Nevada
Environmental
Restoration
Project

DOE/NV--581

Corrective Action Decision Document for Corrective Action Unit 135: Area 25 Underground Storage Tanks, Nevada Test Site, Nevada

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Environmental Restoration
Division

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CORRECTIVE ACTION DECISION DOCUMENT FOR CORRECTIVE ACTION UNIT 135: AREA 25 UNDERGROUND STORAGE TANKS, NEVADA TEST SITE, NEVADA

DOE Nevada Operations Office
Las Vegas, Nevada

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CORRECTIVE ACTION DECISION DOCUMENT FOR
CORRECTIVE ACTION UNIT 135:
AREA 25 UNDERGROUND STORAGE TANKS,
NEVADA TEST SITE, NEVADA

Approved by: Signature Approved Date: 12/23/99

Janet Appenzeller-Wing, Project Manager
Industrial Sites Project

Approved by: Signature Approved Date: 12/23/99

Runore C. Wycoff, Division Director
Environmental Restoration Division

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List of Acronyms and Abbreviations

AST	Aboveground storage tank
BN	Bechtel Nevada
CADD	Corrective Action Decision Document
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CFR	*Code of Federal Regulations*
CLP	Contract Laboratory Program
COC	Contaminant(s) of concern
COPC	Contaminant(s) of potential concern
CRDL	Contract-required detection limit(s)
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DQO	Data Quality Objective(s)
E-MAD	Engine-Maintenance Assembly and Disassembly
EPA	U.S. Environmental Protection Agency
FFACO	*Federal Facility Agreement and Consent Order*
FSL	Field-screening level
ft	Foot (feet)
ICP	Inductively coupled plasma
in.	Inch(es)
IT	IT Corporation
LCS	Laboratory control sample(s)
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MEK	Methylethyl ketone (2-butanone)
mi	Mile(s)
mg/kg	Milligram(s) per kilogram

List of Acronyms and Abbreviations *(Continued)*

mrem/hr	Millirem per hour
MS/MSD	Matrix spike/matrix spike duplicate
NAC	*Nevada Administrative Code*
NDEP	Nevada Division of Environmental Protection
NIST	National Institute for Standards and Technology
NRS	*Nevada Revised Statutes*
NTS	Nevada Test Site
PAL	Preliminary action level(s)
PB	Preparation blanks
PCB	Polychlorinated biphenyl(s)
pCi/g	Picocurie(s) per gram
pCi/s	Picocurie(s) per swipe
PID	Photoionization detector
ppb	Part(s) per billion
PPE	Personal Protective Equipment
ppm	Part(s) per million
PRG	Preliminary Remediation Goals
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RADCON	Radiological Control
RCRA	*Resource Conservation and Recovery Act*
RPD	Relative percent difference
SDG	Sample delivery group
SVOC	Semivolatile organic compound(s)
TCA	Test Cell A
TPH	Total petroleum hydrocarbons

List of Acronyms and Abbreviations (Continued)

UST	Underground Storage Tank
VOC	Volatile organic compound(s)
µg/kg	Microgram(s) per kilogram
%R	Percent recovery

Executive Summary

This Corrective Action Decision Document has been prepared for Corrective Action Unit 135, Area 25 Underground Storage Tanks. The corrective action investigation was conducted in accordance with the *Corrective Action Investigation Plan for Corrective Action Unit 135: Area 25 Underground Storage Tanks, Nevada Test Site, Nevada* as developed under the *Federal Facility Agreement and Consent Order.* Corrective Action Unit 135 is comprised of the following Corrective Action Sites:

- 25-02-01, Underground Storage Tanks, referred to as the Engine-Maintenance Assembly and Disassembly Waste Holdup Tanks and Vault
- 25-02-03, Underground Electrical Vault, referred to as the Deluge Valve Pit at the Test Cell A Facility
- 25-02-10, Underground Storage Tank, referred to as the former location of an aboveground storage tank for demineralized water at the Test Cell A Facility

All three of these corrective actions sites were originally considered to be underground storage tanks. However, during the Data Quality Objectives meeting on January 13, 1999, a determination was made based on site visits and engineering drawings that the Corrective Action Sites 25-02-03 (Deluge Valve Pit) and 25-02-10 (former location of an aboveground storage tank) had been misidentified as underground storage tanks in the *Federal Facility Agreement and Consent Order.* A detailed description and history of the corrective actions sites can be found in the site-specific *Corrective Action Investigation Plan*. Corrective action site 25-02-03 (Deluge Valve Pit) is located west of the Dewar Area at the Test Cell A Facility. The Deluge Valve Pit is a vault that contains the piping and electronic controls for the water cooling system in the Dewar Area at the Test Cell A Facility. Corrective Action Site 25-02-10 is the former location of an aboveground storage tank and is located west of Building 3116 (Pump House). This site was the location of an aboveground storage tank used to hold demineralized water used to cool the reactor carts during tests conducted at Test Cell A. Radiological surveys were conducted at Corrective Action Sites 25-02-03 (Deluge Valve Pit) and 25-02-10 (former location of an aboveground storage tank) by Bechtel Nevada in January 1999. No radiological contamination was detected above background levels for these two sites. In the Closure Report for CAU 135, a recommendation will be made for no further action at these two sites. 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 Corrective Action Site 25-02-01, Engine-Maintenance Assembly and Disassembly Waste Holdup Tanks and Vault.

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 for the remaining Corrective Action Site, 25-02-01, Engine-Maintenance Assembly and Disassembly Waste Holdup Tanks and Vault was conducted in June 1999 as set forth in the *Corrective Action Investigation Plan for Corrective Action Unit 135: Area 25 Underground Storage Tanks, Nevada Test Site, Nevada* (DOE/NV, 1999). Analytes detected during the corrective action investigation were evaluated against preliminary action levels to determine the contaminants of concern for Corrective Action Unit 135. One sample from the radiological survey of the concrete vault interior exceeded radionuclide preliminary action levels. The analytes from the sediment samples that exceeded the preliminary action levels are polychlorinated biphenyls, *Resource Conservation and Recovery Act* metals, total petroleum hydrocarbons as diesel-range organics, and radionuclides. Based on the identification of contaminants of concern above preliminary action levels for 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, 1998b).

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

- Prevent or mitigate human exposure to sediments located in the vault sump containing contaminants of concern at concentrations exceeding preliminary action levels as defined in the Corrective Action Investigation Plan.

- Prevent human exposure to areas inside the vault with surface contamination greater than unrestricted release levels for radiological constituents.

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

- Alternative 1 - No Further Action
- Alternative 2 - Unrestricted Release Decontamination and Verification Survey

The corrective action alternatives were evaluated against four general corrective action standards. Only Alternative 2 was compared to the five remedy selection decision factors because Alternative 1 did not meet the unrestricted release criteria. Based on the results of these evaluations, the preferred corrective action alternative selected for the Corrective Action Site 25-02-01, Engine-Maintenance Assembly and Disassembly Waste Holdup Tanks and Vault is Alternative 2, Unrestricted Release Decontamination and Verification Survey.

The preferred corrective action alternative was evaluated on technical merit, focusing on performance, reliability, feasibility, and safety. The alternative was judged to meet all requirements for the technical components evaluated. The alternative for CAS 25-02-01, E-MAD Waste Holdup Tanks and Vaults meets all applicable state and federal regulations for closure of the site and reduces the potential for future exposure pathways.

During corrective action implementation, this alternative will present a potential threat to site workers who come in contact with the contaminated concrete and sediment during the removal process. However, procedures will be developed and implemented to ensure worker health and safety.

1.0 Introduction

The *Corrective Action Decision Document (CADD) for Corrective Action Unit (CAU) 135, Area 25 Underground Storage Tanks (USTs)* has been prepared in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the U.S. Department of Energy (DOE); the State of Nevada; and the U.S. Department of Defense (FFACO, 1996).

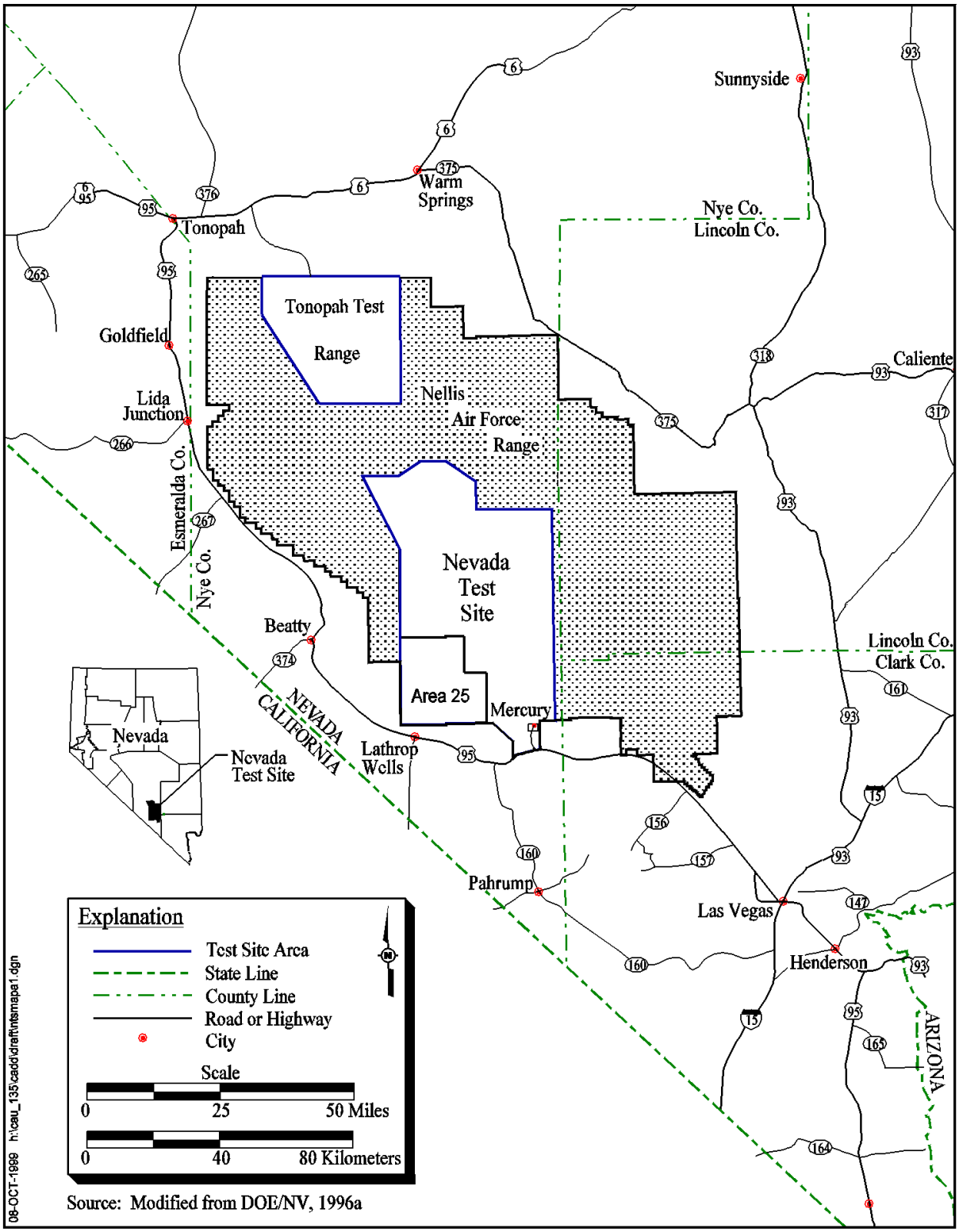
This CADD provides or references the specific information necessary to recommend corrective action for a Corrective Action Site (CAS) within CAU 135. Corrective Action Unit 135 is comprised of the following CASs:

- 25-02-01, Underground Storage Tanks, referred to as the Engine-Maintenance Assembly and Disassembly (E-MAD) Waste Holdup Tanks and Vault
- 25-02-03, Underground Electrical Vault, referred to as the Deluge Valve Pit at the Test Cell A (TCA) Facility
- 25-02-10, Underground Storage Tank, referred to as the former location of an aboveground storage tank (AST) for demineralized water at the TCA Facility

Corrective Action Unit 135 is located on the Nevada Test Site (NTS) in Nye County, Nevada. The NTS is approximately 65 miles (mi) northwest of Las Vegas, Nevada (Figure 1-1 and Figure 1-2).

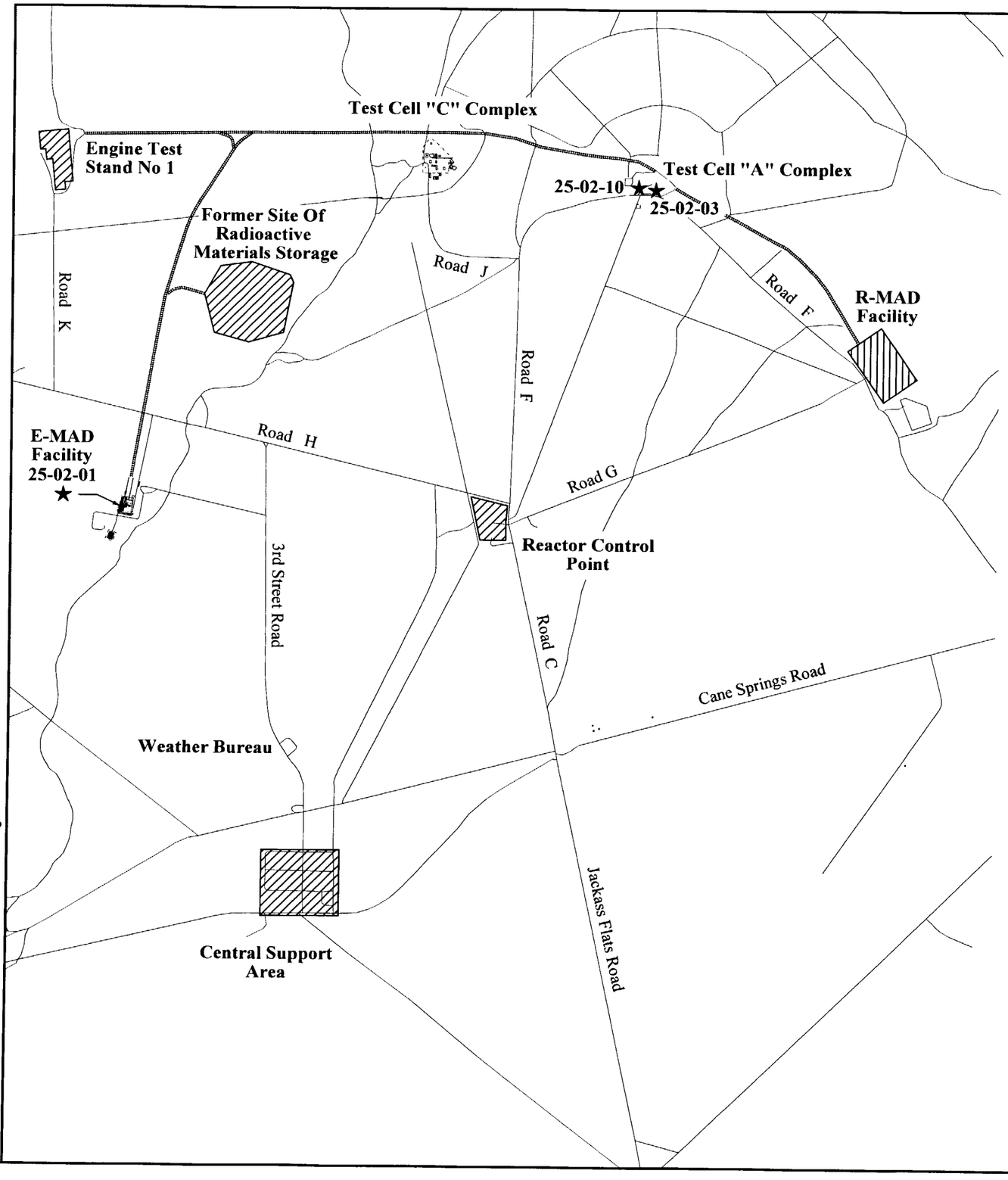
1.1 Purpose

The purpose of this CADD is to identify and provide a rationale for the selection of a recommended corrective action alternative for CAS 25-02-01, E-MAD Waste Holdup Tanks and Vault within CAU 135. The need for evaluation of corrective action alternatives is based on process knowledge and the results of the corrective action investigation at CAU 135 conducted in June 1999, in accordance with the *Corrective Action Investigation Plan (CAIP) for Corrective Action Unit 135: Area 25 Underground Storage Tanks, Nevada Test Site, Nye County, Nevada* (DOE/NV, 1999); the detailed results of that investigation are presented in Appendix A.



Source: Modified from DOE/NV, 1996a

Figure 1-1
Nevada Test Site and Tonopah Test Range



Corrective Action Unit	FFACO Corrective Action Site	CAS Description
135	25-02-01	Underground Storage Tanks
135	25-02-03	Underground Electrical Vault
135	25-02-10	Underground Storage Tank

Explanation

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

Note

The size of some of the Areas have been exaggerated for clarity.

Scale

0 3,000 6,000 Feet

0 1 2 Kilometers

Source: DOE/NV, 1987

Figure 1-2
General Location of the Area 25 and CASs in CAU 135

1.2 Scope

The scope of this CADD consists of the evaluation, identification, and recommendation of a preferred corrective action alternative to be implemented at the E-MAD Waste Holdup Tanks and Vault site. To achieve this scope, the following actions have been taken:

- Evaluated current site conditions, including the concentration and extent of contamination.
- Developed corrective action objectives.
- Identified corrective action alternative screening criteria.
- Developed corrective action alternatives.
- Performed detailed evaluation of the corrective action alternatives in relation to corrective action objectives and screening criteria.
- Recommended and justified a preferred corrective action alternative for CAS 25-02-01, E-MAD Waste Holdup Tanks and Vault.

1.3 CADD Contents

This CADD has been divided into the following sections:

- Section 1.0 - Introduction: summarizes the purpose, scope, and contents of this CADD.
- Section 2.0 - Corrective Action Investigation Summary: summarizes the investigation activities, the results of the investigation, and the need for corrective action.
- Section 3.0 - Evaluation of Alternatives: documents steps taken to determine a preferred corrective action alternative.
- Section 4.0 - Recommended Alternative: presents the preferred corrective action alternative and rationale for its selection based on the corrective action objectives and alternative screening criteria.
- Section 5.0 - References: provides a list of cited documents.
- Appendix A: *Corrective Action Investigation Report for CAU 135: Area 25 Underground Storage Tanks, Nevada Test Site, Nevada.*
- Appendix B: Cost Estimates.

- Appendix C - Bechtel Nevada Phase I Analytical Results.
- Appendix D - MARSSIM Discussion.
- Appendix E - Response to NDEP Comments.

All work was performed in accordance with the following documents:

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

2.0 Corrective Action Investigation Summary

The following sections describe and summarize the results of the corrective action investigation activities conducted at CAU 135. During the Data Quality Objectives (DQO) process and the development of the CAIP, it was determined that CAS 25-02-03 (Deluge Valve Pit) and CAS 25-02-10 (location of the former aboveground storage tank) were misidentified as USTs in the FFACO (1996). Based on limited radiological surveys of the two CASs, it was found that neither site is contaminated (DOE/NV, 1999). Furthermore, there are no structures or media related to these sites (i.e., nearby exposed piping, the Pump House [Building 3116], Deluge Valve Pit #2) that have been identified for corrective action in the FFACO (DOE/NV, 1999). In the CAIP, a determination was made that sufficient information existed for CASs 25-02-03 and 25-02-10 and that no further investigation would be required at these sites (DOE/NV, 1999). Based on the preceding rationale, these two sites should be included in the CAU 135 Closure Report with a recommendation for no further action. A detailed discussion of the rationale for the exclusion of these sites from the corrective action investigation is found in Section 2.2.2 and Section 2.2.3 of the CAIP (DOE/NV, 1999). Therefore, only CAS 25-02-01, E-MAD Waste Holdup Tanks and Vault, was included in the corrective action investigation. For detailed results of the corrective action investigation for the E-MAD Waste Holdup Tanks and Vault, refer to Appendix A.

2.1 Corrective Action Investigation Activities

In June 1999, a corrective action investigation was conducted at the E-MAD Waste Holdup Tanks and Vault in accordance with the CAIP (DOE/NV, 1999). The investigation was conducted in two separate phases, Phase I by Bechtel Nevada (BN) and Phase II by IT Corporation (IT). The activities for each phase are summarized below:

Phase I

- Grouted the process wastewater drains inside the E-MAD Building that drained into the vault.
- Disconnected piping to the trailers which were connected to the radioactive waste drain system, cut the piping flush with the ground surface, and grouted the piping.

- Performed a preliminary inspection of the vault including vault lid removal, air monitoring, a radiological survey of selected locations inside the vault, and a visual inspection of the tank interiors after removal of the existing access covers.

- Inserted a wet tap into the influent piping inside the vault in order to remove any free standing liquids contained inside the pipes. Approximately six gallons of liquid was collected from the two influent pipes.

- Unbolted or saw-cut flange bolts and small diameter pipes and removed them from the vault.

- Removed two 1,500-gallon waste holdup tanks from the vault.

- Cut the remaining ancillary pipes and valves with welding equipment. The piping was stubbed and capped near the vault interior surface.

- Removed the sump pump inside the vault. There was no liquid in the sump or the sump pump when it was removed.

- Swept up debris that accumulated on top of the concrete floor during the tank and pipe removal activities, as well as the existing sediment.

- Transported the vault contents to the Area 6 Decontamination Facility for characterization and appropriate disposal.

- In early December 1999, engineering measures were emplaced to minimize and/or prevent the potential for the accumulation of liquid in the drains and/or remaining piping. These engineering measures are as follows:

  - Welded the isolation valves from the stacks and the train decontamination pad closed.

  - Inspected and grouted E-MAD floor drains as necessary. Some floor drains in the interior area of the E-MAD building (i.e., hot cells) were not grouted because these drains are not expected to accumulate any liquid.

<u>Phase II</u>

- Sectioned the concrete vault interior into predetermined sized grid squares in order to conduct a radiological survey.

- Performed a radiological survey for the purpose of identifying the extent and quantity of the fixed and removable contamination inside the vault. Exposure rates were documented for each grid square. Collected a total of 99 swipe samples during the survey. Quality Control (QC)/Quality Assurance (QA) samples were also collected for the swipe samples and are included in the total count.

- Collected a sediment sample from the sump inside the vault. Quality Control/Quality Assurance samples were also collected for the sump.

2.2 Results

The Phase I analytical results are included in Appendix C. The waste determination and final disposal of the material removed from the vault during Phase I activities is pending and will be documented in the CAP.

A summary of the corrective action investigation analytical results (Appendix A) indicated the following:

- For the radiological survey of the vault interior, only one direct frisk measurement (Table A.3-5), from a pipe located at grid location number N03, exceeded the DOE allowable values for total residual surface contamination. Review of the swipe sample results did not identify any samples with removable activity in excess of the removable limits listed in the *NV/YMP Radiological Control (RADCON) Manual* (DOE/NV, 1996c).

- Two sediment samples collected from the sump had radionuclide concentrations exceeding background (Table A.3-6) (U.S. Ecology and Atlan-Tech, 1992; McArthur and Miller, 1989).

- All volatile organic compound (VOC) and semivolatile organic compound (SVOC) results for the sediment samples (Section A.3.1 and Section A.3.2) were below the preliminary action levels (PALs) outlined in the CAIP (DOE/NV, 1999).

- Total petroleum hydrocarbons (TPH) as diesel range organics in the sediment samples (Section A.3.3) exceeded the Nevada Division of Environmental Protection (NDEP) action level of 100 milligrams per kilogram (mg/kg).

- For the sediment samples, the total *Resource Conservation and Recovery Act* (RCRA) metal concentrations (Table A.3-4) for arsenic and lead exceeded the established PALs in the CAIP (DOE/NV, 1999).

- Two polychlorinated biphenyls (PCBs) were detected in the sediment samples (Section A.3.5), Aroclor-1254 and Aroclor-1260 were determined to exceed the PALs outlined in the CAIP (DOE/NV, 1999).

Details of the methods used and results found during the investigation are presented in Appendix A. Based on these results, the nature and extent of contamination at CAS 25-02-01, E-MAD Waste

Holdup Tanks and Vault has been adequately identified to develop and evaluate corrective action alternatives.

2.3 Need for Corrective Action

Analytes detected during the corrective action investigation were evaluated against PALs to determine contaminants of concern (COCs) for the E-MAD Waste Holdup Tanks and Vault. Results from the radiological survey and the sediment samples indicate that PCBs, total RCRA metals, TPH as diesel-range organics, and radionuclide concentrations exceeded the established PALs in the CAIP (DOE/NV, 1999). Based on the identification of COCs above PALs, potential corrective action alternatives are identified and evaluated in this CADD to ensure worker, public, and environmental protection against potential exposure to COCs in accordance with the *Nevada Administrative Code* (NAC) 445A (NAC, 1998b).

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

3.0 Evaluation of Alternatives

The purpose of this section is to present the corrective action objectives for the E-MAD Waste Holdup Tanks and Vault site, describe the general standards and decision factors used to screen the corrective action alternatives, and develop and evaluate a set of corrective action alternatives that could be used to meet the corrective action objectives.

3.1 Corrective Action Objectives

Corrective action objectives are media-specific goals for protecting human health and the environment and constitute the basis for the development of corrective action alternatives. The proposed corrective action must be technically sound, provide a permanent solution for the site, and be cost-effective. In addition, the corrective action must be acceptable to the U.S. Department of Energy, Nevada Operations Office (DOE/NV), NDEP, and the public. Based on the potential exposure pathways (see Section 3.1.2), the following corrective action objectives have been identified for CAU 135:

- Prevent or mitigate human exposure to sediments located in the vault sump containing COCs at concentrations exceeding PALs as defined in the CAIP (DOE/NV, 1999).
- Prevent human exposure to areas of surface contamination greater than unrestricted release limits for radionuclides inside the vault (DOE/NV, 1996c).

3.1.1 Contaminants of Concern

Contaminants of potential concern (COPCs) were determined in the DQO process as listed in the CAIP (DOE/NV, 1999). Analytical results obtained from the corrective action investigation were evaluated to determine if COPCs were detected above PALs. If the PALS are exceeded, those analytes become COCs and must be considered for corrective action. Based on the results of the evaluation, PCBs (i.e., Aroclor-1254 and Aroclor-1260), total RCRA metals (i.e., arsenic and lead), TPH as diesel-range organics, and radionuclides have been identified as COCs for this site.

3.1.2 Potential Exposure Pathways

As identified in the CAIP, the future use for the CAU is assumed to include industrial use, educational tours, research, and support sites. As part of the CAIP (DOE/NV, 1999), a conceptual model for E-MAD Waste Holdup Tanks and Vault was developed which identified potential exposure pathways as ingestion, inhalation, dermal contact, and direct exposure with contaminated sediments and/or the concrete vault surface under an industrial-use scenario. The potential exposure mechanism would most likely be from site personnel that could be exposed to the contaminated vault area during general facility maintenance or construction and maintenance of utilities. Contaminant migration to the groundwater is not considered to be a significant exposure pathway because the vault is constructed of concrete and acts as a barrier to the downward migration of COCs. Any migration of COCs from the vault interior is expected to be negligible if at all.

3.2 Screening Criteria

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

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

The general corrective action standards are as follows:

- Protection of human health and the environment
- Compliance with media cleanup standards
- Control the source(s) of the release
- Compliance with applicable federal, state, and local standards for waste management

The remedy selection decision factors are as follows:

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

3.2.1 Corrective Action Standards

The corrective action general standards and decision factors used to evaluate the corrective action alternatives are described in further detail in the following text.

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 needed. 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 IX Preliminary Remediation Goals (PRGs) (EPA, 1998), which are derived from the Integrated Risk Information System, are the basis for establishing the PALs for chemical contaminants in accordance with NAC 445A.2272 (NAC, 1998c). The PAL for petroleum substances in soil is 100 mg/kg in accordance with NAC 445A.2272 (NAC, 1998c). The PALs for radiological contamination are based on the total and removable limits for surface radioactivity listed in Table 2-2 of the RADCON Manual (DOE/NV, 1996c) and radiological concentrations in soil samples collected in undisturbed background locations (McArthur and Miller, 1989; U.S. Ecology and Atlan-Tech, 1992).

Control the Source(s) of the Release

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

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

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

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

3.2.2 Remedy Selection Decision Factors

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

Short-Term Reliability and Effectiveness

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

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

Reduction of Toxicity, Mobility, and/or Volume

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

Long-Term Reliability and Effectiveness

Each corrective action alternative must be evaluated in terms of risk remaining at the CAU 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 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: This refers to the feasibility of implementing a corrective action alternative given the existing set of waste and site-specific conditions.

- Administrative Feasibility: This 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: This 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 CAU 135:

- Alternative 1 - No Further Action
- Alternative 2 - Unrestricted Release Decontamination and Verification Survey
- Other alternatives, such as engineering or institutional controls, were considered. However, engineering or institutional controls were deemed to be inappropriate due to the limited extent of contamination and potential future uses of the site.

The following evaluation of NAC 445A.227 (2) (a-k) (NAC, 1998c) supports the protection of groundwater from CAU 135 COCs and the need for corrective action:

a. The depth to groundwater in Well J-11 (nearest well) is approximately 1,040 feet (ft) below ground surface (USGS, 1993). Field screening and analytical data indicate that COCs are confined primarily to the concrete vault interior walls and in the sump sediment on the concrete floor. Groundwater is not expected to be impacted from COCs from this site because the vault is constructed of concrete and all exits have been sealed.

b. The distance to the nearest water-supply well, Well J-11, is approximately 18,000 ft south of the Test Cell A facility and approximately 9,100 ft southeast of the E-MAD building. Groundwater is not expected to be impacted from COCs from this site.

c. The vault and sump floor inside the vault are concrete. Most of the sediment found on the surface of the concrete floor was removed during sampling. Field screening and analytical data indicate that COCs are confined predominantly to the concrete vault interior walls and in the sediment on the concrete floor.

d. Average annual precipitation is approximately 6 inches (in.) (DOE/NV, 1996a).

e. Due to the low annual average precipitation at the site, the presence of a transport mechanism for contaminant migration (i.e., the infiltration of precipitation) is largely absent.

f. The lateral extent of contamination is confined to the concrete vault interior.

g. Presently, the CAU is located in 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 uses of the CAU site are likely to be similar to current uses at the NTS including industrial use, educational tours, research, and support sites.

h. Preferred routes of COC migration have been minimized by the removal of the primary point sources of COC contaminants (i.e., waste holdup tanks, sump pump, associated piping). In order to minimize and/or prevent the potential for the accumulation of liquid in the remaining drains and/or piping, engineering measures have been emplaced. These engineering measures include welding closed isolation valves from the stacks and the train decontamination pad, and the inspection and grouting of E-MAD floor drains as necessary. Some floor drains in the interior area of the E-MAD building (i.e., hot cells) were not grouted and these drains are not expected to accumulate any liquid. Additionally, the vault is constructed of concrete and migration of COCs from the vault interior is expected to be negligible if at all.

i. The E-MAD Waste Holdup Tanks have been removed from the concrete vault and were transported to the Area 6 Decontamination Facility for characterization and disposal as part of the Phase I corrective action investigation activities. The remaining pipes were capped after the tanks were removed.

j. The potential for a hazard related to fire, vapor, or explosion is nonexistent for the COCs at the CAU.

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. As discussed in the CAIP and Section 2.0, CASs 25-02-03 (Deluge Valve Pit) and 25-02-10 (former location of an aboveground storage tank for demineralized water) will be included in the CAU 135 Closure Report with a recommendation for no further action. These CASs will not be considered in the following alternatives.

3.3.1 Alternative 1 - No Further Action

Under the No Further Action Alternative, no corrective action activities would be implemented. This alternative is used as a starting point to establish a baseline for comparison with the other corrective action alternative. However, Alternative 1 does not meet the corrective action objectives for CAU 135 because it fails to meet the radiological unrestricted release criteria (DOE/NV, 1996c). For the purposes of this discussion, a comparison was made between Alternative 1 and Alternative 2 to the general corrective action standards but not to the remedy selection decision factors. This comparison is shown in Table 3-1.

3.3.2 Alternative 2 - Unrestricted Release Decontamination and Verification Survey

Alternative 2 consists of the removal of concrete and any remaining sediment from the vault with COC concentrations greater than the established PALs in accordance with the CAIP (DOE/NV, 1999) and the corrective action objectives. After verification that the contamination has been removed, the vault will be repaired with concrete, as necessary.

Under this alternative, radiological- and chemical-contaminated sediments and concrete removed from the vault would be disposed of at the Area 5 Radioactive Waste Management Site. The vault interior will be field surveyed following removal of contaminated material to verify unrestricted release criteria are achieved. This will ensure complete removal of contamination.

CAU 135 will be closed as described in this section and in accordance with NAC 445A (NAC, 1998b).

3.4 Evaluation and Comparison of Alternatives

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

Table 3-1
Evaluation and Comparison of the Corrective Action Alternatives
for CAS 25-02-01 E-MAD Waste Holdup Tanks and Vault
(Page 1 of 2)

Evaluation Criteria	Alternative 1 No Further Action	Alternative 2 Unrestricted Release Decontamination and Verification Survey
General Standards		
Protection of Human Health and the Environment	• Radiological and chemical contamination detected above human health and unrestricted release screening levels would remain in place. • NAC 445A.227 (2) (a-k) analysis shows the contaminants are not impacting groundwater. • Protection to the public remains high because the NTS is a restricted access facility and there are no populated areas near the subject sites. • No worker exposure associated with implementation. • Does not address the environmental persistence of contaminants.	• Meets corrective action objectives by removal of contaminated sediment and concrete in excess of unrestricted release criteria and PALs. • Low exposure associated with fugitive dust and/or contact with impacted media. • Protection to the public remains high because the NTS is a restricted access facility and there are no populated areas near the subject sites. • NAC 445A.227 (2) (a-k) analysis shows the contaminants are not impacting groundwater. • Moving contaminated material to an appropriate disposal facility addresses the persistence of contaminants.
Compliance with Media Cleanup Standards	• Does not comply with media cleanup standards because COCs remain at levels above PALs and unrestricted release criteria. • NAC 445A.227 (2) (a-k) analysis shows the contaminants are not impacting groundwater.	• Complies with media cleanup standards because any remaining sediments and all surface contamination above unrestricted release criteria will be removed and disposed of at an appropriate facility. • Removal locations will be field screened to verify that radiation activity is below acceptable criteria. • NAC 445A.227 (2) (a-k) analysis shows the contaminants are not impacting groundwater.
Control the Source(s) of Release	• There is no control of contaminant release to humans or the environment.	• At completion of the activities, the contaminated material will be permanently removed from the site and the surfaces will be screened to verify that unrestricted release criteria are achieved.

Table 3-1
Evaluation and Comparison of the Corrective Action Alternatives
for CAS 25-02-01 E-MAD Waste Holdup Tanks and Vault
(Page 2 of 2)

Evaluation Criteria	Alternative 1 No Further Action	Alternative 2 Unrestricted Release Decontamination and Verification Survey
Comply with Applicable Federal, State, and Local Standards for Waste Management	• No waste generated.	• All waste (primarily contaminated concrete) 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, direct contact, and heavy equipment. • Public protected by remote location and NTS site access controls. • Environmental impacts are not anticipated due to implementation. • Implementation should not require an extended period of time.
Reduction of Toxicity, Mobility, and/or Volume	• Not evaluated.	• Removal and clean closure would effectively eliminate associated toxicity, mobility, and volume of materials at the site.
Long-Term Reliability and Effectiveness	• Not evaluated.	• Risk of exposure to COCs will be significantly reduced upon completion of the corrective action. • Site would achieve unrestricted release criteria.
Feasibility	• Not evaluated.	• Decontamination is easily implemented.
Cost	$0	$92,801

4.0 Recommended Alternative

Based on the results of the detailed analysis of the potential corrective action alternatives presented in this document, the preferred corrective action alternative selected for implementation at CAU 135 is Alternative 2, Unrestricted Release Decontamination and Verification Survey. Alternative 2 was chosen for the following reasons:

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

The preferred corrective action alternative was evaluated on its technical merits, focusing on performance, reliability, feasibility, and safety. The alternative was judged to meet all requirements for the technical components evaluated. The alternative for CAS 25-02-01, E-MAD Waste Holdup Tanks and Vaults meets all applicable state and federal regulations for closure of the site and reduces the potential for future exposure pathways.

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

Based on the evaluation in this CADD, closure of the CAS 25-02-01, E-MAD Waste Holdup Tanks and Vault, by unrestricted release decontamination is the preferred closure method.

5.0 References

CFR, see *Code of Federal Regulations*.

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

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

EPA, see U.S. Environmental Protection Agency.

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

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

McArthur, R.D., and F.L. Miller, Jr. 1989. *Off-Site Radiation Exposure Review Project, Phase II Soil Program,* DOE/NV/10384--23. Las Vegas, NV: Desert Research Institute.

NAC, see *Nevada Administrative Code*.

Nevada Administrative Code. 1998a. NAC 444, "Solid Waste Disposal." Carson City, NV.

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

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

Nevada Administrative Code. 1998d. NAC 459, "Disposal and Evaluation of Contaminated Soil." Carson City, NV.

NRS, see *Nevada Revised Statutes*.

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

U.S. Department of Energy, Nevada Operations Office. 1987. *Nevada Test Site - Environmental Compliance Atlas*,15 June. Las Vegas, NV.

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

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

U.S. Department of Energy, Nevada Operations Office. 1996b. *Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada,* Rev. 1, DOE/NV--372. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1996c. *NV/YMP Radiological Control Manual,* Rev. 2, DOE/NV/11718--079, UC-702. Prepared by A.L. Gile of Bechtel Nevada. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1999. *Corrective Action Investigation Plan for Corrective Action Unit 135: Area 25 Underground Storage Tanks, Nevada Test Site, Nevada*, Rev. 0, DOE/NV--543. Las Vegas, NV.

U.S. Ecology and Atlan-Tech. 1992. *Environmental Monitoring Report for the Proposed Ward Valley California Low Level Radioactive Waste (LLRW) Facility.* Rosewell, GA.

U.S. Environmental Protection Agency. 1991. *Guidance on RCRA Corrective Action Decision Documents,* EPA/540/G-91/011. Washington, DC: Office of Research and Development.

U.S. Environmental Protection Agency. 1994. *Final RCRA Corrective Action Plan,* EPA/520-R-94-004. Washington, DC: Office of Solid Waste and Emergency Response.

U.S. Environmental Protection Agency. 1998. *Region 9 Preliminary Remediation Goals (PRGs) 1998.* San Francisco, CA.

U.S. Geological Survey. 1993. *Selected Data for Yucca Mountain Region, Southern Nevada and Eastern California, Calendar Year 1993,* Open-File Report 95-158. Las Vegas, NV.

Appendix A

Corrective Action Investigation Report for CAU 135: Area 25 Underground Storage Tanks, Nevada Test Site, Nevada

A.1.0 Introduction

This appendix presents the investigation activities and analytical results for the corrective action investigation conducted at CAU 135, Area 25 USTs, NTS, Nevada. The CAU 135 includes CAS 25-02-01, E-MAD Waste Holdup Tanks and Vault; CAS 25-02-03, Deluge Valve Pit at the TCA Facility; and CAS 25-02-10, the former location of an AST at the TCA Facility (FFACO, 1996). The corrective action investigation was conducted in accordance with the requirements set forth in the *Corrective Action Investigation Plan for Corrective Action Unit 135, Area 25 Underground Storage Tanks, Nevada Test Site, Nevada* (DOE/NV, 1999) as developed under the FFACO (1996).

The CAS 25-02-01, E-MAD Waste Holdup Tanks and Vault, was the only site investigated for CAU 135. At the DQO meeting for CAU 135, it was determined that CAS 25-02-03 and CAS 25-02-10 would not be investigated and would be closed with no further action required as the recommended corrective action. Reasons for the decision are provided in Section 2.2.2 and 2.2.3 of the CAIP (DOE/NV, 1999). The E-MAD Waste Holdup Tanks and Vault site was investigated because process knowledge indicated that the tanks received radioactive and possibly hazardous liquid effluent during operations at the E-MAD Facility. Additional information regarding the history of each CAS, 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 follows:

- Assess the concentration and presence of COPCs.
- Determine the location of radiological contamination within the vault and determine the extent of COPCs in the sump area and on the floor.
- Provide sufficient information and data to develop and evaluate appropriate corrective action alternatives for CAS 25-02-01.

As identified in the DQO process outlined in the CAIP (DOE/NV, 1999), potential contamination may exist within the E-MAD Waste Holdup Tanks and Vault. The vault ceiling, floor, and walls were investigated by conducting a radiological survey for alpha- and beta-contamination, and

collecting swipe samples for removable radiological contamination. Additionally, one environmental and one duplicate sample of the sediment in the sump were collected for laboratory analyses.

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

A.1.2 Appendix Content

The contents of this appendix are as follows:

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

To make this appendix a concise summary, the complete field documentation and laboratory data, including Field Activity Daily Logs, Sample Collection Logs, Analysis Request/Chain-of-Custody Forms, laboratory certificates of analyses, analytical results, and surveillance results not contained in this appendix are retained in the project files.

A.2.0 Corrective Action Investigation Activities

The corrective action field investigation and sampling activities for the E-MAD Waste Holdup Tanks and Vault was conducted in June 1999. The investigation was separated into two phases, and is summarized as follows:

Phase I

- Grouted the process wastewater drains inside the E-MAD Building that drained into the vault.
- Disconnected, cut (flush with the ground surface), and grouted the piping associated with trailers E-26321 and E-26428.
- Performed a preliminary inspection of the vault including vault lid removal, air monitoring, a radiological survey of selected locations inside the vault, and a visual inspection of the tank interiors after removal of the existing access covers.
- Inserted a wet tap in the influent piping inside the vault in order to remove any free standing liquids held up inside the pipes. Collected approximately six gallons of liquid from the two influent pipes.
- Unbolted or saw cut all flange bolts and small diameter pipes and removed them from the vault.
- Removed two 1,500-gallon waste holdup tanks from the vault.
- Cut the remaining ancillary pipes and valves with welding equipment. The piping was stubbed and capped near the vault interior.
- Removed the sump pump inside the vault. There was no liquid in the sump or the sump pump when it was removed.
- Swept up debris that accumulated on top of the concrete floor during the tank and pipe removal activities.
- Transported the vault contents and drain components to the Area 6 Decontamination Facility for characterization and appropriate disposal.

- In early December 1999, engineering measures were emplaced to minimize and/or prevent the potential for the accumulation of liquid in the drains and/or remaining piping. These engineering measures are as follows:

  - Welded isolation valves from the stacks and the train decontamination pad closed.

  - Inspected and grouted E-MAD floor drains as necessary. Some floor drains in the interior area of the E-MAD building (i.e., hot cells) were not grouted because these drains are not expected to accumulate any liquid.

Phase II

- Sectioned the concrete vault interior into predetermined sized grid squares in order to conduct a radiological survey.

- Performed a radiological survey for the purpose of identifying the extent and quantity of the fixed and removable contamination inside the vault. Exposure rates were also documented for each grid square. Swipe samples were collected during the survey.

- Collected one environmental sediment sample from the sump inside the vault. Quality Control/Quality Assurance samples were also collected for the sump.

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, 1999). The samples were collected and documented following approved protocols and procedures for sampling, field activity, and sample collection documentation, decontamination, chain of custody, shipping, and radiation screening as indicated in the CAIP (DOE/NV, 1999). Quality control samples (e.g., field blanks, equipment rinsate blanks, source blanks, trip blanks, matrix spike/matrix spike duplicate [MS/MSD], and field duplicates) were collected as required by the *Industrial Sites Quality Assurance Project Plan* (QAPP) (DOE/NV, 1996a) and approved procedures. Field activities included waste minimization practices in accordance with approved procedures in the CAIP (DOE/NV, 1999), including segregation of the waste by waste stream.

A.2.1 Site Description and Conditions

The E-MAD Waste Holdup Tanks and Vault are located on the western side of Building 3900 just outside the west gallery door at the E-MAD facility in Area 25 of the NTS (see Figure 1-2). The CAS

consists of two 1,500-gallon storage tanks located inside an underground concrete vault which is covered by a concrete pad. The two tanks have been removed from the vault along with all other vault contents. The concrete pad contains three lids that lead into the vault. One lid has been replaced by a thin, aluminum, padlocked trap door. A sump is located in the low spot or northwest corner of the vault and is an integrated part of the floor. The sump was used as a secondary catchment for overflows, spills, or leaks. The vault is approximately 17.3 ft wide by 22.2 ft long by 16.5 ft high (see Figure 2-2 of the CAIP [DOE/NV, 1999]). When all lids are removed, the vault opening is approximately 13.8 ft long by 6.5 ft wide. There is a built-in ladder that runs down the western side of the vault. Four tank pedestals are the only items that remain inside the vault. They are made of reinforced concrete and extend approximately 12 to 20 in. above the vault floor surface. Bechtel Nevada was unable to remove the tank pedestals during their field activities. The purpose of the Phase II investigation was to identify the extent and quantity of radiological contamination inside the E-MAD Waste Holdup Vault.

A.2.2 Sampling Logistics and Locations

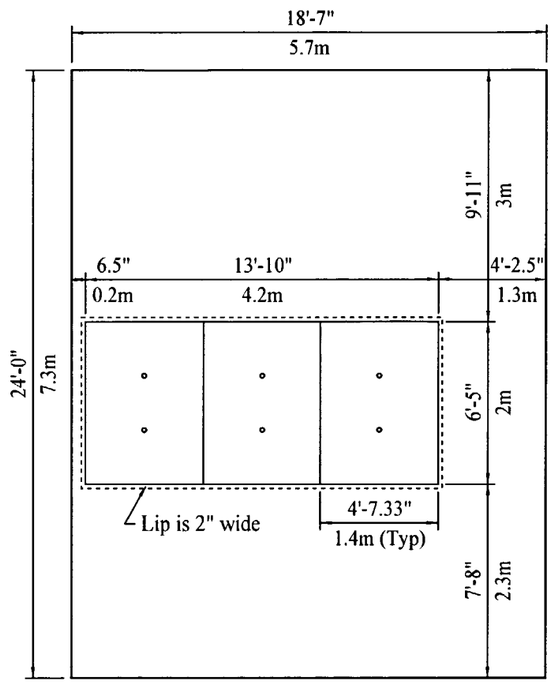
This section describes sample collection and investigation activities at the E-MAD Waste Holdup Tanks and Vault. The sampling locations were selected based on guidance provided by MARSSIM (NRC, 1997) for a vault radiological survey, visual observations, elevated readings on radiological instruments, and process knowledge. The planned sample locations are described in the CAIP (DOE/NV, 1999). Actual sample locations are shown in Figure A.2-1, Parts 1 and 2.

A.2.3 Field Screening

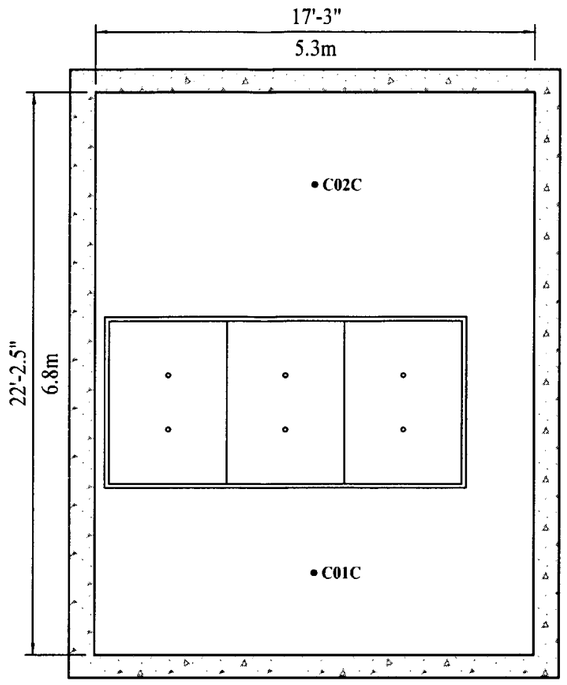
Field screening and surveys were performed as specified in the CAIP (DOE/NV, 1999). The screening and survey methods included the following:

- Radiological screening for alpha and beta concentration using an Electra instrument and exposure rates using a Bicron® Ion Chamber.
- Headspace screening for VOCs using a photoionization detector (PID).

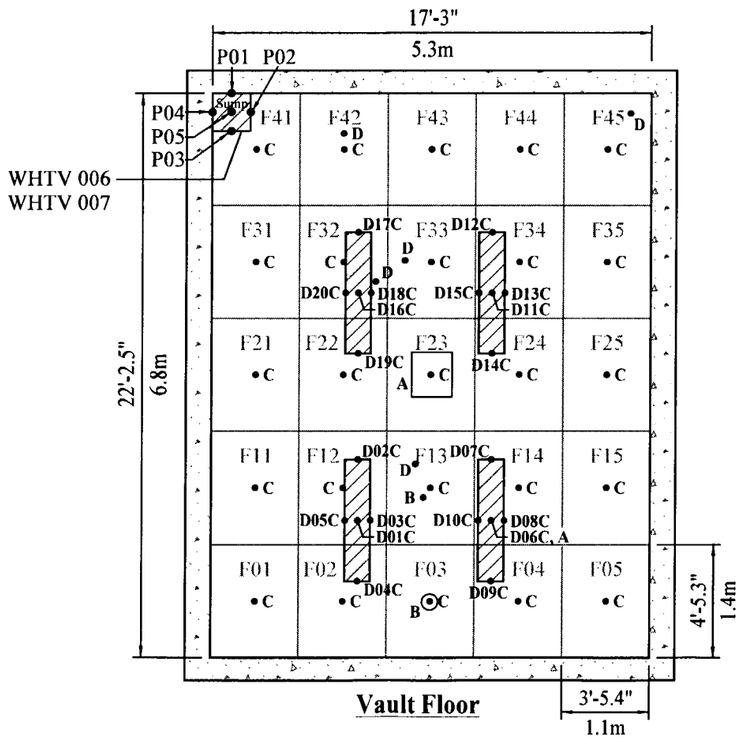
Field-screening levels (FSLs) were used to determine the presence of contamination and guide the investigation. The FSL for VOCs was established at 20 parts per million (ppm) or 2.5 times



Top of Concrete Pad



Vault Ceiling

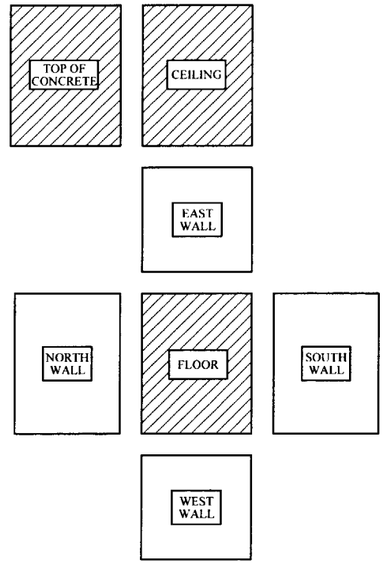


Vault Floor

Explanation

A Field Blank
B Field Duplicate
C Center
S Source Blank

Location Plan

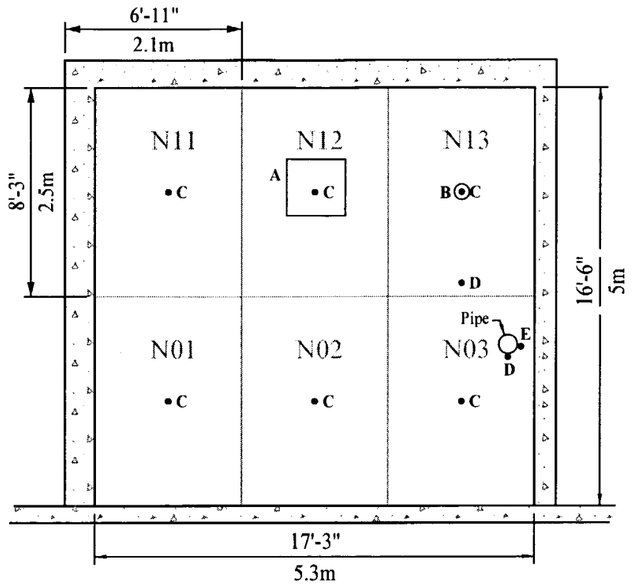


* All grid square and sump sample numbering begins with the letters "WHTV"

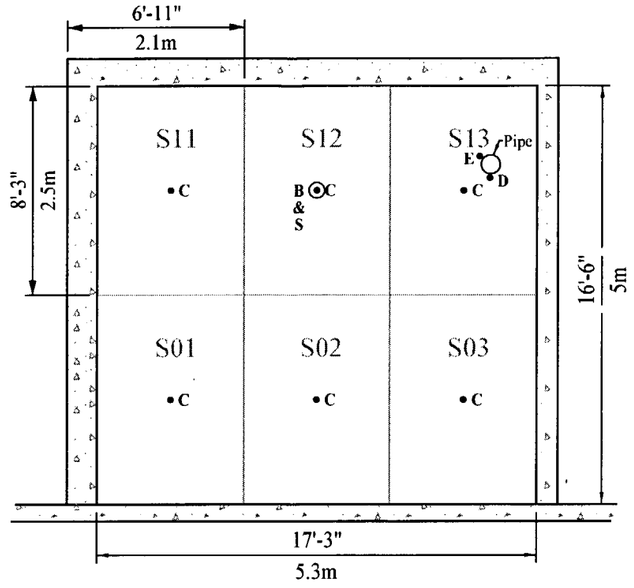
Scale
0 6 12 Feet
0 2 4 Meters

Source: AEC, 1962; NERVA/NRDS, 1967

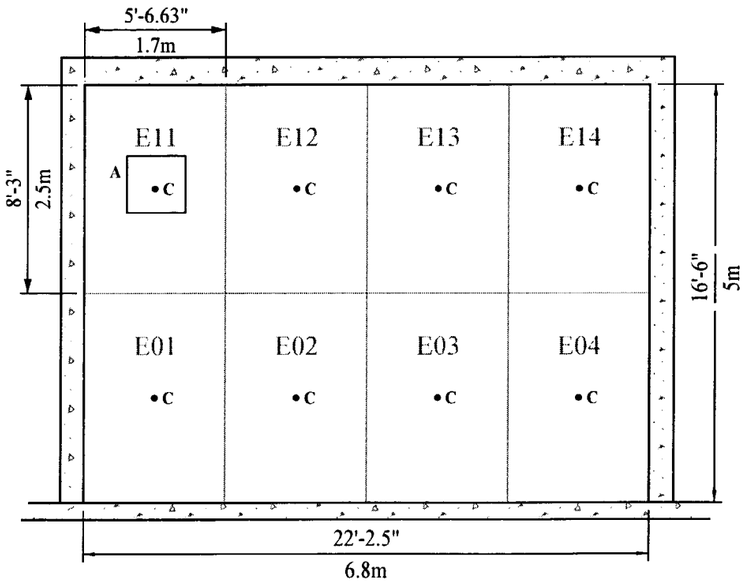
Figure A.2-1
Sampling Locations for
E-MAD Waste Holdup Tank Vault
(Part 1 of 2)



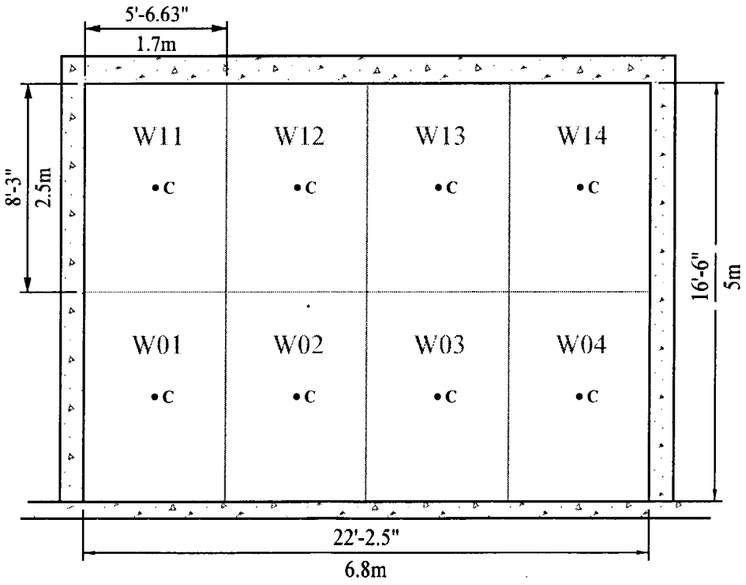
North Vault Wall



South Vault Wall



East Vault Wall

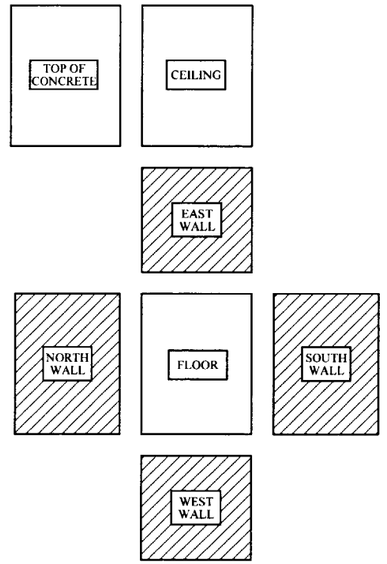


West Vault Wall

Explanation

A Field Blank
B Field Duplicate
C Center
S Source Blank

Location Plan



* All grid square numbering begins with the letters "WHTV"

Scale

0 6 12 Feet

0 2 4 Meters

Source: AEC, 1962; NERVA/NRDS, 1967

Figure A.2-1
Sampling Locations for
E-MAD Waste Holdup Tank Vault
(Part 2 of 2)

background, whichever was higher. Headspace measurements for the one sediment sample collected were below the established FSL. The FSLs for radiological contamination in the sediment collected inside the vault were established prior to the investigation as the mean background concentration level in soil plus two times the standard deviation of the mean background concentration level. Field-screening levels for concrete were also established prior to the investigation as the mean background activity level of an uncontaminated concrete pad next to the vault plus two times the standard deviation of the mean background activity level. Radiological contamination of swipe and sediment samples were also field screened for sample transportation purposes. Allowable levels were gross alpha/beta limits of less than or equal to 2,000 picocuries per gram (pCi/g) and a dose rate of 0.5 millirem per hour (mrem/hr) per package (DOE/NV, 1999; DOE, 1988; CFR, 1998).

A.2.4 Daily Activities During Sampling Effort (Phase II)

Prior to daily intrusive activities, the following was performed:

- Vault lids were removed using a 14.5-ton hydraulic crane and placed to the north of the opening on the concrete pad.

- Vault air conditions were monitored prior to confined space entry into the vault. Monitoring included carbon monoxide, hydrogen sulfide, lower explosive limit, oxygen content, and organic vapor content using a Draeger Multipack and HNu® PID. Vault air conditions were monitored and documented every 15 minutes for the first hour of entry and every hour thereafter. A ventilator/blower was turned on after the initial daily vault air conditions were measured and remained on for the confined space activities.

- An extension ladder was secured. Confined space fall protection/extraction gear was set up on the crane load. Personnel working in the contamination area wore Level D modified personal protective equipment (PPE) and harnesses. Personnel were equipped with fall protection, as necessary.

A.2.5 Sediment Sample Collection

Sample collection was performed as specified in the CAIP (DOE/NV, 1999). Sediment in the vault sump was collected into sample containers using a hand scoop. Sample number WHTV006 was collected in triplicate volume in order to obtain a MS/MSD and an environmental sample. A field duplicate sample (WHTV007) of the sump sediment was also collected. During the collection of the sediment sample from the vault sump, the concrete bottom was encountered and a verification sample

from beneath the sediment layer was unattainable. The majority of sediment was removed from the surface of the concrete sump during sampling.

A.2.6 Radiological Survey

A radiological survey of the vault was performed as specified in the CAIP for CAU 135 (DOE/NV, 1999).

A.2.6.1 Grid Square Locations

The vault floor was sectioned off into grid squares that were approximately 4.4 ft by 3.5 ft (see Figure A.2-1, Part 1 and 2 for grid square details and sampling locations). Four pedestals that are located on the vault floor were surveyed on all exposed sides. The north and south vault walls were sectioned into grid squares approximately 8.3 ft by 6.9 ft. The east and west vault wall grid square dimensions were approximately 8.3 ft by 5.6 ft. There were pipes located within grid square N03 and S13 that were also surveyed.

A.2.6.2 Radiological Survey and Swipe Sampling Logistics

Each grid square was surveyed for alpha and beta radiological contamination using an Electra instrument, except for sample location N11 which could not be reached. The instrument was scanned over the entire grid surface area and an integrated reading was entered on a Radiological Survey Form. If there were any locations within the grid square that were elevated (greater than FSLs), a one-minute direct reading with the Electra was also taken. For locations with elevated readings, an aluminum plate was placed between the spot and the instrument for a “closed window” reading. The closed window reading was subtracted from the open window reading to determine the count rate contribution from beta-gamma surface contamination. On the north and south ends of the vault ceiling, two one-minute direct readings were conducted with an Electra. A “Masslin Mop” was also swiped over a large area of the vault ceiling and readings were taken using an Electra.

The center of each grid square was swiped for removable radiological contamination. The swipe samples were labeled WHTV, the three-digit grid square location, and the letter “C.” If there were any locations in the grid square that were above established FSLs, another swipe sample was collected at those locations. Those sample locations were labeled in the same manner, with

successive letter designation as an extension. One field blank was collected for every 20 sample swipes and was obtained by waving a clean swipe in the vault airspace. One field duplicate was collected for every 20 sample swipes and was collected next to the original swipe location. One swipe was collected as a source blank for the investigation. Field blanks were labeled with an "A," field duplicates were labeled with a "B," and the source blank was labeled with an "S" at the end. Two locations (C01C and C02C) on the ceiling were swiped for removable radiological contamination.

There was an exposure rate measurement taken for each grid square. If there were any areas that measured elevated readings above FSLs, additional exposure rate measurements were taken. Exposure rate information was documented on the Radiological Survey Form.

A.3.0 Investigation Results

The analytical results of samples collected from the E-MAD Waste Holdup Tanks and Vault investigation have been compiled and evaluated to determine the presence and/or extent of contamination. The analytical results, above the minimum reporting limits, are summarized in the following subsections.

During the investigation, one sediment sample and one duplicate sample was submitted to Paragon Analytics, Fort Collins, Colorado, for laboratory analyses. The sample was analyzed for chemical and radiological constituents. A total of 99 swipes were analyzed for gross alpha and gross beta by Paragon Analytics. Of those 99 swipes, only 9 swipe samples were analyzed for specific radiological isotopes. The parameters that were used to decide which swipes were to be analyzed was the minimum unrestricted release limits to the public which is summarized in Table 2-2 in the *NV/YMP RADCON Manual* (DOE/NV, 1996b). If the swipe exceeded either the alpha limits or beta limits, it was analyzed for corresponding radiological isotopes. A list of the samples collected and analyzed for the investigation are presented in Table A.3-1. The analytical parameters and laboratory analytical methods requested for this investigation are presented in Table A.3-2. Preliminary action levels for off-site laboratory analytical methods were determined during the DQO process (DOE/NV, 1999) and are based on levels presented in the following:

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

The analytical parameters were selected through the application of site process knowledge according to the EPA's *Guidance for the Data Quality Objectives Process* (EPA, 1994a). Sampling activities

Table A.3-1
Samples Collected During the CAU 135 Underground Storage Tanks Corrective Action Investigation
(Page 1 of 4)

Sample Location	Sample Matrix	Quality Control Comments	Parameters Analyzed
Sediment			
WHTV001	Water	Equipment Rinsate Blank	Set 1
WHTV002	Water	Trip Blank	Set 2
WHTV003	Water	Field Blank	Set 1
WHTV004	Water	Trip Blank	Set 2
WHTV005	Water	Trip Blank	Set 2
WHTV006	Sediment	MS/MSD and Environmental Sample	Set 1
WHTV007	Sediment	Field Duplicate	Set 1
Swipe			
WHTVF01C	Swipe	Sample	Set 3
WHTVF11C	Swipe	Sample	Set 3
WHTVF21C	Swipe	Sample	Set 3
WHTVF31C	Swipe	Sample	Set 3
WHTVF41C	Swipe	Sample	Set 3
WHTVF02C	Swipe	Sample	Set 3
WHTVF12C	Swipe	Sample	Set 3
WHTVF22C	Swipe	Sample	Set 3
WHTVF32C	Swipe	Sample	Set 4
WHTVF32D	Swipe	Sample	Set 3
WHTVF42C	Swipe	Sample	Set 3
WHTVF42D	Swipe	Sample	Set 3
WHTVF03C	Swipe	Sample	Set 3
WHTVF03B	Swipe	Field Duplicate	Set 3
WHTVF13C	Swipe	Sample	Set 3
WHTVF13D	Swipe	Sample	Set 5
WHTVF23C	Swipe	Sample	Set 3
WHTVF23A	Swipe	Field Blank	Set 3
WHTVF33C	Swipe	Sample	Set 6
WHTVF33D	Swipe	Sample	Set 6
WHTVF43C	Swipe	Sample	Set 4
WHTVF04C	Swipe	Sample	Set 3
WHTVF14C	Swipe	Sample	Set 3
WHTVF24C	Swipe	Sample	Set 3

Table A.3-1
Samples Collected During the CAU 135 Underground Storage Tanks Corrective Action Investigation
(Page 2 of 4)

Sample Location	Sample Matrix	Quality Control Comments	Parameters Analyzed
WHTVF34C	Swipe	Sample	Set 6
WHTVF44C	Swipe	Sample	Set 4
WHTVF05C	Swipe	Sample	Set 3
WHTVF15C	Swipe	Sample	Set 3
WHTVF25C	Swipe	Sample	Set 3
WHTVF35C	Swipe	Sample	Set 3
WHTVF45C	Swipe	Sample	Set 3
WHTVF45D	Swipe	Sample	Set 3
WHTVP01	Swipe	Sample	Set 3
WHTVP02	Swipe	Sample	Set 3
WHTVP03	Swipe	Sample	Set 3
WHTVP04	Swipe	Sample	Set 5
WHTVP05	Swipe	Sample	Set 5
WHTVS01C	Swipe	Sample	Set 3
WHTVS02C	Swipe	Sample	Set 3
WHTVS03C	Swipe	Sample	Set 3
WHTVS11C	Swipe	Sample	Set 3
WHTVS12C	Swipe	Sample	Set 3
WHTVS12B	Swipe	Field Duplicate	Set 3
WHTVS12S	Swipe	Source Blank	Set 3
WHTVS13C	Swipe	Sample	Set 3
WHTVS13D	Swipe	Sample	Set 3
WHTVS13E	Swipe	Sample	Set 3
WHTVN01C	Swipe	Sample	Set 3
WHTVN02C	Swipe	Sample	Set 3
WHTVN03C	Swipe	Sample	Set 3
WHTVN03D	Swipe	Sample	Set 3
WHTVN03E	Swipe	Sample	Set 3
WHTVN11C	Swipe	Sample	Set 3
WHTVN12C	Swipe	Sample	Set 3
WHTVN12A	Swipe	Field Blank	Set 3
WHTVN13C	Swipe	Sample	Set 3
WHTVN13B	Swipe	Field Duplicate	Set 3
WHTVN13D	Swipe	Sample	Set 3

Table A.3-1
Samples Collected During the CAU 135 Underground Storage Tanks Corrective Action Investigation
(Page 3 of 4)

Sample Location	Sample Matrix	Quality Control Comments	Parameters Analyzed
WHTVE01C	Swipe	Sample	Set 3
WHTVE02C	Swipe	Sample	Set 3
WHTVE03C	Swipe	Sample	Set 3
WHTVE04C	Swipe	Field Blank	Set 3
WHTVE11A	Swipe	Sample	Set 3
WHTVE11C	Swipe	Sample	Set 3
WHTVE12C	Swipe	Sample	Set 3
WHTVE13C	Swipe	Sample	Set 3
WHTVE14C	Swipe	Sample	Set 3
WHTVW01C	Swipe	Sample	Set 3
WHTVW02C	Swipe	Sample	Set 3
WHTVW03C	Swipe	Sample	Set 3
WHTVW04C	Swipe	Sample	Set 3
WHTVW11C	Swipe	Sample	Set 3
WHTVW12C	Swipe	Sample	Set 3
WHTVW13C	Swipe	Sample	Set 3
WHTVW14C	Swipe	Sample	Set 3
WHTVD01C	Swipe	Sample	Set 3
WHTVD02C	Swipe	Sample	Set 3
WHTVD03C	Swipe	Sample	Set 3
WHTVD03B	Swipe	Field Duplicate	Set 3
WHTVD04C	Swipe	Sample	Set 3
WHTVD05C	Swipe	Sample	Set 3
WHTVD06A	Swipe	Field Blank	Set 3
WHTVD06C	Swipe	Sample	Set 3
WHTVD07C	Swipe	Sample	Set 3
WHTVD08C	Swipe	Sample	Set 3
WHTVD09C	Swipe	Sample	Set 3
WHTVD10C	Swipe	Sample	Set 3
WHTVD11C	Swipe	Sample	Set 3
WHTVD12C	Swipe	Sample	Set 3

Table A.3-1
Samples Collected During the CAU 135 Underground Storage Tanks Corrective Action Investigation
(Page 4 of 4)

Sample Location	Sample Matrix	Quality Control Comments	Parameters Analyzed
WHTVD13C	Swipe	Sample	Set 3
WHTVD14C	Swipe	Sample	Set 3
WHTVD15C	Swipe	Sample	Set 3
WHTVD16C	Swipe	Sample	Set 3
WHTVD17C	Swipe	Sample	Set 3
WHTVD18C	Swipe	Sample	Set 3
WHTVD19C	Swipe	Sample	Set 3
WHTVD20C	Swipe	Sample	Set 3
WHTVC01C	Swipe	Sample	Set 3
WHTVC02C	Swipe	Sample	Set 3

Set 1: Analytical parameters are total VOC, total SVOC, TPH-diesel/oil, total RCRA metals, polychlorinated biphenyls, total gross alpha/beta, gamma spectroscopy, isotopic uranium, isotopic plutonium, strontium-90
Set 2: Analytical parameter is for total VOCs only
Set 3: Analytical parameter are for total gross alpha/beta only
Set 4: Analytical parameters are isotopic uranium and isotopic plutonium only
Set 5: Analytical parameters are gamma spectrometry and strontium-90 only
Set 6: Analytical parameters are isotopic uranium, isotopic plutonium, gamma spectrometry, and strontium-90 only

MS/MSD = Matrix Spike/Matrix Spike Duplicate
RCRA = *Resource Conservation and Recovery Act*
SVOC = Semivolatile Organic Compounds
TPH = Total Petroleum Hydrocarbons
VOC = Volatile Organic Compounds

were conducted to confirm or disprove assumptions (i.e., models outlined in CAIP) made in the DQO process (DOE/NV, 1999).

A.3.1 Total Volatile Organic Compound Analytical Results

There were no total VOC analytical results above the minimum reporting limits established in the CAIP (DOE/NV, 1999).

A.3.2 Total Semivolatile Organic Compound Analytical Results

The total SVOCs detected above the minimum reporting limits (DOE/NV, 1999) are presented in Table A.3-3. All other SVOC results were reported as nondetects or at concentrations below their

Table A.3-2
Laboratory Analytical Methods Used for Samples Collected at the CAU 135 Area 25 Underground Storage Tanks, Nevada Test Site

Analytical Parameter	Analytical Method
Total volatile organic compounds	EPA 8260B[a]
Total petroleum hydrocarbons - gasoline and diesel/oil	EPA 8015B (modified)[a]
Total semivolatile organic compounds	EPA 8270C[a]
Total Polychlorinated Biphenyls	EPA 8082[c]
Total RCRA metals (arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury)	EPA 6010B/7470A[a] EPA 6010B/7471A[a]
Total Gross Alpha/Beta	SM 7110[b]
Gamma Spectroscopy	HASL 300, 4.5.2.3[c]
Isotopic Uranium	NAS-NS-3050
Isotopic Plutonium	NAS-NS-3058
Strontium-90 Extraction	VAJDA 1993

[a]EPA *Test Methods for Evaluating Solid Waste*, 3rd Edition, Parts 1-4, SW-846 (EPA, 1996)
[b]*Standard Methods for the Examination of Water and Wastewater*, American Public Health Association (APHA, 1992)
[c]*Environmental Measurements Laboratory Procedures Manual*, HASL-300 (DOE, 1992)

Table A.3-3
Summary of Total SVOC Results Detected Above Minimum Reporting Limits, CAU 135 Area 25 USTs, Nevada Test Site

Sample Number	Sample Depth	Contaminants of Potential Concern (μg/kg)			
		bis-2-ethylhexylphthlate	di-n-butylphthlate	fluoranthene	pyrene
	Industrial PRG[a]	**210,000**	**110,000,000**	**37,000**	**26,000**
WHTV006	surface	24,000 (J)	21,000 (J)	3,200 (J)	3,400 (J)
WHTV007	surface	24,000 (J)	25,000 (J)	N/A	N/A

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

J = Estimated value

minimum reporting limits. The total SVOCs results were all below the PALs (DOE/NV, 1999; EPA, 1996). All other SVOC results were reported as nondetects or at concentrations below their minimum reporting limits.

A.3.3 Total Petroleum Hydrocarbon Results

Total petroleum hydrocarbons were detected as diesel-range organics in sediment samples WHTV006 and WHTV007 at 1,500 mg/kg and 1,600 mg/kg, respectively exceed the NDEP regulatory action level of 100 mg/kg for TPH. Total petroleum hydrocarbons were not detected in the waste-oil range above the NDEP regulatory action level of 100 mg/kg for TPH.

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.3-4. The total RCRA metal results were all below the PALs except for arsenic and lead (DOE/NV, 1999; EPA, 1996). Arsenic was detected above the PAL of 3.0 mg/kg in both the original and duplicate sample. The arsenic concentrations for samples WHTV006 and WHTV007 are 37 mg/kg and 39.6 mg/kg, respectively. Lead was detected above the PAL of 1,000 mg/kg in both the original and duplicate sample. The lead concentrations for samples WHTV006 and WHTV007 are 1,470 mg/kg and 1,190 mg/kg, respectively.

A.3.5 Polychlorinated Biphenyl Results

Analytical results for sediment sample WHTV006 and WHTV007 indicated the presence of Aroclor-1254 at 28,000 micrograms per kilogram (µg/kg) and 48,000 µg/kg; and Arolocr-1260 at 28,000 µg/kg and 37,000 µg/kg. These results exceed the PAL of 1,300 µg/kg (EPA, 1998).

A.3.6 Radioanalytical Results

The radionuclide analytical results for the frisk, swipe, and sediment samples with concentrations that exceed established background concentration ranges (McArthur and Miller, 1989; U.S. Ecology and Atlan-Tech, 1992) are shown in Table A.3-5 and Table A.3-6, respectively. Only one location, listed in Table A.3-5 as WHTVN03, exceeds the unrestricted release criteria (DOE/NV, 1996b). None of the swipe samples had radionuclide concentrations exceeding the unrestricted release criteria listed in

Table A.3-4
Summary of Total RCRA Metals Results Detected
Above Minimum Reporting Limits, CAU 135 Area 25 USTs, Nevada Test Site

Sample Number	Sample Depth	Contaminants of Potential Concern (mg/kg)						
		Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Silver
	Industrial PRG[a]	3.0	100,000	850	450	1,000	68	8500
WHTV006	surface	37	76.8	12.1 (J)	107	1,470 (J)	1.9 (J)	0.4 (B)
WHTV007	surface	39.6	81.8	12.1 (J)	180	1,190 (J)	2.4 (J)	0.36 (B)

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

J = Estimated value
B = Reported value is below Contract-Required Detection Limit but above the Instrument Detection Limit

Table 2-2 of the *NV/YMP Radiological Control Manual* (DOE/NV, 1996b). Samples WHTV007 and WHTV006 had radionuclide concentrations exceeding background concentrations (McArthur and Miller, 1989; U.S. Ecology and Atlan-Tech, 1992).

Table A.3-5
Radioanalytical Results for Frisk and Swipe Samples Collected at CAU 135 E-MAD Waste Holdup Tanks and Vault

Frisk/Swipe Sample No.	Frisk Survey[a]	Contaminants of Potential Concern in pCi/s (bolded values are in dpm/100 cm^2)						
	5,000 (average) **15,000 dpm/ 100 cm^2** (maximum)	**Cobalt-60**	**Cesium-137**	**Plutonium-239**	**Strontium-90**	**Uranium-234**	**Uranium-235**	**Uranium-238**
WHTVN03*	25,269	--	--	--	--	--	--	--
WHTVP04	NA	--	21.4 ± 7.0 (J) **47.5 ± 15.5**	--	7.3 ± 1.3 (J) **16.2 ± 2.9**	--	--	--
WHTVP05	NA	--	69 ± 14 (J) **153.2 ± 31.1** (J)	--	34.8 ± 6.3 (J) **77.3 ± 14**	--	--	--
WHTVF32C	NA	--	--	--	--	4.76 ± 0.82 (J) **10.6 ± 1.82**	0.21 ± 0.14 (J) **0.47 ± 0.31**	--
WHTVF33C	NA	--	72 ± 15 (J) **160 ± 33.3**	--	40.3 ± 7.3 (J) **89.5 ± 16.2**	12.6 ± 1.8 (J) **28 ± 4.0**	0.40 ± 0.19 (J) **0.89 ± 0.42**	--
WHTVF34C	NA	--	54 ± 12 (J) **120 ± 27**	--	27.1 ± 4.9 (J) **60.2 ± 10.9**	8.8 ± 1.5 (J) **19.5 ± 3.3**	--	--
WHTVF43C	NA	--	--	--	--	4.16 ± 0.74 (J) **9.24 ± 1.64**	--	--
WHTVF44C	NA	--	--	--	--	3.80 ± 0.80 (J) **8.44 ± 1.78**	--	--
WHTVF13D	NA	--	71 ± 14 (J) **157.6 ± 31.1**	--	36.1 ± 6.5 (J) **80.1 ± 14.4**	--	--	--
WHTVF33D	NA	12.0 ± 5.1 (J) **26.6 ± 11.3**	218 ± 39 (J) **484 ± 86.6**	0.31 ± 0.16 (J) **0.69 ± 0.36**	110 ± 20 (J) **244 ± 44.4**	34.5 ± 4.4 (J) **76.6 ± 9.8**	1.54 ± 0.40 (J) **3.42 ± 0.89**	0.42 ± 0.19 (J) **0.93 ± 0.42**

[a]DOE/NV, 1996b. *NV/YMP Radiological Control Manual,* Rev. 2
***** = Sample location where pipe is located
dpm/100 cm^2 = Disintegrations per minute divided by 100 square centimeters
NA = Not Applicable
pCi/s = Picocuries per swipe
-- = Not detected above minimum reporting limits

Table A.3-6
Radioanalytical Results for Sediment Samples Collected at CAU 135 E-MAD Waste Holdup Tanks and Vault

Sediment Number	Contaminants of Potential Concern (pCi/g)						
	Cobalt-60	Cesium-137	Niobium-94	Plutonium-239/240	Strontium-90	Uranium-234	Uranium-235
Background Concentration	**<0.02-0.1[a]**	**.04-7.0[b]**	**NA**	**0.0003-0.24[b]**	**<0.01-1.17[a]**	**0.10-2.6[a]**	**<0.05-0.1[a]**
WHTV007	37.9 ± 6.3	425 ± 70	2.97 ± 0.58	0.58 ± 0.20	120 ± 22	106 ± 14	6.0 ± 1.7
WHTV006	35.8 ± 6.0	407 ± 67	2.24 ± 0.45	--	138 ± 25	88 ± 12	4.8 ± 1.5

[a]U.S. Ecology and Atlan-Tech. 1992. *Environmental Monitoring Report for the Proposed Ward Valley California Low Level Radioactive Waste Facility.* Auburn, Ca.
[b]McArthur and Miller. 1989. *Off-Site Radiation Exposure Review Project Phase II Soil Program,* Water Resources Center Publication No. 45064. Las Vegas, NV: Desert Research Institute.

pCi/g = Picocuries per gram
-- = Not detected above minimum reporting limits

A.4.0 Quality Assurance

The results of the QA/QC activities for the E-MAD Waste Holdup Tanks and Vault corrective action investigation sampling events are summarized in the following text. Detailed information regarding the QA program is contained in the Industrial Sites QAPP (DOE/NV, 1996a).

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

A.4.1 Precision

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

A.4.2 Accuracy

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

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

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

A.4.3 Representativeness

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

A.4.4 Completeness

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

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

A.4.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another (EPA, 1987). To ensure comparability, the E-MAD Waste Holdup Tanks and Vault 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, 1996a), all requirements were met.

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

A.4.6 Tier I and Tier II Data Evaluations

All laboratory data from samples collected at the E-MAD Waste Holdup Tanks and Vault site 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.

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

A.4.6.1 Tier I Evaluation

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

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

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

A.4.6.2 Tier II Evaluation

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

Chemical:

- Sample date, preparation date, and analysis date for each sample
- Holding time criteria met
- QC batch association for each sample
- Cooler temperature upon receipt
- Sample pH for aqueous samples, as required
- Detection limits properly adjusted for dilution, as required
- Blank contamination evaluated and applied to sample results/qualifiers
- MS/MSD percent recoveries (%R) and RPDs evaluated and applied to laboratory results/qualifiers
- Field duplicate RPDs evaluated using professional judgement and applied to laboratory results/qualifiers
- Laboratory duplicate RPDs evaluated and applied to laboratory results/qualifiers
- Surrogate %R evaluated and applied to laboratory results/qualifiers
- Laboratory control sample %R evaluated and applied to laboratory results/qualifiers
- Initial and continuing calibration evaluated and applied to laboratory results/qualifiers
- Internal standard evaluated and applied to laboratory results/qualifiers
- Recalculation of 10 percent of laboratory results from raw data

Radioanalytical:

- 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, MS/MSD) 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

Tier III review of at least 5 percent of the sample analytical data was performed by EMAX in Carlsbad, California. No changes to the data were incorporated as a result of this Tier III review.

A.4.7 Quality Control Samples

There were three trip blanks, five field blanks, one equipment rinsate blank, one source blank, one MS/MSD, and five field duplicates collected and submitted for laboratory analysis as shown in Table A.3-1. The samples and duplicates were assigned individual sample numbers and sent to the laboratory "blind." The sediment field blank was taken by placing distilled water into appropriate sample bottles and preserving them according to the requirements specified in the Industrial Sites QAPP (DOE/NV, 1996a). The sediment field blank was taken inside the vault. The equipment rinsate blank was obtained by collecting distilled water, which was poured over the decontaminated sampling equipment into the appropriate sample bottles and preserved as applicable. The sediment field duplicate was taken at the same spot as the environmental sample and MS/MSD. The trip blanks, which were received sealed and preserved from the laboratory, were placed in each cooler containing samples for VOC analysis. The results of the QC samples are discussed in the following sections. The sediment MS/MSD sample was collected in triplicate volume and contained the only environmental sample collected for sediment. The swipe field blanks were taken by waving a clean swipe in the vault airspace. The swipe field duplicate was obtained by swiping the area adjacent to a swipe sample location with a clean swipe. The source blank was collected by placing an untouched clean swipe into a sample container without coming in contact with the vault air or surface.

A.4.7.1 Field Quality Control Samples

Review of the field-collected blank analytical data for the CAU 135 investigation 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, one field duplicate sediment sample and four duplicate swipe samples were sent as a 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 duplicates exceeded the 20 percent criteria stated in the Industrial Sites QAPP (DOE/NV, 1996a) for chromium, lead, and selenium.

The laboratory duplicate samples were compared to the criteria set forth in the EPA Functional Guidelines (EPA, 1994b and 1994c) and the associated sample results were qualified accordingly. Both detections and non-detections 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.

One field sample was 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 the spike recovery is greater than the upper acceptance limits (>125 percent), non-detections are acceptable for use. If the spike recovery is greater than the upper acceptance limits (>125 percent) or less than the lower acceptance limits (<75 percent), positive results are qualified as estimated (J). If spike recovery is within the range of 30-74 percent, non-detections are qualified as estimated (UJ).

A.4.7.2 Laboratory Quality Control Samples

Analysis of method QC blanks, laboratory control samples, and surrogate spikes for organic analyses, and method blanks, preparation blanks, initial and continuing calibration blanks, and laboratory control samples for total RCRA metals were performed for each SDG by Paragon Analytics, Inc. The

results of these analyses were used to qualify associated environmental sample results according to EPA Functional Guidelines (EPA, 1994b and 1994c).

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

For most VOCs, SVOCs, PCBs, TPH, and radionuclides, if an analyte is detected in the sample and was also detected in an associated blank the result is qualified as undetected (U) if the sample concentration is less than five times (5X) the blank concentration.

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., total RCRA metals), sample results greater than the instrument detection limit, but less than five times (5X) the amount found in an associated blank, are qualified as undetected (U). There are no metallic common laboratory contaminants, so there is no "10X Rule" for metals, and the sample result is never altered. When applying the 5X criteria to soil sample data or calibration blank data, the raw data results are used to evaluate and qualify the reported results on the Certificate of Analysis. Preparation blanks (PB) are evaluated for each matrix, with every SDG, or with each batch of samples digested, whichever is more frequent. The analyte concentration in the PB should be below the contract-required detection limits (CRDL). If any analyte concentration in the PB is above the CRDL, the lowest concentration of that analyte in the associated samples must be ten times (10X) the PB concentration. Otherwise, all samples associated with the PB with the analyte's concentration less than 10X the PB concentration, and above the CRDL, should be redigested and reanalyzed. If the concentration of the PB is less than or equal to the CRDL, no corrective action to the associated sample is required.

Surrogate spikes, or system monitoring compounds, are added to the environmental samples analyzed by chromatographic techniques for VOCs, SVOCs, TPH, and PCBs for the E-MAD Waste Holdup Tanks and Vault site. 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 non-detections, respectively) or unusable (R).

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

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

A.4.8 Field Nonconformances

During the corrective action investigation IT Corporation provided field guidance and oversight to verify that sampling activities were performed in accordance with applicable requirements. Quality assurance did not observe any findings, deficiencies, or nonconformances with sampling activities as they met the requirements of the plans and procedures governing the activities at the site.

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. Laboratory nonconformances were documented for this project for VOC and radiochemistry. Documentation of these results is retained in the project files.

A.5.0 Summary

Analysis of the data generated from corrective action investigation activities conducted at the E-MAD Waste Holdup Tanks and Vault indicates the following:

- For the radiological survey of the vault interior, only one direct frisk measurement exceeded the DOE allowable values of total residual radiological surface contamination (DOE/NV, 1996b) [from a pipe at survey grid location N03]. Review of the swipe sample results did not identify any samples with removable activity in excess of the removable limits listed in the *NV/YMP Radiological Control Manual* (DOE/NV, 1996b).

- Eight radionuclides were detected in two sump sediment samples in concentrations exceeding the background concentration ranges. These radionuclide concentrations also exceeded the POC "rad added" screening levels.

- The PALs were not exceeded in the sediment samples collected for total VOCs and total SVOCs.

- TPH concentrations for diesel range organics exceeded the NDEP action level of 100 mg/kg for the sediment samples. However, TPH concentrations did not exceed the NDEP action level of 100 mg/kg for waste-oil range in these samples.

- Total RCRA metals exceeded the established PALs for arsenic and lead for the sediment samples.

- In the sediment samples, the PAL was exceeded for PCBs (i.e., Aroclor-1254 and Aroclor-1260).

A.6.0 References

AEC, see U.S. Atomic Energy Commission.

APHA, see American Public Health Association.

American Public Health Association. 1992. *Gross Alpha and Gross Beta Radioactivity, Standard Methods for the Examination of Water and Wastewater*, 18th Edition. Washington, DC.

CFR, see *Code of Federal Regulations*.

Code of Federal Regulations. 1998. 49 CFR Part 172, "Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements." Washington, DC: U.S. Government Printing Office.

DOE, see U.S. Department of Energy.

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

EPA, see U.S. Environmental Protection Agency.

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

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

IT, see IT Corporation.

IT Corporation. 1999. *Site-specific Health and Safety Plan, Area 25 Underground Storage Tanks, Nevada Test Site*. Las Vegas, NV.

McArthur, R.D., and F.L. Miller, Jr. 1989. *Off-Site Radiation Exposure Review Project, Phase II Soil Program*, DOE/NV/10384--23. Las Vegas, NV: Desert Research Institute.

NAC, see *Nevada Administrative Code*

Nevada Administrative Code. 1998a. NAC 445A.345 - 445A.22755, "Corrective Active Regulations." Carson City, NV: Nevada Division of Environmental Protection.

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

NERVA/NRDS, see Nuclear Engine Rocket for Vehicle Application Test Operation, Nuclear Research Development Station.

NRC, see U.S. Nuclear Regulatory Commission.

Nuclear Engine Rocket for Vehicle Application Test Operation, Nuclear Research Development Station. 1967. Engineering drawing entitled, "N.R.D.S. - E-MAD Facility Radioactive Waste Drain System," drawing number E1012975, 5 June. Mercury, NV: Archives and Records Center.

U.S. Atomic Energy Commission. 1962. Engineering drawings entitled, "NRDS E-MAD Facility Piping Diagram Waste Systems," Drawing Number 1425-M-2 and "NRDS E-MAD Facility Waste Holdup Tank Pit Plan, Sections and Details," Drawing Number 1425-M-213 August. Prepared by Vitro Engineering Company. Mercury, NV: Archives and Records Center.

U.S. Department of Energy. 1992. *Environmental Measurements Laboratory Procedures Manual*, HASL-300, 27th Edition, Vol. 1. New York, NY.

U.S. Department of Energy. 1988. *Radioactive Waste Management*, DOE Order 5820.2A. Washington, DC.

U.S. Department of Energy, Nevada Operations Office. 1996a. *Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada*, Rev. 1, DOE/NV--372. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1996b. *NV/YMP Radiological Control Manual*, DOE/NV/11718--079, Rev. 2. Prepared by A.L. Gile of Bechtel Nevada. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1999. *Corrective Action Investigation Plan for CAU 135, Area 25 Underground Storage Tanks, Nevada Test Site, Nevada*, DOE/NV--543. Las Vegas, NV.

U.S. Ecology and Atlan-Tech. 1992. *Environmental Monitoring Report for the Proposed Ward Valley California Low Level Radioactive Waste (LLRW) Facility.* Rosewell, GA: Atlan-Tech, Inc.

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

U.S. Environmental Protection Agency. 1994a. *Guidance for the Data Quality Objectives Process*, EPA QA/G-4. Washington, DC.

U.S. Environmental Protection Agency. 1994b. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013. Washington, DC.

U.S. Environmental Protection Agency. 1994c. *Contract Laboratory Program National Functional Guidelines for Organic Data Review*, EPA 540/R-94/012. Washington, DC.

U.S. Environmental Protection Agency. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846*, CD ROM PB97-501928GEI which contains updates for 1986, 1992, 1994 and 1996. Washington, DC.

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

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

Appendix B

Cost Estimates

EST: CAU 135 CADD	**BN ENVIRONMENTAL RESTORATION** **COST ESTIMATE SUMMARY**	**Prep Date:** 12/10/99 **Print Date:** 12/10/99

TO: DENNIS GUSTAFSON - Environmental Restoration Task Manager **FROM:** ABDEL AGALLOUCH - ER Project Controls

SUBJECT: REMEDIAL ALTERNATIVES **TEC:** (see totals below)

WORK PKGE: CAU 135 Area 25 Underground Storage Tanks **WBS:** 1040102130311

TAP: CONTAMINATED WASTE SITES SOURCE GROUP **LOCATION:** NTS

TYPE OF ESTIMATE		TYPE OF WORK	
___ ORDER OF MAGNITUDE	___ PRELIMINARY TITLE II	___ RI / FS	
___ PLANNING/STUDY	___ WORK ORDER	X REMEDIATION	
X 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:	Jeff Smith	702-295-7775	___ NTS GENERAL	___ SUBCONTRACT
PROJ MGR:	Wayne Johnson	702-295-0573	___ NTS MAINTENANCE	___ OTHER

STATEMENT OF WORK :

This estimate has been prepared to provide remedial alternative costs for the closure of Corrective Action Unit (CAU) 135, an environmental restoration site listed in the Federal Facilities and Consent Order (FFACO). CAU 135 is specifically described as Area 25 Underground Storage Tanks . Two alternatives will be evaluated for closure of the site: I) No Further Action No associated Costs, or Administrative Controls, II) Free Release Decontamination and Verification Survey. This estimate will be used to identify the most cost effective alternative for closure of the site while being protective of human health and the environment. Total estimated costs are intended for comparative analysis of remedial field work and field management only. 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) FREE RELEASE DECONTAMINATION AND VERIFICATION SURVEY

ALTERNATIVE SPECIFIC BASIS OF ESTIMATE/ASSUMPTIONS

Alternative II: Free Release Decontamination and Verification Survey

- A bioassay program, health physics support and RCT support will be required for work to be performed in hot areas.
- Assume PPE requirements will include levels C and D.
- All surface contamination greater than free release levels will be removed. Locations will be field screened after removal activities to verify radiation activity is below the the free release criteria.
- Decontamination activities will be confined to a six inch diameter area around one vault wall inlet pipe and the a cement lined pump sump. The waste generated from the sump will be classified as mixed due to PCBs.
- Radiologically impacted wall concrete will be containerized in a 55-gal drum for disposal and shipped to Area 5 RWMS .
- Mixed waste impacted sump concrete will be containerized in a 55-gal drum for disposal and shipped to Area 5 RWMS.
- Assume that the hole created by the sump removal will be filled with clean soil and covered with cement.
- Two samples will be required. Assume that one composite sample will be analyzed for verification once the sump has been removed and one sample will be analyzed for waste characterization for disposal of the sump.

ESCALATION:

Escalation is not included in this estimate. All costs are in FY00 dollars

CONTINGENCY:

Contingency costs are not included in this estimate.

COST SUMMARY - TOTAL ESTIMATED COST PER REMEDIAL ALTERNATIVE

- I) NO FURTHER ACTION -NO ASSOCIATED COSTS OR ADMINISTRATIVE CONTROLS **$0**
- II) FREE RELEASE DECONTAMINATION AND VERIFICATION SURVEY **$92,801**

Review / Concurrence:

Requester 12-15-99 Date

Assistant General Manager 12-15-99 Date

Operations Manager Wayne Johnson 12-15-99 Date

Financial Officer Date

Project Control 12/15/99 Date

Copy to: Bill Contine, Project Controls Manager

Appendix C

Bechtel Nevada

Phase I Analytical Results

Bechtel Nevada

Mailing address: P.O. Box 98521
Las Vegas, NV 89193-8521

Express mail only: 2621 Losee Road
North Las Vegas, NV 89030-4129

1300-DC-00-0040

December 22, 1999

Runore C. Wycoff, Director
Environmental Restoration Division
DOE Nevada Operations Office
P.O. Box 98518
Las Vegas, NV 89193-9518

Subject: Contract No. DE-AC08-96NV11718
ANALYTICAL DATA FOR CAU 135 AREA 25 UNDERGROUND STORAGE TANKS NEVADA TEST SITE, NEVADA
Project No. 04029

Enclosed is the analytical data from the liquids and sediments that were sampled from CAU 135 Area 25 Underground Storage Tanks. Analysis was conducted on the liquids recovered from the inlet piping to the vault and from vault floor sweepings collected at CAU 135. In addition, sediment was sampled and analyzed from tanks and piping that were removed and transported to the Area 6 Decontamination Facility. This analytical data was delivered to IT Corporation on December 22, 1999, to be included in the Final CADD for CAU 135.

If you should have any questions, please contact Dennis Gustafson at 295-0684.

D. K. Cowser, Program Manager
Environmental Restoration

DLG:kmk
Subject Code: ENV 38

cc w/enc.
J. L. Appenzeller-Wing, DOE/NV, 505
J. G. Johnson, IT, 439

cc w/o enc.
Correspondence Control, NLV008
K. J. Cabble, DOE/NV, 505
S. D. Lawrence, DOE/NV, 505
D. H. Cox, BN, NTS306
D. L. Gustafson, BN, NTS306

A. M. Heidema, BN, NLV102
W. F. Johnson, BN, NTS306
S. J. Nacht, BN, NTS306

December 22, 1999

SAMPLES COLLECTED FOR WASTE CHARACTERIZATION AT CAU 135 AREA 25 UNDERGROUND STORAGE TANKS NEVADA TEST SITE

SAMPLE IDENTIFICATION NUMBER	SAMPLE DESCRIPTION
99TPS1101-1	Liquid obtained from the inlet piping to the vault
99TPS1101-1A	Matrix Spike
99TPS1101-1B	Matrix Spike Duplicate
99TPS1101-2	Sediment taken from interior of 1500 gallon tank
99TPS1101-3	Sediment collected from vault floor sweepings
99TPS1101-4	Paint chips collected from exterior of 1500 gallon tank

Bechtel Nevada

ANALYTICAL SERVICES LABORATORY

SERVICES REQUEST & CHAIN OF CUSTODY RECORD

PROJECT/ CLIENT INFORMATION

Project: EMAD Holding Tank — BN Org#: 2152
Charge No.: C7B191AA — ASL Prog.: WMC 150
Project Manager: Jan Cowley
Phone: 5-0377 — Fax: 5-4815 — M/S:

REPORT INFORMATION

Send Report to: HARRY PERRY
Phone: 5-0685 — Fax: 5-4815 — M/S: NTS 110
Turnaround: (~~X~~) Standard - 30 days Non-rad, 60 Days Rad, Other: ( ) Rush Preliminary by: _____ Final by: _____
Final report format: (~~X~~) Standard (~~X~~) NTS-WAC ( ) Other: _____

SAMPLE INFORMATION

Sampling Site: A-6 Decon Pad
The samples submitted contain (check); ( ) Hazardous ( ) Radioactive ( ) Unknown contamination. If known, attach a brief narrative summary identifying contaminants. This information will ensure compliance with applicable regulations and allow for the safe handling of the sample materials.

LAB USE ONLY

Rad SGD: C824 — Non-Rad SDG:
Rad Packet: H1938 - Liquid, H1939 - Solid — Non-Rad Packet:
Client Services Representative:

Will these analyses be performed under a signed SOW? ( ) YES ( ) NO
If so, do analyses entered here agree with the SOW? ( ) YES ( ) NO ( ) N/A
If not, identify the variation _____
CSR initials indicating review and approval: _____ Date: _____

ANALYSES & METHOD

ITEM	ID / DESCRIPTION	SAMPLING DATE	SAMPLING TIME	MATRIX	Gamma Spec (20min)	Isotopic Uranium	Isotopic Plutonium	Strontium 90
0	99TPS1101-1	11/01/99	1430	Liquid	X	X	X	X
1	99TPS1101-2	11/01/99	1545	Solid	X	X	X	X
2	99TPS1101-3	11/01/99	1500	Solid	X	X	X	X
3								
4								
5								
6								
7								
8								
9								

SAMPLE RECEIPT INFORMATION

Are all sample containers received intact ( ) Yes ( ) No
Comments: _____

Do the labels agree with this form? ( ) Yes ( ) No
Comments: _____

Was a Material Clearance Tag submitted? ( ) Yes ( ) No
Comments: _____

COMMENTS

(Preservative, size/volume, MS/MSD, special analysis, rad matrix code, count time, etc.)

3.5L	γ-500ml
1547g	γ-532g
2112g	γ-786g

Transfer of samples submitted for analyses

Sampled/Relinquished (Signature/Organization)	DATE / TIME	Received by (Signature/Organization)
Terry Schmeltzer	11/2/99 0815	CD Castro Medina

Complete for samples shipped to an OFF-SITE Subcontract Laboratory

Relinquished (BN Representative Signature)	DATE / TIME	Received (Courier & Tracking Info.)
Relinquished (Courier & Tracking Info.)	DATE / TIME	Received (1st tier Subcontractor Rep)
Relinquished (1st tier Subcontractor Rep)	DATE / TIME	Received (2nd tier Subcontractor Rep)

Distribution: Original - To be retained by laboratory performing final analysis
Copy 1 - To be retained by laboratory performing intermediate analysis
Copy 2 - To be retained by Analytical Services Laboratory
Copy 3 - To be retained by sampler

2 Book No.__ __ TITLE Area 6 Decon. Pad (EMAD) Hold Tan

om Page No.__ Date: 11/01/99 SDG #: C824 V712

Project Description: Collect four different samples to be transported from the Area 25 E-Mad Facility to the Decon Facility. Liquid sample will be taken from a 55 gallon drum, Floor sweepings & metal shavings from another 55 gallon drum, Sediments from a 1500-gallon hold-up tank and paint chips & scraps from the same 1500 gallon tank.

Project Manager:	J. L. Cowley	Phone: 5-0377
	H.A. Perry	5-0685
Q.A.	Pat Morris	5-5397
On Site Contact:	Stefan Dike	5-7365
Sampling Techs	Terry Sonnenburg	5-7141
~~R.A.~~	Matt Weaver	5-7283
Rad Tech	Phil Perez (Area 6 Radiation)	

Charge#: C7B191AA

On Site Description: The two 55 gallon drums and the 1500 gallon Hold-up tank were located in the fenced yard on the South side of the Decon Facility. The temperature was 75° to 80° F with a very mild breeze. We were required to dress out in cotton overalls, double latex gloves with cotton liners, Rubber Overshoes & Safety Glasses. In addition we had to wear continuous air monitors.

The 55 gallon drum had approximately 5 gallons of clear Liquid material in it. The drum was black in color and in good shape. Sampling was accomplished with a 3 ft poly scoop.

Sample ID#	Matrix	Analysis	Volume
99TPS1101-1	Liquid	SemiVOA (8270)	1 Liter Amber Glass
		Metals (6010/7470)	1 Liter Amber Glass
		PCBs (8082)	1 Liter Amber Glass
		pH (9040)	250 ml Plastic
		TPH (8015 Mod)	1 Liter Amber Glass

To Page No.__

ssed & Understood by me. | Date | Invented by | Date

From Page No. (Continued)

SDG #: C824
V712

Sample ID #	Matrix	Analysis	Volume
99TPS1101-1	Liquid	Gamma Spec (20 min)	500 ml Nalgene
		Isotopic Uranium	1 Liter Plastic
		Isotopic Plutonium	1 Liter Plastic
		Strontium 90	1 Qt Glass
99TPS1101-1A (Matrix Spike)	Liquid	Semi VOA (8270)	1 Liter Amber Glass
		PCB's (8082)	1 Liter Amber Glass
		TPH (8015 Mod)	1 Liter Amber Glass
99TPS1101-1B (Matrix Spike Dup)	Liquid	Semi VOA (8270)	1 Liter Amber Glass
		PCB's (8082)	1 Liter Amber Glass
		TPH (8015 Mod)	1 Liter Amber Glass

* The 55 gallon drum had approximately one foot of floor sweeping and debris in the bottom of the drum. The sampling was accomplished with a Stainless Steel Scoop (6 inch). Scoops of material were placed in a one gallon zip lock bag and mixed before sampled into jars. (Labeled Pipe Cuttings in the SAP

Sample ID #	Matrix	Analysis	Volume
99TPS1101-2	Solid	TCLP Semi VOA (1311/8270)	500 ml Glass
		TCLP Metals (1311/6010/7470)	250 ml Glass
		PCB (8082)	250 ml Glass
		pH	250 ml Glass
		TPH	250 ml Glass
		Gamma Spec (20 min)	500 ml Nalgene
		Isotopic Uranium	125 ml Plastic
		Isotopic Plutonium	125 ml Plastic
		Strontium 90	125 ml Plastic

To Page No.

'4 Book No.__ __ TITLE Area 6 Decon Pad (EMAD Hold Tanks)

om Page No.__ (Continued) SDG #. C824
SDG #. V712

* Sediments from the 1500 gallon were taken from the bottom piping and drain Valve on the bottom of the tank. Samples were taken with a 3 ft Trier by sticking it into the drain pipe and pulling sediment that was laying in the pipe. Samples from the Trier were placed into a 1 gallon zip lock bag and mixed before placing into jars with a 6" Stainless Steel Scoop.

Sample ID#	Matrix	Analysis	Volume
99TPS1101-2	Solid	TCLP Semi Vols (1311/8270)	500 ml Glass
		TCLP Metals (1311/6010/7470)	250 ml Glass
		PCB (8082)	250 ml Glass
		pH (9045)	250 ml Glass
		TPH (8015 Mod)	250 ml Glass
		Gamma Spec (20 min)	500 ml Nalgene
		Isotopic Uranium	125 ml Plastic
		Isotopic Plutonium	125 ml Plastic
		Strontium 90	125 ml Plastic

* Paint was scrapped from the 1500 gallon Tank with Paint Scrappers. Plastic bags were used to collect the scrappings and then the scrappings were placed into the jar.

Sample ID#	Matrix	Analysis	Volume
99TPS1101-4	Solid	Total Lead (6010/7470)	125 ml Glass (10 grams)

* The Analysis was a deviation from the SAP which originally called for TCLP Lead. A decision was made by Harry Perry to Sample and Analyze for Total Lead.

Bechtel Nevada Corporation

ANALYTICAL SERVICES LABORATORY
P.O.Box 3936, N. Las Vegas, NV 89036

Reported to: Waste Minimization & Control
H. A. Perry, M/S NTS110
A-25 E-MAD Holdup Tank Project

Analysis: Gamma Spec.-20 Minute Scan

Report Date: 21-DEC-99
Sample Delivery Group: C824
Batch: N339
Program: 150

Report No. :

Sample ***** Identification *****	Isotope	Analysis	Result	Error	Qual Flag	MDC	Result Units	Analysis Date	Sample Coll Date	Size	Size Units	Type Matrix	Tracer Yield %	Spike Recv %	System Detector	Packet-Item Sample
99TPS1101 1	CO60	Gamma S	1.11E+02	3.7E+01		3.5E+01	pCi/L	11-02-99	11-01-99	5.00E+02	ml	Water			06-01	H1938-0-70025
99TPS1101-1	CS137	Gamma S	7.64E+02	1.1E+02		4.3E+01	pCi/L	11-02-99	11-01-99	5.00E+02	ml	Water			06-01	H1938-0-70025
99TPS1101-1	U 235	Gamma S	0.00E+00	0.0E+00	U	3.1E+02	pCi/L	11-02-99	11-01-99	5.00E+02	ml	Water			06-01	H1938-0-70025
99TPS1101-1	U 238	Gamma S	0.00E+00	0.0E+00	U	4.2E+03	pCi/L	11-02-99	11-01-99	5.00E+02	ml	Water			06-01	H1938-0-70025
QA BKG WATER U06	No Nucl Det	Gamma S	0.00E+00	0.0E+00	U	0.0E+00	NA	11-02-99	07-01-98	5.00E+02	ml	QA, Wa			06-01	Q0622-0-00494
QA BKG WATER U06	AM241	Gamma S	0.00E+00	0.0E+00	U	1.0E+02	pCi/L	11-02-99	07-01-98	5.00E+02	ml	QA, Wa			06-01	Q0622-0-00494
QA BKG WATER U06	CO60	Gamma S	0.00E+00	0.0E+00	U	3.0E+01	pCi/L	11-02-99	07-01-98	5.00E+02	ml	QA, Wa			06-01	Q0622-0-00494
QA BKG WATER U06	CS137	Gamma S	0.00E+00	0.0E+00	U	4.2E+01	pCi/L	11-02-99	07-01-98	5.00E+02	ml	QA, Wa			06-01	Q0622-0-00494
QA SP:QAW-6	AM241	Gamma S	3.22E+05	2.4E+04		4.9E+02	pCi/L	11-02-99	08-01-90	2.25E+02	ml	QA, Wa		103.7	06-01	Q0619-1-16582
QA SP:QAW-6	CO60	Gamma S	3.17E+05	2.5E+04		5.7E+02	pCi/L	11-02-99	08-01-90	2.25E+02	ml	QA, Wa		98.7	06-01	Q0619-1-16582

Comment:
Data generated from analyses of samples submitted to the lab on November 2, 1999.

Prepared by: _____ Date: 12/21/99

Approved by: _____ Date: 12/21/99

Qualification Flags:
E = Estimated Quantity
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U = Result is less than Minimum Detectable Activity

Note: Error is the 2.0 Sigma Error

Bechtel Nevada Corporation

ANALYTICAL SERVICES LABORATORY
P.O.Box 3936, N. Las Vegas, NV 89036

Reported to: Waste Minimization & Control
H. A. Perry, M/S NTS110
A-25 E-MAD Holdup Tank Project

Report Date: 21-DEC-99
Sample Delivery Group: C824
Batch: N339
Program: 117

Report No. :

Sample ***** Identification *****	Isotope	Analysis	Result	Error	Qual Flag	MDC	Result Units	Analysis Date	Sample Coll Date	Size	Size Units	Type Matrix	Tracer Yield %	Spike Recv %	System Detector	Packet-Item Sample
QA SP:QAW-6	CS137	Gamma S	2.71E+05	2.0E+04		2.1E+02	pCi/L	11-02-99	08-01-90	2.25E+02	ml	QA, Wa		98.3	06-01	Q0619-1-16582

Comment:
Data generated from analyses of samples submitted to the lab on November 2, 1999.

Prepared by: _____ Date: 12/21/99

Approved by: _____ Date: 12/21/99

Qualification Flags:
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Bechtel Nevada Corporation

ANALYTICAL SERVICES LABORATORY
P.O.Box 3936, N. Las Vegas, NV 89036

Reported to: Waste Minimization & Control
H. A. Perry, M/S NTS110
A-25 E-MAD Holdup Tank Project

Report Date: 21-DEC-99
Sample Delivery Group: C824
Batch: N361
Program: 150

Analysis: Gamma Spec.-20 Minute Scan

Report No. :

Sample ***** Identification *****	Isotope	Analysis	Result	Error	Qual Flag	MDC	Result Units	Analysis Date	Sample Coll Date	Size	Size Units	Type Matrix	Tracer Yield %	Spike Recv %	System Detector	Packet-Item Sample
99TPS1101-2	CO60	Gamma S	5.59E+01	5.3E+00		6.2E-02	pCi/g	11-02-99	11-01-99	5.32E+02	gm	Soil,			05-01	H1939-0-70026
99TPS1101-2	CS137	Gamma S	9.42E+02	7.1E+01		9.4E-02	pCi/g	11-02-99	11-01-99	5.32E+02	gm	Soil,			05-01	H1939-0-70026
99TPS1101-2	K 40	Gamma S	4.08E+00	2.3E+00		1.1E+00	pCi/g	11-02-99	11-01-99	5.32E+02	gm	Soil,			05-01	H1939-0-70026
99TPS1101-2	NB94	Gamma S	2.12E+01	2.4E+00		8.1E-02	pCi/g	11-02-99	11-01-99	5.32E+02	gm	Soil,			05-01	H1939-0-70026
99TPS1101-2	RA226	Gamma S	1.36E+01	2.5E+00		1.7E-01	pCi/g	11-02-99	11-01-99	5.32E+02	gm	Soil,			05-01	H1939-0-70026
99TPS1101-3	CO60	Gamma S	1.23E+01	1.5E+00		5.8E-02	pCi/g	11-02-99	11-01-99	7.86E+02	gm	Soil,			05-01	H1939-1-70027
99TPS1101-3	CS137	Gamma S	3.91E+02	3.0E+01		8.8E-02	pCi/g	11-02-99	11-01-99	7.86E+02	gm	Soil,			05-01	H1939-1-70027
99TPS1101-3	K 40	Gamma S	1.52E+01	3.4E+00		9.9E-01	pCi/g	11-02-99	11-01-99	7.86E+02	gm	Soil,			05-01	H1939-1-70027
99TPS1101-3	NB94	Gamma S	2.94E+00	5.3E-01		6.8E-02	pCi/g	11-02-99	11-01-99	7.86E+02	gm	Soil,			05-01	H1939-1-70027
99TPS1101-3	RA226	Gamma S	3.71E+00	1.2E+00		1.4E-01	pCi/g	11-02-99	11-01-99	7.86E+02	gm	Soil,			05-01	H1939-1-70027

Comment:
Data generated from analyses of samples submitted to the lab on November 2, 1999.

Prepared by: _____ Date: 12/21/99

Approved by: _____ Date: 12/21/99

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Note: Error is the 2.0 Sigma Error

Bechtel Nevada Corporation

ANALYTICAL SERVICES LABORATORY
P.O.Box 3936, N. Las Vegas, NV 89036

Reported to: Waste Minimization & Control
H. A. Perry, M/S NTS110
A-25 E-MAD Holdup Tank Project

Report Date: 21-DEC-99
Sample Delivery Group: C824
Batch: N361
Program: 500

Analysis: Gamma Spec.-20 Minute Scan

Report No. :

Sample ***** Identification *****	Isotope	Analysis	Result	Error	Qual Flag	MDC	Result Units	Analysis Date	Sample Coll Date	Size	Size Units	Type Matrix	Tracer Yield %	Spike Recv %	System Detector	Packet-Item Sample
QA BKG EMPTY BTL U05	No Nucl Det	Gamma S	0.00E+00	0.0E+00	U	0.0E+00	NA	11-02-99	07-01-98	1.00E+00	gm	QA, So			05-01	Q0631-0-00495
QA BKG EMPTY BTL U05	AM241	Gamma S	0.00E+00	0.0E+00	U	2.6E+01	pCi/g	11-02-99	07-01-98	1.00E+00	gm	QA, So			05-01	Q0631-0-00495
QA BKG EMPTY BTL U05	CO60	Gamma S	0.00E+00	0.0E+00	U	8.1E+00	pCi/g	11-02-99	07-01-98	1.00E+00	gm	QA, So			05-01	Q0631-0-00495
QA BKG EMPTY BTL U05	CS137	Gamma S	0.00E+00	0.0E+00	U	1.2E+01	pCi/g	11-02-99	07-01-98	1.00E+00	gm	QA, So			05-01	Q0631-0-00495
QA SP:NAS-A9987	AM241	Gamma S	1.65E+01	2.2E+00		2.8E-01	pCi/g	11-02-99	03-01-99	8.35E+02	gm	QA, So		96.0	05-01	Q0658-C-16581
QA SP:NAS-A9987	CO60	Gamma S	2.56E+01	2.7E+00		6.3E-02	pCi/g	11-02-99	03-01-99	8.35E+02	gm	QA, So		102.2	05-01	Q0658-C-16581
QA SP:NAS-A9987	CS137	Gamma S	1.91E+01	2.0E+00		8.9E-02	pCi/g	11-02-99	03-01-99	8.35E+02	gm	QA, So		98.2	05-01	Q0658-C-16581

Comment:
Data generated from analyses of samples submitted to the lab on November 2, 1999.

Prepared by: _____ Date: 12/21/99

Approved by: _____ Date: 12/21/99

Qualification Flags:
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Note: Error is the 2.0 Sigma Error

Bechtel Nevada Corporation

ANALYTICAL SERVICES LABORATORY
P.O.Box 3936, N. Las Vegas, NV 89036

Reported to: Waste Minimization & Control
H. A. Perry, M/S NTS110
A-25 E-MAD Holdup Tank Project

Report Date: 21-DEC-99
Sample Delivery Group: C824
Batch: N367
Program: 150

Analysis: Strontium-90 by Gas Proportional Counting

Report No. :

Sample ***** Identification *****	Isotope	Analysis	Result	Error	Qual Flag	MDC	Result Units	Analysis Date	Sample Coll Date	Size	Size Units	Type Matrix	Carrier Yield %	Spike Recv %	System Detector	Packet-Item Sample
99TPS1101-1	SR90 A	Stronti	2.41E+02	2.9E+00		3.4E-01	pCi/L	12-06-99	11-01-99	8.60E+02	ml	Water	80.2		15-01	H1938-0-70059
QA REA	SR90 A	Stronti	-2.94E-02	1.9E-01	U	3.5E-01	pCi/L	12-06-99	11-03-99	9.00E+02	ml	QA, Wa	69.2		15-03	H1953-0-06643
QA SP:SR1 03	SR90 A	Stronti	2.77E+00	3.9E-01		3.6E-01	pCi/L	12-06-99	01-01-99	9.00E+02	ml	QA, Wa	68.6	93.4	15-04	H1953-1-06644

Comment:
Data generated from analyses of samples submitted to the lab on November 2, 1999.

Prepared by: _____ Date: 12/21/99

Approved by: Joe Hutchison Date: 12/21/99

Qualification Flags:
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Bechtel Nevada Corporation

ANALYTICAL SERVICES LABORATORY
P.O.Box 3936, N. Las Vegas, NV 89036

Reported to: Waste Minimization & Control
H. A. Perry, M/S NTS110
A-25 E-MAD Holdup Tank Project

Report Date: 21-DEC-99
Sample Delivery Group: C824
Batch: N368
Program: 150

Analysis: Plutonium-238,239/240 by Alpha Spectrometry

Report No. :

Sample ***** Identification *****	Isotope	Analysis	Result	Error	Qual Flag	MDC	Result Units	Analysis Date	Sample Coll Date	Size	Size Units	Type Matrix	Tracer Yield %	Spike Recv %	System Detector	Packet-Item Sample
99TPS1101-1	PU239	Plutoni	3.48E-01	5.8E-02		1.3E-02	pCi/L	11-10-99	11-01-99	1.00E+03	ml	Water	86.6		30-17	H1938-0-70064
99TPS1101-1	PU238	Plutoni	2.60E-02	1.4E-02		1.1E-02	pCi/L	11-10-99	11-01-99	1.00E+03	ml	Water	86.6		30-17	H1938-0-70064
QA REA	PU239	Plutoni	1.01E-02	1.2E-02	U	1.8E-02	pCi/L	11-10-99	11-03-99	9.00E+02	ml	QA, Wa	70.6		30-23	H1954-0-06647
QA REA	PU238	Plutoni	3.65E-03	7.8E-03	U	1.6E-02	pCi/L	11-10-99	11-03-99	9.00E+02	ml	QA, Wa	70.6		30-23	H1954-0-06647
QA SP:PU1 04	PU239	Plutoni	1.43E+00	1.7E-01		1.8E-02	pCi/L	11-10-99	01-01-99	9.00E+02	ml	QA, Wa	72.8	108.5	30-20	H1954-1-06648
QA SP:PU1 04	PU238	Plutoni	6.05E-03	9.2E-03	U	1.5E-02	pCi/L	11-10-99	01-01-99	9.00E+02	ml	QA, Wa	72.8		30-20	H1954-1-06648

Comment:
Data generated from analyses of samples submitted to the lab on November 2, 1999.

Prepared by: _____ Date: 12/21/99

Approved by: Joe Hutchison Date: 12/21/99

Qualification Flags:
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Note: Error is the 2.0 Sigma Error

Bechtel Nevada Corporation

ANALYTICAL SERVICES LABORATORY
P.O.Box 3936, N. Las Vegas, NV 89036

Reported to: Waste Minimization & Control
H. A. Perry, M/S NTS110
A-25 E-MAD Holdup Tank Project

Report Date: 21-DEC-99
Sample Delivery Group: C824
Batch: N369
Program: 150

Analysis: Uranium-234,235,238 by Alpha Spectrometry

Report No. :

Sample ***** Identification *****	Isotope	Analysis	Result	Error	Qual Flag	MDC	Result Units	Analysis Date	Sample Coll Date	Size	Size Units	Type Matrix	Tracer Yield %	Spike Recv %	System Detector	Packet-Item Sample
99TPS1101-1	U 238	Uranium	5.16E+01	8.4E+00		7.0E-01	pCi/L	12-07-99	11-01-99	5.00E+01	ml	Water	52.0		30-27	H1938-0-70063
99TPS1101-1	U 235	Uranium	4.14E+00	1.2E+00		4.8E-01	pCi/L	12-07-99	11-01-99	5.00E+01	ml	Water	52.0		30-27	H1938-0-70063
99TPS1101-1	U 234	Uranium	1.00E+02	1.6E+01		8.1E-01	pCi/L	12-07-99	11-01-99	5.00E+01	ml	Water	52.0		30-27	H1938-0-70063
QA REA	U 238	Uranium	-1.67E-01	1.8E-01	U	5.6E-01	pCi/L	12-07-99	11-03-99	5.00E+01	ml	QA, Wa	68.8		30-28	H1955-0-06649
QA REA	U 235	Uranium	-5.63E-02	1.0E-01	U	3.8E-01	pCi/L	12-07-99	11-03-99	5.00E+01	ml	QA, Wa	68.8		30-28	H1955-0-06649
QA REA	U 234	Uranium	-1.97E-01	2.4E-01	U	6.4E-01	pCi/L	12-07-99	11-03-99	5.00E+01	ml	QA, Wa	68.8		30-28	H1955-0-06649
QA SP:U.25 02	U 238	Uranium	8.63E+00	1.7E+00		5.3E-01	pCi/L	12-07-99	11-01-86	5.00E+01	ml	QA, Wa	67.9	93.8	30-29	H1955-1-06650
QA SP:U.25 02	U 235	Uranium	3.56E-01	2.9E-01	U	3.7E-01	pCi/L	12-07-99	11-01-86	5.00E+01	ml	QA, Wa	67.9	83.2	30-29	H1955-1-06650
QA SP:U.25 02	U 234	Uranium	7.87E+00	1.6E+00		6.2E-01	pCi/L	12-07-99	11-01-86	5.00E+01	ml	QA, Wa	67.9	88.8	30-29	H1955-1-06650

Comment:
Data generated from analyses of samples submitted to the lab on November 2, 1999.

Prepared by: _____ Date: 12/21/99

Approved by: Joe Hutchinson Date: 12/21/99

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Note: Error is the 2.0 Sigma Error

Bechtel Nevada Corporation

ANALYTICAL SERVICES LABORATORY
P.O.Box 3936, N. Las Vegas, NV 89036

Reported to: Waste Minimization & Control
H. A. Perry, M/S NTS110
A-25 E-MAD Holdup Tank Project

Analysis: Uranium-234,235,238 by Alpha Spectrometry

Report Date: 21-DEC-99
Sample Delivery Group: C824
Batch: N370
Program: 150

Report No. :

Sample ***** Identification *****	Isotope	Analysis	Result	Error	Qual Flag	MDC	Result Units	Analysis Date	Sample Coll Date	Size	Size Units	Type Matrix	Tracer Yield %	Spike Recv %	System Detector	Packet-Item Sample
99TPS1101-2	U 238	Uranium	1.08E+00	1.6E+00	U	2.8E+00	pCi/g	12-07-99	11-01-99	1.00E-02	gm	Soil,	62.2		30-25	H1939-0-70008
99TPS1101-2	U 235	Uranium	1.40E+00	1.4E+00	U	2.0E+00	pCi/g	12-07-99	11-01-99	1.00E-02	gm	Soil,	62.2		30-25	H1939-0-70008
99TPS1101-2	U 234	Uranium	4.30E+01	8.8E+00		3.3E+00	pCi/g	12-07-99	11-01-99	1.00E-02	gm	Soil,	62.2		30-25	H1939-0-70008
99TPS1101-3	U 238	Uranium	6.79E-01	8.8E-01	U	1.5E+00	pCi/g	12-07-99	11-01-99	2.00E-02	gm	Soil,	67.0		30-26	H1939-1-70009
99TPS1101-3	U 235	Uranium	4.72E-01	6.2E-01	U	1.0E+00	pCi/g	12-07-99	11-01-99	2.00E-02	gm	Soil,	67.0		30-26	H1939-1-70009
99TPS1101-3	U 234	Uranium	2.47E+01	4.9E+00		1.7E+00	pCi/g	12-07-99	11-01-99	2.00E-02	gm	Soil,	67.0		30-26	H1939-1-70009
QA REA	U 238	Uranium	-2.38E-02	4.0E-02	L	1.1E-01	pCi/g	11-10-99	11-03-99	5.00E-01	gm	QA, So	31.9		30-25	H1956-0-06651
QA REA	U 235	Uranium	-1.12E-02	2.1E-02	L	7.6E-02	pCi/g	11-10-99	11-03-99	5.00E-01	gm	QA, So	31.9		30-25	H1956-0-06651
QA REA	U 234	Uranium	-2.05E-02	5.4E-02	L	1.3E-01	pCi/g	11-10-99	11-03-99	5.00E-01	gm	QA, So	31.9		30-25	H1956-0-06651

Comment:
Data generated from analyses of samples submitted to the lab on November 2, 1999.

Prepared by: _____ Date: 12/21/99

Approved by: _____ Date: 12/21/99

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Bechtel Nevada Corporation

ANALYTICAL SERVICES LABORATORY
P.O.Box 3936, N. Las Vegas, NV 89036

Reported to: Waste Minimization & Control
H. A. Perry, M/S NTS110
A-25 E-MAD Holdup Tank Project

Report Date: 21-DEC-99
Sample Delivery Group: C824
Batch: N372
Program: 150

Analysis: Plutonium-238,239/240 by Alpha Spectrometry

Report No. :

Sample ***** Identification *****	Isotope	Analysis	Result	Error	Qual Flag	MDC	Result Units	Analysis Date	Sample Coll Date	Size	Size Units	Type Matrix	Tracer Yield %	Spike Recv %	System Detector	Packet-Item Sample
99TPS1101-2	PU239	Plutoni	1.03E+00	1.1E-01		1.1E-02	pCi/g	11-10-99	11-01-99	1.08E+00	gm	Soil,	94.8		30-39	H1939-0-70005
99TPS1101-2	PU238	Plutoni	1.15E-01	2.7E-02		9.9E-03	pCi/g	11-10-99	11-01-99	1.08E+00	gm	Soil,	94.8		30-39	H1939-0-70005
99TPS1101-3	PU239	Plutoni	4.40E-01	6.6E-02		1.3E-02	pCi/g	11-10-99	11-01-99	1.00E+00	gm	Soil,	81.2		30-35	H1939-1-70007
99TPS1101-3	PU238	Plutoni	1.29E-02	1.0E-02		1.2E-02	pCi/g	11-10-99	11-01-99	1.00E+00	gm	Soil,	81.2		30-35	H1939-1-70007
QA REA	PU239	Plutoni	2.54E-03	7.9E-03	U	1.7E-02	pCi/g	11-10-99	11-03-99	1.00E+00	gm	QA, So	69.9		30-36	H1958-0-06655
QA REA	PU238	Plutoni	7.23E-04	6.1E-03	U	1.6E-02	pCi/g	11-10-99	11-03-99	1.00E+00	gm	QA, So	69.9		30-36	H1958-0-06655
QA SP:PU1 04	PU239	Plutoni	1.06E+00	1.3E-01		1.5E-02	pCi/g	11-10-99	01-01-99	1.00E+00	gm	QA, So	81.2	89.2	30-38	H1958-1-06656
QA SP:PU1 04	PU238	Plutoni	6.44E-04	5.4E-03	U	1.4E-02	pCi/g	11-10-99	01-01-99	1.00E+00	gm	QA, So	81.2		30-38	H1958-1-06656

Comment:
Data generated from analyses of samples submitted to the lab on November 2, 1999.

Prepared by: _____ Date: 12/21/99

Approved by: Joe Hutchison Date: 12/21/99

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Note: Error is the 2.0 Sigma Error

***** End of Report *****

(Level 1)

Bechtel Nevada Corporation

ANALYTICAL SERVICES LABORATORY
P.O.Box 3936, N. Las Vegas, NV 89036

Reported to: Environmental Restoration
H. A. Perry, M/S NTS110
A-25 E-MAD Holdup Tank Project

Report Date: 21-DEC-99
Sample Delivery Group: C824
Batch: N371
Program: 150

Analysis: Strontium 90 by Gas Proportional Count

Report No.:

Sample Identification	Isotope	Result	Error	Result Units	Analysis Date	Sample Coll Date	Size	Size Units	Type Matrix	Spike Recv %	Packet-Item Sample
99TPS1101-2	SR-90	1.56E+02	3.0E+00	pCi/g	12-21-99	11-01-99	1.06E+00	g	Soil		H1939-0-70060
99TPS1101-3	SR-90	1.26E+02	3.0E+00	pCi/g	12-21-99	11-01-99	1.06E+00	g	Soil		H1939-1-70061
QA REA	SR-90	1.70E-01	3.0E-01	pCi/g	12-21-99		1.00E+00	g	Soil Blank		H1957-0-06653
QA SP:SR1	SR-90	2.67E+00	5.8E-01	pCi/g	12-21-99		1.00E+00	g	Soil Spike	102 %	H1957-1-06654

Comment: The data presented here were manually calculated from the initial counts of the samples. The samples will undergo a second count after allowing for the two week Y-90 ingrowth period. Final strontium data for these samples will be submitted at that time.

Note: Error is the 2.0 Sigma Error

Prepared by: _____ Date: 12/21/99

Approved by: Joe Hutchison Date: 12/21/99

Date: 08-Dec-99

Barringer Laboratories, Inc.

15000 W 6th Avenue Suite 300 Golden, Colorado 80401-5047 (800) 654-0506 (303) 277-1687 Fax (303) 277-1689

Ted Redding
Bechtel Nevada Corp.
P.O. Box 98521
MS NTS 273
Las Vegas, NV 89193-8521

Phone: 1-702-295-7220
Fax: 1-702-295-4773

Work Order: 9911042
Project: V712

Dear Ted Redding,

Barringer Laboratories received 6 samples on 11/04/99 for the analyses presented in the following report.

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications except where noted in the Case Narrative.

If you have any questions regarding these test results, please feel free to call.

12/8/99
Steve Mustain
Inorganic Laboratory Manager

John Murray 12/08/99
John Murray
Organic Laboratory Manager

C E Lott Jr
Clarence Lott
Project Review 12/8/99

Date: 08-Dec-99

Barringer Laboratories, Inc.

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Client: Bechtel Nevada Corp.
Project: V712
Work Order: 9911042
Date Received: 11/4/99
Temp Received: 4°C

SAMPLE SUMMARY

Lab Sample ID	Client Sample ID	Tag Number	Collection Date	Matrix	Bottle and Preservation
9911042-01A	99TPS1101-1		11/1/99 2:30:00 PM	Aqueous	1L amber glass, preserved 1:1 H2SO4 to pH<2
9911042-01B	99TPS1101-1		11/1/99 2:30:00 PM	Aqueous	1L amber glass, unpreserved
9911042-01C	99TPS1101-1		11/1/99 2:30:00 PM	Aqueous	
9911042-01D	99TPS1101-1		11/1/99 2:30:00 PM	Aqueous	250mL plastic, unpreserved
9911042-01E	99TPS1101-1		11/1/99 2:30:00 PM	Aqueous	1L amber glass, preserved by BL! 1:1 HNO3 to pH<2
9911042-02A	99TPS1101-1A		11/1/99 2:30:00 PM	Aqueous	1L amber glass, preserved 1:1 H2SO4 to pH<2
9911042-02B	99TPS1101-1A		11/1/99 2:30:00 PM	Aqueous	1L amber glass, unpreserved
9911042-02C	99TPS1101-1A		11/1/99 2:30:00 PM	Aqueous	1L amber glass, unpreserved
9911042-03A	99TPS1101-1B		11/1/99 2:30:00 PM	Aqueous	1L amber glass, preserved 1:1 H2SO4 to pH<2
9911042-03B	99TPS1101-1B		11/1/99 2:30:00 PM	Aqueous	1L amber glass, unpreserved
9911042-03C	99TPS1101-1B		11/1/99 2:30:00 PM	Aqueous	1L amber glass, unpreserved
9911042-04A	99TPS1101-2		11/1/99 2:45:00 PM	Soil	8oz amber glass, unpreserved
9911042-04B	99TPS1101-2		11/1/99 2:45:00 PM	Soil	8oz amber glass, unpreserved
9911042-04C	99TPS1101-2		11/1/99 2:45:00 PM	Soil	8oz amber glass, unpreserved
9911042-04D	99TPS1101-2		11/1/99 2:45:00 PM	Soil	8oz amber glass, unpreserved
9911042-04E	99TPS1101-2		11/1/99 2:45:00 PM	Soil	500g gamma jar, unpreserved
9911042-05A	99TPS1101-3		11/1/99 3:00:00 PM	Soil	8oz amber glass, unpreserved
9911042-05B	99TPS1101-3		11/1/99 3:00:00 PM	Soil	8oz amber glass, unpreserved
9911042-05C	99TPS1101-3		11/1/99 3:00:00 PM	Soil	8oz amber glass, unpreserved
9911042-05D	99TPS1101-3		11/1/99 3:00:00 PM	Soil	8oz amber glass, unpreserved
9911042-05E	99TPS1101-3		11/1/99 3:00:00 PM	Soil	500g gamma jar, unpreserved
9911042-06A	99TPS1101-4		11/1/99 3:50:00 PM	Solid	4oz amber glass, unpreserved

Date: 08-Dec-99

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Client: Bechtel Nevada Corp.
Project: V712
Work Order: 9911042

CASE NARRATIVE

All reported values in this report have been rounded to the correct number of significant figures. All calculations have been performed before applying significant figures, therefore, not all calculations may be reproducible with the results printed in this report.

The temperature range for the TCLP extraction was 20-27C.

Analytical Comments for method SW8082, sample 9911042-04A: The surrogates failed their set QC limits because they were diluted out due to the high concentration of Aroclors 1254.

Analytical Comments for method SW8082, sample 9911042-05A: The surrogates failed their set QC limits because they were diluted out due to the high concentration of Aroclors 1254.

Analytical Comments for method SW8082, sample 9911042-05AMS/MSD: The matrix spike and matrix spike duplicate samples were not analyzed because of the dilution required for the spiked sample.

Date: 08-Dec-99

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CLIENT SAMPLE REPORT

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-1**
Tag Number:

Lab Sample ID: **9911042-01A**
Date Collected: **11/01/1999**
Matrix: **Aqueous**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
1,2,4-Trichlorobenzene	120-82-1	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
1,2-Dichlorobenzene	95-50-1	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
1,2-Diphenylhydrazine	122-66-7	SW8270C	ND	50		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
1,3-Dichlorobenzene	541-73-1	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
1,4-Dichlorobenzene	106-46-7	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2,4,5-Trichlorophenol	95-95-4	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2,4,6-Trichlorophenol	88-06-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2,4-Dichlorophenol	120-83-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2,4-Dimethylphenol	105-67-9	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2,4-Dinitrophenol	51-28-5	SW8270C	ND	50		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2,4-Dinitrotoluene	121-14-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2,6-Dinitrotoluene	606-20-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2-Chloronaphthalene	91-58-7	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2-Chlorophenol	95-57-8	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2-Methylnaphthalene	91-57-6	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2-Methylphenol	95-48-7	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2-Nitroaniline	88-74-4	SW8270C	ND	50		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2-Nitrophenol	88-75-5	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
3 & 4-Methylphenol	108-39-	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
3,3'-Dichlorobenzidine	91-94-1	SW8270C	ND	20		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
3-Nitroaniline	99-09-2	SW8270C	ND	50		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
4,6-Dinitro-2-methylphenol	534-52-1	SW8270C	ND	50		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
4-Bromophenyl phenyl ether	101-55-3	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
4-Chloro-3-methylphenol	59-50-7	SW8270C	ND	20		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
4-Chloroaniline	106-47-8	SW8270C	ND	20		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
4-Chlorophenyl phenyl ether	7005-72-3	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
4-Nitroaniline	100-01-6	SW8270C	ND	20		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
4-Nitrophenol	100-02-7	SW8270C	ND	50		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Acenaphthene	83-32-9	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Acenaphthylene	208-96-8	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Anthracene	120-12-7	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Benz(a)anthracene	56-55-3	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934

Qualifiers:
ND - Not detected at the reporting limit
J - Analyte detected below quantitation limits
E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

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CLIENT SAMPLE REPORT

Benzidine	92-87-5	SW8270C	ND	50	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Benzo(a)pyrene	50-32-8	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Benzo(b)fluoranthene	205-99-2	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Benzo(g,h,i)perylene	191-24-2	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Benzo(k)fluoranthene	207-08-9	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Benzoic acid	65-85-0	SW8270C	ND	50	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Benzyl alcohol	100-51-6	SW8270C	ND	20	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Bis(2-chloroethoxy)methane	111-91-1	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Bis(2-chloroethyl)ether	111-44-4	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Bis(2-chloroisopropyl)ether	108-60-1	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Bis(2-ethylhexyl)phthalate	117-81-7	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Butyl benzyl phthalate	85-68-7	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Carbazole	86-74-8	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Chrysene	218-01-9	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Di-n-butyl phthalate	84-74-2	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Di-n-octyl phthalate	117-84-0	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Dibenz(a,h)anthracene	53-70-3	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Dibenzofuran	132-64-9	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Diethyl phthalate	84-66-2	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Dimethyl phthalate	131-11-3	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Diphenylamine	122-39-4	SW8270C	ND	20	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Fluoranthene	206-44-0	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Fluorene	86-73-7	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Hexachlorobenzene	118-74-1	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Hexachlorobutadiene	87-68-3	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Hexachlorocyclopentadiene	77-47-4	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Hexachloroethane	67-72-1	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Indeno(1,2,3-cd)pyrene	193-39-5	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Isophorone	78-59-1	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
N-Nitrosodi-n-propylamine	621-64-7	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
N-Nitrosodiphenylamine	86-30-6	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Naphthalene	91-20-3	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Nitrobenzene	98-95-3	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Pentachlorophenol	87-86-5	SW8270C	ND	50	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Phenanthrene	85-01-08	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934
Phenol	108-95-2	SW8270C	ND	10	µg/L	1	11/08/1999 11/11/1999	RDH	P1934

Qualifiers:
ND - Not detected at the reporting limit
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E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

Date: 08-Dec-99

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CLIENT SAMPLE REPORT

Pyrene	129-00-0	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Surr: 2,4,6-Tribromophenol	118-79-6	SW8270C	89	10-123	%REC	1	11/08/1999	11/11/1999	RDH	P1934
Surr: 2-Fluorobiphenyl	321-60-8	SW8270C	97	43-116	%REC	1	11/08/1999	11/11/1999	RDH	P1934
Surr: 2-Fluorophenol	367-12-4	SW8270C	26	21-110	%REC	1	11/08/1999	11/11/1999	RDH	P1934
Surr: 4-Terphenyl-d14	1718-51-0	SW8270C	92	33-141	%REC	1	11/08/1999	11/11/1999	RDH	P1934
Surr: Nitrobenzene-d5	4165-60-0	SW8270C	83	35-114	%REC	1	11/08/1999	11/11/1999	RDH	P1934
Surr: Phenol-d6	13127-88-3	SW8270C	16	10-110	%REC	1	11/08/1999	11/11/1999	RDH	P1934

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-1**
Tag Number:

Lab Sample ID: **9911042-01B**
Date Collected: **11/01/1999**
Matrix: **Aqueous**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
Aroclor 1016	12674-11-2	SW8082	ND	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1221	11104-28-2	SW8082	ND	2		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1232	11141-16-5	SW8082	ND	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1242	53469-21-9	SW8082	ND	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1248	12672-29-6	SW8082	ND	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1254	11097-69-1	SW8082	2.7	1		µg/L	1	11/08/1999	11/29/1999	RDH	P1933
Aroclor 1260	11096-82-5	SW8082	1.1	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1262	37324-23-5	SW8082	ND	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1268	11100-14-4	SW8082	ND	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Surr: Decachlorobiphenyl	2051-24-3	SW8082	87	18-111		%REC	1	11/08/1999	11/29/1999	RDH	P1933
Surr: Decachlorobiphenyl	2051-24-3	SW8082	87	18-111		%REC	1	11/08/1999	11/09/1999	RDH	P1933
Surr: Tetrachloro-m-xylene	877-09-8	SW8082	96	23-110		%REC	1	11/08/1999	11/29/1999	RDH	P1933
Surr: Tetrachloro-m-xylene	877-09-8	SW8082	93	23-110		%REC	1	11/08/1999	11/09/1999	RDH	P1933

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-1**
Tag Number:

Lab Sample ID: **9911042-01C**
Date Collected: **11/01/1999**
Matrix: **Aqueous**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
T/R Hydrocarbons: C10-C22		SW8015B	0.64	1	J	mg/L	1	11/04/1999	11/10/1999	MTB	P1876
Surr: 4-Terphenyl-d14	1718-51-0	SW8015B	115	30-120		%REC	1	11/04/1999	11/10/1999	MTB	P1876

Qualifiers:
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E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

Date: 08-Dec-99

Barringer Laboratories, Inc.

CLIENT SAMPLE REPORT

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Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-1**
Tag Number:

Lab Sample ID: **9911042-01D**
Date Collected: **11/01/1999**
Matrix: **Aqueous**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
pH	10-29-7	SW9040	7.71	0.01		pH Units	1		11/08/1999	PKL	A2907

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-1**
Tag Number:

Lab Sample ID: **9911042-01E**
Date Collected: **11/01/1999**
Matrix: **Aqueous**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
Arsenic, total	7440-38-2	EPA200.7	ND	0.1		mg/L	1	11/05/1999	11/09/1999	JCB	P1865
Barium, total	7440-39-3	EPA200.7	0.043	0.02		mg/L	1	11/05/1999	11/09/1999	JCB	P1865
Cadmium, total	7440-43-9	EPA200.7	0.016	0.005		mg/L	1	11/05/1999	11/09/1999	JCB	P1865
Chromium, total	7440-47-3	EPA200.7	0.019	0.01		mg/L	1	11/05/1999	11/09/1999	JCB	P1865
Lead, total	7439-92-1	EPA200.7	0.27	0.05		mg/L	1	11/05/1999	11/09/1999	JCB	P1865
Selenium, total	7782-49-2	EPA200.7	ND	0.1		mg/L	1	11/05/1999	11/11/1999	SLM	P1865
Silver, total	7440-22-4	EPA200.7	ND	0.01		mg/L	1	11/05/1999	11/09/1999	JCB	P1865
Mercury, total	7439-97-6	EPA245.1	0.00023	0.0002		mg/L	1		11/09/1999	AW	A2938

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-1A**
Tag Number:

Lab Sample ID: **9911042-02A**
Date Collected: **11/01/1999**
Matrix: **Aqueous**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
1,2,4-Trichlorobenzene	120-82-1	SW8270C	44	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
1,2-Dichlorobenzene	95-50-1	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
1,2-Diphenylhydrazine	122-66-7	SW8270C	ND	50		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
1,3-Dichlorobenzene	541-73-1	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
1,4-Dichlorobenzene	106-46-7	SW8270C	37	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2,4,5-Trichlorophenol	95-95-4	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2,4,6-Trichlorophenol	88-06-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2,4-Dichlorophenol	120-83-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2,4-Dimethylphenol	105-67-9	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2,4-Dinitrophenol	51-28-5	SW8270C	ND	50		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2,4-Dinitrotoluene	121-14-2	SW8270C	36	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2,6-Dinitrotoluene	606-20-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934

Qualifiers:
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R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

Date: 08-Dec-99

Barringer Laboratories, Inc.

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CLIENT SAMPLE REPORT

2-Chloronaphthalene	91-58-7	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2-Chlorophenol	95-57-8	SW8270C	56	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2-Methylnaphthalene	91-57-6	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2-Methylphenol	95-48-7	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2-Nitroaniline	88-74-4	SW8270C	ND	50		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
2-Nitrophenol	88-75-5	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
3 & 4-Methylphenol	108-39-	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
3,3'-Dichlorobenzidine	91-94-1	SW8270C	ND	20		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
3-Nitroaniline	99-09-2	SW8270C	ND	50		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
4,6-Dinitro-2-methylphenol	534-52-1	SW8270C	ND	50		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
4-Bromophenyl phenyl ether	101-55-3	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
4-Chloro-3-methylphenol	59-50-7	SW8270C	52	20		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
4-Chloroaniline	106-47-8	SW8270C	ND	20		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
4-Chlorophenyl phenyl ether	7005-72-3	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
4-Nitroaniline	100-01-6	SW8270C	ND	20		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
4-Nitrophenol	100-02-7	SW8270C	7.5	50	J	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Acenaphthene	83-32-9	SW8270C	46	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Acenaphthylene	208-96-8	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Anthracene	120-12-7	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Benz(a)anthracene	56-55-3	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Benzidine	92-87-5	SW8270C	ND	50		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Benzo(a)pyrene	50-32-8	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Benzo(b)fluoranthene	205-99-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Benzo(g,h,i)perylene	191-24-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Benzo(k)fluoranthene	207-08-9	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Benzoic acid	65-85-0	SW8270C	ND	50		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Benzyl alcohol	100-51-6	SW8270C	ND	20		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Bis(2-chloroethoxy)methane	111-91-1	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Bis(2-chloroethyl)ether	111-44-4	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Bis(2-chloroisopropyl)ether	108-60-1	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Bis(2-ethylhexyl)phthalate	117-81-7	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Butyl benzyl phthalate	85-68-7	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Carbazole	86-74-8	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Chrysene	218-01-9	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Di-n-butyl phthalate	84-74-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Di-n-octyl phthalate	117-84-0	SW8270C	ND	10		µg/L	1	11/08/1999	11/11/1999	RDH	P1934

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CLIENT SAMPLE REPORT

Dibenz(a,h)anthracene	53-70-3	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Dibenzofuran	132-64-9	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Diethyl phthalate	84-66-2	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Dimethyl phthalate	131-11-3	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Diphenylamine	122-39-4	SW8270C	ND	20	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Fluoranthene	206-44-0	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Fluorene	86-73-7	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Hexachlorobenzene	118-74-1	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Hexachlorobutadiene	87-68-3	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Hexachlorocyclopentadiene	77-47-4	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Hexachloroethane	67-72-1	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Indeno(1,2,3-cd)pyrene	193-39-5	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Isophorone	78-59-1	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
N-Nitrosodi-n-propylamine	621-64-7	SW8270C	42	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
N-Nitrosodiphenylamine	86-30-6	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Naphthalene	91-20-3	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Nitrobenzene	98-95-3	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Pentachlorophenol	87-86-5	SW8270C	62	50	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Phenanthrene	85-01-08	SW8270C	ND	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Phenol	108-95-2	SW8270C	17	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Pyrene	129-00-0	SW8270C	50	10	µg/L	1	11/08/1999	11/11/1999	RDH	P1934
Surr: 2,4,6-Tribromophenol	118-79-6	SW8270C	87	10-123	%REC	1	11/08/1999	11/11/1999	RDH	P1934
Surr: 2-Fluorobiphenyl	321-60-8	SW8270C	97	43-116	%REC	1	11/08/1999	11/11/1999	RDH	P1934
Surr: 2-Fluorophenol	367-12-4	SW8270C	25	21-110	%REC	1	11/08/1999	11/11/1999	RDH	P1934
Surr: 4-Terphenyl-d14	1718-51-0	SW8270C	105	33-141	%REC	1	11/08/1999	11/11/1999	RDH	P1934
Surr: Nitrobenzene-d5	4165-60-0	SW8270C	88	35-114	%REC	1	11/08/1999	11/11/1999	RDH	P1934
Surr: Phenol-d6	13127-88-3	SW8270C	19	10-110	%REC	1	11/08/1999	11/11/1999	RDH	P1934

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-1A**
Tag Number:

Lab Sample ID: **9911042-02B**
Date Collected: **11/01/1999**
Matrix: **Aqueous**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
Aroclor 1016	12674-11-2	SW8082	4.7	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1221	11104-28-2	SW8082	ND	2		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1232	11141-16-5	SW8082	ND	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1242	53469-21-9	SW8082	ND	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933

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CLIENT SAMPLE REPORT

Aroclor 1248	12672-29-6	SW8082	ND	1	µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1254	11097-69-1	SW8082	8.8	1	µg/L	1	11/08/1999	11/29/1999	RDH	P1933
Aroclor 1260	11096-82-5	SW8082	5.1	1	µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1262	37324-23-5	SW8082	ND	1	µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1268	11100-14-4	SW8082	ND	1	µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Surr: Decachlorobiphenyl	2051-24-3	SW8082	106	18-111	%REC	1	11/08/1999	11/29/1999	RDH	P1933
Surr: Decachlorobiphenyl	2051-24-3	SW8082	101	18-111	%REC	1	11/08/1999	11/09/1999	RDH	P1933
Surr: Tetrachloro-m-xylene	877-09-8	SW8082	89	23-110	%REC	1	11/08/1999	11/09/1999	RDH	P1933
Surr: Tetrachloro-m-xylene	877-09-8	SW8082	97	23-110	%REC	1	11/08/1999	11/29/1999	RDH	P1933

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-1A**
Tag Number:

Lab Sample ID: **9911042-02C**
Date Collected: **11/01/1999**
Matrix: **Aqueous**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
T/R Hydrocarbons: C10-C22		SW8015B	1.2	1		mg/L	1	11/04/1999	11/09/1999	MTB	P1876
Surr: 4-Terphenyl-d14	1718-51-0	SW8015B	108	30-120		%REC	1	11/04/1999	11/09/1999	MTB	P1876

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-1B**
Tag Number:

Lab Sample ID: **9911042-03A**
Date Collected: **11/01/1999**
Matrix: **Aqueous**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
1,2,4-Trichlorobenzene	120-82-1	SW8270C	52	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
1,2-Dichlorobenzene	95-50-1	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
1,2-Diphenylhydrazine	122-66-7	SW8270C	ND	50		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
1,3-Dichlorobenzene	541-73-1	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
1,4-Dichlorobenzene	106-46-7	SW8270C	40	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
2,4,5-Trichlorophenol	95-95-4	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
2,4,6-Trichlorophenol	88-06-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
2,4-Dichlorophenol	120-83-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
2,4-Dimethylphenol	105-67-9	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
2,4-Dinitrophenol	51-28-5	SW8270C	ND	50		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
2,4-Dinitrotoluene	121-14-2	SW8270C	38	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
2,6-Dinitrotoluene	606-20-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
2-Chloronaphthalene	91-58-7	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
2-Chlorophenol	95-57-8	SW8270C	62	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
2-Methylnaphthalene	91-57-6	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934

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CLIENT SAMPLE REPORT

2-Methylphenol	95-48-7	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
2-Nitroaniline	88-74-4	SW8270C	ND	50		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
2-Nitrophenol	88-75-5	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
3 & 4-Methylphenol	108-39-	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
3,3'-Dichlorobenzidine	91-94-1	SW8270C	ND	20		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
3-Nitroaniline	99-09-2	SW8270C	ND	50		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
4,6-Dinitro-2-methylphenol	534-52-1	SW8270C	ND	50		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
4-Bromophenyl phenyl ether	101-55-3	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
4-Chloro-3-methylphenol	59-50-7	SW8270C	57	20		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
4-Chloroaniline	106-47-8	SW8270C	ND	20		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
4-Chlorophenyl phenyl ether	7005-72-3	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
4-Nitroaniline	100-01-6	SW8270C	ND	20		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
4-Nitrophenol	100-02-7	SW8270C	6.8	50	J	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Acenaphthene	83-32-9	SW8270C	51	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Acenaphthylene	208-96-8	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Anthracene	120-12-7	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Benz(a)anthracene	56-55-3	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Benzidine	92-87-5	SW8270C	ND	50		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Benzo(a)pyrene	50-32-8	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Benzo(b)fluoranthene	205-99-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Benzo(g,h,i)perylene	191-24-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Benzo(k)fluoranthene	207-08-9	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Benzoic acid	65-85-0	SW8270C	ND	50		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Benzyl alcohol	100-51-6	SW8270C	ND	20		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Bis(2-chloroethoxy)methane	111-91-1	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Bis(2-chloroethyl)ether	111-44-4	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Bis(2-chloroisopropyl)ether	108-60-1	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Bis(2-ethylhexyl)phthalate	117-81-7	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Butyl benzyl phthalate	85-68-7	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Carbazole	86-74-8	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Chrysene	218-01-9	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Di-n-butyl phthalate	84-74-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Di-n-octyl phthalate	117-84-0	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Dibenz(a,h)anthracene	53-70-3	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Dibenzofuran	132-64-9	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Diethyl phthalate	84-66-2	SW8270C	ND	10		µg/L	1	11/08/1999	11/12/1999	RDH	P1934

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Date: 08-Dec-99

CLIENT SAMPLE REPORT

Dimethyl phthalate	131-11-3	SW8270C	ND	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Diphenylamine	122-39-4	SW8270C	ND	20	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Fluoranthene	206-44-0	SW8270C	ND	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Fluorene	86-73-7	SW8270C	ND	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Hexachlorobenzene	118-74-1	SW8270C	ND	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Hexachlorobutadiene	87-68-3	SW8270C	ND	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Hexachlorocyclopentadiene	77-47-4	SW8270C	ND	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Hexachloroethane	67-72-1	SW8270C	ND	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Indeno(1,2,3-cd)pyrene	193-39-5	SW8270C	ND	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Isophorone	78-59-1	SW8270C	ND	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
N-Nitrosodi-n-propylamine	621-64-7	SW8270C	43	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
N-Nitrosodiphenylamine	86-30-6	SW8270C	ND	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Naphthalene	91-20-3	SW8270C	ND	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Nitrobenzene	98-95-3	SW8270C	ND	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Pentachlorophenol	87-86-5	SW8270C	76	50	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Phenanthrene	85-01-08	SW8270C	ND	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Phenol	108-95-2	SW8270C	17	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Pyrene	129-00-0	SW8270C	58	10	µg/L	1	11/08/1999	11/12/1999	RDH	P1934
Surr: 2,4,6-Tribromophenol	118-79-6	SW8270C	101	10-123	%REC	1	11/08/1999	11/12/1999	RDH	P1934
Surr: 2-Fluorobiphenyl	321-60-8	SW8270C	106	43-116	%REC	1	11/08/1999	11/12/1999	RDH	P1934
Surr: 2-Fluorophenol	367-12-4	SW8270C	29	21-110	%REC	1	11/08/1999	11/12/1999	RDH	P1934
Surr: 4-Terphenyl-d14	1718-51-0	SW8270C	120	33-141	%REC	1	11/08/1999	11/12/1999	RDH	P1934
Surr: Nitrobenzene-d5	4165-60-0	SW8270C	95	35-114	%REC	1	11/08/1999	11/12/1999	RDH	P1934
Surr: Phenol-d6	13127-88-3	SW8270C	19	10-110	%REC	1	11/08/1999	11/12/1999	RDH	P1934

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-1B**
Tag Number:

Lab Sample ID: **9911042-03B**
Date Collected: **11/01/1999**
Matrix: **Aqueous**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
Aroclor 1016	12674-11-2	SW8082	5.0	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1221	11104-28-2	SW8082	ND	2		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1232	11141-16-5	SW8082	ND	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1242	53469-21-9	SW8082	ND	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1248	12672-29-6	SW8082	ND	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1254	11097-69-1	SW8082	9.4	1		µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1260	11096-82-5	SW8082	5.4	1		µg/L	1	11/08/1999	11/29/1999	RDH	P1933

Qualifiers:
ND - Not detected at the reporting limit
J - Analyte detected below quantitation limits
E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

Date: 08-Dec-99

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CLIENT SAMPLE REPORT

Aroclor 1262	37324-23-5	SW8082	ND	1	µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Aroclor 1268	11100-14-4	SW8082	ND	1	µg/L	1	11/08/1999	11/09/1999	RDH	P1933
Surr: Decachlorobiphenyl	2051-24-3	SW8082	94	18-111	%REC	1	11/08/1999	11/29/1999	RDH	P1933
Surr: Decachlorobiphenyl	2051-24-3	SW8082	97	18-111	%REC	1	11/08/1999	11/09/1999	RDH	P1933
Surr: Tetrachloro-m-xylene	877-09-8	SW8082	87	23-110	%REC	1	11/08/1999	11/29/1999	RDH	P1933
Surr: Tetrachloro-m-xylene	877-09-8	SW8082	90	23-110	%REC	1	11/08/1999	11/09/1999	RDH	P1933

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-1B**
Tag Number:

Lab Sample ID: **9911042-03C**
Date Collected: **11/01/1999**
Matrix: **Aqueous**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
T/R Hydrocarbons: C10-C22		SW8015B	1.3	1		mg/L	1	11/04/1999	11/10/1999	MTB	P1876
Surr: 4-Terphenyl-d14	1718-51-0	SW8015B	121	30-120	S	%REC	1	11/04/1999	11/10/1999	MTB	P1876

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-2**
Tag Number:

Lab Sample ID: **9911042-04A**
Date Collected: **11/01/1999**
Matrix: **Soil**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
Aroclor 1016	12674-11-2	SW8082	ND	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1221	11104-28-2	SW8082	ND	700		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1232	11141-16-5	SW8082	ND	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1242	53469-21-9	SW8082	ND	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1248	12672-29-6	SW8082	ND	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1254	11097-69-1	SW8082	6900	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1260	11096-82-5	SW8082	960	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1262	37324-23-5	SW8082	ND	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1268	11100-14-4	SW8082	ND	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Surr: Decachlorobiphenyl	2051-24-3	SW8082	0	43-141	S	%REC	10	11/10/1999	11/18/1999	RDH	P1942
Surr: Tetrachloro-m-xylene	877-09-8	SW8082	0	26-119	S	%REC	10	11/10/1999	11/18/1999	RDH	P1942

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-2**
Tag Number:

Lab Sample ID: **9911042-04B**
Date Collected: **11/01/1999**
Matrix: **Soil**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
pH	10-29-7	SW9045B	7.63	0.01		pH Units	1		11/08/1999	PKL	A2907

Qualifiers:
ND - Not detected at the reporting limit
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R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

Date: 08-Dec-99

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CLIENT SAMPLE REPORT

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-2**
Tag Number:

Lab Sample ID: **9911042-04C**
Date Collected: **11/01/1999**
Matrix: **Soil**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
T/R Hydrocarbons: C10-C22		SW8015B	200	10		mg/Kg	1	11/09/1999	11/18/1999	MTB	P1937
Surr: 4-Terphenyl-d14	1718-51-0	SW8015B	89	30-120		%REC	1	11/09/1999	11/18/1999	MTB	P1937

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-2**
Tag Number:

Lab Sample ID: **9911042-04D**
Date Collected: **11/01/1999**
Matrix: **Soil**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
Arsenic, TCLP	7440-38-2	SW6010B	ND	0.5		mg/L	1	11/12/1999	11/16/1999	SLM	P1986
Barium, TCLP	7440-39-3	SW6010B	1.8	0.1		mg/L	1	11/12/1999	11/16/1999	SLM	P1986
Cadmium, TCLP	7440-43-9	SW6010B	ND	0.03		mg/L	1	11/12/1999	11/17/1999	SLM	P1986
Chromium, TCLP	7440-47-3	SW6010B	ND	0.05		mg/L	1	11/12/1999	11/16/1999	SLM	P1986
Lead, TCLP	7439-92-1	SW6010B	ND	0.3		mg/L	1	11/12/1999	11/17/1999	SLM	P1986
Selenium, TCLP	7782-49-2	SW6010B	ND	0.5		mg/L	1	11/12/1999	11/16/1999	SLM	P1986
Silver, TCLP	7440-22-4	SW6010B	ND	0.05		mg/L	1	11/12/1999	11/16/1999	SLM	P1986
Mercury, TCLP	7439-97-6	SW7470	ND	0.002		mg/L	1		11/17/1999	AW	A3120a

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-2**
Tag Number:

Lab Sample ID: **9911042-04E**
Date Collected: **11/01/1999**
Matrix: **Soil**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
1,4-Dichlorobenzene, TCLP	106-46-7	SW8270C	ND	50		µg/L	1	11/22/1999	11/24/1999	RDH	P2146
2,4,5-Trichlorophenol, TCLP	95-95-4	SW8270C	ND	200		µg/L	1	11/22/1999	11/24/1999	RDH	P2146
2,4,6-Trichlorophenol, TCLP	88-06-2	SW8270C	ND	50		µg/L	1	11/22/1999	11/24/1999	RDH	P2146
2,4-Dinitrotoluene, TCLP	121-14-2	SW8270C	ND	50		µg/L	1	11/22/1999	11/24/1999	RDH	P2146
2-Methylphenol, TCLP	95-48-7	SW8270C	ND	50		µg/L	1	11/22/1999	11/24/1999	RDH	P2146
3 & 4-Methylphenol, TCLP	108-39-	SW8270C	ND	50		µg/L	1	11/22/1999	11/24/1999	RDH	P2146
Hexachlorobenzene, TCLP	118-74-1	SW8270C	ND	50		µg/L	1	11/22/1999	11/24/1999	RDH	P2146
Hexachlorobutadiene, TCLP	87-68-3	SW8270C	ND	50		µg/L	1	11/22/1999	11/24/1999	RDH	P2146
Hexachloroethane, TCLP	67-72-1	SW8270C	ND	50		µg/L	1	11/22/1999	11/24/1999	RDH	P2146
Nitrobenzene, TCLP	98-95-3	SW8270C	ND	50		µg/L	1	11/22/1999	11/24/1999	RDH	P2146
Pentachlorophenol, TCLP	87-86-5	SW8270C	ND	200		µg/L	1	11/22/1999	11/24/1999	RDH	P2146

Qualifiers:
ND - Not detected at the reporting limit
J - Analyte detected below quantitation limits
E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

Date: 08-Dec-99

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CLIENT SAMPLE REPORT

Pyridine, TCLP	110-86-1	SW8270C	ND	50	µg/L	1	11/22/1999	11/24/1999	RDH	P2146
Surr: 2,4,6-Tribromophenol	118-79-6	SW8270C	90	10-123	%REC	1	11/22/1999	11/24/1999	RDH	P2146
Surr: 2-Fluorobiphenyl	321-60-8	SW8270C	83	43-116	%REC	1	11/22/1999	11/24/1999	RDH	P2146
Surr: 2-Fluorophenol	367-12-4	SW8270C	40	21-110	%REC	1	11/22/1999	11/24/1999	RDH	P2146
Surr: 4-Terphenyl-d14	1718-51-0	SW8270C	87	33-141	%REC	1	11/22/1999	11/24/1999	RDH	P2146
Surr: Nitrobenzene-d5	4165-60-0	SW8270C	82	34-114	%REC	1	11/22/1999	11/24/1999	RDH	P2146
Surr: Phenol-d6	13127-88-3	SW8270C	25	10-110	%REC	1	11/22/1999	11/24/1999	RDH	P2146

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-3**
Tag Number:

Lab Sample ID: **9911042-05A**
Date Collected: **11/01/1999**
Matrix: **Soil**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
Aroclor 1016	12674-11-2	SW8082	ND	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1221	11104-28-2	SW8082	ND	700		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1232	11141-16-5	SW8082	ND	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1242	53469-21-9	SW8082	ND	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1248	12672-29-6	SW8082	ND	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1254	11097-69-1	SW8082	7000	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1260	11096-82-5	SW8082	5000	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1262	37324-23-5	SW8082	ND	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Aroclor 1268	11100-14-4	SW8082	ND	300		µg/Kg	10	11/10/1999	11/18/1999	RDH	P1942
Surr: Decachlorobiphenyl	2051-24-3	SW8082	0	43-141	S	%REC	10	11/10/1999	11/18/1999	RDH	P1942
Surr: Tetrachloro-m-xylene	877-09-8	SW8082	0	26-119	S	%REC	10	11/10/1999	11/18/1999	RDH	P1942

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-3**
Tag Number:

Lab Sample ID: **9911042-05B**
Date Collected: **11/01/1999**
Matrix: **Soil**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
pH	10-29-7	SW9045B	7.40	0.01		pH Units	1		11/08/1999	PKL	A2907

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-3**
Tag Number:

Lab Sample ID: **9911042-05C**
Date Collected: **11/01/1999**
Matrix: **Soil**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
T/R Hydrocarbons: C10-C22		SW8015B	180	10		mg/Kg	1	11/09/1999	11/18/1999	MTB	P1937
Surr: 4-Terphenyl-d14	1718-51-0	SW8015B	79	30-120		%REC	1	11/09/1999	11/18/1999	MTB	P1937

Qualifiers:
ND - Not detected at the reporting limit
J - Analyte detected below quantitation limits
E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
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Date: 08-Dec-99

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CLIENT SAMPLE REPORT

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-3**
Tag Number:

Lab Sample ID: **9911042-05D**
Date Collected: **11/01/1999**
Matrix: **Soil**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
Arsenic, TCLP	7440-38-2	SW6010B	ND	0.5		mg/L	1	11/12/1999	11/16/1999	SLM	P1986
Barium, TCLP	7440-39-3	SW6010B	0.84	0.1		mg/L	1	11/12/1999	11/16/1999	SLM	P1986
Cadmium, TCLP	7440-43-9	SW6010B	0.40	0.03		mg/L	1	11/12/1999	11/17/1999	SLM	P1986
Chromium, TCLP	7440-47-3	SW6010B	ND	0.05		mg/L	1	11/12/1999	11/16/1999	SLM	P1986
Lead, TCLP	7439-92-1	SW6010B	1.4	0.3		mg/L	1	11/12/1999	11/17/1999	SLM	P1986
Selenium, TCLP	7782-49-2	SW6010B	0.53	0.5		mg/L	1	11/12/1999	11/16/1999	SLM	P1986
Silver, TCLP	7440-22-4	SW6010B	ND	0.05		mg/L	1	11/12/1999	11/16/1999	SLM	P1986
Mercury, TCLP	7439-97-6	SW7470	ND	0.002		mg/L	1		11/17/1999	AW	A3120a

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-3**
Tag Number:

Lab Sample ID: **9911042-05E**
Date Collected: **11/01/1999**
Matrix: **Soil**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
1,4-Dichlorobenzene, TCLP	106-46-7	SW8270C	ND	50		µg/L	1	11/22/1999	11/27/1999	RDH	P2146
2,4,5-Trichlorophenol, TCLP	95-95-4	SW8270C	ND	200		µg/L	1	11/22/1999	11/27/1999	RDH	P2146
2,4,6-Trichlorophenol, TCLP	88-06-2	SW8270C	ND	50		µg/L	1	11/22/1999	11/27/1999	RDH	P2146
2,4-Dinitrotoluene, TCLP	121-14-2	SW8270C	ND	50		µg/L	1	11/22/1999	11/27/1999	RDH	P2146
2-Methylphenol, TCLP	95-48-7	SW8270C	ND	50		µg/L	1	11/22/1999	11/27/1999	RDH	P2146
3 & 4-Methylphenol, TCLP	108-39-	SW8270C	ND	50		µg/L	1	11/22/1999	11/27/1999	RDH	P2146
Hexachlorobenzene, TCLP	118-74-1	SW8270C	ND	50		µg/L	1	11/22/1999	11/27/1999	RDH	P2146
Hexachlorobutadiene, TCLP	87-68-3	SW8270C	ND	50		µg/L	1	11/22/1999	11/27/1999	RDH	P2146
Hexachloroethane, TCLP	67-72-1	SW8270C	ND	50		µg/L	1	11/22/1999	11/27/1999	RDH	P2146
Nitrobenzene, TCLP	98-95-3	SW8270C	ND	50		µg/L	1	11/22/1999	11/27/1999	RDH	P2146
Pentachlorophenol, TCLP	87-86-5	SW8270C	ND	200		µg/L	1	11/22/1999	11/27/1999	RDH	P2146
Pyridine, TCLP	110-86-1	SW8270C	ND	50		µg/L	1	11/22/1999	11/27/1999	RDH	P2146
Surr: 2,4,6-Tribromophenol	118-79-6	SW8270C	87	10-123		%REC	1	11/22/1999	11/27/1999	RDH	P2146
Surr: 2-Fluorobiphenyl	321-60-8	SW8270C	76	43-116		%REC	1	11/22/1999	11/27/1999	RDH	P2146
Surr: 2-Fluorophenol	367-12-4	SW8270C	38	21-110		%REC	1	11/22/1999	11/27/1999	RDH	P2146
Surr: 4-Terphenyl-d14	1718-51-0	SW8270C	85	33-141		%REC	1	11/22/1999	11/27/1999	RDH	P2146
Surr: Nitrobenzene-d5	4165-60-0	SW8270C	73	34-114		%REC	1	11/22/1999	11/27/1999	RDH	P2146

Qualifiers:
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R - RPD outside accepted recovery limits
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Z - Sample > 10 times blank result

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Date: 08-Dec-99

CLIENT SAMPLE REPORT

Surr: Phenol-d6	13127-88-3	SW8270C	23	10-110	%REC	1	11/22/1999	11/27/1999	RDH	P2146

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Client Sample ID: **99TPS1101-4**
Tag Number:

Lab Sample ID: **9911042-06A**
Date Collected: **11/01/1999**
Matrix: **Solid**

Analyte	CAS#	Method	Result ± 2 sigma	Limit	Qual	Unit	DF	Prepped	Analyzed	Analyst	Batch
Lead, total	7439-92-1	SW6010B	120	20		mg/Kg	5	11/30/1999	11/30/1999	CLH	P2215

Qualifiers:
ND - Not detected at the reporting limit
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Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

Date: 08-Dec-99

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BATCH QC SUMMARY REPORT

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **A2907**
Sample Duplicate

Sample ID: **9911042-01DDUP** Method: **SW9040** Prepped:
Seq No: **54326** Unit: **pH Units** Analyzed: **11/8/99**
Run ID: **TB_991108A** Matrix: **Aqueous** Analyst: **PKL**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
pH	7.80	0.01						7.71		1	20	

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **A2907**
Laboratory Control Spike

Sample ID: **LCS** Method: **SW9040** Prepped:
Seq No: **55699** Unit: **pH Units** Analyzed: **11/8/99**
Run ID: **TB_991108A** Matrix: **Aqueous** Analyst: **PKL**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
pH	7.00	0.01	7.00		100	99	101					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **A2938**
Sample Duplicate

Sample ID: **9911015-01DDUP** Method: **EPA245.1** Prepped:
Seq No: **55048** Unit: **mg/L** Analyzed: **11/9/99**
Run ID: **FIMS_991109A** Matrix: **Aqueous** Analyst: **AW**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Mercury	ND	0.0002						ND		0	20	

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **A2938**
Sample Duplicate

Sample ID: **9911042-01EDUP** Method: **EPA245.1** Prepped:
Seq No: **55051** Unit: **mg/L** Analyzed: **11/9/99**
Run ID: **FIMS_991109A** Matrix: **Aqueous** Analyst: **AW**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Mercury	0.00023	0.0002						0.00023		2	20	

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **A2938**
Laboratory Control Spike

Sample ID: **LCSW** Method: **EPA245.1** Prepped:
Seq No: **55046** Unit: **mg/L** Analyzed: **11/9/99**
Run ID: **FIMS_991109A** Matrix: **Aqueous** Analyst: **AW**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Mercury	0.0048	0.0002	0.0050		97	85	115					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **A2938**
Method Blank

Sample ID: **ICB** Method: **EPA245.1** Prepped:
Seq No: **55045** Unit: **mg/L** Analyzed: **11/9/99**
Run ID: **FIMS_991109A** Matrix: **Aqueous** Analyst: **AW**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Mercury	ND	0.0002										

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Y - Unspiked sample > 4 times amount spiked
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BATCH QC SUMMARY REPORT

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **A2938**
Matrix Spike

Sample ID: **9911015-01DMS**
Seq No: **55049**
Run ID: **FIMS_991109A**

Method: **EPA245.1**
Unit: **mg/L**
Matrix: **Aqueous**

Prepped:
Analyzed: **11/9/99**
Analyst: **AW**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Mercury	0.0010	0.0002	0.0010	ND	105	75	125					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **A2938**
Matrix Spike

Sample ID: **9911042-01EMS**
Seq No: **55052**
Run ID: **FIMS_991109A**

Method: **EPA245.1**
Unit: **mg/L**
Matrix: **Aqueous**

Prepped:
Analyzed: **11/9/99**
Analyst: **AW**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Mercury	0.0013	0.0002	0.0010	0.00023	111	75	125					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **A3120a**
Sample Duplicate

Sample ID: **9910293-10ADUP**
Seq No: **58793**
Run ID: **FIMS_991117A**

Method: **SW7470**
Unit: **mg/L**
Matrix: **Solid**

Prepped:
Analyzed: **11/17/99**
Analyst: **AW**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Mercury	ND	0.002						0.0072		200	20	X

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **A3120a**
Laboratory Control Spike

Sample ID: **LCSW**
Seq No: **58788**
Run ID: **FIMS_991117A**

Method: **SW7470**
Unit: **mg/L**
Matrix: **Aqueous**

Prepped:
Analyzed: **11/17/99**
Analyst: **AW**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Mercury	0.0048	0.0002	0.0050		95	85	115					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **A3120a**
Method Blank

Sample ID: **TCLP BLK**
Seq No: **58789**
Run ID: **FIMS_991117A**

Method: **SW7470**
Unit: **mg/L**
Matrix: **Solid**

Prepped:
Analyzed: **11/17/99**
Analyst: **AW**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Mercury	ND	0.002										

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **A3120a**
Matrix Spike

Sample ID: **9910293-10AMS**
Seq No: **58794**
Run ID: **FIMS_991117A**

Method: **SW7470**
Unit: **mg/L**
Matrix: **Solid**

Prepped:
Analyzed: **11/17/99**
Analyst: **AW**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Mercury	0.011	0.002	0.020	0.0072	19	75	125					S

Qualifiers:

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Date: 08-Dec-99

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BATCH QC SUMMARY REPORT

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: P1865
Sample Duplicate

Sample ID: **9911042-01EDUP** Method: **EPA200.7** Prepped: **11/5/99**
Seq No: **56346** Unit: **mg/L** Analyzed: **11/9/99**
Run ID: **ICAP_991109A** Matrix: **Aqueous** Analyst: **JCB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Arsenic	ND	0.1						ND		0	20	
Barium	0.041	0.02						0.043		5	20	
Cadmium	0.018	0.005						0.016		12	20	
Chromium	0.019	0.01						0.019		2	20	
Lead	0.27	0.05						0.27		2	20	
Silver	ND	0.01						ND		0	20	

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: P1865
Sample Duplicate

Sample ID: **9911042-01EDUP** Method: **EPA200.7** Prepped: **11/5/99**
Seq No: **56386** Unit: **mg/L** Analyzed: **11/10/99**
Run ID: **ICAP_991109A** Matrix: **Aqueous** Analyst: **JCB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Arsenic	ND	0.1						ND		0	20	
Barium	0.039	0.02						0.042		7	20	
Cadmium	0.021	0.005						0.022		3	20	
Chromium	0.021	0.01						0.022		6	20	
Lead	0.30	0.05						0.35		16	20	
Silver	ND	0.01						ND		0	20	

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: P1865
Sample Duplicate

Sample ID: **9911042-01EDUP** Method: **EPA200.7** Prepped: **11/5/99**
Seq No: **56881** Unit: **mg/L** Analyzed: **11/11/99**
Run ID: **ICAP_991111A** Matrix: **Aqueous** Analyst: **SLM**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Selenium	ND	0.1						ND		0	20	

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: P1865
Laboratory Control Spike

Sample ID: **LCS-1865** Method: **EPA200.7** Prepped: **11/5/99**
Seq No: **56343** Unit: **mg/L** Analyzed: **11/9/99**
Run ID: **ICAP_991109A** Matrix: **Aqueous** Analyst: **JCB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Arsenic	5.0	0.1	5.0		101	85	115					
Barium	10	0.02	10		104	85	115					
Cadmium	1.0	0.005	1.0		101	85	115					
Chromium	2.1	0.01	2.0		103	85	115					

Qualifiers:

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BATCH QC SUMMARY REPORT

Lead	5.1	0.05	5.0		103	85	115
Silver	1.0	0.01	1.0		103	85	115

Client: **Bechtel Nevada Corp.** Batch ID: **P1865** Sample ID: **LCS-1865** Method: **EPA200.7** Prepped: **11/5/99**
Work Order: **9911042** **Laboratory Control Spike** Seq No: **56879** Unit: **mg/L** Analyzed: **11/11/99**
Project: **V712** Run ID: **ICAP_991111A** Matrix: **Aqueous** Analyst: **SLM**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Selenium	5.2	0.1	5.0		104	85	115					

Client: **Bechtel Nevada Corp.** Batch ID: **P1865** Sample ID: **MBLK-1865** Method: **EPA200.7** Prepped: **11/5/99**
Work Order: **9911042** **Method Blank** Seq No: **56342** Unit: **mg/L** Analyzed: **11/9/99**
Project: **V712** Run ID: **ICAP_991109A** Matrix: **Aqueous** Analyst: **JCB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Arsenic	ND	0.1										
Barium	ND	0.02										
Cadmium	ND	0.005										
Chromium	ND	0.01										
Lead	ND	0.05										
Silver	ND	0.01										

Client: **Bechtel Nevada Corp.** Batch ID: **P1865** Sample ID: **MBLK-1865** Method: **EPA200.7** Prepped: **11/5/99**
Work Order: **9911042** **Method Blank** Seq No: **56878** Unit: **mg/L** Analyzed: **11/11/99**
Project: **V712** Run ID: **ICAP_991111A** Matrix: **Aqueous** Analyst: **SLM**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Selenium	ND	0.1										

Client: **Bechtel Nevada Corp.** Batch ID: **P1865** Sample ID: **9911042-01EMS** Method: **EPA200.7** Prepped: **11/5/99**
Work Order: **9911042** **Matrix Spike** Seq No: **56347** Unit: **mg/L** Analyzed: **11/9/99**
Project: **V712** Run ID: **ICAP_991109A** Matrix: **Aqueous** Analyst: **JCB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Arsenic	4.0	0.1	4.0	ND	100	75	125					
Barium	4.2	0.02	4.0	0.043	103	75	125					
Cadmium	0.11	0.005	0.10	0.016	94	75	125					
Chromium	0.44	0.01	0.40	0.019	105	75	125					
Lead	1.3	0.05	1.0	0.27	106	75	125					
Silver	0.11	0.01	0.10	ND	114	75	125					

Qualifiers:

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Date: 08-Dec-99

BATCH QC SUMMARY REPORT

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **P1865**
Matrix Spike

Sample ID: **9911042-01EMS** Method: **EPA200.7** Prepped: **11/5/99**
Seq No: **56387** Unit: **mg/L** Analyzed: **11/10/99**
Run ID: **ICAP_991109A** Matrix: **Aqueous** Analyst: **JCB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Arsenic	4.0	0.1	4.0	ND	100	75	125					
Barium	4.1	0.02	4.0	0.042	102	75	125					
Cadmium	0.12	0.005	0.10	0.022	94	75	125					
Chromium	0.45	0.01	0.40	0.022	106	75	125					
Lead	1.3	0.05	1.0	0.35	98	75	125					
Silver	0.12	0.01	0.10	ND	116	75	125					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **P1865**
Matrix Spike

Sample ID: **9911042-01EMS** Method: **EPA200.7** Prepped: **11/5/99**
Seq No: **56882** Unit: **mg/L** Analyzed: **11/11/99**
Run ID: **ICAP_991111A** Matrix: **Aqueous** Analyst: **SLM**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Selenium	4.3	0.1	4.0	ND	107	75	125					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **P1876**
Laboratory Control Spike

Sample ID: **LCS-1876** Method: **SW8015B** Prepped: **11/4/99**
Seq No: **55896** Unit: **mg/L** Analyzed: **11/9/99**
Run ID: **CURLY_991109A** Matrix: **Aqueous** Analyst: **MTB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
T/R Hydrocarbons: C10-C22	0.93	0.5	1.0		93	30	120					
Surr: 4-Terphenyl-d14					105	30	120					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **P1876**
Laboratory Control Spike Duplicate

Sample ID: **LCSD-1876** Method: **SW8015B** Prepped: **11/4/99**
Seq No: **55897** Unit: **mg/L** Analyzed: **11/9/99**
Run ID: **CURLY_991109A** Matrix: **Aqueous** Analyst: **MTB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
T/R Hydrocarbons: C10-C22	1.1	0.5	1.0		111	30	120	0.93		17	20	
Surr: 4-Terphenyl-d14					119	30	120					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **P1876**
Method Blank

Sample ID: **MBLK-1876** Method: **SW8015B** Prepped: **11/4/99**
Seq No: **55895** Unit: **mg/L** Analyzed: **11/9/99**
Run ID: **CURLY_991109A** Matrix: **Aqueous** Analyst: **MTB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual

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Date: 08-Dec-99

BATCH QC SUMMARY REPORT

T/R Hydrocarbons: C10-C22	ND	1										
Surr: 4-Terphenyl-d14					98	30	120					

Client: **Bechtel Nevada Corp.** Batch ID: **P1876** Sample ID: **9911042-02CMS** Method: **SW8015B** Prepped: **11/4/99**
Work Order: **9911042** **Matrix Spike** Seq No: **55899** Unit: **mg/L** Analyzed: **11/9/99**
Project: **V712** Run ID: **CURLY_991109A** Matrix: **Aqueous** Analyst: **MTB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
T/R Hydrocarbons: C10-C22	1.2	1	1.0	0.64	59	30	120					
Surr: 4-Terphenyl-d14					108	30	120					

Client: **Bechtel Nevada Corp.** Batch ID: **P1876** Sample ID: **9911042-03CMSD** Method: **SW8015B** Prepped: **11/4/99**
Work Order: **9911042** **Matrix Spike Duplicate** Seq No: **55901** Unit: **mg/L** Analyzed: **11/10/99**
Project: **V712** Run ID: **CURLY_991109A** Matrix: **Aqueous** Analyst: **MTB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
T/R Hydrocarbons: C10-C22	1.3	1	1.0	0.64	64	30	120	1.2		3	20	
Surr: 4-Terphenyl-d14					121	30	120					S

Client: **Bechtel Nevada Corp.** Batch ID: **P1933** Sample ID: **LCS-1933** Method: **SW8082** Prepped: **11/8/99**
Work Order: **9911042** **Laboratory Control Spike** Seq No: **57913** Unit: **µg/L** Analyzed: **11/9/99**
Project: **V712** Run ID: **MOE JR._991108C** Matrix: **Aqueous** Analyst: **RDH**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Aroclor 1016	5.0	1	5.0		99	50	114					
Aroclor 1260	3.8	1	5.0		77	8	127					
Surr: Decachlorobiphenyl					103	18	111					
Surr: Tetrachloro-m-xylene					94	23	110					

Client: **Bechtel Nevada Corp.** Batch ID: **P1933** Sample ID: **LCSD-1933** Method: **SW8082** Prepped: **11/8/99**
Work Order: **9911042** **Laboratory Control Spike Duplicate** Seq No: **57914** Unit: **µg/L** Analyzed: **11/9/99**
Project: **V712** Run ID: **MOE JR._991108C** Matrix: **Aqueous** Analyst: **RDH**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Aroclor 1016	4.9	1	5.0		99	50	114	5.0		1	20	
Aroclor 1260	4.0	1	5.0		80	8	127	3.8		5	20	
Surr: Decachlorobiphenyl					113	18	111					
Surr: Tetrachloro-m-xylene					85	23	110					S

Qualifiers:
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Date: 08-Dec-99

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BATCH QC SUMMARY REPORT

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: P1933
Method Blank

Sample ID: **MBLK-1933** Method: **SW8082** Prepped: **11/8/99**
Seq No: **57912** Unit: **µg/L** Analyzed: **11/9/99**
Run ID: **MOE JR._991108C** Matrix: **Aqueous** Analyst: **RDH**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Aroclor 1016	ND	1										
Aroclor 1221	ND	2										
Aroclor 1232	ND	1										
Aroclor 1242	ND	1										
Aroclor 1248	ND	1										
Aroclor 1254	ND	1										
Aroclor 1260	ND	1										
Aroclor 1262	ND	1										
Aroclor 1268	ND	1										
Surr: Decachlorobiphenyl					105	18	111					
Surr: Tetrachloro-m-xylene					91	23	110					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: P1933
Matrix Spike

Sample ID: **9911042-01BMS** Method: **SW8082** Prepped: **11/8/99**
Seq No: **57917** Unit: **µg/L** Analyzed: **11/9/99**
Run ID: **MOE JR._991108C** Matrix: **Aqueous** Analyst: **RDH**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Aroclor 1016	4.7	1	5.0	ND	95	50	114					
Aroclor 1260	5.1	1	5.0	1.1	79	8	127					
Surr: Decachlorobiphenyl					101	18	111					
Surr: Tetrachloro-m-xylene					89	23	110					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: P1933
Matrix Spike Duplicate

Sample ID: **9911042-01BMSD** Method: **SW8082** Prepped: **11/8/99**
Seq No: **57919** Unit: **µg/L** Analyzed: **11/9/99**
Run ID: **MOE JR._991108C** Matrix: **Aqueous** Analyst: **RDH**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Aroclor 1016	5.0	1	5.0	ND	101	50	114	4.7		6	20	
Aroclor 1260	5.4	1	5.0	1.1	85	8	127	5.1		5	20	
Surr: Decachlorobiphenyl					97	18	111					
Surr: Tetrachloro-m-xylene					90	23	110					

Qualifiers:

ND - Not detected at the reporting limit
J - Analyte detected below quantitation limits
E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

Date: 08-Dec-99

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BATCH QC SUMMARY REPORT

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: P1934
Laboratory Control Spike

Sample ID: **LCS-1934** Method: **SW8270C** Prepped: **11/8/99**
Seq No: **57022** Unit: **µg/L** Analyzed: **11/11/99**
Run ID: **ALBERT_991111A** Matrix: **Aqueous** Analyst: **RDH**

Analyte	Result	± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
1,2,4-Trichlorobenzene	36		10	50		72	39	98					
1,4-Dichlorobenzene	33		10	50		66	36	97					
2,4-Dinitrotoluene	32		10	50		64	24	96					
2-Chlorophenol	59		10	75		78	12	110					
4-Chloro-3-methylphenol	59		20	75		79	23	97					
4-Nitrophenol	9.8		50	75		13	10	80					J
Acenaphthene	39		10	50		79	46	118					
N-Nitrosodi-n-propylamine	37		10	50		74	41	116					
Pentachlorophenol	51		50	50		103	9	103					
Phenol	20		10	75		27	12	110					
Pyrene	60		10	50		120	26	127					
Surr: 2,4,6-Tribromophenol						82	10	123					
Surr: 2-Fluorobiphenyl						82	43	116					
Surr: 2-Fluorophenol						32	21	110					
Surr: 4-Terphenyl-d14						122	33	141					
Surr: Nitrobenzene-d5						75	35	114					
Surr: Phenol-d6						22	10	110					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: P1934
Laboratory Control Spike Duplicate

Sample ID: **LCSD-1934** Method: **SW8270C** Prepped: **11/8/99**
Seq No: **57023** Unit: **µg/L** Analyzed: **11/11/99**
Run ID: **ALBERT_991111A** Matrix: **Aqueous** Analyst: **RDH**

Analyte	Result	± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
1,2,4-Trichlorobenzene	29		10	50		57	39	98	36		23	28	
1,4-Dichlorobenzene	25		10	50		49	36	97	33		29	28	X
2,4-Dinitrotoluene	25		10	50		51	24	96	32		24	38	
2-Chlorophenol	45		10	75		60	12	110	59		26	42	
4-Chloro-3-methylphenol	47		20	75		62	23	97	59		23	42	
4-Nitrophenol	7.2		50	75		10	10	80	ND		30	50	J
Acenaphthene	31		10	50		62	46	118	39		25	31	
N-Nitrosodi-n-propylamine	27		10	50		54	41	116	37		31	38	
Pentachlorophenol	37		50	50		73	9	103	51		34	50	J
Phenol	15		10	75		20	12	110	20		30	42	

Qualifiers:

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R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

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BATCH QC SUMMARY REPORT

Pyrene	47	10	50	94	26	127	60	24	31	
Surr: 2,4,6-Tribromophenol				64	10	123				
Surr: 2-Fluorobiphenyl				64	43	116				
Surr: 2-Fluorophenol				23	21	110				
Surr: 4-Terphenyl-d14				93	33	141				
Surr: Nitrobenzene-d5				59	35	114				
Surr: Phenol-d6				16	10	110				

Client: **Bechtel Nevada Corp.** Batch ID: **P1934** Sample ID: **MBLK-1934** Method: **SW8270C** Prepped: **11/8/99**

Work Order: **9911042** **Method Blank** Seq No: **57021** Unit: **µg/L** Analyzed: **11/11/99**

Project: **V712** Run ID: **ALBERT_991111A** Matrix: **Aqueous** Analyst: **RDH**

Analyte	Result	± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
1,2,4-Trichlorobenzene	ND		10										
1,2-Dichlorobenzene	ND		10										
1,2-Diphenylhydrazine	ND		50										
1,3-Dichlorobenzene	ND		10										
1,4-Dichlorobenzene	ND		10										
2,4,5-Trichlorophenol	ND		10										
2,4,6-Trichlorophenol	ND		10										
2,4-Dichlorophenol	ND		10										
2,4-Dimethylphenol	ND		10										
2,4-Dinitrophenol	ND		50										
2,4-Dinitrotoluene	ND		10										
2,6-Dinitrotoluene	ND		10										
2-Chloronaphthalene	ND		10										
2-Chlorophenol	ND		10										
2-Methylnaphthalene	ND		10										
2-Methylphenol	ND		10										
2-Nitroaniline	ND		50										
2-Nitrophenol	ND		10										
3 & 4-Methylphenol	ND		10										
3,3'-Dichlorobenzidine	ND		20										
3-Nitroaniline	ND		50										
4,6-Dinitro-2-methylphenol	ND		50										
4-Bromophenyl phenyl ether	ND		10										
4-Chloro-3-methylphenol	ND		20										

Qualifiers:

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S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
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BATCH QC SUMMARY REPORT

4-Chloroaniline	ND	20
4-Chlorophenyl phenyl ether	ND	10
4-Nitroaniline	ND	20
4-Nitrophenol	ND	50
Acenaphthene	ND	10
Acenaphthylene	ND	10
Anthracene	ND	10
Benz(a)anthracene	ND	10
Benzidine	ND	50
Benzo(a)pyrene	ND	10
Benzo(b)fluoranthene	ND	10
Benzo(g,h,i)perylene	ND	10
Benzo(k)fluoranthene	ND	10
Benzoic acid	ND	50
Benzyl alcohol	ND	20
Bis(2-chloroethoxy)methane	ND	10
Bis(2-chloroethyl)ether	ND	10
Bis(2-chloroisopropyl)ether	ND	10
Bis(2-ethylhexyl)phthalate	ND	10
Butyl benzyl phthalate	ND	10
Carbazole	ND	10
Chrysene	ND	10
Di-n-butyl phthalate	ND	10
Di-n-octyl phthalate	ND	10
Dibenz(a,h)anthracene	ND	10
Dibenzofuran	ND	10
Diethyl phthalate	ND	10
Dimethyl phthalate	ND	10
Diphenylamine	ND	20
Fluoranthene	ND	10
Fluorene	ND	10
Hexachlorobenzene	ND	10
Hexachlorobutadiene	ND	10
Hexachlorocyclopentadiene	ND	10
Hexachloroethane	ND	10
Indeno(1,2,3-cd)pyrene	ND	10

Qualifiers:
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BATCH QC SUMMARY REPORT

Isophorone	ND	10			
N-Nitrosodi-n-propylamine	ND	10			
N-Nitrosodiphenylamine	ND	10			
Naphthalene	ND	10			
Nitrobenzene	ND	10			
Pentachlorophenol	ND	50			
Phenanthrene	ND	10			
Phenol	ND	10			
Pyrene	ND	10			
Surr: 2,4,6-Tribromophenol			73	10	123
Surr: 2-Fluorobiphenyl			80	43	116
Surr: 2-Fluorophenol			27	21	110
Surr: 4-Terphenyl-d14			105	33	141
Surr: Nitrobenzene-d5			73	35	114
Surr: Phenol-d6			20	10	110

Client: **Bechtel Nevada Corp.** Batch ID: **P1934** Sample ID: **9911042-01AMS** Method: **SW8270C** Prepped: **11/8/99**

Work Order: **9911042** Seq No: **57026** Unit: **µg/L** Analyzed: **11/11/99**

Project: **V712** **Matrix Spike** Run ID: **ALBERT_991111A** Matrix: **Aqueous** Analyst: **RDH**

Analyte	Result	± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
1,2,4-Trichlorobenzene	44		10	50	ND	88	39	98					
1,4-Dichlorobenzene	37		10	50	ND	75	36	97					
2,4-Dinitrotoluene	36		10	50	ND	72	24	96					
2-Chlorophenol	56		10	75	ND	74	12	110					
4-Chloro-3-methylphenol	52		20	75	ND	69	23	97					
4-Nitrophenol	7.5		50	75	ND	10	10	80					J
Acenaphthene	46		10	50	ND	92	46	118					
N-Nitrosodi-n-propylamine	42		10	50	ND	85	41	116					
Pentachlorophenol	62		50	50	ND	124	9	103					S
Phenol	17		10	75	ND	22	12	110					
Pyrene	50		10	50	ND	101	26	127					
Surr: 2,4,6-Tribromophenol						87	10	123					
Surr: 2-Fluorobiphenyl						97	43	116					
Surr: 2-Fluorophenol						25	21	110					
Surr: 4-Terphenyl-d14						105	33	141					
Surr: Nitrobenzene-d5						88	35	114					

Qualifiers:

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J - Analyte detected below quantitation limits
E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
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BATCH QC SUMMARY REPORT

Surr: Phenol-d6					19	10	110						

Client: **Bechtel Nevada Corp.** Batch ID: **P1934** Sample ID: **9911042-01AMSD** Method: **SW8270C** Prepped: **11/8/99**
Work Order: **9911042** **Matrix Spike Duplicate** Seq No: **57028** Unit: **µg/L** Analyzed: **11/12/99**
Project: **V712** Run ID: **ALBERT_991111A** Matrix: **Aqueous** Analyst: **RDH**

Analyte	Result	± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
1,2,4-Trichlorobenzene	52		10	50	ND	104	39	98	44		16	28	S
1,4-Dichlorobenzene	40		10	50	ND	81	36	97	37		8	28	
2,4-Dinitrotoluene	38		10	50	ND	76	24	96	36		7	38	
2-Chlorophenol	62		10	75	ND	83	12	110	56		11	42	
4-Chloro-3-methylphenol	57		20	75	ND	76	23	97	52		10	42	
4-Nitrophenol	6.8		50	75	ND	9	10	80	ND		11	50	JS
Acenaphthene	51		10	50	ND	102	46	118	46		10	31	
N-Nitrosodi-n-propylamine	43		10	50	ND	85	41	116	42		0	38	
Pentachlorophenol	76		50	50	ND	152	9	103	62		20	50	S
Phenol	17		10	75	ND	23	12	110	17		4	42	
Pyrene	58		10	50	ND	116	26	127	50		14	31	
Surr: 2,4,6-Tribromophenol						101	10	123					
Surr: 2-Fluorobiphenyl						106	43	116					
Surr: 2-Fluorophenol						29	21	110					
Surr: 4-Terphenyl-d14						120	33	141					
Surr: Nitrobenzene-d5						95	35	114					
Surr: Phenol-d6						19	10	110					

Client: **Bechtel Nevada Corp.** Batch ID: **P1937** Sample ID: **LCS-1937** Method: **SW8015B** Prepped: **11/9/99**
Work Order: **9911042** **Laboratory Control Spike** Seq No: **59756** Unit: **mg/Kg** Analyzed: **11/18/99**
Project: **V712** Run ID: **CURLY_991117A** Matrix: **Soil** Analyst: **MTB**

Analyte	Result	± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
T/R Hydrocarbons: C10-C22	13		10	33		40	30	120					
Surr: 4-Terphenyl-d14						51	30	120					

Client: **Bechtel Nevada Corp.** Batch ID: **P1937** Sample ID: **LCSD-1937** Method: **SW8015B** Prepped: **11/9/99**
Work Order: **9911042** **Laboratory Control Spike Duplicate** Seq No: **59757** Unit: **mg/Kg** Analyzed: **11/18/99**
Project: **V712** Run ID: **CURLY_991117A** Matrix: **Soil** Analyst: **MTB**

Analyte	Result	± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
T/R Hydrocarbons: C10-C22	9.9		10	33		30	30	120	13		29	20	JX

Qualifiers:

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E - Value above quantitation range
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X - Duplicate sample(s) < 5 times limit
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Y - Unspiked sample > 4 times amount spiked
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Z - Sample > 10 times blank result

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BATCH QC SUMMARY REPORT

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Surr: 4-Terphenyl-d14					42	30	120					

Client: **Bechtel Nevada Corp.** | Work Order: **9911042** | Project: **V712**

Batch ID: P1937 — Method Blank

Sample ID: **MBLK-1937** | Seq No: **59755** | Run ID: **CURLY_991117A**

Method: **SW8015B** | Unit: **mg/Kg** | Matrix: **Soil**

Prepped: **11/9/99** | Analyzed: **11/18/99** | Analyst: **MTB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
T/R Hydrocarbons: C10-C22	ND	10										
Surr: 4-Terphenyl-d14					55	30	120					

Client: **Bechtel Nevada Corp.** | Work Order: **9911042** | Project: **V712**

Batch ID: P1937 — Matrix Spike

Sample ID: **9911042-04CMS** | Seq No: **59759** | Run ID: **CURLY_991117A**

Method: **SW8015B** | Unit: **mg/Kg** | Matrix: **Soil**

Prepped: **11/9/99** | Analyzed: **11/18/99** | Analyst: **MTB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
T/R Hydrocarbons: C10-C22	230	10	33	200	102	30	120					
Surr: 4-Terphenyl-d14					104	30	120					

Client: **Bechtel Nevada Corp.** | Work Order: **9911042** | Project: **V712**

Batch ID: P1937 — Matrix Spike Duplicate

Sample ID: **9911042-04CMSD** | Seq No: **59760** | Run ID: **CURLY_991117A**

Method: **SW8015B** | Unit: **mg/Kg** | Matrix: **Soil**

Prepped: **11/9/99** | Analyzed: **11/18/99** | Analyst: **MTB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
T/R Hydrocarbons: C10-C22	230	10	33	200	82	30	120	230		3	20	
Surr: 4-Terphenyl-d14					109	30	120					

Client: **Bechtel Nevada Corp.** | Work Order: **9911042** | Project: **V712**

Batch ID: P1942 — Laboratory Control Spike

Sample ID: **LCS-1942** | Seq No: **63446** | Run ID: **MOE JR._991118A**

Method: **SW8082** | Unit: **µg/Kg** | Matrix: **Soil**

Prepped: **11/10/99** | Analyzed: **11/18/99** | Analyst: **RDH**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Aroclor 1016	140	30	170		82	50	114					
Aroclor 1260	100	30	170		62	8	127					
Surr: Decachlorobiphenyl					102	43	141					
Surr: Tetrachloro-m-xylene					86	26	119					

Client: **Bechtel Nevada Corp.** | Work Order: **9911042** | Project: **V712**

Batch ID: P1942 — Laboratory Control Spike Duplicate

Sample ID: **LCSD-1942** | Seq No: **63447** | Run ID: **MOE JR._991118A**

Method: **SW8082** | Unit: **µg/Kg** | Matrix: **Soil**

Prepped: **11/10/99** | Analyzed: **11/18/99** | Analyst: **RDH**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual

Qualifiers:

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J - Analyte detected below quantitation limits
E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
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Z - Sample > 10 times blank result

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BATCH QC SUMMARY REPORT

Aroclor 1016	140	30	170		84	50	114	140	2	20
Aroclor 1260	110	30	170		67	8	127	100	7	20
Surr: Decachlorobiphenyl					108	43	141			
Surr: Tetrachloro-m-xylene					88	26	119			

Client: **Bechtel Nevada Corp.** Batch ID: **P1942** Sample ID: **MBLK-1942** Method: **SW8082** Prepped: **11/10/99**
Work Order: **9911042** **Method Blank** Seq No: **63445** Unit: **µg/Kg** Analyzed: **11/18/99**
Project: **V712** Run ID: **MOE JR._991118A** Matrix: **Soil** Analyst: **RDH**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Aroclor 1016	ND	30										
Aroclor 1221	ND	70										
Aroclor 1232	ND	30										
Aroclor 1242	ND	30										
Aroclor 1248	ND	30										
Aroclor 1254	ND	30										
Aroclor 1260	ND	30										
Aroclor 1262	ND	30										
Aroclor 1268	ND	30										
Surr: Decachlorobiphenyl					106	43	141					
Surr: Tetrachloro-m-xylene					101	26	119					

Client: **Bechtel Nevada Corp.** Batch ID: **P1986** Sample ID: **LCS-1986** Method: **SW6010B** Prepped: **11/12/99**
Work Order: **9911042** **Laboratory Control Spike** Seq No: **58764** Unit: **mg/L** Analyzed: **11/16/99**
Project: **V712** Run ID: **ICAP_991116A** Matrix: **Solid** Analyst: **SLM**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Arsenic	4.8	0.1	5.0		96	85	115					
Barium	10	0.02	10		104	85	115					
Cadmium	1.0	0.006	1.0		102	85	115					
Chromium	2.1	0.01	2.0		105	85	115					
Silver	1.0	0.01	1.0		105	85	115					

Client: **Bechtel Nevada Corp.** Batch ID: **P1986** Sample ID: **MBLK-1986** Method: **SW6010B** Prepped: **11/12/99**
Work Order: **9911042** **Method Blank** Seq No: **58762** Unit: **mg/L** Analyzed: **11/16/99**
Project: **V712** Run ID: **ICAP_991116A** Matrix: **Solid** Analyst: **SLM**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Arsenic	ND	0.1										

Qualifiers:
ND - Not detected at the reporting limit
J - Analyte detected below quantitation limits
E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

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BATCH QC SUMMARY REPORT

Barium	ND	0.02
Cadmium	ND	0.006
Chromium	ND	0.01
Silver	ND	0.01

Client: **Bechtel Nevada Corp.** Batch ID: **P1986** Sample ID: **9911045-03AMS** Method: **SW6010B** Prepped: **11/12/99**
Work Order: **9911042** **Matrix Spike** Seq No: **58656** Unit: **mg/L** Analyzed: **11/16/99**
Project: **V712** Run ID: **ICAP_991116A** Matrix: **Solid** Analyst: **SLM**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Arsenic	6.2	0.5	5.0	ND	123	75	125					
Barium	1.3	0.1	10	0.45	8	75	125					S
Chromium	6.2	0.05	5.0	ND	124	75	125					
Selenium	1.5	0.5	1.0	ND	148	75	125					S
Silver	0.19	0.05	1.0	ND	19	75	125					S

Client: **Bechtel Nevada Corp.** Batch ID: **P1986** Sample ID: **9911045-03AMS** Method: **SW6010B** Prepped: **11/12/99**
Work Order: **9911042** **Matrix Spike** Seq No: **59140** Unit: **mg/L** Analyzed: **11/16/99**
Project: **V712** Run ID: **ICAP_991116B** Matrix: **Solid** Analyst: **JCB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Cadmium	1.0	0.03	1.0	ND	104	75	125					

Client: **Bechtel Nevada Corp.** Batch ID: **P1986** Sample ID: **9911045-03AMSD** Method: **SW6010B** Prepped: **11/12/99**
Work Order: **9911042** **Matrix Spike Duplicate** Seq No: **58657** Unit: **mg/L** Analyzed: **11/16/99**
Project: **V712** Run ID: **ICAP_991116A** Matrix: **Solid** Analyst: **SLM**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Arsenic	6.7	0.5	5.0	ND	134	75	125	6.2		8	20	S
Barium	1.5	0.1	10	0.45	10	75	125	1.3		16	20	S
Chromium	6.5	0.05	5.0	ND	130	75	125	6.2		5	20	S
Selenium	1.5	0.5	1.0	ND	155	75	125	1.5		5	20	S
Silver	0.25	0.05	1.0	ND	25	75	125	0.19		28	20	SX

Client: **Bechtel Nevada Corp.** Batch ID: **P1986** Sample ID: **9911045-03AMSD** Method: **SW6010B** Prepped: **11/12/99**
Work Order: **9911042** **Matrix Spike Duplicate** Seq No: **59141** Unit: **mg/L** Analyzed: **11/16/99**
Project: **V712** Run ID: **ICAP_991116B** Matrix: **Solid** Analyst: **JCB**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Cadmium	1.1	0.03	1.0	ND	107	75	125	1.0		3	20	

Qualifiers:
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E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

Date: 08-Dec-99

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BATCH QC SUMMARY REPORT

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: P2146
Laboratory Control Spike

Sample ID: **LCS-2146** Method: **SW8270C** Prepped: **11/22/99**
Seq No: **61924** Unit: **µg/L** Analyzed: **11/24/99**
Run ID: **GALILEO_991124A** Matrix: **Solid** Analyst: **RDH**

Analyte	Result	± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
1,4-Dichlorobenzene	180		50	250		73	10	125					
2,4,5-Trichlorophenol	180		200	250		71	10	125					J
2,4,6-Trichlorophenol	180		50	250		74	10	125					
2,4-Dinitrotoluene	220		50	250		86	10	125					
2-Methylphenol	130		50	250		53	10	125					
3 & 4-Methylphenol	210		50	500		43	10	125					
Hexachlorobenzene	280		50	250		111	10	125					
Hexachlorobutadiene	180		50	250		72	10	125					
Hexachloroethane	190		50	250		77	10	125					
Nitrobenzene	210		50	250		86	10	125					
Pentachlorophenol	190		200	250		75	10	125					J
Pyridine	74		50	250		30	10	125					
Surr: 2,4,6-Tribromophenol						94	10	123					
Surr: 2-Fluorobiphenyl						90	43	116					
Surr: 2-Fluorophenol						40	21	110					
Surr: 4-Terphenyl-d14						99	33	141					
Surr: Nitrobenzene-d5						86	34	114					
Surr: Phenol-d6						24	10	110					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: P2146
Laboratory Control Spike Duplicate

Sample ID: **LCSD-2146** Method: **SW8270C** Prepped: **11/22/99**
Seq No: **61925** Unit: **µg/L** Analyzed: **11/24/99**
Run ID: **GALILEO_991124A** Matrix: **Solid** Analyst: **RDH**

Analyte	Result	± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
1,4-Dichlorobenzene	190		50	250		76	10	125	180		5	20	
2,4,5-Trichlorophenol	180		200	250		74	10	125	ND		4	20	J
2,4,6-Trichlorophenol	170		50	250		68	10	125	180		8	20	
2,4-Dinitrotoluene	260		50	250		105	10	125	220		20	20	
2-Methylphenol	160		50	250		63	10	125	130		18	20	
3 & 4-Methylphenol	260		50	500		52	10	125	210		19	20	
Hexachlorobenzene	260		50	250		103	10	125	280		7	20	
Hexachlorobutadiene	170		50	250		67	10	125	180		8	20	

Qualifiers:
ND - Not detected at the reporting limit
J - Analyte detected below quantitation limits
E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

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BATCH QC SUMMARY REPORT

Hexachloroethane	200	50	250	78	10	125	190	1	20	
Nitrobenzene	210	50	250	83	10	125	210	3	20	
Pentachlorophenol	200	200	250	81	10	125	ND	8	20	J
Pyridine	84	50	250	34	10	125	74	13	20	
Surr: 2,4,6-Tribromophenol				93	10	123				
Surr: 2-Fluorobiphenyl				86	43	116				
Surr: 2-Fluorophenol				45	21	110				
Surr: 4-Terphenyl-d14				91	33	141				
Surr: Nitrobenzene-d5				83	34	114				
Surr: Phenol-d6				29	10	110				

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **P2146**

Method Blank

Sample ID: **MBLK-2146** Method: **SW8270C** Prepped: **11/22/99**
Seq No: **61923** Unit: **µg/L** Analyzed: **11/24/99**
Run ID: **GALILEO_991124A** Matrix: **Solid** Analyst: **RDH**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
1,4-Dichlorobenzene	ND	50										
2,4,5-Trichlorophenol	ND	200										
2,4,6-Trichlorophenol	ND	50										
2,4-Dinitrotoluene	ND	50										
2-Methylphenol	ND	50										
3 & 4-Methylphenol	ND	50										
Hexachlorobenzene	ND	50										
Hexachlorobutadiene	ND	50										
Hexachloroethane	ND	50										
Nitrobenzene	ND	50										
Pentachlorophenol	ND	200										
Pyridine	ND	50										
Surr: 2,4,6-Tribromophenol					99	10	123					
Surr: 2-Fluorobiphenyl					99	43	116					
Surr: 2-Fluorophenol					43	21	110					
Surr: 4-Terphenyl-d14					115	33	141					
Surr: Nitrobenzene-d5					91	34	114					
Surr: Phenol-d6					25	10	110					

Qualifiers:

ND - Not detected at the reporting limit
J - Analyte detected below quantitation limits
E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

Date: 08-Dec-99

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BATCH QC SUMMARY REPORT

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **P2146**
Method Blank

Sample ID: **MBLK2-2146** Method: **SW8270C** Prepped: **11/22/99**
Seq No: **62527** Unit: **µg/L** Analyzed: **11/27/99**
Run ID: **GALILEO_991127B** Matrix: **Solid** Analyst: **RDH**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
1,4-Dichlorobenzene	ND	50										
2,4,5-Trichlorophenol	ND	200										
2,4,6-Trichlorophenol	ND	50										
2,4-Dinitrotoluene	ND	50										
2-Methylphenol	ND	50										
3 & 4-Methylphenol	ND	50										
Hexachlorobenzene	ND	50										
Hexachlorobutadiene	ND	50										
Hexachloroethane	ND	50										
Nitrobenzene	ND	50										
Pentachlorophenol	ND	200										
Pyridine	ND	50										
Surr: 2,4,6-Tribromophenol					96	10	123					
Surr: 2-Fluorobiphenyl					81	43	116					
Surr: 2-Fluorophenol					42	21	110					
Surr: 4-Terphenyl-d14					106	33	141					
Surr: Nitrobenzene-d5					83	34	114					
Surr: Phenol-d6					23	10	110					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **P2146**
Matrix Spike

Sample ID: **9911042-05EMS** Method: **SW8270C** Prepped: **11/22/99**
Seq No: **62519** Unit: **µg/L** Analyzed: **11/27/99**
Run ID: **GALILEO_991127A** Matrix: **Solid** Analyst: **RDH**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
1,4-Dichlorobenzene	170	50	250	ND	69	10	125					
2,4,5-Trichlorophenol	160	200	250	ND	65	10	125					
2,4,6-Trichlorophenol	150	50	250	ND	61	10	125					J
2,4-Dinitrotoluene	200	50	250	ND	81	10	125					
2-Methylphenol	120	50	250	ND	48	10	125					
3 & 4-Methylphenol	220	50	500	ND	44	10	125					
Hexachlorobenzene	240	50	250	ND	97	10	125					
Hexachlorobutadiene	160	50	250	ND	65	10	125					
Hexachloroethane	160	50	250	ND	63	10	125					

Qualifiers:
ND - Not detected at the reporting limit
J - Analyte detected below quantitation limits
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R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

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BATCH QC SUMMARY REPORT

Nitrobenzene	190	50	250	ND	75	10	125		
Pentachlorophenol	200	200	250	ND	80	10	125		
Pyridine	50	50	250	ND	20	10	125		J
Surr: 2,4,6-Tribromophenol					87	10	123		J
Surr: 2-Fluorobiphenyl					78	43	116		
Surr: 2-Fluorophenol					38	21	110		
Surr: 4-Terphenyl-d14					85	33	141		
Surr: Nitrobenzene-d5					74	34	114		
Surr: Phenol-d6					21	10	110		

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **P2146**

Matrix Spike Duplicate

Sample ID: **9911042-05EMSD**
Seq No: **62520**
Run ID: **GALILEO_991127A**

Method: **SW8270C**
Unit: **µg/L**
Matrix: **Solid**

Prepped: **11/22/99**
Analyzed: **11/27/99**
Analyst: **RDH**

Analyte	Result	± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
1,4-Dichlorobenzene	170		50	250	ND	67	10	125	170		2	20	
2,4,5-Trichlorophenol	160		200	250	ND	62	10	125	ND		5	20	J
2,4,6-Trichlorophenol	150		50	250	ND	60	10	125	150		2	20	
2,4-Dinitrotoluene	210		50	250	ND	83	10	125	200		2	20	
2-Methylphenol	130		50	250	ND	52	10	125	120		8	20	
3 & 4-Methylphenol	240		50	500	ND	48	10	125	220		8	20	
Hexachlorobenzene	220		50	250	ND	87	10	125	240		11	20	
Hexachlorobutadiene	150		50	250	ND	61	10	125	160		7	20	
Hexachloroethane	160		50	250	ND	63	10	125	160		1	20	
Nitrobenzene	180		50	250	ND	73	10	125	190		2	20	
Pentachlorophenol	190		200	250	ND	77	10	125	ND		3	20	J
Pyridine	51		50	250	ND	20	10	125	50		2	20	
Surr: 2,4,6-Tribromophenol						85	10	123					
Surr: 2-Fluorobiphenyl						73	43	116					
Surr: 2-Fluorophenol						39	21	110					
Surr: 4-Terphenyl-d14						85	33	141					
Surr: Nitrobenzene-d5						72	34	114					
Surr: Phenol-d6						24	10	110					

Qualifiers:
ND - Not detected at the reporting limit
J - Analyte detected below quantitation limits
E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

Date: 08-Dec-99

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BATCH QC SUMMARY REPORT

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **P2215**
Laboratory Control Spike

Sample ID: **LCS-2215** Method: **SW6010B** Prepped: **11/30/99**
Seq No: **65606** Unit: **mg/Kg** Analyzed: **11/30/99**
Run ID: **ICAP_991130B** Matrix: **Soil** Analyst: **CLH**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Lead	57	10	52		108	53	142					

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **P2215**
Method Blank

Sample ID: **MBLK-2215** Method: **SW6010B** Prepped: **11/30/99**
Seq No: **65605** Unit: **mg/Kg** Analyzed: **11/30/99**
Run ID: **ICAP_991130B** Matrix: **Soil** Analyst: **CLH**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Lead	ND	3										

Client: **Bechtel Nevada Corp.**
Work Order: **9911042**
Project: **V712**

Batch ID: **P2215**
Matrix Spike

Sample ID: **9911042-06AMS** Method: **SW6010B** Prepped: **11/30/99**
Seq No: **65642** Unit: **mg/Kg** Analyzed: **11/30/99**
Run ID: **ICAP_991130C** Matrix: **Soil** Analyst: **CLH**

Analyte	Result ± 2 sigma	Limit	SpikeVal	SpikeRefVal	%REC	LowLimit	HighLimit	DupRefVal	± 2 sigma	RPD/RER	RPDLimit	Qual
Lead	150	20	25	120	113	75	125					

Qualifiers:

ND - Not detected at the reporting limit
J - Analyte detected below quantitation limits
E - Value above quantitation range
R - RPD outside accepted recovery limits
X - Duplicate sample(s) < 5 times limit
S - Spike recovery outside accepted recovery limits
Y - Unspiked sample > 4 times amount spiked
B - Analyte detected in the associated method blank
Z - Sample > 10 times blank result

Appendix D

MARSSIM Discussion

DESIGN OF THE RADIOLOGICAL CHARACTERIZATION SURVEY FOR THE ENGINE-MAINTENANCE ASSEMBLY AND DISASSEMBLY (E-MAD) WASTE HOLDUP TANKS, CORRECTIVE ACTION SITE (CAS) 25-02-01, CORRECTIVE ACTION UNIT (CAU) 135

Introduction

The purpose of this Appendix is to describe the rationale and provide the technical basis for the design of the radiological characterization survey for CAU 135. The radiological characterization survey design was selected to determine the location and extent of the total and removable radiological contamination on the surface of the walls, floor, and ceiling of the E-MAD Waste Holdup Tanks Vault, CAS 25-02-01, CAU 135. Guidance recommended in the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM) (NRC, 1997) was used to determine the minimum number of surface contamination samples required for the radiological surveys of the vault walls, floor, and ceiling. It was recognized that the purpose and scope of MARSSIM are to provide both a scientifically rigorous and flexible approach for planning and implementing a final status survey demonstrating that a remediated site is acceptable for either restricted or unrestricted release to the public. The radiological characterization survey was not designed to be a final status survey. However, some guidance recommended in MARSSIM was used to select the number of survey locations, the number of required samples, and the locations for the samples.

Characterization surveys are performed to determine the location and extent of radiological contamination that may require decontamination, disposal, or other remediation options. As a general rule, a characterization survey requires fewer sampling locations and fewer samples than a final status survey. Characterization surveys typically use more biased sampling locations and fewer random sample locations than a final status survey. In addition, a characterization survey may not require measurement technologies with the accuracy and precision of a final status survey. This is because the purpose of a final status survey is to determine if the average residual radiological contamination exceeds a derived concentration guideline level that may result in an unacceptable dose to a member of the public. The characterization survey data for the CAU 135 site was needed for decision making purposes, including potential corrective action and waste determination. The minimum detectable concentrations, accuracy, and precision in the measurements required to make these decisions are significantly less rigorous than those needed for a final status survey.

IT Corporation, Las Vegas (ITLV) investigated the nature and extent of the contaminants of potential concern (COPCs) in order to:

- Identify the presence and nature of COPCs in the E-MAD Waste Holdup Tanks Vault.
- Define the vertical and lateral extent of the COPCs in the E-MAD Waste Holdup Tanks Vault.
- Provide sufficient information and data to develop and evaluate appropriate corrective actions for E-MAD Waste Holdup Tanks Vault.

Bechtel Nevada removed the waste holdup tanks, sump pump, and the associated piping prior to the start of ITLV investigation activities. After the removal of the tanks and piping, ITLV measured the total and removable gross alpha and gross beta surface contamination on the vault interior including the floor, walls, and ceiling. ITLV collected sediment samples from within the sump. The sediment samples were analyzed using gamma spectrometry, alpha spectrometry for isotopic uranium and isotopic plutonium, and liquid scintillation for strontium-90.

In the CAU 135 Corrective Action Investigation Plan (DOE/NV, 1999) preliminary action levels for total and removable radiological contamination on the surfaces of the vault floor, walls, and ceiling was established as the criteria listed in Table 2-2 of the *NV/YMP Radiological Control (RadCon) Manual* (BN, 1996). In Table 2-2, criteria are listed for removable contamination, total contamination (defined as fixed plus removable contamination), and averaged total contamination for five categories (Attachment 1 of this Appendix).

The remaining sections of this Appendix provide a brief description of CAU 135, present historical radiological survey data, discuss how the MARSSIM was applied in the design of the CAU 135 radiological characterization survey, and describe the radiological survey requirements for each CAU 135 vault substructures.

Description of CAU 135

The E-MAD Waste Holdup Tanks consisted of two 1,500-gallon tanks in an underground vault located at the E-MAD Facility on the western side of Building 3900 in Area 25 of the Nevada Test Site (NTS). These tanks received liquid waste from all of the radioactive drains at the E-MAD Facility. The CAU 135 tanks were in use from about 1966 when the E-MAD Facility became operational to about 1987 when the E-MAD Facility was abandoned (SNPO, 1979; Garey, 1998). Corrective Action Unit 135 has been closed for about 12 years. Therefore, the criteria listed in Table 2-2 of the *NV/YMP RadCon Manual* (BN, 1996) for short-lived and volatile beta emitters such as iodine-125, 131, and 133 are not appropriate and were not applied to the radiological characterization survey design.

Historical Radiological Surveys

Limited radiological surveys of the CAU 135 vault floors and walls were performed in 1997 and 1999 (DOE/NV, 1998; BN, 1999). In 1997, swipe samples were collected and radiological surveys performed at eight locations on the vault walls and at five locations on the vault floor. The survey results were reported in units of gross alpha and gross beta concentrations. In 1999, 13 swipe samples were collected from the vault floor and analyzed for gross alpha and gross beta concentration. However, the radiological survey report only documented the swipe samples with the maximum activity (BN, 1999). The results of the historical radiological surveys are listed in Table 1.

Table 1. Historical Radiological Surveys for the CAU 135 Vault

Vault Walls (DOE/NV, 1998)

Total: Fixed plus Removable (dpm/100 cm²)		Removable (dpm/100 cm²)	
Gross Alpha	Gross Beta	Gross Alpha	Gross Beta
108	3791	2	18
108	3150	0	-5
103	2850	2	6
103	4261	2	12
60	7360	0	33
103	5359	0	4
81	7325	5	37
60	9058	0	5
91	**5394**	**1.38**	**14**
21	**2280**	**1.77**	**15**

Mean
Standard Deviation

Vault Floor (BN, 1999)

Total: Fixed plus Removable (dpm/100 cm²)		Removable (dpm/100 cm²)	
Gross Alpha	Gross Beta	Gross Alpha	Gross Beta
308	29596	8	145
81	44996	2	-1
161	43896	11	145
-1	231196	0	-1
4	29996	0	4
		6.73	64.73
111	**75936**	**4.6**	**59**
129	**87103**	**4.6**	**71**

Mean
Standard Deviation

dpm/100 cm² = disintegrations per minute/100 square centimeters

None of the historical radiological survey data measurements exceeded the minimum Table 2-2 criteria for total alpha contamination, removable alpha contamination, or removable beta contamination. Sixty-nine percent of the historical radiological survey data measurements exceeded the maximum criterion listed in Table 2-2 for total beta contamination. The historical radiological survey data show that the radiological contamination on the vault floor and walls exceeded the preliminary action levels.

Rationale

Based upon the results of the historical radiological surveys, the radiological characterization survey was designed to determine which areas on the floor, walls, and ceiling of the CAU 135 vault exceeded the criteria in Table 2-2. The MARSSIM does not require that survey grids be defined for swipe surveys. Nevertheless, survey grids were defined and documented.

The number of data points required to meet specific statistical criteria for the radiological surveys were calculated using the following information and guidance:

1. Historical radiological survey data of the vault walls and floor.
2. The most limiting applicable criteria listed in Table 2-2 of the *NV/YMP RadCon Manual* (BN, 1996).
3. MARSSIM Section 5.5.2.
4. Decision error percentiles of 90 percent for the vault walls and 95 percent for the vault floor.
5. The surface contamination criterion requiring the maximum number of data points.

For the radiological characterization survey, CAU 135 was considered to consist of three substructures; the vault walls, floor, and ceiling. The vault walls and floor were divided into survey grids. In accordance with the guidance in Section 4.6 of the MARSSIM, the number of survey grids in each substructure was set equal to the number of data points required to meet the data quality objectives.

Application of MARSSIM

The guidance in Section 5 of the MARSSIM was applied to determine the minimum number of swipe samples and sampling grids for the CAU 135 vault walls, floor, and ceiling. Section 5 of the MARSSIM presents two statistical methods for calculating the minimum number of samples and sampling grids. The first method is the two-sample Wilcoxon Rank Sum test that is used when COPCs are present in the referenced background media. The second method is the one-sample Sign test that is used when the COPCs are not present in the referenced background media.

The following rationale was used to determine the minimum number of swipe samples and survey grids needed for the CAU 135 vault. A conservative approach would be to assume that the COPCs are present in a background reference facility which would require more swipes and survey grids than a less conservative approach that assumes that COPCs are not present in a background reference facility. The more conservative approach was used to design the

radiological characterization survey and the Wilcoxon Rank Sum test was used to calculate the minimum number of swipe samples and survey grids for the CAU 135 vault.

The number of swipes and sampling grids is defined in the MARSSIM as the minimum number of data points required to meet the decision error percentile. The decision error percentile is the maximum acceptable rate of false positive (Type I errors) and false negative (Type II) error rates. For the radiological characterization design, it was assumed that the Type I and Type II error rates should not exceed 10 percent for the CAU 135 vault walls. The Type I and Type II error rates should not exceed 5 percent for the CAU 135 vault floor. Lower Type I and Type II error rates were assumed for the CAU 135 vault floor because, in comparison to the CAU 135 vault walls, there is less historical radiological survey data for the floor.

The calculated number of data points required by the two-sample Wilcoxon Rank Sum test is a function of the preliminary action level, the standard deviation of the concentration of the radiological COPCs on the surface being investigated, and the decision error percentile. There were four steps used to determine the number of data points required by the two-sample Wilcoxon Rank Sum test.

Step one was to calculate the relative shift of the radiological COPCs. The relative shift is defined in MARSSIM as one-half of the derived concentration guideline level (DCGL) divided by the standard deviation of the concentration of the radiological COPCs. The DCGLs are generally used to design a final status survey, not a characterization survey. However, the application of the Wilcoxon Rank Sum test is independent of the recommended use in MARSSIM. This statistical test has been a tool used for hypothesis testing and designing sampling protocols prior to the publication of MARSSIM (Walpole and Myers, 1972; and Gilbert, 1987). The Wilcoxon Rank Sum test has been used to test whether the measurements from one population tend to be consistently larger or smaller than those from another population. This test has two main advantages in comparison to other independent-sample tests such as the student-*t* test. The two datasets need not be drawn from normal populations and the Wilcoxon Rank Sum test can handle a moderate number of nondetect measurements. For the CAU 135 vault, instead of applying the Wilcoxon Rank Sum test to a DCGL, the test criteria were defined by the radionuclide concentrations listed in Table 2-2 of the *NV/YMP RadCon Manual* (BN, 1996). The standard deviation of the concentration of the radiological contamination was calculated using the historical gross alpha and gross beta survey data. Details on the application of the Wilcoxon Rank Sum test are found in Attachment 1 of this Appendix.

Step two was to determine the P_r. The P_r is the probability that a random measurement of the radiological contamination on a surface in CAU 135 would exceed a random measurement from a background reference area by less than the criterion in Table 2-2, when the true radiological contamination concentration on the CAU 135 surface being sampled is equal to one-half the criterion in Table 2-2 above background. The value of P_r assumed for this analysis is found in Table 5.1 of the MARSSIM and is a function of the relative shift. Details on how the P_r was determined are found in Attachment 1 of this analysis.

Step three was to determine the decision error percentile. For the radiological characterization survey design, the decision error percentile for the walls was chosen to ensure that the rate for both Type I and Type II errors would be less than 10 percent. For the floors the decision error percentile was chosen to ensure that the rate for both Type I and Type II errors would be less than 5 percent. The lower error rate was chosen for the floor because there was less historical radiological contamination data for the floor.

Step four was to calculate the number of data points required to meet the decision error percentile using equation 5-1 in MARSSIM. Details on the methodology and supporting calculations used in the four steps are in Attachment 1of this Appendix. The following sections of this Appendix describe the radiological survey requirements for each CAU 135 vault substructure.

Vault Walls

Radiological scanning was performed with NE Technology Electra scintillation detectors over 100 percent of the CAU 135 vault walls. A 100 percent scan was in accordance with the guidance in MARSSIM for a Class 1 structure. A Class 1 structure is a structure, or a portion of a structure, where it is likely that the structure has been impacted by operations such that the radiological criteria are expected to be exceeded. A minimum of 28 data points was required to ensure the Type I and Type II error rates were not exceeded. The vault walls were divided into 28 grids. Each grid was monitored for total gross alpha and total gross beta contamination. A swipe sample was taken from each grid, at a location with the maximum total gross alpha or maximum total gross beta contamination. Each swipe sample was analyzed in the field using a proportional or scintillation swipe counter.

Typically, the radiological contamination on the vault walls did not extend much above the elevation where the pipes enter the tanks.

Vault Floor

The total gross beta concentration on the CAU 135 vault floor greatly exceeded the criteria in Table 2-2. Therefore, radiological scanning was performed with NE Technology Electra scintillation detectors over 100 percent of the CAU 135 vault floor. A minimum of 25 data points was required to ensure the Type I and Type II error rates were not exceeded. Therefore, the vault floor was divided into 25 grids. Each grid was scanned for total gross alpha and total gross beta contamination. A swipe sample was taken from each grid, at the location with the maximum total gross alpha or maximum total gross beta contamination. Each swipe sample was analyzed in the field using a proportional or scintillation swipe counter.

Vault Ceiling

The radiological surveys performed on the upper elevation grids of the vault walls demonstrated that concentrations did not exceed Table 2-2 criteria. Therefore, only large area swipes using Masslin® mops were taken. The swipes were monitored using the NE Technology Electra and the readings documented.

Radiological Survey Measurements

Measurement methods used to generate field data during the radiological characterization survey of the CAU 135 vault surfaces included scanning surveys, direct measurements, and swipes. In general, direct measurements are analogous to collecting and analyzing samples to determine the average activity in a survey unit. Scanning surveys are generally performed to identify areas of elevated activity that may not be detected by other measurement methods. The scanning and direct measurement surveys for CAU 135 were performed with NE Technology Electra survey instruments. The detector is a 100-square centimeter (cm^2) zinc sulfide/silver phosphor on an NE102 plastic scintillator. They are capable of simultaneously monitoring alpha and beta contamination simultaneously. Their beta efficiency ranges from 38 percent to 41 percent, their 4-π alpha efficiency is 16 percent, and their gamma response is five counts per second in a cesium-137 radiation field of 10 microroentgens per hour (NE Technology Limited, 1995).

Swipes are generally taken and analyzed to determine the concentration of easily removable radioactive contamination. Each of these measurement methods is discussed in additional detail in the following paragraphs.

Scanning Surveys

The scanning surveys were performed first by moving the Electra at a rate not to exceed three centimeters per second, approximately one inch per second, at a distance of less than one-half an inch from the surface being surveyed. The scanning surveys were used to identify hot spots. This technique has demonstrated that the Electra is capable of detecting elevated beta-gamma surface contamination at 300 disintegrations (dpm)/100 cm^2 to 500 dpm/100 cm^2 and alpha surface contamination of 300 dpm/100 cm^2. This sensitivity is sufficient to ensure a high probability of detecting total surface concentrations exceeding the criteria in Table 2-2 of the *NV/YMP RadCon Manual* (BN, 1996).

Direct Measurements

After the scanning surveys were complete, direct measurements of gross alpha and gross beta surface contamination (i.e., hot spots) were obtained by placing the NE Technology Electra less than one-half inch from the concrete surface for one minute and recording the count rate. A one minute integrated count is a practical field survey procedure for the Electra and provides detection sensitivities that are below the total surface contamination criteria listed in Table 2-2 of the *NV/YMP RadCon Manual* (BN, 1996). This direct measurement method is recommended in Sections 6.4.1 and 6.4.2 of MARSSIM for measuring the total gross alpha and gross beta surface concentration.

Thin aluminum plates were used to shield the detector probe in order to determine the effect on the Electra count rate from the general radiation field. The shielded count rate is then subtracted from the nonshielded count rate in order to determine the net count rate from any radiological contamination on the vault surface being monitored.

Swipe Samples

After the direct measurement of hot spot areas, swipe samples were taken by applying moderate pressure to the surface with a dry filter and wiping it over an area of approximately 100 cm^2. The

swipes are analyzed on site using a Ludlum 2929. All swipes with gross alpha and gross beta concentrations exceeding the criteria in Table 2-2 of the *NV/YMP RadCon Manual* receive additional spectrometry analysis.

Consolidation of Swipe Samples

Swipe samples with gross beta contamination that exceeded the minimum criterion in Table 2-2 for long-lived beta emitters were submitted for gamma spectrometry and strontium-90 analysis. Swipe samples with gross alpha contamination that exceeded the minimum criterion in Table 2-2 for alpha emitters were submitted for isotopic plutonium and isotopic uranium analysis.

An analysis was performed to determine whether or not swipes with low levels of radiological contamination would exceed the minimum detectable concentrations (MDCs) of the potential radiological contaminants. A comparison between the laboratory estimated MDCs for the most likely radionuclide contaminants on a swipe sample and the criterion for that radionuclide are listed in Table 2.

The potential radionuclide contaminants present on the surfaces of the CAU 135 vault have laboratory MDCs well below the criteria established in Table 2-2 of the *NV/YMP RadCon Manual* (BN, 1996). Therefore, there was no need to composite swipe samples. If the radioanalysis of a swipe resulted in a radionuclide concentration less than its MDC, then the concentration of the radionuclide on the vault surface was considered to be significantly less than the radionuclide's criterion in Table 2-2.

Table 2. Comparison of Minimum Detectable Concentrations (MDCs) of COPCs on Swipe Samples with RadCon Manual Table 2-2 Criteria

Radionuclide	Laboratory MDC (pCi/filter)	Laboratory MDC (dpm/100 cm^2)	Table 2-2 Removable Criterion (dpm/100 cm^2)
Cobalt-60	1 - 5	2 - 11	1,000
Strontium/Yttrium-90	0.1 - 0.2	0.2 - 0.4	200
Niobium-94	3 - 15	7 - 33	1,000
Cesium-137/Barium-137m	2 - 10	4 - 22	1,000
Europium-154	10 - 50	22 - 110	1,000
Uranium-234	0.1 - 0.2	0.2 - 0.4	1,000
Uranium-235	0.1 - 0.2	0.2 - 0.4	1,000
Plutonium-239/240	0.1 - 0.2	0.2 - 0.4	20

pCi/filter = picocuries/filter
dpm/100 cm^2 = disintegrations per minute/100 square centimeters

References

BN, see Bechtel Nevada.

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

Garey, K. 1998. Record of Telecon with J. Markowsky (SAIC) regarding the E-MAD waste holdup tanks, 18 December. Las Vegas, NV.

Gilbert, R.O. 1987. *Statistical Methods for Environmental Pollution Monitoring.* New York, NY: Van Nostrand Reinhold.

Bechtel Nevada. 1996. *NV/YMP Radiological Control Manual.* Compiled by A.L. Gile. Las Vegas, NV.

Bechtel Nevada. 1999. *Bechtel Nevada Radiation Survey Report of CAU 135, Number A 14644,* 22 March. Compiled by L. McCloskey. Las Vegas, NV.

NE Technology Limited. 1995. "Instruction Manual for Non-Intelligent & Intelligent Scintillation Probes & Associated Kits." Berkshire, England.

SNPO, see Space Nuclear Propulsion Office.

Space Nuclear Propulsion Office. 1970. *NRDS Master Plan 1969-1970, Nuclear Rocket Development Station, Jackass Flats, Nevada.* Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1998. Decontamination and Decommissioning Subproject Characterization Report for the E-MAD Decontamination Project, DOE/NV-485. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1999. *Corrective Action Investigation Plan for Corrective Action Unit 135.* Las Vegas, NV.

Walpole, R.E., and R.H. Myers. 1972. *Probability and Statistics for Engineers and Scientists.* New York, NY: The Macmillan Company.

ATTACHMENT 1
DETERMINING THE NUMBER OF SURVEY LOCATIONS FOR RADIOLOGICAL CHARACTERIZATION OF CAU 135 VAULT WALLS AND FLOOR

The number of survey locations required to implement the Wilcoxon Rank Sum Test is a function of the variability in the concentration of the radiological contaminants, the criterion for acceptable radiological contamination, and the statistical confidence assumed for not making Type I or Type II decision errors.

The variability is defined as the standard deviation in the gross alpha and beta concentrations. The criteria are the concentrations listed in Table 2-2 of the NV/YMP RadCon Manual.

Total Alpha =	5,000 dpm/100 cm^2	= Derived concentration guideline level
Removable Alpha =	1,000 dpm/100 cm^2	= Derived concentration guideline level
Total Beta =	5,000 dpm/100 cm^2	= Derived concentration guideline level
Removable Beta =	1,000 dpm/100 cm^2	= Derived concentration guideline level

Statistical confidence in not making a Type I & II error =	0.1 for vault walls
Statistical confidence in not making a Type I & II error =	0.05 for the floor of the vault

The radiological survey measurements are gross alpha and gross beta, it is not possible to distinguish whether elevated measurements are due to natural radionuclides or contamination. The criteria are defined for radionuclides that are not found in significant concentrations in undisturbed background locations. The radiological survey data has already had the instrument background count rate subtracted. The count rate due to natural radionuclides has not been subtracted. Under these circumstances the number of data points required is calculated by assuming that the contamination is present in the background.

Vault Walls

Total Gross Beta Surface Contamination

Sr/Y-90 is assumed to be the limiting beta/gamma emitting radiological COPC. About 25 - 50% of all beta/gamma activity is assumed to be due to Sr/Y-90 (Tinney and Wheeler, 1999). However, since the Sr/Y-90 is part of the mixed fission products the criteria for total beta surface is defined for beta + gamma emitters. The criteria for total surface contamination is 5,000 dpm/100 cm^2.

Step 1: Calculate the relative shift:

Relative shift is defined as the (0.5 x criteria)/standard deviation where

Criteria Table 2-2 NV/YMP RadCon Manual =	5,000 dpm/100 cm^2 for MFP + MAP
0.5 x Table 2-2 NV/YMP RadCon Manual =	2,500 dpm/100 cm^2 for MFP + MAP

Where MFP = mixed fission products and MAP = mixed activation products

Standard Deviation = 2,280 dpm/100 cm^2

Relative shift = 1.096491

Step 2: Determine the value for P_r using Table 5.1 in MARSSIM for a relative shift of 1.096491:

The value for P_r is 0.781627 using the next larger value for the relative shift, as recommended in MARSSIM.

$P_r = 0.781627$

Total Gross Beta Surface Contamination

Step 3: Determine Decision Error Percentiles:

Type I error rate = Type II error rate = 0.1, Percentiles for these error rates are:

The Z_{1-a} and Z_{1-b} = 1.282 from Table 5.2, MARSSIM

This value should ensure that there is a 90 percent confidence that the number of data points will result in a decision with no Type I or Type II error.

Step 4: Calculate the number of data points required:

$N = (Z_{1-a} + Z_{1-b})^2 / 3(P_r - 0.5)^2$ where

N = the required number of data points = 27.62907

Based upon the Total Gross Beta Contamination the required data points = 28

The same calculational methods are performed to determine the number of data points for total gross alpha, removable gross beta, and removable gross alpha.

Total Gross Alpha Surface Contamination

Relative Shift

Criteria: Table 2-2 NV/YMP RadCon Manual =	500	dpm/100 cm^2 for transuranics
0.5 x Table 2-2 NV/YMP RadCon Manual =	250	dpm/100 cm^2 for transuranics
Criteria: Table 2-2 NV/YMP RadCon Manual =	5,000	dpm/100 cm^2 for uranium
0.5 x Table 2-2 NV/YMP RadCon Manual =	2,500	dpm/100 cm^2 for uranium
Standard Deviation =	21	

The probability that all of the total alpha contamination is due to transuranics is very low. Process knowledge shows TRU concentrations are 0.5 percent of the uranium concentrations in fuel and contamination samples (Tinney and Wheeler, 1999)

Relative Shift =	119.0476	for uranium
Relative Shift =	11.90476	for plutonium
P_r =	1	If the relative shift >4, P_r = 1 MARSSIM, Table 5.1
The Z_{1-a} and Z_{1-b} =	1.282	from Table 5.2, MARSSIM

N = 8.765461

The number of data points using gross alpha surface contamination is 9

Removable Gross Beta Surface Contamination

Relative Shift

Criteria: Table 2-2 NV/YMP RadCon Manual =	1,000	dpm/100 cm^2 for MFP + MAP
0.5 x Table 2-2 NV/YMP RadCon Manual =	500	dpm/100 cm2 for MFP + MAP
Standard Deviation =	15	
Relative Shift =	33.33333	for MFP and MAP
P_r =	1	If the relative shift >4, P_r = 1 MARSSIM, Table 5.1
The Z_{1-a} and Z_{1-b} =	1.282	from Table 5.2, MARSSIM

N = 8.765461

Data points needed based on removable gross beta surface contamination is 9

Removable Gross Alpha Surface Contamination

Relative Shift for uranium

Criteria: Table 2-2 NV/YMP RadCon Manual = 1,000 dpm/100 cm^2 for uranium

0.5 x Table 2-2 NV/YMP RadCon Manual = 500 dpm/100 cm^2 for uranium

Standard Deviation = 1.77

Relative Shift = 282.4859 for uranium

P_r = 1 If the relative shift >4, P_r = 1 MARSSIM, Table 5.1

The Z_{1-a} and Z_{1-b} = 1.282 from Table 5.2, MARSSIM

N = 8.765461

Data points needed based on removable gross alpha surface contamination is 9

Relative Shift for Plutonium and other Transuranics

Criteria: Table 2-2 NV/YMP RadCon Manual = 20 dpm/100 cm^2 for transuranics

0.5 x Table 2-2 NV/YMP RadCon Manual = 10 dpm/100 cm^2 for transuranics

Standard Deviation = 1.77

Relative Shift = 5.649718 for uranium

P_r = 1 If the relative shift >4, P_r = 1 MARSSIM, Table 5.1

The Z_{1-a} and Z_{1-b} = 1.282 from Table 5.2, MARSSIM

N = 8.765461

Data points needed based on removable gross alpha surface contamination is 9

Vault Floor

There are only five data points for the total radiological contamination on the floor and only six data points for the removable radiological contamination on the floor. The historical data are not sufficient for determining the number of data points. In addition, it is obvious that the total gross beta surface contamination exceeds the largest Table 2-2 criterion for any beta emitter. The floor obviously has fixed gross beta contamination. Sufficient data points should be taken to ensure the extent of the removable beta, removable alpha, and total alpha contamination is less than the minimum Table 2-2 criterion. The number of data points will be determined as follows:

Removable Gross Alpha Surface Contamination

Relative Shift for uranium

Criteria: Table 2-2 NV/YMP RadCon Manual = 1000 dpm/100 cm^2 for uranium

0.5 x Table 2-2 NV/YMP RadCon Manual = 500 dpm/100 cm^2 for uranium

Standard Deviation = 4.6

Relative Shift = 108.6957 for uranium

P_r = 1 If the relative shift >4, P_r = 1 MARSSIM, Table 5.1

The Z_{1-a} and Z_{1-b} = 1.645 from Table 5.2, MARSSIM

95 percent confidence level is used because of the lack of historical data.

N = 14.43213

N is increased by 20% to account for measurements near or below the minimum detectable concentration in accordance with the guidance in MARSSIM.

Data points needed based on removable gross alpha contamination is 18

Removable Gross Alpha Surface Contamination

Relative Shift for Plutonium and other Transuranics

Criteria: Table 2-2 NV/YMP RadCon Manual = 20 dpm/100 cm^2 for transuranics

0.5 x Table 2-2 NV/YMP RadCon Manual = 10 dpm/100 cm^2 for transuranics

Standard Deviation = 4.6

Relative Shift = 2.173913 for uranium

P_r = 0.944167 If the relative shift >4, P_r = 1 MARSSIM, Table 5.1

The Z_{1-a} and Z_{1-b} = 1.645 from Table 5.2, MARSSIM

N = 14.43213

N is increased by 20% to account for measurements near or below the minimum detectable concentration in accordance with the guidance in MARSSIM.

Data points needed based on removable gross alpha contamination is 18

Removable Gross Beta Surface Contamination

Relative Shift for mixed fission products (MFP) and mixed activation products (MAP)

Criteria: Table 2-2 NV/YMP RadCon Manual = 1,000 dpm/100 cm^2 for MFP + MAP

0.5 x Table 2-2 NV/YMP RadCon Manual = 500 dpm/100 cm^2 for MFP + MAP

Standard Deviation = 71

Relative Shift = 7.042254 for MFP and MAP

P_r = 1 If the relative shift >4, P_r = 1 MARSSIM, Table 5.1

The Z_{1-a} and Z_{1-b} = 1.645 from Table 5.2, MARSSIM

N = 14.43213

N is increased by 20% to account for measurements near or below the minimum detectable concentration in accordance with the guidance in MARSSIM.

Data points needed based on removable gross alpha contamination is 18

Total Gross Alpha Surface Contamination

Relative Shift

Criteria: Table 2-2 NV/YMP RadCon Manual = 500 dpm/100 cm^2 for transuranics

0.5 x Table 2-2 NV/YMP RadCon Manual = 250 dpm/100 cm^2 for transuranics

Criteria: Table 2-2 NV/YMP RadCon Manual = 5,000 dpm/100 cm^2 for uranium

0.5 x Table 2-2 NV/YMP RadCon Manual = 2,500 dpm/100 cm^2 for uranium

Standard Deviation = 129

About 99.5% of the alpha contamination is due to uranium (Tinney and Wheeler,1999).

Relative Shift = 19.37984 for uranium

Relative Shift = 1.937984 for plutonium

P_r = 1 If the relative shift >4, P_r = 1 MARSSIM, Table 5.1

P_r = 0.921319 for plutonium

The Z_{1-a} and Z_{1-b} = 1.645 from Table 5.2, MARSSIM

N = 14.43213 for uranium

N = 20.32584 for plutonium

N is increased by 20% to account for measurements near or below the minimum detectable concentration in accordance with the guidance in MARSSIM.

Data points needed based on total gross alpha contamination is 25

Appendix E

Response to NDEP Comments

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

1. Document Title/Number: Draft Corrective Action Decision Document for Corrective Action Unit 135: Area 25 Underground Storage Tanks, Nevada Test Site, Nevada	2. Document Date: October 1999
3. Revision Number: 0	4. Originator/Organization: IT Corporation
5. Responsible DOE/NV ERP Project Mgr.: Janet Appenzeller-Wing	6. Date Comments Due:
7. Review Criteria: Full	
8. Reviewer/Organization/Phone No.: David P. Friedman, NDEP, 486-2856	9. Reviewer's Signature:

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
1)	M	CAS 25-02-10 was originally identified as an underground storage tank (UST) at the Test Cell A facility. Further investigation indicated that what was believed to be the surface expression of an UST, was actually the concrete ringwall foundation and asphalt pavement subgrade of a former 100,000 gallon above-ground storage tank (AST). Part of the confusion is likely to have developed due to the presence of some underground piping which terminates at the surface in this location. The AST which formerly occupied this location and the underground piping that was connected to it were components of the reactor cart cooling system. The 100,000-gallon AST was moved to the Test Cell C facility and has been identified as CAS 25-01-05 in CAU 168. As NDEP commented in the Corrective Action Investigation Plan (CAIP) (Appendix E, Comment 10), the only items recognized as comprising CAS 25-02-10 are the ground surface area of the concrete ringwall, the asphalt pavement subbase, and the exposed piping of the reactor cart coolant system. The remaining run of piping below the ground surface to the reactor cart cooling bay will be part of the Test Cell A facility, now identified as CAU 115. Therefore, NDEP believes it would have been more appropriate for DOE/NV to move CAS 25-02-10 into CAU 115. Since DOE/NV has not done this, the CADD (and following Closure Report) needs to more clearly identify the two CASs 25-02-03 and 25-02-10. In the Executive Summary, this can be accomplished by identifying the location of CAS 25-02-03, which is an underground electrical vault in the Test Cell A facility, and more appropriately identifying CAS 25-02-10 as other than the "former AST at the Test Cell A facility", leading one to believe that CAS 25-02-10 is an AST, which it is not at all. In Section 1.0 Introduction, again clarification needs to be made that CAS 25-02-10 is not an AST. In Section 2.0 Corrective Action Investigation Summary, discussion of the radiological surveys conducted at CAS 25-02-03 and CAS 25-02-10 and the survey findings need to be added which justifies the conclusion that no further action be required at these two sites.	The text has been modified to clarify the location of the CAS 25-02-03 and CAS 25-02-10, to clarify that CAS 25-02-10 is the former location of an aboveground tank used to store demineralized water for the Test Cell A Facility, and to support the decision that no further action is required for 25-02-03 and 25-02-10 developed during the DQO Process and stated in the CAIP.	Yes
2) Section 1.3 1st Sentence	E	"...*This CADD has divided into the following sections...*" Correct the typographical error. Sentence should read, "...The CADD has been divided into the following sections..."	The text has been corrected to read, "This CADD has been divided into the following sections:"	Yes

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
3) Section 2.1	M	The third bullet states the waste hold-up tank interior was visually inspected. With reference to Comment #5 of this letter, NDEP is very interested in the characterization of these wastes. NDEP needs to know how the tank interiors were visually inspected (i.e., was an end of the tank cut-off?; a small view hole cut into the tank wall?; have the tanks been crushed for disposal?; etc.).	The text was changed to indicate that the tank interiors were visually inspected by Bechtel Nevada after removal of existing access covers.	Yes
4)	M	As stated previously by NDEP in comment to the CAIP report (refs.: CAU 135 CAIP Report, Appendix E, Comment #4, May 1999; and CAU 135 CAIP Acceptance Letter with Comments, Comment #1, May 20, 1999), NDEP recognizes the primary sources of contamination at CAS 25-02-01 to be the appurtenances of the radiological decontamination and wastewater drainage system. This includes the piping leading into and out of the vault, the waste holdup tanks, the sump pump and piping, and any fluid contained therein. Therefore, NDEP made clear the requirement that any fluid in sufficient quantity removed from these appurtenances should be sampled and analyzed, preferably for total constituents, but at least for waste characterization purposes. The intent of this requirement is to establish the nature and degree of the contamination being left in place by not removing and properly disposing of the underground piping that runs between the E-MAD building and the waste holdup tank vault. Since direct sampling of this piping was impractical, NDEP viewed analysis of this fluid as a simple and cost-effective means with which to gain an indirect measure of this potential contamination source. Section 2.1, fourth bullet indicates that approximately six gallons of water were drained from the inlet piping to the vault. No discussion of the analysis and characterization of this water is made. Failure to resolve this item in the CADD, as required by the CAIP Acceptance Letter with Comments, is potentially viewed by NDEP as constituting a substantial deficiency.	The liquid removed from the inlet piping during the Phase I effort by Bechtel Nevada, was sampled and analyzed. The analytical results for the liquid collected from the inlet piping are included in Appendix C. Text was added to Section 2.2 Results to refer the reader to Appendix C. "The Phase I analytical results are included in Appendix C. The waste determination and final disposal of the material removed during Phase I activities is pending and will be documented in the CAP."	Yes
5)	M	As stated previously by NDEP in comment to the CAIP report (ref.: CAU 135 CAIP Acceptance Letter with Comments, Comments #2 and #3, May 20, 1999), discussion of the characterization and appropriate disposal of the wastes generated during the CAIP, especially the analytical results, needs to be included in this CADD document. As stated above in this letter, NDEP is interested in the characterization and degree of contamination in these wastes, particularly the components of the radiological wastewater drainage system, for what they can reveal about the remaining portions of the drainage system which will remain in place. Removal and handling of these waste streams is mentioned in Section 2.1, but detail about specific characterization results and final disposition is not given. This information was required by comment in the CAIP Acceptance Letter, and lack of this information can be potentially viewed by NDEP as a substantial deficiency in the CADD.	See comment response for Comment 4.	Yes

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
6) Section 2.1, 10th Bullet	M	The tenth bullet states the three isolation valves located in the piping system downstream of the train decontamination station and the two stacks and scrubbers were not welded closed, as specified in the approved CAIP. This document states this action was not necessary, as connection to the waste holdup tanks and the leachfield was "severed", ostensibly through the removal of the tanks and placement of grout plugs in the open pipe ends. NDEP has two concerns with this issue. First, if these valves are currently open or are not disabled from being opened in the future, there remains a considerable volume of contaminated piping in which water can collect and reside (Note: six gallons of water removed during the CAIP). Second, grout plugs can, and probably will, fail over time, thereby allowing any potentially contaminated fluid from within the pipe to flow out. Therefore, DOE/NV should reconsider its efforts to minimize the potential accumulation of liquid wastes in the abandoned drainage system.	The text in this bullet has been changed to read, • In early December 1999, engineering measures were emplaced to minimize and/or prevent the potential for the accumulation of liquid in the drains and/or remaining piping. These engineering measures are as follows: - Welded the isolation valves from the stacks and the train decontamination pad closed. - Inspected and grouted E-MAD floor drains as necessary. Some floor drains in the interior area of the E-MAD building (i.e., hot cells) were not grouted and these drains are not expected to accumulate any liquid.	Yes
7) Section 3.3 (e)	M	*"...There is no driving force present for the downward migration of the COCs..."* This statement is inaccurate. Contaminants migrate through the subsurface based on a number of physical and chemical properties. In most cases, the strongest downward force resulting in contaminant migration is gravity. Other forces might include dispersion, polar attraction, etc. NDEP assumes the intended thought here is that due to the low annual average precipitation at the site, the presence of a transport mechanism for contaminant migration (i.e., the infiltration of precipitation) is largely absent. DOE/NV's intent in this statement requires clarification.	The text has been changed to more accurately reflect the intent of this statement. The text has been changed to read, "Due to the low annual average precipitation at the site, the presence of a transport mechanism for contaminant migration (i.e., the infiltration of precipitation) is largely absent."	Yes
8) Section 3.3(h)	M	"*...Preferred routes of COC migration are nonexistent since the sources for contamination have been eliminated and no driving force is available..."* As has already been established in the above comments, the sources for contamination at this site have not been completely "eliminated". Some of the potential sources have been removed (the tanks, sump pump, etc.) and an engineering control over the other potential sources has been attempted through placement of a grout plug. Because a grout plug has a limited functional lifetime (freeze-thaw, weathering), it is not appropriate to say potential contamination sources into the vault have been eliminated. In addition, the use of the term "driving force" is not appropriate here.	See the comment response for Comment 6. The bullet has been changed to read, "Preferred routes of COC migration have been minimized by the removal of the primary point sources of COC contaminants (i.e., waste holdup tanks, sump, associated piping). In order to minimize and/or prevent the potential for the accumulation of liquid in the remaining drains and/or piping, engineering measures have been emplaced. These engineering measures include welding closed isolation valves from the stacks and the train decontamination pad and the inspection and grouting of E-MAD floor drains as necessary. Some floor drains in the interior area of the E-MAD building (i.e., hot cells) were not grouted and these drains are not expected to accumulate any liquid. Additionally, the vault is constructed of concrete and migration of COCs from the vault interior is expected to be negligible if at all."	Yes

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10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
9) Table 3-1 Column "Alternative 2", Row "Long-Term Reliability" & Section 4.0, 1st Bullet	M	*"...All risks will be eliminated..."* and *"...Eliminates human health risks by removal of surface contamination in excess of free release criteria and disposal at an appropriate facility..."* The use of the term "eliminates" implies a degree of certainty and "absoluteness" which is unachievable. With respect to the usage in Section 4.0, it does not take into consideration the potential exposure to the workers who will be removing the contamination. In all cases, it does not take in consideration the fact that concrete is a porous medium and there is a chance that some contamination, particularly along fractures or other pathways, may have penetrated the entire thickness of the slab.	Table 3-1 text in the 1st bullet has been changed to read, "Risk of exposure to COCs will be significantly reduced upon completion of the corrective action." Section 4.0 text has been changed in the 1st and 3rd bullets to read, "Risk to human health is minimal because of the removal of surface contamination in excess of unrestricted release criteria and disposal at an appropriate facility. Appropriate ALARA principles will be utilized to minimize worker risk during removal activities." "Long-term risks are significantly reduced by removing and disposing contaminated sediment and concrete at an appropriate disposal facility."	Yes
10) Section 4.0 2nd Paragraph	M	"...The alternative meets all applicable state and federal regulations for closure of the site and will eliminate potential future exposure pathways at CAS 25-02-01, E-MAD Waste Holdup Tanks and Vaults..." NDEP has established its position in the preceding comments above regarding the use of the term "eliminates" and the remaining presence of the potential sources of contamination represented by the inlet and outlet piping. DOE/NV should edit the sentence accordingly.	See comment response to Comment 9. Text has been changed to read, "The alternative for CAS 25-02-01, E-MAD Waste Holdup Tanks and Vaults meets all applicable state and federal regulations for closure of the site and reduces the potential for future exposure pathways."	Yes
11)	M	An appendix should be added discussing how the MARSSIM process was used at the site. Because the MARSSIM process does not apply well to sampling small quantities of soil or sediment, NDEP does not anticipate the process was used to collect the sump samples. NDEP needs to know the underlying assumptions used to apply the process to the concrete vault floor, walls, and lid. Some of the specific issues NDEP needs answered are as follows: (1) what class survey unit was assigned each surface. (2) what are the derived concentration guidance levels $_{\text{wilcox rank sum}}$ ($DCGL_W$) that were used. (3) state the project action levels (PAL) and give the values of these action levels taken from Table 2.2 of the NV/YMP Radiological Control Manual (RADCON). (4) discuss the statistical analysis used to determine the number of samples collected. Include in the discussion of the statistical analysis the values of Type I (") and Type II ($) errors assumed to be acceptable and the underlying assumptions used to estimate a value for the relative shift (/F), such as instrumentation error and surface variability. It should be clear in this discussion that all relevant aspects of the MARSSIM process for conducting a statistically verifiable survey were properly considered.	A discussion of MARSSIM is included in Appendix D.	Yes
12) Appendix A, Table A.3-2, 4th Row	E	*"Total Polychlorinated Biphynels"*. Correct typographical error in spelling, correct spelling is "Biphenyls".	Text has been changed to read,*"Total Polychlorinated Biphenyls."*	Yes

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