Technical Change No	Page _1 _01 _2
Project/Job No. 831841-02010005	Date <u>August 28, 2002</u>
Project/Job Name CAU 168: Areas 25 and 26 Contaminated Materials and Waste Dumps, Nevada Test Site, Nevada	
The following technical changes (including justification) a	re requested by:
Jeffrey G. Johnson	Task Manager
(Name)	(Title)
	•

Justification: Modification of the Waste Management Section 5.3 is required to address a comment provided by the Nevada Division of Environmental Protection (NDEP) in an approval letter dated January 29 20, 2002, titled "Approval of the Corrective Action Investigation Plan, Corrective Action Unit 168, Areas 25 and 26 Contaminated Materials and Waste Dumps, Federal Facility Agreement and Consent Order." The comment is as follows: "The waste management plan Section 5.3.4.1 needs to be modified in accordance with the NDEP Investigative Derived Waste Position Paper sent to your office in a January 24, 2002 letter (Liebendorfer to Wycoff)." The applicable changes, as indicated below, are in accordance with the requirements of *Resource Conservation and Recovery Act* (RCRA) and the agreements between U.S. Department of Energy National Nuclear Security Administration Nevada Operations Office (NNSA/NV) and NDEP.

Section 5.0 Waste Management (sixth paragraph) Delete the last sentence.

Section 5.3.4.1 Personal Protective Equipment (last sentence)

Delete: "...within 45 days from receipt of the final CAU analytical data package from the laboratory."

Insert: "...where it will be managed and dispositioned according to the requirements of RCRA or subject to agreements between NNSA/NV and NDEP."

Section 5.3.4.1 Decontamination Rinsate (2nd paragraph, 2nd sentence)

Delete: "...within 45 days from receipt of the final CAU analytical data package from the laboratory."

Insert: "...where it will be managed and dispositioned according to the requirements of RCRA or subject to agreements between NNSA/NV and NDEP."

Section 5.3.4.2 Personal Protective Equipment (4th sentence)

Delete: "...within 45 days from receipt of the final CAU analytical data package from the laboratory."

Insert: "...where it will be managed and dispositioned according to the requirements of RCRA or subject to agreements between NNSA/NV and NDEP."

Technical Change No1	Page <u>2</u> of <u>2</u>
Project/Job No. <u>831841-02010005</u>	Date August 28, 2002
Project/Job Name CAU 168: Areas 25 and 26 Co	ntaminated Materials and Waste Dumps, Nevada Test Site, Nevada
Section 5.3.4.2 Decontamination Rinsate (5)	th sentence)
Delete: "within 45 days from receipt of the	final CAU analytical data package from the laboratory."
Insert: "where it will be managed and dispo	ositioned according to the requirements of RCRA or subject to
agreements between NNSA/NV and NDEP."	
Section 5.3.5 Mixed Wastes (4th sentence)	
Delete: "within 45 days from receipt of the fin	nal CAU analytical data package from the laboratory."
Insert: "where it will be managed and disposi	itioned according to the requirements of RCRA or subject to
agreements between NNSA/NV and NDEP."	
The project time will be (Increased)(Decrease	d)(<u>Unchanged</u>) by approximately -0- days.
The project time win se (mercasea)(Beercase	duys.
Amilianhia Praiast Smarifia Dagumentia). Ca	Aution Aution Division Division Division Division Aution Division Aution Division Aution Division Aution Division Divisi
	orrective Action Investigation Plan for Corrective Action Unit 168: Areas 25 os, Nevada Test Site, Nevada, Rev. 0, DOE/NV780.
and 20 Comminuted Materials and Waste Dump	s, wevada Test Sile, wevada, Nev. 0, DOL/NV700.
	1
Approved	By: Janes Spen-Wm Date 8/27/02
Apploved	Jane Appenzeller-Wing, Project Manager
	Industrial Sites Project
	Q. 21. 17 5.27.27
	Kunsuffycogg Date 8-27-0Z
	Runore C. Wycoff, Division Director Environmental Restoration Division
	Client Notified Yes X No Date $9 - 9 - 0.2$
	NDEP Concurrence:Date
	Contract Change Order Required Yes No _X
	Contract Change Order No. Not applicable

NO.259 P.

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RECORD OF TECHNICAL CHANGE

Technical Change No.	Page 1 of 2
Project/Job No. <u>831841-02010005</u>	Date August 28, 2002
Project/Job Name CAU 168: Areas 25 and 26 Conteminated Materials and Waste Dumps. Novada Ton Site, Nevada	
The following technical changes (including justification) are r	equested by:
Jeffhev G. Johnson	Task Mannear
(Name)	(Title)
Justification: Modification of the Waste Management Section the Nevada Division of Environmental Protection (NDEP) in an "Approval of the Corrective Action Investigation Plan, Correcti	a approval letter dated January 29 20, 2002, titled
Materials and Weste Dumps, Federal Facility Agreement and C	
waste management plan Section 5.3.4.1 needs to be modified in	accordance with the NDEP Investigative Derived
Waste Position Paper sent to your office in a January 24, 2002	atter (Liebendorfer to Wysoff)." The applicable
changes, as indicated below, are in accordance with the require	ments of Resource Conservation and Recovery Act
(RCRA) and the agreements between U.S. Department of Energy National Muclear Security Administration Nevada	
Operations Office (NNSA/NV) and NDEP.	
Section 5.0 Waste Management (sixth paragraph) Delete the is	aat scattonco.
Section 5.3.4.1 Personal Protective Equipment (last sentence)
Delete: "within 45 days from receipt of the final CAU analysis	cal data package from the laboratory."
Insert: "where it will be managed and dispositioned according	g to the requirements of RCRA or subject to
agreements between NNSA/NV and NDEP."	
Section 5.3.4.1 Decontamination Rineate (2nd paragraph, 2nd se	entencs)
Delete: "within 45 days from receipt of the final CAU analyti	cal data package from the laboratory."
Insert: "where it will be managed and dispositioned according to the requirements of RCRA or subject to	

Section 5.3.4.2 Personal Protective Equipment (4º sentence)

agreements between NNSA/NV and NDEP."

Delete: "...within 45 days from receipt of the final CAU analytical data package from the laboratory."

Insert: "...where it will be managed and dispositioned according to the requirements of RCRA or subject to agreements between NNSA/NV and NDEP."

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63 P. 03 **No.259 P.3/4**

Technical Change No.	Page _2_ of _2_
Project/Job No831841-02010005	Date_Aueust 28, 2002_
Preject/Job Nume CAU 168: Areas 25 and 26 Contami	nated Materials and Waste Dumns, Nevada Test Sita, Nevada
Coding \$2.40 December Vestion Dispute (6th con-	
Section 5.3.4.2 Decontamination Rinsate (5th sec	
Delete: "within 45 days from receipt of the final	· · ·
	ned according to the requirements of RCRA or subject to
agreements between NNSA/NV and NDEP."	
Section 5.3.5 Mixed Wastes (4th sentence)	
Delete: "within 45 days from receipt of the finel C	
_ · · · · ·	d according to the requirements of RCRA or subject to
agreements between NNSA/NV and NDEP."	
The project time will be (Increased)(Decreased)(Li	ochanesa) by approximently days.
Applicable Project-Spacific Document(s): Correcti	ve Action Investigation Plan for Corrective Action Unit 168: Areas 25
and 36 Contaminated Meterials and Waste Dumps, Ne	rado Tast Site. Nevada, Rov. 0, DOE/NV-780.
	0 10 114 3/20/2
Approved By:	Janes poor - War Dan 8/27/02
	Indu Apparenter-Wing, Project Manager Industrial Sites Project
	Keen Steller 577 mm 8-27-02
	Dam 0-61-00
	Runare C. Wycolf, Division Director
	Runare C. Wycelf, Division Director Buviropmental Restoration Division
	Runare C. Wycolf, Division Director
	Rurana C. Wyoolf, Divinian Director Buviropmoutal Restoration Division Client Notified Yeax No Date 9-9-02
	Rurers C. Wycelf, Division Director Buviropmental Restoration Division Client Notified Yea X No Date
	Rurana C. Wyoolf, Divinian Director Buviropmoutal Restoration Division Client Notified Yeax No Date 9-9-02

Technical Change No. 2	Page <u>1</u> of <u>1</u>
Project/Job No. <u>831841-02010005</u>	Date September 23, 2002
Project/Job NameCAU 168: Areas 25 and 26 Contar	ninated Materials and Waste Dumps, Nevada Test Site, Nevada
The following technical changes (including justif	ication) are requested by:
Jeffrey G. Johnson	Task Manager
(Name)	(Title)
bunker floors, to a height of 3 meters. The survey entrance to each bunker from the floor to a height of above 3 meters, to include the ceiling. The location judgement and each swipe will cover a minimum of Justification: Survey results for the lower three 3 meters.	formed on all interior surfaces of each bunker, excluding the areas will include interior and exterior walls outside the of 3 meters. A swipe will be taken from each interior surface ns to be swiped will be selected based on professional of 100 square centimeters. The term of the walls and ceilings did not indicate any
The project time will be (Increased)(Decreased)(U	nchanged) by approximately0 days.
Applicable Project-Specific Document(s): Correction and 26 Contaminated Materials and Waste Dumps, Nevertheen Contaminated Materials and Mate	ive Action Investigation Plan for Corrective Action Unit 168: Areas 25 ada Test Site, Nevada, Rev. 0, DOE/NV780.
Approved By:	Janet Appenzeller-Wing, Project Manager Industrial Sites Project At a Law Date 9/23/02 Runore C. Wycoff, Division Director Environmental Restoration Division Client Notified Yes X No Date 9-9-02 NDEP Concurrence:

Technical Change No2	Page 1 of 1
Project/Job No	Data September 23, 2002
Project/Job Name CAU 168: Areas 25 and 26 Conteminated Materials and Waste Dumps. Neveda Test Site. Nevada	
The following technical changes (including justifi	ication) are requested by:
Jeffrey G. Johnson	Task Manager
(Name)	(Title)
Section 4.3.2.4 CASs 25-34-01 and 25-34-02, NR	PC Contouring and Brustians
Delete: 2 ^M and 3 ^d sentences	IDO CONTENUMENOS BUNKETS
	formed on all interior surfaces of each bunker, excluding the
· · · · · · · · · · · · · · · · · ·	areas will include interior and exterior walls outside the
entrance to each bunker from the floor to a height	of 3 meters. A swipe will be taken from each interior surface
•	ous to be swiped will be selected based on professional
udgement and each swipe will cover a minimum o	of 100 square continuents.
•	meters did not identify any locations with readings greater than
_	the remainder to the walls and collings did not indicate any
staining or other indications of possible contamina	tion.
The project time will be (increased)(Decreased)(U	Inchanand) by approximately days.
Avalicable Project Specific Decume (s).	tive Action Investigation Plan for Corrective Action Unit 168: Areas 25
and 26 Contaminated Materials and Waste Dumps, New	
Approved By:	Henri Callle Des 9/23/02
	Janut Appenditor-Wing, Project Manager Industrial Sites Project
	Oto and for pm 9/23/02
	Rumers C. Wycoff, Division Director Servingsmental Restocation Division
	Client Notified Yat 2 10 2
	NDEP Concurrence:
	Contract Change Order No. Not explicable

Technical Change No03	Page1 of 3
Project/Job No. <u>Industrial Sites/IS04-386</u>	Date06/02/2004
Project/Job Name Corrective Action Investigation Plan for CAU 168:	Areas 25 and 26 Contaminated Materials and
Waste Dumps, Nevada Test Site, Nevada, Revision 0, November 2001	:
The following technical changes (including justification) are requested by	у:
Alfred N. Wickline	Industrial Sites Task Manager
(Name)	(Title)
D 1.1 0.01	

Description of Change:

- 1. <u>Section 3.2 Contaminants of Potential Concern</u>. Table 3-4, under Radiochemistry section, replace description for minimum reporting limit with the following:
 - "The MRL is set equal to 5 times the minimum detectable activity (MDA), or if 5 times the MDA is greater than the PAL, the MRL is set equal to the MDA."
- 2. <u>Section 3.3 Preliminary Action Levels</u>. Replace the 1st paragraph with the following:
 - "Analytical methods and MRLs for each chemical analyte are provided in Table 3-4. The PALs for radionuclides are provided in Table 3-5. The MRLs for radionuclides are set equal to 5 times the MDA, or if 5 times the MDA is greater than the PAL, the MRL is set equal to the MDA. The MDA is the smallest amount of activity of a particular analyte that can be detected in a sample with an acceptable level of error. The radiological PALs are taken from the National Council on Radiation Protection and Measurement (NCRP), Report No. 129, recommended screening limits for construction, commercial, and industrial land use scenario (NCRP, 1999) scaled from 25- to 15-millirem (mrem) per year dose and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993)."
- 3. Replace existing Table 3-5 with the revised Table 3-5 attached.
- 4. Section 3.3.3 Radiological Preliminary Action Levels. Replace paragraph with the following:
 - "The PALs for radiological contaminants are taken from the National Council on NCRP, Report No. 129, recommended screening limits for construction, commercial, and industrial land use scenario (NCRP, 1999) scaled from 25- to 15-mrem per year dose and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993). The radiological PALs for the CAU 168 Corrective Action Investigation (CAI) are listed in Table 3-5.
 - Potassium-40 will not be considered a COPC with respect to gamma spectroscopy analysis.
- 5. Section A.2.3.1 Determine the Basis for the Preliminary Action Levels.

Replace the 6th bullet with the following:

- "The PALs for radiological contaminants are taken from the NCRP, Report No. 129, recommended screening limits for construction, commercial, and industrial land use scenario (NCRP, 1999) scaled from 25- to 15-mrem per year dose, and, the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993).
- Potassium-40 will not be considered a COPC with respect to gamma spectroscopy analysis.
- 6. Sections 8.0 and A.4.0 References. Add the following references:
 - National Council on Radiation Protection and Measurements. 1999. Recommended Screening Limits for Contaminated Surface Soil and Review of Factors Relevant to Site-Specific Studies, NCRP Report No. 129. Bethesda, MD.
 - US Department of Energy. 1993. "Radiation Protection of the Public and the Environment," DOE Order 5400.5, Change 2, 7 January. Washington, D.C.: U.S. Government Printing Office.

Justification:

Through ongoing discussions between DOE and NDEP it was determined that the PALs currently being used for the site investigations are not practical and should be replaced with dose-based action levels. In an agreement between NDEP and DOE (approved March 9, 2004), the PALs to be used for evaluating the potential radioactive contamination in soils will be based on an acceptable dose as specified by the

NCRP Report No. 129 and the DOE 5400.5 guidance, rather than a comparison to background values. The use of the new radiological PALs has been accepted and approved for use in the planning and evaluation phases of site investigations.

Potassium-40 (K-40) is a naturally occurring unstable isotope of potassium with a half-life of 1.3 x 10E+09 years. The abundance of K-40 is approximately 0.0118 percent of natural potassium. Because of the abundance of potassium in the environment, K-40 is the predominant radionuclide in soil, foods, and human tissues. The average human male contains approximately 100,000 picocuries of K-40. The human body strictly regulates the potassium content within the body and is not influenced by variations in environmental levels. Therefore, the internal dose from K-40 remains constant.

Potassium-40 is not considered to be a contaminant of potential concern due to its predominance in the environment. In addition, the only mechanism for K-40 to be a contaminant is through concentration.

There are no reported activities at the NTS that would have concentrated K-40 or released it as a contaminant.

The CAU 168 CAI will not be expanded to delineate the extent of K-40, nor will K-40 be evaluated in the Corrective Action Decision Document.

The project time will be (Increased) (Decrea	used) (Unchanged) by approximately days.
Applicable Project-Specific Document(s):	Corrective Action Investigation Plan for Corrective Action Unit 168: Areas 25 and 26 Contaminated Materials and Waste Dumps, Nevada Test Site, Nevada, Rev. 0, November, 2001
Approved	By: Janet Appenzeller-Wing, NNSA/NSO Project Manager
	Solvent M. Gungarley Date 5/26/04 Son Monica Sanchez, NNSA/NSO Environmental Restoration Acting Division Director
	NDEP Date

Table 3-5 Preliminary Action Levels for Radionuclides in Soil Samples Collected at CAU 168

Radionuclide	PAL (pCl/g)	
Cesium-137 ^a	7.30	
Cobalt-60 ^a	1.61	
Niobium-94 ^a	2.43	
Radium-226⁵	5/15 ^c	
Strontium-90 ^a	503	
Uranium-234ª	85.9	
Uranium-235ª	10.5	
Uranium-238ª	63.2	

^{*}Taken from the Construction, Commercial, and Industrial land use scenario in Table 2.1 of the NCRP Report No. 129, Recommended Screening Limits for Contaminated Surface Soil and Review Factors Relevant to Site-Specific Studies

pCi/g = Picocuries per gram.

⁽NCRP, 1999). The values provide in this source document were scaled to a 15-mrem per year dose.

Thorium-230 and its daughter Radium-226 are considered to be in equilibrium and will use the DOE 5400.5 general guidance of 5 and 15 pOi/g for the PALs (DOE, 1993).

The PAL for this isotope is specified as 5 pOi/g averaged over the first 15 centimeters (approximately 6 inches) of soil and 15 pOi/g for deeper soils (DOE, 1993).

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RECORD OF TECHNICAL CHANGE

Tochnical Change No03	Page of
Project/Job No. <u>Industrial Sines/ISO4-386</u>	Date
Project/Job Name Corrective Action Investigation Pien for	CAU 168: Areas 25 and 26 Contaminated Materials and
Waste Dumps, Navada Tost Site, Nevada, Revision 0, Nove	nber 2001
The following technical changes (including justification) are	requested by:
Alfred N. Wickline	Industrial Sites Task Menager
(Namo)	(Title)
Description of Change:	•

- 1. Section 3.2 Conteminents of Potential Concern. Table 3-4, under Redicchemistry section, replace description for minimum reporting firms with the following:
 - The MRL is set equal to 5 times the minimum detectable solvity (MDA), or if 5 times the MDA is greater than the PAL, the MRL is set equal to the MDA."
- 2. Section 3.3 Preliminary Action Levels. Replace the 1st personant with the following:
 - "Analytical methode and MRLs for each chemical energy are provided in Table 3-4. The PALs for radionuclides are provided in Table 3-5. The MRLs for radionuclides are set equal to 8 times the MDA, or if 8 times the MDA is greater than the PAL, the MRL is set equal to the MDA. The MDA is the smallest amount of ectivity of a particular analyte that can be detected in a sample with an acceptable level of error. The radiological PALs are taken from the National Council on Radiation Protection and Messurement (NCRP), Report No. 129, recommended screening limits for construction, commercial, and industrial land use scenario (NCRP, 1996) scaled from 25- to 15-millinem (mrem) per year does and the generic guidelines for residual concentration of radionuclides in DOE Order 6400.6 (DOE, 1993)."
- 2. Replace existing Table 3-5 with the revised Yable 3-6 attached
- 4. Section 3.3.2 Registration Profession Levels. Replace paragraph with the following:
 - "The PALE for radiological contempents are taken from the National Council on NCRP, Report No. 129, recommended ecreening limits for construction, commercial, and industrial land use ecentria (NCRP, 1990) scaled from 25- to 15-most per year doze and the generic guidelines for recidual concentration of radiohucides in DOE Order \$400.5 (DOE, 1995). The radiological PALE for the CALI 168 Corrective Action Investigation (CAI) are fished in Table 3-5.
 - Potacsium-40 will not be considered a COPC with respect to assume specificatory enables.
- 5. Section A23.1 Determine the Basis for the Preliminary Action Levels.

Replace the 6th bullet with the following:

- "The PALs for resilving contaminants are taken from the NCRP, Report No. 129, recommended screening limits for construction, commencial, and industrial land use accounts (NCRP, 1800) scaled from 25- to 15-mem per year does, and, the generic guidelines for residual concentration of radiomucities in DOE Order 6400.5 (DOE, 1803)."
- Probaselum-40 will not be considered a COPC with respect to garrens spectroscopy analysis.
- 6. Sections 8.0 and A.4.0 References. Add the following references:
 - National Council on Radiation Protection and Measurements. 1999. Recommended Screening Limits for Conteminated Surface Soil and Review of Factors Relevant to Site-Specific Studies, NCRP Report No. 129. Bethosds, MD.
 - US Department of Energy, 1993. "Radiation Protection of the Public and the Environment," DOE Order 5400.5. Change 2, 7 Jemsery. Weshington, D.C.: U.S. Government Printing Office.

Justification:

Through ongoing discussions between DOE and NDEP it was determined that the PALs currently being used for the site investigations are not practically and should be replaced with does-based action levels. In an agreement between NDEP and DOE (approved March 9, 2004), the PALs to be used for evaluating the potential redisactive contamination in soils will be based on an acceptable does as specified by the

NCRP Report No. 129 and the DOE 5400.5 guidence, rather than a comparison to bediaground values. The use of the new radiological PALs has been accepted and approved for use in the planning and evaluation phases of the investigations.

Potassium-40 (K-40) is a naturally occurring uncable teotope of potassium with a helf-life of 1.3 x 105109 years. The abundance of K-40 is approximately 0.0118 percent of potassium. Boosupe of the abundance of potassium in the environment, K-40 is the predominent reticeutalide in soil, foods, and human tissues. The everage numan maje contains approximately 100,000 pixocuries of K-40. The human body strictly regulates the potassium content within the body and is not influenced by variations in environmental involu-. Therefore, the internal does from K-40 remains constant.

Petessium-40 is not considered to be a conteminant of potential concern due to its predeminance in the environment. In addition, the only mechanism for K-40 to be a conteminant is through concentration.

Trace are no reported activities at the NTB that would have concentrated K-40 or released it as a contaminant.

The CAU 163 CAI will not be expanded to deliquate the extent of K-40, nor will K-40 be evaluated in the Corrective Action Decision Document.

The project time will be (Increased) (Decreased) Applicable Project-Specific Document(s):	Corrective Action Investigation Plan for Corrective Action Unit 168:
	Arcss 25 and 26 Contaminated Materials and Waste Dumps, Novada Test Site, Nevada, Rov. 9, Novamber, 2001
Approved	By: Jane 1000 Date 5 26 04 Abort Appeared for Wing, NNSANSO Project Manager
	Police TM George Top Date 5/26/04 Monica Sancticz, NNSANSC Environmental Restoration Acting Division Director
	Don COO. NDEP

Table 3-5
Preliminary Action Levels for Radionuclides in Soli Samples Collected at CAU 168

Radionustide	PAL (pCVg)
Cesium-137	7.30
Copek-60"	1.61
Nioblum-94*	2,43
Redium-226°	5/16*
Strontium-90	603
Uranium-294	85.9
Uranlum-235	10.5
Uranium-238*	63.2

Taken from the Construction, Convenercial, and Industries land use econario in Table 2.1 of the NCRP Report No. 129, Recommended Screening Limits for Contemporated Surface Stall and Review Pasters Relevant to Site-Specific Stadies (NCRP, 1998). The values provide in this source document were ecoled to a 16-inversion per year does.

Thorium-230 and its daughter Radium-228 are considered to be in equilibrium and will use the DOE 6400.5 general guidance of 6 and 16 pClig for the PALs (DOE, 1993).

The PAL for this isotopa to specified as 6 pClig averaged over the fast 16 continuous (approximately 6 inches) of eatl 15 pClig for deeper solls (DOE, 1993).

pClig = Ploscuries per grant.

Nevada Environmental Restoration Project

DOE/NV--780



Corrective Action Investigation Plan for Corrective Action Unit 168: Areas 25 and 26 Contaminated Materials and Waste Dumps, Nevada Test Site, Nevada

Controlled Copy No.: ____ Revision No.: 0

November 2001

Approved for public release; further distribution is authorized.

Environmental Restoration Division

U.S. Department of Energy National Nuclear Security Administration Nevada Operations Office Available for public sale, in paper, from:

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CORRECTIVE ACTION INVESTIGATION PLAN FOR CORRECTIVE ACTION UNIT 168: AREAS 25 AND 26 CONTAMINATED MATERIALS AND WASTE DUMPS, NEVADA TEST SITE, NEVADA

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

Controlled Copy No.: ____

Revision No.: 0

November 2001

Approved for public release; further distribution is authorized.

CORRECTIVE ACTION INVESTIGATION PLAN FOR CORRECTIVE ACTION UNIT 168: AREAS 25 AND 26 CONTAMINATED MATERIALS AND WASTE DUMPS, NEVADA TEST SITE, NEVADA

Approved by:_		Date:	
	Janet Appenzeller-Wing, Project Manager Industrial Sites Project		
Approved by: _		Date:	
	Runore C. Wycoff, Division Director Environmental Restoration Project		

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List of Acronyms and Abbreviations

amsl Above mean sea level

bgs Below ground surface

BN Bechtel Nevada

CADD Corrective Action Decision Document

CAIP Corrective Action Investigation Plan

CAS Corrective Action Site

CAU Corrective Action Unit

CFR Code of Federal Regulations

CLP Contract Laboratory Program

cm² Square centimeter

Co-60 Cobalt-60

COC Contaminant of Concern

COPC Contaminant of Potential Concern

Cs-137 Cesium-137

CSM Conceptual site model

cps Counts per second

CWD-2 Contaminated Waste Dump #2

DoD U.S. Department of Defense

DOE U.S. Department of Energy

DOT U.S. Department of Transportation

dpm Disintegrations per minute

DQI Data quality indicator

DQO Data quality objective

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List of Acronyms and Abbreviations (Continued)

E-MAD Engine Maintenance, Assembly, and Disassembly

EPA U.S. Environmental Protection Agency

ETL Engine Test Laboratory

FFACO Federal Facility Agreement and Consent Order

FSL Field-screening level

ft Foot (feet)

ft² Square foot (feet)

ft³ Cubic foot (feet)

GPR Ground-penetrating radar

GPS Global positioning system

HEPA High efficiency particulate air

IDW Investigation-derived waste

in. Inch(es)

INEL Idaho National Engineering Laboratory

ITLV IT Corporation, Las Vegas Office

LASL Los Alamos Scientific Laboratory

LCS Laboratory control sample

LRL Lawrence Radiation Laboratory

mCi Millicurie

MDA Minimum detectable activity

mi Mile

mg/kg Milligrams per kilogram

mg/L Milligrams per liter

MOSA Methods of Soil Analysis

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List of Acronyms and Abbreviations (Continued)

MRL Minimum reporting limit

MS Matrix spike

MSD Matrix spike duplicate

MX Missile Experiment

NAC Nevada Administrative Code

ND Normalized difference

NDEP Nevada Division of Environmental Protection

NEPA National Environmental Policy Act

NERVA Nuclear Engine for Rocket Vehicle Application

NF Nuclear Furnace

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

Operations Office

NRDS Nuclear Rocket Development Station

NTS Nevada Test Site

NTSWAC Nevada Test Site Waste Acceptance Criteria

PAL Preliminary action level

PCB Polychlorinated biphenyl

pCi/g Picocuries per gram

pCi/L Picocuries per liter

PPE Personal protective equipment

ppm Parts per million

QA Quality assurance

QAPP Quality Assurance Project Plan

QC Quality control

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List of Acronyms and Abbreviations (Continued)

RadCon Radiation Control

RCA Radiologically Controlled Area

RCRA Resource Conservation and Recovery Act

REECo Reynolds Electrical & Engineering Co., Inc.

R-MAD Reactor Maintenance, Assembly, and Disassembly

RMSF Radioactive Materials Storage Facility

ROTC Record of Technical Change

RPD Relative percent difference

RR Railroad

SDWS Safe Drinking Water Standards

SVOC Semivolatile organic compound

TCA Test Cell A

TCLP Toxicity Characteristic Leaching Procedure

TPH Total petroleum hydrocarbon

TTF Treatability Test Facility

USW Underground Southern Nevada Well

VOC Volatile organic compound

VCP Vitrified clay pipe

yd³ Cubic yard

YMP Yucca Mountain Project

μg/L Micrograms per liter

μR/h Microroentgens per hour

%R Percent recovery

μg/kg Micrograms per kilogram

Executive Summary

This Corrective Action Investigation Plan (CAIP) contains the project-specific information including facility descriptions, environmental sample collection objectives, and criteria for conducting site investigation activities at Corrective Action Unit (CAU) 168: Areas 25 and 26 Contaminated Materials and Waste Dumps, Nevada Test Site (NTS), Nevada. The CAIP has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the State of Nevada, the U.S. Department of Energy, and the U.S. Department of Defense.

Corrective Action Unit 168 is comprised of the following Corrective Action Sites (CASs):

- CAS 25-16-01, Construction Waste Pile
- CAS 25-16-03, MX Construction Landfill
- CAS 25-19-02, Waste Disposal Site
- CAS 25-23-02, Radioactive Storage RR Cars
- CAS 25-23-18, Radioactive Material Storage
- CAS 25-34-01, NRDS Contaminated Bunker
- CAS 25-34-02, NRDS Contaminated Bunker
- CAS 25-23-13, ETL Lab Radioactive Contamination
- CAS 25-99-16, USW G3
- CAS 26-08-01, Waste Dump/Burn Pit
- CAS 26-17-01, Pluto Waste Holding Area
- CAS 26-19-02, Contaminated Waste Dump #2

This CAIP provides investigative detail specific to CAU 168. Managerial aspects of this project are discussed in the *Project Management Plan* (DOE/NV, 1994). General field and laboratory quality assurance (QA) and quality control (QC) issues are presented in the *Industrial Sites Quality Assurance Project Plan* (DOE/NV, 1996b). Project-specific QA/QC is included in this CAIP. The health and safety aspects of this project are documented in the IT Corporation, Las Vegas Office, *Health and Safety Plan* (IT, 2001a) and will be supplemented with a site-specific health and safety plan written prior to the start of field work.

The CASs addressed by CAU 168 are a relatively diverse group of sites in terms of the sources and nature of potential contamination at each CAS. The CASs are located and/or associated with the following NTS facilities:

Area 25

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- Page ES-2 of ES-4
- Engine Maintenance, Assembly, and Disassembly (E-MAD) Facility
- Missile Experiment (MX) Salvage Yard
- Reactor Maintenance, Assembly, and Disassembly (R-MAD) Facility
- Radioactive Materials Storage Facility (RMSF)
- Treatment Test Facility (TTF) Building at Test Cell A
- Area 26
 - Project Pluto testing area
- Yucca Mountain
 - Underground Southern Nevada Well (USW) G3 (CAS 25-99-16) is a groundwater monitoring well located west of the NTS on the ridgeline of Yucca Mountain.

As integral parts of the Nuclear Rocket Development Station (NRDS), the E-MAD and R-MAD facilities and the RMSF supported the development and testing of nuclear reactors for use in space propulsion vehicles. Activities associated with the NRDS program were conducted between 1958 and 1973. Subsequent to 1973, various other projects utilized these facilities. In 1981 and 1982, the MX Construction Waste Landfill received construction debris from the MX test program; it may have also received nonhazardous waste prior to the MX program. Well USW G3 was drilled and completed in the 1980s to evaluate the geologic, geophysical, and hydrologic potential of Yucca Mountain as a prospective underground repository for high-level nuclear waste. The Project Pluto facilities in Area 26 supported nuclear-reactor testing conducted for development of a ramjet propulsion system; tests were conducted between 1961 and 1964. Various other projects utilized the Project Pluto facilities after 1964.

The data quality objectives (DQO) process was used to identify and define the type and quality of data needed to complete the investigation phase of the CAU 168 corrective action process. A phased approach was developed to address the data needs during the investigation. The Phase I investigation will determine if contaminants of potential concern (COPCs) are present in concentrations exceeding preliminary action levels. If COPCs are found to be present above preliminary action levels, a

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Phase II investigation will be implemented to determine the extent of contamination to support the appropriate corrective action alternative to complete closure of the site.

Phase I data collection will be conducted at all CASs (except CASs 25-23-02, 25-23-13, 25-23-18, and 25-99-16). Corrective Action Sites 25-23-02, 25-23-13, and 25-23-18 are known to be radiologically contaminated; therefore, they will advance directly to a Phase II investigation to define both the nature and extent of contamination.

Upon reviewing historical documentation and current site conditions, it has been determined that no further characterization is required at USW G3 (CAS 25-99-16) to select the appropriate corrective action. A cesium-137 source was accidentally encased in cement within the vadous zone during the drilling of the well. A corrective action of closure in place with a land-use restriction for drilling near USW G3 is appropriate. The corrective action will be documented in the Corrective Action Decision Document (CADD) for CAU 168.

Based on site history and existing characterization data obtained to support the DQO process, COPCs for CAU 168 are primarily radionuclides. However, the COPCs for several CASs were not defined. To address COPC uncertainty, the Phase I analytical program for most CASs will include volatile organic compounds, semivolatile organic compounds, Resource Conservation and Recovery Act metals, total petroleum hydrocarbons, polychlorinated biphenyls, and radionuclides. Based on the results of Phase I sampling, the analytical program for Phase II characterization may be reduced.

In general, field activities will consist of collecting soil samples at biased locations by hand-tool methods, backhoe excavation, direct-push, or drilling techniques as appropriate. Where necessary for Phase II characterization, soil samples will be collected from horizontal and vertical step-outs to bound the extent of contamination. For CASs 25-23-02, 25-23-13, 25-34-01, and 25-34-02, the nature of the media and materials that comprise the CASs preclude collection of samples for laboratory analysis. At these CASs, characterization will consist primarily of radiological scanning surveys and collection and counting of swipes.

Specifically, the technical approach for investigation of CAU 168 will consist of the following activities:

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- Perform best management practices and housekeeping activities on miscellaneous debris, where necessary.
- Perform geophysical surveys (CAS 25-16-01 only).
- Perform radiological surveys (CASs 25-16-01, 25-23-02, 25-23-13, 25-23-18, 25-34-01, 25-34-02, and 26-08-01).
- Collect and count swipes for radiological characterization (CASs 25-23-13, 25-23-02, 25-34-01, and 25-34-02).
- Collect soil samples from biased locations.
- Field screen samples for volatile organic compounds, radiological activity, and possibly total petroleum hydrocarbons.
- Collect required QC samples.
- Inspect and sample a radioactive effluent pipeline at CAS 26-17-01, as required and where possible.
- Collect additional soil samples to define the lateral and vertical extent of contamination, if necessary.
- Scabble or shot-blast concrete surfaces at selected locations in CASs 25-34-01 and 25-34-02, if necessary, to determine the extent of radiological contamination into the concrete.
- Collect samples of residual fluids in the railroad cars at CAS 25-23-02, if necessary, for waste management purposes.
- Collect samples from native soils and analyze for geotechnical/hydrologic parameters, if necessary.
- Collect and analyze bioassessment samples at the discretion of the Site Supervisor, if VOCs exceed field-screening levels in a pattern that suggests that a VOC plume may be present.
- Stake or flag sample locations and record coordinates (in Universal Transverse Mercator coordinate system).

Under the FFACO, this CAIP will be submitted to the Nevada Division of Environmental Protection (NDEP) for approval. Field work will be conducted following approval of the plan. The results of the field investigation will support a defensible evaluation of corrective action alternatives in the Corrective Action Decision Document.

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1.0 Introduction

This Corrective Action Investigation Plan (CAIP) contains the project-specific information including facility descriptions, environmental sample collection objectives, and criteria for conducting site investigation activities at Corrective Action Unit (CAU) 168: Areas 25 and 26 Contaminated Materials and Waste Dumps, Nevada Test Site (NTS), Nevada. The CAIP has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the State of Nevada, the U.S. Department of Energy (DOE), and the U.S. Department of Defense (DoD) (FFACO, 1996).

The CAIP is a document that provides or references all the specific information for investigation activities associated with a CAU. Corrective action units consist of one or more corrective action sites (CASs) grouped together, based on geography, technical similarity, or agency responsibility, for the purpose of determining corrective actions. According to the FFACO (1996), CASs are sites potentially requiring corrective action(s) and may include solid waste management units or individual disposal or release sites. The NTS is located approximately 65 miles (mi) northwest of Las Vegas, Nevada (Figure 1-1).

The CAU 168 CASs are associated with various facilities that supported projects in Areas 25 and 26 of the NTS. Table 1-1 lists the 12 CASs that comprise CAU 168 and their facility locations.

Figure 1-2 shows the locations of the nine CASs in Area 25. Seven of these CASs (25-16-01, 25-19-02, 25-23-02, 25-23-13, 25-23-18, 25-34-01, and 25-34-02) are associated with the Nuclear Rocket Development Station (NRDS) that operated in Area 25 from 1958 to 1973. Corrective Action Site 25-16-03 was associated with the missile experiment (MX) test program from 1981 to 1982, and may have also received sanitary waste from Area 25 prior to 1980. Corrective Action Site 25-99-16 is associated with the Underground Southern Nevada Well (USW) G3 located on Yucca Mountain.

Figure 1-3 shows the location of the three CASs in Area 26. All three CASs are associated with the Project Pluto facilities that operated from 1961 to 1964. For operational reasons, the Project Pluto facilities were separated into three functional areas - control, testing, and disassembly. The three

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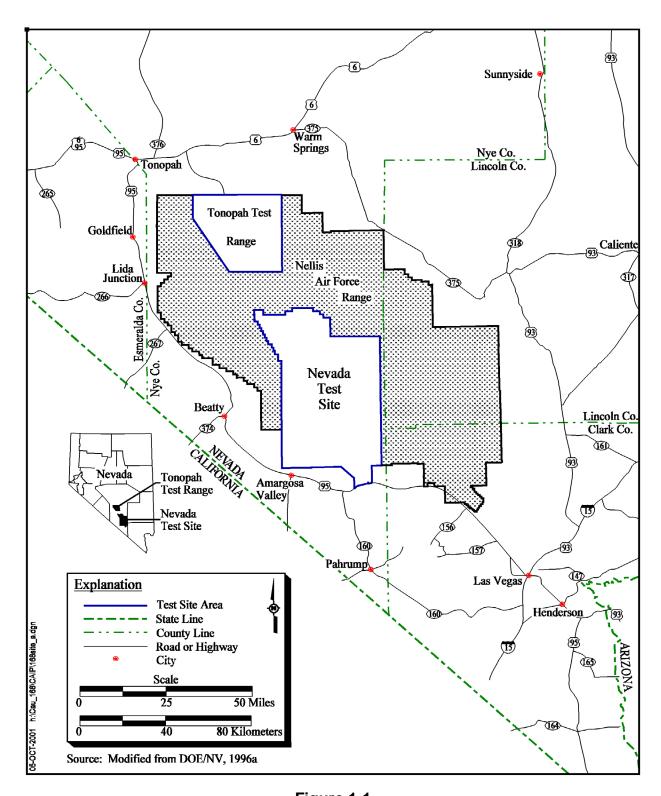


Figure 1-1 Nevada Test Site Location Map

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Table 1-1
CAU 168 Corrective Action Sites

Location	CAS Number	CAS Description ^a	Facility Association ^b
	25-16-01	Construction Waste Pile	E-MAD Facility
	25-16-03	MX Construction Waste Landfill	MX Salvage Yard
	25-19-02	Waste Disposal Site	SE Corner Outside R-MAD
	25-23-02	Radioactive Storage RR Cars	
Area 25	25-23-18	Radioactive Material Storage	Radioactive Material Yard
	25-34-01	NRDS Contaminated Bunker	Radioactive Material Tard
	25-34-02	NRDS Contaminated Bunker	
	25-23-13	ETL - Lab Radioactive Contamination	TTF Building
	25-99-16	USW G3	Yucca Mountain
	26-08-01	Waste Dump/Burn Pit	Building 2204
Area 26	26-17-01	Pluto Waste Holding Area	Pluto Facility
	26-19-02	Contaminated Waste Dump #2	Tom Reactor Test

^aFunctional categories from the FFACO (1996)

E-MAD = Engine Maintenance, Assembly, and Disassembly

ETL = Engine Test Laboratory

MX = Missile experiment

R-MAD = Reactor Maintenance, Assembly, and Disassembly

RR = Railroad

NRDS = Nuclear Rocket Development Station

TTF = Treatability Test Facility

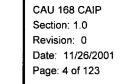
USW = Underground Southern Nevada Well

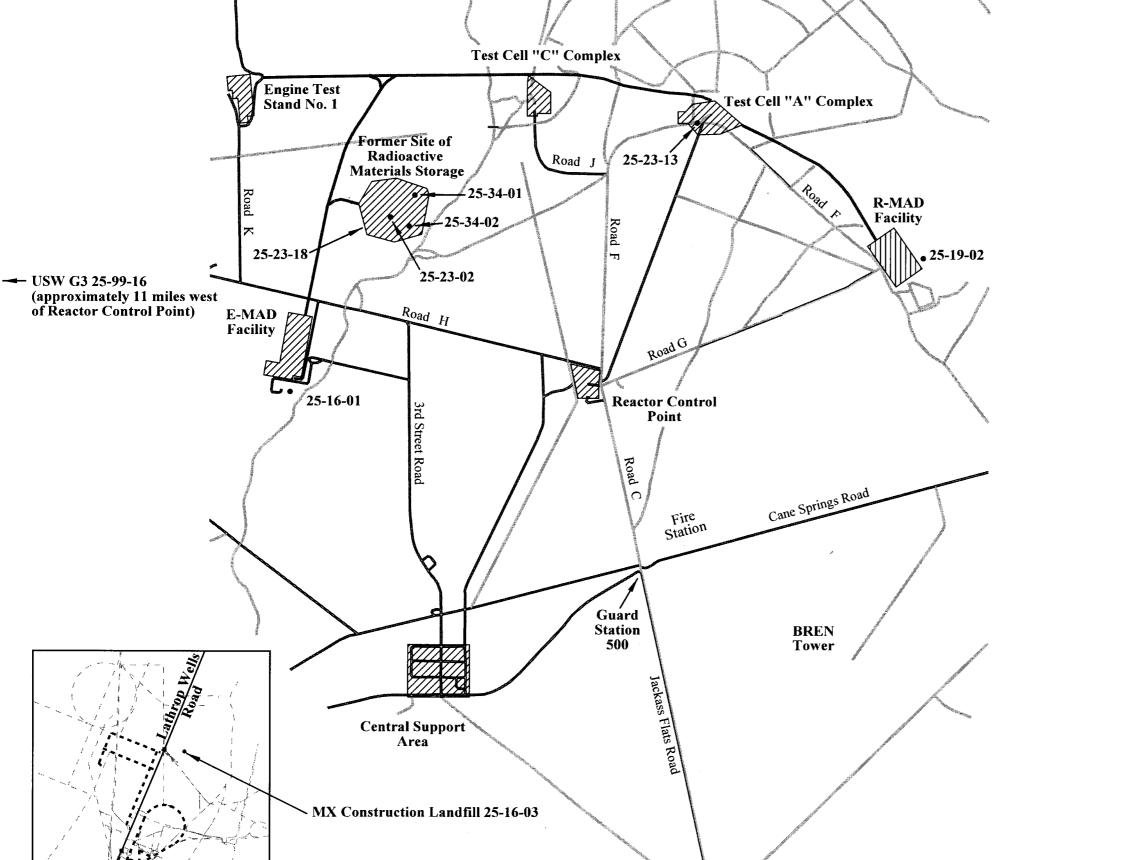
Area 26 CASs (26-08-01, 26-17-01, and 26-19-02) included in CAU 168 are located in the vicinity of the testing area (Figure 1-3).

1.1 Purpose

Existing information and process knowledge on the expected nature and extent of contamination are insufficient to select preferred corrective actions for all but one site (CAS 25-99-16). Therefore, additional information will be obtained by performing a field investigation prior to choosing a preferred closure alternative for each CAS.

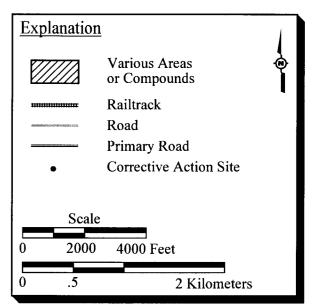
^bGeneral location from the FFACO (1996)





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FFACO Corrective Action Site	<u>Site</u> <u>Location</u>	
25-16-01	Construction Waste Pile	
25-16-03	MX Construction Landfill	
25-19-02	Waste Disposal Site	
25-23-02	Radioactive Storage Railroad Cars	
25-23-13	ETL - Lab Radioactive Contamination	
25-23-18	Radioactive Material Storage	
25-34-01	NRDS Contaminated Bunker	
25-34-02	NRDS Contaminated Bunker	
25-99-16	USW G3	



Source: Modified from Leachfield Work Plan Figure A.1-1 (DOE/NV, 1998a)

Figure 1-2
CAU 168: Area 25 Corrective Action Sites
Nevada Test Site, Nye County, Nevada

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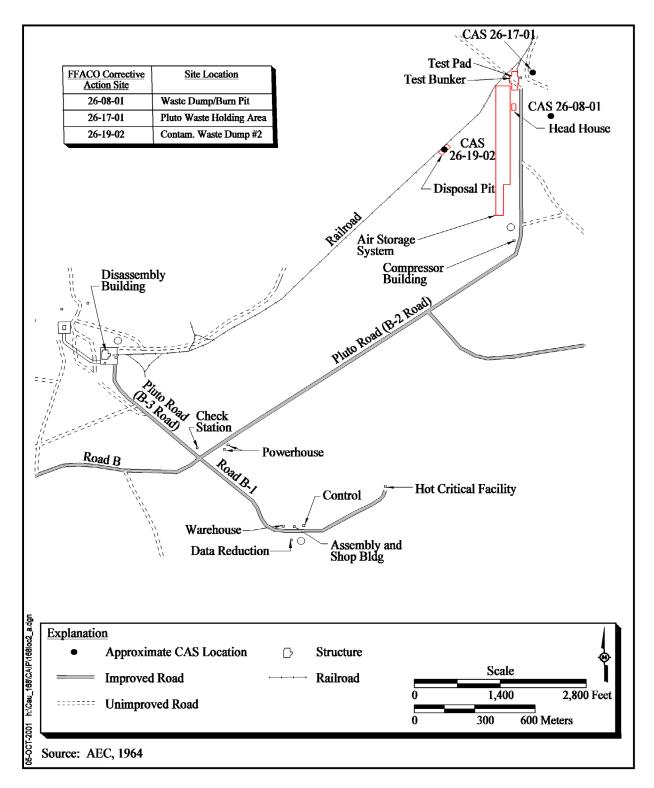


Figure 1-3
CAU 168: Area 26 Corrective Action Sites
Nevada Test Site, Nye County, Nevada

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The investigation strategy for CAU 168 is based on Data Quality Objectives (DQOs) developed by

representatives of the Nevada Division of Environmental Protection (NDEP) and the DOE National

Nuclear Security Administration Nevada Operations Office (NNSA/NV). The DQOs are used to

identify and define the type and quality of data needed to complete the investigation phase of the

corrective action process. This CAIP will describe the investigation developed to collect the data

needed to select the appropriate corrective actions for CAU 168. The general purpose of the

investigation is to:

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

• Determine whether COPCs exceed action levels (e.g., preliminary action levels [PALs]).

• Determine the vertical and lateral extent of contaminants of concern (COCs), if present.

• Ensure adequate data have been collected to close the sites under NDEP, *Resource*

Conservation and Recovery Act (RCRA), and the DOE requirements.

A COPC becomes a COC once it is known to be present in concentrations exceeding PALs. It is

inherent in the definition of COC that it is present in concentrations greater than the corresponding

PALs.

1.2 Scope

A phased approach has been developed to address the data needs during the investigation. The scope

of this CAIP is to resolve the problem statements identified in Phase I and Phase II of the DQO

process.

Phase I will determine if COPCs are present in concentrations exceeding PALs. The Phase I problem

statement is that potentially hazardous and radioactive wastes may be present at the sites and existing

data are insufficient to evaluate and select preferred corrective actions.

If COPCs are present above PALs, a Phase II investigation will be implemented to determine the

extent of contamination to support the selection of corrective action alternatives. The Phase II

problem statement is that the exact nature and/or extent of contamination at these sites is unknown.

Contamination at these sites may present risk to human health and environment and additional data

are required to select a preferred corrective action alternative.

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The scope of the corrective action investigation for CAU 168 includes the following activities to address the problem statements:

- Remove and dispose of materials at various CASs.
- Collect biasing factor data, where necessary (e.g., surface geophysical and radiological surveys at CAS 25-16-01).
- At selected CASs, collect environmental samples from biased locations and submit for laboratory analysis to determine if COPC concentrations exceed PALs.
- At CASs where contaminant concentrations exceed PALs, collect environmental samples and submit for laboratory analysis to define the lateral and vertical extent of COCs.
- Visually define the extent of buried construction debris, if present, at CAS 25-16-01.
- Perform radiological surveys at CASs 25-16-01, 25-23-13, 25-34-01, 25-34-02, 25-23-02, 25-23-18, and 26-08-01. Collect and analyze swipes for radioactivity at these CASs, as necessary.
- Inspect portions of the collection system piping associated with CAS 26-17-01 using a combination of visual, video, and/or radiological surveys, as appropriate. Collect sediment samples from the piping, if possible, and submit for laboratory analysis.
- Collect soil samples for laboratory analysis of geotechnical parameters, as needed.

As noted in Section 1.1, sufficient information and historical documentation for CAS 25-99-16 exists regarding the nature and extent of contaminant and the potential risk to a receptor such that a preferred corrective action alternative can be selected for site closure. For this reason, additional characterization of CAS 25-99-16 will not be performed.

1.3 CAIP Contents

The organization and content of this CAIP follows the NDEP-approved CAIP outline (Wycoff, 2001a). Section 1.0 provides an introduction to this project, including the purpose and scope for this corrective action investigation. Section 2.0 provides facility descriptions, including physical setting, operational history, waste inventory, release information, and investigative background. The remainder of the document details the investigation strategy. The FFACO (1996) requires that CAIPs address the following elements:

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- Management
- Technical aspects
- Field sampling
- Waste management
- Quality assurance (QA)
- Health and safety
- Public involvement

The managerial aspects of this project are discussed in the *Project Management Plan* (DOE/NV, 1994) and the site-specific field management plan that will be developed prior to field activities. The technical aspects of this CAIP are contained in Section 3.0 through Section 6.0 of this document; and in the DQO summary presented in Appendix A. Field sampling activities are discussed in Section 4.0, and waste management issues are discussed in Section 5.0. General field and laboratory QA and quality control (QC) issues, including collection of QC samples, are presented in Section 6.0 of this CAIP and also in the *Industrial Sites Quality Assurance Project Plan* (QAPP) (DOE/NV, 1996b). The health and safety aspects of this project are documented in the IT Corporation, Las Vegas Office (ITLV), Health and Safety Plan (IT, 2001a), and will be supplemented with a site-specific health and safety plan written prior to the start of field work. No CAU-specific public involvement activities are planned at this time; however, an overview of public involvement is documented in the "Public Involvement Plan," Appendix V, of the FFACO (1996). The project schedule and records-availability information for this document are discussed in Section 7.0. Section 8.0 provides a list of references. Appendix B contains information on the project organization, and Appendix C presents the photographs and facility engineering drawings referenced in this CAIP. Appendix D contains radiological data from surveys of the Radioactive Materials Storage Facility (RMSF). Appendix E contains the response to NDEP comments.

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2.0 Facility Description

The CASs grouped into CAU 168 were selected based on their geographical location, technical similarities, and agency responsibility for closure.

2.1 Physical Setting

The following sections describe the general physical setting for Area 25, Area 26, and Yucca Mountain. General background information pertaining to topography, geology, hydrogeology, and climatology are provided for these areas or the NTS region in the *Geologic Map of the Nevada Test Site*, Southern Nevada; USGS Map I-2046 (USGS, 1990); CERCLA Preliminary Assessment of DOE's Nevada Operations Office Nuclear Weapons Testing Areas (DRI, 1988); the Nevada Test Site Final Environmental Impact Statement (ERDA, 1977b); and the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (DOE/NV, 1996a).

2.1.1 Area 25

Area 25 (Jackass Flats) is an intermontane valley bordered by highlands on all sides except for a large drainage outlet to the southwest. Elevations range from 3,400 to 5,600 feet (ft) above mean sea level (amsl). The dominant plant community is *Larrea-Ambrosia* associated with a transition zone between the Mojave and Great Basin Deserts (DOE, 1988b).

The Jackass Flats basin is underlain by alluvial, colluvial, and volcanic rocks of Cenozoic age. The alluvium and colluvium are above the saturated zone throughout most of Jackass Flats. Paleozoic sedimentary rocks, limestone, and dolomite, occur at greater depths. The Paleozoic rocks are productive aquifers throughout the region but locally are considered too deep (approximately 1,700 ft) to be an economic source of water. In western Jackass Flats, a highly fractured welded-tuff aquifer (Topopah Spring Member) is an important water-producing unit. Groundwater flow for the region is generally to the south and southwest (DOE, 1988b). Depths to groundwater for the three water supply wells located within Area 25 are approximately 1,041; 740; and 928 ft below ground surface (bgs) (USGS, 1995).

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Surface water flow in Area 25 is ephemeral and is a function of variations in annual climate patterns. The climate in this area is affected by the rain shadow of the Sierra Nevada mountain range in California. The average annual precipitation for Jackass Flats is approximately 4 inches (in.). Most of the precipitation (approximately 65 percent) occurs between October and April as a result of storms originating in the Pacific Ocean. The remaining precipitation occurs in the summer months and is the result of convection of moist air brought on by southeasterly winds from the Gulf of Mexico, or cyclonic lows developed over the Great Basin. Summer showers are generally isolated and precipitation is variable. Occasionally, storms move directly northward from the Gulf of California, resulting in wide-spread heavy rain (DOE, 1988b). Potential evaporation rates for the NTS/Yucca Mountain region are approximately 66 in. per year (DOE/OCRWM, 1998).

Facility-specific infrastructure information for Area 25 is provided in the NRDS Master Plan (SNPO, 1970).

2.1.2 Area 26

Area 26 is generally bounded on the southwest by the low drainage divide between Wahmonie Flat and Jackass Flats, on the northwest by Lookout Peak, on the north and northeast by small rugged hills that are unnamed, and on the south by Skull Mountain. Area 26 is located midway between Jackass Flats and Frenchman Flat (USGS, 1964).

The portion of Area 26 of concern to CAU 168 is an intermontane valley bordered by highlands on all sides except for drainage outlets to the southwest and southeast. Area 26 is located in the transition zone between the northern edge of the Mojave Desert and the southern portion of the Great Basin Desert. Elevations where Project Pluto facilities are present range from 4,200 to 4,400 ft amsl (AEC, 1961).

The Skull Mountain region is underlain by alluvium and colluvium, which ranges in age from Miocene to Holocene (USGS, 1990). The alluvium and colluvium consist of unconsolidated to moderately cemented, locally deformed, alluvial fan, flood plain, streambed, talus, slope wash, and eolian deposits. The thickness is variable and, in some cases, is as much as 1,970 ft thick (DRI, 1988). Nearby hills consist of Miocene-age Wahmonie and Salyer Formations, which are rhyodactic and dacitic volcanic deposits (DRI, 1988).

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The portion of Area 26 used for Project Pluto is covered by thin gravels capping a pediment that dips

3 to 6 degrees to the southeast. The pediment gravels merge with valley alluvium along Cane Springs

wash to the south. Where exposed, bedrock consists mostly of extrusive igneous rocks with some

associated breccias of limited areal extent. A few thin beds of consolidated sedimentary rock are

present between some of the extrusive rocks.

A perched water table occurs in a zone of the highly fractured rock. Static perched water levels range

from 81 to 167 ft bgs (USGS, 1964). The perched water may extend to depths exceeding 261 ft bgs

before encountering rocks with a low-fracture permeability. The regional water table is thought to be

at a depth of approximately 1,700 ft bgs (DRI, 1988). The climate of Area 26 is similar to that of

Area 25 (Section 2.1.1).

Facility-specific infrastructure information for Area 26 is provided in the *Environmental Survey*

Preliminary Report (DOE, 1988a), Background Information Project Pluto - Tory II-A (Author

Unknown, 1960), and the *Tory IIC Reactor Test Report* (AEC, 1964).

2.1.3 Yucca Mountain

Well USW G-3 (CAS 25-99-16) is located on the crest of Yucca Mountain, the wellhead is located at

an elevation of 4,856 ft amsl (USGS, 1984). Yucca Mountain is an eastward-tilted volcanic plateau

that consists of a thick sequence of ash-flow and related rocks of Miocene age within the southwest

Nevada volcanic field.

The west-facing slopes of Yucca Mountain are steep, and east-facing slopes are gentle, expressing the

underlying geologic structure. Small valleys eroded in the mountain are narrow, V-shaped drainages

that flatten and broaden near the mountain base. The Yucca Mountain crest is between 4,600 and

4,900 ft amsl, and the adjacent valleys are approximately 2,000 ft lower.

The static groundwater table at USW G3 well is present within the Crater Flat Tuff at a depth of

2,460 ft bgs (USGS, 1984; USGS, 1993). The climate of Yucca Mountain is similar to that given in

Section 2.1.1 for Area 25, except that annual precipitation totals on the Yucca Mountain crest are

greater than those reported for Area 25. From a network of gauges on Yucca Mountain, the USGS

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(1995a) reports average annual precipitation totals of 8.2 and 10.3 in. for water years 1992 and 1993,

respectively.

2.2 Operational History

The following subsections provide a description of the use and history of each of the CAU 168 CASs, beginning with a general discussion of each area, narrowing the discussion to a facility or landmark, and finally focusing on an individual CAS. The CAS-specific summaries are designed to illustrate any significant known waste-generating activities or releases. All engineering drawings and

photographs referenced in the following subsections are included in Appendix C.

2.2.1 History of Area 25

for the United States space program.

In the early 1960s, the U.S. Atomic Energy Commission and the National Aeronautics and Space Administration negotiated an interagency agreement to establish and manage a test area known as the NRDS. The NRDS, located in Area 25, was used from the 1960s until 1973 to conduct full-scale testing of reactors, engines, and rocket stages to evaluate the feasibility of developing nuclear reactors

When Project Rover was completed in 1973, NRDS activities were concluded, and the NRDS area was returned to NTS for closedown. Following closedown, the facilities were deactivated and decontaminated for their potential transfer to other DOE programs. Since 1980, Area 25 has been primarily used for nonweapons research and development.

Within the Area 25 test area, several major installations were built to conduct and support NRDS activities. Collectively, these installations cover approximately 8,000 acres of land. The installations include the Engine Maintenance, Assembly, and Disassembly (E-MAD) Building, Reactor Maintenance, Assembly, and Disassembly (R-MAD) Building, Test Cell A (TCA), Test Cell C, and Engine Test Stand No. 1 (see Figure 1-2).

Subsequent to NRDS activities, the U.S. Air Force, Ballistic Missile Office selected Area 25 for development and testing of the MX missile support systems and programs. The program operated from 1978 to 1983. Activities at the NTS involved siting studies for 71-ft long MX Peacekeeper missiles and canister ejection tests (Center for Land Use Interpretation, 1996).

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The following sections provide historical information on individual facilities and CASs in Area 25.

2.2.1.1 CAS 25-16-01, Construction Waste Pile (located at E-MAD)

The E-MAD facility was used to assemble and prepare Nuclear Engine for Rocket Vehicle Application (NERVA) engines for testing. It was also used to refurbish NERVA engines for additional testing, and to disassemble and conduct detailed post-testing inspections of the engines and components. The E-MAD facility was built in 1965 and used from 1966 to 1973 (DRI, 1996).

Corrective Action Site 25-16-01 is located approximately 500 ft south of the southeast corner of the E-MAD facility (Figure 1-2). The site has alternatively been referred to as a construction waste landfill, but will be referred to as the Construction Waste Pile throughout this document. The site is roughly 3 acres of disturbed area containing a considerable amount of refuse, much of which remains uncovered and has been scattered as far as the E-MAD complex. Material that litters the ground surface includes pieces of cement, metal, pipe, roof tar, and as many as 17 two- and five-gallon containers that resemble paint or solvent cans. All of the metal objects found on the site are well rusted with no labels. A 75-ft long by 26-ft wide elliptical-shaped mound is located at the southwestern end of the disturbed area. The mound is approximately 8 ft high with sloping sides and, at the surface, appears to be composed of soil and rock.

Historical documentation suggests that the Construction Waste Pile was used only for the disposal of wastes generated during the construction of the E-MAD facility (REECo, 1992). Interviews with former workers indicate that the construction debris may have been burned prior to burial in the Construction Waste Pile (Garey, 1997). There was no indication that the materials were hazardous or radioactive in nature (REECo, 1992). Aerial photograph 65125-12 shows an elliptical-shaped area of charred debris (EG&G/EM, 1965). It is assumed that the debris was covered with soil; the depth of burial is assumed to be shallow (less than 5 ft bgs). This area of buried debris is thought to be only a portion of the overall 3 acres of disturbed ground. Although not located in the active part of the wash, the Construction Waste Pile may be located within a 100-year, flood-prone area (USGS, 1980).

No engineering drawings of this site were located. No previous analytical sample results, radiological surveys, geophysical surveys, or COPCs have been identified.

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2.2.1.2 CAS 25-16-03, MX Construction Landfill

Corrective Action Site 25-16-03 (MX Construction Landfill) is located approximately 1 mi north of Lathrop Wells Guard Station 510 (Figure 1-2), across Lathrop Wells Road from the MX silos. The site consists of a 230-ft by 375-ft covered landfill, with four concrete monuments marking the corners. The total depth of the landfill is unknown. Two areas of subsidence were noted at the central and north ends of the site. The subsidence depths are relatively shallow, 0.5 to 1 ft vertical. The site also contains miscellaneous debris including cable, metal, plastic pipe, rebar, and wood scattered on the ground surface or partially buried. Engineering drawing A25-15 shows the layout of the MX site, with the construction landfill located east across Lathrop Wells Road from the site (H&N, 1987).

The first reported period of operation for the landfill was 1967 to 1979 (DOE/NV, 1993; Elle, 1996). Interviews indicate that the site was reopened from 1981 to 1982 to receive nonhazardous construction debris generated by the MX project (Hoar, 2000). The concrete monuments at the four corners of the landfill list the dates of operation as 1981 to 1982. Interviews indicate that waste disposed of in the landfill included sanitary waste, construction debris, and other nonhazardous waste (Elle, 1996; Hoar, 2000).

In 1993, the MX Construction Landfill was proposed for closure by the Nevada Operations Office in accordance with 1989 solid waste regulations (Elle, 1994). The NDEP concurred with the closure proposal, with the stipulations that documentation was required to indicate the landfill had not received hazardous wastes and also that a schedule for the final closure actions was completed (Liebendorfer, 1994). However, NDEP later rescinded this concurrence, stating: (1) the disposed waste was inadequately described, and (2) information was lacking to determine that the waste was not hazardous and migration of contaminants had not occurred (Liebendorfer, 1996).

No engineering drawings detailing the construction of this site were located. No previous analytical sample results or COPCs have been identified. Radiological and geophysical surveys have been completed at this site and are discussed in Section 2.5.7.1 and Section 2.5.8.1, respectively.

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2.2.1.3 CAS 25-19-02, Waste Disposal Site (located at R-MAD)

The R-MAD facility was constructed in 1959 to support the field testing of reactors. Various reactors were assembled and disassembled at R-MAD, including the Kiwi and Phoebus reactors from Project Rover, NERVA reactors, and NRX-EST and NRX/A3 reactors. The R-MAD facility consisted of two assembly bays where nuclear rocket reactors were assembled and installed on test cars. The R-MAD compound was also equipped with a 2,560-square ft (ft²) decontamination facility which was accessible via a railroad (RR) system. The RR trackage was provided to allow remote-controlled transport of the reactor from the assembly bay to the test cell, approximately 1.5 mi away; and after testing, back to the disassembly bay. The use of the R-MAD in reactor testing was concluded in 1969. (RSN, 1995; DOE, Date Unknown)

Corrective Action Site 25-19-02 is located outside of the R-MAD facility fence line near the southeastern corner (Figure 1-2). The Waste Disposal Site is roughly "L" shaped (more accurately backward "L" shaped). The longest leg of the "L", which parallels the eastern R-MAD fence line (trending north-south), is approximately 650 ft long, with a width of approximately 150 ft. The shorter leg of the "L" parallels the southern R-MAD fence line (trending east-west) and measures approximately 475 ft long by 200 ft wide.

A north-south trending berm is located along the east side of the CAS. The berm is approximately 2 to 3 ft high, consistent in size, and appears to be composed of natural material from the grading of a dirt access road, located on the east side of the berm. A well-developed wash runs around the southeast corner of the R-MAD fence line, within the southern portion of CAS 25-19-02.

Aerial photographs and historical ground photographs show pieces of equipment were stored on the ground surface at this CAS during the time period of 1964 and 1969 (EG&G/EM, 1964; EG&G/EM, 1966a and b). Interviews indicate that the origin of the equipment is from disassembly activities conducted at R-MAD, during the ROVER Project (Garey, 2000a and b; Henderson, 2000). Current waste on the surface consists of scrap wood, bolts, nuts, scrap metal, broken pieces of Plexiglas, plywood, a piece of fiberglass material, a weathered wooden crate, and a lead brick wrapped in green tape.

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No engineering drawings of this site were located. No previous analytical sample results or COPCs have been identified. Radiological and geophysical surveys have been completed at this site and are discussed in Section 2.5.5 and Section 2.5.6.

2.2.1.4 CAS 25-23-13, Engine Test Laboratory Lab Radioactive Contamination

Corrective Action Site 25-23-13 is located in Building 3124 at the TCA. Specifically, CAS 25-23-13 refers to two potentially radioactively contaminated laboratory fume hoods, associated ducting, and contamination of the building related to operation of the hoods. This may include the walls behind the hoods and the roof. Photograph 252313p1 shows one of the fumes hoods and radiological postings (IT, 1999). During the DQO process for CAU 168, the scope of CAS 25-23-13 was expanded to include any other radiologically posted areas or objects within Building 3124 (e.g., floor and equipment in the former soil preparation bay) (Appendix A).

The larger of the two fume hoods is approximately 8 ft high and 7 ft wide. The smaller hood is 4 ft wide and 1 ft or more shorter than the large fume hood. The larger hood is posted "Caution, Contamination Area," and the smaller hood is posted "Danger, High Contamination." The area encompassing the fume hoods is approximately 150 ft².

Test Cell A was constructed in 1962 and operated as a facility for testing nuclear rocket reactors. The TCA was constructed with piping and systems required to handle numerous gases and liquids. Building 3124, built as part of the TCA complex, was originally designated as the Equipment Test Laboratory (ETL). The ETL was used during the NERVA Program from 1962 to 1973 to test valve and gauge fittings prior to installation on the reactor and engine test cars. Flow rate calibration was also performed at the ETL. Specifically, the ETL was used for water and gas flow testing, static pressure testing, equipment maintenance and cleaning, and limited analytical work.

According to personnel interviews, testing of animal tissue may have taken place in the ETL in the mid 1970s, after the NERVA Program was terminated. In March 1977, the Building 3124 laboratory was refurbished for use by the Nevada Applied Ecology Group. Historical documents state that existing fume hoods required refurbishing as well. It is not clear if the referenced fume hoods are the same hoods currently present in Building 3124. In the early 1980s, the building was apparently used for biological experiments such as preparing samples after the sacrifice of laboratory animals.

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Radionuclides (e.g., americium) were reportedly used during the animal testing (Sygitowicz, 1999; Garey, 1999).

In the early 1990s, Building 3124 was cleaned, refurbished, and designated the Treatability Test Facility (TTF). Operations at the TTF focused on the bench-scale treatability testing of soil contaminated with uranium and transuranic radionuclides (Bliss, 1992). According to documents describing the conversion of Building 3124 to the TTF, it appears that new fume hoods may have been installed as part of the renovation. It is not clear if the fume hoods of this CAS are these new hoods. The TTF operated until it was closed in early 1995.

Common laboratory operations at the ETL may have included the use of various chemicals that could have impacted the fume hood systems. According to one source, mercury was found under the floor tiles during the conversion to the TTF (Kerschner, 1999). The COPCs identified for CAS 25-23-13 are listed in Table 3-2. Although interviews indicated that radiological surveys were conducted on abandoned buildings (including Building 3124) in 1974 or 1975, no records of these survey results could be located.

2.2.1.5 CAS 25-99-16, USW G3 (at Yucca Mountain)

Corrective Action Site 25-99-16 (USW G3) is located outside of the NTS boundary, west of Area 25 on the crest of Yucca Mountain. The USW G3 well was drilled in 1982 to support the evaluation of the geologic, geophysical, and hydrologic potential of Yucca Mountain as a prospective underground repository for high-level nuclear waste (Fenix & Scisson, 1987; USGS, 1984). The well is located on U.S. Bureau of Land Management land that has been withdrawn from mining and mineral exploration to maintain the physical integrity of the subsurface environment of the Yucca Mountain Project (YMP) (BLM, 1990). The land withdrawal is currently effective until late 2002.

The CAS consists of a cesium-137 (Cs-137) source lost on January 26, 1982, from a Birdwell Nuclear Annulus Investigation Logging tool during cementation activities at the USW G3 well. Records show that the source was lost at a depth interval of 1,247 to 1,250 ft bgs. The volume of cement used at this depth interval was 45 cubic feet (ft³), indicating the size of the area where the Cs-137 source might be located. Records indicate that the source was not detected by a gamma ray logging tool that was run downhole to a depth of 1,247 ft bgs. Following the loss of the Cs-137 source, drilling was

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diverted to avoid debris left in the original shaft, and the drill hole depth was completed to a total depth of 5,031 ft bgs (Fenix & Scisson, 1987). A Rad-Safe report prepared in February 1982 documents that the cuttings from USW G3 were continually monitored for radioactivity until the drill team had successfully bypassed the cement plug (Juniel, 2000). No elevated radiation was detected and the source is believed to remain sealed in the concrete plug.

The original receipt for the source (dated July 7, 1977) confirmed that it had an original activity level of 200 millicuries (mCi) of Cs-137. Accounting for radioactive decay, the activity of the source is 115 mCi as of September 2001.

At the ground surface, USW G3 is capped and is situated in a fenced, square-shaped area that measures 20 x 20 ft. The area is marked with signs designating it as an "underground radioactive material area" indicating that caution is required due to buried radioactive material, and any digging operations in the immediate area require precautions.

Groundwater elevations have been monitored at USW G3 from 1983 through 1995. The depth to groundwater at this site is approximately 2,460 ft bgs (USGS, 1993). The YMP is not currently using USW G3; however, it may be used in the future (Esp, 2001).

The only known radiological surveys conducted at this CAS were the downhole gamma logging run performed the same day the source was lost and monitoring of cuttings discussed above. Geophysical surveys were conducted throughout the actual drilling process; however, subsequent survey data have not been found. Analytical sampling of cuttings or groundwater has not been identified for this site.

2.2.1.6 Radioactive Materials Storage Facility (RMSF)

Four of the CAU 168 CASs are located within the Area 25 RMSF. The RMSF is located north of the turnoff from Road H to the E-MAD Facility (Figure 1-2). It is composed of approximately 140 acres enclosed within two fenced perimeters. The RMSF is posted with "Caution Contamination Area" signs on the inner fence. Seven RR spurs, extending from a main RR spur, exist within the facility. Concrete bunkers are present at the ends of the two easternmost spurs (Figure 2-1). The main RR spur was connected to the rail line between the E-MAD and the NRDS test cells in Area 25. The RMSF was constructed to support the NRDS. According to interviews and documentation pertaining

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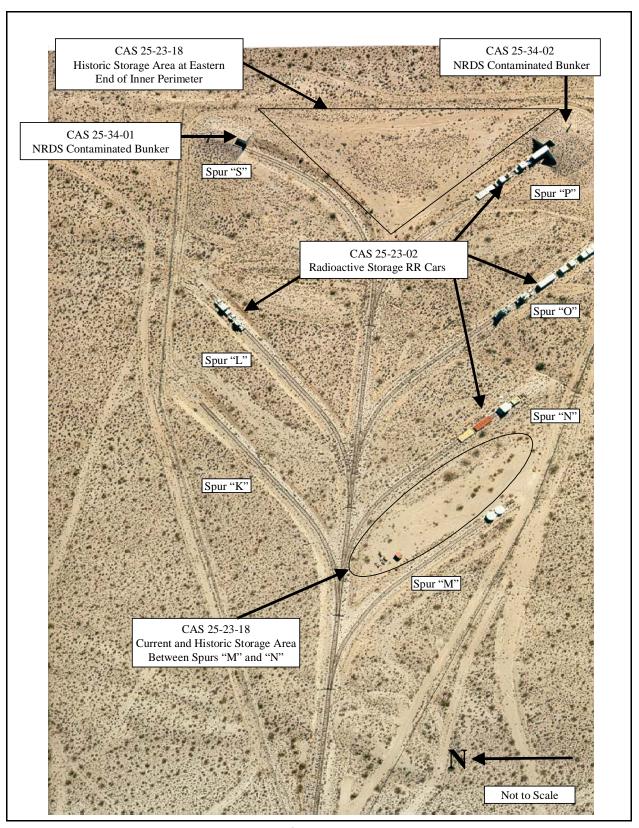


Figure 2-1
Corrective Action Sites in the Radioactive Material Storage Area

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to the RMSF, the facility was referred to as a conditional release yard. The main purpose of the RMSF was to store materials that could be reused at a later date.

The NRDS began operating in 1962 and the RMSF began operations in late 1965. Following the reactor and engine tests, the spent fuel was placed on flatbed RR cars in casks under protective "hoods" and moved to the RMSF for storage. Documentation suggests that the spent fuel rods were subsequently removed and shipped to the Idaho National Engineering Laboratory (INEL) for enriched uranium recovery. In addition, components of the reactors used in the Phoebus and Nuclear Furnace test series as well as components of the NRX-EST and NRX-A6 engines are known to be stored at the facility. It is presumed that much of the equipment currently stored in the yard was brought to the RMSF from the various NRDS facilities when the NRDS project was terminated in 1973. In July 1974, arrangements were made to retrieve fuel from storage and package it for shipment to INEL. It is presumed that the spent fuel rods that were stored at the RMSF were part of this effort.

A cleanup project took place at Area 25 beginning in 1978. As a part of this effort, a comprehensive radiological survey of the RMSF yard and its contents was performed. The survey was conducted using portable instruments and by collecting swipe samples. Items with removable contamination exceeding 20 disintegrations per minute (dpm) per 100 square centimeters (cm²) were moved to either the Area 5 or Area 3 Radioactive Waste Management Sites. Approximately 225 cubic yards (yd³) of contaminated steel, concrete, and wood were removed for disposal. In addition, 1,900 yd³ of soil was removed from around the RR spurs for disposal. Contaminated portions of RR ties were chiseled out and also sent for disposal (REECo, 1984a).

The RMSF received equipment moved from E-MAD during decommissioning in 1980. According to an interview regarding Bechtel Nevada (BN) field notes, materials were brought to the RMSF during the decommissioning of the E-MAD facility in 1997 and 1998 (Smith, 2000). Based on BN field notes that detailed some of the materials brought to the RMSF, it appears that most of the items were placed inside of or near a red transportainer located in the storage area between RR Spurs "M" and "N."

A brief description and history of each of the CASs in the RMSF are presented in the subsections that follow.

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2.2.1.6.1 CAS 25-23-02, Radioactive Storage RR Cars

Corrective Action Site 25-23-02 includes 19 RR cars (of which two are locomotive engines) located within the inner perimeter fencing of the RMSF. The RR cars are located on six of the seven RR spurs in the yard. Three of the cars are located inside two bunkers located on the site, one car in the northern bunker and two locomotives in the southern bunker. The bunkers, without the RR cars, are CASs 25-34-01 (Section 2.2.1.6.3) and 25-34-02 (Section 2.2.1.6.4), respectively.

Table 2-1 provides a brief description of each RR car. It is known that several of the cars were used during the nuclear engine tests to transport the rocket engine to the test pad. Flatbed cars were used to transport cask inserts containing fuel rods from reactor disassembly. Other cars may also have been used to support the tests. Reynolds Electrical & Engineering Co., Inc. (REECo) (1984a) reports that the superstructures of seven of the cars were dismantled and were sent to buried disposal, presumably on the NTS.

A site demarcation survey of several of the RR cars was conducted by BN on February 6, 1996. The results are discussed in Section 2.5.3.1; several areas of elevated radiation readings were detected on the cars. The area surrounding the Los Alamos Scientific Laboratory (LASL) Nuclear Furnace (NF) and the T-2, T-5, and T-6 cars were posted with "Caution, Radioactive Material" signs. The LASL NF car was also posted with "Caution, Radiation Area" and "Danger, High Contamination Area" signs.

Two additional radiological surveys were conducted by Bechtel Nevada (BN) in 1998. The survey conducted in March 1998 included ten RR cars and the red transportainer (discussed in Section 2.2.1.6.2). The highest readings were obtained from the LASL NF railcar. A survey conducted in September 1998 included 18 RR cars (all but the LASL NF car), the red transportainer, and miscellaneous equipment. The highest levels of alpha and beta radiation were measured on flatcars with objects or boxes on them (F-2, F-8, RMSF-1) and on test cars (T-4, T-6, NRX-A6, NRX-EST). The highest gamma exposure rates were measured at flatcar F-8 and test cars T-4, T-6, NRX-A6, and NRX-EST. The surveys indicated that radioactivity levels were above release limits for some of the RR cars from the yard. The results of these surveys are discussed further in Section 2.5.3.1.

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Table 2-1 CAS 25-23-02 RMSF Railroad Car Description

Location	Railroad Car Name	Description	Posting	
Spur "M"	RMSF-1	Flatbed railroad car with three large steel rotating platforms	None	
Spur "N"	Flatcar #2	Empty yellow flatcar		
	Test Vehicle #2	Empty red flatcar		
	Unlabeled	Gray reactor car]	
	Unlabeled	Yellow dump car		
Spur "O"	LASL Nuclear Furnace	Gray nuclear furnace car	"Caution, Radiation Area" and "Danger, High Contamination Area"	
	A-5 or T-6	Gray flatbed car with a metal box and "tower" structure	"Caution, Radioactive Material"	
	F-8	Yellow flatcar with three vented storage boxes	"Caution, Radiation Area"	
	F-2	Yellow flatcar with two vented storage boxes	"Caution, Radiation Area"	
	F-4	Yellow flatcar with three vented storage boxes	"Caution, Radiation Area"	
Spur "P"	Unlabeled	Empty blue flatcar with yellow wheels	None	
	NRX-EST or T-2	Gray test car	"Caution, Radioactive Material"	
	Phoebus-1B or T-5	Gray test car	"Caution, Radioactive Material"	
	F-7	Yellow flatcar with three large solid- walled bins	"Caution, Radioactive Material"	
	Engine #2	Engine, located inside southern bunker	"Caution, Radioactive Material"	
	Engine L-1	Engine, located inside southern bunker	"Caution, Radioactive Material"	
Spur "S"	Unlabeled	Blue flatcar, located inside northern bunker, with bags of Dicalite stacked on wooden pallets	None	
Spur "L"	T-4	Gray test car	"Caution, Radioactive Material"	
	NRX-A6	Gray test car	"Caution, Radioactive Material"	

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A radiological contamination survey was performed by ITLV Radiation Physics Group personnel in 2001. The highest total alpha and beta contamination levels were observed on test car T-5. The highest gamma exposure rates were measured at flatcar F-8 and test car T-6. The results of this survey are discussed further in Section 2.5.7.2.

2.2.1.6.2 CAS 25-23-18, Radioactive Material Storage

Corrective Action Site 25-23-18 addresses potential contamination at the Area 25 RMSF, but does not include the 19 RR cars (CAS 25-23-02) and the two bunkers (CASs 25-34-01 and 25-34-02) located at the ends of the easternmost RR spurs (see Figure 2-1). An inventory survey to document and photograph all relevant items within the RMSF was performed on March 15, 2000, by ITLV and BN personnel. The survey identified five discrete areas where materials are currently stored or may have been stored in the past. Each of these areas are discussed below.

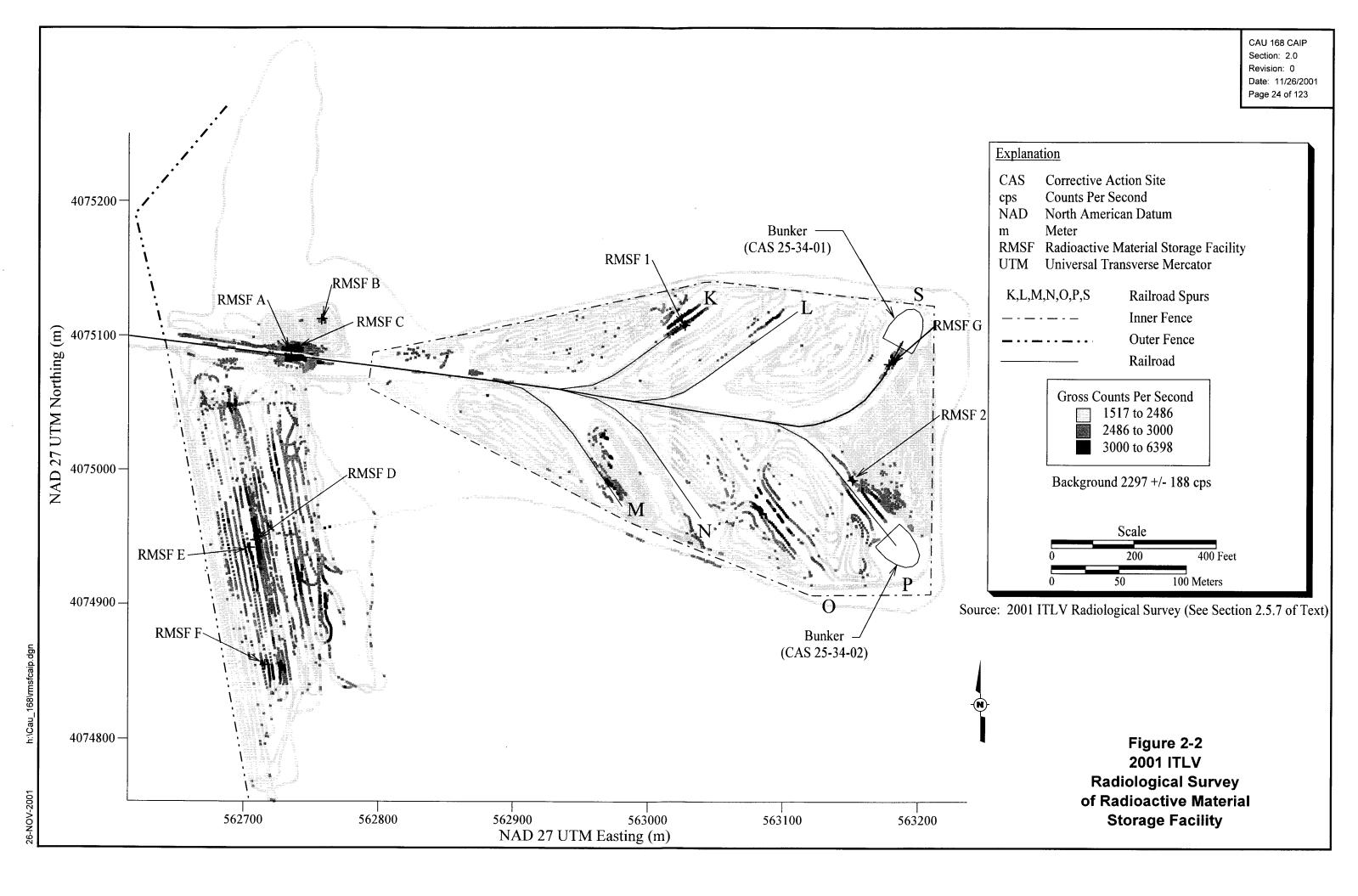
Current Storage Area Near Western RMSF Gate

Immediately inside the outer perimeter gate is a roped off area approximately 20 x 80 ft posted as "Caution, Contaminated Area." Inside the area are 15 round steel storage casks; each is approximately 2 ft high, with a 3-ft diameter. One of the casks is approximately 4 ft high. The pieces are laid side by side and are not stacked. The casks appear to have heavy steel lids. One of the casks with the lid missing appears to contain a structure made of lead.

Other miscellaneous equipment is present in this area; some of it is outside of the posting boundaries. A two-wheel cart holding an old carbon dioxide fire extinguisher and a crushed steel trash can are located in the northwest corner. Immediately south of the posted area are large yellow structural steel sections from a hydraulic lift. Three pallets of miscellaneous equipment and a pile of coiled hoses are also located outside the posted area. The origin of this equipment is not known.

Historic Storage Area Near Western RMSF Gate

An area of the RMSF outside of the inner fence was used to store equipment and/or material on the ground surface. The approximately 5.4-acre storage area is located south of the cask storage area discussed above (area surrounding locations RMSF D, E, and F shown on Figure 2-2). The storage area appears to have been arranged into 61 "bins," with five rows of bins running approximately north



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to south, away from the main rail line into the yard (REECo, 1984a). No equipment or material is currently present in the area. However, existing documentation indicates that equipment had previously been stored at this location, and that the material had been removed from the RMSF for disposal at NTS Areas 3 and 5 facilities (REECo, 1984a). The numbered signposts demarcating the storage bins are still present. The objects may have been placed in the RMSF to allow radiation levels to decline before the equipment or materials were reused. Subsurface burial of material is not suspected in this area.

Surface radiological and geophysical surveys of the area were performed by ITLV in 2001. The results of the surveys are discussed in Section 2.5.7 and Section 2.5.8 (see Figure 2-2). The geophysical surveys do not indicate the presence of buried debris.

Current Storage Area Between Spurs "M" and "N"

Radiologically contaminated materials and equipment were transported from the E-MAD to the RMSF in 1997 and 1998 (Smith, 2000) and are currently stored on the ground surface between Spurs "M" and "N." A list of the stored items was made from existing surveys and notes which document when some of the items were moved to the RMSF. The prominent items include two forklifts, boxes, a pallet of train parts, a large box trailer, high-efficiency particulate air (HEPA) filter housings, miscellaneous aluminum racks and stands, other metallic equipment, 55-gallon drums containing radioactive material, and a red-colored transportainer. The transportainer contains numerous objects including bags of radioactive parts, two buckets with spent fuel rod fragments, lead bricks, HEPA filters, and a vacuum cleaner. Most of the items are individually tagged or posted to indicate the level and type of radiological contamination; the transportainer is posted "Danger, Contamination Area." A site visit conducted by ITLV in March 2000 confirmed the presence of the stored materials and items discussed above. Radiological survey results for some of the objects are presented in Appendix D.

Historic Storage Area Between Spurs "M" and "N"

According to REECo (1984a), 13 "bins" for aboveground storage of equipment and/or materials were present between RR Spurs "M" and "N." The bins are arranged in two rows running parallel to the spurs. The historic storage area covers approximately 0.6 acres. REECo (1984a) indicated that the

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equipment/materials were removed from the RMSF and disposed of at NTS Areas 3 and 5 facilities.

The objects currently present in this area (discussed above) do not appear to be those referenced in the

REECo (1984a) report. The signposts used to marked each storage bin were apparently pulled from

their original locations and placed in a ditch just east of Spur "N."

An aerial photograph of the RMSF suggests that the soil in the area between Spurs "M" and "N" was

scraped or disturbed (see Figure 2-1). REECo (1984a) reported that radiologically contaminated soil

was removed from areas around the RR spurs in the RMSF. Subsurface burial of material is not

suspected in this area.

Surface radiological and geophysical surveys of the area were performed by ITLV in 2001. The

results of the surveys are discussed in Section 2.5.7 and Section 2.5.8. The geophysical surveys do

not indicate the presence of buried debris.

Historic Storage Area at Eastern End of Inner Perimeter

According to REECo (1984a), equipment and/or materials were stored in the area between RR Spurs

"S" and "P," at the eastern terminus of the rail lines. This area occupies approximately 0.2 acres,

although the actual storage area is not known. According to the REECo (1984a) report, the

equipment/material stored in this area were removed and disposed of at an NTS Areas 3 or 5 facility.

No stored objects were observed during site visits conducted by ITLV in 2000 and 2001.

An aerial photograph of the RMSF suggests that the soil in several locations immediately east and

parallel to Spurs "S" and "P" was scraped or disturbed (see Figure 2-1). REECo (1984a) reports that

radiologically contaminated soil was removed from areas around the RR spurs in the RMSF.

Subsurface burial of material is not suspected in this area.

Surface radiological and geophysical surveys of the area were performed by ITLV in 2001. The

results of the surveys are discussed in Section 2.5.7 and Section 2.5.8. The geophysical surveys do

not indicate the presence of buried debris.

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2.2.1.6.3 CAS 25-34-01, NRDS Contaminated Bunker

Corrective Action Site 25-34-01 is a concrete bunker located at the end of RR Spur "S" in the northeastern corner of the RMSF inner perimeter fencing (Figure 2-1). Three exterior sides and the roof of the bunker are covered with soil. The floor is soil and gravel; the rail line extends to the back wall. The interior walls and ceiling are composed of concrete. The walls are approximately 20 ft high, and the bunker is approximately 45 ft long. Construction details are shown on engineering drawing 2817-C-4 (Vitro Engineering Company, 1964). A blue flatcar loaded with bags of Dicalite (diatomaceous earth) is stored inside the bunker. This car is included in CAS 25-23-02, Radioactive Storage RR Cars.

The bunker had no radiological postings; however, the outer fence of the RMSF is posted with signs indicating "Radiation Area," and "Caution, Low Level Induced Radioactivity." A radiological survey was performed by REECo between 1974 and 1983 and is described in Section 2.5.1.

The specific uses of the bunker are unknown. It is presumed that during the nuclear rocket program, the bunker was used to house RR cars used in conjunction with the nuclear tests. It can also be assumed that the bunker either protected equipment on the railcars from weather or that the bunker provided radiation shielding. Sampling of environmental media has not been identified with respect to this CAS.

2.2.1.6.4 CAS 25-34-02, NRDS Contaminated Bunker

Corrective Action Site 25-34-02 is a concrete bunker located at the end of RR Spur "P" in the southeastern corner of the RMSF inner perimeter fencing (Figure 2-1). The dimensions and construction details are identical to those presented in Section 2.2.1.6.3 for the CAS 25-34-01 bunker. Two RR engines (designated "Engine 2" and "Engine L-1") are stored inside the bunker. A yellow flatbed car (designated "F-7") is in front of the engines at the bunker entrance. Three large solid metal boxes with unknown contents are stored on top of the flatcar. The RR cars are not part of CAS 25-34-02 but are addressed by CAS 25-23-02, Radioactive Storage RR Cars.

The bunker had no radiological postings; however, the outer fence of the RMSF is posted with signs indicating "Radiation Area" and "Caution, Low Level Induced Radioactivity." The RR engines and

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the flatbed cars are posted as "Caution, Radioactive Material." A radiological survey was performed by REECo between 1974 and 1983 and is described in Section 2.5.1.

The specific uses of the bunker are unknown. It is presumed that during the nuclear rocket program, the bunker was used to house RR cars used in conjunction with the nuclear tests. It can also be assumed that the bunker either protected equipment on the railcars from weather or that the bunker provided radiation shielding. Sampling of environmental media has not been identified with respect to this CAS.

2.2.2 History of Area 26

In 1958, the Lawrence Radiation Laboratory (LRL), predecessor of Lawrence Livermore and Lawrence Berkeley National Laboratories, was contracted to begin construction for Project Pluto in Area 26, formerly known as Area 401. Project Pluto was a joint program between the U.S. Atomic Energy Commission and DoD to demonstrate the feasibility of using a nuclear-powered ramjet engine to propel a supersonic low altitude missile (Author Unknown, 1960). Between 1961 and 1964, LRL conducted six experimental tests in Area 26 to develop the nuclear reactor for the ramjet. Four of the tests involved the Tory II-A nuclear reactor and the other two involved the Tory II-C reactor (DRI, 1988). The Tory reactors were air-cooled reactors fueled with highly enriched uranium dioxide homogeneously mixed with beryllium oxide.

Several activities have taken place in Area 26 subsequent to the initial Project Pluto activities. From 1979 to 1983, the DoD and the DOE conducted three joint nuclear weapons accident training exercises, called NUWAX, at the Project Pluto control point and surrounding area. The exercises were designed to practice and evaluate planned emergency response to scattering of radioactive material as a result of a nuclear weapons accident. In preparation for the exercises, short-lived radioisotopes (e.g., radium-223, mercury-197) were distributed on the ground surface to simulate contamination by weapons-grade plutonium (U.S. Army, 1989).

The facilities built to support Project Pluto were separated into three functional areas for operational reasons: control, testing, and disassembly areas. The three CAU 168 CASs are located in the vicinity of the testing area. Only the testing area will be discussed further in this CAIP.

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2.2.2.1 Project Pluto Testing Area

The testing area included the Test Bunker Building 2203 (Test Bunker), Building 2204 (Head House), and Building 2205 (Compressor House). Historical documentation reports that all three buildings were constructed in 1960, and were used from 1961 to 1964 during the Project Pluto activities (DRI, 1988). Personal interviews also indicate that the buildings may have been used sporadically after that time period for training exercises and other "classified activities" (Cebe, 1997). The nature of these activities are not known. Building 2203 is a facility of approximately 7,502 ft² that served as the location to house equipment required to supply and control the air, heat, electrical power, and instrumentation necessary to the test the Tory reactors. The reactors were tested on a pad on the north side of the Building 2203. A remote-controlled RR system (401 RR) was used to transport the reactors from the disassembly area to Building 2203 for testing. The status of Building 2203 is currently listed as active (BN, 2000b).

Building 2204 (Head House), measuring approximately 1,272 ft², housed the ventilation blowers and provided a sheltered entrance to the test bunker. A 392-ft long access tunnel connected the Head House to the Test Bunker. The status of Building 2204 is currently listed as active (BN, 2000b).

Building 2205 (Compressor House), measuring approximately 6,460 ft², housed water compressors and all the air drying equipment necessary to provide high-pressure air (3,600 pounds per square inch) for testing. The status of Building 2205 is currently listed as standby (BN, 2000b).

2.2.2.1.1 CAS 26-08-01, Waste Dump/Burn Pit (at Building 2204)

Corrective Action Site 26-08-01 is located north of Cane Springs Road, approximately 380 ft east/southeast of Building 2204 (Figure 1-3). The site consists of a waste dump situated along the edge of a natural wash and a suspected burn pit. The facilities possibly associated with the site are Buildings 2203, 2204, and 2205 (discussed in Section 2.2.2.1). Based on information obtained during a review of historical photographs, it appears the waste dump was in place by 1962. The exact date the waste was generated or where it originated from is unknown; however, from recent site visits it appears that the waste is construction debris. It may have been dumped in the area during construction of the Project Pluto testing facilities in 1960. However, it is possible that the debris was

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generated and dumped after expansion of the testing facilities that occurred sometime prior to June 1963 (AEC, 1963).

According to recent site visits, the area consists of a waste dump, which encompasses partially buried waste and surface debris along a wash area and a smaller waste pile. The waste dump is approximately 200 yards wide and 500 yards long. The waste associated with this dump consists of two 55-gallon drums, vitrified clay pipe fragments, concrete with rebar (possibly broken up building foundations), cinder blocks, wooden pallets and spools, tires, roofing material, piping, rusted cans, bricks, aluminum strips, and weathered canvas. Also noted were possible solvent cans, a can labeled diesel oil, a can labeled "Stay Clean," and Quaker State Motor Oil cans. The area appears to be littered with general construction debris. Stains and discolored soil were noted in several areas within the boundaries of the larger waste dump. A smaller waste pile, located southeast of the main waste pile, consists of construction debris piled on an 8 x 8-ft wooden pallet. The debris consists of piping, rusted metal cans, nuts, bolts, rock debris, and a rusted 55-gallon drum lid.

A possible burn pit was observed in a historical photograph from October 1962 (Author Unknown, 1962). The feature presumed to be the pit is located approximately 50 to 75 ft north of the natural wash. It appears to be approximately 6 to 10 ft in diameter. During a recent site visit by ITLV, fused rock pieces were found scattered in the general area; no other signs of the pit were observed.

Prior to installation of Area 26 facilities, runoff in the Pluto testing area flowed from highlands in the northwest toward Cane Spring Wash to the southeast. However, construction of the rail line, air storage tank farm, and three testing facilities necessitated diversion of the natural drainages. The upstream portion of the natural wash at CAS 26-08-01 was diverted, and the wash currently receives runoff only from the immediate area.

No records or data were found regarding previous sampling or characterization activities at this site. Geophysical or radiological surveys have not been conducted.

2.2.2.1.2 CAS 26-17-01, Pluto Waste Holding Area

Corrective Action Site 26-17-01 is located approximately 200 ft northeast of Building 2203 (Figure 1-3). The site consists of 300 ft of buried vitrified clay pipe (VCP), a small concrete wall at

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the pipe outfall, and a dry evaporative pond area. Engineering drawing 2203-SW1.1 (BMEC, 1959c) indicates that the Pluto Waste Holding Area was constructed by 1961 and its use most likely began with the advent of Project Pluto in May of that same year. The Pluto Waste Holding Area was connected to as many as ten floor drains in Building 2203 and three drains located on the test pad (BMEC, 1959a).

It is not definitively known if water was a by-product of the reactor tests, if the test pad was decontaminated with water after the tests were completed, or if any nonradioactive hazardous materials (e.g., solvents/cleaners) were disposed of down concreted drains. It is assumed that the Tory II-A utilized both light and heavy water to cool the pressure shell and the reflector/control valves, respectively (Author Unknown, 1960). As such, it is possible that once tests on the Tory II-A were completed, this water may have been drained into the hot waste line which leads to the Pluto Waste Holding Area. Existing documentation specifically states that there was no cooling water on the test vehicle of the Tory II-C (UCRL, 1962). Nonetheless, the placement of two fire hydrants in close proximity to the test pad suggests that the pad may have been washed down as part of testing, potentially producing contaminated liquid effluent.

Information obtained through personal interviews indicates that Building 2203 has been utilized for a variety of purposes, including training and a number of other "classified" activities. No information was found that substantiates the dates or specific purposes of these projects, nor has there been any indication that the Pluto Waste Holding Area was used during any of these projects.

A 300-ft length of VCP connects the drains in Building 2203 to the western side of the holding basin, where an outfall extends from a 3-ft high concrete wall. The basin appears to have been built to take advantage of the natural topography; the eastern and southeastern sides were bermed to form the basin. The site is irregular in shape and covers approximately 9,200 ft². The entire area is bounded with yellow rope and "Underground Radioactive Material" signs. Site visits have found that the Tory reactor test pad has been covered with dirt, suggesting that the use of the floor drains in the pad is no longer possible.

Radiological surveys of the Pluto Waste Holding Area were conducted in 1998 and 2001 by BN and ITLV personnel and are described in Section 2.5.4.1 and Section 2.5.7.4, respectively.

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2.2.2.1.3 CAS 26-19-02, Contaminated Waste Dump #2

The Contaminated Waste Dump #2 (CWD-2) (CAS 26-19-02) is located approximately 1,600 ft southwest of the Building 2203, on the south side of the 401 RR, which connects Building 2203 with the Maintenance, Assembly, and Disassembly Building (Building 2201) (Figure 1-3). The site was originally constructed to dispose of "high level waste" associated with Project Pluto (UCRL, 1960).

The CWD-2 consists of a 125 x 40-ft fenced area posted with "Underground Radioactive Material." During a site inspection, ITLV personnel noted a sign within the fence that had been painted over. However, the paint has faded to the extent that "Caution - High Radiation Area at Perimeter of Pit - Do Not Enter" could be read beneath the paint.

Engineering drawing 2202-RR6 shows that the dump is essentially a concrete enclosure, designed to accept waste dumped remotely from RR cars. The back wall, closest to the RR tracks, is 20 ft high (when empty). The front wall (now buried) slopes from the ground surface to a depth of 14.5 ft below grade. The base of the concrete enclosure is also 14.5 ft below grade, and is 10 ft wide by 110 ft long. Approximately 2 ft of loose soil backfill was placed on the base of the box, and weepholes were installed in the back wall just above the soil backfill, spaced 15 ft apart. ITLV personnel estimate that the CWD-2 currently contains approximately 62,500 ft³ of material.

Based on historical documentation, it is assumed that the site received Project Pluto waste from 1961 to 1964. It is unknown if the CWD-2 was used for further disposal after that time. Information obtained from site investigations, personal interviews, and historical documentation indicate that the CWD-2 may have been used to dispose of radioactive materials, including fuel elements, from the Tory Reactor (REECo, 1986a). Radioactive waste disposal forms document the 1963 disposal of solid wastes, including metal, paper, wood, and plastic waste in CWD-2 (previously known as the Area 401, Waste Disposal Pit). The forms document that approximately 520 ft³ of waste containing 19.2 curies of radioactivity was disposed of in the CWD-2.

Radiological surveys were performed in 1998 and 2001 by BN and ITLV personnel. The results are discussed in Section 2.5.4.2 and Section 2.5.7.5, respectively. A geophysical survey was performed by ITLV personnel in 2001 and is described in Section 2.5.8.3.

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Samples of surface and shallow subsurface soil were collected at the CWD-2 by REECo. The soil contained only naturally occurring radionuclides (Section 2.5.2). No documentation indicating other sampling activities has been identified.

2.3 Waste Inventory

Interviews with former site employees, review of procedures, and interpretations of aerial and ground photographs indicate that potential waste may include: construction debris, sanitary waste, radiologically contaminated materials (primarily activation and fission products), radioactive effluent, and/or potentially hazardous wastes. 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. Available information was evaluated during the DQO process, and a list of potential contaminants was developed (described further in Section 3.2).

2.4 Release Information

The sources of potential contamination related to the CAU 168 CASs are varied, but are generally representative of each of the individual conceptual site model (CSM) elements discussed in Table A.1-1. The CAS-specific release information for each of the CSM elements is discussed in Section A.1.3.

The five waste dump/landfill CASs (25-16-01, 25-16-03, 25-19-02, 26-19-02, and 26-08-01) contain debris and material of various origins, reportedly buried in the subsurface and covered with fill materials. The Building 2204 Waste Pile/Burn Pit (CAS 26-08-01) is an exception because debris is located on the ground surface with no cover material. The primary source of potential contamination at these CASs is the disposal and/or burial of various combinations of construction debris, sanitary waste, radiologically contaminated materials, and/or potentially hazardous wastes. Surface and subsurface soils are the affected media where material contributing to potential contamination may have been directly released via residual fluids in discarded containers, erosion of various contaminants off the surface of solid materials, and/or leaching of contaminants from materials. The primary materials contributing to potential contamination at each site as determined by historical information are listed in Table A.1-1.

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Corrective action sites consisting of contaminated facilities and materials have in common potential contamination of surfaces structures (i.e., walls, concrete, various metallic parts). The COPCs are associated with the release of radionuclides directly or indirectly onto the surface of materials. At CASs 25-23-02, 25-34-01, and 25-34-02 the primary sources of radioactivity were activation and fission products from the nuclear engine/reactor testing. Uranium contamination from reactor fuel may also be present. The potential sources of release for CAS 25-23-13 were the various soil and tissue experiments involving a variety of radionuclides at the TTF laboratory.

At CAS 26-17-01, COPCs are associated with potentially radioactive effluent from the Project Pluto Test Bunker (Building 2203) floor drains and test pad. The release of contaminants and the driving force for their migration into soil was limited because of the relatively short duration of Project Pluto in the early 1960s; however, subsequent use of the basin is not known. Affected media include the VCP pipeline, surface soil in the holding basin, and shallow subsurface soil beneath the basin and possibly beneath the pipeline.

At CAS 25-23-18, radionuclides in surface soil are the primary COPCs. The radionuclides are associated with releases through direct contact with or by erosion and runoff from contaminated materials and equipment stored historically and/or currently at various locations in the facility. Remaining potential sources of contamination to the soils of this CAS include railroad cars (CAS 25-23-02), equipment stored between Spurs "M" and "N," and equipment stored near the western gate to the RMSF.

At CAS 25-99-16, a Cs-137 source from a downhole geophysical logging tool was accidentally emplaced in USW G3 during drilling operations. The source is encased within cement at approximately 1,250 ft bgs within a plugged portion of USW G3. The source is located at the approximate midpoint of a 2,460-ft vadose zone.

2.5 Investigative Background

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 168. This checklist compels NNSA/NV project personnel to evaluate their proposed project personnel against a list of several potential impacts which include, but are not limited to, air quality,

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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. An evaluation of the historical significance of CAS 25-23-02, Radioactive Storage RR Cars,

will be completed prior to selection of closure alternatives.

Site investigation activities associated with CAU 168 have been identified and documented, in

general, in the Final Impact Statement for the Nevada Test Site and Off-Site Locations in the State of

Nevada (DOE/NV, 1996a). No subsurface sampling has been conducted by ITLV at the CAU 168

CASs to date.

The following subsections describe the known previous characterization activities that have taken

place at the CAU 168 CASs.

2.5.1 Area 25 Radiological Survey and Cleanup Project

The Nevada Test Site Area 25 Radiological Survey and Cleanup Project 1974-1983 (REECo, 1984a)

gives a description of the facility and details the cleanup activities at the RMSF. Additionally, it

provides information on a comprehensive radiological survey conducted in 1978 and a final

post-cleanup survey conducted in 1983. The survey included all surface items, bunkers, and land

areas encompassing the RR track spurs within the RMSF. The report states that items in the RMSF

with removable contamination levels exceeding 20 dpm per 100 cm² beta plus gamma activity were

removed to the NTS Area 5 or Area 3 Radioactive Waste Management Sites. Approximately

17,100 ft³ of soil and 2,295 ft³ of contaminated or activated equipment/material were removed.

Tabulated data in REECo (1984a) for the 1978 and 1983 RMSF surveys include removable beta plus

gamma radioactivity and gamma exposure rates. Also included in the 1978 survey results is

removable alpha radioactivity.

2.5.2 1986 REECo Report

Soil samples were collected from CAS 26-19-02 (CWD-2) and analyzed for radionuclides sometime

prior to 1986. The results are reported in Nevada Test Site Underground Contaminants

(REECo, 1986b). Two surface soil samples (0-6 in.), two shallow subsurface soil samples (7.5-8 ft),

and two full-interval (0-8 ft) samples were collected from the CWD-2. Only background levels of

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naturally occurring radionuclides were reported to be present in the samples. The radionuclides were

potassium-40, radium-226, and thorium-228 and -232.

2.5.3 BN RMSF 1996 and 1998 Radiological Surveys

Bechtel Nevada personnel conducted one radiological survey in 1996 and three radiological surveys

in 1998 at the RMSF (BN, 1998a and b; Betrand and Takahashi, 1998). The surveys included alpha

and beta/gamma activity (total and removable) and gamma exposure rate readings. Survey data were

obtained from various equipment and the RR cars; soil was not included in the surveys. The data are

applicable to CASs 25-23-02 and 25-23-18.

2.5.3.1 CAS 25-23-02, Radioactive Storage RR Cars

Radiological measurements for the CAS 25-23-02 railroad cars (or objects on the cars) surveyed by

BN in 1996 and 1998 are tabulated in Appendix D.

The results indicate that removable and total alpha and beta/gamma activity contamination is

associated with the RR cars. The contamination is highly variable, even for an individual car. In

general, the highest activity levels were measured at the LASL NF car, the test cars (T-2, T-5, T-4,

T-6, NRX-A6), and flatcars RMSF-1, F-2, and F-8. The source of the activity measured at the

flatcars may be the objects stored on the cars.

2.5.3.2 CAS 25-23-18, Radioactive Material Storage

Radiological survey results for miscellaneous equipment stored in the RMSF are presented in

Appendix D. The data were collected in 1998. This equipment is primarily stored in the area

between RR Spurs "M" and "N."

The results of the survey indicate that removable alpha and beta/gamma radiation is present above

background on many of the surveyed objects. Total alpha activities were below background.

However, several objects, including the forklifts and Victoreen meter, had total beta/gamma readings

in excess of 1,000 dpm per 100 cm².

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2.5.4 1998 BN Demarcation Surveys

Bechtel Nevada radiological control personnel performed demarcation surveys at two Area 26 CASs.

The results are discussed in the following subsection.

2.5.4.1 CAS 26-17-01, Pluto Waste Holding Area

On June 8, 1998, BN collected seven readings for alpha and beta radioactivity at the Pluto Waste

Holding Area (O'Donahue, 2000a). Two of the final alpha measurements may have exceeded

background levels. Both were reported as only 2 dpm per 100 cm² above background.

2.5.4.2 CAS 26-19-02, Contaminated Waste Dump #2

On June 6, 1998, a demarcation survey of the CWD-2 was performed by BN personnel

(O'Donahue, 2000b). Several of the final alpha measurements may have exceeded background

levels.

2.5.5 1999 ITLV Surface Radiological Survey

In October 1999, ITLV personnel performed a walkover radiological surface survey at CAS 25-19-02

(Waste Disposal Site located at R-MAD Facility) to determine if the surface of the areas to be

surveyed using geophysical methods were radiologically contaminated. Beta/gamma measurements

were collected approximately 1 ft from the surface of the soil. An area of 90 by 335 ft was surveyed,

with a spacing of approximately 30 ft. A total of 160 readings were collected. Radiation levels were

monitored between each of the survey points for the purpose of determining whether surface debris

(including metallic debris) was elevated. However, the data from this activity were not recorded.

Beta/gamma radiation measurements from the survey ranged from 1,122 and 1,633 dpm. The

average background reading was 1,350 dpm. None of the measurements were significantly above

background.

2.5.6 1999 ITLV Surface Geophysical Survey

In November 1999, ITLV personnel performed a surface geophysical investigation at CAU 25-19-02

(Waste Disposal Site located at R-MAD). The purpose for the survey was to locate waste or debris

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buried in the shallow subsurface. The survey area was approximately 530 by 130 ft. Electromagnetic

survey data (EM-31 and EM-61) were collected along traverses spaced 10 ft apart. A limited GPR

survey was performed at the locations of EM-31 and EM-61 anomalies.

The geophysical survey data from CAS 25-19-02 indicate that there are five significant anomalies

present within the survey area. The anomalies appear to be isolated objects in the subsurface and do

not appear to be connected together in a trench. The data indicate that the five targets are small or are

just beneath the ground surface. No surface indications of these anomalies were visible.

2.5.7 2001 ITLV Radiological Survey

During April 2001, ITLV personnel performed various radiological surveys, collected and counted

swipes, and collected several surface soil samples for preliminary gamma spectrometry analysis.

Data were collected at five CASs; not all of the activities were performed at each CAS (i.e., swipes

were only collected at the RMSF). Results of the surveys and sampling were used to identify areas of

radiological contamination, to provide safety information for protection of workers and environment,

and to support the planning of the corrective action investigation.

2.5.7.1 CAS 25-16-03, MX Construction Landfill

A total of 1,344 individual beta/gamma measurements were recorded by a driveover survey of

CAS 25-16-03. The survey indicated that no radioactive contamination above the established area

background was detected in surface and near-surface soil. The site-maximum detection of

3,174 counts per second (cps) was just below the background range maximum.

2.5.7.2 CAS 25-23-02, Radioactive Storage RR Cars

Scanning and static surveys were used to define areas of elevated radioactivity where swipe samples

were collected and analyzed for removable activity. Each RR car was initially scanned for alpha and

beta/gamma radiation. Static measurements were taken on the test cars in areas identified as elevated

by the scanning surveys. Swipe samples were collected in the same areas as the elevated static

measurements. The data from these activities are included in Appendix D of this CAIP. Because the

LASL NF car is a posted high contamination area, it was not included in the surveys. Most railcars

stored outside of the bunkers had areas of fixed beta/gamma contamination above the free release

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limit. Test car T-5 (alternatively known as Phoebus-1B) had the highest total contamination level of 236,000 dpm/100 cm² beta/gamma and 726 dpm/100 cm² alpha. This same location had elevated removable contamination of 1,280 dpm/100 cm² beta/gamma and 53 dpm/100 cm² alpha.

General area exposure rate measurements (at one meter) were taken around the RR cars to determine radiological health hazards. The maximum exposure rate of 600 microroentgens per hour (μR/hr) was measured on the north sides of flatcar F-8 and test car T-6. All exposure rate measurements were less than the free release limit established in the *NV/YMP Radiological Control (RadCon) Manual* (Revision 4) (DOE/NV, 2000a).

2.5.7.3 CAS 25-23-18, Radioactive Material Storage

Driveover survey results indicate that widespread radioactive soil contamination was present in the surface and near-surface soil throughout the facility. Figure 2-2 shows the survey data for CAS 25-23-18. Contamination is present over most of the historic storage area located near the western gate. Radioactive contamination is also present along the RR tracks, mostly near the end of the RR spurs. The maximum count rate measurement of 6,397 cps (equivalent to 30.1 picocuries per gram [pCi/g] of Cs-137) were located in the middle of the historic storage yard near the western gate.

Figure 2-2 also shows the nine RMSF locations where surface soil was sampled and analyzed on site by gamma spectroscopy. The data are considered preliminary because they have not been validated. The results indicate that the primary radiological gamma emitters in this area are Cs-137 and cobalt-60 (Co-60). Niobium-94 and uranium-235 were also detected in at least one soil sample. The Cs-137 activity concentrations were generally less than 100 pCi/g. At two locations (RMSF A and RMSF B), Co-60 concentrations exceeded 2,000 pCi/g. At the other sample locations, Co-60 was not detected or less than 1.0 pCi/g. This implies that hot spots were sampled at locations RMSF A and RMSF B, and the samples probably included pieces of activated metal.

Equipment stored between rail Spurs "M" and "N" were scanned for alpha and beta/gamma radiation using radiological survey instruments. Scanning and static surveys were used to define the areas of elevated radioactivity where swipe samples were collected and analyzed for removable activity. The results are listed in Appendix D. Many items in this current storage area had total contamination levels below the RadCon Manual (DOE/NV, 2000a) free release limits. The two forklifts stored in

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the area had radiological surface contamination over the concentration free release limits. A piece of equipment reported as a "4-ft stand" exhibited the highest levels of fixed and removable beta/gamma contamination over the reporting value criteria (28,500 and 3,200 dpm/100 cm², respectively).

The posted contamination area containing the shipping casks (current storage area near the western RMSF gate) was not entered during this survey. However, it was noted that elevated beta/gamma levels were originating from the casks. Two cask lids were missing or partially opened allowing rain water infiltration and animals to enter, possibly spreading contamination onto the surrounding soil. Significant hoisting would be required to open the casks to verify that they do not contain spent fuel and to perform contamination surveys. One cask that had liquid standing inside also appeared to contain lead.

2.5.7.4 CAS 26-17-01, Pluto Waste Holding Area

A total of 944 individual beta/gamma measurements were recorded during a driveover survey of CAS 26-17-01. The resulting data indicate that radioactivity exceeding the established range for area background is present in surface and near-surface soil at several locations within the holding basin. The maximum exposure rate and total net beta/gamma measurements of 18 µR/hr and 1,139 dpm/ 100 cm², respectively, were taken below the outfall on the western side of the basin. These maximum measurements may be due to the discharge of contaminated waste water through the outfall.

Two surface soil samples were collected within the holding basin and analyzed on site for gamma-emitting radionuclides. One sample was taken from the location determined to be the lowest lying point on the basin floor, and another sample was collected below the outfall. Only naturally occurring radionuclides at background levels were identified. The data are considered preliminary because they have not been validated.

2.5.7.5 CAS 26-19-02, Contaminated Waste Dump #2

A static beta/gamma radiological survey with a grid spacing of approximately 6.5 ft was performed at CAS 26-19-02. The vegetation was too thick to permit alpha measurements without damaging the detector. All beta/gamma measurements were less than 1,000 dpm/100 cm² over the background.

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Approximately 100 percent of the ground area was also scanned with the beta/gamma detector to

identify hot spots. No areas of elevated radiation were identified during the scanning survey.

Exposure rate survey data were between 14 and 18 µR/hr, indicating background gamma radiation

levels.

2.5.8 2001 ITLV Surface Geophysical Survey Report

During April 2001, ITLV personnel performed a geophysical investigation at three CASs in

CAU 168. A combination of electromagnetic (EM-31), time domain metal detection (EM-61), and

ground-penetrating radar (GPR) methods were used to complete the geophysical surveys. The results

of the surveys were used to confirm or deny the existence of potentially buried materials and/or

subsurface features. The survey data were intended to support the planning and execution of the

CAU 168 corrective action investigation.

EM-31 data were obtained in conjunction with global positioning system (GPS) data to construct

contour maps of these sites. These surveys were used as reconnaissance surveys. EM-61 data were

then obtained in conjunction with GPS data to better define anomalous areas that may represent

buried materials detected by the EM-31 survey. If necessary, GPR data were acquired to provide

further definition of anomalies.

Section 2.5.8.1 through Section 2.5.8.3 discuss the results for each CAS surveyed.

2.5.8.1 CAS 25-16-03, MX Construction Landfill

The surveys located numerous anomalies in the subsurface that are likely caused by buried metallic

objects or debris. These anomalies may represent several large objects of an accumulation of

localized metallic debris. The EM-61 data indicate that the objects or debris are located

approximately 6 ft or shallower below the ground surface. The pattern of the EM-31 and EM-61 data

suggests linear features or trenches, with long axis oriented northeast-southwest.

2.5.8.2 CAS 25-23-18, Radioactive Material Storage

Several suspect areas were gridded and surveyed in the RMSF. Each area is discussed separately in

the sections below.

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Historic Storage Area Near Western RMSF Gate

Elongated EM-31 and EM-61 anomalies in the central portion of the surveyed area were interpreted

to be caused by the rows of metal signposts that delineate the storage "bins." No anomalies

characteristic of buried material were found in the geophysical survey data from this area.

Historic Storage Area Between Spurs "M" and "N"

Based on EM-31, EM-61, and GPR data, no anomalies associated with buried material were detected

in the historic storage area between spurs "M" and "N." The only anomaly that appears in the data

sets is a result of a RR car (RMSF-1) influencing the survey equipment.

Historic Storage Area at Eastern End of Inner Perimeter

The EM-31, EM-61, and GPR data indicate no anomalies with characteristics similar to buried

material or storage bins are located in the historical storage area east of the RR Spurs "S" and "P."

Miscellaneous Areas

Two other areas in the RMSF were also surveyed using geophysical methods. The first area is

immediately north of main RR spur, approximately 300 ft east of the main gate to outer perimeter

fence (see sampling locations RMSF A and RMSF C, Figure 2-2). The other area is also immediately

north of the main RR spur, approximately 300 ft further east from the first area. In both areas, no

anomalies associated with buried material were detected, based on EM-31 and EM-61 data.

2.5.8.3 CAS 26-19-02, Contaminated Waste Dump #2

EM-31, EM-61, and GPR surveys indicated anomalies are present that are interpreted to be caused by

buried material. The northwest portion of the survey area contained elevated EM-31 and EM-61 data.

A linear anomaly that parallels the long axis of the CWD-2 is probably related to the buried sloping

concrete wall that forms the front (southeastern) side of the concrete box.

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3.0 Objectives

This section presents an overview of the DQOs for CAU 168 and formulation of the CSMs. Also presented is information on the COPCs and PALs for the investigation.

3.1 Conceptual Site Models

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. Because the diversity of the CASs, several CSMs were developed for CAU 168. The CSMs are based on assumptions formulated from information presented in Section 2.0. The CSMs are discussed in detail in Section A.1.3. The following are common elements of all the CAU 168 CSMs:

- Future land-use scenarios limit future uses to various nonresidential uses (DOE/NV, 1996a; BLM, 1990).
- Exposure pathways are oral ingestion, inhalation, dermal contact (absorption), or external/gamma exposure.
- Groundwater is not thought to have been impacted because of its significant depth and because the environmental conditions (i.e., arid climate, relatively low permeability soils) are not conducive to downward migration of contaminants.
- Temporal constraints due to weather conditions are not expected in Areas 25 and 26. However, rainfall and snow events will place constraints on sampling and surveying of radiologically contaminated soils because of the attenuating effect of moisture on 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 because conditions would have stabilized over the last 10 to 40 years since the sites were last active.

If additional elements are identified during investigation/characterization activities that are outside the scope of the CSMs 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 or concur with the recommendation.

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As discussed above, several CSMs were developed for CAU 168. Table 3-1 presents the CSM groupings. Several CASs were grouped together based on similar conceptual model elements and documented assumptions. Appendix A, Table A.1-1, provides information on CSM elements for each CAS. The following subsections discuss each of the CSMs.

Table 3-1 CAU 168 CSM Components

Waste Dumps and Landfills	Contaminated Materials and Facilities	Individual CSMs
25-16-01 25-16-03 25-19-02 26-19-02 26-08-01	25-23-02 25-23-13 25-34-01 25-34-02	25-23-18 26-17-01 25-99-16

3.1.1 Waste Dumps and Landfills

Figure A.1-1 in Appendix A shows a generalized representation of the CSM constructed for current site conditions at the waste disposal sites, except for CAS 26-19-02 (CWD-2). Figure A.1-2 is required to illustrate differences in migration and transport pathways due to the presence of an engineered barrier at CAS 26-19-02. The following are information and assumptions that were used in developing the Waste Dumps and Landfills CSM:

- The production of leachate generated in any of the waste disposal sites is assumed to be minimal based on low precipitation, high evapotranspiration rates, limited volumes of residual fluids from discarded containers, and the nature of debris/waste disposed at site.
- Vertical migration predominates over lateral migration, with the exception of CAS 26-19-02. Corrective Action Site 26-19-02 has an engineered barrier that would limit migration and transport pathways.
- Contaminants may have migrated laterally at CASs located within natural flood plains (CASs 25-19-02, and 26-08-01).
- Subsurface anomalies identified by geophysical surveys represent the areas of likely buried waste and COPC releases (CAS 25-16-03, and 25-19-02). The volume of this debris is limited and located close to the surface. If buried material is identified, it may be radiologically contaminated.
- Surface radiation is not expected.

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3.1.2 Contaminated Facilities and Materials

Individual CSM diagrams are not included for these sites; however, the CASs located within the RMSF are included in Appendix A, Figure A.1-3, as potential sources of contamination to surrounding soils. The following information and assumptions were used in developing the Contaminated Facilities and Materials CSM:

- The COPCs, if present, are associated with the release of radionuclides directly or indirectly onto the surface of materials.
- All sites have the potential for migration of removable radionuclides from structural surfaces
 to surrounding soils via precipitation runoff and/or corrosion of the material. At
 CAS 25-23-13, no viable transport mechanism exists for the migration of radionuclides
 remaining on equipment and surfaces within the building; however, potential contamination
 on the roof may migrate due to precipitation.
- Contamination from migration of these contaminants is covered by other CASs, except CAS 25-23-13.
- The primary sources of potential contamination of the facilities and materials are: (1) direct contact with materials contaminated with activation and fission products and/or uranium fuel particles, and/or (2) through indirect processes, such as erosion.
- Corrective Action Site 25-23-18 may contain PCB hydraulic fluid, asbestos, and lead not associated with radioactivity.

3.1.3 CSM for CAS 26-17-01, Pluto Waste Holding Area

Figure A.1-4 shows the CSM constructed for surface releases with limited potential for subsurface migration at CAS 26-17-01. The following information and assumptions were used in developing the CSM:

- The release of contaminants and the driving force for their migration into soil was limited.
- Affected media include the VCP pipeline, surface soil in the holding basin, and shallow subsurface soil beneath the basin and possibly beneath the pipeline.
- Vertical migration of COPCs will predominant over lateral migration.
- Migration will be limited due to the low mobility of expected COPCs in soils (primarily radionuclides), the lack of precipitation, and the high evaporation rates.

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- Contaminants, if present within the basin, will tend to accumulate in higher concentrations at particular locations including:
 - Surface and near-surface at the outfall pipe, where contaminants of low solubility, higher density, and/or associated with large-sized particles would tend to accumulate
 - Near-surface and subsurface at the current lowest surface elevation within the basin, where contaminants of high solubility, lower density, and/or associated with smaller-sized particles would tend to accumulate
 - Near the base of the historically lowest elevation, for the same reasons as given for the current lowest elevation
 - The VCP effluent pipeline
 - The shallow subsurface soil at possible unrepaired breaks or leaks in the pipeline

3.1.4 CSM for CAS 25-23-18, Radioactive Material Storage Facility

Figure A.1-3 shows the CSM constructed for current conditions at CAS 25-23-18. The following information and assumptions were used in developing the CSM:

- Radionuclides are the primary contaminants in surface soils. The radionuclides are associated
 with releases through direct contact with or by erosion and runoff from contaminated
 materials and equipment stored historically and/or currently at various locations in the facility.
- Any incidental chemical contamination present within the site will be colocated with known
 areas of radiological contamination. (Limited PCB, hydraulic oil, asbestos, and lead
 contamination may be present at the site and not colocated with radiological contamination.)
- Any radiological contamination within the RMSF will be identified through radiological soil surveys.
- Lateral migration of contaminants, whether solubilized or in particulate form, is possible via precipitation, runoff, and erosion. These driving forces will become enhanced if contamination migrates into dry washes crossing through the site boundaries.
- Physical characteristics of the COPCS, low precipitation, and high evaporation rates limit vertical migration.

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3.1.5 CSM for CAS 25-99-16, Well USW-G3

Figure A.1-5 shows the CSM constructed for CAS 25-99-16. The following information and assumptions were used in developing the CSM:

- The Cs-137 source is encased in a cement plug.
- Cesium-137 is the only COPC at CAS 25-99-16. As of September 2001, the activity of Cs-137 remaining is calculated to be 115 mCi.
- Cement and possibly adjacent bedrock are the affected media within the CAS.
- Groundwater would not be affected due to lack of a mechanism to transport Cs-137 to the saturated zone.
- The only viable future exposure pathway is to intercept the source by drilling through the plugged portion of the well.

3.2 Contaminants of Potential Concern

Types of contaminants that could be present were identified through a review of site history documentation, process knowledge, personal interviews, past investigation efforts, and inferred activities associated with the CAU. Based on these sources of information, the list of COPCs was developed as shown in Table 3-2.

Laboratory analysis of soil samples will provide the means for quantitative measurement of the COPCs. All soil samples collected in Phase I from a given CAS will be analyzed in the laboratory for the analytes listed in Table 3-3. The analytical requirements and methods for these COPCs are listed in Table 3-4. If the CAS advances to Phase II, the list of COCs may be revised based on Phase I results. If the list is revised, the appropriate NNSA/NV and NDEP representatives will be notified.

As shown in Table 3-3, samples for laboratory analysis will not be collected from CASs 25-23-02, 25-23-13, 25-34-01, 25-34-02, and 25-99-16. At CASs 25-23-02, 25-23-13, 25-34-01, and 25-34-02, radiological surveys and swipe counting will provide semiquantitative data to support a free-release determination in accordance with Table 4.2 of the NV/YMP RadCon Manual, Rev. 4 (DOE, 2000a). Release criteria is established in units of activity per unit area (dpm). Laboratory analytical data are presented in units of activity per mass or volume (pCi/g). So laboratory analytical data are not

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Table 3-2
Contaminants of Potential Concern

CAS	Chemical COPCs	Radiological COPCs	Source of Information				
25-16-01							
25-16-03	None Confirmed	None Confirmed	N/A				
25-19-02							
	Lubricating Oil	Uranium					
25-23-02	Desire Ores	Fission Products	Process Knowledge				
	Bearing Grease	Activation Products					
		Cobalt-60					
		Iron-55	7				
		Lead-210	EDDA 4077-				
		Radium-226	- ERDA, 1977a				
		Strontium-90	7				
25-23-13	Asbestos	Thorium-230/232	1				
25-25-15	A3DE3103	Isotopic Uranium	ERDA, 1977a; Fraser, 1993				
		Americium-241	ERDA, 1977a; Bliss, 1992				
		Plutonium-238, -239/240	ERDA, 1977b; Bliss, 1992; Kerschner, 1999; Fraser, 1993				
		Californium	Garey, 1999				
		Uranium-235/238	Bliss, 1992				
		Cesium-137	DDI 4000				
		Strontium-90	DRI, 1989				
25-23-18	None Confirmed	Cobalt-60	2001 ITLV Radiological Survey (see Section 2.5.7.3)				
		Uranium	Process Knowledge				
05.04.04	Nana Oanfinna ad	Uranium	N/A				
25-34-01	None Confirmed	Fission Products	N/A				
05.04.00	Name Orașii and	Uranium	NIA				
25-34-02	None Confirmed	Fission Products	N/A				
25-99-16	None Confirmed	Cesium-137	Marchand, 1998				
	Beryllium	Uranium	AEC, Date Unknown; UCRL, 1963; UCRL, 1964				
		Fission Products	Process Knowledge				
26-08-01	Acetone						
	Kerosene	N/A	Bybee, 1961				
	Potential Explosives (burn pit only)	14/7	Dy5008, 1801				
26-17-01	Beryllium	Uranium	AEC, Date Unknown; UCRL, 1963; UCRL, 1964				
		Fission Products	Process Knowledge				
26-19-02	Beryllium	Uranium	AEC, Date Unknown; UCRL, 1963; UCRL, 1964				
		Fission Products	Process Knowledge				

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Table 3-3 Analytical Program for CAU 168^a

CAS ^b	Sample Medium	Total VOCs	Total SVOCs	Total RCRA Metals	Total Be	TPH	PCBs	Isotopic Uranium	Strontium-90	Gamma Spectroscopy
25-16-01	Soil	Х	Х	Х		Х	Х			Х
25-16-03	Soil	Х	Х	Х		Х	Х			Х
25-19-02	Soil	Х	Х	Х		Х	Х			Х
25-23-02	Residual fluids ^c	Х	Х	Х		Х	Х			Х
25-23-18	Soil	Х	Х	Х		Х	Х	Х	Х	Х
26-08-01	Soil	Х	Х	Х	Х	Х	Х	Х		Х
26-17-01	Soil	Х	Х	Х	Х	Х	Х	Х	Х	Х
26-19-02	Soil	Х	Х	Х	Х	Х	Х	Х	Х	Х

Be - Beryllium

PCB - Polychlorinated biphenyl

RCRA - Resource Conservation and Recovery Act

SVOC - Semivolatile organic compound

TPH - Total petroleum hydrocarbon (oil- and diesel-range organics)

VOC - Volatile organic compound

^a For a given CAS, the analytical program for Phase II may not include all the analytes listed (see text).
^b Samples for laboratory analysis will not be collected from CASs 25-23-13, 25-34-01, 25-34-02, and 25-99-16 (see text).

^c For waste management purposes, residual fluids in RR cars may be sampled.

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Table 3-4 Analytical Requirements for CAU 168 (Page 1 of 3)

Parameter or Analyte Medium or Matrix		Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Relative Percent Difference (RPD) ^a	Percent Recovery (%R) ^b	
			ORGANICS				
Total Volatile Organic	Water	000000	Analyte-specific	N A (NA)		Lab-specific ^e	
Compounds (VOCs)	Soil	8260B°	estimated quantitation limits ^d	Not Applicable (NA)	Lab-specific ^e		
Toxicity Characteristic Leaching Procedure (TCLP) VOCs							
Benzene			0.050 mg/L ^d	0.5 mg/L ^f			
Carbon Tetrachloride	1		0.050 mg/L ^d	0.5 mg/L ^f			
Chlorobenzene	1		0.050 mg/L ^d	100 mg/L ^f			
Chloroform	1		0.050 mg/L ^d	6 mg/L ^f	1		
1,2-Dichloroethane	Aguagua	1311/8260B ^c	0.050 mg/L ^d	0.5 mg/L ^f	Lab-specific ^e	Lab-specific ^e	
1,1-Dichloroethene	Aqueous	1311/02006	0.050 mg/L ^d	0.7 mg/L ^f	Lab-specific	Lab-specific	
Methyl Ethyl Ketone	1		0.050 mg/L ^d	200 mg/L ^f			
Tetrachloroethene	1		0.050 mg/L ^d	0.7 mg/L ^f			
Trichloroethene	1		0.050 mg/L ^d	0.5 mg/L ^f	1		
Vinyl Chloride	1		0.050 mg/L ^d	0.2 mg/L ^f			
Total Semivolatile Organic Compounds (SVOCs)	Water Soil	8270C°	Analyte-specific estimated quantitation limits ^d	NA	Lab-specific ^e	Lab-specific ^e	
TCLP SVOCs							
o-Cresol			0.10 mg/L ^d	200 mg/L ^f			
m-Cresol			0.10 mg/L ^d	200 mg/L ^f			
p-Cresol			0.10 mg/L ^d	200 mg/L ^f	1		
Cresol (total)	1		0.30 mg/L ^d	200 mg/L ^f	1	Lab-specific ^e	
1,4-Dichlorobenzene	1		0.10 mg/L ^d	7.5 mg/L ^f	1		
2,4-Dinitrotoluene	1		0.10 mg/L ^d	0.13 mg/L ^f			
Hexachlorobenzene	1.		0.10 mg/L ^d	0.13 mg/L ^f	Lab-specific ^e		
Hexachlorobutadiene	Aqueous	1311/8270C°	0.10 mg/L ^d	0.5 mg/L ^f			
Hexachloroethane	1		0.10 mg/L ^d	3 mg/L ^f	1		
Nitrobenzene	1		0.10 mg/L ^d	2 mg/L ^f	1		
Pentachlorophenol	1		0.50 mg/L ^d	100 mg/L ^f	1		
Pyridine	1		0.10 mg/L ^d	5 mg/L ^f	1		
2,4,5-Trichlorophenol	1		0.10 mg/L ^d	400 mg/L ^f	1		
2,4,6-Trichlorophenol	1		0.10 mg/L ^d	2 mg/L ^f			
Polychlorinated Biphenyls (PCBs)	Water Soil	8082°	Analyte-specific (CRQL) ⁹	NA	Lab-specific ^e	Lab-specific ^e	
	Water Gasoline		0.1 mg/L ^h				
Total Petroleum Hydrocarbons (TPH)	Soil Gasoline	8015B modified ^c	0.5 mg/kg ^h	NA	Lab-specific ^e	Lab-specific ^e	
	Water Diesel		0.5 mg/L ^h				
	Soil Diesel		25 mg/kg ^h				
Explosives	Water	8330°	14 μg/L°	NA	Lab-specific ^e	Lab-specific ^e	
•	Soil		2.2 mg/kg ^c				

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Table 3-4 Analytical Requirements for CAU 168 (Page 2 of 3)

Parameter or Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Relative Percent Difference (RPD) ^a	Percent Recovery (%R) ^b						
	INORGANICS											
Total Resource Conservation and Recovery Act (RCRA) Metals												
Arsenic	Water	6010B ^c	10 μg/L ^{h, i}		20 ⁱ							
Arsenic	Soil	6010B°	1 mg/kg ^{h, i}		35 ⁱ	1						
Barium	Water	6010B°	200 μg/L ^{h, i}		20 ⁱ	1						
Banum	Soil	6010B°	20 mg/kg ^{h, i}		35 ⁱ	1						
Beryllium	Water	6010B°	5 μg/L ^{h, i}		20 ⁱ	1						
Beryllium	Soil	6010B°	0.5 mg/kg ^{h, i}		35 ⁱ	1						
Codmium	Water	6010B°	5 μg/L ^{h, i}		20 ⁱ							
Cadmium	Soil	6010B ^c	0.5 mg/kg ^{h, i}		35 ⁱ	Matrix Spike Recovery						
Chromium	Water	6010B°	10 μg/L ^{h, i}	NA	20 ⁱ	75-125 ⁱ						
	Soil	6010B°	1 mg/kg ^{h, i}		35 ⁱ	Laboratory Control Sample Recovery 80 - 120 ⁱ						
Lead	Water	6010B°	3 μg/L ^{h, i}		20 ⁱ							
Leau	Soil	6010B°	0.3 mg/kg ^{h, i}		35 ⁱ							
Maraum	Water	7470A°	0.2 μg/L ^{h, i}		20 ⁱ							
Mercury	Soil	7471A°	0.1 mg/kg ^{h, i}		35 ⁱ							
Selenium	Water	6010B°	5 μg/L ^{h, i}		20 ⁱ	1						
Selenium	Soil	6010B°	0.5 mg/kg ^{h, i}		35 ⁱ	1						
Silver	Water	6010B°	10 μg/L ^{h, i}		20 ⁱ	1						
Silver	Soil	6010B°	1 mg/kg ^{h, i}		35 ⁱ	1						
TCLP RCRA Metals												
Arsenic	Aqueous	1311/6010B° 1311/7470A°	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						
lgnitability	Soil	1010°	NA	Flash Point <140 F ^f	NA	NA						
	Water	1030°		See 40 CFR 261 ^f								

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Table 3-4 **Analytical Requirements for CAU 168**

(Page 3 of 3)

Parameter or Analyte	Medium or Matrix			RCRA Hazardous Waste Regulatory Limit	Relative Percent Difference (RPD) ^a	Percent Recovery (%R) ^b							
	INORGANICS (continued)												
Barium			2 mg/L ^{h, i}	100 mg/L ^f									
Cadmium	1		0.05 mg/L ^{h, i}	1 mg/L ^f		Matrix Spike							
Chromium	1		0.10 mg/L ^{h, i}	5 mg/L ^f		Recovery 75-125 ⁱ							
Lead	Aqueous	1311/6010B ^c 1311/7470A ^c	0.03 mg/L ^{h, i}	5 mg/L ^f	20 ⁱ	Laboratory Control Sample Recovery 80 - 120							
Mercury	1		0.002 mg/L ^{h, i}	0.2 mg/L ^f									
Selenium	1		0.05 mg/L ^{h, i}	1 mg/L ^f									
Silver	1		0.10 mg/L ^{h, i}	5 mg/L ^f	1								
	-		RADIOCHEMIST	RY									
Gamma-Emitting Radionuclides	Water	EPA 901.1 ^j		NA		N/A							
Gamma-Emitting Nationaciaes	Soil	HASL-300 ¹		INA		19/7							
Icotonic Uranium	Water	HASL-300 ¹ ASTM D3972-97 ^m	The Minimum Reporting Limits and Minimum Detectable	NA	Normalized Difference	Chemical Yield 30-105°							
Isotopic Uranium	Soil	HASL-300 ¹ ASTM C1000-90 ^m	Activities for radionuclides are given in Table 3-5	NA .	(ND) -2 <nd<2<sup>k</nd<2<sup>								
Strontium - 90	Water	ASTM D5811-95 ^m		NA		Sample Recovery 80-120°							
	Soil	HASL-300 ¹											

^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 {(|C₁-C₂|)/[(C₁+C₂)/2]}, where C₁ = Concentration of the analyte in the first sample aliquot, $\rm C_2$ = Concentration of the analyte in the second sample aliquot. $^{\rm b}$ %R is used to calculate accuracy.

Accuracy is assessed from the recovery of analytes 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 analyte is calculated by: %R = 100 x (C_x-C_x/C_x), where C_x = Concentration of the analyte in the spiked sample, C_y = Concentration of the analyte in the unspiked sample, C_y = Concentration increase that should result from spiking the sample ° U.S. Environmental Protection Agency (EPA) Test Methods for Evaluating Solid Waste, 3rd Edition, Parts 1-4, SW-846 CD ROM, Washington, DC (EPA,1996)

d Estimated Quantitation Limit as given in SW-846 (EPA, 1996) 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 15-20 samples of each matrix and calculating the mean %R for each analyte. The standard deviation (SD) of each %R is then calculated, and the warning and control limits for each analyte 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.

¹ Title 40 Code of Federal Regulations, Part 261, "Identification and Listing of Hazardous Waste" (CFR, 2001b)

- 9 EPA Contract Laboratory Program Statement of Work for Organic Analysis (EPA, 1988b; 1991; and 1994c)

h Industrial Sites Quality Assurance Project Plan (DOE/NV, 1996b)

- EPA Contract Laboratory Program Statement of Work for Inorganic Analysis (EPA, 1988a; 1994b; and 1995)
- Prescribed Procedures for Measurements of Radioactivity in Drinking Water, EPA-600/4-80-032 (EPA, 1980)
- *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
- 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 = Picocurie per liter mg/L = Milligram per liter pCi/g = Picocurie per gram μg/kg = Microgram per kilogram mg/kg = Milligram per kilogram μg/L = Microgram per liter

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appropriate for free-release determination. If the material does not meet the free-release criteria, the appropriate radiological controls will be taken to manage the material. The rationale for not collecting samples for analysis from CAS 25-99-16 is presented in Section 4-2. If necessary, samples of residual fluids may be collected for laboratory analysis from the CAS 25-23-02 RR cars.

Not all the radionuclides listed in Table 3-5 have been specifically identified as COPCs for CAU 168. However, since general categories of COPCs such as "activation and fission products" have been included at some sites (Appendix A), it was appropriate for Table 3-5 to contain an inclusive group of radionuclides.

3.3 Preliminary Action Levels

Analytical methods and minimum reporting limits (MRLs) for each chemical analyte are provided in Table 3-4. The MRLs for radionuclides are listed in Table 3-5. The MRL is a practical reporting limit that ensures data generated by the laboratory will be usable by the investigation. Radionuclide minimum detectable activities (MDAs) and PALs are also provided in Table 3-5. The MDA is the smallest amount of activity of a particular analyte that can be detected in a sample with an acceptable level of error. The MDAs listed in Table 3-5 are typical default levels available for commercial radioanalytical laboratory. Radionuclide PALs were calculated using data from Nevada and surrounding region (Adams, 2000a and b). The radionuclide MRLs were developed considering both the MDA and the PAL (Adams and Dionne, 2000).

Preliminary action levels for both on-site field-screening methods and off-site analytical methods will be used to determine the presence of contamination.

The comparison of laboratory results to PALs will be discussed in the Corrective Action Decision Document (CADD). Laboratory results above action levels indicate the presence of COPCs 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 determined during the CADD.

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Table 3-5
Minimum Detectable Activities, Preliminary Action Levels,
and Minimum Reporting Limits for Radionuclides in Samples Collected at CAU 168

		Soil		Liquid					
Isotope	MDA ^a (pCi/g) ^d	PAL [♭] (pCi/g) ^d	MRL [∘] (pCi/g) ^d	MDA ^a (pCi/L) ^e	PAL ^b (pCi/L) ^e	MRL ^c (pCi/L) ^e			
Cobalt-60	0.66 ^f	0.1	0.66	15	15	10			
Strontium-90	0.41 ^f	1.17	0.41	1	0.22	1			
Niobium-94	0.63 ^f	0.63	0.63	15	15	10			
Cesium-137	0.43 ^f	7	2.14	10	10	10			
Radium-226	0.18 ^f	3.21	0.91	1	0.69	1			
Uranium-234	0.08 ^f	1.56	0.38	0.07 ^f	8.92	0.37			
Uranium-235	0.27 ^f	0.07	0.27	0.06 ^f	0.36	0.32			
Uranium-238	0.06 ^f	3.2	0.29	0.07 ^f	9.39	0.33			

^a MDA is the minimum detectable activity, values are the default levels listed in Paragon Analytics, Inc. *Laboratory Quality Manual*, Revision 4, February 2000 (unless annotated otherwise) (PAI, 2000).

3.3.1 Field-Screening Levels

Field screening may be instituted in the field to assist in providing additional semiquantitative screening measurements. These field-screening results, along with biasing factors, may help guide the selection of the most appropriate sampling locations for collection of laboratory samples. The following action levels may be used for on-site field surveys:

- Headspace screening for VOC headspace screening levels at 20 parts per million (ppm) or
 2.5 times background, whichever is greater
- The total petroleum hydrocarbons (TPH) field-screening results greater than 75 ppm when measured using an appropriate field-screening method (i.e., Hanby or other test kit)

^b PAL is the preliminary action level and is defined as the maximum concentration listed in the literature for a sample taken from an undisturbed background location (McArthur and Miller, 1989; U.S. Ecology and Atlan-Tech, 1991; and DOE/NV, 1999). The PAL is equal to the MDA for isotopes not reported in soil samples from undisturbed background locations, or if the PAL is less than the MDA.

^c MRL is the minimum reporting level. It is set equal to 5 times the MDA, or if 5 times the MDA is greater than the PAL, the MRL is set equal to the MDA.

^d pCi/g is picocuries per gram.

^e pCi/L is picocuries per liter.

MDA for this nuclide is based on the 95 percent Upper Confidence Level for the MDAs reported for soil samples collected by ITLV in Area 25 during site investigations in 1999 and 2000.

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• The radiological (alpha and beta/gamma) field-screening level for soil samples is the mean background activity plus two times the standard deviation of the mean background activity.

Field-screening results exceeding the action levels presented above will indicate potential contamination at a sample location. This information will be documented and, for Phase II sampling, the investigation will be continued to delineate the extent of the contamination. Field-screening results may also be used to select samples to be submitted to the laboratory for both Phase I and II sampling.

3.3.2 Chemical Preliminary Action Levels

Off-site laboratory analytical results will be compared to the following PALs to evaluate the need for possible corrective actions:

- Region IX Risk-Based Preliminary Remediation Goals for Industrial Soil (EPA, 2000)
- Background concentrations for RCRA metals will be evaluated when natural background exceeds the PAL (i.e., arsenic). Background is considered the mean plus two times the standard deviation of the mean based on data published in *Mineral and Energy Resource Assessment of the Nellis Air Force Range* (NBMG, 1998).
- TPH concentrations above the TPH limit of 100 ppm per the NAC 445A.2272 (NAC, 2000c)
- TCLP data, if collected, will be compared to 40 Code of Federal Regulations (CFR) 261.24, (CFR, 2001c)
- Asbestos level exceeding 1 percent by volume will comply with 40 CFR 763, "Asbestos" (CFR, 2001j)

The application of industrial PRGs restricts future use of the sites to industrial use. An industrial use exposure scenario is appropriate because a series of public land orders has withdrawn the NTS from public use (DOE/NV, 1996a), and public access is restricted. Areas 25 and 26 are within a research, test, and experiment land-use zone (DOE/NV, 1998).

3.3.3 Radiological Preliminary Action Levels

The PALs for radionuclides listed in Table 3-5 are isotope-specific and are defined as the maximum concentration of a given isotope found in environmental samples taken from undisturbed background locations. Environmental background samples may be taken in the vicinity of CAU 168. If collected,

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these samples will be analyzed and compared with the results for environmental samples previously taken from other undisturbed background locations in Area 25. In addition, the radionuclide concentrations in the CAU 168 and Area 25 background samples may be compared with the radionuclide concentrations found in environmental samples taken from undisturbed background locations in the vicinity of the NTS (McArthur and Miller, 1989; U.S. Ecology and Atlan-Tech, 1991).

3.4 DQO Process Discussion

Data quality objectives are qualitative and quantitative statements that specify the quality of data required to support potential closure alternative for CAU 168. The DQOs were developed to clearly define the purposes for which environmental data will be used and to design a data collection program that will satisfy these purposes. The formulation of the CSMs (Section 3.1) is an aid to the development of the DQOs for the site.

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 agreed upon, and the appropriate QA/QC required for particular data collection activities were assigned. The analytical methods and reporting limits prescribed through the DQO process are listed in Table 3-4, and the data quality indicators (DQIs) for laboratory analysis (e.g., precision and accuracy requirements) are provided in more detail in Section 6.0 of this CAIP. At the end of the investigation, resulting laboratory data will be evaluated to confirm or refute the CSMs and to determine if the DQOs were met by using the DQIs of precision, representativeness, completeness, and comparability. Other DQIs may be used, such as sensitivity.

The DQO decision flow process applied to the CAU 168 investigation is depicted in Figure A.1-6. A Phase I data collection will be conducted at all CASs (except CASs 25-23-02, 25-23-18, 25-23-13, and 25-99-16). If laboratory data obtained from the Phase I investigation indicates the need for further characterization, the process will continue with a Phase II investigation. The process ends with closure of the site based on the laboratory analytical results from the environmental samples. Corrective action alternatives of closure-in-place and clean closure will be evaluated for each CAS where COCs above PALs are detected.

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Sufficient information about CAS 25-99-16 (USW-G3) has been collected through historical documentation regarding the nature and extent of contamination and potential risk to a receptor; therefore, a preferred corrective action alternative can be selected for site closure. Following the decision flow path, the site bypasses Phase I due to the known presence of Cs-137 contamination, continues through with positive responses to the decision points of nature and extent to reach the "completed investigation" end point. Therefore, this CAS will not be addressed in the DQO process and the selection of a corrective action will be addressed in the CADD. The existing site information is documented in Section 2.0.

The surface soils at the RMSF (CAS 25-23-18) are known to be radiologically contaminated so the site will advance directly to a Phase II investigation. The railroad cars (CAS 25-23-02) and materials at the TTF (CAS 25-23-13) are known to be radiologically contaminated and will also proceed directly to Phase II.

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4.0 Field Investigation

This section of the CAIP contains the approach for investigating CAU 168.

4.1 Technical Approach

The technical approach for CAU 168 consists of the following activities:

- Perform best management practices and housekeeping activities on miscellaneous debris, where necessary.
- Perform geophysical surveys (CAS 25-16-01 only).
- Perform radiological surveys (CASs 25-16-01, 25-23-02, 25-23-13, 25-23-18, 25-34-01, and 25-34-02).
- Collect and count swipes for radiological characterization (CASs 25-23-13, 25-23-02, 25-34-01, and 25-34-02).
- Collect soil samples from biased locations and analyze samples as described in Table 3-3.
- Field screen samples for VOCs, radiological activity, and possibly TPH.
- Collect required QC samples.
- Inspect and sample the effluent pipeline at CAS 26-17-01, as required and where possible.
- Collect additional soil samples to define the lateral and vertical extent of contamination, if necessary.
- Scabble or shot-blast concrete surfaces at selected locations in CASs 25-34-01 and 25-34-02, if necessary, to determine the extent of radiological contamination into the concrete.
- Collect samples of residual fluids in the RR cars at CAS 25-23-02, if necessary, for waste management purposes.
- Collect samples from native soils and analyze for geotechnical/hydrologic parameters, if necessary.
- Collect and analyze bioassessment samples at the discretion of the Site Supervisor, if VOCs exceed field-screening levels (FSLs) in a pattern that suggests that a VOC plume may be present.

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• Stake or flag sample locations and record coordinates (in the Universal Transverse Mercator coordinate system).

4.2 No Further Action Sites

Upon reviewing the historical documentation, current site conditions, and the CSM for CAS 25-99-16 (USW-G3), it has been determined that no further characterization is warranted at this site, as nature and extent of contamination are known. A pathway for contamination to reach potential receptors is not present since the Cs-137 source is encased in cement and the distances from the ground surface to the source and the source to groundwater are large (both are approximately 1,200 ft). Given the low precipitation rates (Section 2.1.3) at Yucca Mountain and location of the source in the vadose zone, aqueous transport of Cs-137 to groundwater is not feasible. A corrective action of closure in place with a land-use restriction for drilling near the USW G3 well is appropriate. This corrective action will be documented in the CADD report.

4.3 Field Activities

This section provides a description of the field activities for CAU 168. A phased approach has been chosen to address the data collection activities. Biased sampling will be conducted during Phase I and Phase II. Process knowledge indicates that contamination, if any, is confined to the spatial boundaries of the sites as defined in the DQO process and CSMs. If Phase I characterization determines that COPCs are present above PALs at a CAS, then the CAS will be addressed further by a Phase II investigation before implementing a corrective action alternative. The COPCs determined to be not present in Phase I will be eliminated from further consideration during a Phase II characterization effort. It is important to note that the target population(s) to be investigated in Phase I may be different than those in Phase II; therefore, the target populations for each phase are documented in the relevant sections.

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). Written NDEP concurrence with ROTC modifications is required prior to proceeding with investigation activities significantly different from those described in this document. Section A.3.4.2 presents the spatial boundaries of each CAS. If contamination extends either laterally or vertically beyond the boundaries, the investigation may require rescoping.

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In general, the investigation of each CAS will begin with a Phase I, and may then advance to a Phase II characterization. This investigation strategy is depicted in Figure A.1-6 of Appendix A. The exceptions to this strategy are CAS 25-99-16 (will have no further action), and CASs 25-23-02, 25-23-13, and 25-23-18 (will proceed directly to Phase II). The ordered flow of activities is discussed further in the sections that follow.

Samples will be collected at biased sampling locations by hand-tool methods, backhoe excavation, direct-push, or drilling techniques as appropriate. Sample collection and handling activities will follow standard procedures. Table 3-4 and Table 3-5 provides the analytical methods and laboratory requirements (i.e., detection limits, precision, and accuracy requirements) to be used when analyzing the COPCs. Field sampling and laboratory analytical activities will be conducted in compliance with the QA/QC requirements and specifications given in Section 6.0, the Industrial Sites QAPP (DOE/NV, 1996b), and other applicable, approved procedures. Where overlap exists, the project-specific requirements of Section 6.0 will supersede those of other documents. Additional documents that govern performance of field activities include the current version of the applicable health and safety plan and an approved site-specific health and safety plan prepared prior to the field effort.

4.3.1 Site Preparation Activities

Several site preparation activities will be completed prior to conducting sampling activities. Table 4-1 lists the site preparation activities to be completed at each site.

Housekeeping, in general, will consist of removal of various pieces of debris and trash on the ground surface. Because CAS 25-16-01 lies within a natural wash designated as "Waters of the State" (Wong, 2001), debris present on the ground surface at this CAS will be removed. Prior to the start of the field investigation of CAS 25-23-18, various radiologically contaminated equipment and material will be removed by the management and operations contractor as a best management practice. This will include the storage casks and equipment near the western entrance of the RMSF, and the equipment stored between RR Spurs "M" and "N." For the NRDS Bunkers (CASs 25-34-01 and 25-34-02), site preparation activities are simply moving the railcars presently parked in the bunkers or limiting access to the bunkers. The documentation for the disposal of any material removed as a best

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Table 4-1
Site Preparation Activities for CAU 168

	Site Preparation Activities												
CAS	Housekeeping/Best Management Practice Activities	Surface Geophysical Surveys	Radiological Surveys	None									
25-16-01	Х	Х	Х										
25-16-03	X												
25-19-02	X												
25-23-02				Х									
25-23-13				Х									
25-23-18	X		Х										
25-34-01	X												
25-34-02	X												
26-08-01	Х		Х										
26-17-01				Х									
26-19-02				Х									

management practice will be provided in the closure report. Any additional housekeeping activities completed during the course of the investigation will be documented in the closure report.

A surface geophysical survey is planned for CAS 25-16-01. The survey will be used to confirm and/or determine the location and configuration of the buried waste pile. The geophysical survey at CAS 25-16-01 will consist of electrical imaging methods and possibly ground-penetrating radar. Geophysical surveys previously conducted by ITLV at various CAU 168 CASs are discussed in Section 2.5.

Surface radiological surveys will be performed at CASs 25-16-01, 25-23-18, and 26-08-01 to identify any potential areas of elevated radiological readings. Radionuclides above background levels are not expected at CAS 25-16-01; however, a confirmation surface soil survey will be conducted in the area where waste is assumed to be buried. The soil mound present at the site will also be included in the survey. A driveover radiological survey at CAS 25-23-18 will be conducted to increase survey coverage in the area between the inner and outer RMSF fences. A driveover beta/gamma survey was conducted by ITLV in 2001 (Section 2.5.7).

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4.3.2 Phase I Activities

The objective of the Phase I investigation strategy is to determine whether COPCs are present at concentrations above PALs. Laboratory analytical results from this phase will be used to confirm the presence or absence of COPCs, and to determine if concentrations exceed PALs. If field data generated during the course of the Phase I investigation strongly indicate that COPCs are above PALs (e.g., elevated radiological field-screening results), the investigation may proceed directly to a Phase II characterization without the support of analytical results.

The Phase I sampling strategy targets locations and media most likely to be contaminated. Table 4-2 identifies the primary biasing factors for selecting sample locations and lists the minimum number of samples to be collected (also see Section A.2.3, Table A.2-1, and Section A.2.7 of Appendix A for further details).

The following subsections provide CAS-specific Phase I investigation strategies. Figures showing sample locations are provided in these subsections as guidance to where samples may be taken. Actual sampling locations may change based on site conditions.

4.3.2.1 CAS 25-16-01, Construction Waste Pile (located at E-MAD)

Phase I activities at CAS 25-16-01 will consist of visually confirming the location and configuration of the buried waste pile, identifying potential areas of radiological contamination, and collecting samples for laboratory analysis to determine COPC concentrations in soil. Samples may be collected from soil associated with three populations: a waste pile, a soil pile, and a small pile of debris (located north of the soil mound).

A minimum of three excavations will be made perpendicular to the long axis of the buried waste pile to access and collect biased soil samples. Each excavation will be continued to the depth of the waste/native soil interface, and a minimum of one soil sample per excavation will be collected based on the primary biasing factors shown in Table 4-2. If biasing factors are not evident, a soil sample will be collected from the first 12-in. interval of soil below the waste/native soils interface. If the geophysical survey (discussed in Section 4.3.1) confirms that the configuration of the waste pile is a linear feature, the survey will not serve as a biasing factor. However, if the geophysical survey

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Table 4-2 Phase I Criteria for CAU 168 Sampling (Page 1 of 2)

				Bias	sing Fac	ctora			# San	ıples ^b	Location of Sample		
CAS	Population/Potential Sampling Location	Visual indicators	Odor	Textural discontinuities	VOC screening results	Radiological screening results	Geophysical survey results	Process knowledge	Minimum # of excavation and samples	Minimum # of surface samples or swipes	Minimum of 1 per biasing factor	First 12 in. of soil below the waste/native soil interface	Other
	Buried Waste Pile	Х	Х	Х	х	х	х		3		х	х	
25-16-01	Soil Mound	х	х	Х	х	х			1		х		
	Small Surface Pile	х	х		х	х		х		1	х		
25-16-03	Linear Feature "A"	х	х	Х	х	х			3		х	х	
23-10-03	Linear Feature "B"	х	х	Х	х	х			3		х	х	
	Anomaly 1	х	х	Х	х	х	х		1		х	х	
	Anomaly 2	х	х	Х	х	х	х		1		х	Х	
	Anomaly 3	х	х	Х	х	х	х		1		х	Х	
25-19-02	Anomaly 4	х	х	Х	х	х	х		1		х	Х	
	Anomaly 5	Х	Х	Х	х	Х	Х		1		х	х	
				OF	۲								
	Areas with high radiological levels					х				3	х	Х	
25-34-01	Concrete Bunker					х				5			Surface of concrete
25-34-02	Concrete Bunker					х				5			Surface of concrete

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Table 4-2 Phase I Criteria for CAU 168 Sampling

(Page 2 of 2)

				Bias	ing Fa	ctora			# Sam	ıples ^b		Locat	ion of Sample
CAS	Population/Potential Sampling Location	Visual indicators	Odor	Textural discontinuities	VOC screening results	Radiological screening results	Geophysical survey results	Process knowledge	Minimum # of excavation and samples	Minimum # of surface samples or swipes	Minimum of 1 per biasing factor	First 12 in. of soil below the waste/native soil interface°	Other
	Burn Pit	х						Х		1	х	х	
26-08-01	Soil Piles	х						х		3	х	х	
20-00-01	Metal Debris	х								3	х	х	
	Construction Debris	х								3	х	х	
	Below Outfall Pipe	х	х	х	х	х			1	1	х	х	
	Area of Lowest Elevation	х	х	х	х	х			1	1	х	х	
26-17-01	Area of Historically Lowest Elevation	х	х	х	х	х			1	1	х	х	
	Highest Radiological Survey Result					х				1	х	х	
	Radioactive Effluent Pipeline	х				х				1	х		Sediment or swipes
26-19-02	Concrete Pit	х	х	х	х	х	х		3		х		Soil fill at base of concrete pit

^aBiased sample locations will be determined by the Site Supervisor based on the culmination of all biasing data generated throughout the investigation.

bAdditional samples may be collected for waste management characterization and disposal purposes. clf no biasing factor is identified, the interface will be submitted for analysis.

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locates discontinuous anomalies, then geophysics becomes a primary biasing factor in determining locations of excavations to identify and/or confirm buried waste and access potential sample locations.

An excavation (meeting the same criteria as described for the buried waste pile) that transects the soil mound will be completed. If the soil mound contains waste or debris, a sample will be collected at the waste/soil interface and submitted for laboratory analysis. Additionally, a surface soil sample will be collected at the waste/soil interface beneath the small pile of surface debris.

To support decisions regarding closure alternatives, the boundaries of the buried Construction Waste Pile will be determined visually by excavation. Figure 4-1 depicts the proposed sampling locations within the spatial boundaries of CAS 25-16-01.

4.3.2.2 CAS 25-16-03, MX Construction Landfill

Phase I activities at CAS 25-16-03 will consist of confirming the location of the two linear trending subsurface features (Features "A" and "B," Figure 4-2) identified in previous geophysical surveys and collecting samples for laboratory analysis to determine COPC concentrations in the subsurface soils. A minimum of three excavations will be made perpendicular to both linear trending features for a total of six excavations to determine the types of debris present and access potential sampling points. Each excavation will be continued to the depth of the waste/native soil interface, and a minimum of one sample per excavation will be collected based on the primary biasing factors listed in Table 4-2. If biasing factors are not evident, a soil sample will be collected from the waste/native soils interface. Figure 4-2 depicts the proposed sampling locations within the spatial boundaries of CAS 25-16-03.

4.3.2.3 CAS 25-19-02, Waste Disposal Site (located at R-MAD)

Phase I activities at CAS 25-19-02 will consist of confirming the location of subsurface geophysical anomalies identified in previous geophysical surveys and collecting samples for laboratory analysis to determine COPC concentrations within the subsurface soils. A minimum of one excavation will be made at each anomaly (Anomalies 1 through 5) to determine whether or not material is present. The excavation will not continue past 5 ft bgs if material is not identified. This is a reasonable depth

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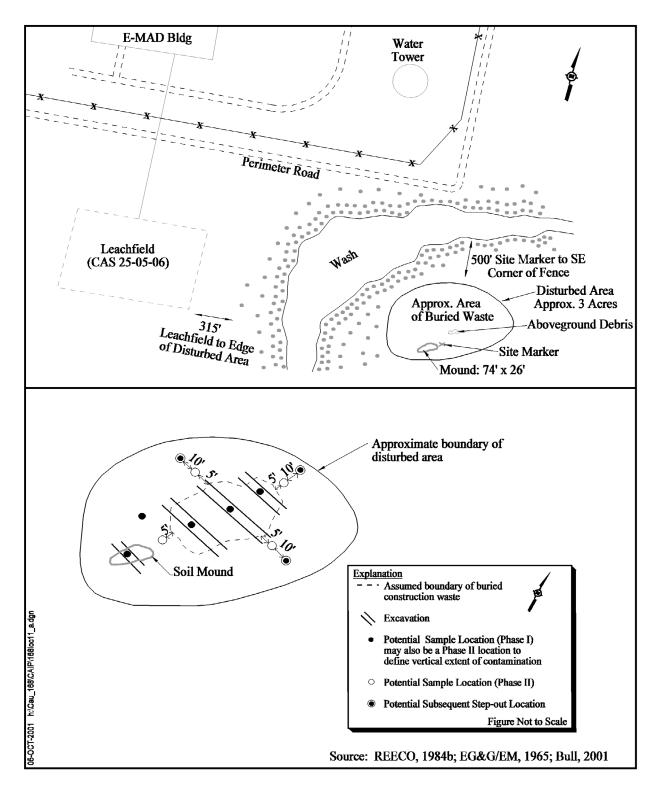


Figure 4-1
Proposed Sampling Locations, CAS 25-16-01

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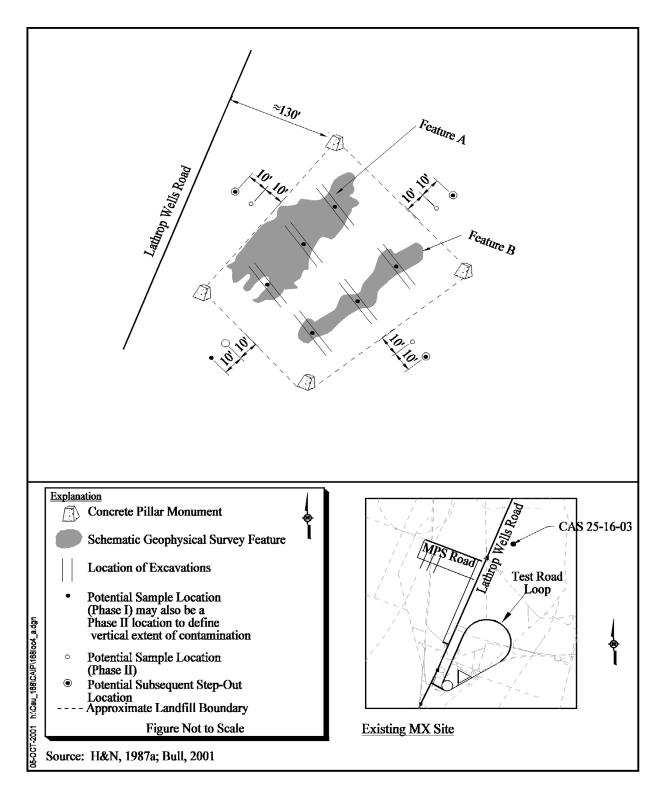


Figure 4-2
Proposed Sampling Locations, CAS 25-16-03

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based on geophysical results and the assumption that material would be close to the surface since the area was not originally designated as a burial waste dump. If buried material is found, the excavation will continue until the waste/native soil interface is identified. A minimum of one sample per excavation will be collected and submitted for laboratory analysis based on the primary biasing factors listed in Table 4-2. If biasing factors are not evident, a soil sample will be collected from the first 12-in. interval of soil below the waste/native soils interface. Figure 4-3 depicts the proposed sampling locations within the spatial boundaries of CAS 25-19-02.

If the geophysical anomalies are attributed to natural materials (e.g., boulders or caliche layer) and no evidence of contamination is found within an excavation, a minimum of three surface soil samples (0-6 in.) will be collected based on the highest radiological survey results, based on data from the 1999 survey discussed in Section 2.5.5.

4.3.2.4 CASs 25-34-01 and 25-34-02, NRDS Contaminated Bunkers

Phase I activities at CASs 25-34-01 and 25-34-02 will consist of radiological scanning surveys of the concrete bunkers and on-site counting of swipes from biased locations. Radiological scanning surveys will be performed on all interior surfaces of each bunker excluding the bunker floors. The survey areas will include the interior walls from floor to ceiling, the ceiling, and exterior walls outside the entrance to each bunker. Contamination of the floor will be addressed under CAS 25-23-18.

A minimum of five swipes will be taken at each bunker and counted to assess the potential for removable contamination. The primary biasing factor for swipe locations will be the results of the radiological scanning surveys (Table 4-2).

4.3.2.5 CAS 26-08-01, Pluto Building 2204 Waste Pile/Burn Pit

Phase I activities at this CAS will consist of sample collection for laboratory analysis to determine the COPC concentrations within soils from the four distinct populations: soil piles, miscellaneous debris, construction debris, and the burn pit soil. As shown in Table 4-2, a minimum of three soil samples will be collected from each of the populations (except the burn pit) or a minimum of one sample per biasing factor, whichever is greater. Surface soil samples will be collected from beneath or adjacent to the material that is assumed to be a potential source of contamination based on the biasing factors

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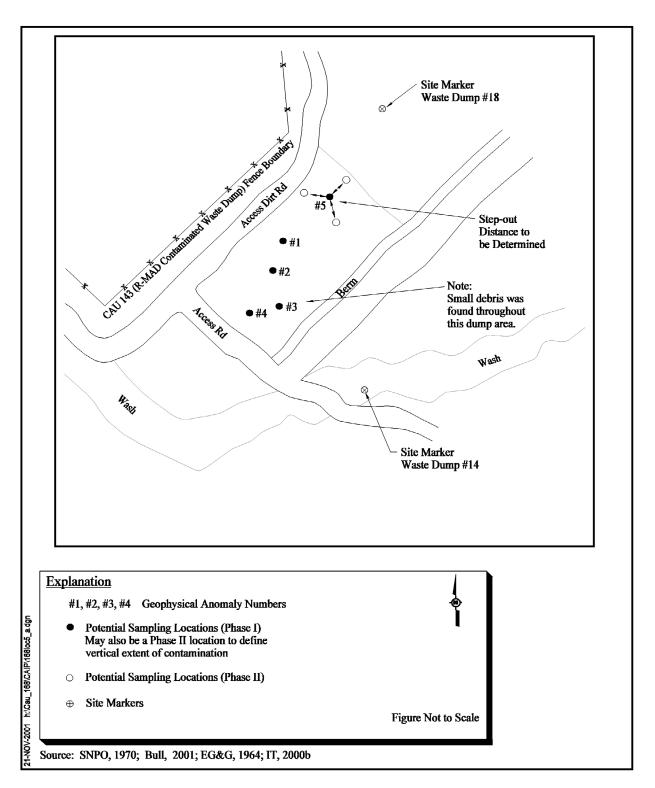


Figure 4-3
Proposed Sampling Locations, CAS 25-19-02

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listed in Table 4-2. If the burn pit is located, one soil sample will be collected. The sample may be collected from the shallow subsurface, depending on observed biasing factors. A soil sample will not be collected if evidence of the burn pit cannot be located.

It is assumed that if any sample within a population contains COPC concentrations above PALs, then the population as a whole is contaminated and the investigation will proceed to Phase II.

Additional Phase I activities will consist of adequately defining the footprint of each population present at the site to approximate potential waste volumes and aid in developing the Phase II strategy, if required. Figure 4-4 depicts the proposed sampling locations within the spatial boundaries of CAS 26-08-01.

4.3.2.6 CAS 26-17-01, Pluto Waste Holding Area

Phase I activities at CAS 26-17-01 will consist of sample collection for laboratory analysis to determine COPC concentrations within the surface and subsurface soils. Sampling locations were selected based on the physical characteristics of the contaminant transport system and the results of a radiological survey. The physical characteristics are discussed in detail in Section 3.1.3 and Section A.2.7 in Appendix A. Samples will be collected from a minimum of four locations within the holding basin. Three of the biased locations will be based on the physical characteristics of the system, and the other location will target the highest radiological survey result (Section 2.5.7.4). Each sample location will consist of two discrete sample depth intervals. One sample will be collected at the ground surface (0-6 in.). The second sample interval will be selected at the discretion of the Site Supervisor from additional biasing factors identified during the course of the investigation (Table 4-2).

In addition to the basin, a radioactive effluent pipeline is associated with this system. Manholes and cleanouts will serve as access points to the pipeline. These access points will be opened, and a visual inspection of the pipeline will be conducted. If an adequate volume of sediment is present, a minimum of one sample will be collected and analyzed. If sediment is not present within the manhole, a limited radiological survey of accessible portions of the pipeline will be performed and swipes may be collected and analyzed to support decisions to meet the free-release criteria. These data may be obtained "remotely" using extended probe cables and attaching swipes to long-handled

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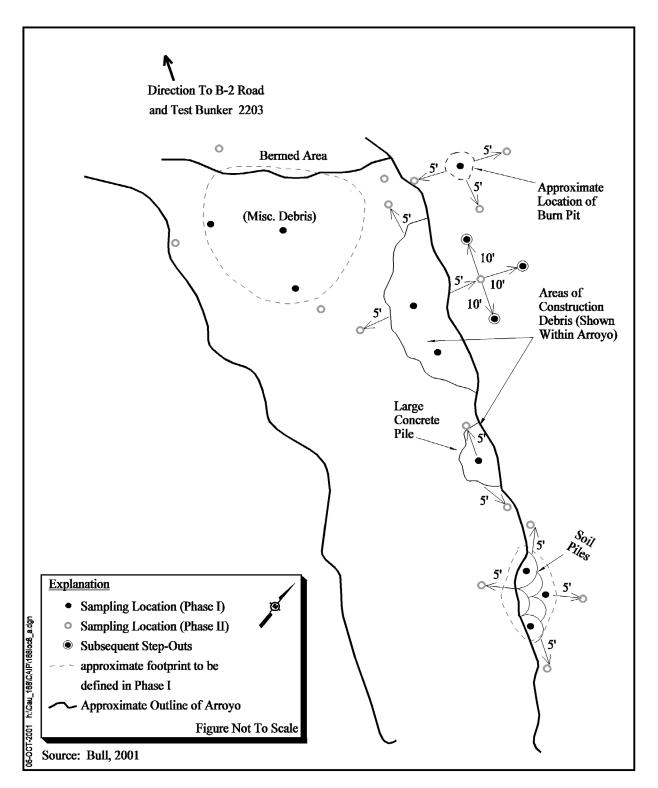


Figure 4-4
Proposed Sampling Locations, CAS 26-08-01

tools. Figure 4-5 depicts the proposed sampling locations within the spatial boundaries of CAS 26-17-01.

4.3.2.7 CAS 26-19-02, Pluto Contaminated Waste Dump #2

Phase I activities at CAS 26-19-02 will consist of sample collection for laboratory analysis to determine the COPC concentrations of soil within the CWD-2. A minimum of three excavations extending to the base of the concrete pit will be performed to determine the types of debris present and to access potential sampling points. A minimum of one soil sample will be collected from each excavation based on the primary biasing factor of radiological field screening. Additional biasing factors may be identified during the investigation (Table 4-2). A minimum of one sample per identified biasing factor will be collected and submitted for laboratory analysis. In the absence of biasing factors, samples of the fill material will be collected from the base of the concrete pit and submitted for analysis.

Direct-push technology (e.g., Geoprobe) rather than excavation may be used to collect soil samples, if conditions warrant. Figure 4-6 depicts the proposed sampling locations within the spatial boundaries for CAS 26-19-02.

4.3.3 Phase II Activities

Phase II investigation efforts will consist of further characterizing sites where COCs have been confirmed to be present during Phase I activities. As discussed in Section 1.1, it is implicit in the definition of COC that the concentration in samples exceeds PALs. Data obtained from Phase II will be used to determine the extent of contamination and may be used to further define the nature of contamination. Only the COCs confirmed to be present (by the Phase I effort) will be analyzed during the Phase II characterization effort. Thus, COPCs determined not to be present in Phase I will be eliminated from further consideration during the Phase II characterization effort.

For a given CAS, Phase II activities will be performed only if the requirements to proceed to Phase II have been met (i.e., contamination greater than PALs or PRGs is detected). This does not apply to CASs 25-23-02, 25-23-13, and 25-23-18, which proceeded directly to Phase II without a Phase I investigation.

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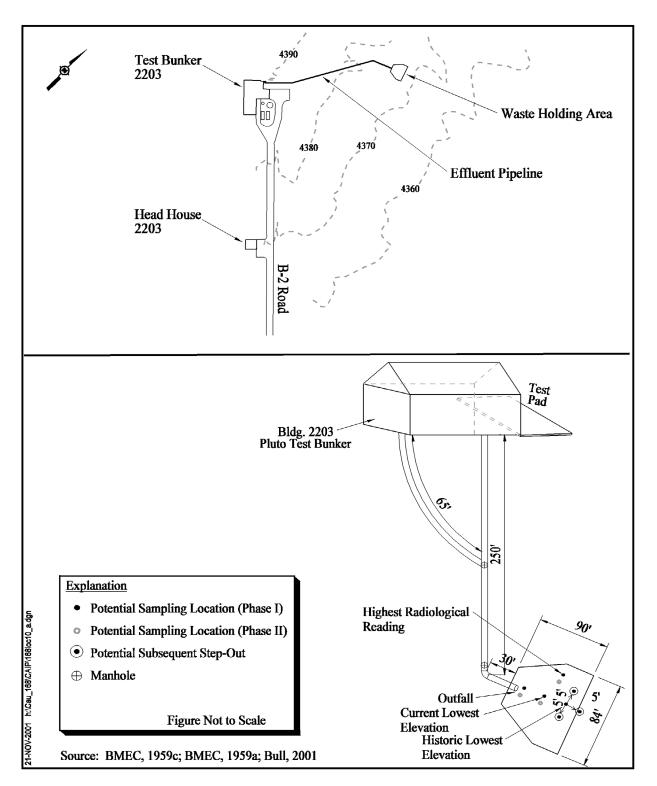


Figure 4-5
Proposed Sampling Locations, CAS 26-17-01

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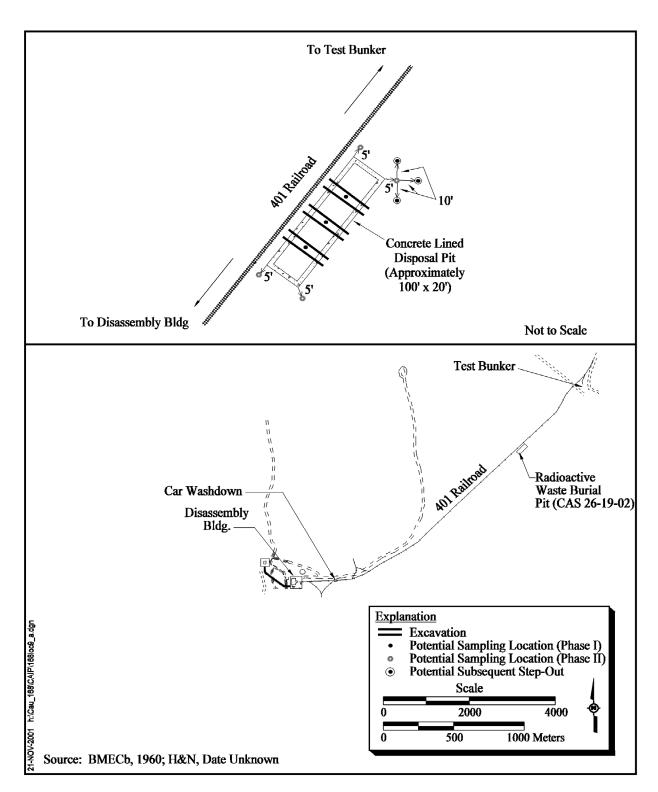


Figure 4-6
Proposed Sampling Locations, CAS 26-19-02

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For all CASs subject to a Phase II investigation, with the exception of CASs 25-23-02, 25-23-13, 25-34-01 and 25-34-02, the lateral and vertical extent of contamination will be bounded by a minimum of one soil sample showing all COC concentrations below PALs. Only laboratory analytical results will be used to make the decision that extent of contamination has been defined. This is implicit in the Phase II characterization; therefore, will not be repeated in the sections that follow. Details specifying determination of contaminant-bounding sample locations are discussed for each CAS in Sections 4.3.3.1 to 4.3.3.10.

For CASs 25-23-02, 25-23-13, 25-34-01, and 25-34-02, the criteria stated above for extent of contamination is not applicable as conducting vertical and/or lateral step-outs is inappropriate based on the finite boundaries and nature of the material being characterized. Also, samples for laboratory analysis will not be collected from these CASs, with the possible exception of residual fluid samples from CAS 25-23-02. The criteria for completing the characterization phase of each of these CASs are described in the relevant sections below.

The spatial boundaries that apply to each CAS for a Phase II investigation are defined in Table A.3-2. If the nature and/or extent of contamination is inconsistent with the CSMs or if contamination extends beyond the spatial boundaries identified in Table A.3-2, work will be temporarily suspended, NDEP will be notified, and the investigation strategy will be reevaluated. As long as contamination is consistent with the CSM and is within the spatial boundaries, sampling will continue to define extent.

Where Phase II characterization requires subsurface soil sampling, excavation by backhoe will be the primary investigation technique to access sample locations. However, if the vertical extent of contamination is deeper or inaccessible to excavation, then an appropriate direct-push or drilling technique will be used.

Figures 4-1 through 4-6 showing Phase II sample locations are provided as guidance to identify potential sampling locations. Actual sampling locations will be based on site conditions. The following subsections provide CAS-specific Phase II investigation strategies.

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4.3.3.1 CAS 25-16-01, Construction Waste Pile (located at E-MAD)

If a continuous area of debris was delineated during Phase I, a minimum of three locations within the area of debris will be sampled to define the vertical extent of COCs. At least one sample location will include the Phase I sampling location where the highest concentrations of COCs were detected. Defining vertical extent of contamination will initially begin at the waste/native soil interface and will proceed with depth until one "clean" sample has been collected. Biasing factors listed in Table 4-2 will support the selection of soil sampling interval(s) for analysis. At least four initial step-outs to bound lateral contamination will be sampled outside the area of debris, as determined visually in Phase I. The initial lateral step-outs will be located approximately 5 ft outward from the edge of the area of debris, and the distance between subsequent step-outs will be 10 ft. These distances may be modified in the field by the Site Supervisor, based on Phase I data and other biasing factors. The vertical depth of initial lateral step-out locations will be based on the deepest contamination observed during sampling to define vertical extent. The depth of subsequent step-outs will be based on the deepest contamination observed at all locations. If field screening or other biasing factor suggests contamination exceeding PALs is present at a step-out, additional step-out locations will be investigated until lateral and vertical contamination has been bounded.

If Phase I activities indicate that contamination exceeding PALs is present only in discrete locations (e.g., spill from a container), Phase II characterization will proceed as follows. The vertical extent of contamination will be determined at the Phase I location(s) where contamination exceeded PALs. To bound lateral and vertical contamination, a minimum of three step-out locations, arranged in a triangular pattern with the Phase I location in the center, will be investigated. Initial step-outs will be located laterally a distance from the edge of the potential contamination determined as follows: the step-out distance will equal approximately one-half of the length of the long axis of the feature or object that is assumed to be the potential contamination (e.g., for a 5-ft long object, the step-out distance will be 2.5 ft). The step-out distance will not exceed 10 ft. Initial step-outs will be at least as deep as the vertical extent of contamination defined at the Phase I sampling location. The spacing of subsequent step-outs will be twice the initial spacing defined above. The depth of subsequent step-outs will be based on the deepest contamination observed at all locations. The number, location, and spacing of step outs may be modified by the Site Supervisor, if warranted by site conditions.

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If COCs are detected during Phase I sampling of the soil mound, Phase II characterization activities will be similar to those described for a discrete area of contamination. However, the lateral extent of contamination may be limited by the extent of the soil pile itself. Figure 4-1 depicts the proposed sampling locations within the spatial boundaries of CAS 25-16-01.

4.3.3.2 CAS 25-16-03, MX Construction Landfill

Phase II characterization strategy will be the same discussed in Section 4.3.3.1 for the Construction Waste Pile located at the E-MAD Facility. However, initial step-outs will be located approximately 10 ft outside of the boundaries of the landfill, as defined by the four concrete monuments that mark the corners of the landfill. Subsequent step-out locations will be spaced 10 ft apart. The strategy for determining step-out depths will be identical to that given in Section 4.3.3.1. Figure 4-2 depicts the proposed sampling locations within the spatial boundaries of CAS 25-16-03.

4.3.3.3 CAS 25-19-02, Waste Disposal Site (located at R-MAD)

Phase II activities will consist of soil sampling to determine the nature and extent of contamination. This CAS is somewhat unique compared to other CASs in the Waste Dumps and Landfills CSM (Section 3.1.1) because buried waste/debris is not known to be present and is not expected. However, as a contingency, if contamination is identified within a continuous feature (e.g., trench or pit) or at a discrete feature (e.g., soil stain) during Phase I activities, Phase II characterization will be similar to that described in Section 4.3.3.1 for CASs 25-16-01. Figure 4-3 depicts the proposed sampling locations within the spatial boundaries of CAS 25-19-02.

4.3.3.4 CAS 25-23-02, Radioactive Storage Railroad Cars

The Phase II investigation will generate the data required for a free-release determination or to support other waste management decisions. A radiological scanning survey will be performed over the accessible surfaces of each railroad car. The survey will determine the nature and extent of radiological contamination. The survey will also include the accessible portions of equipment and materials stored on some of the cars. If the survey identifies radiological contamination, swipes will be taken from the cars and counted to assess the potential for removable contamination. The primary biasing factor in selecting locations for swipes will be the results of the radiological scanning survey.

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Because of observed radiation levels, health and safety considerations may limit characterization of certain cars (e.g., LASL NF car). To reduce radiation exposure rates and/or to reach otherwise inaccessible areas, survey data may be obtained "remotely" using extended probe cables and attaching swipes to long-handled tools.

The dimensions and volume of contaminated railroad cars, equipment, and materials will be estimated. Documentation will be sufficient such that hot spots or other areas of contamination can be located at a later date. If residual fluids are present in the cars (this applies primarily to the two locomotives), samples may be collected for analysis. The analyses would be for waste management purposes.

4.3.3.5 CAS 25-23-13, ETL (TTF) Laboratory Radioactive Contamination

Areas within the TTF (Building 3124) are known to be radiologically contaminated; therefore, the characterization will proceed directly to Phase II. The objective of the Phase II investigation of the fume hoods, associated ventilation system, and other radiologically posted areas/objects in the TTF is to characterize radiological contamination sufficiently to support a free-release determination for these materials. Definition of the nature and extent of contamination will be based on data from radiological scanning surveys and swipes taken from the objects and associated building structures. Because the criteria for meeting free release is different than comparing soil data to PALs, the quality of data resulting from radiological scanning surveys and swipe counting will be sufficient for decision making (provided the requirements of Section 6.3 are met). The laboratory fume hoods, accessible surfaces in contact with the hoods, duct work, roof vents, and portions of the TTF roof will be included in characterization activities. Other areas of the TTF and associated objects that are radiologically posted (e.g., soil preparation bay) will also be included in characterization activities.

Engineering drawings of the ETL and TTF have been reviewed; the available drawings were insufficient to assist in the selection of survey and sample locations. Therefore, professional judgement and direct inspection of the building and equipment will be used to select biased survey/sample locations where worst-case contamination may be expected. At accessible locations (e.g., roof or wall), radiological scanning survey data will be used to support the selection of worst-case locations for swipe collection. Areas that are difficult to access may be surveyed or swiped "remotely" by increasing the length of probe cables or collecting swipes with long-handled

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tools. All characterized materials are expected to remain intact for future corrective actions, except for remote access points, if necessary.

4.3.3.6 CAS 25-23-18, Area 25 Radioactive Material Storage Facility

Surface soil in portions of the RMSF is known to be radiologically contaminated (Section 2.5.7.3). For this reason, the investigation of CAS 25-23-18 will proceed directly to Phase II. The Phase II characterization activities at the RMSF will include radiological surface surveys and surface soil sampling to define the nature and extent of contamination.

Best management practices that will be completed prior to the field investigation of CAS 25-23-18 include removal of various objects and equipment currently stored in the RMSF (specifically stored near the western entrance to the RMSF and the area between Spurs "M" and "N"). Documentation of the disposal of any materials removed as part of best management practices will be provided in the closure report. To identify areas of surface soil radiological contamination, driveover and possibly walkover radiological surveys will be performed within and adjacent to the footprint of these storage areas. A driveover radiological survey of ground surface between the inner and outer fences will also be performed to confirm that contamination is not present in this area or to identify any additional locations of contamination. The results of these surveys will be combined with the data from the 2001 ITLV survey (see Figure 2-2) to characterize the extent of radiological contamination in surface soils at CAS 25-23-18.

To define the nature of contamination, biased soil samples will be collected from locations within areas of contamination. The selection of sampling locations will be based primarily on radiological survey data and possibly other biasing factors (e.g., staining). At these locations, the vertical extent of potential contamination will be determined. The sampling intervals will be determined in the field, as guided by field-screening results. At a minimum, the 0- to 6-in. depth interval will be collected for analysis.

As discussed above, radiological surface survey data will define the extent of laterally continuous areas of contamination. Soil samples may be collected from step-out locations and submitted for laboratory analysis to confirm the radiological surface survey results (i.e., confirm the lateral extent of contamination). Additional step-out locations will be investigated, as required, to determine the

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extent of contamination. Lateral step-out spacings will be 10 ft. The number, location, and spacing of step-outs may be modified by the Site Supervisor, if warranted by site conditions.

As discussed above, the extent of laterally continuous areas of contamination will be defined by step-outs. However, the extent of individual "hot spots" will not evaluated by sampling and analysis. The radiological surface survey data will suffice to characterize hot spots.

4.3.3.7 CASs 25-34-01 and 25-34-02, NRDS Contaminated Bunkers

Scabbling or shot-blasting of concrete will be performed at CASs 25-34-01 and 25-34-02 to determine the extent of contamination into the concrete perpendicular to the surface of the wall or ceiling. Scabbling or shot-blasting will take place at a minimum of two of the worst-case contamination locations in each bunker, as determined by Phase I characterization. Following scabbling or shot blasting, the locations will be resurveyed using radiological survey instruments to evaluate the extent of radiological contamination (i.e., determine if the contamination is limited to the surface of the concrete). The lateral extent of contamination will have been determined previously in Phase I by the radiological scanning survey performed over 100 percent of each structure.

4.3.3.8 CAS 26-08-01, Building 2204 Waste Pile/Burn Pit

Phase II activities will consist of additional surface soil sampling and excavation sampling (potentially) to determine the extent of contamination for each population in which Phase I sampling indicated contamination is present above PALs. Phase I characterization activities will have delineated the areal extent (i.e., footprint) of each population.

This Phase II strategy applies to each population where PALs were exceeded. Sampling will determine the vertical extent of contamination at each Phase I location where COCs were found. To establish the lateral extent of contamination, soil samples will be collected and analyzed from a minimum of four step-outs located outside the footprint of the population. The step-outs will be approximately 5 ft laterally from the edge of the footprint. Initial step-outs will be at least as deep as the vertical extent of contamination defined at the Phase I sampling location(s). Lateral spacing of subsequent step-outs will be 10 ft, and the depth will be based on the deepest contamination observed at all locations. The number, location, and spacing of step-outs may be modified by the Site

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Supervisor, if warranted by site conditions. Figure 4-4 depicts the proposed sampling locations within the spatial boundaries of CAS 26-08-01.

4.3.3.9 CAS 26-17-01, Pluto Waste Holding Area

Phase II activities will consist of additional soil sampling to determine the extent and, if necessary, better define the nature of contamination. Phase II activities may also consist of additional characterization of the effluent pipeline extending from the Project Pluto Test Bunker (Building 2203) to the holding basin.

Soil samples will be collected from a minimum of four locations on the interior edges of the holding basin. At each location, a surface soil sample and a subsurface soil sample will be collected for analysis. The sampling depth will be sufficient to intercept the horizon/interval where COCs were detected in Phase I sampling locations.

If necessary, additional step-out locations will be investigated to define the extent of contamination. The lateral spacing of additional step-outs will be approximately 5 ft. If a berm is present, as on the south and east sides, the step-out may be located at the outside base of the berm. The depth of step-outs will be sufficient to intercept the horizon/interval where COCs are present in Phase I and subsequent samples. Only subsurface soil samples will be collected from step-outs located outside of the basin; surface soil samples will not be collected. The location, depth, and spacing of step-outs may be modified by the Site Supervisor based on site conditions.

Phase II characterization of the radioactive effluent pipeline is dependent on the data and observations obtained during Phase I. Several options for further characterization are available; the selected method(s) will be dependent on site conditions. Manholes and cleanouts will serve as the primary access points to the pipeline. Additional access points may be created by excavating a break in the line. Excavated sections of pipe may be directly surveyed and swiped for radiological characterization. A limited video survey may be performed using a video mole. Large area swipes may be collected using fish tape or pipe snake. *In situ* radiological characterization of the pipeline may also be performed using specialized equipment. Figure 4-5 depicts the proposed sampling locations within the spatial boundaries of CAS 26-17-01.

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4.3.3.10 CAS 26-19-02, Pluto Contaminated Waste Dump #2

Phase II characterization activities will consist of confirming the integrity of the concrete structure as a barrier to migration (i.e., will determine if contamination extends into the soil outside of the waste dump structure).

A minimum of four sample locations (one per side) will be excavated and/or drilled immediately outside of the concrete walls. In the absence of biasing factors, the approximate midpoint of each wall will be the initial sample location, except for the back (northernmost) wall. Sampling point(s) outside this wall may be biased laterally to the location of weep holes shown on Engineering Drawing 2202-RR6 (BMEC, 1960). Other biasing factors from Phase I may indicate more appropriate sampling locations outside of the concrete walls. The depth of investigation will extend to the concrete footer to collect integrity samples for laboratory analysis. If COCs are detected, additional step-outs will be investigated to bound vertical and lateral contamination. The step-out spacing will be approximately 10 ft and may be modified by the Site Supervisor, based on site conditions. The depth of additional step-outs will be based on the deepest contamination observed at all locations.

Direct-push technology (e.g., Geoprobe) or drilling rather than excavation may be used to collect soil samples, if conditions warrant. Figure 4-6 depicts the proposed sampling locations within the spatial boundaries of CAS 26-19-02.

4.3.4 Geotechnical/Hydrological Analysis and Bioassessment Tests

In some cases, it may be necessary to measure the geotechnical/hydrological and bioassessment parameters of a site. At the discretion of the field investigation Task Manager, a geotechnical and hydrological analytical suite may be performed on at least one sample collected from the soil underlying a CAS where soil samples were collected for COPC analysis. These samples will be collected within brass sleeves (or other containers, as appropriate) so as not to disturb the natural physical characteristics of the soil. Table 4-3 lists the general geotechnical and hydrological parameter suite. The testing methods shown are minimum standards and other equivalent or superior testing methods may be used.

Bioassessment tests include determinations of nutrient availability, pH, microbial population density, and the ability of a microbial population to grow under enhanced conditions. This type of analysis is

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Table 4-3
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			

^aASTM, 1996

most appropriate for hydrocarbon contamination sites where bioremediation is a potential corrective action. Bioassessment samples may be collected if field screening detects VOC concentrations greater than FSLs and the spatial pattern of detection suggests a fuel or solvent plume may be present. Significant concentrations of VOCs indicate the potential for contamination that may respond to bioremediation-based corrective actions.

bUSACE, 1970

^cMethods of Soil Analysis (MOSA) (Soil Science Society of America, 1986)

^dvan Genuchten, 1980

^eKaranthanasis and Hajek, 1982

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5.0 Waste Management

Management of investigation-derived waste (IDW) will be based on regulatory requirements, field observations, process knowledge, and the results of laboratory analysis of CAU 168 investigation samples.

Disposable sampling equipment, personal protective equipment (PPE), and rinsate are considered potentially contaminated waste only by virtue of contact with potentially contaminated media (e.g., soil) or potentially contaminated debris (e.g., construction materials). Therefore, sampling and analysis of IDW, separate from analyses of site investigation samples, may not be necessary for all IDW. However, if associated investigation samples are found to contain COCs above regulatory levels, rinsate samples may be taken to support waste characterization.

Sanitary, hazardous, radioactive, and/or mixed waste, if generated, will be managed and disposed of in accordance with DOE Orders, U.S. Department of Transportation (DOT) regulations, 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 (i.e., *Toxic Substances Control Act*) (USC, 1976). Materials that are thought to potentially contain the hantavirus will be managed and disposed of in accordance with appropriate health and safety procedures.

Decontamination activities will be performed according to approved contractor procedures specified in the contractor field sampling instructions and as appropriate for the COPCs likely to be identified at CAU 168.

In the following sections, operational requirements are provided for managing sanitary, hydrocarbon, hazardous, low-level radioactive, and mixed wastes. However, when the waste is initially generated, the waste will be managed according to mixed waste requirements until laboratory analyses are received and a final waste determination is made.

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5.1 Waste Minimization

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

5.2 Potential Waste Streams

Wastes generated during the investigation activities will include the following:

- Environmental media (e.g., soil)
- Debris (construction)
- Personal Protective Equipment 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)

Each waste stream generated will be segregated, and further segregation may occur within each waste stream.

5.3 Investigation-Derived Waste Management

The on-site management and ultimate disposition of IDW may be guided by several factors, including, but not limited to, the analytical results of samples either directly or indirectly associated with the waste, historical site knowledge, knowledge of the waste generation process, field observations, field monitoring/screening results, and /or radiological survey/swipe results. Table 4-2 of the NV/YMP RadCon Manual (DOE/NV, 2000a) shall be used to determine if such materials may

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be declared nonradioactive. On-site IDW management requirements by waste type are detailed in the following sections. Applicable waste management regulations and requirements are listed in Table 5-1.

5.3.1 Sanitary Wastes

Sanitary waste will be contained in plastic bags, dumpsters, or drums and transported to an approved sanitary waste landfill for disposal.

5.3.2 Hydrocarbon

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

5.3.3 Low-Level Waste

Waste may be characterized 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 and the PPE and disposable sampling equipment waste streams exiting a radiologically controlled area. This allows for the immediate segregation of radioactive waste from waste that may be unrestricted regarding radiological release. Removable contamination limits, as defined in Table 4-2 of the current version of the NV/YMP RadCon Manual, 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 low-level radioactive waste, as necessary. Waste that is determined to be below the values of Table 4-2 by either direct radiological survey/swipe results or through process knowledge will not be managed as potential radioactive waste, but will be managed in accordance with the appropriate section of this document. Wastes in excess of Table 4-2 values will be managed as potential radioactive waste and be managed in accordance with this section and any other applicable section of this document.

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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 NTS Landfill Permit SW13.097.04 ^c NTS Landfill Permit SW13.097.03 ^d			
Liquid/Rinsate (nonhazardous)	NA	NTS Waste Water Facility Permit GNEV93001, Rev. 3iii ^e			
Hazardous	RCRA ^f	NRS 459.400 - 459.600 ⁹ NAC 444.850 - 444.8746 ^h POC ⁱ			
Low-Level Radioactive	NA	DOE Orders and NTSWAC ^j			
Mixed	RCRA ^f	NTSWAC ⁱ POC ⁱ			
Hydrocarbon	NA	NAC 445A.2272(b) ^k NTS Landfill Permit SW13.097.02 ^l			
Polychlorinated Biphenyls	TSCA ^m	NRS 459.400 - 459.600 ⁹ NAC 444.940 - 444.9555 ⁿ			
Asbestos	TSCA ^m	NAC 444.965-444.976°			

^aNevada Revised Statues (NRS, 1998a)

NA = Not applicable

b Nevada Administrative Code (NAC, 2000a)

^cArea 23

^dU10c Crater located in Area 9

^eNevada Test Site Sewage Lagoons

fResource Conservation and Recovery Act (CFR, 2001a)

^gNevada Revised Statues (NRS, 1998b)

^hNevada Administrative Code (NAC, 2000b)

Performance Objective for the Certification of Nonradioactive Hazardous Waste (BN, 1995)

Nevada Test Site Waste Acceptance Criteria, Revision 3 (DOE/NV, 2000b)

^kNevada Administrative Code (NAC, 2000c)

Area 6 Hydrocarbon Landfill

Toxic Substance Control Act (USC, 1976)

ⁿNevada Administrative Code (NAC, 2000d)

[°] Nevada Administrative Code (NAC, 2000e)

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Low-level radioactive waste, if generated, will be managed in accordance with the contractor-specific waste certification program plan, DOE Orders, and the requirements of the Nevada Test Site Waste Acceptance Criteria (NTSWAC) (DOE/NV, 2000b). Potential radioactive waste drums containing soil, PPE, disposable sampling equipment, and/or rinsate shall be staged at a designated Radioactive Materials Area (RMA) when full or at the end of an investigation phase. The waste drums will remain at the RMA pending certification and disposal under NTSWAC requirements (DOE/NV, 1997).

5.3.4 Hazardous Waste

Corrective Action Unit 168 will have waste storage areas that are properly controlled for access and equipped with spill kits and appropriate spill containment. Suspected hazardous wastes will be placed in DOT-compliant containers (49 CFR 172 [CFR, 2001k]) compatible with the waste (40 CFR 265.172 [CFR, 2001f]). Containers shall be handled and inspected in accordance with the requirements of 40 CFR 265.173 and 174, respectively (CFR, 2001g and h). Based on process knowledge, incompatible wastes shall be managed in accordance with 40 CFR 265.177 (CFR, 2001i) (i.e., shall not be placed in the same container), and shall be separated so that in the event of a spill, leak, or release, incompatible wastes shall not contact one another. All containers (excluding those in Satellite Accumulation Areas [SAAs]) will be managed consistent with the requirements of 40 CFR 265, Subpart I (CFR, 2001h). SAAs will be managed according to the applicable requirements of 40 CFR 262.34(c)(1) (CFR, 2001h).

Waste storage areas will be inspected weekly and be covered under a site-specific emergency response and contingency action plan until such time that the waste is determined to be nonhazardous or all containers of hazardous waste have been removed from the storage area. Hazardous wastes will be characterized in accordance with the requirements of 40 CFR 261 (CFR, 2001b) and this document. Characterization will be based on laboratory results and/or process knowledge. Characterization is deemed complete once all data relating to the IDW has been validated, reviewed, and a waste characterization report finalized. Hazardous wastes will be transported for treatment and/or disposal by an approved hazardous waste transporter to an appropriate permitted treatment, storage, and disposal facility.

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5.3.4.1 Sites Where RCRA "Listed" Constituents are COPCs

CAS 26-08-01 is the only CAS identified in this CAU as having the potential to encounter listed waste. As described in Table 3-2, acetone is identified as a chemical COPC, and if encountered, would only be found in the burn pit, where it was discarded as a used solvent. Since acetone is a solvent with the characteristic of ignitability, if it no longer exhibits the characteristic of ignitability, it will no longer be considered a hazardous waste, in accordance with 40 CFR 261.3 (g)(1). As documented by the Preliminary Assessment, the remaining portion of the CAS should not contain any listed wastes. Waste generated from the burn pit area of this CAS should be managed as follows:

Personal Protective Equipment - PPE and associated waste generated during sampling will only be contaminated by virtue of contact with potentially contaminated media (i.e., soil, sludge, etc.). The PPE, disposable sampling equipment, and debris will be visually inspected for stains, discoloration, and gross contamination as it is generated. Staining or discoloration may be an indication of (1) a chemical reaction between the PPE/equipment and the contaminant(s) or (2) adsorption/absorption of the contaminant to the PPE/equipment. Staining and/or discoloration will be assumed to be the result of contact with potentially contaminated media such as soil, sludge, or liquid. Gross contamination is the visible contamination on an item (e.g., clumps of soil/sludge on a sampling scoop or free liquid smeared on a glove). While gross contamination can often be removed through decontamination methods, removal of gross contamination from small items (e.g., gloves or booties) is not typically conducted. Waste with observable staining, discoloration, or gross contamination will be segregated and managed as suspect "listed" hazardous waste. This segregated population of waste will either be sampled directly or assigned the characterization of the media sampled. Waste without observable staining, discoloration, or gross contamination will be considered to not contain any "listed" constituents and will be managed in accordance with the appropriate section of this document. Waste that is determined to be hazardous will be entered into an approved waste management system within 45 days from receipt of the final CAU analytical data package from the laboratory.

Decontamination Rinsate - Decontamination rinsate is the result of the cleaning of potentially contaminated material. Nondisposable sampling equipment, PPE (e.g., rubber boots), heavy machinery, and other equipment used during site activities are washed with pressurized water and/or chemicals to allow reuse. This process can result in the rinsate becoming contaminated with dissolved and/or suspended contaminants from the item being cleaned. Decontamination rinsate

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generated at these sites will be managed as potentially "listed" hazardous waste. The rinsate will initially be evaluated using analytical results for samples associated with the rinsate (i.e., soil sample results from borehole or sampling activities associated with the generation of rinsate). If the associated samples do not indicate the presence of "listed" hazardous constituents, then the rinsate will be considered to not contain any "listed" constituents and will be managed in accordance with the appropriate section of this document.

If the associated samples indicate the presence of "listed" hazardous constituents, the rinsate will be sampled directly. If analytical results from direct sampling indicate the presence of "listed" hazardous constituents, the rinsate will be managed as "listed" hazardous waste and will be entered into an approved waste management system within 45 days from receipt of the final CAU analytical data package from the laboratory. If the results of direct sampling do not indicate the presence of "listed" constituents, then the rinsate will be considered to not contain any "listed" constituents and will be managed in accordance with the appropriate section of this document.

5.3.4.2 Sites Where RCRA "Listed" Constituents are not COPCs

Personal Protective Equipment - PPE and disposable sampling equipment will be visually inspected for stains, discoloration, and gross contamination as the waste is generated. Any materials that display these characteristics will be segregated and managed as potentially "characteristic" hazardous waste. This segregated population of waste will either be (1) assigned the characterization of the soil/sludge that was sampled, (2) sampled directly, or (3) undergo further evaluation using the soil/sludge sample results to determine how much soil/sludge would need to be present in the waste to exceed regulatory levels. Waste that is determined to be hazardous will be entered into an approved waste management system within 45 days from receipt of the final CAU analytical data package from the laboratory. The PPE/equipment that is not visibly stained, discolored, or grossly contaminated will be managed as nonhazardous waste in accordance with the appropriate section of this document.

Decontamination Rinsate - Rinsate at these sites will not be considered hazardous waste unless there is evidence that the rinsate would display a RCRA characteristic. Evidence may include such things as the presence of a visible sheen, pH, or association with equipment/materials used to respond to a release/spill of a hazardous waste/substance. Decontamination rinsate that is determined to be potentially hazardous (using associated sample results and/or process knowledge) will be managed as

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potentially "characteristic" hazardous waste. The regulatory status of the potentially hazardous

rinsate will be determined through direct sampling. If determined to be hazardous, the rinsate will be

entered into an approved waste management system within 45 days from receipt of the final CAU

analytical data package from the laboratory.

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 5x Safe Drinking Water

Standards (SDWS) is not restricted as to disposal. Nonhazardous rinsate which is contaminated at

5x to 10x SDWS will be disposed of in an established infiltration basin or solidified and disposed of as

sanitary waste or low-level waste in accordance with the respective sections of this document.

Nonhazardous rinsate which is contaminated at greater than 10x SDWS will be disposed of in a lined

basin or solidified and disposed of as sanitary waste or low-level waste in accordance with the

respective sections of this document.

5.3.4.3 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 same approximate

location from which it originated. If this cannot be accomplished, the material will either be managed

on site by berming and covering next to the excavation, or by placement in a container(s). Material

that is containerized at a site where hazardous constituents are COPCs will be labeled "Hazardous

Waste Pending Analysis." The disposition of containerized material may be deferred until

implementation of corrective action at the site.

5.3.4.4 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.

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5.3.5 Mixed Wastes

Mixed waste, if generated, shall be managed in accordance with RCRA (40 CFR 262) (CFR, 2001d) and State of Nevada regulations as well as DOE requirements for radioactive waste, interpreted as follows. 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." However, within 45 days from receipt of the final CAU analytical data package from the laboratory, the mixed waste 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 plan under the requirements of the Mutual Consent Agreement between DOE and the State of Nevada (NDEP, 1995).

5.3.6 PCB and Radioactive PCB Waste

The management of polychlorinated biphenyls (PCBs) is governed by the *Toxic Substances Control Act* (TSCA) and its implementing regulations at 40 CFR 761. Polychlorinated biphenyl contamination may be found as a sole contaminant or in combination with any of the types of waste discussed in this document. For example, PCBs may be a cocontaminant in soil that contains a RCRA "listed" chemical constituent, resulting in a PCB/hazardous waste. PCBs may also be a cocontaminant in radioactive wastes (PCB/radioactive waste), in sanitary or hydrocarbon waste (PCB waste), in RCRA "characteristic" waste (PCB/hazardous waste), or even in mixed waste (PCB/radioactive/hazardous waste). The IDW will initially be evaluated using analytical results for media samples from the investigation. If any type of PCB waste is generated, it will be managed according to 40 CFR 761 (CFR, 2001j) as well as State of Nevada requirements, guidance, and agreements with NNSA/NV.

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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 168. The following two subsections (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. The last subsection (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 (DOE/NV, 1996b).

6.1 Quality Control Field Sampling Activities

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

- Trip blanks (1 per sample cooler containing VOC environmental samples)
- Equipment blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per lot of source material that contacts sampled media)
- Field duplicates (1 per 20 environmental samples or 1 per CAS if less than 20 collected)
- Field blanks (1 per 20 environmental samples)
- Matrix spike/matrix spike duplicates (MS/MSD) (1 per 20 environmental samples or 1 per CAS per matrix if less than 20 collected)

Additional QC samples may be submitted based on site conditions at the discretion of the Site Supervisor. Field quality control samples shall be analyzed using the same analytical procedures implemented for environmental samples (Section 3.2). The results of the QC sample analyses will be included in the analytical report. Additional details regarding field QC samples are available in the Industrial Sites QAPP (DOE/NV, 1996b).

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6.2 Laboratory/Analytical Quality Assurance

Criteria for Phase I and Phase II, 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 meeting the requirements of DQIs as they relate to laboratory analysis.

6.2.1 Data Validation

Data verification and validation will be performed in accordance with the Industrial Sites QAPP (DOE/NV, 1996b), 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 SQP ITLV-0528, "Tier II Radiological Data Review - Data Verification," Rev. 2. The data will be reviewed to ensure that all critical samples were appropriately collected, analyzed, and the results passed data validation criteria. Validated data 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 168 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., analyte performance).

Precision and accuracy are quantitative measures used to assess overall analytical method performance as well as to assess the need to potentially "flag" (qualify) individual analyte results when corresponding QC sample results are not within established control limits. Therefore, performance metrics have been established for both analytical methods and individual analytical

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results. Data qualified as estimated for reasons of precision or accuracy may be considered to meet

the analyte performance criteria based on an assessment of the data.

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 6.2.2.1 through Section 6.2.2.6.

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 (DOE/NV, 1996b) 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.

6.2.2.1 Precision

Precision is used to assess the variability of sample handling, preservation, and storage along 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

agreement is expressed as the relative percent difference (RPD) between duplicate measurements

among a replicate set of measurements of the same property under similar conditions. This

(DOE/NV, 1996b). 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 = The sample value, and

a2 = The duplicate sample value.

Determinations of precision will be made for field duplicate samples and laboratory duplicate

samples. Field duplicate samples are collected simultaneously with samples from the same source

under similar conditions in separate containers. The duplicate sample is treated independently of the

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Table 6-1 Laboratory/Analytical Data Quality Indicators

Data Quality Indicator	Performance Criteria	Potential Impact on Decision if Performance Criteria Not Met			
Precision	Uncertainty associated with each measurement system is controlled sufficient to have confidence in comparison of analytical results to action levels.	Data that does not meet the performance criteria will be considered missing for purposes of evaluating completeness. Decisions may not be valid if analytical method performance criteria for precision are not met.			
Accuracy	Uncertainty associated with each measurement system is controlled sufficient to have confidence in comparison of analytical results to action levels.	Data that does not meet the performance criteria will be considered missing for purposes of evaluating 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 respective PALs.	Cannot determine if COCs are present at levels of concern; therefore, investigation objectives cannot be met.			
Phase I Completeness	100% of locations identified in DQOs sampled 100% of requested analyses conducted 100% of critical analytes are valid ^a 80% of noncritical analytes are valid	Cannot make decision on whether COCs are present above PALs with high confidence.			
Phase II Completeness	100% of locations identified in DQOs sampled 100% of requested analyses conducted 100% of critical analytes are valid ^a 80% of noncritical analytes are valid	Decision of whether or not extent of contamination has been bounded cannot be determined.			
Comparability	Consistent sampling, handling, preparation, analysis, reporting, and validation criteria will be used. Approved standard methods and procedures will be used to analyze and report the data.	Inability to compare results to established decision levels.			
Representativeness	Valid data reflects appropriate target population. Followed DQO specifications for number of samples, sample locations, and sample analyses. Followed approved sampling plan.	Cannot identify COC or estimate concentration of COC; therefore, cannot make decision(s) on target population.			

 $^{^{\}rm a}$ Critical analytes specific to each CAS are discussed in Table 6-2.

COC = Contaminant of concern

COPC = Contaminant of potential concern

DQO = Data quality objective

PAL = Preliminary action level

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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, other laboratory duplicate QC samples include MSD and laboratory control sample (LCS) duplicate samples for organic, inorganic, and radiological analyses.

The variability in the results from the analysis of field duplicates is generally greater than the variability in the results of laboratory duplicates. This higher variability for field duplicates may cause an increased potential to introduce factors influencing the analytical results during sampling, sample preparation, containerization, handling, packaging, preservation, and environmental conditions before the samples reach the laboratory. Laboratory QC samples assess only the variability of results introduced by sample handling and preparation in the laboratory and by the analytical procedure, which also impacts field duplicates. In addition, the variability in duplicate results is expected to be greater for soil samples than water samples, primarily due to the inherent heterogeneous nature of soil samples despite sample preparation methods that include mixing to improve sample homogeneity.

6.2.2.1.1 Precision for Chemical Analysis

The RPD criteria to be used for assessment of precision are the analyte-specific criteria listed in Table 3-4 for polychlorinated biphenyls (PCBs), TPH, semivolatile organic compounds (SVOCs), VOCs, and RCRA metals. The RPD criteria for precision are based on laboratory-specific control limits. Control limits are evaluated 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 assessment of precision will only be conducted for analytical results when either the sample or duplicate result is above the instrument detection limit or method detection limit, as applicable. Consequently, when both the sample and duplicate results are "nondetects" or analytical results are

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below the applicable limit of detection for the instrument or method, associated sample results are not included in the calculation of precision.

The analyte 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 analysis 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. Inorganic laboratory sample duplicate RPD values outside the established control criteria do result in the qualification of associated analytical results as estimated. Qualified data does 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 potential impact on data applicability in meeting site characterization objectives.

The criteria in Table 6-1 to evaluate analytical method performance for precision 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.

6.2.2.1.2 Precision for Radiochemical Analysis

The analyte performance criteria for precision will be compared to the RPD or normalized difference (ND) results of duplicate samples. The criteria to be used for assessment of precision are the radiochemical analyte-specific criteria listed in Table 3-4. 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 potential impact on data applicability in meeting site characterization objectives.

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If the RPD or ND criteria are exceeded, samples will be qualified. Field duplicates will be evaluated, but these samples will not be qualified based on their results. The MSD results outside the control limit 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 MDA. This excludes many measurements because the samples contain nondetectable or low levels of the target radionuclide. However, ND methods may also be used for evaluating duplicate data. 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

TPUs = 2σ total propagated uncertainty (TPU) of the sample

TPUD = 2σ TPU of the duplicate

= Standard deviation σ

The control limit for the normalized difference is -2 to 2, which represents a confidence level of 95 percent.

The criteria in Table 6-1 to evaluate analytical method performance for precision 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 corresponding total number of RPD or ND tests, and multiplying by 100. Each analytical method-specific precision measurements will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

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6.2.2.2 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 analyte concentration or by reanalyzing a sample to which a material of known concentration or amount of analyte has been added (spiked). The measure of accuracy is expressed as the percent recovery (%R) (DOE/NV, 1996b). This is calculated by dividing the measured sample concentration by the true concentration and multiplying the quotient by 100.

6.2.2.2.3 Accuracy for Chemical Analyses

The %R criteria to be used for assessment of accuracy are the analyte-specific criteria listed in Table 3-4 for PCBs, TPH, SVOCs, VOCs, and RCRA metals. 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 analyte to a specified amount of matrix sample for which an independent estimate of the target analyte concentration is available. Laboratory control samples are prepared by adding a known concentration of a target analyte to a "clean" sample matrix (does not contain the target analyte). Surrogate samples are prepared by adding known concentrations of specific organic compounds to each sample analyzed for organic analyses (including QC samples).

The %R criteria to be used will be based on laboratory-specific control limits. For organic analyses, laboratory control limits are re-evaluated 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 analyte 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

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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 in Table 6-1 to evaluate analytical method performance for accuracy 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.

6.2.2.2.4 Accuracy for Radiochemical Analysis

Accuracy for radiochemical analyses will be evaluated based on results from LCS 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.

As listed in Table 3-4, isotopic tracers are added to all samples analyzed for isotopic uranium. Stable strontium is added as a carrier to all samples analyzed for Sr-90. These tracers and carriers are used to determine chemical yield. Acceptance for chemical yield is 30 to 105%.

The %R criteria to be used for assessment of accuracy will be the control limits for radiochemical analyses listed in Table 3-4. 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.

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The criteria in Table 6-1 to evaluate analytical method performance for accuracy 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.

6.2.2.3 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.

Representativeness may be assured by reviewing field documentation, operating in accordance with approved procedures and plans, conducting field surveillances, and field-collected blank data. An evaluation of this qualitative criterion will be presented in the CADD.

6.2.2.4 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), and samples that were collected and sent but never received by the laboratory. If these criteria are not achieved, the dataset will be assessed for potential impacts on meeting site characterization objectives.

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Critical analytes for CAU 168 are identified in Table 6-2; they are defined as those analytes most

likely present in the target population at concentrations of concern. Critical analytes have been

identified through process knowledge and historical documentation.

Critical analytes for Phase I samples at the construction waste disposal sites (CASs 25-16-01,

25-16-03, 25-19-02, and 26-08-01) cannot be determined until the nature of buried debris is known.

Once known, the critical analytes will be determined. Critical analytes for Phase II critical samples

will be determined based on Phase I analytical results.

The qualitative criterion for evaluation of measurement system performance is that sufficient data of

the appropriate quality has been generated to satisfy the data needs identified in the DQOs. An

evaluation of this qualitative criterion will be presented in the CADD.

6.2.2.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set 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 other data sets. An evaluation of this qualitative criterion will be presented in the

CADD.

6.2.2.6 Sensitivity

Sensitivity is a quantitative parameter that evaluates the capability of a method or instrument to

measure analyte 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. As

shown in Table 3-5, the MDCs for Co-60 and U-235 will normally exceed their corresponding PAL.

However, the MDCs will be less than the NRC and NCRP screening levels for soil. If this criterion is

not achieved, the affected data will be assessed for usability and potential impacts on meeting site

characterization objectives.

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Table 6-2
Critical Analytes by CAS and Investigation Phase

Phase	CAS	TPH (Diesel)	PCBs	Be	Cs-137	Co-60	Sr-90	Isotopic Uranium	Total and/or Removable Alpha Radiation ^a	Total and/or Removable Beta/Gamma Radiation ^a
	25-16-01	Critical analytes for Phase I samples at the construction waste disposal sites cannot be determined until the nature of buried debris is known.								
	25-16-03									
	25-19-02									
l b	26-08-01									
I.	25-34-01								х	х
	25-34-02								х	х
	26-17-01			х	Xc	Xc	х	х		
	26-19-02			х	Xc	Xc	х	х		
II	25-23-02		X ^d						Х	х
	25-23-13								х	х
	25-23-18	х	х		Xc	Xc	х	х		

^aSemiquantitative data from radiological surveys and swipe collection and counting

Be = Beryllium⁴
Co-60 = Cobalt-60
Cs-137 = Cesium-137
PCBs = Polychlorinated biphenyl
Sr-90 = Strontium-90
TPH = Total petroleum hydrocarbon

^bCritical analytes for Phase II critical samples will be determined based on Phase I analytical results

^cGamma spectroscopy analytes

dFor samples of residual fluids only, if collected

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6.3 Radiological Survey Quality Assurance

Radiological survey data used for making critical decisions will receive rigorous QA/QC scrutiny to determine if the data are of the right type, quality, and quantity to support a free-release determination. A review of survey documentation, data verification, and data validation will be performed for free-release radiological surveys as prescribed in the QAPP (DOE/NV, 1996b), except where otherwise stipulated in this CAIP. The DQIs of the radiological survey data will also be reviewed. The DQIs presented in this section are addressed specifically for radiological surveys used for free-release determinations.

The radiological survey data will be evaluated for consistency with the CSMs developed for the sites. If data are not consistent with the CSM, either the model will need to be re-evaluated, or reasons for the differences and the effects of those differences on decisions will be documented. This will be performed by examining summary statistics and plots of the subsets of the data (e.g., histograms and quantile-quantile plots).

6.3.1 Data Validation

The radiological survey data will be evaluated to determine their validity. Individual data points within the context of the entire data set will be evaluated graphically and statistically to determine suspect data (e.g., outliers and anomalous values). A decision about how to treat the anomalous data (e.g., remove from the data set, censor, or leave data in data set without modification) will be made before proceeding with the data validation. Anomalies will be discussed in the data assessment section of the CADD.

The radiological survey data validation will examine:

- Completeness of Radiological Survey Forms
- Completeness of signatures, dates, and survey locations
- Proper field documentation of problems and deviations from procedures
- Scanning survey area coverage
- Scanning MDA

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• Static survey MDA

• Quantity and spatial distribution of static survey results

• Detector system calibrated to National Institute of Standards and Technology-traceable

sources

Corrections made for geometry, self-absorption, backscatter, and daughter-product ingrowth

Detector response to daily background and source checks

6.3.2 Data Quality Indicators

6.3.2.1 Precision

Precision is a quantitative measure of the variability in repeated measurements under a given set of conditions, compared to their mean value (Section 6.2.2.1). The degree of precision will be presented in terms of relative standard deviation (σ_r) of a set of measurements by the expression:

σ

 $\sigma_{\rm r} = \frac{\sigma}{X} \times 100 \%$

Where

 σ = standard deviation of the data set

 \bar{x} = mean of the data set

The lower the relative standard deviation, the more precise the data. Precision is assessed for radiological survey instruments by collecting a series of measurements of a known activity and determining the relative standard deviation of the measurements.

The degree of precision will be determined each day of instrument use and verified to be within 20 percent (ANSI, 1997). If the degree of precision for a survey instrument is determined to be outside this range, the instrument will be removed from use and replaced by an instrument that meets this performance standard.

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6.3.2.2 Accuracy

Accuracy is a measure of the proximity of an individual measurement to the true value (Section 6.2.2.2). Accuracy is determined by taking measurements of a known quantity of radioactive material and determining the relative bias by the following formula:

Relative Bias =
$$\left(\frac{x-y}{y}\right) \times 100 \%$$

Where:

y = The known true value

x = The predicted value using the detection system

In field measurements, the accuracy error comes from the overall calibration factor, which relates the detector response (i.e., count rate) to physical quantities of interest (i.e., beta activity in disintegrations per 100 cm²). The major sources of error for the calibration factor in radiological survey instruments are:

- Backscatter of the radiation back into the detector
- Surface self-absorption of the radiation
- Distance of detector from surface under measurement
- Difference of radiation energy from the calibration standard energy
- Gamma radiation background

All of these major sources of errors are random errors because they vary with locations by chance; the accuracy error itself is given by the propagation of these errors to the final result. The greater the variability associated with these sources of error, the larger the accuracy error is for radiation measurement systems. Accuracy is assessed for radiological survey instruments by collecting a series of measurements of a known activity and determining the relative bias of the measurements.

Accuracy will be determined each day of instrument use and verified to be within 20 percent (ANSI, 1997). If the accuracy for a survey instrument is determined to be outside this range, the instrument will be removed from use and replaced by an instrument that meets this performance standard.

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6.3.2.3 Representativeness

Representativeness expresses the degree to which measurement data accurately and precisely represent a characteristic of a population, parameter variations at a measurement location, or an environmental condition (Section 6.2.2.3). The representativeness criterion is best satisfied by making certain that measurement locations are selected properly and a sufficient number of measurements are collected. For this characterization project, where surveys are conducted, 100 percent surface scans will be performed in addition to systematic static measurements. This method allows one to survey a large area and bias static (point) measurements using the scanning data, ensuring that all survey measurements will be representative.

6.3.2.4 Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid measurements (Section 6.2.2.4). A high completeness level ensures that critical data points will be collected. Missing or unusable data can occur with any detection program. The pattern of missing or unusable data needs to be documented along with the operation to determine if a bias in statistical testing could arise. To account for the likelihood of missing/unusable data during free-release radiological surveys, a repeated measurement will be taken when a data point is found to be suspect or invalid.

6.3.2.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another (EPA, 1987). The evaluation of data comparability can be conducted: (1) within the same survey plan, or (2) across different survey and sampling plans that have the same objectives and the same sampling and measurement environment. In the first case, data comparability can be achieved by using standard survey techniques to take radiological measurements and reporting radiological results in appropriate units. At a minimum, in the free-release survey, the data sets collected under the same survey plan using the same survey methods should be comparable with one another and to the release criteria. In the second case, the validation of surface activity measurements using a building material sampling plan can be deemed as a data comparability evaluation that crosses different sampling and measurement programs. However, assumptions may have to be made

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(e.g., depth of contamination, radionuclide identity, and density) to allow for qualitative comparability of surface contamination activity to nuclide concentration. An evaluation of this qualitative criterion and all assumptions will be presented in the CADD.

6.3.2.6 Sensitivity

The sensitivity of a direct measurement system is a quantity of radioactive material that can be detected with a known level of confidence (Section 6.2.2.6). This quantity is a factor of both the instrumentation and the technique or procedure being used. The primary parameters that affect the sensitivity of radiological detection instruments are the background count rate, the detection efficiency, and the counting time interval. In performing free-release surveys, the sensitivity must be sufficiently low enough to ensure that levels below the release criteria can be detected with a high degree of confidence. In order to determine the needed sensitivity prior to performing the free-release surveys, the concept of the MDA is used. The MDA for radiological surveying is the minimum activity concentration on a surface that an instrument is expected to detect with a 95 percent confidence. The expression for MDA is given as:

$$MDA = \frac{3 + 4.65\sqrt{C_B}}{KT}$$

Where:

 $MDA = dpm/100 cm^2$

 $C_{\rm B}$ = background count in time T

K = proportionality constant that relates detector response to the activity level in a sample for a given set of measurement conditions

The MDA depends on instrument characteristics (e.g., instrument efficiency, background, integration time) and the survey measurement process (e.g., surface type, source to detector geometry, backscatter, and self-absorption) (NRC, 1997). These factors will be considered when planning characterization activities and will be documented in the CADD.

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7.0 Duration and Records Availability

7.1 Duration

After the submittal of the CAIP to NDEP (FFACO milestone date of November 30, 2001), the following is a tentative schedule of activities (in calendar days):

- Day 0: Preparation for field work will begin.
- Day 45: The field work, including field screening and sampling, will commence. Samples will be shipped to meet laboratory holding times.
- Day 135: The field investigation will be completed.
- Day 200: The quality-assured laboratory analytical data will be available for NDEP review.
- The FFACO date for the CADD is August 29, 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 NNSA/NV Project Manager. The NDEP maintains the official Administrative Record for all activities conducted under the auspices of the FFACO.

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8.0 References

- Adams, S.R., IT Corporation. 2000a. Memorandum to J.M. Moore (ITLV) entitled, "Preliminary Action Levels for the Radiological Contaminants of Potential Concern Identified for Corrective Action Unit 262," 21 February. Las Vegas, NV.
- Adams, S.R., IT Corporation. 2000b. Memorandum to D. Wilson (ITLV) entitled, "Revisions to Preliminary Action Levels Listed in 'CAU 262' Proposed Minimum Reporting Levels (MRLs) for Radionuclides in Soil/Solid/Sludge and Water," 12 May. Las Vegas, NV.
- Adams, S.R., and B.J. Dionne, IT Corporation. 2000. Memorandum to J.M. Moore (ITLV) entitled, "CAU 262 Proposed Minimum Reporting Levels (MRLs) for Radionuclides in Soil/Solids/Sludge and Water," 25 April. Las Vegas, NV.
- AEC, see U.S. Atomic Energy Commission.
- American National Standards Institute. 1997. *Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments*, ANSI N323A-1997. New York: Institute of Electrical and Electronics Engineers, Inc.
- American Society for Testing and Materials. 1996. Section 04.08 and 04.09, "Construction," *Annual Book of ASTM Standards*. Philadelphia, PA.
- ANSI, see American National Standards Institute.
- ASTM, see American Society for Testing and Materials.
- Author Unknown. 1960. Background Information, Project Pluto Tory II-A: Final Draft, CIC 78665.
- Author Unknown. 1962. Aerial Photograph CNP-4493, 15 October.
- Bechtel Nevada. 1995. Nevada Test Site Performance Objective Criteria for Certification of Nonradioactive Hazardous Waste, Rev. 0, G-E11/96.01. Las Vegas, NV.
- Bechtel Nevada. 1998a. Radiation Survey Report, 26 September. Las Vegas, NV.
- Bechtel Nevada. 1998b. Radiation Survey Report, 28 September. Las Vegas, NV.
- Bechtel Nevada. 2000a. Aerial photograph 10292-229, 02 February. Nellis Air Force Base, NV: Remote Sensing Laboratory Photo Library.
- Bechtel Nevada. 2000b. Nevada Test Site Occupancy Report, 7 August. Las Vegas, NV.

CAU 168 CAIP Section: 8.0 Revision: 0 Date: 11/26/2001 Page 112 of 123

- Bertrand, K., and E. Takahashi, Bechtel Nevada. 1998. Record of Telecon with S. Bernard (ITLV) regarding the RMSF (includes 06 February 1996 and 16 March 1998 radiological survey results). Las Vegas, NV: IT Corporation.
- Bliss, W., Reynolds Electrical & Engineering Co., Inc. 1992. Letter to R.F. Smiecinski (DOE/NV) entitled, "Facility Classification Checklists," 6 April. Las Vegas, NV.
- BLM, see U.S. Department of Interior, Bureau of Land Management.
- BMEC, see Burns and McDonnell Engineering Co.
- BN, see Bechtel Nevada.
- Bull, R., Science Applications International Corporation. 2001. Memorandum to C. Fillmore (ITLV) entitled, "Preliminary Assessment Data for CAU 168," 7 August. Las Vegas, NV.
- Burns and McDonnell Engineering Co. 1959a. As-Built Engineering Drawing 2203- M1.1 entitled, "Building 2203 Test Bunker Plumbing Plan and Details," 24 April. Prepared for U.S. Atomic Energy Commission. Mercury, NV: Archives and Records Center.
- Burns and McDonnell Engineering Co. 1959b. As-Built Engineering Drawing 2203- PP3.1 entitled, "Test Bunker and Miscellaneous Structures Process Yard Piping Plan and Profile #3," 24 April. Prepared for U.S. Atomic Energy Commission. Mercury, NV: Archives and Records Center.
- Burns and McDonnell Engineering Co. 1959c. As-Built Engineering Drawing 2203-SW1.1 entitled, "Test Bunker and Miscellaneous Structures," 24 April. Prepared for U.S. Atomic Energy Commission. Mercury, NV: Archives and Records Center.
- Burns and McDonnel Engineering Co. 1960. Engineering Drawing 2202-RR6 entitled, "NTS 401 Railroad Construction Details," 21 January. Prepared for the U.S. Atomic Energy Commission. Mercury, NV: Archives and Records Center.
- Bybee, R., Lawrence Radiation Laboratory. 1961. Memorandum regarding LRL-N Safety Manual, 3 August. Livermore, CA.
- Cebe, J., U.S. Department of Energy, Nevada Operations Office. 1997. Record of Telecon with D. Arnold (ITLV) regarding the Test Bunker facility, 18 December. Las Vegas, NV: IT Corporation.
- Center for Land Use Interpretation. 1996. *The Nevada Test Site A Guide to America's Nuclear Proving Ground*. Las Vegas, NV.
- CFR, see Code of Federal Regulations.

CAU 168 CAIP Section: 8.0 Revision: 0 Date: 11/26/2001 Page 113 of 123

- Code of Federal Regulations. 2001a. Title 40 CFR, "Protection of the Environment," Parts 260-282. Washington, DC: U.S. Government Printing Office.
- Code of Federal Regulations. 2001b. Title 40 CFR, "Protection of the Environment," Part 261, "Identification and Listing of Hazardous Waste." Washington, DC: U.S. Government Printing Office.
- Code of Federal Regulations. 2001c. Title 40 CFR, "Protection of the Environment," Part 261.24, "Identification and Listing of Hazardous Waste, Subpart C Characteristics of Hazardous Waste, Toxicity Characteristic." Washington, DC: U.S. Government Printing Office.
- Code of Federal Regulations. 2001d. Title 40 CFR, "Protection of the Environment," Part 262, "Standards Applicable to Generators of Hazardous Waste." Washington, DC: U.S. Government Printing Office.
- Code of Federal Regulations. 2001e. Title 40 CFR, "Protection of the Environment," Part 262.34, "Standards Applicable to Generators of Hazardous Waste, Subpart C Pre-Transport Requirements, Accumulation Time." Washington, DC: U.S. Government Printing Office.
- Code of Federal Regulations. 2001f. Title 40 CFR, "Protection of the Environment," Part 265.172, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart I Use and Management of Containers, Compatibility of Waste with Container." Washington, DC: U.S. Government Printing Office.
- Code of Federal Regulations. 2001g. Title 40 CFR, "Protection of the Environment," Part 265.173, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart I Use and Management of Containers, Management of Containers." Washington, DC: U.S. Government Printing Office.
- Code of Federal Regulations. 2001h. Title 40 CFR, "Protection of the Environment," Part 265.174, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart I Use and Management of Containers, Inspections." Washington, DC: U.S. Government Printing Office.
- Code of Federal Regulations. 2001i. Title 40 CFR, "Protection of the Environment," Part 265.177, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Subpart I Use and Management of Containers, Special Requirements for Incompatible Wastes." Washington, DC: U.S. Government Printing Office.
- Code of Federal Regulations. 2001j. Title 40 CFR, "Protection of the Environment," Part 761, "PCBs." Washington, DC: U.S. Government Printing Office.
- Code of Federal Regulations. 2001k. Title 40 CFR, "Protection of the Environment," Part 763, "Asbestos." Washington, DC: U.S. Government Printing Office.

CAU 168 CAIP Section: 8.0 Revision: 0 Date: 11/26/2001 Page 114 of 123

- Code of Federal Regulations. 20011. Title 49 CFR, "Transportation," Part 172, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements." Washington, DC: U.S. Government Printing Office.
- Desert Research Institute. 1988. CERCLA Preliminary Assessment of DOE's Nevada Operations Office Nuclear Weapons Testing Areas, Vol. 1. Las Vegas, NV.
- Desert Research Institute. 1989. Nevada Test Site Radionuclide Inventory and Distribution Program: Report #5, Areas 5, 11, 12, 15, 17, 18, 19, 25, 26, and 30, DOE/NV/10384-26. Las Vegas, NV.
- Desert Research Institute. 1996. *Nevada Test Site Historic Structures Survey*, March. Prepared in conjunction with Carey & Co., Inc. for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV.

DOE, see U.S. Department of Energy.

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

DOE/OCRWM, see U.S. Department of Energy, Office of Civilian Radioactive Waste Management.

DOE/RAPIC, see U.S. Department of Energy, Remedial Action Program Information Center.

DRI, see Desert Research Institute.

DSI, see Design Sciences, Incorporated.

EG&G/EM, see EG&G Energy Measurements.

- EG&G Energy Measurements. 1964. Aerial Photograph 64117-20, 26 September. Nellis Air Force Base, NV: Remote Sensing Laboratory Photo Library.
- EG&G Energy Measurements. 1965. Aerial Photograph 65125-12. Nellis Air Force Base, NV: Remote Sensing Laboratory Photo Library.
- EG&G Energy Measurements. 1966a. Aerial Photograph 66339-03, 15 March. Nellis Air Force Base, NV: Remote Sensing Laboratory Photo Library.
- EG&G Energy Measurements. 1966b. Aerial Photograph 66339-06, 15 March. Nellis Air Force Base, NV: Remote Sensing Laboratory Photo Laboratory.
- EG&G Rocky Flats. 1991. General Radiochemistry and Routine Analytical Services Protocol (GRASP), Version 2.1, July. Golden, CO: Environmental Management Department.

CAU 168 CAIP Section: 8.0 Revision: 0 Date: 11/26/2001 Page 115 of 123

- Elle, D., U.S. Department of Energy, Nevada Operations Office. 1994. Letter entitled, "Final Cover Requirements for Inactive Landfills on the Nevada Test Site (NTS)," 18 January. Las Vegas, NV.
- Elle, D., U.S. Department of Energy, Environmental Protection Division. 1996. Letter entitled, "Notice of Completion of Inactive Solid Waste Disposal Units on the Nevada Test Site (NTS)," 25 March. Las Vegas, NV.
- EPA, see U.S. Environmental Protection Agency.
- ERDA, see U.S. Energy Research and Development Administration.
- Esp, M., Bechtel SAIC Company. 2001. Personal communication to R. Sobocinski (ITLV) regarding information on Well USW G3, 10 September. Mercury, NV.
- FFACO, see Federal Facility Agreement and Consent Order.
- Federal Facility Agreement and Consent Order. 1996 (as amended). Agreed to by the State of Nevada, the U.S. Department of Energy, and the U.S. Department of Defense.
- Fenix & Scisson, Inc. 1987. *NNWSI Hole Histories, USW G-1, USW G-2, USW G-3, USW G-4, USW GA-1, USW GU-3*, DOE/NV/10322-19. Prepared for the U.S. Department of Energy, Nevada Operations Office. Mercury, NV.
- Fraser, D.L., Reynolds Electrical & Engineering Co., Inc. 1993. *Operational Readiness Review Implementation Plan*, 14 July. Prepared for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV.
- Garey, K., Peer Consultants. 1997. Record of Telecon with D. Filmyer (IT) and A. O'Hagan (IT) regarding various Area 25 sites, 24 February. Las Vegas, NV.
- Garey, K., Peer Consultants. 1999. Record of Telecon with D. Rainwater (ITLV) concerning the ETL/TTF, 3 February. Las Vegas, NV.
- Garey, K., Peer Consultants. 2000a. Record of Telecon with B. Whitfield (ITLV) pertaining to the Waste Disposal Site and R-MAD activities, 9 March. Las Vegas, NV.
- Garey, K., Peer Consultants. 2000b. Record of Telecon with B. Whitfield (ITLV) pertaining to the Waste Disposal Site and R-MAD activities, 14 March. Las Vegas, NV.
- H&N, see Holmes and Narver.
- Henderson, R., Los Alamos National Laboratory. 2000. Record of Telecon with B. Whitfield (ITLV) pertaining to the Waste Disposal Site and R-MAD activities, 14 March. Las Vegas, NV.

CAU 168 CAIP Section: 8.0 Revision: 0 Date: 11/26/2001 Page 116 of 123

- Hoar, K., U.S. Department of Energy, Nevada Operations Office. 2000. Record of Telecon with P. Lucot (ITLV) regarding CAU 168, CAS 25-16-03, 20 March. Las Vegas, NV.
- Holmes & Narver, Inc. Date Unknown. Engineering Drawing A26-4 entitled, "Nevada Test Site Area 26 Project Area Site Plan." Prepared for the U.S. Department of Energy, Nevada Operations Office. Mercury, NV: BN Archives and Records Center.
- Holmes & Narver, Inc. 1987. Engineering Drawing A25-15 entitled, "Nevada Test Site Area 25 Existing Site Plan MX." Prepared for the U.S. Department of Energy, Nevada Operations Office. Mercury, NV: Archives and Records Center.
- IT, see IT Corporation.
- IT Corporation, Las Vegas. 1999. Digital Photograph 252313p1 for CAU 168, CAS 25-23-13, 02 December. Las Vegas, NV.
- IT Corporation, Las Vegas. 2001a. *ITLV Health and Safety Plan*, February, ITLV/13052--105, Rev. 1. Las Vegas, NV.
- IT Corporation, Las Vegas, Nevada. 2001b. Second Quarter 2001 Surface Geophysical Survey Report Corrective Action Unit (CAU) 168 Nevada Test Site (NTS), Mercury, Nevada, May. Prepared by Science Applications International Corporation. Harrisburg, PA.
- Juniel G., Bechtel Nevada. 2000. Record of Telecon with E. Moyer-Durham (ITLV) and C. Fillmore (ITLV) regarding USW G3, 24 February. Las Vegas, NV: IT Corporation.
- Karanthanasis, A.D., and B.F. Hajek. 1982. "Quantitative Evaluation of Water Adsorption on Soil Clays." In *Soil Science Society of America Journal*, 46: 1321-1325. Madison, WI.
- Kerschner, H., Reynolds Electrical & Engineering Co., Inc. (Retired). 1999. Record of Telecon with D. Rainwater (IT) concerning the ETL/TTF, 2 February. Las Vegas, NV: IT Corporation.
- Leibendorfer, P., Nevada Division of Environmental Protection. 1994. Letter entitled, "Final Closure of Inactive Landfills on the Nevada Test Site," 24 January. Carson City, NV.
- Leibendorfer, P., Nevada Division of Environmental Protection. 1996. Letter entitled, "Notice of Completion of Inactive Solid Waste Disposal Units on the Nevada Test Site (NTS); Notice Dated 25 March 1996," 8 July. Carson City, NV.
- Marchand, A., Bechtel Nevada. 1998. Record of Telecon with C. Benedict (ITLV) regarding USW G3, 11 March. Las Vegas, NV: IT Corporation.
- McArthur, R.D., and R.L. Miller, Jr. 1989. *Off-Site Radiation Exposure Review Project, Phase II Soil Program*, DOE/NV/10384-23. Las Vegas, NV: Desert Research Institute.

CAU 168 CAIP Section: 8.0 Revision: 0 Date: 11/26/2001 Page 117 of 123

NAC, see Nevada Administrative Code.

NBMG, see Nevada Bureau of Mines and Geology.

NDEP, see Nevada Division of Environmental Protection.

- Nevada Administrative Code. 2000a. NAC 444.570 444.7499, "Solid Waste Disposal." Carson City, NV.
- Nevada Administrative Code. 2000b. NAC 444.850 444.8746, "Disposal of Hazardous Waste." Carson City, NV.
- *Nevada Administrative Code.* 2000c. NAC 445A.2272, "Contamination of Soil: Establishment of Action Levels." Carson City, NV.
- Nevada Administrative Code. 2000d. NAC 444.940 444.9555, "Polychlorinated Biphenyl." Carson City, NV.
- Nevada Administrative Code. 2000e. NAC 444.965 444.976, "Disposal of Asbestos." Carson City, NV.
- Nevada Bureau of Mines and Geology. 1998. *Mineral and Energy Resource Assessment of the Nellis Air Force Range*, Open-File Report 98-1. Reno. NV.
- Nevada Division of Environmental Protection. 1995. *Mutual Consent Agreement Between the State of Nevada and the U.S. Department of Energy for the Storage of Low-Level Land Disposal Restricted Mixed Waste*, 7 June. Transmittal from P. Liebendorfer (NDEP) to D. Elle (DOE/NV). Carson City, NV.
- NRC, see U.S. Nuclear Regulatory Commission.
- Nevada Revised Statues. 1998a. NRS 444.440 444.620, "Collection and Disposal of Solid Waste." Carson City, NV.
- Nevada Revised Statues. 1998b. NRS 459.400 459.600, "Disposal of Hazardous Waste." Carson City, NV.
- NRS, see Nevada Revised Statutes.
- O'Donahue J., Bechtel Nevada. 2000a. Record of Telecon with E. Moyer-Durham (ITLV) regarding Area 26, Building 2203, 4 February. Las Vegas, NV: IT Corporation.
- O'Donahue, J, Bechtel Nevada. 2000b. Record of Telecon with J. Markowsky (ITLV) regarding Area 26 RMAs, 10 January. Las Vegas, NV: IT Corporation.

CAU 168 CAIP Section: 8.0 Revision: 0 Date: 11/26/2001 Page 118 of 123

Paar, J.G., and Porterfield, D.R. 1997. *Evaluation of Radiochemical Data Usability*, April, ES/ER/MS-5.

PAI, see Paragon Analytics, Inc.

Paragon Analytics, Inc. 2000. Laboratory Quality Manual, Rev. 4, February. Fort Collins, CO.

Raytheon Services Nevada. 1995. Radiological Effluents Released from Nuclear Rocket and Ramjet Engine Tests at the Nevada Test Site, 1959 through 1969, Fact Book. Prepared for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV.

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

Reynolds Electrical & Engineering Co., Inc. 1984a. *Radiological Survey and Cleanup Project,* 1974-1983, Rev. 1, DOE/NV/103275. Prepared for the U.S. Department of Energy, Nevada Operations Office. Prepared by M.G. Miller. Las Vegas, NV.

Reynolds Electrical & Engineering Co., Inc. 1984b. Engineering Drawing 25-E-MAD-C1.1 entitled, "Existing Water & Sewer Layout E- MAD Facility Plan," 06 January. Prepared for the U.S. Department of Energy. Mercury, NV: BN Archives and Records Center.

Reynolds Electrical & Engineering Co., Inc. 1986a. *Hazardous Waste Installation Assessment Report*, DOE/NV/10327-23. Prepared by D.N. Fauver for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV.

Reynolds Electrical & Engineering Co., Inc. 1986b. *Nevada Test Site Underground Contaminants*. Prepared by D.L. Fraser.

Reynolds Electrical & Engineering Co., Inc. 1992. *Detailed Site Activity Summary NTS Cleanup and Restoration*, 14 May. Las Vegas, NV.

RSN, see Raytheon Services Nevada.

Smith, J., Bechtel Nevada. 2000. Record of Telecon with J. Markowsky (ITLV) concerning Areas 25 and 27, 5 January. Las Vegas, NV: IT Corporation.

SNPO, see Space Nuclear Propulsion Office.

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

Space Nuclear Propulsion Office. 1970. NRDS Master Plan 1969-1970, Nuclear Rocket Development Station, Jackass Flats, Nevada, CD:HFA:299. Prepared for the U.S. Atomic Energy Commission. Las Vegas, NV.

CAU 168 CAIP Section: 8.0 Revision: 0 Date: 11/26/2001 Page 119 of 123

- Sygitowicz, L., Bechtel Nevada. 1999. Record of Telecon with D. Rainwater (ITLV) concerning operations at Building 3124, ETL/TTF, 2 February. Las Vegas, NV.
- UCRL, see University of California, Lawrence Radiation Laboratory.
- University of California, Lawrence Radiation Laboratory. 1960. Manual of Procedures Applicable to Operations Involving Accountable, Radioactive, Hazardous and Toxic Material for the University of California Lawrence Radiation Laboratory, Nevada Test Site, Supplementary Procedures for Special Operations, Tory II-A, Pluto Program, Pre-Nuclear and Nuclear Phases III, IV, and V, CIC133180, 27 October. Prepared for the U.S. Atomic Energy Commission. Livermore, CA.
- University of California, Lawrence Radiation Laboratory. 1962. *The Pluto Program*, UCRL—6941, 08 June. Prepared for the U.S. Atomic Energy Commission. Livermore, CA.
- University of California, Lawrence Radiation Laboratory. 1963. *Tory II-A Reactor Test Final Report, AEC Research and Development Report*, UCRL-- 7249. Prepared for the U.S. Atomic Energy Commission, 3 May. Livermore, CA.
- University of California, Lawrence Radiation Laboratory. 1964. *Tory II-C Reactor Test Report*, *AEC Research and Development Report*, UCRL-- 12069. Prepared for the U.S. Atomic Energy Commission, 12 October. Livermore, CA.
- USACE, see U.S. Army Corps of Engineers.
- U.S. Army Corps of Engineers. 1970. "Laboratory Soils Testing." In *Engineering Manual* 1110-2-1906, Appendix II. Washington, DC.
- U.S. Army. 1989. *NUWAX-81: Army Radcon Team Participation*, BRL-MR-3775. Edited by E.F. Wisely. Arberdeen Proving Ground, MD: Ballistic Research Laboratory.
- U.S. Atomic Energy Commission, Nevada. Date Unknown. *Pluto Fact Sheet Summary*. Berkeley, CA.
- U.S. Atomic Energy Commission. 1961. *The Pluto Program*, UCRL-6398. Livermore, CA: University of California, Lawrence Radiation Laboratory.
- U.S. Atomic Energy Commission. 1963. *Project Pluto Construction and Expansion has been Completed*, NV0182587, 7 June. Las Vegas, NV.
- U.S. Atomic Energy Commission. 1964. *Tory IIC Reactor Test Report*, UCRL-12069. Livermore, CA: University of California, Lawrence Radiation Laboratory.
- USC, see *United States Code*.

CAU 168 CAIP Section: 8.0 Revision: 0 Date: 11/26/2001 Page 120 of 123

- *United States Code.* 1976. 15 USC 2601 et seq., "Toxic Substances Control Act." Enacted by Public Law No. 94-469, as amended. Washington, DC: U.S. Government Printing Office.
- U.S. Department of Energy, Remedial Action Program Information Center. Date Unknown. *Abstracts on Decontamination of Hot Cells*.
- U.S. Department of Energy. 1988a. *Environmental Survey Preliminary Report, Nevada Test Site, Mercury, Nevada*, DOE/EH/OEV-15-P. Washington, DC: Environment, Safety, and Health Office of Environmental Audit.
- U.S. Department of Energy. 1988b. *Site Characterization Plan; Yucca Mountain Site, Nevada*, Vols. I-IX, DOE/RW-0199. Washington, DC.
- U.S. Department of Energy. 1997. *Environmental Measurements Laboratory Procedures Manual*, HASL-300, 28th Ed., Vol. I. New York, NY.
- U.S. Department of Energy, Nevada Operations Office. 1992. *RCRA Part B Permit Application Nevada Test Site Section L Potential Solid Waste Management Units*. Las Vegas, NV: IT Corporation.
- U.S. Department of Energy, Nevada Operations Office. 1993. Surveillance on Inactive Landfills at the NTS and List of Solid Waste Disposal Sites, Rev. 0. Las Vegas, NV.
- U.S. Department of Energy, Nevada Operations Office. 1994. *Project Management Plan*, Rev. 0. Las Vegas, NV.
- U.S. Department of Energy, Nevada Operation Office. 1996a. Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada, DOE/EIS 0243. Las Vegas, NV.
- U.S. Department of Energy, Nevada Operations Office. 1996b. *Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada*, Rev. 1, DOE/NV-372. Las Vegas, NV.
- U.S. Department of Energy, Nevada Operations Office. 1998a. Work Plan for Leachfield Corrective Action Units: Nevada Test Site and Tonopah Test Range, Nevada, Rev. 1, DOE/NV--514. Las Vegas, NV.
- U.S. Department of Energy, Nevada Operations Office. 1998b. *Nevada Test Site Resource Management Plan*, DOE/NV-518. Las Vegas, NV.
- U.S. Department of Energy, Nevada Operations Office. 1999. *Nevada Test Site Annual Site Environmental Report for Calender Year 1998*, DOE/NV-11718-361. Las Vegas, NV.

CAU 168 CAIP Section: 8.0 Revision: 0 Date: 11/26/2001 Page 121 of 123

- U.S. Department of Energy, Nevada Operations Office. 2000a. *NV/YMP Radiological Control Manual*, Rev. 4, DOE/NV/11718-079, May. Prepared by A.L. Gile. Las Vegas, NV: Bechtel Nevada.
- U.S. Department of Energy, Nevada Operations Office. 2000b. *Nevada Test Site Waste Acceptance Criteria*, DOE/NV-325, Rev. 3. Las Vegas, NV.
- U.S. Department of Energy, Office of Civilian Radioactive Waste Management. 1998. *Viability Assessment of a Repository at Yucca Mountain*, DOE/RW-0508. Washington, DC.
- U.S. Department of Interior, Bureau of Land Management. 1990. 43 CFR Public Land Order 6802, Withdrawal of Public Land to Maintain the Physical Integrity of the Subsurface Environment, Yucca Mountain Project, Nevada, 25 September, 55 FR 39152.
- U.S. Ecology and Atlan-Tech. 1991. Environmental Monitoring Report for the Proposed Ward Valley Low Level Radioactive Waste (LLRW) Facility. Auborn, CA.
- U.S. Energy Research and Development Administration. 1977a. *Environmental Plutonium on Nevada Test Site and Environs, Interim Report of LFE Analytical Services for NAEG*, NVO-171 (Page 275). Prepared by Major W. J., and Leventhal, L. for the U.S. Energy Research and Development Administration. Las Vegas, NV.
- U.S. Energy Research and Development Administration. 1977b. *Final Environmental Impact Statement, Nevada Test Site, Nye County, Nevada*, ERDA-1551. Washington, DC.
- U.S. Environmental Protection Agency. 1980. *Prescribed Procedures for Measurement of Radioactivity in Drinking Water*, EPA 600/4-80-032 (NTIS/PB80-224744; CD ROM; NEPIS/http://www.epa.gov/cincl). Washington, DC.
- U.S. Environmental Protection Agency. 1987. *Data Quality Objectives for Remedial Response Activities*, EPA/540/G-87/003. Washington, DC.
- U.S. Environmental Protection Agency. 1988a. *Contract Laboratory Program Statement of Work for Inorganic Analysis*, SOW No. 788, EPA/540/R-94/093. Washington, DC.
- U.S. Environmental Protection Agency. 1988b. *Contract Laboratory Program Statement of Work for Organic Analysis*, SOW No. 2/88, EPA/540/R-94/096. Washington, DC.
- U.S. Environmental Protection Agency. 1991. *Contract Laboratory Program Statement of Work for Organic Analysis*, OLMO 1.8, EPA/540/R-94/078. Washington, DC.
- U.S. Environmental Protection Agency. 1994a. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA/540/R-94/013. Washington, DC.

CAU 168 CAIP Section: 8.0 Revision: 0 Date: 11/26/2001 Page 122 of 123

- U.S. Environmental Protection Agency. 1994b. *Contract Laboratory Program Statement of Work for Inorganic Analysis*, ILMO 3.0, EPA/540/R-94/076. Washington, DC.
- U.S. Environmental Protection Agency. 1994c. *Contract Laboratory Program Statement of Work for Organic Analysis*, OLMO 3.1, EPA/540/R-94/073. Washington, DC.
- U.S. Environmental Protection Agency. 1995. *Contract Laboratory Program Statement of Work for Inorganic Analysis*, ILMO 4.0, EPA/540/R-95/121. Washington, DC.
- U.S. Environmental Protection Agency. 1996. *Test Method for Evacuating Solid Waste Physical/Chemical Methods*, SW-846, 3rd Edition, CD-ROM PB97-501928GEI. Washington, DC.
- U.S. Environmental Protection Agency. 1999. *Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA 540/R-99/008. Washington, DC.
- U.S. Environmental Protection Agency. 2000. Memorandum from S.J. Smucker to PRG table mailing list regarding *Region IX Preliminary Remediation Goals (PRGs)*, 1 August. San Francisco, CA.
- USGS, see U.S. Geological Survey.
- U.S. Geological Survey. 1964. *Geology of the Pluto Site, Area 401, Nevada Test Site, Nye County, Nevada*, USGS-TEI-841. Prepared by R.B. Johnson and J.R. Ege. Denver, CO.
- U.S. Geological Survey. 1980. Flood Potential of Topopah Wash and Tributaries, Eastern Part of Jackass Flats, Nevada Test Site, Southern Nevada, USGS-OFR-80-963. Prepared by R.C. Christensen and N.E. Spahr. Lakewood, CO: U.S. Department of Energy.
- U.S. Geological Survey. 1984. *Stratigraphic and Structural Relations of Volcanic Rocks in Drill Holes USW GU-3, and USW G-3, Yucca Mountain, Nye County, Nevada*, USGS-OFR-84-491. Prepared by R.B. Scott, and M. Castellanos. Denver, CO.
- U.S. Geological Survey. 1990. *Geologic Map of the Nevada Test Site, Southern Nevada*, USGS Map I-2046. Prepared by V.A. Frizzell, Jr. and J. Shulters. Denver, CO.
- U.S. Geological Survey. 1993. *Water Levels in Continuously Monitored Wells in the Yucca Mountain Area, Nevada, 1985-88*, USGS-OFR-91-493. Prepared by R.R. Luckey, D.H. Lobmeyer, and D.J. Burkhardt. Denver, CO.
- U.S. Geological Survey. 1995. *Selected Ground-Water Data for Yucca Mountain Region, Southern Nevada and Eastern California, Calender Year 1993*, USGS-OFR-95-158. Prepared by G.S. Hale and C.L. Westenburg. Denver, CO.

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- U.S. Nuclear Regulatory Commission. 1997. *Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions*, NUREG-1507. Washington, DC.
- van Genuchten, M. 1980. "A Closed Form Equation for Predicting the Hydraulic Conductivity of Unsaturated Soils." In *Soil Science Society of America Journal*, 44: 892-898. Madison, WI.
- Vitro Engineering Company. 1964. Engineering Drawing 2817-C-4 entitled, "Nuclear Rocket Development Station-Nevada, Radioactive Materials Storage Facility, Structural-Storage Bunker-Plans & Sections," 20 October. Prepared for the U.S. Atomic Energy Commission National Aeronautics and Space Administration. Mercury, NV: Archives and Records Center.
- Wong, J., Nevada Division of Environmental Protection. 2001. Record of Telecon with K. Cabble (NNSA/NV) regarding *Nevada Revised Statute*: 445A.415, *Water Controls*, "Waters of the State," *Defined*, 27 August. Las Vegas, NV.
- Wycoff, R.C., U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office. 2001a. Memorandum entitled, "Approved Document Outlines Under the Federal Facility Agreement and Consent Order (FFACO)," 26 July. Las Vegas, NV.
- Wycoff, R.C., U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office. 2001b. Letter entitled, "Revised Position Paper for the Management of Investigation Derived Waste (IDW)," 5 June. Las Vegas, NV.

Appendix A Data Quality Objectives

A.1.0 DQO Overview

The CAU 168 investigation will be based on the DQOs developed by representatives of NDEP and NNSA/NV. The DQO process is a strategic planning approach based on the scientific method that is used to prepare for a site investigation/characterization data collection activity. The DQO process is designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and technically defend the chosen corrective action, if necessary.

Existing information about the nature and extent of contamination at 11 of the 12 CASs in CAU 168 is insufficient to evaluate and select preferred corrective actions. Only CAS 25-99-16 has enough existing information to select a preferred corrective action alternative of close in place with land-use restrictions. Therefore, this site will not be addressed during the DQO process. Because the investigation of CAU 168 will occur in two phases, separate DQOs for each phase have been developed. Step 1, State the Problem has elements common to both phases of the investigation (e.g., CSMs and Planning Team) and those common elements will be addressed in Section A.1.0. The environmental problem particular to each phase will be addressed in each separate phase. The remaining Steps 2 through 7 will be specific to each phase.

A.1.1 DQO Planning Team

The DQO planning team for the FFACO-required DQO Kick-Off Meeting consists of representatives from ITLV, NNSA/NV, BN, and NDEP. The primary decision makers include representatives from NNSA/NV and NDEP. Decision makers will receive notifications as work progresses and when decision points are reached within the investigation/characterization data collection activities.

A.1.2 Background

The August 14, 2001, DQO meeting provided brief descriptions of each CAS to acquaint the planning team with the environmental problems identified at CAU 168 (copies of the presentation are available in project files). Section 2.0 of the CAIP provides background information including physical setting and operational history. Existing references that were reviewed and are the primary source for the background information are provided in Section A.4.0.

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Twelve CASs comprise CAU 168, Area 25 and 26 Contaminated Materials and Waste Dumps. Nine CASs are in Area 25 and three CASs are in Area 26. The twelve CASs are:

- CAS 25-16-01, Construction Waste Pile
- CAS 25-16-03, MX Construction Landfill
- CAS 25-19-02, Waste Disposal Site
- CAS 25-23-02, Radioactive Storage RR Cars
- CAS 25-23-13, ETL-Lab Radioactive Contamination
- CAS 25-23-18, Area 25 Radioactive Material Storage
- CAS 25-34-01, NRDS Contaminated Bunker
- CAS 25-34-02, NRDS Contaminated Bunker
- CAS 25-99-16, Underground Southern Nevada Well G3 (USW G3)
- CAS 26-08-01, Waste Pile/Burn Pit
- CAS 26-17-01, Pluto Waste Holding Area
- CAS 26-19-02, Contaminated Waste Dump #2

A.1.3 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. An accurate conceptual site model is important as it serves as the basis for all subsequent inputs and decisions throughout the DQO process. The basis for developing the CSMs was process knowledge and historical records.

If additional elements are identified during investigation/characterization activities that are outside the scope of the CSMs as presented, the situation will be reviewed and a recommendation will be made has to how best to proceed. For example, if radionuclides are found to be present at CAS 25-16-01, a construction/sanitary waste pile, then the sample design will be reevaluated for its adequacy in generating the type of data required for decision making. In such cases, NDEP will be notified and given the opportunity to comment on, or concur with, the recommendation.

Future land-use scenarios limit future uses to various nonresidential uses (DOE/NV, 1998). Eleven of the CASs in Areas 25 and 26 are located within the Research, Test, and Experiment Zone under Alternative 3 (DOE/NV, 1998). This zone is designated for small-scale research and development projects; demonstrations; pilot projects; outdoor tests; and experiments for the development, quality assurance, or reliability of conditions. This zone includes compatible defense and nondefense research, development, and testing projects and activities (DOE/NV, 1998). Corrective Action

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Site 25-99-16 is located west of Area 25 on U.S. Bureau of Land Management property in Nye County. It is currently in an area under a mineral and mining leasing withdrawal for the Yucca

Mountain Site Characterization Project.

Exposure scenarios for sites located within the NTS boundaries are limited by the future land-use scenarios to site workers who may be exposed to COPCs through oral ingestion, inhalation, or dermal contact (absorption) of soils and/or debris (e.g., equipment, concrete) due to inadvertent disturbance of these materials. An additional exposure pathway through external/gamma exposure is present at

each site containing potential radiological contamination (e.g., CASs within the RMSF).

Several of the CASs are grouped together based on similar conceptual model elements and documented assumptions and are discussed in the following sections. Table A.1-1 provides information on additional CSM elements for each CAS that will be used throughout the remaining steps of the DQO process.

A.1.3.1 Waste Dumps and Landfills

This section describes CSM elements and assumptions for CASs designated as various types of waste disposal sites and include the following:

- 25-16-01
- 25-16-03
- 25-19-02
- 26-19-02
- 26-08-01

Debris of various origins are reportedly buried in the subsurface and covered with fill materials, with the exception of CAS 26-08-01 where debris is located primarily at the surface with no cover material. Figure A.1-1 and Figure A.1-2 show generalized representations of the CSM constructed for current site conditions at the waste disposal sites. The CSM diagram shown in Figure A.1-2 for CAS 26-19-02 (CWD-2) is required to illustrate differences in migration and transport pathways due to the presence of an engineered barrier.

The primary source of potential contamination for all five CASs is associated with the disposal and/or burial of various combinations of construction debris, sanitary waste, radiologically contaminated materials, and/or potentially hazardous wastes. Surface and subsurface soils are the affected media

Table A.1-1 Conceptual Site Model Description of Elements for Each CAS in CAU 168 (Page 1 of 2)

СЅМ	Waste Disposal Sites ^a				Contaminated Materials and Facilities ^b				Individual CSMs ^c			
CAS Identifier	25-16-01	25-16-03	25-19-02	26-19-02	26-08-01	25-23-02	25-23-13	25-34-01	25-34-02	25-23-18	26-17-01	25-99-16
CAS Description	Construction Waste Pile at E-MAD	MX Construction Landfill	Waste Disposal Site at R-MAD	Project Pluto Contaminated Waste Dump #2	Project Pluto Waste Pile/ Burn Pit	Radioactive Storage Railroad Cars	ETL Laboratory Radioactive Contamination	NRDS Contaminated Bunker	NRDS Contaminated Bunker	Area 25 Radioactive Material Storage	Project Pluto Waste Holding Area	Underground Southern Nevada Well USW G-3
Source(s) of Potential Contamination	Disposal of construction waste	Disposal of sanitary and construction waste	Surface disposal of discarded equipment and materials	Disposal of operational wastes	Disposal of construction waste and miscellaneous materials	Nuclear engine and rocket testing	Experiments with contaminated soils and animal parts	Contamination from storage of contaminated materials	Contamination from storage of contaminated materials	Nuclear engine and rocket testing; soil contaminated from stored materials	Radioactive effluent from building floor drains and test pad	Logging tool with gamma-radiation source lost downhole at approximately 1,250 ft bgs
Affected Media	Soil/sediment	Soil	Soil/sediment	Soil/concrete	Soil/sediment	Solid materials, predominantly metals	Solid materials	Concrete	Concrete	Soil and solid materials	Soil and effluent line piping	Concrete and bedrock
Site Status	Sites are inactive and/or abandoned with no additional disposal of materials or liquids Radioactively contaminated materials present at site may contribute additional contamination to soil Radioactively additional framework if it is unknown if drains are still open within building							drains are still open within	As of 1995, USW G-3 was used to monitor groundwater elevation, current status is not known			
Amount Released	cesiur							200 millicuries of cesium-137 as of July 30, 1977				
Potentially Released Material	Contaminants released or eroded from solids; residual amounts of fluids from discarded containers			Solubilized and/or particulate activation and fission products and uranium	Contaminants released or eroded from solids; residual amounts of fluids from discarded containers	Solubilized and/or particulate activation and fission products, and uranium	Solubilized and/or particulate radionuclides including plutonium and uranium isotopes	activation and fission products and uranium		Solubilized and/or particulate activation and fission products and uranium; hydrocarbons (grease and oil) from leaking equipment	Solubilized and/or particulate fission products and uranium	Cesium-137 source
Existing/Historical Data on COPCs	No records available				Alpha, beta, and gamma radioactivity above free release based on surveys and swipe counts	No records available			Radiological survey/sampling indicates above- background cobalt-60 and cesium-137 activity	Two surface soil samples analyzed for gamma emitters only naturally occurring radionuclides detected	Remaining activity calculated at 115 millicuries of cesium-137	

Table A.1-1 Conceptual Site Model Description of Elements for Each CAS in CAU 168 (Page 2 of 2)

СЅМ	Waste Disposal Sites ^a					Contaminated Materials and Facilities ^b				Individual CSMs ^c		
CAS Identifier	25-16-01	25-16-03	25-19-02	26-19-02	26-08-01	25-23-02	25-23-13	25-34-01	25-34-02	25-23-18	26-17-01	25-99-16
CAS Description	Construction Waste Pile at E-MAD	MX Construction Landfill	Waste Disposal Site at R-MAD	Project Pluto Contaminated Waste Dump #2	Project Pluto Waste Pile/ Burn Pit	Radioactive Storage Railroad Cars	ETL Laboratory Radioactive Contamination	NRDS Contaminated Bunker	NRDS Contaminated Bunker	Area 25 Radioactive Material Storage	Project Pluto Waste Holding Area	Underground Southern Nevada Well USW G-3
Migration Mechanism(s)	Soil: infiltration of precipitation Surface water and sediment: possible runoff to a natural wash	Soil: infiltration of precipitation	Soil: infiltration of precipitation Surface water and sediment: possible runoff to a natural wash	Soil: infiltration of precipitation (limited if disposal pit has concrete floor) From concrete surfaces: runoff of precipitation and/or degration of concrete may cause migration to soil	Soil: infiltration of precipitation Surface water and sediment: possible runoff to a natural wash	From railroad cars and material: runoff of precipitation and degradation of solids may cause migration to surface soil at CAS 25-23-18	From parts of system on roof: runoff of precipitation and/or degradation may cause release to environment From parts inside building: no credible pathway to environment	From concrete sur precipitation and/o concrete may caus at CAS 25-23-18	r degration of	Soil: infiltration of precipitation From materials: runoff of precipitation and degradation of materials may cause migration to soil	Soil: infiltration of precipitation Effluent line piping: potential flushing of contaminants from line	None (see text)
Groundwater	Groundwater impacts are not expected. The depth to groundwater measured in six wells in Jackass Flats (Area 25) varies between 710 to 1,160 feet (ft) below ground surface (bgs) (USGS, 1995a). In Area 26, perched groundwater is reported from 81 to 167 ft bgs (USGS, 1964). The regional water table in Area 26 is thought to be approximately 1,700 ft bgs (DRI, 1988).								Depth to groundwater in Well USW G-3 is 2,460 ft bgs (USGS, 1993)			

^aRefer to Section A.1.3.1 for additional text.

^bRefer to Section A.1.3.2 for additional text.

 $^{^{\}circ}\text{Refer}$ to Sections A.1.3.3 through A.1.3.5 for additional text.

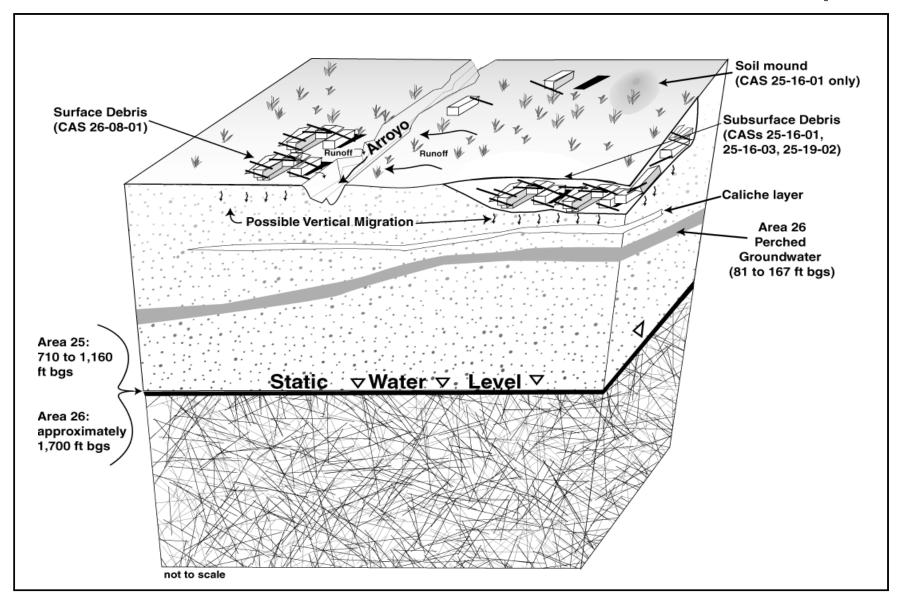


Figure A.1-1
Conceptual Site Model for Waste Disposal Sites

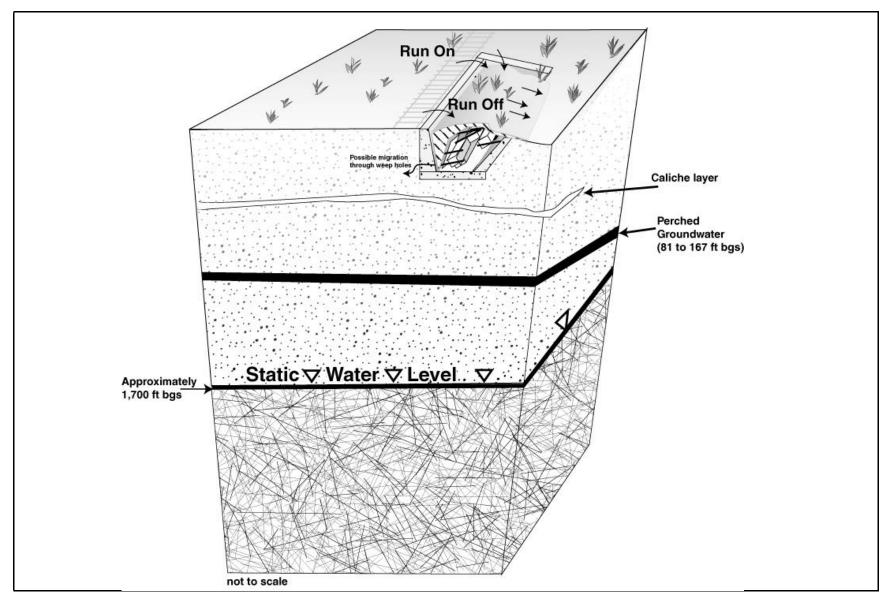


Figure A.1-2
Conceptual Site Model for CAS 26-19-02, Project Pluto Contaminated Waste Dump #2

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where material contributing to potential contamination may have been directly released via residual fluids in discarded containers, erosion of various contaminants off the surface of solid materials, and/or leaching of contaminants from materials. The primary materials disposed at each site as determined by historical information are listed in Table A.1-1.

The production of leachate generated in any of the waste disposal sites is assumed to be minimal based on low precipitation, high evapotranspiration rates, limited volumes of residual fluids from discarded containers, and the nature of debris/waste disposed at site (e.g., construction debris). For CASs 25-16-01, 25-16-03, 25-19-02, and 26-08-01, it is assumed that the waste disposal sites are not lined with engineered barriers; therefore, vertical migration of potentially hazardous leachate would typically predominate over lateral migration. However, three of the CASs are located within potential water courses (25-16-01, 25-19-02, and 26-08-01), which increase the likelihood of lateral migration of contaminants downstream during heavy rainfall events. The CWD-2 (CAS 26-19-02) is constructed with concrete barriers so that vertical and lateral migration of potential radioactive leachate would be restricted from reaching surrounding soils.

Historical documentation and field observations identify the approximate locations of buried materials at CASs 25-16-01 (E-MAD area) and 25-16-03 (MX landfill). Although geophysical surveys are not yet available for CAS 25-16-01, it is assumed that subsurface anomalies identified by geophysics represent the areas of buried waste and locations of any COPC releases into the environment. Process knowledge indicates that only construction and possibly sanitary wastes were disposed of at these two sites. Historical photos indicate that material was burned within a trench or depression at CAS 25-16-01, thereby potentially limiting the volume of debris.

At CAS 25-19-02 (R-MAD area), historical documentation provides information for only the "potential" of buried materials. There are no records that specifically identify the area as a buried waste disposal area, rather the area has been historically identified as a holding area. Therefore, its assumed that if debris (and consequently potential contamination) is present anywhere within geographic area of the CAS, it will be located at subsurface geophysical anomalies identified in recent surveys. In addition, it is assumed that material would be close to the surface (e.g., less than 5 ft bgs) since the area was not originally designated as a burial waste dump or landfill. The anomalies suggest discrete, separate areas rather than a trench-like configuration. If buried material

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is identified, its assumed that materials may be radiologically contaminated based on historical R-MAD operations.

Debris and waste, and consequently any contamination, present at CAS 26-08-01 is confined to the surface and near-surface soils and primarily along the north side of a small drainage. The debris present can be divided conceptually into four populations or source terms based on common properties within each population. These consist of (1) soil piles, (2) construction debris, (3) miscellaneous debris, and (4) the burn pit soil. The existence and location of a burn pit has not been confirmed. Uses for the pit are assumed to have been burning trash, debris, and possibly explosives. If explosives were burned, residues are assumed to be minimal based on burning properties of explosives. The debris appears stable along sides of wash, but erosion into the arroyo during heavy rainfall and flash flood events is possible. However, the arroyo appears to have been modified by construction activities for the Project Pluto Testing facility, which subsequently truncated the arroyo from the upstream drainage. This limits the potential volume of water for flash flood events to the drainage from the immediate area.

Based on historical documentation and recent radiological surface surveys, potentially radiologically contaminated materials at CAS 26-19-02 are not immediately located at the surface. Based on field observations during recent site visits, limited excavation appears to have occurred in portions of the dump which could have diminished the original volume of waste. However, no documentation has been identified to support this assumption. Based on field observations of the exposed sections, the concrete barriers of the CWD-2 appear to be intact with minimal degradation. A linear anomaly observed in geophysical survey data appears to represent a buried sloping concrete wall; it is not caused by buried waste or debris.

A.1.3.2 Contaminated Facilities and Materials

Corrective action sites with radiologically contaminated materials and/or facilities comprise this CSM. Individual CSM diagrams are not included for these sites; however, the CASs located within the RMSF are included in Figure A.1-3 as sources of potential contamination to surrounding soils. This CSM includes the following CASs:

- 25-23-02
- 25-34-01

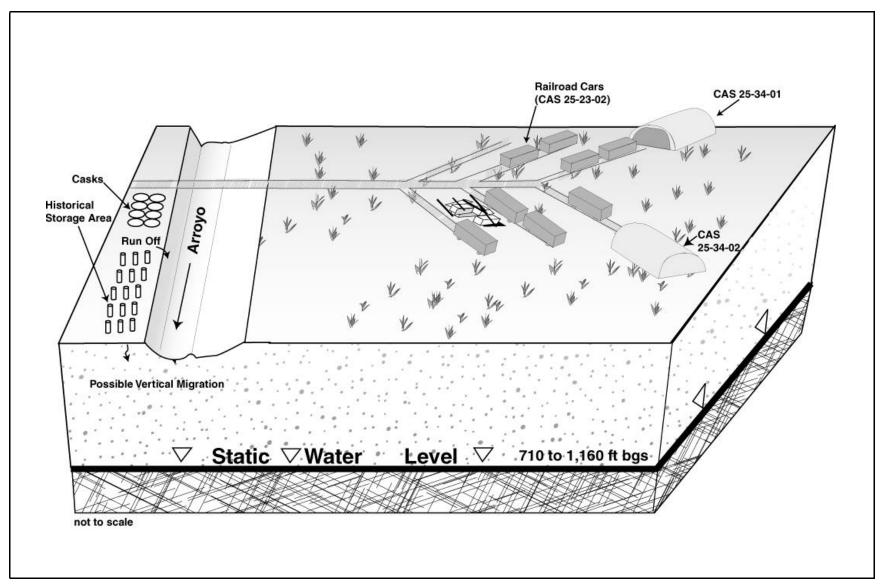


Figure A.1-3
Conceptual Site Model for CASs in the Radioactive Material Storage Facility

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- 25-34-02
- 25-23-13

These CASs are grouped together based on the nature of contamination affecting surfaces of structures such as walls, concrete, and various metallic parts rather than soil contamination. The COPCs, if present, are associated with the release of radionuclides directly or indirectly onto the surface of materials. The primary sources of radioactivity were activation and fission products from the nuclear engine/reactor testing at Area 25 and 26 at four of five CASs. The source of release for the fifth CAS, 25-23-13, was various soil and animal tissue experiments involving a variety of radionuclides at the TTF laboratory. The original source terms for all five CASs have been removed.

With the exception of CAS 25-23-13, all sites have the potential for migration of removable radionuclides from structural surfaces to surrounding soils via precipitation runoff and/or corrosion of the material (e.g., metal). In each case, resulting contamination from migration of these contaminants is covered by other CASs; therefore, investigation activities would be limited to the structures themselves and not the surrounding soil. For example, the extent of contamination on the concrete bunker walls will not extend to include the soils at the ground surface because those soils will be investigated under CAS 25-23-18.

At CAS 25-23-02, parts of the railroad cars and other materials stored on the cars are known to have been directly activated by the neutron source present during nuclear engine/reactor operation; additionally, fission products and uranium fuel particles may be present on the same materials. Activation products may decay to removable contamination and activated materials may corrode or rust, subsequently contributing radiological contamination as a secondary source to underlying soil and nearby structures. Removable and fixed fission products and uranium fuel particles are considered to be secondary sources of contamination to buildings, surrounding soil, and other nearby materials.

The concrete bunker walls (CASs 25-34-01 and 25-34-02) are potentially contaminated through their use as storage areas for radiologically activated and contaminated materials resulting from nuclear engine/reactor testing. The primary sources of potential contamination of the concrete surface are: (1) direct contact with materials contaminated with activation and fission products and/or uranium fuel particles, and/or (2) through indirect processes, such as erosion, where contaminated particles from RR cars and their materials are carried onto the concrete by wind or water. It is assumed the

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concrete is not activated because a neutron source did not exist at the facility. Based on the known uses and type of materials stored, its assumed contamination of the concrete would be limited to the surface only and the highest concentrations of COPCs located on the lower half of the walls (i.e., the height of RR car with stored equipment) and near the roof vent. If contamination is present on bunker walls, runoff of precipitation and/or degradation of concrete may cause migration to surrounding soil included under CAS 25-23-18.

The source of contamination released onto the vent hoods or other posted radiological area within the ETL/TTF laboratory (CAS 25-23-13) are a result of various experiments with radiologically contaminated soils and animal tissues. Currently, no viable transport mechanism exists for the migration of radionuclides remaining on the equipment within the building; however, potential contamination on the roof may migrate due to precipitation. The extent of contamination from the vent hood through other building structures is unknown. Any residual amounts of potentially hazardous chemicals remaining within the hoods such as mercury are not expected in amounts that pose an unacceptable risk to human health; therefore, they will not be investigated.

A.1.3.3 CSM for CAS 26-17-01, Pluto Waste Holding Area

Figure A.1-4 shows a generalized CSM constructed for surface releases with limited potential for subsurface migration. This generalized model applies to the current conditions at CAS 26-17-01. The following text provides information unique to CAS 26-17-01.

The COPCs, if present, are associated with potentially radioactive effluent from the Project Pluto Test Bunker (Building 2203) floor drains and test pad. The release of contaminants and the driving force for their migration into soil was limited because of the relatively short duration of Project Pluto in the early 1960s; however, subsequent use of the basin is not known. Affected media include the VCP pipeline, surface soil in the holding basin, and shallow subsurface soil beneath the basin and possibly beneath the pipeline.

Effluent was removed from the basin by the combined effects of evaporation and infiltration. The holding basin is unlined so vertical migration of COPCs, in the absence of an impermeable layer (e.g., caliche), will predominant over lateral migration. Migration will be limited due to the low mobility of expected COPCs in soils (primarily radionuclides), the lack of precipitation, and high evaporation rates.

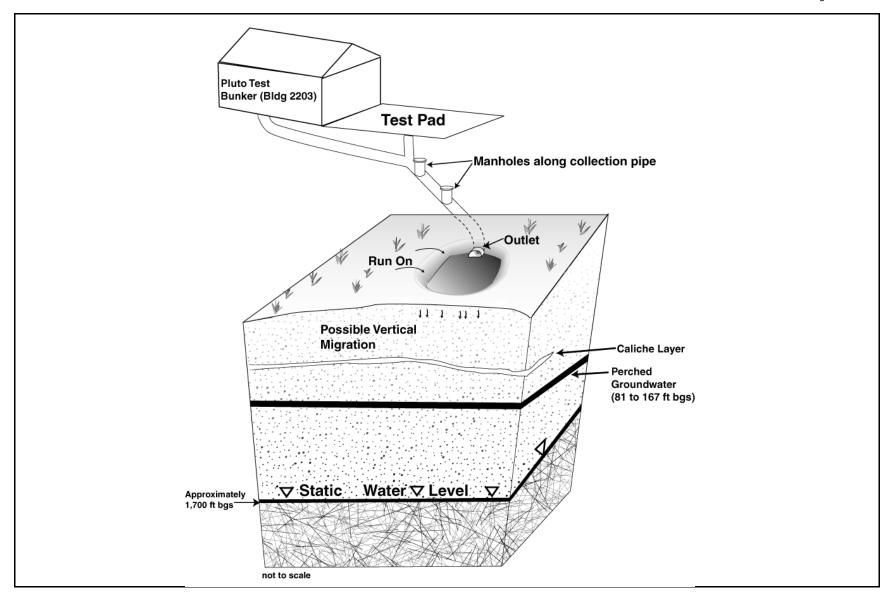


Figure A.1-4
Conceptual Site Model for CAS 26-17-01, the Pluto Waste Holding Area

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Contaminants, if present within the basin, will tend to accumulate in higher concentrations at particular locations based on distinguishing physical and chemical characteristics of the contaminants and the liquid transport media. For example, some radionuclides would tend to be found in higher concentrations at the surface and near an influent location because of their low solubility and association with large-sized particles. Other distinguishing characteristics can be used to draw inferences on other locations within the basin. The following areas represent the preferential locations:

- Surface and near-surface at the outfall pipe, where contaminants of low solubility, higher density, and/or associated with large-sized particles would tend to accumulate.
- Near-surface and subsurface at the lowest surface elevation within the basin, where contaminants of high solubility, lower density, and/or associated with smaller-sized particles would tend to accumulate.
- Near the base of the historically lowest elevation, where contaminants of higher density would tend to accumulate.

The VCP effluent pipeline may also be contaminated with COPCs. It is likely that effluents discharged to the system were aqueous, with little or no solids, so it is also likely that the pipe does not contain residual contaminated solid material. It is possible that effluent may have been released to shallow subsurface soil at an unrepaired break or leak in the pipeline.

A.1.3.4 CSM for CAS 25-23-18, Radioactive Material Storage Facility

Figure A.1-3 shows a generalized CSM constructed for current conditions at CAS 25-23-18. Radionuclides are the primary contaminants in surface soils. The radionuclides are associated with releases through direct contact with or by erosion and runoff from contaminated materials and equipment stored historically and/or currently at various locations in the facility. Remaining potential sources of contamination to the soils of this CAS include railroad cars (CAS 25-23-02), equipment stored between Spurs M and N, and equipment stored near the western gate of the RMSF.

Surface geophysical surveys performed in April 2001 at several suspect locations did not locate any anomalies indicative of buried objects or debris. This finding is consistent with the use of the RMSF as a storage facility, not a disposal facility. Thus, potential contamination at the RMSF is confined to surface soil.

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Several assumptions are made regarding the location of contamination within the RMSF. One assumption is that any incidental chemical contamination present within the site (e.g., hydraulic fluid from railroad cars) will be colocated with known areas of radiological contamination. This is based on assumption that the RMSF was used for storing radiologically contaminated materials, not hazardous materials. Secondly, because radionuclides typically do not infiltrate into surface soils more than a few inches under the climatic conditions prevalent at the NTS, any radiological contamination within the RMSF will be identified through radiological soil surveys.

Lateral migration of contaminants, whether solubilized or in particulate form, is possible via precipitation, runoff, and erosion. These driving forces will become enhanced if contamination migrates into arroyos crossing through the site boundaries. Physical characteristics of the COPCS, low precipitation, and high evaporation rates limit vertical migration.

A.1.3.5 CSM for CAS 25-99-16, Well USW-G3

This CSM applies only to CAS 25-99-16. Figure A.1-5 shows a generalized CSM constructed for this site. A cesium-137 source from a downhole geophysical logging tool was accidentally emplaced in Well USW-G3 during drilling operations. The source is encased within cement at approximately 1,250 ft bgs within a plugged portion of Well USW-G3. The source is approximately 1,210 ft above the water table, based on a depth to groundwater of 2,460 ft bgs (USGS, 1993).

Cesium-137 is the only COPC at CAS 25-99-16. As of 2001, the activity of cesium-137 remaining is calculated to be 114.9 mCi. Cement and possibly adjacent bedrock are the affected media within the CAS. As discussed below, groundwater would not be affected due to lack of a mechanism to transport cesium-137 to the saturated zone.

A pathway to potential receptors is currently not present since the source is encased in cement and the distances from the ground surface to the source and the source to groundwater are large (i.e., both are approximately 1,200 ft). Given the low precipitation rate of less than 10 inches per year (USGS, 1995b) and location of the source in the vadose zone, aqueous transport of Cs-137 to groundwater is not feasible. The only viable future exposure pathway is to intercept the source by drilling through the plugged portion of the well.

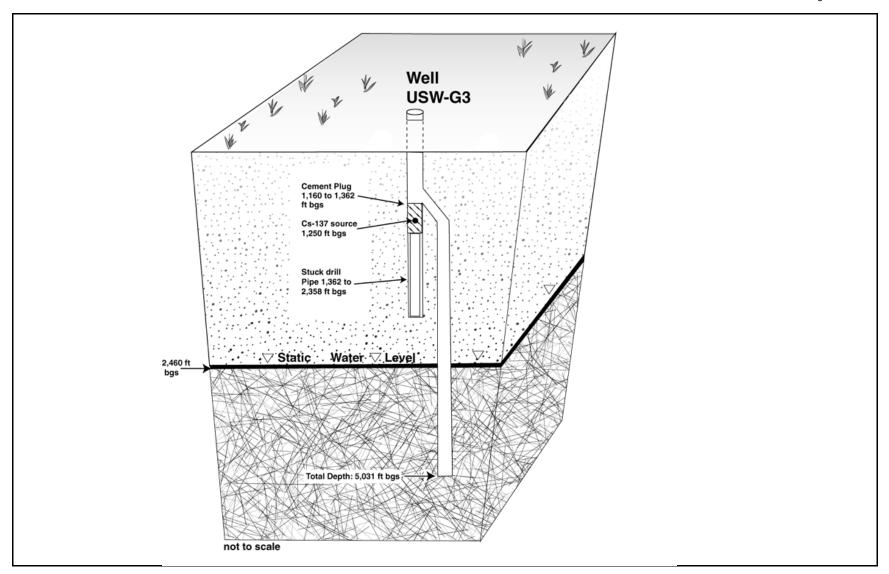


Figure A.1-5
Conceptual Site Model for CAS 25-99-16, Well USW G-3

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Well USW-G3 is located in the Yucca Mountain Site Characterization Project zone on U.S. Bureau of Land Management (BLM) land. The BLM granted the DOE a right-of-way reservation for Yucca Mountain site characterization activities. Well USW-G3 is within an area of BLM land withdrawn from subsurface exploration by Public Land Order 6802 (BLM, 1990). This land order, which will expire September 2002, was established to maintain the physical integrity of the subsurface environment for the Yucca Mountain Site Characterization Project.

A.1.4 Data Quality Objective Decision Flow

Figure A.1-6 depicts the decision flow process that will be applied to the investigation of CAU 168. All CASs within CAU 168 start at the beginning of the flow process. The decision diamonds with shadows are key points in the flow path in which a CAS may proceed to the end point of the process (i.e., the investigation is complete). Therefore, resolving these decisions are the focus of the DQO process. Details regarding criteria and metrics that need to be met in order to resolve these decisions are the focus of DQO Steps 3 and 7 of both the Phase I and Phase II DQO processes. Decision points which require that a consensus be reached between NNSA/NV and the NDEP prior to continuing are indicated in the diagram with asterisks. Contingencies are built into the process in the event new information indicates that a CAS should move directly to a Phase II investigation.

Sufficient information about CAS 25-99-16 (USW-G3) has been collected through historical documentation and the CSM regarding the nature and extent of contamination and potential risk to a receptor such that a preferred corrective action alternative can be selected for site closure. Following the decision flow path, the site bypasses Phase I due to the known presence of Cs-137 contamination, continues through with positive responses to the decision points of nature and extent to reach the "completed investigation" end point. Therefore, this CAS will not be addressed in the DQO process and the selection of a corrective action will be addressed in the CADD. The existing site information is documented in Section 2.0 of the CAIP.

All other CASs, except 25-23-02, 25-23-18, and 25-23-13, are expected to follow the flow path to a Phase I data collection. The railroad cars (CAS 25-23-02), surface soils at the RMSF (CAS 25-23-18), and materials at the TTF (CAS 25-23-13) are known to be radiologically contaminated, so these CASs will advance directly to a Phase II investigation.

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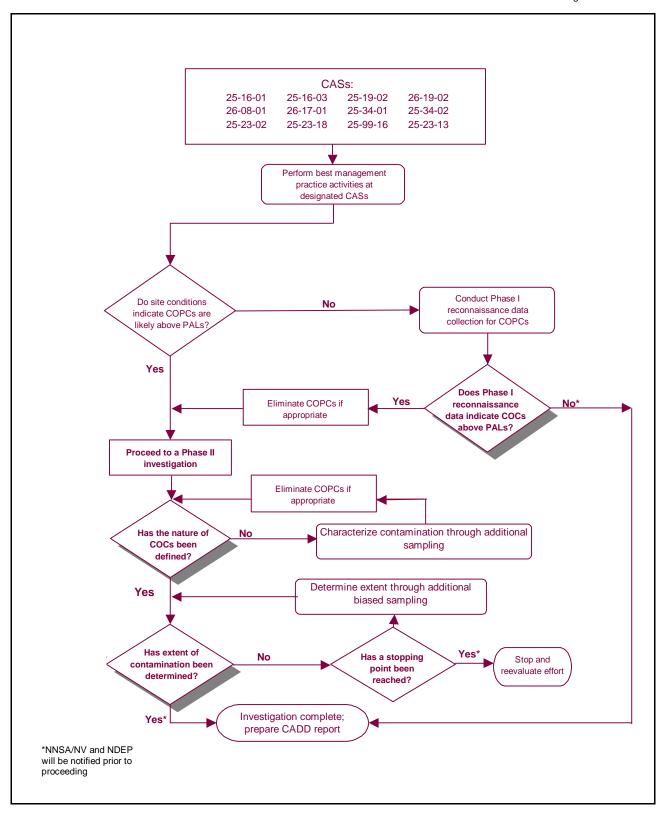


Figure A.1-6
Data Quality Objective Decision Flow

A.2.0 Seven-Step DQO Process for Phase I Investigations

This section discusses the seven-step DQO process for Phase I investigations. The objective of a Phase I investigation is to determine whether or not contaminants of concern are present at potentially unacceptable risks to human health, thereby requiring further investigation.

A.2.1 Step 1, State the Problem

It is unknown if hazardous and/or radioactive contamination is present; thus further investigation is required.

A.2.2 Step 2, Identify the Decisions

The following is the Phase I investigation decision:

• Determine whether COPCs are present above PALs.

Analytical sample data may be collected for a site prior to investigation in order to provide data for waste management and/or health and safety decisions. This data, if generated, will be evaluated to determine if it can be used in any of the decisions.

A.2.2.1 Alternative Actions to the Decisions

The following is the alternative action to the decision:

• If no COPCs exceed PALs, further assessment is not required and results will be documented in the CADD. If any COPCs exceed PALs, a Phase II investigation will be conducted at the CAS to determine exact nature and extent of contamination.

A.2.3 Step 3, Identify Inputs to the Decision

Prior to resolving the Phase I decision, best management practice activities will be performed as identified in and according to the CAIP. All completed best management practice activities and their results will be documented in the CADD.

If existing information and/or field observations following best management practice activities indicate that the site is likely contaminated with COPCs above PALs, then the CAS moves directly to a Phase II characterization. On the other hand, if information is insufficient to indicate the presence

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of contamination, then a Phase I assessment will be appropriate to determine the presence or absence of contamination. Based on existing information, three CASs (25-23-02, 25-23-18, and 25-23-13) will advance directly to a Phase II investigation (described in Section A.3.0).

In order to resolve the Phase I decision of determining if contamination is present above PALs, sample data must be collected and analyzed following two criteria: (1) if contamination is present within the CAS, it will be sampled; and (2) the analyses must be sufficient to detect any contamination present within those samples. Table A.2-1 provides the information/data need to meet these two criteria as well as the information metric by which to measure that the appropriate information was collected to meet the criteria. The last column addresses the quality metric required for a particular data collection activity and is determined by the intended use of the resulting data in decision making.

Other identified information needs which are not directly related to the principal study questions are listed below and will be discussed in detail in Section 4.0 of the CAIP:

- Collect GPS coordinates of all sample locations and delineation of boundaries of CAS features (e.g., foundations).
- Perform housekeeping activities on miscellaneous debris at various sites.
- Collect data to make appropriate waste management/disposal decisions.

A.2.3.1 Determine the Basis for the Preliminary Action Levels

Laboratory analytical results will be compared to the following PALs to evaluate if COPCs are present and require further investigation:

- EPA Region 9 Risk-Based Preliminary Remediation Goals for Industrial Soils (EPA, 2000).
- TPH concentrations above the TPH limit of 100 ppm per the Nevada Administrative Code (NAC) 445A.2272 (NAC, 2000c)
- Background concentrations for RCRA metals will be evaluated when natural background exceeds the PAL (i.e., arsenic). Background is considered the mean plus two times the standard deviation of the mean based on data published in *Mineral and Energy Resource* Assessment of the Nellis Air Force Range (NBMG, 1998).

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Table A.2-1 Phase I Identified Information/Data Needs to Resolve Decision

(Criteria 1 - If Contamination is present in the CAS, it will be sampled			
Information/Data Needs	Information Metric	Quality Metric ^a		
Determine sample locations that would contain contamination, if present	The CAS-specific metrics are described in DQO Step 7. Locations will be selected based on biasing factors.	Qualitative Semiquantitative		
Collect samples from those locations	Minimum number of samples will be submitted for analysis.	Quantitative		
Criteria 2 - If cor	ntamination is present in samples at concentrations above PALs, it will be detect	ed		
Information/Data Needs	ntion/Data Needs Information Metric			
Perform analyses that would detect contamination present at concentrations above PALs	All Phase I soil samples will be analyzed for gamma spectroscopy to detect the presence of potential radionuclide at concentrations above PALs. Analyze all soil samples from CASs 25-16-01, 25-16-03, 25-19-02, 26-19-02, 26-08-01, 26-17-01, and 25-23-18 for TPH (oil and diesel), VOCs, SVOCs, RCRA metals, and PCBs. Analyze all soil samples from CASs 26-19-02, 26-17-01, and 26-08-01 for beryllium. Collect radiological scanning survey data and swipe counting data for free-release determination at CASs 25-34-01 and 25-34-02	Quantitative Semiquantitative		
	Other Phase I Information Needs	1		
Information/Data Needs	Information Metric	Quality Metric ^a		
Determine extent of waste for landfill CASs that do not have Phase II investigation.	A geophysical survey will be conducted at qualifying CASs to identify anomalies that would indicate the extent of disposal cells. Pothole will be excavated at two locations per cell to verify geophysical data.	Semiquantitative		

^aQuantitative 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.

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 of interest 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. The data are often used to guide investigations toward quantitative data collection.

Qualitative data identify or describe the characteristics, components, or features of the population of interest. The QA/QC requirements are the least rigorous on data collection methods and measurement systems. Professional judgement is often used to generate qualitative data. 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.

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- For COPCs without established PRGs, a protocol similar to EPA Region 9 will be used in establishing an action level; otherwise, an established PRG from another region will be chosen.
- For radiologically contaminated materials and structures, the total residual surface contamination for unrestricted release of materials and equipment to the general public allowed by DOE Order 5400.5 (DOE, 1993) and as defined in the *NV/YMP Radiological Control Manual* (DOE/NV, 2000).
- The PALs for radiological results are isotope-specific for the radionuclides identified and are defined as the maximum concentration for that isotope found in environmental samples taken from undisturbed background location in the vicinity of the NTS, as presented in McArthur and Miller (1989), Atlan-Tech (1992), and BN (1996).

A.2.3.2 Potential Sampling Techniques and Appropriate Analytical Methods

Samples will be collected at biased sampling locations by hand augering, backhoe excavation, direct-push, or drilling techniques as appropriate. Sample collection and handling activities will follow standard procedures. Section 3.0 and Section 6.0 of the CAIP provides the analytical methods and laboratory requirements (i.e., detection limits, precision, and accuracy requirements) to be used when analyzing the COPCs as listed in Table A.2-1. Unless otherwise required by the results of this DQO and stated in the CAIP, this investigation will adhere to the Industrial Sites QAPP (DOE/NV, 1996).

A.2.4 Step 4, Define the Boundaries of the Study

The purpose of this step is to define the target population of interest and specify the spatial and temporal features of the population that are pertinent for decision making.

A.2.4.1 Define the Target Population

The target population for each CAS is defined in Table A.2-2.

A.2.4.2 Determine the Spatial and Temporal Boundaries

The spatial boundaries that apply to each CAS are defined in Table A.2-3 and encompass the area under investigation for that CAS. Each CAS is considered geographically independent. Although CASs 25-34-01, 25-34-02, and 25-23-02 are located within the boundaries of CAS 25-23-18, their boundaries are distinct and will be considered separate for investigation purposes.

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Table A.2-2 Target Populations for CASs

CAS	Target Population
25-16-01	COPC concentrations within surface ^a and subsurface soils
25-16-03	COPC concentrations within surface and subsurface soils
25-19-02	COPC concentrations within surface and subsurface soils
26-19-02	COPC concentrations within surface and subsurface soils
26-08-01	COPC concentrations within surface and subsurface soils
26-17-01	COPC concentrations within surface and subsurface soils
25-23-18	COPC concentrations within surface and subsurface soils
25-34-01	Radionuclide concentrations on surface of concrete walls
25-34-02	Radionuclide concentrations on surface of concrete walls
25-23-02	Radionuclide concentrations of railroad car materials and equipment stored on cars; COPC concentrations in fluids within cars (primarily a concern for the locomotives)
25-23-13	Radionuclide concentrations on surface of materials and associated building structures

^aDefined as 0- to 6-inch vertical soil interval.

Temporal boundaries are those time constraints set up by weather conditions and project schedules in the baseline. Temporal constraint due to weather conditions are not expected in Areas 25 and 26. However, rainfall and snow events will place constraints on sampling and surveying of radiologically contaminated soils because of the attenuating effect of moisture on 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 last 10 to 40 years since last used. Current schedules for submitting the CAIP are September 28, 2001, for the Draft CAIP and November 30, 2001, for the Final CAIP. Field work is currently scheduled to begin in FY 2002.

A.2.4.3 Identify Practical Constraints

The NTS-controlled activities may affect ability to characterize these sites. Table A.2-4 indicates other practical constraints that may be encountered at each CAS.

Table A.2-3
Phase I Spatial Boundaries Identified for CASs Within CAU 168

CAS	Spatial Boundary
25-16-01	Area of visible debris adjacent to soil mound, including soil mound; will include any geophysical anomalies identified by surveys
25-16-03	Boundary of landfill marked by monuments
25-19-02	Geographic area that encompasses each of the five geophysical anomalies
26-19-02	Physical boundaries of concrete barrier walls and base
26-08-01	The extent of visible debris on north side of arroyo and 200 ft to the north away from the wash
26-17-01	Physical boundaries of basin surrounding the outfall area; includes the length of underground piping from outfall to building foundation
25-23-18	The outer perimeter fence
25-34-01	Concrete walls from wall base to roof, including vent
25-34-02	Concrete walls from wall base to roof, including vent
25-23-02	Railroad cars including equipment and materials storied on them
25-23-13	Vent hood and its system components within the laboratory to the roof area and adjacent building structures (e.g., wall behind hood)

A.2.4.4 Define the Scale of Decision Making

The scale of decision making is defined as each individual CAS so that individual CASs may be advanced to a Phase II characterization, if necessary, rather than submitting the entire CAU. The scale also allows for corrective actions appropriate to each CAS rather than the entire CAU.

A.2.5 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.2.5.1 Specify the Population Parameter

Because the sampling design is biased towards likely locations of contamination, the population parameter will be the maximum observed concentration of each COC within each CAS.

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Table A.2-4
Practical Constraints Identified for CAU 168

CAS	Utilities Likely to be Encountered ^a	Topography/Site Conditions Likely to Effect Planned Activities	Structures (e.g., materials, building) Likely to Effect Planned Activities	Area Subject to Access Restrictions ^b
25-16-01	No	No	No	No
25-16-03	No	No	No	Yes
25-19-02	No	No	No	No
26-19-02	No	Yes	Yes	Yes
26-08-01	No	No	Yes	Yes
26-17-01	Yes	No	Yes	Yes
25-23-18	Yes	Yes	Yes	Yes
25-34-01	Yes	No	Yes	Yes
25-34-02	Yes	No	Yes	Yes
25-23-02	No	No	No	Yes
25-23-13	Yes	No	Yes	Yes

^aUtility constraints are subject to change as detailed information is collected prior to commencement of investigation activities and will be appropriately documented.

A.2.5.2 Choose an Action Level

Action levels were defined in Step 3 (Section A.2.3).

A.2.5.3 Measurement and Analysis Methods

This step was previously addressed in Step 3 (Section A.2.3.2). The measurement and analysis methods given in Section 6.0 of the CAIP are capable of performing over the expected range of values, and the detection limit of the measurement method to be used is less than the action limit for each COPC.

A.2.5.4 Decision Rule

If laboratory data indicate the maximum observed concentrations of COPCs are below PALs within a CAS, then further investigation at that CAS is not required. If laboratory data indicate concentrations of a COC exceed PALs, then proceed to Phase II investigation.

^bAccess restrictions include both scheduling conflicts on the NTS with other entities and areas posted as contamination areas requiring appropriate work controls.

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A.2.6 Step 6, Specify the Tolerable Limits on Decision Errors

The sampling approach for the Phase I investigations relies upon biased samples; therefore, statistical analysis is not appropriate.

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

- Baseline condition COPCs are present above PALs
- Alternative condition COPCs are not present above PALs

A.2.6.1 False Rejection Decision Error

The false rejection or alpha error would mean accepting that COPCs are not present above PALs when they really are, increasing risk to human health and environment.

The false rejection decision error is controlled by meeting the following two criteria: (1) having a high confidence that the sample locations selected will identify COCs above PALs if present within the CAS; and (2) having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples. To satisfy that the first criteria is met, locations for Phase I samples will be chosen using biasing factors as described in Step 7 (sample design). To meet the second criterion, all samples will be analyzed for the appropriate COPCs as defined in Table A.2-1 using the analytical methods provided in Section 6.0. Following established quality assurance procedures during sample collection, handling, and analysis, as well as during the evaluation of results protects against false negatives.

A.2.6.2 False Acceptance Decision Error

The false acceptance error or beta error would mean accepting that COCs are above PALs when they are not, resulting in increased costs for unneeded characterization.

The false acceptance decision error is controlled by protecting against false-positive analytical results. False-positive results are typically attributed to laboratory errors and sampling/handling errors. Quality assurance/quality control samples such as field blanks, trip blanks, laboratory control samples, and method blanks should minimize the risk of a false-positive analytical result. Other factors are following established procedures for decontamination of sampling equipment to avoid cross contamination, and using clean sample containers.

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A.2.6.3 Quality Assurance/Quality Control

Quality control samples will be collected as required by established procedures. The required QC samples include:

- Trip blanks (1 per sample cooler containing VOC environmental samples)
- Equipment blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per batch of equipment or supplies [e.g., direct-push liners or decontamination water])
- Field duplicates (minimum of 1 per 20 environmental samples or 1 per CAS if less than 20 collected)
- Field blanks (minimum of 1 per 20 environmental samples or 1 per sampling location)
- Matrix spike/matrix spike duplicate (minimum of 1 per 20 environmental samples or 1 per CAS if less than 20 collected)

Additional QC samples may be submitted based on site conditions.

Quality data indicators of precision, accuracy, comparability, completeness, and representativeness are defined in the Industrial Sites QAPP (DOE/NV, 1996). Sensitivity has been included as a DQI for laboratory analysis. Site-specific data quality indicators are discussed in more detail in Section 6.0 of the CAIP.

A.2.7 Step 7, Optimize the Design for Obtaining Data

The objective of the Phase I investigation strategy is to determine whether COPC concentrations are present above PALs. Laboratory analytical results from this phase will be used to confirm the presence or absence of COPCs and if the concentrations exceed PALs. If field data generated during the course of the Phase I investigation strongly indicate that COPCs are above PALs, the investigation may proceed directly to a Phase II characterization without support of analytical results (i.e., heavy concentrations of hydrocarbon staining and odor). The COPCs determined not to be present in Phase I may be eliminated from further consideration during a Phase II characterization effort.

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A biased sampling strategy will be conducted at CAU 168 during Phase I to target areas with the highest potential for contamination, if it were present anywhere within the CAS. The justification behind the selection of biased sample locations will be based on a variety of biasing factors to meet the criteria that if contamination were present anywhere within the CAS, it will be sampled. A general list of the biasing factors to be considered during the selection of the location are indicated below. As the sampling strategy for each CAS is provided, the primary biasing factors used in justifying a sample location will be described:

- Visual indicators such as staining, discoloration, and/or textural discontinuities
- Location of debris/waste
- Odor
- Elevated screening results
- Geophysical survey data
- · Radiological survey data
- Physical and chemical characteristics of contaminants
- Known source and location of release
- Geologic and/or hydrologic conditions
- Process knowledge and experience at similar sites

In the absence of other biasing factors, default sampling locations are described for each CAS.

A.2.7.1 CAS 25-16-01, E-MAD Construction Waste Pile

Site preparation activities will include surface geophysical and radiological surveys, and general housekeeping to pick up and dispose of objects and debris (e.g., pieces of metal and wood) present on the ground surface. The geophysical survey will consist of electrical imaging methods and possibly ground-penetrating radar to aid in confirming and/or determining the location and configuration of the buried waste pile. Although radionuclides are not expected COPCs, a radiological survey will be performed on surface soils in the area where construction waste is assumed to be buried to identify any potential areas of radiological contamination. The soil mound present at the site will also be included in the surveys. The geophysical survey will not serve as a biasing factor, but instead allows confirmation of the configuration of the waste pile.

Assuming that the waste pile is a linear feature, a minimum of three excavations will be made perpendicular to the long axis of the feature to access and collect biased soil samples. Each excavation will be continued to the depth of the waste/native soil interface and will have a minimum of one sample collected based on the primary biasing factors of staining, odor, screening, and/or

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textural discontinuities. Additional biasing factors may be identified during the course of the investigation. A minimum of one sample per identified biasing factor will be collected and submitted for analysis. If no biasing factor is identified, the first 12 in. of soil below the waste/native soil interface will be submitted for analysis.

If the geophysical surveys locate discontinuous anomalies, then geophysics becomes a primary biasing factor in determining locations of excavations to identify and/or confirm buried waste and access potential sample locations. The same biasing factors as described above will apply in determining sample locations within these excavations.

An additional excavation will target the soil mound. If the mound contains waste or debris, a biased soil sample will be collected. To support decisions regarding closure alternatives, the boundaries of the buried construction waste pile will be determined by excavation. For the small surface waste pile located north of the soil mound, a minimum of one surface soil sample will be collected from beneath surface debris using the primary biasing factors of staining, odor, screening, and/or process knowledge.

A.2.7.2 CAS 25-16-03, MX Construction Landfill

Two linear trending subsurface features were identified in previous geophysical surveys at the MX construction landfill and will be investigated as the buried construction waste. Site preparation activities will include general housekeeping to pick up and dispose of objects present on the ground surface.

A minimum of three excavations will be made perpendicular to the long axis of both linear trending features, for a total of six excavations, to determine the types of debris present and access potential sampling points. Each excavation will be continued to the depth of the waste/native soil interface and will have a minimum of one sample collected based on the primary biasing factors of staining, odor, screening, and/or textural discontinuities. Additional biasing factors may be identified during the course of the investigation. A minimum of one sample per identified biasing factor will be collected and submitted for analysis. If no biasing factor is identified, the first 12 in. of soil below the waste/native soil interface will be submitted for analysis.

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A.2.7.3 CAS 25-19-02, R-MAD Waste Disposal Site

Site preparation activities will include general housekeeping to pick up and dispose of objects and debris currently present on the ground surface.

Because process knowledge suggests that equipment was stored at this site, rather than disposed in the subsurface, geophysical anomalies will be used as a primary biasing factor in determining where to excavate. A minimum of one excavation will be made at each anomaly to determine whether or not material is present. The excavation will not continue past 5 ft bgs if material is not identified. This is a reasonable depth based on geophysical results and the assumption that material would be close to the surface since the area was not originally designated as a burial waste dump. If buried material is found, the excavation will continue until the waste/native soil interface is identified. A minimum of one sample per excavation will be collected and submitted for analysis based on the primary biasing factors of visual indicators, odor, and screening. If these biasing factors are not evident, then a soil sample will be collected from the first 12 in. of soil below the waste/native soil interface.

If the geophysical anomalies are attributed to natural materials (e.g., boulders or caliche layer) and no evidence of contamination is found within an excavation, a minimum of three surface soil samples (0-6 in.) will be collected based on the highest radiological survey results within the defined spatial boundaries or areas of surface debris.

A.2.7.4 CAS 26-19-02, Pluto Contaminated Waste Dump #2

This CAS is well-bounded spatially by the presence of concrete walls that form an enclosed pit. Geophysical surveys show the presence of a buried linear feature along the southeastern edge of the dump; it is thought that this feature is a buried sloping concrete wall identified from historic photographs. Other than the anomaly thought to represent the sloping wall, anomalies are not observed in the geophysical data. To determine the feasibility of using a backhoe excavation technique for accessing sampling locations within potentially radiologically contaminated soil and materials, a direct-push may be performed within the soil at one or more locations.

A minimum of three excavations extending to the base of the concrete pit will be performed to determine the types of debris present and access potential sampling points. Each excavation will have

a minimum of one sample collected based on the primary biasing factor of radiological field screening. Additional biasing factors may be identified during the course of the investigation. A minimum of one sample per identified biasing factor will be collected and submitted for analysis. If no biasing factor is identified, soil samples will be collected at the base of the concrete pit and submitted for analysis.

A.2.7.5 CAS 26-08-01, Pluto Building 2204 Waste Pile/Burn Pit

This site is divided into four distinct populations: soil piles, miscellaneous debris, construction debris, and the burn pit soil. The minimum number of soil samples to be collected and the primary biasing factors in selecting sample locations for each population are identified in Table A.2-5. Each sample collected will be submitted for analysis. Additional biasing factors may be identified during the course of the investigation. A minimum of one sample per identified biasing factor will be collected and submitted for analysis. It is assumed that if any samples within a population have COPC concentrations above PALs, the population as a whole is contaminated and will proceed to Phase II. Additional Phase I activities will consist of adequately defining the footprint of each population present at the site to approximate potential waste volumes and aid in developing the Phase II strategy.

Table A.2-5
Phase I Criteria for Waste Pile/Burn Pit Sampling

Population	Burn Pit	Soil Piles	Metal debris	Construction debris
No. of samples	Minimum of 1 per area or minimum of 1 per biasing factor	Minimum of 3 or minimum of 1 per biasing factor, whichever is greater	Minimum of 3 or minimum of 1 per biasing factor, whichever is greater	Minimum of 3 or minimum of 1 per biasing factor, whichever is greater
Biasing factors	Location of fused rock Photo with pit location Visual indicators Source and release of COPCs		Visual indicators	Visual indicators

A.2.7.6 CASs 25-34-01 and 25-34-02, NRDS Contaminated Bunkers

The target population for Phase I activities for the bunkers is the concrete surface from the ceiling to the base of the wall where it intersects the soil. This includes the exterior walls outside the entrance to each bunker and the inside roof area with vents. A radiological scanning survey will be performed

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over 100 percent of the concrete surface from these areas. A minimum of five swipes will be taken and counted to assess the potential for removable contamination. The primary biasing factor in selecting locations for swipes will be the results of the radiological scanning survey.

A.2.7.7 CAS 26-17-01, Pluto Waste Holding Area

There are two primary biasing factors identified for the waste holding area: physical characteristics of the contaminants and radiological survey results.

Based on the physical characteristics (i.e., high or low solubility, high or low density, and large or small particle size) of the contaminants, if concentrations above PALs are present they will be located at three preferential locations. These locations include the surface and near-subsurface at the outfall pipe, where contaminants with characteristics of large particle size, low solubility, and high density would tend to accumulate; the near-surface and subsurface at the lowest surface elevation, where contaminants of high solubility and low density would tend to accumulate; and the near the base of the historically lowest elevation, where contaminants of higher density would tend to accumulate.

Radiological survey results indicate there are additional areas in the basin above background radiological levels. A minimum of one sample location will be collected based on the highest radiological survey result.

Based on the two primary biasing factors described above, a minimum of four sampling locations have been identified. Each sample location will consist of two discrete sample depth intervals. One sample will be collected at the surface (0 to 6 inches) within the basin. The second sample interval will be selected at the discretion of the Site Supervisor from additional biasing factors such as staining, odor, screening results, or textural discontinuity, identified during the course of investigation. A minimum of one sample per identified biasing factor will be collected and submitted for analysis.

In addition to the basin, there is a radioactive effluent pipeline associated with this system. Manholes and cleanouts will serve as access points to the pipeline. These access points will be opened, and a visual inspection of the pipeline will be conducted. If sediment is present, it will be collected and analyzed. If sediment is not present within the manhole, a limited radiological survey of accessible portions of the pipeline will be performed and swipes may be collected and analyzed to support

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decisions to meet the free-release criteria. These data may be obtained "remotely" using extended probe cables and attaching swipes to long-handled tools.

A.3.0 Seven-Step DQO Process for Phase II Investigations

This section discusses the seven-step DQO process for CASs where contamination above PALs is known to exist. The sites must be characterized (i.e., Phase II) to provide data to support the selection of a corrective action alternative.

A.3.1 Step 1, State the Problem

The exact nature and/or extent of contamination at these sites is unknown. Contamination at these sites may present a risk to human health and the environment and additional data are required to select a preferred corrective action alternative.

A.3.2 Step 2, Identify the Decisions

The following decisions to be resolved are arranged sequentially:

- 1. Determine the nature of contamination
- 2. Determine the extent of contamination equal to or above PALs

A.3.2.1 Alternative Actions to the Decisions

The following alternative actions are arranged sequentially:

- 1. If the nature of contamination has not been defined for the target population, then continue to collect additional samples. If the nature has been defined, then continue to next decision of determining the extent of contamination.
- 2. If the extent (vertical and lateral) of contamination above PALs has been bounded, no further characterization is necessary. If the extent of contamination above PALs has not been bounded, continue to collect required data (e.g., step-out sampling).

A.3.3 Step 3, Identify the Inputs to the Decisions

Previous sampling and/or survey efforts have provided some data to indicate the presence of contamination; however, information is either too limited, too inconclusive, or nonrepresentative of current conditions to accurately determine the nature and/or extent of contamination.

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Information/data needs related to resolving the two decisions of defining nature and extent of contamination are provided in Table A.3-1. Information metrics provided in the second column are ways against which to measure the appropriate information/data need was collected to make decisions. The last column addresses the quality metric required for a particular data collection activity and is determined by the intended use of the resulting data in decision making.

Other identified information needs which are not directly related to the principal study questions are listed below and will be discussed in detail in Section 4.0 of the CAIP:

- Collection of GPS coordinates of all sample locations and delineation of boundaries of CAS features (e.g., foundations)
- Collection of data to make appropriate waste disposal decisions

A.3.3.1 Determine the Basis for Preliminary Action Levels

Laboratory analytical results will be compared to the PALs, as indicated in Section A.2.3.1, to evaluate if COCs are present at levels that may pose an unacceptable risk to human health and/or the environment and require a corrective action.

A.3.3.2 Potential Sampling Techniques and Appropriate Analytical Methods

Samples will be collected at biased sampling locations by hand augering, backhoe excavation, direct-push, drilling, or other technique as appropriate. Sample collection and handling activities will follow standard procedures. Section 6.0 of the CAIP provides the analytical methods and laboratory requirements (i.e., detection limits, precision, and accuracy requirements) to be used when analyzing for the COCs. Unless otherwise required by the results of this DQO and stated in the CAIP, this investigation will adhere to the Industrial Sites QAPP (DOE/NV, 1996).

A.3.4 Step 4, Define the Boundaries of the Study

The following sections define the target populations, spatial boundaries, and temporal boundaries for CASs within CAU 168.

A.3.4.1 Define the Target Population

The target population for each CAS in Phase II are not expected to differ from those described for Phase I in Section A.2.4.1.

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Table A.3-1 Phase II Identified Information/Data Needs to Resolve Decision

	Decision 1 - Determine Nature of Contamination		
Information/Data Needs	Information Metric	Quality Metric ^a	
Determine nature of contamination	Nature is defined by the observed concentrations of contaminants detected in all Phase I and Phase II samples collected within the areas of contamination.	Quantitative	
	Decision 2 - Determine Extent of Contamination		
Information/Data Needs	Information Metric	Quality Metric ^a	
Determine the extent of contamination	Samples will be collected from selected step-out locations as described in Step 7.		
	The sample must be submitted to a laboratory for analysis of COCs that have not been bounded by previous sample locations.	Qualitative Quantitative	
	Minimum of one sample, both vertically and laterally, with all COC concentrations below PALs is needed to define extent.		
	Other information needs for corrective action decisions		
Information/Data Needs	Information Metric	Quality Metric ^a	
Determine potential waste volumes	A geophysical survey will be conducted at each qualifying CAS to identify anomalies that would indicate extent of disposal cells. Extent sampling will be completed to determine volume of material containing contamination at concentrations exceeding any PAL.	Semiquantitative Quantitative	
Determine potential waste types	Potential waste types will be determined using average contaminant concentrations from all samples collected within the extent of the potential waste volume.	Quantitative	

^aQuantitative 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.

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 of interest 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. The data are often used to guide investigations toward quantitative data collection.

Qualitative data identify or describe the characteristics, components, or features of the population of interest. The QA/QC requirements are the least rigorous on data collection methods and measurement systems. Professional judgement is often used to generate qualitative data. 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.

A.3.4.2 Determine the Spatial and Temporal Boundaries

The spatial boundaries that apply to each CAS for a Phase II investigation are defined in Table A.3-2. The boundaries encompass the area under investigation for that CAS and have been expanded to represent stop or hold points during an investigation in which the scope of the characterization effort may require reevaluation. Each CAS is considered geographically independent. Although CASs 25-34-01, 25-34-02, and 25-23-02 are located within the boundaries of CAS 25-23-18, their boundaries are distinct and will be considered separate for investigation purposes.

Table A.3-2
Phase II Spatial Boundaries Identified for CASs Within CAU 168

CAS	Spatial Boundary
25-16-01	Extend 100 ft laterally in all directions from edges of buried debris. Vertical boundary is 30-ft below base of buried debris.
25-16-03	Laterally, 100 ft beyond boundary of landfill marked by monuments. Vertically, 30 ft below base of buried debris.
25-19-02	Laterally, bounded by R-MAD fence line on west side, then bounded on other sides by area surveyed by geophysics; 30 ft vertically.
26-19-02	Extends 50 ft laterally beyond the concrete barrier walls and 30 ft vertically past concrete base.
26-08-01	Extends 200 ft downstream beyond the visible debris on north side of arroyo and 200 ft to the north away from the wash.
26-17-01	Extends 30 ft laterally beyond the edge of the basin and vertically 30 ft from lagoon base. Includes 5 ft laterally along the length of underground piping and 20 ft vertically below the piping from outfall to building/test pad foundation.
25-23-18	Extends 50 ft beyond the outer perimeter fence, vertical boundaries are 20 ft bgs.
25-34-01	Concrete walls from wall base to roof, including vent.
25-34-02	Concrete walls from wall base to roof, including vent.
25-23-02	Railroad cars including equipment and materials stored on them
25-23-13	Vent hood and its system components within the laboratory to the roof area and adjacent building structures (e.g., wall behind hood).

Temporal constraints due to weather conditions are not expected in Areas 25 and 26. However, rain and snowfall events will place constraints on sampling and surveying activities at radiologically contaminated soil sites because of the attenuating effect of moisture on alpha/beta-emitting radionuclides. There are no time constraints on collecting samples as environmental conditions at all

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sites will not significantly change in the near future, and conditions would have stabilized over the

last 10 to 40 years since last used. Current schedules for submitting the CAIP are September 28,

2001, for the draft CAIP and November 30, 2001, for the final CAIP. Field work is currently

scheduled to begin in FY 2002.

A.3.4.3 Identify Practical Constraints

NTS-controlled activities may affect ability to characterize these sites. The other practical constraints

that apply to each CAS have been previously defined in Table A.2-4.

A.3.4.4 Define the Scale of Decision Making

The scale of decision making is defined for Phase II based on the extent of contiguous contamination

within any CAS so that appropriate corrective actions can be conducted. Specifically at a waste

dump/landfill CAS, where a contiguous area of disposed waste or debris is present, the scale of

decision making is defined as the whole area of waste/debris.

A.3.5 Step 5, Develop a Decision Rule

This step integrates outputs from previous steps 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.3.5.1 Specify the Population Parameter

The population parameter will be the observed concentration of COCs in each sample.

A.3.5.2 Choose an Action Level

Action levels were previously defined in Step 3 of Phase I (Section A.2.3.1).

A.3.5.3 Measurement and Analysis Methods

The measurement and analysis methods used in Phase I will be applied in Phase II and were

previously addressed in Step 3 of Phase I (Section A.2.3.2).

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A.3.5.4 Decision Rule

If existing and/or Phase I laboratory data are insufficient to define the nature of contamination for the

target population, then collect additional characterization samples. If sufficient data are available to

define the nature of contamination, then determine if extent of contamination has been bounded.

If laboratory data determine COC concentrations are below the PALs, then contamination has been

bounded and additional step-out sampling is not required. If COC concentrations of samples exceed

PALs, then the contamination has not been bounded and additional step-out sampling is required.

A.3.6 Step 6, Specify Tolerable Limits on Decision Errors

Based on the understanding of current conditions documented in the CSM, the sampling approach for

Phase II investigation relies upon biased samples; therefore, statistical analysis is not appropriate.

The baseline condition and alternative condition are:

• Baseline condition - The extent of COC concentrations above PALs has not been bounded by

step-out sampling.

• Alternative condition - The extent of COC concentrations above PALs has been bounded by

step-out sampling.

A.3.6.1 False Rejection Decision Error

The false rejection or alpha error would mean deciding that step-out sampling has bounded the extent

of contamination above PALs when it has not. This decision error would result in an increased risk to

human health by not determining the full extent of contamination, thereby implementing an

inappropriate corrective action at the site that would not adequately protect against exposure to future

receptors.

Data collection activities will be designed to minimize the chances of making a false rejection (alpha)

decision error. The characterization of CAU 168 sites is based on biased sampling and will be

conducted under two basic assumptions regarding the area of contamination. The first is that areas of

contamination are contiguous, and secondly that the extent of COC concentrations decrease away

from the area of contiguous contamination. The criteria for bounding the extent of contamination

greater than PALs requires that one "clean" laboratory analytical sample is collected.

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Following established QA/QC practices and standard procedures for data collection help minimize false-negative analytical results.

A.3.6.2 False Acceptance Decision Error

The false acceptance or beta error would mean deciding that the extent of contamination above PALs has not been bounded when it really has. The consequence of this decision error would result in an unnecessary increase in the utilization of resources in implementing additional sample collection and/or an inappropriate corrective action.

The false acceptance decision error is controlled by protecting against false-positive results. False-positive results are typically attributed to laboratory errors and sampling/handling errors. Quality assurance/quality control samples such as field blanks, trip blanks, laboratory control samples, and method blanks should minimize the risk of a false-positive analytical result. Other factors are following established procedures for decontamination of sampling equipment to avoid cross contamination, and using clean sample containers.

A.3.6.3 Quality Assurance/Quality Control

A discussion of QA/QC is provided in Section A.2.6.3.

A.3.7 Step 7, Optimize the Design for Obtaining Data

The Phase II efforts will consist of further characterizing sites where COCs have been confirmed to be present above PALs during Phase I activities. Data obtained from this phase will be used to determine the nature of contamination, and where the COC concentrations have decreased below PALs, thus defining the extent of contamination. Only the COCs determined to be present will be analyzed for during the Phase II characterization effort.

For all CASs in Phase II, with the exception of 25-23-02, 25-23-13, 25-34-01, and 25-34-02, lateral and vertical extent of contamination will be bounded by a minimum of one soil sample showing all COC concentrations below PALs. Only laboratory analytical results can be used for making the decision that extent of contamination has been defined. This is implicit in the Phase II characterization; therefore, it will not be repeated in the sections that follow.

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For CASs 25-23-02, 25-23-13, 25-34-01, and 25-34-02, the criteria stated above for extent of contamination is not applicable, as conducting vertical and/or lateral step-outs may be inappropriate based on the finite boundaries and nature of the material being characterized. The criteria for completing the characterization phase of each of these CASs are described in the relevant sections below.

The spatial boundaries that apply to each CAS for a Phase II investigation are defined in Table A.3-2. If nature and/or extent of contamination is inconsistent with the CSM or extends beyond the spatial boundaries identified in Table A.3-2, then work will be suspended, NDEP will be notified, and the investigation strategy will be reevaluated (see Figure A.1-6). If contamination is consistent with the CSM and is within spatial boundaries, then the decision will be to continue sampling to define extent.

A.3.7.1 CAS 25-16-01, E-MAD Construction Waste Pile

Phase II activities will consist of subsurface soil sampling to determine the nature and extent of contamination. Backhoe excavation will be the primary investigation technique to access sample locations; however, if the vertical extent of contamination is deeper or inaccessible to excavation, then an appropriate direct-push or drilling technique will be used.

Assuming that a continuous area of debris was delineated during Phase I, a minimum of three locations within the area of debris will be sampled to define the vertical extent of COCs. At least one sample location will include the Phase I sample with the highest concentrations of COCs above PALs. Defining vertical extent of contamination will initially begin at the waste/native soil interface and will proceed with depth until one "clean" sample has been collected. Biasing factors will support the selection of soil sampling interval(s) for analysis. At least four initial step-outs to bound lateral contamination will be sampled outside the area of debris (as determined in Phase I). The initial lateral step-outs will be located approximately 5 ft outward from the edge of the area of debris, and the distance between subsequent step-outs will be 10 ft. These distances may be modified in the field by the Site Supervisor, based on Phase I data and other biasing factors. The vertical depth of initial lateral step-out locations will be based on the deepest contamination observed during sampling to define vertical extent. The depth of subsequent step-outs will be based on the deepest contamination observed at all locations. If field screening or other biasing factor suggests COCs are present above

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PALs at a step-out, additional step-out locations will be sampled until lateral and vertical contamination has been bounded.

If Phase I activities indicate that contamination exceeding PALs is present only in discrete locations (e.g., spill from a container), Phase II characterization will proceed as follows. The vertical extent of contamination will be determined at the Phase I location(s) where contamination exceeded PALs. To bound lateral and vertical contamination, a minimum of three step-out locations, arranged in a triangular pattern with the Phase I location in the center, will be sampled. Initial step-outs will be located laterally a distance from the edge of the potential contamination determined as follows: the step-out distance will equal approximately one-half of the length of the long axis of the feature or object that is assumed to be the potential contamination (step-out distance will not exceed 10 ft). Initial step-outs will be at least as deep as the vertical extent of contamination defined at the Phase I sampling location. The spacing of subsequent step-outs will be twice the initial spacing defined above. The depth of subsequent step-outs will be based on the deepest contamination observed at all locations. The number, location, and spacing of step-outs may be modified by the Site Supervisor, if warranted by site conditions.

If COCs exceeding PALs are detected during Phase I sampling of the soil mound, Phase II characterization activities will be similar to those described for a discrete area of contamination. However, the lateral extent of contamination may be limited by the extent of the soil pile itself.

A.3.7.2 CAS 25-16-03, MX Landfill

Phase II characterization will be the same discussed in Section A.3.7.1 for the E-MAD construction waste pile. However, initial step-outs will be located approximately 10 ft outside of the boundaries of the landfill, as defined by the four concrete monuments that mark the corners of the landfill. Subsequent step-out locations will be spaced 10 ft apart. The strategy for determining step-out depths will be identical to that given in Section A.3.7.1.

A.3.7.3 CAS 25-19-02, R-MAD Waste Disposal Site

Phase II activities will consist of soil sampling to determine the nature and extent of contamination. As pointed out elsewhere, this CAS is somewhat unique compared to other CASs in the Waste Disposal Sites CSM because buried waste/debris is not known to be present and is not expected.

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However, as a contingency, if contamination is identified within a continuous feature (e.g. trench or pit) or at a discrete feature (e.g., small soil stain) during Phase I activities, Phase II characterization would be similar to that described for CAS 25-16-01 (Section A.3.7.1).

A.3.7.4 CAS 26-19-02, Pluto Contaminated Waste Dump #2

Phase II characterization activities will consist of confirming the integrity of the concrete structure as a barrier to migration (i.e., will determine if contamination extends into the soil outside of the waste dump structure).

A minimum of four sample locations (one per side) will be excavated and/or drilled immediately outside of the concrete walls. In the absence of biasing factors, the approximate midpoint of each wall will be the initial sample location, except for the back (northernmost) wall. Sampling point(s) outside this wall will be biased laterally to the location of weep holes shown on Engineering Drawing 2202-RR6 (Burns and McDonnell Engineering Co., 1960). Other biasing factors from Phase I may indicate more appropriate sampling locations outside of the concrete walls. The depth of investigation will extend to the concrete footer to collect integrity samples for laboratory analysis. If COCs are detected in concentrations above PALs, additional step-out sampling will be conducted to bound vertical and lateral contamination. The step-out spacing will be approximately 10 ft and may be modified by the Site Supervisor based on site conditions. The depth of additional step-outs will be based on the deepest contamination observed at all locations.

A.3.7.5 CAS 26-08-01, Pluto Building 2204 Waste Pile/Burn Pit

Phase II activities would consist of additional surface soil sampling and possibly excavation sampling to determine the extent of contamination for each population in which Phase I sampling indicated contamination above PALs is present. Phase I characterization activities will include delineating the areal extent (i.e., footprint) of each population.

This Phase II strategy applies to each population where PALs were exceeded. Sampling will determine the vertical extent of contamination at each Phase I location where COC concentrations exceed PALs. To establish the lateral extent of contamination, soil samples will be collected and analyzed from a minimum of four step-outs located outside the footprint of the population. The step-outs will be approximately 5 ft laterally from the edge of the footprint. Initial step-outs will be at

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least as deep as the vertical extent of contamination defined at the Phase I sampling location(s). Lateral spacing of subsequent step-outs will be 10 ft, and the depth will be based on the deepest contamination observed at all locations. The number, location, and spacing of step-outs may be modified by the Site Supervisor, if warranted by site conditions.

A.3.7.6 CAS 25-23-13, ETL (TTF) Laboratory Radioactive Contamination

The objective of the Phase II investigation of the fume hoods, associated ventilation system, and other radiologically posted areas/objects in the TTF (Building 3124) is to determine the presence of radiological contamination to meet free-release criteria of the materials. Defining the nature and extent of contamination will be based on data resulting from radiological scanning surveys and swipe collections limited to the materials and associated building structures. Because the criteria for meeting free release is different than comparing soil data to PRGs, the quality of data resulting from radiological scanning surveys and swipe counting will be sufficient for decision making. The laboratory fume hoods, accessible surfaces in contact with the hoods, duct work, roof vents, portions of the TTF roof will be included in characterization activities. Other areas of the TTF and associated objects that are radiologically posted (e.g., Soil Preparation Bay) will also be included in characterization activities.

Available engineering drawings will be reviewed and, using professional judgement, biased sample locations will be determined where worst-case contamination may be expected. Sample locations may also be determined by direct inspection of the TTF. At accessible locations (e.g., roof or wall), radiological scanning survey data will be used to support selection of worst-case locations for swipe collection. Areas that are difficult to access may be surveyed or swiped "remotely" by increasing the length of probe cables or collecting swipes with long-handled tools. All characterized materials are expected to remain intact for future corrective actions, except for remote access points, if necessary.

A.3.7.7 CASs 25-34-01 and 25-34-02, NRDS Contaminated Bunkers

Scabbling or shot-blasting of concrete will be performed to determine the extent of contamination into the concrete perpendicular to the surface of the wall or ceiling. The scabbling or shot-blasting will take place at a minimum of two worst-case contamination locations determined by Phase I characterization. Following scabbling or shot-blasting, the locations will be resurveyed to evaluate the extent of contamination (i.e., determine if the contamination is limited to the surface of the

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concrete). Lateral extent of contamination will have been determined previously in Phase I during the radiological scanning survey over 100 percent of the structure.

A.3.7.8 CAS 26-17-01, Pluto Waste Holding Area

Phase II activities would consist of additional soil sampling to determine the nature and extent of contamination. Phase II activities may also consist of additional characterization of the effluent pipeline extending from the Project Pluto Test Bunker (Building 2203) to the Waste Holding Area.

Soil samples will be collected from a minimum of four locations on the interior edges of the Waste Holding Area basin. At each location, a surface soil sample and a subsurface soil sample will be collected for analysis. The depth of the excavations or boreholes will be sufficient to intercept the horizon/interval where COC concentrations exceeding PALs were detected in Phase I sampling locations.

Additional step-out locations will be sampled, if necessary, to define the extent of contamination. The lateral spacing of the additional step-outs will be approximately 5 ft. If a berm is present, as on the south and east sides, the step-out may be located at the outside base of the berm. The depth of step-outs will be sufficient to intercept the horizon/interval where COCs were present above PALs in Phase I and subsequent samples. Only subsurface soil samples will be collected from step-outs located outside of the basin, surface soil samples will not be collected from these locations. The location, depth, and spacing of step-out sampling points may be modified by the Site Supervisor based on site conditions.

Phase II characterization of the radioactive effluent pipeline is dependent on the data and observations obtained during Phase I. Several options for further characterization are available; the selected method(s) will be dependent on site conditions. Manholes and cleanouts will serve as the primary access points to the pipeline. Additional access points may be created by excavating a break in the line. Excavated sections of pipe may be directly surveyed and swiped for radiological characterization. A limited video survey may be performed using a video mole. Large area swipes may be collected using fish tape or pipe snake. *In situ* radiological characterization of the pipeline may also be performed using specialized equipment.

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A.3.7.9 CAS 25-23-18, Area 25 Radioactive Material Storage Facility

Surface soil in portions of the RMSF is known to be radiologically contaminated (Section A.1.3.4 and Section A.1.4). For this reason, the investigation of CAS 25-23-18 will proceed directly to Phase II. Phase II characterization activities at the RMSF will include radiological surface surveys and soil sampling to define the nature and extent of contamination.

Best management practices for CAS 25-23-18 will include removal of various objects and equipment currently present in the RMSF. Walkover and/or driveover radiological surveys of the ground surface beneath and adjacent to these materials will be performed following their removal to identify any additional areas of surface soil contamination. A radiological survey of ground surface between the inner and outer fences will also be performed to confirm that contamination is not present in this area or to identify additional locations of contamination. Some of the railroad cars (CAS 25-23-02) may also be moved to support radiological survey activities at CAS 25-23-18.

Biased soil samples will be collected from locations where potential contamination is present, based on biasing factors such as staining or radiological survey results. At these locations, the vertical extent of potential contamination will be determined. The sampling intervals will be determined in the field, as guided by field-screening results. At a minimum, the 0- to 6-in. depth interval will be collected for analysis.

The radiological surface survey data will define the extent of laterally continuous areas of contamination. Soil samples will be collected from step-out locations and submitted for laboratory analysis to confirm the radiological surface survey results (i.e., confirm the lateral extent of contamination). Additional step-out locations will be sampled as required to determine the extent of contamination. Lateral step-out spacings will be 10 ft. The number, location, and spacing of step-outs may be modified by the Site Supervisor, if warranted by site conditions.

As discussed above, the extent of laterally continuous areas of contamination will be defined by step-out sampling. However, the extent of individual "hot spots" will not evaluated by sampling and analysis. The radiological surface survey data will suffice to characterize hot spots.

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A.3.7.10 CAS 25-23-02, Radioactive Storage Railroad Cars

Based on data from previous radiological surveys, specific railroad cars are known to be radioactively contaminated. For this reason, the investigation of CAS 25-23-02 will proceed directly to Phase II. The Phase II investigation will generate the data required for a free-release determination and to support other waste management decisions.

A radiological scanning survey will be performed over the accessible surfaces of each railroad car. The survey will determine the nature and extent of radiological contamination. The survey will also include the accessible portions of equipment and materials stored on some of the cars. If the survey identifies radiological contamination, swipes will be taken from the cars and counted to assess the potential for removable contamination. The primary biasing factor in selecting locations for swipes will be the results of the radiological scanning survey.

Because of observed radiation levels, health and safety considerations may limit characterization of certain cars (e.g., LASL NF car). To reduce radiation exposure rates and/or to reach otherwise inaccessible areas, survey data may be obtained "remotely" using extended probe cables and attaching swipes to long-handled tools.

The dimensions and volume of contaminated railroad cars, equipment, and materials will be estimated. Documentation will be sufficient such that hot spots or other areas of contamination can be located at a later date. If residual fluids are present in the cars (this applies primarily to the two locomotives), samples may be collected for analysis. The analyses would be for waste management purposes.

A.4.0 References

- Atlan-Tech. 1992. Environmental Monitoring Report for the Proposed Ward Valley, California, LLRW Facility. Rosewell, GA.
- BLM, see U.S. Department of Interior, Bureau of Land Management.
- BN, see Bechtel Nevada.
- Bechtel Nevada. 1996. U.S. Department of Energy Nevada Operations Office Environmental Data Report for the Nevada Test Site 1994. Prepared by S.C. Black and Y.E. Townsend. Las Vegas, NV.
- Burns and McDonnel Engineering Co. 1960. Engineering drawing 2202-RR6 entitled, "NTS 401 Railroad Construction Details," 21 January. Prepared for the U.S. Atomic Energy Commission. Mercury, NV: Archives and Records Center.
- DOE, see U.S. Department of Energy.
- DOE/NV, see U.S. Department of Energy, Nevada Operations Office.
- DRI, see Desert Research Institute.
- Desert Research Institute. 1988. CERCLA Preliminary Assessment of DOE's Nevada Operations Office Nuclear Weapons Testing Areas, Vol. 1. Las Vegas, NV.
- EPA, see U.S. Environmental Protection Agency.
- McArthur, R.D., and F.L. Miller, Jr. 1989. *Off-Site Radiation Exposure Review Project, Phase II Soil Program*, DOE/NV/10384-23. Las Vegas, NV: Desert Research Institute.
- NAC, see Nevada Administrative Code.
- NBMG, see Nevada Bureau of Mines and Geology.
- Nevada Administrative Code. 2000a. NAC 444.570 444.7499, "Solid Waste Disposal." Carson City, NV.
- Nevada Administrative Code. 2000b. NAC 444.850 444.8746, "Disposal of Hazardous Waste." Carson City, NV.
- *Nevada Administrative Code.* 2000c. NAC 445A.2272, "Contamination of Soil: Establishment of Action Levels." Carson City, NV.

- Nevada Administrative Code. 2000d. NAC 444.940 444.9555, "Polychlorinated Biphenyl." Carson City, NV.
- Nevada Bureau of Mines and Geology. 1998. Mineral and Energy Resource Assessment of the Nellis Air Force Range, Open-File Report 98-1. Reno, NV.
- Nevada Revised Statues. 1998a. NRS 444.440 444.620, "Collection and Disposal of Solid Waste." Carson City, NV.
- Nevada Revised Statues. 1998b. NRS 459.400 459.600, "Disposal of Hazardous Waste." Carson City, NV.
- NRS, see Nevada Revised Statues.
- U.S. Department of Energy. 1993. *Radiation Protection of the Public and the Environment*, DOE Order 5400.5. Washington, DC: U.S. Government Printing Office.
- U.S. Department of Energy, Nevada Operations Office. 1996. *Industrial Sites Quality Assurance Project Plan, Nevada Test Site and Offsite Locations in the State of Nevada*, Rev. 1, DOE/NV-372. Las Vegas, NV.
- U.S. Department of Energy, Nevada Operations Office. 1998. *Nevada Test Site Resource Management Plan*, DOE/NV--518. Las Vegas, NV.
- U.S. Department of Energy, Nevada Operations Office. 2000. *NV/YMP Radiological Control Manual*, DOE/NV/11718-079, Rev. 4. Prepared by Bechtel Nevada. Las Vegas, NV.
- U.S. Department of Interior, Bureau of Land Management. 1990. 43 CFR Public Land Order 6802 Withdrawal of Public Land to Maintain the Physical Integrity of the Subsurface Environment, Yucca Mountain Project; Nevada, September 25, 55 FR 39152.
- U.S. Environmental Protection Agency. 2000. *Region IX Preliminary Remediation Goals* (PRGs), available at www.epa.gov/region09/waste/sfund/prg/index.htm as accessed on 01/08/2001. Prepared by S.J. Smucker. San Francisco, CA.
- USGS, see U.S. Geological Survey.
- U.S. Geological Survey. 1964. *Geology of the Pluto Site, Area 401, Nevada Test Site, Nye County, Nevada*, USGS-TEI-841. Prepared by R.B. Johnson and J.R. Ege. Denver, CO.
- U.S. Geological Survey. 1993. *Water Levels in Continuously Monitored Wells in the Yucca Mountain Area, Nevada, 1985-88*, USGS-OFR-91-493. Prepared by R.R. Luckey, D.H. Lobmeyer, and D.J. Burkhardt. Las Vegas, NV.

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- U.S. Geological Survey. 1995a. Selected Ground-Water Data for Yucca Mountain Region, Southern Nevada and Eastern California, Calender Year 1993, USGS-OFR-158. Prepared by G.S. Hale and C.L. Westenburg. Denver, CO.
- U.S. Geological Survey. 1995b. *Precipitation Data for Water Years 1992 and 1993 from a Network of Nonrecording Gages at Yucca Mountain, Nevada*, USGS-OFR-95-146. Prepared by D.S. Ambos and A.L. Flint, and J.A. Hevesi for the U.S. Department of Energy, Nevada Operations Office. Las Vegas, NV.

Appendix B Project Organization

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B.1.0 Project Organization

The NNSA/NV Project Manager is Janet Appenzeller-Wing, and her telephone number is (702) 295-0461. The NNSA/NV Task Manager assigned to CAU 168 is Kevin Cabble, and his telephone number is (702) 295-5000.

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

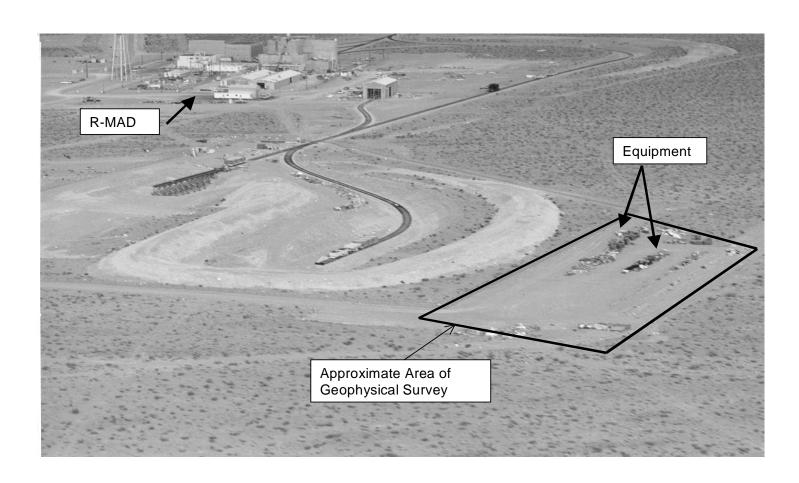
Appendix C

Photographs and Facility Drawings

<u>Photographs</u>	Engineering Drawings
CAS 25-16-01 (1 page)	CAS 25-16-03 (1 page)
CAS 25-19-02 (3 pages)	CASs 25-34-01 and 25-34-02 (1 page)
CAS 25-23-13 (1 page)	CAS 26-17-01 (2 pages)
CAS 26-08-01 (1 page)	CAS 26-19-02 (1 page)



CAS 25-16-01, Construction Waste Pile Aerial Photograph 65125-12 EG&G/EM, 1965



CAS 25-19-02, Waste Disposal Site Aerial Photograph 641-17-20 EG&G/EM, 1964

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CAS 25-19-02, Waste Disposal Site Ground Photograph 663-39-6 EG&G/EM, 1966a

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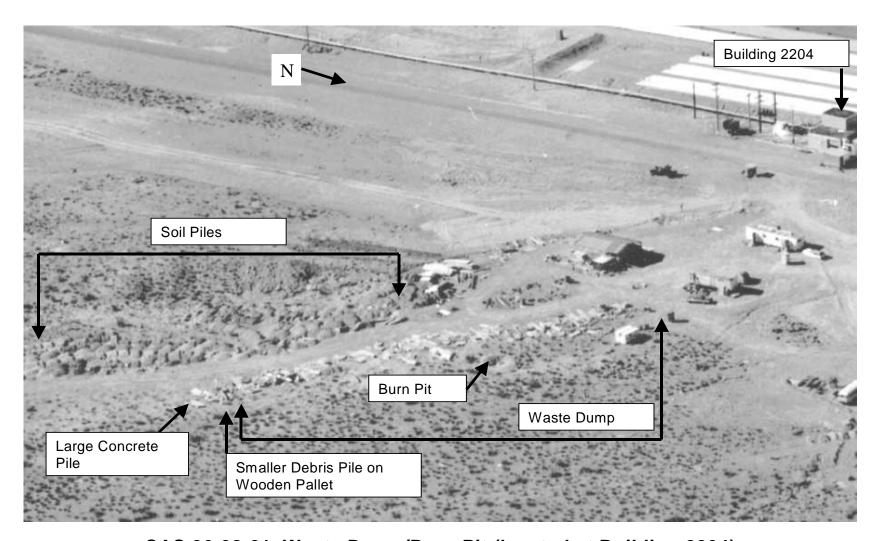
CAS 25-19-02, Waste Disposal Site Ground Photograph 663-39-3 EG&G/EM, 1966b

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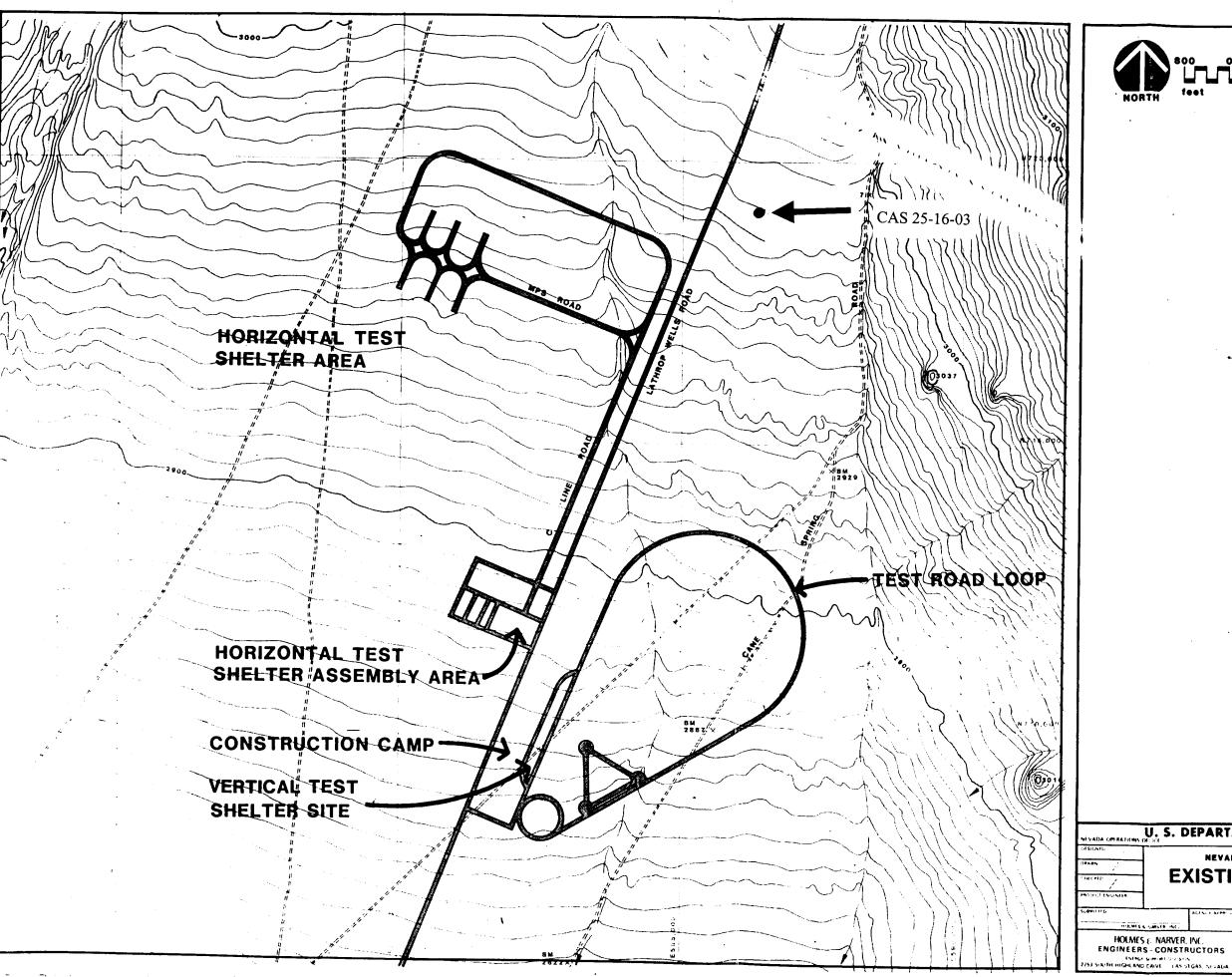


CAS 25-23-13, Engine Test Laboratory (ETL) Lab Radioactive Contamination Ground Photograph 252313p1 IT, 1999

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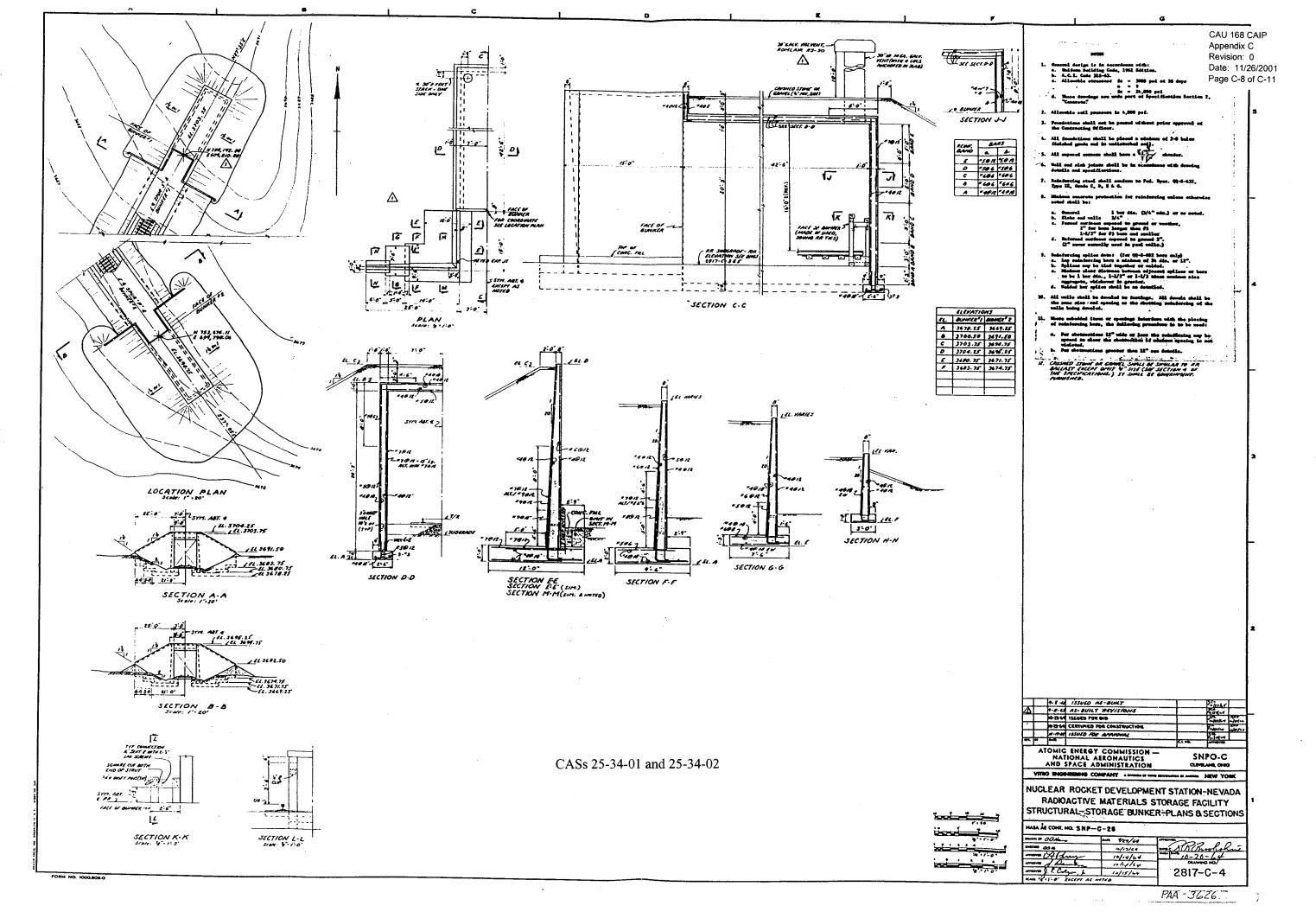
CAS 26-08-01, Waste Dump/Burn Pit (located at Building 2204)
Aerial Photograph CNP-4493
UCRL, 1962

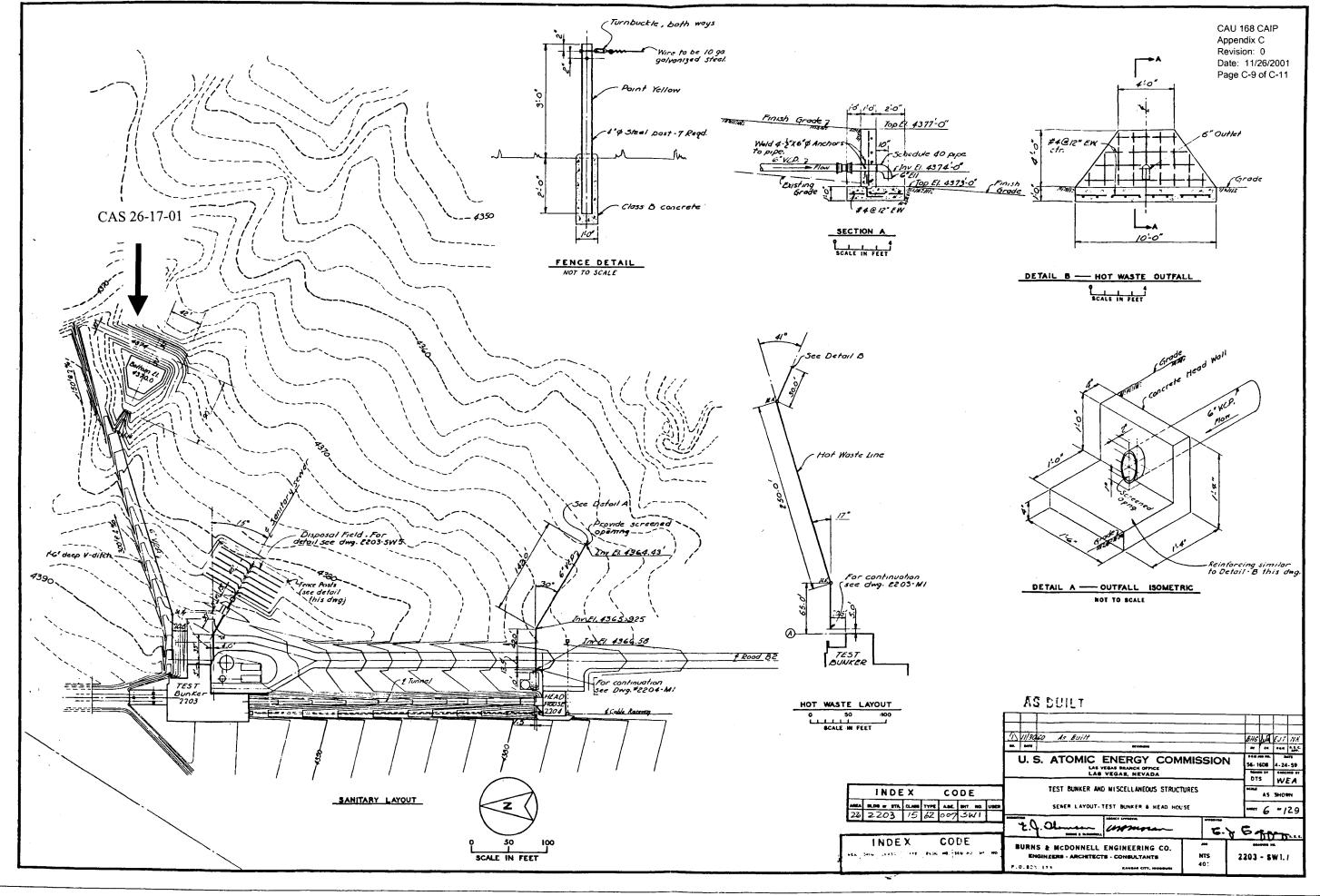


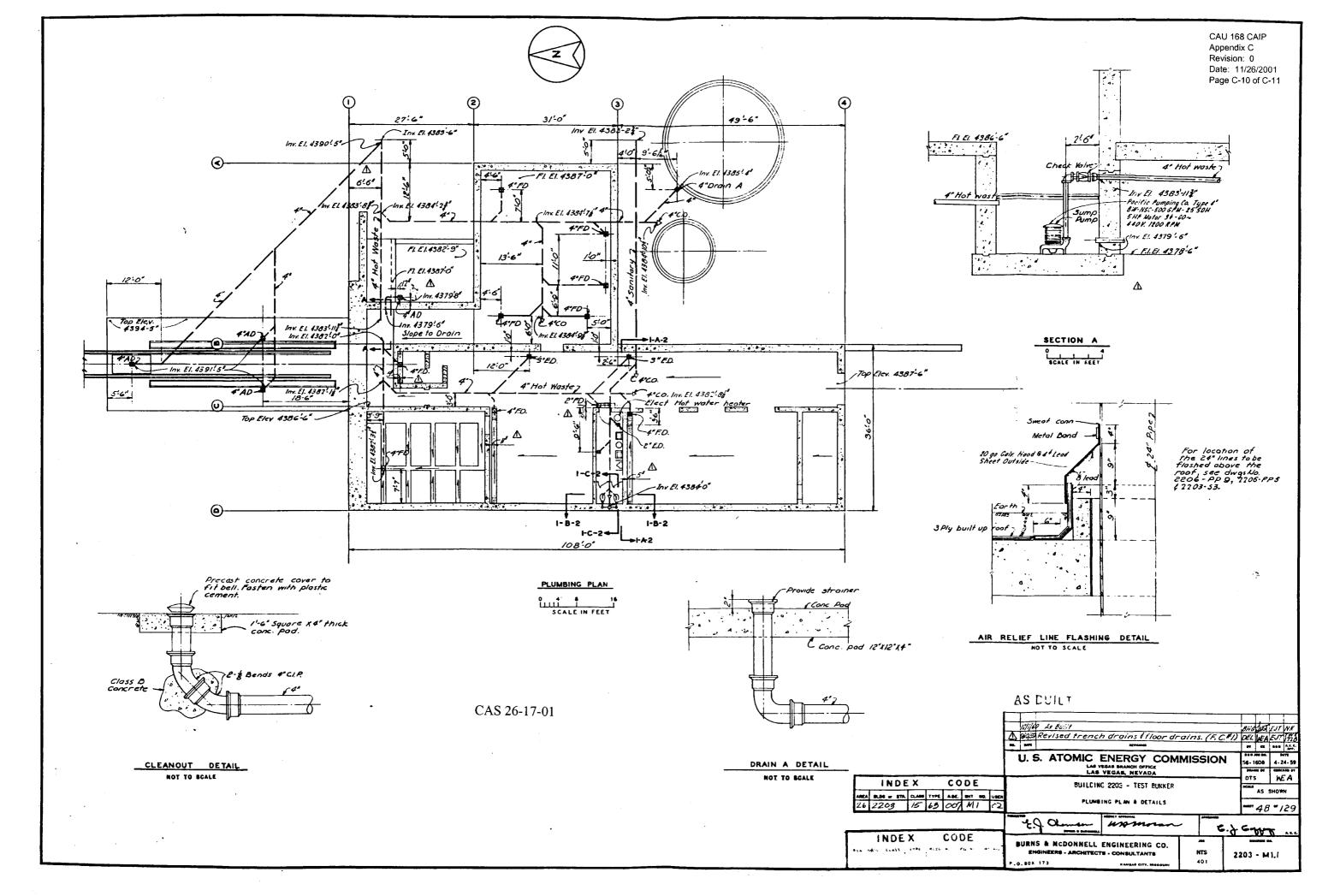
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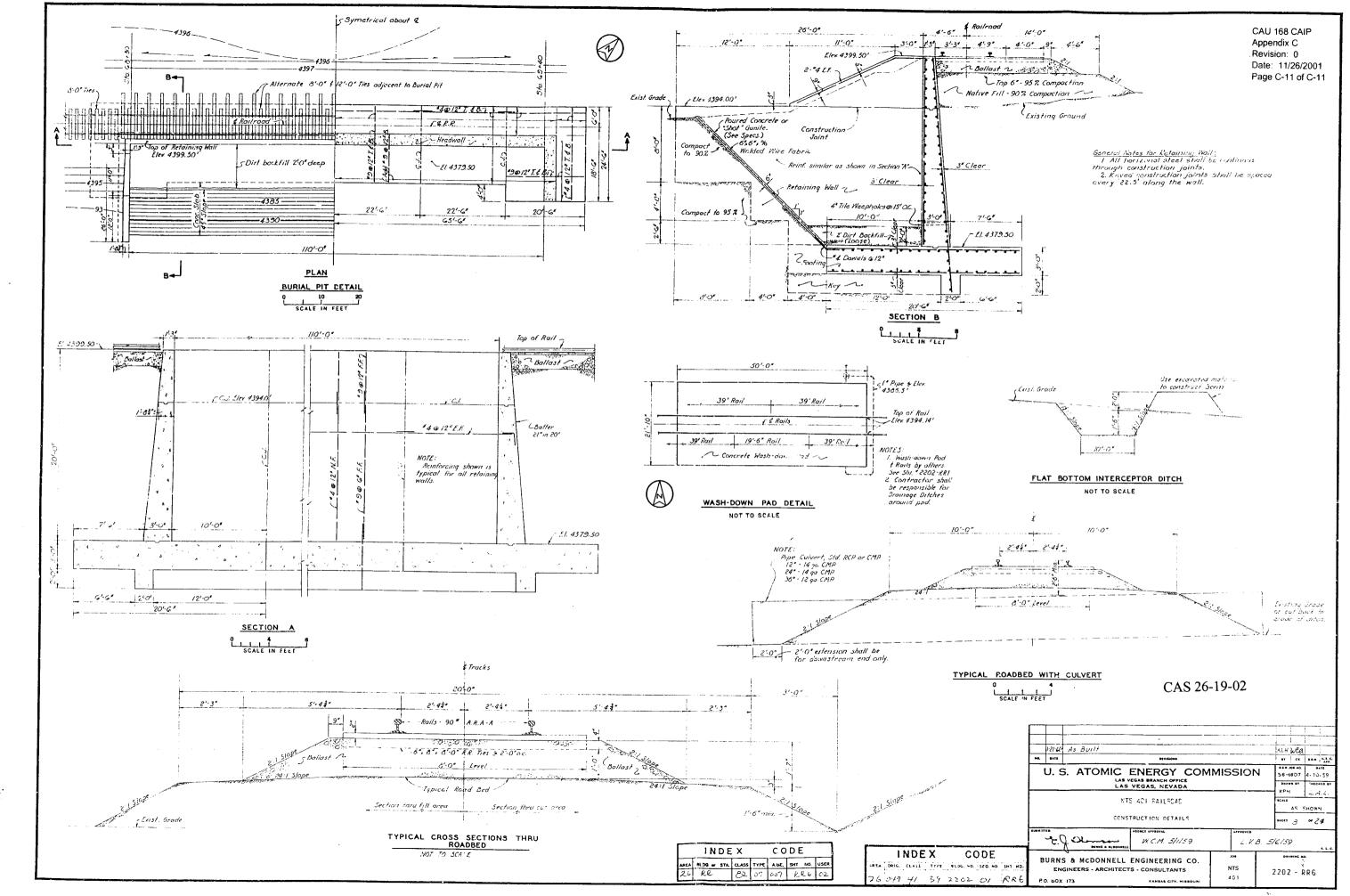
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Appendix D Radiological Survey Data for the RMSF

(20 Pages)

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1996 and 1998 Bechtel Nevada Radiological Survey Results

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Table D.1-1
1996 and 1998 BN Radiological Survey Results for CAS 25-23-02 Railroad Cars
(Page 1 of 2)

			Date of	Surve	у	Swipes (R	emovable)	Fixed + Rem	ovable (Total)	
Location	Location Railroad Car Name		March 16, 1998	September 26, 1998	September 28, 1998	Alpha (dpm/100cm²)*	Beta (dpm/100cm²)*	Alpha (dpm/100cm²)*	Beta/Gamma (dpm/100cm²)*	Gamma Exposure Rate (mR/hr)*
Background (Gros	s)	Х				Not Provided				
			Х			0	0.10	Not Provided	Not Provided	0.04
				Х		0.1	1.0	6.7	733	0.05
					Х	0.1	0.3	6.7	733	0.05
Spur "M"	RMSF-1			Х		7.35	24.21	0	36,000	0
Spur "N"	Flatcar #2		Х			10.39	12.74	Not Provided	Not Provided	0.05
				Х		11.22	22.01	0	0	0
	Test Vehicle #2		Х			3.46	4.10	Not Provided	Not Provided	0.05
				Х		0	4.4	0	1,200	0
	Unlabeled		Х			0	4.10	Not Provided	Not Provided	0.07
	(gray reactor car)			Х		3.48	6.6	25	200	0
	Unlabeled		Х			0	6.26	Not Provided	Not Provided	0.05
	(yellow dump car)			Х		3.48	0	0	0	0
Spur "O"	LASL Nuclear Furnace	Х				Not Provided	Not Provided	5.0E+5	8.6E+6	70
			Х			0	19.21	Not Provided	Not Provided	50.00

^{*} Results have been reported as net values (i.e., the background levels have been subtracted from the total values).

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Table D.1-1
1996 and 1998 BN Radiological Survey Results for CAS 25-23-02 Railroad Cars
(Page 2 of 2)

			Date of	Surve	у	Swipes (R	lemovable)	Fixed + Rem	novable (Total)	Ī
Location	Railroad Car Name	February 6, 1996	March 16, 1998	September 26, 1998	September 28, 1998	Alpha (dpm/100cm²)*	Beta (dpm/100cm²)*	Alpha (dpm/100cm²)*	Beta/Gamma (dpm/100cm²)*	Gamma Exposure Rate (mR/hr)*
Spur "O"	A-5 or T-6	Х				Not Provided	Not Provided	150	2.9E+5	2.5
			Х			3.46	8.42	Not Provided	Not Provided	5.0
				Х		3.48	11.00	289	1.2E+5	3.0
	F-8	Х				Not Provided	Not Provided	0	1200	0.0002
				Х		11.22	191.44	0	2.1E+5	0.8
	F-2			Х		11.22	4.4	0	5.4E+4	0
	F-4			Х		7.35	0	0	0	0
Spur "P"	Unlabeled (blue flatcar		Х			6.92	10.58	Not Provided	Not Provided	0.5
	with yellow wheels)			Х		3.48	26.41	0	2.5E+4	0
	NRX-EST or T-2	Х				Not Provided	Not Provided	150	2.0E+5	2.2
			Х			0	4.10	Not Provided	Not Provided	3.0
				Х		3.48	22.01	0	2.0E+5	0.6
	Phoebus-1B or T-5	Х				Not Provided	Not Provided	0	3.8E+4	0.015
			Х			0	8.42	Not Provided	Not Provided	0.050
				Х		3.48	292.67	0	1.4E+4	0
	F-7		Х			3.46	6.26	Not Provided	Not Provided	0.05
					Х	0	5.92	0	150	0
	Engine #2				Х	0	12.57	0	120	0
	Engine L-1				Х	0	3.73	0	150	0
Spur "S"	Unlabeled (blue flatcar with Dicalite)			Х		0	0	0	0	0
Spur "L"	T-4			Х		0	2.2	100	2.8E+4	0.3
	NRX-A6			Х		3.48	13.2	150	4.5E+4	0.5

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Table D.1-2
1998 BN Radiological Survey Results for CAS 25-23-18 Miscellaneous Equipment
(Page 1 of 2)

		Date o		Swipes (R	emovable)	Fixed + Rem	ovable (Total)	
Object		September 26, 1998	September 28, 1998	Alpha (dpm/100cm²)*	Beta/Gamma (dpm/100cm²)*	Alpha (dpm/100cm²)*	Beta/Gamma (dpm/100cm²)*	Gamma Exposure Rate (mR/hr)*
Background (Gross)	Х			0	0.10	Not Provided	Not Provided	0.04
		Х		0.1	1.0	6.7	733	0.05
			Х	0.1	0.3	6.7	733	0.05
Red transportainer	Х			0	1.94	Not Provided	Not Provided	0.05
			Х	0	3.73	0	200	0
Two Barrels	Х			3.46	6.26	Not Provided	Not Provided	0.05
Baker fork lift		Х		7.35	0	0	21,000	0
Clark fork lift		х		3.48	4.4	0	10,000	0
Welding positioner		Х		3.48	2.2	0	0	0
Stainless steel valve and fitters		Х		3.4	0	0	2,300	0
Victoreen "radiactor" meter (installed beta source)		Х		0	0	0	10,000	0
Black drum w/ springs and misc. parts		х		0	8.8	0	0	0
Stainless steel covers		х		3.48	0	0	2,900	0
Metal stand		Х		0	2.2	0	4,900	0
Metal tank		Х		0	2.2	0	0	0
Metal pipe		Х		3.48	4.4	0	0	0
Box of railroad car brake parts			Х	0	5.92	0	0	0
Aluminum			Х	3.62	0	0	900	0
Metal stands			Х	3.62	10.31	0	0	0
Seven 3 ft metal covered concrete cylinders			Х	0	5.92	0	1,800	0
Two pallets of metal stands and misc. equipment			х	7.64	8.12	0	0	0

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Table D.1-2
1998 BN Radiological Survey Results for CAS 25-23-18 Miscellaneous Equipment
(Page 2 of 2)

	Date of Survey			Swipes (Removable)		Fixed + Removable (Total)		
Object	March 16, 1998	September 26, 1998	September 28, 1998	Alpha (dpm/100cm²)*	Beta/Gamma (dpm/100cm²)*	Alpha (dpm/100cm²)*	Beta/Gamma (dpm/100cm²)*	Gamma Exposure Rate (mR/hr)*
One pallet of aluminum and metal stands, lifting bail, and misc. equip.			Х	3.62	21.28	0	14.50	0
Two 12 ft long 1 ft diameter tanks			Х	3.62	8.12	0	0	0

^{*} Results have been reported as net values (i.e., the background levels have been subtracted from the total values).

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2001 ITLV Radiological Survey Results	
2001 ITLV Radiological Survey Results	

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CORPORA	TION				_
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Q C	1		By Carl Spen	1 1	
		_	Signature	5/2	5-1-2001
Drawing Attached: Y	es No	Review	By: Hacey Alderson / Sta	Date	
	Instrument (1)		Instrument (2)		Instrument (3)
Instrument Model: Instrument Nos.:	Electron 2339	Instrume	ent Model: <u>Lvd lum 19</u> ent Nos.: <u>123 882</u>	Instrument Nos.	el
Calibration Due: 19	0-19-01	Calibrati Efficience	on Due: 1/11/02 cy:	Calibration Due Efficiency:	1
BKG: 20.0 d	pm \$214	Idpm BKG:_	15,4R/hc	BKG: MDA:	
MDAA SAGE	Gross Fixed + Remo	alamana ay ak ara ara ara ara ara ara ara ara ara 			
Survey Point	Beta/Gamma (dpm/100 cm²)	Alpha (dpm/100 cm²)	Dose rate (micro-R/hr)	Instrument:Used::	Comments/Additional Information
EI	2116	12	12	12	NRX-A6 Norzel
EZ	1532	54.2	12-		Side
E3	T926	96.4	100		toρ
NI	24.9K	84.4	50		Side
NZ	16 K	0.0	50		5 bolts
N3 .	20.9K	12.1	50		Steel top
WI	58.6K	106	50		gteel ends
w 2	61.5	294	50		steel and
w3	5256	155	40		Aluminum top
SI	19.3K	0.0	50		holts door
S2	8.5K	72.3K	40	<u> </u>	Chassis

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RADIOLOGICAL SURVEY FORM **CONTINUATION SHEET**

Page 2 of 3

		+ Removable nination	Dose rate		Comments/Additional	
Survey Point	Beta/Gamma (dpm/100 cm²)	Alpha (dpm/100 cm²)	(micro-/R/hr)	Instrument Used	Information	
T5 1	3240	78.6	20	1,2	PH-1B T-5 side	
1 2	236K	720	22		Ne wheels on arms	
3	138K	2250	22		N wheels on arms	
4	23,7K	169	25		NWinnper	
5	23.94	55.6	25		NW bumper	
le	9.19K	40,2	22		Al topon wside	
7	12.5 K	181	30		NW wheels oname	
8	50.1 K	0.0	50		black goo inside	
9	277 K	408	30		NE wheels onarm	
V 10	25,99	93,3	30		top alum deck	
FTI	1429	120	20		Coverd CAR F7	
12	1321	45,7	15		West side	
3	1120	0	15		east side	
14	1590	36.1	20		North side	
5	1000	77.5	20		South side	
PM i	1040	84.3	15		Prime mover 2 From	
1 2	392	213	5		right side	
3	1190	0,0	15		back	
4	1169	00	15		left side (drivaside)	
V_ 5	831	1.81	15		inside	

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RADIOLOGICAL SURVEY FORM CONTINUATION SHEET

		+ Removable nination	Dose rate		Comments/Additional	
Survey Point	Beta/Gamma (dpm/100 cm²)	Alpha (dpm/100 cm²)	(micro-/R/hr)	Instrument Used	Information	
F2-1	121 K	781	50	1,2	F2 Covered CAR top	
2	100 K	78	50		tos	
3	183K	45.1	50		100	
4	15.6 K	203	75		S Front	
5	35 33	90.4	75		S Front	
10	6411	217	50		N back	
T/e 1	14.3K	90 K 5	35		NRX-AS The Chassis	
2	300 K	~A	400 @ 30cm		pipe open ON N side	
3	30 K	0	65		100	
4	34K	67.8	600		wheels on Nside	
5	99.6K	2041	35		laniper	
(0	9.95K	136	50	<u> </u>	isside	
		- Last	Line (s 4/13/01			
	·	<u> </u>				

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RADIOLOGICAL SURVEY FORM

Revision: 0 Date: 11/26/2001 Page D-10 of D-20

Project Name: C	AU 168 PA	Project	Number: <u>799417</u>	·	Page <u>1</u> of <u>\</u>		
Survey Description: Survey of Defusen M	Contamination 3 torage Area , and N Spurs (H) Yes No	Survey D Print Nar Survey B	Survey Date: 4/40/ Print Name: AP Sper Survey By: Alger Signature Signature Signature Date				
Instrument Model: Instrument Nos.: Calibration Due: Efficiency: か し BKG: か ひ.0 MDA: か ろみゃ	2339 10-19-01 10-19-01 10-19-01 10-19-01 10-19-01 10-19-01 10-19-01 10-19-01 10-19-01	Instrume Calibration Efficience BKG:	Instrument (2) nt Model: Ludlum 19 nt Nos.: 123 882 on Due: (Infoz y: MA VA	Instrument Nos	Instrument (3) el		
Survey Point		Contamination Alpha (dpm/100 cm²)	Dose rate (micro-rem)	Instrument.Used	Comments/Additional Information		
ForKlift 1	13 K	57	50	1,2	Drake pedal		
4 ft stand	28.5 K	131	35	1,2	black pad		
FL1 wheel	5878	27	30	1,2	Forklift South		
FL2 5/001	30 K	1.37K	60	1,2	Forklift North		
			Last Line "5//4	pi			
<u></u>					1		

INTERNATIONAL TECHNOLOGY CORPORATION
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RADIOLOGICAL SURVEY FORM

CAU 168 CAIP
Appendix D
Revision: 0
Date: 11/26/2001
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Project Name: PA CAU 168	Project Number: 799 417	Page _1 _ of _2_
Survey Description: RMSF equipment/numerial; unable to get accordence reading on Wiscot of Dump can due to activated sheet ental in close proximity Unmark kep Railcar located on Spur N Drawing Attached: Yes No	Survey Date: 4 14/01 Print Name: Scott Wyler Survey By: Signature Review By: Aueg L Albert Signature	7 1 4-18-2001 Date
Instrument (1) Instrument Model: 1531 Flecting Instrument Nos.: 1531 Calibration Due: 5-16-01 Efficiency: 4 14.7% 8-14.7% BKG: 4-040 8-1565 40 MDAR 340 B-18740	Instrument (2) Instrument Model: Luplum 19 Instrument Nos.: 173862 Calibration Due: VIII/02 Efficiency: MA BKG: 15 MK/bR MDA: MA	Instrument (3) Instrument Nos.: Calibration Due: Efficiency: BKG: MDA:

	Gross Fixed + Removable Contamination -				
Survey Point	Beta/Gamma (dpm/100 cm²)	Alpha (dpm/100 cm²)	Dose rate (micro-R/hr)	Instrument Used	Comments/Additional Information
1	2136	64	20	1,7	Dung Car, N SIDE
2	1279	64	20		Domp CAR S SIDE
3	899	3.2	15		Dung CAR E SIDE
4	1646	21	15		UNMARKED Railcar Alumuum
5	1918	21	20	·	5. WSIDE STEP UNMARKED RailcAR Alumuum 5. MSIDE STEP E.SIDE
ζ.	1497	32	20		UNMARKED RAILCAR Alunum N. 14519E STEP
7	4422	43	70		NINSIDE STEP UNMARKED RailCAR, Aluminum
8	1388	21	20		Tost Vehicle #7 w 5/DE
9	1823	13	26		Test Vehicle #Z S SIDE Top
16	1728	54	Zo		Test Vehicle & EsiDE
11	2059	107	20	\downarrow	Test Vehicle #2, N. SIDE TOP

INTERNATIONAL TECHNOLOGY CORPORATION

RADIOLOGICAL SURVEY FORM CONTINUATION SHEET

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	Gross Fixed + Removable Contamination						
Survey Point	Beta/Gamma (dpm/100 cm²)	Alpha (dpm/100 cm²)	Dose rate (micro-rR/hr)	Instrument Used	Comments/Additional Information		
に	1234	43	20	1,2	Flat CHR #2, & 510E		
13	1252	128	20	1,2	Flat Cue #Z, S SIDE To		
19	1243	75	20	1,7	Flat Cur #Z, S SIDE TO Flat CAR #Z, E SIDE		
15	1184	139	20	1,2	Flat CAR #7 N SIDE BY		
16	NLA	NA	170	1	Flat CUR #7 N SIDE By 2000ACD ATW. END OF IN 5 Pul Activated Metal Sheeting		
				,			
		4					
					1		
		· ·		3			
			E ~ 721				
			WE TO THE RESTRICT				
			EN PILLE				
		Po					

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RADIOLOGICAL SURVEY FORM

CAU 168 CAIP
Appendix D
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Date: 11/26/2001
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99.4 9.5					Fage D-10 01 D 20
Project Name: <u>¿</u> P	NU 168 (PA)	Project N	Number: 799417		Page <u>1</u> of <u>2</u>
Survey Description: RATERIALS; CAR beta readings for an top and interpretations	PS has high game FB has high game on inside contained of feres with some	Print Nam	e: 5-cot to yers Signature Signature Signature	Hyll , 4 Date	17-200/
Instrument Model:! Instrument Nos.: Calibration Due: Efficiency: & \%,7% BKG: & b,7d	1531 5-18-01 6 3 141790 8-18-18-18-18-18-18-18-18-18-18-18-18-18	Instrumer Calibratio	Instrument (2) Int Model: Lundum 19 Int Nos.: 123 882 In Due: 11/52 In MA I SAR hi? MA	Instrument Mo Instrument No Calibration Du Efficiency: BKG: MDA:	s.:
Survey Point	Gross Fixed + Remo Beta/Gamma (dpm/100 cm²)	vable Contamination Alpha (dpm/100 cm²)	Dose rate (micro-R/hr)	Instrument Used	Comments/Additional Information
्रिके वे १८८ वे ४, १८५० व्यक्तिकारी स्थापन विकास १००० विकास	2694	G 4	2 5	12	Blux CAR, SW TOP COPURT
2	13.6 K	43	25	· ·	Blue CAR, SW MIDDLE UNDARSIDE
3	28.2K	187	Z 5		Blue LAR, SE MIDDLE TOP
4	19.1K	21	25		Blucks, SE END UNDERSIDE
5	30,8 K	75	2 5		Bloc LAR, NE END TOP
. م	24.8 K	54	25		Bluebar, NE END UNDERSIDE
7	ПK	21	25		Blue CAR, NIW MIDDLE UNDERSIDE
8	2599	86	40		Blue CHE NEW END TOP
9	186 K	150	210		TZ LAR, SE END BUMPER TOP
10	8654	32	70		FOLAR, SE MIDDLE SIDE
lı.	55.1 K	54	170	<u> </u>	Ta CAR, SW MIDDLE PIPE

CAU 168 CAIP Appendix D Revision: 0

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RADIOLOGICAL SURVEY FORM CONTINUATION SHEET

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Survey Point	Gross Fixed + Removable Contamination		Dose rate		Comments/Additional	
	Beta/Gamma (dpm/100 cm²)	Alpha (dpm/100 cm²)	(micro-rR/hr)	Instrument Used	Information	
17	1265	32	. 70	17	Talar SW END SIDE	
13	2381	225	25	1,2	Ta CAR, NU END Top	
14	4177	43	90	12	Tacar, NW MIDDLE UNDERSIDE	
15	8164	21	106	12	TACAR N INSIDE Floor	
16	34.3 K	54	150	1,7	Tacar, END Bunger	
in	6817	214	15	12	FYCAR, S MIDDLE TOP	
14	1120	128	15	1,2	FYCHR, E eND HITCH	
19	17.5K	, 171	20	1,2	F4 CAR, N MIDDLE TOP	
20	952	0	15	1,2	F4 CAR, & evo HITCH	
21	1510	43	230	1,2	EY EAR, W eno	
27	1129	32	450	1,2	THEAR S SIDE MIDDLE	
23	1107	0	35	1,2	F4 CAR, E eno	
24	1524		600	1,2	FR CAR N SIDE MIDDLE	
			FNR FNR	()		
		No	FURTHER	1		

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MATERIALS

Drawing Attached: Yes

Instrument Model: Electra Instrument Nos.: 1531

Calibration Due: S-14-61
Efficiency: 4-18.76 B-14.73

BKG: 2-10,71- B-1361 den

Project Name: CAU 168 (PA) Survey Description RMF Equipment

Instrument (1)

5-18-01

RADIOLOGICAL SURVEY FORM

Projec Number: 799417	Page _1 of
Survey Date: 4/13/01	;
Print Name: Scott Wyltk	
Survey By: Signature	11
Review By: Stace 1. Alers / Hgl	Date 17-202
Instrument (2) Instrument Model: LUDLUM 19 Instrument Nos.: 123 882 Calibration Due: 11/02 Efficiency: NA BKG: 14 4 8 hR	Instrument (3) Instrument Model Instrument Nos.: Calibration Due: Efficiency: BKG:

BRG. <u>~ 10, 14 ~ 1</u>	8-175dpm	MDA:	N A		
MDA: <u>«18dpm</u>		vable Contamination			
Survey Point	Peta/Gamma (dpm/100 cm²)	Alpha (dpm/100 cm²)	Dose rate (micro-R/hr)	Instrument Used.	Comments/Additional Information
	1537	75	24	1,2	CARTY, SE CONNEY TOP
	212 K	21	35		CARTY SE above STAIRS
3	2762	11	25		CHRTY, S MIDDLE SIDE
u U	1918	64	20		CARTY, SW above Stairs
5	7.4 1	75	20		CARTY, Sw evo buser
6	0,6K	43	. 22		CARTY, NW eno bunger
7	1946	21	28		CARTY, NW above strips
4	2490	21	42728		CARTY, N MIDDLE SIDE
9	18.4K	21	42		CARTY, N.F. Above STANS
10	1605	54	25		CARTY NE COINER TOP
11	1048	54	14	<u> </u>	LAR 17918, N SIDE E END

MDA:



RADIOLOGICAL SURVEY FORM CONTINUATION SHEET

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CAU 168 CAIP Appendix D Revision: 0 Date: 11/26/2001 Page D-16 of D-20

	Gross Fixed + Removable Contamination	Dose rate	Instrument Used	Comments/Additional	
Survey Point	Beta/Gamma ((dpm/100 cm²)	्रा +Alpł a (dpm/10।) cm²)	(micro-rR/hr)		Information
12	982	45	15	1,2	CAR 179KG NSIDE MIDDLE
13	1148 .	107	15	1.2	CAR 179KS N SIDE W END
14	1156	128	17	1,2	CAR 17918, SSIDE E COD
15	1044	62	17	1,2	CAR 17414,5 SIDE MIDDLE
16	1020	32	15	1,2	(AR 17918, 551DE WI END
		W.			
			10 EN 10 1E S		
			LO ENTIN		
		51	1211195		
		No	7 0		
		1		·	



SWIPE SAMPLE ANALYSIS FORM

CAU 168 CAIP Appendix D Revision: 0 Date: 11/26/2001 Page D-17 of D-20

Project Name:	PA 168 Rad and Geo	ophysical Surveys			Project Number:	799417.01140015	
Survey Description/L	_ocation:		_		-		
Swipe survey of RMSF			Analysis Date:	4/16/01			
rail and test cars						_	
			System Technician:	Carl Spee	er (A) A	100	-
<u> </u>				01	. 40 ()		10
			Reviewed By:	Utacey (Print / Sign	1/5-1	200/
						Γ	
Alpha Bkg Count Ra	ate (cpm):	0.1	Alpha MDA (dpm):		12.70549552	Instrument Model:	2929
		Beta MDA (dpm):		66.70092276	Scaler Number:	91240	
-		Background Count 1	Time (minutes)	10	Detector Number:		
Į ·			Sample Count Time			Calibration Due:	11/1/0
Sample	Alpha"	Beta-gamma	Alpha	Alpha Activity	/ _{រ]} េះ BB(a _n ean)ច្រាន់	Eclercamina Avilyi	
	Count Rate (cpm)	THE STATE OF THE PERSON OF THE PERSON AND ADDRESS.	ALCOHOLD TO THE PARTY OF THE PA	The state of the s		a sungeraliny	Conments -
F4 S. MID TOP	1	80	ľ	+/- 6.5	40.8	+/- 52.8	
F4 N MID TOP	0	83	-0.3	+/- 2.0	47.5	+/- 53.3	
F4 W	0	52	-0.3	+/- 2.0	-21.3	3 +/- 47.3	
F4 S	0	58	-0.3	+/- 2.0	-8.0	+/- 48.5	
F4 E.	1	54	2.8	+/- 6.5	-16.9	+/- 47.7	
F4 N	1	67	2.8	+/- 6.5	12.0	+/- 50.3	
F8 W	0	61	-0.3	+/- 2.0	-1.3	3 +/- 49.1	
F8 N	1	65	 	+/- 6.5	7.5	5 +/- 49.9	
Unmarked Car	0	49		+/- 2.0	-27.9	+/- 46.6	
	1	62		+/- 6.5	0.9	9 +/- 49.3	
Dump Car	 	57		3 +/- 2.0	-10.2		
Unmarked Car	1 0	1 3/	-0.5	'l''		<u> </u>	



SWIPE SAMPLE ANALYSIS CONTINUATION FORM

CAU 168 CAIP Appendix D Revision: 0 Date: 11/26/2001 Page D-18 of D-20

Project Name: PA 168 Rad and Geophysical Surveys Project Number: 799417.01140015

Survey Location: Swipe survey of RMSF Analysis Date: 4/16/01 System Technician: Carl Speer

				G Sec. Comp.	and the second second	reconstruction of the second	San Sal		Language and the second section of the second
Sample ∑ _{ber}	Alpha Com	Beta-gamma GountiRate (cpm)	, Alpha	Alp	ha Activity	Beta-gamma	Beta	-gamma Activity	Comments
Number	Count Rate (cpm)	Count Rate (cpm)	Activity (dpm)	🦟 ປ່າ	ncertainty	Activity (dpm)	e in s	Uncertainty	Comments Comments
Unmarked Car	1	53	2.8	1	6.5	-19.1		47.5	
TV#2 W	0	56	-0.3	+/-	2.0	-12.4	+/-	48.1	
TV#2 S	1	62	2.8	+/-	6.5	0.9	+/-	49.3	
TV#2 N	0	59	-0.3	+/-	2.0	-5.8	+/-	48.7	
TV#2 E	0	60	-0.3	+/-	2.0	-3.5	+/-	48.9	
F8 E	1	52	2.8	+/-	6.5	-21.3	+/-	47.3	
F8 S	0	50	-0.3	+/-	2.0	-25.7	+/-	46.8	
Unmarked Car	0	51	-0.3	+/-	2.0	-23.5	+/-	47.1	
FC #2 S	3	-55	9.0	+/-	10.9	-14.6	+/-	47.9	,
FC #2 N	1	63	2.8	+/-	6.5	3.1	+/-	49.5	
DUMP CAR E	1	44	2.8	+/-	6.5	-39.0	+/-	45.6	
DUMP CAR S	1 .	54	2.8	+/-	6.5	-16.9	+/-	47.7	
FC #2 E	0	53	-0.3	+/-	2.0	-19.1	+/-	47.5	
FC #2 W	2	63	5.9	+/-	9.0	3.1	+/-	49.5	
NRXA6 W	0	71	-0.3	+/-	2.0	20.8	+/-	51.1	
NRXA6 N	1	59	2.8	+/-	6.5	-5.8	+/-	48.7	
SCRAP1	0	77	-0.3	+/-	2.0	34.1	+/-	52.2	SCRAP BETWEEN CAR&STOP
F2 TOP1	1	74	2.8	+/-	6.5	27.5	+/-	51.6	
F2 TOP2	0	67	-0.3	+/-	2.0	12.0	+/-	50.3	



SWIPE SAMPLE ANALYSIS CONTINUATION FORM

CAU 168 CAIP Appendix D Revision: 0 Date: 11/26/2001 Page D-19 of D-20

Project Name:

PA 168 Rad and Geophysical Surveys

Project Number:

799417.01140015

Survey Location:

Swipe survey of RMSF

Analysis Date: 4/16/01

System Technician: Carl Speer

S am ple Number 8	Alpha Count Rate (cpm)	Beta-camma CountiRate/(com)	Alpha Activity (dpm).	Alpha Activity Uncertainty	Beta-gamma	Bei	gamma Activity	Comments *
F2 TOP3	0			1		+/-	49.5	
PH-1B ne WHEELS	17	639	52.5	+/- 25.7	1280.3	+/-	117.4	T-5
PH-1B NW BUMPE	1	66	2.8	+/- 6.5	9.8	+/-	50.1	
PH-1B NW BUMPE	0	61	-0.3	+/- 2.0	-1.3	+/-	49.1	
PH-1BINSIDE	2	. 71	5.9	+/- 9.0	20.8	+/-	51.1	
17918 N	0	68	-0.3	+/- 2.0	14.2	+/-	50.5	
17918 S	0	76	-0.3	+/- 2.0	31.9	+/-	52.0	
T2 NE END	0	63	-0.3	+/- 2.0	3.1	+/-	49.5	
T2 N INSIDE FLOO	0	66	-0.3	+/- 2,0	9.8	+/-	50.1	
T2 S SIDE MID	0	63	-0.3	+/- 2.0	3.1	+/-	49.5	PIPE
T2 SE END	1	71	2.8	+/- 6.5	20.8	+/-	51.1	
T4 SW	0	69	-0.3	+/- 2.0	16.4	+/-	50.7	
T4 SE	1	71	2.8	+/- 6.5	20.8	+/-	51.1	
T4 NE	. 0	62	-0.3	+/- 2.0	0.9	+/-	49.3	
T4 NW	0	57	-0.3	+/- 2.0	-10.2	+/-	48.3	
BLUE CAR SE TOP	, o	62	-0.3	+/- 2.0	0.9	+/-	49.3	
BLUE CAR NW TO	2	55	5.9	+/- 9.0	-14.6	+/-	47.9	
BLUE CAR NE UN	0	54	-0.3	+/- 2.0	-16.9	+/-	47.7	
BLUE CAR SE UND	1	62	2.8	+/- 6.5	0.9	+/-	49.3	



SWIPE SAMPLE ANALYSIS FORM

CAU 168 CAIP Appendix D Revision: 0 Date: 11/26/2001 Page D-20 of D-20

Project Name:	PA 168				-	Project Number:	799	417.00000000	
Survey Description/L	ocation:								
Swipe survey of RMSF RAIL AND TEST CARS			Analysis Date:		4/17/01	-			
			System Technician:		Carl Speer	Print / Sign			
	<i>S//</i>		Reviewed By:		Stare C.	Print / Sign		5-1-200	/
Alpha Bkg Count Ra	te (cpm):	0	Alpha MDA (dpm):			9.316770186	instr	ument Model:	2929
H ' -		Beta MDA (dpm):			64.31390657	Scal	er, Number:	91240	
		Background Count Time (minutes)		minutes)	10	Dete	ctor Number:		
		0.451	1 Sample Count Time (minutes)		1	Calib	ration Due:	11/1/0	
Sample	Alpha :	Beta-gamma Count Rate (com)	Alpha Activity (dpm)	23/1/6	na Activity ncertainty	Beta-gammas Activity (dpm)	4.02		
4 FT STAND	5	1500	15.5		13.9	3200.0		175.0	
FL1 BRAKE	0	48		+/-	0.0	-19.5	+/-	45.4	
FL 2 FLOOR	8	65	24.8		17.6	18.2	+/-	48.9	
RAIL TIE SPUR M	9	286	28.0	+/-	18.6	508.2	+/-	82.1	

Appendix E

Nevada Environmental Restoration Project Document Review Sheet

CAU 168 CAIP Appendix E Revision: 0 Date: 11/26/2001 Page E-1 of E-2

NEVADA ENVIRONMENTAL RESTORATION PROJECT DOCUMENT REVIEW SHEET

Document Ti and 26 Contam		2. Document Date: October 2001				
3. Revision Nu	4. Originator/Organization: IT Corp	Organization: IT Corporation				
5. Responsible DOE/NV ERP Project Mgr.: Janet Appenzeller-Wing 6. Date Comments Due: October 2						
7. Review Crite	ria: Full					
8. Reviewer/Or	ganization/F	Phone No.: John A. Wong, NDEP, 486-2866		9. Reviewer's Signature:		
10. Comment Number/ Location	11. Type*	De* 12. Comment Response				
1) Section 3.2 Page 47 3 rd Paragraph		Define and/or appropriately reference the free-release criteria for which swipe counts must meet. Also, indicate the course of action that will be taken in the event that free-release criteria is not met. Where is it established that laboratory data are not required to meet free-release criteria?	Text changed to read accordance with Tabl Rev. 4 (DOE, 2000a). units of activity per ur data are presented in (pCi/g). So laboraton free-release determin free-release criteria the taken to manage t	Yes		
2) Section 3.2 Page 49 1 st Paragraph		"PALs were calculated using data from NTS and surrounding region* What PALs were calculated based on NTS data, radiological PALs, field screening levels, chemical PALs? Please explain. Chemical PALs, as defined in Section 3.3.2, are defined as EPA Region IX PRGs, and other applicable regulatory-based limits that are already established, not levels that are calculated.	Text was changed to read: "Radionuclide PALs were calculated using data from the NTS and surrounding region (Adams, 2000a and b)."		Yes	
3) Section 3.3.1 Page 55 2 nd Bullet		What is the TPH field screening level? The text in this bullet is ambiguous.	Text changed to read: "The TPH field-screening results greater than 75 ppm when measured using an appropriate field-screening method (i.e., Hanby or other test kit)."		Yes	
4) Section 4.3.1 Page 61 2 nd Paragraph		"Surface radiological surveys will be performed at CAS" Will a radiological survey be performed at CAS 26-08-01, as indicated in Table 4-1? If so, please include text to describe the survey at this CAS. If not, please modify Table 4-1.	Text added to reflect conducted at CAS 26	surface radiological survey will be -08-01.	Yes	

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10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
5) Section 4.3.3 1 st Paragraph 1 st Sentence		Define, or explain how contaminants-bounding sample locations will be determined.	Text was added in Section 4.3.3. to read: "Details specifying determination of contaminant-bounding sample locations are discussed for each CAS in Sections 4.3.3.1 to 4.3.3.10."	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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