Nevada
Environmental
Restoration
Project

DOE/NV--587

Corrective Action Decision Document
for Corrective Action Unit 428
Area 3 Septic Waste Systems 1
and 5, Tonopah Test Range, Nevada

Controlled Copy No.: ____

Revision No.: 0

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**CORRECTIVE ACTION DECISION DOCUMENT
FOR CORRECTIVE ACTION UNIT 428:
AREA 3 SEPTIC WASTE SYSTEMS 1 AND 5,
TONOPAH TEST RANGE, NEVADA**

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Las Vegas, Nevada

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**CORRECTIVE ACTION DECISION DOCUMENT
FOR CORRECTIVE ACTION UNIT 428:
AREA 3 SEPTIC WASTE SYSTEMS 1 AND 5,
TONOPAH TEST RANGE, NEVADA**

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List of Acronyms and Abbreviations

bgs	Below ground surface
CADD	Corrective Action Decision Document
CAI	Corrective Action Investigation
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CFR	<i>Code of Federal Regulations</i>
CLP	Contract Laboratory Program
CME	Central Mining Equipment
COC	Contaminant(s) of concern
COPC	Contaminant(s) of potential concern
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DQO	Data Quality Objective(s)
EPA	U.S. Environmental Protection Agency
FFACO	<i>Federal Facility Agreement and Consent Order</i>
ft	Foot (feet)
IDW	Investigation-derived waste
ICP	Inductively coupled plasma
in.	Inch(es)
IT	IT Corporation
km	Kilometer(s)
LCS	Laboratory control sample(s)
LLW	Low-level radioactive waste
MEK	Methylethyl ketone (2-butanone)
m	Meter(s)
mi	Mile(s)
mg/kg	Milligram(s) per kilogram

List of Acronyms and Abbreviations (Continued)

MS/MSD	Matrix spike/matrix spike duplicate
NAC	<i>Nevada Administrative Code</i>
NDEP	Nevada Division of Environmental Protection
NIST	National Institute for Standards and Technology
NRS	<i>Nevada Revised Statutes</i>
NTS	Nevada Test Site
PAI	Paragon Analytics, Incorporated
PAL	Preliminary action level(s)
PCB	Polychlorinated biphenyl(s)
pCi/g	Picocurie(s) per gram
ppm	Part(s) per million
PPE	Personal Protective Equipment
POC	Performance Objective Certification of Nonradioactive Hazardous Waste
PRG	Preliminary Remediation Goals
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RCRA	<i>Resource Conservation and Recovery Act</i>
RPD	Relative percent difference
SDG	Sample delivery group
SVOC	Semivolatile organic compound(s)
SWS	Septic Waste System(s)
TTR	Tonopah Test Range
TPH	Total petroleum hydrocarbon(s)
TCLP	Toxicity Characteristic Leaching Procedure
VCP	Vitrified Clay Pipe
VOC	Volatile organic compound(s)
WEC	Westinghouse Electric Corporation

List of Acronyms and Abbreviations (Continued)

yd ³	Cubic yard(s)
µg/kg	Microgram(s) per kilogram
µg/L	Microgram(s) per liter
%R	Percent recovery

Executive Summary

This Corrective Action Decision Document has been prepared for Corrective Action Unit 428, Area 3 Septic Waste Systems 1 and 5. The corrective action investigation was conducted in accordance with the *Corrective Action Investigation Plan for Corrective Action Unit 428: Area 3 Septic Waste Systems 1 and 5, Tonopah Test Range, Nevada* (DOE/NV, 1999), as developed under the *Federal Facility Agreement and Consent Order* (FFACO, 1996). Corrective Action Unit 428 is located in Area 3 at the Tonopah Test Range, Nevada, and is comprised of the following Corrective Action Sites:

- 03-05-002-SW01, Septic Waste System 1
- 03-05-002-SW05, Septic Waste System 5

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

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

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

A corrective action investigation was performed in 1999 as set forth in the *Corrective Action Investigation Plan for Corrective Action Unit 428: Area 3 Septic Waste Systems 1 and 5, Tonopah Test Range, Nevada* (DOE/NV, 1999). Analytes detected during the corrective action investigation were evaluated against preliminary action levels to determine contaminants of concern for Corrective Action Unit 428.

The benzo(a)pyrene concentration in a septic tank integrity sample associated with Septic Tank 33-1A of Septic Waste System 1 exceeded preliminary action levels. The arsenic concentration in a

leachfield soil sample associated with Septic Waste System 5, Leachfield 1 exceeded preliminary action levels and is significantly higher than the background concentration. These constituents are identified as contaminants of concern for their respective Corrective Action Sites.

Based on the identification of contaminants of concern above preliminary action levels at this site, potential corrective action alternatives are identified and evaluated in this Corrective Action Decision Document to ensure worker, public, and environmental protection against potential exposure to contaminants of concern in accordance with *Nevada Administrative Code 445A* (NAC, 1998b).

Based on the potential exposure pathways, the following corrective action objectives have been identified for Septic Waste Systems 1 and 5:

- Prevent or mitigate exposure to contents of the septic tanks and distribution box.
- Prevent or mitigate exposure to subsurface soil containing contaminants of concern at concentrations exceeding preliminary action levels as defined in the Corrective Action Investigation Plan (DOE/NV, 1999).
- Prevent spread of contaminants of concern beyond the Corrective Action Unit.

Based on the review of existing data, future use, and current operations in Area 3 of the Tonopah Test Range, the following alternatives were developed for consideration at the Septic Waste Systems 1 and 5 site:

- Alternative 1 - No Further Action
- Alternative 2 - Closure in Place with Administrative Controls
- Alternative 3 - Clean Closure by Excavation and Disposal

The corrective action alternatives were evaluated based on four general corrective action standards and five remedy selection decision factors. Based on the results of this evaluation, the preferred alternative for Area 3 Septic Waste Systems 1 and 5 is Alternative 3, Clean Closure by Excavation and Disposal.

The preferred corrective action alternative was evaluated on technical merit, focusing on performance, reliability, feasibility, and safety. The alternative was judged to meet all requirements for the technical components evaluated. The alternative meets all applicable state and federal

regulations for closure of the site and will eliminate potential future exposure pathways to the contaminated soils at Area 3 Septic Waste Systems 1 and 5.

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

1.0 Introduction

This Corrective Action Decision Document (CADD) has been prepared for Corrective Action Unit (CAU) 428, Area 3 Septic Waste Systems 1 and 5, Tonopah Test Range, Nevada, in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) of 1996 that was agreed to by the State of Nevada; U.S. Department of Energy, Nevada Operations Office (DOE/NV); and the U.S. Department of Defense (FFACO, 1996). The CADD provides or references the specific information necessary to recommend corrective actions for the Corrective Action Sites (CASs) within CAU 428, which include the following:

- 03-05-002-SW01 (Septic Waste System 1)
- 03-05-002-SW05 (Septic Waste System 5)

Corrective Action Unit 428 is located within Area 3 of the Tonopah Test Range (TTR), Nye County, Nevada. The TTR is approximately 140 miles (mi) northwest of Las Vegas, Nevada ([Figure 1-1](#) and [Figure 1-2](#)).

1.1 Purpose

This CADD identifies potential corrective action alternatives and provides a rationale for the selection of a recommended corrective action alternative for each CAS within the CAU. The need for evaluation of corrective action alternatives is based on process knowledge and the results of investigative activities conducted in accordance with the *Corrective Action Investigation Plan for Corrective Action Unit 428: Area 3 Septic Waste Systems 1 and 5, Tonopah Test Range, Nevada* (CAIP) (DOE/NV, 1999).

1.2 Scope

The scope of this CADD consists of the following:

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

Figure 1-1
Tonopah Test Range Location Map

Figure 1-2
Location of CAU 428 in Area 3, Tonopah Test Range, Nevada

- Perform detailed and comparative evaluations of corrective action alternatives in relation to corrective action objectives and screening criteria.
- Recommend and justify a preferred corrective action alternative for each CAS within the CAU.

1.3 CADD Contents

This CADD is divided into the following sections:

Section 1.0 - Introduction: summarizes the purpose, scope, and contents of this CADD.

Section 2.0 - Corrective Action Investigation Summary: summarizes the investigation field activities, the results of the investigation, and the need for corrective action.

Section 3.0 - Evaluation of Alternatives: documents steps taken to determine a preferred corrective action alternative.

Section 4.0 - Recommended Alternative: presents the preferred corrective action alternative and the rationale for its selection based on the corrective action objectives and alternative screening criteria.

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

Appendix A: *Corrective Action Investigation Report for CAU 428: Area 3, Septic Waste Systems 1 and 5, Tonopah Test Range, Nevada*

Appendix B: Cost estimates

Appendix C: Soil Boring Logs

Appendix D: Nevada Department of Environmental Protection Document Review Sheets

All work was performed in accordance with the following documents:

- CAIP (DOE/NV, 1999)
- *Work Plan for Leachfield Corrective Action Units: Nevada Test Site and Tonopah Test Range, Nevada* (Leachfield Work Plan) (DOE/NV, 1998)

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

2.0 Corrective Action Investigation Summary

The following sections describe and summarize the results of the investigation activities conducted at CAU 428. For detailed investigation results, please refer to [Appendix A](#).

2.1 Investigation Activities

From May 17 through June 15, 1999, corrective action investigation activities were performed as set forth in the CAIP (DOE/NV, 1999). The primary objectives of the investigation were to:

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

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

CAS 03-05-002-SW01 (Septic Waste System 1)

- Conducted exploratory excavations guided by engineering drawings and video mole/radio location surveys to determine system configuration.
- Sampled contents of four of the seven septic tanks and the distribution box located by the investigation. Submitted eight sludge and four water samples for laboratory analysis. Septic tank and distribution box contents were analyzed for “totals,” Toxicity Characteristic Leaching Procedure (TCLP), and radiological constituents.
- Field screened soil samples for volatile organic compounds (VOCs) and alpha/beta emitters.
- Collected integrity samples for six of the seven septic tanks and the distribution box located by the investigation. Submitted 13 soil samples collected below the discharge and outfall lines and adjacent to the septic tanks, or below the distribution lines and adjacent to the distribution box for laboratory analysis.
- Submitted 12 soil samples from 2 backhoe trenches within Leachfield 1 for laboratory analysis. These samples were collected at the leachrock and native soil interface and 2.5 feet (ft) below the interface.

- Submitted 11 soil samples from 2 backhoe trenches within Leachfield 2 for laboratory analysis. These samples were collected at the leachrock and native soil interface and 2.5 ft below the interface.
- Submitted 19 soil samples from 6 boreholes drilled at Leachfield 1 for laboratory analysis. One geotechnical sample and 18 environmental samples were collected from 4 to 20 ft below ground surface (bgs).
- Submitted 25 soil samples from 5 boreholes and 1 stepout borehole drilled at Leachfield 2 for laboratory analysis. Two geotechnical samples and 23 environmental samples were collected from 4 to 35 ft bgs.
- Analyzed all environmental samples for total VOCs; total semivolatile organic compounds (SVOCs); total *Resource Conservation and Recovery Act* (RCRA) metals; and total petroleum hydrocarbons (TPH) as diesel/waste oil.
- Analyzed 26 environmental soil samples for isotopic uranium based on sampling results from the Septic Waste System 1 septic tank.

CAS 03-05-002-SW05 (Septic Waste System 5)

- Conducted exploratory excavations guided by engineering drawings and video mole/radio location surveys to determine system configuration.
- Field screened soil samples for VOCs and alpha/beta emitters.
- Submitted 15 soil samples from 2 backhoe trenches within the leachfield for laboratory analysis. These samples were collected at the leachrock and native soil interface and 2.5 ft below the interface.
- Submitted 11 soil samples from 5 boreholes drilled within the leachfield for laboratory analysis. One geotechnical sample and 10 environmental samples were collected from 9.5 to 20.2 ft bgs.
- Analyzed all environmental samples for total VOCs; total SVOCs; total RCRA metals; and TPH as diesel/waste oil.
- Analyzed 13 environmental soil samples for isotopic uranium based on Septic Waste System 1 septic tank sampling results.

2.2 Results

The corrective action investigation analytical results indicated the following:

- All soil sample total VOCs results were below the preliminary action levels (PALs) outlined in the CAIP (DOE/NV, 1999).
- Only one soil sample total SVOCs result exceeded the PALs outlined in the CAIP (DOE/NV, 1999). Sample TTR01180 had a benzo(a)pyrene concentration of 480 micrograms per kilogram ($\mu\text{g/kg}$) which exceeds the PAL of 360 $\mu\text{g/kg}$. This is a septic tank integrity sample collected from soil under the discharge line connection and adjacent to Septic Tank 33-1A.
- Total petroleum hydrocarbon soil sample concentrations did not exceed the Nevada Division of Environmental Protection (NDEP) action level of 100 milligrams per kilogram (mg/kg) for diesel.
- Reported levels for all total RCRA metal soil samples (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) were below the PALs established in the CAIP (DOE/NV, 1999) except for arsenic. Arsenic was detected above the PAL of 3.0 mg/kg in all of the samples analyzed. The arsenic concentrations for the samples analyzed ranged from 4 to 68.7 mg/kg . The arsenic concentration for sample TTR01227 is significantly higher than all other samples analyzed. The sample results with lower concentrations that exceed the PAL for arsenic are not unusual for this portion of the state of Nevada; therefore, these concentrations do not imply contamination. Sample TTR01227 is a sample collected from the leachrock and native soil interface under the center distribution line at the proximal end of Septic Waste System 5, Leachfield 1.
- Analysis of 39 soil samples for isotopic uranium was conducted after enriched uranium was detected in Septic Waste System 1 septic tanks. Results from this analysis are not considered to be statistically different from established background levels; therefore, they are below PALs.
- All of the septic tank and distribution box contents sample results were below regulatory limits for TCLP VOCs, TCLP SVOCs, and TCLP RCRA Metals.
- All total petroleum hydrocarbon septic tank and distribution box sample concentrations exceed the NDEP action level of 100 mg/kg for diesel.
- Uranium-234, uranium-235, and uranium-238 were found at concentrations exceeding established uranium background ranges in septic tank and distribution box samples. The uranium-235 was elevated when compared to the natural mass fraction indicating that the uranium had been enriched.

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 contaminants of concern (COCs) at CAU 428 (see [Figures A.2-1](#) and [A.2-2](#)) have 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 COCs for CAU 428. The PALs were exceeded for benzo(a)pyrene in one septic tank integrity sample collected southeast of Septic Tank 33-1A and arsenic for all samples analyzed. Only one sample collected from the leachrock and native soil interface under the center distribution line at the proximal end of Septic Waste System 5, Leachfield 1 is considered contaminated with arsenic; the remaining sample results reflect background concentrations of arsenic in the soil at this location. Based on the identification of COCs above PALs in these areas, potential corrective action alternatives are identified and evaluated in this CADD to ensure worker, public, and environmental protection against potential exposure to COCs in accordance with *Nevada Administrative Code* (NAC) 445A (NAC, 1998b).

The contents of Septic Tanks 33-1A, 33-1B, 33-3, 33-10, and the suspected septic tank near the northwest corner of Building 0101 (if present) will be removed for proper disposal. Septic Tank 33-8 contains soil that flowed into the tank around the poor fitting lid, and the contents will be removed during rinsing associated with closure of the tank. These septic tanks will be closed in place in accordance with applicable regulations (NAC 444.818 [1998a]). Septic tank integrity samples will be collected from soil underlying the southeast end of Septic Tank 33-1A and both ends of Septic Tank 33-10 (east and west), Septic Tank 33-8 (northeast and southwest), and the suspected septic tank if located.

Based on process knowledge and relatively low constituent concentrations, the estimated volume of benzo(a)pyrene impacted soil is 1 cubic yard (yd³) below the discharge line at the southeast end of Septic Tank 33-1A. The lateral and vertical extent of the contamination is unknown. The benzo(a)pyrene concentration should be highest at the discharge line and diminish with depth and distance southeast of Septic Tank 33-1A. A verification sample will be collected from soil below the base of the southeast end of Septic Tank 33-1A.

The estimated volume of arsenic impacted soil is 6 yd³ at the proximal end of Septic Waste System 5, Leachfield 1. The maximum vertical extent of the contamination is constrained by a sample from 7.5 ft bgs at the same location. The maximum lateral extent of the contamination is constrained by samples collected from the native soil and leachrock interface underlying the adjacent distribution lines approximately 7 ft to the northwest and southeast.

Site-specific characteristics which may constrain remediation at CAU 428 include underground and overhead utilities and asphalt roadways.

3.0 Evaluation of Alternatives

The purpose of this section is to present the corrective action objectives for Septic Waste Systems 1 and 5, describe the general standards and decision factors used to screen the corrective action alternatives, and develop and evaluate a set of corrective action alternatives that could be used to meet the corrective action objectives.

3.1 Corrective Action Objectives

The corrective action objectives are media-specific goals for protecting human health and the environment. Based on the potential exposure pathways (see [Section 3.1.2](#)), the following corrective action objectives have been identified for Septic Waste Systems 1 and 5:

- Prevent or mitigate exposure to contents of the septic tanks and distribution box.
- Prevent or mitigate exposure to subsurface soil containing COCs at concentrations exceeding PALs as defined in the CAIP (DOE/NV, 1999).
- Prevent spread of COCs beyond the CAU.

3.1.1 Contaminants of Concern

Contaminants of potential concern were determined in the Data Quality Objective (DQO) process as listed in the CAIP (DOE/NV, 1999). Analytical results obtained from the corrective action investigation were evaluated to determine if COPCs were detected above PALs, and therefore would be COCs for CAU 428 that must be addressed by corrective action. Based on the results of this evaluation, benzo(a)pyrene was identified as the COC for Septic Waste System 1 and arsenic was identified as the COC for Septic Waste System 5.

3.1.2 Potential Exposure Pathways

As identified in the CAIP (DOE/NV, 1999), the future use for the Septic Waste Systems 1 and 5 site is expected to be similar to current industrial, administrative, and research related activities (DOE/NV, 1996b). As part of the CAIP (DOE/NV, 1999), a conceptual model for CAU 428 was developed which identified the potential exposure mechanism as disturbance of contaminated soil by

site workers. This implies a potential exposure pathway through ingestion of, inhalation of, and dermal contact with contaminated soil under industrial scenarios. Site workers could potentially be exposed to contaminated soil during general maintenance or soil excavation associated with construction and maintenance of underground utilities. The depth to groundwater beneath Area 3 is approximately 361 to 394 ft bgs (DOE/NV, 1996a). Therefore, contaminant migration to groundwater is not considered to be an exposure pathway.

3.2 Screening Criteria

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

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

The general corrective action standards are:

- 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:

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

3.2.1 Corrective Action Standards

The following text describes the corrective action standards used to evaluate the corrective action alternatives.

Protection of Human Health and the Environment

Protection of human health and the environment is a general mandate of the RCRA statute (EPA, 1994). This mandate requires that the corrective action include any protective measures that are 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 9 Industrial Soil 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 under NAC 445A.2272 (NAC, 1998b). The PAL for petroleum substances in soil is 100 mg/kg in accordance with NAC 445A.2272 (NAC, 1998b).

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

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

During implementation of any corrective action alternative, all waste management activities must be conducted in accordance with applicable state and federal regulations (e.g., *Nevada Revised Statutes* [NRS] 459.400 - 459.600, "Disposal of Hazardous Waste" [NRS, 1995]; 40 *Code of Federal Regulations* [CFR] 260 - 282, "RCRA Regulations" [CFR, 1998]; NAC 444, "Sanitation" [NAC, 1998a]; and NAC 459.9974, "Disposal and Evaluation of Contaminated Soil" [NAC, 1998c]). The requirements for management of the waste, if any, derived from the corrective action will be determined based on applicable state and federal regulations, field observations, process knowledge, characterization data, and data collected and analyzed during corrective action implementation.

Administrative controls (e.g., decontamination procedures and corrective action strategies) will minimize waste generated during site corrective action activities. Decontamination activities will be performed in accordance with approved procedures and will be designated according to the COCs present at the site.

3.2.2 Remedy Selection Decision Factors

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

Short-Term Reliability and Effectiveness

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

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

Reduction of Toxicity, Mobility, and/or Volume

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

Long-Term Reliability and Effectiveness

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

Feasibility

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

- **Construction and Operation:** 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 TTR, the following alternatives have been developed for consideration at Area 3 Septic Waste Systems 1 and 5:

- Alternative 1 - No Further Action
- Alternative 2 - Closure in Place with Administrative Controls
- Alternative 3 - Clean Closure by Excavation and Disposal

Other technologies, such as administrative controls and a surface cap, were considered.

Administrative controls were not considered to be protective because the COCs are located near the surface. The small volume of contaminated material and the near-surface location resulted in these alternatives not receiving further consideration in this CADD.

The following evaluation of NAC 445A.227 (2) (a-k) (NAC, 1998b) supports the protection of groundwater from COCs at Septic Waste Systems 1 and 5:

- a. The depth to groundwater is 360 to 390 ft (DOE/NV, 1996a). Septic Waste Systems 1 and 5 are abandoned; therefore, no driving force exists to contribute to contaminant migration. The precipitation for the area (5 to 6 inches [in.] annually) (DOE/NV, 1996a) does not significantly influence the movement of the contaminants. Field screening and analytical data indicate that COCs are confined primarily from 3.5 to 7.5 ft bgs. This indicates minimal vertical migration has occurred in the past and, with the removal of man-made driving forces, vertical migration will be negligible in the future.
- b. The distance to the nearest drinking water well (Sandia 6) is approximately 2,000 ft southeast of Septic Tank 33-1A and the proximal end of Septic Waste System 5, Leachfield 1. Groundwater generally flows to the to the northwest (DOE/NV, 1996a). Contaminants would be required to travel the vertical distance to the groundwater and travel through the groundwater in a direction opposite normal groundwater flow to the radius of influence of the well. Based on the low concentrations and volumes of contamination, the likelihood of any impacts to the well is minimal.
- c. Geotechnical data for four samples collected from soil underlying the leachfields will be provided in the final revision of this document. Geotechnical analysis of samples from adjacent CAUs identified porosity ranging from 35.2 percent to 41.3 percent and permeability ranging from 1.6×10^{-3} to 1.2×10^{-7} centimeters/second. Permeability generally decreased with depth which limits potential for downward migration of contaminants.
- d. Annual precipitation averages 5 to 6 in. and annual evaporation is between 58 and 66 in. (DOE/NV, 1996a). The high evaporation and low precipitation rates create a negative water

balance for the area; therefore, no driving force associated with precipitation is available to mobilize COCs vertically.

- e. The types of regulated substances released are benzo(a)pyrene and arsenic. Downward migration of COCs is slowed by the following parameters:
 - Volume of release - small volumes of COCs were released over a long period of time rather than a large volume over a short duration.
 - Soil saturation - the soil tends to be very dry, especially near the surface where the COCs are concentrated.
 - Soil particle adsorption/desorption - contaminants tend to adsorb to the soil particles with little desorption as suggested by the limited vertical migration of COCs.
- f. The lateral and vertical extent of benzo(a)pyrene contamination associated with Septic Tank 33-1A is estimated at 3 ft and 3.5 to 4.0 ft bgs respectively. The lateral and vertical extent of arsenic contamination associated with Septic Waste System 5, Leachfield 1 is estimated at 20 ft and 2.5 ft bgs, respectively. The extent of contamination is estimated based on analytical data.
- g. Presently, the Septic Waste Systems 1 and 5 site is located on a government-controlled facility. The TTR is a restricted area that is guarded on a 24-hour, 365-day-per-year basis; unauthorized personnel are not admitted to the facility. The future use for the Septic Waste Systems 1 and 5 site is expected to be similar to current industrial, administrative, and research related activities.
- h. Preferred routes of vertical migration are nonexistent since the sources have been eliminated and driving forces are not viable. The benzo(a)pyrene contamination at Septic Tank 33-1A is covered with 3.5 ft of clean soil and the arsenic contamination at the proximal end of Septic Waste System 5, Leachfield 1 is covered by approximately 5 ft of clean soil and an asphalt roadway. Inadvertent intrusion is the only pathway from the contaminants to potential receptors.
- i. Numerous aboveground (i.e., propane tanks) and underground utilities are present at the site. An asphalt roadway covers Septic Waste System 5, Leachfield 1.
- j. The potential for a hazard related to fire, vapor, or explosion is nonexistent for the COCs at the Septic Waste System 1 and 5 site.
- k. No other site-specific factors are known at this time.

Based on this evaluation, impacts to groundwater are not expected. Therefore, groundwater monitoring is not proposed for this site and is not considered an element of the alternatives.

3.3.1 Alternative 1 - No Further Action

Under the No Further Action Alternative, no corrective action activities will be implemented. This alternative is a baseline case used to compare the ability of the other corrective action alternative to meet the corrective action standards. This alternative does not meet the corrective action objectives for Septic Waste Systems 1 and 5 because no actions are taken to prevent exposure to the COCs or to prevent continued spread of contamination. This alternative will not be compared to the other alternatives using the selection decision factors.

3.3.2 Alternative 2 - Closure in Place with Administrative Controls

Alternative 2 includes removal and proper disposal of the liquid and sludge from the septic tanks. The outlets and inlets of the septic tanks will be grouted. A verification sample will be collected from soil below the base of the southeast end of Septic Tank 33-1A and submitted for total SVOCs analysis. Septic tank integrity samples will be collected from both ends of Septic Tanks 33-8, 33-10, and the suspected septic tank if located. Septic tank integrity samples will be analyzed for COPCs identified in the CAIP (DOE/NV, 1999). The septic tanks will then be closed in accordance with applicable regulations (NAC 444.818 [NAC, 1998a]).

Alternative 2 will utilize administrative controls to prevent inadvertent contact with COCs at the proximal end of Septic Waste System 5, Leachfield 1 and southeast of Septic Tank 33-1A. These controls will also be applied to potential COCs at Septic Tank 33-8 and the suspected septic tank near the northeast corner of Building 0101. Administrative controls would consist of use restrictions to prevent unauthorized intrusive activities. The future use of portions of the CAU would be restricted from any activity that would alter or modify the containment control unless concurrence was obtained from the NDEP.

The CAU 428 site will be closed in accordance with NAC 445A (NAC, 1998b) as described in this section.

3.3.3 Alternative 3 - Clean Closure by Excavation and Disposal

Alternative 3 activities for the septic tanks and distribution box will be the same as those described in Alternative 2.

Alternative 3 also includes excavating and disposing of the soil with benzo(a)pyrene and arsenic concentrations greater than PALs. The uncontaminated surface soil will be removed to expose contaminated soil southwest of Septic Tank 33-1A and at the proximal end of Septic Waste System 5, Leachfield 1. This soil with additional clean fill as required will be used to backfill the excavation after removal of the contaminated soils to minimize surface depressions. One verification soil sample will be collected from the base of the excavation southwest of Septic Tank 33-1A and submitted for total SVOCs analysis. Verification soil samples will be collected from the five sides (four walls and base) of the excavation at the proximal end of Septic Waste System 5, Leachfield 1 and submitted for total RCRA metals analysis. This will ensure complete removal of soil contaminated at concentrations exceeding the PALs.

Approximately 1 yd³ of soil southeast of Septic Tank 33-1A and 6 yd³ of soil at the proximal end of Septic Waste System 5, Leachfield 1 will be removed. All contaminated excavated material will be disposed of at an appropriate disposal facility.

All excavated areas will be returned to surficial conditions compatible with existing operations. Excavation would be used to remove clean borrow soil from a nearby location for placement in the remaining voids as necessary.

The CAU 428 site will be closed in accordance with NAC 445A (NAC, 1998b) as described in this section.

3.4 Evaluation and Comparison of Alternatives

The general corrective action standards and remedy selection decision factors described in [Section 3.2](#) were used to conduct detailed and comparative analyses of each corrective action alternative. The advantages and disadvantages of each alternative were assessed to select a preferred alternative for Septic Waste Systems 1 and 5. [Table 3-1](#) presents a summary of the detailed analysis of the alternatives. [Table 3-2](#) presents the comparative analysis of alternatives. Cost summaries are provided in [Appendix B](#).

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

Evaluation Criteria	Alternative 1 No Further Action	Alternative 2 Closure in Place and Administrative Controls	Alternative 3 Clean Closure by Excavation and Disposal
Closure Standards			
Protection of Human Health and the Environment	<ul style="list-style-type: none"> Does not meet corrective action objective of preventing or mitigating exposure to surface and subsurface soil containing COCs at concentrations exceeding PALs. Does not prevent spread of COCs. NAC 445A.227 (2) (a-k) analysis shows the contaminants are not expected to impact groundwater. No worker exposure associated with implementation. 	<ul style="list-style-type: none"> Meets corrective action objectives. Prevents inadvertent intrusion into the contaminated soil zone. Low risk to workers associated with heavy equipment and potential contact with impacted media during excavation and transportation activities. Low risk to public because of remote location and controlled access to the TTR. NAC 445A.227 (2) (a-k) analysis shows the contaminants are not expected to impact groundwater. 	<ul style="list-style-type: none"> Meets corrective action objectives. Low risk to workers associated with heavy equipment and potential contact with impacted media during excavation and transportation activities. Low risk to public due to remote location and controlled access to TTR. Moving contaminated soil to an appropriate disposal facility mitigates exposure to impacted media after closure.
Compliance with Media Cleanup Standards	<ul style="list-style-type: none"> Does not comply with media cleanup standards because COCs remain at levels above PALs. NAC 445A.227 (2) (a-k) analysis shows the contaminants are not expected to impact groundwater. 	<ul style="list-style-type: none"> Complies with media cleanup standards by eliminating exposure pathways. NAC 445A.227 (2) (a-k) analysis shows the contaminants are not expected to impact groundwater. 	<ul style="list-style-type: none"> Complies with media cleanup standards because soil containing COCs at concentrations exceeding PALs will be excavated and disposed of at an appropriate facility. Removal of COC concentrations exceeding PALs will be verified with confirmation sampling.
Control the Source(s) of Release	The sources to CAU 428 have been discontinued.	The sources to CAU 428 have been discontinued.	The sources to CAU 428 have been discontinued.

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

Evaluation Criteria	Alternative 1 No Further Action	Alternative 2 Closure in Place and Administrative Controls	Alternative 3 Clean Closure by Excavation and Disposal
Comply with Applicable Federal, State, and Local Standards for Waste Management	No waste generated	All waste (primarily septic tank and distribution box contents, and disposable personal protective equipment) will be handled and disposed of in accordance with applicable standards.	All waste (primarily septic tank and distribution box contents, contaminated soil and disposable personal protective equipment) will be handled and disposed of in accordance with applicable standards.
Remedy Selection Decision Factors			
Short-Term Reliability and Effectiveness	Not evaluated	<ul style="list-style-type: none"> • Low risk to workers associated with heavy equipment and potential contact with impacted media during excavation and transportation activities. • Public protected by remote location and TTR site access controls. • Environmental impacts are not anticipated due to implementation. • Implementation should not require an extended period of time. 	<ul style="list-style-type: none"> • Low risk to workers associated with heavy equipment and potential contact with impacted media during excavation and transportation activities. • Public protected by remote location and TTR 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	<ul style="list-style-type: none"> • The mobility of the remaining subsurface COCs is effectively eliminated by administrative controls and lack of viable driving forces. 	<ul style="list-style-type: none"> • Clean closure would effectively eliminate associated toxicity, mobility, and volume of wastes at CAU 428. • Proper disposal of the waste will result in an ultimate reduction of mobility.

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

Evaluation Criteria	Alternative 1 No Further Action	Alternative 2 Closure in Place and Administrative Controls	Alternative 3 Clean Closure by Excavation and Disposal
Long-Term Reliability and Effectiveness	Not evaluated	<ul style="list-style-type: none"> Controls inadvertent intrusion to remaining COCs. Administrative controls must be maintained. 	<ul style="list-style-type: none"> All risk will be eliminated upon completion. No maintenance required CAU 428 clean closed. Moving contaminated soil to an appropriate disposal facility addresses the persistent adsorption of contaminants to the soil.
Feasibility	Not evaluated	<ul style="list-style-type: none"> Easily implemented. Coordination of all entities is necessary to ensure compliance with administrative controls to prevent intrusion into contaminated soil zones. 	<ul style="list-style-type: none"> Easily implemented.
Cost	\$0	\$261,479	\$279,716

Table 3-2
Comparative Evaluation of Alternatives

Evaluation Criteria	Comparative Evaluation
Closure Standards	
Protection of Human Health and the Environment	Alternatives 2 and 3 meet corrective action objectives; Alternative 1 does not. No worker exposure to risks is associated with Alternative 1. Low risks are associated with Alternative 2 and slightly higher risks with Alternative 3. NAC 445A.227 (2) (a-k) analysis shows the contaminants are not threatening groundwater.
Compliance with Media Cleanup Standards	Alternative 1 does not comply with media cleanup standards. Alternative 2 controls access to contaminants, effectively eliminating exposure pathways. Alternative 3 meets media cleanup standards by removing soil containing COCs at concentrations exceeding PALs and eliminating exposure pathways at the site.
Control the Source(s) of the Release	The sources to CAU 428 have been discontinued.
Comply with Applicable Federal, State, and Local Standards for Waste Management	Alternative 1 does not generate waste. Alternatives 2 and 3 will generate waste that will be handled in accordance with applicable standards.
Remedy Selection Decision Factors	
Short-Term Reliability and Effectiveness	Low risks are associated with Alternative 2 and slightly higher risks with Alternative 3.
Reduction of Toxicity, Mobility, and/or Volume	Alternative 2 results in a reduction of mobility of the subsurface COCs. Alternative 3 results in a reduction of all three characteristics at CAU 428.
Long-Term Reliability and Effectiveness	Residual risk at CAU 428 is low for Alternative 2 and nonexistent for Alternative 3. Alternative 2 requires some administrative measures to control intrusive activities.
Feasibility	Alternatives 2 and 3 are feasible; however, Alternative 3 will be more resource intensive.
Cost	The cost for Alternative 1 is \$0. Alternative 2 is estimated to cost \$261,479. The estimated cost for Alternative 3 is \$279,716.

4.0 Recommended Alternative

Based on the results of the detailed and comparative analysis of the potential corrective action alternatives presented in this document, the preferred corrective action alternative selected for implementation at Area 3 Septic Waste Systems 1 and 5 is Alternative 3, Clean Closure by Excavation and Disposal. Alternative 3 was chosen for the following reasons:

- Verification samples are collected for septic tanks in poor or unknown condition. Septic tanks are closed in accordance with applicable regulations.
- Health risks are minimized by preventing public and worker access to the contaminated soil southeast of Septic Tank 33-1A and at the proximal end of Septic Waste System 5, Leachfield 1 by moving contaminated soil to an appropriate disposal facility.
- All waste will be managed in accordance with federal, state, and local requirements.
- The long-term risks are eliminated by moving contaminated soil to an appropriate disposal facility.
- Easily implementable with standard construction equipment utilized for removal of contaminated soil.
- A cost-effective method for achieving protection and meeting closure requirements.

The preferred corrective action alternative was evaluated on its technical merits, focusing on performance, reliability, feasibility, and safety. The alternative was judged to meet all requirements for the technical components evaluated. The alternative meets all applicable state and federal regulations for closure of the site and will eliminate potential future exposure pathways to the contaminated soils at Area 3 Septic Waste Systems 1 and 5.

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

Based on the evaluation in this CADD, clean closure of Septic Waste Systems 1 and 5 by excavation and disposal is the preferred closure method.

5.0 References

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Appendix A

Corrective Action Investigation Report for CAU 428: Area 3 Septic Waste Systems 1 and 5, Tonopah Test Range, Nevada

A.1.0 Introduction

This appendix details corrective action investigation (CAI) activities and analytical results for the CAU 428 corrective action investigation. This CAU is located within Area 3 of the Tonopah Test Range and is comprised of Septic Waste Systems (SWS) 1 and 5 with respective CAS Numbers 03-05-002-SW01 and 03-05-002-SW05. The septic waste systems are presented in Table 3-1 of the *Corrective Action Unit Work Plan, Tonopah Test Range* (DOE/NV, 1996a). The corrective action investigation was conducted in accordance with the *Corrective Action Investigation Plan for Corrective Action Unit 428: Area 3 Septic Waste Systems 1 and 5, Tonopah Test Range, Nevada* (DOE/NV, 1999) and the *Work Plan for Leachfield Corrective Action Units: Nevada Test Site and Tonopah Test Range, Nevada*, Rev. 1 (DOE/NV, 1998b) as developed under the *Federal Facility Agreement and Consent Order* (1996). These documents are hereafter referred to as the CAIP, Leachfield Work Plan and FFACO.

The CAU is located within Area 3 of the TTR, Nye County, Nevada ([Figure 1-1](#) and [Figure 1-2](#)). The septic waste systems were installed to receive sanitary and industrial wastes generated from site maintenance and daily operations conducted in the northern portion of Area 3. This CAU was investigated because process knowledge indicated that potentially contaminated sanitary effluent was discharged to leachfield distribution pipes and allowed to percolate into the underlying soil for disposal. Septic Waste Systems (SWS) 1 and 5 operated in various combinations from construction of the original Control Point (Building 03-50) in 1956 through the abandonment of SWS 1 after the installation of the consolidated sewer system in 1990.

Additional information regarding the history of each site, planning, and the scope of the investigation is presented in the CAIP and is not repeated in this report.

A.1.1 Project Objectives

The primary objectives of the investigation were to:

- Identify the presence and the vertical and lateral extent of COPCs.
- Provide sufficient information and data to develop appropriate corrective action alternatives for SWSs 1 and 5.

The selection of soil sample locations was based on site conditions and on the strategy developed during the DQO process as outlined in the CAIP.

A.1.2 Report Content

This report contains information and data in sufficient detail to support the selection of a preferred corrective action alternative in the CADD. The contents of this report are as follows:

- [Section A.1.0](#) describes the investigation background, objectives, and the report content.
- [Section A.2.0](#) provides information regarding the field activities and sampling methods.
- [Section A.3.0](#) summarizes the results of the laboratory analysis from the investigation sampling.
- [Section A.4.0](#) discusses the quality assurance (QA) and quality control (QC) procedures that were followed and the results of the QA/QC activities.
- [Section A.5.0](#) is a summary of the investigation results.
- [Section A.6.0](#) provides the cited references.

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

A.2.0 Field Investigation and Sampling Activities

Field investigation and sampling activities were divided into overlapping phases of exploratory excavation and hollow stem auger drilling. The field investigation and sampling activities were conducted from May 17 through June 15, 1999.

The investigation and sampling program was managed in accordance with the requirements set forth in the CAIP. The field activities were performed in accordance with an approved Site-specific Health and Safety Plan (IT, 1999) consistent with the DOE Integrated Safety Management System. The samples were collected and documented following approved protocols and procedures for sampling, chain of custody, shipping, radiation screening, field activity documentation, sample collection documentation, and decontamination as indicated in the CAIP. Quality control samples (e.g., field blanks, equipment rinsate blanks, trip blanks, and duplicate samples) were collected as required by the *Industrial Sites Quality Assurance Project Plan (QAPP)* (DOE/NV, 1996b) and approved procedures. During field activities, waste minimization practices were followed according to approved procedures, including segregation of waste by waste stream.

Samples were collected using both excavation and drilling. Excavation allowed inspection of particular leachfield system components and sample collection. In several cases, excavation disproved the existence of potential leachfields or demonstrated that leachfields were present in different configurations than expected. Drilling allowed collection of samples from depths adequate to establish vertical extent of COPCs.

Borehole locations and boundaries of critical excavations were surveyed subsequent to the investigation. The locations shown in [Plate 1](#) are the critical boring and excavation locations for the investigation. Excavation dimensions are schematic and not all excavations are shown for clarity. The location of Borehole B125 is based on measured distances rather than surveyed coordinates because the borehole grout plug was obscured by grading prior to survey activities. The location of background soil collection location 19 (background locations not shown) is estimated due to a survey error.

A.2.1 Site Description and Conditions

Septic Waste Systems 1 and 5 are located within the northern portion of Area 3 at the TTR. The initial collection system and leachfield investigation locations were based on interpretation of engineering drawings, historical aerial photographs, and interviews with former and current site employees. Access to SWSs 1 and 5 features is limited by buildings, storage areas, and utilities. Numerous aboveground and underground utilities are present throughout the investigation area.

Weather conditions at the site varied from sunny to intermittent cloudiness and light to strong winds. Thunderstorms occasionally delayed site operations but weather conditions were generally favorable.

Utilities, structures, and underground obstructions prevented sample collection at several planned sampling locations, including Septic Tank 33-8 and excavations at the south branch distal end of SWS 5, Leachfield 1. Hazards presented by known and unknown utilities delayed the investigation. Soil conditions at the SWS 5 Leachfield caused poor recovery during drilling operations. Soil was sampled in longer intervals from the SWS 5 Leachfield boreholes to provide adequate volume for the required analyses.

A.2.2 Leachfield System Investigation

The leachfield systems present at SWSs 1 and 5 are similar to the generic conceptual model for leachfields provided in the Leachfield Work Plan and the site-specific conceptual model provided in the CAIP. A significant difference between the generic conceptual model and SWSs 1 and 5 is the absence of distribution boxes for the older leachfields.

A.2.2.1 Excavation

Excavations were used to locate leachfield system components, expose sampling horizons, and remove soil from excavations for sampling. A Westinghouse Electric Corporation (WEC) JCB backhoe was the primary excavation equipment used. In some cases, a Case 580 backhoe or John Deere 595 excavator were used when the JCB backhoe was unavailable due to mechanical problems.

Excavations were designated using the convention EXYZ (excavations) or TXYZ (trenches) where X is the leachfield system (1 or 5), Y is the leachfield number (starting with 1) and Z is an alphanumeric

feature designator (i.e., ST for septic tank). In some cases, alphanumeric location designators were incorporated into the Z term (i.e., NE for northeast). Trenches are excavations with length dimensions significantly larger than width dimensions. Excavations shown on [Plate 1](#) are labeled using this convention.

A.2.2.1.1 Utilities

Utility clearances were performed prior to excavation activities by WEC personnel. Utility clearances included inspection of surface features and engineering drawings and use of a Schonstedt magnetometer to locate conductive utilities. Utility traces were marked with spray paint. General and area-specific utility clearances were approved by the IT Corporation (IT) Site Supervisor and WEC Superintendent prior to subsurface investigation. The utility clearances were updated as unexpected utilities were discovered in the excavation areas. Two active communications lines were damaged during the investigation. Neither of the communications lines were identified by the utility clearance.

A.2.2.1.2 Video Surveys

Pearpoint video survey equipment was used to investigate portions of the SWSs 1 and 5 collection systems. This “video mole” was used to reduce the required number of exploratory excavations by following pipes from known locations into areas where the piping configuration was poorly understood.

The video mole provided a radio location signal in addition to video data which allowed movements of the camera head to be tracked at the ground surface. The Pearpoint radio locator performed poorly in the field but was effectively replaced with a Schonstedt radio locator system. In some cases the Schonstedt radio locator system was used with a fish tape to trace pipes without adequate access for the video mole.

A.2.2.2 Drilling

A total of 17 boreholes were completed for the 3 leachfields. A Central Mining Equipment (CME) continuous core system and CME-95 hollow stem auger drill rig were provided by West HAZMAT, the drilling subcontractor. Utility clearances for excavation activities (see [Section A.2.2.1.1](#)) were

applied to the borehole locations. Boreholes were advanced to a minimum of 6.1 meters (m) (20 ft) bgs. Total depths for boreholes range from 6.1 to 11.1 m (20 to 36.5 ft) bgs (see [Appendix B](#)).

Boreholes were designated using the convention BWXYZ where W is the leachfield system number (1 or 5), X is the leachfield number (starting with 1), Y is the sequential borehole number (starting with 1), and Z is the sequential alphanumeric designator applied when the borehole is a stepout (starting with A). Boreholes shown on [Plate 1](#) are labeled using this convention.

Boreholes were abandoned using bentonite grout after completion of sampling activities at each leachfield, except boreholes B511, B512, and B513 which were abandoned with hydrated bentonite chips.

A.2.2.3 Waste Management

Investigation-derived waste was managed according to the requirements of the CAIP, Leachfield Work Plan, and contractor approved procedures. Investigation-derived waste was segregated into the following five waste streams:

- Personal Protective Equipment (PPE) and sampling equipment that contacted potentially contaminated media
- Decontamination rinsate that contacted potentially contaminated media
- Soil and debris incidental to sample collection (e.g., soil cuttings, discarded samples)
- Plastic or other material (e.g., soil, absorbent materials) contaminated by equipment hydrocarbon leaks (i.e., minor amounts of hydraulic oil from the drilling rig)
- PPE, debris, solvent and rinsate generated from the Hanby field-screening kit

Soil removed to expose leachfield system components and sampling horizons was used to backfill the excavations. Soil cuttings produced by drilling were containerized as investigation-derived waste (IDW). Potentially hazardous waste generated during site operations was properly labeled and transferred to a Hazardous Waste Accumulation Area daily. The IDW associated with the septic tanks was managed as potentially hazardous and potentially radioactive waste.

Based on characterization of the waste, the IDW will be disposed of as follows:

- 3 rinsate drums associated with septic tank sampling will be sampled directly and disposed of as sanitary or low-level radioactive waste (LLW) based on the sampling results.
- 3 PPE drums associated with septic tank sampling will be disposed of as LLW.
- 35 drums (8 rinsate and 27 soil, PPE and debris) associated with soil sampling will be disposed of as sanitary waste.
- 2 drums associated with Hanby TPH waste will be disposed of as hazardous waste.
- 1 drum associated with an operational diesel spill will be disposed of as hydrocarbon soil.

A.2.3 Leachfield System Sampling

Both the collection and distribution systems of the leachfields were sampled. Collection system samples include septic tank and distribution box contents and integrity samples. Distribution system samples consist of samples of native soil underlying the leachfields.

A.2.3.1 Sample Locations

The sampling locations for each site were selected based on the approach provided in the Leachfield Work Plan, process knowledge, engineering drawings, and interviews. Placement of the stepout boring was based on field-screening results. The planned sample locations are shown in the CAIP. Some locations were not used or vary from those planned because of field observations or conditions encountered during sampling. Actual sample locations are shown in [Figures A.2-1, A.2-2, and A.2-3](#).

A.2.3.2 Field Screening

Field screening activities were performed as specified in the CAIP. The field-screening level for VOC headspace was established at 20 parts per million (ppm) or 2.5 times background, whichever was greater. The field-screening level for TPH was the NDEP regulatory action level of 100 milligrams per kilogram (mg/kg) for TPH (NAC, 1998). Field screening for TPH was conducted only when the VOC field screening-level was exceeded. The site-specific field-screening levels for alpha and beta radiation were defined as the mean background activity level plus two times the standard deviation of readings from 20 background locations. These radiation field-screening levels

Explanation

- Septic Waste System 1 Line
- ST33-8 Septic Tank
- Distribution Box
- Fence
- Schematic Dimensions of Investigation Excavation
- T12LFP**
- B124** • Location of Soil Boring with Associated Sample Numbers

Scale

0 20 40 Feet

0 6 12 Meters

Figure A.2-3
Septic Waste Systems 1 and 5
Sample Locations

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are instrument specific and were established for each instrument prior to use. Field screening was conducted for VOCs using a headspace method (HNu photoionization detector and a warm water bath) and for alpha and beta radiation (using an Electra).

The field-screening level for VOCs was exceeded in one soil sample (sample number TTR01298) collected during the SWSs 1 and 5 investigation. Field-screening measurements for this soil, from 5.8 to 6.1 m (19 to 20 ft) bgs in borehole B121, identified a headspace VOC concentration of 29.4 ppm and a Hanby hydrocarbon field test kit value of 1 to 10 mg/kg motor oil. These measurements were not confirmed by laboratory analysis of the soil from this location. Total VOCs and TPH as diesel were not detected (see [Sections A.3.1](#) and [A.3.3](#)). Field-screening levels were not exceeded for soil from stepout borehole B121A, approximately 4.6 m (15 ft) to the northwest.

A.2.3.3 Leachfield System Component Sampling

Septic Waste System 1 and 5 leachfield system components were generally in good condition except those damaged or removed by construction activities contemporaneous with or subsequent to installation of the consolidated sewer system in 1990. Most discharge and outfall lines in the collection system were in good condition except those broken for installation of the consolidated sewer system pipes or other utilities. Extensive damage was inflicted on the abandoned SWSs 1 and 5 discharge and outfall lines in the vicinity of the active consolidated sewer system manways. Logically, the active consolidated sewer system is superimposed on the abandoned leachfield systems.

This investigation located Septic Tanks 33-1A, 33-1B, 33-1C, 33-2, 33-3, 33-8, and 33-10. The SWS 1 septic tanks located by the investigation are in the following condition:

- 33-1A is in good condition and is full of liquid and sludge.
- 33-1B is in good condition and is full of liquid and sludge.
- 33-1C is in good condition and is full of sand.
- 33-2 is in good condition and is full of concrete.
- 33-3 is in good condition and is full of liquid and sludge.
- 33-8 is in poor condition and contains a layer of soil.
- 33-10 is in poor condition and contains a layer of dried sludge.

The only SWS 5 septic tank (33-11) was not located by this investigation. The tank may never have existed, may be equivalent to another tank (see [Section A.2.4.1](#)), or it may have been removed. Removal of this tank was not documented but may have been required for general construction activities or utility installation within the Area 3 Compound.

No evidence of the suspected septic tank and pipes associated with Buildings 0100 and 0101 was found in the field. Excavation at the site of the “Suspected Septic Tank” shown in Figure 1-1 of the CAIP located only a clean out riser for the Septic Tank 33-8 outfall line. A drawing (RSN, 1989) inspected after the completion of the field investigation suggests that the suspected septic tank is located approximately 47 m (155 ft) to the northeast of the location shown in the CAIP. The drawing shows the tank 13.4 m (44 ft) south and 4.6 m (15 ft) west of the northwest corner of Building 0101.

The only distribution box investigated is associated with SWSs 1, Leachfield 2. The distribution box is in good condition and contained a layer of dried sludge.

Samples were collected from the leachfield system components in the sequence provided in [Table A.2-1](#).

Table A.2-1
Sample Container Collection Sequence

Collection Sequence	Liquid	Sludge	Soil
1st	Gamma Spectroscopy	Gamma Spectroscopy	Total VOCs
2nd	Isotopic Uranium	Isotopic Uranium	Total SVOCs, Total RCRA Metals, TPH (oil/diesel)
3rd	Total VOCs	Total VOCs	Gamma Spectroscopy*
4th	Total SVOCs	Total SVOCs, Total RCRA Metals, TPH (oil/diesel)	Isotopic Uranium*
5th	Total RCRA Metals	TCLP VOCs	
6th	TPH (oil/diesel)	TCLP SVOCs	
7th		TCLP RCRA Metals	

*No gamma spectroscopy or isotopic uranium soil samples were collected in the field because radiological field-screening levels were not exceeded.

VOC = Volatile Organic Compounds

SVOC = Semivolatile Organic Compounds

RCRA = *Resource Conservation and Recovery Act*

TPH = Total Petroleum Hydrocarbons

TCLP = Toxicity Characteristic Leaching Procedure

A.2.3.3.1 Septic Tank Contents

Septic tank contents were sampled for Septic Tanks 33-1A, 33-1B, 33-3, and 33-10. The septic tanks contained both liquid and sludge components, except Septic Tank 33-10 which contained only a several-inch-thick layer of dried sludge. Septic Tank 33-8 contained no liquid and the bottom of the tank is covered by soil that has entered through the access point at the top of the tank. The contents of Septic Tank 33-8 were not sampled because the exposed material did not appear to be related to effluent and several conditions precluded access, including the depth of the excavation required to reach the tank and the construction and dimensions of the tank. The contents of the suspected septic tank are unknown.

The three septic tanks containing both liquid and sludge were sampled from progressively deeper phases. Overlying liquids were sampled prior to sampling underlying sludge. Material was removed from each tank using a dedicated, disposable, long-handle, 1-liter polyethylene scoop. The material was field screened for VOCs while in the scoop. Liquid was field screened for radiation by pouring it into a styrofoam plate and holding the Electra probe as close as possible to the liquid surface. Sludge was screened for radiation after the removal of water by gravity filtration with cheesecloth. All field-screened material was returned to the associated septic tank after sampling activities at the septic tank were completed.

Liquids were poured directly from the scoop into the sample containers. In most cases, the thicker, more viscous sludge was poured from the scoop into the sample containers through a decontaminated stainless steel funnel. Samples were collected in uniquely marked, appropriate containers. Sample containers were filled according to the sequence for liquid or sludge samples based on the sample media (see [Table A.2-1](#)). Material not used for sample collection was returned to the septic tank. In most cases, the sealed sample containers were decontaminated with an alconox and water solution and rinsed with water prior to application of the custody seals and permanent sample labels.

Minimal variations in sample collection were required for Septic Tank 33-10. Three large chunks of the dried sludge were removed from the tank with a decontaminated shovel and rake used as tongs and were placed in a plastic bag until transferred into a stainless steel bowl. The material was field screened for VOCs and radioactivity in the bowl prior to filling sample containers according to the sequence for sludge samples (see [Table A.2-1](#)). Decontaminated stainless steel spoons were used to

expose fresh material within these chunks and transfer it to sample containers or a second stainless steel bowl for homogenization and sample collection as required.

A.2.3.3.2 Septic Tank Integrity

Septic tank integrity samples were collected for Septic Tanks 33-1A, 33-1B, 33-1C, 33-2, 33-3, and 33-10. Septic tank integrity samples could not be collected for Septic Tank 33-8 due to access problems, including extensive concrete cover at both ends of the tank and numerous underground and overhead utilities. Septic tank integrity samples were not collected for the suspected septic tank because it was not located during the field investigation.

Septic tank integrity samples were collected by expanding the excavations used to expose the septic tank lids. The excavations exposed the influent and effluent pipes allowing soil underlying the pipes to be sampled. Two septic tank integrity samples were collected for each septic tank from soil located immediately below the pipes and adjacent to the tanks.

Soil was screened for health and safety parameters and field screened for radiation *in situ*. Labelled sample containers were filled according to the sequence for soil samples (see [Table A.2-1](#)). The total VOCs sample container was filled with soil directly from the excavation followed by collection of material for field screening. Additional soil was transferred into a stainless steel bowl and homogenized prior to filling the remaining sample containers. Excess soil was returned to the excavation after custody seals were applied to the samples.

A.2.3.3.3 Distribution Box

Septic Waste System 1, Leachfield 2 is the only investigated leachfield with a distribution box. The contents of the distribution box were almost entirely removed by sampling. Sample containers were filled according to the sequence for sludge samples (see [Table A.2-1](#)) using methods analogous to the collection of the septic tank contents samples. The sludge consisted of dry, fine-grained material. Two integrity samples were collected from the distal end of the distribution box using methods analogous to the collection of septic tank integrity samples.

A.2.3.3.4 Medical Trailer Pipe

One sludge sample was collected from the distal end of the former Medical Trailer pipe connected to SWS 1. The sample was collected based on the Site Supervisor's discretion to determine if the effluent from the former Medical Trailer was significantly different from other SWS 1 effluent. Sample containers were filled according to the sequence for sludge samples (see [Table A.2-1](#)) using methods analogous to the collection of the septic tank contents samples. This sample was collected using a stainless steel spoon to transfer sludge from the pipe into the total VOCs container and then to a stainless steel bowl for homogenization. The remaining sample containers were filled with the homogenized sludge. Samples for TCLP analysis were not collected due to limited volume of sludge within the pipe.

A.2.3.4 Leachfield Sampling

Leachfields were sampled using excavations and drilling. Excavation samples were collected from soil at the leachrock and native soil interface and at relatively shallow depths under the interface. Drilling allowed confirmatory samples to be collected from greater depths within the leachfield boundaries.

A.2.3.4.1 Excavation Sampling

Samples were collected from soil underlying distribution pipes exposed by excavations within the leachfields. The upper sampling interval was at the interface between leachrock and native soil and the lower interval was approximately 0.75 m (2.5 ft) below the interface. All excavation samples collected were submitted to the laboratory for analysis. Field-screening levels were not exceeded for any samples collected from leachfield excavations.

Soil samples were collected either directly from the excavation or from the backhoe bucket. Samples were collected directly from the excavations to maximize sample quality when personnel safety was adequate. Soil was screened for health and safety parameters and field screened for radiation *in situ*. Labelled sample containers were filled according to the sequence for soil samples (see [Table A.2-1](#)). The total VOCs sample container was filled with soil directly from the excavation or backhoe bucket followed by collection of material for field screening. Additional soil was transferred into a stainless

steel bowl and homogenized prior to filling the remaining sample containers. Excess soil was returned to the excavation after custody seals were applied to the samples.

A.2.3.4.2 Drilling Sampling

Drilling leachfield samples were collected at 5-ft intervals and at the interface between leachrock and native soil if not already sampled by excavations. When the interface depth was known based on excavation, sample collection did not begin until after the interface depth was reached.

Core barrels from the continuous core system were transferred to the sampling table prior to removing the cutting shoe. The core barrels were opened by the sampler and the soil was screened for health and safety parameters and for radiation. Labelled sample containers were filled according to the sequence for soil samples (see [Table A.2-1](#)). The total VOCs sample container was filled with soil directly from the core barrel followed by collection of material for field screening. Additional soil was transferred into a stainless steel bowl and homogenized prior to filling the remaining sample containers. Excess soil was containerized as IDW after custody seals were applied to the samples.

A.2.3.5 Acid Waste Sewer Outfall Sampling

Samples were not recovered from the SWS 5 Acid Waste Sewer Outfall. The Acid Waste Sewer Outfall is not located under the Area 3 boxcars (B01 - B12 shown on [Plate 1](#)) because the discharge line was not located in T51ASO (see [Figure A.2-1](#)). Extensive excavation north and northwest of Building 03-73 failed to locate the Acid Waste Sewer Outfall. It is assumed that all SWS 5 effluent was routed to the SWS 5 Leachfield and SWS 1.

A.2.4 Septic Waste System 1 Leachfields

Septic Waste System 1 was used to dispose of most effluent generated in the northern portion of Area 3. Construction apparently progressed from east to west as this system was enlarged over time to receive effluent from new buildings.

A.2.4.1 Initial Configuration

The initial configuration of SWS 1 may have shared the leachfield addressed as SWS 5, Leachfield 1 (see [Section A.2.5](#)). Objective evidence of this shared leachfield has been obliterated by installation

of the active consolidated sewer system manways and pipes. The interconnection of SWSs 1 and 5 is complicated and appears to have occurred in several places as the systems developed.

It is unlikely that SWS 1, Leachfield 1 was the first leachfield used due to the relatively long distance separating it from Building 03-50. It is more likely that one leachfield was used for all effluent generated by Building 03-50 until further development in Area 3 required additional disposal capacity. As stated in Section 2.2.1 of the CAIP, Septic Tank 33-1 consisted of a single tank until approximately 1962 when two more septic tanks were added, resulting in three, in-series tanks identified as Septic Tank 33-1. Septic Tanks 33-11 and 33-1C (the single tank used prior to 1962) may be the same tank.

A.2.4.2 Septic Waste System 1, Leachfield 1

Septic Waste System 1, Leachfield 1 (Leachfield A in CAIP) is a four-pipe branching leachfield that extends under the loading dock and concrete pad north of Building 03-73. The leachfield was in good condition and constructed from 10-cm (4-in.) vitrified clay pipe (VCP) tiles surrounded by gravel-sized leachrock. The distribution lines extend approximately 14 m (46 ft) from the single 10-cm (4-in.) VCP central distribution manifold. This leachfield was probably used after SWS 5, Leachfield 1 was abandoned and prior to construction of SWS 1, Leachfield 2.

Soil samples were not collected from excavations for the distal ends of distribution pipes on the south side of SWS 1, Leachfield 1 because access was restricted by the concrete pad and loading dock. Soil samples were collected from excavations 4.3 and 5.8 m (14 and 19 ft) from the distal ends of the distribution pipes on the north side of the leachfield because the distribution lines are longer than expected based on an engineering drawing. Samples were collected at the distal ends of the distribution pipes on both sides of the leachfield by drilling.

A.2.4.3 Septic Waste System 1, Leachfield 2

Septic Waste System 1, Leachfield 2 (Leachfield B in CAIP) is a three-pipe leachfield that extends under the loading dock and concrete pad north of Building 03-73. The leachfield was in good condition and constructed from 10-cm (4-in.) perforated plastic pipe surrounded by gravel-sized leachrock. The distribution lines extend approximately 64 m (210 ft) from a distribution box located

just north of the Area 3 security fence. This leachfield was probably used after SWS 1, Leachfield 1 was abandoned and prior to construction of the consolidated sewer system in Area 3.

Soil samples were not collected from the excavation at the distal end of the SWS 1, Leachfield 2 east distribution pipe due to depth of fill over the line. Samples were collected at the distal end of the distribution pipe by drilling.

A.2.5 Septic Waste System 5, Leachfield 1

Septic Waste System 5, Leachfield 1 is a four-pipe leachfield that extends under the main north trending road in Area 3. The leachfield was in good condition and constructed from 10-cm (4-in.) VCP tiles surrounded by gravel-sized leachrock. The distribution lines extend approximately 23 m (75 ft) from the 10-cm (4-in.) VCP distribution manifold located at the proximal end of the leachfield. This leachfield was probably abandoned after construction of SWS 1, Leachfield 1.

Soil samples were not collected from excavations for the proximal end of a SWS 5, Leachfield 1 for one distribution pipe because only three lines were exposed during the excavation. The central distribution line exposed at the proximal end of the leachfield apparently splits into two distribution lines. The fourth distribution line in the leachfield was discovered at the distal end of the leachfield.

A.2.6 Geology

The SWSs 1 and 5 site consists of reworked and compacted sands and gravels overlying native soils. Regional native surface soil consists of poorly graded, moderately consolidated alluvial silty sands with gravel and cobble-sized volcanic detritus (DOE/NV, 1996a). Field Descriptions were performed for each boring by the field geologist and recorded on Visual Classification of Soil Logs ([Appendix C](#)) and augmented by laboratory analysis of eight geotechnical samples (see [Section A.3.8](#)). The strata encountered below the leachfields are summarized below:

- Gravelly sand with fines
- Gravelly sand
- Well-graded sands

Results of the geotechnical and hydrological analysis of the samples will be discussed in the final revision of this document.

A.2.7 Hydrology

The Area 3 topography slopes gently to the northwest with surface drainage flowing in the same direction. Depth to groundwater beneath Area 3 is estimated at 110 to 120 m (361 to 394 ft) bgs (DOE/NV, 1996a). Potential contamination associated with SWSs 1 and 5 is limited to a shallow vadose zone less than 6.1 m (20 ft) bgs. Groundwater at the TTR is not expected to be impacted by COPC migration due to the depth of groundwater. No saturated zones (e.g., perched water, contaminant saturation) were found in the subsurface below the leachfield systems.

A.3.0 Investigation Results

The analytical results of samples collected from the CAU 428 investigation have been compiled and evaluated to determine the presence and/or extent of contamination. The analytical results that are above the minimum reporting limits are summarized in the following subsections. The complete laboratory result data packages are available in the project files.

During investigation activities, 106 soil, 8 sludge, and 40 water samples were submitted for analyses. All analyses were performed by Paragon Analytics, Inc., Fort Collins, Colorado except for the geotechnical analyses performed by Daniel B. Stephens, Inc., Albuquerque, New Mexico. A list of the samples submitted to the laboratory are presented in [Table A.3-1](#). Sample collection locations and associated sample numbers are shown on [Figures A.2-1, A.2-2, and A.2-3](#).

The analytical parameters and laboratory analytical methods requested for this investigation are presented in [Table A.3-2](#). In some cases, both “totals” and TCLP samples were collected. In these cases, “totals” results were used for comparability with previous sampling and other samples collected, and the TCLP results were used for waste management.

The analytical parameters were selected through the application of site process knowledge according to the EPA’s *Guidance for the Data Quality Objectives Process* (EPA, 1994a). Preliminary action levels for off-site laboratory analytical methods were determined during the DQO process (EPA, 1998) and are documented in the Leachfield Work Plan and CAIP. Sampling activities were conducted to confirm or disprove assumptions (i.e., models outlined in CAIP) made in the DQO process.

A.3.1 Total Volatile Organic Compound Analytical Results

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

Table A.3-1
Samples Collected During Septic Waste Systems 1 and 5
Corrective Action Investigation
(Page 1 of 7)

Sample Number	Sample Location	Depth Below Datum	Sample Matrix	Quality Control Comments	Parameters Analyzed
TTR01180	E11ST331ASE	3.5-4.0 ft bgs	Soil		Set 4
TTR01181	E11ST331CNW	3.0-3.5 ft bgs	Soil		Set 4
TTR01182	E11ST331CNW	3.0 ft bgs	Soil		Set 4
TTR01183	N/A	N/A	Water	Trip Blank	VOCs
TTR01184	E11ST331A	2.0 ft bts	Liquid		Set 1
TTR01185	E11ST331A	~5 ft bts	Sludge		Set 2
TTR01186	E11ST331B	1 ft bts	Liquid		Set 1
TTR01187	E11ST331B	~ 5 ft bts	Sludge		Set 2
TTR01188	N/A	N/A	Water	Trip Blank	VOCs
TTR01189	N/A	N/A	Water	Trip Blank	VOCs
TTR01190	E11ST332	N/A	Water	Equipment Rinsate Blank	Set 1
TTR01191	E11ST332N	0-6 in bsp	Soil		Set 4
TTR01192	E11ST332S	1.0-1.5 ft bts	Soil		Set 4
TTR01193	E11ST332	N/A	Water	Field Blank	Set 1
TTR01194	N/A	N/A	Water	Trip Blank	VOCs
TTR01195	E11FMTJ	3 ft bgs	Soil/Sludge		Set 4
TTR01196	E12ST333	1 ft bts	Liquid		Set 1
TTR01197	E12ST333	6 ft bts	Sludge		Set 2
TTR01198	E12ST333N	3.5-4.0 ft bgs	Soil		Set 4
TTR01199	E12ST333S	3.5-4.0 ft bgs	Soil		Set 4
TTR01200	E12ST3310	4 ft bts	Soil/Sludge		Set 2
TTR01201	E12ST3310E	4.0-4.5 ft bgs	Soil		Set 4
TTR01202	E12ST3310W	2.0-2.5 ft bgs	Soil		Set 4
TTR01203	N/A	N/A	Water	Trip Blank	VOCs
TTR01204	E12ST333	1 ft bts	Liquid	Field Duplicate of TTR01196 and Designated as MS/MSD Sample	Set 1

Table A.3-1
Samples Collected During Septic Waste Systems 1 and 5
Corrective Action Investigation
(Page 2 of 7)

Sample Number	Sample Location	Depth Below Datum	Sample Matrix	Quality Control Comments	Parameters Analyzed
TTR01205	E12ST333	4 ft bts	Sludge	Field Duplicate of TTR01197 and Designated as MS/MSD Sample	Set 1
TTR01206	N/A	N/A	Water	Trip Blank	VOCs
TTR01207	E11ST331CSE	1.5 ft bts	Soil		Set 4
TTR01208	E11ST331BSE	1.0 ft bts	Soil		Set 4
TTR01209	DLSWPA	7.0 ft bgs	Soil		Set 5
TTR01210	DLSEPA	6 ft 6 in bgs	Soil		Set 5
TTR01211	DLSEPB	9 ft bgs	Soil		Set 4
TTR01212	N/A	N/A	Water	Trip Blank	VOCs
TTR01213	DLNEPA	7 ft bgs	Soil		Set 5
TTR01214	DLNEPB	9.5 ft bgs	Soil		Set 4
TTR01215	DLSWPB	9.5 ft bgs	Soil		Set 4
TTR01216	DLNWPA	5.5 ft bgs	Soil		Set 5
TTR01217	DLNWPB	8 ft bgs	Soil		Set 4
TTR01218	DLNEDA	6 ft 6 in bgs	Soil		Set 5
TTR01219	DLNEDB	9 ft bgs	Soil		Set 4
TTR01220	DLNWDA	5.5 ft bgs	Soil		Set 5
TTR01221	DLNWDB	8 ft bgs	Soil		Set 4
TTR01222	SWS1,LF1	N/A	Water	Field Blank	Set 1
TTR01223	N/A	N/A	Water	Trip Blank	VOCs
TTR01224	N/A	N/A	Water	Trip Blank	VOCs
TTR01225	5DLSWPA	5 ft bgs	Soil		Set 5
TTR01226	5DLSWPB	7.5 ft bgs	Soil		Set 4
TTR01227	5DLSPA	5 ft bgs	Soil		Set 5
TTR01228	5DLSPB	7.5 ft bgs	Soil		Set 4
TTR01229	5DLSEPA	6.5 ft bgs	Soil		Set 5

Table A.3-1
Samples Collected During Septic Waste Systems 1 and 5
Corrective Action Investigation
(Page 3 of 7)

Sample Number	Sample Location	Depth Below Datum	Sample Matrix	Quality Control Comments	Parameters Analyzed
TTR01230	5DLSEPA	6.5 ft bgs	Soil	Field Duplicate of TTR01229	Set 5
TTR01231	5DLSEPB	9 ft bgs	Soil		Set 4
TTR01232	5DLSEDA	7 ft bgs	Soil		Set 5
TTR01233	5DLSEDB	9 ft bgs	Soil		Set 4
TTR01234	5DLS2DA	7 ft bgs	Soil	Designated as MS/MSD Sample	Set 5
TTR01235	5DLS2DB	9.5 ft bgs	Soil		Set 4
TTR01236	N/A	N/A	Water	Trip Blank	VOCs
TTR01237	5DLS1DA	6 ft bgs	Soil		Set 5
TTR01238	5DLS1DB	8.5 ft bgs	Soil		Set 4
TTR01239	5DLSWDA	6 ft bgs	Soil		Set 5
TTR01240	5DLSWDB	9 ft bgs	Soil		Set 4
TTR01241	N/A	N/A	Water	Trip Blank	VOCs
TTR01242	T12LFP DLEPA	9 ft bgs	Soil		Set 5
TTR01243	T12LFP DLEPB	11.5 ft bgs	Soil		Set 4
TTR01244	T12LFP DLCPA	6 ft bgs	Soil		Set 5
TTR01245	T12LFP DLCPB	8.5 ft bgs	Soil		Set 4
TTR01246	T12LFP DLWPA	5.5 ft bgs	Soil		Set 5
TTR01247	T12LFP DLWPA	5.5 ft bgs	Soil	Field Duplicate of TTR01246	Set 5
TTR01248	T12LFP DLWPB	8.0 ft bgs	Soil		Set 4
TTR01249	T12LFD DLWDA	7.0 ft bgs	Soil	Designated as MS/MSD Sample	Set 5
TTR01250	T12LFD DLWDB	9.5 ft bgs	Soil		Set 4
TTR01251	T12LFD DLCDA	6.5 ft bgs	Soil		Set 5
TTR01252	T12LFD DLCDB	9.0 ft bgs	Soil		Set 4
TTR01253	N/A	N/A	Water	Trip Blank	VOCs
TTR01254	N/A	N/A	Water	Trip Blank	VOCs

Table A.3-1
Samples Collected During Septic Waste Systems 1 and 5
Corrective Action Investigation
(Page 4 of 7)

Sample Number	Sample Location	Depth Below Datum	Sample Matrix	Quality Control Comments	Parameters Analyzed
TTR01255	N/A	N/A	Water	Trip Blank	VOCs
TTR01256	N/A	N/A	Water	Trip Blank	VOCs
TTR01257	N/A	N/A	Water	Field Blank	Set 2
TTR01258	N/A	N/A	Water	Trip Blank	VOCs
TTR01259	N/A	N/A	Water	Source Blank	Set 1
TTR01260	N/A	N/A	Water	Trip Blank	VOCs
TTR01261	N/A	N/A	Water	Equipment Rinsate Blank	Set 1
TTR01262	Borehole B511	14-15 ft bgs	Soil		Set 5
TTR01263	Borehole B511	18-20 ft bgs	Soil		Set 4
TTR01264	Borehole B512	14-15 ft bgs	Soil		Set 5
TTR01265	Borehole B512	18-20 ft bgs	Soil		Set 4
TTR01266	Borehole B513	14-15 ft bgs	Soil		Set 5
TTR01267	Borehole B513	17.5-20.2 ft bgs	Soil		Set 4
TTR01268	Borehole B514	9.5-10.5 ft bgs	Soil		Geotechnical
TTR01269	Borehole B514	14-15 ft bgs	Soil		Set 5
TTR01270	Borehole B514	19-20 ft bgs	Soil		Set 4
TTR01271	Borehole B515	14-15 ft bgs	Soil		Set 5
TTR01272	Borehole B515	19-20 ft bgs	Soil		Set 4
TTR01273	N/A	N/A	Water	Trip Blank	VOCs
TTR01274	Borehole B111	4-5 ft bgs	Soil		Set 4
TTR01275	Borehole B111	9-10 ft bgs	Soil		Set 5
TTR01276	Borehole B111	14-15 ft bgs	Soil		Set 5
TTR01277	Borehole B111	19-20 ft bgs	Soil		Set 4
TTR01278	N/A	N/A	Water	Trip Blank	VOCs
TTR01279	SWS1 LF1	N/A	Water	Field Blank	Set 1
TTR01280	Borehole B112	4-5 ft bgs	Soil		Set 4

Table A.3-1
Samples Collected During Septic Waste Systems 1 and 5
Corrective Action Investigation
(Page 5 of 7)

Sample Number	Sample Location	Depth Below Datum	Sample Matrix	Quality Control Comments	Parameters Analyzed
TTR01281	Borehole B112	9-10 ft bgs	Soil	Designated as MS/MSD Sample	Set 5
TTR01282	Borehole B112	14-15 ft bgs	Soil		Set 5
TTR01283	Borehole B112	14-15 ft bgs	Soil	Field Duplicate of TTR01282	Set 4
TTR01284	Borehole B112	19-20 ft bgs	Soil		Set 4
TTR01285	N/A	N/A	Water	Trip Blank	VOCs
TTR01286	Borehole B113	14-15 ft bgs	Soil		Set 5
TTR01287	Borehole B113	19-20 ft bgs	Soil		Set 4
TTR01288	Borehole B114	9-10 ft bgs	Soil		Set 4
TTR01289	Borehole B114	14.5-15.5 ft bgs	Soil		Set 5
TTR01290	Borehole B114	19-20 ft bgs	Soil		Set 4
TTR01291	Borehole B114	13.5-14.5 ft bgs	Soil		Geotechnical
TTR01292	Borehole B115	14-15 ft bgs	Soil		Set 5
TTR01293	Borehole B115	19-20 ft bgs	Soil		Set 4
TTR01294	Borehole B116	14-15 ft bgs	Soil		Set 5
TTR01295	Borehole B116	19-20 ft bgs	Soil		Set 4
TTR01296	N/A	N/A	Water	Trip Blank	VOCs
TTR01297	Borehole B121	14-15 ft bgs	Soil		Set 5
TTR01298	Borehole B121	19-20 ft bgs	Soil		Set 4
TTR01299	Borehole B121	24-25 ft bgs	Soil		Set 4
TTR01300	Borehole B121	29-30 ft bgs	Soil		Set 4
TTR01301	Borehole B122	9-10 ft bgs	Soil		Set 4
TTR01302	Borehole B122	14-15 ft bgs	Soil		Set 5
TTR01303	N/A	N/A	Water	Trip Blank	VOCs
TTR01304	Borehole B122	24-25 ft bgs	Soil	Designated as MS/MSD Sample	Set 4

Table A.3-1
Samples Collected During Septic Waste Systems 1 and 5
Corrective Action Investigation
(Page 6 of 7)

Sample Number	Sample Location	Depth Below Datum	Sample Matrix	Quality Control Comments	Parameters Analyzed
TTR01305	Borehole B122	34-35 ft bgs	Soil		Set 4
TTR01306	Borehole B121A	4-5 ft bgs	Soil		Set 4
TTR01307	Borehole B121A	9-10 ft bgs	Soil		Set 4
TTR01308	N/A	N/A	Water	Trip Blank	VOCs
TTR01309	N/A	N/A	Water	Field Blank	Set 1
TTR01310	Borehole B121A	19-20 ft bgs	Soil		Set 4
TTR01311	Borehole B121A	24-25 ft bgs	Soil		Set 4
TTR01312	Borehole B123	6-8 ft bgs	Soil		Set 4
TTR01313	Borehole B123	9-10 ft bgs	Soil		Set 5
TTR01314	Borehole B123	9-10 ft bgs	Soil	Field Duplicate of TTR01313	Set 5
TTR01315	Borehole B123	19-20 ft bgs	Soil		Set 4
TTR01316	N/A	N/A	Water	Trip Blank	VOCs
TTR01317	N/A	N/A	Water	Field Blank	Set 1
TTR01318	Borehole B125	15.5-16.5 ft bgs	Soil		Geotechnical
TTR01319	Borehole B124	8-9 ft bgs	Soil		Set 5
TTR01320	Borehole B124	14-15 ft bgs	Soil	Designated as MS/MSD Sample	Set 4
TTR01321	Borehole B124	18-19 ft bgs	Soil		Set 4
TTR01322	Borehole B125	6-7 ft bgs	Soil		Set 4
TTR01323	Borehole B125	14-15 ft bgs	Soil		Set 5
TTR01324	Borehole B125	24-25 ft bgs	Soil		Set 4
TTR01325	Borehole B125	25.5-26.5 ft bgs	Soil		Geotechnical
TTR01326	Borehole B125	24-25 ft bgs	Soil		Set 4
TTR01327	N/A	N/A	Water	Trip Blank	VOCs
TTR01328	N/A	N/A	Water	Trip Blank	VOCs

Table A.3-1
Samples Collected During Septic Waste Systems 1 and 5
Corrective Action Investigation
(Page 7 of 7)

Sample Number	Sample Location	Depth Below Datum	Sample Matrix	Quality Control Comments	Parameters Analyzed
TTR01329	E12DB	5 ft bgs	Soil/Sludge	Designated as MS/MSD Sample	Set 2
TTR01330	E12DB	5 ft bgs	Soil/Sludge	Field Duplicate of TTR01329	Set 2
TTR01331	E12DBA	7 ft bgs	Soil		Set 4
TTR01332	E12DBB	9.5 ft bgs	Soil		Set 3
TTR01333	N/A	N/A	Water	Trip Blank	VOCs

Set 1: Analytical parameters are Total VOC, Total SVOC, Total RCRA Metals, TPH-Diesel/Oil, Gamma Spectroscopy, Isotopic Uranium

Set 2: Analytical parameters are Total VOC, Total SVOC, Total RCRA Metals, TPH-Diesel/Oil, TCLP VOC, TCLP SVOC, TCLP RCRA Metals, Gamma Spectroscopy, Isotopic Uranium

Set 3: Analytical parameters are Total VOC, Total SVOC, Total RCRA Metals, TPH-Diesel/Oil, TCLP VOC, TCLP SVOC, TCLP RCRA Metals

Set 4: Analytical parameters are Total VOCs, Total SVOCs, Total RCRA Metals, TPH Diesel/Oil

Set 5: Analytical parameters are Total VOCs, Total SVOCs, Total RCRA Metals, TPH Diesel/Oil, Isotopic Uranium

Geotechnical: Analytical parameters are Initial Moisture Content, Dry Bulk Density, Calculated Porosity, Moisture Retention Characteristics, Particle Size Distribution, Saturated/Unsaturated Hydraulic Conductivity

N/A = Not Applicable

MS/MSD = Matrix Spike/Matrix Spike Duplicate

bts = Below tank surface

bsp = Below septic pipe

Table A.3-2
Laboratory Analytical Methods Used for Samples Collected at the
CAU 428, Septic Waste Systems 1 and 5, Tonopah Test Range

Analytical Parameter	Analytical Method
Total VOCs	EPA 8260B 5030B ^a
Total SVOCs	EPA 8270C ^a
Total RCRA metals (arsenic, barium, cadmium, chromium, lead, selenium, silver, and mercury)	EPA 6010B/7470A ^a EPA 6010B/7471A ^a
Total petroleum hydrocarbons - diesel/oil range	EPA 8015B (modified) ^a
Toxicity Characteristic Leaching Procedure VOCs	EPA 1311/8260B 5030B ^a
TCLP SVOCs	EPA 1311/8270C ^a
TCLP RCRA Metals	EPA 1311/6010B/ 7470A ^a
Gamma-emitting radionuclides	SOP 739/713 ^b
Isotopic uranium	PAI 777/778/714 ^b

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

^bParagon Analytics, Incorporated, *Standard Operation Procedure Manual* (PAI, 1996 and 1999)

Table A.3-3
Soil Sample Results for Total Volatile Organic Compounds
Detected Above Minimum Reporting Limits
Septic Waste Systems 1 and 5 Corrective Action Investigation

Sample No.	Sample Location	Depth Below Datum	Contaminants of Potential Concern (µg/kg)
			Acetone
Preliminary Action Level ^a (µg/kg)			6,100,000
TTR01269	B514	14-15 ft bgs	35
TTR01271	B515	14-15 ft bgs	36
TTR01280	B112	4-5 ft bgs	80
TTR01299	B121	24-25 ft bgs	23
TTR01301	B122	9-10 ft bgs	96
TTR01312	B123	6-8 ft bgs	59
TTR01319	B124	8-9 ft bgs	26

^aEnvironmental Protection Agency Region 9, Industrial Preliminary Remediation Goals (PRGs) (EPA, 1998)

Acetone was the only total VOC detected. No process knowledge was identified to indicate that any release or disposal of acetone occurred. Therefore, for the purpose of waste management, acetone would not be considered “listed.”

A.3.2 Total Semivolatile Organic Compound Analytical Results

The total SVOC analytical results detected above minimum reporting limits established in the CAIP, along with the associated PALs, are presented in [Table A.3-4](#). Total SVOCs were detected only in sample TTR01180 and the result for benzo(a)pyrene exceed the PALs (DOE/NV, 1999; EPA, 1998).

Sample TTR01180 also had a bis(2-ethylhexyl)phthalate concentration of 1,700 (µg/kg) which is well below the 210,000 µg/kg PAL (DOE/NV, 1999; EPA, 1998). This constituent is a common laboratory contaminant.

Table A.3-4
Soil Sample Results for Total Semivolatile Organic Compounds
Detected Above Minimum Reporting Limits
Septic Waste Systems 1 and 5 Corrective Action Investigation

Sample No.	Sample Location	Depth Below Datum	Contaminants of Potential Concern (µg/kg)						
			Benzo(a) Anthracene	Benzo(a) Pyrene	Benzo(b) Fluoranthene	Bis(2-Ethylhexyl) Phthalate	Chrysene	Fluoranthene	Pyrene
Preliminary Action Levels ^a (µg/kg)			3,600	360	3,600	210,000	360,000	37,000,000	26,000,000
TTR01180	E11ST331ASE	3.5 - 4.0 ft bgs	500	480 (J) ^b	820 (J) ^b	1,700	570	550	630

^aEnvironmental Protection Agency Region 9, Industrial Preliminary Remediation Goals (PRGs) (EPA, 1998)

^bThe area of the interval standard exceeded the criteria.

bgs = Below ground surface

µg/kg = Microgram(s) per kilogram

J = Estimated value (see [Section A.4.7](#))

Shading indicates result above Preliminary Action Level

A.3.3 Total Petroleum Hydrocarbon Analytical Results

The TPH-diesel concentrations detected above the minimum reporting limits (DOE/NV, 1999) are presented in [Table A.3-5](#). No TPHs were detected in the diesel range above the NDEP regulatory action level of 100 mg/kg (NAC, 1998).

**Table A.3-5
Soil Sample Results for Total Petroleum Hydrocarbons
Detected Above Minimum Reporting Limits
Septic Waste Systems 1 and 5 Corrective Action Investigation**

Sample No.	Sample Location	Depth Below Datum	Contaminants of Potential Concern (mg/kg)
			Diesel Range Organics
Preliminary Action Level ^a (mg/kg)			100
TTR01181	E11ST331CNW	3.0-3.5 ft bgs	40
TTR01182		3 ft bgs	31
TTR01192	E11ST332S	1.0-1.5 ft bts	41
TTR01201	E12ST3310E	4.0-4.5 ft bgs	43
TTR01202	E12ST3310W	2.0-2.5 ft bgs	90
TTR01207	E11ST331CSE	1.5 ft bts	55
TTR01312	B123	6-8 ft bgs	29

^aNevada Department of Environmental Protection regulatory action level for total petroleum hydrocarbons (NAC, 1998)

bgs = Below ground surface

bts = Below tank surface

mg/kg = Milligram(s) per kilogram

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.3-6](#). The total RCRA metal results were all below the PALs except for arsenic (DOE/NV, 1999; EPA, 1998).

Arsenic was detected above the PAL of 3.0 mg/kg in all of the samples analyzed. The arsenic concentrations for the samples analyzed ranged from 4 mg/kg to 68.7 mg/kg. Arsenic contamination is present in shallow soils associated with the proximal end of SWS 5 Leachfield 1, but only sample TTTR01227 exceeds expected arsenic concentrations at the site. The highest concentrations of arsenic are present in soil at the native soil and leachrock interface under the central distribution pipe.

The source of arsenic contamination in SWS 5 Leachfield 1 is unknown, but was probably contained within Building 03-50 or the Former Medical Trailer. Application of arsenic containing pesticides or

Table A.3-6
Soil Sample Results for Total RCRA Metals Detected Above
Minimum Reporting Limits, Septic Waste Systems 1 and 5
Corrective Action Investigation
(Page 1 of 5)

Sample No.	Sample Location	Sample Interval	Contaminants of Potential Concern (mg/kg)						
			Arsenic	Barium	Chromium	Lead	Mercury	Selenium	Silver
Preliminary Action Levels (mg/kg) ^a			3.0	100,000	450	1,000	560	9,400	9,400
TTR01180	E11ST331ASE	3.5-4 ft bgs	10.8	143	10.4	11.6	--	--	--
TTR01181	E11ST331CNW	3.0-3.5 ft bgs	6.7	202	6.7	8.3	0.1 (B) ^b	--	--
TTR01182	E11ST331CNW	3.0 ft bgs	9.3	92.3	5.8	8.8	0.1 (B) ^b	--	--
TTR01191	E11ST332N	0-6 in bsp	20.1	118	4.1	8.2	--	--	6.3
TTR01192	E11ST332S	1.0-1.5 ft bts	12.1	152	3.6	5.7	--	--	16.7
TTR01198	E12ST333N	3.5-4.0 ft bgs	7.1	110	5	7.8 (J) ^{c,d}	--	--	--
TTR01199	E12ST333S	3.5-4.0 ft bgs	4.8	93.1	4.3	8.2 (J) ^{c,d}	--	--	--
TTR01201	E12ST3310E	4.0-4.5 ft bgs	5.3	73.9	5.3	10.3 (J) ^{c,d}	0.31	0.58	1.2
TTR01202	E12ST3310W	2.0-2.5 ft bgs	5.3	91.9	7.6	10.6 (J) ^{c,d}	0.13	--	--
TTR01207	E11ST331CSE	1.5 ft bts	11.3	139	7	9.1	0.13	--	--
TTR01208	E11ST331BSE	1 ft bts	10.5	161	6.8	8.9	--	--	--
TTR01209	DLSWPA	7 ft bgs	6.3	154	5	9	--	--	--
TTR01210	DLSEPA	6 ft 6 in bgs	7.3	195	6.6	10.4	--	--	--
TTR01211	DLSEPB	9 ft bgs	5.9	113	6.2	8.9	--	--	--
TTR01213	DLNEPA	7 ft bgs	6.5	93.7	5.1	8	--	0.8	--
TTR01214	DLNEPB	9.5 ft bgs	5.9	117	4.8	7.3	--	--	--
TTR01215	DLSWPB	9.5 ft bgs	5.9	78.8	3.5	6.5	--	--	--
TTR01216	DLNWPA	5.5 ft bgs	7.9	134	4.3	7.1	--	--	--
TTR01217	DLNWPB	8 ft bgs	6.4	96.6	4.4	7	--	0.6	--
TTR01218	DLNEDA	6 ft 6 in bgs	6.9	153	4.7	9.2	--	0.64	--
TTR01219	DLNEDB	9 ft bgs	6.5	80.4	4.1	6.8	--	0.69	--
TTR01220	DLNWDA	5.5 ft bgs	5.9	188	3.6	9.5	--	0.56	--
TTR01221	DLNWDB	8 ft bgs	6.2	132	5.3	7.8	--	--	--

Table A.3-6
Soil Sample Results for Total RCRA Metals Detected Above
Minimum Reporting Limits, Septic Waste Systems 1 and 5
Corrective Action Investigation
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Sample No.	Sample Location	Sample Interval	Contaminants of Potential Concern (mg/kg)						
			Arsenic	Barium	Chromium	Lead	Mercury	Selenium	Silver
Preliminary Action Levels (mg/kg) ^a			3.0	100,000	450	1,000	560	9,400	9,400
TTR01225	5DLSWPA	5 ft bgs	25.8	128	3.6	5.9	--	--	--
TTR01226	5DLSWPB	7.5 ft bgs	16	119	3.4	7.2	--	--	--
TTR01227	5DLSPA	5 ft bgs	68.7	204	3.3	6.3	--	1.5	--
TTR01228	5DLSPB	7.5 ft bgs	14.3	114	3.6	8.7	--	--	--
TTR01229	5DLSEPA	6.5 ft bgs	15.5	226	4	8.1	--	1	--
TTR01230		6.5 ft bgs	14.9	116	3.3	8.3	--	0.98	--
TTR01231	5DLSEPB	9 ft bgs	17	132	3.8	8	--	0.82	--
TTR01232	5DLSEDA	7 ft bgs	11.4	347	3.6	11.2	--	0.8	--
TTR01233	5DLSedb	9 ft bgs	13.2	337	3.6	6.3	--	0.7	--
TTR01234	5DLS2DA	7 ft bgs	14.9	307	3.6	9.6	--	0.68	--
TTR01235	5DLS2DB	9.5 ft bgs	14.5	89.2	1.6	5.4	--	--	--
TTR01237	5DLS1DA	6 ft bgs	17.3	120	2.7	6.3	--	--	--
TTR01238	5DLS1DB	8.5 ft bgs	16.1	164	7.1	9.5	--	--	--
TTR01239	5DLSWDA	6 ft bgs	11.2	125	2.7	5.8	--	--	--
TTR01240	5DLSWDB	9 ft bgs	9.2	109	2.6	4.5	--	--	--
TTR01242	T12LFP DLEPA	9 ft bgs	6.9 (J) ^d	140	6.3 (J) ^d	10.1	--	0.51 (B) ^b	--
TTR01243	T12LFP DLEPB	11.5 ft bgs	5.8 (J) ^d	124	5.9 (J) ^d	8.5	--	--	--
TTR01244	T12LFP DLCPA	6 ft bgs	6.2 (J) ^d	104	5.7 (J) ^d	8.7	--	--	--
TTR01245	T12LFP DLCPB	8.5 ft bgs	5.4 (J) ^d	113	5.1 (J) ^d	8.1	--	--	--
TTR01246	T12LFP DLWPA	5.5 ft bgs	5.7 (J) ^d	97.3	6.1 (J) ^d	9.8	--	--	--
TTR01247		5.5 ft bgs	4.5 (J) ^d	119	4.3 (J) ^d	7.5	--	--	--
TTR01248	T12LFP DLWPB	8 ft bgs	6.1 (J) ^d	83.5	7.7 (J) ^d	10.3	--	--	--
TTR01249	T12LFD DLWDA	7 ft bgs	4.6 (J) ^d	107	3.8 (J) ^d	7.3	--	--	--

Table A.3-6
Soil Sample Results for Total RCRA Metals Detected Above
Minimum Reporting Limits, Septic Waste Systems 1 and 5
Corrective Action Investigation
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Sample No.	Sample Location	Sample Interval	Contaminants of Potential Concern (mg/kg)						
			Arsenic	Barium	Chromium	Lead	Mercury	Selenium	Silver
Preliminary Action Levels (mg/kg) ^a			3.0	100,000	450	1,000	560	9,400	9,400
TTR01250	T12LFD DLWDB	9.5 ft bgs	4.8 (J) ^d	102	4.8 (J) ^d	7.9	--	0.59	--
TTR01251	T12LFD DLCDA	6.5 ft bgs	5.7 (J) ^d	78.5	4.7 (J) ^d	8.9	--	--	--
TTR01252	T12LFD DLCDB	9 ft bgs	6 (J) ^d	123	6.1 (J) ^d	9.2	--	--	--
TTR01262	B511	14-15 ft bgs	8.9	120	2.5	6.4	--	--	--
TTR01263		18-20 ft bgs	8.5	159	4.1	5.4	--	--	--
TTR01264	B512	14-15 ft bgs	6.8	136	2.2	4.3	--	--	--
TTR01265		18-20 ft bgs	6	92.8	3	3.5	--	--	--
TTR01266	B513	14-15 ft bgs	15.7	95	4.1 (J) ^d	6.2	--	0.64	--
TTR01267		17.5-20.2 ft bgs	8.5	154	7.5 (J) ^d	5.3	--	--	--
TTR01269	B514	14-15 ft bgs	9.9	82.5	5.8 (J) ^d	7.5	--	--	--
TTR01270		19-20 ft bgs	12.9	165	7 (J) ^d	12.4	--	--	--
TTR01271	B515	14-15 ft bgs	12.1	303	6.2 (J) ^d	8.6	--	--	--
TTR01272		14-15 ft bgs	7.2	49.7	3.7 (J) ^d	5.5	--	--	--
TTR01274	B111	4-5 ft bgs	6.8	165	8.8 (J) ^d	11	--	--	--
TTR01275		9-10 ft bgs	9.4	116	6 (J) ^d	9	--	--	--
TTR01276		14-15 ft bgs	7.7	190	6.8 (J) ^d	8.8	--	--	--
TTR01277		19-20 ft bgs	8.6	117	4.2 (J) ^d	8.3	--	--	--
TTR01280	B112	4-5 ft bgs	6.5	134	8.2 (J) ^d	9.5	--	--	--
TTR01281		9-10 ft bgs	5.5	109	5.5 (J) ^d	7.9	--	--	--
TTR01282		14-15 ft bgs	7.7	171	5.9 (J) ^d	7.9	--	--	--
TTR01283		14-15 ft bgs	7.4	125	6.2 (J) ^d	7.6	--	--	--
TTR01284		19-20 ft bgs	8.2	150	6.3 (J) ^d	7.6	--	--	--

Table A.3-6
Soil Sample Results for Total RCRA Metals Detected Above
Minimum Reporting Limits, Septic Waste Systems 1 and 5
Corrective Action Investigation
(Page 4 of 5)

Sample No.	Sample Location	Sample Interval	Contaminants of Potential Concern (mg/kg)						
			Arsenic	Barium	Chromium	Lead	Mercury	Selenium	Silver
Preliminary Action Levels (mg/kg) ^a			3.0	100,000	450	1,000	560	9,400	9,400
TTR01286	B113	14-15 ft bgs	6.2	146	6.9	9.7	--	--	--
TTR01287		19-20 ft bgs	7.2	170	8.5	11.7	--	--	--
TTR01288	B114	9-10 ft bgs	7.4	128	6.4	7.9	--	--	--
TTR01289		14.5-15.5 ft bgs	8.6	240	6.8	9.3	--	--	--
TTR01290		19-20 ft bgs	7.5	174	6.1	8	--	--	--
TTR01292	B115	14-15 ft bgs	6.2	164	6	7.8	--	--	--
TTR01293		19-20 ft bgs	6.6	90.3	4	6.6	--	--	--
TTR01294	B116	14-15 ft bgs	8	146	6.3	8.1	--	--	--
TTR01295		19-20 ft bgs	5.1	67.3	3.1	6.9	--	--	--
TTR01297	B121	14-15 ft bgs	4.8 (J) ^d	114	5.6 (J) ^{d,e}	8.9	--	--	--
TTR01298		19-20 ft bgs	4.2 (J) ^d	107	5.2 (J) ^{d,e}	7.8	--	--	--
TTR01299		24-25 ft bgs	4.1 (J) ^d	98.9	5 (J) ^{d,e}	8.9	--	--	--
TTR01300		29-30 ft bgs	4.1 (J) ^d	135	5.3 (J) ^{d,e}	9	--	--	--
TTR01301	B122	9-10 ft bgs	4.6 (J) ^d	109	4.3 (J) ^{d,e}	7.4	--	--	--
TTR01302		14-15 ft bgs	6.9 (J) ^d	179	8.1 (J) ^{d,e}	11.2	--	--	--
TTR01304		24-25 ft bgs	7.5 (J) ^d	174	5.4 (J) ^{d,e}	6.7	--	--	--
TTR01305		34-35 ft bgs	11 (J) ^d	179	5.9 (J) ^{d,e}	7.5	--	0.89	--
TTR01306	B121A	4-5 ft bgs	4.2	69.2	3.7	6.3	--	--	--
TTR01307		9-10 ft bgs	4.4	155	4.4	7.7	--	--	--
TTR01310		19-20 ft bgs	4.4	109	5.7	9.5	--	--	--
TTR01311		24-25 ft bgs	4	95.5	4.6	9.9	--	--	--

Table A.3-6
Soil Sample Results for Total RCRA Metals Detected Above
Minimum Reporting Limits, Septic Waste Systems 1 and 5
Corrective Action Investigation
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Sample No.	Sample Location	Sample Interval	Contaminants of Potential Concern (mg/kg)						
			Arsenic	Barium	Chromium	Lead	Mercury	Selenium	Silver
Preliminary Action Levels (mg/kg) ^a			3.0	100,000	450	1,000	560	9,400	9,400
TTR01312	B123	6-8 ft bgs	10.6	131	7.8	11.6	0.23	1	--
TTR01313		9-10 ft bgs	5.4	143	5.9	10.1	--	--	--
TTR01314		9-10 ft bgs	5.2	163	5.4	9	--	0.64	--
TTR01315		19-20 ft bgs	4	114	4.6	8.1	--	--	--
TTR01319	B124	8-9 ft bgs	5.4 (J) ^d	105	7.2 (J) ^{d,e}	8.3	--	--	--
TTR01320		14-15 ft bgs	5 (J) ^d	99.6	5.5 (J) ^{d,e}	9.4	--	--	--
TTR01321		18-19 ft bgs	5.4 (J) ^d	103	6.6 (J) ^{d,e}	10.4	--	--	--
TTR01322	B125	6-7 ft bgs	4.3 (J) ^d	145	4.6 (J) ^{d,e}	7.6	--	--	--
TTR01323		14-15 ft bgs	5.6 (J) ^d	147	5.8 (J) ^{d,e}	7.3	--	--	--
TTR01324		24-25 ft bgs	6.1 (J) ^d	125	5.6 (J) ^{d,e}	8.1	--	--	--
TTR01331	E12DBA	7 ft bgs	4.8	165 (J) ^c	6 (J) ^c	9.2 (J) ^c	--	--	--
TTR01332	E12DBB	9.5 ft bgs	5	155 (J) ^c	5.1 (J) ^c	9.6 (J) ^c	--	--	--

^aEnvironmental Protection Agency Region 9, Industrial Preliminary Remediation Goals (PRGs) (EPA, 1998)

^bReported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL).

^cSpike recovery was outside control limits.

^dDuplicate precision analyses were outside control limits.

^eICP serial dilution recovery was not met.

-- = Not detected above minimum reporting limit

J = Estimated value (see [Section A.4.7](#))

Shading indicates result above Preliminary Action Level

mg/kg = Milligram(s) per kilogram

bts = Below tank surface

bsp = Below septic pipe

bgs = Below ground surface

rodenticides within these buildings may have allowed arsenic to be washed into floor drains but no historical evidence of pest control operations has been located.

Although analysis of most samples reveal arsenic concentrations near or above 3.0 mg/kg, this PAL is lower than the 7 to 8 ppm (mg/kg) mean concentration of arsenic in silt from the Nellis Air Force Range (NBMG, 1998; Moore, 1999) and lower than the concentrations ranging from 6 to 43 mg/kg in soils from locations near the TTR (SNL, 1999). Data from previous sampling efforts at Area 3 also demonstrate arsenic concentrations consistently greater than the PAL and as high as 24.1 mg/kg at an undisturbed location (DOE/NV, 1998a). Arsenic concentrations presented in [Table A.3-4](#) exceed the PAL but most are considered representative of ambient conditions at the sites.

A.3.5 *Gamma Spectroscopy Results*

No gamma spectroscopy soil samples were collected in the field because radiological field-screening levels were not exceeded.

A.3.6 *Isotopic Uranium Results*

The isotopic uranium activities detected are presented in [Table A.3-7](#) for the 39 samples analyzed for isotopic uranium. Isotopic uranium analysis of leachfield soil was not required by the CAIP but was performed as a best management practice and for IDW characterization after enriched uranium was detected in SWS 1 septic tanks (see [Section A.3.7](#)).

Soil not used by other analyses was analyzed for isotopic uranium. No isotopic uranium soil samples were collected in the field because radiological field-screening levels were not exceeded. In general, the samples selected represent soil at the leachrock and native soil interface underlying each of the three SWSs 1 and 5 leachfields or are the shallowest sample from boreholes at the corners and centers of each leachfield. The excavation samples were selected because they were most likely to be contaminated if effluent containing enriched uranium was discharged to the leachfields. The borehole samples were selected to define boundaries for any contamination detected in the excavation samples and to help characterize the IDW.

Review of the isotopic uranium results did not identify any samples with radionuclide concentrations in excess of the established radionuclide specific background concentrations (McArthur and

Table A.3-7
Soil Sample Results for Isotopic Uranium Detections
Septic Waste Systems 1 and 5
Corrective Action Investigation
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Sample No.	Sample Location	Depth Below Datum	Contaminants of Potential Concern (pCi/g)		
			U-234	U-235	U-238
Background Concentrations (pCi/g)			0.1 - 2.6 ^a	<0.05 - 0.1 ^a	0.5 - 3.21 ^b
TTR01209	DLSWPA	7 ft bgs	1.54 ± 0.32	--	1.17 ± 0.27
TTR01210	DLSEPA	6 ft 6 in bgs	1.11 ± 0.20	--	1.11 ± 0.20
TTR01213	DLNEPA	7 ft bgs	1.40 ± 0.31	--	1.52 ± 0.33
TTR01216	DLNWPA	5.5 ft bgs	1.32 ± 0.23	--	1.18 ± 0.21
TTR01218	DLNEDA	6 ft 6 in bgs	1.39 ± 0.24	--	1.29 ± 0.23
TTR01220	DLNWDA	5.5 ft bgs	1.50 ± 0.26	--	1.22 ± 0.22
TTR01225	5DLSWPA	5 ft bgs	2.02 ± 0.32	--	1.82 ± 0.30
TTR01227	5DLSPA	5 ft bgs	2.06 ± 0.33	--	1.84 ± 0.30
TTR01229	5DLSEPA	6.5 ft bgs	1.72 ± 0.29	--	1.37 ± 0.25
TTR01230		6.5 ft bgs	1.58 ± 0.34	--	1.39 ± 0.32
TTR01232	5DLSEDA	7 ft bgs	1.03 ± 0.20	--	1.33 ± 0.24
TTR01234	5DLS2DA	7 ft bgs	1.28 ± 0.24	--	1.53 ± 0.28
TTR01237	5DLS1DA	6 ft bgs	1.17 ± 0.22	--	1.43 ± 0.26
TTR01239	5DLSWDA	6 ft bgs	1.19 ± 0.22	--	1.21 ± 0.22
TTR01242	T12LFP DLEPA	9 ft bgs	0.98 ± 0.19	--	1.03 ± 0.19
TTR01244	T12LFP DLCPA	6 ft bgs	1.38 ± 0.25	0.121 ± 0.059	1.27 ± 0.23
TTR01246	T12LFP DLWPA	5.5 ft bgs	1.33 ± 0.24	--	1.28 ± 0.23
TTR01247		5.5 ft bgs	1.39 ± 0.25	--	1.36 ± 0.24
TTR01249	T12LFD DLWDA	7 ft bgs	1.27 ± 0.24	--	1.20 ± 0.23
TTR01251	T12LFD DLCDA	6.5 ft bgs	1.30 ± 0.23	0.093 ± 0.047 (B)	1.25 ± 0.22
TTR01262	B511	14-15 ft bgs	1.09 ± 0.20	--	1.15 ± 0.21
TTR01264	B512	14-15 ft bgs	0.90 ± 0.14	--	1.03 ± 0.16
TTR01266	B513	14-15 ft bgs	1.05 ± 0.20	--	1.20 ± 0.22
TTR01269	B514	14-15 ft bgs	1.59 ± 0.28	--	1.46 ± 0.26
TTR01271	B515	14-15 ft bgs	1.14 ± 0.20	--	1.34 ± 0.22
TTR01275	B111	9-10 ft bgs	1.47 ± 0.32	--	1.31 ± 0.30

Table A.3-7
Soil Sample Results for Isotopic Uranium Detections
Septic Waste Systems 1 and 5
Corrective Action Investigation
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Sample No.	Sample Location	Depth Below Datum	Contaminants of Potential Concern (pCi/g)		
			U-234	U-235	U-238
Background Concentrations (pCi/g)			0.1 - 2.6 ^a	<0.05 - 0.1 ^a	0.5 - 3.21 ^b
TTR01276		14-15 ft bgs	1.25 ± 0.22	--	1.18 ± 0.21
TTR01281	B112	9-10 ft bgs	1.48 ± 0.26	--	1.41 ± 0.25
TTR01282		14-15 ft bgs	1.25 ± 0.22	0.091 ± 0.047 (B)	1.52 ± 0.26
TTR01286	B113	14-15 ft bgs	1.24 ± 0.21	--	1.26 ± 0.22
TTR01289	B114	14.5-15.5 ft	1.44 ± 0.25	--	1.37 ± 0.25
TTR01292	B115	14-15 ft bgs	1.04 ± 0.19	--	1.12 ± 0.20
TTR01294	B116	14-15 ft bgs	1.14 ± 0.20	--	1.11 ± 0.20
TTR01297	B121	14-15 ft bgs	0.96 ± 0.19	--	1.15 ± 0.21
TTR01302	B122	14-15 ft bgs	1.14 ± 0.22	--	1.09 ± 0.22
TTR01313	B123	9-10 ft bgs	1.14 ± 0.21	--	1.12 ± 0.21
TTR01314		9-10 ft bgs	1.29 ± 0.23	--	1.34 ± 0.24
TTR01319	B124	8-9 ft bgs	1.50 ± 0.26	--	1.46 ± 0.25
TTR01323	B125	14-15 ft bgs	1.26 ± 0.23	--	1.27 ± 0.23

^aBackground concentration listed in *Environmental Monitoring Report for the Proposed Ward Valley California Low-Level Radioactive Waste (LLRW) Facility* (Atlan-Tech, 1992)

^bBackground concentration listed or derived in *Off-Site Radiation Exposure Review Project, Phase II Soils Program* (McArthur and Miller, 1989)

-- = Not detected above minimum reporting limit

B = Analyte concentration greater than Minimum Detectable Concentration

pCi/g = Picocurie(s) per gram

Miller, 1989; REEC0, 1992) and the Nevada Test Site (NTS) Performance Objective for Certification of Nonradioactive Hazardous Waste (POC) “rad added” screening levels. Sample TTR01244 has a uranium-235 activity of 0.121 ± 0.059 picocuries per gram (pCi/g) and a minimum detectable activity of 0.121 pCi/g. This result is not significantly different than the background activity of 0.1 pCi/g.

A.3.7 Septic Tank, Distribution Box, and Pipe Contents Sampling

Septic tank, distribution box, and pipe contents sampling analytical results for detected analytes are shown in [Table A.3-8](#). “Totals” samples were collected from both liquid and sludge phases in septic tanks. “Totals” sludge samples were collected to allow comparison of septic tanks contents with the results of soil sampling.

Sludge samples were also analyzed for TCLP for waste management purposes. Review of the sample results against regulatory limits produced the following waste determinations for IDW associated with the septic tank, distribution box, and pipe contents sampling:

- None of the parameters exceeded regulatory limits for TCLP VOCs, TCLP SVOCs, and TCLP Metals.
- Diesel range organics were detected at levels exceeding regulatory limits. The IDW contained only small quantities (less than 5 percent) of soil, sludge, or liquids from the features and was not considered hydrocarbon waste.
- Based on a review of the gamma spectroscopy radioanalytical results against the NTS POC for Hazardous Waste, none of the parameters exceeded NTS POC established limits.
- Based on a review of the isotopic uranium radioanalytical results, uranium-234, uranium-235, and uranium-238 were found at concentrations exceeding established uranium background ranges (Atlan-Tech, 1992; McArthur and Miller, 1989). The uranium-235 was elevated when compared to the natural mass fraction indicating that the uranium had been enriched.

The COPCs detected in liquid samples included naphthalene, 1,4-dichlorobenzene, arsenic, lead, uranium-234 and uranium-238.

The COPCs detected in sludge samples included benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, 1,4-dichlorobenzene, naphthalene, indeno(1,2,3-cd)pyrene, p-isopropyltoluene,

Table A.3-8
Sludge and Water Sample Results for Detection of
Constituents of Potential Concern,
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Sample No.	Sample Matrix	Parameter	Results	Units
Septic Tank 33-1A				
TTR01184	Water	Naphthalene	77 (J) ^a	µg/L
TTR01184	Water	1,4-Dichlorobenzene	33	µg/L
TTR01184	Water	Arsenic	38.9	µg/L
TTR01184	Water	Barium	119	µg/L
TTR01184	Water	Chromium	3.2 (B) ^b	µg/L
TTR01184	Water	Mercury	0.4	µg/L
TTR01184	Water	U-234	0.219 ± 0.083 (LT)	pCi/L
TTR01184	Water	U-238	0.158 ± 0.069 (LT)	pCi/L
TTR01185	Sludge	1,4-Dichlorobenzene	880,000	µg/kg
TTR01185	Sludge	2-Butanone	180,000 (B) ^c	µg/kg
TTR01185	Sludge	Naphthalene	540,000 (J) ^a	µg/kg
TTR01185	Sludge	p-Isopropyltoluene	470,000 (B) ^c	µg/kg
TTR01185	Sludge	1,4-Dichlorobenzene	1,200,000 (J) ^d	µg/kg
TTR01185	Sludge	Arsenic	30.9	mg/kg
TTR01185	Sludge	Barium	771	mg/kg
TTR01185	Sludge	Cadmium	17.5	mg/kg
TTR01185	Sludge	Chromium	33.3	mg/kg
TTR01185	Sludge	Lead	46.4	mg/kg
TTR01185	Sludge	Mercury	4.2	mg/kg
TTR01185	Sludge	Selenium	4.4 (B) ^b	mg/kg
TTR01185	Sludge	Silver	6.8 (B) ^b	mg/kg
TTR01185	Sludge	Diesel Range Organics	8,900 (J) ^e	mg/kg
TTR01185	Sludge	1,4-Dichlorobenzene	0.57	mg/L
TTR01185	Sludge	Arsenic	52.1 (B) ^b	µg/L
TTR01185	Sludge	Barium	2,110	µg/L
TTR01185	Sludge	Chromium	9.2 (B) ^b	µg/L
TTR01185	Sludge	K-40	10.4 ± 3.7 (J)	pCi/g
TTR01185	Sludge	Pb-212	0.65 ± 0.32 (J)	pCi/g

Table A.3-8
Sludge and Water Sample Results for Detection of
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Sample No.	Sample Matrix	Parameter	Results	Units
Septic Tank 33-1B				
TTR01186	Water	Arsenic	26.7	µg/L
TTR01186	Water	Barium	30.1 (B) ^b	µg/L
TTR01186	Water	U-234	3.55 ± 0.51	pCi/L
TTR01186	Water	U-238	2.03 ± 0.33	pCi/L
TTR01187	Sludge	1,4-Dichlorobenzene	110,000	µg/kg
TTR01187	Sludge	p-Isopropyltoluene	560,000 (B) ^c	µg/kg
TTR01187	Sludge	Arsenic	44.6	mg/kg
TTR01187	Sludge	Barium	426	mg/kg
TTR01187	Sludge	Cadmium	15.2	mg/kg
TTR01187	Sludge	Chromium	21.5	mg/kg
TTR01187	Sludge	Lead	52.2	mg/kg
TTR01187	Sludge	Mercury	1.6	mg/kg
TTR01187	Sludge	Selenium	2.2 (B) ^b	mg/kg
TTR01187	Sludge	Silver	6.6	mg/kg
TTR01187	Sludge	Diesel Range Organics	3,400 (J) ^e	mg/kg
TTR01187	Sludge	Arsenic	75.8 (B) ^b	µg/L
TTR01187	Sludge	Barium	922 (B) ^b	µg/L
TTR01187	Sludge	Chromium	6.3 (B) ^b	µg/L
TTR01187	Sludge	Silver	6 (B) ^b	µg/L
TTR01187	Sludge	Th-234	6.3 ± 2.8 (J)	pCi/g
TTR01187	Sludge	U-234	11.4 ± 1.4	pCi/g
TTR01187	Sludge	U-235	0.40 ± 0.10 (LT)	pCi/g
TTR01187	Sludge	U-238	6.56 ± 0.85	pCi/g
Former Medical Trailer Pipe				
TTR01195	Sludge	Anthracene	6,200 (J) ^f	µg/kg
TTR01195	Sludge	Benzo(a)Anthracene	20,000 (J) ^f	µg/kg
TTR01195	Sludge	Benzo(a)Pyrene	18,000 (J) ^f	µg/kg
TTR01195	Sludge	Benzo(b)Fluoranthene	19,000 (J) ^f	µg/kg

Table A.3-8
Sludge and Water Sample Results for Detection of
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Sample No.	Sample Matrix	Parameter	Results	Units
TTR01195	Sludge	Benzo(g,h,i)Perylene	8,100 (J) ^f	µg/kg
TTR01195	Sludge	Benzo(k)Fluoranthene	7,900 (J) ^f	µg/kg
TTR01195	Sludge	Bis(2-Ethylhexyl)Phthalate	20,000 (J) ^f	µg/kg
TTR01195	Sludge	Butyl Benzyl Phthalate	6,800 (J) ^f	µg/kg
TTR01195	Sludge	Chrysene	17,000 (J) ^f	µg/kg
TTR01195	Sludge	Fluoranthene	20,000 (J) ^f	µg/kg
TTR01195	Sludge	Indeno(1,2,3-CD)Pyrene	7,100 (J) ^f	µg/kg
TTR01195	Sludge	Phenanthrene	17,000 (J) ^f	µg/kg
TTR01195	Sludge	Pyrene	49,000 (J) ^f	µg/kg
TTR01195	Sludge	Arsenic	30.4	mg/kg
TTR01195	Sludge	Barium	279	mg/kg
TTR01195	Sludge	Cadmium	12.1	mg/kg
TTR01195	Sludge	Chromium	18.6	mg/kg
TTR01195	Sludge	Lead	70.1	mg/kg
TTR01195	Sludge	Mercury	4.4 (J) ^g	mg/kg
TTR01195	Sludge	Selenium	3.4	mg/kg
TTR01195	Sludge	Silver	4.3	mg/kg
Septic Tank 33-3				
TTR01196	Water	1,4-Dichlorobenzene	16	µg/L
TTR01196	Water	Naphthalene	9.4 (J) ^a	µg/L
TTR01196	Water	Arsenic	17.4	µg/L
TTR01196	Water	Barium	226	µg/L
TTR01196	Water	Chromium	6 (B) ^b	µg/L
TTR01196	Water	Lead	18.6	µg/L
TTR01196	Water	Mercury	0.49	µg/L
TTR01196	Water	U-234	0.47 ± 0.17 (B)	pCi/L
TTR01196	Water	U-238	0.25 ± 0.12 (B)	pCi/L
TTR01197	Sludge	1,2,4-Trimethylbenzene	3,300 (J) ⁱ	µg/kg
TTR01197	Sludge	1,3,5-Trimethylbenzene	2,000 (J) ⁱ	µg/kg

Table A.3-8
Sludge and Water Sample Results for Detection of
Constituents of Potential Concern,
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(Page 4 of 8)

Sample No.	Sample Matrix	Parameter	Results	Units
TTR01197	Sludge	1,4-Dichlorobenzene	9,000	µg/kg
TTR01197	Sludge	Acetone	1,800 (J) ^{a,h}	µg/kg
TTR01197	Sludge	Isopropylbenzene	590 (J) ⁱ	µg/kg
TTR01197	Sludge	m+p-Xylene	1,000 (J) ⁱ	µg/kg
TTR01197	Sludge	Naphthalene	1,400	µg/kg
TTR01197	Sludge	o-Xylene	490 (J) ⁱ	µg/kg
TTR01197	Sludge	p-Isopropyltoluene	800 (J) ⁱ	µg/kg
TTR01197	Sludge	Tert-Butylbenzene	370 (J) ⁱ	µg/kg
TTR01197	Sludge	Toluene	1,500	µg/kg
TTR01197	Sludge	Arsenic	72.2	mg/kg
TTR01197	Sludge	Barium	152	mg/kg
TTR01197	Sludge	Cadmium	14.3	mg/kg
TTR01197	Sludge	Chromium	46	mg/kg
TTR01197	Sludge	Lead	213	mg/kg
TTR01197	Sludge	Mercury	4.1 (J) ^g	mg/kg
TTR01197	Sludge	Diesel Range Organics	18,000 (J) ^e	mg/kg
TTR01197	Sludge	Arsenic	114	µg/L
TTR01197	Sludge	Barium	1,940	µg/L
TTR01197	Sludge	Mercury	0.23 (B) ^b	µg/L
TTR01197	Sludge	K-40	8.3 ± 3.9 (J)	pCi/g
TTR01197	Sludge	Th-234	11.7 ± 3.5 (J)	pCi/g
TTR01197	Sludge	U-234	28.9 ± 3.5	pCi/g
TTR01197	Sludge	U-235	0.93 ± 0.18	pCi/g
TTR01197	Sludge	U-238	15.6 ± 1.9	pCi/g
Septic Tank 33-3 Duplicate				
TTR01204	Water	1,2,4-Trimethylbenzene	5.9	µg/L
TTR01204	Water	1,4-Dichlorobenzene	24	µg/L
TTR01204	Water	Naphthalene	6.9	µg/L

Table A.3-8
Sludge and Water Sample Results for Detection of
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Sample No.	Sample Matrix	Parameter	Results	Units
TTR01204	Water	1,4-Dichlorobenzene	17	µg/L
TTR01204	Water	Arsenic	13	µg/L
TTR01204	Water	Barium	115	µg/L
TTR01204	Water	Lead	1.2 (B) ^b	µg/L
TTR01204	Water	Mercury	0.05 (B) ^b	µg/L
TTR01205	Sludge	1,2-Dichlorobenzene	59	µg/kg
TTR01205	Sludge	1,2,4-Trimethylbenzene	520	µg/kg
TTR01205	Sludge	1,3,5-Trimethylbenzene	230	µg/kg
TTR01205	Sludge	1,4-Dichlorobenzene	1,300	µg/kg
TTR01205	Sludge	2-Chlorotoluene	79	µg/kg
TTR01205	Sludge	Acetone	190 (B) ^c	µg/kg
TTR01205	Sludge	Ethylbenzene	59	µg/kg
TTR01205	Sludge	Isopropylbenzene	67	µg/kg
TTR01205	Sludge	m+p-Xylene	260	µg/kg
TTR01205	Sludge	n-Butylbenzene	61	µg/kg
TTR01205	Sludge	n-Propylbenzene	120	µg/kg
TTR01205	Sludge	o-Xylene	130	µg/kg
TTR01205	Sludge	p-Isopropyltoluene	180	µg/kg
TTR01205	Sludge	Toluene	150	µg/kg
TTR01205	Sludge	Bis(2-Ethylhexyl)Phthalate	68,000	µg/kg
TTR01205	Sludge	Arsenic	62.5	mg/kg
TTR01205	Sludge	Barium	218 (J) ^g	mg/kg
TTR01205	Sludge	Cadmium	34.3	mg/kg
TTR01205	Sludge	Chromium	211	mg/kg
TTR01205	Sludge	Lead	1,490 (J) ^j	mg/kg
TTR01205	Sludge	Mercury	3.5 (J) ^g	mg/kg
TTR01205	Sludge	Silver	6.3 (B) ^b	mg/kg
TTR01205	Sludge	Diesel Range Organics	49,000	mg/kg
TTR01205	Sludge	K-40	12.3 ± 5.1 (J)	pCi/g

Table A.3-8
Sludge and Water Sample Results for Detection of
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Sample No.	Sample Matrix	Parameter	Results	Units
TTR01205	Sludge	Th-234	10.5 ± 3.3 (J)	pCi/g
TTR01205	Sludge	U-234	2.26 ± 0.34	pCi/g
TTR01205	Sludge	U-235	0.099 ± 0.048 (B)	pCi/g
TTR01205	Sludge	U-238	1.79 ± 0.28	pCi/g
Septic Tank 33-10				
TTR01200	Sludge	Acetone	82 (J) ^k	µg/kg
TTR01200	Sludge	Arsenic	14.2	mg/kg
TTR01200	Sludge	Barium	93.1	mg/kg
TTR01200	Sludge	Cadmium	3.6 (J) ^l	mg/kg
TTR01200	Sludge	Chromium	19.9	mg/kg
TTR01200	Sludge	Lead	101 (J) ^{g,j}	mg/kg
TTR01200	Sludge	Mercury	3.8	mg/kg
TTR01200	Sludge	Selenium	9.5	mg/kg
TTR01200	Sludge	Silver	3.9	mg/kg
TTR01200	Sludge	Diesel Range Organics	1,300	mg/kg
TTR01200	Sludge	Arsenic	167	µg/L
TTR01200	Sludge	Barium	2,200	µg/L
TTR01200	Sludge	K-40	18.1 ± 6.2 (J)	pCi/g
TTR01200	Sludge	Pb-212	0.88 ± 0.46 (J)	pCi/g
TTR01200	Sludge	U-234	13.5 ± 1.7	pCi/g
TTR01200	Sludge	U-235	0.371 ± 0.096 (LT)	pCi/g
TTR01200	Sludge	U-238	7.36 ± 0.94	pCi/g
SWS1 LF2 Distribution Box				
TTR01329	Sludge	2-Butanone	74 (J) ^{e,f,k}	µg/kg
TTR01329	Sludge	Acetone	500 (J) ^{e,f,k}	µg/kg
TTR01329	Sludge	Carbone Disulfide	6.3 (J) ^{e,f,k}	µg/kg
TTR01329	Sludge	m+p-Xylene	6.9 (J) ^{e,f,k}	µg/kg
TTR01329	Sludge	Arsenic	41	mg/kg
TTR01329	Sludge	Barium	521 (J) ^j	mg/kg

Table A.3-8
Sludge and Water Sample Results for Detection of
Constituents of Potential Concern,
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Sample No.	Sample Matrix	Parameter	Results	Units
TTR01329	Sludge	Cadmium	4.6	mg/kg
TTR01329	Sludge	Chromium	47.3 (J) ⁱ	mg/kg
TTR01329	Sludge	Lead	100 (J) ⁱ	mg/kg
TTR01329	Sludge	Mercury	12.4 (J) ^{g,i}	mg/kg
TTR01329	Sludge	Selenium	2.6 (J) ^g	mg/kg
TTR01329	Sludge	Silver	2.2 (J) ^g	mg/kg
TTR01329	Sludge	Diesel Range Organics	840 (J) ^k	mg/kg
TTR01329	Sludge	Barium	238 (B) ^b	µg/L
TTR01329	Sludge	Cadmium	20.1 (B) ^b	µg/L
TTR01329	Sludge	Lead	26.2 (B) ^b	µg/L
TTR01329	Sludge	Ac-228	1.40 ± 0.43 (J)	pCi/g
TTR01329	Sludge	Bi-214	1.29 ± 0.35 (J)	pCi/g
TTR01329	Sludge	K-40	25.0 ± 4.9 (J)	pCi/g
TTR01329	Sludge	Pb-212	1.61 ± 0.36 (J)	pCi/g
TTR01329	Sludge	Pb-214	1.49 ± 0.35 (J)	pCi/g
TTR01329	Sludge	Th-234	5.0 ± 2.2 (J)	pCi/g
TTR01329	Sludge	Tl-208	0.57 ± 0.17 (J)	pCi/g
TTR01329	Sludge	U-234	7.2 ± 1.4	pCi/g
TTR01329	Sludge	U-238	4.9 ± 1.1	pCi/g
SWS1 LF2 Distribution Box Duplicate				
TTR01330	Sludge	Acetone	47 (J) ^{e,f}	µg/kg
TTR01330	Sludge	Arsenic	42.2	mg/kg
TTR01330	Sludge	Barium	527 (J) ⁱ	mg/kg
TTR01330	Sludge	Cadmium	4.9	mg/kg
TTR01330	Sludge	Chromium	38.3 (J) ⁱ	mg/kg
TTR01330	Sludge	Lead	80.3 (J) ⁱ	mg/kg
TTR01330	Sludge	Mercury	8.8 (J) ^{g,i}	mg/kg
TTR01330	Sludge	Selenium	3.4 (J) ^g	mg/kg
TTR01330	Sludge	Silver	1.7 (J) ^g	mg/kg

Table A.3-8
Sludge and Water Sample Results for Detection of
Constituents of Potential Concern,
Septic Waste Systems 1 and 5 Corrective Action Investigation
(Page 8 of 8)

Sample No.	Sample Matrix	Parameter	Results	Units
TTR01330	Sludge	Diesel Range Organics	850	mg/kg
TTR01330	Sludge	Barium	300 (B) ^b	µg/L
TTR01330	Sludge	Ac-228	1.87 ± 0.58 (J)	pCi/g
TTR01330	Sludge	Bi-214	1.82 ± 0.49 (J)	pCi/g
TTR01330	Sludge	K-40	26.7 ± 5.9 (J)	pCi/g
TTR01330	Sludge	Pb-212	1.78 ± 0.44 (J)	pCi/g
TTR01330	Sludge	Pb-214	1.50 ± 0.40 (J)	pCi/g
TTR01330	Sludge	Th-234	6.9 ± 2.7 (J)	pCi/g
TTR01330	Sludge	Tl-208	0.53 ± 0.23 (J)	pCi/g
TTR01330	Sludge	U-234	8.7 ± 1.3	pCi/g
TTR01330	Sludge	U-235	0.28 ± 0.14 (B)	pCi/g
TTR01330	Sludge	U-238	5.43 ± 0.88	pCi/g

Shaded data is Toxicity Characteristic Leaching Procedure result

^aAssociated continuing calibration showed elevated %D for compound.

^bReported value was obtained from a reading that was less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL) for inorganic analyses.

^cAnalyte is detected in the associated method blank as well as in the sample for organic analyses.

^dSurrogates diluted out.

^eSurrogate recovery exceeded the lower limits.

^fInternal standard area count exceeded the QC limits.

^gDuplicate precision analyses were outside control limits.

^hAverage relative response factor <0.05.

ⁱMass spectra do not match reference spectra.

^jSpike recovery was outside control limits.

^kSurrogate recovery exceeded the upper limits.

^lICP serial dilution recovery was not met.

J = Estimated value (see [Section A.4.7](#))

B = Analyte concentration greater than Minimum Detectable Concentration

LT = Concentration is greater than the Minimum Detectable Concentration but less than the reporting level

µg/L = Microgram(s) per liter

pCi/L = Picocurie(s) per liter

mg/L = Milligram(s) per liter

phenanthrene, tert-butylbenzene, arsenic, chromium, lead, diesel range organics, thorium-234, uranium-234, uranium-235, and uranium-238.

A.3.8 Geotechnical Sampling Results

Geotechnical and hydrological analytical methods requested are presented in [Table A.3-9](#). Results of the geotechnical and hydrological analysis of the geotechnical samples are included in [Tables A.3-10](#), [A.3-11](#), and [A.3-12](#).

**Table A.3-9
General Geotechnical and Hydrological
Analyses for Leachfield CAUs**

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

^aASTM, 1996

^bUSACE, 1970

^cMOSA (Soil Science Society of America, 1986)

^dvan Genuchten, 1980

^eKaranthanas and Hajek, 1982

**Table A.3-10
Summary of Particle Size Characterization**

Sample Number	Sample Location	Sample Depth (feet bgs)	d ₁₀ ^a (mm)	d ₃₀ (mm)	d ₅₀ ^b (mm)	d ₆₀ (mm)	C _u ^c	C _c ^d	Method
TTR01268	Borehole B514	9.5 - 10.5	0.014	0.19	0.74	1.7	121	1.5	WS/H ^g
TTR01291	Borehole B114	13.5 - 14.5	0.016	0.10	0.19	0.28	18	2.2	WS/H
TTR01318	Borehole B125	15.5 - 16.5	0.071	0.32	0.94	1.5	21	0.96	WS/H
TTR01325	Borehole B125	25.5 -26.5	0.054	0.33	1.8	2.7	50	0.75	WS/H

^aMillimeter(s)

^bd₆₀ = Median particle diameter

^cUniformity coefficient, C_u = d₆₀/d₁₀

^dCoefficient of curvature, C_c = (d₃₀)²/(d₁₀)*(d₆₀)

^eDry sieve

^fWet sieve

^gHydrometer

Table A.3-11
Summary of Initial Moisture Content, Dry Bulk Density,
Wet Bulk Density, and Calculated Porosity Results

Sample Number	Borehole Number	Sample Depth (feet bgs)	Initial Moisture Content		Dry Bulk Density (g/cm ³) ^c	Wet Bulk Density (g/cm ³)	Calculated Porosity (%) ^d
			Gravimetric (% g/g) ^a	Volumetric (% cm ³ /cm ³) ^b			
TTR01268	B514	9.5 - 10.5	13.7	24.3	1.78	2.02	33.0
TTR01291	B114	13.5 - 14.5	20.3	32.1	1.58	1.90	40.3
TTR01318	B125	15.5 - 16.5	4.7	7.9	1.70	1.78	35.9
TTR01325	B125	25.5 -26.5	11.6	16.7	1.45	1.61	45.4

^aPercent, gram per gram

^bPercent, cubic centimeter per cubic centimeter

^cGram(s) per cubic centimeter

^dPercent

Table A.3-12
Summary of Hydrologic Parameters Test Results

Sample Number	Borehole Number	Sample Depth (feet bgs)	Saturated Hydraulic Conductivity	Unsaturated Hydraulic Conductivity			
			Ksat ^a (cm/s) ^b	α^c (cm ⁻¹) ^d	N ^c (dimensionless)	Θr^e % ^f	Θs^g % ^f
TTR01268	B514	9.5 - 10.5	5.3E-06	0.0280	1.1151	0.0000	0.3118
TTR01291	B114	13.5 - 14.5	1.3E-05	0.0374	1.1253	0.0000	0.4003
TTR01318	B125	15.5 - 16.5	3.1E-03	0.0396	1.7709	0.0627	0.3384
TTR01325	B125	25.5 -26.5	7.2E-04	0.0232	1.4580	0.0705	0.4142

^aSaturated permeability

^bCentimeter(s) per second

^cCalculated parameter

^dUnit(s) per centimeter

^eResidual soil-water content

^fPercent

^gSaturated soil-water content

A.4.0 Quality Assurance

The results of the QA/QC activities for the SWSs 1 and 5 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, 1996b).

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

A.4.1 Precision

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

A.4.2 Accuracy

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

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

from the correct locations at the correct time, placed in a correctly labeled container with the correct preservative, and sealed with custody tape to prevent tampering. All samples in this sampling event were properly collected and forwarded to the laboratory 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 for this project (DOE/NV, 1996b).

The specified sampling locations were utilized as planned with few exceptions. No samples were collected from Septic Tank 33-11 because the tank was not located. Samples were not collected from Septic Tank 33-8 due to the nature of the contents and access limitations. Samples were not collected from the Acid Waste Outfall because the SWS 5 Leachfield was located. All other planned samples were collected, 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, SWSs 1 and 5 field and sampling activities were performed and documented in accordance with approved procedures, and all samples

were collected in accordance with the CAIP. 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, 1996b), all requirements were met.

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

A.4.6 Tier I and Tier II Data Evaluations

All laboratory data from samples collected at CAU 428 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. Data were rejected for CAU 428 but the data rejection did not influence the investigation. Only valid data, whether estimated (i.e., J-qualified) or not, were used.

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

A.4.6.1 Tier I Evaluation

Tier I evaluation for both chemical and radiological 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:

- Correct detection limits achieved
- Sample date, preparation date, and analysis date for each sample
- Holding time criteria met
- QC batch association for each sample
- Cooler temperature upon receipt
- Sample pH for aqueous samples, as required
- Detection limits properly adjusted for dilution, as required
- Blank contamination evaluated and applied to sample results/qualifiers
- MS/MSD percent recoveries 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 (LCS) %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
- Mass spectrometer tuning criteria
- Organic compound quantitation
- Inductively coupled plasma (ICP) interference check sample evaluation
- Graphite furnace atomic absorption quality control
- ICP serial dilution effects
- Recalculation of 10 percent of laboratory results from raw data

Radioanalytical:

- Correct detection limits achieved
- Blank contamination evaluated and applied to sample results/qualifiers
- Certificate of Analysis consistent with data package documentation
- Quality control sample results (duplicates, laboratory control samples, laboratory blanks) evaluated and applied to laboratory result qualifiers
- Sample results, error, and minimum detectable activity evaluated and applied to laboratory result qualifiers
- Detector system calibrated to National Institute for Standards and Technology (NIST) traceable sources
- Calibration sources preparation was documented, demonstrating proper preparation and appropriateness for sample matrix, emission energies, and concentrations
- Detector system response to daily, weekly, and monthly background and calibration checks for peak energy, peak centroid, peak full-width half-maximum, and peak efficiency, depending on the detection system
- Tracers NIST-traceable, appropriate for the analysis performed, and recoveries that met QC requirements
- Documentation of all QC sample preparation complete and properly performed
- QC sample results (e.g., calibration source concentration, percent recovery, and RPD) verified
- Spectra lines, emissions, particle energies, peak areas, and background peak areas support the identified radionuclide and its concentration
- Recalculation of 10 percent of laboratory results from raw data

A.4.6.3 Tier III

The Tier III review is an examination of the Tier II evaluation. The Tier III review duplicates the Tier II review for a limited number of samples (typically 5 percent) and includes the following additional evaluations:

Chemical:

- Recalculation of all laboratory results from raw data

Radioanalytical:

- 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
- Recalculation of all laboratory results from raw data

A Tier III review of at least 5 percent of the sample analytical data was performed by TechLaw, Inc. in Lakewood, Colorado. No changes to the radioanalytical data were necessary as a result of this Tier III review. However, changes were necessary to the chemical data for Total SVOC ([Table A.3-4](#)), TPH ([Table A.3-5](#)), and RCRA Metals ([Table A.3-6](#)).

A.4.7 Quality Control Samples

Twenty-seven trip blanks, two equipment rinsate blanks, six field blanks, one source blank, eight MS/MSD, and seven field duplicates were collected and submitted for laboratory analysis as shown in [Table A.3-1](#). The blanks and duplicates were assigned individual sample numbers and sent to the laboratory “blind” except in one case when two samples (TTR01328 and TTR01333) were identified as a trip blanks on the analysis request/chain of custody paperwork. Additional samples were selected by the laboratory to be analyzed as laboratory duplicates. Documentation related to the collection and analyses of these samples is retained in project files.

A.4.7.1 Field Quality Control Samples

Review of the field-collected blank analytical data for the investigation sampling indicates that cross-contamination from field methods did not occur during sample collection. Field blanks, source blanks, and equipment rinsate blanks were analyzed for the parameters listed in [Table A.3-1](#) 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, seven field duplicate soil samples were sent as blind samples to the laboratory to be analyzed for the investigation parameters listed in [Table A.3-1](#). For these samples, the duplicate results precision (i.e., RPDs between the environmental sample results and their corresponding field duplicate sample results) were evaluated to the guidelines set forth in EPA Functional Guidelines (EPA, 1994b and 1994c). The EPA Functional Guidelines state that there are no required review criteria for field duplicate analyses comparability, but allow the data reviewer to

exercise professional judgement. The RPD between the environmental samples results and their corresponding field duplicate sample results exceeded the 20 percent criteria stated in the Industrial Sites QAPP (DOE/NV, 1996b) for some target analytes. The variability in the results between the environmental samples and their corresponding field duplicate samples could be attributed to nonhomogeneous samples and the difficulties associated with collecting identical field samples. It is expected that soil field duplicate results will have a greater variance than water matrices.

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

Eight field samples were selected for use as MS/MSD samples. The percent recoveries of these samples (a measure of accuracy) and the relative percent differences in these sample results (a measure of precision) were compared to EPA Functional Guideline criteria (EPA, 1994b and 1994c). The results were used to qualify associated environmental sample results accordingly.

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

The EPA Functional Guidelines for inorganic data review allows professional judgement to be applied in evaluating the results of matrix spikes (EPA, 1994c). Generally, if spike recovery is greater than the upper acceptance limits (>125%), nondetections are acceptable for use. If spike recovery is greater than the upper acceptance limit (>125%) or less than the lower acceptance limit (<75%), positive results are qualified as estimated (J). If spike recovery falls within the range of 30-74%, nondetections are qualified as estimated (UJ). If spike recovery is less than 30 percent (grossly low), positive results are not qualified and nondetections are qualified as unusable (R).

A.4.7.2 Laboratory Quality Control Samples

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

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

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

For the common laboratory contaminants (e.g., methylene chloride, acetone, 2-butanone [methylethyl ketone or MEK], and phthalate esters [especially bis(2-ethylhexyl)phthalate]), the factor is raised to ten times (10X) the blank concentration. The sample result is elevated to the quantitation limit if it is less than the quantitation limit or remains unaltered if the sample result is greater than or equal to the quantitation limit, and is qualified as undetected (U).

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

Surrogate spikes, or system monitoring compounds, are added to the environmental samples analyzed by chromatographic techniques for VOCs, SVOCs, pesticides, PCBs, herbicides, gasoline, and diesel. Surrogate compounds are analytes that are not expected to be present in associated environmental samples, but behave similar to target compounds chromatographically. Known amounts of each surrogate are added prior to sample preparation and are carried throughout the

preparation/analysis procedure. The percent recoveries of these surrogate compounds give some measure of the anticipated recoveries of the target compounds whose chromatographic behavior they mimic.

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

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

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

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

Documentation of data qualifications resulting from the application of these guidelines is retained in project files as both hard copy and electronic media.

A.4.8 *Field Nonconformances*

Four field surveillances (EM-99-28, -29, -30 and EM-99-32) were conducted for this corrective action investigation by the DOE/NV Environmental Management office. Two of these surveillances

(EM-99-29 and EM-99-32) examined field sampling procedures to verify that sampling activities were performed in accordance with applicable requirements.

Surveillance EM-99-29 identified one finding associated with sampling procedures. This finding noted that administrative access controls for the temporary sample storage refrigerator in use were not consistent with the applicable approved contractor procedure. Sample quality was not jeopardized by this administrative issue because other physical controls were maintained by project personnel. No findings were identified by Surveillance EM-99-32.

A.4.9 Laboratory Nonconformances

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

A.5.0 Summary

Analysis of the data generated from corrective action investigation activities conducted at the SWSs 1 and 5 site indicates the following:

- All total VOCs and total SVOCs results for leachfield soil were below the PALs outlined in the CAIP (DOE/NV, 1999).
- No diesel range total petroleum hydrocarbon concentrations in soil exceeded the NDEP action level of 100 mg/kg for diesel.
- Reported levels for all total RCRA metal (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) soil samples were below the PALs established in the CAIP (DOE/NV, 1999) except for arsenic. Arsenic was detected above the PAL of 3.0 mg/kg in all the soil samples analyzed. The arsenic concentrations for the samples analyzed ranged from 4 to 68.7 mg/kg. Although these concentrations exceed the PAL for arsenic, most of these concentrations are typical for this portion of the state of Nevada. Arsenic contamination is present at low concentrations at the proximal end of Septic Waste System 5, Leachfield 1.
- Radiological results for all soil samples are considered not to be statistically different from their respective established background levels; therefore, are below PALs.
- One septic tank integrity soil sample contained benzo(a)pyrene at a concentrations greater than the PAL.
- VOC, SVOC, RCRA metal, TPH, and radiological contamination is associated with SWS 1 septic tanks.

A.6.0 References

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Appendix B

Cost Estimates

11/23/99

BECHTEL NEVADA

ESTIMATE DATA SHEET

CH #: _____

EST ID: 00EM-010

TO: International Technologies

FROM: Bechtel Nevada Environmental Restoration Project

SUBJECT: DRAFT CAU 428 Septic Systems 1 & 5 TTR Estimate

ESTIMATOR: S. Parsons-Depry

RFE #: _____

TYPE OF ESTIMATE:

____ ORDER OF MAGNITUDE
____ PRELIMINARY / PLANNING / STUDY
☒ CONCEPTUAL / BUDGET
____ TITLE I

____ TITLE II
____ WORK ORDER
____ COMPARATIVE
____ OTHER

TYPE OF WORK:

____ NON-MANUAL ONLY
____ MANUAL ONLY
☒ MANUAL & NON-MANUAL
____ OTHER

PROJECT WORK SCOPE IS EXPECTED TO BE PERFORMED BY:

DOE PRIME (LUMP SUM)

NTS GENERAL

NTS MAINTENANCE

☒

SUBCONTRACT (Lump Sum)

GPP

OTHER

SCOPE and ASSUMPTIONS:

Assumptions: Alternative 1 - No further Action

No actions; no associated costs. No administrative controls implied.

Assumptions: Alternative 2 - Closure of Septic Tank and Administrative Controls

Remove and dispose of approximately 4000 gallons of LLW sludge from tanks 33-1A, 33-1B, 33-3, and 33-8 and 0.5 cubic yards of dried LLW sludge from tank 33-10

Excavate a total of approximately 27 cubic yards of soil to expose the tops of the tanks.

Pump tank contents into 55 gallon drums.

Transport to the NTS for solidification.

Requires RWAP profiling and approval

Locate and sample suspected septic tank near northwest corner of Building 0101.

Excavate a total of approximately 1.75 cubic yards of soil to expose the tops of the tank.

Collect and analyze 1 sludge and 1 liquid sample from the tank

Analyze samples for VOC, SVOC, Total Metals, TPH, Gamma Scan and Isotopic Uranium

Pump approximately 2000 gallons of sludge from tank into tanker truck.

Dispose of sludge as septic waste.

Triple rinse tanks

Containerize rinsate into 55 gallon drums.

Collect 1 waste characterization samples from each rinse for gamma spectroscopy.

Assume 1000 gallons sanitary waste.

Grout outlets and inlet of septic tank and distribution box

Grout placement accessible from tank interior piping

Fill septic tanks with inert material for closure in place.

Collect Verification samples from below the tanks.

Collect 2 samples below tanks 33-8, 33-10, and the suspected tank and analyze for VOC, SVOC, Total Metals, TPH, Gamma Scan and Isotopic Uranium.

Collect 1 sample below tank 33-1A and analyze for SVOC only.

Administrative activities and costs associated with use restrictions for the leachfield

Survey leachfield boundaries for Use Restriction site map.

Assumptions: Alternative 3 - Clean Closure by Removal

Remove and dispose of approximately 4000 gallons of LLW sludge from tanks 33-1A, 33-1B, 33-3, and 33-8 and 0.5 cubic yards of dried LLW sludge from tank 33-10

Excavate a total of approximately 27 cubic yards of soil to expose the tops of the tanks.

Pump tank contents into 55 gallon drums.

Transport to the NTS for solidification.

Requires RWAP profiling and approval

Remove and dispose of approximately 1 cubic yard benzo(a)pyrene contaminated soil associated with tank 33-1A

Waste soil will be transported to the NTS for disposal as nonhazardous solid waste.

Locate and sample suspected septic tank near northwest corner of Building 0101.

Excavate a total of approximately 1.75 cubic yards of soil to expose the tops of the tank.

Collect and analyze 1 sludge and 1 liquid sample from the tank

Analyze samples for VOC, SVOC, Total Metals, TPH, Gamma Scan and Isotopic Uranium

Pump approximately 2000 gallons of sludge from tank into tanker truck.

Dispose of sludge as septic waste.

Triple rinse tanks

Containerize rinsate into 55 gallon drums.

Collect 1 waste characterization samples from each rinse for gamma spectroscopy.

Assume 1000 gallons sanitary waste.

CH#:

EST ID: 00EM-010

BECHTEL NEVADA**ESTIMATE DATA SHEET**

CAU 428 CADD

Appendix B

Revision: 0

Date: 02/09/2000

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11/23/99

*Grout outlets and inlet of septic tank and distribution box**Grout placement accessible from tank interior piping**Fill septic tanks with inert material for closure in place.**Collect Verification samples from below the tanks.**Collect 2 samples below tanks 33-8, 33-10, and the suspected tank and analyze for VOC, SVOC, Total Metals, TPH, Gamma Scan and Isotopic Uranium.**Collect 1 sample below tank 33-1A and analyze for SVOC only.**Excavate and dispose of 6 cubic yards of arsenic impacted soil from the proximal end of the leachfield**Excavate 11 cubic yards of clean soil to expose impacted soil.**Waste soil will be containerized in a roll-off container and disposed by an off-site contract vendor.**Collect 5 verification samples and analyze for Total Metals.**Excavation will be backfilled with clean soil from a nearby location.**No administrative activities associated with use restrictions will be required.***SCHEDULE MILESTONES:**

None

ESCALATION:

- No escalation has been added to this estimate

CONTINGENCY:

- No contingency has been added to this estimate.

RATES:

- FY00 rates, Revision 1, were applied using the BN FY00 cost model.

COST SUMMARY:

		CIP		CBR
PROJECT COSTS	\$	261,479	\$	279,716
ESCALATION	\$	-	\$	-
SUBTOTAL	\$	261,479	\$	279,716
CONTINGENCY (0%)	\$	-	\$	-
TOTAL ESTIMATED COST	\$	261,479	\$	279,716

Review / Concurrence:

Requester

Kand O Nelson

11-23-99

Date

Paul H. Tomich

11/23/99

Date

Assistant General Manager

Operations Manager

for Michael Shotton

11-23-99

Date

Financial Officer

Dorey Swenson

11/23/99

Date

Project Control

Mark S. Mendenhall

11/23/99

Date

Copy to: Bill Contine, Project Controls Manager

Appendix C

Soil Boring Logs

SOIL BORING LOG				BORING NUMBER: B111		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-1 of C-17
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/09/99		
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/09/99		
SURFACE ELEVATION (meters):1674.26				GEOLOGIST: M. England		
TOTAL DEPTH DRILLED (feet): 21.50				QA CHECK: R. McCall		
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182100.00		
DRILLING METHOD: Hollow Stem Auger				Easting: 521421.00		
DRILLING CONTRACTOR: West Hazmat Drilling				Comments: Soil colors per Munsell Soil Color Chart		
Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/4). Moist, cohesive coarse-grain sand with gravel to 3.5 cm.	Location: SWS1, Leachfield 1 SW Corner DLSW	
	1.0					
5.0				Gravelly Sand with Fines, reddish brown (10YR 5/4). Moist and cohesive.		TTR01274
	2.0					
10.0	3.0			Gravelly Sand with Fines, yellowish brown (10YR 5/6). More compact material with less moisture. Increased fines with minimal gravel.		TTR01275
	4.0					
15.0	5.0			Gravelly Sand with Fines, (10YR 5/4). Increased compaction with higher amount of fines and decreased gravel.		TTR01276
	6.0			Gravelly Sand with Fines, (10YR 5/4). Increased compaction with higher amount of fines and decreased gravel.	Portland Cement with Bentonite 5% by weight used to grout hole	TTR01277
20.0						

SOIL BORING LOG				BORING NUMBER: B112		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-2 of C-17	
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/09/99			
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/09/99			
SURFACE ELEVATION (meters):1674.37				GEOLOGIST: M. England			
TOTAL DEPTH DRILLED (feet): 24.00				QA CHECK: R. McCall			
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182099.00			
DRILLING METHOD: Hollow Stem Auger				Easting: 521427.20			
DRILLING CONTRACTOR: West Hazmat Drilling				Comments: Soil colors per Munsell Soil Color Chart			
Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.	
0.0	0.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/4). Moist, cohesive, coarse grain sand with gravel and minimal fines. Top 8 inches was concrete with rebar noted at 4 inch depth.	Location: SWS1, Leachfield 1 DLSE		
	1.0		LR	Leachrock/Fill Material, yellowish brown (10YR 5/6). 4 inches of sluff noted at 4 ft interval, with leachrock noted at approximately 5.5 ft depth.			TTR01280
5.0	2.0		GM	Gravelly Sand with Fines (10YR 5/6).			
	3.0			Gravelly Sand with Fines (10YR 5/4). Less moisture with increased fines.			TTR01281
10.0	4.0						
	5.0			Gravelly Sand with Fines (10YR 5/6). Less moisture with increased fines.	Sample TTR01283 was Field Duplicate of TTR01282	TTR01282 & TTR01283	
15.0	6.0						
	7.0			Gravelly Sand with Fines (10YR 5/6). Less moisture with increased fines.	Portland Cement with Bentonite 5% by weight used to grout hole	TTR01284	
20.0							

SOIL BORING LOG				BORING NUMBER: B113		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-3 of C-17	
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/09/99			
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/09/99			
SURFACE ELEVATION (meters):1673.93				GEOLOGIST: M. England			
TOTAL DEPTH DRILLED (feet): 24.00				QA CHECK: R. McCall			
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182108.00			
DRILLING METHOD: Hollow Stem Auger				Easting: 521437.60		Comments: Soil colors per Munsell Soil Color Chart	
DRILLING CONTRACTOR: West Hazmat Drilling							
Depth Feet	Depth Meters	Legend	USCS	Classification		Remarks	Sample No.
0.0	0.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/4). Moderately moist and cohesive, fine to medium grain sand with an appreciable amount of fines.		Location: SWS1, Leachfield 1 DLCE	
	1.0						
5.0	2.0			Gravelly Sand with Fines, yellowish brown (10YR 5/6). Moderately moist, large percentage of fines with gravel to 4 cm.			
	3.0						
10.0	4.0			Gravelly Sand with Fines (10YR 5/6). Cohesive, fine to medium grain sand with silt and gravel to 2 cm.			TTR01286
	5.0						
15.0	6.0			Gravelly Sand with Fines (10YR 5/6). Somewhat moist, fine to medium grain sand.			
	7.0					Portland Cement with Bentonite 5% by weight used to grout hole	TTR01287
20.0				Gravelly Sand with Fines, reddish brown (10YR 5/6). Large percentage of fines.			

SOIL BORING LOG				BORING NUMBER: B114		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-4 of C-17	
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/09/99			
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/09/99			
SURFACE ELEVATION (meters):1673.22				GEOLOGIST: M. England			
TOTAL DEPTH DRILLED (feet): 21.50				QA CHECK: R. McCall			
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182110.00			
DRILLING METHOD: Hollow Stem Auger				Easting: 521432.10			
DRILLING CONTRACTOR: West Hazmat Drilling				Comments: Soil colors per Munsell Soil Color Chart			
Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.	
0.0	0.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/6), loose, moist, cohesive fine to medium grain sand. Darker band of soil, dark yellowish brown (10YR 4/4) noted from 7 to 13 inches from top of core.	Location: SWS1, Leachfield 1 DLCW		
	1.0			Gravelly Sand with Fines, yellowish brown (10YR 5/4), moist, very fine grain sand with appreciable amount of fines and minimal gravel.			
5.0							
	2.0						
10.0	3.0			Gravelly Sand with Fines (10YR 5/6), very fine grain sand with increased fines.			TTR01288
				Gravelly Sand with Fines (10YR 5/6), insufficient material collected for Geotechnical sample.	Geotechnical Sample collected at 13.5-14.5 ft depth		
	4.0			Gravelly Sand with Fines (10YR 5/6), geotechnical sample was collected from 13.5 to 14.5 ft.		TTR01291	
15.0				Gravelly Sand with Fines (10YR 5/6), minimal moisture, cohesive, fine to medium grain sand with gravel to 4 cm.		TTR01289	
	5.0						
20.0	6.0			Gravelly Sand with Fines (10YR 5/6), moist, appreciable amount of fines.	Portland Cement with Bentonite 5% by weight used to grout hole	TTR01290	

SOIL BORING LOG				BORING NUMBER: B115		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-5 of C-17	
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/09/99			
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/09/99			
SURFACE ELEVATION (meters):1673.16				GEOLOGIST: M. England			
TOTAL DEPTH DRILLED (feet): 24.00				QA CHECK: R. McCall			
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182121.00			
DRILLING METHOD: Hollow Stem Auger				Easting: 521426.70			
DRILLING CONTRACTOR: West Hazmat Drilling				Comments: Soil colors per Munsell Soil Color Chart			
Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.	
0.0	0.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/6). Moist, cohesive fine to medium grain sand with fines and gravel to 4 cm.	Location: SWS1, Leachfield 1 DLNW		
	1.0						
5.0	2.0	LR	Leachrock was noted at approximately 4-8 ft depth, averaging 2-4 cm, sub angular to round. Exact depth interval was unknown.				
	3.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/4), fine grain sand.			
10.0	4.0						
	5.0			Gravelly Sand with Fines, brownish yellow (10YR 6/6). Consolidated fine grain sand with fines.			TTR01292
15.0	6.0						
	7.0			Gravelly Sand with Fines (10YR 6/6). Fine grain sand with appreciable amount of fines and gravel to 1.5 cm.	Portland Cement with Bentonite 5% by weight used to grout hole	TTR01293	
20.0							

SOIL BORING LOG				BORING NUMBER: B116		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-6 of C-17	
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/09/99			
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/09/99			
SURFACE ELEVATION (meters):1673.25				GEOLOGIST: M. England			
TOTAL DEPTH DRILLED (feet): 24.00				QA CHECK: R. McCall			
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182120.00			
DRILLING METHOD: Hollow Stem Auger				Easting: 521430.70		Comments: Soil colors per Munsell Soil Color Chart	
DRILLING CONTRACTOR: West Hazmat Drilling							
Depth Feet	Depth Meters	Legend	USCS	Classification		Remarks	Sample No.
0.0	0.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/6). Fine to medium grain sand with appreciable fines and gravel to 1 cm.		Location: SWS1, DLNE	
	1.0						
			LR	Leachrock was noted at approximately 4-8 ft depth, exact depth interval was not known. Recovery was poor.		Small piece of vitrified clay pipe noted at 4 - 8 ft depth	
5.0	2.0						
			GM	Gravelly Sand with Fines (10YR 5/6). Fine to medium grain sand with appreciable fines.			
	3.0			Gravelly Sand with Fines (10YR 5/6). Fine grain sand with fines and gravel to 4 cm. Lamination noted at approximately 14 ft depth.			
10.0	4.0						
	5.0			Gravelly Sand with Fines (10YR 5/6). Cohesive material with appreciable amount of silt noted.			TTR01294
15.0	6.0						
	7.0			Gravelly Sand with Fines (10YR 5/6). Fine grain sand with fines, increased amount of gravel noted at 22-24 ft depth.		Portland Cement with Bentonite 5% by weight used to grout hole	TTR01295
20.0							

SOIL BORING LOG				BORING NUMBER: B121		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-7 of C-17	
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/10/99			
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/10/99			
SURFACE ELEVATION (meters):1670.30				GEOLOGIST: M. England			
TOTAL DEPTH DRILLED (feet): 34.00				QA CHECK: R. McCall			
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182262.00			
DRILLING METHOD: Hollow Stem Auger				Easting: 521397.90			
DRILLING CONTRACTOR: West Hazmat Drilling				Comments: Soil colors per Munsell Soil Color Chart			
Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.	
0.0	0.0		GM	Gravelly Sand with Fines, light yellowish brown (10YR 6/4). Dry, fine grain sand with silt and gravel. Moisture increased at 4 ft depth with color change to yellowish brown (10YR 5/6).	Location: SWS1, Leachfield 2 NW Corner		
	1.0						
5.0			LR	Leachrock, light gray (10YR 7/2) was noted from approximately 4-8 ft depth, exact depth interval unknown.			
	2.0						
			GM	Gravelly Sand with Fines (10YR 6/4). Dry, fine, loose unconsolidated material.			
	3.0		LR	Leachrock noted from approximately 9 to 9.5 ft depth.			
10.0			GM	Gravelly Sand with Fines, yellowish brown (10YR 5/6). Unconsolidated, fine grain sand with silt and gravel to 1 cm.			
	4.0						
15.0				Gravelly Sand with Fines, brownish yellow (10YR 6/6). Fine grain sand with minimal fines and gravel to 3 cm		TTR01297	
	5.0						
				Gravelly Sand with Fines (10YR 5/6). Dry, loose, unconsolidated fine to medium grain sand with fines and gravel averaging 0.5 cm.		TTR01298	
20.0	6.0						
	7.0			Gravelly Sand with Fines (10YR 5/6). Dry, unconsolidated gravelly sand with fines. Sluff noted at 24 to 26 ft depth.		TTR01299	
25.0							
	8.0						
	9.0			Gravelly Sand with Fines (10YR 5/6). Dry, loose, unconsolidated fine grain sand with fines and gravel.	Portland Cement with Bentonite 5% by weight used to grout hole	TTR01300	
30.0							
	10.0						

SOIL BORING LOG				BORING NUMBER: B121A		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-8 of C-17	
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/11/99			
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/11/99			
SURFACE ELEVATION (meters):1670.07				GEOLOGIST: M. England			
TOTAL DEPTH DRILLED (feet): 29.00				QA CHECK: R. McCall			
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182265.00			
DRILLING METHOD: Hollow Stem Auger				Easting: 521394.20			
DRILLING CONTRACTOR: West Hazmat Drilling				Comments: Soil colors per Munsell Soil Color Chart			
Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.	
0.0	0.0		GM	Gravelly Sand with Fines, light yellowish brown (10YR 6/4). Dry, unconsolidated fine to medium grain sand with fines and gravel to 3.5 cm.	Location: SWS1, Leachfield 2 NW Stepout		
	1.0						
5.0	2.0			Gravelly Sand with Fines (10YR 6/4). Dry, unconsolidated, increased gravel with fewer fines. The majority of gravel was pea-size, with fine to medium grain sand		TTR01306	
	3.0						
10.0	4.0			Gravelly Sand with Fines (10YR 6/4). Very dry, fine to medium grain sand with gravel to 2 cm.		TTR01307	
	5.0						
15.0	6.0		GM	Gravelly Sand with Fines (10YR 6/4). Dry, unconsolidated fine grain sand with an appreciable amount of fines.			
	7.0						
20.0	8.0			Gravelly Sand with Fines, brownish yellow (10YR 6/6). Fine grain sand with fines. Material became more coarse-grained at the 20 ft depth.		TTR01310
		GM		Portland Cement with Bentonite 5% by weight used to grout hole		
25.0				Gravelly Sand with Fines (10YR 6/6). Fine to medium grain sand, with silt lamination noted from 26 to 28 ft. Coarse grain sand and increased gravel noted at 29 ft depth.		TTR01311
		GM				

SOIL BORING LOG				BORING NUMBER: B122		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-9 of C-17
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/10/99		
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/10/99		
SURFACE ELEVATION (meters):1671.61				GEOLOGIST: M. England		
TOTAL DEPTH DRILLED (feet): 36.50				QA CHECK: R. McCall		
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182264.00		
DRILLING METHOD: Hollow Stem Auger				Easting: 521416.20		
DRILLING CONTRACTOR: West Hazmat Drilling				Comments: Soil colors per Munsell Soil Color Chart		
Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/6). Coarse grain sand with fines and gravel to 3 cm.	Location: SWS1, Leachfield 2 NE Corner	
	1.0		GW	Fine Grain Gravel, pale brown (10YR 6/3). Fine gravel with coarse grain sand.		
5.0			GM			
	2.0			Gravelly Sand with Fines (10YR 5/6). Coarse grain sand with gravel.		
	3.0			Gravelly Sand with Fines (10YR 5/6).		TTR01301
10.0				Coarse Grain Sand/Fine Grain Gravel band noted at 12.5 to 13.0 ft (10YR 5/3). Some large gravel to 4 cm noted within band.		
	4.0		GW
		GM	Gravelly Sand with Fines (10YR 5/6). Moist, cohesive, fine grain sand with numerous fines and very little gravel.		TTR01302
15.0	5.0
	6.0			Gravelly Sand with Fines, brownish yellow (10YR 6/6). Very cohesive and dense with a high amount of fines.		
20.0				Gravelly Sand with Fines (10YR 5/6). Cohesive, moist, very dense with fines increasing at 24 to 25 ft.		
	7.0
	8.0			Well-Graded Sand, gray (7.5YR 6/1). Band of fine-grain sand noted at 33.5 ft depth.		TTR01304
25.0
	9.0		SW	Gravelly Sand with Fines, yellowish brown (10YR 5/4)/(10YR 5/6). Cohesive, moist and dense.		
30.0			GM			
	10.0			Well Graded Sand, brown (7.5YR 5/2). Band of fine grain sand noted at 35.5 to 36.5 ft depth.	Portland Cement with Bentonite 5% by weight used to grout hole	TTR01305
35.0			SW			

SOIL BORING LOG				BORING NUMBER: B123		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-10 of C-17	
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/11/99			
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/11/99			
SURFACE ELEVATION (meters):1671.05				GEOLOGIST: M. England			
TOTAL DEPTH DRILLED (feet): 24.00				QA CHECK: R. McCall			
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182237.00			
DRILLING METHOD: Hollow Stem Auger				Easting: 521406.70			
DRILLING CONTRACTOR: West Hazmat Drilling				Comments: Soil colors per Munsell Soil Color Chart			
Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.	
0.0	0.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/4). Moist, cohesive medium grain sand with minimal fines and gravel.	Location: SWS1, Leachfield 2 Center		
	1.0						
5.0			LR	Leachrock/Fill Material noted at approximately 4 to 7 ft depth with gravel averaging 4.5 cm.			
	2.0						TTR01312
		GM	Gravelly Sand with Fines, brown (10YR 5/3). Loose, unconsolidated material.			
	3.0			Gravelly Sand with Fines, yellowish brown (10YR 5/6). Moist, cohesive, very fine grain sand with appreciable fines and minimal gravel.	Sample TTR01314 was Field Duplicate of TTR01313	TTR01313 & TTR01314	
10.0							
	4.0						
15.0				Gravelly Sand with Fines (10YR 5/6). Moist, cohesive, very fine grain sand with high amount of fines and minimal gravel.			
	5.0						
20.0				Gravelly Sand with Fines (10YR 5/6). Moist, cohesive, very fine grain sand with appreciable fines. Coarse gravel noted near 24 ft depth.	Portland Cement with Bentonite 5% by weight used to grout hole	TTR01315	
	6.0						
	7.0						

SOIL BORING LOG				BORING NUMBER: B124		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-11 of C-17	
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/11/99			
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/11/99			
SURFACE ELEVATION (meters):1671.21				GEOLOGIST: M. England			
TOTAL DEPTH DRILLED (feet): 24.00				QA CHECK: R. McCall			
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182210.00			
DRILLING METHOD: Hollow Stem Auger				Easting: 521399.50			
DRILLING CONTRACTOR: West Hazmat Drilling				Comments: Soil colors per Munsell Soil Color Chart			
Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.	
0.0	0.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/4). Moist, cohesive, very fine grain sand with appreciable amount of fines.	Location: SWS1, Leachfield 2 Southwest		
	1.0						
5.0			LR	Leachrock/Fill Material, light brownish gray (10YR 6/2). Leachrock noted from approximately 4 to 8 ft depth with gravel averaging .5 cm.			
	2.0
		GM	Gravelly Sand with Fines, light yellowish brown (10YR 6/4).		TTR01319	
10.0	3.0			Gravelly Sand with Fines, yellowish brown (10YR 5/6). Moist, cohesive, very fine grain sand with increased fines.			
	4.0						
				Gravelly Sand with Fines (10YR 5/6). Moist, somewhat cohesive, fine to medium grain sand with higher gravel content and fewer fines.		TTR01320	
15.0	5.0
		Gravelly Sand with Fines (10YR 5/6). Fine to medium grain sand with fewer fines. Laminations of silt noted at 21 to 24 ft depth.	Portland Cement with Bentonite 5% by weight used to grout hole	TTR01321	
20.0	6.0						
	7.0						

SOIL BORING LOG				BORING NUMBER: B125		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-12 of C-17	
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/11/99			
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/11/99			
SURFACE ELEVATION (meters):1671.61				GEOLOGIST: M. England			
TOTAL DEPTH DRILLED (feet): 26.50				QA CHECK: R. McCall			
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182210.00			
DRILLING METHOD: Hollow Stem Auger				Easting: 521411.90			
DRILLING CONTRACTOR: West Hazmat Drilling				Comments: Soil colors per Munsell Soil Color Chart			
Depth Feet	Depth Meters	Legend	USCS	Classification		Remarks	Sample No.
0.0	0.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/6). Moist, cohesive, fine grain sand with fines and minimal gravel.		Location: SWS1, Leachfield 2 Southeast	
	1.0						
	5.0			Gravelly Sand with Fines (10YR 5/6). Fine to medium grain sand with fines, gravel increasing at 9 ft depth.			
	2.0						TTR01322
				No recovery from 9 to 11.5 ft.			
	10.0						
	3.0		GM	Gravelly Sand with Fines (10YR 5/6). Fine to medium grain sand with fines and gravel to 1 cm.			
	4.0						
	15.0			Gravelly Sand with Fines (10YR 5/6). Geotechnical sample was collected from 15.5 to 16.5 ft.			
	5.0			Gravelly Sand with Fines (10YR 5/6). Geotechnical sample was collected from 15.5 to 16.5 ft.			TTR01318
				Gravelly Sand with Fines (10YR 5/6). Fine to medium grain sand with minimal fines.			
	20.0			Gravelly Sand with Fines, brownish yellow (10YR 6/6). Medium to coarse grain sand with minimal fines and gravel to 2 cm.			
	6.0					Sample TTR01326 was Field Duplicate of TTR01324	
	7.0			Gravelly Sand with Fines (10YR 5/6). Geotechnical sample was collected from 25.5 to 26.5 ft.			
	25.0						
				Portland Cement with Bentonite 5% by weight used to grout hole			TTR01324 & TTR01326
							TTR01325

SOIL BORING LOG				BORING NUMBER: B511		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-13 of C-17	
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/07/99			
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/07/99			
SURFACE ELEVATION (meters):1679.80				GEOLOGIST: M. England			
TOTAL DEPTH DRILLED (feet): 20.00				QA CHECK: R. McCall			
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182026.00			
DRILLING METHOD: Hollow Stem Auger				Easting: 521520.20		Comments: Soil colors per Munsell Soil Color Chart	
DRILLING CONTRACTOR: West Hazmat Drilling							
Depth Feet	Depth Meters	Legend	USCS	Classification		Remarks	Sample No.
0.0	0.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/4). Moist, cohesive sand with gravel and minimal fines.		Location: Center of Leachfield	
	1.0						
5.0			GW	Well Graded Gravel, brown (10YR 5/3). Compacted fill material.			
	2.0		LR	Leachrock/Fill Material was noted from 6.5 to 8 ft.			
	3.0		GM	Gravelly Sand with Fines (10YR 5/3). Very moist, cohesive, coarse grain subangular to round sand with fines and gravel to 4.5 cm.			
10.0							
	4.0			Gravelly Sand with Fines (10YR 5/3). Moist, cohesive, higher percentage of fines, with some clay present. Subrounded gravel to 5 cm.			
	5.0			Gravelly Sand with Fines, yellowish brown (10YR 5/6). Soil was moist and cohesive. Band of pink rock was noted at approximately 15.5 ft depth, and a band of dark gray rock was noted at approximately 16.5 ft depth.			
15.0						Wyoming Bentonite used to grout hole	TTR01263
	6.0			Gravelly Sand with Fines, light yellowish brown (10YR 6/4). Minimal moisture, coarse grain sand with gravel to 2.5 cm.			

SOIL BORING LOG				BORING NUMBER: B512		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-14 of C-17	
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/07/99			
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/07/99			
SURFACE ELEVATION (meters):1679.90				GEOLOGIST: M. England			
TOTAL DEPTH DRILLED (feet): 20.00				QA CHECK: R. McCall			
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182016.00			
DRILLING METHOD: Hollow Stem Auger				Easting: 521518.70		Comments: Soil colors per Munsell Soil Color Chart	
DRILLING CONTRACTOR: West Hazmat Drilling							
Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.	
0.0	0.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/6). Very moist, cohesive subangular gravel to 2 cm. Recovery was poor (1.5 ft was actually recovered) consisting of loose backfill material. Auger walked.	Location: Southeast corner of Leachfield		
	1.0						
5.0				Gravelly Sand with Fines, yellowish brown (10YR 5/4). Moist, very coarse sand with subangular to subround gravel to 4.5 cm consisting of backfill material.			
	2.0						
10.0	3.0			Gravelly Sand with Fines (10YR 5/4). Very coarse grain sand.			
	4.0			Gravelly Sand with Fines (10YR 5/4). A large cobble of tuff with plagioclase and hornblende was noted at 12.5 ft depth.			
						TTR01264	
15.0				Gravelly Sand with Fines (10YR 5/4). Moisture decreased with depth.	Wyoming Bentonite used to grout hole		
	5.0			Gravelly Sand with Fines (10YR 5/4). Moisture continued to decrease.			
	6.0					TTR01265	

SOIL BORING LOG				BORING NUMBER: B513		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-15 of C-17	
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/08/99			
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/08/99			
SURFACE ELEVATION (meters):1679.67				GEOLOGIST: M. England			
TOTAL DEPTH DRILLED (feet): 20.00				QA CHECK: R. McCall			
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182019.00			
DRILLING METHOD: Hollow Stem Auger				Easting: 521513.00		Comments: Soil colors per Munsell Soil Color Chart	
DRILLING CONTRACTOR: West Hazmat Drilling							
Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.	
0.0	0.0			0 to 7.5 ft was backfill material, not available for description.	Location: Southwest corner of leachfield		
	1.0						
5.0							
	2.0
		GM	Gravelly Sand with Fines, brown (10YR 5/3). Moist, cohesive coarse grained sand.			
10.0	3.0			Gravelly Sand with Fines (10YR 5/3). Geotechnical sample was attempted but not taken due to poor recovery.			
				Gravelly Sand with Fines, light yellowish brown (10YR 6/4). Coarse grain sand with high moisture content, some light brown discoloration.			
	4.0			Gravelly Sand with Fines. Coarse grain sand with high moisture content.			
15.0				Gravelly Sand with Fines, yellowish brown (10YR 5/4). Very coarse grain sand.		TTR01266	
	5.0						
				Gravelly Sand with Fines (10YR 5/4). Very coarse grain sand.	Portland Cement with Bentonite 5% by weight used to grout hole	TTR01267	
	6.0						

SOIL BORING LOG				BORING NUMBER: B514		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-16 of C-17
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/08/99		
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/08/99		
SURFACE ELEVATION (meters):1679.89				GEOLOGIST: M. England		
TOTAL DEPTH DRILLED (feet):21.50				QA CHECK: R. McCall		
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182034.00		
DRILLING METHOD: Hollow Stem Auger				Easting: 521528.20		
DRILLING CONTRACTOR: West Hazmat Drilling				Comments: Soil colors per Munsell Soil Color Chart		
Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/4). Moist, cohesive backfill material.	Location: Northeast corner of Leachfield	
	1.0					
	5.0			Gravelly Sand with Fines (10YR 5/4). Moist, with increased coarse grain sand from 8.5 to 9 ft depth.		
	2.0				Fill material was noted to approximately 7-7.5 ft bgs	
	10.0			Gravelly Sand with Fines, brown (10YR 5/3). Geotechnical sample was collected from 9 to 10.5 ft.		TTR01268
	3.0			Gravelly Sand with Fines (10YR 5/4). Moist, somewhat cohesive coarse grain sand with gravel to 4 cm.		
	4.0					
	15.0			Gravelly Sand with Fines, yellowish brown (10YR 5/6). High moisture content, with very cohesive angular to sub-round coarse grain sand with a large amount of fines.		TTR01269
	5.0					
	20.0			Gravelly Sand with Fines, strong brown (7.5YR 5/6). Very moist, cohesive with increased fines. Soil showed reddish color.	Portland Cement with Bentonite 5% by weight used to grout hole	TTR01270

SOIL BORING LOG				BORING NUMBER: B515		CAU 428 CADD Appendix C Revision: 0 Date: 02/09/2000 Page C-17 of C-17
PROJECT NAME: Area 3 Septic Waste Systems 1&5				DATE HOLE STARTED: 06/08/99		
PROJECT NUMBER: 776711.06020100				DATE HOLE COMPLETED: 06/08/99		
SURFACE ELEVATION (meters):1679.82				GEOLOGIST: M. England		
TOTAL DEPTH DRILLED (feet):21.50				QA CHECK: R. McCall		
ENVIRONMENTAL CONTRACTOR: IT Corporation				Northing: 4182035.00		
DRILLING METHOD: Hollow Stem Auger				Easting: 521524.70		
DRILLING CONTRACTOR: West Hazmat Drilling				Comments: Soil colors per Munsell Soil Color Chart		
Depth Feet	Depth Meters	Legend	USCS	Classification	Remarks	Sample No.
0.0	0.0		GM	Gravelly Sand with Fines, yellowish brown (10YR 5/6). Moist, cohesive, coarse grain sand with subangular to round gravel to 3 cm. Silt content increased from 0 to 2.5 ft depth.	Location: Northwest corner of Leachfield	
	1.0					
5.0	2.0			Gravelly Sand with Fines, yellowish brown (10YR 5/4). Decreased moisture, coarse grain sand with gravel to 5.5 cm.		
	3.0		Gravelly Sand with Fines, strong brown (7.5YR 5/6). Coarse grain sand with gravel to 4 cm. Silt content increased at the 9 to 10 ft depth.			
	4.0					
15.0	5.0			Gravelly Sand with Fines (10YR 5/4). Moist, cohesive, coarse grain sand.		TTR01271
	</					

Appendix D

Response to NDEP Comments

NEVADA ENVIRONMENTAL RESTORATION PROJECT

DOCUMENT REVIEW SHEET

(Page 1 of 2)

1. Document Title/Number: Corrective Action Decision Document for Corrective Action Unit 428: Area 3 Septic Waste Systems 1 and 5, Tonopah Test Range, Nevada		2. Document Date: November 1999		
3. Revision Number: 0		4. Originator/Organization: IT Corporation		
5. Responsible DOE/NV ERP Project Mgr.: Janet Appenzeller-Wing		6. Date Comments Due: December 30, 1999		
7. Review Criteria: Full				
8. Reviewer/Organization/Phone No.: Gregory Raab, NDEP, 486-2867			9. Reviewer's Signature:	

10. Comment Number/Location	11. Type*	12. Comment	13. Comment Response	14. Accept
1) Page 24 of 26, 1 st Paragraph, 1 st Sentence		"...Clean Closure by Excavation and Disposal..." Since the PALs are equated to the industrial PRGs, it is unacceptable for DOE to consider Clean Closure of a site with no LURs that has been remediated utilizing industrial PRGs.	All detected constituents are less than the residential-use PRGs with the exception of arsenic, Benzo(a)Pyrene, and Benzo(b)Fluoranthene. The preferred alternative specifies the removal of contaminated soil in excess of Industrial PRGs. The necessity for establishing use restrictions limiting future utilization to industrial activities will be evaluated based on post closure verification sample results and will be addressed in the CAP.	Partial
2) Page A-1 of A-62, 2 nd Paragraph, Last Sentence		"...Septic Waste Systems (<u>SWS</u>) 1 and 5..." Insert acronym "SWS".	Acronym inserted.	Yes
3) Page A-12 of A-62, 4 th Paragraph		"...Samples were collected from the leachfield system components in the sequence provided in Table A.2-1...". There is a disconnect in logic here relative to this sentence and Table A.2-1 as there is no sequence specified; therefore, this sentence makes no sense. The table lists analytical procedures. If there are specific sampling protocols required for each analytical procedure, and the sequence is set up for ease and efficiency of sampling in the field, then state that, and clarify the sentence.	Table A.2-1 has been revised to indicate collection sequence.	Yes

NEVADA ENVIRONMENTAL RESTORATION PROJECT

DOCUMENT REVIEW SHEET

(Page 2 of 2)

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
4) Page A-13 through A-16 of A-62		Any references to Table A.2-1 relate to comment 3 above, and may need to be rewritten depending upon possible corrections made on Table A.2-1.	See Comment 3.	No
5) A-16 of A-62, 3 rd Paragraph, 4 th Sentence		"...To total VOCs sample container was filled with soil directly from the core barrel followed by collection of material for field screening...". Something is missing in this sentence and as such does not make sense; please clarify.	The sentence has been clarified.	Yes
6) Page A-29 of A-62, 1 st Paragraph, 2 nd Sentence		"...Detections of acetone at low concentrations is not a significant concern because acetone is a common laboratory contaminant...". This must be rewritten. Acetone is a commonly used organic solvent; however, as a waste it is F-listed. In this case, determining if it is a concern depends upon whether it can be attributed to the laboratory's operations or whether it actually reflects soil contamination.	We concur with your comment that the acetone concentration was not a laboratory contaminant, and the CADD has been revised. No process knowledge has been identified to indicate that any release or disposal of acetone occurred. Therefore, for the purpose of waste management, acetone would not be considered "listed."	Partial
7) Page A-39 of A-62, Last Paragraph, 2 nd Sentence		"...Results of the geotechnical and hydrological analysis of the geotechnical samples will be discussed in the final revision of this document...". NDEP cannot approve this CADD without reviewing and approving the supportive analyses.	The geotechnical and hydrological analytical results have been added to the CADD.	Yes
8) Page A-40 to A-47 of A-62, Table A.3-8		The identifier for each of the sites is blacked out to the point of not being readable. All parts of the final document must be readable.	Table A.3-8 has been revised for greater readability.	Yes
9) Page A-54 of A-62, 1 st Paragraph after Bullets, 2 nd Sentence		"...Any resultant data changes will be incorporated in the final revision of this document...". If the data changes alter the outcome of the investigation, NDEP may need to re-evaluate what is necessary to accomplish the recommended alternative.	The changes to the data as a result of the Tier III review are discussed in Section A.4.6.3.	Yes

* Comment Types: M = Mandatory, S = Suggested.

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

Plate 1

**Septic Waste Systems 1 and 5, Area 3
Tonopah Test Range, Nevada**

Explanation

- **SWS 1** Septic Waste System 1 Line
- **SWS 5** Septic Waste System 5 Line
- **ST33-2** Septic Tank
- Distribution Box
- Building
- Concrete Pad
- Propane Tank
- Fence
- **E12AMH** Schematic Dimensions of Investigation Excavation
- **B124** Location of Soil Boring

Scale

0 50 100 Feet
0 15 30 Meters

REV. #	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY
PROJECT MANAGER:			DRAWN BY: SHYFACE			
<div>PLATE 1</div> <div>SEPTIC WASTE SYSTEMS 1 AND 5, AREA 3</div> <div>TONOPAH TEST RANGE, NEVADA</div>						
LAYER(S)		DATE INITIATED		DRAWING NUMBER		
		08-MAR-2000		h:\cau_428\cadd\final\base_50_1p1.dgn		

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