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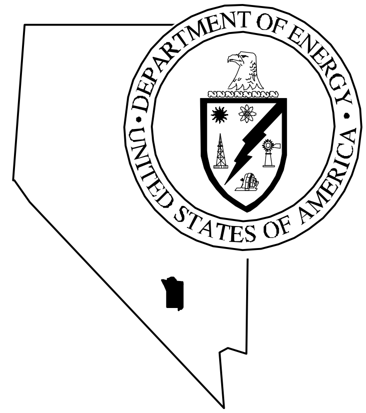

Corrective Action Investigation Plan for Corrective Action Unit 428: Area 3 Septic Waste Systems 1 and 5, Tonopah Test Range, Nevada

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Revision No: 0

March 1999

Environmental Restoration Division

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CORRECTIVE ACTION INVESTIGATION PLAN FOR CORRECTIVE ACTION UNIT 428: AREA 3 SEPTIC WASTE SYSTEMS 1 AND 5, TONOPAH TEST RANGE, NEVADA

DOE Nevada Operations Office
Las Vegas, Nevada

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CORRECTIVE ACTION INVESTIGATION PLAN
FOR CORRECTIVE ACTION UNIT 428:
AREA 3 SEPTIC WASTE SYSTEMS 1 AND 5,
TONOPAH TEST RANGE, NEVADA

Signature Approved — 3/26/99

Approved by:_____________________________________ Date:_______________

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List of Acronyms and Abbreviations

bgs	Below ground surface
CADD	Corrective Action Decision Document
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site(s)
CAU	Corrective Action Unit(s)
COPC	Contaminant(s) of potential concern
CWA	*Clean Water Act*
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DOE/SAO	U.S. Department of Energy, Sandia Area Office
DQO	Data Quality Objective(s)
FFACO	*Federal Facility Agreement and Consent Order*
ft	Foot (feet)
IDW	Investigation-derived waste
km	Kilometer(s)
m	Meter(s)
MCL	Maximum Contaminant Levels
mi	Mile(s)
NDEP	*Nevada Division of Environmental Protection*
NEPA	*National Environmental Policy Act*
PAL	Preliminary action level(s)
PCB	Polychlorinated biphenyl(s)
pCi/L	Picocuries per liter
ppm	Parts per million
PRG	Preliminary Remediation Goal

List of Acronyms and Abbreviations (Continued)

QAPP	*Quality Assurance Project Plan*
RCRA	*Resource Conservation and Recovery Act*
SDWA	*Safe Drinking Water Act*
SNL	Sandia National Laboratories
SVOC	Semivolatile organic compound(s)
SWS	Septic waste system
TPH	Total petroleum hydrocarbon(s)
TTR	Tonopah Test Range
UST	Underground storage tank
VOC	Volatile organic compound(s)

Executive Summary

The Corrective Action Investigation Plan for Corrective Action Unit 428, Area 3 Septic Waste Systems 1 and 5, has been developed in accordance with the *Federal Facility Agreement and Consent Order* that was agreed to by the U.S. Department of Energy, Nevada Operations Office; the State of Nevada Division of Environmental Protection; and the U.S. Department of Defense. Corrective Action Unit 428 consists of Corrective Action Sites 03-05-002-SW01 and 03-05-002-SW05, respectively known as Area 3 Septic Waste System 1 and Septic Waste System 5.

This Corrective Action Investigation Plan is used in combination with the *Work Plan for Leachfield Corrective Action Units: Nevada Test Site and Tonopah Test Range, Nevada*, Rev. 1 (DOE/NV, 1998c). The Leachfield Work Plan was developed to streamline investigations at leachfield Corrective Action Units by incorporating management, technical, quality assurance, health and safety, public involvement, field sampling, and waste management information common to a set of Corrective Action Units with similar site histories and characteristics into a single document that can be referenced. This Corrective Action Investigation Plan provides investigative details specific to Corrective Action Unit 428.

A system of leachfields and associated collection systems was used for wastewater disposal at Area 3 of the Tonopah Test Range until a consolidated sewer system was installed in 1990 to replace the discrete septic waste systems. Operations within various buildings at Area 3 generated sanitary and industrial wastewaters potentially contaminated with contaminants of potential concern and disposed of in septic tanks and leachfields. Corrective Action Unit 428 is composed of two leachfield systems in the northern portion of Area 3.

Based on site history collected to support the Data Quality Objectives process, contaminants of potential concern for the site include oil/diesel range total petroleum hydrocarbons, and *Resource Conservation and Recovery Act* characteristic volatile organic compounds, semivolatile organic compounds, and metals. A limited number of samples will be analyzed for gamma-emitting radionuclides and isotopic uranium from four of the septic tanks and if radiological field screening levels are exceeded. Additional samples will be analyzed for geotechnical and hydrological properties and a bioassessment may be performed. No Corrective Action Unit-specific deviations from the general conceptual site model for leachfield Corrective Action Units developed in the

Leachfield Work Plan were identified during the Data Quality Objectives process for Corrective Action Unit 428.

The technical approach for investigating this Corrective Action Unit consists of the following activities:

- Perform video surveys of the discharge and outfall lines.
- Collect samples of material in the septic tanks.
- Conduct exploratory trenching to locate and inspect subsurface components.
- Collect subsurface soil samples in areas of the collection system including the septic tanks and outfall end of distribution boxes.
- Collect subsurface soil samples underlying the leachfield distribution pipes via trenching.
- Collect surface and near-surface samples near potential locations of the Acid Sewer Outfall if Septic Waste System 5 Leachfield cannot be located.
- Field screen samples for volatile organic compounds, total petroleum hydrocarbons, and radiological activity.
- Drill boreholes and collect subsurface soil samples if required.
- Analyze samples for total volatile organic compounds, total semivolatile organic compounds, total *Resource Conservation and Recovery Act* metals, and total petroleum hydrocarbons (oil/diesel range organics). Limited number of samples will be analyzed for gamma-emitting radionuclides and isotopic uranium from particular septic tanks and if radiological field screening levels are exceeded.
- Collect samples from native soils beneath the distribution system and analyze for geotechnical/hydrologic parameters.
- Collect and analyze bioassessment samples at the discretion of the Site Supervisor if total petroleum hydrocarbons exceed field-screening levels.

Additional sampling and analytical details are presented in Section 4.0 of the Corrective Action Investigation Plan and in the Leachfield Work Plan. Details of the waste management strategy for the Corrective Action Unit are included in the Leachfield Work Plan.

Under the *Federal Facility Agreement and Consent Order*, the Corrective Action Investigation Plan will be submitted to the Nevada Division of Environmental Protection for approval. Field work will be conducted following approval of the plan. The results of the field investigation will support a defensible evaluation of corrective action alternatives in the Corrective Action Decision Document.

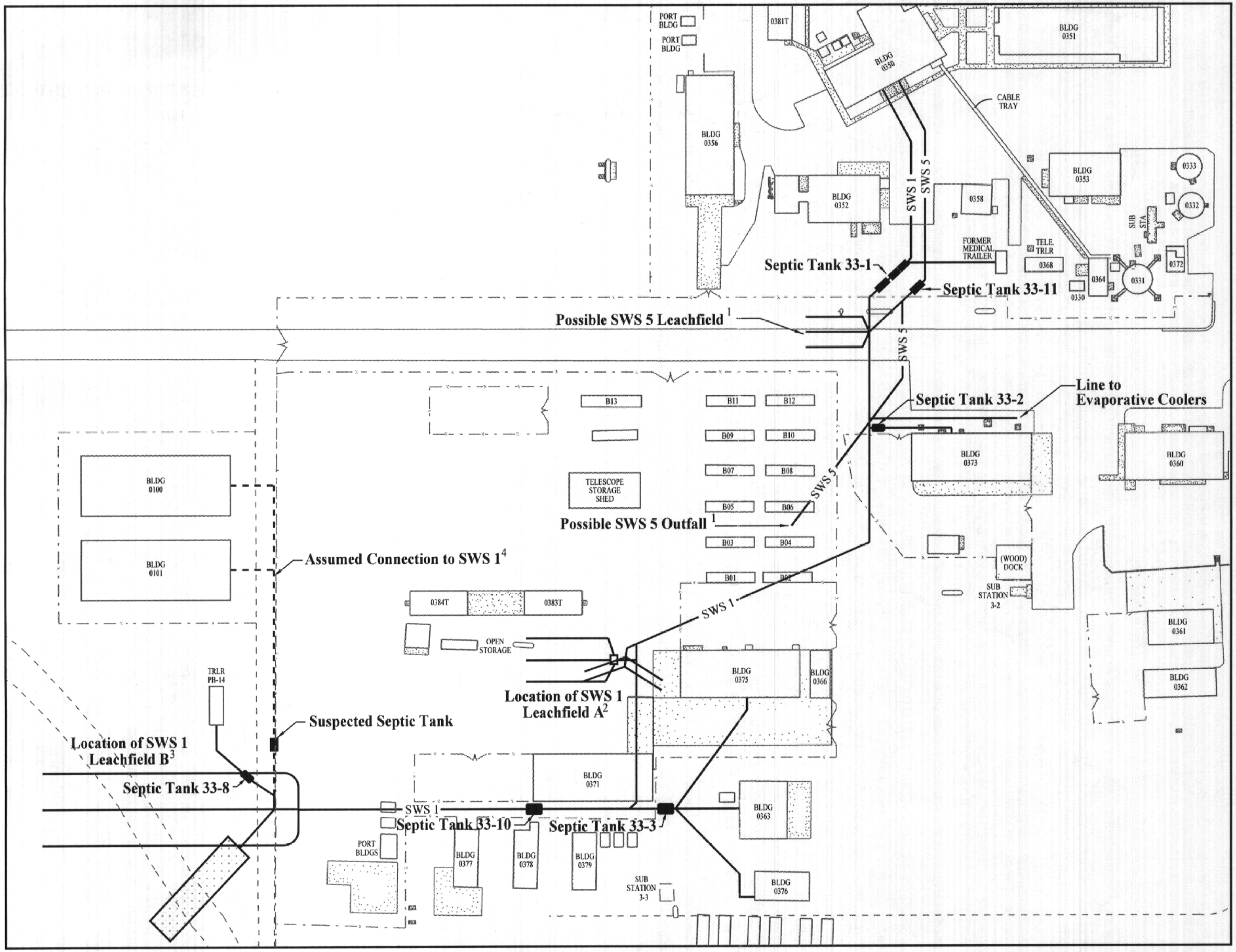
1.0 Introduction

This Corrective Action Investigation Plan (CAIP) has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the U.S. Department of Energy, Nevada Operations Office (DOE/NV); the State of Nevada Division of Environmental Protection (NDEP); and the U.S. Department of Defense (DoD) (FFACO, 1996). The CAIP is a document that provides or references all of the specific information for investigation activities associated with Corrective Action Units (CAUs) or Corrective Action Sites (CASs). According to the FFACO (1996), CASs are sites potentially requiring corrective action(s), and may include solid waste management units, individual disposal sites, or release sites. Corrective Action Units consist of one or more CASs grouped together based on geography, technical similarity, or agency responsibility for the purpose of determining corrective actions.

This CAIP will be used in conjunction with the *Work Plan for Leachfield Corrective Action Units: Nevada Test Site and Tonopah Test Range, Nevada*, Rev. 1 (DOE/NV, 1998c), hereafter referred to as the Leachfield Work Plan. Under the FFACO, a work plan is an optional planning document that provides information for a CAU or group of CAUs where significant commonality exists. This CAIP contains CAU-specific information including a facility description, environmental sample collection objectives, and the criteria for conducting site investigation activities at CAU 428: Area 3 Septic Waste Systems 1 and 5, Tonopah Test Range, Nevada.

This CAIP addresses two septic waste systems in Area 3 of the Tonopah Test Range (TTR). The TTR is approximately 255 kilometers (km) (140 miles [mi]) northwest of Las Vegas, Nevada (see Leachfield Work Plan Figure 1-1). Corrective Action Unit 428 is comprised of Septic Waste System 1 (SWS 1) (CAS 03-05-002-SW01) and Septic Waste System 5 (SWS 5) (CAS 03-05-002-SW05) (FFACO, 1996) as shown in Figure 1-1.

Septic Waste System 1 consists of at least two leachfields and an associated collection system that received effluent from several buildings in the northern portion of Area 3. Source buildings for Leachfield A include 03-50, 03-73, and a medical trailer. Source buildings for Leachfield B include the previous three buildings, 03-75, 03-63, 03-76, various buildings on the northwest corner of the Area 3 compound, and the former DoD buildings and trailers north of Area 3.



Explanation

- SWS 1 — Septic Waste System 1 Line
- SWS 5 — Septic Waste System 5 Line
- Septic Tank
- Distribution Box
- Building
- Concrete Pad
- Potential Leachfield
- Propane Tank
- Fence

Notes

1. The location and nature of the Septic Waste System 5 terminus is unknown. Interviews state effluent was routed to an acid sewer leachfield not shown on engineering drawings. Field investigation will determine if the leachfield or outfall exist at the locations shown.

2. The configuration of this leachfield is unknown. Interviews state the leachfield is a three-pipe system. Engineering drawings show the leachfield as a four-pipe system in a different orientation. Field investigation will determine the leachfield configuration.

3. Two leachfields may exist at this location. Field investigation will determine the configuration and number of leachfields.

4. Although not shown on engineering drawings, it is assumed that Buildings 0100 and 0101 were connected to Septic Waste System 1.

Scale

0 100 200 Feet

0 30 60 Meters

Figure 1-1
Septic Waste Systems 1 and 5
Area 3, Tonopah Test Range

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Septic Waste System 5 consists of a single leachfield or outfall and associated collection system that received effluent from a former photoprocessing laboratory and floor drains in Building 03-50.

1.1 Purpose

This CAIP describes the investigation of the nature and extent of contaminants of potential concern (COPCs) at CAU 428. The general purpose of corrective action investigations for leachfield CAUs is described in the Leachfield Work Plan.

1.2 Scope

The scope of this CAIP is to resolve the problem statement identified in the Data Quality Objective (DQO) process (see Appendix A). This statement is that potentially hazardous waste were discharged to the two septic waste systems that comprise CAU 428, and that existing data are insufficient to support the development and evaluation of potential corrective actions and selection of a preferred corrective action for the CAU. Therefore, the scope of the corrective action investigation at the CAU includes the following activities to answer the problem statement:

- Conducting a video survey of subsurface piping
- Sampling the contents of the septic tanks
- Conducting discrete field screening
- Conducting exploratory trenching and excavations of particular subsurface components for visual inspection and to access sampling horizons
- Collecting environmental samples for laboratory and geotechnical/hydrological analyses and waste management purposes
- Conducting subsurface sampling from soil borings, where needed, which are capable of reaching the expected vertical extent of COPCs
- Logging core recovered from soil borings to assess soil characteristics

1.3 CAIP Contents

Section 1.0 of this CAIP provides an introduction to this project, including the purpose and scope for this corrective action investigation. The remainder of the document details the investigation strategy. The FFACO (1996) requires that CAIPs address the following elements:

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

The managerial aspects of this project are discussed in the DOE/NV *Project Management Plan* (DOE/NV, 1994) and the site-specific Field Management Plan that will be developed prior to field activities. The technical aspects of this CAIP are contained in the Leachfield Work Plan, Section 3.0, Section 4.0, and Section 5.0 of this document, and in the DQO summary presented in Appendix A. General field and laboratory quality assurance and quality control issues, including collection of quality control samples, are presented in the *Industrial Sites Quality Assurance Project Plan* (QAPP) (DOE/NV, 1996c). The health and safety aspects of this project are documented in the *Environmental Restoration Project Health and Safety Plan* (DOE/NV, 1998b), and will also be supplemented with a site-specific health and safety plan written prior to the start of field work. No CAU-specific public involvement activities are planned at this time; however, an overview of public involvement is documented in the "Public Involvement Plan" in Appendix V of the FFACO (1996). Field sampling activities are discussed in the Leachfield Work Plan and in Section 4.0 of this CAIP and waste management issues are discussed in the Leachfield Work Plan and in Section 5.0 of this CAIP. The project schedule and records availability information for this CAIP are discussed in Section 6.0 of this CAIP. Section 7.0 provides a list of references.

2.0 Facility Description

General background information pertaining to the history of the TTR and Area 3, a geologic assessment, and an overview of the area hydrogeology including depths to groundwater are provided in the *Corrective Action Unit Work Plan, Tonopah Test Range, Nevada* (DOE/NV, 1996a). The TTR facility is operated by the Sandia National Laboratories (SNL) for the U.S. Department of Energy (DOE). Historically, the TTR has been a research facility with the mission to perform defense-related projects. Industrial operations, experiments, and site maintenance operations that may have resulted in impacts to the environment were associated with these projects. Operations within various buildings at Area 3 of the TTR generated sanitary and industrial wastewaters potentially contaminated with COPCs and disposed of in septic tanks and leachfields (DOE/NV, 1996a).

2.1 Physical Setting

Surface materials around the site consist of pavement, sand, gravel, and cobbles with little to no vegetation. The topography slopes gently to the northwest with surface drainage flowing the same direction. Depth to groundwater beneath Area 3 is estimated at 110 to 120 meters (m) (361 to 394 feet [ft]) below ground surface (bgs). The groundwater flow direction is generally to the north-northwest (DOE/NV, 1996a).

2.2 Operational History

A system of leachfields and associated collection systems was used for wastewater disposal at Area 3 of the TTR until a consolidated sewer system was installed in 1990 to replace the discrete septic waste systems. Effluent is currently discharged into a flocculating lagoon maintained by the U.S. Air Force north of Area 10 of the TTR. Septic Waste Systems 1 and 5 (see Figure 1-1) will be addressed by this investigation.

2.2.1 Septic Waste System 1

Septic Waste System 1 consists of Septic Tanks 33-1, 33-2, 33-3, 33-8, and 33-10; possibly two additional unconfirmed septic tanks; and Septic Waste System 1 Leachfield A, Leachfield B, and a third possible leachfield. Septic Waste System 1 served restrooms and floor drains in several buildings and trailers in the northern portion of Area 3. The complexity of SWS 1 increased with the development of Area 3 from about 1956 until the installation of the consolidated sewer system in 1990. Septic Waste System 1 was probably constructed and maintained as independent east and west systems until Leachfield A was abandoned in the late 1970s.

The eastern portion of SWS 1 is the oldest part of the system. Septic Waste System 1 initially received effluent from Building 03-50, the first building constructed in Area 3. The Control Point Building (Building 03-50) was completed in 1956 and contained a kitchen, restrooms, computer laboratories, a test directors facility, and a photographic laboratory. Septic Tank 33-1 received effluent from Building 03-50 sinks and toilets. Photoprocessing waste and effluent from the floor drains were routed to a separate collection system associated with SWS 5. Septic Tank 33-1 also received effluent from a medical trailer stationed inside the secured compound between 1956 and 1966 (Quas, 1998). 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 (Quas, 1998).

Septic Tank 33-2 received effluent from the restroom and restroom floor drain in the Carpenter, Plumbing, and Paint Shop Building (Building 03-73). A machine room floor drain and three evaporative cooler drains associated with this building contributed effluent to SWS 1, but bypassed Septic Tank 33-2. The two lines are shown on engineering drawing 91409/M8 and engineering drawing “As-Built” 91409/M6 (AEC, 1968). The septic tank is believed to be located east of the fenced area north of Building 03-73.

Septic Tanks 33-1 and 33-2 initially drained to SWS 1 Leachfield A. Interviews suggest an additional septic tank east of Building 03-75 (not shown on Figure 1-1) may have also drained effluent from the Building 03-75 restroom to this leachfield (Quas, 1998). Septic Waste System 1 Leachfield A is located approximately 21 m (70 ft) north of Building 03-75. Two potential configurations of this leachfield have been identified by inspection of engineering drawings and interviews. Interviews suggest that the leachfield was a three-pipe system that drained to the north, but engineering drawing “As-Built” 91409/M6 (AEC, 1968) shows the leachfield as a four-pipe system that may extend under the concrete pad of Building 03-75. Leachfield A was supposedly abandoned in the late 1970s and the effluent rerouted to SWS 1 Leachfield B. The construction date of Leachfield B is unknown, but both leachfields may have been used simultaneously until Leachfield A was abandoned.

The western portion of SWS 1 includes Septic Tanks 33-3, 33-8, 33-10 and possibly an additional septic tank. This system was probably initially designed to support only the buildings on the west side of Area 3 and possibly utilized a leachfield located in the same area as, but smaller than, the ultimate Leachfield B.

Septic Tank 33-3 serviced several floor drains and possibly the restroom in the Shipping and Receiving Building (Building 03-75). The Generator Shop (Building 03-63) and the Pilot's Lounge (Building 03-76) each contain restrooms that also drained to Septic Tank 33-3 located immediately south of the Facility Equipment Storage (Building 03-71).

Septic Tank 33-10 serviced the restroom in Building 03-79 and the restroom and shower in Building 03-78 formerly used as a gym for Advanced Security, Incorporated personnel. Septic Tank 33-10 is located at the southeast corner of Building 03-78.

Septic Tank 33-8 serviced the restroom in Trailer PB-14 and possibly two additional trailers. The septic tank is believed to be located south of Trailer PB-14 and north of the Area 3 perimeter fence.

Interviews suggest an additional septic tank associated with the DoD Administration Building (Building 0100) and Plant Engineering Building (Building 0101) drained to Leachfield B. The restrooms in these buildings may have drained to the "suspected septic tank" shown under the north fence of Area 3 directly south of Trailer PB-14 on Figure 1-1.

Leachfield B is located at the northwest corner of Area 3. There may be a second smaller leachfield located in the same area. The construction dates for the two leachfields are unknown but the location and configuration of the larger leachfield can be interpreted based on estimated locations on engineering drawings and vegetation differences shown in aerial photographs. The larger leachfield was probably installed to increase system capacity when the east and west portions of SWS 1 were combined in the late 1970s. Leachfield B is believed to have received all effluent associated with SWS 1 from the late 1970s until the consolidated sewer system was activated in 1990.

The contents of Septic Tanks 33-1, 33-2, 33-3, 33-8 and 33-10 were sampled in 1991. The contents of one of the Septic Tank 33-1 tanks and Septic Tanks 33-3 and 33-10 were resampled in 1993. The results of both sampling events are described in Section 2.5 and summarized in Appendix C. The contents of all of these septic tanks were removed in 1993 as part of a septic tank abandonment program. The septic tank abandonment procedure included pumping the contents of the tanks, air-drying the tanks, and filling the tanks with concrete or sand. The abandonment procedure was not completed for several SWS 1 septic tanks, and only Septic Tank 33-2 was filled (DOE/NV, 1996a) (Quas, 1994).

2.2.2 Septic Waste System 5

Septic Waste System 5 consists of Septic Tank 33-11 and an associated leachfield or outfall. The system was designed to receive waste from the acid sewer line leaving Building 03-50. Effluent from this system may have been routed to SWS 1 after the leachfield or outfall was abandoned.

Septic Waste System 5 received effluent from floor drains and photoprocessing waste from the photographic laboratory in Building 03-50. The photographic laboratory operated from 1956 until it was replaced by the Building 03-55 photographic laboratory in 1964 (Quas, 1998). The Control Point Building plumbing plan and details are represented on engineering drawing 87582 (DOE/SAO, 1950s). The acid sewer line is shown on engineering drawing 87984 (SNL, 1983).

The acid sewer discharge line was connected to an underground tank located inside the Area 3 Compound. Septic Tank 33-11 functioned as a holdup tank for effluent flowing through SWS 5 rather than a conventional septic tank used for separating effluent into solid and liquid material. The tank is probably a modified metal underground storage tank (UST) and may not have maintenance manholes. The actual location, construction, and condition of Septic Tank 33-11 are unknown.

The only evidence suggesting that the SWS 5 leachfield exists has been obtained from interviews with personnel from Area 3 (Quas, 1993; Quas, 1998). The leachfield has not been identified on engineering drawings. The leachfield may not have been a formal leachfield, but an outfall that allowed effluent to leach into a rock bed (Quas, 1998). The suspected outfall location was obtained from engineering drawing “As-Built” 91409/M6 (AEC, 1968) but is poorly constrained. The suspected site of this leachfield or outfall is outside of the Area 3 Compound (Figure 1-1).

2.3 Waste Inventory

Interviews with former TTR personnel, interpretation of engineering drawings, and descriptions of processes and chemicals used in potential source buildings (IT, 1994) indicate that sanitary and industrial wastewaters were discharged to the septic waste systems. Records of wastewater volumes discharged to the septic systems are not available. Septic tanks at the TTR were usually pumped out every few years with the resulting sludge buried on site (DOE/NV, 1996a). Septic Waste Systems 1 and 5 have not received additional wastewaters since the installation of the consolidated sewer system in 1990. During the DQO process, available information including historical sampling results (Appendices A and C) was evaluated, and a list of potential contaminants was developed.

2.4 Release Information

The source of potential contamination related to the CAU 428 leachfield system was wastewater routed through drain lines from the source buildings. The effluent was released to the leachfield after it passed through leachfield system features including septic tanks and distribution boxes. The leachfields were designed for liquid to be dispersed over an area just above the leachfield base (leachrock/native soil interface), and to percolate through the leachrock and into the underlying soil. Surface discharge associated with SWS 5 may have occurred if effluent was discharged to an outfall rather than a leachfield. The driving force for downward migration of the contamination was the discharge from the septic tanks. The possibility of leakage at points along the collection system exists, but there is no evidence of documented leaks or releases. The leachfield systems are now inactive.

2.5 Investigative Background

In accordance with the DOE/NV *National Environmental Policy Act* (NEPA) compliance program, a NEPA checklist will be completed prior to commencement of site investigation activities at CAU 428. This checklist compels DOE/NV projects to evaluate their proposed project against a list of several potential environmental impacts which include, but are not limited to, air quality, chemical use, waste generation, noise level, and land use. Completion of the checklist results in a determination of the appropriate level of NEPA documentation by the DOE/NV NEPA Compliance Officer.

General site investigation activities are described in Section 2.0 of the Leachfield Work Plan. Site investigation activities associated with CAU 428 have been identified and documented in the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV 1996b).

Geophysical surveys attempted to locate several SWS 1 and 5 features in 1993 (IT, 1997). The geophysical surveys were generally inconclusive, and did not provide data useful for this investigation.

Most of the SWS 1 and 5 septic tanks were sampled in 1991 (IT, 1991) and three of the tanks were resampled in 1993 (IT, 1994). The sampling efforts were conducted to allow disposal of the septic tank contents in a publicly owned treatment works facility, and provide concentrations of COPCs present in effluent discharged to the system. Summaries of these investigations are provided in Sections 2.5.1 and 2.5.2.

Based on the 1991 and 1993 sampling reports, the *Corrective Action Unit Work Plan, Tonopah Test Range, Nevada* (DOE/NV, 1996a) indicated that *Clean Water Act* (CWA) target metals, volatile organic compounds (VOCs), oil and grease, and radiological constituents were detected in all or nearly all of the sampled septic tanks in Area 3. All of the radionuclides identified were naturally occurring. Nitrates and cyanide were detected in Septic Tank 33-2 (DOE/NV, 1996a).

2.5.1 1991 Sampling Effort

The contents of thirteen TTR septic tanks were sampled and analyzed for CWA target metals, VOCs, semivolatile organic compounds (SVOCs), general chemistry parameters, and selected radiological parameters as part of a 1991 sampling effort conducted to support closure of the septic tanks (IT, 1991). Septic Tanks 33-2, 33-3, 33-8, 33-10, and the three Septic Tank 33-1 tanks were all sampled and a new, unique number was assigned to each tank. The sampling results for the contents of these septic tanks are summarized in Table C-1 of Appendix C. The 1991 report concluded that elevated levels of toxic and radioactive pollutants were present in some of the septic tank systems sampled. The report stated that resampling or reanalysis of samples for septic tanks containing detectable concentrations of isotopic uranium might be necessary based on the high precision measurements associated with the isotopic uranium analyses.

A SNL review of the radiological data produced by this sampling (Robertson, 1992) identified that the contents of Septic Tank 33-8 had elevated uranium-234, Septic Tank 33-10 had elevated gross alpha and gross beta, Septic Tank 33-3 could be disposed of in a public owned treatment works facility, and that one Septic Tank 33-1 tank had elevated oil and grease and another tank had elevated uranium-238. The memorandum stated that radiological and other contamination present in Septic Tanks 33-8 and 33-10 could make the contents unacceptable for disposal in a public owned treatment works facility, and resampling was recommended for these tanks.

2.5.2 1993 Sampling Effort

Septic Tanks 33-1, 33-3, and 33-10 were resampled as part of a larger effort to identify the types and concentrations of potential contaminants present in the liquid and sludge contained within several septic tanks at the Nevada Test Site and TTR in August 1993 (IT, 1994). The analytical results for the three septic tanks are summarized in Table C-2 of Appendix C. Based on these results, the report provides the following conclusions. Analytical results for the aqueous sample from Septic Tank 33-1 had no chemical or radiological parameters above their Maximum Contaminant Levels (MCL) as defined in the *Safe Drinking Water Act* (SDWA). The sludge sample did not contain metals or if present they were at low concentrations, and gamma-emitting radionuclides were limited to naturally occurring isotopes. Analytical results for Septic Tank 33-3 identified no metals, organic compounds, or radionuclides at concentrations above their SDWA MCLs. The sludge sample did not contain any metals at elevated concentrations and gamma-emitting radionuclides were naturally occurring isotopes. Analytical results for liquid and sludge samples from Septic Tank 33-10 detected VOCs and arsenic. Gross-beta particle activity was detected in the liquid sample slightly above the proposed SDWA MCL threshold value. Analytical data for sludge samples did not indicate beta or gamma-emitting radionuclides at abnormal levels. No metals were present in elevated concentrations.

2.5.3 Summary of Previous Sampling Efforts

Previous sampling efforts suggest that chemical and radiological contamination may be associated with SWS 1 and 5. The chemical results are not unexpected based on the conceptual model developed during the DQO process. Unexpected radiological results produced by the 1991 sampling effort include elevated measurements for uranium isotopes. In general, these measurements were not confirmed by the 1993 sampling effort. Quality control problems have been identified for at least the 1991 sampling effort.

Elevated concentrations of radionuclides including uranium-234, -235, and -238 were reported for Septic Tank 33-8 by the 1991 sampling effort. Resampling recommended in the SNL memorandum (Robertson, 1992) was not conducted for this tank during the 1993 sampling effort.

The 470±70 picocuries per liter (pCi/L) uranium-238 concentration reported for Septic Tank 33-1C by the 1991 sampling effort is significantly higher than background concentrations, but the value is not reported or addressed in the text or original data (IT, 1991). It is likely that the sample collected from this septic tank was actually sample number 5598 rather than 5698 as reported in the document. Sample 5698 is not included in supporting documentation (certificates of analysis and chain of custody) for the 1991 report. The uranium-238 concentration reported for sample 5598 is 1.6±0.4 pCi/L. This septic tank may be highly contaminated with uranium-238, but it is more likely that the measurement provided is invalid. The measurement is probably the result of multiple typographical errors including an inaccurate sample number and concentration provided in Table 10 of the report. None of the isotopic uranium analyses meet the precision requirements established in the Industrial Sites QAPP (DOE/NV, 1996c). The chemical yield for uranium was low, and the relative percent difference for uranium analysis laboratory duplicates failed the quality requirements. Elevated uranium-238 concentrations were not detected in the aqueous and sludge samples collected from one of the Septic Tank 33-1 tanks during the 1993 sampling effort. These samples are assumed to have been collected from Septic Tank 33-1C.

Elevated concentrations of cadmium-109 and strontium-85 reported by the 1993 sampling effort were not addressed by the 1991 sampling effort analysis methods. Cadmium-109 concentrations of 2.90±0.984 and 2.21±0.85 pCi/L were reported for sludge samples from Septic Tanks 33-3 and 33-10, respectively. Strontium-85 was detected at a concentration of 0.115±0.083 pCi/L in a liquid sample from Septic Tank 33-1. These concentrations indicate potential cadmium-109 and strontium-85 contamination associated with SWS 1 and 5, but the presence of these radionuclides is unlikely. Cadmium-109 is a neutron activation and fission product not associated with historical Area 3 operations. Strontium-85 is a fission product with a 65 day half-life and should be associated with much greater concentrations of other fission products. Certificates of Analysis and Radiological Data Packages for the 1993 sampling effort have not been located for examination of potential quality control problems.

3.0 Objectives

A discussion of general objectives for leachfield CAUs is presented in Section 3.0 of the Leachfield Work Plan. Objectives addressed in this CAIP are based on the Leachfield Work Plan and CAU-specific DQOs. Unless otherwise noted, objectives for CAU 428 are identical to those developed in the Leachfield Work Plan.

3.1 Conceptual Site Model

The conceptual model for CAU 428 is analogous to the general leachfield conceptual model presented in Section 3.1 of the Leachfield Work Plan and is outlined in detail in Appendix A, Table A.2-1. The scope and strategy of this investigation may be revised if the conceptual model provided in this CAIP and applicable portions of the conceptual model provided in the Leachfield Work Plan fail. The CAU 428 conceptual model may fail if substantially different historical operational information is discovered, or field observations demonstrate the nature or extent of contamination associated with the CAU is substantially different than anticipated. If necessary, a rescoping of the investigation will be conducted.

3.2 Contaminants of Potential Concern

Potential types of contaminants that could be present were identified through a review of site history documentation, subjective process knowledge, and inferred activities associated with the CAU. Contaminants are expected to be similar to those in septage from sanitary and light duty industrial sewage systems. Laboratory analysis of liquid, soil, and sludge samples will provide the means for a quantitative measurement of the COPCs. Based on process knowledge and the results of previous septic tank sampling efforts, the following analytes will be measured in the laboratory to determine the nature of potential contamination at CAU 428:

- Total VOCs
- Total SVOCs
- Total *Resource Conservation and Recovery Act* (RCRA) Metals
- Total petroleum hydrocarbons (TPH) (oil/diesel-range organics)

- Gamma-emitting radionuclides (field screening will be conducted for alpha and beta radiation; analysis will be performed if field-screening levels are exceeded)
- Isotopic uranium (analysis will be performed if field-screening levels are exceeded)

The analytical methods and minimum reporting limits for each analyte are provided in Table 3-1 of the Leachfield Work Plan.

Samples recovered from Septic Tanks 33-1, 33-3, 33-8, and 33-10 will be analyzed for gamma-emitting radionuclides and isotopic uranium regardless of field screening results. In addition, a limited number of samples will be collected and analyzed for gamma-emitting radionuclides and isotopic uranium if alpha and beta field screening results exceed radiological field screening levels. Radioanalytical samples submitted to the laboratory will be analyzed for these parameters according to the method provided in Table 3-1 of the Leachfield Work Plan. Minimum reporting limits for gamma-emitting radionuclides are 0.2 picocuries per gram for soil and 20 pCi/L for water (DOE/NV, 1996b).

Geotechnical and hydrological analysis will be performed according to the requirements of Section 3.2.1 of the Leachfield Work Plan. Bioassessment samples collected will be analyzed according to the requirements of the Leachfield Work Plan. Bioassessment samples may be collected if field screening detects of TPH concentrations greater than field screening levels indicate the potential for a hydrocarbon plume or significant hydrocarbon contamination that would be amenable to bioremediation processes.

3.3 Preliminary Action Levels

Screening levels for on-site field screening methods and preliminary action levels (PALs) for off-site analytical methods will be used to determine the presence of contamination. Specific screening levels and PALs or methods used to determine these levels are provided in Section 3.3 of the Leachfield Work Plan, and were agreed upon during the CAU-specific DQO process.

3.4 DQO Process Discussion

Details of the DQO process are presented in Appendix A. The DQO results for CAU 428 indicated the need for a biased sampling approach. Due to potential subsurface migration of COPCs, an investigation consisting of subsurface sampling was identified. The applicable COPCs, analytical methods, and reporting limits agreed upon during the DQO process are provided in Table 3-1 of the Leachfield Work Plan and Section 3.2. Data quality will be verified and evaluated as stated in the Leachfield Work Plan.

4.0 Field Investigation

The investigation activities to be performed at CAU 428 are based on general field investigation activities discussed in Section 4.0 of the Leachfield Work Plan.

4.1 Technical Approach

The technical approach for CAU 428 consists of the following activities:

- Perform video surveys of the discharge and outfall lines.
- Collect samples of material in the septic tanks.
- Conduct exploratory trenching to locate and inspect subsurface components.
- Collect subsurface soil samples in areas of the collection system including the septic tanks and outfall end of distribution boxes.
- Collect subsurface soil samples underlying the leachfield distribution pipes via trenching.
- Collect surface and near-surface samples near potential locations of the Acid Sewer Outfall if SWS 5 Leachfield cannot be located.
- Field screen samples for VOCs, TPH, and radiological activity.
- Drill boreholes and collect subsurface soil samples if required.
- Analyze soil samples for total VOCs, total SVOCs, total RCRA metals, and TPH (oil/diesel range organics). Limited number of samples will be analyzed for gamma-emitting radionuclides and isotopic uranium if radiological field screening levels are exceeded.
- Collect samples from native soils beneath the distribution system and analyze for geotechnical/hydrologic parameters.
- Collect and analyze bioassessment samples at the discretion of the Site Supervisor if TPH exceeds field-screening levels.

This investigation strategy will allow the extent of contamination associated with the leachfield systems to be established. In general, the contents of the leachfields and the underlying soil will be investigated until soil samples from two consecutive intervals with contaminant concentrations below appropriate field screening levels (described in Section 3.3 of the Leachfield Work Plan) are obtained. If contamination is more extensive than anticipated and drilling is necessary, the maximum investigation depth will be limited by the capability of the drilling rig. If this occurs, the investigation will be rescoped.

4.2 Field Activities

Excavation and trenching will be the primary investigation tool for these leachfield systems. Excavation and trenching may not be possible due to existing facilities and utilities. Damage to roads, concrete pads, and utilities will be minimized. Excavation locations will be based on interpretation of engineering drawings, surface features, and video surveys. Excavated soil will be stored in a manner which will prevent run-on and run-off. Upon completion of the investigation activities, excavated soil will be returned to the excavation nearest its original location as practical.

All sampling activities will be conducted in compliance with the Industrial Sites QAPP (DOE/NV, 1996c). Quality requirements for field sampling and laboratory analysis are also contained in the Industrial Sites QAPP (DOE/NV, 1996c) and the Leachfield Work Plan.

4.2.1 Video Survey

Video surveys will be conducted inside the discharge and outfall lines to inspect the pipes associated with the collection systems. The collection systems will be mapped by following the piping, and locating or ruling out the existence of other possible tie-ins. This survey may not be possible for some lines because of small pipe diameters (i.e., less than 7.5-centimeters [3-inches] diameter), limited access, pipe damage, blockage, or other factors.

The camera and cable system will be introduced through various manholes and cleanouts associated with the collection system (Figure 4-1). Manholes in the septic tanks may be used to access the discharge and outfall lines. Other entry points may be accessed by excavating at the required locations and cutting collection system pipes as necessary.

The video survey will evaluate the existence of unexpected contributing collection system lines. If a tie-in is discovered, the line will be investigated to the source (if possible) and sampling activities will be suspended until NDEP is notified and a record of technical change to this document is initiated as

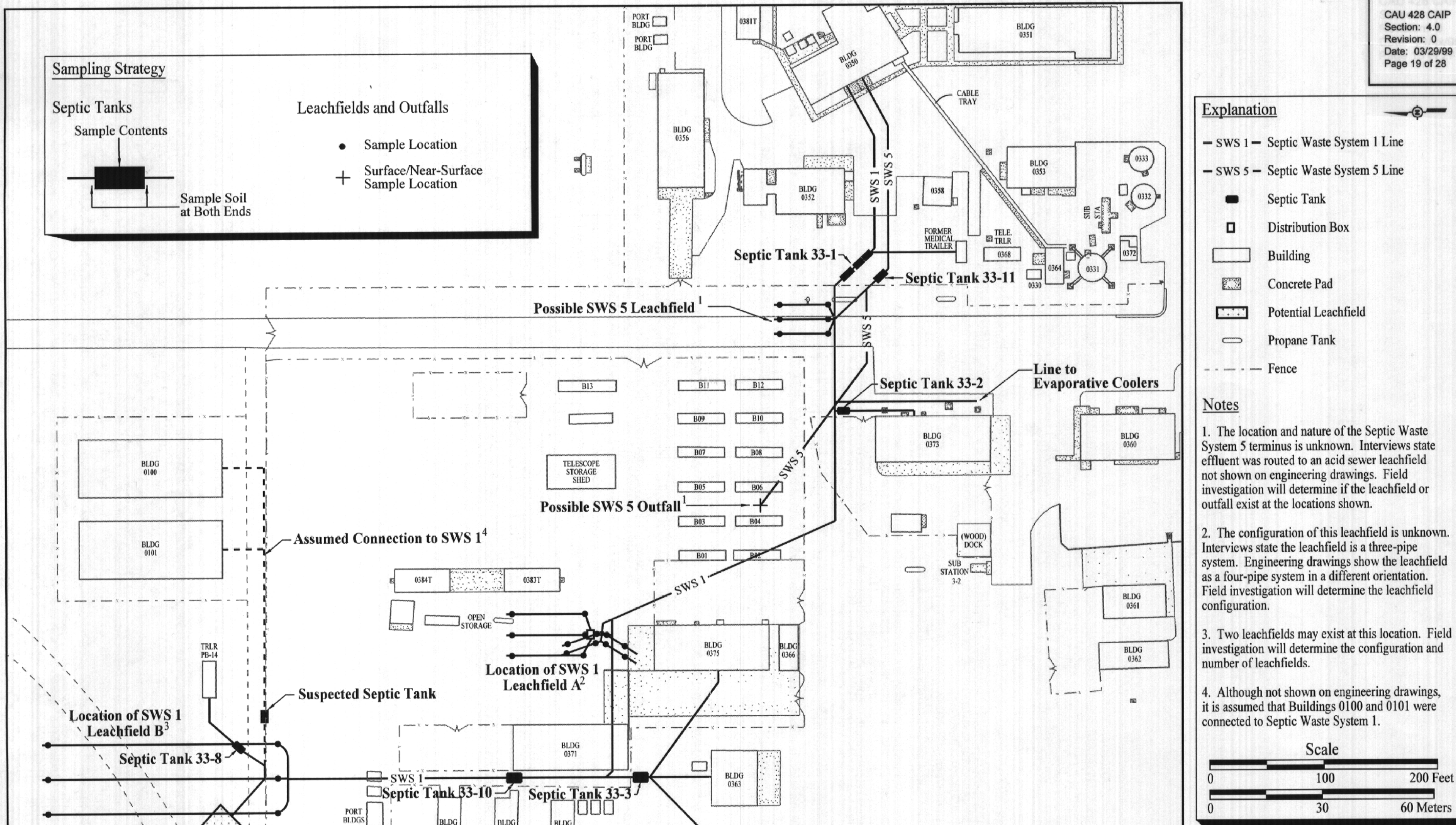

Figure 4-1
Proposed Sampling Locations
Septic Waste Systems 1 and 5
Area 3, Tonopah Test Range

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required. The discovery of an unexpected contributing line may imply an additional source input and could increase the scope of the investigation.

4.2.2 Field Screening

Field screening for VOCs, TPH, and radiological activity will be performed to guide the investigation and sampling selection and to assist with health and safety and waste management decisions. Field screening will be conducted for VOCs using the headspace method, TPH using the Hanby™ hydrocarbon screening kit, and elevated radiological activity using an alpha/beta scintillator. Field screening for TPH will only be conducted on samples that exceed headspace screening levels and at the Site Supervisor's discretion. Field screening requirements are discussed in Section 3.3 and Section 4.1.3 of the Leachfield Work Plan.

4.2.3 Leachfield System Investigation

The investigation of the CAU 428 leachfield systems focuses on both accidental and designed effluent releases. While leachfields are designed to release effluent to the underlying soil, collection system releases are typically caused by a loss of system integrity. Potential accidental releases will be identified by sampling at specific collection system features, including soil outside septic tanks and diversion chambers. Soil underlying breached discharge and outfall lines identified during the video survey will also be sampled. The impact of designed releases will be determined by sampling the septic tank contents and soil underlying the leachfield. The impact of effluent release at the Acid Sewer Outfall will be determined as described in Section 4.2.3.3 if the SWS 5 Leachfield is not located.

4.2.3.1 Collection System Sampling Activities

A first stage of soil samples will be collected in four general areas to investigate possible release points associated with collection system components of the leachfield system. Samples will be collected from the following locations:

- Pipe disruptions identified by video survey
- Inside the septic tanks
- Both ends of septic tanks
- Outfall end of distribution boxes

These locations are presented in Figure 4-1. Most samples will be collected directly from excavations or the backhoe bucket, but some surface and near-surface samples may be collected using hand tools or direct-push methods (i.e., Geoprobe™). If results show that contaminant concentrations exceed field screening levels and/or PALs, a second stage of samples described in Section 4.3 will be collected as step-outs or at greater depths below the first stage of samples.

Samples of the soil under the discharge and outfall lines connected to each septic tank will be collected. Soil samples will be collected from the effluent end of distribution structures associated with leachfields. Samples will also be collected from soil surrounding pipe breaks or other apparent losses of system integrity identified by the video survey. These samples will be representative of soil likely to have been impacted if leachfield system leakage occurred.

The septic tank contents will be sampled and analyzed to determine the contents and the nature of the most recent discharge to the leachfield system. More than one sample may be required if the septic tank contents appear to have separated into multiple phases (i.e., liquid over solid phase). The results of these samples should be representative of the effluent stream discharged to the system subsequent to the most recent septic tank pumping event. Most of the septic tanks associated with SWS 1 and 5 were pumped in 1993. Septic Tank 33-11 and any unknown septic tanks were not pumped at this time. It is unknown if septage has ever been removed from these tanks. The contents of the diversion chambers may be sampled at the discretion of the Site Supervisor if effluent is present.

4.2.3.2 Leachfield Sampling Activities

The leachfields were designed for disposal of effluent after it passed through the septic tanks. The leachfields will be investigated using a backhoe equipped with a narrow bucket to excavate at least two trenches within each leachfield area. Depending on the configuration of the leachfield, at least two linear trenches perpendicular to the lengths of the distribution pipes will be excavated as described in Section 4.0 of the Leachfield Work Plan. The SWS 1 and 5 leachfields are expected to be parallel, three-pipe systems similar to the upper system shown on Figure 4-1 of the Leachfield Work Plan. Modifications to the investigation strategy described will be required if a branching leachfield similar to the lower system shown on Figure 4-1 of the Leachfield Work Plan is discovered. Any modifications to the investigation strategy provided in this document will be consistent with the Leachfield Work Plan.

Assuming that the leachfields are parallel, three-pipe systems, the first trench will be excavated 1.5 m (5 ft) from the estimated location of each distribution stem (see Figure 4-1). Limited excavations may be used to verify the location of the distribution pipe ends and establish the pipes orientation and location if these cannot be reasonably estimated based on surface features and engineering drawings. A second trench will be excavated 1.5 m (5 ft) from the distal end of the distribution pipes based on estimated pipe lengths. The extent of these trenches will be more limited and based on the distribution pipe locations observed in the first trenches.

Engineering drawings suggest that the SWS 1 Leachfield A is a four distribution pipe, branching leachfield (see Figure 4-1). If this is the actual configuration of this leachfield, samples will be collected approximately 1.5 m (5 ft) from both the distribution manifold and distal ends of each distribution pipe. If distribution pipes extend under the Building 03-75 pad, samples will be collected at the edge of the pad, but the pad will not be removed. Additional samples will be collected during second stage activities if soil underlying the pad must be sampled.

An estimated depth to the leachfield base for a shallow system is 0.6 to 0.9 m (2 to 3 ft), and for a deep system is 0.9 m (3 ft) to a maximum of 1.8 m (6 ft) (DOE/NV, 1998a). The actual depth to the leachfield base for the CAU 428 leachfields is unknown. The interval 0.3 m (1.0 ft) below the leachfield base (i.e., the leachrock and native soil interface) will define the uppermost sampling interval (see Figure 4-1 of the Leachfield Work Plan). A second sampling interval 0.75 m (2.5 ft) to 1.1 m (3.5 ft) beneath the leachfield base will be exposed by deeper trenching within the same walls. If samples from a particular sampling location exceed field screening levels, a third 0.3-m (1-ft) sampling interval 2.3 m (7.5 ft) below the leachfield base may be sampled, if accessible by the backhoe.

Trenching activities will expose just enough pipe or material to access the required sampling horizons and will be conducted within the leachfield boundaries. Sampling locations within the trenches will be positioned below each of the distribution pipes. For a three distribution pipe leachfield, three samples per depth-interval will be collected from each end of the leachfield for a total of six samples per horizon. Eight samples per depth-interval will be collected for a four distribution pipe, branching leachfield. Soil will be collected out of the backhoe bucket immediately upon retrieval. Only material (soil) suitable for analysis will be submitted to the laboratory. Leachrock will not be sampled. If extra volume for a given sampling event is required, then sample collection will be extended laterally at the same depth.

For a three distribution pipe leachfield, approximately six first-stage samples will be obtained from each sampling interval within the area of the leachfield based on the conceptual model. Samples will be collected from at least two sampling intervals, resulting in at least 12 samples. For a four distribution pipe branching leachfield, approximately eight first-stage samples will be obtained from each sampling interval, resulting in at least 16 samples. While all of the samples will be field screened, a limited number of these samples will be submitted to the off-site laboratory. Samples to be analyzed will be selected based on the results of field screening and minimum sampling requirements. The actual number of samples analyzed will depend on decisions made in the field.

A sample of the soil underlying each leachfield/soil interface will be collected to assess its geotechnical and hydrologic characteristics. Bioassessment samples may be collected at the Site Supervisor's discretion if TPH is detected by field screening. These samples will be collected within brass sleeves (or other container, as appropriate) so as not to disturb the natural physical characteristics of the soil. Section 3.2.1 of the Leachfield Work Plan addresses these analyses.

4.2.3.3 Acid Sewer Outfall Sampling

Surface sampling may be required if the SWS 5 leachfield is not located. Surface and near-surface samples will be collected from potential locations of the Acid Sewer Outfall to determine the impact of potential soil contamination associated with surface discharge from the system. The area surrounding the potential outfall locations has been disturbed during construction activities at Area 3 including grading operations and the installation of the box cars (see Figure 4-1). Any evidence of the outfall location has been obscured by these activities and its exact location is unknown. The location of the Acid Sewer Outfall may be estimated based on engineering drawings or located through limited excavation. The video survey may be used in an attempt to locate the Acid Sewer Outfall.

Six samples will be collected from two depths at the three most likely locations of the Acid Sewer Outfall as shown on Figure 4-1. Fewer samples will be collected if the actual Acid Sewer Outfall location can be determined or potential locations discredited. The uppermost sample interval will consist of soil collected from at least 0.1 to 0.4 m (0.25 to 1.25 ft) bgs. Ideally, these samples will be collected from at or below the assumed grade of the Acid Sewer Outfall and will exclude soil at the surface so recently disturbed or transported material will not be included. Lower-interval samples will be collected from at least 0.8 to 1.1 m (2.5 to 3.5 ft) bgs.

4.3 Second-Stage Activities

The first stage sampling results from the leachfield trenches will be used to determine if second stage samples are required. Analytical results from first-stage samples will be considered if they are available, but further investigation may be initiated based on field screening data. If field screening or analytical results indicate contamination extent is not defined because concentrations exceed specified field screening levels or PALs, additional sampling locations or depths will be selected to determine the contamination extent.

Additional investigation may consist of boreholes drilled within the leachfield to determine the vertical extent of contamination or step-out boreholes designed to establish lateral contamination extent as required for successful site investigation. Initial step-out boreholes will be drilled 4.6 m (15 ft) outside the margins of the leachfield. Boreholes will be advanced to depths adequate to determine the vertical extent of contamination. Samples will be collected at 1.5-m (5-ft) intervals beginning at the greatest depth contamination exceeding field screening levels or PALs was detected at adjacent first-stage sample locations. Sample collection will begin at the established leachfield base depth if boreholes without associated first-stage sample locations are required.

At least one confirmatory sample will be submitted to the off-site laboratory from each borehole. If contamination is detected by field screening, the sample with the highest contamination concentration will be submitted. Additional samples may be submitted at the discretion of the Site Supervisor.

Alternative approaches outlining borehole placement strategies should certain site conditions be encountered are addressed in Section 4.1.2.1 of the Leachfield Work Plan.

5.0 Waste Management

Waste management activities to be performed for CAU 428 are addressed in Section 5.0 of the Leachfield Work Plan.

5.1 Waste Minimization

Waste Minimization activities to be performed for CAU 428 are addressed in Section 5.1 of the Leachfield Work Plan.

5.2 Potential Waste Streams

All potential waste types and waste streams associated with the leachfield CAUs are covered in Section 5.2 of the Leachfield Work Plan. Based on process knowledge obtained for CAU 428, possible hazardous wastes are anticipated at this site. Process knowledge compiled thus far does not indicate that a specific listed hazardous waste was discharged to the leachfield systems. Radiological contamination may be present but is unlikely. Action levels for investigation-derived waste (IDW) contaminants are stated in Table 5-1 of the Leachfield Work Plan.

5.3 Investigation-Derived Waste Management

Waste will be managed according to hazardous waste requirements until laboratory analyses are received and a final waste determination is made. If field screening or laboratory analysis detects radiological activity above background levels, the waste will subsequently be managed according to the mixed waste requirements addressed in Section 5.3 of the Leachfield Work Plan.

Any IDW generated during this investigation will be segregated by waste stream and placed in U.S. Department of Transportation-compliant packages appropriate for the type and amount of waste generated that meet the specifications for containers outlined in Section 5.3 of the Leachfield Work Plan.

6.0 Duration and Records Availability

6.1 Time Frame

After submittal of the Final CAIP for CAU 428 to NDEP (FFACO milestone deadline of June 1, 1999), the following is a tentative schedule of activities (in calendar days):

- Day 0: Preparation for field work will begin.
- Day 45: The field work, including field screening and sampling, will begin. Samples will be shipped to meet laboratory holding times.
- Day 120: The field work will be completed.
- Day 185: The quality-assured laboratory analytical sample data will be available for NDEP review.
- The FFACO date for the Corrective Action Decision Document (CADD) is February 29, 2000.

6.2 Records Availability

Historic information and documents referenced in this plan are retained in the DOE/NV project files in Las Vegas, Nevada, and can be obtained through written request to the DOE/NV Project Manager. This document is available in the DOE public reading rooms located in Las Vegas and Carson City, Nevada, or by contacting the DOE Project Manager. The NDEP maintains the official Administrative Record for all activities conducted under the auspices of the FFACO.

7.0 References

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Appendix A

Data Quality Objectives Worksheets

A.1.0 Introduction

A.1.1 Problem Statement

Potentially hazardous wastes were discharged to the two septic waste systems that comprise CAU 428: Septic Waste System 1 (CAS 03-05-002-SW01) and Septic Waste System 5 (CAS 03-05-002-SW05). Existing information about the nature and extent of contamination is insufficient to evaluate and select preferred corrective actions for these sites.

These septic waste systems will be investigated based on DQOs developed by representatives of NDEP and DOE/NV. This investigation will determine if COPCs are present and if concentrations exceed regulatory levels in soils underlying the leachfields and surrounding the leachfield system components. If COPCs are detected, the lateral and vertical extent of contamination will be determined. Data adequate to close the site under NDEP, RCRA, and DOE requirements will be collected.

A.1.2 DQO Kickoff Meeting

Table A.1-1 lists the participants present at the FFACO-required DQO Kickoff Meeting and any subsequent meetings. The goal of the DQO process is to establish the quantity and quality of environmental data required to support corrective action decisions for the CAU. The process ensures that the information collected will provide sufficient and reliable information to identify, evaluate, and technically defend the chosen corrective action. Unless otherwise required by the results of this DQO and stated in the CAIP, this investigation will adhere to the *Industrial Sites Quality Assurance Project Plan* (DOE/NV, 1996c) and the *Work Plan for Leachfield Corrective Action Units: Nevada Test Site and Tonopah Test Range, Nevada* (DOE/NV, 1998a) hereafter referred to as the Leachfield Work Plan.

Table A.1-1
DQO Kickoff Meeting Participants

Participant	Affiliation	Meeting Date
		Kickoff Meeting December 15, 1998
Steve Adams	IT	X
Jerry Bonn	BN	X
Kevin Cabble	DOE	X
Lydia Coleman	SAIC	X
Linda Linden	SAIC	X
Steve Mergenmeier	IT	X
Michael Monahan	SAIC	X
Jason Moore	SAIC	X
Greg Raab	NDEP	X
Cheryl Rodriguez	IT	X
John Stokowski	IT	X
Matt Truax	IT	X
Mary Todd	SAIC	X
Jeanne Wightman	Mactec	X

BN - Bechtel Nevada
DOE/NV - U.S. Department of Energy, Nevada Operations Office
IT - IT Corporation
MACTEC - Management Analysis Company Technologies
NDEP - Nevada Division of Environmental Protection
SAIC - Science Applications International Corporation

A.2.0 Conceptual Model

Before the early 1990s, leachfield systems were used to dispose of liquid waste related to several operations at the Tonopah Test Range, Nevada. Potentially contaminated sanitary effluent was discharged to the leachfields via distribution lines and allowed to percolate into the underlying soil for disposal. This conceptual model is consistent with the general conceptual model for leachfield CAUs provided in Section 3.1 of the Leachfield Work Plan. Section 2.0 of the CAIP provides site-specific operational histories, waste inventories, release information, and investigative backgrounds for this CAU.

An outline of site-specific elements of the conceptual model for CAU 428 is provided in Table A.2-1.

Table A.2-1
Conceptual Model for the CAU 428 Leachfield Systems
(Page 1 of 2)

Conceptual Model Element	Assumptions	Source
System dynamics	Infiltration and concentration of contaminants in the form of liquid waste into the soil directly below (surrounding) the distribution pipes and within the leachfield may have occurred.	Knowledge of similar sites
	Groundwater contamination is unlikely due to environmental conditions at the site, such as an arid climate, low permeabilities, and depth to groundwater greater than 360 ft.	Knowledge of similar sites, CAU Work Plan (DOE/NV, 1996a)
	No driving forces other than infiltration of limited precipitation. Also, liquid disposal through the leachfields has not occurred since the consolidated sewer system was installed in 1990.	Knowledge of similar sites, CAU Work Plan (DOE/NV, 1996a)
	Septic tank abandonment program conducted in 1993. Septic tanks pumped, air dried, and filled with sand or concrete. Interview states Septic Tank 33-2 abandoned according to this procedure but Septic Tanks 33-1, 33-3, 33-8, and 33-10 were only pumped. Remaining septic tanks associated with SWS 1 and 5 apparently not addressed by abandonment program.	CAU Work Plan (DOE/NV, 1996a)
Source location	Septic Waste System 1 received effluent from several buildings in the northern portion of the Area 3 compound. Source buildings for Leachfield A include: 03-50, Medical Trailer, and 03-73. Source buildings for Leachfield B include the previous three buildings, 03-75, 03-63, 03-76, various buildings on the northwest corner of the Area 3 compound, and the former DoD buildings and trailers north of the Area 3 Compound.	Archival engineering drawings and site visits
	Septic Waste System 5 received effluent from a former photoprocessing lab and floor drains in Building 03-50.	Archival engineering drawings and site visits
Contaminants of Potential Concern	VOCs, SVOCs, RCRA Metals, petroleum hydrocarbons, phenolics, cyanide, polychlorinated biphenyls (PCBs), and elevated radiological activities detected by previous sampling of several SWS 1 septic tanks.	Septic tank sampling efforts (IT, 1991 and IT, 1994)
	Concentrations of COPCs determined for disposal of SWS 1 septic tank contents in a public-owned treatment works. Analysis based on CWA MCLs.	Septic tank sampling efforts (IT, 1991 and IT, 1994)

Table A.2-1
Conceptual Model for the CAU 428 Leachfield Systems
(Page 2 of 2)

Conceptual Model Element	Assumptions	Source
Lateral extent of potential contaminants	Subsurface effects limited by relatively low contaminant concentrations and volume and/or low mobility of constituents.	Process knowledge and similar site investigations (i.e., SWS 2 & 6 [DOE/NV, 1998b]).
	The potential lateral migration of contaminants is unknown, but if migration has occurred, it will likely be confined within the boundaries of the leachfields.	Process knowledge and similar site investigations (i.e., SWS 2 & 6 [DOE/NV, 1998b]).
Vertical extent of potential contaminants	The vertical extent of potential contamination is unknown, but if present, will be around and below the distribution lines. Potential contamination is probably concentrated at the native soil/leachfield material interface. Vertical extent should be limited by low contaminant concentrations and volumes, lack of driving force, relatively low mobility of COPCs.	Process knowledge and similar site investigations (i.e., SWS 2 & 6 [DOE/NV, 1998b]).
Physical and practical constraints	Hand excavation required within the Control Point; nearby utilities, buildings and security fencing; adverse weather conditions; restricted access; heavy equipment and resource availability; health and safety concerns; approval of the CAIP.	Site knowledge; site visits
Future use	Similar to current industrial, administrative, and research related activities.	Assumptions are defined in the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (DOE/NV, 1996b)*
Potential exposures	Oral ingestion, inhalation, or dermal contact (absorption) of COPCs in the soil due to inadvertent exposure during excavation	Process knowledge
Waste management	No evidence of listed waste has been found; waste will be considered characteristic unless contrary information is discovered during the investigation.	Process knowledge

A.3.0 Potential Contaminants

Additional information on the COPCs for CAU 428, including PALs and QA/QC requirements are provided in Section 3.0 of either the Leachfield Work Plan or the CAIP.

Previous septic tank sampling efforts and process knowledge identify the following potential contaminants for SWS 1 and 5:

- Septic Waste System 1 served several buildings in the northern portion of the Area 3 compound. This system was used from the construction of Building 03-50 until completion of the consolidated sewer system in 1990. Potentially contaminated sanitary effluent discharged to the system produced elevated levels of COPCs within the system. Septic tank sampling has identified VOCs, SVOCs, RCRA metals, petroleum hydrocarbons, phenolics, cyanide, PCBs, and elevated radiological activities.

- Septic Waste System 5 probably received effluent contaminated with RCRA metals (especially silver) associated with photoprocessing waste generated in the photoprocessing lab of Building 03-50. The system also received effluent from floor drains that may have been contaminated with constituents produced by janitorial activities or by operations within Building 03-50.

Several COPCs will be considered for SWS 1 and 5 including VOCs, SVOCs, and RCRA metals. These constituents are most likely to have been produced by activities within buildings served by these septic systems. Phenolics will be detected by SVOCs analyses. Detections of cyanide, PCBs, and radiological activities represent insignificant concentrations and will not be analyzed as part of this investigation. A summary of previous sampling results is provided in Appendix C. Samples submitted for laboratory analysis will be analyzed according to Table 3-1 of the Leachfield Work Plan for the following COPCs:

- VOCs
- SVOCs
- RCRA metals
- TPH

A.4.0 Decisions and Inputs

A.4.1 Decisions

Decisions to be resolved by the investigation include:

- Determine if COPCs are present at the site.
- Determine if COPC concentrations exceed field screening levels.
- Determine if COPC concentrations exceed PALs.
- Determine the nature and extent of contamination with enough certainty to develop and evaluate a range of potential corrective actions, including closure in place and clean closure.

A.4.2 Inputs and Strategy

Inputs to the decisions include those elements of information used to support the decisions in addressing the identified problem. A list of information inputs, existing data, identified data gaps, and brief strategies are discussed in Table A.4-1.

Table A.4-1
Decisions, Inputs, and General Strategies
(Page 1 of 3)

Decision	Input	Existing Data	Data Gap	Strategy
Are COPCs present above PALs at site?	Potential contaminant identification	Septic tank sampling efforts (IT, 1991 and IT, 1994)	Exact COPCs	Collect laboratory samples; analyze for COPCs
	Potential contaminant concentration	Septic tank sampling efforts (IT, 1991 and IT, 1994)	COPC concentrations produced by SW846 methods, unsampled components including tanks and leachfields; do concentrations exceed PALs?	Collect samples from septic tanks and soil; perform field screening; submit samples for laboratory analysis from biased locations that represent worst case for contamination and confirmatory clean locations; compare results to field screening levels or to PALs
	Potential contaminant distribution	Locations of most septic tanks are known or generally known with some degree of certainty; vertical and lateral extent limited by removal of driving force, mobility of COPCs	Exact vertical and lateral extent of COPCs. Exact location of several system components including some septic tanks and leachfields.	Video surveys and excavation to investigate leachfield systems as needed; collect samples at and in septic tanks; collect samples from leachfields. Use drilling to establish worst case depth of COPCs if phase 1 trenching samples exceed PALs; drill step-out borings as required to determine lateral extent if COPCs are detected; collect laboratory samples to confirm extent

Table A.4-1
Decisions, Inputs, and General Strategies
(Page 2 of 3)

Decision	Input	Existing Data	Data Gap	Strategy
Are potential contaminants migrating?	Meteorologic data	Data on annual precipitation, evapotranspiration, and weather	None identified	No specific meteorological data collection anticipated; weather and wind speed and direction noted on daily field logs
	Geologic/hydrologic data	General geologic/hydrologic characteristics of site; specific geologic conditions of nearby sites (i.e., CAU 423, 427, 424)	Existence and characteristics of differing permeability zones	Field log all core by qualified geologist; collect and analyze geotechnical samples
	Biological degradation factors	Potential hydrocarbons release	Presence of biomass; biological parameters to evaluate natural biological process	May collect bioassessment samples from hydrocarbon sites depending on field screening results
	Radioactive decay	Radionuclides not expected in Area 3; 1991 Septic tank sampling effort identified ^{238}U, ^{234}U, and elevated gross alpha and gross beta counts for some samples. Only gross beta particle activity slightly above proposed SDWA MCL threshold value in Septic Tank 33-10 was confirmed by 1993 resampling. Sampling results are discussed in Section A.3.0 and provided in Appendix C.	Presence and type of radionuclides	Establish background; field screen for alpha/beta radiation using Electra instrument; collect limited samples for gamma spec analysis depending on field screening results

Table A.4-1
Decisions, Inputs, and General Strategies
(Page 3 of 3)

Decision	Input	Existing Data	Data Gap	Strategy
Data sufficient to support closure options?	No further action	Historical evidence that COPCs were released to the environment; assume no actions	Presence, concentration, and extent of COPCs	Insufficient evidence to proceed without investigation. Collect field and laboratory samples; compare results to PALs. If no COPCs above PALs, prepare CADD/Closure Report
	Closure in place	Potential for TPH and RCRA constituents; assume industrial Preliminary Remediation Goals (PRGs) and 100 parts per million (ppm) TPH per NAC 445A (NAC, 1998); assume use restrictions	Presence of regulated COPCs; concentrations above PALs	Collect field and laboratory samples; compare results to PALs. If no COPCs above PALs, prepare CADD/Closure Report; otherwise prepare CADD
	In situ bioremediation	Oil and grease detected above PALs by septic tank sampling; assume 100 ppm PAL per NAC 445A (NAC, 1998)	Presence, concentration, and extent of COPCs; biodegradation parameters	Collect field and laboratory samples; compare results to PALs. If no COPCs above PALs, prepare CADD/Closure Report; otherwise prepare CADD
	Clean closure by contaminant removal	Potential for TPH and RCRA constituents; assume industrial PRGs and 100 ppm TPH per NAC 445A (NAC, 1998)	Presence, concentration, and extent of COPCs; volume of contaminated material above PALs	Collect field and laboratory samples; compare results to PALs. If no COPCs above PALs, prepare CADD/Closure Report; otherwise prepare CADD

A.5.0 Investigation Strategy

Biased sampling will be conducted during the field investigation to assess the extent of COPCs and determine if COPC concentrations exceed PALs for the site.

Samples will be collected at CAU 428 system components using the basic technical approach for leachfield system investigation provided in the Leachfield Work Plan. Samples will be analyzed according to Section A.3.0. The primary investigation techniques will be video surveys and exploratory excavation and trenching, but additional methods including drilling may be required depending on the extent of potential contamination. If drilling is required, it will be conducted in a second phase of the investigation based on field observations or laboratory analysis of samples generated by the initial phase of investigation.

Bioassessment samples may be collected based on field screening results. At least one geotechnical sample will be collected from each leachfield identified by the investigation according to Section 3.2.1 of the Leachfield Work Plan. Additional samples will be collected if drilling is required or at the discretion of the Site Supervisor. Geotechnical samples will be analyzed using the methods in Table 3-2 of the Leachfield Work Plan to measure the following parameters:

- Initial moisture content
- Dry bulk density
- Calculated porosity
- Moisture retention characteristics
- Particle size distribution
- Saturated and unsaturated hydraulic conductivity

A.6.0 Decision Rules

The following decision rules will be used to guide the investigation and subsequent data evaluation for CAU 428.

- If, in the course of the investigation, either of the following occur, then the investigation will be halted and rescoped as necessary:
    - The conceptual model fails to such a degree that rescoping is required.
    - Sufficient data are collected to support evaluation of corrective actions.
- If field screening indicates no COPCs above field-screening levels, then a sample at the next prescribed subsurface location will be field-screened. If no COPCs are indicated, a confirmatory laboratory sample will be submitted for each depth.
- If field screening indicates the presence of COPCs above field-screening levels, then the investigation will continue to determine extent of COPCs until two, consecutive samples with field screening results below field screening levels are obtained for laboratory submittal. Samples will also be submitted for laboratory analysis from the subsurface interval that represents the worst-case, field-screening result and at the discretion of the Site Supervisor. Additional samples may be required for waste management purposes.
- If laboratory results indicate the presence of contaminants of concern above PALs, then a CADD will be prepared.
- If no COPCs are identified above PALs, then a CADD/Closure Report will be prepared according to the outline agreed upon by NDEP and DOE/NV. This type of CADD incorporates the elements of the regular CADD and the corrective action plan and serves as the closure report for the site.

Table A.6-1 provides additional decision points and rules.

Table A.6-1
Activity-Specific Decision Points and Rules
(Page 1 of 3)

Investigation Activity	Decision Point	Decision Result	Decision Rule
Survey and Exploration	Does video survey provide adequate inspection of collection system?	Yes	Collect samples from required locations based on survey results.
		No	Exploratory excavation of collection system may be required to locate specific features including septic tanks and distribution boxes and leachfields. Additional excavation of collection system may be required if samples collected from known system components exceed PALs.
	Unexpected branches/ offshoots/tie-ins discovered during video survey?	Yes	Attempt to determine source or outlet of unexpected pipe. Conduct exploratory excavation if required. Rescoping may be required.
		No	No additional exploration required.
	Can system components be located using video survey or exploratory excavation?	Yes	Collect samples using trenching and excavation (or drilling) as required.
		No	Revise conceptual model. Conduct additional research and attempt to locate features with alternative methods (i.e., geophysics). Features may not exist.
Sampling	Can samples be recovered from/around septic tanks, distribution structures, and soil underlying leachfields?	Yes	Collect samples as required.
		No	Samples that cannot be collected will be replaced or eliminated at the site supervisors discretion. Justification for such omissions will be provided to the DOE/NV Task Manager and in the CADD.
	Are field data above field screening levels?	Yes	Submit samples with highest field screening values for laboratory analysis. Collect additional samples from greater depths or using stepouts as required.
		No	Submit samples to laboratory for confirmation as required.
	Do COPCs exceed PALs?	Yes	Prepare CADD. Additional sampling may be required.
		No	Prepare CADD/Closure Report.

Table A.6-1
Activity-Specific Decision Points and Rules
(Page 2 of 3)

Investigation Activity	Decision Point	Decision Result	Decision Rule
Septic Waste System 5 Investigation	Can Septic Tank 33-11 be located?	Yes	Sample tank contents.
		No	Tank may never have existed. Effluent may have been disposed through leachfield or outfall without tank.
	Can SWS 5 Leachfield be located?	Yes	Sample soil underlying leachfield and use exploratory trenches to determine leachfield extent.
		No	Leachfield may never have existed. Suspect surface discharge at outfall location of Acid Sewer line shown on several engineering drawings. Collect surface samples at outfall location.
	Can Acid Waste outfall location be located?	Yes	Collect surface/near-surface samples based on outfall location.
		No	Collect larger number of surface/near-surface samples based on possible outfall locations determined from engineering drawings. Statistically based sampling approach may be required.

Table A.6-1
Activity-Specific Decision Points and Rules
(Page 3 of 3)

Investigation Activity	Decision Point	Decision Result	Decision Rule
Septic Waste System 1 Investigation	Is SWS 1 Leachfield A configured as described by interviews rather than as shown on engineering drawings?	Yes	Sample as required.
		No	Pad north of Building 03-75 may have to be drilled through or broken to investigate leachfield.
	Does Building 03-75 restroom have a previously unknown septic tank on east side of building?	Yes	Sample septic tank.
		No	Septic tank may have been removed, or contrary to interviews, septic tank may not have existed.
	Does Building 03-76 restroom drain to Septic Tank 33-9?	Yes	System is not included in SWS 1. Note location for future investigations. Building 03-76 no longer considered a source for SWS 1.
		No	No additional sampling required.
	Is a previously unknown septic tank associated with former DoD buildings near SWS 1 Leachfield B?	Yes	Sample septic tank.
		No	Septic tank may have been removed, or contrary to interviews, septic tank may not have existed. All former U. S. Department of Defense buildings effluent probably routed through Septic Tank 33-8.
	Does smaller/older SWS 1 Leachfield B exist?	Yes	Collect additional samples from soil underlying leachfield.
		No	Leachfield probably did not exist, was located in a different location, or was removed or destroyed during installation of SWS 1 Leachfield B.

A.7.0 Decision Error

Biased sampling will be conducted for SWSs 1 and 5. Biased sampling is appropriate because the system component locations are known, will be located through exploratory surveys, or can be reasonably assumed. Table A.6-1 describes actions if specific component locations cannot be identified.

The sampling strategy targets the worst-case contamination by sampling the leachfield system especially at points with highest potential for contamination. This will ensure that the extent of the contamination has been adequately located and identified. Two consecutive samples below field screening levels will be obtained from the predetermined sampling locations in excavations or soil borings to define the lower limit of the affected soils. Field screening results will be confirmed by off-site laboratory analysis for these samples.

A.8.0 References

DOE, see U.S. Department of Energy.

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

IT, see IT Corporation.

IT Corporation. 1991. Tonopah *Test Range Septic Tank Sampling and Analysis Final Report*, September. Albuquerque, NM.

IT Corporation. 1994. *Sandia National Laboratories / New Mexico, Septic Tank Monitoring Report*, Tonopah Test Range and Nevada Test Site, June. Tonopah NV.

NAC, see *Nevada Administrative Code.*

Nevada Administrative Code. 1998. NAC445A.345 - 445A.22755, "Corrective Action Regulations." Carson City, NV: Nevada Division of Environmental Protection.

U.S. Department of Energy, Nevada Operations Office. 1996a. *Corrective Action Unit Work Plan, Tonopah Test Range, Nevada*, July, DOE/NV--443. Las Vegas, NV: Environmental Restoration Division.

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

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

U.S. Department of Energy, Nevada Operations Office. 1998a. *Work Plan for Leachfield Corrective Action Units: Nevada Test Site and Tonopah Test Range, Nevada,* DOE/NV--514, Rev. 1. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1998b. *Corrective Action Decision Document for CAU 427: Area 3 Septic Waste Systems 2 and 6, Tonopah Test Range, Nevada,* Rev. 0, DOE/NV--509. Las Vegas, NV.

Appendix B

Project Organization

B.1.0 Project Organization

The DOE/NV Industrial Sites Project Manager is Janet Appenzeller-Wing and her telephone number is (702) 295-0461.

The names of the project Health and Safety Officer and the Quality Assurance Officer can be found in the appropriate DOE/NV plan. However, personnel are subject to change, and it is suggested that the Project Manager be contacted for further information. The Task Manager will be identified in the FFACO Biweekly Activity Report prior to the start of field activities.

Appendix C

Summaries of Previous Sampling Results

Table C-1
Summary of Analytical Results for Detected Parameters, Tonopah Test Range, Septic Tank Sampling 1991 Sampling Event[1]
(Page 1 of 3)

Parameter	Units	33-1A	33-1B	33-1C	33-2	33-3	33-8	33-8 DUP	33-10
Volatile Organics									
Acetone	µg/L	--	--	49	--	34	230.0[2] (µg/kg)	270.00 (µg/kg)	100[3]
2-Butanone	µg/L	--	--	--	--	--	62.0 (µg/kg)	59.0 (µg/kg)	49
Ethylbenzene	µg/L	--	--	--	--	--	--	--	60
Toluene	µg/L	--	--	--	--	220	41.0 (µg/kg)	--	92
Xylenes	µg/L	--	--	--	12	--	--	--	270
Total Toxic Organics	µg/L	--	--	--	--	220	41 (µg/kg)	--	17152
Semivolatile Organics									
4-Methylphenol	µg/L	--	--	1000	--	--	--	--	17000
Naphthalene	µg/L	--	--	430	--	--	--	--	--
Metals									
Arsenic	mg/L	0.015	0.016	--	0.015	0.019	2.7 (mg/kg)	2.3 (mg/kg)	0.048
Barium	mg/L	0.036	0.33	0.64	0.039	0.17	127.0 (mg/kg)	117.0 (mg/kg)	1.9
Cadmium	mg/L	--	0.011	0.0098	--	0.0074	0.63 (mg/kg)	1.5 (mg/kg)	0.086
Chromium	mg/L	--	0.021	0.013	--	0.013	3.8[4] (mg/kg)	2.2 (mg/kg)	0.23
Copper	mg/L	0.026	0.14	0.20	0.070	0.18	19.0 (mg/kg)	25.1 (mg/kg)	6.4

Table C-1
Summary of Analytical Results for Detected Parameters, Tonopah Test Range, Septic Tank Sampling 1991 Sampling Event[1]
(Page 2 of 3)

Parameter	Units	33-1A	33-1B	33-1C	33-2	33-3	33-8	33-8 DUP	33-10
Lead	mg/L	--	0.016	0.015	--	--	3.2 (mg/kg)	7.1 (mg/kg)	1.7
Manganese	mg/L	0.057	0.12	0.39	0.026	0.19	127.0 (mg/kg)	150.0 (mg/kg)	5.1
Mercury	mg/L	0.00097	0.0033	0.0029	--	0.0014	0.35 (mg/kg)	0.28 (mg/kg)	0.037
Nickel	mg/L	--	--	--	---	--	--	--	0.37
Silver	mg/L	--	--	--	--	--	--	--	0.066
Zinc	mg/L	0.18	1.2	1.8	0.066	1.4	166.0 (mg/kg)	145.0 (mg/kg)	41.1
Total Metals	mg/L	<0.256	<1.4	<2.05	<0.186	<1.63	193.0 (mg/kg)	<176.0 (mg/kg)	<48.1
General Inorganics									
Nitrate plus Nitrite	mg/L	--	--	--	0.25	--	--	--	--
Phenolics	mg/L	0.012	0.041	0.27	0.027	0.29	--	--	0.29
Oil and Grease	mg/L	3.0	180	70.4	5.7 (units unknown)	36.1	9180.0 (mg/kg)	7300.0 (mg/kg)	36.1
Cyanide	unknown	--	--	--	0.020	--	--	--	--
Radiological									
Radium-226	pCi/gm	--	--	--	--	--	--	1.7±0.2 (pCi/gm)	--
Uranium-234	pCi/L	--	--	2.9±0.5[5]	11±3	2.2±0.5[5]	87±14 (pCi/gm)	26±6 (pCi/gm)	--
Uranium-235	pCi/L	--	--	--	1.1±1.0	--	7.2±4 (pCi/gm)	2.4±1.7 (pCi/gm)	--

Table C-1
Summary of Analytical Results for Detected Parameters, Tonopah Test Range, Septic Tank Sampling 1991 Sampling Event[1]
(Page 3 of 3)

Parameter	Units	33-1A	33-1B	33-1C	33-2	33-3	33-8	33-8 DUP	33-10
Uranium-238	pCi/L	--	--	470±70	1.6±1.3	--	9.9±4.8 (pCi/gm)	3.2±2.0 (pCi/gm)	--
Potassium-40	pCi/L	690±70[5,6]	590±70[5,6]	20±16	720±80[5,6]	740±80[5,6]	42±5[6] (pCi/gm)	49±5 (pCi/gm)	640±70[5,6]
Gross Alpha	pCi/L	3.8±2.7	--	96±20	--	21±10	11±5 (pCi/gm)	11±5 (pCi/gm)	130±60
Gross Beta	pCi/L	36±8	38±10	2±0.2	63±10	56±14	34±6 (pCi/gm)	46±6 (pCi/gm)	190±80
Tritium	pCi/ml	--	--	--	--	--	--	--	--
Polychlorinated Biphenyls									
Aroclor 1242	µg/L	--	0.92	--	--	--	--	--	--

Note: Values for samples considered liquid by the laboratory provided in volume units (i.e., mg/L). Values for samples considered solid by the laboratory provided in mass units (i.e., mg/kg).

[1]*Tonopah Test Range Septic Tank Sampling and Analysis Final Report* (IT, 1991)
[2]Method blank contained 11 µg/kg acetone
[3]Method blank contained 24 µg/L acetone
[4]Method blank contained 1.2 mg/L chromium
[5]2 sigma error
[6]Method blank contained 480±70 pCi/L potassium-40

--Not detected
pCi/gm = Picocuries per gram
pCi/ml = Picocuries per milliliter
µg/L = Micrograms per liter
mg/L = Milligrams per liter
µg/kg = Micrograms per kilogram
mg/L = Milligrams per liter
pCi/L = Picocuries per liter

Table C-2
Results of Septic Tank Sample Analysis, Tonopah Test Range, 1993 Sampling Event[1]
(Page 1 of 3)

Parameter	Units	33-1	33-3	33-10
Volatile Organics (EPA 624) (Aqueous Sample)				
Methylene Chloride	mg/L	0.0054	J (0.0014)	J (0.0027)
1,4-Dichlorobenzene	mg/L	0.037	0.034	0.120
Ethylbenzene	mg/L	--	--	0.049
Toluene	mg/L	0.12	J (0.0032)	0.280
Semivolatile Organics (EPA 625) (Aqueous Sample)				
Naphthalene	mg/L	0.120	J (0.0086)	J (0.011)
1,4-Dichlorobenzene	mg/L	0.038	0.027	0.070
Dibenz(a,h)anthracene	mg/L	J (0.0025)	--	--
bis(2-ethylhexyl)phthalate	mg/L	J (0.0032)	0.015	--
Benzo(g,h,i,)perylene	mg/L	J (0.0039)	--	--
Indeno(1,2,3)-cd pyrene	mg/L	J (0.0028)	--	--
Pesticides (EPA 608) (Aqueous Sample)				
Endosulfan sulfate	mg/L	J (0.00026)	--[2]	--[2]
PCBs (EPA 608) (Aqueous Sample)				
PCBs	mg/L	--[2]	--[2]	--[2]
Metals (Aqueous Sample)				
Arsenic	mg/L	0.025	0.013	0.11
Barium	mg/L	0.12	0.094	0.79
Cadmium	mg/L	J (0.0011)	u (0.00050)	J (0.0020)
Chromium	mg/L	u (0.010)	J (0.0089)	0.032
Copper	mg/L	0.036	J (0.014)	0.18
Lead	mg/L	J (0.0031)	J (0.0034)	J (0.0032)
Manganese	mg/L	0.22	0.48	2.6
Mercury	mg/L	u (0.00020)	u (0.00020)	u (0.00020)
Nickel	mg/L	J (0.025)	J (0.010)	0.049
Selenium	mg/L	u (0.010)	u (0.010)	u (0.050)
Silver	mg/L	J (0.0063)	J (0.00044)	J (0.0075)
Uranium	mg/L	0.00195	0.000321	0.00556
Zinc	mg/L	0.30	0.056	0.93
Miscellaneous Analytes (Aqueous Sample)				
Phenolic Compounds	mg/L	0.010	0.030	0.051
Nitrates/Nitrites	mg/L	u (1.0)	u (1.0)	u (1.0)
Formaldehyde	mg/L	u (1.2)	u (0.50)	2.5

Table C-2
Results of Septic Tank Sample Analysis, Tonopah Test Range, 1993 Sampling Event[1]
(Page 2 of 3)

Parameter	Units	33-1	33-3	33-10
Fluoride	mg/L	0.13	0.32	0.51
Cyanide	mg/L	0.038	u (0.010)	u (0.010)
Oil and Grease	mg/L	8.3	3.1	14.0
Radionuclides (Aqueous Sample)				
Gross Alpha	pCi/L	5.18±3.95	0.836±1.8	11.2±5.28
Gross Beta	pCi/L	49.2±6.72	24.0±3.31	75.9±9.48
Tritium	pCi/L	-292±180	-294±180	-223±181
Radium-226	pCi/L	0.211±0.099	0.149±0.072	0.307±0.101
Radium-228	pCi/L	0.334±0.358	0.402±0.246	0.382±0.287
Metals (Sludge Sample)				
Arsenic	mg/kg	2.6	3.4	2.1
Barium	mg/kg	10.5	9.0	49.2
Cadmium	mg/kg	u (0.50)	u (0.50)	u (0.50)
Chromium	mg/kg	J (0.86)	1.2	6.3
Lead	mg/kg	1.6	10.7	2.4
Mercury	mg/kg	0.16	u (0.10)	0.13
Selenium	mg/kg	u (0.50)	J (0.41)	0.32
Silver	mg/kg	J (0.84)	2.3	0.57
Radionuclides (Sludge Sample)				
Gross Alpha	pCi/L	10.7±2.95	19.9±4.77	13.3±3.41
Gross Beta	pCi/L	15.3±3.55	35.6 ±7.41	24.3±5.24
Tritium (pCi/L)	pCi/L	-43±177	-140±174	-47.6±177
Actinium-228	pCi/L	ND (0.438)	1.67±0.43	1.31±0.36
Americium-241	pCi/L	ND (0.094)	ND (0.098)	ND (0.096)
Bismuth-212	pCi/L	--	--	1.49±0.82
Bismuth-214	pCi/L	0.264±0.148	1.27±0.28	1.24±0.25
Cadmium-109	pCi/L	--	2.90±0.984	2.21±0.85
Cerium-144	pCi/L	ND (0.277)	ND (0.29)	ND (0.26)
Cobalt-60	pCi/L	ND (0.084)	ND (0.11)	ND (0.11)
Chromium-51	pCi/L	ND (1.18)	ND (1.48)	ND (1.38)
Cesium-134	pCi/L	ND (0.078)	ND (0.084)	ND (0.077)
Cesium-137	pCi/L	ND (0.103)	ND (0.12)	ND (0.11)
Europium-155	pCi/L	--	--	0.067±0.10
Iron-59	pCi/L	ND (0.290)	ND (0.33)	ND (0.34)

Table C-2
Results of Septic Tank Sample Analysis, Tonopah Test Range, 1993 Sampling Event[1]
(Page 3 of 3)

Parameter	Units	33-1	33-3	33-10
Lead-210	pCi/L	1.10±0.915	2.35±0.940	3.57±1.13
Lead-212	pCi/L	0.464±0.121	1.75±0.26	1.53±0.22
Lead-214	pCi/L	0.513±0.149	1.27±0.23	1.10±0.22
Potassium-40	pCi/L	6.24±1.44	24.5±3.60	19.6±3.00
Radium-224	pCi/L	1.40±0.830	3.02±1.08	3.14±1.03
Radium-226	pCi/L	0.513±0.149	1.27±0.23	1.10±0.22
Radium-228	pCi/L	ND (0.440)	1.67±0.43	1.38±0.36
Ruthenium-106	pCi/L	ND (0.799)	ND (0.83)	ND (0.80)
Strontium-85	pCi/L	0.115±0.083	--	--
Thallium-208	pCi/L	0.204±0.084	0.661±0.14	0.51±0.11
Thorium-228	pCi/L	--	2.52±2.85	3.05±2.62
Thorium-231	pCi/L	ND (5.26)	ND (6.62)	ND (6.02)
Thorium-234	pCi/L	5.89±1.34	3.36±1.26	6.07±1.25
Uranium-235	pCi/L	0.332±0.080	0.24±0.078	0.37±0.084
Uranium-238	pCi/L	5.89±1.34	3.36±1.26	6.07±1.25
Zirconium-95	pCi/L	ND (0.209)	ND (0.25)	ND (0.26)

[1]*Sandia National Laboratories/New Mexico Septic Tank Monitoring Report, Tonopah Test Range and Nevada Test Site* (IT, 1994)
[2]None detected above laboratory reporting limits

J - Analyte present in sample below the quantitation limit listed in parentheses.
ND - Radionuclide not detected in sample at minimum detectable activity listed in parentheses.
u - Analyte not detected at laboratory detection limit listed in parentheses.
mg/L = Milligrams per liter
pCi/L = Picocuries per liter
mg/kg = Milligrams per kilogram

Appendix D

NDEP Document Review Sheet

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET
(Page 1 of 1)

1. Document Title/Number: Corrective Action Investigation Plan for Corrective Action, Unit 428: Area 3 Septic Waste Systems 1 & 5, Tonopah Test Range, Nevada	2. Document Date: January 1999
3. Revision Number: Draft Rev. 0	4. Originator/Organization: IT Corporation
5. Responsible DOE/NV ERP Subproject Mgr.: Janet Appenzeller-Wing	6. Date Comments Due:
7. Review Criteria:	
8. Reviewer/Organization/Phone No.: Gregory A. Raab/NDEP	9. Reviewer's Signature:

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
1. Page 14 of 27, Sect. 3.2, Contaminants of Potential Concern, bullets after 1st paragraph		This listing of COPCs should include alpha and beta screening to be in agreement with Table A.4.1, Decisions, Inputs, and General Strategies, page 2 of 3.	Change made.	
2. Page 15 of 27, Sect. 3.2, Contaminants of Potential Concern, 2nd paragraph		This listing of COPCs should include alpha and beta screening to be in agreement with Table A.4.1, Decisions, Inputs, and General Strategies, page 2 of 3.	Change made.	

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

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

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