the site. Geophysical surveys did not identify any subsurface metallic debris at the location.

A.1.1.3.5 CAS 03-19-001, Waste Disposal Site

This location was identified as a Waste Disposal Site as a result of the CAU 405 investigation. There was debris found at the 4.5- to 5-ft interval, and TPH was identified above the PALs. Bechtel Nevada field screened additional locations to identify the plume. This site borders a current-use restriction for the a landfill in CAU 424. There is no debris present at the surface, and no subsurface metallic debris was identified during the geophysical surveys.

Future Land-Use Scenarios

Future land-use scenarios limit future uses of the CASs to various nonresidential (i.e., industrial) uses (DOE/NV, 1998). The future land-use scenarios for CAU 410 are presented in Table A.1-3.

Exposure scenarios for sites located within the TTR boundaries are limited by the future land-use scenarios and to site workers who may be exposed to COPCs through oral ingestion, inhalation, or dermal contact (absorption) of soils and/or debris due to inadvertent disturbance of these materials.

Table A.1-3
Future Land-Use Scenarios for CASs Within CAU 410

CAS	Name	Zone	Zone Description
TA-19-002-TAB2	Debris Mound	Tonopah Test Range	Impact Tests, Passive Tests, Chemical Tests (DOE/NV, 1998)
TA-21-003-TANL	Disposal Trench		
TA-21-002-TAAL	Disposal Trench		
09-21-001-TA09	Disposal Trenches		
03-19-001	Waste Disposal Site		Administrative Area (DOE/NV, 1998)

COPCs/Released Material

Interviews with former site employees, review of historic documents, and interpretations of ground photographs indicate the sources of potential contamination related to the CAU 410 CASs are varied, but are generally representative of the CSM. The CAS-specific release information, migration routes, exposure pathways, and affected media are discussed in Section 2.4 of the CAIP. Section 3.2 of the CAIP identifies the critical analytes. Additional analyses are listed for each site to identify any additional releases that may have occurred at the CAS locations. The COPCs are defined as the analytes reported from the analytical methods listed in the *Region IX Preliminary Remediation Goals* (EPA, 2000) or are in the IRIS Database (EPA, 2001) as identified in Table A.1-3 for CAU 410. The selected COPCs are those commonly analyzed by the laboratory and have PRGs. There is no reason to believe that other compounds would be present at concentrations of concern if the selected compounds do not exceed PALs Table A.1-2 provides the past use, physical description, and the suspect contaminants for each specific CAS.

Affected Media

Affected media includes surface and subsurface soil.

Location of Contamination/Release

The native soil interface below and adjacent to the disposed waste is the most likely location for soil contamination. Any contaminants migrating from these CASs, regardless of physical or chemical characteristics, are expected to be in soil adjacent to disposal feature's lateral and vertical native-soil interfaces.

Transport Mechanisms

Contaminants may have been transported by infiltration of precipitation through surface soil which serves as a driving force for downward migration of contaminants; however, the annual average precipitation for this region is only 2 to 9 inches (DOE/NV, 1996).

Preferential Pathways

Preferential pathways at the CASs are expected to be limited to typical vertical migration due to gravity and minor lateral migration due to voids or confining layers.

Lateral and Vertical Extent of Contamination

Contamination, if present, is expected to be contiguous to the site. Concentrations are expected to decrease with distance and depth from the sites. Based on the depth to groundwater which varies for each CAS within the Cactus Flat region at TTR, groundwater contamination is not considered a likely

Table A.1-4
Analytical Methods for CAU 410

CAS	VOCs	SVOCs	Total Be	RCRA metals[a]	TPH (GRO)	TPH (DRO)	Total HE	Gamma Spec	Iso U	Iso Pu
CAS TA-19-002-TAB2, Debris Mound	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	No
CAS TA-21-003-TANL, Disposal Trench (NEDS Lake)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CAS TA-21-002-TAAL, Disposal Trench (Antelope Lake)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CAS 09-21-001-TA09, Disposal Trenches (Area 9)	Yes	Yes	No	Yes	No	No	Yes	Yes	No	No
CAS 03-19-00, Waste Disposal Site (Area 3)	No	No	No	No	No	Yes	No	No	No	No

Contaminants of potential concern are defined as the analytes reported from the analytical methods listed in this table that have established *Region IX Preliminary Remediation Goals* (EPA, 2000) or are listed in the IRIS Database (EPA, 2001).

[a]Metal analysis will be determined in the field based on type and amount of debris.

Be = Beryllium
CAS = Corrective action site
Gamma Spec = Gamma spectrometry
HE = High explosives
Iso Pu = Isotopic plutonium
Iso U = Isotopic uranium
RCRA = *Resource Conservation and Recovery Act*
SVOCs = Semivolatile organic compounds
TPH (DRO) = Total petroleum hydrocarbons (diesel-range organics)
TPH (GRO) = Total petroleum hydrocarbons (gasoline-range organics)
VOCs = Volatile organic compounds

scenario at CAU 410. A listing of the depth to groundwater for each CAS is identified in Section 2.1 of the CAIP.

Surface migration may occur as a result of a spill or as runoff of precipitation. Surface migration is a biasing factor considered in the selection of sampling points.

A.1.2 Step 2 - Identify the Decision

This step develops decision statements and defines alternative actions. Figure A.1-2 is a flow chart that identifies decisions and alternative actions appropriate for the investigation.

A.1.2.1 Develop a Decision Statement

Two decision statements are required for this investigation. Decision I is “Define nature of contamination at a location.” Decision II is “Determine extent of the contamination identified above PALs.”

A.1.2.2 Alternative Actions to the Decision

If disposal of waste (i.e., debris or liquid) has not occurred or there are no COCs, further assessment of the CAS is not required. Confirmatory samples will be collected at the CAS location and sent to the laboratory for analysis.

If disposal of waste has occurred, samples will be collected at the CAS based on biasing factors to determine the nature and/or extent of the contamination.

A.1.3 Step 3 - Identify the Inputs to the Decision

This step identifies the information needed, determines sources for information, determines the basis for establishing the action level, and identifies sampling and analysis methods that can meet the data requirements.

A.1.3.1 Information Needs and Information Sources

In order to define nature of contamination, data must be collected and analyzed following these three criteria: (1) data must be collected in areas most likely to contain disposed waste, (2) samples will be

CAU 410 Investigation

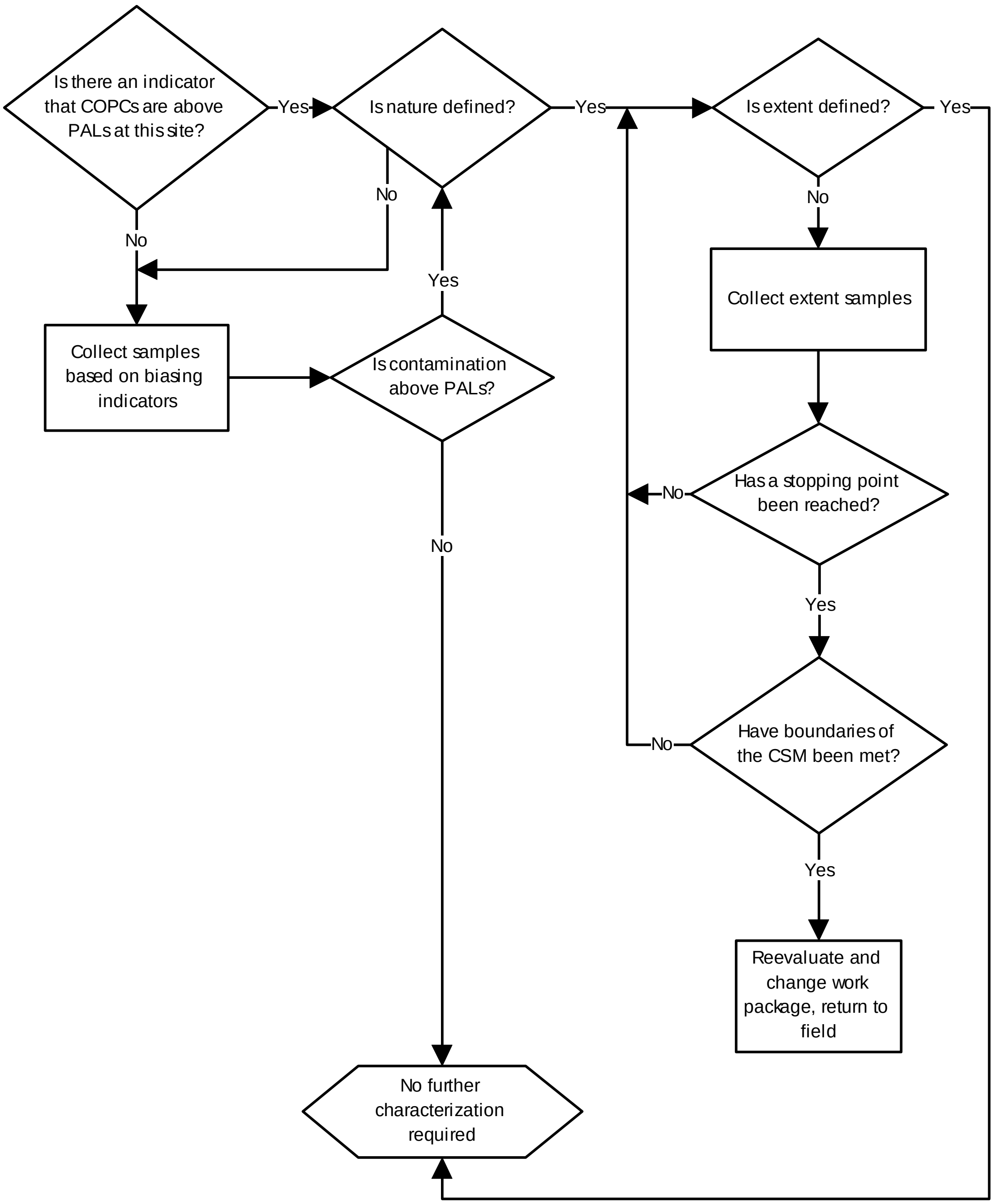

Figure A.1-2
Decision Flow Chart

collected in areas most likely to be contaminated, and (3) the data collection method must be adequate to detect COCs.

In order to determine if a COC is present at a particular CAS, sample data must be collected and analyzed following these two criteria: (1) samples must be collected in areas most likely to be contaminated (e.g., adjacent to the vertical extent of waste) and (2) the analytical suite selected must be sufficient to detect any contamination present in the samples. Table A.1-4 represents the CAS-specific COPCs which will dictate the analytical suite.

Biasing factors to support the nature criteria include:

- Geophysical surveys
- Documented process knowledge on source and location of release
- Field observations
- Historical sample results
- Experience and data from investigations of similar sites
- Professional judgement

In order to define extent of contamination, data must be collected and analyzed using a data collection method adequate to detect COCs.

In order to determine the extent of contamination, the lateral and vertical extent of the contamination must be defined. Samples will be collected based on geophysical surveys, field observations, and field-screening results. In order to determine the extent of a COC at a particular CAS, samples must be collected in areas least likely to be affected by the contamination identified for the CAS (i.e., below the vertical extent of waste). The analytical suite will be determined by the defined nature of the CAS.

Biasing factors to support the extent criteria include:

- Geophysical surveys
- Field observations
- Historical sample results
- Experience and data from investigations of similar sites
- Professional judgement
- Field-screening results

Table A.1-5 and Table A.1-6 list the information needs, the source of information for each need, and the proposed methods to collect the data. The last column addresses the QA/QC data type and associated metric. The data type is determined by the intended use of the resulting data in decision making. Data types are discussed below.

Quantitative Data

Quantitative data measure the quantity or amount 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 decisions (i.e., rejecting or accepting the null hypothesis) and/or verifying closure standards have been met. Laboratory analytical data are generally considered quantitative.

Semiquantitative Data

Semiquantitative data indirectly measure the quantity or amount of a characteristic or component. Inferences are drawn about the quantity or amount of a characteristic or component because a correlation has been shown to exist between the indirect measurement and the results from a 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 used alone to resolve primary decisions. Field-screening data are generally considered semiquantitative. The data are often used to guide investigations toward quantitative data collection.

Qualitative Data

Qualitative data identify or describe the characteristics or components of the population of interest. The QA/QC requirements are the least rigorous on data collection methods and measurement systems. The intended use of the data is for information purposes, to refine conceptual models, and guide investigations rather than resolve primary decisions. This measurement of quality is typically assigned to historical information and data where QA/QC may be highly variable or not known. Professional judgement is often used to generate qualitative data.

Table A.1-5
Information Needs to Resolve Decision I

Information Need	Information Source	Collection Method	Data Type/Metric
Decision I: Define nature of contamination at a location. Criteria 1: Data will be collected in areas most likely to contain disposed waste.			
Historical use of site	Process knowledge compiled by Preliminary Assessments (PA) 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
	Previous analytical results	Data collected from previous sampling effort	Quantitative – Validated analytical results will be compared to PALs
Physical characteristics of disposed waste	Geophysical surveys	Perform geophysical surveys using appropriate methods	Semiquantitative – Surveys based on biasing criteria stipulated in DQO Step 7
Decision I: Define nature of contamination at a location. Criteria 2: Samples will be collected from areas most likely to be contaminated.			
Identification of all potential contaminants	Process knowledge compiled by PA and previous investigations of similar sites; a full suite of analyses will be used	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 – Validated analytical results will be compared to PALs
Physical characteristics of disposed waste	Radiological surveys	Perform radiological surveys using appropriate methods	Semiquantitative – Surveys based on biasing criteria stipulated in DQO Step 7
	Inspection of biased samples	Visual inspection via drilling or excavation	Qualitative – CSM has not been shown to be inaccurate
Decision I: Define nature of contamination at a location. Criteria 3: Data collection method must be adequate to detect COCs.			
Identification of all potential contaminants	Process knowledge compiled by PA 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 – Validated analytical results will be compared to PALs

Table A.1-6
Information Needs to Resolve Decision II

Information Need	Information Source	Collection Method	Data Type/Metric
Decision II: Determine extent of the contamination identified above PALs. Criteria 1: Data collection method must be adequate to detect COCs			
Lateral and vertical extent of disposed waste	Process knowledge compiled by PA 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
	Geophysical surveys	Perform geophysical surveys using appropriate methods	Semiquantitative – Sampling based on biasing criteria stipulated in DQO Step 7
Physical characteristics of disposed waste	Field-screening results	Perform field screening using appropriate methods	Semiquantitative – results based on biasing criteria stipulated in DQO Step 7

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.1.3.2 Determine the Basis for the Preliminary Action Levels

To define both nature and extent, 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:

- *EPA Region 9 Risk-Based Preliminary Remediation Goals* for chemical constituents in industrial soils (EPA, 2000)
- 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 TTR. Background is considered the mean plus two times the standard deviation of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nellis Air Force Range (NBMG, 1998; Moore, 1999).
- The TPH action limit of 100 ppm per the NAC 445A.2272 (NAC, 2002)

- The PALs for radionuclides are isotope-specific and defined as the maximum concentration for that isotope found in samples from undisturbed background locations in the vicinity of the NTS (McArthur and Miller, 1989; Atlan-Tech, 1992; BN, 1996). The PAL is equal to the minimum detectable activity for isotopes not reported in soil samples from undisturbed background locations or if the PAL is less than the MDA (Table 3-2).

- For detected chemical COPCs without established PRGs, a similar protocol to that used by EPA Region 9 will be used in establishing an action level for those COPCs listed in *Integrated Risk Information System Database* (EPA, 2001).

For COPCs without established PRGs, a protocol similar to EPA Region 9 will be used in establishing an action level if necessary.

A.1.3.3 Potential Sampling Techniques and Appropriate Analytical Methods

To evaluate both the nature and extent of contamination for each CAS, the sampling techniques and analytical methods identified below will be used to resolve the decision rules.

Geophysical Surveys

Electromagnetic surveys were used to determine presence/lateral extent of applicable waste. Resistivity surveys may be used to determine presence/vertical extent of applicable waste. Geophysical surveys followed standard procedures. If geophysical results are inconclusive (CAS 09-21-001-TA09), the intrusive investigation will continue to confirm that debris is not present. Other methods may be used based on site conditions.

Radiological Surveys

Radiological surveys were used to determine the presence/lateral extent of potential radiological contamination.

Soil Sampling

Drilling, excavation, or other appropriate sampling methods will be used. Sample collection and handling activities will follow standard procedures.

The Industrial Sites QAPP (NNSA/NV, 2002), unless otherwise stipulated in the CAIP, provides analytical methods and laboratory requirements (e.g., detection limits, precision and accuracy requirements, minimum sample volume). Specific analyses required for the disposal of IDW are identified in Section 5.0 of the CAIP.

To assure that laboratory analyses are sufficient to detect contamination in soil samples at concentrations exceeding the MRL, chemical and radiological parameters of interest have been selected for each CAS. Solid media (e.g., concrete, wood) will not be analyzed by a laboratory for chemical or radiological parameters.

For each CAS, the chemical and radiological parameters for soil samples are included in Table A.1-4.

A.1.4 Step 4 - Define the Boundaries of the Study

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

A.1.4.1 Define the Target Population

The nature target populations are:

- Soil adjacent to below disposed waste
- COC concentrations of potential disposal features not conclusively identified by geophysical surveys or visual observations

The extent target populations are:

- Identified COCs
- COC concentrations in lateral native soil interfaces
- COC concentrations in soil at the native soil interface and below debris

These target populations represent locations within the CAS that will encounter contamination, if migration has occurred. Additional target populations may also be sampled, at the discretion of the Site Supervisor.

A.1.4.2 Identify the Spatial and Temporal Boundaries

The spatial boundaries that apply to each CAS are the survey and sample locations selected as determined by process knowledge, visual observations, and geophysical surveys for both nature and extent. Table A.1-7 exhibits the boundaries and buffers for each CAS, temporal issues, and the obstructions which may impede the investigation. Figures 4-1 through 4-5 of the CAIP depict the sites and surrounding boundaries.

Table A.1-7
Spatial and Temporal Boundaries for CAU 410

CAS	Boundaries/Buffers	Temporal	Obstructions
TA-19-002-TAB2, Debris Mound	The area of the debris is 15 x 20 ft, yet the entire disturbed area is 120 x 110 ft. CAU 409, Sludge Disposal Pits 1 & 2 are approximately 100 ft to the southeast.	Snow may cover the area in the winter.	None
TA-21-003-TANL, Disposal Trench	The trench is approximately 20 x 50 ft.	Snow may cover the area in the winter. Standing water may be an issue after rainfall.	Metal and wood arched structure over the top of the trench
TA-21-002-TAAL, Disposal Trench	There is no surface expression of a trench; however, there is an area with an approximate circumference of 883 ft which is disturbed.	Snow may cover the area in the winter. Standing water may be an issue after rainfall.	None
09-21-001-TA09, Disposal Trenches	The CAS consists of two open trenches in a perpendicular configuration. The east-west trench is 198 x 90 ft for the and the north-south trench is 56 X 268 ft.	Snow may cover the area in the winter. Standing water may be an issue after rainfall.	Possible underground utilities
03-19-001, Waste Disposal Site	Unknown	Snow may cover the area in the winter.	Use restrictions, possible underground utilities, buildings in Area 3

Temporal boundaries are those time constraints set up by weather conditions and project schedules. Snow events at TTR may affect site access during the months of December, January, and February. Moist weather may place constraints on sampling and field screening contaminated soils because of the attenuating effect of moisture in samples (e.g., alpha/beta-emitting radionuclides). There are no time constraints on 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 sites were last used.

A.1.4.3 Identify Practical Constraints

The practical constraints which may affect activities at TTR include underground utilities, topography, access, and physical obstructions. Table A.1-8 indicates other practical constraints that may be encountered at each CAS.

Table A.1-8
Practical Constraints Identified for CAU 410

CAS	Utilities Likely to be Encountered[a]	Topography/Site Conditions Likely to Effect Planned Activities	Structures (e.g., materials) Likely to Effect Planned Activities	Area Subject to Access Restrictions[b]
TA-19-002-TAB2, Debris Mound	No	No	No	Yes
TA-21-003-TANL, Disposal Trench	No	Yes	Yes	Yes
TA-21-002-TAAL, Disposal Trench	No	Yes	No	Yes
09-21-001-TA09, Disposal Trenches	Yes	Yes	No	Yes
03-19-001, Waste Disposal Site	Yes	No	Yes	Yes

[a]All CASs will be surveyed for utilities prior to field activities in accordance with the SSHASP. Utility constraints are subject to change as detailed information is collected prior to commencement of investigation activities. All changes will be appropriately documented.
[b]Access restrictions include both scheduling conflicts on the TTR with other entities, locations posted as contamination areas requiring appropriate work controls, and areas requiring authorized access.

Source: Site visits on 02/21/2001 (IT, 2001a and b)

A.1.4.4 Define the Scale of Decision Making

The scale of decision making for the investigation is defined as each CAS.

A.1.5 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.1.5.1 Specify the Population Parameter

For geophysical surveys, individual results will be the population parameter and compared against method specific parameters. If sampling is performed to support inconclusive geophysical results (CAS 09-21-001-TA09), the maximum observed concentration of each COC will be the population parameter.

Because the sampling to resolve Decision II (Identify extent of the COCs identified above PALs) is biased towards concentrations of migrated contaminants, the population parameter will be the maximum observed concentration of each COC within the target population.

A.1.5.2 Choose an Action Level

Action levels are defined in Section A.1.3.2.

A.1.5.3 Measurement and Analysis Methods

Decision I (Determine nature of contamination at a location) will be resolved in three steps. First, geophysical surveys were performed to identify buried debris. Next, excavating identified anomalies to determine if debris is present. Finally, if debris or visible staining is present, then environmental soil sampling will be performed to resolve Decision I (Determine nature of contamination at a location) using the measurement and analysis methods discussed below.

The measurement and analysis methods in the Industrial Sites QAPP (NNSA/NV, 2002) are capable of achieving the expected range of values to resolve nature and extent. 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.1.3.3 for additional details.

A.1.5.4 Decision Rule

If evidence of waste disposal is obtained, then extent must be resolved. If evidence of waste disposal is not obtained (i.e., debris or liquid) to indicate that there is no contamination, then the decision will be to collect confirmatory samples. If evidence (geophysical or intrusive excavation) is inconclusive for any of the CASs (CAS 09-21-001-TA09), then confirmatory samples will be collected to determine if the concentration of any COPCs in a target population exceeds the PALs. If the COPC concentration is less than the PAL, then the decision will be no further action.

A.1.6 Step 6 - Specify the Tolerable Limits on Decision Errors

The approach for resolving the nature of the contamination present at these CASs relies on assuming that historical disposal activities occurred within a distinct geographical area. Disposed waste is assumed to be identified by excavation if the geophysical surveys are inconclusive. If geophysical results are inconclusive (CAS 09-21-001-TA09), then visual observation of waste, field screening, or validated analytical results (quantitative data) will be used to determine if COCs are present. The baseline condition (i.e., null hypothesis) and alternative condition for determining nature are:

- Baseline condition – Disposed waste is present and/or a COC is present.
- Alternative condition – Disposed waste is not present and/or a COC is not present.

The sampling approach for resolving extent relies on biased sampling locations such as knowing the location of disposed waste and field-screening results exceeding the field-screening levels; therefore, random sample locations are not considered. Only validated analytical results (quantitative data) will be used to determine if COCs are migrating. The baseline condition and alternative condition for defining extent are:

- Baseline condition – A COC has migrated.
- Alternative condition – A COC has not migrated.

A.1.6.1 False Negative Decision Error

The false negative (alpha) decision error would mean deciding that:

- Disposed waste or a COC is not present when it is, increasing the risk to human health and the environment.

- A COC has not migrated when it has, increasing risk to human health and environment.

A false negative decision error (where consequences are more severe) is controlled by meeting these criteria: (1) having a high degree of confidence that the geophysical survey areas and/or sample locations selected will identify disposed waste or COCs (only necessary if geophysics are inconclusive for discrete potential disposal features) if present anywhere within the CAS, (2) having a high degree of confidence that the sample locations selected will identify COCs if migrating from the CAS, and (3) having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.

To satisfy the first two criteria, data and samples will be collected in areas most likely to contain disposed waste, contain COCs where geophysical results were inconclusive, based on trench configuration, based on field-screening results, and be contaminated by any migrating COCs. To accomplish this, the following characteristics are considered:

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

These characteristics were considered during the development of the CSM. The biasing factors listed in Section A.1.3.3 will be used to further ensure that these criteria are met.

All samples will be analyzed for the chemical and radiological parameters listed in Section A.1.3.2. Strict adherence to established procedures and QA/QC protocol protects against false negatives.

A.1.6.2 False Positive Decision Error

The false positive (beta) decision error would mean deciding that:

- Disposed waste or a COC is present when it is not, resulting in increased costs for unnecessary characterization.

- A COC has migrated when it has not, resulting in increased costs for unnecessary characterization.

For determining if disposed waste is present, the false positive decision error is controlled by well-established methodology, experienced personnel, and direct sampling where geophysical results may be inconclusive.

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

A.1.6.3 Quality Assurance/Quality Control

Geophysical survey instruments were calibrated in accordance with manufacturer's instructions and periodic calibrations will be performed in accordance with approved procedures.

Quality control samples will be collected as required by established procedures. The required QC samples 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 source lot per sampling method)
- Field duplicates (minimum of 1 per matrix per 20 environmental samples or 1 per CAS if less than 20 collected)
- Field blanks (minimum of 1 per 20 environmental samples)
- Matrix spike/matrix spike duplicate (minimum of 1 per matrix per 20 environmental samples or 1 per CAS if less than 20 collected, not required for all radionuclide measurements)

Additional QC samples may be submitted based on site conditions.

Data Quality Indicators of precision, accuracy, comparability, completeness, and representativeness are defined in the Industrial Sites QAPP (NNSA/NV, 2002). In addition, sensitivity has been included as a DQI for laboratory analyses. Site-specific DQIs are discussed in more detail in Section 6.0 of the CAIP.

A.1.7 Step 7 - Optimize the Design for Obtaining Data

Geophysical surveys and biased sampling were conducted at CAU 410 prior to the investigation. Geophysical surveys were performed to estimate the volume and location of disposed waste. Biased sampling locations will be determined based on the results of the geophysical surveys and other biasing factors listed in Section A.1.3.1. The Site Supervisor has the discretion to modify these locations and minimize samples for off-site analyses, but only if the decision needs and criteria stipulated in Section A.1.3 are still satisfied.

The following sections provide general investigation activities. The CAS-specific investigation activities will be developed as CAS-specific data becomes successively more detailed.

A.1.7.1 Geophysical Surveys

Geophysical surveys were conducted at each of the CAU 410 CASs to determine the location and volume of disposed waste. Site preparation will be required by the TTR Performanced-Based Management Contractor prior to the surveys. Site preparation will include removal and proper disposal of large surface debris and temporarily moving staged equipment.

Electromagnetic (EM) induction methodology using instruments such as the Geonics EM31 and EM61 were used to determine the approximate lateral extent of disposed waste. Trench configuration was acquired from the results of these surveys. The grid spacing for data collection locations was determined by the geophysical manager. The EM31 was the primary instrument. The EM61 was used to supplement EM31 data as necessary, especially near areas of interference (i.e., utilities and fences). The number and length of data collection traverses was determined based on the results of the EM surveys.

A.1.7.2 Intrusive Investigation

Intrusive investigations will be conducted at each of the CAU 410 CASs to determine if a COC is present or has migrated. Locations for these activities were based on the results of the geophysical surveys and other biasing factors listed in Section A.1.3.3.

Direct-push, hand auger, drilling, and/or excavation will be used to access sample intervals for laboratory analysis at select locations to determine if a COC is present or has migrated. Potential disposal features identified by inconclusive geophysics may be accessed directly at the discretion of the Site Supervisor.

Sample intervals will be selected from the biased locations focusing on any COC that may have migrated from the disturbed area within the disposal feature based on FSRs. If FSRs do not exceed FSLs, the frequency of sample intervals above the native soil interface will be based on biasing factors such as debris, staining, odor, low surface point, and native soil interface. Biased sample locations will be based debris identified during the geophysical surveys (Shaw E & I, 2002).

A.1.7.2.1 Investigation Strategy for CASs TA-19-002-TAB2, TA-21-003-TANL, and TA 21-002-TAAL

The sampling strategy for CASs TA-19-002-TAB2, TA-21-003-TANL, and TA-21-002-TAAL will be based on historical documentation and current site conditions. The strategy will be to collect samples from the native soil interface under excavated debris to characterize the soil in the trench. If FSRs are exceeded at the native soil interface, continue to excavate and field screen until there are two clean intervals. Collect an additional sample at the second clean interval. Sample locations will be based on FSRs. If FSRs are not exceeded, the sample depth will be the native soil interface directly below the partially buried debris. If step-out samples are necessary, samples will mirror the depths at 5-ft lateral intervals and 2.5-ft vertical intervals. Step-out samples exceeding field-screening results will have step-out samples performed in a triangular pattern at 5-ft lateral intervals. Additional samples may be collected based on site conditions, for waste determination purposes and/or for other identified data needs.

A.1.7.2.2 Investigation Strategy for CAS 09-21-001-TA09

The investigation for CAS 03-21-001-TA09 is based on current site conditions and geophysical results collected prior to the project. If debris is encountered, it will be excavated and disposed. The sampling strategy will follow the same strategy identified in Section A.1.7.2.1. If subsurface debris is not identified, a confirmatory sample will be collected based on biasing factors for each trench (i.e., lowest point) at the native soil interface. Additional samples may be collected based on site conditions, for waste determination purposes and/or other identified data needs.

A.1.7.2.3 Investigation Strategy for CAS 03-19-001

The investigation for the Waste Disposal Site is based on current site conditions and geophysical results collected prior to the project. The starting sample point for the investigation is the previously sampled location from the CAU 405 investigation that identified the location. The geophysical data did not identify any subsurface debris, so the locations previously sampled by BN will guide the lateral extent in 5-ft intervals to the previously sampled locations that were identified in Figure 4-5 of the CAIP. Step-out samples exceeding FSRs will be performed in a triangular pattern. According to the previously collected analytical data, the interval of 4.5 to 5 ft bgs is the interval where FSLs were exceeded for TPH DRO. Samples were collected from two intervals past at 6.5 to 7.5 ft bgs and 9 to 9.5 ft bgs which did not exceed PALs. Lateral step-out samples will continue at the CAU 405 depths for this location as identified until FSRs do not exceed FSLs for TPH. Use restrictions will not be entered if step-out sampling is guided toward the boundaries. Additional samples may be collected based on site conditions, for waste determination purposes and/or other identified data needs.

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Appendix B

Project Organization

B.1.0 Project Organization

The NNSA/NV Project Manager is Janet Appenzeller-Wing, and her telephone number is (702) 295-0461.

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/NV Project Manager be contacted for further information. The Task Manager will be identified in the FFACO Biweekly Activity Report prior to the start of the 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 410: Waste Disposal Trenches, Tonopah Test Range, Nevada	2. Document Date: May 2002
3. Revision Number: 0	4. Originator/Organization: IT Corporation
5. Responsible DOE/NV ERP Project Mgr.: Janet Appenzeller-Wing	6. Date Comments Due: June 17, 2002
7. Review Criteria: Full	
8. Reviewer/Organization/Phone No.: Clemens Goewert, NDEP, 486-2865	9. Reviewer's Signature:

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
1) Appendix A		There is no description of the sites. These descriptions are necessary for the development of the Conceptual Site Model (CSM).	The current physical description and past use of each CAS was added to Section A.1.1.3.	Yes

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

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

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