Nevada
Environmental
Restoration
Project

DOE/NV--564

Corrective Action Decision Document for Corrective Action Unit 240: Area 25 Vehicle Washdown, Nevada Test Site, Nevada

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CORRECTIVE ACTION DECISION DOCUMENT FOR CORRECTIVE ACTION UNIT 240: AREA 25 VEHICLE WASHDOWN, NEVADA TEST SITE, NEVADA

DOE Nevada Operations Office
Las Vegas, Nevada

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CORRECTIVE ACTION DECISION DOCUMENT
FOR CORRECTIVE ACTION UNIT 240:
AREA 25 VEHICLE WASHDOWN,
NEVADA TEST SITE, NEVADA

Approved by: Signature Approved Date: 9/16/99

Janet Appenzeller-Wing, Project Manager
Industrial Sites Project

Approved by: Signature Approved Date: 9/16/99

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Environmental Restoration Division

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List of Acronyms and Abbreviations

bgs	Below ground surface
CADD	Corrective Action Decision Document
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CFR	*Code of Federal Regulations*
CLP	Contract Laboratory Program
COC	Contaminant(s) of concern
COPC	Contaminant(s) of potential concern
CPSA	Central Propellant Support Area
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethylene
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DQO	Data Quality Objective(s)
EPA	U.S. Environmental Protection Agency
FFACO	*Federal Facility Agreement and Consent Order*
ft	Foot (feet)
ICP	Inductively coupled plasma
in.	Inch(es)
LCS	Laboratory control sample(s)
MEK	Methylethyl ketone (2-butanone)
mi	Mile(s)
mg/kg	Milligram(s) per kilogram
MS/MSD	Matrix spike and matrix spike duplicate
NAC	*Nevada Administrative Code*
NDEP	Nevada Division of Environmental Protection

List of Acronyms and Abbreviations *(Continued)*

NIST	National Institute for Standards and Technology
NRS	*Nevada Revised Statutes*
NRDS	Nuclear Rocket Development Station
NTS	Nevada Test Site
PAL	Preliminary action level(s)
PCB	Polychlorinated biphenyl(s)
pCi/g	Picocurie(s) per gram
ppm	Part(s) per million
PRG	Preliminary Remediation Goals
PVC	Polyvinyl chloride
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RCRA	*Resource Conservation and Recovery Act*
RPD	Relative percent difference
SDG	Sample delivery group
SVOC	Semivolatile organic compound(s)
TPH	Total petroleum hydrocarbons
VOC	Volatile organic compound(s)
yd^3	Cubic yard(s)
µg/kg	Microgram(s) per kilogram
%R	Percent recovery

Executive Summary

This Corrective Action Decision Document has been prepared for Corrective Action Unit 240, Area 25 Vehicle Washdown. The corrective action investigation was conducted in accordance with the *Corrective Action Investigation Plan for Corrective Action Unit 240: Area 25 Vehicle Washdown, Nevada Test Site, Nevada* (DOE/NV, 1999) as developed under the *Federal Facility Agreement and Consent Order* (FFACO, 1996). Corrective Action Unit 240 is located in Area 25 at the Nevada Test Site, Nevada, and is comprised of the following Corrective Action Sites:

- 25-07-01; Vehicle Washdown Area (Propellant Pad)
- 25-07-02; Vehicle Washdown Area (F and J Roads Pad)
- 25-07-03; Vehicle Washdown Station (RADSAFE Pad)

The purpose of this Corrective Action Decision Document is to identify and provide a rationale for the selection of a recommended corrective action alternative for each Corrective Action Site.

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

- Develop corrective action objectives.
- Identify corrective action alternative screening 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 each Corrective Action Site.

A corrective action investigation was performed in March 1999 as set forth in the *Corrective Action Investigation Plan for Corrective Action Unit 240: Area 25 Vehicle Washdown, Nevada Test Site, Nevada* (DOE/NV, 1999). Analytes detected during the corrective action investigation were evaluated against preliminary action levels to determine contaminants of concern for Corrective Action Unit 240. There were no contaminants of concern identified at Corrective Action Site 25-07-01, Propellant Pad, or Corrective Action Site 25-07-03, RADSAFE Pad, so there is no need for corrective action at these Corrective Action Sites.

Diesel-range organics and radionuclide concentrations in soil samples taken from the F and J Roads Pad exceeded preliminary action levels. Based on the identification of contaminants of concern above preliminary action levels at this site, potential corrective action alternatives are identified and evaluated in this Corrective Action Decision Document to ensure worker, public, and environmental protection against potential exposure to contaminants of concern in accordance with *Nevada Administrative Code* 445A (NAC, 1997b).

Based on the potential exposure pathways, the following corrective action objectives have been identified for the F and J Roads Pad:

- Prevent or mitigate exposure to surface and near-surface soil containing contaminants of concern at concentrations exceeding preliminary action levels as defined in the Corrective Action Investigation Plan (DOE/NV, 1999).
- Prevent spread of contaminants of concern beyond the Corrective Action Site.

Based on the review of existing data, future use, and current operations in Area 25, the following alternatives were developed for consideration at the F and J Roads Pad:

- Alternative 1 - No Further Action
- Alternative 2 - Clean Closure by Excavation and Disposal

The corrective action alternatives were evaluated based on four general corrective action standards and five remedy selection decision factors. Based on the results of this evaluation, the preferred alternative for the F and J Roads Pad is Alternative 2, Clean Closure by Excavation and Disposal.

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 meets all applicable state and federal regulations for closure of the site and will eliminate potential future exposure pathways to the contaminated soils at the F and J Roads Pad.

During corrective action implementation, this alternative may potentially present low risks to site workers who come in contact with the contaminated soil. Therefore, procedures will be developed and implemented to ensure worker health and safety.

1.0 Introduction

This Corrective Action Decision Document (CADD) has been prepared for Corrective Action Unit (CAU) 240, Area 25 Vehicle Washdown, in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) of 1996 that was agreed to by the U.S. Department of Energy, Nevada Operations Office (DOE/NV); the Nevada Division of Environmental Protection (NDEP); and the U.S. Department of Defense (FFACO, 1996). The CADD provides or references the specific information necessary to recommend corrective actions for the Corrective Action Sites (CASs) within CAU 240, which include the following:

- 25-07-01; Vehicle Washdown Area (Propellant Pad)
- 25-07-02; Vehicle Washdown Area (F and J Roads Pad)
- 25-07-03; Vehicle Washdown Station (RADSAFE Pad)

Corrective Action Unit 240 is located in Area 25 at the Nevada Test Site (NTS) in Nevada. The NTS is approximately 65 miles (mi) northwest of Las Vegas, Nevada (Figure 1-1 and Figure 1-2).

1.1 Purpose

This CADD identifies potential corrective action alternatives and provides a rationale for the selection of a recommended corrective action alternative for each CAS within the CAU. The need for evaluation of corrective action alternatives is based on process knowledge and the results of investigative activities conducted in accordance with the *Corrective Action Investigation Plan for Corrective Action Unit 240: Area 25 Vehicle Washdown, Nevada Test Site, Nye County, Nevada* (CAIP) (DOE/NV, 1999).

1.2 Scope

The scope of this CADD consists of the following:

- Develop corrective action objectives.
- Identify corrective action alternative screening criteria.
- Develop corrective action alternatives.

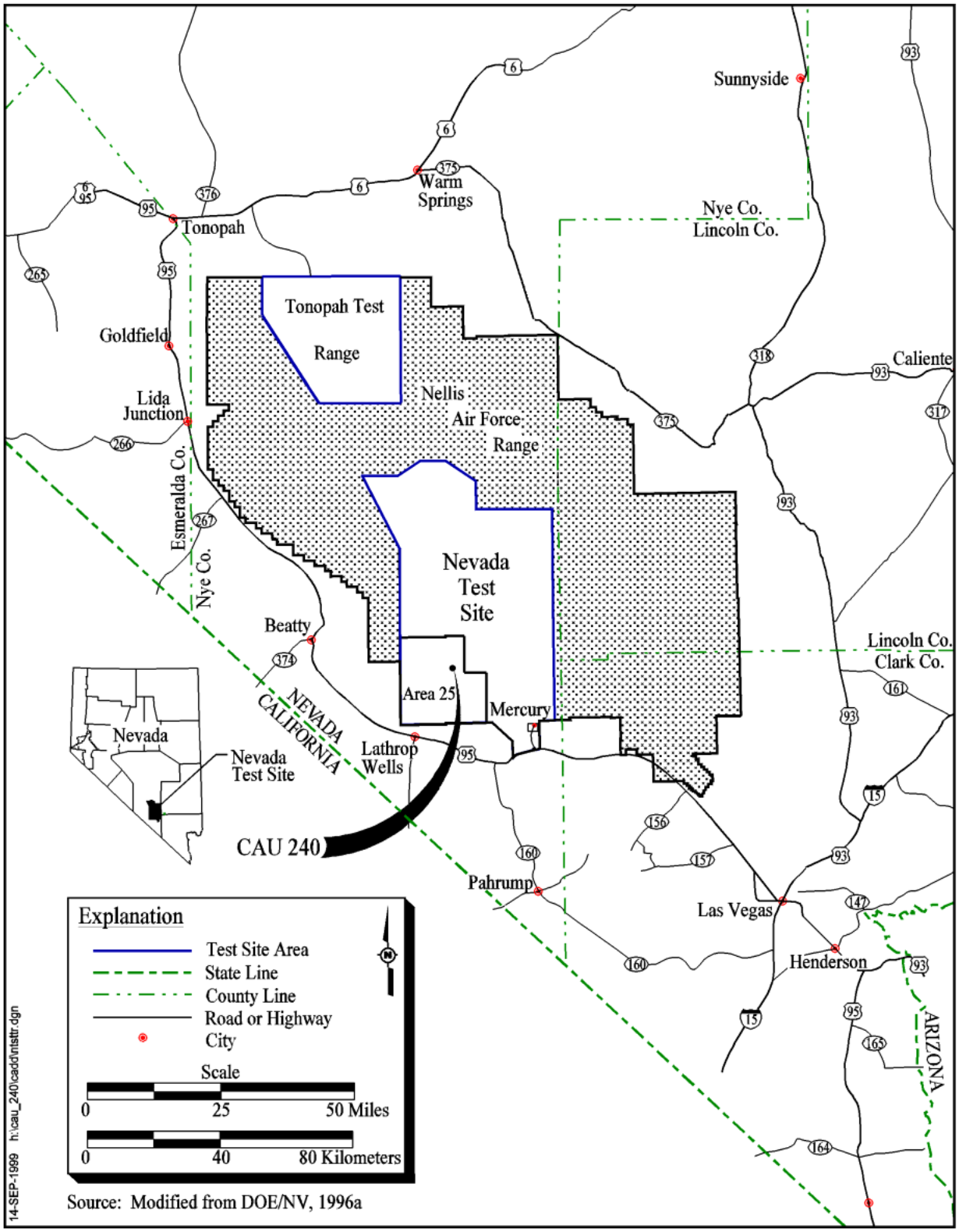
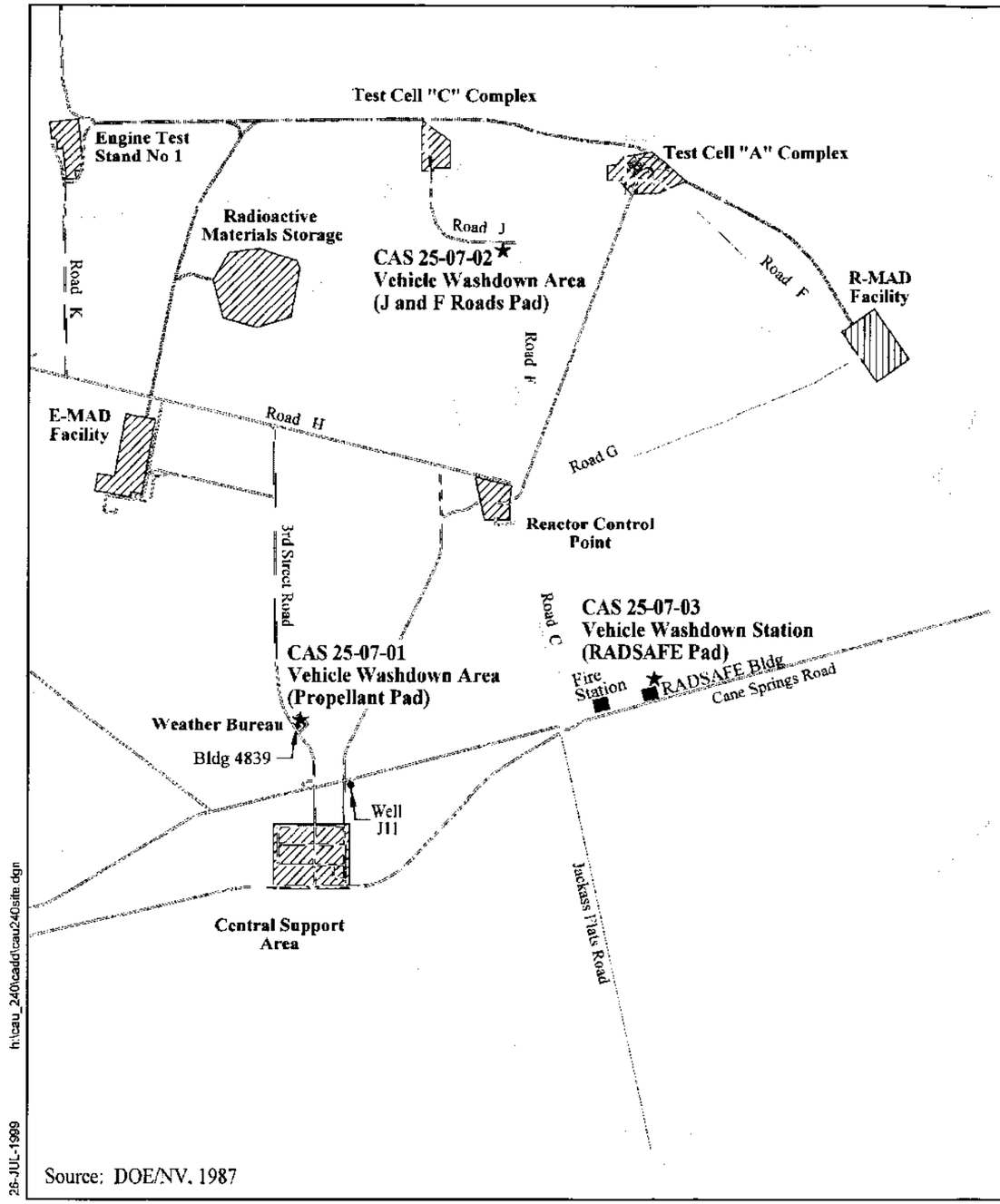


Figure 1-1
Nevada Test Site



Corrective Action Unit	Corrective Action Site	CAS Description
240	25-07-01	Vehicle Washdown Area
240	25-07-02	Vehicle Washdown Area
240	25-07-03	Vehicle Washdown Station

Explanation

- Various Areas or Compounds
- Railtrack
- Road
- Road
- ★ Corrective Action Site
- ■ Buildings

Note

The size of the buildings have been exaggerated for clarity.

Scale

0 1000 2000 Feet

0 1 2 Kilometers

Figure 1-2
CAU 240, Area 25 Vehicle Washdown, Nevada Test Site

- Perform detailed and comparative evaluations of corrective action alternatives in relation to corrective action objectives and screening criteria.

- Recommend and justify a preferred corrective action alternative for each CAS within the CAU.

1.3 CADD Contents

This CADD is 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 field 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 the rationale for its selection based on the corrective action objectives and alternative screening criteria.

Section 5.0 - References: provides a list of all referenced documents.

Appendix A: *Corrective Action Investigation Report for CAU 240: Area 25 Vehicle Washdown, Nevada Test Site, Nevada.*

Appendix B: Cost estimates.

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 investigation activities conducted at CAU 240. For detailed investigation results, please refer to Appendix A.

2.1 Investigation Activities

From March 1 through March 17, 1999, corrective action investigation activities were performed as set forth in the CAIP (DOE/NV, 1999). The purpose of the investigation is described as follows:

- Identify the presence and concentrations of contaminants of potential concern (COPCs) at each CAS.
- Determine the vertical and lateral extent of COPCs.
- Provide sufficient information and data from which corrective action alternatives may be developed and evaluated in this CADD for each CAS.

Investigation activities were conducted at each CAS. These activities are summarized below:

CAS 25-07-01 (Propellant Pad)

- Collected a total of four background surface and near-surface samples from two undisturbed locations. These samples were analyzed for total *Resource Conservation and Recovery Act* (RCRA) metals; strontium-90; radioactive isotopes by gamma spectrometry; and isotopic uranium and plutonium.
- Field screened soil samples for volatile organic compounds (VOCs) and alpha/beta and gamma emitters.
- Collected a total of 16 surface and near-surface soil samples from 8 locations using a direct-push method (Geoprobe®). These samples were collected from 0 to 1 feet (ft) and 3 to 5 ft below ground surface (bgs). Fifteen of the samples were submitted for laboratory analyses.
- All nonbackground soil samples were analyzed for total VOCs; total semivolatile organic compounds (SVOCs); total polychlorinated biphenyls (PCBs); total pesticides; and radioactive isotopes by gamma spectrometry. Gamma spectrometry results did not exceed the preliminary action levels (PALs); therefore, analyses for isotopic uranium and plutonium were not performed.

CAS 25-07-02 (F and J Roads Pad)

- Conducted a video mole survey of the sewer pipe located in the gravel sump.

- Collected a total of four background surface and near-surface samples from two undisturbed locations. These samples were analyzed for total RCRA metals; strontium-90; radioactive isotopes by gamma spectrometry; and isotopic uranium and plutonium.

- Field-screened soil samples for VOCs and alpha/beta and gamma emitters.

- Collected a total of 26 surface, near-surface, and subsurface soil samples from 12 locations using a direct-push method (Geoprobe®). These samples were collected from 0 to 1 ft and 3 to 5 ft bgs. Samples were also collected at 5 to 7 ft and 7 to 9 ft bgs using a Geoprobe® at two locations where field-screening results exceeded field-screening levels. Twenty-nine samples were submitted for laboratory analyses.

- Collected a total of six soil samples from three locations at the F and J Roads Pad using a backhoe. These samples were collected from 0 to 1 ft and 1 to 2 ft below the gravel/soil interface in the sump. The samples were submitted for laboratory analyses.

- All nonbackground soil samples were analyzed for total VOCs; total SVOCs; total RCRA metals; total PCBs; total pesticides; total petroleum hydrocarbons (TPH) as diesel/waste oil; strontium-90; radioactive isotopes by gamma spectrometry; and isotopic uranium and plutonium if gamma spectrometry results exceeded PALs.

CAS 25-07-03 (RADSAFE Pad)

- Conducted a video mole survey of the asbestos-cement pipe located at the northwest corner of the pad and the pipe from the metal vault at the northeast corner of the concrete pad.

- Collected a total of four background surface and near-surface soil samples from two undisturbed locations. These samples were analyzed for total RCRA metals; strontium-90; radioactive isotopes by gamma spectrometry; and isotopic uranium and plutonium.

- Field screened soil samples for VOCs and alpha/beta and gamma emitters.

- Collected a total of 19 surface and near-surface soil samples from 9 locations at the RADSAFE Pad using a direct-push method (Geoprobe®). These samples were collected from 0 to 1 ft and 3 to 5 ft bgs. The samples were submitted for laboratory analyses.

- Nonbackground soil samples were analyzed for some or all of the following: total VOCs; total SVOCs; total RCRA metals; total PCBs; total pesticides; TPH as diesel/waste oil; and

radioactive isotopes by gamma spectrometry. Gamma spectrometry results did not exceed the PALs; therefore, analyses for isotopic uranium and plutonium were not performed.

2.2 Results

The corrective action investigation analytical results indicated the following:

- All total VOCs, total SVOCs, PCBs, and pesticides results were below the PALs outlined in the CAIP (DOE/NV, 1999) at all CASs.

- Total petroleum hydrocarbon concentrations exceeded the NDEP action level of 100 milligrams per kilogram (mg/kg) for diesel around the perimeter of the concrete decontamination pad at F and J Roads Pad. The TPH action level was not exceeded at the other two CASs.

- Reported levels for all total RCRA metal samples (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) were below the PALs established in the CAIP (DOE/NV, 1999) except for arsenic. Arsenic was detected above the PAL of 3.0 mg/kg in most of the samples analyzed. The arsenic concentrations for the samples analyzed ranged from 1.9 to 10.2 mg/kg. Although these concentrations exceed the PAL for arsenic, these concentrations are not unusual for this portion of the state of Nevada; therefore, these concentrations do not imply contamination and arsenic is not a contaminant of concern (COC).

- Radiological results for the Propellant Pad and the RADSAFE Pad are considered not to be statistically different from their respective established background levels and; therefore, are within the PALs and radionuclides are not considered COCs.

- Radiological results from the F and J Roads Pad indicated that two samples had concentrations above established background levels and; therefore, are above PALs. Sample VWDFJ011 had a strontium-90 concentration of 6.9 ± 1.3 picocuries per gram (pCi/g). Sample VWDFJ013 had cesium-137 and strontium-90 concentrations of 14.7 ± 1.6 pCi/g and 12.5 ± 2.3 pCi/g, respectively. All other results, including the isotopic uranium and plutonium results for sample VWDFJ013, are considered not to be statistically different from their respective established background levels and; therefore, are below PALs.

Details of the methods used and results found during the investigation are presented in Appendix A. Based on these results, the concentrations and extent of COCs at CAU 240 (see Figure 2-1) have been adequately identified to develop and evaluate corrective action alternatives.

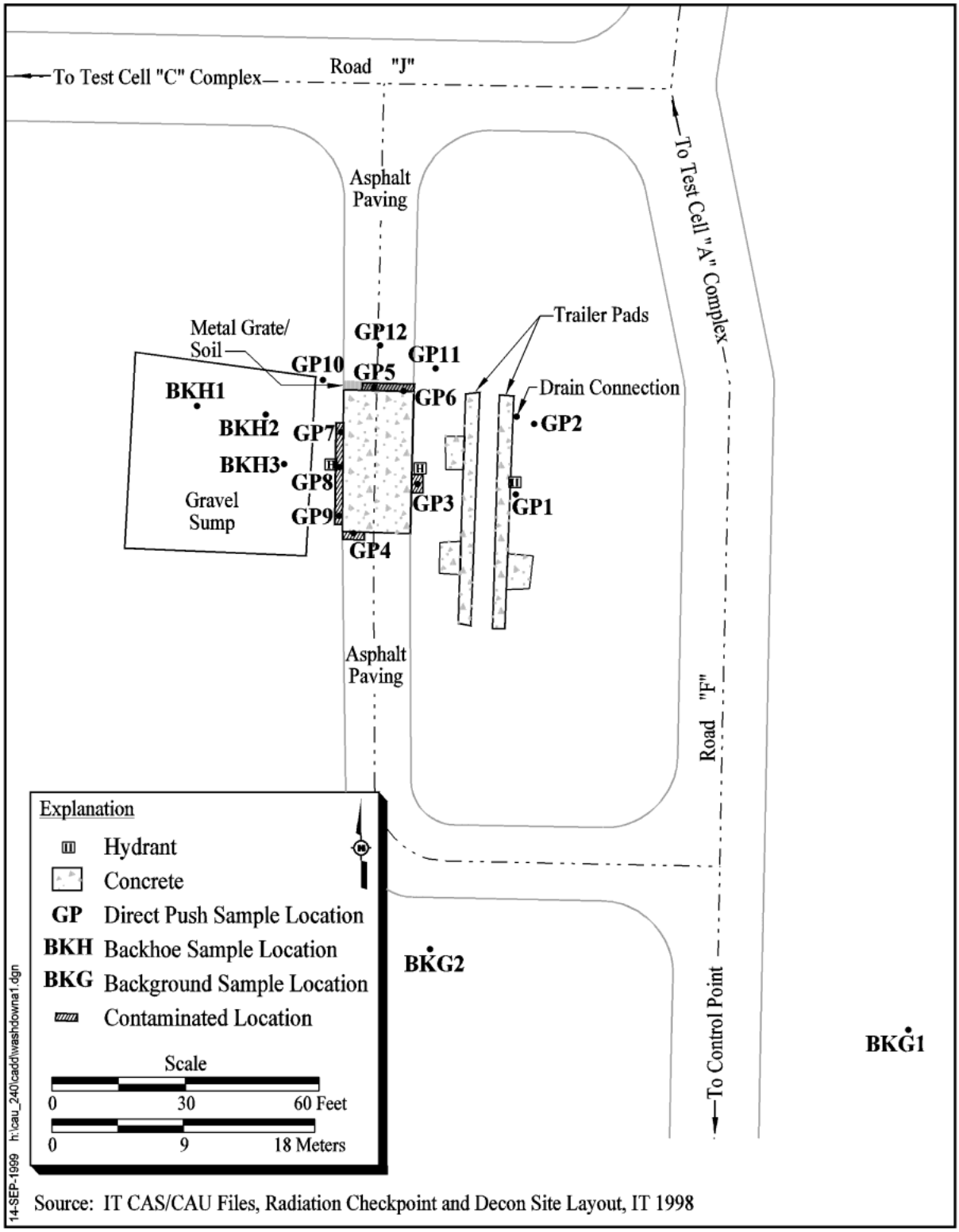


Figure 2-1
Contamination Locations at CAS 25-07-02, Vehicle Washdown Area (F and J Roads Pad), Area 25, Nevada Test Site

2.3 Need for Corrective Action

Analytes detected during the corrective action investigation were evaluated against PALs to determine COCs for CAU 240. There were no COCs identified at CAS 25-07-01, Propellant Pad, or CAS 25-07-03, RADSAFE Pad, so there is no need for corrective action at these CASs.

The TPH-diesel and radiological results from the F and J Roads Pad exceeded PALs. Based on the identification of COCs above PALs at this CAS, 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 *Nevada Administrative Code* (NAC) 445A (NAC, 1997b).

The estimated volume of impacted soil is 19 cubic yards (yd^3) at the F and J Roads Pad. The contamination extends to a maximum depth of 6 ft vertically and around the perimeter of the concrete pad (Figure 2-1).

There are no site-specific characteristics that will constrain remediation at the F and J Roads Pad.

3.0 Evaluation of Alternatives

The purpose of this section is to present the corrective action objectives for the F and J Roads Pad, 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

The corrective action objectives are media-specific goals for protecting human health and the environment. Based on the potential exposure pathways (see Section 3.1.2), the following corrective action objectives have been identified for the F and J Roads Pad:

- Prevent or mitigate exposure to surface and near-surface soil containing COCs at concentrations exceeding PALs as defined in the CAIP (DOE/NV, 1999).
- Prevent spread of COCs beyond the CAS.

3.1.1 Contaminants of Concern

Contaminants of potential concern were determined in the Data Quality Objective (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, and would therefore be COCs for CAU 240 that must be addressed by corrective action. Based on the results of this evaluation, TPH-diesel and radionuclides were identified as COCs for the F and J Roads Pad.

3.1.2 Potential Exposure Pathways

As identified in the CAIP, the future use for the F and J Roads Pad is assumed to include light industrial, industrial, educational tours, research, and support sites. As part of the CAIP (DOE/NV, 1999), a conceptual model for CAU 240 was developed which identified the potential exposure mechanism as disturbance of contaminated soil by site workers. This implies a potential exposure pathway through ingestion of, inhalation of, and dermal contact with contaminated soil under industrial scenarios. Site workers could potentially be exposed to contaminated soil during general maintenance or construction and maintenance of underground utilities. The well (J-11)

nearest the F and J Roads Pad is located approximately 14,900 ft southwest of the F and J Roads Pad. The depth to groundwater at this well is approximately 1,040 ft bgs (USGS, 1993). These factors, along with others presented in Section 3.3, support the determination that contaminant migration to groundwater is not considered to be an exposure pathway.

3.2 Screening Criteria

The screening criteria used to evaluate and select the preferred corrective action alternatives are identified in the U.S. Environmental Protection Agency (EPA) *Guidance on RCRA Corrective Action Decision Documents* (EPA, 1991) and the *Final RCRA Corrective Action Plan* (EPA, 1994).

Corrective action alternatives will be evaluated based on four general corrective action standards and five remedy selection decision factors. 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 following text describes the corrective action standards used to evaluate the corrective action alternatives.

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 protective measures that

are necessary. These measures may or may not be directly related to media cleanup, source control, or management of wastes. The corrective action alternatives are evaluated for the ability to meet corrective action objectives as defined in Section 3.1.

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 9 Preliminary Remediation Goals (PRGs), which are derived from the Integrated Risk Information System, are the basis for establishing the PALs for chemical contaminants under NAC 445A.2272 (NAC, 1997b). The PAL for petroleum substances in soil is 100 mg/kg in accordance with NAC 445A.2272 (NAC, 1997b). The PALs for radiological contaminants are based on background concentrations. Laboratory results above PALs indicate the presence of COPCs at levels that may require corrective action.

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 applicable state and federal regulations (e.g., *Nevada Revised Statutes* [NRS] 459.400 - 459.600 "Disposal of Hazardous Waste" [NRS, 1995]; 40 *Code of Federal Regulations* [CFR] 260 - 282 "RCRA Regulations" [CFR, 1998]; NAC 444, "Sanitation" [NAC, 1997a]; and NAC 459.9974, "Disposal and Evaluation of Contaminated Soil" [NAC, 1997c]). 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 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 implementation
- Environmental impacts that may result from 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 after the corrective action alternative has been implemented. The primary focus of this evaluation is on the extent and effectiveness of the controls that may be required to manage the risk posed by treatment residuals and/or untreated wastes.

Feasibility

The feasibility criterion 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: These 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: These 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 the F and J Roads Pad:

- Alternative 1 - No Further Action
- Alternative 2 - Clean Closure by Excavation and Disposal

Other technologies, such as administrative controls (closure in place) and partial excavation, were considered. Administrative controls were not considered to be protective because the COCs are located at the surface. The small volume of contaminated material and the surface location resulted in these alternatives not receiving further consideration in this CADD.

The following evaluation of NAC 445A.227 (2) (a-k) (NAC, 1997b) supports the protection of groundwater from COCs at the F and J Roads Pad:

a. Depth to groundwater at the nearest well (J-11) is approximately 1,040 ft bgs (USGS, 1993). This well is located 14,900 ft southwest of the F and J Roads Pad. Groundwater flow is generally to the southwest and may discharge at Ash Meadows (SNPO, 1970). Field screening and analytical data indicate that COCs are confined primarily from 0 to 5 ft bgs. This indicates minimal vertical migration has occurred in the past and, with the removal of man-made driving forces, vertical migration will be negligible in the future.

b. The distance to the nearest active water-supply well, Well J-12, is approximately 5.5 mi northwest of the F and J Roads Pad (DOE/NV, 1996a). Well J-12 is primarily used to provide potable water for Area 25. The groundwater flow direction is generally to the southwest (Laczniak et al., 1996).

c. Soil at the F and J Roads Pad is silty-to-sandy gravels. No geotechnical data were collected because COCs were assumed to occur near the ground surface. Field screening and analytical data indicate that COCs are confined primarily from 0 to 5 ft bgs.

d. Average annual precipitation for valleys in the South-Central Great Basin ranges from 3 to 6 inches [in.] (Winograd and Thordarson, 1975). Annual evaporation is roughly 5 to 25 times the annual precipitation (Winograd and Thordarson, 1975). The high evaporation and low precipitation rates create a negative water balance for the area; therefore, no driving force associated with precipitation is available to mobilize COCs vertically.

e. The types of regulated substances released are diesel-range petroleum hydrocarbons and limited radionuclides. Downward migration of COCs is slowed by the following parameters:

    - Volume of release - small volumes of COCs were released over a long period of time rather than a large volume over a short duration.

- Soil saturation - the soil tends to be very dry, especially near the surface where the COCs are concentrated.

- Soil particle adsorption/desorption - the petroleum hydrocarbons and radionuclides tend to adsorb to the soil particles with little desorption as suggested by the limited vertical migration of COCs.

f. The lateral extent of contamination is defined by the area immediately surrounding the concrete decontamination pad. The vertical extent of contamination is primarily confined to 5 ft bgs based on field screening and analytical data.

g. Presently, the F and J Roads Pad is located on a government-controlled facility. The NTS is a restricted area that is guarded on a 24-hour, 365-day-per-year basis; unauthorized personnel are not admitted to the facility. Future use of the F and J Roads Pad is assumed to include light industrial, industrial, educational tours, research, and support sites.

h. Preferred routes of vertical migration are nonexistent since the sources have been eliminated and driving forces are not viable. Currently, the area is controlled by fence and rope to prevent activities from further contributing to the lateral movement of the COCs; however, surface drainage may mobilize the contaminated surface soil down gradient. Precipitation events are ephemeral and highly variable in the arid environment. Wind could also mobilize the contaminants located at the surface.

i. Facility operations at the F and J Roads Pad are presently terminated (i.e., decontamination activities were last conducted in the 1970s).

j. The potential for a hazard related to fire, vapor, or explosion is nonexistent for the COCs at the F and J Roads Pad.

k. No other site-specific factors are known at this time.

Based on this evaluation, 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 will be implemented. This alternative is a baseline case with which to compare and assess the other corrective action alternative's ability to meet the corrective action standards. This alternative does not meet the corrective action objectives for the F and J Roads Pad because no actions are taken to prevent

exposure to the COCs or to prevent continued spread of contamination. This alternative will not be compared to the other alternatives using the selection decision factors for these sites.

3.3.2 Alternative 2 - Clean Closure by Excavation and Disposal

Alternative 2 consists of excavating and disposing of the concrete decontamination pad and the soil with TPH-diesel concentrations greater than 100 mg/kg. The TPH-diesel contaminated soil from the northern and southern sides of the decontamination pad should be segregated from all other excavated material due to the associated low-level radioactive contamination. All excavated material will be disposed of in an appropriate disposal facility. The excavated areas will be returned to surficial conditions compatible with existing operations. The excavation will be backfilled with clean borrow soil.

Under this alternative, soil will be excavated to a depth of 2 ft bgs at the perimeter of the former decontamination pad. Soil in the southwest corner of the pad will be excavated to a depth of 6 ft bgs. Activities will include excavation and proper disposal of approximately 14 yd^3 of TPH contaminated soil and 5 yd^3 of TPH and radionuclide contaminated soil. Verification sampling will be performed in approximately the same locations as those identified in the investigation as having COC concentrations exceeding PALs. This will ensure complete removal of TPH contaminated soil at concentrations exceeding the PALs.

The F and J Roads Pad will be closed in accordance with NAC 445A (NAC, 1997b) as described in this section.

3.4 Evaluation and Comparison of Alternatives

The general corrective action standards and remedy selection decision factors described in Section 3.2 were used to conduct detailed and comparative analyses of each corrective action alternative. The advantages and disadvantages of each alternative were assessed to select a preferred alternative for the F and J Roads Pad. Table 3-1 presents a summary of the detailed analysis of the alternatives. Table 3-2 presents the comparative analysis of alternatives. Cost summaries are provided in Appendix B.

Table 3-1
Detailed Evaluation of Alternatives
(Page 1 of 2)

Evaluation Criteria	Alternative 1 No Further Action	Alternative 2 Clean Closure by Excavation and Disposal
Corrective Action Standards		
Protection of Human Health and the Environment	• Does not meet corrective action objective of preventing or mitigating exposure to the contaminated soil zone (surface and near-surface). • Does not prevent spread of COCs. • NAC 445A.227 (2) (a-k) analysis shows the contaminants are not expected to impact groundwater. • No worker exposure is associated with implementation. • Does not address the environmental persistence of contaminants.	• Meets corrective action objectives by removal of contaminated soil. • Low worker exposure associated with fugitive dust and/or contact with impacted media. • Low risk to public because of remote location and controlled access to the NTS. • NAC 445A.227 (2) (a-k) analysis shows the contaminants are not expected to impact groundwater. • Moving contaminated soil to an appropriate disposal facility addresses the persistence of contaminants.
Compliance with Media Cleanup Standards	• Does not comply with media cleanup standards because TPH remain at levels above the PAL, and no corrective action is taken to prevent inadvertent intrusion. • NAC 445A.227 (2) (a-k) analysis shows the contaminants are not expected to impact groundwater.	• Complies with media cleanup standards because soil containing TPH at concentrations exceeding the PAL will be excavated and disposed of at an appropriate facility. • Removal of TPH concentrations exceeding the PAL will be verified with confirmation sampling. • NAC 445A.227 (2) (a-k) analysis shows the contaminants are not expected to impact groundwater.
Control the Source(s) of Release	• The sources (decontamination operations) to the F and J Roads Pad have been discontinued.	• The sources (decontamination operations) to the F and J Roads Pad have been discontinued.
Comply with Applicable Federal, State, and Local Standards for Waste Management	No waste generated	All waste (primarily contaminated soil, concrete, and disposable personal protective equipment) will be handled and disposed of in accordance with applicable standards.
Remedy Selection Decision Factors		
Short-Term Reliability and Effectiveness	Not evaluated	• Low risk to workers associated with fugitive dusts and heavy equipment. • Public protected by remote location and NTS site access controls. • Implementation should not require an extended period of time.

Table 3-1
Detailed Evaluation of Alternatives
(Page 2 of 2)

Evaluation Criteria	Alternative 1 No Further Action	Alternative 2 Clean Closure by Excavation and Disposal
Reduction of Toxicity, Mobility, and/or Volume	Not evaluated	• Clean closure would effectively eliminate associated toxicity, mobility, and volume of wastes at the F and J Roads Pad. • Proper disposal of the waste after removal would result in ultimate reduction of mobility.
Long-Term Reliability and Effectiveness	Not evaluated	• All risks will be eliminated upon completion. • No maintenance required. • F and J Roads Pad clean closed. • Moving contaminated soil to an appropriate disposal facility addresses the persistent adsorption of contaminants to the soil.
Feasibility	Not evaluated	• Closure of F and J Roads Pad is easily implemented.
Cost	$0	$105,835

Table 3-2
Comparative Evaluation of Alternatives

Evaluation Criteria	Comparative Evaluation
Corrective Action Standards	
Protection of Human Health and the Environment	Alternative 2 meets corrective action objectives; Alternative 1 does not. No worker exposure to risks are associated with Alternative 1. Low risks are associated with Alternative 2. NAC 445A.227 (2) (a-k) analysis shows the contaminants are not threatening groundwater.
Compliance with Media Cleanup Standards	Alternative 1 does not comply with media cleanup standards. Alternative 2 meets media cleanup standards by removing soil containing TPH at concentrations exceeding the PAL and eliminating exposure pathways at the site.
Control the Source(s) of the Release	The sources (decontamination operations) to the F and J Roads Pad have been discontinued.
Comply with Applicable Federal, State, and Local Standards for Waste Management	Alternative 1 does not generate waste. Alternative 2 will generate waste that will be handled in accordance with applicable standards.
Remedy Selection Decision Factors	
Short-Term Reliability and Effectiveness	Low risks are associated with Alternative 2.
Reduction of Toxicity, Mobility, and/or Volume	Alternative 2 results in a reduction of all three characteristics at the F and J Roads Pad.
Long-Term Reliability and Effectiveness	Residual risk at the F and J Roads Pad is nonexistent for Alternative 2.
Feasibility	Alternative 2 is feasible. Alternative 2 requires heavy equipment, operating personnel, and disposal of wastes.
Cost	The cost for Alternative 1 is $0. The estimated cost for Alternative 2 is $105,835 for excavation and disposal.

4.0 Recommended Alternative

Based on the results of the detailed and comparative analysis of the potential corrective action alternatives presented in this document, the preferred corrective action alternative selected for implementation at the F and J Roads Pad is Alternative 2, Clean Closure by Excavation and Disposal. Alternative 2 was chosen for the following reasons:

- It minimizes health risks by preventing public and worker access to the contaminated soil at the F and J Roads Pad by moving contaminated soil to an appropriate disposal facility.
- It complies with standards for management of wastes because all waste will be managed in accordance with federal, state, and local requirements.
- It eliminates long-term risks by moving contaminated soil to an appropriate disposal facility.
- It is easily implemented with standard construction equipment utilized for removal of contaminated soil.
- It provides a cost-effective method for achieving protection and meeting closure 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 the site and will eliminate potential future exposure pathways to the contaminated soils at the F and J Roads Pad.

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

Based on the evaluation in this CADD, clean closure of the F and J Roads Pad by excavation and disposal is the preferred closure method.

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Appendix A

Corrective Action Investigation Report for CAU 240: Area 25 Vehicle Washdown, Nevada Test Site, Nevada

A.1.0 Introduction

This appendix presents corrective action investigation activities and analytical results for Area 25 Vehicle Washdown, CAU 240, at the NTS. The Area 25 Vehicle Washdown CAU includes CAS 25-07-01, Vehicle Washdown Area (Propellant Pad); CAS 25-07-02, Vehicle Washdown Area (F and J Roads Pad); and CAS 25-07-03, Vehicle Washdown Station (RADSAFE Pad). The corrective action investigation was conducted in accordance with the CAIP (DOE/NV, 1999) as developed under the FFACO (1996).

The Area 25 Vehicle Washdown CASs were investigated because limited process knowledge indicated that reactor parts, parts associated with reactors, and beagles may have been decontaminated at these facilities. Preliminary analytical results indicated the presence of pesticides in the surface soil at these sites. Additional information regarding the history of each site, planning, and the 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 were as described below:

- Identify the presence and the vertical and lateral extent of COPCs.
- Provide sufficient information and data to develop appropriate corrective action alternatives for the Area 25 Vehicle Washdown.

The selection of soil sample locations for the three sites was based on site conditions and the strategy developed during the DQO process as outlined in the CAIP (DOE/NV, 1999).

A.1.2 Report Content

This report contains information and data in sufficient detail to support the selection of a preferred corrective action alternative in the CADD. The contents of this report 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 from the investigation sampling.
- 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 is a summary of the investigation results.
- Section A.6.0 provides the cited references.

The complete field documentation and laboratory data, including Field Activity Daily Logs, Sample Collection Logs, Analysis Request/Chain-of-Custody Forms, soil sample descriptions, laboratory certificates of analyses, analytical results, and surveillance results are retained in project files as either hard copy files or electronic media.

A.2.0 Field Investigation and Sampling Activities

The field investigation and sampling activities were conducted from March 1 through March 17, 1999, at the three CASs within CAU 240, Area 25 Vehicle Washdown.

Sampling activities at CAS 25-07-01 (Propellant Pad) were performed using a direct-push method (Geoprobe®) for the collection of soil samples from 0 to 1 ft bgs (surface) and 3 to 5 ft bgs (near-surface). The 10 planned samples were collected and sent to the laboratories for analyses. In step-out samples, the first of the two consecutive, nondetect intervals was sent to the laboratories for analyses.

At CAS 25-07-03 (RADSAFE Pad), a video mole survey was conducted to determine the condition and extent of the asbestos-cement pipe located at the northwest corner of the concrete pad and to determine the condition and extent of the pipe from the metal vault at the northeast corner of the concrete pad. The 18 planned samples were collected from 0 to 1 ft and 3 to 5 ft bgs using a direct-push method (Geoprobe®) and submitted to the laboratories for analyses. Step-outs were not necessary at this CAS.

At CAS 25-07-02 (F and J Roads Pad), a video mole survey was conducted to determine the condition and extent of the pipe from the pad to the gravel sump. The 16 planned samples outside of the gravel sump were collected from 0 to 1 ft and 3 to 5 ft bgs using a direct-push method (Geoprobe®) and submitted to the laboratories for analyses. The six planned samples in the gravel sump were collected from 0 to 1 ft and 1 to 2 ft below the gravel/soil interface using a backhoe. In step-out samples, the first of the two consecutive, nondetect intervals was sent to the laboratories for analyses.

The field investigation and sampling program 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, 1998b). The samples were collected and documented by following approved protocols and procedures for sampling, field activity and sample collection documentation, decontamination, chain of custody, shipping, and radiation survey as indicated in the CAIP (DOE/NV, 1999). Quality control samples (e.g., field blanks, equipment rinsate blanks, trip blanks, and sample duplicates) were collected as required by the *Industrial Sites*

Quality Assurance Project Plan (DOE/NV, 1996) and approved procedures. During field activities, waste minimization practices were followed according to approved procedures, including segregation of the waste by waste stream.

A.2.1 Site Descriptions and Conditions

Area 25 Vehicle Washdown is located in the Nuclear Rocket Development Station (NRDS) area on the NTS (see Figure 1-2 of the CADD). The three CASs are located in an area that is relatively flat.

Propellant Pad is located in the Central Propellant Support Area (CPSA), east of Building 4839, along 2nd Street. Running water from a faucet located on the east side of the concrete pad was observed at the beginning of the investigation. The concrete pad is surrounded by soil to the east and west sides and has an asphalt road to the south and north of the concrete pad.

The RADSAFE Pad is located east of the intersections of Jackass Flats Road and Cane Springs Road, on the north side of Cane Springs Road, directly behind the RADSAFE Building (Building 3152). The RADSAFE Pad site consists of a concrete pad with a drain/trench covered by a metal grate located along the north edge of the concrete pad. A cleanout pipe is located near the northeast corner of the concrete pad. This pipe is connected to the asbestos-cement pipe located at the northwest corner of the concrete pad which extends approximately 100 ft northwest of the concrete pad. At the end of this pipe is a dry well consisting of a gravel pit. Located along the south edge of the RADSAFE Pad is a concrete pad historically used for drum storage and an associated ramp.

The F and J Roads Pad is located at the southwest corner of the intersection of the F and J Roads. The site consists of a concrete washdown pad, a gravel sump along the west side of the pad, two concrete trailer pads located east of the concrete pad, and remaining piping system. Prior to the start of sampling activities, the pad and eastern side of the gravel sump was fenced and posted as a soil contamination area.

During the investigation, the weather conditions at the sites were generally favorable and varied from sunny to intermittent cloudiness and light to strong winds. Strong winds impacted one day of sampling activities during the field investigation at F and J Roads Pad.

Soil conditions at these sites made sample collection difficult. The very soft and fine materials encountered (i.e., silts and sands) caused sandlocking during core retrieval, and caused the direct-push holes to collapse. At the greater depths (above 5 ft), very compacted soils were encountered, causing difficulty in the penetration of the Geoprobe® core barrels. In addition to sample collection difficulties, road closures, personnel training, and health and safety concerns impacted the schedule of this field investigation.

A.2.2 Investigation Logistics

This section describes sample collection and investigation activities for each of the CASs in CAU 240, Area 25 Vehicle Washdown.

A.2.2.1 Sample Locations

The sampling locations for each site were selected based on process knowledge, engineering drawings, interviews, and in the case of step-outs, field-screening results. The planned sample locations are shown in the CAIP (DOE/NV, 1999). Some locations vary slightly from those planned because of field observations or conditions encountered during sampling. Actual sample locations are shown in Figure A.2-1, Figure A.2-2, and Figure A.2-3.

A.2.2.2 Excavation Activities

Excavation activities were performed with a backhoe to expose the junction of the asbestos-cement pipe and the cleanout pipe, and to expose the dry well location at the RADSAFE Pad. In addition, the backhoe was used to perform backhoe bucket sampling at the F and J Roads Pad gravel sump. The backhoe was also used to retrieve a core barrel from depth at the F and J Roads Pad.

A.2.2.3 Video Survey Activities

Video surveys were conducted at the RADSAFE Pad and the F and J Roads Pad. These surveys were conducted to identify obvious breaches, unexpected branchings (i.e., tie-ins or off-shoots), and open joints.

The surveys at both the RADSAFE Pad and F and J Roads Pad were inconclusive. The pipes at the RADSAFE Pad were found to be full of mouse nests and droppings. Due to the health risks

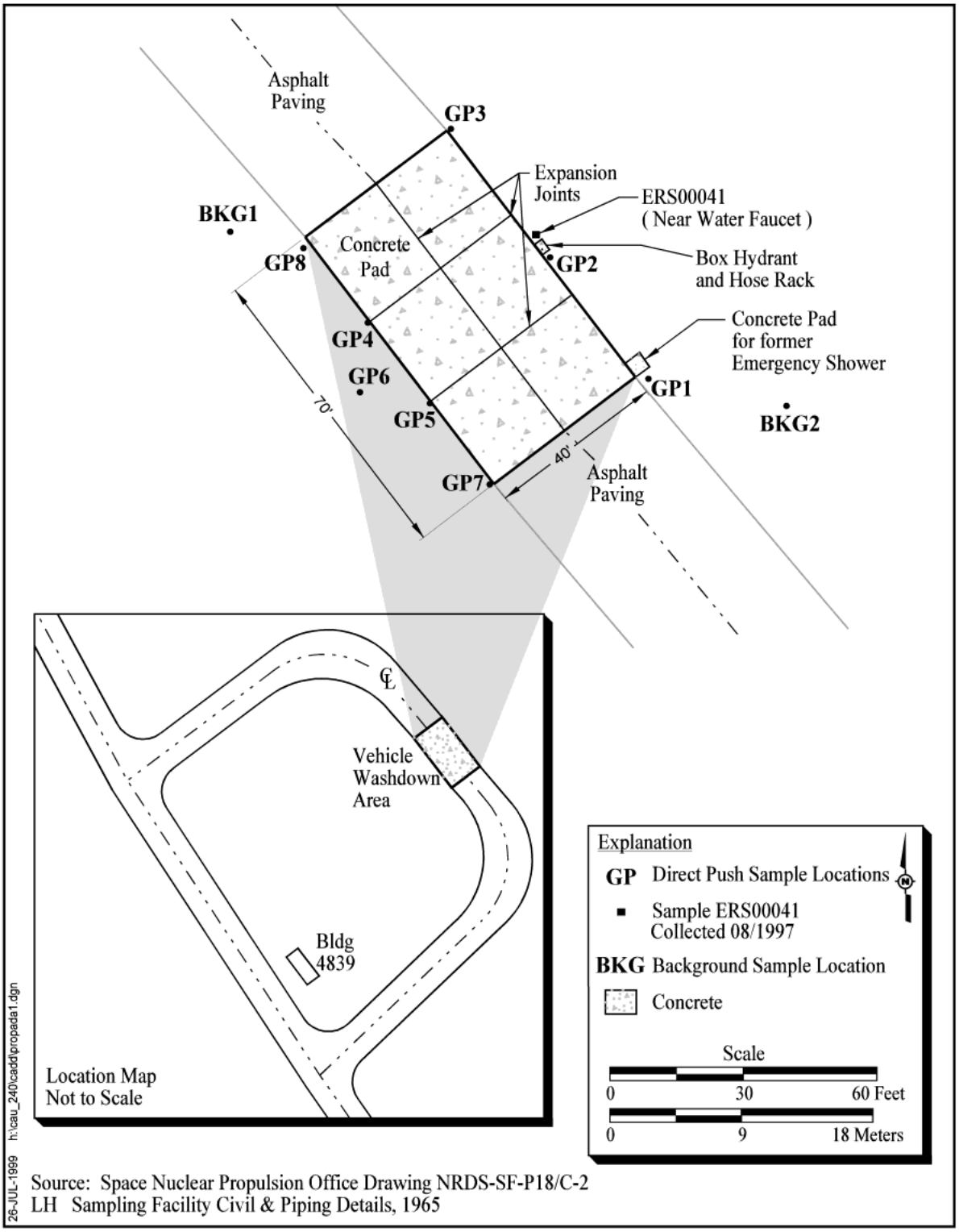
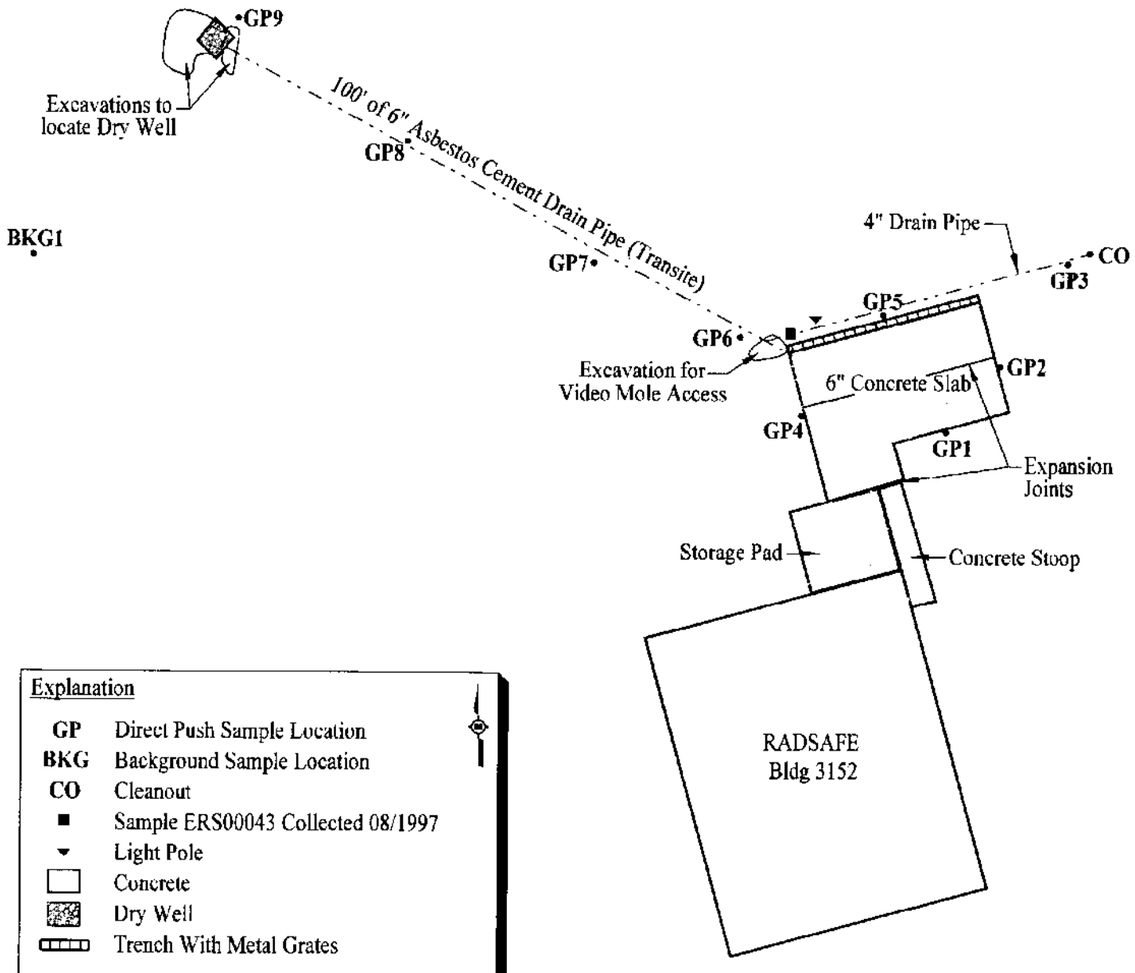
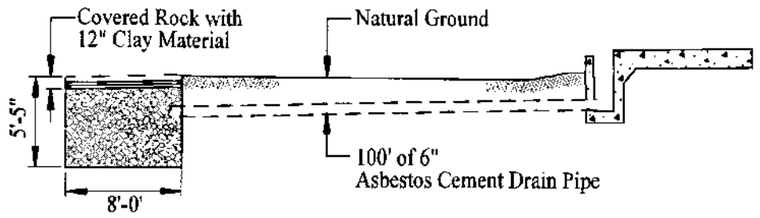
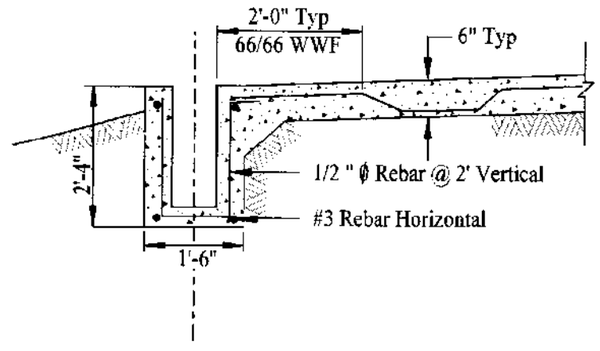


Figure A.2-1
Sample Locations at CAS 25-07-01, Vehicle Washdown Area (Propellant Pad), Area 25, Nevada Test Site





Dry Well and Trench Section
Not To Scale



Concrete Washdown Slab and Trench Detail
Not To Scale

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28-JUL-1999

Source: U.S. Atomic Energy Commission, Drawing RE-3152-C2 Structure 3152-RADSAFE Bldg. Miscellaneous Layout and Details, 1961

Figure A.2-2
Sample Locations at CAS 25-07-03, Vehicle Washdown Station (RADSAFE Pad), Area 25, Nevada Test Site

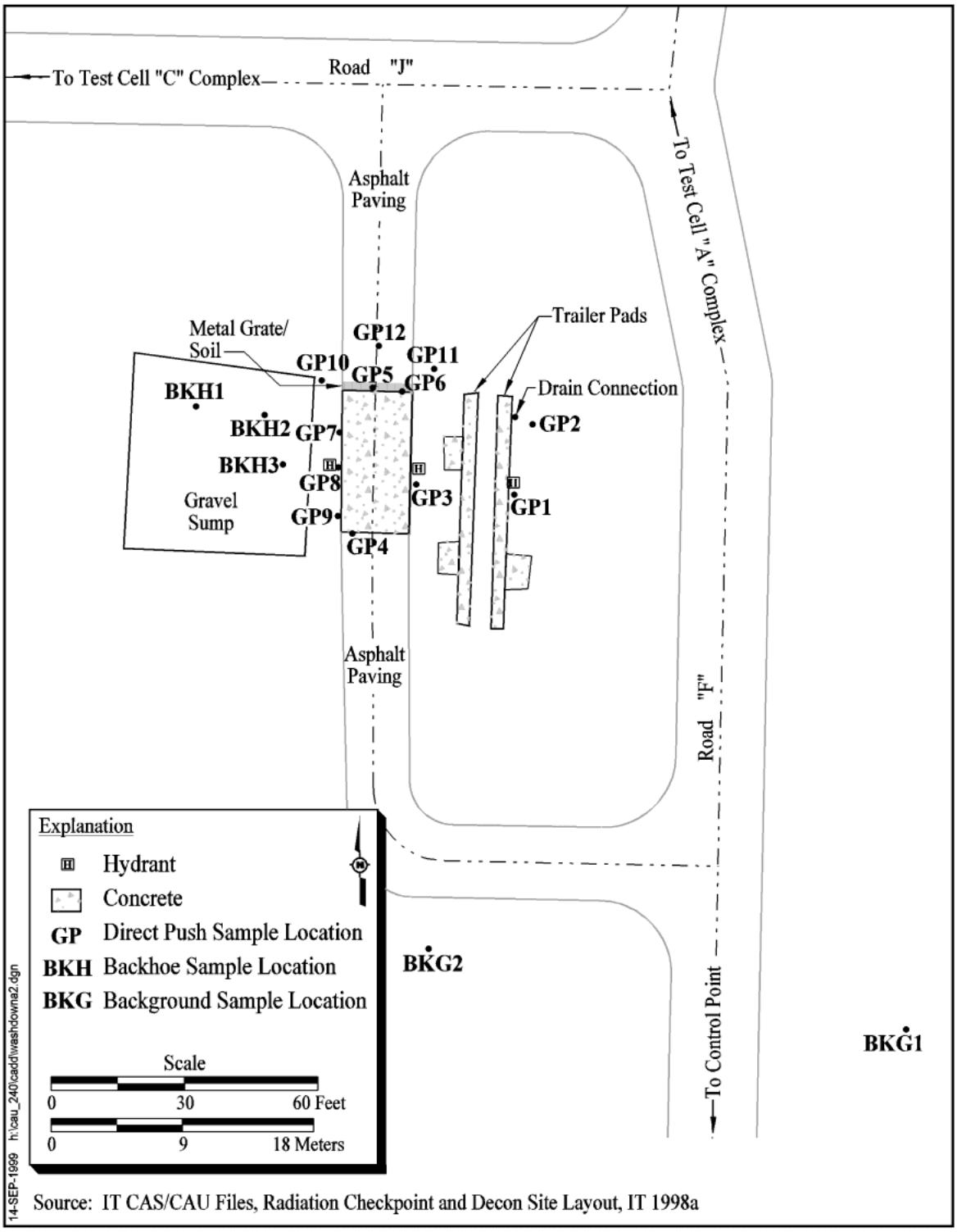

Figure A.2-3
Sample Locations at CAS 25-07-02, Vehicle Washdown Area (F and J Roads Pad), Area 25, Nevada Test Site

associated with mouse droppings (hantavirus), the video mole survey at this pipe was discontinued. The drain pipe was observed for about 10 ft and then found to be full of soil, blocking the path and view of the camera survey. At the F and J Roads Pad, a survey was attempted from the sewer pipe located in the gravel sump towards the eastern edge of the CAS. Using the video camera, it was discovered that the diameter of the sewer pipe became significantly smaller after approximately 38 ft, thereby restricting the progress of the video camera equipment.

A.2.2.4 Direct-Push Sampling

A direct-push method (Geoprobe®) was used to collect samples at the Area 25 Vehicle Washdown CASs from 0 to 1 ft, 3 to 5 ft, 5 to 7 ft, and 7 to 9 ft bgs. Soil samples were collected using a Macrocore® sampler (2 in. outside diameter) with stainless-steel or polyvinyl chloride (PVC) liners.

At the conclusion of the field investigation, all remaining voids from direct-push sampling were backfilled with bentonite.

A.2.2.5 Field-Screening

Field-screening activities were performed as specified in the CAIP (DOE/NV, 1999).
Field-screening levels were determined for VOCs (headspace method using a photoionization detector and a water bath at constant temperature), and for radiation (alpha and beta using an Electra and gamma using a sodium iodide detector). The field-screening level for VOC headspace was established at 20 parts per million (ppm) or 2.5 times background, whichever was greater. The field-screening level for radiation was defined as the mean background activity level plus two times the standard deviation of 20 background sample readings. The radiological field-screening levels were determined prior to the start of field activities. Established field-screening levels were used to guide sample collection both laterally and vertically and to provide a basis for the selection of additional environmental samples for laboratory analyses.

A.2.3 Sample Collection

Sample collection was performed as specified in the CAIP (DOE/NV, 1999). Samples were collected as planned from the 0 to 1 ft and 3 to 5 ft bgs intervals. When field-screening results exceeded field-screening levels, samples were collected at the 5 to 7 ft and the 7 to 9 ft bgs intervals or until two

consecutive samples were collected with field-screening results below field-screening levels. Sample collection was also performed within the gravel sump of the F and J Roads Pad using the backhoe method. At the gravel sump, samples were collected at the 0 to 1 ft and 1 to 2 ft interval. The depth interval at each sample location varied depending on whether the location was used for identification of lateral and/or vertical extent of the contaminants of potential concern (for example, at some locations only the 0 to 1 ft and 3 to 5 ft intervals were sampled) and at other locations additional intervals (for example, the 5 to 7 ft and 7 to 9 ft) were sampled. Soil descriptions performed by the sampling team were recorded on Sample Collection Logs which are located in the project files.

The samples were removed from the liners for the aforementioned intervals and placed into the appropriate containers. The VOC and headspace soil samples were immediately placed into jars and sealed. The headspace sample, used for field-screening purposes, was then placed in a water bath. The soil samples for the SVOCs, RCRA metals, PCBs, pesticides, and radionuclides analyses were homogenized in a steel bowl, containerized, and sealed.

A.2.3.1 CAS 25-07-01, Propellant Pad

Process knowledge indicated that prior activities at the Propellant Pad included sampling of gases and liquid gases as the dewars arrived at the NRDS from the supplier. Sampling was performed prior to releasing the gases and liquid gases to the test cells in the NRDS. Liquid gases and gases such as propane, helium, nitrogen, and oxygen may also have been sampled at the CPSA. The use of the Propellant Pad for sampling gases and liquid gases probably continued through 1973, until the nuclear rocket tests at the NRDS were terminated.

Nineteen surface and near-surface soil samples were collected from eight locations using the direct-push method. Sixteen soil samples were sent to off-site laboratories for analyses (Table A.3-1). Ten samples were planned to be submitted to the laboratories for this CAS. Two additional samples were submitted to the laboratories for analyses from the 5 to 7 ft intervals at the GP4 and GP5 locations as shown in Figure A.2-1. Three additional stepout samples (GP6, GP7, and GP8) were submitted to the laboratories for analyses from the 0 to 1 ft interval. The remaining three samples were collected but not analyzed. These samples were the second of two consecutive, nondetect intervals and since no contamination was detected above field-screening levels, only the first of the

two consecutive samples below field-screening levels were required to be submitted to the laboratories for confirmation of the nondetect field-screening readings.

A.2.3.2 CAS 25-07-03, RADSAFE Pad

Process knowledge indicated that the RADSAFE Building and Pad were originally designed as a radiation checkpoint and decontamination area for the NRDS and are believed to have been in operation from 1959, when the NRDS began operation, until the 1973 termination of the NRDS program. The washdown pad was originally intended to be a radiation control area and occasional decontamination facility. Vehicles reentering the test cell and reactor facilities were decontaminated at the RADSAFE Pad. Also, parts associated with reactor runs were believed to have been decontaminated at the RADSAFE Pad (Sorom, 1998).

Nineteen soil samples were collected (by direct-push) from nine locations (Figure A.2-2); all 19 of these samples were sent to an off-site laboratories for analyses (Table A.3-1). Field-screening results did not exceed field-screening levels for any of the samples collected at this CAS.

A.2.3.3 CAS 25-07-02, F and J Roads Pad

Process knowledge indicated that the F and J Roads Pad was used as a radiation checkpoint and decontamination site. Historical information regarding the operation of the F and J Roads Pad is limited. Interviews with former workers at the NRDS indicate that the site was operated by Pan American Corporation during the 1960s and early 1970s. Based on this information, the site is believed to have been used to decontaminate vehicles and possibly disassembled engine and reactor parts from Test Cell C. It is unknown how often this site was used. Due to a lack of visible drains leading from the pad to the gravel sump and the washdown pad sloping to the west towards the gravel sump, it is believed that the liquid from the decontamination activities flowed from the concrete pad into the gravel sump.

Twenty-six soil samples were collected (by direct-push) from 12 locations (Figure A.2-3); 29 of these samples were sent to off-site laboratories for analyses. Due to field-screening results exceeding field-screening levels, samples were collected from three step-out locations (GP10, GP11, and GP12), as well as four additional depth intervals at GP5 and GP6 (5 to 7 ft and 7 to 9 ft). Of these

four additional intervals, only the 5 to 7 ft interval at GP5 and GP6 was submitted to the laboratories (two samples) for analyses because this interval constituted the first of two consecutive, nondetect intervals. The step-out intervals were 0 to 1 ft and 3 to 5 ft. Of these additional six samples, only three were submitted to the laboratories for analyses, namely the 0 to 1 ft interval at each step-out. This interval constituted the first of two consecutive, nondetect intervals (Figure A.2-3).

Surface sampling at 0 to 1 ft and near-surface sampling at 1 to 2 ft was conducted using a backhoe bucket and hand tools (spoons, bowls etc.) in the gravel sump located at the F and J Roads Pad. The samples were collected from the center of the backhoe bucket after removing the top 1-in. layer of soil. These samples were analyzed for VOCs, SVOCs, RCRA metals, PCBs, pesticides, TPH-diesel/oil, and radionuclides (same analyses used for the samples collected using the direct-push method).

A.2.3.4 Background Sampling

Background surface and near-surface samples were collected from two undisturbed background locations at each CAS (see Figures A.2-1, A.2-2, and A.2-3). Analytical results of the background samples were used to evaluate environmental sample results and to support the corrective action at this CAU. Background samples were collected from 0 to 1 ft and 3 to 5 ft bgs using the direct-push method. Background samples were sent to the laboratories to be analyzed for RCRA metals, gamma emitters using gamma spectrometry, strontium-90, and isotopic uranium and plutonium as detailed in Table A.3-4 in Appendix A of the CAIP (DOE/NV, 1999).

A.2.4 Geology

Corrective Action Unit 240 is located in Jackass Flats. The Jackass Flats basin was formed by faulting of Paleozoic carbonate rocks. The Paleozoic rock and clastic sediment are approximately 22,000 ft thick and are overlain by welded and semiwelded ash flow and ash fall tuffs of Tertiary age, approximately 5,000 ft thick. The most prominent structural feature in Jackass Flats is a fault which trends northeast and is located west of Well J-11. Surface geology and soils in Area 25 consist of silty sand, ranging from fine sand to coarse sand and gravel. These types of soils are generally unstable and cohesionless. Other rock types in the surrounding area include shales, quartzites, and carbonates of Lower to Middle Cambrian age; carbonate and thin shale layers of Middle Cambrian to

Devonian age; and argillites, cherty limestones, and conglomerates of Devonian to Permian age. Soils in the area range from poorly sorted silt to coarse sand and gravel (SNPO, 1970).

A.2.5 Hydrology

Depth to groundwater at the NRDS Facility and vehicle washdown stations ranges from 700 to 1,700 ft. Yucca Flats, Frenchman Flats, and Jackass Flats are believed to be hydraulically connected, with groundwater moving through fracture zones in carbonate strata. Groundwater flow is generally to the southwest and may discharge at Ash Meadows, located approximately 35 mi southwest of Yucca Flats (SNPO, 1970). Groundwater at Well J-11, the nearest well to the F and J Roads Pad, is approximately 1,040 ft. This well is located approximately 14,900 ft southwest of the F and J Roads Pad (USGS, 1993). Wells J-12 and J-13 are also nearby wells. Water from these wells is derived from an aquifer approximately 591 to 1,138 ft deep at Well J-12 and 679 to 1,476 ft deep at Well J-13 (DOE/NV, 1988). There are no perennial surface water sources at the any of the CAU 240, Area 25 Vehicle Washdown CASs that would impact the investigation sites.

A.3.0 Investigation Results

The analytical results of samples collected from the CAU 240 investigation have been compiled and evaluated to determine the presence and/or extent of contamination. The analytical results that are above the minimum reporting limits are summarized in the following subsections. The complete laboratory result data packages are available in the project files.

During investigation activities, 79 soil and 39 water samples were submitted for analyses. All raidoanalyses except 43 strontium-90 analyses were performed by Bechtel Nevada Analytical Services, Las Vegas, Nevada. All other analyses were performed by Paragon Analytics, Inc., Fort Collins, Colorado. A list of the samples collected and analyzed for the investigation are presented in Table A.3-1. The analytical parameters and laboratories' analytical methods requested for this investigation are presented in Table A.3-2.

Table A.3-1
Samples Collected During the CAU 240 Area 25 Vehicle Washdown Corrective Action Investigation
(Page 1 of 6)

Sample Number	Sample Location	Depth (ft bgs)	Sample Matrix	Quality Control Comments	Parameters Analyzed
CAS 25-07-01 Propellant Pad					
VWDPP001	BKG1	0-1	Soil	Background Sample	RCRA Metals, Gamma, Pu, U, Sr-90
VWDPP002	BKG1	3-5	Soil	Background Sample	RCRA Metals, Gamma, Pu, U, Sr-90
VWDPP003	BKG2	0-1	Soil	Background Sample	RCRA Metals, Gamma, Pu, U, Sr-90
VWDPP004	BKG2	3-5	Soil	Background Sample	RCRA Metals, Gamma, Pu, U, Sr-90
VWDPP005	NA	NA	Water	Equipment Blank	VOCs, SVOCs, RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDPP006	NA	NA	Water	Field Blank	VOCs, SVOCs, RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDPP007	NA	NA	Water	Source Blank	VOCs, SVOCs, RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDPP008	GP1	0-1	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma
VWDPP009	GP1	3-5	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma
VWDPP010	GP2	0-1	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma
VWDPP011	GP2	3-5	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma
VWDPP012	GP3	0-1	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma
VWDPP013	GP3	3-5	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma
VWDPP014	GP4	0-1	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma

Table A.3-1
Samples Collected During the CAU 240 Area 25 Vehicle Washdown Corrective Action Investigation
(Page 2 of 6)

Sample Number	Sample Location	Depth (ft bgs)	Sample Matrix	Quality Control Comments	Parameters Analyzed
VWDPP015	GP4	3-5	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma
VWDPP016	GP4	3-5	Soil	Field Duplicate of VWDPP015	VOCs, SVOCs, PCBs, Pesticides, Gamma
VWDPP017	GP5	0-1	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma
VWDPP018	GP5	3-5	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma
VWDPP019	NA	NA	Water	Trip Blank	VOCs
VWDPP020	NA	NA	Water	Trip Blank	VOCs
VWDPP021	NA	NA	Water	Trip Blank	VOCs
VWDPP022	NA	NA	Water	Trip Blank	VOCs
VWDPP023	NA	NA	Water	Trip Blank	VOCs
VWDPP024	NA	NA	Water	Trip Blank	VOCs
VWDPP025	GP4	5-7	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma
VWDPP027	GP5	5-7	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma
VWDPP028	GP6	0-1	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma
VWDPP030	GP7	0-1	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma
VWDPP032	GP8	0-1	Soil	Environmental Sample	VOCs, SVOCs, PCBs, Pesticides, Gamma
CAS 25-07-02 F and J Roads Pad					
VWDFJ001	BKG1	0-1	Soil	Background Sample	RCRA Metals, Gamma, Pu, U, Sr-90
VWDFJ002	BKG1	3-5	Soil	Background Sample	RCRA Metals, Gamma, Pu, U, Sr-90
VWDFJ003	BKG2	0-1	Soil	Background Sample	RCRA Metals, Gamma, Pu, U, Sr-90
VWDFJ004	BKG2	3-5	Soil	Background Sample	RCRA Metals, Gamma, Pu, U, Sr-90
VWDFJ005	GP1	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ006	GP1	3-5	Soil	Environmental Sample MS/MSD	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ007	GP2	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ008	GP2	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ009	GP3	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ010	GP3	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJX10	GP3	3-5	Soil	Field Duplicate of VWDFJ010	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ011	GP4	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90

Table A.3-1
Samples Collected During the CAU 240 Area 25 Vehicle Washdown Corrective Action Investigation
(Page 3 of 6)

Sample Number	Sample Location	Depth (ft bgs)	Sample Matrix	Quality Control Comments	Parameters Analyzed
VWDFJ012	GP4	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ013	GP5	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Pu, U, Sr-90
VWDFJ014	GP5	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ015	GP6	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ016	GP6	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ017	GP7	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ018	GP7	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ019	GP7	3-5	Soil	Field Duplicate of VWDFJ018	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ020	GP8	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ021	GP8	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ022	GP9	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ023	GP9	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ024	GP5	5-7	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ025	BKH1	0-1*	Soil	Environmental Sample MS/MSD	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ026	NA	NA	Water	Source Blank	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ027	NA	NA	Water	Equipment Blank	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ028	NA	NA	Water	Field Blank	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ030	BKH1	1-2*	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ031	GP6	5-7	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ032	GP11	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ033	NA	NA	Water	Trip Blank	VOCs

Table A.3-1
Samples Collected During the CAU 240 Area 25 Vehicle Washdown Corrective Action Investigation
(Page 4 of 6)

Sample Number	Sample Location	Depth (ft bgs)	Sample Matrix	Quality Control Comments	Parameters Analyzed
VWDFJ034	NA	NA	Water	Trip Blank	VOCs
VWDFJ035	NA	NA	Water	Trip Blank	VOCs
VWDFJ036	NA	NA	Water	Trip Blank	VOCs
VWDFJ037	NA	NA	Water	Trip Blank	VOCs
VWDFJ038	NA	NA	Water	Trip Blank	VOCs
VWDFJ039	NA	NA	Water	Trip Blank	VOCs
VWDFJ040	NA	NA	Water	Field Blank	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ041	NA	NA	Water	Equipment Blank	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ042	NA	NA	Water	Trip Blank	VOCs
VWDFJ042A	N/A	N/A	Water	Trip Blank	VOCs
VWDFJ043	NA	NA	Water	Trip Blank	VOCs
VWDFJ044	NA	NA	Water	Trip Blank	VOCs
VWDFJ045	NA	NA	Water	Equipment Blank	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ047	BKH3	0-1*	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ048	GP10	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ050	BKH3	1-2*	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ051	GP12	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ053	BKH2	0-1*	Soil	Environmental Sample MS/MSD	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ054	BKH2	1-2*	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ056	NA	NA	Water	Trip Blank	VOCs
VWDFJ060	NA	NA	Water	Trip Blank	VOCs
VWDFJ061	BKH3	0-1*	Soil	Field Duplicate of VWDFJ047	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDFJ062	NA	NA	Water	Source Blank	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
CAS 25-07-03 (RADSAFE Pad)					
VWDRP001	BKG1	0-1	Soil	Background Sample	RCRA Metals, Gamma, Pu, U, Sr-90
VWDRP002	BKG1	3-5	Soil	Background Sample	RCRA Metals, Gamma, Pu, U, Sr-90
VWDRP003	BKG2	0-1	Soil	Background Sample	RCRA Metals, Gamma, Pu, U, Sr-90

Table A.3-1
Samples Collected During the CAU 240 Area 25 Vehicle Washdown Corrective Action Investigation
(Page 5 of 6)

Sample Number	Sample Location	Depth (ft bgs)	Sample Matrix	Quality Control Comments	Parameters Analyzed
VWDRP004	BKG2	3-5	Soil	Background Sample	RCRA Metals, Gamma, Pu, U, Sr-90
VWDRP005	GP1	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP006	GP1	3-5	Soil	Environmental Sample Chem. MS/MSD	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP007	GP2	0-1	Soil	Environmental Sample Rad. MS/MSD	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP008	GP2	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP009	GP3	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP010	GP3	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP011	GP4	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRPX11	GP4	0-1	Soil	Field Duplicate of VWDRP011	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP012	GP4	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP013	GP5	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP014	GP5	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP015	GP6	0-1	Soil	Environmental Sample MS/MSD	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRPX16	NA	NA	Water	Source Blank	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDRP017	NA	NA	Water	Equipment Blank	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDRP018	NA	NA	Water	Field Blank	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma, Sr-90
VWDRP020	GP6	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP021	GP7	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP022	GP7	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP023	GP8	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP024	GP8	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma

Table A.3-1
Samples Collected During the CAU 240 Area 25 Vehicle Washdown Corrective Action Investigation
(Page 6 of 6)

Sample Number	Sample Location	Depth (ft bgs)	Sample Matrix	Quality Control Comments	Parameters Analyzed
VWDRP025	GP9	0-1	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP026	GP9	3-5	Soil	Environmental Sample	VOCs, SVOCs, TPH (Diesel/Oil), RCRA Metals, PCBs, Pesticides, Gamma
VWDRP027	NA	NA	Water	Trip Blank	VOCs
VWDRP028	NA	NA	Water	Trip Blank	VOCs
VWDRP029	NA	NA	Water	Trip Blank	VOCs
VWDRP030	NA	NA	Water	Trip Blank	VOCs
VWDRP031	NA	NA	Water	Trip Blank	VOCs
VWDRP032	NA	NA	Water	Trip Blank	VOCs
VWDRP033	NA	NA	Water	Trip Blank	VOCs

BKG denotes background sample location
BKH denotes backhoe sample location
GP denotes Geoprobe® sample location
MS/MSD = Matrix spike and matrix spike duplicate
NA = Not Applicable
VOCs = Volatile organic compounds
TPH = Total petroleum hydrocarbons
SVOCs = Semivolatile organic compounds
RCRA = *Resource Conservation and Recovery Act*
PCB = Polychlorinated biphenyls
Sr-90 = Strontium-90
Gamma = Gamma spectrometry
Pu = Isotopic plutonium
U = Isotopic uranium

*Depth represents feet below soil/gravel interface.

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). Preliminary action levels for off-site laboratory analytical methods were determined during the DQO process and are documented in the CAIP (DOE/NV, 1999; EPA, 1998). Sampling activities were conducted to confirm or disprove assumptions (i.e., models outlined in CAIP) made in the DQO process (DOE/NV, 1999).

Table A.3-2
Laboratory Analytical Methods Used for Samples Collected at the CAU 240, Area 25 Vehicle Washdown, Nevada Test Site

Analytical Parameter	Analytical Method
Total volatile organic compounds	EPA 8260B[a]
Total petroleum hydrocarbons - diesel/oil	EPA 8015B (modified)[a]
Total semivolatile organic compounds	EPA 8270C[a]
Total RCRA metals (arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury)	EPA 6010B/7470A[a] EPA 6010B/7471A[a]
Total pesticides	EPA 8081A[a]
Polychlorinated biphenyls	EPA 8082[a]
Gamma spectrometry	BN-L-E10.602.PC[c]
Strontium-90	BN-L-E10610.PL[c] SOP-PAI-717, 724[b]
Isotopic plutonium	BN-L-E10.601.PL[c]
Isotopic uranium	BN-L-E10.605.PL[c]

[a]EPA *Test Methods for Evaluating Solid Waste*, 3rd Edition, Parts 1-4, SW-846 (EPA, 1996)
[b]Paragon Analytics Incorporated Standard Operation Procedure Manual (PAI, 1996 and 1999)
[c]Bechtel Nevada Analytical Services Laboratory Procedure Manual I (BN ASL, 1999)

A.3.1 Total Volatile Organic Compound Analytical Results

The total VOC analytical results detected above minimum reporting limits established in the CAIP (DOE/NV, 1999), along with the associated preliminary action levels, are presented in Table A.3-3. None of these results exceed the PALs (DOE/NV, 1999; EPA, 1998).

Approximately half of the results for acrolein were rejected for samples collected from the Propellant Pad and the RADSAFE Pad. Acrolein is most commonly used as an herbicide in irrigation canals (EPA, 1989). It is also used as a pesticide. Acrolein is highly volatile and is not persistent in the environment. It does not concentrate in sediments (EC, 1999). This is an acceptable data gap because acrolein is not expected at these CASs and it was not detected in other usable results for acrolein.

Table A.3-3
Soil Sample Results for Total Volatile Organic Compounds Detected Above Minimum Reporting Limits, Area 25 Vehicle Washdown, Nevada Test Site
(Page 1 of 2)

Sample Location	Sample No.	Start Depth (ft)	End Depth (ft)	Contaminant of Potential Concern (μg/kg)		
				2-Butanone	Acetone	Methylene Chloride
Preliminary Action Levels[a]				27,000,000	6,100,000	20,000
CAS 25-07-01 Propellant Pad						
GP1	VWDPP008	0.0	1	--	15 (J)	--
	VWDPP009	3.0	5.0	--	16 (J)	--
GP2	VWDPP010	0.0	1.0	--	15 (J)	--
	VWDPP011	3.0	5.0	--	6.9 (J)	--
GP3	VWDPP012	0.0	1.0	--	13 (J)	--
	VWDPP013	3.0	5.0	--	8.6 (J)	--
GP4	VWDPP014	0.0	1.0	--	10 (J)	--
	VWDPP016	3.0	5.0	--	8 (J)	--
GP5	VWDPP018	3.0	5.0	--	7.5 (J)	--
GP4	VWDPP025	5.0	7.0	--	12 (J)	--
GP6	VWDPP028	0.0	1.0	--	15 (J)	--
GP7	VWDPP030	0.0	1.0	--	6.4 (J)	--
GP8	VWDPP032	0.0	1.0	--	8.2 (J)	--
CAS 25-07-02 F and J Roads Pad						
GP1	VWDFJ005	0.0	1.0	--	23	--
	VWDFJ006	3.0	5.0	--	7.8 (J)	--
GP2	VWDFJ007	0.0	1.0	--	22	--
	VWDFJ008	3.0	5.0	--	8.5 (J)	--
GP3	VWDFJ009	0.0	1.0	--	15 (J)	--
	VWDFJ010	3.0	5.0	--	13 (J)	--
	VWDFJX10	3.0	5.0	--	14 (J)	--
GP4	VWDFJ011	0.0	1.0	--	13 (J)	--
	VWDFJ012	3.0	5.0	--	19 (J)	--
GP5	VWDFJ013	0.0	1.0	--	26	--
	VWDFJ014	3.0	5.0	--	8.5 (J)	--
GP9	VWDFJ022	0.0	1.0	5.8 (J)	--	--
BKH1	VWDFJ030	1.0	2.0	5.4 (J)	--	5.5 (J)
GP6	VWDFJ031	5.0	7.0	6.5 (J)	--	6 (J)
BKH3	VWDFJ047	0.0	1.0	5.6 (J)	8.7 (J)	--

Table A.3-3
Soil Sample Results for Total Volatile Organic Compounds Detected Above Minimum Reporting Limits, Area 25 Vehicle Washdown, Nevada Test Site
(Page 2 of 2)

Sample Location	Sample No.	Start Depth (ft)	End Depth (ft)	Contaminant of Potential Concern (µg/kg)		
				2-Butanone	Acetone	Methylene Chloride
Preliminary Action Levels[a]				27,000,000	6,100,000	20,000
CAS 25-07-05 RADSAFE Pad						
GP1	VWDRP005	0.0	1.0	--	6.6 (J)	--
	VWDRP006	3.0	5.0	--	5 (J)	--
GP2	VWDRP008	3.0	5.0	--	8.4 (J)	--
GP3	VWDRP009	0.0	1.0	--	15 (J)	--
	VWDRP010	3.0	5.0	--	9.4 (J)	--
GP4	VWDRP011	0.0	1.0	--	25 (J)	--
	VWDRPX11	0.0	1.0	--	36 (J)	--
	VWDRP012	3.0	5.0	--	17 (J)	--
GP5	VWDRP013	0.0	1.0	--	20 (J)	--
	VWDRP014	3.0	5.0	--	15 (J)	--
GP6	VWDRP015	0.0	1.0	--	33 (J)	--
GP7	VWDRP021	0.0	1.0	--	30 (J)	--
GP8	VWDRP023	0.0	1.0	--	21 (J)	--
	VWDRP024	3.0	5.0	--	13 (J)	--
GP9	VWDRP025	0.0	1.0	--	27 (J)	--
	VWDRP026	3.0	5.0	--	11 (J)	--

[a]EPA Region 9 Industrial PRGs (EPA, 1998)

J = Estimated value
-- = Not detected above minimum reporting limit
µg/kg = Micrograms per kilogram

A.3.2 Total Semivolatile Organic Compound Analytical Results

Sample VWDPP016 had a bis(2-ethylhexyl)phthalate concentration of 240 micrograms per kilogram (µg/kg) which is well below the 210,000 µg/kg PAL (DOE/NV, 1999; EPA, 1998). This constituent is a common laboratory contaminant. All other SVOC results were reported as nondetects. Therefore, SVOCs were not detected at concentrations exceeding PALs.

A.3.3 Total Petroleum Hydrocarbon Analytical Results

The TPH-diesel detected in soil above the minimum reporting limits (DOE/NV, 1999) are presented in Table A.3-4. Total petroleum hydrocarbons were detected in the diesel range above the NDEP regulatory action level of 100 mg/kg for TPH (NAC, 1997) only at the F and J Roads Pad. The TPH-diesel concentrations ranged from 29 mg/kg to 1,500 mg/kg at the F and J Roads Pad. The highest concentrations were found around the perimeter of the concrete decontamination pad (Figure A.2-3).

A.3.4 Total RCRA Metals Results

The total RCRA metals detected above the minimum reporting limits (DOE/NV, 1999) are presented in Table A.3-5. The total RCRA metal results were all below the PALs except for arsenic (DOE/NV, 1999; EPA, 1998).

Arsenic was detected above the PAL of 3.0 mg/kg in most of the samples analyzed. The arsenic concentrations for the samples analyzed ranged from 1.9 mg/kg to 10.2 mg/kg. The 10.2 mg/kg concentration for sample VWDFJ023 is nearly twice that of the next highest concentration of 5.3 mg/kg in sample VWDRP022. Both of these samples were collected from 3 to 5 ft bgs. Samples collected from 0 to 1 ft bgs at the same locations contained lower concentrations of arsenic.

Although analysis of most samples, including the site-specific background samples, reveal arsenic concentrations near or above 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). Several arsenic concentrations presented in Table A.3-5 exceed the PAL but are considered representative of ambient conditions at the sites.

A.3.5 Total Pesticides Results

The total pesticides results detected in soil above the minimum reporting limits (DOE/NV, 1999) are presented in Table A.3-6. One sample from the Propellant Pad site and five samples from the RADSAFE site, indicated that pesticides were present above the minimum reporting limits; however, these results were well below the PALs (DOE/NV, 1999; EPA, 1998). The alpha- and gamma-chlordane isomer concentrations were reported instead of the chlordane concentration. To

Table A.3-4
Soil Sample Results for Total Petroleum Hydrocarbons Detected Above Minimum Reporting Limits, Area 25 Vehicle Washdown, Nevada Test Site

Sample Location	Sample No.	Start Depth (ft)	End Depth (ft)	Contaminant of Potential Concern (mg/kg)
				DIESEL-RANGE ORGANICS
Preliminary Action Level				100
CAS 25-07-02 F and J Roads Pad				
GP3	VWDFJ009	0.0	1.0	890
GP4	VWDFJ011	0.0	1.0	1,200
GP5	VWDFJ013	0.0	1.0	1,500
GP6	VWDFJ015	0.0	1.0	1,200
GP7	VWDFJ017	0.0	1.0	910
	VWDFJ018	3.0	5.0	31
	VWDFJ019	3.0	5.0	29
GP8	VWDFJ020	0.0	1.0	1,200
GP9	VWDFJ022	0.0	1.0	31
	VWDFJ023	3.0	5.0	380
GP11	VWDFJ032	0.0	1.0	36
GP10	VWDFJ048	0.0	1.0	75
GP12	VWDFJ051	0.0	1.0	91
CAS 25-07-03 RADSAFE Pad				
GP2	VWDRP007	0.0	1.0	26

Shading indicates analytical result exceeds the 100 mg/kg NDEP established action level.

compare these concentrations to the PAL, the alpha- and gamma-chlordane isomer concentrations were summed and presented in Table A.3-6 as chlordane.

A.3.6 PCB Results

Sample VWDRP007 had an aroclor-1260 concentration of 36 µg/kg. This concentration is less than the 1,300 µg/kg PAL (DOE/NV, 1999; EPA 1998) for PCBs. All other PCB results were reported as nondetects or at concentrations below their minimum reporting limits (DOE/NV, 1999). Therefore, PCBs were not detected in soil at concentrations exceeding PALs.

Table A.3-5
Summary of Total RCRA Metals Results Detected Above Minimum Reporting Limits, Area 25 Vehicle Washdown, Nevada Test Site
(Page 1 of 2)

Sample Location	Sample No.	Start Depth (ft)	End Depth (ft)	Contaminant of Potential Concern (mg/kg)					
				Arsenic	Barium	Chromium	Lead	Mercury	Selenium
Preliminary Action Levels[a]				3.0	100,000	64.0	1,000	560	9,400
CAS 25-07-01 Propellant Pad									
BKG1	VWDPP001	0.0	1.0	2.8 (J)	105 (J)	4.5 (J)	6.1 (J)	--	--
	VWDPP002	3.0	5.0	3.9 (J)	55.9 (J)	2.8 (J)	4.4 (J)	--	--
BKG2	VWDPP003	0.0	1.0	2.2 (J)	99.9 (J)	3.4 (J)	5.3 (J)		--
	VWDPP004	3.0	5.0	3.8 (J)	131 (J)	3 (J)	5.4 (J)	--	--
CAS 25-07-02 F and J Roads Pad									
BKG1	VWDFJ001	0.0	1.0	2.9 (J)	82.9	5.2 (J)	6.1	--	--
	VWDFJ002	3.0	5.0	2.8 (J)	103	2.9 (J)	5.8	--	--
BKG2	VWDFJ003	0.0	1.0	2.7 (J)	105	4.2 (J)	6.5	--	--
	VWDFJ004	3.0	4.0	2.2 (J)	110	1.8 (J)	4.4	--	--
GP1	VWDFJ005	0.0	1.0	3.5 (J)	100	4.9 (J)	8	--	--
	VWDFJ006	3.0	5.0	3.1 (J)	81.8	3.1 (J)	6.3	--	--
GP2	VWDFJ007	0.0	1.0	3.7 (J)	116	5.5 (J)	9.3	--	--
	VWDFJ008	3.0	5.0	3.5 (J)	88.4	2.2 (J)	5	0.14	--
GP3	VWDFJ009	0.0	1.0	3.5 (J)	105	5 (J)	10.2	--	--
	VWDFJ010	3.0	5.0	2.5 (J)	76.9	1.9 (J)	7	--	--
	VWDFJX10	3.0	5.0	2.7 (J)	98.6	1.9 (J)	4.1	--	--
GP4	VWDFJ011	0.0	1.0	3.2 (J)	152	4.6 (J)	9.4	--	--
	VWDFJ012	3.0	5.0	2.5 (J)	99.6	1.7 (J)	4.9	--	--
GP5	VWDFJ013	0.0	1.0	4.9 (J)	114	4.9 (J)	10.4	--	--
	VWDFJ014	3.0	5.0	2.3 (J)	78.6	1.5 (J)	4.8	--	--
GP6	VWDFJ015	0.0	1.0	4.1 (J)	132 (J)	8.7 (J)	9.3 (J)	--	--
	VWDFJ016	3.0	5.0	2.4 (J)	73.3 (J)	1.9 (J)	6.6 (J)	--	--
GP7	VWDFJ017	0.0	1.0	3.6 (J)	223 (J)	4.5 (J)	8.9 (J)	--	--
	VWDFJ018	3.0	5.0	2.4 (J)	75.8 (J)	2.3 (J)	4.3 (J)	--	--
	VWDFJ019	3.0	5.0	2.3 (J)	49.8 (J)	1.7 (J)	4.2 (J)	--	--
GP8	VWDFJ020	0.0	1.0	3.9 (J)	107 (J)	4.3 (J)	6.6 (J)	--	--
	VWDFJ021	3.0	5.0	2.7 (J)	53.1 (J)	1.6 (J)	3.8 (J)	--	--
GP9	VWDFJ022	0.0	1.0	3.2 (J)	103 (J)	4.4 (J)	8.1 (J)	--	--
	VWDFJ023	3.0	5.0	10.2 (J)	172 (J)	6.2 (J)	14.5 (J)	--	2.8 (J)
GP5	VWDFJ024	5.0	7.0	2.2 (J)	89.6 (J)	1.8 (J)	4.2 (J)	--	--
BKH1	VWDFJ025	0.0	1.0	1.9 (J)	63.8 (J)	1.5 (J)	3.2 (J)	--	--
	VWDFJ030	1.0	2.0	2.1 (J)	66.1 (J)	1.4 (J)	3.4 (J)	--	--
GP6	VWDFJ031	5.0	7.0	2.3 (J)	105 (J)	2.1 (J)	5.3 (J)	--	--
GP11	VWDFJ032	0.0	1.0	3.1 (J)	113 (J)	3.6 (J)	8.2 (J)	--	--
GP10	VWDFJ048	0.0	1.0	3.2 (J)	113 (J)	4.8 (J)	7.6 (J)	--	--

Table A.3-5
Summary of Total RCRA Metals Results Detected Above Minimum Reporting Limits, Area 25 Vehicle Washdown, Nevada Test Site
(Page 2 of 2)

Sample Location	Sample No.	Start Depth (ft)	End Depth (ft)	Contaminant of Potential Concern (mg/kg)					
				Arsenic	Barium	Chromium	Lead	Mercury	Selenium
Preliminary Action Levels[a]				3.0	100,000	64.0	1,000	560	9,400
CAS 25-07-02 F and J Roads Pad									
GP12	VWDFJ051	0.0	1.0	3.2 (J)	99.8 (J)	4.2 (J)	6.3 (J)	--	--
BKH2	VWDFJ053	0.0	1.0	2.5 (J)	44.1 (J)	1.4 (J)	3.9 (J)	--	--
	VWDFJ054	1.0	2.0	2.6 (J)	104 (J)	2 (J)	5.1 (J)	--	--
BKH3	VWDFJ047	0.0	1.0	2.7 (J)	94.8 (J)	2 (J)	4.6 (J)	--	--
	VWDFJ050	1.0	2.0	3.8 (J)	76.4 (J)	2 (J)	5.3 (J)	--	--
	VWDFJ061	0.0	1.0	2.7 (J)	89.8 (J)	2.5 (J)	5.2 (J)	--	--
CAS 25-07-03 RADSAFE Pad									
BKG1	VWDRP001	0.0	1.0	3.4 (J)	97.9	5.3	7.2	--	--
	VWDRP002	3.0	5.0	3.9 (J)	95.9	4.2	6.3	--	--
BKG2	VWDRP003	0.0	1.0	3.3 (J)	116	5.4	9.7	--	--
	VWDRP004	3.0	5.0	3.5 (J)	161	4.6	6.3		--
GP1	VWDRP005	0.0	1.0	3.2 (J)	84.2	5.5	7.3	--	--
	VWDRP006	3.0	5.0	4.3 (J)	121	7.8	7.5	--	--
GP2	VWDRP007	0.0	1.0	3.2 (J)	88.6 (J)	4.8 (J)	15.5 (J)	--	--
	VWDRP008	3.0	5.0	4.3 (J)	110 (J)	5.4 (J)	6.7 (J)	--	--
GP3	VWDRP009	0.0	1.0	3.3 (J)	106 (J)	5.8 (J)	7.1 (J)	--	--
	VWDRP010	3.0	5.0	3.5 (J)	88.1 (J)	4.2 (J)	6.4 (J)	--	--
GP4	VWDRP011	0.0	1.0	3.7 (J)	96.1 (J)	5.2 (J)	13.2 (J)	--	--
	VWDRPX11	0.0	1.0	3.4 (J)	82.8 (J)	6 (J)	33.2 (J)	--	--
	VWDRP012	3.0	5.0	3.9 (J)	120 (J)	5.1 (J)	7 (J)	--	--
GP5	VWDRP013	0.0	1.0	2.8 (J)	100 (J)	5.6 (J)	6.9 (J)	--	--
	VWDRP014	3.0	5.0	3.8 (J)	104 (J)	4.8 (J)	6.3 (J)	--	--
GP6	VWDRP015	0.0	1.0	3.7 (J)	117 (J)	6.1 (J)	8.8 (J)	--	--
	VWDRP020	3.0	5.0	3 (J)	104 (J)	4.3 (J)	6 (J)	--	--
GP7	VWDRP021	0.0	1.0	4 (J)	101 (J)	5.8 (J)	8.2 (J)	--	--
	VWDRP022	3.0	5.0	5.3 (J)	281 (J)	4.9 (J)	6.7 (J)	--	--
GP8	VWDRP023	0.0	1.0	3.9 (J)	113 (J)	5.7 (J)	8.3 (J)	--	--
	VWDRP024	3.0	5.0	3.8 (J)	293 (J)	3.8 (J)	5.8 (J)	--	--
GP9	VWDRP025	0.0	1.0	3.8 (J)	114 (J)	5 (J)	6.2 (J)	--	--
	VWDRP026	3.0	5.0	4.9 (J)	116 (J)	4.9 (J)	8 (J)	--	--

[a]EPA Region 9 Industrial PRGs (EPA, 1998)

J = Estimated value
B = Reported value is less than the Contract Required Detection Limit but greater than the Instrument Detection Limit
-- = Not detected above minimum reporting limit

Table A.3-6
Summary of Total Pesticides Results Detected Above Minimum Reporting Limits, Area 25 Vehicle Washdown, Nevada Test Site

Sample Location	Sample No.	Start Depth (ft)	End Depth (ft)	Contaminants of Potential Concern (µg/kg)			
				4,4'-DDD	4,4'-DDE	4,4'-DDT	Chlordane
Preliminary Action Levels[a]				19,000	13,000	13,000	12,000
CAS 25-07-03 RADSAFE Pad							
GP1	VWDRP005	0.0	1.0	--	--	4.8	--
GP2	VWDRP007	0.0	1.0	4.4 (J)	23	83	20.8
GP4	VWDRP011	0.0	1.0	--	29	59	33
GP5	VWDRP013	0.0	1.0	--	27	63	33
CAS 25-07-01 Propellant Pad							
GP5	VWDRP017	0.0	1.0	--	--	3.7	--

[a]EPA Region 9 Industrial PRGs (EPA, 1998)

J = Estimated value
-- = Not detected above minimum reporting limit

µg/kg = Micrograms per kilogram
DDD = dichlorodiphenyldichloroethane
DDE = dichlorodiphenyldicloroethylene
DDT = dichlorodiphenyltrichloroethylene

A.3.7 Gamma Spectrometry Results

The radionuclides detected in soil using gamma spectrometry at concentrations above the minimum reporting limits as specified in the CAIP (DOE/NV, 1999) are presented in Table A.3-7. Sample VWDFJ013, from the F and J Roads Pad, had a cesium-137 concentration above established background levels and; therefore, above PALs (DOE/NV, 1999). All other results are considered not to be statistically different from their respective established background levels.

A.3.8 Isotopic Uranium, Isotopic Plutonium, and Strontium-90 Results

Sample VWDFJ013 was analyzed for isotopic uranium and plutonium because gamma spectrometry indicated the presence of cesium-137 above PALs (DOE/NV, 1999). Selected samples were analyzed for strontium-90. Analytical results exceeding minimum reporting limits (DOE/NV, 1999) for these parameters are presented in Table A.3-8. Samples VWDFJ011 and VWDFJ013, from the F and J Roads Pad, had strontium-90 concentrations above established background levels and; therefore, above PALs (DOE/NV, 1999). All other results are considered not to be statistically different from their respective established background levels.

Table A.3-7
Soil Sample Results for Gamma Spectrometry Above Contract Required Detection Limit, Area 25 Vehicle Washdown, Nevada Test Site
(Page 1 of 4)

Sample Location	Sample No.	Start Depth (ft)	End Depth (ft)	Contaminant of Potential Concern (pCi/g)					
				Cesium-137	Bismuth-214	Potassium-40	Radium-226	Thorium-228	Thorium-232
Background Concentrations				0.04 - 7.0[a]	0.1 - 3.47[b]	11 - 96[b]	0.21 - 3.21[a]	0.49 - 2.4[a]	0.49 - 2.4[a]
CAS 25-07-01 Propellant Pad									
BKG1	VWDPP001	0.0	1.0	--	--	32.46 ± 5.66 (J)	1.32 ± 0.34 (J)	2.35 ± 0.45 (J)	1.80 ± 0.64 (J)
	VWDPP002	3.0	5.0	--	--	30.69 ± 5.45 (J)	0.88 ± 0.30 (J)	2.65 ± 0.48 (J)	1.63 ± 0.60 (J)
BKG2	VWDPP003	0.0	1.0	--	--	34.81 ± 5.93 (J)	1.08 ± 0.31 (J)	2.49 ± 0.46 (J)	1.88 ± 0.65 (J)
	VWDPP004	3.0	5.0	--	--	30.78 ± 5.46 (J)	1.00 ± 0.31 (J)	2.67 ± 0.47 (J)	1.86 ± 0.62 (J)
GP1	VWDPP008	0.0	1.0	--	--	26.16 ± 4.92 (J)	0.87 ± 0.29 (J)	2.49 ± 0.46 (J)	2.51 ± 0.76 (J)
	VWDPP009	3.0	5.0	--	--	29.90 ± 5.35 (J)	1.14 ± 0.32 (J)	2.64 ± 0.47 (J)	1.64 ± 0.60 (J)
GP2	VWDPP010	0.0	1.0	--	--	29.99 ± 5.42 (J)	1.01 ± 0.30 (J)	2.45 ± 0.46 (J)	2.34 ± 0.72 (J)
	VWDPP011	3.0	5.0	--	--	27.65 ± 5.19 (J)	0.81 ± 0.28 (J)	2.59 ± 0.47 (J)	1.90 ± 0.66 (J)
GP3	VWDPP012	0.0	1.0	--	--	31.60 ± 5.56 (J)	0.86 ± 0.30 (J)	2.54 ± 0.46 (J)	2.10 ± 0.66 (J)
	VWDPP013	3.0	5.0	--	--	33.49 ± 5.78 (J)	0.82 ± 0.28 (J)	2.44 ± 0.45 (J)	2.05 ± 0.67 (J)
GP4	VWDPP014	0.0	1.0	--	--	29.29 ± 5.30 (J)	1.22 ± 0.33 (J)	2.32 ± 0.44 (J)	2.30 ± 0.72 (J)
	VWDPP015	3.0	5.0	--	--	28.23 ± 5.16 (J)	1.04 ± 0.30 (J)	2.43 ± 0.45 (J)	2.17 ± 0.67 (J)
	VWDPP016	3.0	5.0	--	--	32.06 ± 5.62 (J)	0.82 ± 0.29 (J)	2.40 ± 0.45 (J)	2.30 ± 0.70 (J)
GP5	VWDPP017	0.0	1.0	--	--	31.83 ± 5.62 (J)	0.97 ± 0.31 (J)	2.54 ± 0.47 (J)	1.99 ± 0.66 (J)
	VWDPP018	3.0	5.0	--	--	28.48 ± 5.26 (J)	0.85 ± 0.28 (J)	2.41 ± 0.45 (J)	2.22 ± 0.70 (J)
GP4	VWDPP025	5.0	7.0	--	--	30.51 ± 5.43 (J)	1.24 ± 0.32 (J)	2.30 ± 0.44 (J)	1.51 ± 0.56 (J)
GP5	VWDPP027	5.0	7.0	--	--	29.34 ± 5.31 (J)	0.98 ± 0.30 (J)	2.67 ± 0.48 (J)	1.81 ± 0.63 (J)
GP6	VWDPP028	0.0	1.0	--	--	34.65 ± 5.93 (J)	1.18 ± 0.32 (J)	2.67± 0.48 (J)	1.78 ± 0.63 (J)
GP7	VWDPP030	0.0	1.0	--	--	29.49 ± 5.34 (J)	1.12 ± 0.31 (J)	2.29 ± 0.44 (J)	2.16 ± 0.70 (J)
GP8	VWDPP032	0.0	1.0	--	--	33.13 ± 5.75 (J)	1.29 ± 0.35 (J)	2.77 ± 0.50 (J)	1.83 ± 0.64 (J)

Table A.3-7
Soil Sample Results for Gamma Spectrometry Above Contract Required Detection Limit, Area 25 Vehicle Washdown, Nevada Test Site
(Page 2 of 4)

Sample Location	Sample No.	Start Depth (ft)	End Depth (ft)	Contaminant of Potential Concern (pCi/g)					
				Cesium-137	Bismuth-214	Potassium-40	Radium-226	Thorium-228	Thorium-232
Background Concentrations				0.04 - 7.0[a]	0.1 - 3.47[b]	11 - 96[b]	0.21 - 3.21[a]	0.49 - 2.4[a]	0.49 - 2.4[a]
CAS 25-07-02 F and J Roads Pad									
BKG1	VWDFJ001	0.0	1.0	--	--	31.93 ± 5.59 (J)	1.25 ± 0.35 (J)	2.56 ± 0.48 (J)	2.30 ± 0.71 (J)
	VWDFJ002	3.0	5.0	--	--	35.49 ± 6.02 (J)	1.31 ± 0.36 (J)	3.01 ± 0.54 (J)	2.79 ± 0.80 (J)
BKG2	VWDFJ003	0.0	1.0	--	--	32.44 ± 5.69 (J)	1.35 ± 0.37 (J)	3.18 ± 0.55 (J)	2.94 ± 0.80 (J)
	VWDFJ004	3.0	4.0	--	--	32.87 ± 5.71 (J)	1.20 ± 0.36 (J)	3.17 ± 0.55 (J)	3.16 ± 0.85 (J)
GP1	VWDFJ005	0.0	1.0	--	--	33.48 ± 5.80 (J)	1.17 ± 0.36 (J)	3.33 ± 0.56 (J)	3.50 ± 0.89 (J)
	VWDFJ006	3.0	5.0	--	--	37.31± 6.30 (J)	1.14 ± 0.34 (J)	3.52 ± 0.59 (J)	2.66 ± 0.77 (J)
GP2	VWDFJ007	0.0	1.0	--	--	32.03 ± 5.63 (J)	1.18 ± 0.35 (J)	3.23 ± 0.54 (J)	2.22 ± 0.70 (J)
	VWDFJ008	3.0	5.0	--	--	34.58 ± 5.92 (J)	1.31 ± 0.35 (J)	2.70 ± 0.50 (J)	2.47 ± 0.74 (J)
GP3	VWDFJ009	0.0	1.0	0.20 ± 0.11 (J)	--	25.99 ± 4.90 (J)	1.10 ± 0.32 (J)	2.48 ± 0.46 (J)	1.89 ± 0.65 (J)
	VWDFJ010	3.0	5.0	--	--	35.95 ± 6.13 (J)	1.36 ± 0.36 (J)	3.10 ± 0.54 (J)	2.35 ± 0.72 (J)
GP4	VWDFJ011	0.0	1.0	1.07 ± 0.24 (J)	--	23.71 ± 4.60 (J)	1.19 ± 0.32 (J)	2.25 ± 0.44 (J)	2.22 ± 0.69 (J)
	VWDFJ012	3.0	5.0	--	--	33.60 ± 5.80 (J)	1.09 ± 0.33 (J)	3.04 ± 0.52 (J)	2.42 ± 0.73 (J)
GP5	VWDFJ013	0.0	1.0	14.65 ± 1.61 (J)	--	24.91± 4.76 (J)	0.98 ± 0.36 (J)	2.50 ± 0.54 (J)	1.75 ± 0.63 (J)
	VWDFJ014	3.0	5.0	--	--	35.71 ± 6.07 (J)	1.09 ± 0.31 (J	3.22 ± 0.55 (J)	2.68 ± 0.77 (J)
GP6	VWDFJ015	0.0	1.0	0.45 ± 0.15 (J)	--	25.48 ± 4.83 (J)	1.26 ± 0.34 (J)	2.39 ± 0.45 (J)	1.69 ± 0.61 (J)
	VWDFJ016	3.0	5.0	--	--	30.68 ± 5.47 (J)	1.28 ± 0.33 (J)	2.79 ± 0.51 (J)	2.53 ± 0.73 (J)
GP7	VWDFJ017	0.0	1.0	3.45 ± 0.54 (J)	--	28.37 ± 5.20 (J)	0.95 ± 0.31 (J)	2.38 ± 0.46 (J)	1.74 ± 0.63 (J)
	VWDFJ018	3.0	5.0	0.53 ± 0.17 (J)	--	33.44 ± 5.81 (J)	1.22 ± 0.34 (J)	2.96 ± 0.53 (J)	2.34 ± 0.72 (J)
	VWDFJ019	3.0	5.0	--	--	33.71± 5.82 (J)	1.33 ± 0.34 (J)	2.97 ± 0.53 (J)	2.24 ± 0.71 (J)
GP8	VWDFJ020	0.0	1.0	--	--	32.78 ± 5.71 (J)	1.27 ± 0.34 (J)	2.85 ± 0.51 (J)	2.30 ± 0.71 (J)
	VWDFJ021	3.0	5.0	--	--	33.50 ± 5.80 (J)	1.23 ± 0.34 (J)	3.06 ± 0.54 (J)	2.80 ± 0.77 (J)
GP9	VWDFJ022	0.0	1.0	--	--	28.13 ± 5.14 (J)	1.13 ± 0.34 (J)	2.18 ± 0.43 (J)	2.20 ± 0.69 (J)
	VWDFJ023	3.0	5.0	--	--	33.33 ± 5.76 (J)	1.30 ± 0.35 (J)	3.09 ± 0.54 (J)	2.38 ± 0.72 (J)
GP5	VWDFJ024	5.0	7.0	--	--	33.46 ± 5.83 (J)	1.16 ± 0.33 (J)	3.10 ± 0.53 (J)	3.03 ± 0.82 (J)
BKH1	VWDFJ025	0.0	1.0	--	--	30.60 ± 5.43 (J)	1.51 ± 0.38 (J)	2.91 ± 0.51 (J)	2.59 ± 0.74 (J)
	VWDFJ030	1.0	2.0	--	--	35.23 ± 5.99 (J)	1.16 ± 0.32 (J)	2.81 ± 0.50 (J)	2.59 ± 0.75 (J)

Table A.3-7
Soil Sample Results for Gamma Spectrometry Above Contract Required Detection Limit, Area 25 Vehicle Washdown, Nevada Test Site
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Sample Location	Sample No.	Start Depth (ft)	End Depth (ft)	Contaminant of Potential Concern (pCi/g)					
				Cesium-137	Bismuth-214	Potassium-40	Radium-226	Thorium-228	Thorium-232
Background Concentrations				0.04 - 7.0[a]	0.1 - 3.47[b]	11 - 96[b]	0.21 - 3.21[a]	0.49 - 2.4[a]	0.49 - 2.4[a]
GP6	VWDFJ031	5.0	7.0	--	--	33.83 ± 5.85 (J)	1.44 ± 0.36 (J)	3.14 ± 0.54 (J)	2.88 ± 0.81 (J)
GP11	VWDFJ032	0.0	1.0	--	--	33.09 ± 5.73 (J)	1.21 ± 0.34 (J)	2.78 ± 0.50 (J)	2.17 ± 0.69 (J)
BKH3	VWDFJ047	0.0	1.0	--	--	33.18 ± 5.77 (J)	1.41 ± 0.35 (J)	3.03 ± 0.53 (J)	2.81 ± 0.79 (J)
GP10	VWDFJ048	0.0	1.0	--	--	30.38 ± 5.42 (J)	1.37 ± 0.39 (J)	2.73 ± 0.48 (J)	2.08 ± 0.67 (J)
BKH3	VWDFJ050	1.0	2.0	--	--	29.79 ± 5.36 (J)	1.42 ± 0.36 (J)	3.18 ± 0.54 (J)	2.22 ± 0.68 (J)
GP12	VWDFJ051	0.0	1.0	--	--	32.46 ± 5.67 (J)	1.28 ± 0.36 (J)	2.58 ± 0.48 (J)	2.70 ± 0.77 (J)
BKH2	VWDFJ053	0.0	1.0	--	--	28.25 ± 5.15 (J)	1.23 ± 0.33 (J)	3.08 ± 0.53 (J)	2.63 ± 0.74 (J)
	VWDFJ054	1.0	2.0	--	--	35.20 ± 6.00 (J)	1.18 ± 0.33 (J)	3.21 ± 0.54 (J)	2.49 ± 0.73 (J)
BKH3	VWDFJ061	0.0	1.0	--	--	31.52 ± 5.76 (J)	1.45 ± 0.38 (J)	3.25 ± 0.53 (J)	2.42 ± 0.74 (J)
GP3	VWDFJX10	3.0	5.0	--	1.22 ± 0.32 (J)	32.47 ± 5.70 (J)	--	2.73 ± 0.50 (J)	2.37 ± 0.71 (J)
CAS 25-07-03 RADSAFE Pad									
BKG1	VWDRP001	0.0	1.0	--	--	27.95 ± 5.12 (J)	1.15 ± 0.32 (J)	2.52 ± 0.46 (J)	2.37 ± 0.70 (J)
	VWDRP002	3.0	5.0	--	--	29.75 ± 5.37 (J)	0.99 ± 0.30 (J)	2.30 ± 0.42 (J)	1.72 ± 0.61 (J)
BKG2	VWDRP003	0.0	1.0	--	--	29.31 ± 5.28 (J)	1.09 ± 0.31 (J)	2.50 ± 0.46 (J)	2.18 ± 0.68 (J)
	VWDRP004	3.0	5.0	--	--	27.29 ± 5.06 (J)	1.08 ± 0.31 (J)	2.19 ± 0.43 (J)	1.89 ± 0.64 (J)
GP1	VWDRP005	0.0	1.0	--	--	31.19 ± 5.50 (J)	1.18 ± 0.34 (J)	2.50 ± 0.47 (J)	2.47 ± 0.75 (J)
	VWDRP006	3.0	5.0	--	--	31.18 ± 5.50 (J)	1.07 ± 0.32 (J)	2.34 ± 0.45 (J)	2.22 ± 0.70 (J)
GP2	VWDRP007	0.0	1.0	--	--	26.58 ± 4.95 (J)	1.12 ± 0.32 (J)	2.47 ± 0.46 (J)	2.09 ± 0.67 (J)
	VWDRP008	3.0	5.0	--	--	30.73 ± 5.45 (J)	1.27 ± 0.34 (J)	2.35 ± 0.45 (J)	1.78 ± 0.62 (J)
GP3	VWDRP009	0.0	1.0	--	--	34.22 ± 5.87 (J)	1.38 ± 0.35 (J)	2.59 ± 0.48 (J)	2.17 ± 0.67 (J)
	VWDRP010	3.0	5.0	--	--	31.40 ± 5.54 (J)	1.07 ± 0.31 (J)	2.58 ± 0.47 (J)	1.46 ± 0.55 (J)
GP4	VWDRP011	0.0	1.0	--	--	24.58 ± 4.70 (J)	1.13 ± 0.32 (J)	2.37 ± 0.44 (J)	1.74 ± 0.63 (J)
	VWDRP012	3.0	5.0	--	--	29.77 ± 5.32 (J)	1.27 ± 0.33 (J)	2.01 ± 0.41 (J)	2.07 ± 0.67 (J)
GP5	VWDRP013	0.0	1.0	--	--	32.78 ± 5.70 (J)	1.01 ± 0.30 (J)	2.69 ± 0.48 (J)	2.10 ± 0.66 (J)
	VWDRP014	3.0	5.0	--	--	26.15 ± 4.90 (J)	1.13 ± 0.31 (J)	2.20 ± 0.42 (J)	1.60 ± 0.59 (J)
GP6	VWDRP015	0.0	1.0	--	--	30.44 ± 5.41 (J)	1.45 ± 0.37 (J)	2.54 ± 0.46 (J)	2.29 ± 0.68 (J)
	VWDRP020	3.0	5.0	--	--	28.39 ± 5.17 (J)	0.90 ± 0.28 (J)	2.35 ± 0.44 (J)	2.18 ± 0.68 (J)

Table A.3-7
Soil Sample Results for Gamma Spectrometry Above Contract Required Detection Limit, Area 25 Vehicle Washdown, Nevada Test Site
(Page 4 of 4)

Sample Location	Sample No.	Start Depth (ft)	End Depth (ft)	Contaminant of Potential Concern (pCi/g)					
				Cesium-137	Bismuth-214	Potassium-40	Radium-226	Thorium-228	Thorium-232
Background Concentrations				0.04 - 7.0[a]	0.1 - 3.47[b]	11 - 96[b]	0.21 - 3.21[a]	0.49 - 2.4[a]	0.49 - 2.4[a]
GP7	VWDRP021	0.0	1.0	--	--	28.41 ± 5.17 (J)	1.36 ± 0.36 (J)	2.14 ± 0.43 (J)	2.37 ± 0.70 (J)
	VWDRP022	3.0	5.0	--	--	28.49 ± 5.20 (J)	1.00 ± 0.30 (J)	2.54 ± 0.45 (J)	1.43 ± 0.57 (J)
GP8	VWDRP023	0.0	1.0	--	--	31.98 ± 5.60 (J)	1.41 ± 0.32 (J)	2.37 ± 0.45 (J)	1.78 ± 0.63 (J)
	VWDRP024	3.0	5.0	--	--	32.50 ± 5.67 (J)	1.16 ± 0.33 (J)	2.51 ± 0.45 (J)	2.07 ± 0.67 (J)
GP9	VWDRP025	0.0	1.0	--	--	32.73 ± 5.70 (J)	1.25 ± 0.34 (J)	2.52 ± 0.47 (J)	2.05 ± 0.67 (J)
	VWDRP026	3.0	5.0	--	--	27.63 ± 5.08 (J)	0.91 ± 0.30 (J)	2.35 ± 0.43 (J)	1.36 ± 0.54 (J)
GP4	VWDRPX11	0.0	1.0	--	--	29.87 ± 5.47 (J)	1.17 ± 0.33 (J)	2.55 ± 0.48 (J)	1.87 ± 0.64 (J)

[a]Background concentration listed or derived in *Off-Site Radiation Exposure Review Project, Phase II Soils Program* (McArthur and Miller, 1989)
[b]Background concentration listed in *Environmental Monitoring Report for the Proposed Ward Valley California Low-Level Radioactive Waste (LLRW) Facility* (Atlan-Tech, 1992)

J = Estimated value
-- = Not detected above contract required detection limit
pCi/g = Picocuries per gram

Table A.3-8
Soil Sample Results for Isotopic Uranium and Strontium-90 Detected Above Contract Required Detection Limit, Area 25 Vehicle Washdown, Nevada Test Site

Sample Location	Sample No.	Start Depth (ft)	End Depth (ft)	Contaminant of Potential Concern (pCi/g)		
				Uranium-234	Uranium-238	Strontium-90
Background Concentrations				0.1 - 2.6[a]	0.21 - 3.2[a]	0.01 - 1.17[b]
CAS 25-07-02 F and J Roads Pad						
BKG1	VWDFJ001	0.0	1.0	0.89 ± 0.17 (J)	0.86 ± 0.16 (J)	--
BKG2	VWDFJ004	3.0	4.0	0.88 ± 0.15 (J)	--	--
GP5	VWDFJ013	0.0	1.0	1.06 ± 0.17 (J)	0.87 ± 0.15 (J)	12.5 ± 2.3 (J)
GP4	VWDFJ011	0.0	1.0	--	--	6.9 ± 1.3 (J)
CAS 25-07-03 RADSAFE Pad						
BKG1	VWDRP002	3.0	5.0	0.99 ± 0.19	1.03 ± 0.19	--

[a]Background concentration listed or derived in *Off-Site Radiation Exposure Review Project, Phase II Soils Program* (McArthur and Miller, 1989)
[b]Background concentration listed in *Environmental Monitoring Report for the Proposed Ward Valley California Low-Level Radioactive Waste (LLRW) Facility* (Atlan-Tech, 1992)

J = Estimated value
-- = Not detected above contract required detection limit

Shading indicates analytical result exceeds PAL.

A.4.0 Quality Assurance

The results of the QA/QC activities for the Area 25 Vehicle Washdown 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, 1996).

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 matrix spike and matrix spike duplicate (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 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 custody was maintained during shipment to the laboratories.

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 for this project (DOE/NV, 1996). Although a portion of the results for acrolein were rejected, the minimum 80 percent completeness was achieved. Please refer to Section A.3.1 for more information regarding rejected data for acrolein.

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, the Area 25 Vehicle Washdown field and 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, 1996), 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 soil 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 CAU 240 have been evaluated for data quality according to the EPA Functional Guidelines (EPA, 1994b and 1994c). 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.

Changes resulting from the data evaluation process are documented in project files and are summarized in memoranda for each sample delivery group (SDG). These memoranda are maintained in IT project files.

A.4.6.1 Tier I Evaluation

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

Chemical:

- Correct detection limits achieved
- 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 %Rs 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

Radioanalytical:

- Correct detection limits achieved
- Blank contamination evaluated and applied to sample results/qualifiers
- Certificate of Analysis consistent with data package documentation

- Quality control sample results (duplicates, laboratory control samples, laboratory blanks) evaluated and applied to laboratory result qualifiers
- 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

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

Chemical:

- 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
- 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

A Tier III review of at least 5 percent of the sample analytical data is currently being performed by Laboratory Data Consultants, Inc. in Carlsbad, California. Results will be incorporated in the final version of this document.

A.4.7 Quality Control Samples

Twenty-six trip blanks, four field blanks, five equipment rinsate blanks, five MS/MSD, and five field duplicates were collected and submitted for laboratory analyses as shown in Table A.3-1. The blanks and duplicates were assigned individual sample numbers and sent to the laboratory "blind." Additional samples were selected by the laboratory to be analyzed as laboratory duplicates. Documentation related to the collection and analyses of these samples is retained in project files.

A.4.7.1 Field Quality Control Samples

Review of the field-collected blank analytical data for the investigation sampling indicates that cross-contamination from field methods did not occur during sample collection. Field and equipment rinsate blanks were analyzed for the parameters listed in Table A.3-2 and trip blanks were analyzed for VOCs only. None of the results for these field-collected blanks exceeded the minimum laboratory reporting limits (DOE/NV, 1999).

During the sampling event, five field duplicate soil 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 duplicate results precision (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 1994c). The EPA Functional Guidelines state that there are no required review criteria for field duplicate analyses comparability, but allow the data reviewer to exercise professional judgement. The RPD between the environmental samples results and their corresponding field duplicate sample results exceeded the 20 percent criteria stated in the Industrial Sites QAPP (DOE/NV, 1996) for some target analytes. The variability in the results between the environmental samples and their corresponding field duplicate samples could be attributed to nonhomogeneous samples and the difficulties associated with collecting identical field samples. It is expected that soil field duplicate results will have a greater variance than water matrices.

The laboratory duplicate samples were compared to the criteria set forth in the EPA Functional Guidelines (EPA, 1994c) 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.

Five field samples were selected for use as MS/MSD 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 Guideline criteria (EPA, 1994b and 1994c). 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 spike recovery is greater than the upper acceptance limits, nondetections are not qualified. If spike recovery is greater than the upper acceptance limit or less than the lower acceptance limit, positive results are qualified as estimated (J) and 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 method QC blanks and surrogate spikes for organic analyses, method blanks, preparation blanks, initial and continuing calibration blanks for total metals, and LCS 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 1994c).

The EPA Functional Guidelines (EPA, 1994b and 1994c) state that no qualification action is taken if a compound is found in an associated blank, but not in the sample or if a compound is found in the sample, but not in an 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, herbicides, and pesticides, 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.

For the common laboratory contaminants (e.g., methylene chloride, acetone, 2-butanone [methylethyl ketone or 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., 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.

Surrogate spikes, or system monitoring compounds, are added to the environmental samples analyzed by chromatographic techniques for VOCs, SVOCs, pesticides, PCBs, gasoline, and diesel. 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 calls for 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). Documentation of data qualifications resulting from the application of these guidelines is retained in the project files as both hard copy and electronic media.

One laboratory duplicate analysis for metals was performed for each SDG that reported total 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, 1994c) call for all results for that analyte in all associated samples of the same matrix to be qualified as estimated (J). Documentation of data qualifications resulting from the application of these guidelines is retained in the project files as both hard copy and electronic media.

Laboratory control samples, also known as blank spikes, consist of known quantities of target compounds added to purified sand or deionized, distilled water 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. Documentation of data qualifications resulting from the application of these guidelines is retained in project files as both hard copy and electronic media.

A.4.8 Field Nonconformances

A procedural deficiency was identified during Tier I review. Three samples arrived at the Bechtel Nevada Analytical Services Laboratory without custody tape on the sample containers. Because the samples were hand delivered and remained in the custody of the sample collector until relinquished to the laboratory, there was no breach of custody. The resultant data was not impacted.

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 laboratory nonconformances were documented for this project. These nonconformances have been accounted for in the data qualification process. All nondetect acrolein results were rejected due to the compounds response in the initial calibration. The laboratory is not required to generate a nonconformance for this type of deficiency as long as the laboratory met all the required QC criteria for the initial calibration analysis. Documentation of these results is retained in project files.

A.5.0 Summary

Analysis of the data generated from corrective action investigation activities conducted at the Area 25 Vehicle Washdown sites indicates the following:

- All total VOCs, total SVOCs, PCBs, and pesticides results were below the PALs outlined in the CAIP (DOE/NV, 1999) at all CASs.

- Total petroleum hydrocarbon concentrations exceeded the NDEP action level of 100 mg/kg for diesel around the perimeter of the concrete decontamination pad at F and J Roads Pad. The TPH action level was not exceeded at the other two CASs.

- Reported levels for all total RCRA metal samples (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) were below the PALs established in the CAIP (DOE/NV, 1999) except for arsenic. Arsenic was detected above the PAL of 3.0 mg/kg in most of the samples analyzed. The arsenic concentrations for the samples analyzed ranged from 1.9 to 10.2 mg/kg. Although these concentrations exceed the PAL for arsenic, these concentrations are not unusual for this portion of the state of Nevada; therefore, these concentrations do not imply contamination and arsenic is not a COC.

- Radiological results for the Propellant Pad and the RADSAFE Pad are considered not to be statistically different from their respective established background levels and; therefore, are below PALs.

- Radiological results from the F and J Roads Pad indicated that two samples had concentrations above established background levels and; therefore, are above PALs. Sample VWDFJ011 had a strontium-90 concentration of 6.9 ± 1.3 pCi/g. Sample VWDFJ013 had cesium-137 and strontium-90 concentrations of 14.7 ± 1.6 pCi/g and 12.5 ± 2.3 pCi/g, respectively. All other results, including the isotopic uranium and plutonium results for sample VWDFJ013, are considered not to be statistically different from their respective established background levels and; therefore, are below PALs.

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Appendix B

Cost Estimates

EST: CAU 240 CADD	**BN ENVIRONMENTAL RESTORATION** **COST ESTIMATE SUMMARY**	Prep Date: 7/19/99 Print Date: 9/13/99

TO: SHANNON PARSONS-DEPRY - Environmental Restoration Task Manager **FROM:** ABDEL AGALLOUCH - ER Project Controls

SUBJECT: REMEDIAL ALTERNATIVES **TEC:** $105,835

WORK PKGE: CAU 240 Area 25 Vehicle Washdown **WBS:** 1040102130601

TAP: DRAINS AND SUMPS SOURCE GROUP **LOCATION:** Area 25- NTS

TYPE OF ESTIMATE		TYPE OF WORK	
X ORDER OF MAGNITUDE	PRELIMINARY TITLE II	RI/FS	
PLANNING/STUDY	WORK ORDER	X REMEDIATION	
CONCEPTUAL/BUDGET	COMPARATIVE	X CONSTRUCTION	
TITLE I/PRELIMINARY	OTHER	OTHER	

BN REMEDIATION PROJECT			WORK TO BE PERFORMED BY	
ESTIMATOR: Abdel Agallouch	702-295-5275	X DOE PRIME CONTRACTOR		NATIONAL LAB
TASK MGR: Shannon Parsons Depry	702-295-0645	NTS GENERAL		SUBCONTRACT
PROJ MGR: Steve Nacht	702-295-7234	NTS MAINTENANCE		OTHER

STATEMENT OF WORK:

This estimate has been prepared to provide remedial alternative costs for the closure of Corrective Action Unit (CAU) 240, Corrective Action Site (CAS) 25-07-02, an environmental restoration site listed in the Federal Facilities and Consent Order (FFACO). CAU 240 is specifically described as the Area 25 Vehicle Washdown. CAS 25-07-02 is specifically described as Vehicle Washdown Area. Two alternatives will be evaluated for closure of the site: I) No Further Action - no associated costs or administrative controls; II) Clean Closure by Excavation and Disposal - this estimate will be used to identify the cost associated with 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. Costs for project management, plan preparation, project support, or other overhead functions are not included.

SCOPE

Provide site closure using one of the following alternatives:

I) NO FURTHER ACTION - NO ASSOCIATED COSTS OR ADMINISTRATIVE CONTROLS

II) CLEAN CLOSURE BY EXCAVATION AND DISPOSAL

BASIS OF ESTIMATE AND ASSUMPTIONS

Alternative II: Clean Closure by Excavation and Disposal

- Total soil volume includes an expansion factor of 20 percent.
- Clean soil from a nearby location will be used to backfill the excavations to minimize surface depression.
- Removal and disposal of the 15-ft by 30-ft by 6-in concrete decon pad. Assume that the pad will be nonhazardous/non rad and will be disposed of as sanitary waste.
- Excavation and disposal of approximately 14 CY of TPH-diesel contaminated soil from the eastern and western sides of the decontamination pad. Excavations will each be 2-ft wide by 30-ft long by 2-ft deep. The soils in the vicinity of the southwest corner of the pad will require additional excavation. This excavation will be 2-ft wide by 6-ft long by 6-ft deep.
- Verification soil and waste characterization samples will be required on the eastern and western sides. Samples will be analyzed for TPH-diesel. Assume a total of 4 samples will be required.
- Excavation and disposal of approximately 5 CY of TPH-diesel contaminated soil from the northern and southern ends of the decontamination pad. There is low level radioactive contamination associated with this TPH contaminated soil. Assume no treatment required prior to disposal. Excavations will each be 2-ft wide by 15-ft long by 2-ft deep.
- Assume a total of 6 verification soil and waste characterization samples will be required for the northern and southern ends. Samples will be analyzed for Sr-90, Cs-137 and TPH-diesel.
- RWAP process needed for waste management and disposal activities.
- Required support will include equipment operators, laborers, and teamsters.
- Assume bioassay program will be required for Sr-90 and gamma-20 minute-100 count
- PPE requirements and hotline support will include level C.

RATES

FY99 indirect rates, effective 5/31/99 were applied using the BN FY99 cost model.

ESCALATION:

Escalation is not included in this estimate. All costs are in FY99 dollars

CONTINGENCY:

Contingency costs are not included in this estimate.

COST SUMMARY - TOTAL ESTIMATED COST PER REMEDIAL ALTERNATIVE

- NO FURTHER ACTION -NO ASSOCIATED COSTS OR ADMINISTRATIVE CONTROLS $0
- CLEAN CLOSURE BY EXCAVATION AND DISPOSAL $105,835

Review / Concurrence.

Estimator 9/13/99 Date — Checked By 9/13/99 Date

Appendix C

Response to NDEP Comments

NEVADA ENVIRONMENTAL RESTORATION PROJECT

DOCUMENT REVIEW SHEET

(Page 1 of 3)

1. Document Title/Number: Draft Corrective Action Decision Document for Corrective Action Unit 240: Area 25 Washdown, Nevada Test Site, Nevada	2. Document Date: July 1998
3. Revision Number: 0	4. Originator/Organization: IT Corporation
5. Responsible DOE/NV ERP Project Mgr.: Janet Appenzeller-Wing	6. Date Comments Due: August 26, 1999
7. Review Criteria: Full	
8. Reviewer/Organization/Phone No.: John A. Wong/NDEP/702-486-2866	9. Reviewer's Signature:

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
1. Page 7, Section 2.2, 3rd bullet		Add silver to the list of RCRA metals. Also DOE needs to state what levels of arsenic were observed in background samples to substantiate the claim that typical concentrations of arsenic in this part of Nevada are higher than the PAL of 3.0 ppm.	Silver has been added to the list of RCRA Metals. Section A.3.4 provides a mean concentration of arsenic observed in background samples.	Yes
2. Page 17, Section 3.3.2, Last Paragraph		*"Activities will include...and 5 yd^3 of TPH with associated radionuclide contamination."* I believe that "soil" should be inserted in place of "TPH" in this sentence. Also, soil in the SW corner will be excavated to 6 ft bgs. Is sample VWDFJ023 located in the SW corner? According to Table A.3-4, sample location GP9 (VWDFJ023) was found to contain 380 ppm TPH. Based on the results presented in this table, most of the contamination is present at a depth within 1 ft bgs. How was it determined that soil in the SW corner will be excavated to a depth of 6 ft bgs and soil at the perimeter excavated to a depth of 2 ft bgs? Are the plans for excavation consistent with the sample results in Table A.3-4, page A-24. Please address, verify, and/or confirm.	The sentence has been modified as follows: "Activities will include....and 5yd^3 of TPH and radionuclide contaminated soil." Sample VWDFJ023 was collected from near the southwest corner at a depth of 3-5 ft bgs. Most of the contamination is within 1 ft bgs. The contamination at location GP9 extends to the 3-5 ft bgs interval. The depths of excavation necessary to remove contaminated soil that exceeds action levels are estimated in the CADD. For example, sample results indicate contamination at several locations at a depth of 0-1 ft bgs, but not at 3-5 ft bgs. The assumption was made that contamination extends beyond 1 ft bgs at these locations to 2 ft bgs. The estimates for excavation are consistent with the sample results in Table A.3-4.	Yes

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET
(Page 2 of 3)

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
3. Page A-3, Section A.2.0, 1st Paragraph, 2nd Sentence		Capitalize *"field"* screening.	This sentence has been deleted. The information deleted here is in Section A.2.2.5.	Yes
4. Page A-25, Table A.3-5		Why have results for cadmium and silver, two of the eight RCRA metals, been excluded from this table? Please add these results.	The results for cadmium and silver have been excluded from this table because the concentrations of these constituents were not detected above the approved minimum reporting limits.	No
5. Page A-35, Section A.4.6, 1st Paragraph, 3rd Sentence		*"There were no data rejected..."* This statement is not accurate if indeed a portion of acrolein results were rejected as stated (see Section A.4.4, among other locations in the document where it was stated that some results for acrolein were rejected).	The subject sentence has been replaced with the following: "No data rejected during the data evaluation process were used to draw the conclusions presented in the CADD." The reader is also referred in Section A.4.4 to Section A.3.1 for more information regarding rejected data for acrolein.	Yes

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET
(Page 3 of 3)

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
6. Page A-38, Section A.4.7-A.4.7.2		Why were QC sample results compared with EPA Functional Guidelines. EPA Functional Guidelines and criteria apply to CLP activities. It seems as though the QC results for this project should be compared to project-specific DQOs, which should have been established in the Final CAIP or the Industrial Sites QAPP.	The QC sample results were initially compared to the project-specific DQOs, which are stated in the CAIP's "Laboratory Analytical Requirements," Table A.3-4. This table was used to create the Analytical Services Request Form before sampling activities commenced. The laboratory followed the QC criteria stated in the Analytical Services Request Form. When the analytical results arrived from the laboratory, Tier II Data Validation was performed. Tier II Data Validation followed the guidelines set forth in the U.S. EPA's Contract Laboratory Program National Functional Guidelines for Inorganic and Organic Data Review, published in February 1994. The data review process provides information on analytical limitations and data usability based on specific QC criteria stated in the "Laboratory Analytical Requirements" table. The EPA Functional Guidelines provide guidance in the data qualification of the analytical results using an overview of all QC results. The data validation process provided the technical review of analytical data based on the CAIP's "Laboratory Analytical Requirements" table criteria. The EPA Functional Guidelines document applies to non-CLP activities as long as the QC criteria being followed are the criteria stated by the project or by the method. Third party contractors performing Tier III Data Validation also follow the EPA Functional Guidelines.	Partial
7. Page A-43, 3rd bullet		Add silver to the list of RCRA metals.	Silver has been added to the list of RCRA Metals.	Yes

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

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

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