Nevada
Environmental
Restoration
Project

DOE/NV--619

Corrective Action Decision Document
for Corrective Action Unit 254:
Area 25 R-M AD Decontamination
Facility, Nevada Test Site, Nevada

Controlled Copy No.: ____

Revision No.: 0

June 2000

Approved for public release; further dissemination unlimited.

Environmental Restoration
Division

U.S. Department of Energy
Nevada Operations Office

Available for sale to the public, in paper, from:

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

Available electronically at <http://www.doe.gov/bridge>.

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

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

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

**CORRECTIVE ACTION DECISION DOCUMENT FOR
CORRECTIVE ACTION UNIT 254:
AREA 25 R-MAD DECONTAMINATION FACILITY
NEVADA TEST SITE, NEVADA**

DOE Nevada Operations Office
Las Vegas, Nevada

Controlled Copy No.: ____

Revision No.: 0

June 2000

Approved for public release; further dissemination unlimited.

**CORRECTIVE ACTION DECISION DOCUMENT FOR
CORRECTIVE ACTION UNIT 254:
AREA 25 R-MAD DECONTAMINATION FACILITY
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 Division

Table of Contents

List of Figures.....	iv
List of Plates.....	v
List of Tables.....	vi
List of Acronyms and Abbreviations.....	viii
Executive Summary.....	ES-1
1.0 Introduction.....	1
1.1 Purpose.....	1
1.2 Scope.....	1
1.3 CADD Contents.....	4
2.0 Corrective Action Investigation Summary.....	5
2.1 Corrective Action Investigation Activities.....	5
2.2 Results.....	6
2.3 Need for Corrective Action.....	8
3.0 Evaluation of Alternatives.....	9
3.1 Corrective Action Objectives.....	9
3.1.1 Contaminants of Concern.....	9
3.1.2 Potential Exposure Pathways.....	10
3.2 Screening Criteria.....	10
3.2.1 Corrective Action Standards.....	11
3.2.2 Remedy Selection Decision Factors.....	12
3.3 Development of Corrective Action Alternatives.....	14
3.3.1 Alternative 1 - No Further Action.....	15
3.3.2 Alternative 2 - Unrestricted Release Decontamination and Verification Survey.....	15
3.3.3 Alternative 3 - Unrestricted Release Decontamination, Verification Survey, and Dismantle Building 3126.....	15
3.4 Evaluation and Comparison of Alternatives.....	16
4.0 Recommended Alternative.....	21
5.0 References.....	22

Appendix A - Corrective Action Investigation Report for CAU 254: R-MAD Decontamination Facility, Nevada Test Site, Nevada

A.1.0 Introduction.....	A-1
A.1.1 Project Objectives.....	A-1
A.1.2 Appendix Content.....	A-2

Table of Contents *(Continued)*

A.2.0	Corrective Action Investigation Activities	A-3
A.2.1	Site Description and Conditions	A-5
A.2.2	Sampling Logistics and Locations	A-5
A.2.3	Direct-Push Sampling	A-5
A.2.4	Field Screening	A-7
A.2.5	Environmental Samples	A-7
A.2.5.1	Soil Samples	A-8
A.2.5.2	Sediment Samples	A-8
A.2.5.3	Concrete Samples	A-8
A.2.5.4	Wood Samples	A-8
A.2.5.5	Insulation Samples	A-9
A.2.5.6	Lead Solder Samples	A-9
A.2.5.7	Filter Samples	A-9
A.2.5.8	Paint Samples	A-9
A.2.5.9	Rubber Samples	A-10
A.2.5.10	Miscellaneous Building Material Samples	A-10
A.2.5.11	Swipe Samples	A-10
A.2.6	Background Soil Samples	A-10
A.2.7	Radiological Preliminary Action Levels	A-11
A.2.7.1	Grid Square Locations	A-11
A.2.7.2	Radiological Survey Units	A-11
A.2.7.3	Radiological Surveys	A-14
A.2.7.4	Radiation Dose Rate Surveys	A-14
A.2.7.5	Total Surface Contamination Measurements	A-14
A.2.7.6	Removable Surface Contamination Measurements	A-15
A.2.7.7	Building and Equipment Samples	A-15
A.2.8	Video Survey	A-15
A.3.0	Investigation Results	A-17
A.3.1	Total Volatile Organic Compound Analytical Results	A-26
A.3.2	Semivolatile Organic Compound Analytical Results	A-26
A.3.3	TCLP Semivolatile Organic Compound Analytical Results	A-26
A.3.4	Total Petroleum Hydrocarbon Analytical Results	A-26
A.3.5	Total RCRA Metals Analytical Results	A-27
A.3.6	TCLP RCRA Metals Analytical Results	A-27
A.3.7	Polychlorinated Biphenyl Analytical Results	A-30
A.3.8	Total Pesticides Analytical Results	A-30
A.3.9	TCLP Pesticides Analytical Results	A-30
A.3.10	Radioanalytical Results	A-30
A.3.10.1	Radiation Dose Rate Survey Results	A-30
A.3.10.2	Radiological Scanning and Static Survey Results	A-37
A.3.10.3	Removable Radiation Swipe Sample Results	A-37
A.3.10.4	Building and Equipment Radiation Sample Results	A-37

Table of Contents (Continued)

A.4.0	Quality Assurance.....	A-39
A.4.1	Precision	A-39
A.4.2	Accuracy	A-39
A.4.3	Representativeness	A-40
A.4.4	Completeness	A-40
A.4.5	Comparability	A-40
A.4.6	Tier I and Tier II Data Evaluations.....	A-41
A.4.6.1	Tier I Evaluation	A-41
A.4.6.2	Tier II Evaluation.....	A-42
A.4.6.3	Tier III Evaluation	A-43
A.4.7	Quality Control Samples.....	A-44
A.4.7.1	Field Quality Control Samples.....	A-44
A.4.7.2	Laboratory Quality Control Samples.....	A-46
A.4.8	Field Nonconformances	A-48
A.4.9	Laboratory Nonconformances	A-48
A.5.0	Summary.....	A-49
A.6.0	References	A-51

Appendix B - Cost Estimates

Appendix C - Radiological Survey Units: Data Packages

C.1.0	References.....	C-24
-------	-----------------	------

Appendix D - CAU 254, Area 25 R-MAD Decontamination Facility, Building Material and Swipe Samples Detected Above Minimum Reporting Limits

D.1.0	References.....	D-19
-------	-----------------	------

Appendix E - Evaluation of Risk

List of Figures

<i>Number</i>	<i>Title</i>	<i>Page</i>
1-1	Nevada Test Site and CAU 254, Area 25 R-MAD Decontamination Facility, Location Map.	2
1-2	CAU 254, Area 25 R-MAD Location Map.	3
A.2-1	CAU 254 Site Layout	A-6
A.2-2	CAU 254, Area 25 R-MAD Decontamination Facility (Building 3126) Layout	A-13
C-1	CAU 254: Water Heater and Compressor Room Total Surface Contamination Survey Map	C-2
C-2	CAU 254: Locker and Shower Room Total Surface Contamination Survey Map. . .	C-4
C-3	CAU 254: Office Total Surface Contamination Survey Map	C-6
C-4	CAU 254: North Side of Decontamination Bay Total Surface Contamination Survey Map	C-8
C-5	CAU 254: South Side of Decontamination Bay Total Surface Contamination Survey Map	C-11
C-6	CAU 254: Loft and Stairway Total Surface Contamination Survey Map	C-14
C-7	CAU 254: West Decontamination Pad Total Surface Contamination Survey Map	C-16
C-8	CAU 254: East Decontamination Pad Total Surface Contamination Survey Map	C-18
C-9	CAU 254: External Surfaces of Building Total Surface Contamination Survey Map	C-20
C-10	CAU 254: Surface and Subsurface Soil Total Surface Contamination Survey Map	C-23

List of Plates

<i>Number</i>	<i>Title</i>
1	Position Sensitive Radiation Monitor Surface Beta Contamination Survey Results

List of Tables

Number	Title	Page
3-1	Detailed Evaluation of the Corrective Action Alternatives for CAU 254, Area 25 R-MAD Decontamination Facility	17
3-2	Evaluation and Comparison of the Corrective Action Alternatives for CAU 254, Area 25 R-MAD Decontamination Facility	20
A.2-1	Radiological Preliminary Action Levels for Off-Site Analytical Methods.	A-12
A.3-1	CAU 254, Area 25 R-MAD Decontamination Facility, Sampling Locations and Analyses.	A-18
A.3-2	Laboratory Analytical Methods Used for Samples Collected from CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site	A-25
A.3-3	Total Petroleum Hydrocarbons (Diesel Range Organics) Results for Soil Samples from CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site	A-27
A.3-4	Total RCRA Metals Detected Above Minimum Reporting Limits for Soil Samples from CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site	A-28
A.3-5	Polychlorinated Biphenyls (PCBs) Detected Above Minimum Reporting Limits for Soil Samples from CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site	A-31
A.3-6	Isotopic Results Detected Above Minimum Reporting Limits for Soil Samples from CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site	A-32
A.3-7	Gamma Spectrometry Results for Soil Samples from CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site	A-34
A.3-8	Building and Equipment Material Sample Results Exceeding Radiological Preliminary Action Levels for CAU 254, R-MAD Decontamination Facility, Nevada Test Site	A-38

List of Tables (Continued)

<i>Number</i>	<i>Title</i>	<i>Page</i>
D.1-1	CAU 254, Area 25 R-MAD Decontamination Facility, Building Material and Swipe Samples Detected Above Minimum Reporting Limits	D-1

List of Acronyms and Abbreviations

ALARA	As low as reasonably achievable
AST	Aboveground storage tank
BN	Bechtel Nevada
CADD	Corrective Action Decision Document
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CFR	<i>Code of Federal Regulations</i>
CLP	Contract Laboratory Program
cm ²	Square centimeter(s)
COC	Contaminant(s) of concern
COPC	Contaminant(s) of potential concern
CRDL	Contract-required detection limit(s)
Cs-137	Cesium-137
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
dpm	Disintegrations per minute
DQO	Data Quality Objective(s)
DRO	Diesel range organics
EPA	U.S. Environmental Protection Agency
Eu	Europium
FFACO	<i>Federal Facility Agreement and Consent Order</i>
FSL	Field-screening level(s)
ft	Foot (feet)
HEPA	High Efficiency Particulate Air Filter
ICP	Inductively coupled plasma
in.	Inch(es)

List of Acronyms and Abbreviations (Continued)

in ³	Cubic inch(es)
ITLV	IT Corporation, Las Vegas
LCS	Laboratory control sample(s)
m ²	Square meters
MARSSIM	<i>Multi-Agency Radiation Survey and Site Investigation Manual</i>
MDA	Minimum Detectable Activity
mi	Mile(s)
microrem/hr	Microrem per hour
mg/kg	Milligram(s) per kilogram
mg/L	Milligram(s) per liter
MRL	Minimum Reporting Limit(s)
MS/MSD	Matrix spike/matrix spike duplicate
NAC	<i>Nevada Administrative Code</i>
Nb-94	Niobium-94
NDEP	Nevada Division of Environmental Protection
NIST	National Institute for Standards and Technology
NRDS	Nuclear Rocket Development Station
NRS	<i>Nevada Revised Statutes</i>
NTS	Nevada Test Site
PAL	Preliminary action level(s)
PB	Preparation blanks
PCB	Polychlorinated biphenyl(s)
pCi/g	Picocurie(s) per gram
PID	Photoionization detector
ppm	Part(s) per million
PRG	Preliminary Remediation Goals
PSRM	Position Sensitive Radiation Monitor

List of Acronyms and Abbreviations (Continued)

Pu	Plutonium
Pu-239	Plutonium-239
PVC	Polyvinyl chloride
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RADCON	Radiological Control
RCRA	<i>Resource Conservation and Recovery Act</i>
R-MAD	Reactor - Maintenance Assembly, and Disassembly
RPD	Relative percent difference
SDG	Sample delivery group
Sr-90	Strontium-90
SVOC	Semivolatile organic compound(s)
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total petroleum hydrocarbons
U	Uranium
U-234	Uranium-234
U-235	Uranium-235
VOC	Volatile organic compound(s)
µg/kg	Microgram(s) per kilogram
%R	Percent recovery

Executive Summary

This Corrective Action Decision Document has been prepared for Corrective Action Unit 254, Area 25 Reactor-Maintenance Assembly and Disassembly (R-MAD) Decontamination Facility. The corrective action investigation was conducted in accordance with the *Corrective Action Investigation Plan for Corrective Action Unit 254: Area 25 R-MAD Decontamination Facility, Nevada Test Site, Nye County, Nevada* as developed under the *Federal Facility Agreement and Consent Order*. Corrective Action Unit 254 consists of Corrective Action Site 25-23-06, Decontamination Facility.

The scope of this Corrective Action Decision Document consists of the following tasks:

- Develop corrective action objectives.
- Identify corrective action alternative evaluation criteria.
- Develop corrective action alternatives.
- Perform detailed and comparative evaluations of the corrective action alternatives in relation to the corrective action objectives and screening criteria.
- Recommend and justify a preferred corrective action alternative for the Corrective Action Site.

A corrective action investigation for Corrective Action Site, 25-23-06, Decontamination Facility was conducted in January 2000 as set forth in the *Corrective Action Investigation Plan for Corrective Action Unit 254: Area 25 R-MAD Decontamination Facility, Nevada Test Site, Nye County, Nevada*. Analytes detected during the corrective action investigation were evaluated against preliminary action levels to determine the contaminants of concern for Corrective Action Unit 254. Analysis of the data generated from corrective action investigation activities conducted at Corrective Action Unit 254 indicates the following:

- Radiation dose rates inside the Decontamination Facility, Building 3126, and in the storage yard exceeded the average general dose rate.
- Both scanning and static total surface contamination surveys indicated that portions of the locker and shower room floor; decontamination bay floor; loft floor; east and west decon pads; north and south decontamination bay interior walls, exterior west and south walls, and loft walls were above Preliminary Action Levels.

- Removable surface contamination exceeded the corresponding Preliminary Action Levels in one sample. All other removable surface contamination surveys indicated that the floor, walls, and ceilings, were below the Preliminary Action Levels for removable surface contamination.
- Radionuclides were detected at concentrations above the Preliminary Action Levels for concrete, rubber, wood, insulation, vent stack filters, piping, sediment, and paint. Radionuclides which exceeded Preliminary Action Levels in building materials were strontium-90, niobium-94, cesium-137, uranium-234, uranium-235, and plutonium-239.
- Radionuclides were detected at concentrations above the Preliminary Action Levels in soil samples collected in the storage yard. Radionuclides which exceeded Preliminary Action Levels in soil samples were strontium-90, cesium-137, uranium-234, and uranium-235.
- Total Volatile Organic Compounds were not detected at concentrations above the minimum reporting limits in soil samples. Total Volatile Organic Compounds were detected at concentrations above the minimum reporting limits and below the Preliminary Action Levels in samples of concrete, filters, insulation, sediment, water, and wood.
- Total Semivolatile Organic Compounds were detected at concentrations above the minimum reporting limits but less than the Preliminary Action Level in one soil sample. Total Semivolatile Organic Compounds were detected at concentrations above the minimum reporting limits in samples of concrete, filters, insulation, sediment, water, and wood. The Preliminary Action Levels were exceeded in insulation.
- The Toxicity Characteristic Leaching Procedure Semivolatile Organic Compounds were not detected at concentrations above the minimum reporting limits in soil samples. Toxicity Characteristic Leaching Procedure Semivolatile Organic Compounds were detected at concentrations above the minimum reporting limits in one wood sample.
- Total Petroleum Hydrocarbons were detected in the diesel/oil ranges above minimum reporting limits but less than the Preliminary Action Level in soil samples. Total Petroleum Hydrocarbons were detected in the diesel/oil range at concentrations above the minimum reporting limits in samples of concrete, filters, sediment, and wood. The results for wood, concrete, and filter material were greater than the Preliminary Action Level.
- Total *Resource Conservation and Recovery Act* Metals were detected at concentrations above the minimum reporting limits but less than the Preliminary Action Level in soil samples. Total *Resource Conservation and Recovery Act* Metals were detected at concentrations above the minimum reporting limits in samples of concrete, filters, insulation, sediment, water, wood, and paint. The results for sediment, concrete, paint, and liquid from the drains were greater than the Preliminary Action Level.
- The Toxicity Characteristic Leaching Procedure *Resource Conservation and Recovery Act* Metals were detected at concentrations above the minimum reporting limits for lead in one

soil sample. Total *Resource Conservation and Recovery Act* Metals were detected at concentrations above the minimum reporting limits in samples of concrete, rubber, sediment, and wood.

- Polychlorinated Biphenyls were detected at concentrations above the minimum reporting limits in soil samples, concrete, filters, insulation, oil, sediment, and wood. The wood, insulation, and filter material results were greater than the Preliminary Action Level.
- Total and Toxicity Characteristic Leaching Procedure Pesticides were not detected at concentrations above the minimum reporting limits in soil or building material samples.

The following corrective action objectives have been identified for this site and are based on potential exposure pathways:

- Prevent or mitigate human exposure to soil and building materials containing contaminants of concern at concentrations exceeding preliminary action levels as defined in the Corrective Action Investigation Plan.
- Prevent human exposure to soil and building materials with surface contamination greater than unrestricted release levels for radiological constituents.

The following corrective action alternatives were developed for consideration and are based on the review of existing data, future use, and current operations at the Nevada Test Site:

- Alternative 1 - No Further Action
- Alternative 2 - Unrestricted Release Decontamination and Verification Survey
- Alternative 3 - Unrestricted Release Decontamination and Verification Survey and Dismantling of Building 3126

The corrective action alternatives were evaluated against four general corrective action standards. Only Alternatives 2 and 3 were compared to the five remedy selection decision factors because Alternative 1 did not meet the unrestricted release criteria. Based on the results of these evaluations, the preferred corrective action alternative selected for Corrective Action Site 25-23-06, Decontamination Facility is Alternative 2, Unrestricted Release Decontamination and Verification Survey.

The preferred corrective action alternative was evaluated on technical merit, focusing on performance, reliability, feasibility, and safety. The alternative was judged to meet all requirements for the technical components evaluated. The alternative for Corrective Action Site 25-23-06,

Decontamination Facility meets all applicable state and federal regulations for closure of the site and reduces the potential for future exposure pathways.

During corrective action implementation, this alternative will present a potential threat to site workers who come in contact with the contaminated concrete and sediment during the removal process.

Procedures should be developed and implemented to ensure worker health and safety.

1.0 Introduction

The *Corrective Action Decision Document (CADD) for Corrective Action Unit (CAU) 254, Area 25 Reactor-Maintenance, Assembly, and Disassembly (R-MAD) Decontamination Facility* has been prepared in accordance with the *Federal Facility Agreement and Consent Order (FFACO)* that was agreed to by the U.S. Department of Energy (DOE), the State of Nevada, and the U.S. Department of Defense (FFACO, 1996).

Corrective Action Unit 254 is located on the Nevada Test Site (NTS) in Nye County, Nevada. The NTS is approximately 65 miles (mi) northwest of Las Vegas, Nevada ([Figure 1-1](#) and [Figure 1-2](#)).

Corrective Action Unit 254 is comprised of Corrective Action Site (CAS) 25-23-06, Decontamination Facility.

1.1 Purpose

The purpose of this CADD is to identify and provide a rationale for the selection of a recommended corrective action alternative for CAU 254. The need for evaluation of corrective action alternatives is based on process knowledge and the results of the corrective action investigation at CAU 254 conducted in January 2000, in accordance with the *Corrective Action Investigation Plan (CAIP) for Corrective Action Unit 254: Area 25 R-MAD Decontamination Facility, Nevada Test Site, Nye County, Nevada* (DOE/NV, 1999). The detailed results of the investigation are presented in [Appendix A](#).

1.2 Scope

The scope of this CADD consists of the evaluation, identification, and recommendation of a preferred corrective action alternative to be implemented at the CAU 254 Site. To achieve this scope, the following actions have been taken:

- Evaluated current site conditions, including the concentration and extent of contamination.
- Developed corrective action objectives.
- Identified corrective action alternative screening criteria.

Figure 1-1
Nevada Test Site and CAU 254, Area 25 R-MAD Decontamination Facility,
Location Map

Figure 1-2
CAU 254, Area 25 R-MAD Location Map

h:\cau_254\cadd\final\254locmap_b.dgn

01-JUN-2000

- Developed corrective action alternatives.
- Performed detailed evaluation of the corrective action alternatives in relation to corrective action objectives and screening criteria.
- Recommended and justified a preferred corrective action alternative for the CAU 254 Site.

1.3 CADD Contents

This CADD has been divided into the following sections:

- [Section 1.0](#) - Introduction: summarizes the purpose, scope, and contents of this CADD.
- [Section 2.0](#) - Corrective Action Investigation Summary: summarizes the investigation activities, the results of the investigation, and the need for corrective action.
- [Section 3.0](#) - Evaluation of Alternatives: documents steps taken to determine a preferred corrective action alternative.
- [Section 4.0](#) - Recommended Alternative: presents the preferred corrective action alternative and rationale for its selection based on the corrective action objectives and alternative screening criteria.
- [Section 5.0](#) - References: provides a list of cited documents.
- [Appendix A](#): *Corrective Action Investigation Report for CAU 254: Area 25 R-MAD Decontamination Facility, Nevada Test Site, Nevada.*
- [Appendix B](#): Cost Estimates
- [Appendix C](#): Radiological Survey Unit Data Packages
- [Appendix D](#): [Table D.1-1](#), CAU 254, Area 25 R-MAD Decontamination Facility, Building Material and Swipe Samples Detected Above Minimum Reporting Limits
- [Appendix E](#): Evaluation of Risk

All work was performed in accordance with the following documents:

- CAIP (DOE/NV, 1999)
- *Industrial Sites Quality Assurance Project Plan (QAPP)* (DOE/NV, 1996b)
- FFACO (FFACO, 1996)
- *Project Management Plan* (DOE/NV, 1994)

2.0 Corrective Action Investigation Summary

The following sections describe and summarize the results of the corrective action investigation activities conducted at CAU 254. For detailed results of the CAU 254 corrective action investigation refer to [Appendix A](#).

2.1 Corrective Action Investigation Activities

The corrective action field investigation and sampling activities for CAU 254 were conducted by IT Corporation, Las Vegas (ITLV) in January and February 2000, in accordance with the CAIP (DOE/NV, 1999). Preliminary work was conducted from the mid to latter months in 1999. The following is a nonsequential summary of the preliminary work and field investigation activities conducted at CAU 254:

- Conducted nonintrusive radiological walkover survey of the storage yard and the exterior concrete decontamination pads to evaluate areas of potential contamination.
- Established presence or absence of underground storage areas and verified location of septic and radiological sewage piping.
- Evaluated building for potential hazards, such as asbestos, hantavirus, utility systems, and other health and safety hazards. Collected samples for off-site asbestos analysis. Performed housekeeping activities to mitigate potential exposure of workers to hantavirus.
- Established and marked grids for radiological surveys.
- Conducted preliminary radiological scanning and static surveys to determine if contamination was wide-spread throughout the building or confined to smaller, hot-spot areas such as the drains. Marked identified contaminated areas.
- Conducted dose rate surveys at random locations within and outside the building for worker protection.
- Conducted scanning and static radiological surveys to identify areas of fixed radiological contamination.
- Collected swipe samples from biased locations based on radiological scanning and static surveys and from random locations.

- Collected surface and subsurface environmental soil samples from random and biased locations within the confines of the storage yard fence.
- Conducted field screening on soil and building material samples for volatile organic compounds (VOCs) and radiological contamination.
- Marked and surveyed soil sample locations.
- Collected building material samples from random locations based on sampling criteria.
- Collected building material samples from biased locations based on radiological scanning and static surveys, visual observation, and/or process knowledge.
- Segregated miscellaneous materials and collected environmental samples (e.g., railroad ties, pipe joints, wallboard, drain and sump sediments, and concrete) and waste management samples (e.g., fluid removed from equipment) to characterize potential *Resource Conservation and Recovery Act* (RCRA) constituents. Opened the aboveground storage tank (AST) to examine and document the presence or absence of fluids.
- Attempted video and radiation survey on below-grade drain piping to establish the condition (i.e., possible leakage) and relative radiological levels.
- Submitted swipe, soil, and building material samples for off-site analysis.
- Filled excess void space in each soil sample location with dry bentonite upon completion of the field investigation.

2.2 Results

Data was collected from the corrective action investigation activities conducted at the CAU 254. Results from radiological surveys; on-site radiological analysis of swipe samples; and off-site laboratory analysis of soil, swipe, and building material samples indicate the following:

- Radiation dose rates inside the Decontamination Facility, Building 3126, and in the storage yard exceeded the average general dose rate.
- Both scanning and static total surface contamination surveys indicated that portions of the locker and shower room floor; decontamination bay floor; loft floor; east and west decon pads; north and south decontamination bay interior walls, exterior west and south walls, and loft walls were above Preliminary Action Levels (PALs).

- Removable surface contamination exceeded the corresponding PALs in one sample. All other removable surface contamination surveys indicated that the floor, walls, and ceilings were below the PALs for removable surface contamination.
- Radionuclides were detected at concentrations above the PALs for concrete, rubber, wood, insulation, vent stack filters, piping, sediment, and paint. Radionuclides which exceeded PALs in building materials were strontium-90 (Sr-90), niobium-94 (Nb-94), cesium-137 (Cs-137), uranium-234 (U-234), uranium-235 (U-235), and plutonium-239 (Pu-239).
- Radionuclides were detected at concentrations above the PALs in soil samples collected in the storage yard. Radionuclides which exceeded PALs in soil samples were Sr-90, Cs-137, U-234, and U-235.
- Total VOCs were not detected at concentrations above the minimum reporting limits in soil samples. Total VOCs were detected at concentrations above the minimum reporting limits and below the PALs in samples of concrete, filters, insulation, sediment, water, and wood.
- Total Semivolatile Organic Compounds (SVOCs) were detected at concentrations above the minimum reporting limits but less than the Preliminary Action Level (PALs) in one soil sample. Total SVOCs were detected at concentrations above the minimum reporting limits in samples of concrete, filters, insulation, sediment, water, and wood. The PALs were exceeded in insulation.
- The Toxicity Characteristic Leaching Procedure (TCLP) SVOCs were not detected at concentrations above the minimum reporting limits in soil samples. Toxicity Characteristic Leaching Procedure SVOCs were detected at concentrations above the minimum reporting limits in one wood sample.
- Total Petroleum Hydrocarbons (TPH) were detected in the diesel/oil ranges above minimum reporting limits but less than the the PAL in soil samples. Total Petroleum Hydrocarbons were detected in the diesel/oil range at concentrations above the minimum reporting limits in samples of concrete, filters, sediment, and wood. The results for wood, concrete, and filter material were greater than the PAL.
- Total RCRA Metals were detected at concentrations above the minimum reporting limits but less than the PALs in soil samples. Total RCRA Metals were detected at concentrations above the minimum reporting limits in samples of concrete, filters, insulation, sediment, water, wood, and paint. The results for sediment, concrete, paint, and liquid from the drains were greater than the PALs.
- The TCLP RCRA Metals were detected at concentrations above the minimum reporting limits for lead in one soil sample. Total RCRA Metals were detected at concentrations above the minimum reporting limits in samples of concrete, rubber, sediment, and wood.

- Polychlorinated Biphenyls (PCBs) were detected at concentrations above the minimum reporting limits in soil samples, concrete, filters, insulation, oil, sediment, and wood. The wood, insulation, and filter material results were greater than the PAL.
- Total and TCLP Pesticides were not detected at concentrations above the minimum reporting limits in soil or building material samples.

The analytical results supporting this information are provided in [Appendix A](#) and [Appendix D](#). The waste determination and final disposal of investigation-derived waste is pending and will be documented in the Corrective Action Plan.

2.3 Need for Corrective Action

Analytes detected during the corrective action investigation were evaluated against PALs to determine contaminants of concern (COCs) for the CAU 254 Site. Results from the radiological survey and the analysis of soil and building materials indicate that PCBs, total RCRA metals, TPH as diesel-range organics (DRO), U-234, U-235, Pu-239, Cs-137, Nb-94, and Sr-90 exceeded the established PALs listed in the CAIP (DOE/NV, 1999). Based on the identification of COCs above PALs, potential corrective action alternatives are identified and evaluated in this CADD to ensure worker, public, and environmental protection against potential exposure to COCs in accordance with the *Nevada Administrative Code* (NAC) 445A (NAC, 1998b).

Based on an evaluation of the overall effectiveness, feasibility, and cost estimates the recommended alternative for corrective action is to decontaminate, and dispose of the associated waste at Building 3126. In addition, the recommended alternative for the contaminated soil is excavation followed by on-site disposal. The volumes and cost estimates for waste disposal are provided in [Appendix B](#). The volume and cost estimate for waste removal from the subsurface sanitary and industrial drain piping was not within the scope of this evaluation.

At this time, there are no site-specific characteristics identified that may constrain remediation.

3.0 Evaluation of Alternatives

The purpose of this section is to present the corrective action objectives for the CAU 254 Site, describe the general standards and decision factors used to screen the corrective action alternatives, and develop and evaluate a set of corrective action alternatives that could be used to meet the corrective action objectives.

3.1 Corrective Action Objectives

Corrective action objectives are media-specific goals for protecting human health and the environment and constitute the basis for the development of corrective action alternatives. The proposed corrective action must be technically sound, provide a permanent solution for the site, and be cost-effective. In addition, the corrective action must be acceptable to the U.S. Department of Energy, Nevada Operations Office (DOE/NV), Nevada Division of Environmental Protection (NDEP), and the public. Based on the potential exposure pathways (see [Section 3.1.2](#)), the following corrective action objectives have been identified for CAU 254:

- Prevent or mitigate human exposure to soil and building material containing COCs at concentrations exceeding PALs as defined in the CAIP (DOE/NV, 1999).
- Prevent human exposure to areas of surface contamination greater than the PALs for radionuclides present at the CAU 254 Site (DOE/NV, 1996c).

3.1.1 Contaminants of Concern

Contaminants of potential concern (COPCs) were determined in the Data Quality Objectives (DQO) process as listed in the CAIP (DOE/NV, 1999). Analytical results obtained from the corrective action investigation were evaluated to determine if COPCs were detected above PALs. If the PALs are exceeded, those analytes become COCs and must be considered for corrective action. Based on the analytical results of the radiological surveys and building material samples, the following radionuclides have been identified as COCs for building materials: Sr-90, Cs-137, Nb-94, U-234, U-235, and Pu-239. Based on the analytical results of the soil samples collected from the storage yard at building 3126, the following radionuclides have been identified as COCs for soils: Sr-90, U-234, U-235, and Cs-137.

Based on analytical results of soils and building material samples the following chemical COCs have been identified for building materials: arsenic, chromium, lead, Bis(2-ethylhexyl)Phthalate, Aroclor-1260, Aroclor-1254, TPH-Diesel Range Organics, and toluene. There were no chemical COC's identified for soil samples.

3.1.2 Potential Exposure Pathways

As identified in the CAIP, the future use for the CAU is assumed to be similar to current industrial use. As part of the CAIP (DOE/NV, 1999), a conceptual model for the CAU 254 Site was developed which identified potential exposure pathways as ingestion, inhalation, dermal contact, and direct exposure with contaminated soil and building material under an industrial-use scenario. Site personnel could potentially be exposed to the contaminated soil and building material during general facility maintenance or construction and maintenance of utilities. Contaminant migration to the groundwater is not considered to be a significant exposure pathway because the low mobility of the COCs and depth to groundwater. Any migration of COCs is expected to be negligible.

3.2 Screening Criteria

The screening criteria used to evaluate and select the preferred corrective action alternatives consisted of a variety of general standards and decision factors described in Title 40, *Code of Federal Regulations* (CFR) Sections 260-271 (CFR, 1998); the U.S. Environmental Protection Agency's (EPA) *Guidance on Resource Conservation and Recovery Act Corrective Action Decision Documents* (EPA, 1991); and the *Final Resource Conservation and Recovery Act Corrective Action Plan* (EPA, 1994).

Corrective action alternatives will be evaluated based on four general corrective action standards and five remedy selection decision factors, as described in the following text. All corrective action alternatives must meet the general standards to be selected for evaluation using the remedy selection decision factors.

The general corrective action standards are as follows:

- Protection of human health and the environment
- Compliance with media cleanup standards

- Control the source(s) of the release
- Compliance with applicable federal, state, and local standards for waste management

The remedy selection decision factors are as follows:

- Short-term reliability and effectiveness
- Reduction of toxicity, mobility, and/or volume
- Long-term reliability and effectiveness
- Feasibility
- Cost

3.2.1 Corrective Action Standards

The corrective action general standards and decision factors used to evaluate the corrective action alternatives are detailed in the following text. The corrective action alternatives are evaluated for the ability to meet corrective action objectives as defined in [Section 3.1](#).

Protection of Human Health and the Environment

Protection of human health and the environment is a general mandate of the RCRA statute (EPA, 1994). This mandate requires that the corrective action include any necessary protective measures. These measures may or may not be directly related to media cleanup, source control, or management of wastes.

Compliance with Media Cleanup Standards

Each corrective action alternative must have the ability to meet the proposed media cleanup standards as set forth in applicable state and federal regulations and as specified in the CAIP (DOE/NV, 1999). For this CAU, the EPA's Region IX Preliminary Remediation Goals (PRGs) (EPA, 1998), derived from the Integrated Risk Information System, are the basis for establishing the PALs for chemical contaminants in accordance with NAC 445A.2272 (NAC, 1998c). The PAL for petroleum substances in soil is 100 mg/kg in accordance with NAC 445A.2272 (NAC, 1998c). The PALs for radiological contamination in soil are based on radiological concentrations in soil samples collected in undisturbed background locations (McArthur and Miller, 1989; U.S. Ecology and Atlan-Tech, 1992). The PALs for radiological contamination on building surfaces and in building materials are based on the total and removable limits for surface radioactivity listed in Table 2-2 of the *Radiological Control (RADCON) Manual* (DOE/NV, 1996c) and the concentrations in the "Nevada

Test Site Performance Objectives for Certification of Non-Radioactive Hazardous Waste”
(BN, 1995).

Control the Source(s) of the Release

An objective of a corrective action remedy is to stop further environmental degradation by controlling or eliminating additional releases that may pose a threat to human health and the environment.

Unless source control measures are taken, efforts to clean up releases may be ineffective or, at best, will essentially involve a perpetual cleanup. Therefore, each corrective action alternative must use an effective source control program to ensure the long-term effectiveness and protectiveness of the corrective action.

Comply with Applicable Federal, State, and Local Standards for Waste Management

During implementation of any corrective action alternative, all waste management activities must be conducted in accordance with all applicable state and federal regulations (e.g., *Nevada Revised Statutes* [NRS] 459.400 - 459.600, “Disposal of Hazardous Waste” [NRS, 1996]; 40 CFR 260 - 282, “RCRA Regulations” [CFR, 1998]; NAC 444, “Sanitation” [NAC, 1998a]; and NAC 459.9974, “Disposal and Evaluation of Contaminated Soil” [NAC, 1998d]). The requirements for management of the waste, if any, derived from the corrective action will be determined based on applicable state and federal regulations, field observations, process knowledge, characterization data, and data collected and analyzed during corrective action implementation. Administrative controls (e.g., decontamination procedures and corrective action strategies) will minimize waste generated during site corrective action activities. Decontamination activities will be performed in accordance with approved procedures and will be designated according to the COCs present at the site.

3.2.2 Remedy Selection Decision Factors

The following text describes the remedy selection decision factors used to evaluate the corrective action alternatives.

Short-Term Reliability and Effectiveness

Each corrective action alternative must be evaluated with respect to its effects on human health and the environment during the construction and implementation of the corrective action. The following factors will be addressed for each alternative:

- Protection of the community from potential risks associated with implementation such as fugitive dusts, transportation of hazardous materials, and explosion
- Protection of workers during construction and implementation
- Environmental impacts that may result from construction and implementation
- The amount of time until the corrective action objectives are achieved

Reduction of Toxicity, Mobility, and/or Volume

Each corrective action alternative must be evaluated for its ability to reduce the toxicity, mobility, and/or volume of the contaminated media. Reduction in toxicity, mobility, and/or volume refers to changes in one or more characteristics of the contaminated media by the use of corrective measures that decrease the inherent threats associated with that media.

Long-Term Reliability and Effectiveness

Each corrective action alternative must be evaluated in terms of risk remaining at the CAU 254 Site after the corrective action alternative has been implemented. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage risk posed by treatment residuals and/or untreated wastes.

Feasibility

This factor addresses the technical and administrative feasibility of implementing a corrective action alternative and the availability of services and materials needed during implementation. Each corrective action alternative must be evaluated for the following criteria:

- **Construction and Operation:** Refers to the feasibility of implementing a corrective action alternative given the existing set of waste and site-specific conditions.
- **Administrative Feasibility:** Refers to the administrative activities needed to implement the corrective action alternative (e.g., permits, public acceptance, rights of way, off-site approval).
- **Availability of Services and Materials:** Refers to the availability of adequate off-site and on-site treatment, storage capacity, disposal services, necessary technical services and materials, and prospective technologies for each corrective action alternative.

Cost

Costs for each alternative are estimated for comparison purposes only. The cost estimate for each corrective action alternative includes both capital and operation and maintenance costs, as applicable.

The following is a brief description of each component:

- **Capital Costs:** Include both direct and indirect costs. Direct costs may consist of materials, labor, mobilization, demobilization, site preparation, construction materials, equipment purchase and rental, sampling and analysis, waste disposal, and health and safety measures. Indirect costs include such items as engineering design, permits and/or fees, start-up costs, and any contingency allowances.
- **Operation and Maintenance Costs:** Costs include labor, training, sampling and analysis, maintenance materials, utilities, and health and safety measures.

Cost summaries for this CADD are provided in [Appendix B](#).

3.3 Development of Corrective Action Alternatives

This section identifies and briefly describes the viable corrective action technologies and the corrective action alternatives considered for the affected media. Based on the review of existing data, future use, and current operations at the NTS, the following alternatives have been developed for consideration at CAU 254:

- Alternative 1 - No Further Action
- Alternative 2 - Unrestricted Release Decontamination and Verification Survey
- Alternative 3- Unrestricted Release Decontamination and Verification Survey and Dismantling of Building 3126

Other alternatives, such as engineering or institutional controls, were considered; however, deemed to be inappropriate due to the limited extent of contamination and potential future uses of the site.

The two alternatives considered both specify the removal of all contamination exceeding PALs in soils and building materials at the site. An evaluation of NAC 445A.227 (2) (a-k) (NAC, 1998c) will not be conducted because impacts to groundwater are not expected. Therefore, groundwater monitoring is not proposed for this site and is not considered an element of the alternatives.

3.3.1 Alternative 1 - No Further Action

Under the No Further Action Alternative, no corrective action activities would be implemented. This alternative is used as a starting point to establish a baseline for comparison with the other corrective action alternatives. However, Alternative 1 does not meet the corrective action objectives for CAU 254 because it fails to meet the radiological unrestricted release criteria (DOE/NV, 1996c). For the purposes of this discussion, a comparison was made between Alternative 1, Alternative 2, and Alternative 3 to the general corrective action standards but not to the remedy selection decision factors. This comparison is shown in [Table 3-1](#).

3.3.2 Alternative 2 - Unrestricted Release Decontamination and Verification Survey

Alternative 2 consists of the removal of soil and building material from the CAU 254 Site with COC concentrations greater than the established PALs in accordance with the CAIP (DOE/NV, 1999) and the corrective action objectives. After verification that the contamination has been removed, the remaining portions of the R-MAD Decontamination Facility will be released for unrestricted use.

Under this alternative, radiological or hazardous contaminated material removed from the CAU 254 Site would be disposed of at an approved waste management site. The facility will be field surveyed following removal of contaminated material and verification samples will be collected for laboratory analysis to verify unrestricted release criteria are achieved and all chemical COCs have been removed to less than PALs. This will ensure complete removal of contamination.

CAU 254 will be closed as described in this section and in accordance with NAC 445A (NAC, 1998b).

3.3.3 Alternative 3 - Unrestricted Release Decontamination, Verification Survey, and Dismantle Building 3126

Alternative 3 consists of the removal of soil and building material from the CAU 254 Site with COC concentrations greater than the established PALs in accordance with the CAIP (DOE/NV, 1999) and the corrective action objectives. The building will be demolished and the portions of the building floor and concrete pads with radionuclide contamination greater than free release criteria or chemical contamination greater than PALs will be removed for disposal. The portions of the concrete pads and

floor of the building that do not exceed free release criteria or PALs will remain. After verification that the contamination has been removed, the remaining portions of the R-MAD Decontamination Facility floor and concrete pads will be released for unrestricted use.

Under this alternative, radiological or hazardous contaminated material removed from the CAU 254 Site would be disposed of at an approved waste management site. The facility will be field surveyed following removal of contaminated material and verification samples will be collected for laboratory analysis to verify unrestricted release criteria are achieved and all chemical COCs have been removed to less than PALs. This will ensure complete removal of contamination.

CAU 254 will be closed as described in this section and in accordance with NAC 445A (NAC, 1998b).

3.4 *Evaluation and Comparison of Alternatives*

An evaluation and comparison was made between Alternative 2 and Alternative 3 to the general corrective action standards described in [Section 3.2](#) and to the remedy selection decision factors. A comparison between the three alternatives for the remedy selection decision factors was not necessary because Alternative 1 does not meet the radiological unrestricted release criteria (DOE/NV, 1996c). A summary of the comparison between Alternative 1, Alternative 2, and Alternative 3 and the evaluation of Alternative 2 and Alternative 3 to the remedy selection decision factors are shown in [Table 3-1](#). The advantages and disadvantages of each alternative were assessed to select a preferred alternative for the site. Cost summaries are provided in [Appendix B](#).

Table 3-1
Detailed Evaluation of the Corrective Action Alternatives
for CAU 254, Area 25 R-MAD Decontamination Facility
(Page 1 of 3)

Evaluation Criteria	Alternative 1 No Further Action	Alternative 2 Unrestricted Release Decontamination and Verification Survey	Alternative 3 Unrestricted Release Decontamination, Verification Survey, and Dismantle Building 3126
Closure Standards			
Protection of Human Health and the Environment	<ul style="list-style-type: none"> • Radiological and chemical contamination detected above human health and unrestricted release screening levels would remain in place. • NAC 445A.227 (2) (a-k) analysis shows the contaminants are not impacting groundwater. • Protection to the public remains high because the NTS is a restricted access facility and there are no populated areas near the subject sites. • No worker exposure associated with implementation. • Does not address the environmental persistence of contaminants. • Does not prevent spread of COCs. 	<ul style="list-style-type: none"> • Meets corrective action objectives by removal of contaminated soil and building material in excess of unrestricted release criteria and PALs. • Low exposure associated with fugitive dust and/or contact with impacted media during removal activities. • Protection to the public remains high because the NTS is a restricted access facility and there are no populated areas near the subject sites. • NAC 445A.227 (2) (a-k) analysis shows the contaminants are not impacting groundwater. • Moving contaminated material to an appropriate disposal facility addresses the persistence of contaminants. 	<ul style="list-style-type: none"> • Meets corrective action objectives by removal of contaminated soil and all building material in excess of unrestricted release criteria and PALs. • Moderate exposure associated with fugitive dust and/or contact with impacted media during removal activities. • Moving contaminated material to an appropriate disposal facility addresses the persistence of contaminants.

Table 3-1
Detailed Evaluation of the Corrective Action Alternatives
for CAU 254, Area 25 R-MAD Decontamination Facility
(Page 2 of 3)

Evaluation Criteria	Alternative 1 No Further Action	Alternative 2 Unrestricted Release Decontamination and Verification Survey	Alternative 3 Unrestricted Release Decontamination, Verification Survey, and Dismantle Building 3126
Compliance with Media Cleanup Standards	<ul style="list-style-type: none"> Does not comply with media cleanup standards because COCs remain at levels above PALs and unrestricted release criteria. NAC 445A.227 (2) (a-k) analysis shows the contaminants are not impacting groundwater. 	<ul style="list-style-type: none"> Complies with media cleanup standards because any remaining sediments and all surface contamination above unrestricted release criteria will be removed and disposed of at an appropriate facility. Removal locations will be field screened to verify that radiation activity is below unrestricted release criteria. NAC 445A.227 (2) (a-k) analysis shows the contaminants are not impacting groundwater. Verification samples will be submitted for laboratory analysis to confirm removal of all COCs to less than PALs. 	<ul style="list-style-type: none"> Complies with media cleanup standards because any remaining sediments and all surface contamination above unrestricted release criteria will be removed and disposed of at an appropriate facility. Removal locations will be field screened to verify that radiation activity is below unrestricted release criteria. Verification samples will be submitted for laboratory analysis to confirm removal of all COCs to less than PALs.
Control the Source(s) of Release	<ul style="list-style-type: none"> There is no control of contaminant release to humans or the environment. 	<ul style="list-style-type: none"> At completion of the activities, the contaminated material will be permanently removed from the site and the surfaces will be screened to verify that unrestricted release criteria are achieved. Verification samples will be submitted for laboratory analysis to confirm removal of all COCs to less than PALs. 	<ul style="list-style-type: none"> At completion of the activities, the contaminated material will be permanently removed from the site and the surfaces will be screened to verify that unrestricted release criteria are achieved. Verification samples will be submitted for laboratory analysis to confirm removal of all COCs to less than PALs.

Table 3-1
Detailed Evaluation of the Corrective Action Alternatives
for CAU 254, Area 25 R-MAD Decontamination Facility
(Page 3 of 3)

Evaluation Criteria	Alternative 1 No Further Action	Alternative 2 Unrestricted Release Decontamination and Verification Survey	Alternative 3 Unrestricted Release Decontamination, Verification Survey, and Dismantle Building 3126
Comply with Applicable Federal, State, and Local Standards for Waste Management	<ul style="list-style-type: none"> No waste generated. 	<ul style="list-style-type: none"> All waste (primarily contaminated soil and building material) will be handled and disposed of in accordance with applicable standards. 	<ul style="list-style-type: none"> All waste (primarily contaminated soil and building material) will be handled and disposed of in accordance with applicable standards.
Remedy Selection Decision Factors			
Short-Term Reliability and Effectiveness	<ul style="list-style-type: none"> Not evaluated. 	<ul style="list-style-type: none"> Low risk to workers associated with fugitive dusts, direct contact, and heavy equipment. Public protected by remote location and NTS site access controls. Environmental impacts are not anticipated due to implementation. Implementation should not require an extended period of time. 	<ul style="list-style-type: none"> Moderate risk to workers associated with fugitive dusts, direct contact, and heavy equipment. Public protected by remote location and NTS site access controls. Environmental impacts are not anticipated due to implementation. Implementation should not require an extended period of time.
Reduction of Toxicity, Mobility, and/or Volume	<ul style="list-style-type: none"> Not evaluated. 	<ul style="list-style-type: none"> Removal and clean closure would effectively eliminate associated toxicity, mobility, and volume of materials at the site. 	<ul style="list-style-type: none"> Removal and clean closure would effectively eliminate associated toxicity, mobility, and volume of materials at the site.
Long-Term Reliability and Effectiveness	<ul style="list-style-type: none"> Not evaluated. 	<ul style="list-style-type: none"> Risk of exposure to COCs will be significantly reduced upon completion of the corrective action. Site would achieve unrestricted release criteria. 	<ul style="list-style-type: none"> Risk of exposure to COCs will be significantly reduced upon completion of the corrective action. Site would achieve unrestricted release criteria.
Feasibility	<ul style="list-style-type: none"> Not evaluated. 	<ul style="list-style-type: none"> Decontamination is easily implemented. 	<ul style="list-style-type: none"> Decontamination is easily implemented.
Cost	\$0	\$619,637	\$1,050,181

Table 3-2
Evaluation and Comparison of the Corrective Action Alternatives
for CAU 254, Area 25 R-MAD Decontamination Facility

Evaluation Criteria	Comparative Evaluation
General Standards	
Protection of Human Health and the Environment	<ul style="list-style-type: none"> Alternatives 2 and 3 meet corrective action objectives; Alternative 1 does not. No worker exposure to risks is associated with Alternative 1. Low risks are associated with Alternative 2 and moderately higher risks are associated with Alternative 3.
Compliance with Media Cleanup Standards	<ul style="list-style-type: none"> Alternative 1 does not comply with media cleanup standards. Alternatives 2 and 3 remove soil and building materials containing COCs at concentrations exceeding PALs and eliminating exposure pathways at the site.
Control the Source(s) of Release	<ul style="list-style-type: none"> The sources to CAU 254 have been discontinued.
Comply with Applicable Federal, State, and Local Standards for Waste Management	<ul style="list-style-type: none"> Alternative 2 will generate minimal hazardous and low-level waste that will be handled in accordance with applicable standards. Alternative 3 will generate larger volumes of sanitary waste that will be handled in accordance with applicable standards.
Remedy Selection Decision Factors	
Short-Term Reliability and Effectiveness	<ul style="list-style-type: none"> Low risks are associated with Alternative 2. Higher risks are associated with Alternative 3 during the dismantling and disposal of Building 3126.
Reduction of Toxicity, Mobility, and/or Volume	<ul style="list-style-type: none"> Alternative 2 and 3 result in a reduction of all three characteristics at CAU 254.
Long-Term Reliability and Effectiveness	<ul style="list-style-type: none"> Residual risk at CAU 254 is nonexistent for Alternatives 2 and 3. Administrative measures will not be required for either alternative.
Feasibility	<ul style="list-style-type: none"> Alternatives 2 and 3 are feasible; however, Alternative 3 will be more resource intensive.
Cost	<p>The cost for Alternative 1 is \$0. The estimated cost for Alternative 2 is \$619,637. The estimated cost for Alternative 3 is \$1,050,181.</p>

4.0 Recommended Alternative

Based on the results of the detailed analysis of the potential corrective action alternatives presented in this document, the preferred corrective action alternative selected for implementation at CAU 254 is Alternative 2. Alternative 2 was chosen for the following reasons:

- Risk to human health is minimal from the removal of surface contamination in excess of unrestricted release criteria and disposal at an appropriate facility. Appropriate As-Low-As-Reasonable-Achievable (ALARA) principles will be utilized to minimize worker risk during removal activities.
- All waste will be managed in accordance with federal, state, and local requirements.
- Long-term risks are significantly reduced by removing and disposing of contaminated soil and/or building material to an appropriate disposal facility.
- Easily implemented with standard construction equipment utilized for decontamination and removal of contaminated material.
- Provides a cost-effective method for achieving protection of human health and the environment and meeting unrestricted release requirements.

The preferred corrective action alternative was evaluated on its technical merits, focusing on performance, reliability, feasibility, and safety. The alternative was judged to meet all requirements for the technical components evaluated. The alternative meets all applicable state and federal regulations for closure of CAU 254 and reduces the potential for future exposure pathways.

During corrective action implementation, this alternative may potentially present moderate to high industrial safety risks to site workers. Therefore, appropriate health and safety procedures should be developed and implemented.

Based on the evaluation in this CADD, closure of the CAU 254 Site by Alternative 2 is the preferred closure method.

5.0 References

CFR, see *Code of Federal Regulations*.

Code of Federal Regulations. 1998. Title 40 CFR Parts 260 - 282, "RCRA Regulations."
Washington, DC: U.S. Government Printing Office.

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

EPA, see U.S. Environmental Protection Agency.

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.

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*.

Nevada Administrative Code. 1998a. NAC 444, "Sanitation." Carson City, NV.

Nevada Administrative Code. 1998b. NAC 445A, "Water Controls." Carson City, NV.

Nevada Administrative Code. 1998c. NAC 445A.227, "Contamination of Soil: Order by director for corrective action; factors to be considered in determining whether corrective action required."
Carson City, NV.

Nevada Administrative Code. 1998d. NAC 459.9974, "Disposal and Evaluation of Contaminated Soil." Carson City, NV.

NRS, see *Nevada Revised Statutes*.

Nevada Revised Statutes. 1996. 459.400 - 459.600, "Disposal of Hazardous Waste." Carson City, NV: Nevada Division of Environmental Protection.

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

U.S. Department of Energy, Nevada Operations 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. 1996c. *NV/YMP Radiological Control Manual*, Rev. 2, DOE/NV/11718--079, UC-702. Prepared by A.L. Gile of Bechtel Nevada. Las Vegas, NV.
- U.S. Department of Energy, Nevada Operations Office. 1999. *Corrective Action Investigation Plan for Corrective Action Unit 254: Area 25 R-MAD Decontamination Facility, Nevada Test Site*, Rev. 0, DOE/NV--557. Las Vegas, NV.
- U.S. Ecology and Atlan-Tech. 1992. *Environmental Monitoring Report for the Proposed Ward Valley California Low Level Radioactive Waste (LLRW) Facility*. Rosewell, GA.
- U.S. Environmental Protection Agency. 1991. *Guidance on RCRA Corrective Action Decision Documents*, EPA/540/G-91/011. Washington, DC: Office of Research and Development.
- U.S. Environmental Protection Agency. 1994. *Final RCRA Corrective Action Plan*, EPA/520-R-94-004. Washington, DC: Office of Solid Waste and Emergency Response.
- U.S. Environmental Protection Agency. 1998. Memo from S.J. Smucker to PRG mailing list regarding Region 9 Preliminary Remediation Goals (PRGs) 1998. San Francisco, CA.
- U.S. Geological Survey. 1993. *Selected Data for Yucca Mountain Region, Southern Nevada and Eastern California, Calendar Year 1993*, Open-File Report 95-158. Las Vegas, NV.

Appendix A

Corrective Action Investigation Report for CAU 254: R-MAD Decontamination Facility, Nevada Test Site, Nevada

A.1.0 Introduction

This appendix presents the investigation activities and analytical results for the corrective action investigation conducted at CAU 254, Area 25 R-MAD Decontamination Facility, NTS, Nevada. The CAU 254 Site contains CAS 25-23-06, Decontamination Facility (FFACO, 1996). The corrective action investigation was conducted in accordance with the requirements set forth in the *Corrective Action Investigation Plan for Corrective Action Unit 254, Area 25, Nevada Test Site, Nevada* (DOE/NV, 1999) as developed under the FFACO (1996).

The CAU 254 Site was investigated because process knowledge indicates that decontamination activities at CAU 254 may have resulted in the release of COPCs onto building surfaces, down building drains to associated leachfields, and to soils bordering two concrete decontamination pads located outside the building. Equipment and materials associated with the historical operation of the decontamination facility were stored in the yard surrounding the facility which may have resulted in the release of COPCs to the surrounding soil. In addition, building materials used in the construction of the Decontamination Facility, Building 3126, may contain COPCs as a result of decontamination activities conducted within the building. Additional information regarding the history of CAU 254 and the planning and scope of the investigation is presented in the CAIP (DOE/NV, 1999) and will not be repeated in this report.

A.1.1 Project Objectives

The primary objectives of the investigation of the CAU 254 Site were as follows:

- Identify the presence and nature of COPCs within and on the external surfaces Building 3126.
- Identify the presence and nature of COPCs in soil surrounding the building.
- Determine the vertical and lateral extend of COPCs in the soil.
- Obtain sufficient information and data to develop and evaluate appropriate corrective actions for the CAU.
- Determine the nature and extent of potential chemical contamination of building material to support waste management activities associated with demolition activities.

The Building 3126 ceiling, floor, and walls were investigated by conducting a radiological survey for alpha- and beta-contamination and collecting swipe samples for removable radiological contamination. Random and biased building material and sediment samples were collected from Building 3126 and associated systems. Random and biased soil samples were collected from the storage yard. An attempt was made to conduct a video survey on associated piping, but proved to be unsuccessful as a result of obstructions in the manhole and pipes and narrow pipe diameters.

The number and type of samples were based upon site-specific conditions and the strategy developed during the DQO process as outlined in the CAIP (DOE/NV, 1999). In addition to the foregoing factors, the selection of survey and sample locations were based on guidance provided in the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) (NRC, 1997).

A.1.2 Appendix Content

The contents of this appendix are as follows:

- [Section A.1.0](#) describes the investigation background, objectives, and the report content.
- [Section A.2.0](#) provides information regarding the field activities and sampling methods.
- [Section A.3.0](#) summarizes the results of the laboratory analyses and radiological surveys from the investigation.
- [Section A.4.0](#) discusses the Quality Assurance (QA) and Quality Control (QC) procedures that were followed and the results of the QA/QC activities.
- [Section A.5.0](#) summarizes the significant investigation results.
- [Section A.6.0](#) cites the references.

To make this appendix a concise summary, complete field documentation and laboratory data not contained in this appendix are retained in the project files.

A.2.0 Corrective Action Investigation Activities

The corrective action field investigation and sampling activities for CAU 254 were conducted in January and February 2000. Preliminary work was conducted from mid- to late-1999. The following is a nonsequential summary of the preliminary work and field investigation activities:

- Conducted nonintrusive radiological walkover survey of the storage yard and the exterior concrete decontamination pads to evaluate areas of potential contamination.
- Established presence or absence of underground storage areas and verified location of septic and radiological sewage piping.
- Evaluated building for potential hazards, such as asbestos, hantavirus, utility systems, and other health and safety hazards. Collected samples for off-site asbestos analysis. Performed housekeeping activities to mitigate potential exposure of workers to hantavirus.
- Established and marked grids for radiological surveys.
- Conducted preliminary radiological scanning and static surveys to determine if contamination was wide-spread throughout the building or confined to smaller, hot-spot areas such as the drains. Marked identified contaminated areas.
- Conducted dose rate surveys at random locations within and outside the building for worker protection.
- Conducted scanning and static radiological surveys to identify areas of fixed radiological contamination.
- Collected swipe samples from biased locations based on radiological scanning and static surveys and from random locations.
- Collected surface and subsurface environmental soil samples from random and biased locations within the confines of the storage yard fence.
- Conducted field screening on soil and building material samples for VOCs and radiological contamination.
- Marked and surveyed soil sample locations.
- Collected building material samples from random locations based on sampling criteria.

- Collected building material samples from biased locations based on radiological scanning and static surveys, visual observation, and/or process knowledge.
- Segregated miscellaneous materials and collected environmental samples (e.g., railroad ties, pipe joints, wallboard, drain and sump sediments, and concrete) and waste management samples (e.g., fluid removed from equipment) to characterize potential RCRA constituents. Opened the AST to examine and document the presence or absence of fluids.
- Attempted video and radiation survey on below-grade drain piping to establish the condition (i.e., possible leakage) and relative radiological levels.
- Submitted swipe, soil, and building material samples for off-site analysis.
- Filled excess void space in each borehole with dry bentonite upon completion of the field investigation.

The field investigation summarized above was managed in accordance with the requirements set forth in the CAIP (DOE/NV, 1999). The field activities were performed in accordance with an approved site-specific health and safety plan (IT, 1999a). The samples were collected and documented following approved protocols and procedures for sampling, conducting field activities, documenting sample collection, chain of custody, and shipping. Decontamination processes and radiological surveys were conducted as indicated in the CAIP (DOE/NV, 1999). Quality control samples (e.g., field blanks, equipment rinsate blanks, source blanks, trip blanks, matrix spike/matrix spike duplicate [MS/MSD], and field duplicates) were collected as required by the *Industrial Sites Quality Assurance Project Plan* (DOE/NV, 1996a) and approved procedures. Field activities included waste minimization practices in accordance with approved procedures in the CAIP (DOE/NV, 1999), including segregation of the waste by waste stream.

The Site Supervisor was responsible for all sampling activities and determined the final sample locations and number of samples collected and analyzed. Where sample volume was limited or inaccessible, the Site Supervisor was responsible for providing proper direction to the sampling team. The rationale for any changes were documented on the Field Daily Activity Logs and Daily Field Activity Reports.

A.2.1 Site Description and Conditions

Corrective Action Unit 254, is located in Area 25 of the NTS (see [Figure 1-2](#)). The CAU consists of a Decontamination Facility (Building 3126), an associated AST, and two concrete decontamination pads within a fenced area measuring approximately 119 feet (ft) by 158 ft. The exterior of the building measures approximately 80 ft by 32 ft. The two concrete decontamination pads, one leached on the west side of the building and one on the east side, each measure approximately 35 ft by 25 ft. Building 3126 contains a hot bay area measuring approximately 66 ft by 32 ft, an interior loft on the north side of the building measuring approximately 15 ft by 30 ft, and additional rooms that accommodated staff.

A.2.2 Sampling Logistics and Locations

Sampling locations were randomly and biasly selected as described in the CAIP (DOE/NV, 1999). Biased samples were based on guidance provided by MARSSIM (NRC, 1997) for various types of radiological surveys, visual observations, elevated radiological readings, and process knowledge. Sample locations are shown in [Figure A.2-1](#).

A.2.3 Direct-Push Sampling

A Geoprobe Macro-Core[®] Soil Sampler with a polyvinyl chloride (PVC) liner was used to collect subsurface soil samples. Soil samples were collected directly from the PVC liner from 0- to 1-ft and 2- to 3-ft intervals. If soil field-screening results (i.e., VOC and Radionuclides) were greater than established field-screening levels (FSLs), the core was advanced in 4-ft intervals and samples collected at each depth until field-screening results for VOCs and radionuclides were below established FSLs for two consecutive intervals or until refusal was encountered.

Soil characteristics (e.g., color, grain size, and distribution) were described by a sampling team member for each soil sample. Visible discoloration and unusual or distinguishable physical characteristics (e.g., biomass layer, moisture) were documented on the Sample Collection Log. No soil characteristic anomalies were identified.

Sample locations were marked and surveyed. Excess void space in each borehole was filled with dry bentonite upon completion of the field investigation.

A.2.4 Field Screening

Field screening for VOCs and gross alpha and beta-gamma emitters were performed as specified in the CAIP (DOE/NV, 1999). Field screening methods included:

- Headspace field screening for VOCs using a photoionization detector (PID).
- Radiological screening for gross alpha and beta-gamma concentration using an NE Technology Electra instrument and exposure rates using a Bicron[®] Ion Chamber.

Field-screening levels were used to determine the presence of contamination and guide the investigation. The FSL for VOCs was established at 20 parts per million (ppm) or 2.5 times background, whichever was higher. The FSLs for radiological contamination in the soil and sediment collected were established prior to the investigation as the mean background concentration level in soil plus two times the standard deviation of the mean background concentration level. The advancement of a sample borehole or step-out direct pushes were conducted where soil samples exceeded FSLs or until refusal was encountered. A minimum of two soil samples below FSLs from each environmental sample location were submitted for off-site analysis for confirmation and verification. Swipe samples exceeding FSLs were submitted for off-site laboratory analysis. All building material samples were submitted for off-site laboratory analysis regardless of field-screening results.

Samples were also field screened for radiological activity and contamination for sample transportation purposes to determine if the samples were regulated as radioactive material according to the U.S. Department of Transportation.

A.2.5 Environmental Samples

A total of 106 environmental samples and 55 associated QC samples, background, blanks, duplicate, and MS/MSD were collected. Environmental sample media included soil, water, sediment, concrete, wood, insulation, solder, air filters, paint, rubber, and swipe filter paper. [Table A.3-1](#) is a list of the environmental, background, and QC samples collected during this field investigation. All samples were field screened for VOCs and radionuclides. Field duplicates and MS/MSD samples were collected for every 20 environmental samples. If the sample volume was limited or the sample morphology not conducive for collection, alternate instructions were provided by the Site Supervisor

and documented accordingly. Sample collection and analysis were performed in accordance with applicable procedures and CAIP (DOE/NV, 1999) requirements.

A.2.5.1 Soil Samples

A total of 44 soil samples were collected. Analyses requested are listed in [Table A.3-1](#). Samples were collected from the storage yard within the fenced area of the CAU site and from each of the concrete decontamination pad sumps. Samples were a mixture of alluvial and reworked soils. Three field duplicate and three MS/MSD samples were collected.

A.2.5.2 Sediment Samples

A total of five sediment samples were collected from building interior and exterior drains and sumps. Analyses performed are listed in [Table A.3-1](#). The sample morphology was loose, sand-size grains. Some drain sediments were suspended in water and collected using a coliwasa. Dry sediments were collected using a handheld scoop. The majority of sediments were removed from the interior sumps and drains during sampling. No QC samples were collected because of limited volume.

A.2.5.3 Concrete Samples

A total of nine concrete samples were collected. Analyses performed are listed in [Table A.3-1](#). Samples were collected from the floor inside the building, the exterior decontamination pads, and the generator pad located at the western exterior of the building. Samples varied from well cured (30 years) chunks of a mixture of cement and aggregate not exceeding 1 cubic inch (in³), and powdered concrete derived from the coring process. Samples were collected from 0 to 2-inch (in.) intervals using a Hilti® DD100 coring device and Euroclean® dry-vacuum with a prefilter and an exhaust High Efficiency Particulate Air (HEPA) filter. One field duplicate and one MS/MSD sample were collected.

A.2.5.4 Wood Samples

A total of six wood samples were collected from the interior wallboard. Analyses requested are listed in [Table A.3-1](#). Samples were wood slivers not exceeding 1 in³. One field duplicate was collected.

A.2.5.5 Insulation Samples

A total of five insulation samples were collected from the interior of the building. Analyses requested are listed in [Table A.3-1](#). The samples were fibrous and easily pulled apart. One field duplicate was collected.

A.2.5.6 Lead Solder Samples

One solder sample was collected and analyzed for TCLP RCRA Metal for the presence and concentration of lead. The sample was collected from a soldered pipe joint located on the southwest interior wall of the hot bay. The sample was solder flakes that were chiseled from the pipe joint. No QC samples were collected because of limited volume. The sample was lost during extraction at the laboratory and there was not enough material available for reextraction; therefore, no analytical results were reported.

A.2.5.7 Filter Samples

A total of two samples were collected from air filters attached to the air purification wall piping located in the hot bay of the building. Analyses requested are listed in [Table A.3-1](#). The samples consisted of friable pieces no larger than 1 in³. One field duplicate and one MS/MSD sample were collected.

A.2.5.8 Paint Samples

A total of seven paint samples were collected and analyzed for Total RCRA Metals to determine the presence and concentration of lead. In addition, one sample was also analyzed for isotopic Uranium (U), isotopic Plutonium (Pu), Sr-90 and gamma spectrometry. Samples were collected from the interior wallboard, concrete, and piping, and from the exterior decontamination pads. Some samples were flakes of paint, while other samples were small wood chips coated with paint. No QC samples were collected.

A.2.5.9 Rubber Samples

One rubber sample was collected and analyzed for TCLP RCRA Metals, isotopic U, isotopic Pu, Sr-90 and gamma spectrometry. The sample was rubber, rope-like strips from the expansion joints in the hot bay concrete floor. No QC samples were collected.

A.2.5.10 Miscellaneous Building Material Samples

One antifreeze sample and one compressor oil sample were collected from the air compressor in the northwest storage yard. Analyses requested are listed in [Table A.3-1](#). No QC samples were collected.

A.2.5.11 Swipe Samples

A total of 190 swipe samples were collected from the interior of the building and associated building equipment and systems. These samples were initially analyzed in the field for gross alpha and gross beta-gamma emitters using a Ludlum® Model 2929 Swipe Sample Counter. The 24 swipe samples having the highest gross alpha and gross beta/gamma activity were submitted for off-site analysis for isotopic U, isotopic Pu, Sr-90 and gamma spectrometry. The sample morphology was micro- to macroscopic particulates collected onto a dry DefenSAP Smear. Three field duplicate samples were collected.

A.2.6 Background Soil Samples

A total of four surface (0 to 1 ft) and near-surface (2 to 3 ft) background soil samples were collected from two boreholes located outside the Building 3126 storage yard in undisturbed areas. These samples were analyzed for total RCRA Metals, isotopic U, isotopic Pu, Sr-90, and gamma spectrometry. The radiological sample results were compared to the PALs for soil sample concentrations. Background soil samples showed radionuclide concentrations that were within the expected range of concentrations or below the minimum detectable concentrations. All background soil concentrations were below the initial PALs.

A.2.7 Radiological Preliminary Action Levels

The initial PALs used in the field investigation for soils were the maximum concentration of the radionuclides as measured by an off-site analytical laboratory from samples previously taken from undisturbed background locations in off-site areas surrounding the NTS (IT, 1999b). The final PAL established for each isotope found in the CAU 254 soil samples is the maximum concentration from off-site environmental sample concentrations. The PALs for radiological contamination on building surfaces and in building materials are based on the total and removable limits for surface radioactivity listed in DOE Order 5400.5, Chapter IV, Figure IV-1 (DOE, 1993), and the concentrations for radionuclides listed in the *Nevada Test Site Performance Objectives for Certification of Non-Radioactive Hazardous Waste* (BN, 1995). The maximum off-site radionuclide concentrations in both soil and building materials that were expected at the CAU 254 Site are listed in [Table A.2-1](#).

A.2.7.1 Grid Square Locations

A grid system was superimposed on all accessible walls and floor surfaces up to a wall height of 8 ft for the collection of radiological measurements. Grid spacing for building areas was 3 ft by 3 ft. Locations of associated systems (i.e., ventilation duct work) and equipment (i.e., piping, shelving, boiler, compressor) were identified within the grid system, as needed.

A.2.7.2 Radiological Survey Units

The radiological survey unit is a portion of the building that had radiation dose rate, total surface contamination, and removable surface contamination surveys conducted. There were six survey units for the interior structure and three for the exterior structures, including the two decontamination pads and building external surfaces ([Figure A.2-2](#)). All the survey units at the CAU 254 Site were given an area classification of Radiological Survey Class 1 (NRC, 1997). Radiological Survey Class 1 areas require the highest level of detail and documentation. Rooms of normal size with a floor area of 1,076 square feet (ft²) or less were not divided into more than one survey unit. Large spaces such as the decontamination bay were divided into two survey units. Radiation dose rate surveys, total surface contamination surveys, and removable surface contamination surveys were documented in each survey unit inside the building. In addition, a radiation dose rate and total surface contamination

Table A.2-1
Radiological Preliminary Action Levels for Off-Site Analytical Methods

Off-Site Analytical Methods	Preliminary PAL for Soil ^a	PAL for Building Materials ^a
Gross Alpha Emitters (Total Surface)	NA	1,000 dpm/100 cm ² (DOE, 1993) ^c
Gross Beta-Gamma Emitters (Total Surface)	NA	1,000 dpm/100 cm ² (DOE, 1993) ^c
Strontium-90	1.17 pCi/g (McArthur & Miller, 1989) ^g	3.0 pCi/g (Alderson, 1999) ^{b, e}
Cesium-137	7.0 pCi/g (McArthur & Miller, 1989) ^g	3.0 pCi/g (BN, 1995) ^f
Niobium-94	0.1 pCi/g (Adams, 1999) ^d	0.1 pCi/g (Adams, 1999) ^d
Uranium-234	2.6 pCi/g (McArthur & Miller, 1989) ^g	0.9 pCi/g (Alderson, 1999) ^{b, e}
Uranium-235	0.1 pCi/g (U.S. Ecology and Atlan-Tech, 1992) ^h	0.16 pCi/g (Alderson, 1999) ^{b, e}
Uranium-238	3.2 pCi/g (McArthur & Miller, 1989) ^g	10 pCi/g (BN, 1995) ^f
Plutonium-238/239/240	0.24 pCi/g (McArthur & Miller, 1989) ^g	0.5 pCi/g (BN, 1995) ^f
Other Radionuclides	See McArthur & Miller, 1989, and U.S. Ecology and Atlan-Tech, 1992 ^{g, h}	10 CFR 30.70 Schedule A - Exempt Concentrations (NRC, 1994) ⁱ

^a Use sum of the ratios of the measured concentration to the listed PAL value for mixtures.

^bITLV recommended values for PALs.

^cRemovable surface contamination values were taken from U.S. Department of Energy (DOE) Order 5400.5, "Radiation Protection of the Public and the Environment" (DOE, 1993). The PALs for direct contamination measurements for both alpha and beta-gamma may be increased to 5,000 dpm/100 cm², if subsequent measurements indicate that removable contamination is less than 1,000 dpm/100 square centimeters (cm²).

^dMemorandum from S. Adams (ITLV) to J. Johnson (ITLV) regarding Performance Objective Criteria for Niobium at Area 25 (Adams, 1999).

^eMemorandum from S. Alderson (ITLV) to D. Wilson (SAIC) regarding the response to the State of Nevada Division of Environmental Protection comments concerning Corrective Action Units 261, 266, and 500 (Alderson, 1999).

^fNevada Test Site Performance Objective Criteria for Certification of Nonradioactive Hazardous Waste (BN, 1995).

^gOff-Site Radiation Exposure Review Project, Phase II, Soils Program (McArthur and Miller, 1989).

^hEnvironmental Monitoring Report for the Proposed Ward Valley California Low-Level Radioactive Waste Facility (U.S. Ecology and Atlan-Tech, 1992).

ⁱU.S. Nuclear Regulatory Commission 10 CFR 30.70, *Schedule A - Exempt Concentrations* (NRC, 1994).

dpm/100 cm² = Disintegrations per 100 square centimeters

pCi/g = Picocurie(s) per gram

Explanation

- ① Turbulator Tank
- ② Hot Water Heater
- ③ Air Compressor
- ④ Desk
- ⑤ 1,140-gal Aboveground Storage Tank
- ⑥ Generator
- ⑦ Sink
- ⑧ Urinals
- ⑨ Shower
- ⑩ Water Closet
- ⑪ Ledge Shelving
- ⑫ Ventilation
- △ Concrete Pad
- ⊞ Acid Drain
- ||||| Railroad Track
- 254-ES-01 Survey Unit Number

Scale

0 12 24 Feet

0 4 8 Meters

Source: IT, 2000

Figure A.2-2
CAU 254, Area 25
R-MAD Decontamination Facility
(Building 3126) Layout

survey are performed on the storage yard. The results are reported in the associated data packages for each survey unit in [Appendix C](#).

A.2.7.3 Radiological Surveys

Radiological surveys of the interior and exterior of the building were performed. Each unit was surveyed for radiation dose rates and alpha and beta surface contamination. To obtain qualitative measurements of contamination levels, scanning surveys were performed over 100 percent of the accessible floor and walls up to the top of the wood panels (approximately 8 ft). The entire grid surface area was scanned and elevated readings entered on a Radiological Survey Form. Areas of elevated activity were marked with black permanent ink on the building surface along with the maximum reading for total surface contamination.

A.2.7.4 Radiation Dose Rate Surveys

Radiation dose rate surveys were conducted in general work areas and at small areas with elevated levels to aid in defining radiological hazards and in selecting radiological controls to be used during corrective action. The radiation dose rates were obtained using a Bicron[®] Microrem Meter on random and biased grid locations. Measurements were obtained at approximately 3.3 ft above grade or on contact and at approximately 1 ft from equipment.

A.2.7.5 Total Surface Contamination Measurements

Total surface contamination measurements were performed both inside and outside Building 3126 with an NE Technology ELECTRA with a DPGBD alpha/beta detector. These measurements were used in conjunction with other associated data evaluations and guidance documentation to make decisions on the waste classifications and selection of the waste management strategy. A total of 213 gross alpha and 213 gross beta-gamma total surface contamination measurements were collected for the survey units within the building. A total of 35 sample locations were surveyed for total surface contamination on the exterior surfaces of the building. Wall surfaces around pipes or vent penetrations that had an increased potential for contamination were also surveyed. Twenty-nine total contamination measurements were taken on each of the two roof surfaces. Total surface contamination measurements were performed at 73 locations on the exterior walls.

In October 1999, a radiological survey of the Building 3126 decontamination bay and pads was performed by Shonka Research Associates from Marietta, Georgia. This walkover survey was performed using a position sensitive radiation monitor (PSRM) (Plate 1). The survey consisted of six zones with a total of 313 full and partial 1 square meters (m^2). The concrete surfaces were scanned for total alpha and total beta/gamma contamination. Total surface contamination measurements were calculated based on 100 cm^2 areas and are documented in project files (Shonka and Millennium, 1999).

A.2.7.6 Removable Surface Contamination Measurements

The removable surface contamination surveys were conducted by collecting a series of swipe samples from the interior of Building 3126. These measurements were then used in determining the amount of removable radioactive material that may potentially be released from the building surfaces.

Removable contamination measurements were collected by swiping a 1-in. diameter dry filter paper over a 15.5-in² area while applying moderate pressure. The swipe samples were labeled and the sample location coordinates recorded on the Swipe Sample Log. Swipes were counted on site using a Ludlum[®] Model 2929 Swipe Sample Counter and the readings recorded on the Swipe Sample Analysis Form.

A.2.7.7 Building and Equipment Samples

A total of 79 biased and random sample locations from the interior and exterior of the building were swiped for removable surface contamination. Twenty-four swipe samples with the highest contamination levels were sent for off-site laboratory analysis. Random and biased locations on the interior of the building were swiped for removable surface contamination. One field blank and three field duplicates were collected next to original swipe locations. An unused smear was collected as the source blank.

A.2.8 Video Survey

An attempt was made to conduct a video survey of the below-grade piping and drains using a commercial camera system in conjunction with a gamma radiation detector. The objective of the video survey was to establish the condition (e.g., areas of potential leakage) and the relative

radiological levels in the piping. This activity was aborted due to obstruction from tree root growth in the septic sewage system and the small pipe diameter of the radiological sewage system. No additional information on the piping was collected.

A.3.0 Investigation Results

The analytical results of samples collected from the CAU 254 Site investigation have been compiled and evaluated to determine the presence and/or extent of contamination. Analytical results, above the MRLs, are summarized in the following subsections.

During the investigation a total of 44 environmental and QA/QC building material samples, 50 environmental and QA/QC soil samples, 34 QA/QC water samples, and 29 environmental and QA/QC swipes were submitted to Paragon Analytics, in Fort Collins, Colorado, for laboratory analyses. These samples were analyzed for chemical and radiological constituents. A total of 190 swipes were analyzed for gross alpha and gross beta-emitters on-site using a Ludlum 2929 Swipe Counter. Of those 190 swipes, only 24 swipe samples were analyzed for specific radiological isotopes. The parameters used to decide which swipes were to be analyzed the minimum unrestricted release limits to the public listed in DOE Order 5400.5, Chapter IV, Figure IV-1 (DOE, 1993) and Site Supervisor discretion. If the swipe sample exceeded either the PAL for gross alpha or gross beta-gamma, it was analyzed for corresponding radiological isotopes. A list of the samples collected and analyses performed for the investigation are presented in [Table A.3-1](#). The analytical parameters and laboratory analytical methods requested for this investigation are presented in [Table A.3-2](#). Preliminary action levels for off-site laboratory analytical methods were determined during the DQO process (DOE/NV, 1999) and are based on levels presented in the following:

- *Nevada Administrative Code* (NAC, 1998a and 1998b)
- *U.S. Environmental Protection Agency Region IX Preliminary Remediation Goals* (EPA, 1998)
- *Off-Site Radiation Exposure Review Project, Phase II Soil Program* (McArthur and Miller, 1989)
- *Environmental Monitoring Report for the Proposed Ward Valley California Low Level Radioactive Waste Facility* (U.S. Ecology and Atlan-Tech, 1992)
- *NV/YMP Radiological Control Manual*, Rev. 2 (DOE/NV, 1996b)
- *DOE Order 5400.5, Radiation Protection of the Public and the Environment* (DOE, 1993)

Table A.3-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Sampling Locations and Analyses
(Page 1 of 7)

Sample Location	Sample Number	Depth Below Ground Surface (ft)	Matrix	Sample Type	Analyses
Background					
Background 1	25400003	2 - 3	Soil	Background	6, 9, 10, 11, 12
Background 1	25400004	0 - 4 inches	Soil	Background	6, 9, 10, 11, 12
Background 2	25400005	2 - 3	Soil	Background	6, 9, 10, 11, 12
Background 2	25400006	0 - 4 inches	Soil	Background	6, 9, 10, 11, 12
Northwest Storage Yard					
Borehole 3	25400007	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12
Borehole 3	25400008	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
Borehole 4	25400009	0 - 1	Soil	Environmental	1, 2, 3, 5, 8, 9, 10, 11, 12
Borehole 4	25400010	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 5	25400011	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 5	25400012	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 6	25400013	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 6	25400014	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 7	25400015	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 7	25400016	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 8	25400017	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 8	25400018	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 24	25400060	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
Borehole 24	25400061	0 - 1	Soil	Field Duplicate of 25400060	1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12
Borehole 24	25400062	2 - 3	Soil	Environmental/MS/MSD	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
Northeast Storage Yard					
Borehole 19	25400047	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13
Borehole 19	25400048	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13
Borehole 20	25400054	0 - 1	Soil	Environmental	1, 2, 3, 5, 7, 8, 9, 10, 11, 12
Borehole 20	25400055	2 - 3	Soil	Environmental	1, 2, 3, 5, 7, 8, 9, 10, 11, 12
Borehole 21	25400056	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
Borehole 21	25400057	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
Borehole 22	25400058	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
Borehole 22	25400059	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
Borehole 23	25400066	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
Borehole 23	25400067	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12

Table A.3-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Sampling Locations and Analyses
(Page 2 of 7)

Sample Location	Sample Number	Depth Below Ground Surface (ft)	Matrix	Sample Type	Analyses
Southwest Storage Yard					
Borehole 9	25400023	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 9	25400024	2 - 3	Soil	Environmental/ MS/MSD	1, 2, 3, 5, 8, 9, 10, 11, 12, 13
Borehole 9	25400025	0 - 1	Soil	Field Duplicate of 25400023	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 10	25400026	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13
Borehole 10	25400027	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13
Borehole 11	25400028	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 11	25400029	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 12	25400030	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 12	25400031	2 - 3	Soil	Environmental	1, 2, 3, 4, 6, 7, 9, 10, 11, 12, 13
Borehole 13	25400032	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 13	25400033	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Southeast Storage Yard					
Borehole 14	25400034	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 14	25400035	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 15	25400036	0 - 1	Soil	Environmental	1, 2, 3, 6, 8, 9, 10, 11, 12
Borehole 15	25400037	2 - 3	Soil	Environmental	1, 2, 3, 6, 8, 9, 10, 11, 12
Borehole 16	25400038	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
Borehole 16	25400039	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
Borehole 17	25400043	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 17	25400044	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 18	25400045	0 - 1	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
Borehole 18	25400046	2 - 3	Soil	Environmental	1, 2, 3, 5, 6, 8, 9, 10, 11, 12, 13
West Decontamination Pad (SUN-254-ES-01)					
West Decontamination Pad Sump	25400511	-----	Sediment	Environmental	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
West Decontamination Pad	25400545	appr. 0 - 2 inches	Concrete	Environmental	1, 2, 3, 5, 7, 9, 10, 11, 12
West Decontamination Pad Sump	25400548	0 - 1.5	Soil	Environmental	1, 2, 4, 5, 7, 8, 9, 10, 11, 12
East Decontamination Pad (SUN-254-ES-02)					
East Decontamination Bay	25400225	-----	Swipe	Environmental	9, 10, 11, 12
East Decontamination Pad Sump	25400509	-----	Soil	Environmental/ MS/MSD	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
East Decontamination Pad Sump	25400510	-----	Soil	Field Duplicate of 25400509	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
East Decontamination Pad	25400516	appr. 0 - 2 inches	Concrete	Environmental	1, 2, 3, 5, 6, 7, 9, 10, 11, 12

Table A.3-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Sampling Locations and Analyses
(Page 3 of 7)

Sample Location	Sample Number	Depth Below Ground Surface (ft)	Matrix	Sample Type	Analyses
East Decontamination Pad Sump	25400546	0 - 2.5	Soil	Environmental	1, 2, 4, 5, 7, 8, 9, 10, 11, 12
East Decontamination Pad	25400562	appr. 0 - 2 inches	Concrete	Environmental/MS/MSD	1, 2, 3, 5, 7, 9, 10, 11, 12
East Decontamination Pad	25400563	apprx. 0 - 2 inches	Concrete	Environmental	1, 2, 3, 5, 7, 9, 10, 11, 12
East Decontamination Pad	25400564	appr. 0 - 2 inches	Concrete	Field Duplicate of 25400563	1, 2, 3, 5, 7, 9, 10, 11, 12
Office (SUN-254-IS-03)					
Office Bench	25400522	-----	Wood	Environmental	1, 2, 3, 5, 7, 9, 10, 11, 12
Office Door	25400532	-----	Paint	Environmental	6
Office Floor	25400543	-----	Paint	Environmental	6
Loft and Stairs (SUN-254-IS-06)					
Loft	25400129	-----	Swipe	Environmental	9, 10, 11, 12
Loft	25400130	-----	Swipe	Environmental	9, 10, 11, 12
North Loft Wall	25400527	-----	Insulation	Environmental	1, 2, 3, 6, 9, 10, 11, 12
North Loft Wall	25400528	-----	Insulation	Field Duplicate of 25400527	1, 2, 3, 6, 9, 10, 11, 12
Loft Floor	25400529	-----	Wood	Environmental	1, 2, 3, 5, 7
Northwest Loft Wall Piping	25400551	-----	Paint	Environmental	6, 9, 10, 11, 12
Equipment and Materials (SUN-254-EM-01)					
Special Liquids Pump	25400200	-----	Swipe	Environmental	9, 10, 11, 12
Light #2	25400282	-----	Swipe	Environmental	9, 10, 11, 12
Compressor in Northwest Storage Yard	25400544	-----	Antifreeze	Environmental	6, 9, 10, 11, 12
1st Rail Road Tie South of Decontamination Bay	25400552	-----	Wood	Environmental	1, 2, 4, 9, 10, 11, 12
Compressor in Northwest Storage Yard	25400553	-----	Compressor oil	Environmental	2, 9, 10, 11, 12
Piping on Southwest Wall	25400554	-----	Solder	Environmental	7
Air Filters in Decontamination Bay	25400560	-----	Filters	Environmental	1, 2, 3, 5, 7, 9, 10, 11, 12
Compressor Concrete Pad	25400558	appr. 0 - 2 inches	Concrete	Environmental	5, 6
Turbulator Tank	25400177	-----	Swipe	Environmental	9, 10, 11, 12
Turbulator Tank	25400178	-----	Swipe	Environmental	9, 10, 11, 12

Table A.3-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Sampling Locations and Analyses
(Page 4 of 7)

Sample Location	Sample Number	Depth Below Ground Surface (ft)	Matrix	Sample Type	Analyses
Turbulator Tank	25400179	-----	Swipe	Field Duplicate of 25400178	9, 10, 11, 12
Turbulator Tank	25400182	-----	Swipe	Environmental	9, 10, 11, 12
Decontamination Sink Fume Hood	25400185	-----	Swipe	Environmental	9, 10, 11, 12
Fume Hood	25400190	-----	Swipe	Environmental	9, 10, 11, 12
Overhead Crane Motor	25400209	-----	Swipe	Environmental	9, 10, 11, 12
Decontamination Sink Vent Hood Filter	25400224	-----	Swipe	Environmental	9, 10, 11, 12
Decontamination Bay Center Floor Drain	25400539	-----	Water with Sediment	Environmental	1, 9, 10
West Light #7	25400251	-----	Swipe	Environmental	9, 10, 11, 12
Special Liquids Pump	25400201	-----	Swipe	Field Duplicate of 25400200	9, 10, 11, 12
North Center Vent Baffle	25400263	-----	Swipe	Environmental	9, 10, 11, 12
West Wall Special Liquids Pipe	25400273	-----	Swipe	Environmental	9, 10, 11, 12
West Wall Hot Water Pipe	25400274	-----	Swipe	Environmental	9, 10, 11, 12
West Wall Cold Water Pipe	25400275	-----	Swipe	Environmental	9, 10, 11, 12
Water Heater and Compressor Room (SUN-IS-01)					
Compressor Room Drain	25400512	-----	Sediment	Environmental	1, 6, 9, 10, 11, 12
External Surface of Building (SUN-254-ES-03)					
South Roof Vent Stack	25400204	-----	Swipe	Environmental	9, 10, 11, 12
South Roof Middle Vent Stack	25400205	-----	Swipe	Environmental	9, 10, 11, 12
Roof Fume Hood Stack	25400206	-----	Swipe	Environmental	9, 10, 11, 12
Roof Drain Vent Stack	25400207	-----	Swipe	Environmental	9, 10, 11, 12
Turbulator Vent Stack	25400506	-----	Filter	Environmental	1, 2, 3, 5, 6, 9, 10, 11, 12
Turbulator Vent Stack	25400507	-----	Filter	Field Duplicate of 25400506	1, 2, 3, 5, 6, 9, 10, 11, 12
Turbulator Vent Stack	25400508	-----	Filter	MS/MSD of 25400506	1, 2, 3, 5
South Side Decontamination Bay (SUN-254-IS-05)					
South Decontamination Bay	25400159	-----	Swipe	Environmental	9, 10, 11, 12

Table A.3-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Sampling Locations and Analyses
(Page 5 of 7)

Sample Location	Sample Number	Depth Below Ground Surface (ft)	Matrix	Sample Type	Analyses
South Decontamination Bay Floor	25400501	-----	Sediment	Environmental	9, 10
Southwest Decontamination Bay Floor	25400502	-----	Sediment	Environmental	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12
Southeast Decontamination Bay Door	25400514	-----	Wood	Environmental	1, 2, 3, 5, 7, 9, 10, 11, 12
South Decontamination Bay Door	25400519	-----	Wood	Environmental	1, 2, 3, 5, 7, 9, 10, 11, 12
South Half of East Decontamination Bay Door	25400523	-----	Insulation	Environmental	1, 2, 3, 6, 9, 10, 11, 12
South Section of West Decontamination Bay Door	25400526	-----	Insulation	Environmental	1, 2, 3, 6, 9, 10, 11, 12
East Decontamination Bay Floor	25400542	appr. 0 - 2 inches	Concrete	Environmental	1, 2, 3, 5, 7, 9, 10, 11, 12
East Decontamination Bay Floor	25400549	appr. 0 - 2 inches	Concrete	Environmental	1, 2, 3, 5, 7, 9, 10, 11, 12
Southeast Floor Near Turbulator Tank	25400559	appr. 0 - 2 inches	Concrete	Environmental	1, 2, 3, 5, 7, 9, 10, 11, 12
North Side Decontamination Bay (SUN-254-IS-04)					
North Decontamination Bay	25400147	-----	Swipe	Environmental	9, 10, 11, 12,
Northeast Decontamination Bay Floor	25400504	-----	Rubber	Environmental	7, 9, 10, 11, 12
Northwest Decontamination Bay Door	25400520	-----	Wood	Environmental	1, 2, 3, 5, 7, 9, 10, 11, 12
West Decontamination Bay Door	25400521	-----	Wood	Field Duplicate of 25400520	1, 2, 3, 5, 7, 9, 10, 11, 12
Northwest Decontamination Bay Door	25400524	-----	Insulation	Environmental	1, 2, 3, 6, 9, 10, 11, 12
Northeast Decontamination Bay Floor	25400525	appr. 0 - 2 inches	Concrete	Environmental	1, 2, 3, 7, 9, 10, 11, 12
Northwest Floor	25400530	appr. 0 - 2 inches	Concrete	Environmental	1, 2, 3, 7

Table A.3-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Sampling Locations and Analyses
(Page 6 of 7)

Sample Location	Sample Number	Depth Below Ground Surface (ft)	Matrix	Sample Type	Analyses
Northwest Decontamination Bay Wall	25400531	-----	Paint	Environmental	6
Northwest Decontamination Bay Floor	25400533	-----	Paint	Environmental	6
West Decontamination Bay Ceiling	25400540	-----	Insulation	Environmental	1, 2, 3, 6, 9, 10, 11, 12
Locker and Shower Room (SUN-IS-02)					
Shower Room	25400105	-----	Swipe	Environmental	9, 10, 11, 12
Loft	25400135	-----	Swipe	Field Duplicate of 25400105	9, 10, 11, 12
Door	25400534	-----	Paint	Environmental	6
Floor	25400556	-----	Paint	Environmental	6
Quality Control Water Samples					
-----	25400002	-----	Water	Trip Blank	1
Outside of CRZ	2540019A	-----	Water	Equipment Rinsate Blank	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
**	25400020	-----	Water	Field Blank	1, 6, 9, 10, 11, 12
-----	25400021	-----	Water	Trip Blank	1
-----	25400040	-----	Water	Trip Blank	1
-----	25400041	-----	Water	Trip Blank	1
**	25400042	-----	Water	Equipment Rinsate Blank	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
-----	25400050	-----	Water	Trip Blank	1
-----	25400051	-----	Water	Trip Blank	1
-----	25400052	-----	Water	Trip Blank	1
-----	25400053	-----	Water	Trip Blank	1
*Prepackaged	25400063	-----	Water	Trip Blank	1
**	25400064	-----	Water	Field Blank	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
*Prepackaged	25400065	-----	Water	Trip Blank	1
**	25400070	-----	Water	Equipment Rinsate Blank	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
*Prepackaged	25400071	-----	Water	Trip Blank	1
Not Applicable	25400072	-----	Water	Trip Blank	1
Water Wagon	25400073	-----	Water	Source Blank	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
Special Liquids Pump	25400202	-----	Swipe	Field Blank	9, 10, 11, 12
Special Liquids Pump	25400203	-----	Swipe	Source Blank	9, 10, 11, 12
*Prepackaged	25400500	-----	Water	Trip Blank	1

Table A.3-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Sampling Locations and Analyses
(Page 7 of 7)

Sample Location	Sample Number	Depth Below Ground Surface (ft)	Matrix	Sample Type	Analyses
***	25400503	-----	Water	Field Blank	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
*Prepackaged	25400513	-----	Water	Trip Blank	1
East Side of Decontamination Bay	2540515	-----	Water	Field Blank	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
East Side of Decontamination Bay	25400516-TB	-----	Water	Trip Blank	1
*Prepackaged	25400517	-----	Water	Trip Blank	1
*Prepackaged	25400518	-----	Water	Trip Blank	1
East Decontamination Bay	25400535	-----	Water	Field Blank	1, 2, 3, 5, 6, 7, 9, 10, 11, 12
*Prepackaged	25400536	-----	Water	Trip Blank	1
*Prepackaged	25400537	-----	Water	Trip Blank	1
*Prepackaged	25400538	-----	Water	Trip Blank	1
East Decontamination Pad	25400541	-----	Water	Equipment Rinsate Blank	1, 2, 3, 5, 6, 8, 9, 10, 11, 12
*Prepackaged	25400547	-----	Water	Trip Blank	1
*Prepackaged	25400550	-----	Water	Trip Blank	1
*Prepackaged	25400555	-----	Water	Trip Blank	1
*Prepackaged	25400557	-----	Water	Trip Blank	1

1 - Total Volatile Organic Compounds
2 - Polychlorinated Biphenyls
3 - Total Semivolatile Organic Compounds
4 - TCLP Semivolatile Organic Compounds
5 - TPH (Diesel Range Organics)
6 - Total RCRA Metals
7 - TCLP RCRA Metals
8 - Total Pesticides
9 - Strontium-90
10 - Gamma Spectrometry
11 - Isotopic Plutonium
12 - Isotopic Uranium
13 - TCLP Pesticides

* Prepackaged by off-site laboratory
** Collected inside the exclusionary zone at the sample collection station
***Within exclusionary zone
Appr. - approximately
MS/MSD - Matrix spike/matrix spike duplicate
RCRA - *Resource Conservation and Recovery Act*
TCLP - Toxicity Characteristic Leaching Procedure
ft - feet

Table A.3-2
Laboratory Analytical Methods Used for Samples Collected from
CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site

Analytical Parameter	Analytical Method
Total Volatile Organic Compounds	EPA 8260B ^a
Total Semivolatile Organic Compounds	EPA 8270C ^a
TCLP Semivolatile Organic Compounds	EPA 1311/8270C ^a
Total RCRA Metals (arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury)	EPA 6010B/7470A ^a EPA 6010B/7471A ^a
TCLP RCRA Metals	EPA 1311/6010B ^a
Total Petroleum Hydrocarbons - gasoline and diesel/oil	EPA 8015B (modified) ^a
Total Pesticides	EPA 8081A ^a
TCLP Pesticides	EPA 1311/8081A ^a
Polychlorinated Biphenyls	EPA 8082 ^a
Isotopic Uranium	ASTM 3972-97 ^b ASTM C1000-90 ^c
Isotopic Plutonium	ASTM 3865-97 ^d ASTM C1001-90 ^e
Strontium-90	ASTM D5811-95 ^f
Gamma Spectrometry	EPA 901.1 ^g HASL 300 ^h

^a EPA Test Methods for Evaluating Solid Waste, 3rd Edition, Parts 1-4, SW-846 (EPA, 1996)

^b Standard Test Method for Isotopic Uranium Water by Radiochemistry (ASTM, 1997a)

^c Standard Test Method for Radiochemical Determination of Uranium Isotopes in Soil by Alpha Spectroscopy (ASTM, 1995b)

^d Standard Test Method for Plutonium in Water (ASTM, 1997b)

^e Standard Test Method for Radiochemical Determination of Plutonium in Soil by Alpha Spectroscopy (ASTM, 1995a)

^f Standard Test Method for Strontium-90 in Water (ASTM, 1995c)

^g Prescribed Procedure for Measurements of Radioactivity in Drinking Water (EPA, 1980)

^h Environmental Measurements Laboratory Procedures Manual (DOE, 1997)

ASTM = American Society of Testing and Materials

EPA = Environmental Protection Agency

RCRA = Resource Conservation and Recovery Act

TCLP = Toxicity Characteristic Leaching Procedure

The analytical parameters were selected through the application of site process knowledge according to the EPA's *Guidance for the Data Quality Objectives Process* (EPA, 1994a). Sampling activities were conducted to confirm or disprove assumptions (i.e., models outlined in CAIP) made in the DQO process (DOE/NV, 1999). Sample results were compared to the PRGs published in 1998 (EPA, 1998).

A.3.1 Total Volatile Organic Compound Analytical Results

Total VOCs were not detected at concentrations above the MRLs in soil samples (DOE/NV, 1999). Total VOCs were detected at concentrations above the MRLs in samples of concrete, filters, insulation, sediment, water, and wood. Analytical results for building material samples are listed in [Table D.1-1](#) in [Appendix D](#).

A.3.2 Semivolatile Organic Compound Analytical Results

Total SVOCs were detected at concentrations above the MRLs (DOE/NV, 1999) for soil sample number 2540028 with bis(2-ethylhexyl)phthalate at 570 micrograms per kilogram ($\mu\text{g/kg}$). This is less than the PAL. Total SVOCs were detected at concentrations above the MRLs in samples of concrete, filters, insulation, sediment, water, and wood. Analytical results for building material samples are listed in [Table D.1-1](#) in [Appendix D](#).

A.3.3 TCLP Semivolatile Organic Compound Analytical Results

The TCLP for SVOCs were not detected at concentrations above the MRLs for soil samples (DOE/NV, 1999). TCLP SVOCs were detected at concentrations above the MRLs in wood sample 25400552 with 3+4-Methylphenol at 2.025 mg/L.

A.3.4 Total Petroleum Hydrocarbon Analytical Results

Total Petroleum Hydrocarbons detected in the diesel/oil range above MRLs for soil samples are listed in [Table A.3-3](#) (DOE/NV, 1999). Total Petroleum Hydrocarbons were detected at concentrations above the MRLs in samples of concrete, filters, sediment, and wood. Analytical results for building material samples are listed in [Table D.1-1](#) in [Appendix D](#).

**Table A.3-3
Total Petroleum Hydrocarbons (Diesel Range Organics) Results for Soil Samples
from CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site**

Sample Number	Sample Location	Start Depth (feet)	Start Depth (feet)	Contaminants of Potential Concern (mg/kg)
				Diesel Range Organics
Preliminary Action Levels (mg/kg) ^a				100
25400012	5	2	3	5.3
25400013	6	0	1	5.9

^aEPA Region 9 Preliminary Remediation Goals (EPA, 1998)

mg/kg = Milligrams per kilogram

A.3.5 Total RCRA Metals Analytical Results

Total RCRA Metals detected at concentrations above the MRLs in soil samples are listed in [Table A.3-4](#) (DOE/NV, 1999). Total RCRA Metals were detected at concentrations above the MRLs in samples of concrete, filters, insulation, sediment, water, wood, and paint. Analytical results for building material samples are listed in [Table D.1-1](#) in [Appendix D](#).

Arsenic was detected at or above the PAL of 30 mg/kg in 34 of the soil samples analyzed. The arsenic concentrations for the samples analyzed range from 2.3 to 8.4 mg/kg. Although analysis of most samples reveal arsenic concentrations near 3.0 mg/kg, this PAL is lower than the 7 to 8 ppm (mg/kg) mean concentration of arsenic in silt from the Nellis Air Force Range (NBMG, 1998; Moore, 1999). Thirty four arsenic concentrations presented in [Table A.3-4](#) exceeded the PAL but are considered representative of ambient conditions in soil at the site.

A.3.6 TCLP RCRA Metals Analytical Results

The TCLP RCRA Metals were detected at concentrations above the MRLs for lead in soil sample 25400054 at 0.62 mg/L (DOE/NV, 1999). Total RCRA Metals were detected at concentrations above the MRLs in samples of concrete, rubber, sediment, and wood. Analytical results for building material samples are listed in [Table D.1-1](#) in [Appendix D](#).

Table A.3-4
Total RCRA Metals Detected Above Minimum Reporting Limits for Soil Samples
from CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site
(Page 1 of 2)

Sample Number	Sample Location	Start Depth (feet)	End Depth (feet)	Contaminants of Potential Concern (mg/kg)				
				Arsenic	Barium	Chromium	Lead	Selenium
Preliminary Action Levels (mg/kg) Residential/Industrial ^a				0.38/3.0	5,200/100,000	210/450	400/1,000	370/9,400
25400003	1	2	3	2.6	78	9.7	4.7	--
25400004	1	0	4 ^b	3.6	140	7.5	7.8	--
25400005	2	2	3	3	100	6.5	6.5	--
25400006	2	0	4 ^b	3.2	140	7.3	7.8	--
25400007	3	0	1	3.6	140	5.7	7	--
25400008	3	2	3	3.1	110	6.4	6.6	0.59
25400009	4	0	1	3.1	86	5.5	6.4	--
25400010	4	2	3	2.3	69	7	5.5	0.72
25400011	5	0	1	3	120	5.5	6.7	--
25400012	5	2	3	3.7	100	6.7	7.5	--
25400013	6	0	1	2.4	81	4.5	5.8	--
25400014	6	2	3	3.1	89	6	5.9	--
25400015	7	0	1	2.8	93	6.3	5.5	--
25400016	7	2	3	3.3	110	6.5	6.1	--
25400017	8	0	1	2.7	110	5.5	6.4	0.62
25400018	8	2	3	3.2	96	5.7	6.4	0.54
25400023	9	0	1	3.4 (J) ^c	110	6.1 (J) ^c	6.2	0.55
25400024	9	2	3	2.1 (J) ^c	130	5 (J) ^c	4.1	--
25400025	9	0	1	3.4 (J) ^c	99	6.6 (J) ^c	6.3	0.58
25400026	10	0	1	3 (J) ^c	150	5.3 (J) ^c	7.4	--
25400027	10	2	3	2.8 (J) ^c	110	6.5 (J) ^c	6.2	0.55
25400028	11	0	1	4.7 (J) ^c	92	6.2 (J) ^c	7.6	0.92
25400029	11	2	3	3.1 (J) ^c	91	6 (J) ^c	5.2	--
25400030	12	0	1	3.6 (J) ^c	97	7.1 (J) ^c	6.7	--
25400031	12	2	3	3.7 (J) ^c	91	6.5 (J) ^c	6.9	--
25400032	13	0	1	3.1 (J) ^c	160	6.7 (J) ^c	8.8	0.74
25400033	13	2	3	2.8 (J) ^c	96	6.8 (J) ^c	5.4	--

Table A.3-4
Total RCRA Metals Detected Above Minimum Reporting Limits for Soil Samples
from CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site
(Page 2 of 2)

Sample Number	Sample Location	Start Depth (feet)	End Depth (feet)	Contaminants of Potential Concern (mg/kg)				
				Arsenic	Barium	Chromium	Lead	Selenium
Preliminary Action Levels (mg/kg) Residential/Industrial ^a				0.38/3.0	5,200/100,000	210/450	400/1,000	370/9,400
25400034	14	0	1	5.5	99	8.5	11	0.57
25400035	14	2	3	8.4	99	7.1	12	--
25400036	15	0	1	3.2	90	6.4	9.1	--
25400037	15	2	3	3.1	89	5.4	5.8	--
25400038	16	0	1	2.8	130	6.6	12	--
25400039	16	2	3	2.9	120	5.8	6.8	--
25400043	17	0	1	3.1	91	6.7	9	--
25400044	17	2	3	2.8	110	5.6	6.2	--
25400045	18	0	1	2.7	71	5	6.7	--
25400046	18	2	3	3	95	4.6	3.9	--
25400047	19	0	1	3.4	130	6.1	11	--
25400048	19	2	3	5	110	5.3	5.1	--
25400054	20	0	1	--	--	--	0.62	--
25400056	21	0	1	3.9	74	6.2	7	--
25400057	21	2	3	2.8	88	4.8	5.2	--
25400058	22	0	1	3.9	97	6.8	6.4	--
25400059	22	2	3	2.8	140	4.8	5.3	0.54
25400060	24	0	1	3.2	110	6.8	7.6	--
25400061	24	0	1	3.1	100	6.7	4.7	--
25400062	24	2	3	3.5	98	5.4	4.6	1
25400066	23	0	1	3.9	120	8.4	12	--
25400067	23	2	3	2.9	120	6.5	7	--

^aEPA Region 9 Preliminary Remediation Goals (EPA, 1998)

^bDepth in inches

^cDuplicate precision analyses were outside QC limits

J = Estimated

mg/kg = Milligrams per kilogram

A.3.7 Polychlorinated Biphenyl Analytical Results

The PCBs detected at concentrations above the MRLs in soil samples are listed in [Table A.3-5](#) (DOE/NV, 1999). Polychlorinated biphenyls were detected at concentrations above the MRLs in samples of concrete, filters, insulation, oil, sediment, and wood. Analytical results for building material samples are listed in [Table D.1-1](#) in [Appendix D](#).

A.3.8 Total Pesticides Analytical Results

Total Pesticides were not detected at concentrations above the MRLs in soil or building material samples.

A.3.9 TCLP Pesticides Analytical Results

The TCLP for pesticides were not detected at concentrations above the MRLs in soil or building material samples.

A.3.10 Radioanalytical Results

The radionuclide analytical results for soil samples detected at concentrations above the MRLs for isotopic analysis are listed in [Table A.3-6](#) and for gamma spectrometry are listed in [Table A.3-7](#). The radionuclide analytical results for the radiological surveys, swipes, and building material samples detected at concentrations above the MRLs in samples of concrete, rubber, sediment, and wood are listed in [Table D.1-1](#) in [Appendix D](#).

A.3.10.1 Radiation Dose Rate Survey Results

Radiation dose rate surveys were performed in each of the six survey units in Building 3126, on each of the two decontamination pads, and the storage yard. Dose rates in the building interior ranged from a minimum of 10 to a maximum of 70 microrem per hour (microrem/hr) at 3.3 ft from the floor. The average general area dose rate inside Building 3126 was approximately 20 microrem/hr. Dose rates on the west decontamination pad ranged from a minimum of 5 to a maximum of 15 microrem/hr at 3.3 ft from the concrete pad. Dose rates on the east decontamination pad ranged from a minimum of 10 to a maximum of 60 microrem/hr at 3.3 ft. Dose rates from the walkover survey of the storage yard ranged from a minimum of 10 to a maximum of 40 microrem/hr at 3.3 ft above the ground. The

Table A.3-5
Polychlorinated Biphenyls (PCBs) Detected Above Minimum Reporting Limits
for Soil Samples from CAU 254, Area 25 R-MAD Decontamination Facility,
Nevada Test Site

Sample Number	Sample Location	Start Depth (feet)	End Depth (feet)	Contaminants of Potential Concern (µg/kg)	
				Aroclor-1016	Aroclor-1260
Preliminary Action Levels (µg/kg) Residential/Industrial ^a				3,400/63,000	3,400/63,000
25400007	3	0	1	--	180
25400008	3	2	3	--	40
25400010	4	2	3	--	440
25400012	5	2	3	--	100
25400013	6	0	1	--	100
25400015	7	0	1	41 (J) ^{b, c}	2,200 (J) ^d
25400023	9	0	1	--	83
25400025	9	0	1	--	42
25400026	10	0	1	--	290
25400028	11	0	1	--	160
25400030	12	0	1	--	130
25400032	13	0	1	--	100
25400034	14	0	1	--	250
25400036	15	0	1	--	68
25400038	16	0	1	--	490
25400043	17	0	1	--	270
25400045	18	0	1	--	76
25400047	19	0	1	--	250
25400054	20	0	1	--	2,000 (J) ^{b, c}
25400056	21	0	1	--	130
25400058	22	0	1	--	340
25400060	24	0	1	--	810
25400061	24	0	1	--	730
25400066	23	0	1	--	370
25400546	-----	0	2.5	--	1,100
25400548	-----	0	1.5	--	19,000 (J) ^{b, c}

^aEPA Region 9 Preliminary Remediation Goals (EPA, 1998)

^bMatrix effect may exist

^cCompounds/components coelute

^dSurrogates diluted out

J = Estimated

µg/kg = Micrograms per kilogram

Table A.3-6
Isotopic Results Detected Above Minimum Reporting Limits for Soil Samples
from CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site
(Page 1 of 2)

Sample Number	Sample Location	Start Depth (feet)	End Depth (feet)	Contaminants of Potential Concern (pCi/g)				
				Plutonium-239	Strontium-90	Uranium-234	Uranium-235	Uranium-238
Preliminary Action Levels (pCi/g) ^a				0.24	1.17	2.6	0.1	3.2
25400003	1	2	3	--	--	0.90 ± 0.17	0.059 ± .030	0.89 ± 0.17
25400004	1	0	4 ^b	--	--	0.92 ± 0.17	0.063 ± 0.030	0.72 ± 0.14
25400005	2	2	3	--	--	0.93 ± 0.16	--	0.92 ± 0.16
25400006	2	0	4 ^b	--	--	0.86 ± 0.15	0.051 ± 0.025	0.91 ± 0.16
25400007	3	0	1	0.026 ± 0.014 (B)	--	0.86 ± 0.15	0.058 ± 0.027	0.72 ± 0.13
25400008	3	2	3	--	--	0.91 ± 0.16	0.060 ± 0.028	0.78 ± 0.14
25400009	4	0	1	--	--	0.92 ± 0.16	0.117 ± 0.041	0.81 ± 0.15
25400010	4	2	3	--	--	0.89 ± 0.16	0.079 ± 0.035	0.87 ± 0.16
25400011	5	0	1	0.017 ± 0.011 (B)	--	0.89 ± 0.16	0.093 ± 0.035	0.88 ± 0.15
25400012	5	2	3	--	--	0.85 ± 0.15	0.055 ± 0.026	0.92 ± 0.16
25400013	6	0	1	--	--	1.07 ± 0.22	--	0.84 ± 0.18
25400014	6	2	3	--	--	0.82 ± 0.15	0.101 ± 0.038	0.85 ± 0.15
25400015	7	0	1	--	13.9 ± 2.6 (J)	3.44 ± 0.55	0.184 ± 0.071	0.77 ± 0.17
25400016	7	2	3	--	--	0.89 ± 0.17	0.046 ± 0.026 (B)	0.81 ± 0.15
25400017	8	0	1	--	--	1.08 ± 0.22	--	0.93 ± 0.19
25400018	8	2	3	0.024 ± 0.015 (B)	--	0.93 ± 0.17 (J)	0.128 ± 0.045 (J)	0.91 ± 0.17
25400023	9	0	1	--	--	0.96 ± 0.13	0.089 ± 0.021	0.89 ± 0.12
25400024	9	2	3	--	--	0.84 ± 0.13	0.072 ± 0.027	0.90 ± 0.14
25400025	9	0	1	--	--	0.87 ± 0.12	0.097 ± 0.022	0.82 ± 0.11
25400026	10	0	1	--	--	0.88 ± 0.13	0.053 ± 0.022	0.89 ± 0.14
25400027	10	2	3	--	--	0.79 ± 0.11	0.063 ± 0.017	0.75 ± 0.11
25400028	11	0	1	--	--	0.88 ± 0.13	0.084 ± 0.029	0.75 ± 0.12
25400029	11	2	3	--	--	0.91 ± 0.13	0.097 ± 0.023	0.87 ± 0.12
25400030	12	0	1	--	--	0.93 ± 0.13	0.075 ± 0.019	0.88 ± 0.12
25400031	12	2	3	--	--	0.88 ± 0.12	0.096 ± 0.023	0.91 ± 0.13
25400032	13	0	1	--	--	0.91 ± 0.13	0.097 ± 0.022	0.81 ± 0.11
25400033	13	2	3	--	--	0.84 ± 0.12	0.039 ± 0.014 (B)	0.80 ± 0.11
25400034	14	0	1	--	23.5 ± 4.3 (J)	1.98 ± 0.28	0.147 ± 0.039	0.78 ± 0.13
25400035	14	2	3	--	--	1.11 ± 0.17	0.062 ± 0.026	0.96 ± 0.15

Table A.3-6
Isotopic Results Detected Above Minimum Reporting Limits for Soil Samples
from CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site
(Page 2 of 2)

Sample Number	Sample Location	Start Depth (feet)	End Depth (feet)	Contaminants of Potential Concern (pCi/g)				
				Plutonium-239	Strontium-90	Uranium-234	Uranium-235	Uranium-238
Preliminary Action Levels (pCi/g) ^a				0.24	1.17	2.6	0.1	3.2
25400036	15	0	1	--	--	9.2 ± 1.1	0.70 ± 0.10 (J)	0.89 ± 0.12
25400037	15	2	3	--	--	1.09 ± 0.15	0.079 ± 0.021	1.00 ± 0.14
25400038	16	0	1	--	4.29 ± 0.86 (J)	1.90 ± 0.25	0.098 ± 0.023	0.87 ± 0.12
25400039	16	2	3	--	--	1.15 ± 0.16	0.076 ± 0.019	1.00 ± 0.14
25400043	17	0	1	--	--	0.93 ± 0.14	0.083 ± 0.027	0.77 ± 0.12
25400044	17	2	3	--	--	1.06 ± 0.14	0.055 ± 0.016	1.01 ± 0.14
25400045	18	0	1	--	--	1.35 ± 0.19	0.113 ± 0.033	0.85 ± 0.13
25400046	18	2	3	--	--	1.20 ± 0.19	0.088 ± 0.030	1.04 ± 0.17
25400047	19	0	1	0.126 ± 0.053	2.87 ± 0.60 (J)	13.7 ± 1.9	0.92 ± 0.18 (J)	1.10 ± 0.20
25400048	19	2	3	--	--	0.96 ± 0.16	0.089 ± 0.031	0.87 ± 0.15
25400054	20	0	1	--	4.9 ± 1.1 (J)	37.3 ± 5.0	1.72 ± 0.29	1.09 ± 0.20
25400055	20	2	3	--	--	0.86 ± 0.14	0.070 ± 0.026	0.81 ± 0.14
25400056	21	0	1	--	0.71 ± 0.25 (J)	1.16 ± 0.21	0.077 ± 0.038 (J)	0.86 ± 0.17
25400057	21	2	3	--	--	0.92 ± 0.15	0.088 ± 0.031	0.77 ± 0.13
25400058	22	0	1	--	--	0.92 ± 0.15	0.121 ± 0.037	0.85 ± 0.14
25400059	22	2	3	--	--	0.87 ± 0.15	0.075 ± 0.028 (J)	0.81 ± 0.14
25400060	24	0	1	--	--	0.66 ± 0.12	0.066 ± 0.026	0.68 ± 0.12
25400061	24	0	1	--	--	0.84 ± 0.14	0.092 ± 0.031 (J)	0.75 ± 0.13
25400062	24	2	3	--	--	0.88 ± 0.15	0.108 ± 0.035	0.86 ± 0.15
25400066	23	0	1	--	--	0.90 ± 0.15	0.064 ± 0.025	0.85 ± 0.14
25400067	23	2	3	--	--	0.84 ± 0.14	0.078 ± 0.029	0.75 ± 0.13
25400546	East Decon Pad Sump	0	2.5	0.138 ± 0.059	--	11.4 ± 1.6	0.93 ± 0.20	0.99 ± 0.20
25400548	West Decon Pad Sump	0	1.5	--	--	1.86 ± 0.35	0.122 ± 0.063	0.99 ± 0.22

^aField Instructions for Corrective Action Unit 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site (IT, 2000).

^bDepth in Inches

B = Analyte concentration is greater than minimum detectable concentrations

J = Estimated

pCi/g = Picocuries per gram

Decon = Decontamination

Table A.3-7
Gamma Spectrometry Results for Soil Samples
from CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site
(Page 1 of 3)

Sample Number	Sample Location	Start Depth (feet)	End Depth (feet)	Contaminants of Potential Concern (pCi/g)										
				Actinium-228	Bismuth-212	Bismuth-214	Cesium-137	Europium-154	Potassium-40	Niobium-94	Lead-212	Lead-214	Thallium-208	Uranium-235
Preliminary Action Levels (pCi/g) ^{a, b}				3.64 ^a	2.4 ^a	3.47 ^a	7.0 ^b	2.17 ^a	96 ^b	0.1 ^b	2.9 ^a	2.9 ^b	3.4 ^a	0.1 ^b
25400003	1	2	3	2.02 ± 0.55	--	1.12 ± 0.29 (J)	--	--	27.3 ± 5.2	--	1.64 ± 0.35	1.26 ± 0.34	0.73 ± 0.24 (J)	--
25400004	1	0	4 ^c	2.17 ± 0.55	--	0.90 ± 0.29	--	--	29.1 ± 5.5	--	0.95 ± 0.36	1.57 ± 0.37	0.58 ± 0.17 (J)	--
25400005	2	2	3	2.53 ± 0.64	--	1.11 ± 0.29 (J)	--	--	27.7 ± 5.2	--	1.65 ± 0.36	1.19 ± 0.29	0.73 ± 0.26 (J)	--
25400006	2	0	4 ^c	2.24 ± 0.60	--	0.92 ± 0.27	--	--	27.7 ± 5.3	--	0.92 ± 0.32	1.20 ± 0.33	0.86 ± 0.21 (J)	--
25400007	3	0	1	1.73 ± 0.48	--	--	--	--	28.3 ± 5.4	--	1.34 ± 0.37	0.93 ± 0.24	--	--
25400008	3	2	3	1.90 ± 0.53	--	--	--	--	28.3 ± 6.2	--	1.50 ± 0.43	1.14 ± 0.44	--	--
25400009	4	0	1	--	--	--	--	--	27.0 ± 6.0	--	1.55 ± 0.42	1.27 ± 0.47	--	--
25400010	4	2	3	--	--	--	--	--	26.2 ± 5.9	--	1.64 ± 0.44	1.42 ± 0.49	--	--
25400011	5	0	1	--	--	--	1.23 ± 0.26	--	28.8 ± 5.5	--	1.25 ± 0.33	1.11 ± 0.39	--	--
25400012	5	2	3	--	--	--	--	--	28.3 ± 6.2	--	1.50 ± 0.43	1.14 ± 0.44	--	--
25400013	6	0	1	--	--	--	--	--	28.3 ± 6.4	--	1.54 ± 0.41	1.07 ± 0.32	--	--
25400014	6	2	3	2.22 ± 0.69	--	--	--	--	32.9 ± 6.2	--	1.10 ± 0.32	1.15 ± 0.39	--	--
25400015	7	0	1	--	--	--	0.80 ± 0.19	--	30.3 ± 5.7	--	0.89 ± 0.28	0.97 ± 0.36	--	--
25400016	7	2	3	--	--	--	--	--	31.9 ± 6.8	--	1.21 ± 0.37	1.28 ± 0.41	--	--
25400017	8	0	1	--	--	--	--	--	23.0 ± 5.3	--	1.32 ± 0.37	1.17 ± 0.41	--	--
25400018	8	2	3	1.96 ± 0.55	--	1.13 ± 0.32	--	--	29.7 ± 5.7	--	0.94 ± 0.30	1.05 ± 0.37	--	--
25400023	9	0	1	1.77 ± 0.57	--	--	--	--	23.1 ± 4.5	--	1.02 ± 0.36	1.02 ± 0.33	0.73 ± 0.30 (J)	--
25400024	9	2	3	2.11 ± 0.78	--	--	--	--	28.7 ± 6.3	--	1.39 ± 0.43	1.10 ± 0.43	0.56 ± 0.24 (J)	--

Table A.3-7
Gamma Spectrometry Results for Soil Samples
from CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site
(Page 2 of 3)

Sample Number	Sample Location	Start Depth (feet)	End Depth (feet)	Contaminants of Potential Concern (pCi/g)										
				Actinium-228	Bismuth-212	Bismuth-214	Cesium-137	Europium-154	Potassium-40	Niobium-94	Lead-212	Lead-214	Thallium-208	Uranium-235
Preliminary Action Levels (pCi/g) ^{a, b}				3.64 ^a	2.4 ^a	3.47 ^a	7.0 ^b	2.17 ^a	96 ^b	0.1 ^b	2.9 ^a	2.9 ^b	3.4 ^a	0.1 ^b
25400025	9	0	1	2.39 ± 0.67	--	--	--	--	27.7 ± 5.4	--	0.84 ± 0.27	0.95 ± 0.27	0.90 ± 0.34 (J)	--
25400026	10	0	1	2.10 ± 0.77	--	--	--	--	27.6 ± 6.1	--	1.28 ± 0.41	1.25 ± 0.47	0.47 ± 0.22	--
25400027	10	2	3	1.81 ± 0.50	--	--	--	--	30.2 ± 5.8	--	1.06 ± 0.32	1.03 ± 0.26	0.95 ± 0.39	--
25400028	11	0	1	3.02 ± 0.98	--	--	0.63 ± 0.25	--	31.5 ± 6.8	--	1.15 ± 0.35	1.39 ± 0.52	0.57 ± 0.21 (J)	--
25400029	11	2	3	2.39 ± 0.71	--	--	--	--	28.2 ± 5.5	--	1.14 ± 0.31	1.02 ± 0.34	0.93 ± 0.33 (J)	--
25400030	12	0	1	2.35 ± 0.81	--	--	--	--	29.3 ± 6.4	--	1.23 ± 0.37	1.17 ± 0.52	0.54 ± 0.24 (J)	--
25400031	12	2	3	2.05 ± 0.59	--	--	--	--	27.3 ± 5.3	--	1.03 ± 0.30	1.19 ± 0.34	0.74 ± 0.25 (J)	--
25400032	13	0	1	--	--	--	--	--	26.1 ± 5.8	--	1.29 ± 0.40	0.80 ± 0.37	0.74 ± 0.28 (J)	--
25400033	13	2	3	2.75 ± 0.75	--	--	--	--	27.1 ± 5.3	--	0.82 ± 0.25	1.12 ± 0.38	0.83 ± 0.37 (J)	--
25400034	14	0	1	--	--	--	11.0 ± 2.1	--	25.0 ± 5.6	--	1.58 ± 0.51	1.67 ± 0.78	0.88 ± 0.45 (J)	--
25400035	14	2	3	2.09 ± 0.76	--	0.96 ± 0.32 (J)	--	--	27.1 ± 5.4	--	0.94 ± 0.31	1.06 ± 0.40	0.70 ± 0.26 (J)	--
25400036	15	0	1	1.69 ± 0.70	--	--	0.73 ± 0.30	--	28.1 ± 6.4	--	1.74 ± 0.49	1.36 ± 0.52	0.38 ± 0.16 (J)	--
25400037	15	2	3	2.18 ± 0.65	--	1.05 ± 0.30	--	--	25.7 ± 5.0	--	0.93 ± 0.27	1.04 ± 0.35	0.72 ± 0.29 (J)	--
25400038	16	0	1	1.32 ± 0.50	--	--	22.2 ± 3.8	--	28.0 ± 6.2	--	1.34 ± 0.44	--	0.96 ± 0.35 (J)	--
25400039	16	2	3	2.05 ± 0.60	--	0.97 ± 0.33 (J)	--	--	32.7 ± 6.2	--	1.01 ± 0.35	1.10 ± 0.39	0.73 ± 0.30 (J)	--
25400043	17	0	1	1.54 ± 0.67	--	--	1.15 ± 0.37	--	21.3 ± 4.9	--	1.17 ± 0.19	0.83 ± 0.30	0.60 ± 0.24 (J)	--
25400044	17	2	3	2.06 ± 0.61	--	0.80 ± 0.28 (J)	--	--	26.2 ± 5.1	--	1.01 ± 0.33	1.08 ± 0.42	0.79 ± 0.29 (J)	--
25400045	18	0	1	1.48 ± 0.55	3.2 ± 1.5 (J)	--	--	--	27.5 ± 6.2	--	1.33 ± 0.41	1.07 ± 0.41	1.02 ± 0.37 (J)	--
25400046	18	2	3	1.63 ± 0.68	--	--	--	--	26.6 ± 6.2	--	1.39 ± 0.40	1.01 ± 0.36	0.66 ± 0.29 (J)	--
25400047	19	0	1	3.00 ± 0.93	--	1.02 ± 0.36	46.6 ± 7.8	7.3 ± 1.3	27.9 ± 5.4	2.94 ± 0.54	0.84 ± 0.14	--	--	--
25400048	19	2	3	2.56 ± 0.85	--	--	--	--	29.0 ± 6.5	--	1.40 ± 0.38	--	1.06 ± 0.40 (J)	--

Table A.3-7
Gamma Spectrometry Results for Soil Samples
from CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site
(Page 3 of 3)

Sample Number	Sample Location	Start Depth (feet)	End Depth (feet)	Contaminants of Potential Concern (pCi/g)										
				Actinium-228	Bismuth-212	Bismuth-214	Cesium-137	Europium-154	Potassium-40	Niobium-94	Lead-212	Lead-214	Thallium-208	Uranium-235
Preliminary Action Levels (pCi/g) ^{a, b}				3.64 ^a	2.4 ^a	3.47 ^a	7.0 ^b	2.17 ^a	96 ^b	0.1 ^b	2.9 ^a	2.9 ^b	3.4 ^a	0.1 ^b
25400054	20	0	1	2.18 ± 0.67 (J)	--	0.82 ± 0.27 (J)	11.6 ± 2.0	0.96 ± 0.16 (J)	29.4 ± 5.6	0.36 ± 0.12	0.91 ± 0.29	1.11 ± 0.39	1.02 ± 0.48 (J)	--
25400055	20	2	3	2.25 ± 0.62	--	0.89 ± 0.29 (J)	--	--	29.7 ± 5.6	--	1.20 ± 0.35	1.09 ± 0.39	0.92 ± 0.39 (J)	--
25400056	21	0	1	2.80 ± 0.71 (J)	--	0.94 ± 0.29 (J)	1.24 ± 0.27	--	32.4 ± 6.3	--	1.16 ± 0.35	1.12 ± 0.36	0.76 ± 0.26 (J)	0.69 ± 0.71 (J)
25400057	21	2	3	2.23 ± 0.75 (J)	2.6 ± 1.3 (J)	0.75 ± 0.28 (J)	--	--	30.3 ± 5.9	--	1.00 ± 0.30	1.01 ± 0.36	0.62 ± 0.23 (J)	--
25400058	22	0	1	1.96 ± 0.61	--	0.94 ± 0.30 (J)	4.85 ± 0.86	--	31.0 ± 6.2	--	0.96 ± 0.30	1.11 ± 0.40	0.68 ± 0.35 (J)	--
25400059	22	2	3	2.00 ± 0.56	--	0.95 ± 0.30 (J)	--	--	31.9 ± 6.0	--	0.80 ± 0.26	0.99 ± 0.38	0.51 ± 0.23 (J)	--
25400060	24	0	1	2.18 ± 0.63	--	1.05 ± 0.34	--	--	35.9 ± 6.8	--	1.11 ± 0.33	1.05 ± 0.32	0.68 ± 0.20 (J)	--
25400061	24	0	1	2.51 ± 0.67	--	0.85 ± 0.30	--	--	34.9 ± 6.5	--	0.98 ± 0.30	1.06 ± 0.37	0.82 ± 0.29 (J)	--
25400062	24	2	3	2.32 ± 0.66	--	0.92 ± 0.30 (J)	--	--	32.4 ± 6.0	--	0.91 ± 0.15	1.07 ± 0.32	0.71 ± 0.25 (J)	--
25400066	23	0	1	2.82 ± 0.74	--	1.03 ± 0.32	0.27 ± 0.10	--	32.7 ± 6.3	--	1.05 ± 0.34	0.93 ± 0.29	0.73 ± 0.26 (J)	--
25400067	23	2	3	2.34 ± 0.72	--	0.81 ± 0.26 (J)	--	--	33.8 ± 6.3	--	0.98 ± 0.29	1.09 ± 0.35	0.72 ± 0.22 (J)	--
25400546	East Decon Pad Sump	0	2.5	2.15 ± 0.75 (J)	--	--	71.0 ± 12.0	--	31.2 ± 6.0	--	1.08 ± 0.18	--	--	--
25400548	West Decon Pad Sump	0	1.5	1.97 ± 0.75 (J)	--	0.93 ± 0.32 (J)	17.5 ± 3.0	--	30.4 ± 6.0	--	1.21 ± 0.38	1.25 ± 0.53	1.06 ± 0.50 (J)	--

^aField Instructions for Corrective Action Unit 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site (IT, 2000).

^bRadioanalytical Data Review of Sample Results Associated with Corrective Action Unit (CAU) 254, Sample Delivery Groups (SDGs) 0001050, 0001048, 0001062, 0001061, 0001075, 0001144, 0001149, 0001186, 0001167, 0001171, 0001179, 0001180, 0001188, 0002003, 0002040 (Alderson and Orchard, 2000).

^cDepth in Inches

Decon = Decontamination

J = Estimated

pCi/g = Picocuries per gram

maximum dose rate outside Building 3126 was 500 microrem/hr at contact with the railroad tie located at the southern end of the yard. Locations inside Building 3126 and in the storage yard that exceeded the general area dose rates listed in [Appendix C](#).

A.3.10.2 Radiological Scanning and Static Survey Results

Both scanning and static total surface contamination surveys were performed on the structural surface inside and outside of Building 3126. Total surface contamination results indicate that portions of the floors in the locker and shower room, north and south sides of the decontamination bay, loft, east decontamination pad, and west decontamination pad are above PALs (5,000 disintegrations per minute [dpm]/100 square centimeters [cm^2]). Total surface contamination results indicate that portions of the walls in the north and south sides of the decontamination bay and loft are above PALs. In addition, these results also indicate that portions of the south and west walls on the external surfaces of the building are above PALs.

A.3.10.3 Removable Radiation Swipe Sample Results

Removable surface contamination surveys were performed on the structural surfaces inside Building 3126. Only one removable surface contamination result exceeded the PAL for removable surface contamination. This swipe was collected on the wood of the door on the east wall of the decontamination bay. The maximum result for removable surface contamination was 9,837 dpm/100 cm^2 at this location. All other removable surface contamination survey results indicate that floors, walls, and ceiling inside the building are below removable limits (1,000 dpm/100 cm^2) listed in DOE Order 5400.5, Chapter IV, Figure IV-1 (DOE, 1993).

A.3.10.4 Building and Equipment Radiation Sample Results

A total of 32 environmental building and equipment material samples were collected from the structural surfaces on the building and from equipment associated with major building systems. The samples were analyzed at an off-site contracted laboratory for the same set of radiochemical analysis as for the soil. The radionuclides that were detected above PALs are Sr-90, Nb-94, Cs-137, U-234, U-235, and Pu-239. The media type, total number of samples, and the percentage of samples with results greater than PALs are listed in [Table A.3-8](#).

Table A.3-8
Building and Equipment Material Sample Results Exceeding Radiological Preliminary
Action Levels for CAU 254, R-MAD Decontamination Facility, Nevada Test Site

Media	Number of Samples	Percent > PALs
Concrete	8	75
Rubber	1	100
Wood	5	80
Insulation	5	100
Filters	2	50
Air Handling System	2	0
Sump/Drain Sediment	8	100
Paint	1	0

PAL - Preliminary Action Levels

A.4.0 Quality Assurance

The results of the QA/QC activities for the CAU 254 corrective action investigation sampling events are summarized in the following text. Detailed information regarding the QA program is contained in the Industrial Sites QAPP (DOE/NV, 1996a).

Quality control results are typically judged in terms of precision, accuracy, representativeness, completeness, and comparability and are described in the following sections.

A.4.1 Precision

Precision is a quantitative measure of the variability of a group of measurements from their average value. Precision is assessed for inorganic analysis by collecting and analyzing duplicate field samples and comparing the results with the original sample. Precision is also assessed by creating, preparing, analyzing, and comparing laboratory duplicates from one or more field samples in inorganic analyses and MS/MSD samples for organic analyses. Precision is reported as relative percent difference (RPD) which is calculated as the difference between the measured concentrations of duplicate samples, divided by the average of the two concentrations, and multiplied by 100. Any deviation from these requirements has been documented and explained and the related data qualified accordingly. The qualification process is described in [Section A.4.7.1](#).

A.4.2 Accuracy

Analytical accuracy is defined as the nearness of a measurement to the true or accepted reference value. It is the composite of the random and systematic components of the measurement system and measures bias in the measurement system. The random component of accuracy is measured and documented through the analyses of spiked samples. Sampling accuracy is assessed by evaluating the results of spiked samples and laboratory control samples. Accuracy measurements are calculated as percent recovery by dividing the measured sample concentration by the true concentration and multiplying the quotient by 100.

Field accuracy is assessed by confirming that the documents of record track the sample from its origin, through transfer of custody, to disposal. The goal of field accuracy is for all samples to be

collected from the correct locations at the correct time, placed in a correctly labeled container with the correct preservative, and sealed with custody tape to prevent tampering. All samples in this sampling event were properly collected and forwarded to the laboratories as described above.

A.4.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition (EPA, 1987). Sample representativeness was achieved through the implementation of a sampling program designed to ensure proper sampling locations, number of samples, and the use of validated analytical methods. Representativeness was assessed through analysis of duplicate samples. Representativeness of the samples taken in this sampling event was assured by collecting the specified number of samples (DOE/NV, 1999) and by analyzing them by the approved analytical methods shown in [Table A.3-2](#).

A.4.4 Completeness

Completeness is defined as a percentage of measurements made that are judged to be valid. A sampling and analytical requirement of 80 percent completeness was established and achieved for this project (DOE/NV, 1996a).

The specified sampling locations were utilized as planned. All samples were collected as specified in the CAIP (DOE/NV, 1999), and all sample containers reached the laboratory intact and properly preserved (when applicable). Sample temperatures were maintained during shipment to the laboratory, and sample chain of custody was maintained during sample storage and/or shipment.

A.4.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another (EPA, 1987). To ensure comparability, sampling activities were performed and documented in accordance with approved procedures, and all samples were collected in accordance with the CAIP (DOE/NV, 1999). Approved standardized methods and procedures were also 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.

Based on the minimum comparability requirements specified in the Industrial Sites QAPP (DOE/NV, 1996a), all requirements were met.

Field (i.e., sample-handling) documentation, laboratory nonconformance reports, and the precision and accuracy of quality-control sample results were evaluated for their effect on the results of the associated environmental sediment samples. The environmental sample results were then qualified according to processes outlined in the following sections. Documentation of the data qualifications resulting from these reviews is retained in project files as both hard copy and electronic media.

A.4.6 Tier I and Tier II Data Evaluations

All laboratory data from samples collected at the CAU 254 Site have been evaluated for data quality according to the EPA Functional Guidelines (EPA, 1994b and 1999). These guidelines are implemented in a tiered process and are presented in the following text. No data rejected during the data evaluation process were used to draw the conclusions presented in the CADD. Only valid data, whether estimated (i.e., J-qualified) or not, were used.

The adjustments to data and data qualifiers resulting from the data evaluation process were documented in the project files and were summarized in memoranda for each sample delivery group (SDG). These memoranda are maintained in the project files.

A.4.6.1 Tier I Evaluation

Tier I evaluation for both chemical and radiological analysis examines (but is not limited to):

- Sample count/type consistent with chain of custody
- Analysis count/type consistent with chain of custody
- Correct sample matrix
- Significant problems stated in cover letter or case narrative
- Completeness of certificates of analysis
- Completeness of CLP or CLP-like packages
- Completeness of signatures, dates, and times on chain of custody
- Condition-upon-receipt variance form included
- Requested analyses performed on all samples
- Date received/analyzed given for each sample
- Correct concentration units indicated
- Electronic data transfer supplied

- Results reported for field and laboratory QC samples
- Whether or not the deliverable met the overall objectives of the project

A.4.6.2 Tier II Evaluation

Tier II evaluation for both chemical and radiological analysis examines (but is not limited to):

Chemical:

- Sample date, preparation date, and analysis date for each sample
- Holding time criteria met
- QC batch association for each sample
- Cooler temperature upon receipt
- Sample pH for aqueous samples, as required
- Detection limits properly adjusted for dilution, as required
- Blank contamination evaluated and applied to sample results/qualifiers
- MS/MSD percent recoveries (%R) and RPDs evaluated and applied to laboratory results/qualifiers
- Field duplicate RPDs evaluated using professional judgement and applied to laboratory results/qualifiers
- Laboratory duplicate RPDs evaluated and applied to laboratory results/qualifiers
- Surrogate %R evaluated and applied to laboratory results/qualifiers
- Laboratory control sample %R evaluated and applied to laboratory results/qualifiers
- Initial and continuing calibration evaluated and applied to laboratory results/qualifiers
- Internal standard evaluated and applied to laboratory results/qualifiers
- Recalculation of 10 percent of laboratory results from raw data
- Mass spectrometer tuning criteria
- Initial and continuing calibration verification
- Internal standard evaluation
- Organic compound quantitation
- Inductively coupled plasma (ICP) interference check sample evaluation
- Graphite furnace atomic absorption quality control
- ICP serial dilution effects

Radioanalytical:

- Blank contamination evaluated and validation data qualifier applied to sample results
- Certificate of Analysis consistent with data package documentation
- Quality control sample results (e.g., duplicates, laboratory control samples, MS/MSD) evaluated and validation data qualifiers applied to sample results
- Sample results, error, and minimum detectable activity evaluated and applied to laboratory result qualifiers
- Detector system calibrated to National Institute for Standards and Technology (NIST) traceable sources
- Calibration sources preparation was documented, demonstrating proper preparation and appropriateness for sample matrix, emission energies, and concentrations
- Detector system response to daily, weekly, and monthly background and calibration checks for peak energy, peak centroid, peak full-width half-maximum, and peak efficiency
- Tracers NIST-traceable, appropriate for the analysis performed, and recoveries that met QC requirements
- Documentation of all QC sample preparation complete and properly performed
- Spectra lines, emissions, particle energies, peak areas, and background peak areas support the identified radionuclide and its concentration

A.4.6.3 Tier III Evaluation

Data quality considerations that are included in EPA data review functional guidelines (EPA, 1994b and 1999) as a Tier III review include the additional evaluations:

Chemical:

- Recalculation of all laboratory results from raw data

Radioanalytical:

- QC sample results (e.g., calibration source concentration, percent recovery, and RPD) verified
- Radionuclides and their concentration appropriate considering their decay schemes, half-lives, and process knowledge and history of the facility and site
- Each identified line in spectra verified against emission libraries and calibration results
- Independent identification of spectra lines, area under the peaks, and quantification of radionuclide concentration in a random number of sample results

Tier III review of at least five percent of the sample analytical data was performed by TechLaw, Inc. in Lakewood, Colorado. Changes to the chemical and radioanalytical data were incorporated as a result of the Tier III review. Documentation of the Tier III is retained in the project files.

A.4.7 Quality Control Samples

There were 24 trip blanks, 6 field blanks, 4 equipment rinsate blanks, 2 source blanks, 10 field duplicates, 5 MS/MSD collected and submitted for off-site laboratory analysis as shown in [Table A.3-1](#). In addition, 45 laboratory duplicates were analyzed. The samples and duplicates were assigned individual sample numbers and sent to the laboratory “blind.” The field blanks were taken by placing distilled water into appropriate sample bottles and preserving them according to the requirements specified in the Industrial Sites QAPP (DOE/NV, 1996a). The equipment rinsate blank was obtained by collecting distilled water, which was poured over the decontaminated sampling equipment, into the appropriate sample bottles and preserved as applicable. The field duplicates were taken at the same spot as the environmental sample and MS/MSD. The trip blanks, which were received preserved and sealed from the laboratory, were placed in each cooler containing samples for VOC analysis. The results of the QC samples are discussed in the following sections. The MS/MSD samples were collected as triplicate volumes of environmental samples. The swipe field blanks were taken by waving a clean swipe in the decontamination building. The swipe field duplicate was obtained by swiping the area adjacent to a swipe sample location with a clean swipe. The source blank was collected by placing an untouched clean swipe into a sample container without coming in contact with the air or surfaces within the decontamination facility.

A.4.7.1 Field Quality Control Samples

Review of the field-collected blank analytical data for the CAU 254 investigation indicates that contamination from field methods may have occurred during sample collection. Although concentrations were above the Contract-Required Detection Limit (CRDL), the PALs were not exceeded and the results did not have an impact on the investigation. Field and equipment rinsate blanks were analyzed for the parameters listed in [Table A.3-2](#) and trip blanks were analyzed for VOCs only. Acetone and chloroform were detected in several equipment rinsate and field blanks at concentrations that exceeded the CRDL. Acetone was also detected in trip blank sample 25400547 at

a concentration that was at the CRDL. An overall review of the data made the possibility of cross-contamination a factor.

During the sampling event, seven field duplicate samples and three duplicate swipe samples were sent as blind samples to the laboratory to be analyzed for the investigation parameters listed in [Table A.3-2](#). For these samples, the precision of duplicate sample results (i.e., RPDs between the environmental sample results and their corresponding field duplicate sample results) were evaluated to the guidelines set forth in EPA Functional Guidelines (EPA, 1994b and 1999). The EPA Functional Guidelines state that there are no required review criteria for field duplicate analyses comparability, but allow the data reviewer is to exercise professional judgement in qualifying data based upon the results of the field duplicates. The RPD between the environmental samples results and their corresponding field duplicates exceeded the 20 percent criteria for water and the 35 percent for soil as stated in the Industrial Sites QAPP (DOE/NV, 1996a).

The laboratory duplicate samples were compared to the criteria set forth in the EPA Functional Guidelines (EPA, 1994b and 1999) and the associated sample results were qualified accordingly. Both detections and nondetections have been qualified as estimated (J and UJ, respectively) if the relative percent difference between an environmental sample and its laboratory duplicate fell outside established criteria.

A total of five field samples were selected for use as MS/MSD (matrix spike/matrix spike duplicate) samples. The percent recoveries of these samples (a measure of accuracy) and the relative percent differences in these sample results (a measure of precision) were compared to EPA Functional Guidelines criteria (EPA, 1994b and 1999). The results were used to qualify associated environmental sample results accordingly.

The EPA Functional Guidelines for review of organic data state that no data qualification action is taken on the basis of MS/MSD results alone. The data reviewer exercises professional judgement in considering these results in conjunction with the results of laboratory control samples (LCSs) and other QC criteria in applying qualifications to the data.

The inorganic data review in EPA Functional Guidelines allows professional judgement to be applied in evaluating the results of matrix spikes. Generally, if the spike recovery is greater than the upper

acceptance limits (>125 percent), nondetections are acceptable for use. If the spike recovery is greater than the upper acceptance limits (>125 percent) or less than the lower acceptance limits (<75 percent), positive results are qualified as estimated (J). If spike recovery is within the range of 30-74 percent, nondetections are qualified as estimated (UJ). If spike recovery is less than 30 percent (grossly low), positive results are not qualified and nondetections are qualified as unusable (R).

A.4.7.2 Laboratory Quality Control Samples

Analysis of QC method blanks, laboratory control samples, and surrogate spikes for organic analyses, and method blanks, preparation blanks, initial and continuing calibration blanks, and laboratory control samples for total RCRA metals were performed for each SDG by Paragon Analytics, Inc. The results of these analyses were used to qualify associated environmental sample results according to EPA Functional Guidelines (EPA, 1994b and 1999).

The EPA Functional Guidelines (EPA, 1994b and 1999) state that no qualification action is taken if a compound is found in a sample, but not in the associated blank. The action taken when a compound is detected in both the sample and the associated blank varies depending upon the analyte involved and is described in the “The 5X/10X Rule.”

For most VOCs, SVOCs, Pesticides, PCBs, TPH (DRO), and radionuclides, if an analyte is detected in the sample and was also detected in an associated blank the result is qualified as undetected (U) if the sample concentration is less than five times (5X) the blank concentration. However, for the common laboratory contaminants (e.g., methylene chloride, acetone, 2-butanone [methyl ethyl ketone (MEK)], and phthalate esters [especially bis(2-ethylhexyl)phthalate]), the factor is raised to ten times (10X) the blank concentration. The sample result is elevated to the quantitation limit if it is less than the quantitation limit or remains unaltered if the sample result is greater than or equal to the quantitation limit.

For inorganics (i.e., total RCRA metals), sample results greater than the instrument detection limit, but less than five times (5X) the amount found in an associated blank, are qualified as undetected (U). There are no metallic common laboratory contaminants, so there is no “10X Rule” for metals, and the sample result is never altered. When applying the 5X criteria to soil sample data or calibration blank data, the raw data results are used to evaluate and qualify the reported results on the Certificate of

Analysis. Preparation blanks (PB) are evaluated for each matrix, with every SDG, or with each batch of samples digested, whichever is more frequent. The analyte concentration in the PB should be below the CRDL. If any analyte concentration in the PB is above the CRDL, the lowest concentration of that analyte in the associated samples must be ten times (10X) the PB concentration. Otherwise, all samples associated with the PB with the analyte's concentration less than 10X the PB concentration, and above the CRDL, should be redigested and reanalyzed. If the concentration of the PB is less than or equal to the CRDL, no corrective action to the associated sample is required.

Surrogate spikes, or system monitoring compounds, are added to the environmental samples analyzed by chromatographic techniques for VOCs, SVOCs, TPH (DRO), Pesticides, PCBs. Surrogate compounds are analytes that are not expected to be present in associated environmental samples, but behave the same as similar target compounds chromatographically. Known amounts of each surrogate are added prior to sample preparation and are carried throughout the preparation/analysis procedure. The percent recoveries of these surrogate compounds give some measure of the anticipated recoveries of the target compounds whose chromatographic behavior they mimic.

If any surrogate percent recoveries are out of the acceptable range (which differs for each surrogate in each method), laboratory protocol requires the sample to be reprepared and/or reanalyzed. When the surrogate recoveries are acceptable on the second run, only the second analysis results are reported. When both analyses yield the same unacceptable range, the results of both analyses are reported.

The evaluation of surrogate spike percent recovery results is not straightforward. The functional guidelines suggest several optional approaches, but require the data reviewer to exercise professional judgement in reviewing surrogate data and qualifying associated data as estimated (J or UJ, for detections or nondetections, respectively) or unusable (R).

One laboratory duplicate analysis for metals was performed for each SDG and sample matrix that reported total RCRA metals. The duplicate results are compared to the results of the original sample to give a measure of analytical laboratory precision. If the results from a duplicate analysis for a particular analyte fall outside the control limits, the EPA Functional Guidelines for Inorganic Data Review (EPA, 1994b) call for all results for that analyte in all associated samples of the same matrix to be qualified as estimated (J).

Laboratory control samples, also known as blank spikes, consist of known quantities of target compounds added to purified sand or deionized, distilled water prepared and analyzed along with the environmental samples in the sample delivery group. The percent recoveries of the compounds in the LCS give a measure of laboratory accuracy. The functional guidelines call for the data reviewer to use professional judgement to qualify associated data according to established criteria.

A.4.8 *Field Nonconformances*

During the corrective action investigation the ITLV QA representatives provided field guidance and oversight to verify that sampling activities were performed in accordance with applicable requirements. Quality assurance representatives did observe findings, deficiencies, or nonconformances with sampling activities. There were also nonconformances found during data review and validation. These nonconformances have been accounted for in the data qualification process. Documentation of these results is retained in the project files.

A.4.9 *Laboratory Nonconformances*

Laboratory nonconformances are generally due to inconsistencies in analytical instrumentation operation, sample preparations, extractions, and fluctuations in internal standard and calibration results. Several nonconformances were documented for this project. These nonconformances have been accounted for in the data qualification process. Documentation of these results is retained in the project files.

A.5.0 Summary

Analysis of the data generated from corrective action investigation activities conducted at the CAU 254 Site indicates the following:

- Radiation dose rates inside the Decontamination Facility, Building 3126, and in the storage yard exceeded the average general dose rate.
- Both scanning and static total surface contamination surveys indicated that portions of the locker and shower room floor; decontamination bay floor; loft floor; east and west decon pads; north and south decontamination bay interior walls, exterior west and south walls, and loft walls were above PALs.
- Removable surface contamination exceeded the corresponding PALs in one sample. All other removable surface contamination surveys indicated that the floor, walls, and ceilings were below the PALs for removable surface contamination.
- Radionuclides were detected at concentrations above the PALs for concrete, rubber, wood, insulation, vent stack filters, piping, sediment, and paint. Radionuclides which exceeded PALs in building materials were strontium-90, niobium-94, cesium-137, uranium-234, uranium-235, and plutonium-239.
- Radionuclides were detected at concentrations above the PALs in soil samples collected in the storage yard. Radionuclides which exceeded PALs in soil samples were strontium-90, cesium-137, uranium-234, and uranium-235.
- Total VOCs were not detected at concentrations above the minimum reporting limits in soil samples. Total VOCs were detected at concentrations above the minimum reporting limits and below the PALs in samples of concrete, filters, insulation, sediment, water, and wood.
- Total SVOCs were detected at concentrations above the minimum reporting limits but less than the PALs in one soil sample. Total SVOCs were detected at concentrations above the minimum reporting limits in samples of concrete, filters, insulation, sediment, water, and wood. The PALs were exceeded in insulation.
- The TCLP SVOCs were not detected at concentrations above the minimum reporting limits in soil samples. Toxicity Characteristic Leaching Procedure SVOCs were detected at concentrations above the minimum reporting limits in one wood sample.
- Total Petroleum Hydrocarbons were detected in the diesel/oil ranges above minimum reporting limits but less than the the PAL in soil samples. Total Petroleum Hydrocarbons were detected in the diesel/oil range at concentrations above the minimum reporting limits in

samples of concrete, filters, sediment, and wood. The results for wood, concrete, and filter material were greater than the PAL.

- Total RCRA Metals were detected at concentrations above the minimum reporting limits but less than the PALs in soil samples. Total RCRA Metals were detected at concentrations above the minimum reporting limits in samples of concrete, filters, insulation, sediment, water, wood, and paint. The results for sediment, concrete, paint, and liquid from the drains were greater than the PALs.
- The TCLP RCRA Metals were detected at concentrations above the minimum reporting limits for lead in one soil sample. Total RCRA Metals were detected at concentrations above the minimum reporting limits in samples of concrete, rubber, sediment, and wood.
- Polychlorinated Biphenyls were detected at concentrations above the minimum reporting limits in soil samples, concrete, filters, insulation, oil, sediment, and wood. The wood, insulation, and filter material results were greater than the PAL.
- Total and TCLP Pesticides were not detected at concentrations above the minimum reporting limits in soil or building material samples.

A.6.0 References

- Adams, S. 1999. Memorandum to Jeff Johnson (IT) regarding Performance Objective Criteria for Niobium at Area 25, December. Las Vegas, NV.
- Alderson, S. 1999. Memorandum to D. Wilson (SAIC) regarding the response to the State of Nevada Division of Environmental Protection comments concerning Corrective Action Units 261, 266, and 500, 27 August. Las Vegas, NV.
- Alderson, S, and C. Orchard. IT Corporation. 2000. Memorandum to J. Johnson (IT) regarding Radioanalytical Data Review of Sample Results Associated with Corrective Action Unit (CAU) 254, Sample Delivery Groups (SDGs) 0001050, 0001048, 0001062, 0001061, 0001075, 0001144, 0001149, 0001186, 0001167, 0001171, 0001179, 0001180, 0001188, 0002003, 0002040, 31 March. Las Vegas, NV.
- American Society for Testing and Materials. 1995a. *Standard Test Method for Radiochemical Determination of Plutonium in Soil by Alpha Spectroscopy*, C1001-90. Philadelphia, PA.
- American Society for Testing and Materials. 1995b. *Standard Test Method for Radiochemical Determination of Uranium Isotopes in Soil by Alpha Spectroscopy*, C1000-90. Philadelphia, PA.
- American Society for Testing and Materials. 1995c. *Standard Test Method for Strontium-90 in Water*, D5811-95. Philadelphia, PA.
- American Society for Testing and Materials. 1997a. *Standard Test Method for Isotopic Uranium in Water by Radiochemistry*, D-3972-97. Philadelphia, PA.
- American Society for Testing and Materials. 1997b. *Standard Test Method for Plutonium in Water*, D-3865. Philadelphia. PA.
- ASTM, see American Society for Testing and Materials.
- BN, see Bechtel Nevada.
- Bechtel Nevada. 1995. *Nevada Test Site Performance Objective Criteria for Certification of Nonradioactive Hazardous Waste*, Rev. 0, G-E11/96.01. Las Vegas, NV.
- DOE, see U.S. Department of Energy.
- DOE/NV, see U.S. Department of Energy, Nevada Operations Office.
- EPA, see U.S. Environmental Protection Agency.

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.

IT, see IT Corporation.

IT Corporation. 1999a. *Site-specific Health and Safety Plan (SSHASP), Area 25 R-MAD Decontamination Facility, Nevada Test Site*. Las Vegas, NV.

IT Corporation. 1999b. Memorandum to Jeffrey Johnson (IT Corporation) from Bruce Dionne (IT Corporation) and Steven Adams (IT Corporation) regarding the radiological survey plan for the characterization of the Decontamination Facility, Building 3126, Area 25 R-MAD, Corrective Action Site 25-03-06, Corrective Action Unit 254.

IT Corporation. 2000. *Field Instructions for Corrective Action Unit 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site*. Las Vegas, NV.

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.

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

NAC, see *Nevada Administrative Code*.

NBMG, see Nevada Bureau of Mines and Geology.

Nevada Administrative Code. 1998a. NAC 444, "Sanitation." Carson City, NV: Nevada Division of Environmental Protection.

Nevada Administrative Code. 1998b. NAC 445A.2272, "Contamination of Soil: Establishment of Action Levels." Carson City, NV: Nevada Division of Environmental Protection.

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.

NRC, see U.S. Nuclear Regulatory Commission.

Shonka and Millennium, see Shonka Research Associates, Inc.

Shonka Research Associates, Inc. and Millennium Services, Inc. 1999. *Survey Report for Position Sensitive Radiation Monitor Deployment Project*, Final Report. Prepared for IT Corporation. Marietta, GA.

- U.S. Department of Energy. 1993. DOE Order 5400.5, "Radiation Protection of the Public and Environment." Washington, DC.
- U.S. Department of Energy. 1997. *The Procedures Manual of the Environmental Measurements Laboratory*, Vol. 1, 28th Edition, HASL-300.
- U.S. Department of Energy, Nevada Operations Office. 1996a. *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. 1996b. *NV/YMP Radiological Control Manual*, DOE/NV/11718--079, Rev. 2. Prepared by A.L. Gile of Bechtel Nevada. Las Vegas, NV.
- U.S. Department of Energy, Nevada Operations Office. 1999. *Corrective Action Investigation Plan for CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site, Nevada*, DOE/NV--557. Las Vegas, NV.
- U.S. Ecology and Atlan-Tech. 1992. *Environmental Monitoring Report for the Proposed Ward Valley California Low Level Radioactive Waste (LLRW) Facility*. Rosewell, GA: Atlan-Tech, Inc.
- U.S. Environmental Protection Agency. 1980. *Prescribed Procedures for Measurements of Radioactivity in Drinking Water*, EPA-600/4-80-032. 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. 1994a. *Guidance for the Data Quality Objectives Process*, EPA QA/G-4. Washington, DC.
- U.S. Environmental Protection Agency. 1994b. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013. Washington, DC.
- U.S. Environmental Protection Agency. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846*, CD ROM PB97-501928GEI which contains updates for 1986, 1992, 1994 and 1996. Washington, DC.
- U.S. Environmental Protection Agency. 1998. Memo from S.J. Smucker to PRG Table Mailing List regarding Region 9 Preliminary Remediation Goals (PRGs). San Francisco, CA.
- 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. Nuclear Regulatory Commission. 1994. 10 CFR 30.70, "Schedule A - Exempt Concentrations." Washington, DC: U.S. Government Printing Office.

U.S. Nuclear Regulatory Commission. 1997. *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM), NUREG-1575/EPA 402-R-97-016. Washington, DC.

Appendix B

Cost Estimates

TEC:

EST ID:

BECHTEL NEVADA

COST ESTIMATE DATA SHEET

CAU 254 CADD

Appendix B

Revision: 0

Date: 06/01/2000

Date: 24-May-00

Page B-1 of B-2

TO: Dennis Gustafson

FROM: Don Jenkins Sr., BN Environmental Cost Estimating Dept. 295-0217

SUBJECT: Area 25 R-MAD Decontamination Facility, Nevada Test SiteESTIMATOR: Don Jenkins, 295-0217

RFE #: _____

TYPE OF ESTIMATE:

☒ ORDER OF MAGNITUDE	☐ TITLE II
☐ PRELIMINARY / PLANNING / STUDY	☐ WORK ORDER
☐ CONCEPTUAL / BUDGET	☐ COMPARATIVE
☐ TITLE I	☐ OTHER

TYPE OF WORK:

☐ NON-MANUAL ONLY
☐ MANUAL ONLY
☒ MANUAL & NON-MANUAL
☐ OTHER

PROJECT WORK SCOPE IS EXPECTED TO BE PERFORMED BY:

DOE PRIME (LUMP SUM) _____

NTS GENERAL ☒

NTS MAINTENANCE _____

SUBCONTRACT _____

GPP _____

OTHER _____

STATEMENT OF WORK

This estimate has been prepared to provide remedial alternative costs for the closure of Corrective Action Unit (CAU 254), an environmental restoration site listed in the Federal Facility Agreement and Consent Order. CAU 254 is specifically described as Area 25 RMAD Decon Facility. Three alternatives will be evaluated for closure of the site: I) No further action, no associated costs, or administrative controls, II) Free Release Decontamination and Verification Survey III) Free Release Decontamination, Verification, and Dismantle Building 3126. This estimate will be used to identify the most cost effective alternative for closure of the site while being protective of human health and the environment. Total estimated costs are intended for comparative analysis of remedial field work and field management only. Cost for project management, plan preparation, project support, or other activities are not included.

SCOPE:

Provide site closure using one of the following alternatives:

- I) NO FURTHER ACTION-NO ASSOCIATED COSTS OR ADMINISTRATIVE CONTROLS
- II) FREE RELEASE DECONTAMINATION AND VERIFICATION SURVEY
- III) FREE RELEASE DECONTAMINATION, VERIFICATION SURVEY, AND DISMANTLE BUILDING 3126

BASIS:

This estimate was priced using standard construction such as RS Means, Richardson's and the BN estimating data base (MC squared)

ALTERNATIVE SPECIFIC BASIS OF ESTIMATE/ASSUMPTIONS**Alternative II: Free Release Decontamination and Verification Survey**

- * A bioassay program, health physics support and RCT support will be required for work to be performed in hot areas.
- * Assume PPE requirements will include levels C and D.
- * All surface contamination greater than free release levels will be removed. Locations will be field screened after removal activities to verify radiation activity is below the free release criteria.
- * Decontamination activities will include removal of contaminated wall board (containing asbestos), plywood, doors, insulation, and asbestos encapsulating piping in the decontamination bay and loft. Concrete within Building 3126, and the east and west decontamination pads, will be shot blasted to remove contamination greater than free release levels.
- * 300 cubic yards of soil adjacent to the east decontamination pad will be removed and disposed as low level radioactive waste.
- * The generator, and 1,140-gal above ground storage tank outside Building 3126 will be removed.
- * The hoist inside Building 3126 will be removed.

Alternative III: Free Release Decontamination, Verification Survey, and Dismantle Building 3126

- * A bioassay program, health physics support and RCT support will be required for work to be performed in hot areas.
- * Assume PPE requirements will include levels C and D.
- * All surface contamination greater than free release levels will be removed. Locations will be field screened after removal activities to verify radiation activity is below the free release criteria.
- * Decontamination activities will include removal of contaminated wall board (containing asbestos), plywood, doors, insulation, and asbestos encapsulating piping in the decontamination bay and loft. Concrete within Building 3126, and the east and west decontamination pads, will be shot blasted to remove contamination greater than free release levels.
- * 300 cubic yards of soil adjacent to the east decontamination pad will be removed and disposed as low level radioactive waste.
- * The generator and 1,140-gal above ground storage tank outside Building 3126 will be removed.
- * The hoist inside Building 3126 will be removed.
- * Dismantle Building 3126.

TEC:

BECHTEL NEVADA

CAU 254 CADD

Appendix B

EST ID:

COST ESTIMATE DATA SHEET

Revision: 0

Date: 06/01/2000

Date: 24-May-00

Page B-2 of B-2

Review / Concurrence:

ASSUMPTIONS:

- * Work to be performed by BN during normal work day (No provisions for overtime provided). Shifts are based on 10 hours per day / 4-days per week.
- * Efficiencies will be realized as work will be performed on similar activities completed in parallel or concurrently
- * This estimate does not include costs for preparation of Corrective Action Plan (CAP) or a Closure Report
- * Soil borrow area is within one (1) mile of site.

ESCALATION:

No escalation factors have been applied. All costs are in FY00 dollars.

CONTINGENCY:

Contingency costs are not included in this estimate.

RATES:

FY00 rates (Rev 0) effective 10/1/99 were applied using the BN FY00 cost model.

COST ALTERNATIVES SUMMARY:

Alternative I: No Action To Be Taken

\$0

Alternative II: Free Release Decontamination and Verification Survey

\$619,637

Alternative III: Free Release Decontamination, Verification Survey, and Dismantle Building 3126

\$1,050,181

Requester

L. A. Noh

5-24-00

Date

Estimating

Wesley W. Wadsworth

5/24/00

Date

Construction

Paul Brown

5/24/00

Date

Operations Management (Designee)

Wesley W. Wadsworth

5-24-00

Date

Project Control

Don Jenkins Sr.

5-24-00

Date

Appendix C

Radiological Survey Units: Data Packages

SURVEY UNIT: 254-IS-01

WATER HEATER AND COMPRESSOR ROOM SURVEY

The Water Heater and Compressor Room unit was surveyed for dose rate, total surface contamination, and removable surface contamination according to the Field Instructions for Corrective Action Unit 254: Area 25 R-MAD Decontamination Facility and ITLV Standard Quality Practices (IT, 2000). The surveys were performed by trained ITLV personnel during January and February 2000.

Radiation Dose Rate - Radiation dose rate was measured at five random grid locations (see [Figure C-1](#)). Radiation dose rates in this area were about 20 microrem/hr at 3.3 ft. Areas of elevated dose rate were not identified in this survey unit. Therefore, no contact or one foot dose rate measurements were performed. The results of the five radiation dose rate measurements are documented on Radiological Survey Forms in project files.

Total Surface Contamination - Approximately 100 percent of accessible floor and wall area were scanned for total surface contamination at a rate of 1 in. per second at a detector distance of 1/4 in. from the surface. Approximately 50 percent of the floor area and 10 percent of the wall area were inaccessible due to the presence of equipment. Six fixed measurements for total surface contamination were taken at random and biased grid locations. Approximately 60 percent of the exterior of the pipes, water tank, boiler, air tank and electrical panels were scanned for total surface contamination. The minimum detectable activities of the scanning measurements for this survey unit were 29 dpm/100 cm² alpha and 185 dpm/100 cm² beta-gamma. The minimum detectable activities of the fixed measurements for total surface contamination for this survey unit were 28 dpm/100 cm² alpha and 154 dpm/100 cm² beta-gamma.

No surface contamination above PALs was identified on the equipment in these systems. All valves on the water tank, boiler, and air tank were opened and no liquids were present. No radiological survey was conducted on the interior of these pieces of equipment. No measurements of total surface contamination above established beta-gamma and alpha PALs were identified during the scanning surveys. The majority of the areas having elevated contamination above 1,000 dpm/100 cm² received a fixed 1 minute total contamination measurement. The maximum total surface contamination level in this survey unit was 4,239 dpm/100 cm² beta-gamma, located on the floor against the west wall. The results of the six total surface contamination measurements are documented on Radiological Survey Forms in project files.

Removable Surface Contamination - Five swipe samples were collected in the small areas identified during the scanning surveys as having total contamination above 1,000 dpm/100 cm². No areas with removable contamination above the PALs were detected. The maximum removable beta-gamma activity was 239.6 +/-76.6 dpm/100 cm² beta-gamma and was located on the south west corner of the west wall. Five results for removable alpha activity were less than the MDA of 15 dpm/100 cm². The results of the five removable surface contamination measurements are documented on Radiological Survey Forms in project files.

Figure C-1
CAU 254: Water Heater and Compressor Room
Total Surface Contamination Survey Map

SURVEY UNIT: 254-IS-02 LOCKER AND SHOWER ROOM

The Locker and Shower Room unit was surveyed for dose rate, total surface contamination, and removable surface contamination according to the Field Instructions for Corrective Action Unit 254: Area 25 R-MAD Decontamination Facility and ITLV Standard Quality Practices (IT, 2000). The surveys were performed by trained ITLV personnel during January and February 2000.

Radiation Dose Rate - Radiation dose rate was measured at five random grid locations (see [Figure C-2](#)). Radiation dose rates in this area were about 20 microrem/hr at 3.3 ft. Areas of elevated dose rate were not identified in this survey unit. Therefore, no contact or one foot dose rate measurements were performed. The results of the five radiation dose rate measurements are documented on Radiological Survey Forms in project files.

Total Surface Contamination - Approximately 100 percent of accessible floor and wall areas were scanned for total surface contamination at a rate of 1 in. per second at a detector distance of 1/4 in. from the surface. Approximately 50 percent of the floor area was inaccessible due to the presence of a tree root. Approximately 100 percent of the stalls, water closet, shower, urinal, sink, and mirror were scanned for total surface contamination. Five fixed measurements for total surface contamination were taken at random and biased grid locations. The MDA of the scanning measurements for this survey unit were 0 dpm/100 cm² alpha and 187 dpm/100 cm² beta-gamma. The minimum detectable activities of the fixed measurements for total surface contamination for this survey unit were 3 dpm/100 cm² alpha and 166 dpm/100 cm² beta-gamma.

No surface contamination above PALs was identified on these items. All valves on the water closet, urinal, and sink were opened and no liquids were present. No radiological survey was conducted on the tree root. Three small areas of total surface contamination above 1,000 dpm/100 cm² were identified during the scanning surveys. The areas of contamination above the 1,000 dpm/100 cm² received an integrated one minute static measurement. The maximum total surface contamination level in this survey unit was 29.6 dpm/100 cm² beta-gamma located on the floor against the west wall and was the only beta-gamma results greater than the PAL of 5,000 dpm/100 cm². The results of the five total surface contamination measurements are documented on Radiological Survey Forms in project files.

Removable Surface Contamination - Five swipe samples were collected in the small areas identified during the scanning survey as having contamination above the 1,000 dpm/100 cm². No areas with removable contamination above the beta-gamma and alpha PALs were detected. The maximum removable beta-gamma activity was 317.1 +/- 81.2 dpm/100 cm² and was located on the floor along the east wall. All results for removable alpha activity measurements were less than the minimum detectable activity of 15 dpm/100 cm². The results of the five removable surface contamination measurements are documented on Radiological Survey Forms in project files.

Figure C-2
CAU 254: Locker and Shower Room
Total Surface Contamination Survey Map

SURVEY UNIT: 254-IS-03 OFFICE

The Office unit was surveyed for dose rate, total surface contamination, and removable surface contamination according to the Field Instructions for Corrective Action Unit 254: Area 25 R-MAD Decontamination Facility and ITLV Standard Quality Practices (IT, 2000). The surveys were performed by trained ITLV personnel during January and February 2000.

Radiation Dose Rate - Radiation dose rate was measured at five random grid locations (see [Figure C-3](#)). Radiation dose rates in this area were about 20 microrem/hr at 3.3 ft. Areas of elevated dose rate were not identified in this survey unit. Therefore, no contact or one foot dose rate measurements were performed. The results of the five radiation dose rate measurements are documented on Radiological Survey Forms in project files.

Total Surface Contamination - Approximately 100 percent of accessible floor and wall areas were scanned for alpha and beta-gamma surface contamination at a rate of 1 in. per second at a detector distance of 1/4 in. from the surface. Eleven fixed measurements for total surface contamination were taken at random and biased grid locations. Approximately 100 percent of the top of the 3 shelves that covered approximately 30 percent of the floor area were scanned for total surface contamination. No radiological survey was conducted on the underside of these shelves. The MDA of the scanning measurements for this survey unit were 0 dpm/100 cm² alpha and 177 dpm/100 cm² beta-gamma. The minimum detectable activities of the fixed measurements for total surface contamination for this survey unit were 3 dpm/100 cm² alpha and 157 dpm/100 cm² beta-gamma.

Six small areas of surface contamination above 1,000 dpm/100 cm² were identified during the scanning surveys. The areas of contamination above 1,000 dpm/100 cm² received and integrated one minute static measurement. The maximum beta-gamma total surface contamination level in this survey unit was 5,425 dpm/100 cm² located on the floor door kick plate. The maximum alpha total surface contamination level in this survey unit was 33 dpm/100 cm² on the floor in front of the doorway. The results of the 11 total surface contamination measurements are documented on Radiological Survey Forms in project files.

Removable Surface Contamination - Five swipe samples were collected in the areas of elevated activity identified during the scanning survey as having contamination above 1,000 dpm/100 cm². No areas with removable contamination above the MDA were detected. The maximum removable activity was 47.2 +/- 63.7 dpm/100 cm² beta-gamma and was located on the floor door kick plate. The results for the removable alpha activity measurements were less than the MDA of 15 dpm/100 cm². The results of the five removable surface contamination measurements are documented on Radiological Survey Forms in project files.

Figure C-3
CAU 254: Office Total Surface Contamination Survey Map

SURVEY UNIT: 254-IS-04

NORTH SIDE OF THE DECONTAMINATION BAY

The North Side of the Decontamination Bay unit was surveyed for dose rate, total surface contamination, and removable surface contamination according to the Field Instructions for Corrective Action Unit 254: Area 25 R-MAD Decontamination Facility and ITLV Standard Quality Practices (IT, 2000). These surveys were performed by trained ITLV personnel during January and February 2000. Surveys conducted with the position sensitive radiation monitor (PSRM) were performed as described in "Survey Report for Position Sensitive Radiation Monitor Deployment Project," November 1999. These surveys were performed by subcontractors from Shonka Research Associates of Marietta, Georgia in October 1999 (Shonka and Millennium, 1999).

Radiation Dose Rate - Radiation dose rate measurements were taken at 33 random and biased locations (see [Figure C-4](#)). Radiation dose rates in this survey unit range from 10 to 60 microrem/hr at 3.3 ft. Areas of elevated dose rates were identified over the drains located between the railroad tracks. The maximum radiation dose rate at 3.3 ft was 60 microrem/hr located over the decontamination bay center floor drain. The PSRM's energy compensated Geiger-Muller detector measured a maximum exposure rate at 3.3 ft above the floor of 30 micro-R/hr east of the center floor drain. The results of the 33 radiation dose rate measurements are documented on Radiological Survey Forms in project files.

Total Surface Contamination - Approximately 90 percent of the floor in this survey unit was scanned for total surface contamination at a rate of 2 in. per second for alpha and 4 in. per second for beta-gamma at 1/4 in. from the surface using a PSRM. About one hundred percent of the floor area (61 m²) had total surface contamination above 5,000 dpm/100 cm² PAL as detected by the PSRM. The maximum total surface contamination level was 537,686 dpm/100 cm² beta-gamma located on the center floor drain of the building. The complete results of these PSRM surveys are documented in project files.

A total of 100 percent of the wall area was scanned for total surface contamination at a rate of 1 in. per second at 1/4 in. from the surface up to a wall height of 8 ft with a NE Technology ElectraTM plastic scintillation detector. Approximately 50 percent of the wall above 8 ft and ceiling area was scanned for total surface contamination. The minimum detectable activities of the ITLV scanning measurements in this survey unit were 25 dpm/100 cm² alpha and 214 dpm/100 cm² beta-gamma. The minimum detectable activities of the fixed measurements for total surface contamination for this survey unit were 25 dpm/100 cm² alpha and 189 dpm/100 cm² beta-gamma.

Seventy-two fixed measurements for total surface contamination were taken at random and biased grid locations. The east wall (17 percent > 5,000 dpm/100 cm²); west wall (28 percent > 5,000 dpm/100 cm²); floor (100 percent > 5,000 dpm/100 cm²); and ceiling (7 percent > 5,000 dpm/100 cm²) had radiological levels above the established PAL with the maximum readings of 61,000 dpm/100 cm² beta-gamma and 23,000 dpm/100 cm² alpha located on the ceiling. This location was an isolated hot spot and was removed during sampling. The results of both the PSRM and 72 NE Technology

Figure C-4
CAU 254: North Side of Decontamination Bay
Total Surface Contamination Survey Map

Electra™ total surface contamination measurements are documented on Radiological Survey Forms in project files.

Removable Surface Contamination - Nineteen swipe samples were collected in the areas identified during the scanning survey as having total surface contamination above 1,000 dpm/100 cm². No areas sampled had removable contamination above the alpha and beta-gamma PAL. The maximum beta-gamma removable activity was 927.5 +/- 111.0 dpm/100 cm² and was located on the decontamination bay floor at grid location Floor (09, 13) (next to wall). The maximum alpha removable activity was 17.4 ± 15.3 dpm/100 cm² and was located on the west wall at grid location West Wall (03,00). All other removable surface contamination measurements for alpha were below the MDA of 15 dpm/100 cm². The results of the 19 removable surface contamination measurements are documented on Radiological Survey Forms in project files.

SURVEY UNIT: 254-IS-05

SOUTH SIDE OF DECONTAMINATION BAY

The South Side of Decontamination Bay unit was surveyed for dose rate, total surface contamination, and removable surface contamination according to the Field Instructions for Corrective Action Unit 254: Area 25 R-MAD Decontamination Facility and ITLV Standard Quality Practices (IT, 2000). These surveys were performed by trained ITLV personnel during January and February 2000. Surveys conducted with the PSRM were performed as described in "Survey Report for Position Sensitive Radiation Monitor Deployment Project," November 1999. These surveys were performed by subcontractors from Shonka Research Associates of Marietta, Georgia in October 1999 (Shonka and Millennium, 1999).

Radiation Dose Rate - Radiation dose rate measurements were taken at 32 random and biased locations (see [Figure C-5](#)). Radiation dose rates in this survey unit ranged from 10 to 70 microrem/hr at 3.3 ft. Areas of elevated dose rates were identified over the drains located between the railroad tracks. The maximum exposure rate at 3.3 ft was 70 microrem/hr located over the decontamination bay center floor drain. The sump located in the southwest corner of the decontamination bay read 600 microrem/hr at contact and 140 microrem/hr at 1 foot. The floor drain in the center of the decontamination bay read 400 microrem/hr at contact and 80 microrem/hr at 1 ft. The southernmost floor drain between the railroad tracks read 200 microrem/hr at contact and 75 microrem/hr at 1 foot. The PSRM energy compensated Geiger-Muller tube detector measured a maximum exposure rate at 3.3 ft above the floor at 30 micro-R/hr east of the center floor drain. The results of the 23 radiation dose rate measurements are documented on Radiological Survey Forms in project files.

Total Surface Contamination - Approximately 90 percent of the floor in this survey unit was scanned for total surface contamination at a rate of 2 in. per second for alpha and 4 in. per second for beta-gamma at 1/4 in. from the surface using a PSRM. One-hundred percent of the floor area (56 m²) had total surface contamination above 5,000 dpm/100 cm² as detected by the PSRM. The maximum total surface contamination level was 278,371 dpm/100 cm² beta-gamma located around the center floor drain of the building. The complete results of these PSRM surveys are documented in project files.

A total of 100 percent of the wall area was scanned for total surface contamination at a rate of 1 in. per second at 1/4 in. from the surface up to a wall height of 8 ft with a NE Technology ElectraTM plastic scintillation detector. Approximately 50 percent of the wall above 8 ft and ceiling area was scanned for total surface contamination. The minimum detectable activities of the ITLV scanning measurements in this survey unit were 30 dpm/100 cm² alpha and 191 dpm/100 cm² beta-gamma. The minimum detectable activities of the fixed measurements for total surface contamination for this survey unit were 30 dpm/100 cm² alpha and 169 dpm/100 cm² beta-gamma.

Seventy-seven fixed measurements for total surface contamination were taken at random and biased locations. The east wall (14 percent > 5,000 dpm/100 cm²); west wall (33 percent > 5,000 dpm/100 cm²); and south wall (26 percent > 5,000 dpm/100 cm²) had radiological levels above the

Figure C-5
CAU 254: South Side of Decontamination Bay
Total Surface Contamination Survey Map

established PAL. The results both the PSRM and NE Technology Electra™ total surface contamination measurements are documented on Radiological Survey Forms in project files.

Removable Surface Contamination - Twenty swipe samples were collected in the areas identified during the scanning survey as having total surface contamination above 1,000 dpm/100 cm². One area was detected with removable contamination above the 1,000 dpm/100 cm² action level. The maximum beta-gamma removable activity was 9,937 dpm/100 cm². This swipe sample was collected on the wood of the door on the East wall of the Decontamination Bay. All removable surface contamination measurements for alpha were below the MDA of 15 dpm/100 cm², except for the results on the swipe from the door. The maximum alpha removable activity was 202 dpm/100 cm². The results of the 20 removable surface contamination measurements are documented on Radiological Survey Forms in project files.

SURVEY UNIT: 254-IS-06

LOFT AND STAIRS

The Loft and Stairs unit was surveyed for dose rate, total surface contamination, and removable surface contamination according to the Field Instructions for Corrective Action Unit 254: Area 25 R-MAD Decontamination Facility and ITLV Standard Quality Practices (IT, 2000). The surveys were performed by trained ITLV personnel during January and February 2000.

Radiation Dose Rate - Radiation dose rates measurements were taken at six random grid locations (see [Figure C-6](#)). Radiation dose rate in this area was 10 microrem/hr at 3.3 ft. No areas of elevated dose rates were identified in this survey unit. Therefore, no contact or one foot dose rate measurements were performed. The results of the six radiation dose rate measurements are documented on Radiological Survey Forms in project files.

Total Surface Contamination - Approximately 100 percent of accessible floor and wall area was scanned for total surface contamination at a rate of 1 in. per second at 1/4 in. from the surface. Forty-one fixed measurements for total surface contamination were taken at random and biased grid locations. Approximately 10 percent of the floor area was inaccessible due to the presence of ventilation ducting for the bathroom and a separate ventilation system for the office. The minimum detectable activities for the scanning measurements in this survey unit were 20 dpm/100 cm² and 213 dpm/100 cm² beta-gamma. The minimum detectable activities of the fixed measurements for total surface contamination for this survey unit were 20 dpm/100 cm² alpha and 188 dpm/100 cm² beta-gamma.

No radiological survey was conducted on the interior of the ventilation system. Fifteen small areas of surface contamination above established beta-gamma PALs were identified during the scanning surveys. The areas of contamination above the PALs received and integrated one minute static measurement. The maximum total surface contamination level in this survey unit was 13,900 dpm/100 cm² beta-gamma located on the floor in grid location Floor (03,01). The results of the 41 total surface contamination measurements are documented on Radiological Survey Forms in project files.

Removable Surface Contamination - Twenty-seven swipe samples were collected in the small areas identified during the scanning survey as having contamination above the PALs. No areas with removable contamination above the PALs were identified. The maximum removable activity was 960.3 +/- 112.4 dpm/100 cm² beta-gamma and was located on the loft floor in grid location Floor (03,01). All removable surface contamination measurements for alpha were below the MDA of 15 dpm/100cm². The results of the 27 removable surface contamination measurements are documented on Radiological Survey Forms in project files.

Figure C-6
CAU 254: Loft and Stairway
Total Surface Contamination Survey Map

SURVEY UNIT: 254-ES-01

WEST DECONTAMINATION PAD SURVEY UNIT

The West Decontamination Pad unit was surveyed for dose rate and total surface contamination according to the Field Instructions for Corrective Action Unit 254: Area 25 R-MAD Decontamination Facility, and ITLV Standard Quality Practices (IT, 2000). These surveys were performed by trained ITLV personnel during January and February 2000. Surveys conducted with the PSRM were performed as described in "Survey Report for Position Sensitive Radiation Monitor Deployment Project," November 1999. These surveys were performed by subcontractors from Shonka Research Associates of Marietta, Georgia in October 1999 (Shonka and Millennium, 1999).

Radiation Dose Rate - Radiation dose rate measurements were taken at 25 random and biased locations (see [Figure C-7](#)). Radiation dose rates in this survey unit ranged from 5 to 15 microrem/hr at 3.3 ft. An area of elevated dose rate was identified near the edges of the pad. It was probably elevated as a result of contamination located in the soil. The maximum dose rate at 3.3 ft at this location was 15 microrem/hr located on the north east edge of the pad near known soil contamination. The PSRM energy compensated Geiger-Muller tube detector measured the general exposure rate at 3.3 ft above the pad of 10 micro-R/hr. The results of the 25 dose rate measurements are documented on Radiological Survey Forms in project files.

Total Surface Contamination - Approximately 100 percent of the pad (60 m²) in this survey unit was scanned for total surface contamination at a rate of 2 in. per second for alpha and 4 in. per second for beta-gamma at 1/4 in. from the surface using a PSRM. Only three percent of the pad area had total surface contamination above established beta-gamma PALs as identified by the PSRM. The area above PALs was located at the southeast corner of the pad. The maximum total surface contamination level was 28,011 dpm/100 cm² beta-gamma located around the sump on the south east corner of the pad. The results of the PSRM total surface contamination measurements are documented on Radiological Survey Forms in project files.

Figure C-7
CAU 254: West Decontamination Pad
Total Surface Contamination Survey Map

SURVEY UNIT: 254-ES-02

EAST DECONTAMINATION PAD SURVEY UNIT NUMBER

The East Decontamination Pad unit was surveyed for dose rate and total surface contamination according to the Field Instructions for Corrective Action Unit 254: Area 25 R-MAD Decontamination Facility and ITLV Standard Quality Practices (IT, 2000). These surveys were performed by trained ITLV personnel during January and February 2000. Surveys conducted with the PSRM were performed as described in "Survey Report for Position Sensitive Radiation Monitor Deployment Project," November 1999. These surveys were performed by subcontractors from Shonka Research Associates of Marietta, Georgia in October 1999 (Shonka and Millennium, 1999).

Radiation Dose Rate - Radiation dose rate measurements were taken at 28 random and biased locations (see [Figure C-8](#)). Radiation dose rate in this survey unit ranged from 10 to 30 microrem/hr at 3.3 ft. Areas of elevated dose rate were identified around the drain in the center of the pad, around the sump on the south west corner of the pad, and near the north and east edges of the pad probably from contamination located in the soil. The maximum dose rate at 3.3 ft was 60 microrem/hr located at 4 locations along the east edge of the pad near known soil contamination. The maximum contact dose rate was 200 microrem/hr located over the drain in the center of the pad. The maximum dose rate at 1 foot was 60 microrem/hr at the same location. The PSRM energy compensated Geiger-Muller tube detector measured the general exposure rate at 3.3 ft above the floor of 20 micro-R/hr. The results of the 28 radiation dose rate measurements are documented on Radiological Survey Forms in project files.

Total Surface Contamination - Approximately 100 percent of the pad (68 m²) in this survey unit was scanned for total surface contamination at a rate of 2 in. per second for alpha and 4 in. per second for beta-gamma at 1/4 in. from the surface using a position sensitive radiation monitor. Approximately 100 percent of the pad area had total surface contamination above established beta-gamma PALs as identified by the PSRM. The maximum total surface contamination level was 219,427 dpm/100 cm² beta-gamma located around the drain in the center of the pad. The results of the PSRM total surface contamination measurements are documented on Radiological Survey Forms in project files.

Figure C-8
CAU 254: East Decontamination Pad
Total Surface Contamination Survey Map

SURVEY UNIT: 254-ES-03

EXTERNAL SURFACES OF BUILDING 3126

The external surfaces of building unit was surveyed for total surface contamination and four samples were collected for radioisotope analysis according to the Field Instructions for Corrective Action Unit 254: Area 25 R-MAD Decontamination Facility and ITLV Standard Quality Practices (IT, 2000). The surveys were performed by trained ITLV personnel during January and February 2000.

Total Surface Contamination - A total of 102 random and biased total surface contamination measurements were collected on the external walls and roof of Building 3126 (see [Figure C-9](#)). The minimum detectable activities of the static total surface contamination measurements for this survey unit were 36 dpm/100 cm² alpha and 135 dpm/100 cm² beta-gamma. Four small areas of total surface contamination above established beta-gamma PALs were detected during the total surface contamination survey. The four locations that were greater than the PAL of 5,000 dpm/100 cm² beta-gamma are West Wall (05, 00); West Wall (07, 00); South Wall (02, 01); and South Wall (05, 00). The maximum total surface contamination measurement in this survey unit was 16,700 dpm/100 cm² beta-gamma located on the west wall at grid location (07,00). This location corresponded to a hot spot on the wall that was located inside of the building. Generally the exterior of the building is below the PALs with the exception of a few hot spots located in areas around wall penetrations and the south decontamination bay door. The results of the 101 total surface contamination measurements are documented on Radiological Survey Forms in project files.

Equipment and Material Samples/Analysis - A total of four swipe samples were collected and sent to an off-site laboratory for radioisotopic analysis. The samples were swipes from the south vent stack, south middle vent stack, exterior fume hood stack, and roof drain vent. The analytical results for the equipment and material samples are provided in Appendix A and Appendix D.

Figure C-9
CAU 254: External Surfaces of Building
Total Surface Contamination Survey Map

BUILDING 3126 STORAGE YARD RADIOLOGICAL WALKOVER SURVEY

Objective

The objective of this radiological walkover survey was to provide the location of surface contamination and identify radiological trends that can be used to focus characterization efforts. Radiological instrumentation was used to define the nature and extent of potential radiological contaminants are as follows:

- Bicron Microrem™ (SN. C566E)
- NE Technology model Electra™ (SN. 3561) with model DP6BD alpha/beta-gamma probe (SN. 130)
- Trimble Pathfinder Pro XRS™ Global Positioning System (GPS) Receiver with a TSC1™ datalogger (SN. 220134393)

Data Acquisition

Background measurements were taken south of the CAU 254 investigation area. Radiological background locations were selected based on soil characteristics similar to the survey area. Care was taken to avoid areas affected by known historical contamination. A total of 20 background soil measurements were collected. Radiological and GPS measurements of the background locations were performed in the same manner as the site survey described below.

A radiological survey was performed January 5 and 6, 2000, at CAU 254, Area 25 R-MAD Decontamination Facility. An investigation grid of 154 ft by 132 ft was established inside the fence with 33 ft by 33 ft internal grid spacing. The grid was marked with flagging to provide uniform measurement spacing. Each measurement location was surveyed using a Trimble Pro XRS™ GPS. Alpha and beta-gamma measurements were collected by placing the detector directly on the surface of the soil at the grid nodes and integrating the measurement for one minute. Some measurement locations changed slightly from the grid nodes so the alpha/beta-gamma probe could be placed directly on the soil. Dose rate measurements were collected by suspending the detector 3.3 ft above the soil surface at the grid nodes. Each grid square was scanned by slowly moving the alpha/beta-gamma detector approximately 15 cm over the soil. All areas identified over the PAL received a static one minute alpha/beta-gamma measurement and a contact dose rate measurement. Each radiological measurement was recorded on the datalogger and stored with its related GPS measurement in a combined GPS/RAD file. A total of 50 alpha, 50 beta-gamma, and 50 dose rate measurements were recorded. The radiological measurements and Universal Transverse Mercator (North American Datum, 1927) coordinates for each measured point are in project files.

Data Processing

The GPS/RAD data from the datalogger was downloaded to a laptop computer and the GPS measurements were post-processed using Trimble's Pathfinder Office™ software. Each GPS measurement was positionally corrected using real-time satellite differential signals. After post-processing, the GPS/RAD data was exported as an ASCII file and converted to an Excel spreadsheet file. The GPS/RAD data was processed using the commercial software package SURFER™ for graphical presentation. A post map was generated for alpha, beta-gamma, and dose rate measurements. [Figure C-10](#) shows the location of these measurements.

Quality Control

Radiological detection equipment used in this survey was checked daily as described in SQP-ITLV-460, "Daily Source and Background Check." To ensure positional accuracy, the GPS system was programmed according to the operational manual to achieve submeter accuracy. The GPS system was checked against surveyed monuments near the survey location. In addition, each positional measurement recorded was an average of at least 30 readings, which increased the positional accuracy to less than 50 cm. A sampling of the data was checked against source information.

Data Review

Radiological measurements of the surrounding soils at CAU 254 show several areas that are elevated over background measurements taken on similar media in the surrounding area. In addition, several of these areas had contamination above the established PALs. The west edge and northeast corner of the east pad had small areas of contamination consisting of very small discrete radioactive particles. The railroad track between the building and the fence had wide spread contamination as well as small discrete radioactive particles. The soil around all edges of the east pad has wide spread contamination as well as small discrete radioactive particles measuring up to approximately 1 million dpm beta-gamma and 14,000 dpm alpha. The southeast corner of the fence also has small areas of small discrete radioactive particles in the soil measuring up to 500 microrem/hr on contact. The washout downgradient from the east pad (draining south) appears to be a transport for contamination into an off-site drainage ditch. Factors affecting these radiological measurements included gamma shine from the contaminated building, changing ambient radon levels, and instrument variations.

Soil samples were collected from the contaminated areas and analyzed for gamma emitters, Sr-90, isotopic U, and isotopic Pu. The location of the soil samples, sample numbers, and analyses results are documented in project files.

Figure C-10
CAU 254: Surface and Subsurface Soil
Total Surface Contamination Survey Map

C.1.0 References

IT Corporation. 2000. *Field Instructions for Corrective Action Unit 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site*. Las Vegas, NV.

Shonka and Millennium, see Shonka Research Associates, Inc.

Shonka Research Associates, Inc. and Millennium Services, Inc. 1999. *Survey Report for Position Sensitive Radiation Monitor Deployment Project*, Final Report. Prepared for IT Corporation. Marietta, GA.

U.S. Department of Energy, Nevada Operations Office. 1999. *Corrective Action Investigation Plan for CAU 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site, Nevada*, DOE/NV--557. Las Vegas, NV.

Appendix D

**CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above
Minimum Reporting Limits**

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 1 of 18)

Sample Location	Sample Number	Matrix	Sample Type
West Decontamination Pad and West Interior of Building (SUN-254-ES-01)			
West Decontamination Pad	25400511	Sediment	Environmental
Parameter		Result	
Aroclor-1260		2,500 µg/kg (J)	
Bis(2-Ethylhexyl)Phthalate		560 µg/kg (J)	
*Arsenic		3.8 mg/kg	
Barium		120 mg/kg (J)	
Cadmium		0.07 mg/L	
Cadmium		2.1 mg/kg (J)	
Chromium		45 mg/kg (J)	
Lead		1.2 mg/L	
Lead		150 mg/kg (J)	
Actinium-228		1.59 ± 0.54 pCi/g	
Bismuth-214		1.84 ± 0.90 pCi/g	
*Cesium-137		124 ± 20 pCi/g	
*Lead-214		2.7 ± 1.3 pCi/g	
*Lead-212		2.8 ± 1.1 pCi/g	
*Niobium-94		1.13 ± 0.24 pCi/g	
Potassium-40		29.0 ± 5.5 pCi/g	
*Plutonium-239		0.41 ± 0.17 pCi/g	
*Strontium-90		177 ± 32 pCi/g	
*Uranium-234		65.2 ± 9.3 pCi/g	
*Uranium-235		4.1 ± 1.0 pCi/g	
Uranium-238		1.46 ± 0.55 pCi/g	
West Decontamination Pad Ceiling	25400540	Insulation	Environmental
Parameter		Result	
Aroclor-1260		1,500 µg/kg	
*Bis(2-Ethylhexyl)Phthalate		50,000 µg/kg (J)	
*Arsenic		1.4 mg/kg	
Barium		23 mg/kg	
Cadmium		0.95 mg/kg	
Chromium		10 mg/kg (J)	
Lead		14 mg/kg (J)	
Selenium		0.48 mg/kg (B)	
*Europium-152		2.9 ± 1.2 pCi/g (J)	
*Lead-214		6.1 ± 1.7 pCi/g (J)	
*Uranium-234		4.93 ± 0.78 pCi/g	
*Uranium-235		0.255 ± 0.091 pCi/g	
Uranium-238		4.70 ± 0.75 pCi/g	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 2 of 18)

Sample Location	Sample Number	Matrix	Sample Type
West Decontamination Pad	25400545	Concrete	Environmental
Parameter		Result	
Aroclor-1260		3,000 µg/kg (J)	
Diesel Range Organics		31 mg/kg	
Lead-214		0.68 ± 0.32 pCi/g	
Potassium-40		14.6 ± 3.3 pCi/g	
Thallium-208		0.54 ± 0.26 pCi/g (J)	
Uranium-238		0.59 ± 0.15 pCi/g	
East Decontamination Pad and East Interior of Building (SUN-254-ES-02)			
East Decontamination Bay	25400225	Swipe	Environmental
Parameter		Result	
Cesium-137		3,750 ± 620 pCi/s (J)	
Plutonium-239		5.08 ± 0.93 pCi/s (J)	
Strontium-90		3,760 ± 680 pCi/s (J)	
Uranium-234		263 ± 35 pCi/s	
Uranium-235		15.5 ± 2.2 pCi/s	
Uranium-238		1.66 ± 0.36 pCi/s	
East Decontamination Pad Sump	25400509	Soil	Environmental
Parameter		Result	
*Aroclor-1260		23,000 µg/kg (J)	
Bis(2-Ethylhexyl)Phthalate		9,500 µg/kg (J)	
Diesel Range Organics		31 mg/kg	
*Arsenic		3.3 mg/kg	
Barium		130 mg/kg (J)	
Cadmium		0.16 mg/L	
Cadmium		5.8 mg/kg (J)	
Chromium		100 mg/kg (J)	
*Lead		730 mg/kg (J)	
Lead		0.72 mg/L	
Mercury		0.17 mg/kg	
*Cesium-137		790 ± 130 pCi/g	
*Cobalt-60		6.3 ± 1.1 pCi/g	
*Niobium-94		20.8 ± 3.5 pCi/g	
Potassium-40		28.8 ± 5.7 pCi/g	
*Plutonium-239		3.52 ± 0.60 pCi/g	
*Strontium-90		2,580 ± 460 pCi/g	
*Uranium-234		265 ± 38 pCi/g	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 3 of 18)

Sample Location	Sample Number	Matrix	Sample Type
*Uranium-235		17.2 ± 2.6 pCi/g	
Uranium-238		2.30 ± 0.49 pCi/g	
East Decontamination Pad	25400516	Concrete	Environmental
Parameter		Result	
Aroclor-1260		810 µg/kg	
Benzene		5.6 µg/kg (J)	
Diesel Range Organics		38 mg/kg	
Chromium		0.12 mg/L	
*Bismuth-212		2.3 ± 1.1 pCi/g (J)	
*Cesium-137		27.8 ± 4.6 pCi/g	
Cobalt-60		0.130 ± 0.064 pCi/g (J)	
Lead-212		1.62 ± 0.58 pCi/g	
*Niobium-94		0.203 ± 0.088 pCi/g (J)	
Potassium-40		17.4 ± 3.7 pCi/g	
Plutonium-239		0.089 ± 0.047 pCi/g	
*Strontium-90		22.0 ± 4.0 pCi/g	
Thallium-208		0.78 ± 0.40 pCi/g (J)	
*Uranium-234		3.81 ± 0.61 pCi/g	
*Uranium-235		0.34 ± 0.11 pCi/g	
Uranium-238		0.66 ± 0.16 pCi/g	
East Decontamination Bay Floor	25400549	Concrete	Environmental
Parameter		Result	
Aroclor-1260		750 µg/kg	
Acetone		95 µg/kg (J)	
Bis(2-Ethylhexyl)Phthalate		1,600 µg/kg (J)	
*Diesel Range Organics		510 mg/kg	
Phenol		500 µg/kg (J)	
Cobalt-60		0.189 ± 0.068 pCi/g (J)	
*Cesium-137		164 ± 27 pCi/g	
*Europium-154		2.97 ± 0.75 pCi/g (J)	
*Niobium-94		0.75 ± 0.19 pCi/g	
Potassium-40		7.9 ± 2.3 pCi/g	
*Plutonium-239		0.65 ± 0.17 pCi/g (J)	
*Strontium-90		1,000 ± 180 pCi/g	
*Uranium-234		64.6 ± 9.3 pCi/g	
*Uranium-235		3.57 ± 0.60 pCi/g	
Uranium-238		1.21 ± 0.26 pCi/g	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 4 of 18)

Sample Location	Sample Number	Matrix	Sample Type
East Decontamination Pad	25400562	Concrete	Environmental
Parameter		Result	
Aroclor-1260		82 µg/kg	
Bis(2-Ethylhexyl)Phthalate		2,600 µg/kg	
Butyl Benzyl Phthalate		230 µg/kg (J)	
Diesel Range Organics		40 mg/kg	
Lead		0.054 mg/L	
Actinium-228		1.77 ± 0.61 pCi/g (J)	
Bismuth-214		0.75 ± 0.28 pCi/g (J)	
Cobalt-60		0.187 ± 0.079 pCi/g (J)	
*Cesium-137		12.6 ± 2.1 pCi/g	
Lead-212		0.69 ± 0.29 pCi/g	
Potassium-40		14.3 ± 3.2 pCi/g	
*Strontium-90		8.0 ± 1.5 pCi/g	
Thallium-208		0.40 ± 0.19 pCi/g (J)	
*Uranium-234		2.23 ± 0.30 pCi/g	
*Uranium-235		0.191 ± 0.046 pCi/g	
Uranium-238		0.565 ± 0.095 pCi/g	
East Decontamination Pad	25400563	Concrete	Environmental
Parameter		Result	
Aroclor-1260		150 µg/kg	
Bis(2-Ethylhexyl)Phthalate		1,800 µg/kg	
*Diesel Range Organics		150 mg/kg	
Acetone		28 µg/kg (J)	
Cadmium		0.15 mg/L	
Actinium-228		1.51 ± 0.86 pCi/g (J)	
Cobalt-60		0.233 ± 0.085 pCi/g (J)	
*Cesium-137		218 ± 36 pCi/g	
*Niobium-94		0.33 ± 0.12 pCi/g	
Potassium-40		17.0 ± 3.7 pCi/g	
Plutonium-239		0.306 ± 0.099 pCi/g	
*Strontium-90		20.5 ± 37 pCi/g	
*Uranium-234		205 ± 2.6 pCi/g	
*Uranium-235		1.42 ± 0.20 pCi/g	
Uranium-238		0.84 ± 0.13 pCi/g	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 5 of 18)

Sample Location	Sample Number	Matrix	Sample Type
Office (SUN-254-IS-03)			
Bench	25400522	Wood	Environmental
Parameter		Result	
Aroclor-1260		330 µg/kg	
*Diesel Range Organics		360 mg/kg (J)	
Acetone		840 µg/kg	
*Toluene		790 µg/kg	
P-Isopropyltoluene		67 µg/kg	
Cesium-137		1.07 ± 0.34 pCi/g	
Uranium-234		0.219 ± 0.071 pCi/g	
Door	25400532	Paint	Environmental
Parameter		Result	
Barium		43 mg/kg (J)	
Cadmium		3.8 mg/kg (J)	
Chromium		5 mg/kg	
Lead		300 mg/kg	
Mercury		0.84 mg/kg	
East Decontamination Bay Floor	25400542	Concrete	Environmental
Parameter		Result	
Aroclor-1260		770 µg/kg	
Bis(2-Ethylhexyl)Phthalate		380 µg/kg	
Diesel Range Organics		32 mg/kg	
Dimethyl Phthalate		650 µg/kg	
Acetone		92 µg/kg (J)	
Actinium-228		1.13 ± 0.19 pCi/g (J)	
*Cesium-137		479 ± 79 pCi/g	
Cobalt-60		0.238 ± 0.094 pCi/g (J)	
*Europium-154		2.12 ± 0.92 pCi/g (J)	
Niobium-94		0.45 ± 0.15 pCi/g	
Potassium-40		9.0 ± 2.4 pCi/g	
Plutonium-239		0.323 ± 0.097 pCi/g	
*Strontium-90		298 ± 54 pCi/g	
*Uranium-234		41.5 ± 5.9 pCi/g	
Uranium-235		2.09 ± 0.38 pCi/g	
Uranium-238		0.70 ± 0.17 pCi/g	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 6 of 18)

Sample Location	Sample Number	Matrix	Sample Type
Floor	25400543	Paint	Environmental
Parameter		Result	
*Arsenic		7.6 mg/kg	
Barium		94 mg/kg (J)	
Chromium		36 mg/kg	
Lead		26 mg/kg	
Loft and Stairs (SUN-254-IS-06)			
Loft	25400129	Swipe	Environmental
Parameter		Result	
Strontium-90		2.01 ± 0.51 pCi/s (J)	
Uranium-234		1.63 ± 0.48 pCi/s (J)	
Loft	25400135	Swipe	Field Duplicate of 25400105
Parameter		Result	
Strontium-90		1.00 ± 0.39 pCi/s (J)	
Uranium-234		0.56 ± 0.24 pCi/s	
North Loft Wall	25400527	Insulation	Environmental
Parameter		Result	
*Aroclor-1260		760,000 µg/kg (J)	
*Bis(2-Ethylhexyl)Phthalate		610,000 µg/kg (J)	
Cadmium		2.8 mg/kg (J)	
Chromium		1.9 mg/kg	
Lead		12 mg/kg	
*Bismuth-214		8.3 ± 3.1 pCi/g (J)	
*Cesium-137		7.0 ± 2.0 pCi/g	
*Lead-214		10.9 ± 3.5 pCi/g	
Strontium-90		1.25 ± 0.34 pCi/g	
*Uranium-234		4.77 ± 0.70 pCi/g	
*Uranium-235		0.332 ± 0.092 pCi/g	
Uranium-238		4.12 ± 0.61 pCi/g	
Left Floor	25400529	Wood	Environmental
Parameter		Result	
*Aroclor-1260		230,000 µg/kg (J)	
*Diesel Range Organics		360 mg/kg (J)	
Acetone		2,800 µg/kg	
1,2,4-Trimethylbenzene		64 µg/kg (J)	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 7 of 18)

Sample Location	Sample Number	Matrix	Sample Type
2-Butanone		350 µg/kg (B)	
Ethylbenzene		63 µg/kg	
P-Isopropyltoluene		310 µg/kg (J)	
Toluene		77 µg/kg	
M+P-Xylene		270 µg/kg	
O-Xylene		190 µg/kg	
Chromium		0.32 mg/L	
Lead		1.4 mg/L	
Northwest Left Wall Piping	25400551	Paint	Environmental
Parameter		Result	
Barium		500 mg/kg	
*Chromium		1,400 mg/kg	
*Lead		23,000 mg/kg	
Mercury		4.2 mg/kg	
Uranium-234		0.286 ± 0.063 pCi/g	
Uranium-238		0.098 ± 0.033 pCi/g	
Equipment and Materials (SUN-254-EM-01)			
Turbulator Tank	25400177	Swipe	Environmental
Parameter		Result	
Uranium-234		0.30 ± 0.13 pCi/s	
Uranium-235		0.113 ± 0.075 pCi/s (B)	
Turbulator Tank	25400182	Swipe	Environmental
Parameter		Result	
Strontium-90		5.13 ± 0.98 pCi/s	
Uranium-234		0.85 ± 0.24 pCi/s	
Decontamination Sink Fume Hood	25400185	Swipe	Environmental
Parameter		Result	
Strontium-90		9.2 ± 1.7 pCi/s	
Uranium-234		6.22 ± 0.94 pCi/s	
Uranium-235		0.30 ± 0.13 pCi/s	
Uranium-238		0.46 ± 0.16 pCi/s	
Special Liquids Pump	25400200	Swipe	Environmental
Cesium-137		38 ± 16 pCi/s	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 8 of 18)

Sample Location	Sample Number	Matrix	Sample Type
Fume Hood	25400190	Swipe	Environmental
Parameter		Result	
Cesium-137		14.2 ± 5.9 pCi/s	
Strontium-90		3.14 ± 0.63 pCi/s	
Uranium-234		5.84 ± 0.89 pCi/s	
Uranium-235		0.28 ± 0.13 pCi/s	
Uranium-238		0.178 ± 0.093 pCi/s (B)	
Overhead Crane Motor	25400209	Swipe	Environmental
Parameter		Result	
Uranium-234		0.51 ± 0.16 pCi/s	
Uranium-238		0.192 ± 0.094 pCi/s (B)	
Decontamination Sink Vent Hood Filter	25400224	Swipe	Environmental
Parameter		Result	
Strontium-90		9.5 ± 1.7 pCi/s	
Uranium-234		1.84 ± 0.37 pCi/s	
Uranium-235		0.23 ± 0.10 pCi/s	
West Light #7	25400251	Swipe	Environmental
Parameter		Result	
Europium-152		27.1 ± 4.5 pCi/s (J)	
Strontium-90		1.25 ± 0.31 pCi/s	
Uranium-234		1.89 ± 0.35 pCi/s	
North Center Vent Baffle	25400263	Swipe	Environmental
Parameter		Result	
Strontium-90		1.72 ± 0.39 pCi/s	
Uranium-234		0.86 ± 0.21 pCi/s	
Special Liquids West Wall Pipe	25400273	Swipe	Environmental
Parameter		Result	
Uranium-234		0.103 ± 0.065 pCi/s (B)	
West Wall Cold Water Pipe	25400275	Swipe	Environmental
Parameter		Result	
Strontium-90		0.83 ± 0.29 pCi/s (J)	
Uranium-234		0.56 ± 0.16 pCi/s	
Uranium-238		0.078 ± 0.052 pCi/s (B)	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 9 of 18)

Sample Location	Sample Number	Matrix	Sample Type
Turbulator Tank	25400282	Swipe	Environmental
Parameter		Result	
Strontium-90		2.63 ± 0.54 pCi/s	
Uranium-234		2.83 ± 0.49 pCi/s	
Uranium-235		0.161 ± 0.079 pCi/s (B)	
Drain	25400512	Sediment	Environmental
Parameter		Result	
Acetone		40 µg/kg (J)	
Chloroform		100 µg/kg	
*Arsenic		12 mg/kg	
Barium		110 mg/kg (J)	
Cadmium		20 mg/kg (J)	
Chromium		21 mg/kg (J)	
*Lead		1,200 mg/kg (J)	
Mercury		0.17 mg/kg	
*Cesium-137		38.5 ± 6.4 pCi/g	
*Lead-212		2.3 ± 1.0 pCi/g	
Potassium-40		14.4 ± 4.2 pCi/g	
*Strontium-90		18.5 ± 3.4 pCi/g	
*Uranium-234		9.2 ± 1.3 pCi/g	
*Uranium-235		0.46 ± 0.14 pCi/g	
Uranium-238		0.57 ± 0.16 pCi/g	
Center Floor Drain in Decontamination Bay	25400539	Water with Sediment	Environmental
Parameter		Result	
Acetone		82 µg/L	
2-Butanone		23 µg/L	
*Cesium-137		1,350 ± 220 pCi/L	
*Strontium-90		7,400 ± 1,300 pCi/L	
Uranium-235		151 ± 57 pCi/L	
Compressor in Storage Yard	25400544	Antifreeze	Environmental
Parameter		Result	
*Arsenic		1,200 mg/kg	
Lead		0.6 mg/kg	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 10 of 18)

Sample Location	Sample Number	Matrix	Sample Type
1 st Rail Road Tie South of the Decontamination Bay	25400552	Wood	Environmental
Parameter		Result	
*Aroclor-1260		3,400 µg/kg (J)	
Acetone		1300 µg/kg (J)	
2-Butanone		59 µg/kg (J)	
Carbon Disulfide		13 µg/kg (J)	
Ethylbenzene		8.8 µg/kg (J)	
P-Isopropyltoluene		65 µg/kg (J)	
Naphthalene		32,000 µg/kg (J)	
Trichloroethene		20 µg/kg (J)	
4-Methyl-2-Pentanone		25 µg/kg (J)	
1,1,1-Trichloroethane		170 µg/kg (J)	
1,2,4-Trimethylbenzene		50 µg/kg (J)	
1,3,5-Trimethylbenzene		18 µg/kg (J)	
Toluene		160 µg/kg (J)	
M+P-Xylene		10 µg/kg (J)	
O-Xylene		9 µg/kg (J)	
2-Methylphenol		0.47 mg/L (J)	
3+4-Methylphenol		2.025 mg/L	
*Cesium-137		740 ± 120 pCi/g	
*Europium-154		9.0 ± 3.4 pCi/g (J)	
*Niobium-94		1.86 ± 0.64 pCi/g	
Plutonium-239		0.37 ± 0.10 pCi/g (J)	
*Strontium-90		191 ± 34 pCi/g	
*Uranium-234		55.7 ± 8.0 pCi/g	
*Uranium-235		3.27 ± 0.56 pCi/g	
Uranium-238		0.58 ± 0.16 pCi/g	
Compressor in Storage Yard	25400553	Compressor Oil	Environmental
*Aroclor-1254		1.08 mg/kg (J)	
Uranium-234		0.0232 ± 0.0087 pCi/g (B)	
Compressor Concrete Pad	25400558	Concrete	Environmental
Parameter		Result	
Diesel Range Organics		24 mg/kg	
*Arsenic		16 mg/kg (J)	
Barium		77 mg/kg (J)	
Cadmium		15 mg/kg (J)	
Chromium		12 mg/kg (J)	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 11 of 18)

Sample Location	Sample Number	Matrix	Sample Type
Lead		270 mg/kg (J)	
Air Filters in Decontamination Bay	25400560	Filter	Environmental
Parameter		Result	
Acetone		290 µg/kg	
Bis(2-Ethylhexyl)Phthalate		1,500 µg/kg	
2-Butanone		50 µg/kg (B)	
Acenaphthylene		530 µg/kg	
Dimethyl Phthalate		2,900 µg/kg	
4-Methylphenol		660 µg/kg	
Phenanthrene		660 µg/kg	
*Diesel Range Organics		640 µg/kg	
Uranium-234		0.049 ± 0.020 pCi/g (B)	
Water Heater and Compressor Room (SUN-254-IS-01)			
No Analytical Results Exceeding MRLs Were Reported for Sample 25400512			
External Surface of Building (SUN-254-ES-03)			
Turbulator Vent Stack	25400506	Filter	Environmental
Parameter		Result	
*Aroclor-1260		180,000 µg/kg (J)	
Bis(2-Ethylhexyl)Phthalate		10,000 µg/kg (J)	
*Arsenic		3.2 mg/kg	
Barium		1,900 mg/kg	
Cadmium		21 mg/kg	
Chromium		66 mg/kg	
Lead		210 mg/kg	
Mercury		2.2 mg/kg	
Cobalt-60		9.3 ± 1.9 pCi/g (J)	
*Cesium-137		341 ± 58 pCi/g (J)	
*Europium-154		10.4 ± 1.7 pCi/g (J)	
Potassium-40		23.4 ± 9.8 pCi/g (J)	
*Plutonium-239		0.75 ± 0.16 pCi/g	
*Strontium-90		144 ± 26 pCi/g (J)	
*Uranium-234		303 ± 41 pCi/g	
*Uranium-235		12.6 ± 1.8 pCi/g (J)	
*Uranium-235		18.6 ± 3.1 pCi/g (J)	
Uranium-238		5.49 ± 0.83 pCi/g	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 12 of 18)

Sample Location	Sample Number	Matrix	Sample Type
South Side of Decontamination Bay (SUN-254-IS-05)			
South Decontamination Bay	25400159	Swipe	Environmental
Parameter		Result	
Cesium-137		86 ± 22 pCi/s (J)	
Strontium-90		37.2 ± 6.8 pCi/s (J)	
Uranium-234		9.0 ± 1.5 pCi/s	
Uranium-235		0.57 ± 0.24 pCi/s	
Uranium-238		0.24 ± 0.15 pCi/s	
South Decontamination Bay Floor	25400501	Sediment	Environmental
Parameter		Result	
*Cesium-137		10,200 ± 1,700 pCi/g	
Cobalt-60		1.20 ± 0.29 pCi/g	
*Europium-154		31.2 ± 5.7 pCi/g (J)	
*Lead-212		7.7 ± 1.3 pCi/g	
*Niobium-94		12.4 ± 2.2 pCi/g	
Potassium-40		19.5 ± 4.4 pCi/g	
*Strontium-90		3,080 ± 560 pCi/g(J)	
Southwest Floor	25400502	Sediment	Environmental
Parameter		Result	
*Aroclor-1260		23,000 µg/kg (J)	
Bis(2-Ethylhexyl) Phthalate		1,000 µg/kg	
Phenol		400 µg/kg	
*Arsenic		6.1 mg/kg	
Barium		82 mg/kg	
Cadmium		2.1 mg/kg	
Chromium		33 mg/kg	
Lead		76 mg/kg	
Selenium		0.047 mg/L (B)	
Actinium-228		1.42 ± 0.72 pCi/g (J)	
*Cesium-137		2700 ± 450 pCi/g	
*Europium-154		2.6 ± 1.3 pCi/g (J)	
Potassium-40		16.8 ± 3.8 pCi/g	
*Strontium-90		4.79 ± 0.97 pCi/g (J)	
*Uranium-234		2.13 ± 0.27 pCi/g	
Uranium-235		0.112 ± 0.024 pCi/g	
Uranium-238		0.84 ± 0.12 pCi/g	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 13 of 18)

Sample Location	Sample Number	Matrix	Sample Type
South Decontamination Bay Door	25400519	Wood	Environmental
Parameter		Result	
Aroclor-1260		1,400 µg/kg	
Acetone		360 µg/kg (J)	
P-Isopropyltoluene		120 µg/kg	
4-Methyl-2-Pentatone		250 µg/kg (B)	
*Diesel Range Organic		200 mg/kg (J)	
*Cadmium		4.7 mg/L	
Chromium		0.42 mg/L	
Lead		0.3 mg/L	
*Cesium-137		561 ± 93 pCi/g	
Cobalt-60		0.78 ± 0.25 pCi/g (J)	
*Niobium-94		0.83 ± 0.33 pCi/g	
Plutonium-239		0.157 ± 0.056 pCi/g	
*Strontium-90		81 ± 15 pCi/g	
*Uranium-234		20.5 ± 2.8 pCi/g	
*Uranium-235		1.32 ± 0.23 pCi/g	
Uranium-238		0.220 ± 0.070 pCi/g	
Southeast Decontamination Bay Door	25400514	Wood	Environmental
Parameter		Result	
Aroclor-1260		600 µg/kg	
Acetone		110 µg/kg (J)	
Bis(2-Ethylhexyl)Phthalate		2,100 µg/kg	
P-Isopropyltoluene		120 µg/kg	
4-Methylphenol		11,000 µg/kg	
*Diesel Range Organics		120 mg/kg (J)	
Cadmium		0.18 mg/L	
Cesium-137		13.8 ± 2.7 pCi/g	
Plutonium-239		0.169 ± 0.057 pCi/g	
*Strontium-90		74 ± 13 pCi/g	
*Uranium-234		20.8 ± 2.8 pCi/g	
*Uranium-235		1.46 ± 0.25 pCi/g	
Uranium-238		0.368 ± 0.095 pCi/g	
South Section of East Decontamination Bay Door	25400523	Insulation	Environmental
Parameter		Result	
Aroclor-1260		1,600 µg/kg	
*Bis(2-Ethylhexyl)Phthalate		140,000 µg/kg (J)	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 14 of 18)

Sample Location	Sample Number	Matrix	Sample Type
Dimethyl Phthalate			43,000 µg/kg (J)
Cadmium			3.2 mg/kg (J)
Chromium			3.2 mg/kg
Lead			6.1 mg/kg
Europium-152			4.5 ± 1.6 pCi/g (J)
*Lead-214			12.3 ± 3.7 pCi/g
Potassium-40			43 ± 17 pCi/g
Strontium-90			2.21 ± 0.51 pCi/g
*Uranium-234			7.8 ± 1.1 pCi/g
*Uranium-235			0.69 ± 0.14 pCi/g
Uranium-238			4.32 ± 0.64 pCi/g
South Decontamination Bay Door	25400526	Insulation	Environmental
Parameter		Result	
*Aroclor-1260		3,600 µg/kg (J)	
*Bis(2-Ethylhexyl)Phthalate		66,000 µg/kg (J)	
Carbon Disulfide		62 µg/kg	
Barium		17 mg/kg	
Cadmium		19 mg/kg (J)	
Chromium		1.1 mg/kg	
Lead		62 mg/kg	
Cesium-137		55 ± 10 pCi/g	
*Lead-214		8.1 ± 2.7 pCi/g	
*Strontium-90		3.84 ± 0.78 pCi/g	
*Uranium-234		5.04 ± 0.73 pCi/g	
*Uranium-235		0.297 ± 0.083 pCi/g	
Uranium-238		3.72 ± 0.55 pCi/g	
Southwest Floor Near Turbulator Tank	25400559	Concrete	Environmental
Parameter		Result	
Aroclor-1260		2,400 µg/kg (J)	
Acetone		280 µg/kg	
Chloroform		26 µg/kg	
Naphthalene		6.3 µg/kg	
Bis(2-Ethylhexyl)Phthalate		2,000 µg/kg	
Diesel Range Organics		67 mg/kg	
Actinium-228		1.57 ± 0.72 pCi/g (J)	
*Cesium-137		163 ± 27 pCi/g	
Cobalt-60		0.69 ± 0.16 pCi/g (J)	
Europium-154		1.19 ± 0.44 pCi/g (J)	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 15 of 18)

Sample Location	Sample Number	Matrix	Sample Type
*Niobium-94			0.31 ± 0.12 pCi/g
Potassium-40			17.8 ± 4.3 pCi/g
*Plutonium-239			0.35 ± 0.10 pCi/g
*Strontium-90			237 ± 43 pCi/g
Thallium-208			0.70 ± 0.12 pCi/g (J)
*Uranium-234			55.3 ± 6.9 pCi/g
*Uranium-235			3.17 ± 0.42 pCi/g (J)
Uranium-238			1.83 ± 0.26 pCi/g
North Side of Decontamination Bay (SUN-254-IS-04)			
North Decontamination Bay	25400147	Swipe	Environmental
Parameter		Result	
Cesium-137		230 ± 54 pCi/s (J)	
Plutonium-239		0.88 ± 0.24 pCi/s	
Strontium-90		411 ± 74 pCi/s (J)	
Uranium-234		33.7 ± 4.9 pCi/s (J)	
Uranium-235		2.29 ± 0.54 pCi/s (J)	
Uranium-238		0.73 ± 0.26 pCi/s (J)	
Northeast Floor	25400504	Rubber	Environmental
Parameter		Result	
Cadmium		0.073 mg/L	
*Cesium-137		1,030 ± 170 pCi/g	
Cobalt-60		0.92 ± 0.21 pCi/g	
Neptunium-235		3.82 ± 0.82 pCi/g (J)	
*Niobium-94		1.68 ± 0.33 pCi/g	
Plutonium-239		0.110 ± 0.046 pCi/g	
*Strontium-90		67 ± 12 pCi/g	
*Uranium-234		18.5 ± 2.5 pCi/g	
*Uranium-235		1.08 ± 0.20 pCi/g	
*Uranium-238		0.142 ± 0.056 pCi/g	
Northwest Decontamination Bay Door	25400520	Wood	Environmental
Parameter		Result	
Aroclor-1260		850 µg/kg	
*Bis(2-Ethylhexyl)Phthalate		55,000 µg/kg (J)	
P-Isopropyltoluene		57 µg/kg (J)	
*Diesel Range Organics		190 mg/kg (J)	
Cadmium		0.41 mg/L	
Lead		0.079 mg/L	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 16 of 18)

Sample Location	Sample Number	Matrix	Sample Type
*Cesium-137			61 ± 10 pCi/g
Plutonium-239			0.235 ± 0.070 pCi/g
*Strontium-90			146 ± 26 pCi/g
*Uranium-234			90 ± 13 pCi/g
*Uranium-235			4.41 ± 0.73 pCi/g
Uranium-238			0.52 ± 0.15 pCi/g
Northwest Decontamination Bay Door	25400524	Insulation	Environmental
Parameter		Result	
Aroclor-1260		2,700 µg/kg (J)	
*Bis(2-Ethylhexyl)Phthalate		140,000 µg/kg (J)	
*Arsenic		1.1 mg/kg	
Barium		16 mg/kg	
Cadmium		19 mg/kg (J)	
Chromium		8.1 mg/kg	
Lead		54 mg/kg	
*Bismuth-214		7.2 ± 2.9 pCi/g (J)	
*Lead-214		8.9 ± 3.6 pCi/g	
*Uranium-234		4.07 ± 0.60 pCi/g	
*Uranium-235		0.259 ± 0.077 pCi/g	
Uranium-238		3.71 ± 0.55 pCi/g	
Northeast Floor	25400525	Concrete	Environmental
Parameter		Result	
Aroclor-1260		280 µg/kg	
Acetone		71 µg/kg (J)	
Cesium-137		0.33 ± 0.13 pCi/g	
Potassium-40		7.6 ± 2.2 pCi/g	
*Strontium-90		1.77 ± 0.39 pCi/g (J)	
Uranium-234		0.67 ± 0.16 pCi/g	
Uranium-238		0.52 ± 0.14 pCi/g	
Northwest Floor	25400530	Concrete	Environmental
Parameter		Result	
Aroclor-1260		850 µg/kg	
Chloroform		7.3 µg/kg	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 17 of 18)

Sample Location	Sample Number	Matrix	Sample Type
Northwest Wall	25400531	Paint	Environmental
Parameter		Result	
Barium		350 mg/kg (J)	
Cadmium		11 mg/kg (J)	
*Chromium		510 mg/kg	
*Lead		5,900 mg/kg	
Mercury		2.2 mg/kg	
Northwest Floor	25400533	Paint	Environmental
Parameter		Result	
*Arsenic		12 mg/kg	
Barium		66 mg/kg (J)	
Chromium		100 mg/kg	
Lead		39 mg/kg	
Selenium		8.5 mg/kg	
Locker and Shower Room (SUN-254-IS-02)			
Shower Room	25400105	Swipe	Environmental
Parameter		Result	
Cesium-137		166 ± 30 pCi/s (J)	
Strontium-90		1.26 ± 0.39 pCi/s (J)	
Uranium-234		2.11 ± 0.56 pCi/s (J)	
Uranium-238		1.26 ± 0.40 pCi/s(J)	
Door	25400534	Paint	Environmental
Parameter		Result	
Barium		350 mg/kg (J)	
Cadmium		4.8 mg/kg (J)	
Chromium		30 mg/kg	
*Lead		4,200 mg/kg	
Mercury		4.6 mg/kg	

Table D.1-1
CAU 254, Area 25 R-MAD Decontamination Facility,
Building Material and Swipe Samples Detected Above Minimum Reporting Limits
(Page 18 of 18)

Sample Location	Sample Number	Matrix	Sample Type
Floor	25400556	Paint	Environmental
Parameter		Result	
*Arsenic		6.9 mg/kg (J)	
Barium		110 mg/kg	
Chromium		23 mg/kg	
Lead		27 mg/kg	

*Concentrations exceed Preliminary Action Levels, Preliminary Remediation Goals, or Regulatory Limits (Not applicable to swipe samples). As determined by the following references:

- EPA Region 9 Preliminary Remediation Goals (PRGs Table 1998) (EPA, 1998)
- *Field Instructions for Corrective Action Unit 254, Area 25 R-MAD Decontamination Facility* (IT, 2000).
- Memorandum from S. Alderson (ITLV) and C. Orchard (ITLV) to J. Johnson (ITLV) regarding Radioanalytical Data Review of Sample Results Associated with Corrective Action Unit (CAU) 254, Sample Delivery Groups (SDGs) 0001050, 0001048, 0001062, 0001061, 0001075, 0001144, 0001149, 0001186, 0001167, 0001171, 0001179, 0001180, 0002003, 0002040.
- *RCRA Regulations and Keyword Index* (Elsevier, 1996).

B = Analyte concentration is greater than minimum detectable concentrations.

J = Estimated

mg/kg = Milligrams per kilogram

mg/L = Micrograms per liter

pCi/s = Picocuries per second

pCi/g = Picocuries per gram

µg/kg = Micrograms per kilogram

D.1.0 References

Alderson, S., and C. Orchard. 2000. Memorandum to J. Johnson (IT) regarding Radioanalytical Data Review of Sample Results Associated with Corrective Action Unit (CAU) 254, Sample Delivery Groups (SDGs) 0001050, 0001048, 0001062, 0001061, 0001075, 0001144, 0001149, 0001186, 0001167, 0001171, 0001179, 0001180, 0001188, 0002003, 0002040, 31 March. Las Vegas, NV: IT Corporation.

Elsevier Science Inc. 1996. *RCRA Regulations and Keyword Index*. New York, NY.

IT, see IT Corporation.

IT Corporation. 2000. *Field Instruction for Corrective Action Unit 254, Area 25 R-MAD Decontamination Facility, Nevada Test Site*. Las Vegas, NV.

U.S. Environmental Protection Agency. 1998. Memo from S.J. Smucker to PRG Table Mailing List regarding Region 9 Preliminary Remediation Goals (PRGs). San Francisco, CA.

Appendix E

Evaluation of Risk

A detailed assessment of risk for no action and evaluation alternatives was not performed for this CAU because COCs exceeding PALs will not be left in place without appropriate controls.

Plate

E=568071.36
N=4074453.53

E=568075.82
N=4074445.9

E=568075.54
N=4074471.82

N=568084.82
E=4074477.05

N=568102.88
E=4074471.76

E=568107.37
N=4074464.14

E=568089.90
N=4074447.36

E=568099.20
N=4074452.54

PROJECT MANAGER: DIONNE		DRAWN BY: SPEER	
<div>PLATE 1</div> <div>POSITION SENSITIVE RADIATION MONITOR SURFACE</div> <div>BETA CONTAMINATION SURVEY RESULTS</div>			
DATE INITIATED		DRAWING NUMBER	
15-JUN-2000		h:\cau_254\CADD\FINAL\image_p.dgn	

Distribution

* Provide copy in distribution of Rev. 0 and subsequent revisions, if applicable.

Copies of the NDEP-approved document will be distributed to others.

Copies

Paul J. Liebendorfer State of Nevada Bureau of Federal Facilities Division of Environmental Protection 333 W. Nye Lane, Room 138 Carson City, NV 89706-0851	2 (Controlled)*
Michael McKinnon State of Nevada Bureau of Federal Facilities Division of Environmental Protection 555 E. Washington, Suite 4300 Las Vegas, NV 89101	1 (Controlled)*
Sabrina Lawrence Environmental Restoration Division DOE/Nevada Operations Office P.O. Box 98518, M/S 505 Las Vegas, NV 89193-8518	1 (Controlled)*
Janet Appenzeller-Wing Environmental Restoration Division DOE/Nevada Operations Office P.O. Box 98518, M/S 505 Las Vegas, NV 89193-8518	1 (Uncontrolled)*
Clayton Barrow Environmental Restoration Division DOE/Nevada Operations Office P.O. Box 98518, M/S 505 Las Vegas, NV 89193-8518	1 (Uncontrolled)*

Dennis Gustafson
Bechtel Nevada
P.O. Box 98521, M/S NTS306
Las Vegas, NV 89193-8521

1 (Uncontrolled)*

Wayne Johnson
Bechtel Nevada
P.O. Box 98521, M/S NTS306
Las Vegas, NV 89193-8521

1 (Uncontrolled)*

Linda Linden
ITLV
P.O. Box 93838
Las Vegas, NV 89193

1 (Uncontrolled)*

Jeff Johnson
ITLV
P.O. Box 93838
Las Vegas, NV 89193

1 (Uncontrolled)*

IT Corporation Central Files
ITLV
P.O. Box 93838
Las Vegas, NV 89193

1 (Uncontrolled)*

Technical Information Resource Center
DOE/Nevada Operations Office
P.O. Box 98518, M/S 505
Las Vegas, NV 89193-8518

1 (Uncontrolled)

U.S. Department of Energy
Office of Scientific and Technical Information
P.O. Box 62
Oak Ridge, TN 37831

1 (Uncontrolled, electronic copy)

Manager Southern Nevada FFACO
Public Reading Room
P.O. Box 98521, M/S NLV040
Las Vegas, NV 89193

1 (Controlled)

1 (Uncontrolled)

Manager Northern Nevada FFACO
Public Reading Room
c/o Nevada State Library Archives
Federal Publications
100 North Stewart Street
Carson City, NV 89701-4285

1 (Uncontrolled)

FFACO Public Reading Room
IT Corporation
P.O. Box 93838
Las Vegas, NV 89193

1 (Controlled)