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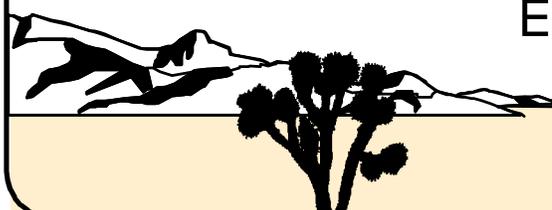
Corrective Action Investigation Plan for Corrective Action Unit 528: Polychlorinated Biphenyls Contamination, Nevada Test Site, Nevada

Controlled Copy No.: ____
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May 2003

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**CORRECTIVE ACTION INVESTIGATION PLAN FOR
CORRECTIVE ACTION UNIT 528:
POLYCHLORINATED BIPHENYLS CONTAMINATION,
NEVADA TEST SITE, NEVADA**

U.S. Department of Energy
National Nuclear Security Administration
Nevada Site Office
Las Vegas, Nevada

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POLYCHLORINATED BIPHENYLS CONTAMINATION,
NEVADA TEST SITE, NEVADA**

Approved by: _____ Date: _____

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List of Acronyms and Abbreviations

AEC	U.S. Atomic Energy Commission
bgs	Below ground surface
BN	Bechtel Nevada
CADD	Corrective Action Decision Document
CAI	Corrective action investigation
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CFR	<i>Code of Federal Regulations</i>
CLP	Contract Laboratory Program
COC	Contaminant of concern
COPC	Contaminant of potential concern
CRDL	Contract-required detection limit
CSM	Conceptual site model
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQI	Data quality indicator
DQO	Data quality objective
DRO	Diesel-range organics
EPA	U.S. Environmental Protection Agency
Eu	Europium
FADL	Field activity daily log
FFACO	<i>Federal Facility Agreement and Consent Order</i>

List of Acronyms and Abbreviations (Continued)

FSL	Field-screening level
FSR	Field-screening result
ft	Foot (feet)
GRO	Gasoline-range organics
HWAA	Hazardous waste accumulation area
IDW	Investigation-derived waste
in.	Inch(es)
IRIS	Integrated Risk Information System
ISMS	Integrated Safety Management System
ITLV	IT Corporation, Las Vegas
kVa	Kilovolt-ampere
LAPS	Large Area Plastic Scintillation
LASL	Los Alamos Scientific Laboratory
LCS	Laboratory control sample
MDA	Minimum detectable activity
MDC	Minimum detectable concentration
MDL	Minimum detection limit
mg/kg	Milligram per kilogram
mi	Mile
M&O	Management and Operating
MRL	Minimum reporting limit
MS	Matrix spike
MSD	Matrix spike duplicate
NAC	<i>Nevada Administrative Code</i>

List of Acronyms and Abbreviations (Continued)

NASA	National Aeronautics and Space Administration
ND	Normalized difference
NDEP	Nevada Division of Environmental Protection
NEPA	<i>National Environmental Policy Act</i>
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NOAA	National Oceanic and Atmospheric Administration
NRDS	Nuclear Site Rocket Development Station
NTS	Nevada Test Site
NTSWAC	<i>Nevada Test Site Waste Acceptance Criteria</i>
PA	Preliminary assessment
PAL	Preliminary action level
PCB	Polychlorinated biphenyl
pCi/g	Picocuries per gram
pCi/L	Picocuries per liter
PID	Photoionization detector
PPE	Personal protective equipment
ppm	Part(s) per million
PRG	Preliminary remediation goal
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RCA	Radiologically controlled area
RCRA	<i>Resource Conservation and Recovery Act</i>
REECo	Reynolds Electric & Engineering Co., Inc.

List of Acronyms and Abbreviations (Continued)

RMA	Radioactive materials area
ROTC	Record of Technical Change
RPD	Relative percent difference
RWMS	Radioactive Waste Management Site
SDWS	<i>Safe Drinking Water Standard</i>
SNPO	Space and Nuclear Propulsion Office
SSHASP	Site-specific health and safety plan
SVOC	Semivolatile organic compound
TCC	Test Cell C
TNT	Transient Nuclear Test
TPH	Total petroleum hydrocarbon
TSCA	<i>Toxic Substance Control Act</i>
VOC	Volatile organic compound
%R	Percent recovery
µg/kg	Micrograms per kilogram

Executive Summary

This Corrective Action Investigation Plan for Corrective Action Unit (CAU) 528, Polychlorinated Biphenyls Contamination, Nevada Test Site, Nevada, has been developed in accordance with the *Federal Facility Agreement and Consent Order* that was agreed to by the State of Nevada, the U.S. Department of Energy, and the U.S. Department of Defense. The general purpose of the investigation is to ensure that adequate data are collected to provide sufficient and reliable information to identify, evaluate, and select potentially technically viable corrective actions.

Corrective Action Unit 528 is comprised of the following corrective action site (CAS) in Nevada Test Site Area 25:

- 25-27-03, Polychlorinated Biphenyl Surface Contamination

This Corrective Action Investigation Plan provides investigative details for CAU 528, whereas programmatic aspects of this project are discussed in the *Project Management Plan* (DOE/NV, 1994). General field and laboratory quality assurance and quality control issues are presented in the *Industrial Sites Quality Assurance Project Plan* (NNSA/NV, 2002a). Health and safety aspects of the project are documented in the IT Corporation, Las Vegas Office, *Health and Safety Plan* (IT, 2001) and will be supplemented with a site-specific health and safety plan.

Corrective Action Site 25-27-03 consists of the soil adjacent to Test Cell C (TCC) concrete pad in Area 25 of the Nevada Test Site and the Substation #3 concrete pad within the boundary of TCC. Corrective Action Site 25-27-03 was identified during the corrective action investigation of CAU 262 as a potential source of polychlorinated biphenyls (PCBs) and petroleum contamination. The actual source of the PCB contamination is unknown but two potential sources have been identified:

- Dust suppression and wind erosion control activities conducted in association with the operation and remedial activities at TCC, using oils containing PCBs
- A release from transformers formerly located on a concrete pad within the boundary of the CAS

A conceptual site model was developed for the CAS to address all releases associated with CAS 25-27-03. The data quality objective (DQO) process was used to identify and define the type,

quantity, and quality of data needed to complete the investigation phase of the corrective action process. The DQOs address the primary problem that sufficient information is not available to determine the appropriate corrective action for the CAS. To be able to determine the corrective action alternative, two critical decisions were identified.

- Is contamination other than PCBs present in the surface and shallow subsurface soil at concentrations that exceed the preliminary action levels?
- Is the extent of contamination including PCBs above action levels sufficiently delineated to identify an effective corrective action and determine the potential waste volumes.

For determining distinct data needs, resolution of the first decision is addressed as Phase I and resolution of the second decision is addressed as Phase II. Phase I data will be generated and evaluated throughout the CAS. Phase II data will be generated and evaluated for each contaminant exceeding preliminary action levels. Corrective action closure alternatives (i.e., no further action, closure in place, or clean closure) will be recommended for CAS 25-27-03 based on an evaluation of all the DQO-required data.

Based on site history, process knowledge, and previous field efforts, contaminants of potential concern for CAU 528 collectively include PCBs, total petroleum hydrocarbons, *Resource Conservation and Recovery Act* (RCRA) metals, volatile organic compounds, semivolatile organic compounds, radionuclides, and beryllium.

The general technical approach for investigation of CAU 528 consists of, but is not limited to, the following activities:

- Perform radiological land area surveys at CAS 25-27-03 in areas that have not been surveyed to ensure worker health and safety.
- Collect and analyze surface and shallow subsurface soil samples from biased locations.
- Submit soil samples for 48- to 72-hour quick-turnaround analysis to aid in determining the nature and extent of known PCB contamination.
- Collect required quality control samples.
- Collect additional samples, as necessary, to estimate potential corrective action waste streams.

- Collect samples from native soils and analyze for geotechnical/hydrologic parameters, if necessary.
- Collect and analyze bioassessment samples, if appropriate (e.g., if volatile organic compound concentrations exceed field-screening levels in a pattern that suggests that a plume may be present).
- Stake or flag sample locations and record coordinates.

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 that will be presented in the Corrective Action Decision Document.

1.0 Introduction

This Corrective Action Investigation Plan (CAIP) contains project-specific information including facility descriptions, environmental sample collection objectives, and criteria for conducting site investigation activities at Corrective Action Unit (CAU) 528: Polychlorinated Biphenyls Contamination, Nevada Test Site (NTS), Nevada.

This CAIP has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) (1996) that was agreed to by the State of Nevada, the U.S. Department of Energy (DOE), and the U.S. Department of Defense (DoD).

The NTS is approximately 65 miles (mi) northwest of Las Vegas, Nevada ([Figure 1-1](#)). Corrective Action Unit 528 is comprised of the one Corrective Action Site (CAS) listed below:

- 25-27-03, Polychlorinated Biphenyls Surface Contamination

This site was identified during the corrective action investigation (CAI) of CAU 262, Area 25 Septic Systems and UDP; CAS 25-04-07 and sampling and analysis conducted during the preliminary assessment for CAU 528. Corrective Action Unit 528 is being investigated because existing information on the nature and extent of potential contamination is insufficient to evaluate and recommend corrective action alternatives. Therefore, additional information will be obtained by conducting a CAI prior to evaluating and selecting the corrective action alternatives for the CAS. The CAI will include field inspections, radiological surveys, and sampling of appropriate media. Data will also be obtained to support investigation-derived waste disposal and potential future waste management decisions.

1.1 Purpose

The CAS in CAU 528 is being investigated because polychlorinated biphenyl (PCB) contamination, as well as other hazardous and/or radioactive constituents, may be present in concentrations that could potentially pose an unacceptable risk to human health and/or the environment.

The CAI will be conducted following the data quality objectives (DQOs) developed by representatives of the Nevada Division of Environmental Protection (NDEP) and the DOE National

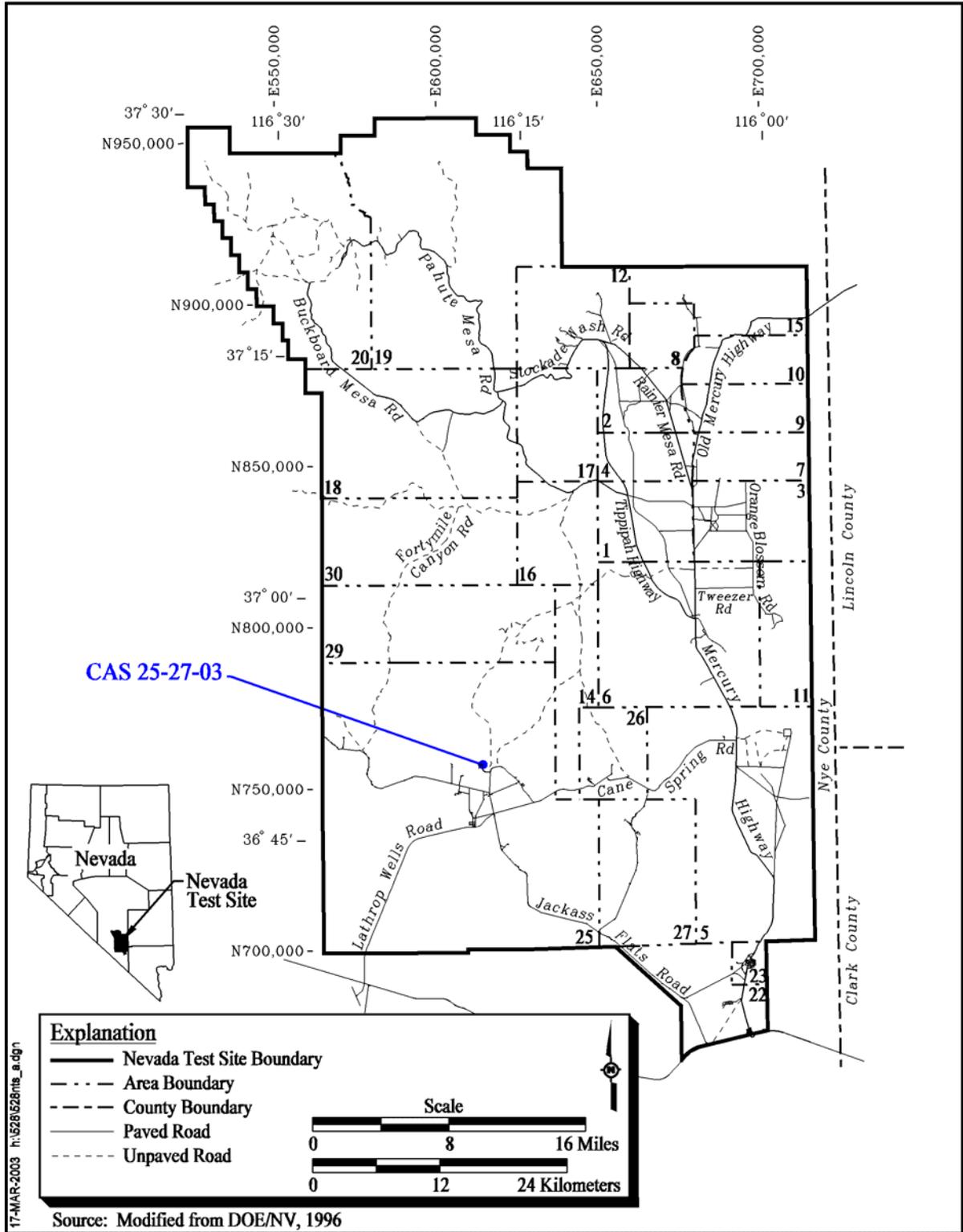


Figure 1-1
CAU 528, CAS 25-27-03 Location Map

Nuclear Security Administration Nevada Site Office (NNSA/NSO). The DQOs are used to identify the type, amount, and quality of data needed to define the nature and extent of contamination and identify and evaluate the most appropriate corrective action alternatives for CAU 528.

The primary problem statement for the investigation is: “Existing information and data concerning the nature and extent of contamination released from CAU 528 are insufficient to determine the risk to human health or the environment. Polychlorinated biphenyls contamination is present at concentrations greater than the preliminary action levels (PALs). However, data are insufficient to evaluate appropriate corrective actions?” To address this problem statement, the resolution of the following two decisions statements is required:

- Decision I is to “Determine if hazardous or radioactive contaminants, other than PCBs, are present at concentrations above PALs.” Analytical data should be collected from areas most likely to contain contamination resulting from site activities, and parameters should be selected that represent all types of potential contamination present at the site. If PALs for COPCs (other than PCBs) are not exceeded, Decision II will only focus on the phase II PCBs.
- Decision II is “Determine the extent of PCBs and other COCs, identified that exceeded PALs during phase I.” This decision will be achieved by the collection of data that are adequate to define the lateral and vertical extent of COCs.

Most of the data necessary to resolve the decisions will be generated from the analysis of environmental samples collected during the CAI for CAS 25-27-03. The general purpose of the investigation is to:

- Identify the presence and nature of other COCs.
- Determine the vertical and lateral extent of PCBs and other identified COCs.
- Ensure that all NDEP, *Resource Conservation and Recovery Act (RCRA)*, *Toxic Substance Control Act (TSCA)*, and DOE closure requirements are identified in the CADD.

In addition, data will be obtained to support investigation derived waste disposal and potential future waste management decisions.

1.1.1 CAS 25-27-03, Polychlorinated Biphenyls Surface Contamination

Corrective Action Unit 528 consists of one CAS, CAS 25-27-03, Polychlorinated Biphenyls Surface Contamination, located in an area adjacent to Test Cell C (TCC) in Area 25 of the NTS as shown in [Figure 1-2](#). The U.S. Atomic Energy Commission (AEC) (predecessor to the DOE) participated jointly with the National Aeronautics and Space Administration (NASA) in the development of nuclear rocket engines between 1959 and 1973. The Space and Nuclear Propulsion Office (SNPO) was formed as a result of the interagency agreement to establish and manage a test area known as the Nuclear Rocket Development Station (NRDS). Test Cell C was one of several installations within Area 25, built to support NRDS activities and was used to conduct ground tests and static firings of nuclear engine reactors. Various nuclear reactor tests were conducted at TCC between 1959 and 1973. Although nuclear rocket engine testing ceased in 1973, various experiments and activities were conducted at TCC until the late 1970s when the facility was closed and “mothballed.” As a result of the construction, maintenance, and operation of TCC, releases of contamination is suspected to have occurred.

Corrective Action Unit 528 was created based on analytical results for soil collected during the CAI of CAU 262, Area 25 Septic Systems and UDP. This investigation showed PCBs to be present above the minimum reporting limits (MRL), and at some locations above the PAL, in soil samples collected on the western edge of TCC from and near the overburden at the TCC Building 3210 sanitary leachfield (CAS 25-04-07). Substation #3 is a former location of three 100 kilovolt-ampere (kVa) transformers. The PCB contamination was not attributed to the septic system because the detected PCBs were limited to the surface and shallow subsurface soil above the depth of the leachfield (DOE/NV, 2001).

In November and December 2002, as part of the preliminary assessment (PA) for CAS 25-27-03, Shaw Environmental, Inc. (Shaw) collected surface soil samples from locations adjacent to Substation #3 and along the boundary of the TCC concrete pad. Analytical results from this sampling indicated PCBs throughout the surface soil surrounding TCC. Based on this information, CAS 25-27-03 has been identified to include the potentially contaminated soil around the Substation #3 concrete pad and the soil adjacent to TCC west to Topopah Wash and the soil within the fenced area of TCC to the north, east, and south. [Figure 1-2](#) shows the CAS 25-27-03 boundary based on current understanding.

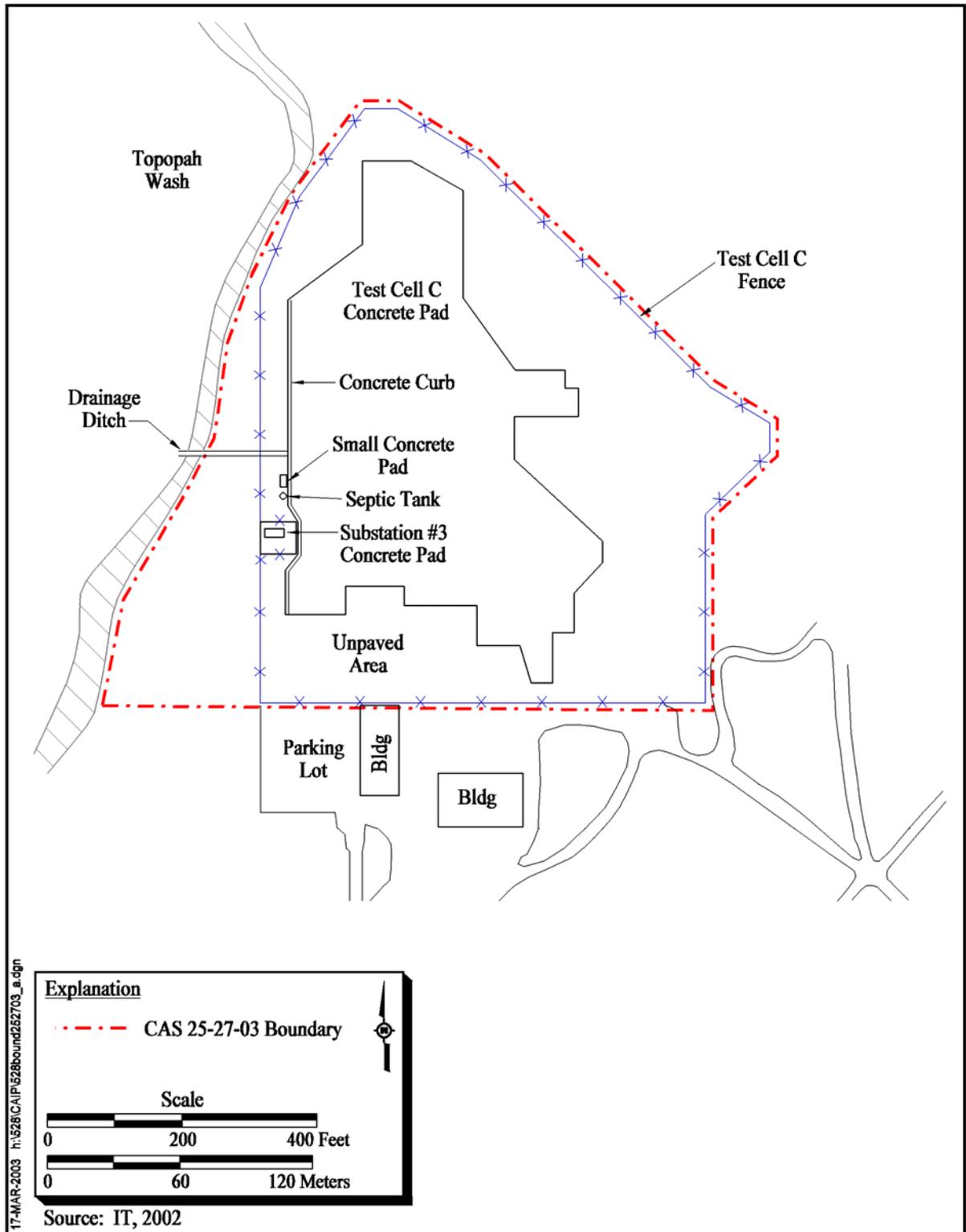


Figure 1-2
CAU 528, CAS 25-27-03 Boundary

Based on the current information, two potential sources of the PCBs in the surface and shallow subsurface soil have been identified. The first potential source of PCBs and petroleum contamination in the surface and shallow subsurface soil is the oil used for dust suppression and to control wind erosion. Based on the operational history of the NTS, it is known that oil, potentially containing PCBs, was used for dust suppression during construction and operational activities. In addition, the use of oil for controlling wind erosion is known to have occurred in association with the remediation activities conducted as a result of the Kiwi Transient Nuclear Test (TNT) Excursion and the Phoebus 1A accident at TCC (Tinney, 2001).

The second potential source is the PCB-containing transformers once located on the concrete pad at Substation #3. It is possible that a leak from, or a catastrophic failure of, one or more of the transformers may have occurred. This would have released oil containing PCBs onto the concrete pad and then to the soil adjacent to the substation. No documentation has been identified to confirm such an occurrence.

1.1.2 DQO Summary

The CAU will be investigated based on DQOs developed by representatives of NDEP and the NNSA/NSO. The DQOs were used to identify and define the type, quantity, and quality of information needed to identify, evaluate, and recommend potentially viable corrective actions. A phased approach has been selected to generate the data needed to satisfy the DQOs. Phase I data will be generated and evaluated to determine the presence of contaminants of concern (COCs). Contaminants of concern are defined as contaminants of potential concern (COPCs) that are present in samples at concentrations above PALs defined in [Section 3.0](#). Phase II data will be generated and evaluated to define the extent of COCs identified during the Phase I sampling. Corrective action closure alternatives (i.e., no further action, closure in place, or clean closure) will be recommended for CAS-25-27-03 based on an evaluation of the DQO-required data. Because PCBs are known to exist in the surface soil within CAU 528 at concentrations exceeding PALs, the no further action alternative is not considered an acceptable remedial alternative.

1.2 Scope

To generate information needed to resolve the decision statements identified in the DQO processes, the scope of the CAI for CAU 528 includes the following activities:

- Conduct land radiological surveys as necessary to provide information for the protection for worker health and safety.
- Conduct Phase I sampling for hazardous and radiological parameter using quick-turnaround analyses to determine the nature of contamination.
- If unknown COCs are present, collect samples to define the horizontal and vertical extent of the contamination. (For PCBs collect samples to define the horizontal and vertical extent of the contamination.)
- Collect quality control (QC) samples for laboratory analyses to evaluate the performance of measurement systems and controls based on the requirements of the data quality indicators (DQIs).
- Comply with regulatory requirements for waste disposal through the collection and analysis of investigation-derived waste (IDW) samples, as needed. Collect samples of IDW and conduct inspections and surveys, as needed, to support waste management decisions.
- Collect soil samples for laboratory analysis of geotechnical parameters and/or bioassessment, as needed.

Radiological and beryllium contamination, resulting from the Kiwi TNT Excursion and the Phoebus 1A accident, is expected in the area of TCC, but these contaminants are not considered to be within the CAI scope for CAU 528. However, radiological (primarily Cesium-137 and Niobium-94) and beryllium contamination within CAS 25-27-03, regardless of the source, will be considered in the evaluation of the CAS and potential corrective actions, but the identification of these constituents will not be used to expand the size of the CAS or to define the extent of potential petroleum, PCB, or other inorganic and organic contamination. The data will primarily be used to assist in the disposal of IDW and in the evaluation of potential future waste management issues. Potential soil contamination, including PCBs contamination, within Topopah Wash, resulting from the Kiwi TNT Excursion or the Phoebus 1A accident and subsequent remediation activities are being addressed under CAU 529.

1.3 CAIP Contents

[Section 1.0](#) presents the purpose and scope of this CAIP, while [Section 2.0](#) provides background information about the CAU. The objectives, including the conceptual site models, are presented in [Section 3.0](#). Field sampling activities are discussed in [Section 4.0](#), and waste management for this project is discussed in [Section 5.0](#). General field and laboratory quality assurance (QA) and QC requirements (including collection of QC samples) are presented in [Section 6.0](#) and in the *Industrial Sites Quality Assurance Project Plan* (QAPP) (NNSA/NV, 2002a). The project schedule and records availability are discussed in [Section 7.0](#). [Section 8.0](#) provides a list of references. [Appendix A.1](#), [Section A.1](#) provides a DQO summary, while [Section A.2](#) contains information on the project organization. The health and safety aspects of this project are documented in the Environmental Architect-Engineer (A-E) Services Contractor's *Health and Safety Plan* (HASP) and will be supplemented with a site-specific health and safety plan written prior to the start of field work. Public involvement activities are documented in the "Public Involvement Plan" contained in Appendix V of the FFACO (1996). The managerial aspects of this project are discussed in the *Project Management Plan* (DOE/NV, 1994) and will be supplemented with a site-specific field management plan that will be developed prior to field activities.

2.0 Facility Description

Corrective Action Unit 528 includes the soil adjacent to the TCC concrete pad in Area 25 of the NTS and is comprised of a single CAS, (CAS 25-27-03) that was identified during the CAI of CAU 262, Area 25 Septic Systems and UDP; CAS 25-04-07, Septic System. This CAU was not considered as a potential source of PCB and petroleum contamination. The actual source of the PCB contamination is unknowns but two potential sources have been identified: (1) dust suppression and wind erosion control activities conducted in association with the operation and remedial activities of TCC, using oils potentially containing PCBs, and (2) a release from transformers formerly located on a concrete pad within the boundary of CAS 25-27-03.

2.1 Physical Setting

Corrective Action Unit 528, CAS 25-27-03 is located in the southwestern portion of Area 25 of the NTS in Jackass Flats, adjacent to the TCC concrete pad. The following sections provide a general overview of the topography, geology, and hydrogeology pertaining to Area 25. General background information pertaining to topography, geology, hydrogeology, and climatology are provided for this specific area of the NTS region as described in the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996). The locations of the CAS on the NTS is shown in [Figure 1-1](#).

2.1.1 Area 25

The CAS is located within Jackass Flats in Area 25 of the NTS. Jackass Flats is an intermontane basin, typical of the Basin and Range Physiographic Province. The basin is surrounded by Yucca Mountain to the west and southwest, Skull Mountain and Little Skull Mountain to the southeast and south, Lookout Peak to the northwest, and small rugged hills to the north and northeast (DRI, 1988). The Calico Hills are directly north and Mid Valley and Lookout Peak are to the northeast and east, respectively. Test Cell C is flanked to the west by Topopah Wash which is a small desert drainage that originates in the Calico Hills and bisects the Jackass Flats alluvial valley, north to south (Drollinger et al., 2000). This ephemeral stream drains south to Jackass Flats, then south by southwest through the middle of the flats adjacent to TCC and then south and parallel to Forty Mile Wash to the confluence with the Amargosa River (USGS and DOE, 1980).

The erosion of the surrounding Tertiary and Paleozoic uplands fills the basin and has created a layer of alluvium and colluvium with a depth up to 1,025 feet (ft) (DOE, 1988; USGS, 1964). The alluvium is underlain by welded and semiwelded ash-flow and ash-fall tuffs of Tertiary age. Beneath the tuff layers lie the Paleozoic carbonate and clastic sediments with a depth of 22,000 ft in some areas. The Paleozoic rocks are made up of shales, quartzites, and carbonates of lower- to middle-Cambrian age; carbonate and thin shale layers of middle Cambrian to Devonian age; and argillites, cherty limestones, and conglomerates of Devonian to Permian age (SNPO, 1970).

Jackass Flats lies within the Alkali Flat-Furnace Creek Ranch subbasin. Groundwater levels range from 709 to 1,185 ft below surface (USGS, 2002). The groundwater contained within the limestone and dolomite units are at a depth too great to be an economic source of water; however, the welded-tuff aquifer (the Topopah Spring member of the Paintbrush tuff) is a water-producing aquifer with transmissivities ranging from 68,000 to 488,000 gallons per day per cubic ft (DRI, 1988).

Groundwater occurs in the area of CAU 528 within alluvial and volcanic aquifers that overlie the carbonate aquifer. This carbonate aquifer underlies large areas of the NTS and is part of a regional groundwater flow system. Within the overlying alluvial and volcanic aquifers, lateral groundwater flow occurs from the margins to the center of the basin. Groundwater flows downward from these aquifers into the carbonate aquifer (Laczniak et al., 1996). The lateral movement of the groundwater within Jackass Flats is southwest, and ultimately discharges into areas within the Amargosa River Valley (DRI, 1988; DOE, 1988). The occurrence of local perched water units is unknown at this time.

The nearest natural-water source to TCC is Topopah Springs about 8 mi directly north at the head of Topopah Wash. However, several NTS wells supplied water for the facilities when the NRDS was in operation. The first of these, J-11 (located approximately 15,000 ft south of TCC) and J-12 (approximately 40,000 ft southwest of TCC) were drilled in 1957. The third one, J-13 (located approximately 33,000 ft south of the CAS site marker at TCC), was drilled in 1962 when the casing failed on the first well. The wells served two interconnected water delivery systems, one for the northern area of the NRDS and the other for the southern (Drollinger et al., 2000). Average depth to water in these wells between 1990 and 2002 were measured as follows: J-11 approximately 1,040 ft

below ground surface (bgs); J-12 approximately 740 ft bgs; and J-13 approximately 928 ft bgs (USGS, 2002).

Surface and near-surface soil within and around CAS 25-27-03 is suspected to have been disturbed during the construction of TCC. The soil consists of fine silt and sand with small pebbles present. No fractures or caliche were observed during the site visit; however, caliche is likely in the undisturbed native soil adjacent to the septic system (IT, 2002) and CAS 25-27-03. The installation of the leachfield associated with the septic system is suspected to have breached the caliche layer, if present.

Average annual precipitation in the Jackass Flats area has been measured at a National Oceanic and Atmospheric Administration (NOAA) Air Research Laboratory Special Operations and Research Division gauging station between 1958 and 2002 (NNSA/NSO, 2003). The gauging station is located at 36 47 05 N longitude and 116 17 20 W latitude within the Jackass Flats of NTS. The average annual precipitation reported during this 44-year period is 5.54 inches (in.) with annual averages ranging from 0.98 in. in 1959 to 14.40 in. in 1998.

2.2 Operational History

The following subsections provide a description of the use and operational history of TCC and CAS 25-27-03, Polychlorinated Biphenyls Surface Contamination. Analytical results for soil collected during the CAI for CAU 262, CAS 25-04-07, showed PCBs to be present above the minimum reporting limits, and at some locations above the PAL, in surface soil samples collected from overburden at the TCC Building 3210 sanitary leachfield. This leachfield is located on the west edge of TCC. The PCB contamination was not attributed to the septic system (DOE/NV, 2001). CAU 528 and CAS 25-27-03 were created in June 2001 to accommodate the corrective action process for this contamination. This summary is intended to illustrate the significant activities known to have been conducted at TCC that may have released contamination to the environment.

The AEC participated jointly with NASA in the development of nuclear rocket engines between 1959 and 1973. The SNPO was formed as a result of the interagency agreement to establish and manage a test area known as the NRDS. The NRDS was used from the 1959 until 1973 to conduct full-scale testing of reactors, engines, and rocket stages to evaluate the feasibility of developing nuclear reactors for the United States' space program (DOE/NV, 2000a). Test Cell C was one of several facilities

within Area 25 built to support NRDS activities and was used to conduct ground tests and static firings of nuclear engine reactors. Reactors tested at TCC include Kiwi, Phoebus, Peewee Series, and Nuclear Engine for Rocket Vehicle Application between 1964 and 1973. Test Cell C was also used for nuclear furnace testing in 1972 (LASL, 1973). Although nuclear rocket engine testing ceased in 1973, various experiments and activities were conducted at TCC until 1977 when the facility was “mothballed.” The construction, operation, and maintenance of TCC is suspected to have released various contaminants, primarily petroleum hydrocarbons and PCBs, to the surface and shallow subsurface soils around the TCC concrete pad during the construction and maintenance activities.

Corrective Action Site 25-27-03 was initially estimated to cover an area estimated to be 93-ft long and 45-ft wide (IT, 2002). Included in the area is a concrete pad where three 100 kVA, oil-filled and self-cooling transformers were installed in 1961. These transformers are thought to have provided power to TCC during the active life of the facility and when these activities were terminated the transformers were no longer necessary and subsequently removed; however, the date of removal is unknown. The transformer pad is surrounded by a chain link fence, yellow rope, and orange construction fencing. Approximately 30 ft north of the transformer pad is a small berm covered with fine, grey gravel. The estimated dimensions of the berm are 39-ft long, 45-ft wide and 1.5-ft high (IT, 2002). During an August 29, 2002, PA site visit to CAS 25-27-03, Shaw identified two areas of potential environmental concern other than the soils within the CAS: a transformer pad and the small earthen berm located approximately 30 ft north of the transformer pad.

In November and December 2002, as part of the PA for CAS 25-27-03, Shaw collected surface soil samples in the vicinity of TCC. Results from this sampling indicated the presence of PCBs extended throughout the area around the TCC concrete pad. Based on this information, CAS 25-27-03 was expanded to include Substation #3, where PCB containing transformers were located, the earthen berm approximately 30 ft north of the transformer pad, and the surface and shallow subsurface soils contiguous to the TCC concrete pad extended to the fence on the north, east, and south, and to the edge of Topopah to the west. [Figure 1-2](#), shows the CAS 25-27-03 boundary based on current understanding.

2.3 Waste Inventory

Available documentation, interviews with former site employees, process knowledge, and general historical NTS practices were used to identify wastes that may be present. These sources did not indicate that this CAU was or was not used to dispose of material considered to be hazardous waste as defined by current standards. Although no known occurrences of waste disposal have been identified for CAS 25-27-03, materials remaining from past activities conducted at, or near, this CAS may be considered hazardous and/or radioactive waste by current standards. Historical information and site visits indicate that the leaking or failure of the transformers and dust suppression or wind erosion control may be identified as hazardous waste. Historical documentation confirms that radiological constituents exceeding various criteria have been released from nearby sites. Available information was evaluated during the DQO process, and a list of potential contaminants was developed and is provided in [Table 3-2](#).

Information concerning the manufacturer, date of manufacture, PCB concentration, volume of fluid in transformer, and fluid type of the transformers formerly located on the concrete pad is unknown. Therefore, according to 40 *Code of Federal Regulations* (CFR) 761.2 (CFR, 2002b), PCBs, if found, will be managed at the as found concentration. Polychlorinated biphenyls were produced in the United States between 1929 and 1977 and used in a wide variety of applications (e.g., electrical transformers and capacitors, hydraulic systems, and heat transfer systems). Because of their rare combination of properties, including a high dielectric constant (good insulator), low flammability, high heat capacity, and low chemical reactivity, PCBs were widely used as coolants in transformers before the 1970s. The PCBs with a high degree of chlorination (Aroclor 1248, 1254, and 1260) are resistant to biodegradation and demonstrate a long-term resistance to degradation in the environment.

The scope of this investigation is to determine the nature and extent of organic and inorganic contamination associated with the dust suppression activities that took place at TCC and the potential release of oil and PCBs from the Substation #3 transformers. Radiological contamination resulting from the Kiwi TNT Excursion, Phoebus 1A accident, and other testing conducted at TCC is outside of the scope of CAU 528. Data on radioactivity have already been obtained for much of the CAS 25-27-03 area that is acceptable to satisfy health and safety planning needs. However, if additional data are required these surveys will be conducted. Radiological analysis may be required to support waste management decisions and IDW disposal. Where potential mixed waste exists,

these areas will be identified and delineated to the extent necessary to properly manage the IDW and address future waste management issues. However, these radiological data are not intended to guide the identification and delineation of contamination within CAS 25-27-03.

2.4 Release Information

The CAS-specific release information, migration routes, exposure pathways, and affected media are discussed in this section. However, based on historical information and process knowledge the primary sources of potential environmental contaminants released to the soil within CAU 528 include:

- Potential leaking or failure of the PCB-containing transformers at Substation #3.
- Application of oil to the surface soil around the TCC concrete pad to suppress dust during construction and operation of the facility
- Oil application to contaminated soil to prevent wind erosion after various remediation activities.

During an August 29, 2002, PA site visit to CAS 25-27-03, Shaw identified two areas of potential environmental concern other than the soils with the CAS. These two areas consist of former Substation #3 concrete pad and a small earthen mound located approximately 30 ft north of the transformer pad. Engineering drawings show that three 100 kVA, oil-filled, self cooling transformers were installed at Substation #3 in 1961. These transformers have since been removed but the actual date of removal is unknown.

No information exists to document the failure of any one of the three transformers while they were in service or during removal. It is likely that any material spilled or leaked onto the concrete pad (e.g., cooling oil containing PCBs) was not of sufficient volume to migrate beyond the CAS boundaries. In addition, the concrete pad would act as a barrier to vertical migration. If PCB containing oil was released from the transformers it would most likely have flowed to the edge of the pad and onto the surrounding soil. Lateral migration also would be expected to be limited by the physical and chemical properties of the PCBs, oil, and the surrounding soil.

Contaminants originating from the dust suppression activities would have been deposited on the surface with a limited potential for vertical or horizontal migration. Grading activities associated with the construction and remediation activities around TCC also may have deposited PCB containing oil on the surface and mixed it into the shallow subsurface soil. Because of their physical and chemical properties, these contaminants would have limited potential for either horizontal or vertical migration.

The nearby Kiwi TNT Excursion and Phoebus 1A accident produced surface and near-surface contamination adjacent to and within the TCC facility (LASL, 1967). The application of oil to control wind erosion during the remediation of the soil within and around the test area also may have allowed the release of PCBs and oil to the surface and shallow subsurface soil. The grading activities associated with the remediation of the Kiwi TNT Excursion and the Phoebus 1A accident may have moved PCB containing oil into the shallow subsurface soil.

No known migration of contamination has occurred at CAS 25-27-03. Potential migration routes are expected to be primarily vertical due to gravity with limited horizontal migration depending on the nature of the release. For example, if the transformers leaked or failed, contaminants may migrate to a limited extent laterally prior to infiltration. Additionally, the presence of relatively impermeable layers could modify vertical transport pathways, both on the ground surface (e.g., concrete) and in the subsurface (e.g., caliche layers). Vertical migration of contaminants directly below the TCC concrete pad is not expected at CAS 25-27-03 because of the thickness and limited permeability of the concrete.

Recharge to groundwater from precipitation is minimal at the NTS and does not provide a significant mechanism for migration of contaminants to groundwater. Lateral migration due to surface runoff of precipitation is also expected to be limited because of the limited amount of precipitation and the negative transpiration in the arid environment. Additional information on migration is presented in [Section 3.1.3](#) and in [Appendix A.1, Section A.1.2.3](#).

Potentially affected media for CAS 25-27-03 include surface and shallow subsurface soil. To support waste management decisions, the concrete pad also may be considered an affected medium. Additional affected media information is given in [Appendix A.1, Section A.1.2.3](#).

2.4.1 Exposure Pathways

Site workers, construction personnel, and military personnel may be exposed to potentially contaminated soil around the TCC concrete pad. Exposure pathways include ingestion, inhalation of dust, and/or dermal contact (absorption) from disturbance of contaminated soils, debris, and/or structures. This exposure pathway is considered unlikely to result in significant exposure to potential receptors from contaminated soil from the site because of the expected limited use and the restricted access to the NTS and the TCC area.

Site workers may also be exposed to radiation by performing activities in proximity to radiologically contaminated materials. Surface soils may have been impacted by radiological contamination associated with the Kiwi TNT Excursion and other TCC activities. As discussed in [Section 1.2](#), this contamination will only be addressed by CAU 528 for the purposes of IDW disposal and future waste management issues and to support worker health and safety.

2.5 Investigative Background

No documented site investigation activities associated with CAU 528 have been identified in the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996). However, radiological surface surveys and downhole radiation measurements for CAS 25-04-07, located within the current boundary of CAS 25-27-03, were conducted during the CAI for CAU 262. These readings were collected to determine the potential presence of radionuclides in the subsurface. The downhole readings were taken by lowering the meter probe into the hole or excavation. There were no readings reported above the action levels. The ground surface and areas adjacent to the sites were surveyed with a vehicle-mounted detector (i.e., Large Area Plastic Scintillation [LAPS] detector). Field conditions required walkover surveys on portions of the investigation area. In addition, a micro-R meter (i.e., Bicron) was used to measure gamma-ray dose rates.

Previous sampling of the septic tank contents, soil underlying the leachfield, and background soil for the CAU 262 leachfield system was conducted by Reynolds Electrical & Engineering Co., Inc. (REECo) in 1994 and 1995. Based on the analytical data, REECo recommended that the tank contents be considered nonhazardous and the tank be closed as a domestic sewage system. Elevated

levels of Europium (Eu)-152 detected in the background soil sample was attributed to sources not related to the operation of the leachfield system and was consistent with other soil samples collected in the vicinity of TCC (REECo, 1995).

Analytical results for soil collected at CAU 262, CAS 25-04-07, showed PCBs to be present above the minimum reporting limits in soil samples collected from and near the leachfield overburden. Four samples exceeded the minimum reporting limits for Aroclor-1016, between 0 and 2 ft bgs, but none exceeded the PAL of 740 micrograms per kilogram ($\mu\text{g}/\text{kg}$). Twenty samples exceeded the minimum reporting limits for Aroclor-1260 between 0 and 6 ft bgs. Of the 20 total samples, 9 surface and 1 subsurface soil sample contained concentrations of Aroclor-1260 that exceeded the PAL. Of these samples, the highest concentration of PCBs (57,000 $\mu\text{g}/\text{kg}$ Aroclor-1260) was detected in a surface soil sample near the TCC concrete pad (DOE/NV, 2001).

Soil sampling results for septic tank investigations at CASs 25-04-06 and 25-04-07 within CAU 262 in the TCC area, suggest that PCB contamination is not widespread and is not consistent with sampling results for CAS 25-04-07. However, it should be noted that most of the soil samples for other CASs in the TCC area were collected from the subsurface at or below the level of the leachfields. Only one soil sample that was taken at CAU 262, CAS 25-04-06, Septic Systems A and B, had a PCB result exceeding minimum reporting limits, but the concentration was less than the PAL. This sample contained Aroclor-1254 between 6.25 and 6.75 ft bgs (DOE/NV, 2001). In addition, the other septic systems in CAU 262 were located beyond the TCC fenceline.

In support of the PA for CAU 528 conducted during November and December 2002, 24 exploratory surface soil samples were collected in the vicinity of the Substation #3 concrete pad and the unpaved area along the western, northern, and eastern sides of TCC. These samples were located either adjacent to the Substation #3 concrete pad or in areas that showed evidence of stained soil in historical aerial photographs. The locations are shown in [Figure 2-1](#). These samples were analyzed for PCBs, total petroleum hydrocarbons (TPH) - diesel-range organics (DRO), TPH - gasoline-range organics (GRO), volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, radionuclides, RCRA metals, and beryllium. The results showed that Aroclor-1260 was present in the soil at concentrations ranging from below detection limits to 1,300 $\mu\text{g}/\text{kg}$. The PCB concentrations in 12 of the samples exceeded the PAL. Total lead was also detected at

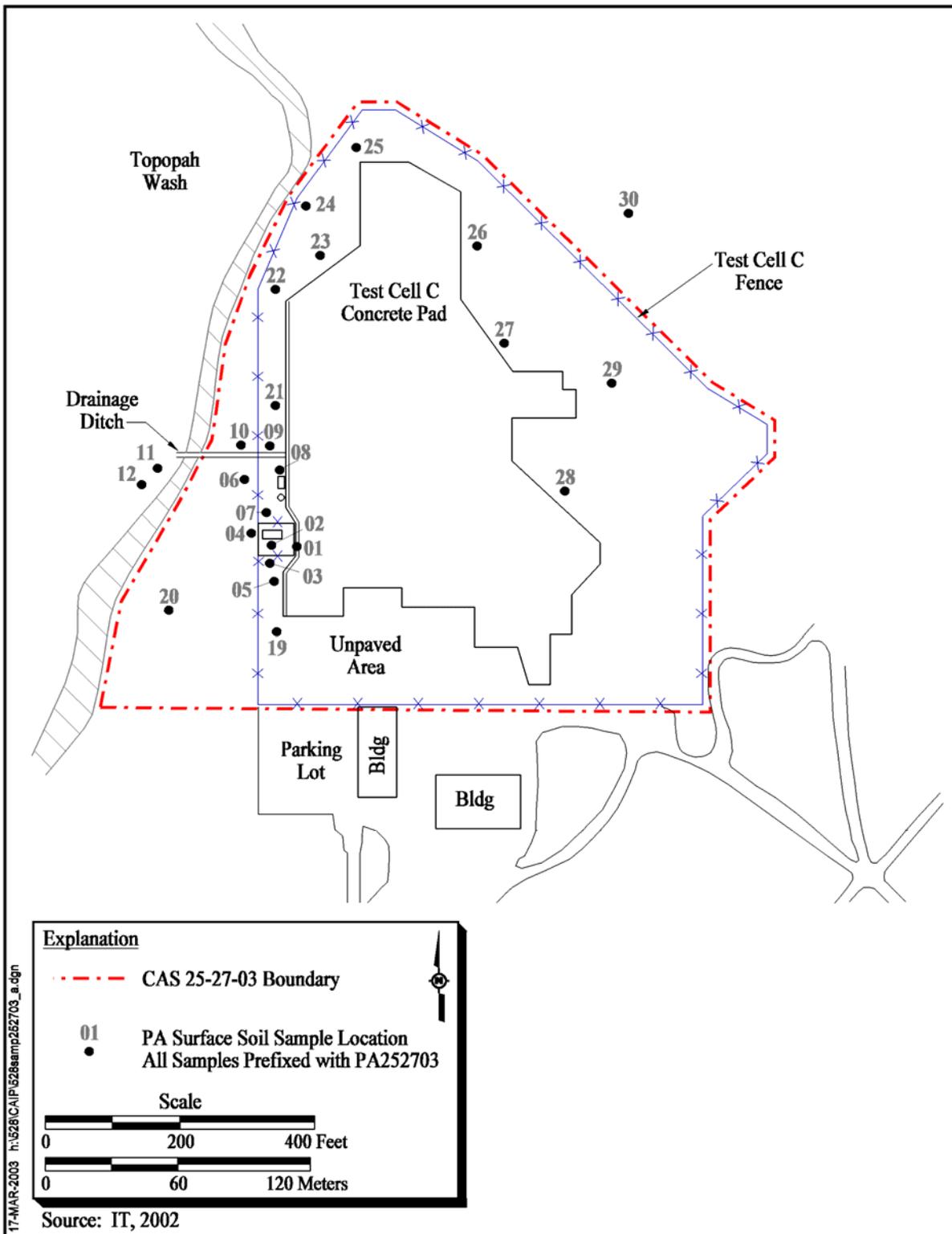


Figure 2-1
 CAU 528, CAS 25-27-03 Preliminary Assessment Surface Soil Sample Location

140 milligrams per kilogram (mg/kg) at one sample location. Other metals, radionuclides, m- and p-xylenes, ethylbenzene, DRO, GRO, and phthalates also were detected at concentrations above the minimum reporting limits in various samples. The radionuclides and metals were present in most of the soil samples, while the VOCs and SVOCs were detected randomly throughout the area. The PCB concentrations adjacent to Substation #3 decrease with distance from the pad; however, concentrations increase north of the drainage ditch leading from TCC. The results of these analyses are shown in [Table 2-1](#) (organic and inorganic) and [Table 2-2](#) (radionuclides) and the distribution of the PCBs are shown on [Figure 2-2](#).

The data confirmed that PCB contamination is present throughout the TCC unpaved area and extends along the edge of the TCC pad north of the original area of concern, and also in a separate area along the northeast side of the TCC pad at concentrations above PALs.

2.5.1 National Environmental Policy Act

In accordance with the NNSA/NSO's *National Environmental Policy Act (NEPA)* Compliance Program, a NEPA checklist will be completed prior to commencement of site investigation activities at CAU 528. This checklist requires NNSA/NSO project personnel to evaluate their proposed project activities against a list of potential impacts that 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 NNSA/NSO NEPA Compliance Officer.

Table 2-1
Preliminary Organic and Inorganic Analytical Results for PA Sampling at CAS 25-27-03^a
 (Page 1 of 2)

Parameters	Units	Reporting Limit	PA25270301 11/19/2003	PA25270302 11/19/2002	PA25270303 11/19/2002	PA25270304 11/19/2002	PA25270305 11/19/2002	PA25270306 11/19/2002	PA25270307 11/19/2002	PA25270308 11/19/2002	PA25270309 11/19/2002	PA25270310 11/19/2002	PA25270311 11/19/2002	PA25270312 11/19/2002
VOCs														
Ethylbenzene	µg/kg	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	11	5 U	2.1 J	5 U
M+P-xylene	µg/kg	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	45	2.7 J	11	5 U
O-xylene	µg/kg	5	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	17	0.99 J	4.2 J	5 U
PCBs														
Aroclor-1260	µg/kg	130	1500	940	1200	1200	460	570	660	13000	5700	4600	8900	1200
SVOCs														
Bis(2-ethylhexyl)phthalate	µg/kg	340	550	340 U	340 U	340 U	580	340 U						
Dimethyl Phthalate	µg/kg	340	340 U	44 J	60 J	340 U	340 U							
Pesticides														
Beta-BHC	µg/kg	1.7	1.7 U	1.7 U	1.7 U	1.7 U	0.23 J	1.7 U						
Metals														
Arsenic	mg/kg	1	2.8	3.1	2.9	2.9	2.7	2.7	2.6	2.5	3.8	2.8	2.5	2.4
Barium	mg/kg	10	95	93	85	93	92	81	79	87	90	72	78	91
Beryllium	mg/kg	0.52	0.38 B	0.46 B	0.46 B	0.43 B	0.38 B	0.42 B	0.43 B	0.37 B	0.47 B	0.41 B	0.37 B	0.37 B
Cadmium	mg/kg	0.52	0.26 B	0.5 U	0.03 B	0.5 U	0.049 B	0.5 U	0.11 B	0.46 B	0.5 U	0.5 U	2.5	1.7
Chromium	mg/kg	1	9.3	9.2	8	8	13	9	11	61	14	8.1	9.9	5.7
Lead	mg/kg	0.31	14	21	17	100	13	11	12	140	33	13	15	19
Mercury	mg/kg	0.1	0.018 B	0.02 B	0.025 B	0.0045 B	0.018 B	0.026 B	0.022 B	0.021 B	0.03 B	0.021 B	0.028 B	0.026 B
Selenium	mg/kg	0.52	0.5 U	0.25 B	0.5 U	0.5 U	0.4 B	0.26 B	0.33 B	0.32 B	0.5 U	0.35 B	0.33 B	0.5 U

Table 2-1
Preliminary Organic and Inorganic Analytical Results for PA Sampling at CAS 25-27-03^a
 (Page 2 of 2)

Parameters	Units	Reporting Limit	PA25270319 12/18/2002	PA25270320 12/18/2002	PA25270321 12/18/2002	PA25270322 12/18/2002	PA25270323 12/18/2002	PA25270324 12/18/2002	PA25270325 12/18/2002	PA25270326 12/18/2002	PA25270327 12/18/2002	PA25270328 12/18/2002	PA25270329 12/18/2002	PA25270330 12/18/2002
VOCs														
Acetone	µg/kg	21	49 B	50 B	49 B	52 B	48 B	49 B	53 B	50 B	51 B	47 B	47 B	64 B
PCBs														
Aroclor-1260	µg/kg	35	69	20 J	2800	690	330	35 U	10 J	3400	1500	34 U	110	42
SVOCs														
Benzo(a)anthracene	µg/kg	350	350 U	340 U	340 U	340 U	340 U	140 J	340 U					
Benzo(a)pyrene	µg/kg	350	350 U	340 U	340 U	340 U	340 U	86 J	340 U					
Benzo(b)fluoranthene	µg/kg	350	350 U	340 U	340 U	340 U	340 U	120 J	340 U					
Chrysene	µg/kg	350	350 U	340 U	340 U	340 U	340 U	160 J	340 U					
Fluoranthene	µg/kg	350	350 U	340 U	340 U	340 U	340 U	370	340 U					
Phenanthrene	µg/kg	350	350 U	340 U	340 U	340 U	340 U	100 J	340 U					
Pyrene	µg/kg	350	350 U	340 U	340 U	340 U	340 U	380	340 U					
Bis(2-ethylhexyl)phthalate	µg/kg	350	350 U	340 U	230 J	340 U	340 U	240 J	340 U					
Total Petroleum Hydrocarbons														
Diesel-Range Organics (DRO)	mg/kg	5.2	3 J	5.2 U	18 H	7.3 H	5.2 U	3.2 J	5.2 U					
Gasoline-Range Organics (GRO)	mg/kg	0.53	0.53 U	0.52 U	0.52 U	0.1 J	0.52 U	0.52 U	0.51 U	0.52 U	0.52 U	0.51 U	0.52 U	0.52 U
Metals														
Arsenic	mg/kg	1	3.1	2.5	4	2.6	3	3.4	2.3	2.1	2.1	2.2	2.8	2.3
Barium	mg/kg	10	90	90	89	86	97	92	82	75	77	81	98	86
Beryllium	mg/kg	0.52	0.4 B	0.47 B	0.4 B	0.45 B	0.44 B	0.43 B	0.41 B	0.3 B	0.31 B	0.4 B	0.35 B	0.36 B
Cadmium	mg/kg	0.52	0.08 B	0.022 B	0.16 B	0.28 B	0.053 B	0.035 B	0.02 B	0.22 B	0.09 B	0.52 U	0.15 B	0.054 B
Chromium	mg/kg	1	3.9	3.5	4.3	5.1	6.5	3.8	3.2	4.2	6.8	3	4.7	3.3
Lead	mg/kg	0.31	10	7.5	7.6	9.6	11	6.5	5.9	14	8.9	5.9	42	13
Mercury	mg/kg	0.1	0.021B	0.019 B	0.11	0.038 B	0.026 B	0.025 B	0.027 B	0.019 B	0.018 B	0.025 B	0.024 B	0.02 B

^aAll data are preliminary and have not been validated/qualified.

Notes:

RL = Reporting Limits

MDL = Method Detection Limit

U = Nondetected

J = Organic Concentration < the RL but > the MDL. Value considered an estimate

B = Inorganics Concentration < the RL but > the MDL. Value considered an estimate

H = Indicates that the fuel pattern was in the heavier end of the retention time window for the analyte of interest

µg/kg = Micrograms per kilogram

mg/kg = Milligrams per kilogram

Table 2-2
Preliminary Results for Radionuclide Analysis at CAS 25-27-03^a
 (Page 1 of 4)

Radionuclide	PA25270301 11/19/2002					PA25270302 11/19/2002				PA25270303 11/19/2002				PA25270304 11/19/2002				PA25270305 11/19/2002				PA25270306 11/19/2002			
	Units	Result	Qualifier	RL	Error	Result	Qualifier	RL	Error	Result	Qualifier	RL	Error	Result	Qualifier	RL	Error	Result	Qualifier	RL	Error	Result	Qualifier	RL	Error
HASL 300																									
Ac-228	pCi/g	1.34		0.4	0.32	1.62		0.5	0.42	1.42		0.32	0.30	1.37		0.34	0.34	1.81		0.48	0.43	1.44		0.5	0.38
Bi-212	pCi/g	1.5	U	1.5	1.0					1.56	U	1.2	0.81	1.48	U	1.1	0.83								
Bi-214	pCi/g	0.85		0.21	0.22	0.86		0.32	0.28	0.63		0.17	0.16	0.79		0.18	0.22	0.7		0.24	0.23	0.83		0.24	0.25
Cs-137	pCi/g	2.23		0.12	0.42	5.9		0.19	1.0	6		0.09	1.0	6.2		0.096	1.1	0.255		0.1	0.097	0.46		0.11	0.13
Eu-152	pCi/g	0.98		0.3	0.26	0.58	TI	0.42	0.25	0.61		0.24	0.17	0.52		0.29	0.17	0.52		0.3	0.20	0.6	TI	0.35	0.24
Pb-212	pCi/g	1.5		0.16	0.30	1.45		0.24	0.31	1.44		0.18	0.28	1.61		0.21	0.33	1.73		0.2	0.35	1.64		0.18	0.33
Pb-214	pCi/g	0.71		0.24	0.19	0.83		0.36	0.25	0.81		0.19	0.18	0.91		0.24	0.22	0.81		0.22	0.20	0.96		0.26	0.23
Pu-239	pCi/g	ND				ND				ND								ND				ND			
Sr-90	pCi/g	ND				ND				0.31	LT	0.24	0.16	0.38	LT	0.22	0.16	ND				ND			
Th-234	pCi/g	ND				ND				ND								ND				ND			
Tl-208	pCi/g	0.53		0.13	0.14	0.57		0.17	0.17	0.42		0.099	0.10	0.48		0.11	0.13	0.59		0.12	0.15	0.55		0.13	0.15
ISOU																									
U-234	pCi/g	5.45		0.018	0.71	5.02		0.014	0.66	7.41		0.015	0.96	6.38		0.021	0.83	3.31		0.025	0.45	2.74		0.014	0.36
U-235	pCi/g	0.317		0.0069	0.066	0.408		0.017	0.081	0.472		0.017	0.091	0.342		0.008	0.073	0.179		0.025	0.049	0.124		0.014	0.035
U-238	pCi/g	0.78		0.013	0.12	0.94		0.027	0.15	0.86		0.018	0.14	0.85		0.015	0.14	0.77		0.023	0.13	0.84		0.012	0.13

Table 2-2
Preliminary Results for Radionuclide Analysis at CAS 25-27-03^a
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Radionuclide	PA25270307 11/19/2002				PA25270308 11/19/2002				PA25270309 11/19/2002				PA25270310 11/19/2002				PA25270311 11/19/2002				PA25270312 11/19/2002				
	Units	Result	Qualifier	RL	Error	Result	Qualifier	RL	Error																
HASL 300																									
Ac-228	pCi/g	1.75		0.62	0.46	1.44		0.37	0.32	1.36		0.31	0.29	1.41		0.43	0.34	1.86		0.58	0.50	1.38		0.55	0.42
Bi-212	pCi/g									1.63	U	1	0.75												
Bi-214	pCi/g	0.79		0.24	0.24	0.68		0.24	0.19	0.73		0.18	0.18	0.54		0.18	0.17	0.86		0.32	0.29	0.9		0.41	0.32
Cs-137	pCi/g	1.8		0.19	0.36	25		0.12	4.1	8.8		0.086	1.5	3.78		0.11	0.67	37.2		0.16	6.2	15.2		0.27	2.6
Eu-152	pCi/g	0.98	TI	0.42	0.29	0.78		0.41	0.21	0.81		0.24	0.18	1.14		0.33	0.27	0.43	TI	0.39	0.22				
Pb-212	pCi/g	1.34		0.24	0.30	1.36		0.23	0.28	1.53		0.18	0.29	1.51		0.18	0.30	1.57		0.37	0.37	1.39		0.3	0.32
Pb-214	pCi/g	0.79		0.33	0.23	0.71		0.29	0.21	0.88		0.19	0.19	0.72		0.23	0.19	0.59	U	0.37	0.24	0.73		0.4	0.27
Pu-239	pCi/g	ND				0.86		0.011	0.16	ND															
Sr-90	pCi/g	0.25	LT	0.24	0.16	0.3	LT	0.23	0.16	ND				0.24	LT	0.24	0.16	0.82		0.24	0.23	0.64		0.26	0.22
Th-234	pCi/g	ND				ND				ND				2.7		2.6	1.6	ND				ND			
Tl-208	pCi/g	0.58		0.13	0.15	0.47		0.12	0.11	0.47		0.092	0.11	0.41		0.12	0.12	0.45		0.16	0.15	0.63		0.19	0.18
ISOU																									
U-234	pCi/g	11.1		0.018	1.4	22.5		0.017	2.8	4.74		0.022	0.62	4.02		0.012	0.52	47.8		0.029	5.9	1.88		0.017	0.27
U-235	pCi/g	0.494		0.028	0.090	1.28		0.026	0.19	0.32		0.021	0.069	0.279		0.022	0.060	4.7		0.02	0.61	0.09		0.02	0.034
U-238	pCi/g	0.87		0.024	0.13	1.08		0.019	0.16	0.84		0.022	0.13	0.83		0.022	0.13	1.53		0.019	0.22	0.69		0.017	0.12

Table 2-2
Preliminary Results for Radionuclide Analysis at CAS 25-27-03^a
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Radionuclide	PA25270319 12/18/2002				PA25270320 12/18/2002				PA25270321 12/18/2002				PA25270322 12/18/2002				PA25270323 12/18/2002				PA25270324 12/18/2002				
	Units	Result	Qualifier	RL	Error	Result	Qualifier	RL	Error																
HASL 300																									
Ac-228	pCi/g	1.22		0.29	0.27	1.08		0.39	0.29	1.33		0.41	0.35	1.41		0.51	0.39	0.88		0.48	0.34	1.44		0.53	0.37
Bi-212	pCi/g	1.56		1.1	0.79	1.9		1.5	1.1	1.14	U	1.3	0.88	0.6	U	2.1	1.3	1.8	U	2	1.3	1.8	U	2.1	1.4
Bi-214	pCi/g	0.76		0.17	0.18	0.6		0.2	0.20	0.69		0.26	0.23	0.7		0.29	0.25	0.89		0.32	0.28	0.64		0.22	0.21
Co-58	pCi/g	-0.007	U	0.074	0.042	0.026	U	0.1	0.060	0.006	U	0.11	0.064	0.116	TI	0.11	0.076	0.033	U	0.15	0.087	-0.032	U	0.15	0.075
Cs-137	pCi/g	2.47		0.082	0.43	0.151		0.11	0.081	15.9		0.11	2.7	17.1		0.17	2.9	10.5		0.19	1.8	1.15		0.12	0.25
Eu-152	pCi/g	0.29	TI	0.23	0.14	0.31	TI	0.31	0.17	0.94		0.41	0.26	1.63		0.46	0.37	2.12		0.56	0.46	1.07		0.28	0.27
Eu-154	pCi/g	0.04	U	0.39	0.23	0.26	U	0.43	0.28	-0.07	U	0.57	0.30	0.21	U	0.68	0.40	0.72	TI	0.64	0.46	0.1	U	0.78	0.44
K-40	pCi/g	26.8		0.92	4.7	25.2		1.2	4.8	24.6		0.73	4.6	26.2		1.4	5.0	23		2	4.6	25		1.2	5.0
Nb-94	pCi/g	0.023	U	0.064	0.038	0.004	U	0.11	0.062	0.056	U	0.099	0.062	0.022	U	0.14	0.078	0.09	U	0.12	0.078	0.03	U	0.12	0.072
Pb-212	pCi/g	1.5		0.15	0.28	1.55		0.16	0.31	1.35		0.22	0.29	1.41		0.31	0.33	1.34		0.26	0.30	1.54		0.18	0.31
Pb-214	pCi/g	0.75		0.16	0.16	0.77		0.2	0.19	0.84		0.3	0.23	0.9		0.39	0.27	0.72		0.37	0.23	0.91		0.24	0.22
Th-234	pCi/g	1.05	U	1.6	1.00	1.19	U	1.5	0.71	0.8	U	2.4	1.5	1.3	U	2.9	1.8	0.4	U	2.2	1.3	1.45		1.2	0.66
Tl-208	pCi/g	0.46		0.083	0.10	0.43		0.11	0.12	0.5		0.12	0.13	0.51		0.17	0.15	0.48		0.19	0.16	0.43		0.13	0.13
ISOU																									
U-234	pCi/g	1.99		0.031	0.30	1.32		0.033	0.22	3.24		0.037	0.47	4.43		0.011	0.63	4.44		0.035	0.62	3.93		0.034	0.56
U-235	pCi/g	0.069		0.022	0.034	0.026	LT	0.025	0.022	0.117		0.027	0.046	0.157		0.013	0.055	0.201		0.028	0.060	0.212		0.036	0.065
U-238	pCi/g	0.83		0.027	0.15	0.7		0.011	0.14	0.8		0.03	0.15	0.83		0.024	0.15	0.71		0.021	0.13	0.98		0.037	0.17

Table 2-2
Preliminary Results for Radionuclide Analysis at CAS 25-27-03^a
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Radionuclides	PA25270325 12/18/2002				PA25270326 12/18/2002				PA25270327 12/18/2002				PA25270328 12/18/2002				PA25270329 12/18/2002				PA25270330 12/18/2002				
	Units	Result	Qualifier	RL	Error	Result	Qualifier	RL	Error																
HASL 300																									
Ac-228	pCi/g	1.42		0.4	0.32	1.49		0.33	0.31	1.57		0.52	0.40	1.37		0.54	0.37	1.47		0.46	0.39	1.33		0.63	0.39
Bi-212	pCi/g	0.89	U	1	0.67	1.4	U	1.7	1.1	1.4	U	2.2	1.4	1.3	U	1.6	1.1	1.9		1.5	1.1	1.9	U	2.1	1.4
Bi-214	pCi/g	0.66		0.19	0.17	0.87		0.19	0.20	0.75		0.25	0.23	0.69		0.22	0.21	0.78		0.22	0.24	0.94		0.31	0.29
Co-58	pCi/g	0.027	U	0.083	0.050	-0.031	U	0.088	0.049	-0.016	U	0.17	0.097	0.011	U	0.13	0.076	-0.008	U	0.16	0.087	-0.042	U	0.15	0.079
Cs-137	pCi/g	0.211		0.093	0.074	10		0.1	1.7	1.15		0.14	0.24	0.019	U	0.13	0.073	2.3		0.13	0.44	0.72		0.16	0.19
Eu-152	pCi/g	0.83		0.22	0.19	1.9		0.33	0.36	4.36		0.37	0.79	1.13		0.32	0.27	0.84		0.32	0.24	1.29	TI	0.64	0.58
Eu-154	pCi/g	0.1	U	0.47	0.28	0.16	U	0.45	0.27	0.44	U	0.72	0.45	0.62	TI	0.58	0.41	-0.03	U	0.7	0.37	-0.15	U	0.8	0.41
K-40	pCi/g	29.5		1.2	5.2	27.6		1	4.8	28		1.4	5.3	25.8		1.5	4.9	25.5		1.4	5.1	28.8		2	5.6
Nb-94	pCi/g	0	U	0.073	0.042	0.058		0.051	0.035	-0.007	U	0.15	0.084	-0.003	U	0.11	0.060	0.013	U	0.12	0.069	0.043	U	0.14	0.084
Pb-212	pCi/g	1.3		0.17	0.25	1.55		0.18	0.30	1.44		0.21	0.30	1.55		0.18	0.31	1.32		0.19	0.28	1.59		0.23	0.34
Pb-214	pCi/g	0.72		0.19	0.16	0.85		0.24	0.20	0.76		0.25	0.21	0.89		0.23	0.22	0.8		0.27	0.21	0.98		0.26	0.25
Th-234	pCi/g	0.73	U	1.2	0.72	0.7	U	1.7	1.0	0.9	U	2.1	1.3	1.1	U	1.8	1.0	1.72		1.7	0.91	0.8	U	2.2	1.3
Tl-208	pCi/g	0.46		0.084	0.10	0.4		0.1	0.10	0.48		0.14	0.14	0.46		0.13	0.13	0.5		0.12	0.14	0.54		0.14	0.15
ISOU																									
U-234	pCi/g	0.94		0.024	0.16	1.38		0.029	0.23	1.23		0.028	0.20	0.84		0.038	0.15	1.91		0.012	0.30	0.89		0.037	0.16
U-235	pCi/g	0.054		0.012	0.029	0.053		0.028	0.031	0.074		0.033	0.036	0.041	LT	0.024	0.027	0.096		0.026	0.044	0.069		0.026	0.037
U-238	pCi/g	0.67		0.024	0.13	0.72		0.024	0.14	0.86		0.024	0.15	0.82		0.024	0.15	0.83		0.026	0.16	0.69		0.022	0.14

^aAll data are preliminary and have not been validated/qualified.

Qualifiers

LT = Result is less than requested MDC but greater than sample-specific MDC
 TI = Identification is tentative
 U = Nondetected

pCi/g = Picocuries per gram

Ac = Actinium
 Bi = Bismuth
 Co = Cobalt
 Cs = Cesium
 Eu = Europium
 K = Potassium
 Nb = Niobium

Pb = Lead
 Pu = Plutonium
 Th = Thorium
 Tl = Thallium
 U = Uranium

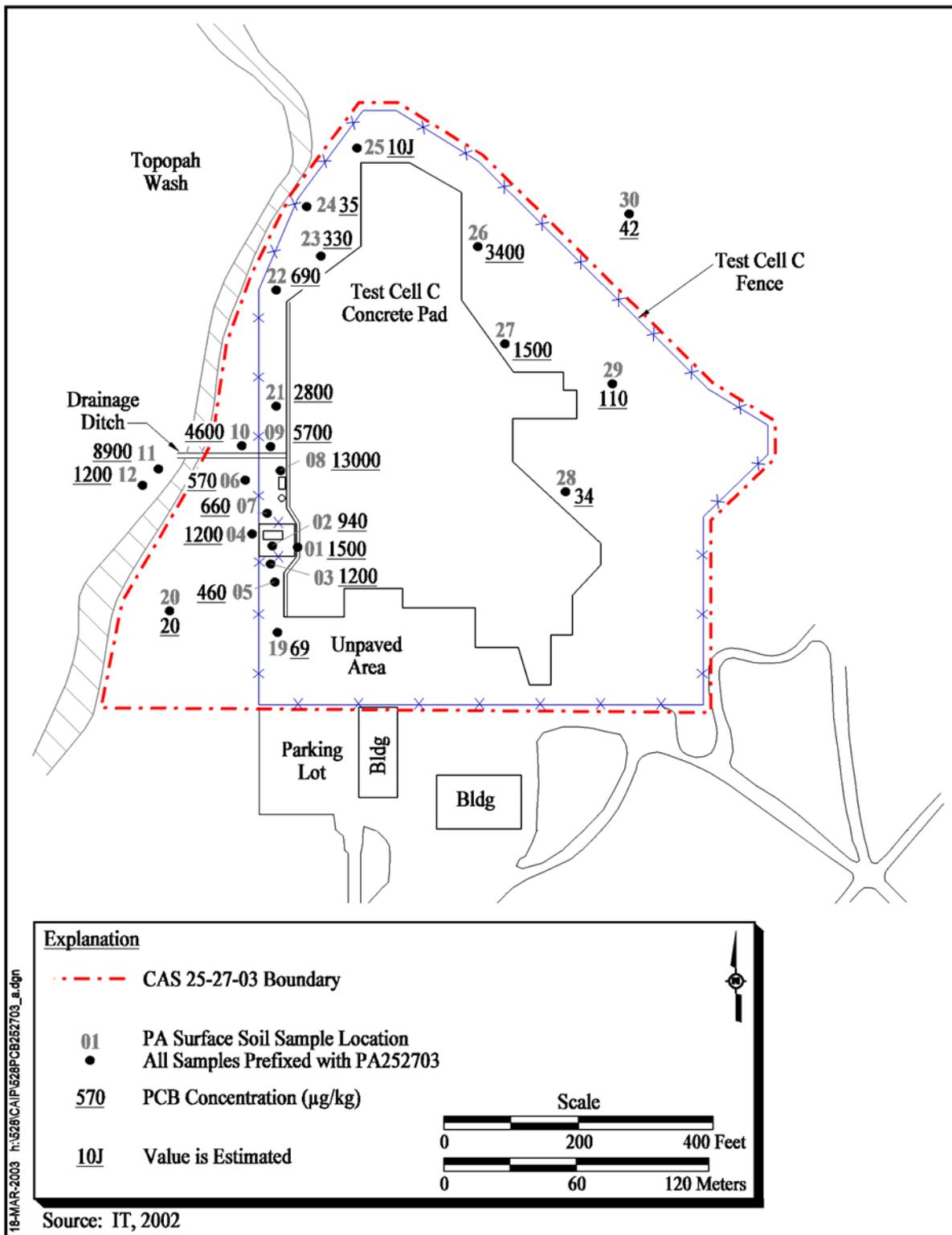


Figure 2-2
CAU 528, CAS 25-27-03 Preliminary Assessment PCB Results

3.0 Objectives

This section presents an overview of the DQOs for CAU 528 and formulation of the conceptual site model (CSM). Also presented is information on the COPCs and PALs for the investigation.

3.1 Conceptual Site Model

The CSM demonstrates the most probable scenario for current conditions at CAS 25-27-03 and defines the assumptions that are the basis for identifying appropriate sampling strategy and data collection methods. A single CSM has been developed for CAU 528 using assumptions formulated from physical setting, potential contaminant sources/release mechanisms, process knowledge, historical background information, knowledge from studies of similar sites, and data from previous sampling efforts. The CSM identifies the failure or leaking from the transformers and the dust suppression during the construction or remedial activities at TCC as the primary sources of PCBs, metals, and TPH. Other unknown activities also may have released contaminants at TCC that could adversely impact the environment. [Appendix A.1, Section A.1.2.3](#) provides more detailed information on the CSM as presented for DQO formulation. [Table 3-1](#) identifies how the potential sources relate to the suspected contaminants identified in the CSM for CAS 25-27-03.

If evidence of potential contamination that is outside the scope of the CSM is identified during investigation activities, the situation will be reviewed and recommendations will be made as to how best to proceed. In such cases, NNSA/NSO and NDEP will be notified and given the opportunity to comment on and/or concur with the recommendation.

[Figure 3-1](#) shows the CSM developed for current site conditions at the CAU 528. The CSM represents the potential release of oil containing PCBs from the application of oil to the surface soil for dust suppression and wind erosion control and from the transformers located on the Substation #3 concrete pad. Releases of other contaminants would also be subject to the same transport mechanisms.

The following sections discuss future land use and the identification of exposure pathways (i.e., combination of source, release, migration, exposure point, and receptor exposure route) for CAU 528.

**Table 3-1
 Conceptual Site Model and Potential Sources**

Potential Sources for Conceptual Site Model	Polychlorinated Biphenyls (PCB)	Petroleum Hydrocarbons (TPH)	Semivolatile Organic Compounds (SVOCs)	Metals	Volatile Organic Compounds (VOCs)	Radionuclides	Beryllium
Substation #3 Transformers	X	X	X				
Dust Suppression and Erosion Control	X	X	X	X			
Other Activities Associated with the Mission and Operation of TCC	X	X	X	X	X	X	X

3.1.1 Future Land Use

The future land-use scenarios for CAU 528 are limited to nonresidential (i.e., industrial) and include, defense and nondefense research, development, and testing activities. Corrective Action Unit 528 is located in an area designated for small-scale research and development projects and demonstrations. Typical future activities include pilot projects; outdoor tests; and experiments for the development, quality assurance, or reliability of material and equipment under controlled conditions. This zone includes compatible defense and nondefense research, development, and testing projects and activities (DOE/NV, 1998).

3.1.2 Contaminant Sources and Release Mechanisms

Two primary contaminant sources are identified in the CSM and include:

- Dust suppression and wind erosion control activities during the construction and operation of TCC.
- Failure of the transformers on the Substation #3 concrete pad.

Release mechanisms for PCBs, metals, TPH, SVOCs, and VOCs contaminants are spills and leaks from the transformers and direct surface application of oil for dust suppression during the construction and operation of TCC and the control of wind erosion on the soil remediated after the

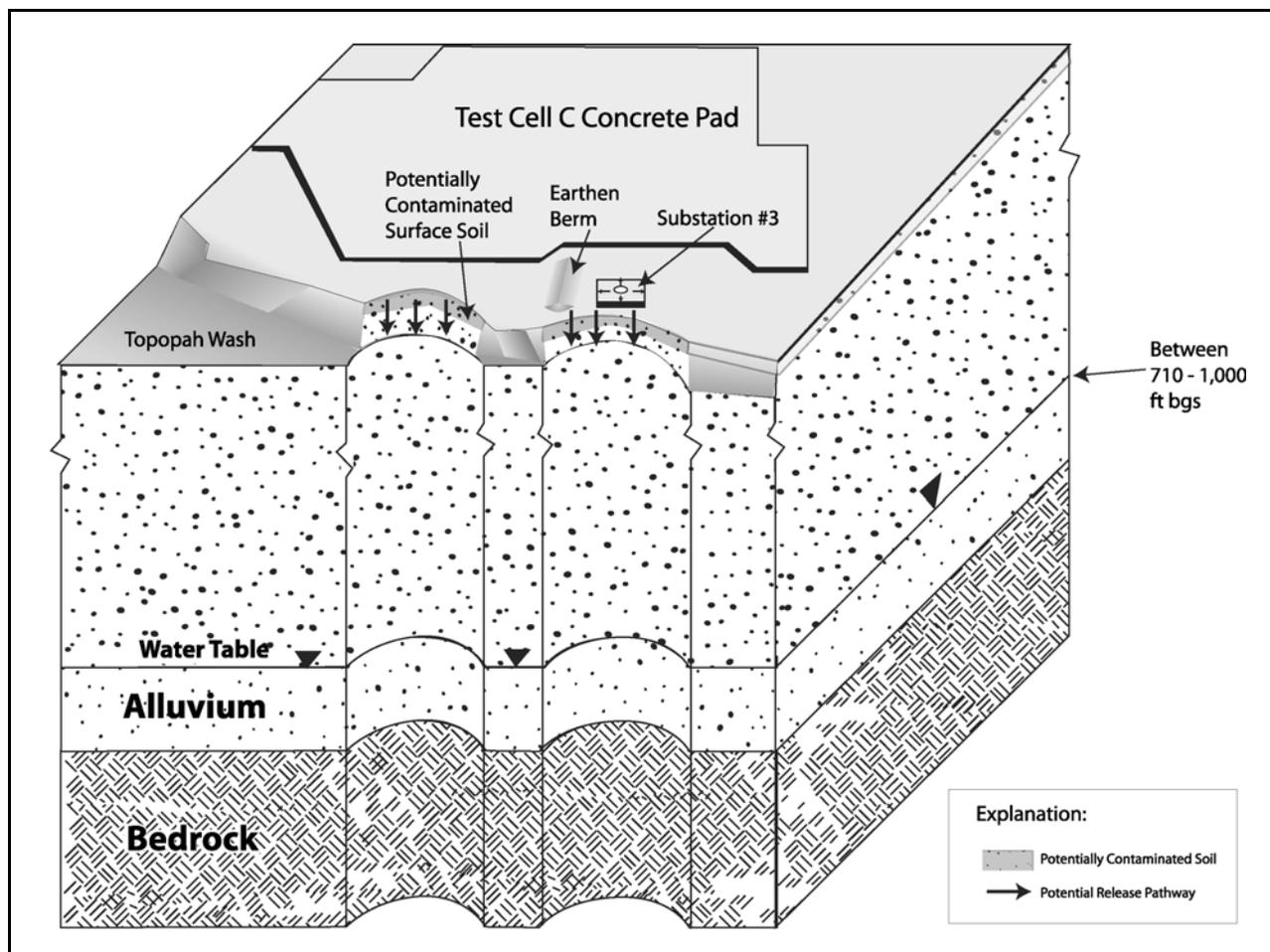


Figure 3-1
CAU 528, CAS 25-27-03 Conceptual Site Model

TNT Excursion and Phoebus 1A Test. For the potential radionuclides and beryllium at CAS 25-27-03, the release mechanism was the dispersal of contamination through fallout after the TNT Excursion, Phoebus 1A accident, and other tests conducted during the life of the facility. When contaminants exist on the surface soil, release mechanisms for these sources include mixing during earth moving activities (e.g., grading and construction) as well as limited leaching and lateral physical dispersal during precipitation events.

3.1.3 Migration Pathways and Transport Mechanisms

An important element of the CSM in developing a sampling strategy is the expected fate and transport of contaminants, which infer how contaminants migrate through media and where they can be

expected in the environment. Fate and transport of contaminants are presented in the CSM as the migration pathways and transport mechanism that could potentially move the contaminants throughout the various media. Fate and transport are influenced by physical and chemical characteristics of the contaminants and media. Contaminant characteristics include, but are not limited to: solubility, density, and adsorption potential. Media characteristics include permeability, porosity, water saturation, sorting, chemical composition, and organic content. In general, contaminants with low solubility, high affinity for media, and high density can be expected to be found relatively close to release points. Contaminants with high solubility, low affinity for media, and low density can be expected to be found further from release points. These factors affect the migration pathways and potential exposure points for the contaminants in the various media under consideration.

The degree of PCB contaminant migration at CAS 25-27-03 is assumed to be minimal based on the affinity of the suspected contaminants for soil particles, and the low precipitation and high evapotranspiration rates typical of the NTS environment. It is also assumed other unknown contaminants would also have limited migration potential. Runoff could cause lateral migration of contaminants over the ground surface for both the application of used oil for dust suppression and the failure or leaking of the transformers. Contaminants may also have been transported by infiltration and percolation of precipitation through soil, which serves as the primary driving force for downward migration. Mixing of the surface soil as a result of grading or construction activities would also move the PCBs into deeper intervals. The migration of organic constituents (e.g., TPH, SVOCs, and PCBs) will be controlled by their respective affinity for adsorption to organic material present in the soil. However, the lack of organic material in the desert soil will reduce the effectiveness of this process. Migration of inorganic constituents (e.g., metals in waste oil) is controlled by geochemical processes, such as adsorption, ion exchange, soil pH, and precipitation of solids from solution.

Because of the low volatility of the PCB contaminants, an airborne release subsequent to the initial contaminant release is not considered a significant release pathway. The main process of migration through the air would be through windblown dust. If PCBs, SVOCs, metals, or petroleum hydrocarbons adsorbed to the fine soil particles, a small amount of migration could be expected via the airborne pathway. This process could allow for the deposition of contaminants beyond the site

boundaries. For all transport mechanisms, it would be expected that contaminant levels decrease with distance from the point of release.

Migration pathways at CAS 25-27-03 are expected to be limited to vertical migration. However, for spills or leaks from the transformers at the ground surface or onto the concrete pad, contaminants may have migrated laterally prior to infiltration. Precipitation would also wash the PCBs off the concrete pad into the surrounding soil.

Preferential pathways at CAS 25-27-03 are expected not to be present or have only had a minor impact on contaminant migration. The presence of relatively impermeable layers (e.g., caliche layers, concrete pads) modify transport pathways both on the ground surface and in the shallow subsurface. Small gullies, if present, could channelize runoff and increase lateral transport prior to infiltration. Contamination could travel laterally to a small degree under both scenarios. For the dust suppression and wind erosion scenarios the source of the contamination is considered the surface and shallow subsurface soil within the CAS boundary. In this case, the migration pathway for contaminants release also would be vertical due to infiltration and precipitation. Although the preferential pathways for contaminant migration has been considered in the development of sampling schemes and sampling contingencies, primary consideration will be given to these release and transport mechanisms.

For the dust suppression and wind erosion control scenario, the PCB and hydrocarbon contamination in the surface and shallow subsurface soil is not expected to be consistent. Concentrations may vary depending on the PCB concentration in a batch of oil, the frequency of dust suppression activities, and where the dust suppression activities were conducted. For the CAU 528 CSM, concentrations of contaminants are expected to decrease with horizontal and vertical distance from the location where a batch of oil was applied to the surface soil.

The PCB contamination source, based on CAU 262 Phase II sampling, is not known. Other contamination, if present, is expected to be contiguous to the source of suspected release (e.g., transformers on the concrete pad and within the surface and shallow subsurface soil). For the PCB transformer release scenario, concentrations are expected to be the highest at the edge of the concrete pad and decrease both laterally and vertically.

Contaminants could be transported into the subsurface and eventually to the groundwater by precipitation infiltration. However, potential evapotranspiration (the evaporative capacity of the atmosphere at the soil surface) at the NTS is significantly greater than precipitation, thus limiting vertical migration of contaminants. The annual average precipitation for this area of Jackass Flats is only 5.5 in. per year (NNSA/NSO, 2003). The total potential evapotranspiration at the Area 3 (located about 10 miles east of Area 25) Radiological Waste Management Site has been estimated at 62.6 in. (Shott et al., 1997). Thus, the potential annual evapotranspiration is approximately 10 times greater than the annual precipitation. These data indicate that evaporation is the dominant factor influencing the movement of water in the upper unsaturated zone. Therefore, recharge to groundwater from precipitation is not significant at the NTS and does not provide a significant mechanism for the movement of contaminants to groundwater.

3.1.4 Exposure Points

Exposure points within CAS 25-27-03 are the locations where visitors, site workers, or military personnel will come in contact with potential contaminants within the CAS boundaries. The exposure points at CAS 25-27-03 would be the surface and shallow subsurface at locations where contamination is present (e.g., chemically contaminated concrete and soil).

3.1.5 Exposure Routes

Exposure routes to visitors, site workers, or military personnel include ingestion, inhalation, and/or dermal contact (absorption) from disturbance of contaminated soils, debris, and/or structures. Site workers may also be exposed to radiation by performing activities in proximity to radiologically contaminated materials.

3.1.6 Additional Information

Additional topographic information for CAU 528 will not be necessary because the data available is adequate to make determinations about the sites.

General surface and subsurface soil descriptions will be observed and recorded during the CAI. These data will be combined with adjacent CAUs (CAU 262 and 529) information to more fully define the soil descriptions.

Climatic conditions for the CAU are well documented for this area of the NTS and have been addressed in the DQO process and reflected in the CSM. No further information is required.

Groundwater data for the CAU is known and has been addressed in the CSM. The CAS-specific depth to groundwater data are presented in [Section 2.1](#). No further information is required.

Specific structure descriptions will be observed and recorded during the CAI. The structures include the concrete pads (both the TCC and Substation #3), septic system distribution access, and various utilities. The CAI will not compromise the structural integrity of the septic system or active utilities.

3.2 Contaminants of Potential Concern

Suspected contaminants for CAU 528 were identified through a review of site history documentation, process knowledge information, personal interviews, past investigation efforts, site-specific analytical data, analytical data from nearby CASs, and inferred activities associated with the CASs. Polychlorinated biphenyls have been identified at the CAS, other types of contamination suspected to be present at CAU 528 include TPH-DRO, TPH-GRO, SVOCs, VOC, metals, and radionuclides. Chemical COPCs are defined as the analytes detected using the analytical methods listed in [Table 3-3](#) for which the U.S. Environmental Protection Agency (EPA) Region IX has established Preliminary Remediation Goals (PRGs) (EPA, 2000) or for which toxicity data are listed in the EPA Integrated Risk Information System (IRIS) database (EPA, 2002). Radiological COPCs are defined as the radionuclides reported from the analytical methods also listed in [Table 3-3](#). The Phase I COPCs are presented in [Table 3-2](#).

[Table 3-2](#) identifies the critical and noncritical COPCs. Critical COPCs for Phase I samples are the potential chemical constituents that are reasonably suspected to be present at the site based on documented use, analytical results, or process knowledge. The critical COPCs are given greater importance in the decision-making process relative to noncritical COPCs and have a completeness goal of 90 percent. For this reason, more stringent performance criteria are specified for critical analyte DQIs ([Section 6.0](#)).

Noncritical COPCs are defined as classes of contaminants (e.g., VOCs) that include all the analytes reported from the respective analytical methods that have PALs. The noncritical COPCs also aid in

**Table 3-2
 Phase I COPCs and Critical Analytes for CAU 528**

Chemical		Radiological ^a	
Known Contaminants	Critical Analyte(s)	Suspected Contaminants	Critical Analyte(s)
PCBs	Aroclor-1016 Aroclor-1221 Aroclor-1232 Aroclor-1242 Aroclor-1248 Aroclor-1254 Aroclor-1260	Gamma Spectrometry	
Suspected Contaminants			
TPH	DRO GRO	Isotopic Uranium	
SVOCs	Bis(2-ethylhexyl)phthalate Dimethyl phthalate	Strontium-90	
VOCs	Acetone		
Metals	Beryllium Lead		

^aRadionuclides are included in the analytical suite to support IDW and waste disposal issues only.

DRO = Diesel-range organics
 GRO = Gasoline-range organics
 PCBs = Polychlorinated biphenyls
 TPH = Total petroleum hydrocarbons
 SVOCs = Semivolatile organic compounds
 VOCs = Volatile organic compounds

reducing the uncertainty concerning the history and potential releases from the CAS and help in the accurate evaluation of potential contamination. Each COPC that is detected in a sample at concentrations exceeding the corresponding PAL becomes a COC for subsequent sampling (Phase II) to define the extent of contamination. These follow-up samples will be collected and analyzed only for the COCs determined by Decision I sampling. However, if extent samples are collected prior to nature-of-contamination data becoming available, the extent samples will be analyzed for the full list parameters given for parameters listed in [Table 3-2](#).

As mentioned previously, the radionuclides are not intended to drive the nature and extent determinations under this investigation. For CAU 528, source characterization are the focus of the sampling and analysis. The radiological analyses parameters are not considered COPCs and will not

Table 3-3
Chemicals of Potential Concern and Analytical Requirements for CAU 528
 (Page 1 of 4)

Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD) ^a	Percent Recovery (%R) ^b
ORGANICS						
Total Volatile Organic Compounds (VOCs)	Aqueous	8260B ^c	Parameter-specific estimated quantitation limits ^d	Not applicable (NA)	Lab-specific ^e	Lab-specific ^e
	Soil					
Toxicity Characteristic Leaching Procedure (TCLP) VOCs						
Benzene	Aqueous	1311/8260B ^c	0.050 mg/L ^d	0.5 mg/L ^f	Lab-specific ^e	Lab-specific ^e
Carbon Tetrachloride			0.050 mg/L ^d	0.5 mg/L ^f		
Chlorobenzene			0.050 mg/L ^d	100 mg/L ^f		
Chloroform			0.050 mg/L ^d	6 mg/L ^f		
1,2-Dichloroethane			0.050 mg/L ^d	0.5 mg/L ^f		
1,1-Dichloroethene			0.050 mg/L ^d	0.7 mg/L ^f		
Methyl Ethyl Ketone			0.050 mg/L ^d	200 mg/L ^f		
Tetrachloroethene			0.050 mg/L ^d	0.7 mg/L ^f		
Trichloroethene			0.050 mg/L ^d	0.5 mg/L ^f		
Vinyl chloride			0.050 mg/L ^d	0.2 mg/L ^f		
Total Semivolatile Organic Compounds (SVOCs)	Aqueous	8270C ^c	Parameter-specific estimated quantitation limits ^d	NA	Lab-specific ^e	Lab-specific ^e
	Soil					
TCLP SVOCs						
o-Cresol	Aqueous	1311/8270C ^c	0.10 mg/L ^d	200 mg/L ^f	Lab-specific ^e	Lab-specific ^e
m-Cresol			0.10 mg/L ^d	200 mg/L ^f		
p-Cresol			0.10 mg/L ^d	200 mg/L ^f		
Cresol (total)			0.30 mg/L ^d	200 mg/L ^f		
1,4-Dichlorobenzene			0.10 mg/L ^d	7.5 mg/L ^f		
2,4-Dinitrotoluene			0.10 mg/L ^d	0.13 mg/L ^f		
Hexachlorobenzene			0.10 mg/L ^d	0.13 mg/L ^f		
Hexachlorobutadiene			0.10 mg/L ^d	0.5 mg/L ^f		
Hexachloroethane			0.10 mg/L ^d	3 mg/L ^f		
Nitrobenzene			0.10 mg/L ^d	2 mg/L ^f		
Pentachlorophenol			0.50 mg/L ^d	100 mg/L ^f		
Pyridine			0.10 mg/L ^d	5 mg/L ^f		
2,4,5-Trichlorophenol			0.10 mg/L ^d	400 mg/L ^f		
2,4,6-Trichlorophenol			0.10 mg/L ^d	2 mg/L ^f		
Polychlorinated Biphenyls (PCBs)			Aqueous	8082 ^c		
	Soil					

Table 3-3
Chemicals of Potential Concern and Analytical Requirements for CAU 528
 (Page 2 of 4)

Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD) ^a	Percent Recovery (%R) ^b
Total Petroleum Hydrocarbons (TPH) (C ₆ -C ₃₈)	Aqueous GRO	8015B modified ^c	0.1 mg/L ^h	NA	Lab-specific ^e	Lab-specific ^e
	Soil GRO		0.5 mg/kg ^h			
	Aqueous DRO		0.5 mg/L ^h			
	Soil DRO		25 mg/kg ^h			
INORGANICS						
Total Metals						
Arsenic	Aqueous	6010B ^c	10 µg/L ^{h,i}	NA	20 ^f	Matrix Spike Recovery 75-125 ^f Laboratory Control Sample Recovery 80 - 120 ^f
	Soil		1 mg/kg ^{h,i}		35 ^h	
Barium	Aqueous	6010B ^c	200 µg/L ^{h,i}		20 ^f	
	Soil		20 mg/kg ^{h,i}		35 ^h	
Beryllium	Aqueous	6010B ^c	5 µg/L ^{h,i}		20 ^f	
	Soil		0.5 mg/kg ^{h,i}		35 ^h	
Cadmium	Aqueous	6010B ^c	5 µg/L ^{h,i}		20 ^f	
	Soil		0.5 mg/kg ^{h,i}		35 ^h	
Chromium	Aqueous	6010B ^c	10 µg/L ^{h,i}		20 ^f	
	Soil		1 mg/kg ^{h,i}		35 ^h	
Lead	Aqueous	6010B ^c	3 µg/L ^{h,i}		20 ^f	
	Soil		0.3 mg/kg ^{h,i}		35 ^h	
Mercury	Aqueous	7470A ^c	0.2 µg/L ^{h,i}		20 ^f	
	Soil	7471A ^c	0.1 mg/kg ^{h,i}		35 ^h	
Selenium	Aqueous	6010B ^c	5 µg/L ^{h,i}		20 ^f	
	Soil		0.5 mg/kg ^{h,i}		35 ^h	
Silver	Aqueous	6010B ^c	10 µg/L ^{h,i}		20 ^f	
	Soil		1 mg/kg ^{h,i}		35 ^h	
Zinc	Aqueous	6010B ^c	20 µg/L ^{h,i}		20 ^f	
	Soil		2 mg/kg ^{h,i}		35 ^h	
TCLP RCRA Metals						

Table 3-3
Chemicals of Potential Concern and Analytical Requirements for CAU 528
 (Page 3 of 4)

Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD) ^a	Percent Recovery (%R) ^b
Arsenic	Aqueous	1311/6010B ^c 1311/7470A ^c	0.10 mg/L ^{h,i}	5 mg/L ^f	20 ^j	Matrix Spike Recovery 75-125 ⁱ Laboratory Control Sample Recovery 80 - 120 ^j
Barium			2 mg/L ^{h,i}	100 mg/L ^f		
Cadmium			0.05 mg/L ^{h,i}	1 mg/L ^f		
Chromium			0.10 mg/L ^{h,i}	5 mg/L ^f		
Lead			0.03 mg/L ^{h,i}	5 mg/L ^f		
Mercury			0.002 mg/L ^{h,i}	0.2 mg/L ^f		
Selenium			0.05 mg/L ^{h,i}	1 mg/L ^f		
Silver			0.10 mg/L ^{h,i}	5 mg/L ^f		
RADIOCHEMISTRY						
Gamma-Emitting Radionuclides	Aqueous	EPA 901.1 ⁱ	The Minimum Reporting Limits and Minimum Detectable Activities for Radionuclides are given in Table 3-4	NA	Relative Percent Difference (RPD ^a) 20% (Water) ^h 35% (Soil) ^h Normalized Difference (ND) -2<ND<2 ^k	Laboratory Control Sample Recovery 80-120 ^j
	Soil	HASL-300 ^l				
Isotopic Uranium	Aqueous	HASL-300 ^l ASTM D3972-02 ^m		NA		Chemical Yield 30-105 ⁿ
	Soil	HASL-300 ^l ASTM C1000-00 ^m				
Isotopic Plutonium	Aqueous	ASTM D3865-02 ^m		NA		Laboratory Control Sample Recovery 80-120 ^j
	Soil	ASTM HASL-300 ^l				
Strontium - 90	Aqueous	ASTM D5811-00 ^m		NA		
	Soil	HASL-300 ^l				

Table 3-3
Chemicals of Potential Concern and Analytical Requirements for CAU 528
 (Page 4 of 4)

Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	RCRA Hazardous Waste Regulatory Limit	Laboratory Precision (RPD) ^a	Percent Recovery (%R) ^b
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^a Relative percent difference (RPD) is used to calculate precision.

Precision is estimated from the relative percent difference of the concentrations measured for the matrix spike and matrix spike duplicate or of laboratory, or field duplicates of unspiked samples. It is calculated by: $RPD = 100 \times \frac{|(C_1 - C_2)|}{(C_1 + C_2)/2}$, where C_1 = Concentration of the parameter in the first sample aliquot, C_2 = Concentration of the parameter in the second sample aliquot.

^b %R is used to calculate accuracy.

Accuracy is assessed from the recovery of parameters spiked into a blank or sample matrix of interest, or from the recovery of surrogate compounds spiked into each sample. The recovery of each spiked parameter is calculated by: percent recovery (%R) = $100 \times (C_s - C_u / C_n)$, where C_s = Concentration of the parameter in the spiked sample,

C_u = Concentration of the parameter in the unspiked sample, C_n = Concentration increase that should result from spiking the sample

^c U.S. Environmental Protection Agency (EPA) *Test Methods for Evaluating Solid Waste*, 3rd Edition, Parts 1-4, SW-846 CD ROM, Washington, DC (EPA, 1996)

^d Estimated Quantitation Limit as given in SW-846 (EPA, 1996)

^e In-House Generated RPD and %R Performance Criteria

It is necessary for laboratories to develop in-house performance criteria and compare them to those in the methods. The laboratory begins by analyzing 15 to 20 samples of each matrix and calculating the mean %R for each parameter. The standard deviation (SD) of each %R is then calculated, and the warning and control limits for each parameter are established at ± 2 SD and ± 3 SD from the mean, respectively. If the warning limit is exceeded during the analysis of any sample delivery group (SDG), the laboratory institutes corrective action to bring the analytical system back into control. If the control limit is exceeded, the sample results for that SDG are considered unacceptable. These limits are reviewed after every quarter and are updated when necessary. The laboratory tracks trends in both performance and control limits by the use of control charts. The laboratory's compliance with these requirements is confirmed as part of an annual laboratory audit. Similar procedures are followed in order to generate acceptance criteria for precision measurements.

^f Title 40 *Code of Federal Regulations* Part 261, "Identification and Listing of Hazardous Waste" (CFR, 2002a)

^g EPA *Contract Laboratory Program Statement of Work for Organic Analysis* (EPA, 1988b; 1991; and 1994c)

^h *Industrial Sites Quality Assurance Project Plan* (NNSA/NV, 2002a)

ⁱ EPA *Contract Laboratory Program Statement of Work for Inorganic Analysis* (EPA, 1988a; 1994b; and 1995)

^j *Prescribed Procedures for Measurements of Radioactivity in Drinking Water*, EPA-600/4-80-032 (EPA, 1980)

^k Normalized Difference is not RPD, it is another measure of precision used to evaluate duplicate analyses. The normalized difference is calculated as the difference between two results divided by the square root of the sum of the squares of their total propagated uncertainties. *Evaluation of Radiochemical Data Usability* (Paar and Porterfield, 1997)

^l *Manual of Environmental Measurements Laboratory Procedures*, HASL-300 (DOE, 1997)

^m American Society for Testing and Materials

ⁿ *General Radiochemistry and Routine Analytical Services Protocol (GRASP)* (EG&G Rocky Flats, 1991)

Definitions:

mg/L = Milligrams per liter

mg/kg = Milligrams per kilogram

µg/L = Micrograms per liter;

CRQL = Contract-required quantitation limits

be used to define the extent of PCB, metal, or organic contamination at CAU 528. These analyses have been included in the analytical suite to support the disposal of IDW and potential waste management decisions.

3.3 Preliminary Action Levels

Laboratory analytical results for COPCs in soil samples will be compared to the following PALs to evaluate the presence of COCs:

- EPA *Region 9 Risk-Based Preliminary Remediation Goals* for chemical constituents in industrial soils (EPA, 2000). The PALs for all the PCB congeners except Aroclor 1016 is 740 µg/kg. The PAL for Aroclor 1016 is 2.1 mg/kg (EPA, 2002b).

- Background concentrations for RCRA metals and beryllium will be used instead of PRGs when natural background exceeds the PRG, as is often the case with arsenic on the NTS. Background is considered the mean plus two standard deviations of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (formerly the Nellis Air Force Range) (NBMG, 1998; Moore, 1999).
- The TPH action limit of 100 parts per million (ppm) per the *Nevada Administrative Code* (NAC) 445A.2272 (NAC, 2000e).
- The PALs for radionuclides are isotope-specific and defined as the maximum concentration for that isotope found in samples from undisturbed background locations in the vicinity of the NTS (McArthur and Miller, 1989; US Ecology and Atlan-Tech, 1992; BN, 1996). The PAL is equal to the minimum detectable concentration (MDC) for isotopes not reported in soil samples from undisturbed background locations. The PAL is also equal to the MDC if the maximum background concentration is less than the MDC.
- For detected chemical COPCs without established PRGs, a similar protocol to that used by the EPA Region 9 will be used in establishing an action level for those COPCs listed in the EPA IRIS database (EPA, 2002).

Solid media such as concrete may pose a potential radiological exposure risk to site workers if contaminated. The radiological PAL for the surface of solid media will be defined as the unrestricted-release criteria defined in the *NV/YMP Radiological Control Manual* (DOE/NV, 2000b).

The comparison of laboratory results to PALs will be discussed in the corrective action decision document (CADD). Laboratory results above PALs indicate the presence of COCs that will require further evaluation. The evaluation of potential corrective actions and the justification for a preferred action will be included in the CADD based on the results of this field investigation. Proposed cleanup levels will be presented in the CADD, if applicable.

3.3.1 Field-Screening Levels

Field screening for radiological parameters and VOCs may be instituted to provide semiquantitative measurements to help bias the selection of samples for confirmatory laboratory analysis. However, the VOC and radiological screening will primarily be used to protect the site workers health and safety. The following action levels may be used for on-site field-screening:

- The radiological (alpha and beta/gamma) field screening level (FSL) for soil samples is the mean background activity plus two times the standard deviation of the mean background activity.
- VOC field-screening results (FSRs) greater than 20 parts ppm or 2.5 time background, whichever is greater.

Samples with contaminant concentrations exceeding FSLs and VOCs indicate potential contamination at the sample location. This information will be documented and the investigation will be continued in order to delineate the extent of contamination to support any future waste management issues. Additionally, these data may also be used to select samples to be submitted for laboratory analysis for waste characterization purposes.

3.4 DQO Process Discussion

The DQO process is a strategic planning approach based on the scientific method that is used to prepare for site characterization data collection. The DQOs are designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and technically defend the recommendation of viable corrective actions (e.g., no further action or close in place).

Details of the DQO process are presented in [Appendix A.1](#). During the DQO discussion for this CAU, the informational inputs and data needs to resolve the problem statements and decision statements were documented. Criteria for data collection activities were assigned. The analytical methods and reporting limits prescribed through the DQO process, as well as the DQIs for laboratory analysis such as precision and accuracy requirements, are provided in more detail in [Section 6.0](#) of this CAIP. Laboratory data will be assessed to confirm or refute the CSM and determine if the DQOs were met based on the DQIs of precision, accuracy, representativeness, completeness, and comparability. Other DQIs, such as sensitivity, also may be used.

The DQO strategy for CAU 528 was developed at a meeting on February 4, 2003, to identify data needs, clearly define the intended use of the environmental data, and to design a data collection program that will satisfy these purposes. During the DQO discussions for this CAU, the informational inputs or data needs to resolve problem statements and decision statements were documented.

The problem statement for the investigation is: “Existing information on the nature and extent of PCB contamination is insufficient to evaluate and recommend corrective action alternatives for CAU 528, CAS 25-27-03. Because PCBs are known to be present, the Decision I is resolved and the field effort will focus on Decision II. To address unknown contamination, resolution of two decisions statements is required:

- Decision I is to “Define the nature of contamination” by identifying any contamination above PALs. Analytical data must be collected from areas most likely to contain contamination resulting from site activities, and parameters must be selected that represent the types of potential contamination present. If PALs are not exceeded, then the investigation is complete. If PALs are exceeded, then Decision II must be resolved. This decision applies only to unknown contamination. PCBs have been identified at the CAS.
- Decision II is “Determine the extent of contamination identified above PALs.” This decision will be achieved by the collection of data that are adequate to define the extent of COCs. This decision applies to both PCBs and any other contaminants identified that exceed PALs.

In addition, data will be obtained to support waste management decisions.

For the CAU 528 DQOs, a CSM has been developed for the one CAS using historical background information, knowledge from studies at similar sites, and data from previous sampling efforts. The CSM includes potential sources from sites within the area of TCC. As discussed in [Section 1.2](#), soil contamination resulting from the Kiwi TNT Excursion or the Phoebus 1A accident is not included in the scope of CAU 528. This contamination will be addressed by the other investigations. However, radiological contamination within the boundary of the CAS will be identified and delineated for waste management purposes.

Laboratory analysis of environmental soil samples will provide the means for quantitative measurement of the COPCs. Phase I chemical and radiological parameters of interest have been selected for CAS 25-27-03 and are listed in [Table 3-3](#). The table includes the analytical methods for CAU 528, minimum reporting limits (MRLs), and precision and accuracy requirements for each method. The analytical methods are capable of generating data that meet the project needs determined through the DQO process. Specifically, the MRLs are set so that laboratory analyses will generate data with the necessary resolution for comparison to PALs. The MRLs for radiological analytes have been developed considering both the MDCs and PALs. As shown in [Table 3-4](#) the MRL for each radiological analyte is less than or equal to the corresponding PAL.

**Table 3-4
 Minimum Detectable Concentrations and Preliminary Action Levels
 for Radionuclides in Samples Collected at CAU 528**

Isotope	Soil and Sludge		Liquid	
	MDC ^a (pCi/g) ^c	PAL ^b (pCi/g) ^c	MDC ^a (pCi/L) ^d	PAL ^b (pCi/L) ^d
Americium-241 (by Gamma spectroscopy)	2.0 ^e	2.0	50	50
Cesium-137	0.5 ^e	7	10	10
Cobalt-60	0.5 ^e	0.5	10 ^e	10
Europium-152	4.0 ^e	4.0	75 ^e	75
Europium-154	2.5 ^e	2.5	65 ^e	65
Europium-155	1.0 ^e	1.35	20 ^e	20
Niobium-94	0.5	1.35	NA	NA
Strontium-90	0.5	1.17	1.0	1.0
Uranium-234	0.05	3.47	0.1	8.92
Uranium-235	0.05	0.07	0.1	0.36
Uranium-238	0.05	3.47	0.1	9.39
Plutonium-238	0.05	0.05	0.1	0.16
Plutonium-239/240	0.05	0.106	0.1	9.0

^aMDC is the minimum detectable concentration: detection limits required for the measurement of Shaw samples. MDC vary depending on the presence of other gamma-emitting radionuclides in the sample.

^bPAL is the preliminary action level and is defined as the maximum concentration listed in the literature for a sample taken from an undisturbed background location (McArthur and Miller, 1989; US Ecology and Atlan-Tech, 1992; and DOE/NV, 1999). The PAL is equal to the MDC for isotopes not reported in soil samples from undisturbed background locations or if the PAL is less than the MDC.

^cpCi/g is picocuries per gram.

^dpCi/L is picocuries per liter.

^eMDC for gamma-emitting radionuclides is relative to Cesium-137.

NA = Not applicable

4.0 Field Investigation

This section of the CAIP contains the approach for investigating CAU 528.

4.1 Technical Approach

The technical approach for the CAU 528, CAS 25-27-03 CAI consists of the following activities:

- Review PCB and hydrocarbon analytical results and radiological land area surveys conducted at CASs adjacent to CAS 25-27-03. This effort will determine the need for additional radiological surveys at CAS 25-27-03.
- Conduct the necessary radiological surveys to ensure worker health and safety.
- Collect and analyze samples from biased locations as described in this section.
- Collect required QC samples.
- Collect additional samples, as necessary, to support the characterization of potential corrective action waste streams.
- Collect samples from native soils and analyze for geotechnical/hydrologic parameters, if necessary.
- Stake or flag sample locations and record coordinates (in North American Datum 1927 UTM coordinate system).

4.2 Field Activities

This section provides a description of the field activities for CAS 25-27-03 at CAU 528. Process knowledge indicates PCBs are present above PALs. If other contamination is identified, it will be found within the spatial boundaries of the CAS as defined in the DQO process and the CSM. If while defining the nature of contamination, the investigation determines that COCs are present other than PCBs, the CAS will be further addressed by determining the lateral and vertical extent of contamination before evaluating corrective action alternatives. Only unbounded PCB and other COCs will be considered during Phase II.

Modification to the investigative strategy may be required should unexpected field conditions be encountered. Significant modification will be justified in a record of technical change (ROTC). The

ROTC is required prior to proceeding with investigation activities significantly different from those described in this document. If contamination is more extensive than anticipated (e.g., the maximum investigation depth is limited by the capabilities of the equipment used to collect subsurface soil samples) the investigation will be rescoped.

Soil samples will be collected by hand from biased locations using various drilling methods (e.g., roto-sonic, hollow-stem auger, or other applicable methods), direct-push, hand/power auger, hand tools, and/or excavation, as appropriate. [Table 3-3](#) provides the analytical methods to be used when analyzing for the COPCs. All sampling activities and QA/QC requirements for field and laboratory environmental sampling will be conducted in compliance with the Industrial Sites QAPP (NNSA/NSO, 2002a) and other applicable procedures. Other governing documents include a current version of the Environmental Architect-Engineer (A-E) Services Contractor's HASP and an approved site-specific health and safety plan prepared prior to the field effort.

4.2.1 Site Preparation Activities

Site preparation will be conducted by the NTS management and Operating (M&O) contractor prior to the investigation. Site preparation may include, but not be limited to: removal and proper disposal of surface debris (e.g., surface metal, wood debris, and concrete) in the TCC area that may interfere with sampling as well as providing access to sample points (e.g., fence removal).

4.2.2 Initial (Phase I and II) Activities

The objective of the Phase I strategy is to initially determine the surficial extent of PCBs identified during the PA sampling effort and to determine if other chemical COCs are present within the CAS boundary. The initial activities planned for CAU 528 will include site surveys and surface soil sampling. The results of the radiological surveys for CASs 25-04-07 and 25-23-17 will be used to identify potential hot spots, radiological health hazards, identify the need for additional radiological surveys and provide safety information to protect workers and the environment during the CAI at CAU 528. Because the PA and CAU 262 sampling indicated the presence of PCBs in much of the CAS the initial soil sampling will serve Phase II (extent) sampling.

The presence of chemical COCs will be determined by biased sampling and laboratory analyses. A comparison of laboratory analytical results from this phase against PALs will be used to confirm the presence or absence of chemical COCs.

Biased sampling locations will be determined based on the results of surveys and other biasing factors. The Site Supervisor has the ability to modify these locations and minimize samples submitted for laboratory analyses, but only if the decision needs and criteria stipulated in [Appendix A.1, Section A.1.3](#), are satisfied.

The Phase I sampling strategy targets location and media most likely to be contaminated by COCs. The PA sampling indicated the presences of PCBs throughout the CAS as well as other potential contaminants (hydrocarbons). [Appendix A.1](#) lists the target populations for Phase I and identifies information needs in selecting data collection locations for Phase I decisions. The following are the biasing factors that currently have been identified for consideration in the selection of the surface soil sample locations:

- Aerial photograph review and evaluation
- Visual indicators (e.g., staining, topography, areas of preferential surface runoff)
- Existing site-specific analytical data (PA and CAU 262 sampling data)
- Known or suspected sources and locations of release
- Process knowledge and experience at similar sites
- Information and/or data from adjacent CASs
- Geologic and/or hydrologic conditions
- Physical and chemical characteristics of suspected contaminants.

Contaminants determined not to be present in Phase I samples may be eliminated from Phase II analytical suites. However, the initial surface soil samples will be analyzed for the full suite of parameters identified in [Table 3-3](#).

Phase II (step-out) sampling locations at CAS 25-27-03 will be selected based on the outer boundary sample locations where a COC is detected in the initial surface soil confirmatory samples. Sample locations may be changed based on current site conditions, obvious debris or staining of soils, field-screening results, or professional judgement. Phase II locations will also be selected based on pertinent features of the CSM and the other biasing factors. If biasing factors indicate a COC potentially extends beyond planned Phase II sample locations, locations may be modified or

additional Phase II samples may be collected from incremental step-out locations. Both surface and subsurface soil samples may be collected and analyzed to determine the extent of a COC.

Due to the nature of buried features possibly present (e.g., structures, buried debris, and utilities), sample locations may be relocated, based upon the review of engineering drawings, and information obtained during the site visit. However, the new locations will meet the decision needs and criteria stipulated in [Section A.1.4.1](#).

Phase II subsurface soil samples will be collected at biased locations by hand augering, direct-push, excavation, or drilling techniques, as appropriate. Subsurface soil sample depth intervals will be selected based on biasing factors. [Section 3.0](#) provides the analytical methods and laboratory requirements (i.e., detection limits, precision, and accuracy requirements) to be used when analyzing the COPCs. The analytical program for CAS 25-27-03 is presented in [Table 3-3](#).

The following outlines the CAS-specific activities for the CAS 25-27-03 investigation.

4.2.3 CAS 25-27-03, Polychlorinated Biphenyls Contamination

A walk-over radiological land area survey of the ground surface where surveys have not previously been conducted within the CAS boundaries initially will be performed to ensure worker health and safety. The initial activities to be conducted will be a visual inspection and photodocumentation of CAS 25-27-03. The visual inspection will focus on identifying evidence of contamination at the Substation #3 concrete pad resulting from a failure or leak from the transformers. The soils surrounding TCC that may have been subjected to dust suppression activities will also be inspected for discoloration or other signs of contamination. The information generated during these initial activities will be used to provide additional biasing factors (i.e., elevated radiological data, stained soil) for the placement of soil samples.

Following visual inspection and the radiological survey, approximately 40 soil sample locations will be identified along eight transects that transverse the TCC fenced area. The transect locations consider the PA sampling results where PCBs are known to be present and the need to determine if PCBs or TPH contamination is present throughout the TCC or limited to smaller areas within the site boundary. This effort will use the data from previously collected samples and other biasing factors to

identify sampling points along the edge of the TCC concrete pad. Previous analytical data may be used in the decision process if the data meet the quality criteria specified in this DQO process. Additional surface soil points will be established at 25- to 50-ft lateral step-out locations moving away from the TCC pad toward the fence along the northern, eastern, and southern side of the facility. Step-out locations will also be identified moving west from the TCC concrete pad toward the edge of Topopah Wash. If the results of the visual survey indicate areas of contamination not within the transects, additional surface soil samples will be collected based on biasing factors (e.g., staining, radiological survey data, etc.). No sampling is planned within the wash.

Surface (0-0.5 ft bgs) samples will be collected at each of the points along the transects to resolve Decision I (nature of contamination) and to provide some initial confirmation on the lateral extent of the PCB contamination identified in the PA sampling. These samples will be submitted to the laboratory for 48- to 72-hour quick-turnaround analysis. If COCs other than PCBs are detected or suspected, additional soil samples from deeper intervals at existing locations or from step-out locations will be collected to define the extent of contamination.

[Figure 4-1](#) depicts possible soil sampling locations at CAS 25-27-03. The number and actual sample locations shown on this figure are for illustration, and the actual locations and number may change. All changes will be thoroughly documented in the field activity daily logs (FADL). Sample locations will be determined from current site conditions based on biasing factors. Samples will be submitted for laboratory analysis as discussed in [Section 3.0](#).

To determine the presence of contaminants other than PCBs that may have potentially originated from the Substation #3 concrete pad, and to define the horizontal extent of PCBs identified in previous sampling events, surface soil sampling points will be located at two 15- to 20-ft intervals from each side of the Substation #3 concrete pad and on and around the earthen berm.

Where PCBs exceed the PALs in surface soil based on the 48- to 72-hour quick turnaround analysis and previous sampling results, shallow subsurface soil samples will be collected from selected locations to define the vertical extent of contamination. Samples will be collected using the most appropriate method (e.g., hand or power auger, drilling or excavation). To determine if clean soil has been placed over contaminated subsoil, shallow subsurface soil samples also will be collected from approximately 25 percent of the locations where PCBs were not detected during the initial analysis of

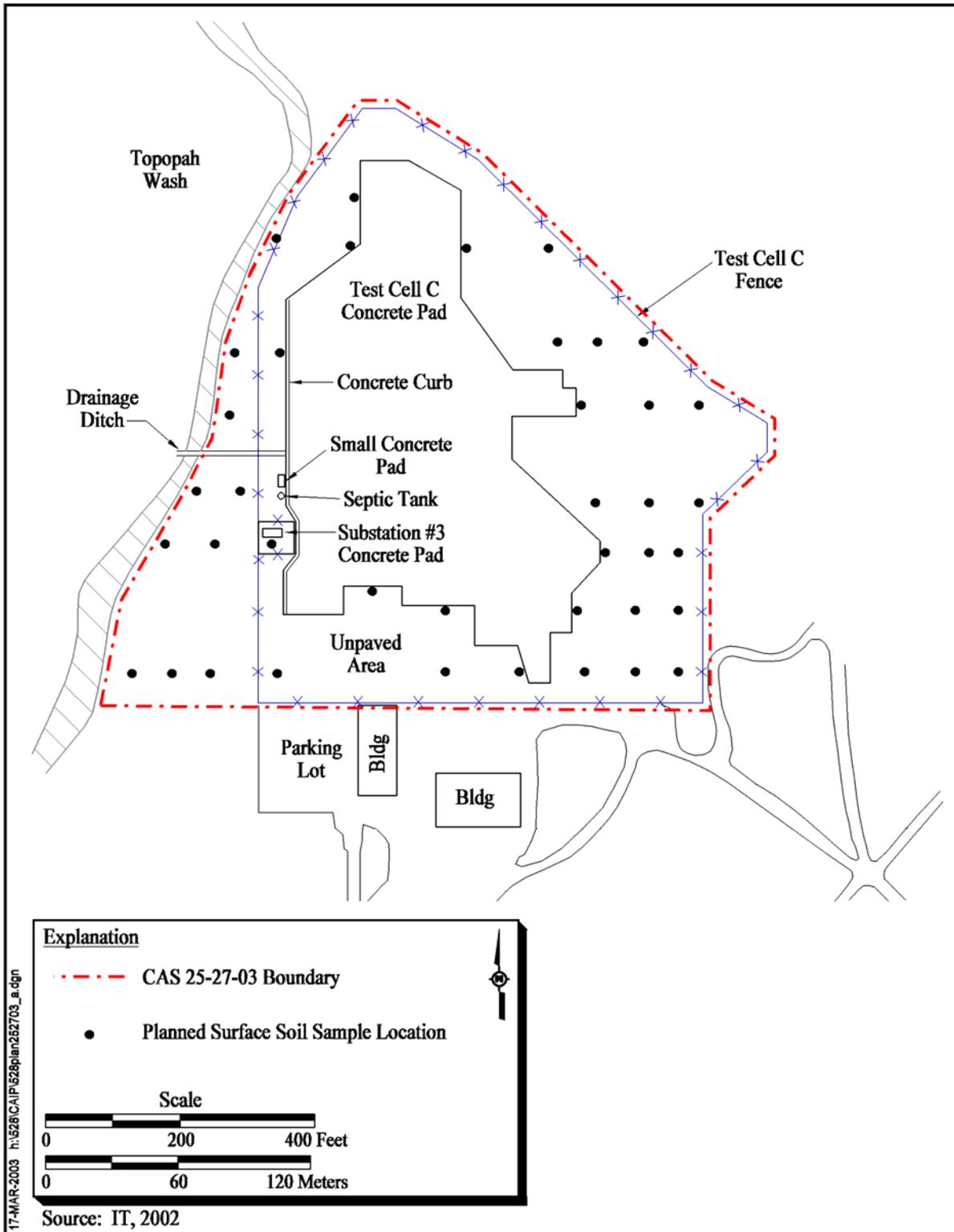


Figure 4-1
CAU 528, CAS 25-27-03 Potential Sampling Locations

the surface samples. The historical remediation efforts for the Kiwi TNT excursion and Phoebus 1A accident will aid in the selection of their sampling points.

The depth intervals at subsurface locations will be based on biasing factors such as presence of debris, staining, odor, FSRs, or professional judgement. Test pits may be excavated to further evaluate the potential that clean soil was backfilled over contamination and to assist in the collection of biased subsurface soil samples. For subsurface sampling locations, generally two consecutive soil samples with results below field-screening action levels are required to define the vertical extent of contamination. Generally, the uppermost “clean” sample from each location will be submitted for laboratory analysis.

At locations where Phase I analytical results show PCB concentrations in soil equal to or greater than 50 ppm, step-out (both vertical and horizontal) samples will be collected during the Phase II sampling to delineate the extent of the potential hot spots. Step-outs from PCB hot spots will continue until the extent of PCB concentrations greater than or equal to 25 ppm is delineated. In addition, step out sampling will be conducted to delineate PCB concentration to values less than the PAL (i.e., 740 µg/kg).

Samples of waste or debris may also be collected for analysis to support IDW disposal and potential future waste management decisions.

4.3 Field-Screening Levels

Field screening, along with other biasing factors, may help guide the selection of the most appropriate sampling location for collection of laboratory samples. The following FSLs may be used for on-site field screening:

- The radiological (alpha and beta/gamma) FSL of the mean background activity plus two times the standard deviation of the mean background activity collected from undisturbed locations within the vicinity of the site (Adams, 1998).
- VOC FSRs greater than 20 ppm or 2.5 time background, whichever is greater.

Field-screening concentrations exceeding FSLs indicate potential contamination at that sample location. This information will be documented and the investigation will collect additional samples

to delineate the extent of the contamination. Additionally, these data may be used to select confirmatory samples for submission to the laboratory.

4.4 Additional Sampling to Define Extent of Contamination

If COCs in addition to PCBs are detected, step-out sampling may be necessary to properly define the extent of contamination (i.e., contaminant boundaries). Sample locations may be determined by the vertical and/or lateral extent of initial contamination, and will be based on process knowledge, site observations, field-screening data, and analytical results (if available) from nature samples. The target populations at step-out locations will be limited to COC concentrations above PALs for the samples that defined the nature of contamination. They will also be limited by previous extent samples (i.e., PCBs) that may continue to exceed PALs.

Step-out samples are typically placed approximately of 15 ft from the previous sample location where COCs were detected. If biasing factors indicate that the COCs may extend beyond the typical 15-ft distance, the distance for the step-outs may be modified to meet regulatory requirements. As field data are generated, these locations may be modified, but only if the modified locations meet the decision needs and criteria stipulated in the DQOs. At each step-out location, soil samples will be collected at the depth(s) where COCs were encountered and from two depth intervals below the lowest depth where COCs were observed. These samples will be screened, and if the results are not greater than FSLs, one of these samples (typically the uppermost) will be submitted to the laboratory for analysis. Laboratory analysis is the only acceptable verification that extent has been determined. In general, samples submitted for laboratory analysis will be those that define the lateral and vertical extent of COCs.

In the event that the nature sampling determine that the site has been affected by more than one source (e.g., transformer containing PCB-oil and fallout from TCC) the extent may be defined for an area that combines sources, rather than defining extent for individual sources. In these situations, sample locations to define the extent of contamination will be selected adjacent to the boundaries of the outer features with limited locations between features.

If the nature and/or extent of contamination is inconsistent with the CSM, or if contamination extends beyond the spatial boundaries identified in [Appendix A.1, Section A.1.4.2](#), identified decisionmakers

will be notified and the investigation strategy will be reevaluated. As long as contamination is consistent with the CSM and is within spatial boundaries, sampling will continue to define extent.

4.5 Geotechnical/Hydrological Analysis and Bioassessment Tests

It may be necessary to measure the geotechnical/hydrological parameters of the CAS. Bioassessment samples may be collected if biasing factors suggests a petroleum plume may be present. Samples to be analyzed for these parameters will be collected within brass sleeves (or other containers, as appropriate) to maintain the natural physical characteristics of the soil. [Table 4-1](#) lists general geotechnical and hydrological parameters of interest. The testing methods shown are minimum standards, and other equivalent or superior testing methods may be used. In some cases, bioassessment will also be performed on the sample material. Bioassessment is a series of tests designed to evaluate the physical, chemical, and microbiological characteristics of a site. Bioassessment tests include determinants of nutrient availability, pH, microbial population density, and the ability of the microbial population to grow under enhanced conditions. This type of analysis is most appropriate for hydrocarbon contamination sites where bioremediation is a potential corrective action.

4.6 Safety

A current version of the Environmental Architect-Engineer (A-E) Services Contractor's HASP will accompany the field documents, and a site-specific health and safety plan (SSHASP) will be prepared and approved prior to the field effort. As required by the DOE Integrated Safety Management System (ISMS) (DOE/NV, 1997), these documents outline the requirements for protecting the health and safety of the workers and the public, and the procedures for protecting the environment. The ISMS program requires that site personnel will reduce or eliminate the possibility of injury, illness, or accidents, and to protect the environment during all project activities. The following safety issues will be taken into consideration when evaluating the hazards and associated control procedures for field activities discussed in the SSHASP:

- Potential hazards to site personnel and the public include, but are not limited to: radionuclides, chemicals (e.g., heavy metals, SVOCs, and petroleum hydrocarbons), adverse and rapidly changing weather, remote location, and motor vehicle and heavy equipment operations

**Table 4-1
 General Geotechnical and Hydrological Analysis**

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

^aASTM, 1996

^bUSACE, 1970

^cMethods of Soil Analysis (MOSA) (Soil Science Society of America, 1986)

^dvan Genuchten, 1980

^eKarathanasis and Hajek, 1982

- Proper training of all site personnel to recognize and mitigate the anticipated hazards
- Work controls to reduce or eliminate the hazards including engineering controls, substitution of less hazardous materials, and use of appropriate personal protective equipment (PPE)
- Occupational exposure monitoring to prevent overexposures to hazards such as radionuclides, chemicals, and physical agents (e.g., heat, cold, and high wind)
- Radiological surveying for alpha/beta and gamma emitters to minimize and/or control personnel exposures; use of the “as-low-as-reasonably-achievable” principle when dealing with radiological hazards
- Emergency and contingency planning to include medical care and evacuation, decontamination, spill control measures, and appropriate notification of project management. The same principles apply to emergency communications.

5.0 Waste Management

Management of IDW will be based on regulatory requirements, field observations, process knowledge, and the results of laboratory analysis of CAU 528 investigation samples.

Disposable sampling equipment, PPE, and rinsate are considered potentially contaminated waste only by virtue of contact with potentially contaminated media (e.g., soil) or potentially contaminated debris (e.g., construction materials). Therefore, sampling and analysis of IDW, separate from analysis of site investigation samples, may not be necessary. However, if associated investigation samples are found to contain contaminants above regulatory levels, direct samples of IDW may be taken to support waste characterization.

Sanitary, hazardous, radioactive, and/or mixed waste, if generated, will be managed and disposed of in accordance with DOE Orders, U.S. Department of Transportation (DOT) regulations, state and federal waste regulations, and agreements and permits between DOE and NDEP.

5.1 Waste Minimization

Investigation activities are planned to minimize IDW generation. This will be accomplished by incorporating the use of process knowledge, visual examination, and/or radiological survey and swipe results. When possible, disturbed media (such as soil removed during trenching) or debris will be returned to its original location. Contained media (e.g., soil managed as waste) as well as other IDW will be segregated to the greatest extent possible to minimize generation of hazardous, radioactive, or mixed waste. Hazardous material used at the sites will be controlled in order to limit unnecessary generation of hazardous or mixed waste. Administrative controls, including decontamination procedures and waste characterization strategies, will minimize waste generated during investigations.

5.2 Potential Waste Streams

Process/historical knowledge was reviewed during the DQO process to identify suspect contaminants that may have been released at a particular site and to identify waste types that may be generated during the investigation process. The types of IDW that may be generated include low-level

radioactive waste (LLW), mixed waste (LLW and hazardous waste), radioactive waste, hydrocarbon waste, hazardous waste, and sanitary waste. Investigation-derived wastes typically generated during investigation activities may include one or more of the following:

- Media (e.g., soil)
- PPE and disposable sampling equipment (e.g., plastic, paper, sample containers, aluminum foil, spoons, bowls)
- Decontamination rinsate
- Field-screening waste (e.g., soil, spent solvent, rinsate, disposable sampling equipment, and PPE contaminate by field-screening activities)
- Construction or other nonhazardous debris

Each waste stream generated will be segregated and further segregation may occur within each waste stream. Waste will be traceable to its source and associated environmental media samples.

5.3 Investigation-Derived Waste Management

The on-site management and ultimate disposition of IDW may be guided by several factors, including, but not limited to: the analytical results of samples either directly or indirectly associated with the waste, historical site knowledge, knowledge of the waste generation process, field observations, field-monitoring/screening results, and/or radiological survey/swipe results. Table 4-2 of the *NV/YMP Radiological Control Manual* (DOE/NV, 2000b) shall be used to determine if such materials may be declared nonradioactive. On-site IDW management requirements by waste type are detailed in the following sections. Applicable waste management regulations and requirements are listed in [Table 5-1](#).

Waste generated during the investigation activities will include the following potential waste streams:

- PPE and disposable sampling equipment (e.g., plastic, paper, sample containers, aluminum foil, spoons, bowls)
- Decontamination rinsate
- Environmental media (e.g., soil)

**Table 5-1
 Waste Management Regulations and Requirements**

Waste Type	Federal Regulation	Additional Requirements
Solid (nonhazardous)	NA	NRS 444.440 - 444.620 ^a NAC 444.570 - 444.7499 ^b NTS Landfill Permit SW13.097.04 ^c NTS Landfill Permit SW13.097.03 ^d
Liquid/Rinsate (nonhazardous)	NA	Water Pollution Control General Permit GNEV93001, Rev. 3iii ^e
Hazardous	RCRA ^f	NRS 459.400 - 459.600 ^g NAC 444.850 - 444.8746 ^h POC ⁱ
Low-Level Radioactive	NA	DOE Orders and NTSWAC ^j
Mixed	RCRA ^f	NTSWAC ^j POC ⁱ
Hydrocarbon	NA	NAC 445A.2272 ^k NTS Landfill Permit SW13.097.02 ^l
Polychlorinated Biphenyls	TSCA ^m	NRS 459.400 - 459.600 ^g NAC 444.940 - 444.9555 ^o
Asbestos	TSCA ⁿ	NRS 618.750-618.801 ^p NAC 444.965-444.976 ^q

^aNevada Revised Statutes (2001a)

^bNevada Administrative Code (2002a)

^cArea 23 Class II Solid Waste Disposal Site (NDEP, 1997a)

^dArea 9 Class III Solid Waste Disposal Site (NDEP, 1997c)

^eNevada Test Site Sewage Lagoons (NDEP, 1999)

^fResource Conservation and Recovery Act (CFR, 2002a)

^gNevada Revised Statutes (2001b)

^hNevada Administrative Code (2002b)

ⁱPerformance Objective for the Certification of Nonradioactive Hazardous Waste (BN, 1995)

^jNevada Test Site Waste Acceptance Criteria, Revision 4 (NNSA/NV, 2002b)

^kNevada Administrative Code (2002e)

^lArea 6 Class III Solid Waste Disposal Site for Hydrocarbon (NDEP, 1997b)

^mToxic Substance Control Act (CFR, 2002b)

ⁿToxic Substance Control Act (CFR, 2002c)

^oNevada Administrative Code (2002c)

^pNevada Revised Statutes (1998)

^qNevada Administrative Code (2002d)

NA = Not applicable

NAC = Nevada Administrative Code

NRS = Nevada Revised Statutes

NTS = Nevada Test Site

RCRA = Resource Conservation and Recovery Act

NTSWAC = Nevada Test Site Waste Acceptance Criteria

TSCA = Toxic Substance Control Act

POC = Performance Objective for the Certification of Nonradioactive Hazardous Waste

- Surface debris in investigation area.
- Field screening waste (e.g., soil, spent solvent, rinsate, disposable sampling equipment, and PPE contaminated by field-screening activities)

Each waste stream generated will be reviewed and segregated at the point of generation.

5.3.1 Sanitary Waste

Office trash and lunch waste will be sent to the sanitary land fill by disposal in the dumpster.

Sanitary IDW generated at each CAS will be collected in plastic bags, sealed, labeled with the CAS number from each site in which it was generated, and dated. The waste will then be placed in a rolloff box located in Mercury, or other approved rolloff box location. The number of bags of sanitary IDW placed in the rolloff box will be counted as they are placed in the rolloff box, noted in a log, and documented in the FADL. These logs will provide necessary tracking information for ultimate disposal in the 10c Industrial Waste Landfill or other approved landfill.

5.3.1.1 Special Sanitary Waste

Hydrocarbon waste is defined as waste containing more than 100 mg/kg of TPH contamination (NAC, 2002e). Hydrocarbon waste will be managed on site in a drum or other appropriate container until fully characterized. Hydrocarbon waste may be disposed of at a designated hydrocarbon landfill (NDEP, 1997), an appropriate hydrocarbon waste management facility (e.g., recycling facility), or other method in accordance with Nevada regulations.

Asbestos-containing materials that may be encountered or generated during this investigation will be managed and disposed of in accordance with appropriate federal (CFR, 2002c) and State of Nevada (NAC, 2002d) regulations.

Materials that are thought to potentially contain the hantavirus will be managed and disposed in accordance with appropriate health and safety procedures.

5.3.2 Hazardous Waste

Corrective Action Unit 528 will have waste storage areas established according to the needs of the project. Satellite accumulation areas and hazardous waste accumulation areas will be managed

consistent with the requirements of federal and state regulations (CFR, 2002a; NAC, 2002b). They will be properly controlled for access and equipped with spill kits and appropriate spill containment. Suspected hazardous wastes will be placed in DOT-compliant containers. All containerized waste will be handled, inspected, and managed in accordance with Title 40 CFR 265, Subpart I (CFR, 2002a). These provisions include managing the waste in containers compatible with the waste type, and segregating incompatible waste types so that in the event of a spill, leak, or release, incompatible wastes shall not contact one another.

Hazardous Waste Accumulation Areas (HWAAs) will be covered under a site-specific emergency response and contingency action plan until such time that the waste is determined to be nonhazardous or all containers of hazardous waste have been removed from the storage area. Hazardous wastes will be characterized in accordance with the requirements of Title 40 CFR 261. *Resource Conservation and Recovery Act* “listed” waste has not been identified at CAU 528. Any waste determined to be hazardous will be managed and transported in accordance with RCRA and DOT to a permitted treatment, storage, and disposal facility (CFR, 2002a).

Management of Personal Protective Equipment - PPE and disposable sampling equipment will be visually inspected for stains, discoloration, and gross contamination as the waste is generated. At the discretion of the SS and SSO, any IDW that meets this description will be segregated and managed as potentially “characteristic” hazardous waste. This segregated population of waste will either be (1) assigned the characterization of the soil/sludge that was sampled, (2) sampled directly, or (3) undergo further evaluation using the soil/sludge sample results to determine how much soil/sludge would need to be present in the waste to exceed regulatory levels. Waste that is determined to be hazardous will be entered into an approved waste management system, where it will be managed and dispositioned according to RCRA requirements or subject to agreements between NNSA/NSO and the State of Nevada. The PPE/equipment that is not visibly stained, discolored, or grossly contaminated will be managed as nonhazardous sanitary waste.

Management of Decontamination Rinsate - Rinsate at this CAU will not be considered hazardous waste unless there is evidence that the rinsate would display a RCRA characteristic. Evidence may include such things as the presence of a visible sheen, pH, or association with equipment/materials used to respond to a release/spill of a hazardous waste/substance. Decontamination rinsate that is

potentially hazardous (using associated sample results and/or process knowledge) will be managed as “characteristic” hazardous waste (CFR, 2002a). The regulatory status of the potentially hazardous rinsate will be determined through the application of associated sample results or through direct sampling. If determined to be hazardous, the rinsate will be entered into an approved waste management system, where it will be managed and dispositioned according to RCRA requirements or subject to agreements between NNSA/NSO and the State of Nevada. If the associated samples do not indicate the presence of hazardous constituents, then the rinsate will be considered to be nonhazardous.

The disposal of nonhazardous rinsate will be consistent with guidance established in current NNSA/NSO Fluid Management Plans for the NTS as follows:

- Rinsate that is determined to be nonhazardous and contaminated to less than 5x *Safe Drinking Water Standards* (SDWS) is not restricted as to disposal. Nonhazardous rinsate which is contaminated at 5x to 10x SDWS will be disposed of in an established infiltration basin or solidified and disposed of as sanitary waste or low-level waste in accordance with the respective sections of this document.
- Nonhazardous rinsate which is contaminated at greater than 10x SDWS will be disposed of in a lined basin or solidified and disposed of as sanitary waste or low-level waste in accordance with the respective sections of this document.

Management of Soil - This waste stream consists of soil produced during soil sampling, excavation, and/or drilling. This waste stream is considered to have the same COPCs as the material remaining in the ground. The preferred method for managing this waste stream is to place the material back into the borehole/excavation in the same approximate location from which it originated. If this cannot be accomplished, the material will either be managed on site by berming and covering next to the excavation, or by placement in a container(s). Containerized soil determined to be hazardous will be subject to RCRA and associated storage time requirements.

Management of Debris - This waste stream can vary depending on site conditions. Debris that requires removal for the investigation activities (soil sampling, excavation, and/or drilling) must be characterized for proper management and disposition. Historical site knowledge, knowledge of the waste generation process, field observations, field-monitoring/screening results, radiological survey/swipe results and/or the analytical results of samples either directly or indirectly associated with the waste will be used to characterize the debris. Debris will be visually inspected for stains,

discoloration, and gross contamination. Debris may be deemed reusable, recyclable, sanitary waste, hazardous waste, PCB waste, or low-level waste. Debris determined to be hazardous will be subject to RCRA and associated storage time requirements. Waste that is not sanitary will be entered into an approved waste management system, where it will be managed and dispositioned according to federal, state requirements, and agreements between NNSA/NSO and the State of Nevada. The debris will either be managed on site by berming and covering next to the excavation, or by placement in a container(s).

Field Screening Waste - The use of field test kits and/or instruments may result in the generation of small quantities of hazardous wastes. If hazardous waste is produced by field screening, it will be segregated from other IDW and managed in accordance with the hazardous waste regulations. (CFR, 2002a). On radiological sites, this may increase the potential to generate mixed waste; however, the generation of a mixed waste will be minimized as much as practicable. In the event a mixed waste is generated, the waste will be managed in accordance with the Mixed Waste section of this document.

5.3.3 Polychlorinated Biphenyls

The management of PCBs is governed by the TSCA and its implementing regulations at 40 CFR 761 (CFR, 2002b). Polychlorinated biphenyls contamination may be found as a sole contaminant or in combination with any of the types of waste discussed in this document. For example, PCBs may be a co-contaminant in soil that contains a RCRA “characteristic” waste (PCB/hazardous waste), or in soil that contains radioactive wastes (PCB/radioactive waste), or even in mixed waste (PCB/radioactive/hazardous waste). The IDW will initially be evaluated using analytical results for media samples from the investigation. If any type of PCB waste is generated, it will be managed according to 40 CFR 761 (CFR, 2002b) as well as State of Nevada requirements (NAC, 2002c), guidance, and agreements with NNSA/NSO.

5.3.4 Low-Level Waste

Radiological swipe surveys and/or direct-scan surveys may be conducted on reusable sampling equipment and the PPE and disposable sampling equipment waste streams exiting a radiologically controlled area. This allows for the immediate segregation of radioactive waste from waste that may

be unrestricted regarding radiological release. Removable contamination limits, as defined in Table 4-2 of the current version of the NV/YMP RadCon Manual (DOE/NV, 2000b), will be used to determine if such waste may be declared unrestricted regarding radiological release versus being declared radioactive waste. Direct sampling of the waste may be conducted to aid in determining if a particular waste unit (e.g., drum of soil) contains low-level radioactive waste, as necessary. Waste that is determined to be below the values of Table 4-2, by either direct radiological survey/swipe results or through process knowledge, will not be managed as potential radioactive waste but will be managed in accordance with the appropriate section of this document. Wastes in excess of Table 4-2 values will be managed as potential radioactive waste and be managed in accordance with this section and any other applicable sections of this document.

Low-level radioactive waste, if generated, will be managed in accordance with the contractor-specific waste certification program plan, DOE Orders, and the requirements of the current version of the *Nevada Test Site Waste Acceptance Criteria* (NTSWAC) (NNSA/NV, 2002b). Potential radioactive waste drums containing soil, PPE, disposable sampling equipment, and/or rinsate may be staged at a designated radioactive materials area (RMA) when full or at the end of an investigation phase. The waste drums will remain at the RMA pending certification and disposal under NTSWAC requirements (NNSA/NV, 2002b).

5.3.5 Mixed Waste

Mixed waste, if generated, shall be managed and dispositioned according to the requirements of RCRA (CFR, 2002a) or subject to agreements between NNSA/NSO and the State of Nevada, as well as DOE requirements for radioactive waste. The waste will be marked with the words “Hazardous Waste Pending Analysis and Radioactive Waste Pending Analysis.” Waste characterized as mixed will not be stored for a period of time that exceeds the requirements of RCRA unless subject to agreements between NNSA/NSO and the State of Nevada. The mixed waste shall be transported via an approved hazardous waste/radioactive waste transporter to the NTS transuranic waste storage pad for storage pending treatment or disposal. Mixed waste with hazardous waste constituents below Land Disposal Restrictions may be disposed of at the NTS Area 5 Radioactive Waste Management Site (RWMS) if the waste meets the requirements of the NTSWAC (NNSA/NV, 2002b). Mixed waste not meeting Land Disposal Restrictions will require development of a treatment and disposal plan under the requirements of the Mutual Consent Agreement between DOE and the State of Nevada (NDEP, 1995).

6.0 Quality Assurance/Quality Control

The primary objective of the corrective action investigation described in this CAIP is to collect accurate and defensible data to support the selection and implementation of a closure alternative for CAS 25-27-03 in CAU 529. [Section 6.1](#) and [Section 6.2](#) discuss the collection of required QC samples in the field and QA requirements for laboratory/analytical data to achieve closure. [Section 6.2.9](#) provides QA/QC requirements for radiological survey data. Data collected during the corrective action investigation will be evaluated against DQI-specific performance criteria to verify that the DQOs established during the DQO process ([Appendix A.1](#)) have been satisfied.

Unless otherwise stated in this CAIP or required by the results of the DQO process ([Appendix A.1](#)), this investigation will adhere to the Industrial Sites QAPP (NNSA/NV, 2002a).

The discussion of the DQIs, including the data sets, will be provided in the CAU 529 CADD to be developed at the completion of the corrective action investigation.

6.1 Quality Control Field Sampling Activities

Field QC samples will be collected in accordance with established procedures. Field QC samples are collected and analyzed to aid in determining the validity of sample results. The number of required QC samples depends on the types and number of environmental samples collected. The minimum frequency of collecting and analyzing QC samples for this investigation, as determined in the DQO process, include:

- Trip blanks (one per sample cooler containing VOC environmental samples)
- Equipment blanks (one per sampling event for each type of decontamination procedure)
- Source blanks (one per lot of source material that contacts sampled media)
- Field duplicates (minimum of 1 per matrix per 20 environmental samples)
- Field blanks (minimum of 1 per 20 environmental samples or 1 per sampling day, whichever best exemplifies field conditions)

- Matrix spike (MS)/matrix spike duplicate (MSD), (minimum of 1 each per matrix per 20 environmental samples), as required by method).

Additional QC samples may be submitted based on site conditions at the discretion of the Site Supervisor. Field QC samples shall be analyzed using the same analytical procedures implemented for associated environmental samples. Additional details regarding field QC samples are available in the Industrial Sites QAPP (NNSA/NV, 2002a).

6.2 Laboratory/Analytical Quality Assurance

Criteria for the investigation, as stated in the DQOs ([Appendix A.1](#)) and except where noted, require laboratory analytical quality data be used for making critical decisions. Rigorous QA/QC will be implemented for all laboratory samples including documentation, data verification and validation of analytical results, and an assessment of DQIs as they relate to laboratory analysis.

6.2.1 Data Validation

Data verification and validation will be performed in accordance with the Industrial Sites QAPP (NNSA/NV, 2002a), except where otherwise stipulated in this CAIP. All nonradiological laboratory data from samples collected and analyzed will be evaluated for data quality according to *EPA Functional Guidelines* (EPA, 1994a and 1999). Radiological laboratory data from samples that are collected and analyzed will be evaluated for data quality according to company-specific procedures. The data will be reviewed to ensure that all critical samples were appropriately collected, analyzed, and the results passed data validation criteria. Validated data, including estimated data (i.e., J-qualified), will be assessed to determine if they meet the DQO requirements of the investigation and the performance criteria for the DQIs. The results of this assessment will be documented in the CADD. If the DQOs were not met, corrective actions will be evaluated, selected, and implemented (e.g., refine CSM or resample to fill data gaps).

6.2.2 Data Quality Indicators

Data quality indicators are qualitative and quantitative descriptors used in interpreting the degree of acceptability or utility of data. The principal DQIs are precision, accuracy, representativeness, comparability, and completeness. A sixth DQI, sensitivity, has also been included for the CAU 528

investigation. Data quality indicators are used to evaluate the entire measurement system and laboratory measurement processes (i.e., analytical method performance) as well as to evaluate individual analytical results (i.e., parameter performance).

Precision and accuracy are quantitative measures used to assess overall analytical method and field sampling performance as well as to assess the need to “flag” (qualify) individual parameter results when corresponding QC sample results are not within established control limits. Therefore, performance metrics have been established for both analytical methods and individual analytical results. Data qualified as estimated for reasons of precision or accuracy may be considered to meet the parameter performance criteria based on assessment of the data.

Representativeness and comparability are qualitative measures, and completeness is a combination of both quantitative and qualitative measures. Representativeness, comparability, and completeness are used to assess the measurement system performance. The DQI parameters are individually discussed in [Section 6.2.3](#) through [Section 6.2.8](#).

[Table 6-1](#) provides the established analytical method/measurement system performance criteria for each of the DQIs and the potential impacts to the decision if the criteria are not met. The Industrial Sites QAPP (NNSA/NV, 2002a) documents the actions required to correct conditions that adversely affect data quality both in the field and the laboratory. All DQI performance criteria deficiencies will be evaluated for data usability and impacts to the DQO decisions. These evaluations will be discussed and documented in the data assessment section of the CADD. The following subsections discuss each of the DQIs that will be used to assess the quality of laboratory data.

6.2.3 Precision

Precision is used to assess the variability of a population of measurements with the variability of the analysis process. It is used to evaluate the performance of analytical methods as well as to evaluate the usability of individual analytical results. Precision is a measure of agreement among a replicate set of measurements of the same property under similar conditions. This agreement is expressed as the relative percent difference (RPD) between duplicate measurements. The method used to calculate RPD is presented in the Industrial Sites QAPP (NNSA/NV, 2002a).

**Table 6-1
 Laboratory and Analytical Performance Criteria for CAU 528 Data Quality Indicators**

Data Quality Indicator	Performance Criteria	Potential Impact on Decision if Performance Criteria Not Met
Precision	Variations between duplicates (laboratory and field) and original sample should not exceed analytical method-specific criteria discussed in Section 6.2.3 .	Data that do not meet the performance criteria will be evaluated for purposes of completeness. Decisions may not be valid if analytical method performance criteria for precision are not met.
Accuracy	Laboratory control sample results, matrix spike results, and surrogate results should be within specified acceptance windows.	Data that do not meet the performance criteria will be evaluated for purposes of completeness. Decisions may not be valid if analytical method performance criteria for accuracy are not met.
Sensitivity	Detection limits of laboratory instruments must be less than or equal to respective PALs.	Cannot determine if COCs are present or migrating at levels of concern; therefore, the affected data will be assessed for usability and potential impacts on meeting site characterization objectives.
Comparability	Equivalent samples analyzed using same analytical methods, the same units of measurement and detection limits must be used for like analyses.	Inability to combine data with data obtained from other sources and/or inability to compare data to regulatory action levels.
Representativeness	Correct analytical method performed for appropriate COPC; valid data reflects appropriate target population.	Cannot identify COC or estimate concentration of COC; therefore, cannot make decision(s) on target population.
Nature Completeness	80% of the CAS-specific noncritical analytes identified in the CAIP have valid results. 90% of critical analytes are valid.	Cannot make decision on whether COCs are present.
Extent Completeness	90% of critical analytes used to define extent of COCs are valid.	Extent of contamination cannot be determined.
Clean Closure Completeness	100% of critical analytes are valid.	Cannot determine if COCs remain in soil.

Determinations of precision will be made for field duplicate samples and laboratory duplicate samples. Field duplicate samples will be collected simultaneously with samples from the same source under similar conditions in separate containers. The duplicate sample is treated independently of the original sample in order to assess field impacts and laboratory performance on precision through a comparison of results. Laboratory precision is evaluated as part of the required laboratory internal QC program to assess performance of analytical procedures. The laboratory sample duplicates are an aliquot, or subset, of a field sample generated in the laboratory. They are not a

separate sample but a split, or portion, of an existing sample. Typically, laboratory duplicate QC samples include MSD and laboratory control sample (LCS) duplicate samples for organic, inorganic, and radiological analyses.

6.2.3.1 Precision for Chemical Analysis

The RPD criteria to be used for assessment of precision are the parameter-specific criteria listed in [Table 6-1](#). When laboratory-specific control limits are indicated, they are based on the evaluation at the laboratory on a quarterly basis by monitoring the historical data and performance for each method. No review criteria for field duplicate RPD comparability have been established; therefore, the laboratory sample duplicate criteria will be applied to the review of field duplicates.

The parameter performance criteria for precision will be compared to RPD results of duplicate samples. This will be accomplished as part of the data validation process. Precision values for organic and inorganic analyses that are within the established control criteria indicate that analytical results for associated samples are valid. The RPD values that are outside the criteria for organic analysis do not necessarily result in the qualification of analytical data. It is only one factor in making an overall judgment about the quality of the reported analytical results. For the purpose of data validation of inorganic analyses, precision is measured in two ways. The RPD is calculated when the sample and its duplicate results are greater than five times the contract-required detection limit (CRDL). The absolute difference is calculated and applied to the CRDL when the results are less than five times the CRDL. Inorganic laboratory sample duplicate RPD values outside the established control criteria result in the qualification of associated analytical results as estimated; however, qualified data does not necessarily indicate that the data are not useful for the purpose intended. This qualification is an indication that data precision should be considered for the overall assessment of the data quality and potential impact on data applicability in meeting site characterization objectives.

The criteria to evaluate analytical method performance for precision ([Table 3-2](#)) will be assessed based on the analytical method-specific (e.g., VOCs) precision measurements. The analytical method-specific precision measurement is calculated by taking the number of analyses meeting the RPD criteria, dividing that by the total number of analyses with detectable concentrations, and multiplying by 100. Each analytical method-specific precision measurement will be assessed for

potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.3.2 Precision for Radiochemical Analysis

The parameter performance criteria for precision will be compared to the RPD or normalized difference (ND) results of duplicate samples. The criteria for assessment of the radiochemical precision are parameter-specific criteria (see [Table 3-3](#)). This assessment will be accomplished as part of the data validation process. Precision values that are within the established control criteria indicate that analytical results for associated samples are valid. Out of control RPD or ND values do not necessarily indicate that the data are not useful for the purpose intended; however, it is an indication that data precision should be considered for the overall assessment of the data quality and the potential impact on data applicability in meeting site characterization objectives.

If the RPD or ND criteria are exceeded, samples will be qualified. Field duplicates will be evaluated, but field samples will not be qualified based on their results. The MSD results outside of the control limits may not result in qualification of the data. An assessment of the entire analytical process, including the sample matrix, is conducted to determine if qualification is warranted.

The evaluation of precision based on duplicate RPD requires that both the sample and its duplicate have concentrations of the target radionuclide exceeding five times their MDC. This excludes many measurements because the samples contain nondetectable or low levels of the target radionuclide. However, the ND method may be used for evaluating duplicate data where the results are less than five times their MDCs. This is based on the measurement uncertainty associated with low-level results. The ND test is calculated using the following formula:

$$\text{Normalized Difference} = \frac{S - D}{\sqrt{(TPU_S)^2 + (TPU_D)^2}}$$

Where:

- S = Sample Result
- D = Duplicate result
- TPU = Total Propagated Uncertainty
- TPU_S = 2 sigma TPU of the sample
- TPU_D = 2 sigma TPU of the duplicate

The control limit for the normalized difference is -1.96 to 1.96, which represents a confidence level of 95 percent.

The criteria to evaluate analytical method performance for precision ([Table 3-2](#)) will be based on the analytical method-specific (e.g., gamma spectrometry) precision measurements. Analytical method-specific precision measurement is calculated by taking the number of analyses meeting the RPD or ND criteria, dividing that by the total number of analyses, and multiplying by 100. Each analytical method-specific precision measurement will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.4 Accuracy

Accuracy is a measure of the closeness of an individual measurement or the average of a number of measurements to the true value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that result from sampling and analytical operations. It is used to assess the performance of laboratory measurement processes as well as to evaluate individual groups of analyses (i.e., sample delivery groups).

Accuracy is determined by analyzing a reference material of known parameter concentration or by reanalyzing a sample to which a material of known concentration or amount of parameter has been added (spiked). The measure of accuracy is expressed as the percent recovery (%R) (NNSA/NV, 2002a). This is calculated by dividing the measured sample concentration by the true concentration and multiplying the quotient by 100.

6.2.4.1 Accuracy for Chemical Analyses

The %R criteria to be used for assessment of accuracy are the parameter-specific criteria listed in [Table 3-3](#). Accuracy for chemical analyses will be evaluated based on results from three types of spiked samples: MS, LCS, and surrogates. Matrix spike samples are prepared by adding a known concentration of a target parameter to a specified amount of matrix sample for which an independent estimate of the target parameter concentration is available. Laboratory control samples are prepared by adding a known concentration of a target parameter to a “clean” sample matrix (does not contain

the target parameter). Surrogate samples are prepared by adding known concentrations of specific organic compounds to each sample analyzed for organic analyses (including QC samples).

For organic analyses, laboratory control limits are used for evaluation of %R. They are reevaluated quarterly at the laboratory by monitoring the historical data and performance for each method. The acceptable control limits for inorganic analyses are established in the EPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, 1994a).

The %R parameter performance criteria for accuracy will be compared to %R results of spiked samples. This will be accomplished as part of the data validation process. Accuracy values for organic and inorganic analysis that are within the established control criteria indicate that analytical results for associated samples are valid. The %R values that are outside the criteria do not necessarily result in the qualification of analytical data. It is only one factor in making an overall judgment about the quality of the reported analytical results. Factors beyond the laboratory's control, such as sample matrix effects, can cause the measured values to be outside of the established criteria. Therefore, the entire sampling and analytical process must be evaluated when determining the quality of the analytical data provided.

The criteria to evaluate analytical method performance for accuracy (Table 3-3) will be based on the analytical method-specific (e.g., VOCs) accuracy measurements. The analytical method-specific accuracy measurement is calculated by taking the number of analyses meeting the %R criteria, dividing that by the total number of analyses, and multiplying by 100. Each analytical method-specific accuracy measurement will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.4.2 Accuracy for Radiochemical Analysis

Accuracy for radiochemical analyses will be evaluated based on results from LCS and MS samples. The LCS is prepared by adding a known concentration of the radionuclide being measured to a sample that does not contain radioactivity (i.e., distilled water). This sample is analyzed with the field samples using the same sample preparation, reagents, and analytical methods employed for the samples. One LCS is prepared with each batch of samples for analysis by a specific measurement.

The MS samples are prepared by adding a known concentration of a target parameter to a specified field sample with a measured concentration. The MS samples are analyzed to determine if the measurement accuracy is affected by the sample matrix. The MS samples are analyzed with sample batches when requested.

The %R criteria to be used for assessment of accuracy will be the control limits for radiochemical analyses listed in [Table 3-3](#). These criteria will be used to assess qualification of data associated with each spiked sample. This will be accomplished as part of the data validation process. Accuracy values that are within the established control criteria indicate that analytical results for associated samples are valid.

The criteria to evaluate analytical method performance for accuracy ([Table 3-2](#)) will be assessed based on the analytical method-specific (e.g., gamma spectrometry) accuracy measurements. The analytical method-specific accuracy measurement is calculated by taking the number of analyses meeting the %R criteria, dividing that by the total number of analyses, and multiplying by 100. Each analytical method-specific accuracy performance will be assessed for potential impacts on meeting site characterization objectives, and results of the assessment will be documented in the CADD.

6.2.5 Representativeness

Representativeness is a qualitative evaluation of measurement system performance. It is the degree to which sample data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition (EPA, 1987). Representativeness is assured by a carefully developed sampling strategy, collecting the specified number of samples from proper sampling locations, and analyzing them by the approved analytical methods. An evaluation of this qualitative criterion will be presented in the CADD.

6.2.6 Completeness

Completeness is a quantitative and qualitative evaluation of measurement system performance. The criterion for meeting completeness is defined as generating sufficient data of the appropriate quality to satisfy the data needs identified in the DQOs. The quantitative measurement to be used to evaluate completeness is presented in [Table 3-2](#) and is based on the percentage of measurements made that are

judged to be valid. Percent completeness is determined by dividing the total number of valid analyses by the total number of analyses required to meet DQO data needs and multiplying by 100. Problems that may affect completeness include total number of samples sent to the laboratory but not analyzed due to problems with samples (e.g., broken bottles, insufficient quantity, insufficient preservation), samples that were collected and sent but never received by the laboratory, and rejected data. If these criteria are not achieved, the dataset will be assessed for potential impacts on meeting site characterization objectives.

The qualitative criterion for evaluation of measurement system performance is that sufficient data of the appropriate quality have been generated to satisfy the data needs identified in the DQOs. An evaluation of this qualitative criterion will be presented in the CADD.

6.2.7 Comparability

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another (EPA, 1987). To ensure comparability, all samples will be subjected to the same sampling, handling, preparation, analysis, reporting, and validation criteria. Approved standard methods and procedures will also be used to analyze and report the data (e.g., Contract Laboratory Program [CLP] and/or CLP-like data packages). This approach ensures that the data from this project can be compared to regulatory action levels. An evaluation of this qualitative criterion will be presented in the CADD.

6.2.8 Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest (EPA, 2001). The evaluation criteria for this parameter will be that measurement sensitivity (detection limits) will be less than or equal to the corresponding PALs. If this criterion is not achieved, the affected data will be assessed for usability and potential impacts on meeting site characterization objectives.

6.2.9 Radiological Survey Quality Assurance

Radiological surveys will be performed and data collected in accordance with approved standard operating procedures.

7.0 Duration and Records Availability

7.1 Duration

After the submittal of the CAIP to NDEP (FFACO milestone has not been established), the following is a tentative schedule of activities (in calendar days):

- Day 0: Preparation for field work will begin.
- Day 120: The field work will commence. Samples will be shipped to meet laboratory holding times.
- Day 200: The field investigation will be completed.
- Day 260: The quality-assured laboratory analytical data will be available for NDEP review.
- The FFACO date for the CADD has not been determined.

7.2 Records Availability

Historic information and documents referenced in this plan are retained in the NNSA/NSO project files in Las Vegas, Nevada, and can be obtained through written request to the NNSA/NSO 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.

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Appendix A.1

Data Quality Objectives

A.1 Seven-Step DQO Process for CAU 528 Investigation

The DQO process described in this appendix is a seven-step strategic planning approach based on the scientific method that is used to plan data collection activities at CAU 528, Polychlorinated Biphenyls Contamination. The DQOs are designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and technically defend the recommended corrective actions (i.e., no further action, closure in place, or clean closure). Existing information about the nature and extent of contamination at the CAS in CAU 528 is insufficient to evaluate and select preferred corrective actions; therefore, a CAI will be conducted.

The CAU 528 investigation will be based on the DQOs presented in this appendix as developed by representatives of the NDEP and the NNSA/NSO. The seven steps of the DQO process developed for CAU 528 and presented in [Sections A.1.2](#) through [A.1.8](#) were developed based on the CAS-specific information presented in [Section A.1.1](#) and in accordance with *EPA Guidance for Quality Assurance Project Plans EPA QA/G-5* (EPA, 2002a). This document identifies and references the associated EPA Quality System Document for DQOs entitled *Data Quality Objectives for Hazardous Waste Site investigation EPA QA/G-4HW* (EPA, 2000), upon which the DQO process presented herein is based.

A.1.1 CAS-Specific Information

Corrective Action Unit 528 consists of one CAS, CAS 25-27-03, Polychlorinated Biphenyls Contamination, located in an area adjacent to TCC in Area 25 of the NTS as shown in [Figure A.1-1](#). Various nuclear reactor tests were conducted at TCC between 1959 and 1973. Although nuclear rocket engine testing ceased in 1973, various experiments and activities were conducted at TCC until 1977 when the facility was “mothballed.” The following presents a summary of the history of the CAS.

Physical Setting and Operational History - Corrective Action Unit 528 was created to address a release of PCBs first identified during the CAI of CAU 262. Analytical results for soil collected during the CAI for CAU 262, CAS 25-04-07, PCBs were detected above the minimum reporting limits, and at some locations above the PALs, in surface soil samples collected from overburden at the TCC Building 3210 sanitary leachfield. This leachfield is located on the west edge of TCC. The

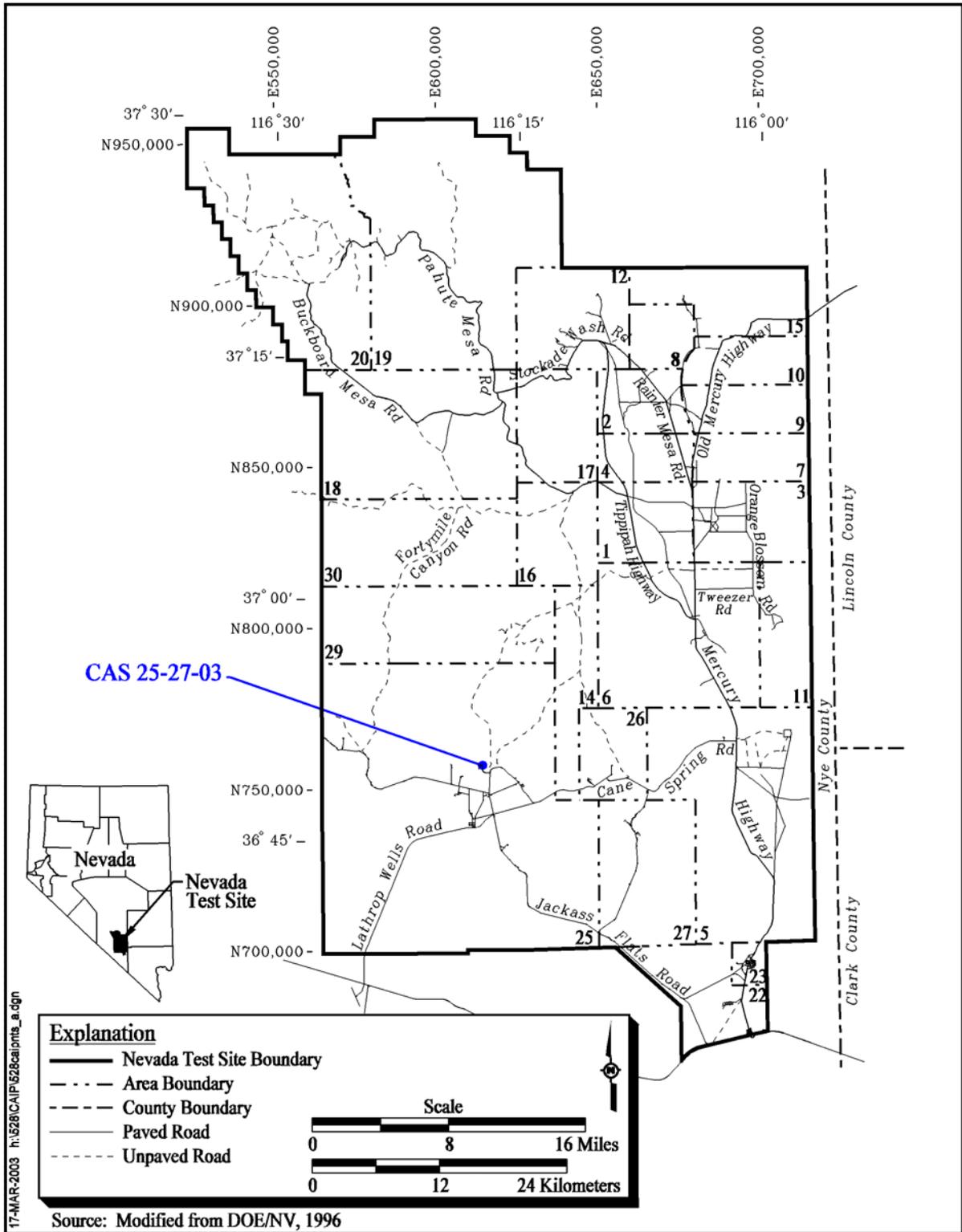


Figure A.1-1
CAU 528, CAS 25-27-03 Location Map

PCB contamination was not attributed to the septic system (DOE/NV, 2001). CAU 528 and CAS 25-27-03 were created in June 2001 to accommodate the corrective action process for this contamination.

During an August 29, 2002, PA site visit to CAS 25-27-03, Shaw identified two areas of potential environmental concern other than the soils within the CAS: a transformer pad and a small earthen mound located approximately 30 ft north of the transformer pad. Another smaller concrete pad is present near the transformer pad and is surrounded by yellow and orange fencing.

As part of the PA for CAS 25-27-03, Shaw collected surface soil samples in the vicinity of TCC in November and December 2002. Results from this sampling indicated the presence of PCBs throughout the area. Based on this information, CAS 25-27-03 includes Substation #3, where PCB containing transformers installed in 1961 were located, the earthen berm approximately 30 ft north of the transformer pad, and the surface and shallow subsurface soils contiguous to the TCC concrete pad. The CAS 25-27-03 includes the area adjacent to the TCC west to Topopah Wash and the soil within the fenced area of TCC to the north, east, and south. [Figure A.1-2](#) shows the CAS 25-27-03 boundary based on current understanding.

Sources of Potential Contamination - Two potential sources of the PCB contamination have been identified. First, it is known that oil, potentially containing PCBs, was used in the past for dust suppression during construction and operational activities at the NTS. In addition, the use of oil for controlling wind erosion is known to have occurred in association with the remediation efforts conducted as a result of the Kiwi TNT Excursion and the Phoebus 1A reactor accident at TCC (Tinney, 2001). Potential residual PCB soil contamination within Topopah Wash resulting from the Kiwi TNT Excursion and other testing and subsequent remediation activities are being addressed under CAU 529. However, the areas outside the wash but within the fenced boundary of TCC and an area immediately west of TCC outside of the fenced boundary will be addressed during the CAS 25-27-03 investigation.

The second potential source of PCBs in the surface and shallow subsurface soil are the PCB-containing transformers once located on the concrete pad at Substation #3. Engineering drawings show that three 100 kVA, oil filled, self-cooling transformers were installed at Substation #3 1961. Because of their insulating and nonflammable properties, PCBs were widely

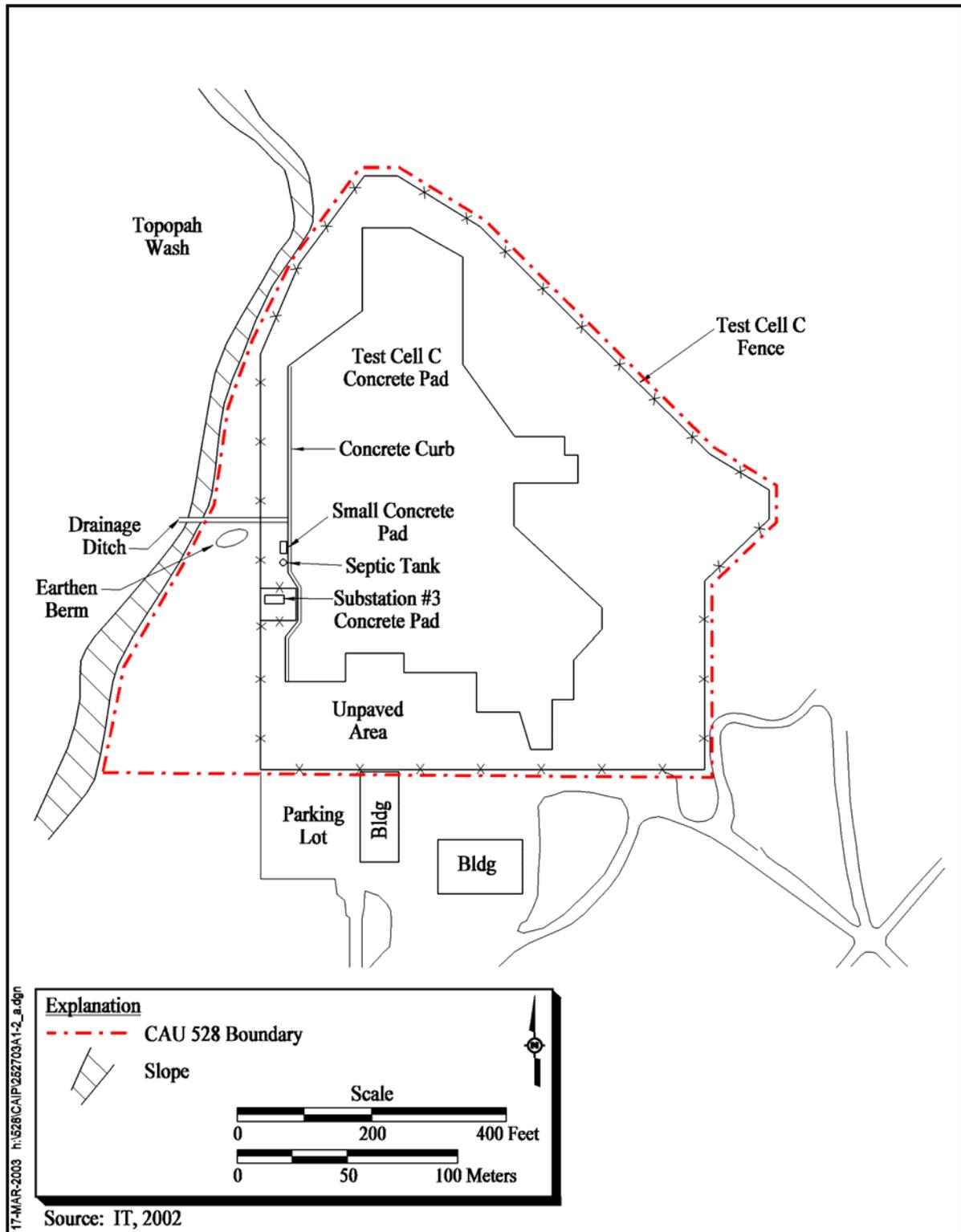


Figure A.1-2
CAU 528, CAS 25-27-03 Boundary

used as coolants in transformers before 1972. It is possible that a leak from, or a catastrophic failure of, one or more of the transformers may have occurred, although no documentation has been identified to confirm this possibility. The transformers have been removed from the pad, but the date of removal is unknown.

Previous Investigation Results - Analytical results for soil collected at CAS 25-04-07 showed PCBs to be present above the minimum reporting limits in soil samples collected from and near the leachfield overburden. Four samples exceeded the minimum reporting limits for Aroclor-1016, between 0 and 2 ft bgs, but none exceeded the PAL of 740 µg/kg. Twenty samples exceeded the minimum reporting limits for Aroclor-1260 between 0 and 6 ft bgs. Of the 20 total samples, 9 surface and 1 subsurface soil sample contained concentrations of Aroclor-1260 that exceeded the PAL. Of these samples, the highest concentration of PCBs (57,000 µg/kg Aroclor-1260) was detected in a surface soil sample near the TCC concrete pad (DOE/NV, 2001).

Soil sampling results for other CAU 262 CASs in the TCC area, indicate that PCB contamination is not widespread and is not consistent with sampling results for CAS 25-04-07. However, it must be noted that most of the soil samples for other CASs in the TCC area were collected from the subsurface. Only one soil sample, TAL09A06, taken at CAU 262, CAS 25-04-06, Septic Systems A and B, had a PCB result that exceeded minimum reporting limits, but the concentration was less than the PAL. This sample contained Aroclor-1254 between 6.25 and 6.75 ft bgs (DOE/NV, 2001).

In support of the November 2002 PA for CAU 528, exploratory surface soil samples were collected in the vicinity of the Substation #3 concrete pad and CAU 262, CAS 25-04-07, on the west side of TCC. The locations are shown in [Figure A.1-3](#). These samples were analyzed for PCBs, TPH-DRO, TPH-GRO, VOCs, SVOCs, pesticides, radionuclides, RCRA metals, and beryllium. The results showed that Aroclor-1260 was present in the soil at concentrations ranging from 460 µg/kg to 13,000 µg/kg. These data show that the PCB contamination extends north, south, and west of the Substation #3 pad along the west side of the TCC concrete pad. The PCB concentrations in all but two of the samples exceeded the PAL. Total lead also was detected at 140 mg/kg at one location. Other metals, radionuclides, m- and p-xylenes, ethylbenzene, and phthalates also were detected at concentrations above the minimum reporting limits in various samples. The radionuclides and metals were present in most of the soil samples, while the VOCs and SVOCs were detected in only three of

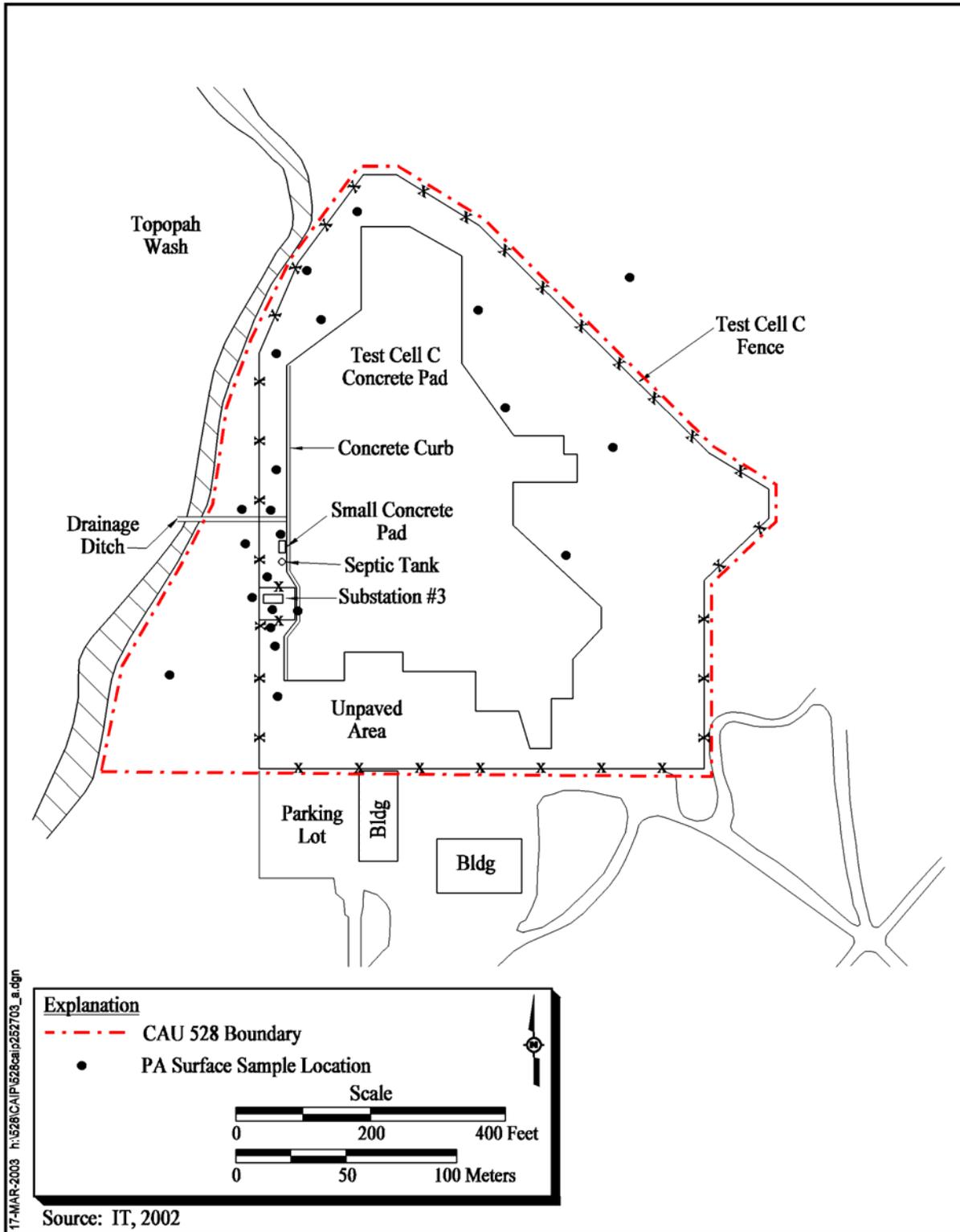


Figure A.1-3
CAU 528, CAS 25-27-03 Preliminary Assessment Surface Soil Sampling Locations

the samples collected north of Substation #3 near the drainage ditch leading from the TCC concrete pad to Topopah Wash. The PCB concentrations adjacent to Substation #3 decrease with distance from the pad; however, concentrations again increase north of the pad adjacent to the previously mentioned drainage ditch leading from TCC to Topopah Wash. This suggests that the PCBs in surface soil are more extensive than originally suspected and probably are not solely associated with the Substation #3 transformer pad.

Because results from the November 2002 sampling indicated PCB contamination was potentially more widespread than initially indicated, additional surface soil samples were collected in December 2002 and also were analyzed for the full suite of parameters mentioned previously. These samples were collected from the unpaved area along the western, northern, and eastern sides of TCC (Figure A.1-3) and were located in areas that showed evidence of stained soil in historical aerial photographs. The data confirmed that PCB contamination is more widespread and extends along the edge of the TCC pad north of the original area of concern, and also in a separate area along the northeast side of the TCC pad. Additional information concerning these sampling events is included in the CAIP.

Potential Contamination - Contaminants suspected of being present at CAS 25-27-03 are PCBs, metals, and TPH. The VOCs and SVOCs also are suspected of being present because the PA sampling identified minor concentrations of these chemicals in the surface soil. The scope of this investigation is to determine the nature and extent of organic and inorganic contamination associated with the dust suppression activities that took place at TCC and the potential release of oil and PCBs from the Substation #3 transformers.

Radiological contamination resulting from the Kiwi TNT Excursion, Phoebus 1A accident, and other testing conducted at TCC is outside of the scope of CAU 528. Enough data on radioactivity have already been obtained at CAS 25-27-03 to satisfy health and safety planning needs. Radiological analysis may be required to support waste management decisions and IDW disposal. However, these radiological data are not intended to guide the identification and delineation of contamination within CAS 25-27-03.

A.1.2 Step 1 – State the Problem

This initial step of the DQO process identifies the planning team members and decisionmakers, describes the problem that has initiated the CAU 536 CAI, and develops the CSM.

A.1.2.1 Planning Team Members

The DQO planning team consists of representatives from NDEP, NNSA/NSO, Shaw, and Bechtel Nevada (BN). The primary decision-makers include NDEP and NNSA/NSO representatives.

Table A.1-1 lists representatives from each organization in attendance at the February 4, 2002, DQO planning meeting.

**Table A.1-1
 DQO Meeting Participants**

Participant	Affiliation
Sabine Curtis	NNSA/NSO
Terrylynn Foley	Shaw
John M. Fowler	Shaw
Orin L. Haworth	BN
Joe Hutchinson	SAIC
Lynn Kidman	Shaw
Barbara Quinn	SAIC
Robert Sobocinski	Shaw
Amber Steed	SAIC
Allison Urbon	BN
Alfred Wickline	SAIC
Jeanne Wightman	Shaw
John Wong	NDEP

BN – Bechtel Nevada
 Shaw – Shaw Environmental, Inc.
 NDEP – Nevada Division of Environmental Protection
 NNSA/NSO – U.S. Department of Energy, National Nuclear Security Administration
 Nevada Site Office
 SAIC – Science Applications International Corporation

A.1.2.2 Describe the Problem

Corrective Action Unit 528 is being investigated because CAS 25-27-03 is located at the inactive and abandoned TCC that may not comply with the requirements of future land use.

The PCBs and related contaminants may be present at CAS 25-27-03 at concentrations that could potentially pose a threat to human health and the environment. The problem statement for CAU 528 is: “Existing information on the nature of other suspected contaminants and extent of PCBs and potential contamination is insufficient to evaluate and recommend corrective action alternatives for CAS 25-27-03.”

A.1.2.3 Develop A Conceptual Site Model

A CSM describes the most probable scenario for current conditions at a CAS and defines the assumptions that are the basis for identifying appropriate sampling strategy and data collection methods. It is the basis for assessing how contaminants could reach receptors both in the present and future by addressing contaminant nature and extent, transport mechanisms and pathways, potential receptors, and potential exposures to those receptors. Accurate CSMs are important because they serve as the starting point for all subsequent inputs and decisions throughout the DQO process. Different CSMs for a single CAS or CAU are not dependent on the types of contaminants suspected, the geographic location, or being part of an engineered system, but rather the release mechanism and potential migration pathways that may influence the sampling strategies. Because the release mechanism and migration pathways are the same for the two potential sources, a single CSM has been developed for CAU 528, CAS 25-27-03.

An important element of a CSM is the expected fate and transport of contaminants, which infer how contaminants move through site media and where they can be expected in the environment. The expected fate and transport is based on distinguishing physical and chemical characteristics of the suspected contaminants and media. The PCBs with a high degree of chlorination (e.g., Aroclor-1248, -1254, and -1260) are resistant to biodegradation and have been shown to degrade very slowly in the environment. Contaminant characteristics include biodegradation potential, solubility, density, and affinity for nonmobile particles (adsorption). Media characteristics include permeability, porosity, hydraulic conductivity, total organic carbon content, and adsorption coefficients. In general,

contaminants with low solubility and high density can be expected to be found relatively close to release points. Contaminants with high solubility and low density are more susceptible to factors that can move them through various media; therefore, can be expected to be found further from release points.

A review of historical documentation and analytical results from CAU 262 and subsequent PA sampling indicate that PCBs are present in the surface and shallow subsurface at concentrations exceeding the PAL. There is no documented evidence of where this contamination originated. A CSM has been developed for CAS 25-27-03 using the historical background information, knowledge from studies at similar sites, and analytical data from the previous sampling efforts. The CSM is based on the two suspected sources of PCB contamination discussed in [Section A.1.1](#): the failure or leaking of transformers at Substation #3, and dust suppression and wind erosion control conducted throughout the TCC area. The two suspected sources are termed transformer release and dust suppression, respectively. The CSM is shown in [Figure A.1-4](#) and discussed in the following paragraphs.

If the Substation #3 transformers leaked or failed, contamination would have been released onto the concrete pad and then flowed onto the adjacent surface soil. Because of the condition of the pad (i.e., good integrity) PCBs and/or petroleum contamination associated with the transformers is not expected beneath the pad. This scenario predicts that if a release occurred as a result of the failure of the transformers, the location most likely to be contaminated would be the soil directly adjacent to the sides of the concrete pad. Contaminants would be expected to migrate away from the release point, primarily downward, and to a lesser degree horizontally. Analytical results from preliminary sampling conducted around and in the area of Substation #3 concrete pad in November 2002 confirmed the presence of PCBs in the surface soil at concentrations that exceed the PALs. However, the concentration gradient either horizontally or vertically is not known. Based on the physical and chemical properties of the PCBs, it is expected that contamination would be somewhat localized at the point of release and decrease with distance from the transformer pad.

Used oil potentially containing PCBs and metals may have been used to suppress dust and control wind erosion during the construction and operation of TCC. Petroleum products containing PCBs may have been sprayed onto the ground surface during discrete events. Reworking of the soil during

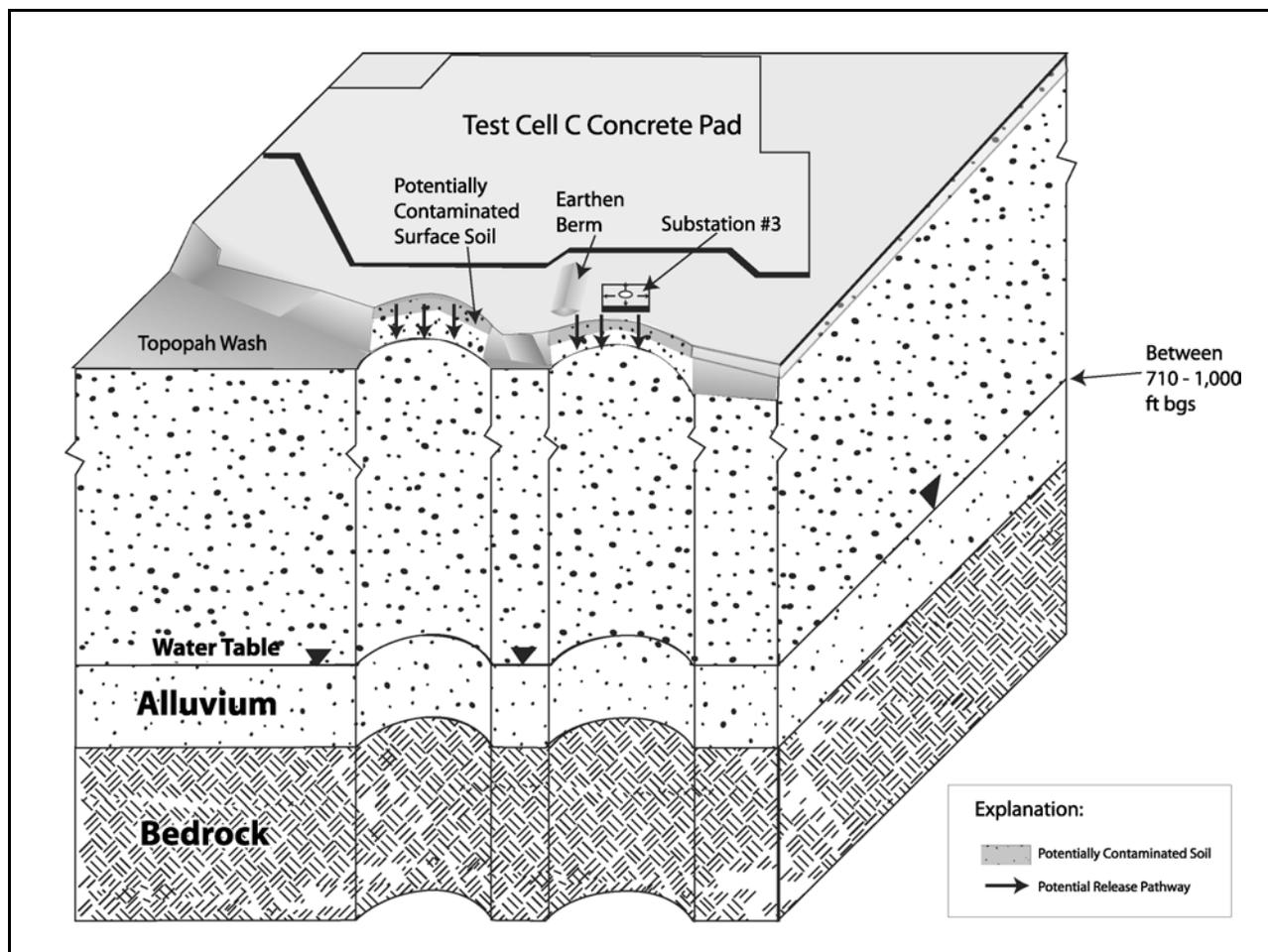


Figure A.1-4
CAU 528 Conceptual Site Model

TCC construction and operations could have physically transported contamination into shallow subsurface soil at some locations. Because the extent and frequency of the dust suppression activities is unknown, the potential contamination may appear to be randomly distributed throughout the site with no obvious source. The analytical results from the PA sampling support the theory that there are sources of PCB contamination other than the transformer release. Therefore, this scenario warrants further consideration. Shallow subsurface PCB contamination may have resulted from downward migration of the contaminated oil or, as discussed above, reworking of surface soils subsequent to the initial release. The CSM predicts that the concentration of contaminants would be highest in the surface soil without an obvious lateral concentration gradient to suggest a release point. However, in both scenarios, shallow subsurface contamination could be caused by the reworking of the surface soil subsequent to the release(s) of contamination.

Based upon the CSM, contamination found at CAS 25-27-03 would result from the failure of the transformers formerly located on a concrete pad at Substation #3 and/or direct application of oil containing PCBs on the surface soil. Insufficient records are available for the suspected source activities to specifically identify chemicals present in the soil. Therefore, COPC information is based upon previous sampling and analysis, limited historical documentation, interviews with current/former site employees, and site visits.

If additional areas or elements are identified during the CAI that go beyond the area or situation identified for investigation in the CSM, the situation will be reviewed and recommendations will be made to revise Step 4 (Define the Study Boundaries) of the DQO process and/or revise the sampling approach. The DQOs will be reviewed and any significant deviation from the planned approach will be presented to the decision makers for approval.

The following discussion of the CSM parameters provide additional details to supplement this model.

Exposure Scenario - The potential for exposure to contamination at the CAU 528 CAS is limited to industrial and construction workers as well as military personnel conducting training (DOE/NV, 1998). These human receptors may be exposed to COPCs through ingestion, inhalation, dermal contact (absorption) from soil and/or debris (e.g., equipment, concrete) due to inadvertent disturbance of these materials. The future land-use scenario limits uses of the CAU to various nonresidential uses (i.e., industrial uses) and include, defense and nondefense research, development, and testing activities ([Table A.1-2](#)).

**Table A.1-2
 Future Land-Use Scenarios for CAS 25-27-03 Within CAU 528**

Land Use Zone	Zone Description
Research, Test, and Experiment Zone	This area is designated for small-scale research and development projects and demonstrations; pilot projects; outdoor tests; and experiments for the development, quality assurance, or reliability of material and equipment under controlled conditions. This zone includes compatible defense and nondefense research, development and testing projects and activities (DOE/NV, 1998).

Affected Media - For the dust suppression scenarios, the potentially affected medium is the surface and shallow subsurface soil throughout the CAS. Because of the unknown procedures employed for dust suppression around TCC, the area potentially affected is unknown. For a release from the transformers, the potentially affected media are the concrete pad, surface and subsurface soil near the Substation #3 pad.

Contamination/Release - Releases to the environment from the suppression of dust during operation or construction activities associated with TCC will be present in the surface or shallow subsurface soil. Under this scenario, the surface soil throughout the CAS would have been the most likely point of release to the environment; therefore, should contain the highest concentrations of the released constituents. Potential contaminant concentrations in the soil beyond the TCC concrete pad could be random with no obvious pattern and may also be found in shallow subsurface soils, if the PCBs and/or petroleum hydrocarbons migrated vertically or if physical mixing occurred during construction or operation activities at TCC. Because dust suppression would have been performed by applying discrete batches of waste oils, and the PCB concentration of individual batches would have varied, it is possible that the PCB contamination may be present in areas where individual batches of waste oil containing PCBs were applied rather than in "hot spots." Review of documentation including Los Alamos Scientific Laboratory (LASL) (1967) indicates that the pad was constructed in sections between 1961 and 1967.

For a transformer release, contaminants would be expected to be present on the substation pad and in the surface and shallow subsurface adjacent to the pad. The highest concentration of PCBs and petroleum hydrocarbons would be expected in the surface soil adjacent to the sides of the concrete pad. Again, physical mixing due to surface activities or vertical migration could distribute the contamination in shallow subsurface soil.

Transport Mechanisms - The degree of contaminant migration at this site is unknown, but it is assumed to be minimal based on the affinity of the PCBs and petroleum hydrocarbons for soil particles, and the low precipitation and high evapotranspiration rates typical of the NTS environment. Runoff could cause lateral migration of contaminants over the ground surface for both release scenarios. Contaminants may also have been transported by infiltration and percolation of precipitation through soil, which would serve as the primary driving force for downward migration.

Mixing of the surface soil as a result of grading or construction activities would also move the PCBs into deeper intervals. The migration of organic constituents (e.g., petroleum hydrocarbons, PCBs) can be controlled to some extent by their affinity for organic material present in soil. However, this mechanism is considered insignificant because of the lack of organic carbon in the desert soil around TCC. Migration of certain inorganic constituents (e.g., metals in waste oil) is controlled by geochemical processes, such as adsorption, ion exchange, and precipitation of solids from solution.

Because of the low volatility of the PCBs and other suspected contaminants, an airborne release subsequent to the initial contaminant release is not considered a significant release pathway. The main process of migration through the air would be through windblown dust. If PCBs, SVOCs, metals, or petroleum hydrocarbons adsorbed to the fine soil particles, a small amount of migration could be expected via the airborne pathway. This process could allow for the deposition of contaminants beyond the site boundaries. For all transport mechanisms, it would be expected that contaminant levels decrease with distance from the point of release.

Preferential Pathways - Preferential pathways for contaminant migration at CAS 25-27-03 are expected not to be present or have only had a minor impact on contaminant migration. The presence of relatively impermeable layers (e.g., caliche layers, concrete pads) modify transport pathways both on the ground surface and in the shallow subsurface. Small gullies, if present, could channelize runoff and increase lateral transport prior to infiltration. Rain may wash PCBs off the concrete pad onto the surrounding soil. Contamination could travel laterally to a small degree under both scenarios. Although the preferential pathways for contaminant migration will be considered in the development of sampling schemes and sampling contingencies discussed in the CAIP, primary consideration will be given to the release and transport mechanisms.

Lateral and Vertical Extent of Contamination - If contamination is present, it is expected to be confined to the surface and shallow subsurface at the site. Concentrations of contamination are expected to decrease with distance (both horizontally and vertically) from the release points. Surface migration may occur as a result of storm events when precipitation rates exceed infiltration (stormwater runoff). However, these events are infrequent. Surface migration is a biasing factor considered in the selection of sampling points. As stated previously, downward contaminant

transport is expected to be limited but is unknown because the quantities of hazardous material released is unknown.

Migration of contamination for the two release scenarios would be expected to be primarily downward, with horizontal migration to a much lesser extent. The lateral extent of contamination, due to dust suppression activities, would be expected to extend over a larger area as a result of the deposition mechanism rather than as a result of lateral migration. Minor amounts of lateral migration may occur due to periodic stormwater runoff. The mixing of the soil at and near the surface also would influence the lateral and vertical extent of contamination.

Groundwater contamination is not considered a likely scenario at CAU 528, due to minimal precipitation, high evapotranspiration, strong attenuation of suspected contaminants in the soil, and significant depths to groundwater. For example, depths to groundwater in Area 25 wells have been recorded between 740 ft bgs at Well J-13 to 1,040.25 ft bgs at well J-11 (USGS, 2002).

A.1.3 Step 2 – Identify the Decision

Step 2 of the DQO process identifies the decisions statements and defines alternative actions. Also presented in this section is the decision logic for the entire process.

A.1.3.1 Develop Decision Statements

The primary problem statement is: Insufficient information is available concerning the nature of suspected contamination other than PCBs and extent of contamination released at CAS 25-27-03 to determine if there is an unacceptable risk to human health and the environment. Because existing information at this CAS is insufficient to resolve the problem statement, the following two decision statements have been established as criteria for determining the adequacy of the data collected during the CAI.

The Decision I statement is: “Is a contaminant other than PCBs present within CAS 25-27-03 at a concentration that could pose an unacceptable risk to human health and the environment?” Any contaminant detected at a concentration exceeding the corresponding PAL, as defined in [Section A.1.4.2](#), will be considered a COC. The presence of a contaminant within this CAS is

defined as the analytical detection of a COC. Samples used to resolve Decision I are identified as Phase I samples.

The Decision II statement is: “If a COC is present, is sufficient information available to evaluate appropriate corrective action alternatives?” Sufficient information is defined as the data needs identified in this DQO process to include the lateral and vertical extent of the PCBs and all COCs within the CAS. Samples used to resolve Decision II are identified as Phase II samples.

A.1.3.2 Alternative Actions to the Decisions

For each decision identified in the previous section there is an alternate decision.

The alternate for Decision I is: If a COC other than PCBs is not present, further assessment of the CAS other than the delineation of the PCBs is not required. If a COC in addition to PCBs is present, resolve Decision II.

The alternate for Decision II is: If the extent of the PCBs and any other COC is defined in both the lateral and vertical direction, further assessment of the CAS is not required. If the extent of a COC is not defined, reevaluate site conditions and collect additional samples.

A.1.4 Step 3 – Identify the Inputs to the Decisions

This step identifies the information needed, determines sources for information, determines the basis for establishing action levels, and identifies sampling and analysis methods that can meet the data requirements. To determine if a COC is present other than PCBs, each sample result is compared to a PAL ([Section A.1.4.2](#)). If any sample result exceeds the PAL, then the CAS is advanced to Decision II (define the lateral and vertical extent) for that parameter. This approach does not use a statistical mean/average for comparison to the PALs, but rather a point-by-point comparison to the established screening criteria to identify COCs.

A.1.4.1 Information Needs and Information Sources

In order to determine if COC other than PCBs is present at CAS 25-27-03, sample data must be collected and analyzed following these two criteria: (1) samples must be collected in areas most

likely to be contaminated, and (2) the analytical suite selected must be sufficient to detect any contamination present in the samples. Biasing factors to support criteria #1 include:

- Previous sample results
- Documented process knowledge on source and location of release
- Field observations
- Potential runoff area from the TCC concrete pad
- Field screening data
- Experience and data from investigations of similar sites
- Professional judgement
- Radiological field screening results

In order to determine the extent of a COC for Decision II, Phase II samples will be collected from locations to bound the lateral and vertical extent. For Phase II sampling, analytical suites will only include those parameters that exceed PALs (i.e., COCs) in prior samples. The data required to satisfy the information needs for Decision II for each COC is a sample concentration that is below the corresponding PAL. Step-out locations will be selected based on the CSM, biasing factors, FSRs, and Phase I analytical results. When analytical results or other biasing factors suggest that the COC concentrations, at the step-out location(s), may still exceed the PAL, then an additional step-out distance may be used to define the lateral extent of contamination. If a location where the PAL is exceeded is surrounded by clean locations, then lateral step-outs may not be necessary. In that case, sampling may consist only of sampling from deeper intervals at or near the original location to determine the vertical extent of contamination. Vertical extent samples will be collected from depth intervals that will meet DQO objectives and in a manner that will conserve resources during possible remediation. Biasing factors to support these information needs may include the factors previously listed and Phase I analytical results. Sampling locations may be moved due to access problems, underground utilities, or safety issues; however, the modified locations must meet the decision requirements and criteria necessary to fulfill the information needs.

[Table A.1-3](#) lists the information needs, the source of information for each need, and the proposed methods to collect the data needed to resolve Decisions I and II. The last column addresses the QA/QC data type and associated metric. The data type is determined by the intended use of the resulting data in decision making.

Table A.1-3
Information Needs to Resolve Decisions I and II
(Page 1 of 3)

Information Need	Information Source	Collection Method	Biasing Factors to Consider	Data Type/Metric
Decision I (Phase I): Determine if a COC is present.				
Criteria I: Samples must be collected in areas most likely to contain a COC.				
Source and location of release points	Process knowledge, historical documentation, and previous investigations of similar sites	Information documented in CSM and public reports – no additional data needed	None	Qualitative – CSM has not been shown to be inaccurate
	Field observations	Conduct site visits and document field observations	Visible evidence of contamination, topographic lows, gullies	Qualitative – CSM has not been shown to be inaccurate
	Aerial photographs	Review and interpret aerial photographs	Disturbed areas, visible evidence of contamination, location of possible sources	Semiquantitative - Sampling based on biasing criteria stipulated in DQO Step 3
	Field screening	Review and interpret FSRs	Bias sample locations/ intervals based on elevated FSRs	Semiquantitative - Sampling based on biasing criteria stipulated in DQO Step 3
	Existing analytical data	Review and interpret sampling results	Bias sample locations based on previous results	Semiquantitative - Sampling based on biasing criteria stipulated in DQO Step 3
Nature of contamination	Biased samples	Collect samples from locations/depths based on biasing factors	Send samples for quick-turnaround analysis to laboratory	Quantitative - Sampling based on quick-turnaround analytical results
	Biased samples	Collect samples from additional locations near CAS features	Worst-case locations such as edge of pad	Quantitative - Sampling based on CAS features

Table A.1-3
Information Needs to Resolve Decisions I and II
(Page 2 of 3)

Information Need	Information Source	Collection Method	Biasing Factors to Consider	Data Type/Metric
Decision I (Phase I): Determine if a COC is present.				
Criteria 2: Analyses must be sufficient to detect any COCs in samples.				
Identification of all potential contaminants	Process knowledge and previous investigations of similar sites; use analytical suite in Table A.1-4 .	Information documented in CSM and public reports – no additional data needed; comprehensive analytical suite developed to account for uncertainty.	None	Qualitative – CSM has not been shown to be inaccurate
Analytical results	Data packages from biased samples	Appropriate sampling techniques and approved analytical methods will be used; MRLs are sufficient to provide quantitative results for comparison to PALs	None	Quantitative - Validated analytical results will be compared to PALs
Decision II (Phase II): Determine the extent of a COC.				
Criteria: Sample collection and analysis methods must be sufficient to bound extent of COC.				
Identification of applicable COCs	Data packages of Phase I samples	Review analytical results and compare to PALs to select COCs	None	Quantitative - Only COCs identified will be analyzed in future sampling events
Extent of Contamination	Field observations	Document field observations	Visible evidence of contamination	Qualitative - CSM has not been shown to be inaccurate
	Field screening	Conduct field screening using appropriate methods	Bias sample locations/ intervals based on FSRs	Semiquantitative - FSRs will be compared to field screening levels
	Step-out samples	Generate locations based on previous sampling results and biasing factors	Locations selected based on the initial sampling results for both horizontal and vertical sampling.	Semiquantitative - Sampling based on previous results and biasing factors
	Data packages of analytical results	Appropriate sampling techniques and approved analytical methods will be used to bound COCs; MRLs are sufficient to provide quantitative results for comparison to PALs	None	Quantitative - Validated analytical results will be compared to PALs to determine COC extent

Table A.1-3
Information Needs to Resolve Decisions I and II
 (Page 3 of 3)

Information Need	Information Source	Collection Method	Biasing Factors to Consider	Data Type/Metric
Decision: Determine if sufficient information exists to characterize waste. Criteria: Analyses must be sufficient to allow disposal options to be accurately identified and estimated.				
Analytical results	Data packages of analytical results; Use analytical suite in Table A.1-4 ; Require TCLP if results are >20X TCLP limits or if PCB contamination exceeds 50 ppm	Appropriate sampling techniques and approved analytical methods will be used; MRLs and minimum detectable activities are sufficient to provide quantitative results for comparison to disposal requirements	Sufficient material must be available for analysis	Quantitative – Validated analytical results will be compared to disposal criteria

Data types are discussed in the following text. All data to be collected are classified into one of three measurement quality categories: quantitative, semiquantitative, and qualitative. The categories for measurement quality are defined below.

Quantitative Data

Quantitative data measure the quantity or amount of a characteristic or component within the population of interest. These data require the highest level of QA/QC in collection and measurement systems because the intended use of the data is to resolve primary decisions (i.e., Decision I or Decision II) and/or verifying closure standards have been met. Laboratory analytical data are generally considered quantitative.

Semiquantitative Data

Semiquantitative data indirectly measure the quantity or amount of a characteristic or component. Inferences are drawn about the quantity or amount of a characteristic or component because a correlation has been shown to exist between the indirect measurement and the results from a quantitative measurement. The QA/QC requirements on semiquantitative collection and measurement systems are high but not as rigorous as a quantitative measurement system. Semiquantitative data contribute to decision making but are not used alone to resolve primary

decisions. Field-screening data are generally considered semiquantitative. The data are often used to guide investigations toward quantitative data collection.

Qualitative Data

Qualitative data identify or describe the characteristics or components of the population of interest. The QA/QC requirements are the least rigorous for data collection methods and measurement systems. The intended use of the data is for information purposes, to refine conceptual models, and guide investigations rather than resolve primary decisions. This measurement of quality is typically assigned to historical information and data where QA/QC may be highly variable or not known. Professional judgement is often used to generate qualitative data.

Metrics provide a tool to determine if the collected data support decision making as intended. Metrics tend to be numerical for quantitative and semiquantitative data, and descriptive for qualitative data.

A.1.4.2 Determine the Basis for the Preliminary Action Levels

Industrial site and construction/remediation workers and military personnel (i.e., ground troops) may be exposed to contaminants through ingestion, inhalation, external (radiological), or dermal contact (absorption) of soil. Laboratory analytical results for soil will be compared to the following PALs to determine if COCs are present:

- EPA Region 9 Risk-Based PRGs for chemical constituents in industrial soils (EPA, 2002b)
- For detected COPCs without established PRGs, a similar protocol to that used by EPA Region 9 will be used in establishing an action level for those COPCs listed in IRIS (EPA, 2002c)
- Background concentrations for RCRA metals will be used instead of PRGs when natural background exceeds the PRG, as is often the case with arsenic on the NTS. Background is considered the mean plus two times the standard deviation of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (NBMG, 1998; Moore, 1999).
- The TPH action limit of 100 ppm per the NAC 445A.2272 (NAC, 2002)

As discussed in [Section A.1.1](#), the presence or extent of radiological contamination of soil within CAS 25-27-03 will not be addressed during the CAI.

A.1.4.3 Potential Sampling Techniques and Appropriate Analytical Methods

As discussed in [Section A.1.4.1](#), the collection, measurement, and analytical methods will be selected so the results will be generated for the PCBs as well as all other potential contaminants at CAS 25-27-03. This effort will include field screening, soil sampling and quick-turnaround laboratory analysis to determine the presence of COPCs and extent of identified COCs.

As discussed in [Section A.1.1](#), the extent of radiological contamination of soil within CAS 25-27-03 will not be addressed during the CAI. For CAS 25-27-03, source characterization sampling and analysis are the focus of the DQO process. However, to support the disposal of IDW and potential future cleanup waste management issues, samples submitted for laboratory analysis will also be analyzed for gamma-emitting radionuclides, and based on the results, samples may also undergo strontium-90 and isotopic uranium analysis (see [Table A.1-4](#)). The radiological parameters are not considered COPCs and will not be used to define the extent of PCB, metal, or organic contamination at CAU 528. However, waste characterization sampling and analysis has been included to support the decision-making process for waste management, and to ensure an efficient field program. Specific analyses required for the disposal of IDW are identified in [Section 5.0](#) of the CAIP.

A.1.4.3.1 Field Screening

Field-screening activities may be conducted for the following analytes and/or parameters:

- Alpha and Beta/Gamma Radiation - a handheld radiological survey instrument or method, may be used based on the possibility that radiologically contaminated soil or concrete may be present CAS 25-27-03. If determined appropriate, on-site gamma spectrometry may also be used to screen samples.
- VOCs - a photoionization detector (PID), or an equivalent instrument or method, may be used to conduct headspace analysis because VOCs are a common concern at the NTS and have not been ruled out based upon process knowledge at CAU 528.

Based on the results of previous CAU investigations and common NTS practices, the aforementioned field-screening techniques may be applied during the Phase I and II sampling at CAS 25-27-03. These field-screening techniques will provide semiquantitative data that can be used to guide confirmatory soil sampling activities and waste management decisions.

A.1.4.3.2 Soil Sampling and Measurement Methods

Hand sampling, augering, direct-push, excavation, drilling, or other appropriate sampling methods will be used to collect soil samples. Sample collection and handling activities will only be conducted in accordance with approved procedures. It may be appropriate to use excavation in selected areas to determine if contaminated soil has been covered with clean fill.

A.1.4.3.3 Analytical Program

The analytical program for CAS 25-27-03 shown in [Table A.1-4](#) has been developed based on the suspected-contamination information presented in [Section A.1.1](#).

**Table A.1-4
 Analytical Program for CAU 528**

Analyses^a
Organics
Total Petroleum Hydrocarbons (DRO and GRO)
Polychlorinated Biphenyls (PCBs)
Volatile Organic Compounds (VOCs)
Semivolatile Organic Compounds (SVOCs)
Metals
<i>Resource Conservation and Recovery Act</i> Metals ^b and Beryllium
Radionuclides^c
Gamma Spectrometry ^d
Isotopic Uranium
Strontium-90

^aIf the volume of material is limited, prioritization of the analyses will be necessary.

^bMay also include Toxicity Characteristic Leaching Procedure metals if sample is collected for IDW disposal or future waste management issues

^cRadionuclides will only be analyzed in support of IDW disposal and future waste management issues.

^dAll submitted samples will be analyzed by gamma spectrometry, and selected samples also will be analyzed for strontium-90 and isotopic uranium

DRO = Diesel-Range Organics
 GRO = Gasoline-Range Organics

Radionuclides have been included in the analytical suite for selected samples to support IDW disposal and potential future waste management issues. The radionuclides are not intended to drive the nature and extent determinations under this investigation. The critical COPCs for CAU 528 are TPH and PCBs. Polychlorinated biphenyls are known to be present within the CAS boundaries and TPH has a reasonable probability of being present at CAS 25-27-03 based on process knowledge, experience at other similar CASs, and other historic information. The critical COPCs are given greater importance in the decision-making process relative to noncritical COPCs. For this reason, more stringent performance criteria are specified for critical analyte DQIs ([Section 6.0](#) of the CAIP). Noncritical COPCs are defined as classes of contaminants that include all the analytes reported from the respective analytical methods that have PALs. The noncritical COPCs also aid in reducing the uncertainty concerning the history and potential releases from the CAS and help in the accurate evaluation of potential contamination. If a COPC, either critical or noncritical, is detected in any sample at a concentration above the respective PAL, the COPC will be identified as a COC. During Phase II sampling and analysis, all COCs are considered critical parameters [Sections 3.0](#) and [6.0](#) of the CAIP provide the analytical methods and laboratory requirements (e.g., detection limits, precision, and accuracy) to be followed during this CAI. Sample volumes are laboratory- and method-specific and will be determined in accordance with laboratory requirements. Analytical requirements (e.g., methods, detection limits, precision, and accuracy) are specified in the Industrial Sites QAPP (NNSA/NV, 2002), unless superseded by the CAIP. These requirements will ensure that laboratory analyses are sufficient to detect contamination in samples at concentrations exceeding the MRL. Specific analyses, if any, required for the disposal of IDW are identified in [Section 5.0](#) of the CAIP.

For sampling performed to define the extent of contamination (Decision II) at CAS 25-27-03, samples will be collected and analyzed only for COCs identified in samples collected to resolve Decision I. However, if extent samples are collected prior to nature-of-contamination data becoming available, the extent samples will be analyzed for the full list parameters given in [Table A.1-4](#). For samples collected to define the extent of contamination, critical analytes are the COCs identified during Decision I (Phase I) activities that exceed PALs.

A.1.5 Step 4 - Define the Study Boundaries

The purpose of this step is to define the target population of interest, specify the spatial and temporal features of that population that are pertinent for decision making, determine practical constraints on data collection, and define the scale of decision making relevant to target populations for Decision I and Decision II.

A.1.5.1 Define the Target Population

Decision I target populations represent locations within the CAS that contain COCs, if present. Decision II target populations are areas within the CAS where COC concentrations are less than PALs and are contiguous to areas of COC contamination. The target populations are dependent upon the CSM developed for CAS 25-27-03. These target populations represent locations within the CAS that, when sampled, will provide sufficient data to resolve the primary problem statement ([Section A.1.3.1](#)).

A.1.5.2 Identify the Spatial and Temporal Boundaries

Spatial (geographic) boundaries are defined as the vertical or horizontal boundaries beyond which the CSM and/or the scope of the investigation will require reevaluation. Intrusive sampling activities are not intended to extend into the boundaries of neighboring areas of environmental concern (e.g., other CASs). The horizontal boundaries at CAS 25-27-03 reflect the area of concern (i.e., the suspected lateral extent of surface contamination) where COCs potentially may exist. Although radiological contamination related to the TCC testing activities may be “superimposed” on the CAS 25-27-03 footprint, the contamination will not be investigated by the CAU 528 CAI. As mentioned previously, radiological concerns are related to IDW disposal and future waste management issues. The spatial boundaries for CAS 25-27-03 are listed in [Table A.1-5](#). The horizontal boundaries at CAS 25-27-03 reflect the uncertainty in the locations where CAS-specific contaminants may be present within TCC.

Temporal boundaries are time constraints due to time-related phenomena, such as weather conditions, seasons, activity patterns, etc. Significant temporal constraints due to weather conditions are not expected; however, snow events may affect site activities during winter months. Moist weather may place constraints on sampling and field-screening of contaminated soils because of the attenuating effect of moisture in samples. There are no time constraints on collecting samples.

**Table A.1-5
 Spatial Boundaries for CAU 528, CAS 25-27-03**

Spatial Boundary	
Horizontal	Vertical
A maximum 100-ft buffer around the TCC fencing on the north, east, and south sides of TCC. The edge of Topopah Wash along the western side of TCC	A maximum of 10 ft bgs
A maximum of 50 ft around the concrete pad to include the earthen berm	A maximum of 10 ft bgs

A.1.5.3 Identify Practical Constraints

Nevada Test Site-controlled activities may affect the ability to characterize the CAS, although the TCC is inactive and abandoned. The primary practical constraints to be encountered at CAS 25-27-03 would be the presence of underground utilities. Utility constraints are subject to change as additional information is collected prior to the commencement of investigation activities, and will be appropriately documented. Locations where intrusive activities are planned will be surveyed for utilities prior to field activities in accordance with the SSHASP.

A.1.5.4 Define the Scale of Decision Making

For CAS 25-27-03, the scale of decision making for Decision I is defined as CAS 25-27-03. The scale of decision making for Decision II is defined as the extent of COC contamination originating from CAS 25-27-03.

A.1.6 Step 5 – Develop a Decision Rule

This step integrates outputs from the previous steps, with the inputs developed in this step into a decision rule (“*If..., then...*”) statement. This decision rule describes the conditions under which possible alternative actions would be chosen.

A.1.6.1 Specify the Population Parameter

The population parameter for Phase I data collected from biased sample locations is the maximum observed concentration of each COC within the target population.

The population parameter for Phase II data will be the observed concentration of each unbounded COC in any sample.

A.1.6.2 Choose an Action Level

Action levels are defined as the PALs, which are specified in [Section A.1.4.2](#).

A.1.6.3 Decision Rule

If the concentration of any COPC in a target population exceeds the PAL for a COPC in a Phase I sample, then that COPC is identified as a COC, and the extent of contamination (Phase II) sampling will be conducted. If the Site Supervisor determines that an indicator of contamination is present, then Phase II sampling may be conducted before the results of Phase I sampling are available. If all COPC concentrations are less than the corresponding PALs, then the decision will be no further actions. Based on PA sampling results, the CAI at CAS 25-27-03 will include extent (Phase II) sampling for PCBs during the initial field effort.

If the observed population parameter of any COC in a Phase II sample exceeds the PALs, then additional samples will be collected to complete the Phase II evaluation. If all observed COC population parameters are less than PALs, then the decision will be that the extent of contamination has been defined in the lateral and vertical directions.

If contamination is inconsistent with the CSM or extends beyond the identified spatial boundaries, then work will be suspended and the investigation strategy will be reevaluated. If contamination is consistent with the CSM and is within spatial boundaries, then the decision will be to continue sampling to define extent.

A.1.7 Step 6 – Specify the Tolerable Limits on Decision Errors

The sampling approach for the investigation relies on biased sampling locations; therefore, statistical analysis is not appropriate. Only validated analytical results (quantitative data) will be used to determine if COCs are present (Phase I) or the extent of a COC (Phase II), unless otherwise stated. .

The baseline condition (i.e., null hypothesis) and alternative condition for Phase I are:

- Baseline condition – A COC other than PCBs is present.
- Alternative condition – A COC other than PCBs is not present.

The baseline condition (i.e., null hypothesis) and alternative condition for Phase II are:

- Baseline condition – The extent of a COC including PCBs has not been defined.
- Alternative condition – Extent of a COC including PCBs has been defined.

Decisions and/or criteria have an alpha (false negative) or beta (false positive) error associated with their determination (discussed in the following subsections). Since quantitative data compared to action levels on a point-by-point basis, statistical evaluations of the data such as averages or confidence intervals are not appropriate.

A.1.7.1 False Negative (Rejection) Decision Error

The false negative (rejection of the null hypothesis or alpha error) decision error would mean:

- Deciding that a COC is not present when it actually is (Decision I), or
- Deciding that the extent of a COC has been defined when it actually has not (Decision II).

In both cases, this would result in an increased risk to human health and environment.

For Decision I, a false negative decision error (where the consequences are more severe) is controlled by meeting the following criteria:

- Having a high degree of confidence that the sample locations selected will identify COCs if present anywhere within the CAS
- Having a high degree of confidence that analyses selected (both field screening and confirmatory laboratory) will be sufficient to detect any COCs present in the sampled media and that the detection limits are adequate to ensure an accurate quantification of the COCs.

For Decision II, the false negative decision error is reduced by:

- Having a high degree of confidence that the sample locations selected will identify the extent of COCs
- Having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples
- Having a high degree of confidence that the dataset is of sufficient quality and completeness

To satisfy the first criterion for both decisions, Phase I samples will be collected in areas most likely to be contaminated by PCBs; any other COCs, and Phase II samples will be collected in areas that represent the lateral and vertical extent of COCs including PCBs. The following characteristics are considered during both phases to accomplish the first criterion:

- Source and location of release
- Chemical nature and fate properties
- Physical properties and migration/transport pathways
- Hydrologic drivers

These characteristics were considered during the development of the CSMs. The biasing factors listed in [Table A.1-3](#) and [Section A.1.8.1](#) will be used to further ensure that these criteria are met.

To satisfy the second criterion for Decision I, all samples used to define the nature of contamination will be analyzed for the parameters listed in [Section A.1.4.3.3](#) using analytical methods that are capable of producing quantitative data at concentrations equal to or below PALs (unless stated otherwise in the CAIP). To satisfy the second criterion for Decision II, Phase II samples will be analyzed for those parameters that identified unbounded COCs.

To satisfy the third criterion for Decision II, the entire dataset, as well as individual sample results, will be assessed against the DQIs of precision, accuracy, comparability, completeness, and representativeness defined in the Industrial Sites QAPP (NNSA/NV, 2002). The goal for the completeness DQI is that 100 percent of the critical COC results are valid for every sample. Critical COCs are defined as those contaminants that are known or expected to be present within a CAS ([Section A.1.4.3.3](#)). In addition, sensitivity has been included as a DQI for laboratory analyses. Site-specific DQIs are discussed in more detail in [Section 6.0](#) of the CAIP. Strict adherence to established procedures and QA/QC protocols also protects against false negatives.

A.1.7.2 False Positive Decision Error

The false positive (acceptance of the null hypothesis or beta) decision error would mean:

- Deciding that a COC is present when it actually is not (Decision I)
- Accepting that the extent of a COC has not been defined when it really has (Decision II)

These errors result in increased costs for unnecessary characterization or corrective actions.

The false positive decision error is controlled by protecting against false positive analytical results. False positive results are typically attributed to laboratory and/or sampling/handling errors. Quality assurance (QC) samples such as field blanks, trip blanks, laboratory control samples, and method blanks minimize the risk of a false positive analytical result. Other measures include proper decontamination of sampling equipment and using certified clean sample containers to avoid cross-contamination.

A.1.7.3 Quality Assurance/Quality Control

Field screening equipment will be calibrated and checked in accordance with the manufacturer's instructions or approved.

Quality control samples will be collected as required by the Industrial Site QAPP (NNSA/NV, 2002) and in accordance with established procedures. These procedures apply to both the quick-turnaround and standard analyses. The required QA field samples include:

- Trip blanks (1 per sample cooler containing environmental VOC samples)
- Equipment blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per source lot per sampling event)
- Field duplicates (minimum of 1 per matrix per 20 environmental samples or 1 per CAS if less than 20 collected)
- Field blanks (minimum of 1 per 20 environmental samples, or 1 per CAS if less than 20 collected)
- Matrix spike/matrix spike duplicate (minimum of 1 per matrix per 20 environmental samples or 1 per CAS if less than 20 collected, not required for all radionuclide measurements)

Additional QC samples may be submitted based on site-specific conditions.

A.1.8 Step 7 – Optimize the Design for Obtaining Data

This section presents an overview of the resource-effective strategy planned to obtain the data required to meet the project DQOs developed in previous six steps. [Section A.1.8.1](#) provides general investigation strategy, and [Section A.1.8.2](#) provides the detailed sampling approach to resolve the decision statements for CAU 528. As additional data or information is obtained, this step will be reevaluated and refined, if necessary, to reduce uncertainty and increase the confidence that the nature and extent of contamination is accurately defined.

A.1.8.1 General Investigation Strategy

The initial activities to be conducted will be a visual inspection and photodocumentation of the area of CAS 25-27-03. The visual inspection will provide additional biasing factors for locating soil samples and to identify any potential conditions that may affect sampling and sample locations.

Following visual inspection, approximately 40 surface soil sample (0 to 0.5 ft bgs) locations will be identified and collected for quick-turnaround PCB laboratory analysis. The selection of these locations considers the locations of the previous sampling results where PCBs are known to be present. The PCB quick-turnaround results, along with existing analytical data, will be used to select locations where additional Phase I (Decision I) confirmatory samples may be necessary. Phase I (Decision I) surface and shallow subsurface soil samples will be collected for laboratory analysis of the parameters identified in [Section A.1.4.3.3](#).

Phase II (step-out) sampling locations at CAS 25-27-03 will be selected based on the outer boundary sample locations where a COC is detected in the Phase I confirmatory samples. Phase II locations will also be selected based on pertinent features of the CSM and the other biasing factors. If biasing factors indicate a COC potentially extends beyond planned Phase II sample points, locations may be modified or additional Phase II samples may be collected from incremental step-out locations. Both surface and subsurface soil samples may be collected and analyzed to determine the extent of a COC.

Contaminants determined not to be present in Phase I samples may be eliminated from Phase II analytical suites. In general, samples submitted for off-site analysis will be those that define the

nature (Phase I) and extent (Phase II) of COCs. This effort will apply to the lateral and vertical extent of the COCs.

A.1.8.2 Detailed Investigation Strategy

The initial activities to be conducted will be a visual inspection and photodocumentation of CAS 25-27-03. The visual inspection will focus on identifying evidence of contamination at the Substation #3 concrete pad resulting from a failure or leak from the transformers. The soils surrounding TCC that may have been subjected to dust suppression activities will also be inspected for discoloration or other signs of contamination. The information generated during these initial activities will be used to provide additional biasing factors for the placement of field screening and confirmatory soil samples.

Following visual inspection, surface soil sample locations will be established for quick-turnaround analysis. This effort will use the data from previously collected samples and other biasing factors to identify sampling points along the edge of the TCC concrete pad. Previous analytical data may be used in the decision process if the data meet the quality criteria specified in this DQO process. Additional surface soil sampling points will be established at 25- to 50-ft lateral step-out locations moving away from the TCC pad toward the fence along the northern, eastern, and southern side of the facility. Step-out locations also will be identified moving west from the TCC concrete pad toward the edge of Topopah Wash. No sampling is planned within the wash. To determine the presence of contaminants that may have potentially originated from the Substation #3 concrete pad, surface soil screening points will be located at two 15- to 20-ft intervals from each side of the Substation #3 concrete pad and on and around the earthen berm. [Figure A.1-5](#) shows a generalized sampling plan for CAU 528. It is anticipated that surface soil samples from approximately 40 to 50 locations will be collected for quick-turnaround laboratory PCB analysis; the actual number will depend on the site-specific conditions and the results of the initial group of quick-turnaround analyses.

The following are the biasing factors that currently have been identified for consideration in the selection of the surface soil field-screening sample locations:

- Aerial photograph review and evaluation
- Visual indicators (e.g., staining, topography, areas of preferential surface runoff)
- Existing site-specific analytical data (PA and CAU 262 sampling data)

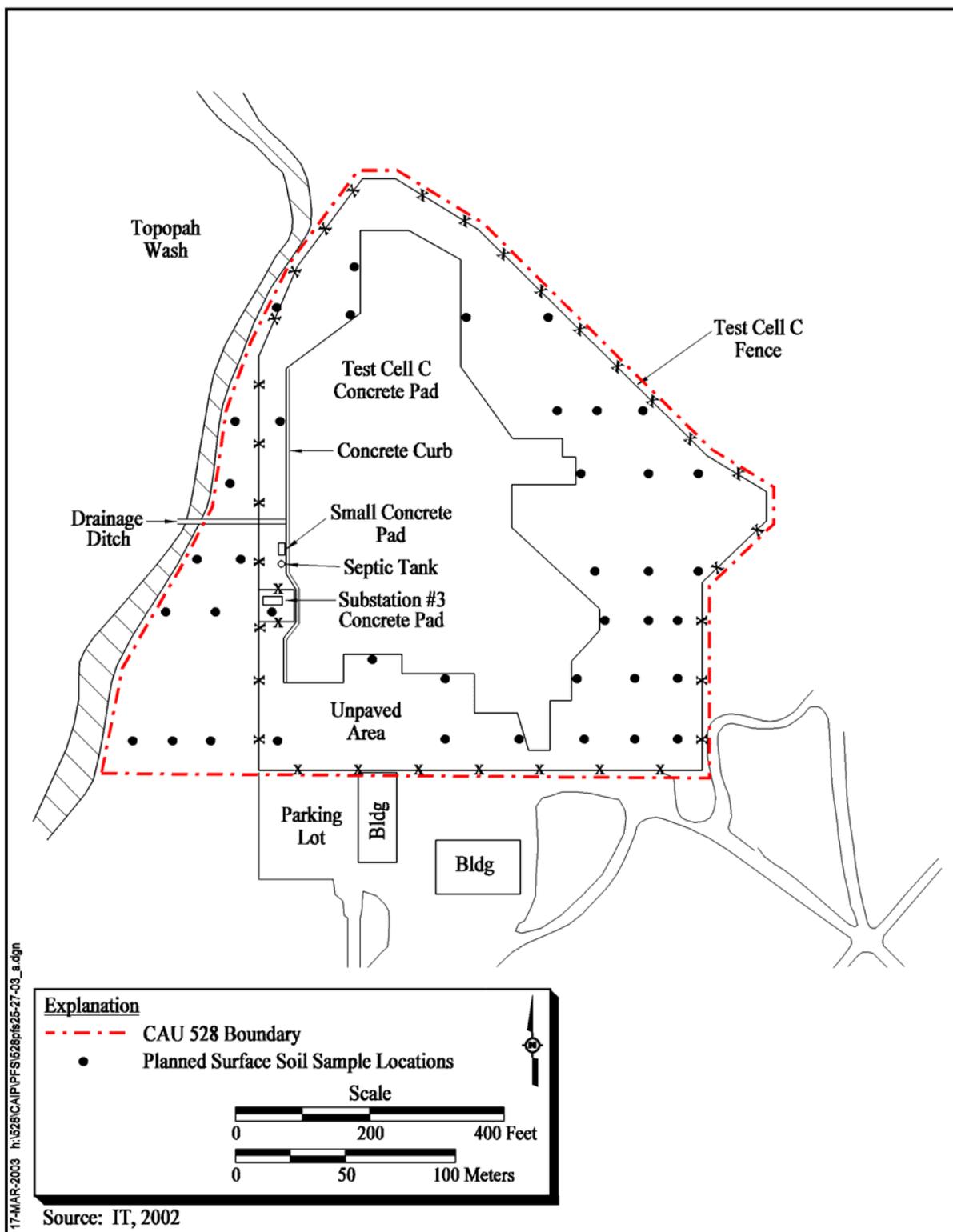


Figure A.1-5
CAU 528, CAS 25-27-03 Potential Surface Soil Sample Locations

- Known or suspected sources and locations of release
- Process knowledge and experience at similar sites
- Information and/or data from adjacent CASs
- Geologic and/or hydrologic conditions
- Physical and chemical characteristics of suspected contaminants

The samples selected for the confirmation of Phase I (approximately 25 percent of total samples submitted for quick-turnaround PCB analysis) will be analyzed for the full suite of analyses presented in [Section A.1.4.3.3](#). Selection of the Phase II (extent) samples will follow the same procedure but are expected to require less quick-turnaround analyses.

These analyses will accurately determine the concentrations of detected PCBs and other COPCs and identify additional COCs. Samples will be submitted to support Decision I (from worst-case locations) and to support Decision II (confirm the horizontal extent of contamination). Data collected during previous sampling events, quick-turnaround results, and the other biasing factors listed above will be used to select locations where the presence of COCs is or is not suspected (Decision I and Decision II, respectively). If necessary, additional surface soil samples will be submitted for laboratory analysis to ensure that the extent of contamination is defined using quantitative data. Lateral step-outs distances will generally be consistent with the 25- to 50-ft spacing discussed above but can be adjusted by the Site Supervisor based on site-specific information obtained during the initial sampling effort.

Where PCBs exceed the PALs in surface soil based on quick-turnaround analyses and previous sampling results, shallow subsurface soil samples will be collected from selected locations to define the vertical extent of contamination. To determine if clean soil has been placed over contaminated subsoil, shallow subsurface soil samples will also be collected from approximately 25 percent of the locations where PCBs were not detected by quick-turnaround or confirmatory analysis in the surface samples.

The sampled depth intervals at subsurface locations will be based on biasing factors such as presence of debris, staining, odor, FSRs, or professional judgement. Test pits may be excavated to further evaluate the potential that clean soil was backfilled over contamination and to assist in the collection of biased subsurface soil samples. For subsurface sampling locations, generally two consecutive soil samples with results below field-screening action levels are required to define the vertical extent of

contamination. Generally, the uppermost “clean” sample from each location will be submitted for laboratory analysis.

At locations where Phase I analytical results show PCB concentrations in soil equal to or greater than 50 ppm, step-out (both vertical and horizontal) samples will be collected during the Phase II sampling to delineate the extent of the potential hot spots. Step-outs from PCB hot spots will continue until the extent of PCB concentrations greater than or equal to 25 ppm is delineated.

Surface soil samples will be collected by hand. Sonic drilling, hollow-stem auger drilling, direct-push, handheld augers, or excavation will be used, as appropriate, to collect subsurface samples. Samples for IDW and waste characterization purposes may also be collected at CAS 25-27-03.

Due to the nature of buried features possibly present (e.g., structures, buried debris, and utilities), sample locations may be relocated, based upon the review of engineering drawings, and information obtained during the site visit. However, the new locations will meet the decision needs and criteria stipulated in [Section A.1.4.1](#).

A.1.9 References

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

EPA, see U.S. Environmental Protection Agency.

IT, see IT Corporation.

IT Corporation. 2002. Project file for CAU 528, CAS 25-27-03, and field forms. Las Vegas, NV.

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NAC, see *Nevada Administrative Code*.

NBMG, see Nevada Bureau of Mines and Geology.

NNSA/NV, see U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office.

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Appendix A.2

Project Organization

A.2 Project Organization

The NNSA/NSO Project Manager is Janet Appenzeller-Wing, and her telephone number is (702) 295-0461. The NNSA/NSO Task Manager for CAU 528 will be identified in the FFACO Biweekly Activity Report prior to the start of field activities.

The names of the project Health and Safety Officer and the Quality Assurance Officer can be found in the appropriate NNSA/NSO plan. However, personnel are subject to change, and it is suggested that the NNSA/NSO Project Manager be contacted for further information.

Appendix A.3

NDEP Response to Comments

NEVADA ENVIRONMENTAL RESTORATION PROJECT DOCUMENT REVIEW SHEET

1. Document Title/Number <u>Draft Corrective Action Investigation Plan for Corrective Action Unit 528: Polychlorinated Biphenyls Contamination, Nevada Test Site, Nevada</u>		2. Document Date <u>March 2003</u>	
3. Revision Number <u>0</u>		4. Originator/Organization <u>Shaw Environmental, Inc.</u>	
5. Responsible DOE/NV ERP Project Mgr. <u>Janet Appenzeller-Wing</u>		6. Date Comments Due <u>April 21, 2003</u>	
7. Review Criteria <u>Full</u>			
8. Reviewer/Organization/Phone No. <u>John Wong, NDEP, 486-2866</u>		9. Reviewer's Signature _____	

10. Comment Number/Location	11. Type ^a	12. Comment	13. Comment Response	14. Accept
1) Section 1.1.2 Page 6		The statement "...closure alternatives will be recommended for each parcel..." needs to be modified; as presented, this investigation consists of one CAS and closure alternatives will be determined by the entire site as a whole. Note: the last sentence in this section also needs modification.	The referenced sentence has been changed to. "Corrective action closure alternatives (i.e., no further action, closure in place, or clean closure) will be recommended for CAS 25-27-03 based on an evaluation of the DQO-required data". The last sentence in the section has been modified to read. "Because PCBs are known to exist in the surface soil within CAU 528 at concentrations exceeding PALs, the no further action alternative is not considered as an acceptable remedial alternative."	Yes
2) Section 3.3 Page 38		Specify the PALs (EPA Region IX PRG) for each Aroclor compound in Table 3-2.	The PAL for all the Aroclors, except 1016, is 740 µg/kg. The PAL for Aroclor 1016 is 2.1 mg/kg. This information has been included on page 38 of 77 in Section 3.3 under the first bullet.	Yes
3) Section 5.2.2 Management of Soil Page 58		Modify the last sentence; soil determined to be hazardous will be subject to RCRA and associated storage time requirements.	The sentence has been modified to read, "containerized soil determined to be hazardous will be subject to RCRA and associated storage time requirements."	Yes
4) Section 5.2.2 Management of Debris Page 58		Modify the last sentence; debris identified as being hazardous will be subject to RCRA and associated storage time requirements.	The sentence has been modified to read, "debris determined to be hazardous will be subject to RCRA and associated storage time requirements."	Yes

^aComment Types: M=Mandatory, S=Suggested.

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