ERRATA SHEET

The Following Corrections and Clarifications Apply to: Streamlined Approach for Environmental Restoration (SAFER) Plan for Corrective Action Unit 540: Spill Sites, Nevada Test Site, Nevada.

DOE Document Number: DOE/NV--1093

Revision: 0

Original Document Issuance Date: November 2005

This errata sheet was issued under cover letter from DOE on: December 21, 2005

Figure 3-2, Conceptual Site Model Diagram for CAU 540 on page 32 of 60 should be replaced with the attached new figure.

The fourth bullet under the fourth paragraph on page B-5 of B-29 should state, "Results from a sample collected at CAS 19-25-08 indicated that VOCs, SVOCs, TPH and RCRA metals were not detected above action levels. However, due to matrix interference, the method detection limit for TPH was 2,500 mg/kg which is greater than the action level of 100 mg/kg. Therefore, additional sampling for TPH is required at this site."

The first bullet under the fifth paragraph on page B-5 of B-29 should state, "Petroleum hydrocarbons (e.g., lubricating oils, waste oils, diesel fuel) used in activities directly involving or supporting drilling or mining activities. Diesel fuel is expected to be the primary COPC (TPH-DRO) with the greatest potential for concentrations above action levels based on process knowledge gained from similar investigations of hydrocarbon spills. Other fuels, motor oil, antifreeze, and hydraulic fluids are compounds that may have leaked from equipment and trucks or spilled directly onto the ground."

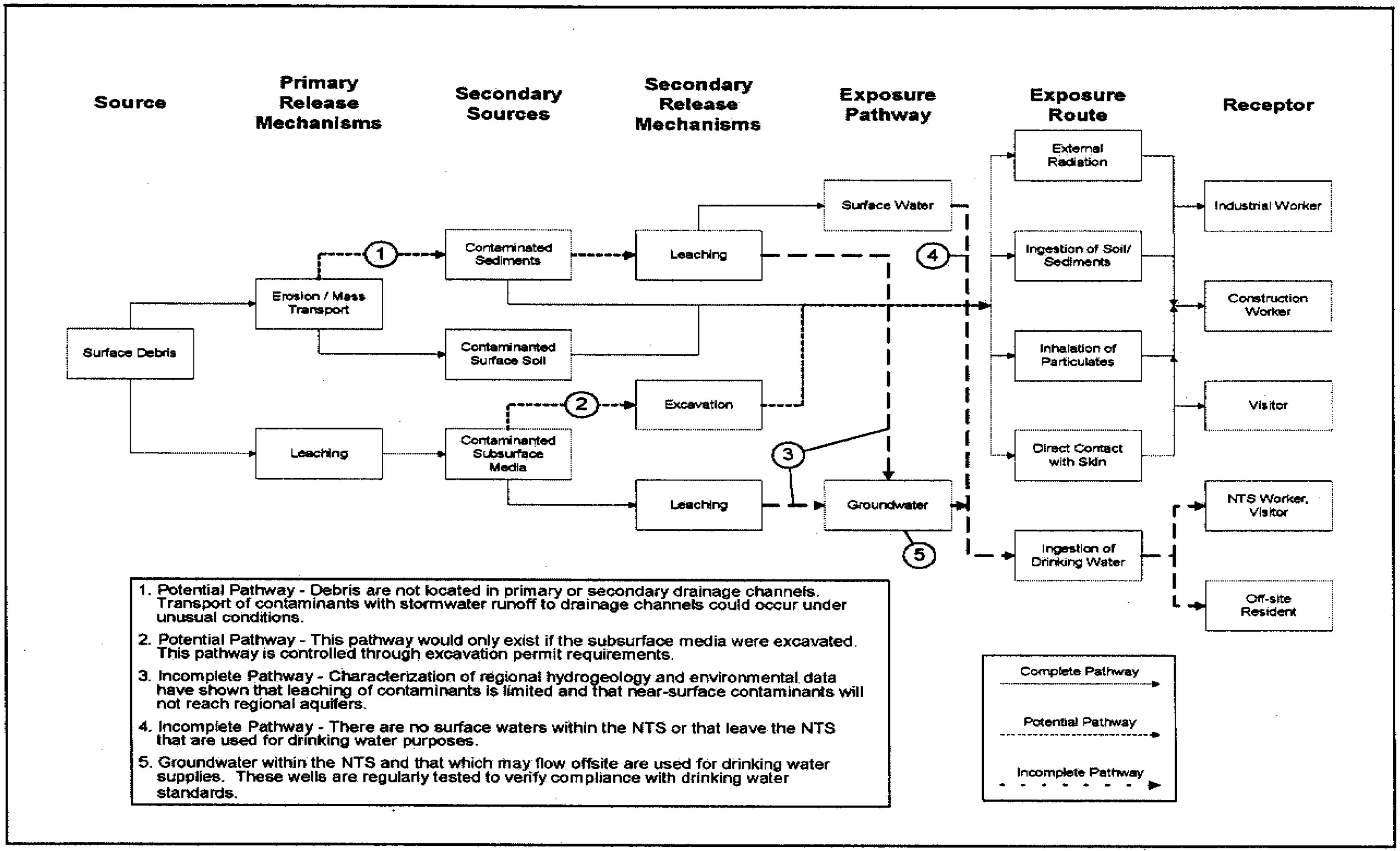

Figure 3-2
Conceptual Site Model Diagram for CAU 540

Nevada
Environmental
Restoration
Project

DOE/NV--1093

Streamlined Approach for Environmental Restoration (SAFER) Plan for Corrective Action Unit 540: Spill Sites
Nevada Test Site, Nevada

Controlled Copy No.: ___
Revision No.: 0

November 2005

Environmental Restoration
Division

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

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STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION (SAFER) PLAN FOR CORRECTIVE ACTION UNIT 540: SPILL SITES NEVADA TEST SITE, NEVADA

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

Controlled Copy No.: ___

Revision No.: 0

November 2005

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STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION (SAFER) PLAN FOR CORRECTIVE ACTION UNIT 540: SPILL SITES NEVADA TEST SITE, NEVADA

Approved by: APPROVED SIGNATURE Date: 11/16/2005

Kevin Cabble, Acting Project Manager
Industrial Sites Project

Approved by: APPROVED SIGNATURE Date: 11/17/2005

Janet Appenzeller-Wing, Acting Division Director
Environmental Restoration Division

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List of Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
bgs	Below ground surface
BN	Bechtel Nevada
CADD	Corrective Action Decision Document
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CFR	*Code of Federal Regulations*
COC	Contaminant of concern
COPC	Contaminant of potential concern
CR	Closure Report
CSM	Conceptual site model
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
EPD	Environmental Protection Division
EQL	Estimated quantitation limit
FAL	Final action level
FFACO	*Federal Facility Agreement and Consent Order*
FSL	Field-screening level
FSR	Field-screening result
ft	Foot
GRO	Gasoline-range organics

List of Acronyms and Abbreviations (Continued)

HWAA	Hazardous waste accumulation area
IDW	Investigation-derived waste
IRIS	*Integrated Risk Information System*
LCS	Laboratory control sample
LLW	Low-level waste
MDC	Minimum detectable concentration
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
mi	Miles
mrem/yr	Millirem per year
MRL	Minimum reporting level
N/A	Not applicable
NAC	*Nevada Administrative Code*
NCRP	National Council on Radiation Protection and Measurement
ND	Normalized difference
NDEP	Nevada Division of Environmental Protection
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NRS	*Nevada Revised Statutes*
NTS	Nevada Test Site
NTSWAC	*Nevada Test Site Waste Acceptance Criteria*
PAL	Preliminary action level
PCB	Polychlorinated biphenyl
pCi/g	Picocuries per gram
pCi/L	Picocuries per liter
POC	Performance objective criteria
PPE	Personal protective equipment

List of Acronyms and Abbreviations *(Continued)*

ppm	Parts per million
PRG	Preliminary remediation goal
QA	Quality assurance
QAPP	*Quality Assurance Project Plan*
QC	Quality control
RadSafe	Radiation Safety
RBCA	Risk-based corrective action
RCRA	*Resource Conservation and Recovery Act*
REECo	Reynolds Electrical & Engineering Co., Inc.
RMA	Radioactive materials area
RPD	Relative percent difference
SAFER	Streamlined Approach for Environmental Restoration
SDWS	*Safe Drinking Water Standards*
SSTL	Site-specific target level
SVOC	Semivolatile organic compounds
TPH	Total petroleum hydrocarbons
TSCA	*Toxic Substances Control Act*
UGTA	Underground Test Area
VOC	Volatile organic compound
%R	Percent recovery

Executive Summary

This Streamlined Approach for Environmental Restoration (SAFER) Plan addresses closure for Corrective Action Unit (CAU) 540, Spill Sites, identified in the *Federal Facility Agreement and Consent Order.* Corrective Action Unit 540 consists of the nine following Corrective Action Sites (CASs) located in Areas 12 and 19 of the Nevada Test Site:

- 12-44-01, ER 12-1, Well Site Release
- 12-99-01, Oil Stained Dirt
- 19-25-02, Oil Spill
- 19-25-04, Oil Spill
- 19-25-05, Oil Spill
- 19-25-06, Oil Spill
- 19-25-07, Oil Spill
- 19-25-08, Oil Spills (3)
- 19-44-03, U-19bf Drill Site Release

This plan provides the methodology for field activities needed to gather the necessary information for closing each CAS. There is sufficient information and process knowledge from historical documentation and investigations of similar sites regarding the expected nature and extent of potential contaminants to recommend closure of CAU 540 using the SAFER process.

The data quality objective process developed for this CAU identified the following expected closure options: (1) investigation and confirmation that no contamination exists above the final action levels (FALs), leading to a no further action declaration; (2) characterization of the nature and extent of contamination, leading to closure in place with use restrictions; or (3) clean closure by remediation and verification. The expected closure options were selected based on available information including contaminants of potential concern (COPC), future land use, and assumed risks. A decision flow process was developed to define an approach necessary to achieve closure. There are two decisions that need to be resolved for closure. Decision I is to conduct an investigation to determine whether COPCs are present in concentrations exceeding the FALs. If COPCs are found to be present above FALs, excavation of the contaminated material will occur with the collection of confirmation samples to ensure removal of contaminants below FALs.

The following text summarizes the types of activities that will support the closure of CAU 540:

- Perform site preparation activities.
- Perform housekeeping activities to remove debris at various CASs, as required.
- Collect environmental samples from biased locations to confirm or disprove the presence of contaminants of concern (i.e., nature of contamination) if these data do not already exist.
- Collect environmental samples from designated target populations (e.g., clean soil adjacent to contaminated soil) and submit for laboratory analyses to define the extent of contamination.
- Determine that no further action is the preferred alternative if no target analytes are detected above FALs.
- Determine whether clean closure is the preferred closure alternative. If clean closure is preferred, the contaminated material will be removed and disposed of as waste, and verification samples will be collected from underlying and adjacent soil.
- Determine whether closure in place is the preferred closure alternative based upon analytical results and the area contaminated. If closure in place is preferred, the appropriate use restrictions will be implemented.
- Confirm the preferred closure option is sufficient to protect human health and the environment, or select an alternative closure option based on validated analytical data, site observations, and professional judgment.
- All closure activities for CAU 540 will be documented in a Closure Report.

Historical information and process knowledge identified sources of potential contamination for the various petroleum hydrocarbon spills/releases. See Table ES.1-1 for a summary of the conceptual site model assumptions and expected closures.

Under the *Federal Facility Agreement and Consent Order*, the SAFER Plan will be submitted to the Nevada Division of Environmental Protection for approval. Field work will be conducted following approval of the plan. On completion of the field activities, a closure report will be prepared and submitted to the Nevada Division of Environmental Protection for review and approval. The Closure Report will contain all necessary documentation to support the selected closure alternatives.

Table ES.1-1
Summary of Conceptual Site Model Assumptions and Expected Closures

Corrective Action Site	Potential Release Mechanisms of COPCs	Conceptual Site Model Assumptions	Expected Closure
12-99-01 - Oil Stained Dirt	Contaminants of potential concern migrating from the current area of contamination	Limited vertical movement of contaminants from the surface to shallow subsurface soils and from the shallow subsurface to deeper subsurface soils	No further action
Oil Spill - 12-44-01, 19-25-02, 19-25-04, 19-25-05, 19-25-06, 19-25-07; Oil Spills (3) - 19-25-08; U-19bf Drill Site Release -19-44-03	Contaminants of potential concern migrating from the current area of contamination	Limited vertical movement of contaminants from the surface to shallow subsurface soils	No further action

1.0 Introduction

This Streamlined Approach for Environmental Restoration (SAFER) Plan addresses the actions necessary for the closure of Corrective Action Unit (CAU) 540, Spill Sites, Nevada Test Site (NTS), Nevada. It 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.

A SAFER may be performed when enough information exists to clearly identify appropriate corrective actions before the completion of the investigation. The purpose of the investigation will be to document and verify the adequacy of existing information; affirm the decision for either no further action, clean closure, or closure in place; and provide sufficient data to implement the corrective action. Uncertainty in defining the nature and extent of contamination and in supporting the selection of the appropriate corrective action must be limited to an acceptable level of risk. The actual corrective action selected will be based on characterization activities implemented under this SAFER Plan. This SAFER Plan identifies decision points developed in cooperation with the Nevada Division of Environmental Protection (NDEP), and where DOE will reach consensus with NDEP before beginning the next phase of work.

Corrective Action Unit 540 is located in Areas 12 and 19 of the NTS, which is approximately 65 miles (mi) northwest of Las Vegas, Nevada (Figure 1-1). Corrective Action Unit 540 is comprised of nine CASs shown in Figure 1-1 and listed below:

- 12-44-01, ER 12-1 Well Site Release
- 12-99-01, Oil Stained Dirt
- 19-25-02, Oil Spill
- 19-25-04, Oil Spill
- 19-25-05, Oil Spill
- 19-25-06, Oil Spill
- 19-25-07, Oil Spill
- 19-25-08, Oil Spills (3)
- 19-44-03, U-19bf Drill Site Release

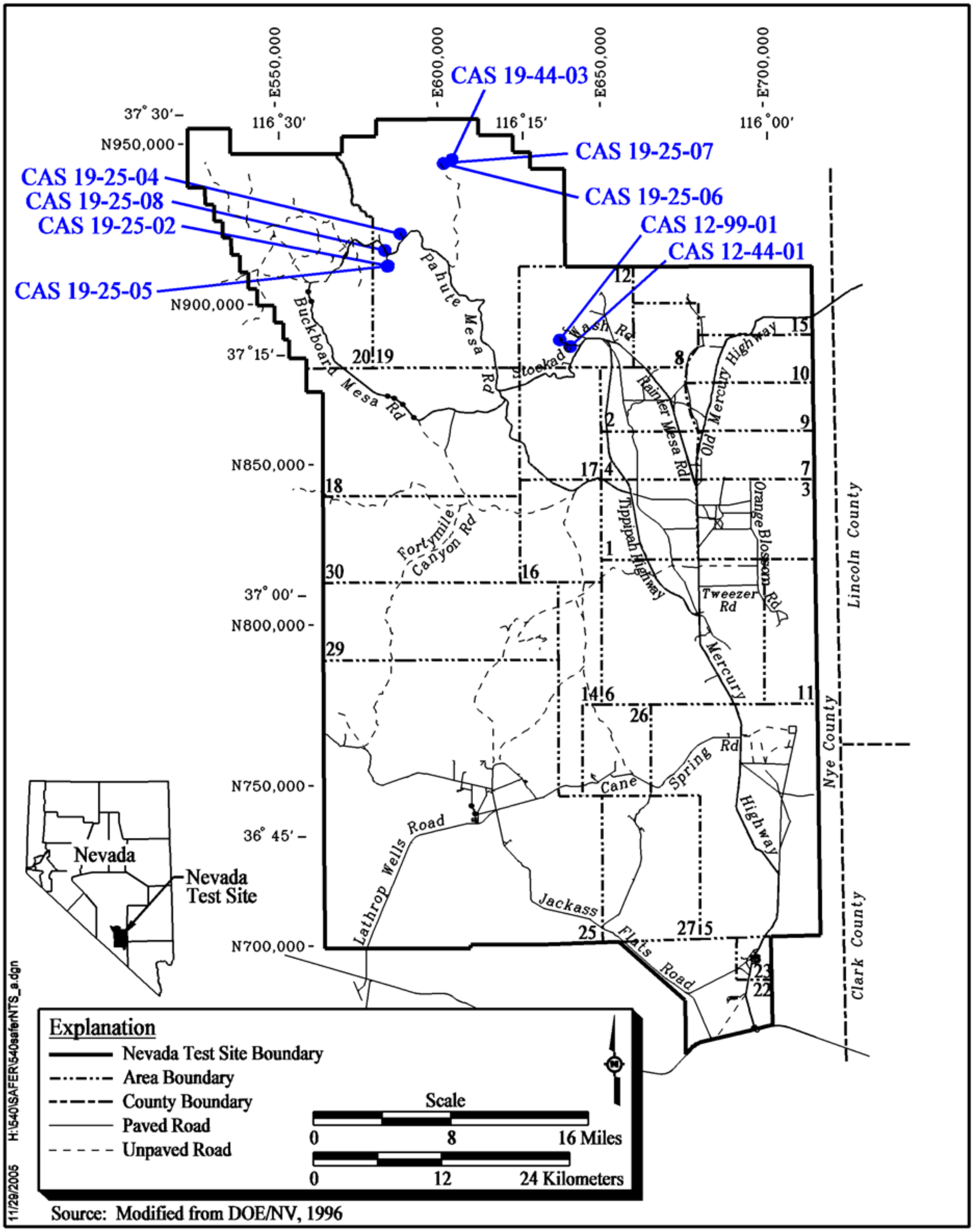

Figure 1-1
Nevada Test Site, Nye County, Nevada

There is sufficient information and process knowledge from historical documentation and investigations of similar sites (i.e., the expected nature and extent of contaminants of potential concern [COPCs]) to recommend closure of CAU 540 using the SAFER process (FFACO, 1996).

1.1 Description

Corrective action units that may be closed using the SAFER process have conceptual corrective actions that are clearly identified. Consequently, corrective action alternatives can be chosen before completing a corrective action investigation, given anticipated results. The CASs in CAU 540 are anticipated to be closed with the designation "no further action," as it is believed that application of the final action level (FAL) approach will result in there being no required activity at these CASs.

The SAFER process combines elements of the data quality objectives (DQOs) process and the observational approach to plan and conduct closure activities. The DQOs are used to identify the problem and define the type and quality of data needed to complete closure of each CAS. The purpose of the investigation phase is to verify the adequacy of existing information and additional information during CAS investigation used to determine the chosen corrective action and to confirm that closure objectives were met.

Use of the SAFER process allows for technical decisions to be made based on incomplete but sufficient information, and the experience of the decision maker. Based on a detailed review of historical documentation, there is sufficient process knowledge to close CAU 540 using the SAFER process. Any uncertainties are addressed by documented assumptions that are verified by sampling and analyses, data evaluation, and on-site observations, as necessary. Closure activities may proceed simultaneously with site investigation as sufficient data are gathered to confirm or disprove the assumptions made during selection of the corrective action. If, at any time during the closure process, new information is discovered that indicates that closure activities should be revised, closure activities will be re-evaluated as appropriate.

1.2 Summary of Corrective Actions and Closures

The decision process for closure of CAU 540 is summarized in Figure 1-2. This process starts with the initial investigation in which the appropriate target population(s) within each CAS (defined in the

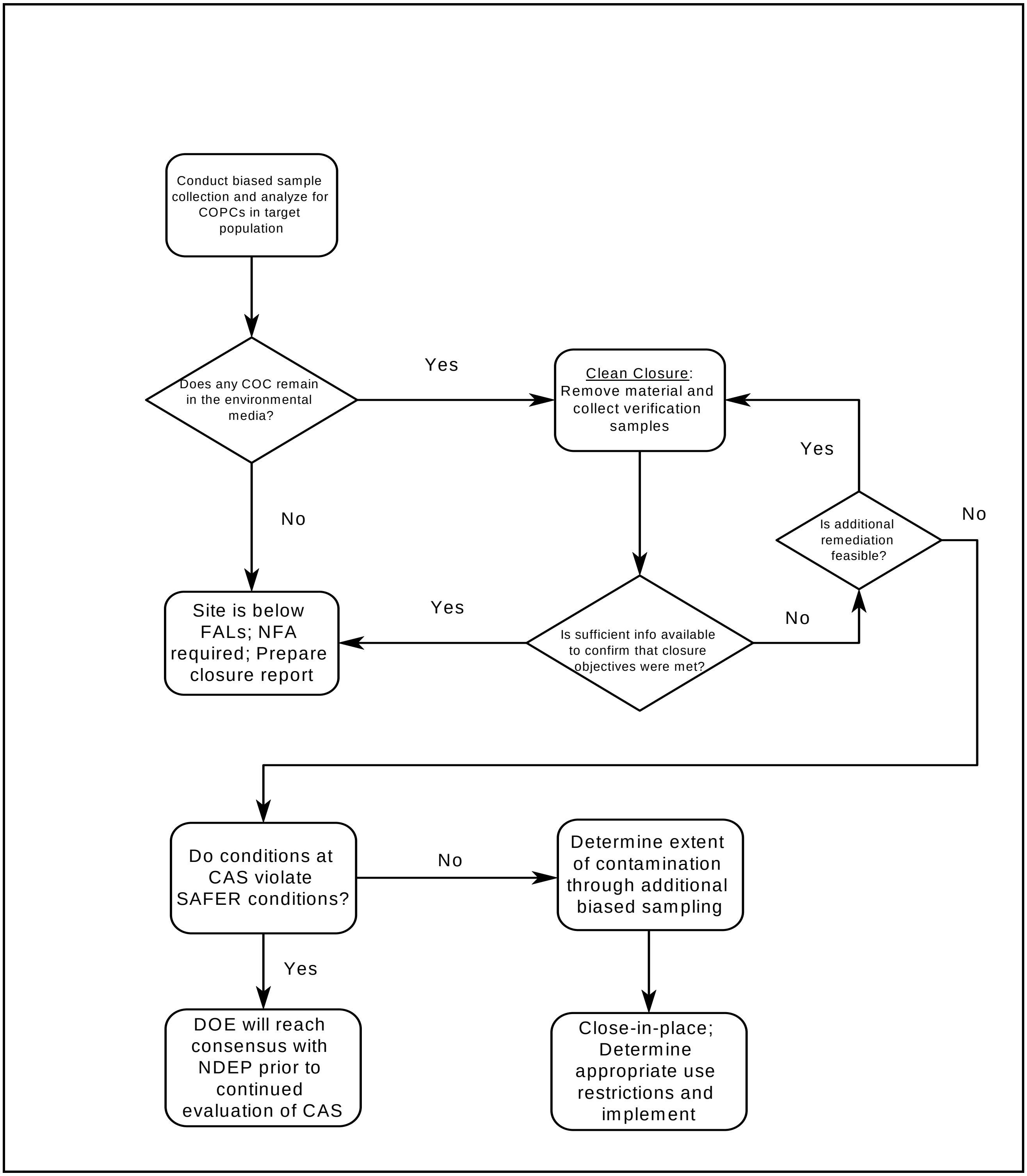

Figure 1-2
CAU 540 SAFER Closure Decision Process

DQO process, Appendix B) is sampled. If contaminants are detected at concentrations that are above the FALs, the nature and extent of contamination has to be delineated. The process continues with additional sampling; however, contingencies are built into the process in the event new information is identified which indicates that the selected, preferred closure option should be revised. The process ends with closure of the site based on laboratory analytical results of the environmental samples and the preparation of a closure report (CR).

Decision points which require a consensus be reached between the DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) and NDEP before continuing are indicated in Figure 1-2.

Work may be temporarily suspended if any of the following unexpected conditions occur:

- Conditions outside the scope of work are encountered.
- Radiological screening yields results that require an upgrade in procedures to continue survey work in specific areas.
- Elevated levels of additional contaminants of concern (COCs) are found that were not originally identified as being present at the sites.
- Unexpected conditions including waste and/or contamination are encountered.
- Out-of-scope work activities are required due to the detection of other COCs that would require re-evaluating a disposal pathway, such as hazardous or low-level waste (LLW).
- Unsafe conditions or work practices posing a threat to personnel, equipment, or the environment, not originally identified in the work authorization documents, are encountered.

2.0 Unit Description

All of the CASs in CAU 540 contain areas of stained soil that are presumably from the release/spill of hydrocarbon-based liquids. Many of the areas of stained soil are believed to have occurred during nearby drilling operations. Some of the spills were reported through appropriate reporting procedures, although the reports lack many specifics, especially the amount of spilled material.

The following sections provide additional site-specific information on the location and description of each CAS.

2.1 CAS 12-44-01, ER 12-1 Well Site Release

This CAS consists of the potential release of contaminants to the site that was the result of a leakage of drill rig lubrication oil on October 10, 1991. The volume of lubrication oil leaked was unknown, as it was discovered at the beginning of the day and presumably had leaked sometime during the previous evening and/or overnight. The oil was reported to have leaked into a drainage ditch and into a water containment pond at the site. The exact location of the spilled oil is unknown. The volume of the spill is also unknown.

A second leak was reported to have consisted of a vegetable-based rock drill oil that covered an area of approximately 50 feet (ft) by 50 ft, with an unknown depth. The stained soil is adjacent to the Groundwater Characterization Project well ER 12-1. The area where the spill occurred has been covered with gravel and leveled. Surface debris over the site includes sandbags, a shovel, 55-gallon drums, tubing, and matting. See Figure 2-1 for a diagram of CAS 12-44-01.

2.1.1 History and Process Knowledge

On October 10, 1991, a report was generated for leaked used rotary chain lubrication oil from a Cardwell 500 Drill Rig, and was assigned the Nevada Division of Environmental Management Case Number 911011B. Well ER 12-1 was part of the system of wells drilled for the NTS Environmental Restoration Program. The well was spudded on July 19, 1991, and was completed on October 10, 1991.

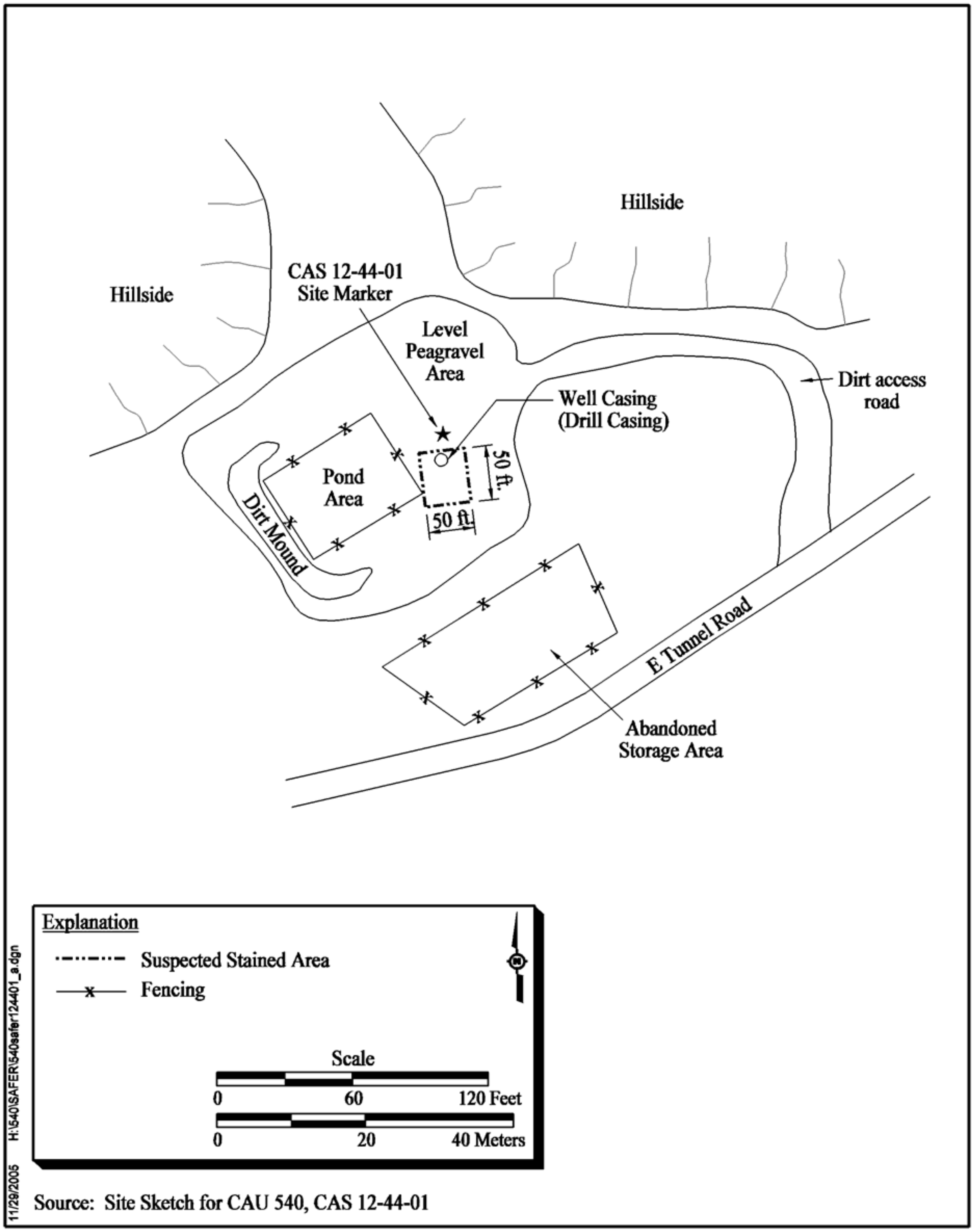

Figure 2-1
CAU 540, CAS 12-44-01, ER 12-1 Well Site Release

The CAS was first identified in the 1991 report entitled, *Nevada Test SIte Inventory of Inactive and Abandoned Facilities and Waste Sites* (REECo, 1991).

2.1.2 Previous Investigation Information

No samples of the affected soil have been obtained. No previous radiological walkover or geophysical walk-over surveys have been conducted.

2.2 CAS 12-99-01, Oil Stained Dirt

This CAS consists of releases associated with two oil-stained concrete pads and an oil-stained concrete trough. Each concrete pad housed a single air compressor. The concrete trough measures 3 ft by 7 ft and is approximately 4 ft deep. The trough's walls and floor contain staining, and piping runs both into and through the trough. The floor of the trough is sand, and it is not known whether there is a non-permeable layer of material beneath the sand. The oil contamination associated with the concrete pads consists of dirt and debris that is located on the pads as well as some staining on the pads themselves, with limited contiguous staining into the soils around the pads. (See Figure 2-2.)

There are two metal tanks adjacent to the concrete pads. These two tanks were placed in FFACO Appendix IV, CAU 5000, in November 2004, indicating they are not considered to be hazardous to personnel or the environment. Therefore, the tanks will not be considered as potential sources of contamination within the footprint of this CAS. A concrete electrical substation pad immediately adjacent to one of the air compressor concrete pads is a potential source of contamination owing to the age of the equipment that would have been used and the operational time period of this CAS. However, no electrical equipment remains within the fenced area. Although staining was not observed in association with the electrical equipment pad, potential contaminants associated with the substation will be considered as potential contaminants within this CAS.

2.2.1 History and Process Knowledge

Corrective Action Site 12-99-01 contains two oil-stained concrete pads that each housed an air compressor used in the generation and transmission of steam, and a concrete trough that contains hydrocarbon-stained sand within its base. The compressors were connected to two large boiler tanks that are currently identified in the FFACO Appendix IV, CAS 5000. These tanks are not a part of this

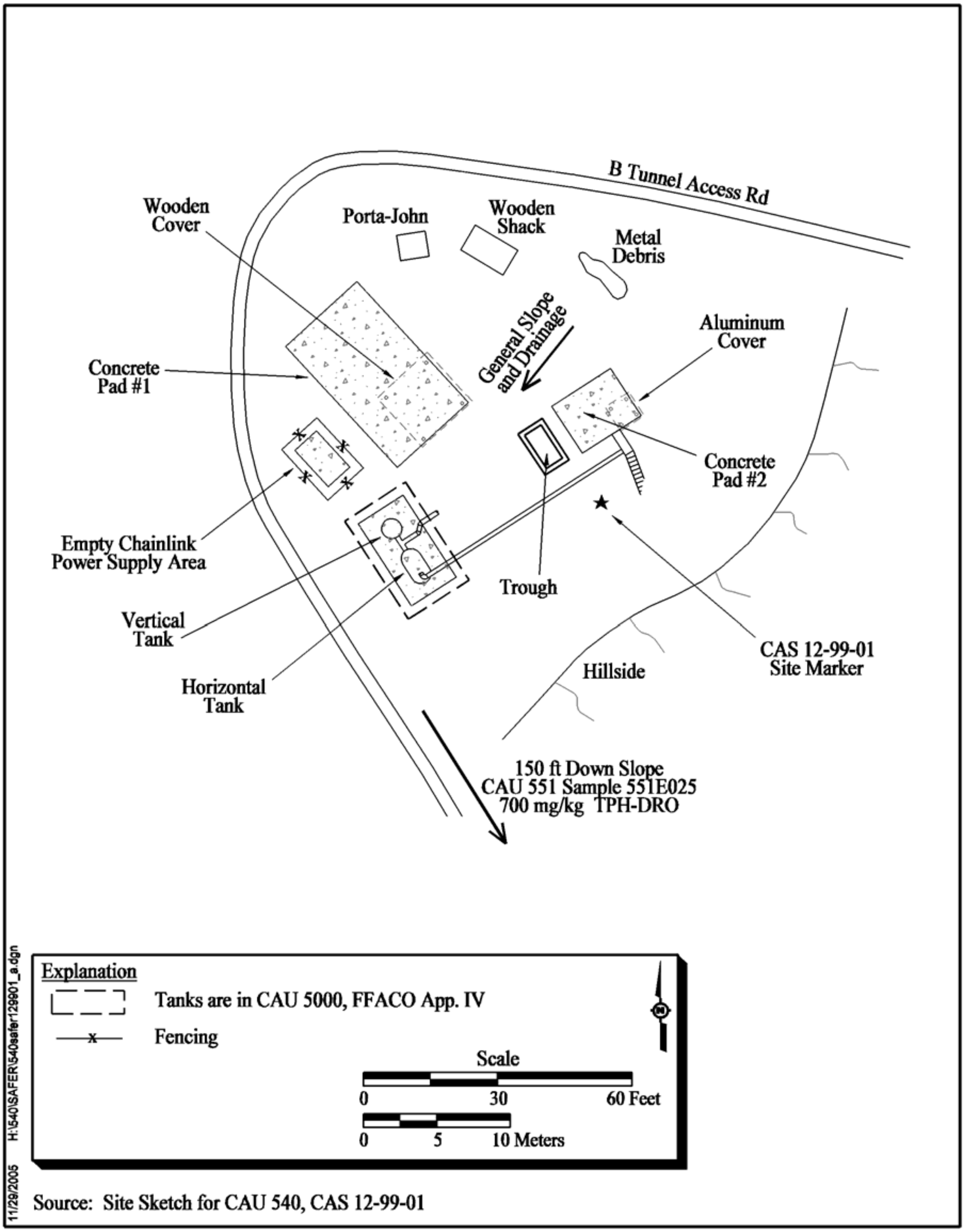

Figure 2-2
CAU 540, CAS 12-99-01, Oil Stained Dirt

CAS. However, a mixture of oil and water from the generation of steam was "blown off" from the tanks to the land downslope (south) from their location. This contamination has the potential to infiltrate the soil within this CAS and migrate downslope (south to southeast) from the CAS in the drainage area along the eastern side of the B-Tunnel access road.

The electrical substation could have leaked fluids that contained polychlorinated biphenyls (PCBs), although the electrical equipment is no longer on site. Contaminants from the substation could have migrated into this CAS, owing to its close proximity.

Oil placed on the B-Tunnel access road for dust suppression may also have contributed to the contamination within this CAS.

Drilling activities at the B- and E-Tunnels began in 1957, and testing ended in 1963 at B-Tunnel and 1977 at E-Tunnel. The site was first identified in the 1991 Reynolds Electrical and Engineering Co., Inc. (REECo) document entitled, *Nevada Test Site Inventory of Inactive and Abandoned Facilities and Waste Sites* (REECo, 1991).

2.2.2 Previous Investigation Information

No samples have been collected from this CAS. One sample was collected from the drainage area that runs south to southeast from this CAS as a part of CAU 551. The sample contained total petroleum hydrocarbons (TPH)-diesel range organics (DRO) at a concentration of 700 milligrams per kilogram (mg/kg).

No radiological walkover or geophysical walk-over surveys have been performed.

2.3 CAS 19-25-02, Oil Spill

The CAS consists of three areas of hydrocarbon-stained soil: a 12-by-20-ft stain and a 14-by-14-ft stain located southwest of U-19av drill hole, as well as a 21-by-16-ft stain southeast of the U-19av drill hole. A site visit on July 6, 2005, failed to identify the locations of the first two stains, and the 21-by-16-ft stain now appears to be approximately 15 by 10 ft. A large, loose piece of metal plate is located within the 15-by-10-ft stained area. (See Figure 2-3.)

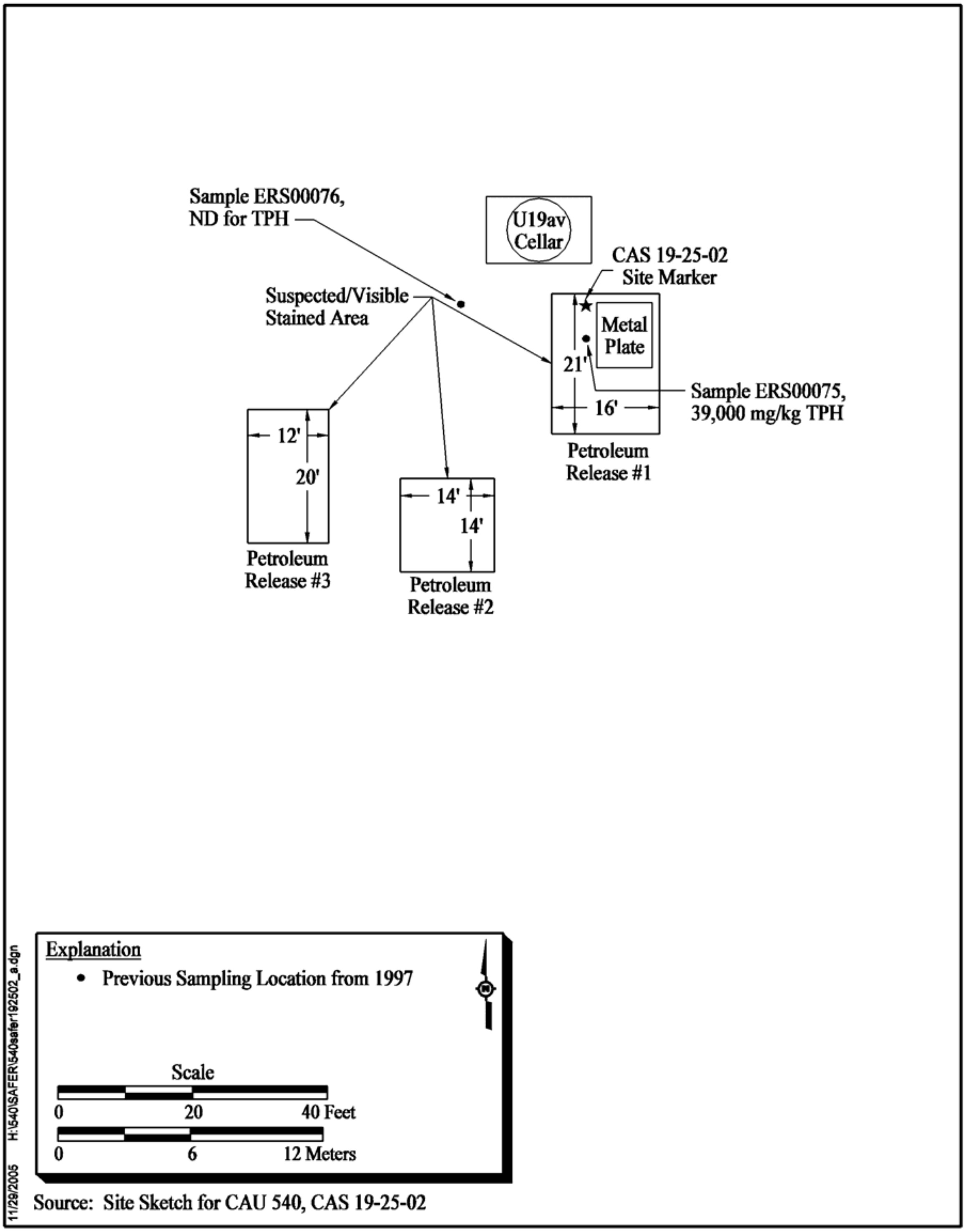

Figure 2-3
CAU 540, CAS 19-25-02, Oil Spill

2.3.1 History and Process Knowledge

The site was first identified in the 1991 REECo document entitled, *Nevada Test Site Inventory of Inactive and Abandoned Facilities and Waste Sites* (REECo, 1991). Although no specific cause for these stains is known, they are believed to associated with drilling activities that occurred at the site.

2.3.2 Previous Investigation Information

On August 26, 1997, two soil samples were collected from different stained areas and analyzed for TPH (gasoline-range organics [GRO], DRO, and waste oil), *Resource Conservation and Recovery Act (*RCRA) metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), PCBs, and radionuclides. Contaminants of concern identified above detection limits but below preliminary action levels (PALs) include VOCs, SVOCs, RCRA metals (e.g., arsenic, barium, chromium, lead), gross beta-emitters, and radionuclides (i.e., lead-212, lead-214, thallium-208). Total petroleum hydrocarbons were detected at a concentration above the PAL (39,000 mg/kg) in sample ERS00075 (Bordelois, 1998a). According to the sample collection log, this sample was collected 6.5 ft due south from the site marker. This would place the sample within the easternmost area of stained soil. Analytical results from sample ERS00076 did not identify any COCs at concentrations exceeding their respective PALs. According to the sample collection log, this sample was collected 17 ft west of the site marker. This, however, does not place the sample location within one of the identified stained areas.

No previous radiological or geophysical walk-over surveys have been performed.

2.4 CAS 19-25-04, Oil Spill

Corrective Action Site 19-25-04, Oil Spill, is located at Radiation Safety (RadSafe) Marker 19P90, approximately 50 ft northeast of the U-19q access road, and approximately 0.4 mi from Pahute Mesa Road. On April 23, 2002, field personnel conducted a site visit and identified two hydrocarbon stains approximately 13 ft and 7 ft in diameter, respectively. Figure 2-4 is a sketch of this CAS.

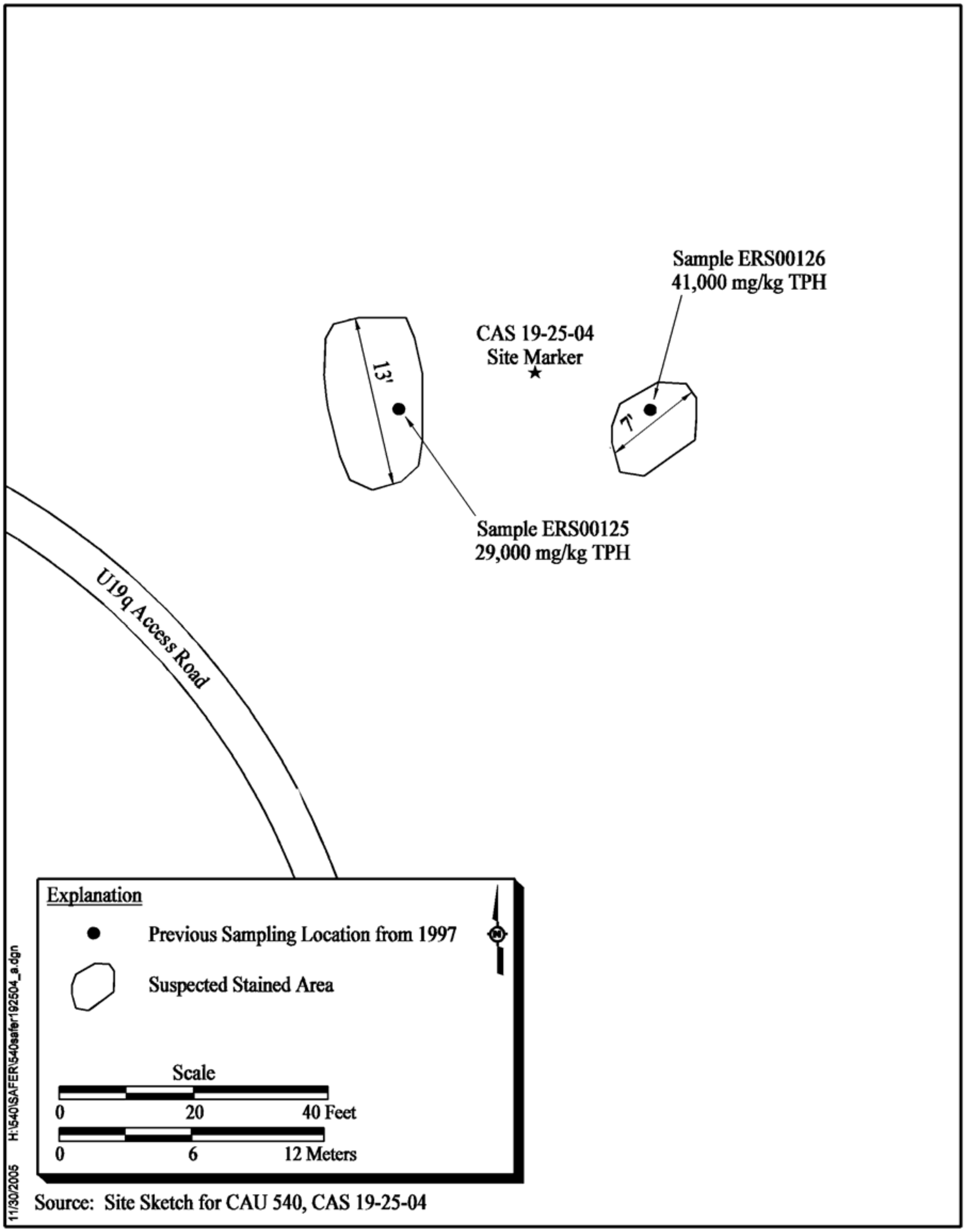

Figure 2-4
CAU 540, CAS 19-25-04, Oil Spill

2.4.1 History and Process Knowledge

This site was first identified in the 1991 REECo document entitled, *Nevada Test Site Inventory of Inactive and Abandoned Facilities and Waste Sites* (REECo, 1991). There is no historical information indicating what activities may have occurred in the area of the CAS. Activities associated with the nearby U-19q drill hole may account for the presence of these stains. The U-19q drill hole is abandoned and inactive. The potential source of the two stains is unknown. No other information regarding activities in this area was found.

2.4.2 Previous Information

A biased soil sample was collected from each of the two stained areas on August 26, 1997. Both samples were analyzed for RCRA metals, VOCs, SVOCs, TPH, PCBs, and radionuclides (Bordelois, 1998b). The detected COCs identified in both samples at concentration levels above detection limits but below PALs included arsenic, barium, chromium, lead, and various radionuclides (i.e., gross beta-emitters) (Bordelois, 1998b; IT, 2002). The two samples had TPH-DRO concentrations of 29,000 mg/kg and 41,000 mg/kg, respectively. These results were obtained from the analytical method specified within the *Industrial Sites Quality Assurance Project Plan* (QAPP) and they underwent the full data review process. All associated quality control (QC) analyses were acceptable within the requirements of the Industrial Sites QAPP (NNSA/NV, 2002a).

No previous radiological or geophysical walk-over surveys were conducted.

2.5 CAS 19-25-05, Oil Spill

Corrective Action Site 19-25-05, Oil Spill, is located approximately 60 yards southwest of U-19av ground zero in Area 19. The CAS consists of three areas of stained soil. The three areas of stained soil are 15, 6, and 5 ft in diameter. The stained soils are located within 15 ft of a mud pit (part of CAU 358). The three stains are darker in color than the surrounding soil and have a hydrocarbon odor. (See Figure 2-5.)

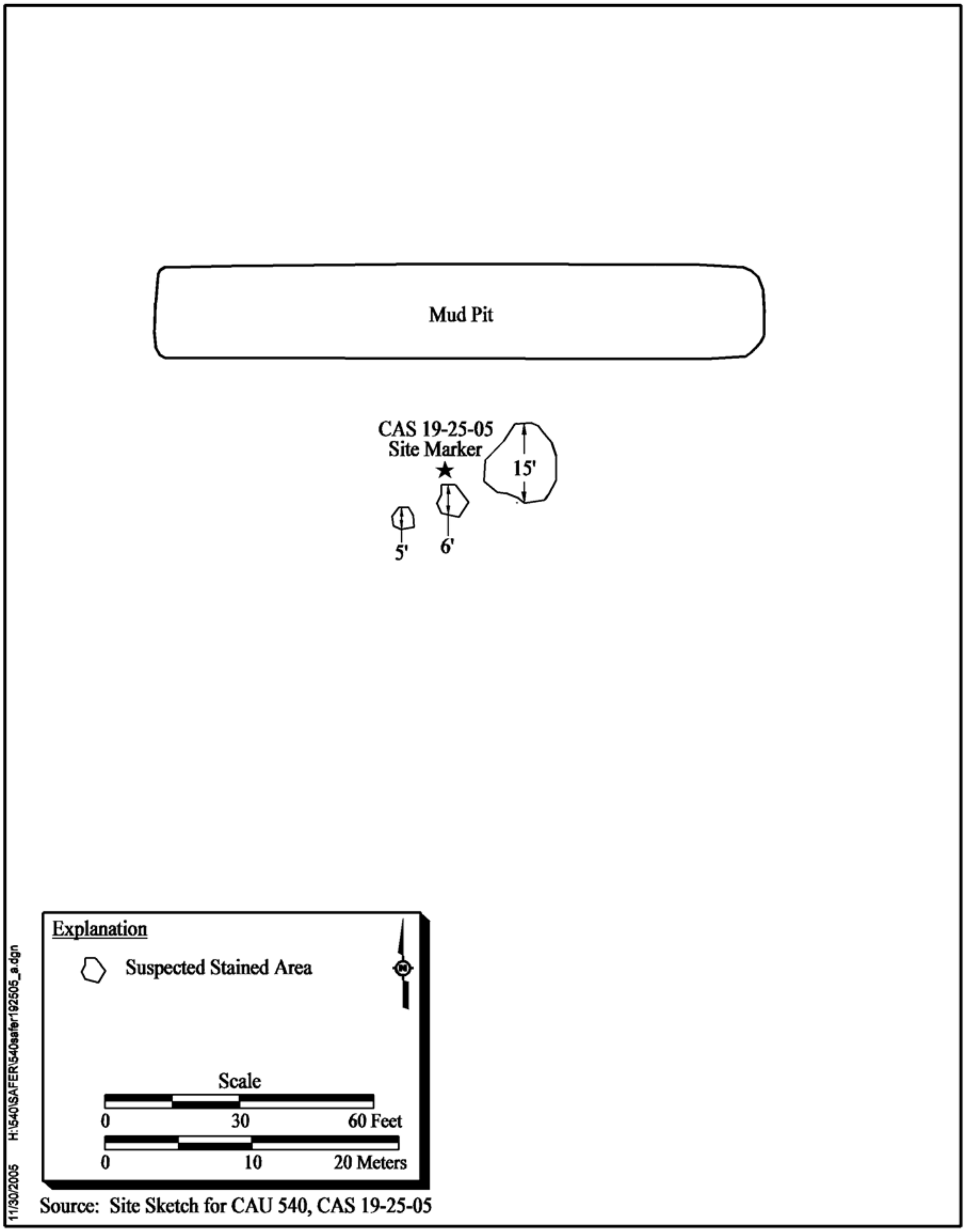

Figure 2-5
CAU 540, CAS 19-25-05, Oil Spill

2.5.1 History and Process Knowledge

The CAS was first identified in the November 19, 1990, REECo Environmental Compliance Inventory Form, which was published in the 1991 *Nevada Test Site Inventory of Inactive and Abandoned Facilities and Waste Sites* report (REECo, 1991).

2.5.2 Previous Information

One soil sample was collected from the CAS on August 26, 1997. It was analyzed for RCRA metals, VOCs, SVOCs, PCBs, TPH, and radiological parameters (Bordelois, 1998c). Several RCRA metals (e.g., arsenic, barium, chromium, and lead) were identified at concentrations above detection limits but all were below PALs. Total petroleum hydrocarbons were reported at a concentration of 50,000 mg/kg; however, the sample collection log indicates that the sample was collected from the eastern end of the mud pit, near the CAS marker. A separate marker exists at this location; however, this is not the area indicated by the site diagram. A site visit on July 19, 2005, identified a marker at the eastern edge of the mud pit, but identified the stains depicted in the site sketch at the CAS marker 19-25-05 on the south side of the mud pit. The sample location described does not coincide with the three stains identified in the sketch of the CAS.

No radiological walkover or geophysical walk-over surveys have been performed.

2.6 CAS 19-25-06, Oil Spill

Corrective Action Site 19-25-06, Oil Spill, is located approximately 12 ft south of the U-19j cellar in Area 19. The site is located in a sparsely vegetated area with uneven ground and various sized rocks on the surface. (See Figure 2-6.)

2.6.1 History and Process Knowledge

The site was first identified during preliminary assessment field activities. On April 23, 2002, field personnel observed a 25-ft-diameter area of suspected hydrocarbon contamination. The staining is believed to be associated with activities occurring around development of the U-19j drill hole.

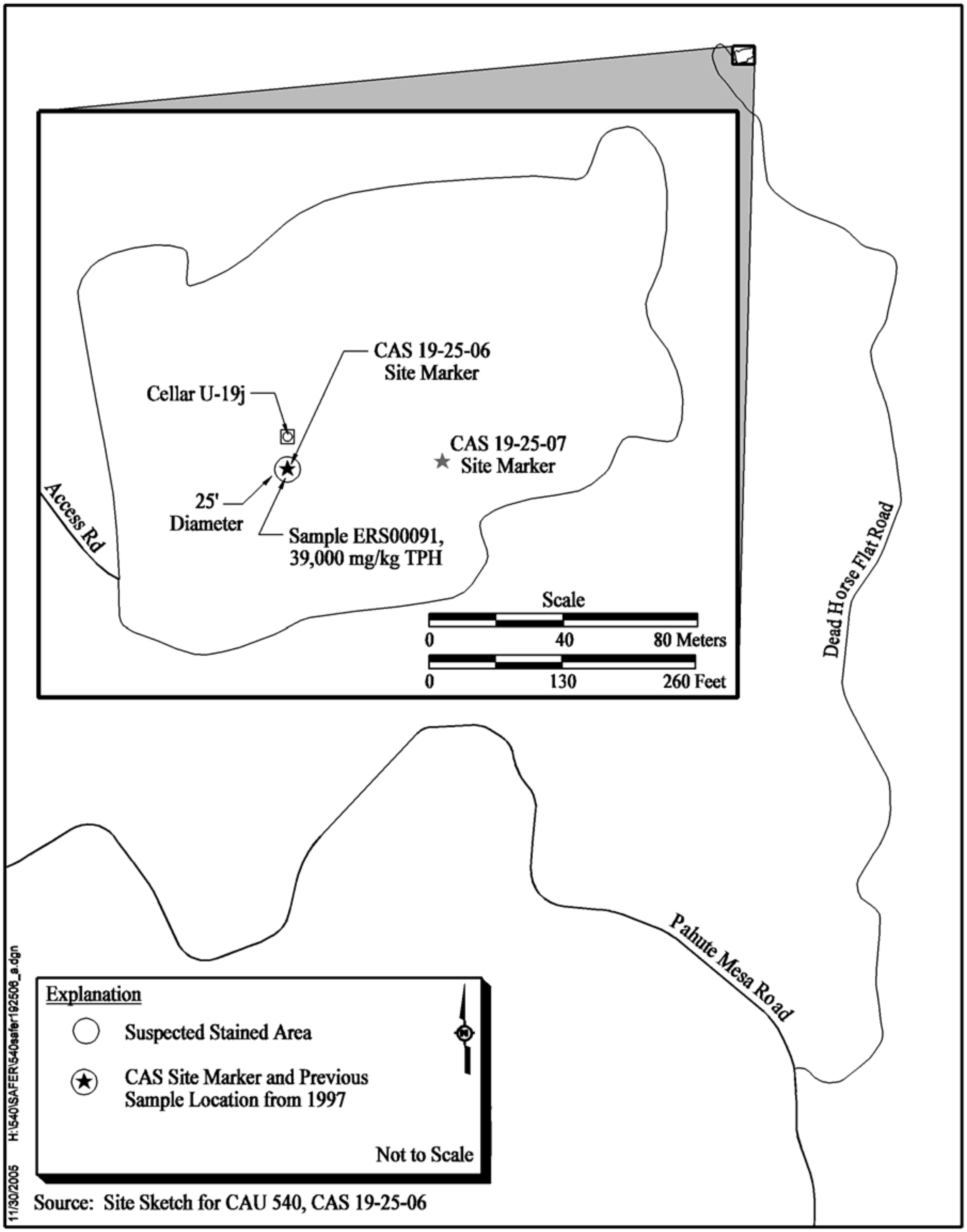

Figure 2-6
CAU 540, CAS 19-25-06, Oil Spill

2.6.2 Previous Investigation Information

One biased soil sample was collected from the center of the hydrocarbon-stained soil by personnel on August 26, 1997. The sample was analyzed for TPH, VOCs, SVOCs, PCBs, RCRA metals, and radionuclides. The sample results showed a TPH concentration of 39,000 mg/kg. The RCRA metals and radionuclides were identified above their method detection limits but below their respective PALs.

No previous radiological or geophysical walk-over surveys were conducted.

2.7 CAS 19-25-07, Oil Spill

Corrective Action Site 19-25-07, Oil Spill, consists of a single area of hydrocarbon-stained soil located approximately 150 ft east of the U-19j cellar in Area 19. The area of stained soil is approximately 15 ft in diameter and is located 150 ft east of the U-19j drill hole. The dark-brown stained soil is located in a sparsely vegetated area with an uneven surface and various sized rocks at the surface. (See Figure 2-7.)

2.7.1 History and Process Knowledge

The CAS was first identified during a 2002 site visit. Activities around the U-19j cellar during its construction are believed to be the cause for the hydrocarbon stain. The U-19j cellar was spudded in July 1983 and was completed in November 1983. The Underground Test Area (UGTA) Borehole Index indicates that the U-19j cellar is a large-diameter placement hole (72 inches in diameter and 1,109 ft deep). The Index also indicates that the U-19j cellar is active, although in November 1983, the hole caved and was filled at 730 ft, then abandoned.

2.7.2 Previous Investigation Information

One biased soil sample was collected on August 26, 1997. The sample was analyzed for TPH, VOCs, SVOCs, PCBs, RCRA metals, and radionuclides. The analytical results indicate that TPH-DRO is present at a concentration of 41,000 mg/kg. The results also indicate that RCRA metals and radionuclides were identified, but all were below their respective PALs.

No radiological or geophysical walk-over surveys have been performed.

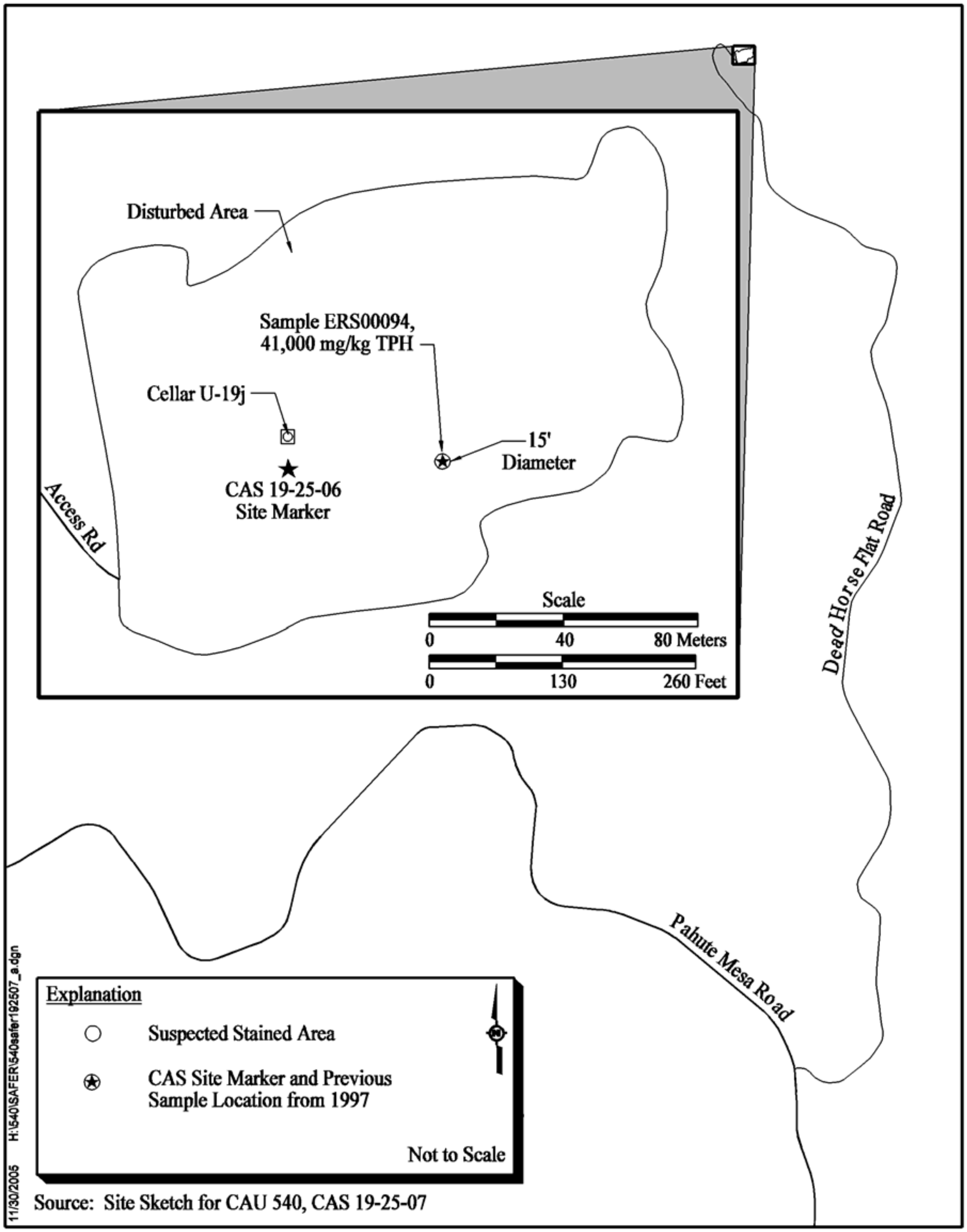

Figure 2-7
CAU 540, CAS 19-25-07, Oil Spill

2.8 CAS 19-25-08, Oil Spills (3)

Corrective Action Site 19-25-08, Oil Spills (3), is located approximately 200 ft northwest of RadSafe Marker 19P97 and approximately 90 ft west of Pahute Mesa Road. The site consists of three areas of hydrocarbon-stained soils. A site visit on July 19, 2005, failed to identify any of the stained areas shown in the site sketch. One location, at the site of the CAS marker, is in the middle of a large sagebrush, obscuring the possible identification of stained soil. Other locations relative to the CAS marker could not be found. Figure 2-8 is a sketch of this CAS.

2.8.1 History and Process Knowledge

The areas of stained soil are reported to be adjacent to the abandoned and dismantled Area 19 Camp. The stains are possibly associated with activities at the camp, but they are identified in an area that would likely be where vehicles would have been parked, as they are between the Pahute Mesa Road and the concrete foundations where Area 12 Camp buildings once stood. Although a spill report was filed for a Pahute Mesa Road 40-gallon diesel spill in January 1995, insufficient information was recorded to identify the exact location of the occurrence. No information was available that identified any cleanup associated with this spill, and no staining of the soil was visible. The Pahute Mesa Road spill was given Environmental Protection Division (EPD) Case Number 89A19-01.

2.8.2 Previous Investigation Information

A single soil sample was collected on August 26, 1997, and analyzed for TPH, VOCs, SVOCs, PCBs, RCRA metals, and radionuclides. The analytical results indicate no parameter was reported at a concentration above its respective PAL. The result for TPH was non-detect, although it should be noted that the detection limit for the analysis was 2,500 mg/kg. The RCRA metals and radionuclides were also identified above their method detection limits (chemical analyses) or method concentration limits (radionuclide analyses), respectively, but none were above their respective PALs.

No radiological walkover or geophysical walk-over surveys have been performed.

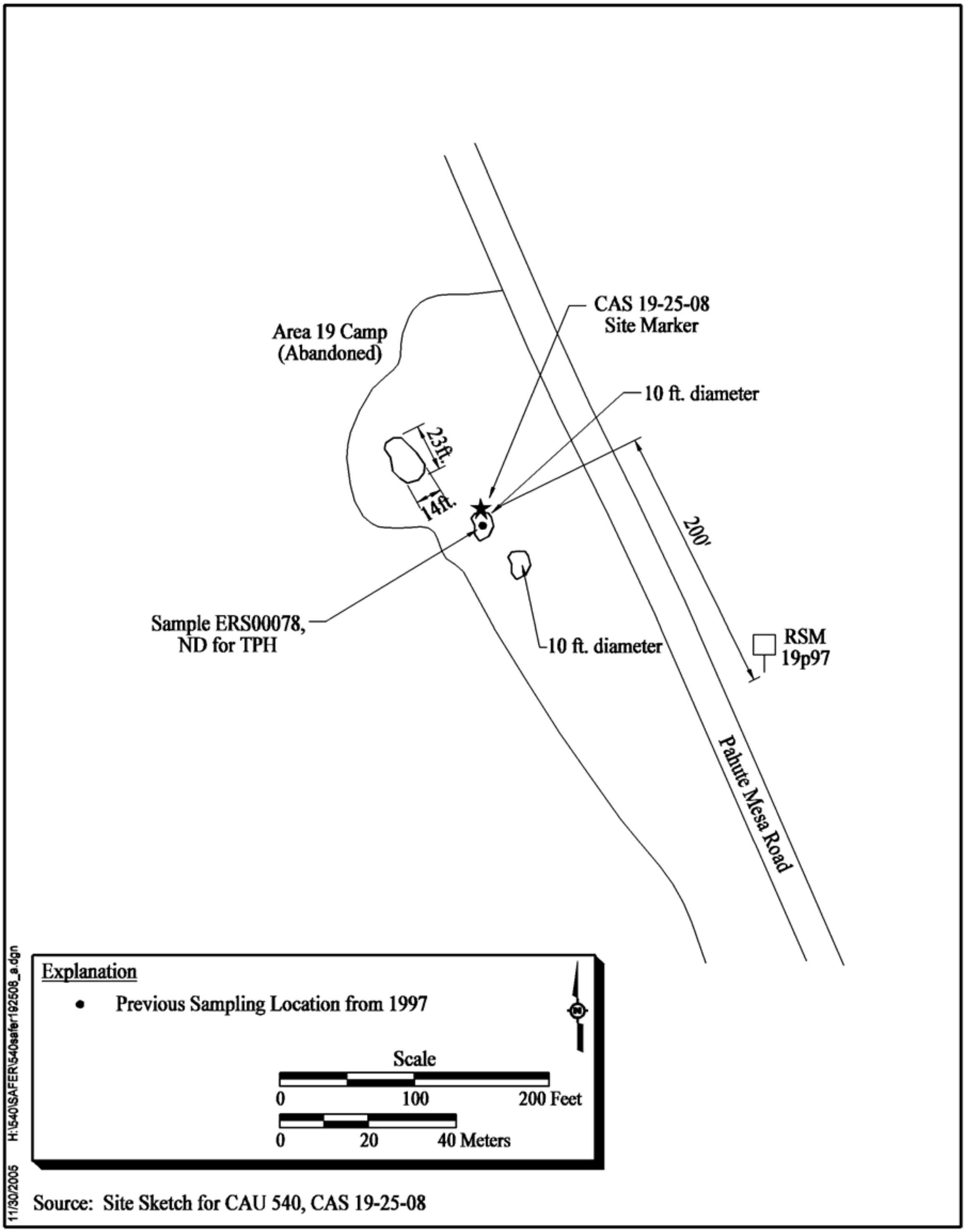

Figure 2-8
CAU 540, CAS 19-25-08, Oil Spills (3)

2.9 CAS 19-44-03, U-19bf Drill Site Release

Corrective Action Site 19-44-03, U-19bf Drill Site Release, is located along Dead Horse Flat Road in Area 19. This CAS is located approximately 60 ft to the northwest of drill hole U-19bf. The CAS consists of a single area of suspected hydrocarbon contaminated soil, measuring approximately 29 by 26 ft. Figure 2-9 is a sketch of this CAS.

2.9.1 History and Process Knowledge

A spill of waste oil was reported on July 13, 1992, and given the REECo number 92-46, the EPD Case Number 92A19-30, and the NDEP Case Number H920714C. The depth of the contamination is unknown. The amount of waste oil released is unknown. No information was identified that indicated any removal activity was performed.

2.9.2 Previous Information

No samples have been collected, and no radiological or geophysical walk-over surveys have been performed.

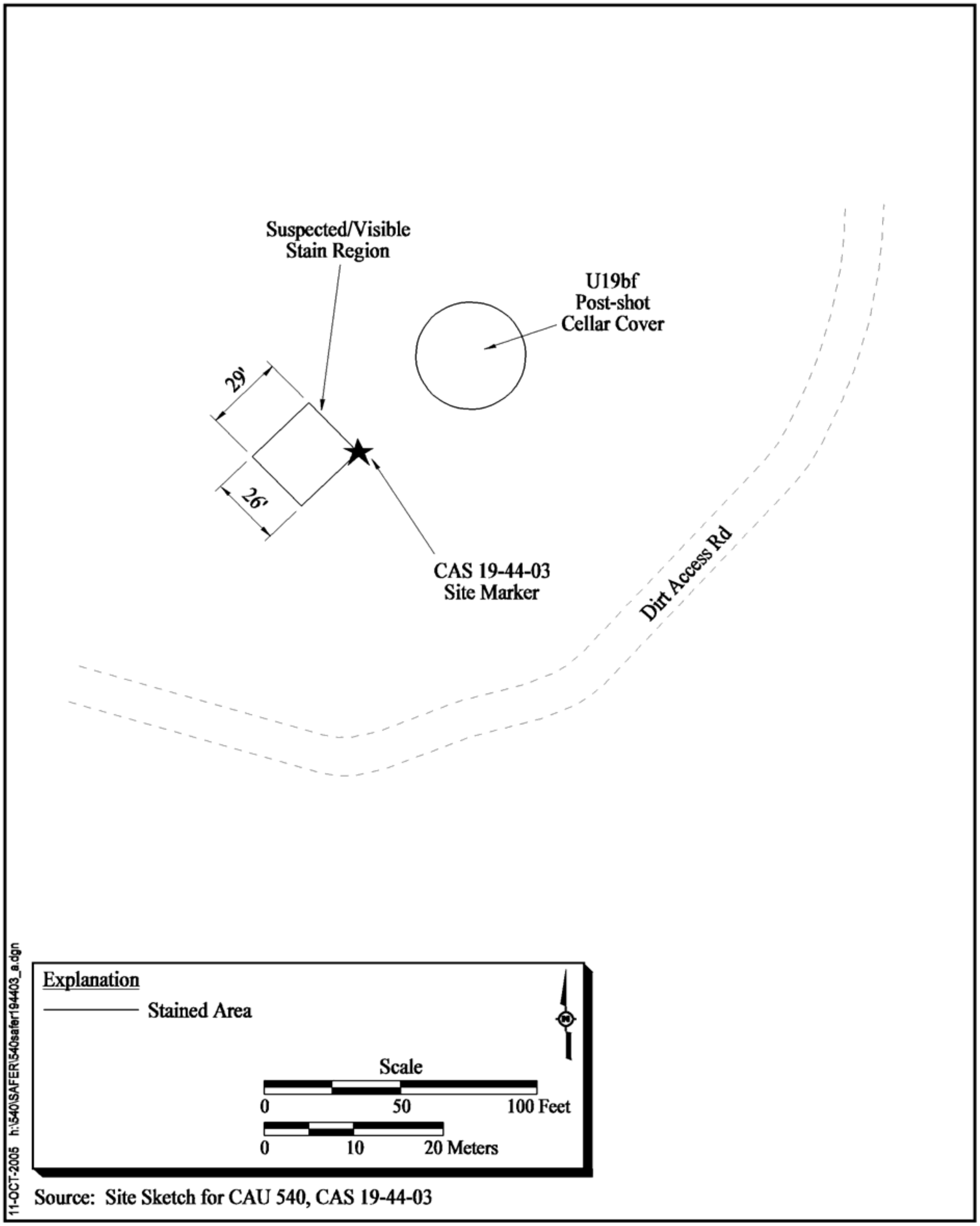

Figure 2-9
CAU 540, CAS 19-44-03, U-19bf Drill Site Release

3.0 Data Quality Objectives

3.1 Summary of Data Quality Objective Analysis

This section contains a summary of the DQO process that is presented in Appendix B. The DQO process is a strategic planning approach based on the scientific method that is designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and technically defend the recommended corrective actions (e.g., no further action, clean closure, or closure in place).

The DQO strategy for CAU 540 was developed at a meeting on July 7, 2005, to identify data needs, clearly define the intended use of the environmental data, and 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 CAU 540 is: "Existing information on the nature and extent of potential contamination is insufficient to validate the assumptions used to select the corrective actions or to verify that closure objectives were met for the CASs in CAU 540." To address this question, the resolution of two decisions statements is required:

- Decision I: "Does any contaminant of concern (COC) remain in the environmental media within the CAS?" Any contaminant associated with a release from the CAS that is remaining at concentrations exceeding its corresponding FAL will be defined as a COC.
- Decision II: "Is sufficient information available to confirm that closure objectives were met?" Sufficient information is defined to include:
  - Identifying the lateral and vertical extent of COC contamination in media, if present
  - The information needed to characterize investigation-derived waste (IDW) for disposal
  - The information needed to determine remediation waste types

Decision I samples will be submitted to analytical laboratories for the analyses listed in Table 3-1. Decision II samples will be submitted for the analysis of all unbounded COCs. In addition, samples will be submitted for analyses as needed to support waste management or health and safety decisions.

Table 3-1
Analytical Program
(Includes Waste Characterization Analyses)

Analyses[b]	Liquid	Soil	12-44-01	12-99-01	19-25-02	19-25-04	19-25-05	19-25-06	19-25-07	19-25-08	19-44-03
Organic Contaminants of Potential Concern (COPCs)											
Total Petroleum Hydrocarbons-Diesel-Range Organics	SW-846 8015B[a] (modified)		X	X	X	X	X	X	X	X	X
Total Petroleum Hydrocarbons-Gasoline-Range Organics			X	X	X	X	X	X	X	X	X
Polychlorinated Biphenyls	SW-846 8082[a]		X	X	X	X	X	X	X	X	X
Semivolatile Organic Compounds	SW-846 8270C[a]		X	X	X	X	X	X	X	X	X
Volatile Organic Compounds	SW-846 8260B[a]		X	X	X	X	X	X	X	X	X
Inorganic COPCs											
Total *Resource Conservation and Recovery Act* Metals[b]	SW-846 6010B[a] (Mercury-7470A[a])		X	X	X	X	X	X	X	X	X
Radionuclide COPCs											
Gamma Spectrometry[c]	EPA Procedure 901.1[d]	HASL-300[e]	X	X	X	X	X	X	X	X	X

X - Required analytical method

[a]*EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, 3rd Edition, Parts 1-4, SW-846 (EPA, 1996).
[b]May also include Toxicity Characteristic Leaching Procedure analytes if sample is collected for waste management purposes.
[c]Results of gamma analysis will be used to determine whether further radioanalytical analysis is warranted.
[d]*Prescribed Procedure for Measurements of Radioactivity in Drinking Water* (EPA, 1980).
[e]*The Procedures Manual of the Environmental Measurements Laboratory* (DOE, 1997).

The data quality indicators (DQIs) of precision, accuracy, representativeness, completeness, comparability, and sensitivity needed to satisfy DQO requirements are discussed in Section 7.2. Laboratory data will be assessed in the CR to confirm or refute the conceptual site model (CSM) and determine whether the DQO data needs were met.

3.2 Results of the Data Quality Objective Analysis

3.2.1 Action Level Determination and Basis

The PALs presented in this section are to be used for site screening purposes. They are not necessarily intended to be used as FALs. However, they are useful in screening out analytes that are not present in sufficient concentrations to warrant further evaluation and, therefore, streamline the consideration of remedial alternatives. The process that will be used to move from PALs to FALs is that specified by *Nevada Administrative Code* (NAC) 445A.22705 (NAC, 2004e). This regulation stipulates that determination of FALs shall be established by an evaluation of the site based on the risk to public health and the environment. This evaluation will be conducted using Method E1739-95, adopted by the American Society for Testing and Materials (ASTM) (ASTM, 2000a).

The ASTM's risk-based corrective action (RBCA) process, summarized in Figure 3-1, uses a tiered approach to data collection and analysis in supporting decisions on site assessment and response to contamination. This process includes a provision for conducting an interim remedial action if necessary and appropriate. The decision to conduct an interim action may be made at any time during the investigation and at any level (tier) of analysis. Concurrence of the decision makers listed in Section B.3.1 of Appendix B will be obtained before any interim action is implemented. Evaluation of DQO decisions will be based on conditions at the site following completion of any interim actions. Any interim actions conducted will be reported in the CR.

The RBCA procedure defines three tiers or levels of evaluation involving increasingly sophisticated levels of analyses.

- Tier 1 – sample results from source areas (highest concentrations) compared to PALs based on generic (non-site-specific) conditions
- Tier 2 – sample results from exposure points compared to site-specific target levels (SSTLs) calculated using site-specific inputs and Tier 1 formulas

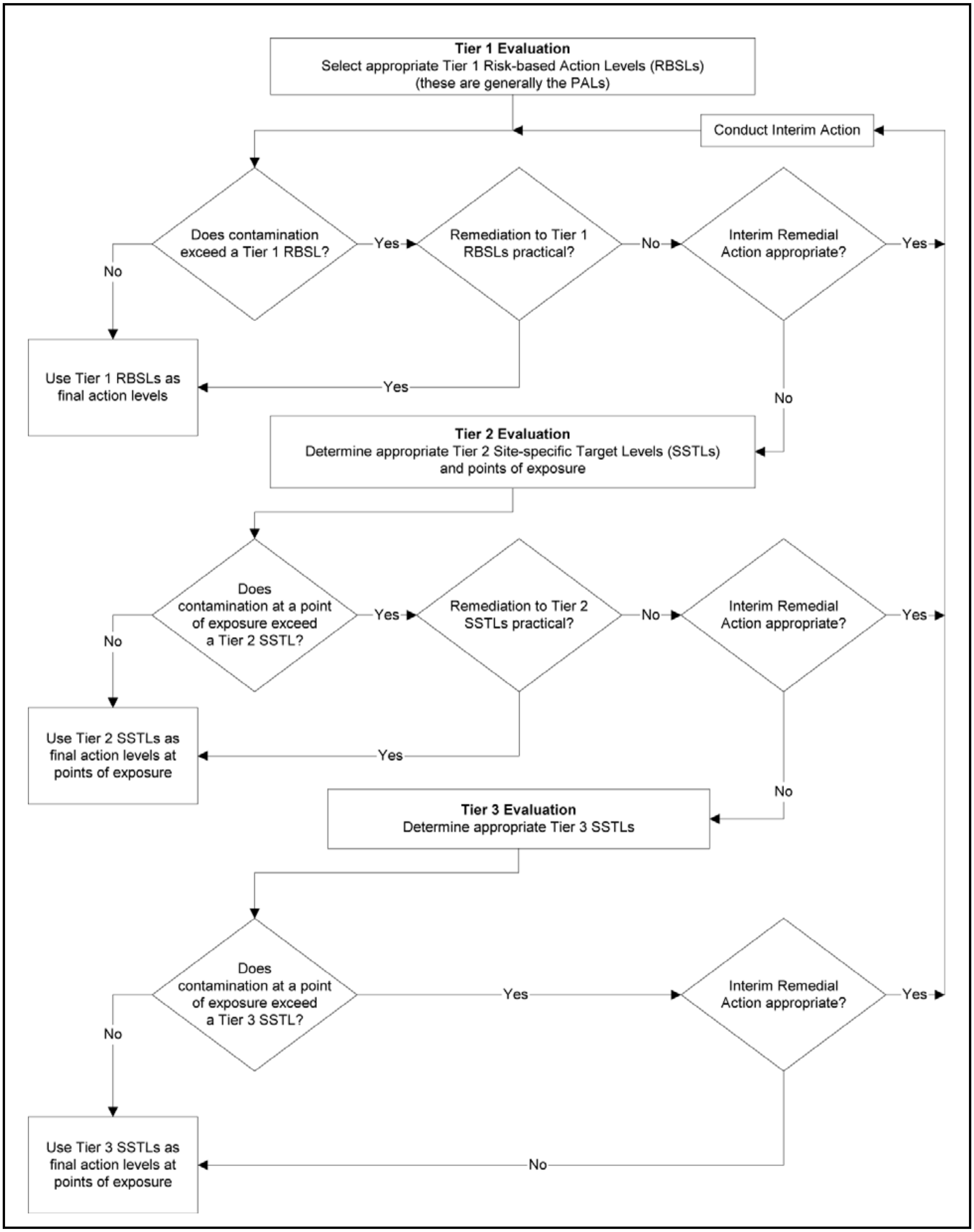

Figure 3-1
Process Used to Move From PALs to FALs

- Tier 3 – sample results from exposure points compared to SSTLs and points of compliance calculated using chemical fate/transport and probabilistic modeling

A Tier 1 evaluation will be conducted to determine whether contaminant levels satisfy the criteria for a quick regulatory closure or warrant a more site-specific assessment. This is accomplished by comparing individual source area contaminant concentration results to PALs. The PALs are a tabulation of chemical- and radioisotope-specific (but not site-specific) screening levels based on potential exposure pathways, media (i.e., soil, water, and air), and potential exposure scenarios using risk information derived from the U.S. Environmental Protection Agency (EPA) *Integrated Risk Information System* (IRIS) database (EPA, 2001) or a dose constraint of 25 millirem per year (mrem/yr). If remediation to Tier 1 action levels (PALs) is not practicable, a Tier 2 evaluation may be conducted. Rationale and justification for using a Tier 2 evaluation will be presented in the CR.

If appropriate, a Tier 2 evaluation may be conducted by calculating Tier 2 SSTLs using site-specific information as inputs to the same or similar methodology used to calculate Tier 1 action levels. The Tier 2 SSTLs are then compared to individual sample results from reasonable points of exposure (as opposed to the source areas as is done in Tier 1) on a point-by-point basis. Total TPH concentrations will not be used for risk-based decisions under Tier 2 or Tier 3. Rather, the individual hazardous constituents of TPH will be compared to the SSTLs (Sections 6.4.3 and X1.4 of ASTM, 2000a).

Alternatively, the Tier 2 RBCA process SSTLs may be compared to the predicted concentration or activity of the contaminant at the point of exposure based on attenuation from the source using relatively simplistic mathematical models. Points of exposure are defined as those locations at which an individual or population may come in contact with a COC originating from a CAS. If a Tier 2 evaluation is conducted, the calculations used to derive the SSTLs and the contaminant attenuation calculations will be provided as an appendix to the CR. If remediation to Tier 2 SSTLs is not practicable, a Tier 3 evaluation may be conducted. Rationale and justification for using a Tier 3 evaluation will be presented in the CR.

If appropriate, a Tier 3 evaluation may be conducted by calculating Tier 3 SSTLs on the basis of more sophisticated risk analyses using methodologies described in Method E1739-95 that consider site-, pathway-, and receptor-specific parameters. Tier 3 evaluation is more complex than Tiers 1 and 2 because it may include additional site characterization, probabilistic evaluations, and sophisticated chemical fate/transport models. The Tier 3 SSTLs are then compared to the upper 95 percent confidence limit of the mean of sample results from reasonable point(s) of exposure (as opposed to individual sample results as is done in Tier 2). Contaminant concentrations exceeding Tier 3 SSTLs require corrective action. If a Tier 3 evaluation is conducted, the calculations used to derive the SSTLs and the upper confidence limit of the means will be provided as an appendix to the CR.

The FALs (along with the basis for their selection) will be proposed in the CR where they will be compared to laboratory results in the evaluation of potential corrective actions.

3.2.1.1 Chemical Preliminary Action Levels

Except as noted herein, the chemical PALs are defined as the EPA *Region 9 Risk-Based Preliminary Remediation Goals* (PRGs) for chemical constituents in industrial soils (EPA, 2004). Background concentrations for RCRA metals will be used instead of PRGs when natural background concentrations exceed 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). For detected chemical COPCs without established PRGs that have toxicity and carcinogenicity data listed in the EPA IRIS database (EPA, 2001), the protocol used by the EPA Region 9 in establishing PRGs (or similar) will be used to establish PALs. If used, this process will be documented in the CR.

3.2.1.2 Total Petroleum Hydrocarbons Preliminary Action Levels

The PAL for TPH is 100 parts per million (ppm) as listed in NAC 445A.2272 (NAC, 2004f).

3.2.1.3 Radionuclide Preliminary Action Levels

The PALs for radiological contaminants (other than tritium) are based on the National Council on Radiation Protection and Measurement (NCRP) Report No. 129 recommended screening limits for construction, commercial, industrial land-use scenarios (NCRP, 1999) of a 25-mrem/yr dose constraint (Murphy, 2004) and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993). These PALs are based on the Construction, Commercial, Industrial land-use scenario provided in the guidance and are appropriate for the NTS based on the exposure scenarios as presented in Section B.2.2.6.

The PAL for tritium is based on the UGTA Project limit of 400,000 picocuries per liter (pCi/L) for discharge of water containing tritium to an infiltration basin/area (NNSA/NV, 2002c). The activity of tritium in the soil moisture of soil samples will be reported in units of pCi/L for comparison to this PAL. The radiological PALs for CAU 540 are listed in Table 7-2.

Solid media such as concrete and/or structures may pose a potential radiological exposure risk to site workers if contaminated. The radiological PAL for solid media will be defined as the unrestricted-release criteria defined in the *NV/YMP Radiological Control Manual* (NNSA/NSO, 2005).

3.2.2 Conceptual Site Model and Drawing

The CSM describes the most probable scenario for current conditions at each site and defines the assumptions that are the basis for identifying the future land use, contaminant sources, release mechanisms, migration pathways, exposure points, and exposure routes. The CSM is also used to support appropriate sampling strategies and data collection methods. The CSM was developed for CAU 540 using information from the physical setting, potential contaminant sources, release information, historical background information, knowledge from similar sites, and physical and chemical properties of the potentially affected media and COPCs. Figure 3-2 depicts a tabular representation of the CSM, while Figure 3-3 depicts a graphical representation of the CSM.

3.2.3 Statistical Model

Because individual sample results, rather than an average concentration, will be used to compare to FALs, statistical methods to generate site characteristics will not be necessary. Section 0.4.4 of the EPA *Guidance for the Data Quality Objectives Process for Hazardous Waste Site Investigations* (EPA, 2002) states that the use of statistical methods may not be warranted by program guidelines of site-specific sampling objectives. The need for statistical methods is dependent upon the decisions being made. Section 7.1 of the EPA QA/G-4HW guidance states that a nonprobabilistic (judgmental) sampling design is developed when there is sufficient information on the contamination sources and history to develop a valid CSM and to select specific sampling locations. This design is used to confirm the existence of contamination at specific locations and provide information (such as extent of contamination) about specific areas of the site.

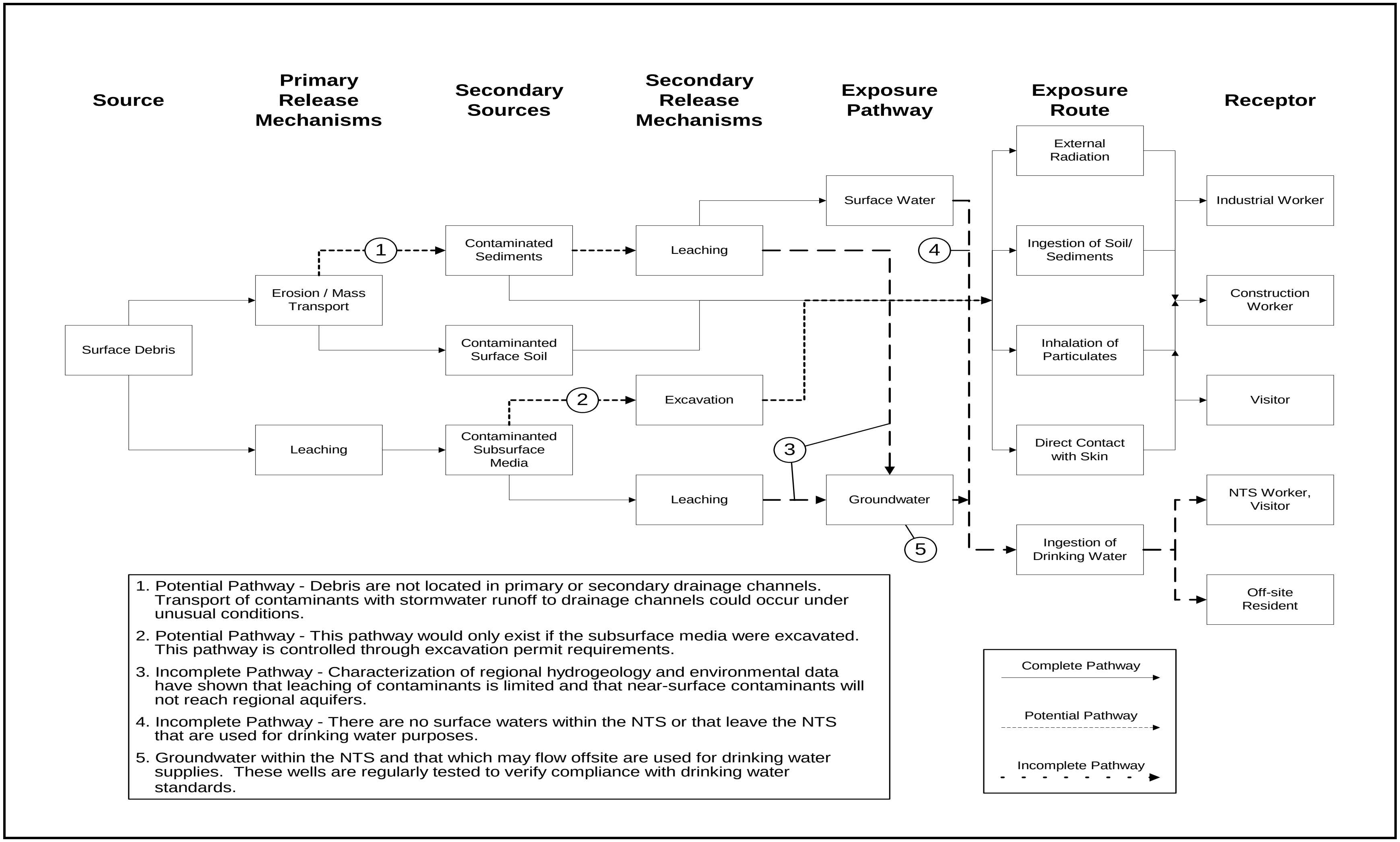

Figure 3-2
Conceptual Site Model Diagram for CAU 540

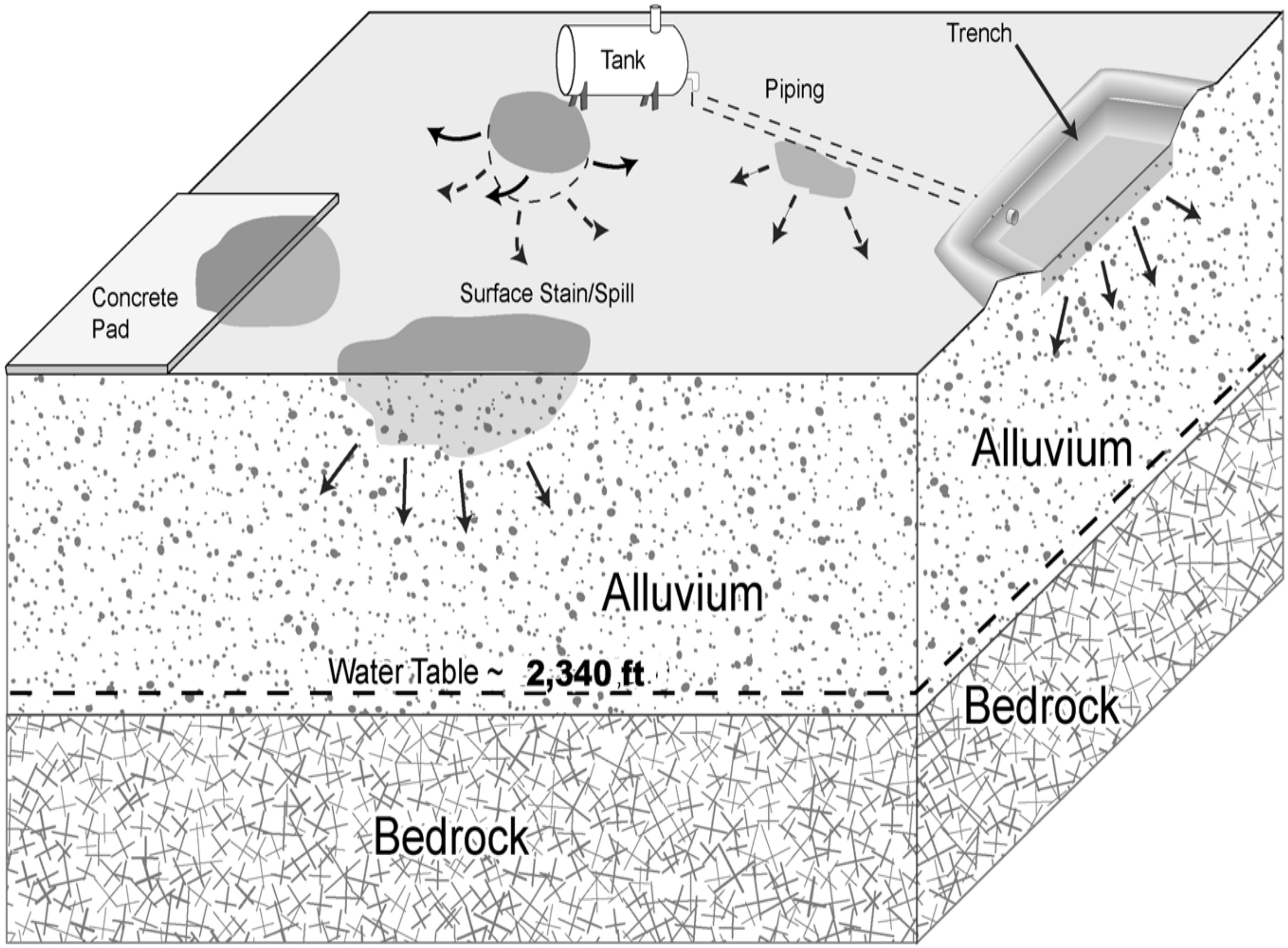

Figure 3-3
CAU 540, Conceptual Site Model

3.2.4 Design Description/Option

A judgmental sampling approach will be used to collect biased samples from the locations most likely to contain any COC, if present within each CAS. Sample locations will be determined based on process knowledge, previously acquired data, or the field-screening and biasing factors listed in Section 4.2. Section 7.1 of the EPA QA/G-4HW guidance states that a nonprobabilistic (judgmental) sampling design is developed when there is sufficient information on the contamination sources and history to develop a valid CSM and to select specific sampling locations.

3.3 Hypothesis Test

Only laboratory analytical results that meet the requirements of the Industrial Sites QAPP (NNSA/NV, 2002a) will be used to resolve DQO decisions. The null hypothesis is that closure objectives have not been met. Sufficient evidence to prove the null hypothesis wrong is:

- The identification of the lateral and vertical extent of COC contamination in media, if present.
- Sufficient information to properly dispose of IDW and remediation waste.

4.0 Field Activities and Closure Objectives

This section of the SAFER Plan provides a description of the field activities and closure objectives for CAU 540. The objectives for the field activities are to determine whether COCs exist (nature) and, if so, define the extent so that closure alternatives may be implemented. All sampling activities will be conducted in compliance with the Industrial Sites QAPP (NNSA/NV, 2002a) and other applicable, approved procedures and instructions.

4.1 Contaminants of Potential Concern

The COPCs applicable to Decision I environmental samples from each of the CASs of CAU 540 are defined as the analytes reported from the analytical methods stipulated in Table 3-1. The list of COPCs is intended to encompass all of the contaminants that could potentially be present at each CAS. These contaminants were identified during the planning process through the review of site history, process knowledge, personal interviews, past investigation efforts (where available), and inferred activities associated with the CASs. Because complete information regarding activities performed at the CAU 540 sites is not available, contaminants detected at other similar or other NTS sites were included in the contaminant lists to reduce the uncertainty.

Based on site history documentation, process knowledge information, personal interviews, past investigation efforts (where available), and inferred activities associated with the CASs, the only contaminant of concern for CAU 540 is TPH-DRO.

4.2 Remediation

The DQOs developed for CAU 540 identified data gaps that require additional data collection prior to identifying and implementing the preferred closure alternative for each CAS. A decision point approach, based on the DQOs, has been chosen to address the data collection activities. The presence of contamination, if any, is assumed to be confined to the spatial boundaries of the sites as defined in the DQO process and CSM. Biased sampling will be conducted at CAU 540 according to DQO guidelines.

If COCs are located within a CAS based on the initial investigation results, that CAS will be further assessed before implementing closure activities. If COPCs are not present at concentrations exceeding PALs, or if COCs are present but at concentrations below their respective FALs, the CAS will be eliminated from further consideration.

After remediation, if concentrations of COC are above their respective PALs and FALs, confirmation samples will be obtained. Failure of the confirmation samples to demonstrate that all of the COCs have been removed to below their respective FALs requires that additional media be removed followed by the collection of confirmation samples. If the results of this second set of confirmation samples indicates that contamination continues to exist above FALs, the activities at the CAS will stop and the investigation and closure processes will be moved to the complex model (i.e., Corrective Action Investigation Plan [CAIP], Corrective Action Decision Document [CADD]).

The volume of contaminated media removed is based on several factors, including the original concentrations of FAL-exceeding COCs, the spatial location of COCs that exceed their respective FALs, and visual examination of stained media. An estimate of the removed volume will be based on these factors and the desire to obtain confirmation samples that will delineate the extent of contamination.

Field screening may be instituted to provide additional semiquantitative screening measurements and to assist in defining the volume of media removed before confirmation sampling. These field-screening results (FSRs), along with other biasing factors, will help guide the selection(s) of the most appropriate sampling location for collection of samples for laboratory analysis. Potential field-screening methods, with their respective field-screening levels (FSLs), are presented below:

- Total petroleum hydrocarbons - TPH screening levels are established at 75 ppm, using an appropriate field gas chromatographic procedure. Soil may be field screened for TPH at any of the stained soil sites.

- Volatile organic compounds - VOC headspace screening levels are established at 20 ppm or 2.5 times background, whichever is greater, using a flame ionization detector or photoionization detector.

- Radionuclides - Radiological FSLs are based on CAS-specific background measurements. The CAS specific background is defined as the mean count rate plus two standard deviations of the mean count rate.

4.3 Verification

Verification that the appropriate closure alternative has been chosen for each CAS in CAU 540 is based on the process used to initially delineate the extent of COC contamination and by demonstration (through confirmation sampling) that the appropriate amount of contaminated media has been removed.

The collection of Decision I samples is used to identify the extent of COC contamination and guide the determination of the volume of contaminated media that will require removal. If the results of the Decision I samples indicate that no COPCs are present above their respective FALs, the CAS closure alternative is “no further action.”

If the Decision I samples indicate the presence of COCs above their respective FALs, they will be used to guide the removal of contaminated media. The amount of media removed will be based upon the results of field-screening analyses, which will guide the collection of samples that will delineate the extent of COC contamination. After the appropriate volume of contaminated media has been removed, confirmation samples will be collected to demonstrate that there are no remaining media with COC concentrations above their respective FALs. Once this is demonstrated, the excavation will be backfilled with clean media and the CAS will be designated the closure alternative “clean closure.”

Failure to verify that enough of the contaminated media has been removed and that additional removal of contaminated media takes the amount of removed material beyond the spatial boundaries of the CAS will require that the work be stopped and the complex approach of CAIP and CADD be utilized.

4.4 Closure

The following activities, at a minimum, have been identified for closure of these CASs. The decision logic behind the activities is provided in Figure 1-2.

- If no contaminants are detected above FALs, the CAS will be closed with no further action.
- Sufficient data will be collected and analyzed to determine the nature and extent of contamination above the FALs, so that the appropriate closure may be selected and implemented.
- If closure in place is the preferred corrective action alternative, the appropriate use restrictions will be implemented and documented in the CR.
- If clean closure is the preferred corrective action alternative, the material to be remediated will be removed and disposed as waste, and verification samples will be collected in remaining soil. Verification analytical results will be documented in the CR.
- Housekeeping waste will be accumulated at the CAS, as necessary, and may be photodocumented. Soil verification sampling will be conducted for appropriate COCs.
- All completed activities in support of the closure of CAU 540 will be documented in a CR.

4.5 Duration

Table 4-1 shows a tentative schedule of activities (in calendar days) for SAFER activities:

Table 4-1
CAU 540 SAFER Project Duration

Duration (Days)	Activity
10	Site Preparation
76	Field Work Preparation and Mobilization
30	Remediation
30	Verification Sampling
30	Site Restoration
160	Data Assessment
180	Waste Management

5.0 Reports and Records Availability

During field activities, a daily report will be prepared summarizing all field activities conducted that day. The report will include the project accomplishments, problems encountered, and personnel and equipment utilized. The report will be submitted to the NNSA/NSO Environmental Restoration Division Task Manager for submittal to NDEP, if requested.

Upon completion of the field activities, a CR will be prepared to include the following:

- Introduction (Purpose and Scope)
- Closure Activities (Description of Field Activities)
- Waste Disposition
- Closure Verification Results (Data Quality Assessment)
- Conclusions

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 appropriate DOE Project Manager. The NDEP maintains the official Administrative Record for all activities conducted under the auspices of the FFACO.

6.0 Investigation/Remediation Waste Management

Management of IDW and remediation waste will be based on regulatory requirements, field observations, process knowledge, and the results of laboratory analysis of CAU 540 SAFER investigation samples.

Disposable sampling equipment, personal protective 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 analyses of site investigation samples, may not be necessary for all IDW. However, if associated investigation samples are found to contain contaminants above regulatory levels, conservative estimates of total waste contaminant concentrations may be used based on the mass of waste, the amount of contaminated media contained in the waste, and the maximum concentration of contamination found in the media. 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.

6.1 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 (e.g., 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.

6.1.1 Personal Protective Equipment

Personal protective equipment and disposable sampling equipment will be visually inspected for stains, discoloration, and gross contamination as the waste is generated. Any IDW that meets the description will be segregated and managed as potentially “characteristic” hazardous waste. This segregated population of waste will either be (1) be assigned the characterization of the soil that was sampled, (2) be sampled directly, or (3) undergo further evaluation using the soil sample results to determine how much soil would need to be present in the waste to exceed regulatory levels. The PPE and equipment that is not visibly stained, discolored, or grossly contaminated and that is within radiological free-release criteria will be managed as nonhazardous sanitary waste.

6.1.2 Management of Decontamination Rinsate

Rinsate at CAU 540 will not be considered hazardous waste unless there is evidence that the rinsate may 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, 2004b). The regulatory status of the potentially hazardous rinsate will be determined through the application of associated sample results or through direct sampling. If the associated samples do not indicate the presence of hazardous constituents, then the rinsate will be considered as nonhazardous waste.

The disposal of nonhazardous rinsate will be consistent with guidance established in the current NNSA/NSO Fluid Management Plan for the NTS as follows (NNSA/NV, 2002c):

- 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 that 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 LLW in accordance with the respective sections of this document.

- Nonhazardous rinsate that is contaminated at greater than 10x SDWS will be disposed of in a lined basin or solidified and disposed of as sanitary waste or LLW in accordance with the respective sections of this document.

6.1.3 Management of Soil

This waste stream consists of soil removed for disposal during soil sampling, excavation, and/or drilling. This waste stream will be characterized based on laboratory analytical results from representative locations. If the soil is determined to potentially contain COCs, the material will either be managed on site or containerized for transportation to an appropriate disposal site.

On-site management of the waste soil will be allowed only if it is managed within an area of concern and it is appropriate to defer the management of the waste until final remediation of the site. If this option is chosen, the waste soil shall be protected from the run-on and runoff using appropriate protective measures based on the type of contaminant(s) (e.g., hazardous, hydrocarbon, mixed).

Note that soil placed back into a borehole or excavation in the same approximate location from which it originated is not considered to be a waste.

6.1.4 Management of Debris

This waste stream can vary depending on site conditions. Debris that requires removal for the investigation activities (e.g., soil sampling, excavation, drilling) must be characterized for proper management and disposition. Historical site knowledge, knowledge of the waste generation process, field observations, field monitoring/screening results and/or the analytical results of samples wither directly or indirectly associated with the waste may 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 LLW. Waste that is not sanitary will be entered into an approved waste management system, where it will be managed and dispositioned and dispositioned according to federal and/or 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). The disposal of debris may be deferred until implementation of corrective action at the site.

6.2 Potential Waste Streams

The on-site management and ultimate disposition of IDW will be determined based on a determination of the waste type (e.g., sanitary, low level, hazardous, hydrocarbon mixed), or the combination of waste types (e.g., sanitary, low level, hazardous, hydrocarbon, mixed), or the combination of waste types. A determination of the waste type will 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. Office trash and lunch waste will be sent to the sanitary landfill by placing the waste in a dumpster. Each waste stream generated will be reviewed and segregated to the greatest extent at the point of generation.

Table 4-2 of the *NV/YMP Radiological Control Manual* (NNSA/NSO, 2005) shall be used to determine whether such materials may be released unrestricted. On-site IDW management requirements by waste type are detailed in the following sections. Applicable waste management regulations and requirements are listed in Table 6-1.

6.2.1 Sanitary Waste

Sanitary IDW generated at each CAS will be collected, managed, and disposed of in accordance with the sanitary waste management regulations and the permits for operation of the NTS 10c Industrial Waste Landfill.

6.2.2 Low-Level Radioactive 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 the work site. 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 Radiological Control Manual* (NNSA/NSO, 2005), will be used to determine whether 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 whether a particular waste unit (e.g., drum of soil) contains LLW, as necessary. Waste

Table 6-1
Waste Management Regulations and Requirements

Waste Type	Federal Regulation	Additional Requirements
Solid (nonhazardous)	N/A	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)	N/A	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	N/A	DOE Orders and NTSWAC[j]
Mixed	RCRA[f]	NTSWAC[j] POC[i]
Hydrocarbon	N/A	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]

[a] *Nevada Revised Statutes* (NRS, 2003a)
[b] *Nevada Administrative Code* (NAC, 2004a)
[c] Area 23 (NDEP, 1997a)
[d] U10c crater located in Area 9 (NDEP, 1997c)
[e] Nevada Test Site Sewage Lagoons (NDEP, 1999)
[f] *Resource Conservation and Recovery Act* (CFR, 2004a)
[g] *Nevada Revised Statutes* (NRS, 2003b)
[h] *Nevada Administrative Code* (NAC, 2004b)
[i] *Nevada Test SIte Performance Objective for the Certification of Nonradioactive Hazardous Waste* (BN, 1995)
[j] *Nevada Test Site Waste Acceptance Criteria*, Revision 4 (NNSA/NV, 2002b)
[k] *Nevada Administrative Code* (NAC, 2004e)
[l] Area 6 Hydrocarbon Landfill (NDEP, 1997b)
[m] *Toxic Substance Control Act* (CFR, 2004c)
[n] *Toxic Substance Control Act* (CFR, 2004d)
[o] *Nevada Administrative Code* (NAC, 2004c)
[p] *Nevada Revised Statutes* (NRS, 2003c)
[q] *Nevada Administrative Code* (NAC, 2004d)

N/A = Not applicable

that is determined to be below the values of Table 4-2 of the *NV/YMP Radiological Control Manual* (NNSA/NSO, 2005), 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 of the *NV/YMP Radiological Control Manual* (NNSA/NSO, 2005) 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). Radioactive waste drums containing soil, PPE, disposable sampling equipment, and/or rinsate may be staged at a designated radioactive materials area (RMA) or radiologically controlled area 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).

6.2.3 Hazardous Waste

Suspected hazardous wastes will be placed in RCRA-compliant containers. All containerized hazardous waste will be handled, inspected, and managed in accordance with Title 40 *Code of Federal Regulations* (CFR) 265, Subpart I (CFR, 2004a). 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 leak, spill, or release, incompatible waste shall not contact one another. Corrective Action Unit 540 will have waste storage areas established according to the needs of the project. Satellite accumulation areas and hazardous waste accumulation areas (HWAAs) will be managed consistent with the requirements of federal (CFR, 2004a) and state regulations (NAC, 2004a). The HWAAs will be properly controlled for access and equipped with spill kits and appropriate spill containment.

The 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 (CFR, 2004b). No RCRA "listed" wastes have been identified at CAU 540. Any waste determined to be hazardous will be managed and transported in accordance with RCRA and DOT requirements to a permitted treatment, storage, and disposal facility (CFR, 2004b).

6.2.4 Hydrocarbon Waste

Hydrocarbon waste containing more than 100 mg/kg of TPH 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, 1997b), an appropriate hydrocarbon waste management facility (e.g., recycling facility), or other method in accordance with Nevada regulations.

6.2.5 Mixed Low-Level Waste

Mixed waste, if generated, shall be managed and dispositioned according to the requirements of RCRA (CFR, 2004a) 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. Waste with hazardous waste constituent concentrations below Land Disposal Restrictions may be disposed of at the NTS Area 5 Radioactive Waste Management Site if the waste meets the requirements of the NTSWAC (NNSA/NV, 2002b). Waste with hazardous waste constituent concentrations exceeding 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).

6.2.6 Polychlorinated Biphenyls

The management of PCBs is governed by the *Toxic Substances Control Act* (TSCA) (USC, 1976) and its implementing regulations at 40 CFR 761 (CFR, 2004c). Polychlorinated biphenyl 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, 2004c) as well as State of Nevada requirements, (NAC, 2004a) guidance, and agreements with NNSA/NSO.

7.0 Quality Assurance/Quality Control

The overall objective of the characterization activities described in this SAFER Plan is to collect accurate and defensible data to support the selection and implementation of a closure alternative for each CAS in CAU 540. Section 7.1 and Section 7.2 discuss the collection of required QC samples in the field and quality assurance (QA) requirements for laboratory/analytical data to achieve closure. Unless otherwise stated in this SAFER Plan or required by the results of the DQO process (see Appendix B), this investigation will adhere to the Industrial Sites QAPP (NNSA/NV, 2002a).

7.1 Sample Collection 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 environmental 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 (1 per sample cooler containing VOC environmental samples)
- Equipment blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per lot of source material that contacts sampled media)
- Field duplicates (1 per 20 environmental samples or 1 per CAS)
- Field blanks (1 per 20 environmental samples or 1 per CAS)
- Laboratory QC samples (1 per 20 environmental samples or 1 per CAS)

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

7.2 Applicable Laboratory/Analytical Data Quality Indicators

The DQIs are qualitative and quantitative descriptors used in interpreting the degree of acceptability or utility of data. 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). The quality and usability of data used to make DQO decisions will be assessed based on the following DQIs:

- Precision
- Accuracy/bias
- Representativeness
- Comparability
- Completeness
- Sensitivity

Table 7-1 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 following subsections discuss each of the DQIs that will be used to assess the quality of laboratory data. Due to changes in analytical methodology and changes in analytical laboratory contracts, criteria for precision and accuracy in Table 7-2 and Table 7-3 that vary from corresponding information in the QAPP will supersede that information in the QAPP (NNSA/NV, 2002a).

7.2.1 Precision

Precision is used to assess the variability between two equal samples. This is a measure of the repeatability of the analysis process from sample collection through analysis results. Precision is measured as the relative percent difference (RPD) or normalized difference (ND) of duplicate samples as presented in the Industrial Sites QAPP (NNSA/NV, 2002a).

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 will be 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 may include matrix spike duplicate and laboratory control sample duplicate samples for organic, inorganic, and radiological analyses.

Table 7-1
Data Quality Indicator Performance Metrics

Data Quality Indicator	Performance Metric	Potential Impact on Decision if Performance Metric Not Met
Precision	At least 80% of the sample results for each measured analyte are not qualified for precision based on the RPD criteria for each analytical method-specific and laboratory-specific criteria presented in Table 7-2 and Table 7-3 or for the field duplicate criteria of 80% RPD or 2 percent normalized difference.	If the performance metric is not met, the affected analytical results from each affected CAS will be assessed to determine whether there is sufficient confidence in analytical results to use the data in making DQO decisions.
Accuracy	At least 80% of the sample results for each measured analyte are not qualified for accuracy based on the method-specific and laboratory-specific criteria presented in Table 7-2 and Table 7-3.	If the performance metric is not met, the affected analytical results from each affected CAS will be assessed to determine whether there is sufficient confidence in analytical results to use the data in making DQO decisions.
Sensitivity	Laboratory detection limits are less than or equal to respective final action levels.	Cannot determine whether COCs are present or migrating at levels of concern.
Comparability	Sampling, handling, preparation, analysis, reporting, and data validation are performed using standard methods and procedures.	Inability to combine data with data obtained from other sources and/or inability to compare data to regulatory action levels.
Representativeness	Samples contain contaminants at concentrations present in the environmental media from which they were collected.	Analytical results will not represent true site conditions. Inability to make appropriate DQO decisions.
Completeness	80% of the CAS-specific COPC analytes have valid results. 100% of CAS-specific targeted analytes have valid results.	Cannot support/defend decision on whether COCs are present.
Extent Completeness	100% of COC analytes used to define extent have valid results.	Extent of contamination cannot be accurately determined.
Clean Closure Completeness	100% of targeted analytes have valid results.	Cannot determine whether COCs remain in soil.

COC = Contaminant of concern
COPC = Contaminant of potential concern
DQO = Data quality objective
RPD = Relative percent difference

Precision is a quantitative measure 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. The RPD and ND criteria to be used for assessment of precision for laboratory duplicates are the parameter-specific criteria listed in Table 7-2 and Table 7-3. The performance metric for assessing the DQI of precision on DQO decisions (see Table 7-1) is that 80 percent of sample results for each measured analyte are not qualified due to precision based on the analytical method-specific and laboratory-specific criteria presented in Table 7-2 and Table 7-3. If this performance metric is not met, an assessment will be conducted in the CR on the impacts to DQO decisions specific to affected analytes and CASs. Any RPD or ND values outside the specified 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.

7.2.2 Accuracy

Accuracy is a measure of the closeness of an individual measurement or the average of a number of measurements to the true value. 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). Accuracy will be evaluated based on results from three types of spiked samples: matrix spike, laboratory control sample (LCS), and surrogates. The LCS sample is analyzed with the field samples using the same sample preparation, reagents, and analytical methods employed for the samples. One LCS will be prepared with each batch of samples for analysis by a specific measurement.

The criteria for chemical analyses to be used for assessment of accuracy are the parameter-specific criteria listed in Table 7-3. The percent recovery criteria for radiochemical analyses to be used for assessment of accuracy will be the control limits listed in Table 7-2.

The performance metric for assessing the DQI of accuracy on DQO decisions (see Table 7-1) is that at least 80 percent of the samples are not qualified for exceeding percent recovery criteria for each measured analyte. If this performance is not met, an assessment will be conducted in the CR on the impacts to DQO decisions specific to affected analytes and CASs. Any percent recovery values outside the specified 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 may be evaluated when determining the usability of the affected data.

Table 7-2
Analytical Requirements for Radionuclides for CAU 540

Parameter/Analyte	Matrix	Analytical Method	MDC[a]	PAL[b,c]	Laboratory Precision (RPD)	Percent Recovery (%R)
Gamma Spectrometry						
Americium-241	soil	HASL-300[d]	2.0 pCi/g[e]	12.7 pCi/g	Relative Percent Difference (RPD) 35% Normalized Difference -2<ND<2[f]	Laboratory Control Sample Recovery 80-120[g] %R
Cesium-137	soil	HASL-300[d]	0.5 pCi/g[e]	12.2 pCi/g		
Cobalt-60	soil	HASL-300[d]	0.5 pCi/g[e]	2.68 pCi/g		
Other Radionuclides						
Tritium	soil	lab specific	400 pCi/L[h]	4.0E+05 pCi/L[h]	No chemical yield	No chemical yield
Plutonium-238	soil	ASTM C1001-00[i]	0.05 pCi/g	13.0 pCi/g	Relative Percent Difference (RPD) 35% Normalized Difference -2<ND<2[f]	Laboratory Control Sample Recovery 80-120[g] %R Chemical Yield 30-105[j] %R
Plutonium-239/240	soil	ASTM C1001-00[i]	0.05 pCi/g	12.7 pCi/g		
Strontium-90	soil	HASL 300[d]	0.5 pCi/g	838 pCi/g		
Uranium-234	soil	ASTM C1000-02[j]	0.05 pCi/g	143 pCi/g		
Uranium-235	soil	ASTM C1000-02[j]	0.05 pCi/g	17.6 pCi/g		
Uranium-238	soil	ASTM C1000-02[j]	0.05 pCi/g	105 pCi/g		

[a]The MDC is the lowest concentration of a radionuclide, if present in a sample, that can be detected with a 95 percent confidence level.
[b]The PALs for soil are based on the National Council for Radiation Protection and Measurement (NCRP) Report No. 129 Recommended Screening Limits for Contaminated Soil and Review of Factors Relevant to Site-Specific Studies (NCRP, 1999) of 25 mrem/yr dose and the guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993).
[c]PALs for liquids will be developed as needed
[d]*The Procedures Manual of the Environmental Measurements Laboratory*, HASL-300 (DOE,1997)
[e]MDCs vary depending on the presence of other gamma-emitting radionuclides in the sample and are relative to the MDC for cesium-137
[f] ND is not RPD, it is another measure of precision used to evaluate duplicate analyses. The ND 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)
[g]EPA *Contract Laboratory Program Statement of Work for Inorganic Analysis* (EPA, 1988; 1994; and 1995)
[h]Units of pCi/L will be reported by the analytical laboratory based on the activity of the tritium in the soil moisture. The PAL for tritium in soil is based on the UGTA Project limit of 400,000 pCi/L for discharge of water containing tritium to an infiltration basin/area (NNSA/NV, 2002c)
[i]*Standard Test Method for Radiochemical Determination of Plutonium in Soil by Alpha Spectroscopy* (ASTM, 2000b)
[j]*Standard Test Method for Radiochemical Determination of Uranium Isotopes in Soil by Alpha Spectroscopy* (ASTM, 2002)

ASTM = American Society for Testing and Materials
MDC = Minimum detectable concentration
ND = Normalized difference
mrem/yr = Millirem per year
PAL = Preliminary action level
pCi/g = Picocuries per gram
pCi/L = Picocuries per liter

Table 7-3
Analytical Requirements for Chemical COPCs for CAU 540

Parameter/Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit (MRL)	Laboratory Precision (RPD)[a]	Percent Recovery (%R)[b]
ORGANICS					
Total Volatile Organic Compounds	Aqueous	8260B[c]	Parameter-specific EQLs[d]	Lab-specific[e]	Lab-specific[e]
	Soil				
Total Semivolatile Organic Compounds	Aqueous	8270C[c]	Parameter-specific EQLs[d]	Lab-specific[e]	Lab-specific[e]
	Soil				
Polychlorinated Biphenyls	Aqueous	8082[c]	Parameter-specific EQLs[f]	Lab-specific[e]	Lab-specific[e]
	Soil				
Total Petroleum Hydrocarbons (Gasoline-Range Organics)	Aqueous	8015B modified[c]	0.5 mg/kg[g]	Lab-specific[e]	Lab-specific[e]
	Soil				
Total Petroleum Hydrocarbons (Diesel-Range Organics)	Aqueous	8015B modified[c]	25 mg/kg[g]	Lab-specific[e]	Lab-specific[e]
	Soil				
INORGANICS					
Total RCRA Metals, plus Beryllium					
Arsenic	Aqueous	6010B[c]	0.01 mg/L[g, h]	20[h]	Matrix Spike Recovery at 75-125[h] Laboratory Control Sample Recovery at 80-120[h]
	Soil	6010B[c]	1 mg/kg[g, h]	35[g]	
Barium	Aqueous	6010B[c]	0.20 mg/L[g, h]	20[h]	
	Soil	6010B[c]	20 mg/kg[g, h]	35[g]	
Beryllium	Aqueous	6010B[c]	0.005 mg/L[g, h]	20[h]	
	Soil	6010B[c]	0.5 mg/kg[g, h]	35[g]	
Cadmium	Aqueous	6010B[c]	0.005 mg/L[g, h]	20[h]	
	Soil	6010B[c]	0.5 mg/kg[g, h]	35[g]	
Chromium	Aqueous	6010B[c]	0.01 mg/L[g, h]	20[h]	
	Soil	6010B[c]	1 mg/kg[g, h]	35[g]	
Lead	Aqueous	6010B[c]	0.003 mg/L[g, h]	20[h]	
	Soil	6010B[c]	0.3 mg/kg[g, h]	35[g]	
Mercury	Aqueous	7470A[c]	0.0002 mg/L[g, h]	20[h]	
	Soil	7471A[c]	0.1 mg/kg[g, h]	35[g]	
Selenium	Aqueous	6010B[c]	0.005 mg/L[g, h]	20[h]	
	Soil	6010B[c]	0.5 mg/kg[g, h]	35[g]	
Silver	Aqueous	6010B[c]	0.01 mg/L[g, h]	20[h]	
	Soil	6010B[c]	1 mg/kg[g, h]	35[g]	

[a, b, c] - *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846 (EPA, 1996)
[d, e, f] - *Contract Laboratory Program Statement of Work for Organic Analyses* (EPA, 1998)
[g] - *Industrial Sites Quality Assurance Project Plan* (NNSA/NV, 2002a)
[h] - *Contract Laboratory Program Statement of Work for Inorganic Analysis* (EPA, 1995)

COPC = Contaminant of potential concern
EQL = Estimated quantitation limit
mg/kg = Milligrams per kilogram
mg/L = Milligrams per liter
RCRA = *Resource Conservation and Recovery Act*

7.2.3 Representativeness

Representativeness is the degree to which sample characteristics accurately and precisely represent a characteristics of a population or an environmental condition (EPA, 2000). Representativeness is assured by a carefully developing the sampling strategy during the DQO process such that false negative and false positive decision errors are minimized. The criteria listed in DQO Step 6 - Specify the Tolerable Limits on Decision Errors are:

- For Decision I, 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 conducted will be sufficient to detect any COCs present in the samples.
- For Decision II, having a high degree of confidence that the sample locations selected will identify the extent of COCs.

These are qualitative measures that will be used to assess measurement system performance for representativeness. The assessment of this qualitative criterion will be presented in the CR.

7.2.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another (EPA, 2000). The criteria for the evaluation of comparability will be that all sampling, handling, preparation, analysis, reporting, and data validation were performed using approved standard methods and procedures. This will ensure that data from this project can be compared to regulatory action levels that were developed based on data generated using the same or comparable methods and procedures. An evaluation of comparability will be presented in the CR.

7.2.5 Completeness

Completeness is defined as generating sufficient data of the appropriate quality to satisfy the data needs identified in the DQOs. For judgmental sampling, completeness will be evaluated using both a quantitative measure and a qualitative assessment. The quantitative measurement to be used to evaluate completeness is presented in Table 7-1 and is based on the percentage of measurements made that are judged to be valid. The completeness goal for targeted analytes and the remaining

COPCs is 100 percent and 80 percent, respectively. If these criteria are not achieved, the dataset will be assessed for potential impacts on making DQO decisions.

The qualitative assessment of completeness is an evaluation of the sufficiency of information available to make DQO decisions. This assessment will be based on meeting the data needs identified in the DQOs and will be presented in the CR.

7.2.6 Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest (EPA, 2000). The evaluation criteria for this parameter will be that measurement sensitivity (detection limits) will be less than or equal to the corresponding action levels. If this criterion is not achieved, the affected data will be assessed for usability and potential impacts on meeting site characterization objectives. This assessment will be presented in the CR.

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NAC, see *Nevada Administrative Code.*

NBMG, see Nevada Bureau of Mines and Geology.

NCRP, see National Council on Radiation Protection and Measurements.

NDEP, see Nevada Division of Environmental Protection.

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

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

NRS, see *Nevada Revised Statutes.*

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Appendix A
Project Organization

A.1 Project Organization

The NNSA/NSO Acting Project Manager is Kevin Cabble. He can be contacted at (702) 295-5000. The NNSA/NSO Task Manager is Kevin Cabble. He can be contacted at (702) 295-5000.

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

Appendix B

Data Quality Objectives Process

B.1.0 Data Quality Objectives Process

The DQO process described in this appendix is a seven-step strategic planning approach based on the scientific method used to plan data collection activities. The DQOs are designed to ensure that the data collected will provide sufficient and reliable information to verify adequacy of existing information, to provide sufficient data to implement the corrective actions, and to verify that closure was achieved.

B.2.0 Step 1 - State the Problem

This initial step of the seven-step DQO process for CAU 540 identifies the planning team participants, describes the problem that has initiated the CAU 540 SAFER investigation, and develops the CSM. Corrective Action Unit 540 is being investigated because some data gaps exist concerning the nature and extent of potential contamination, and this data is necessary to evaluate and confirm closure alternatives for the individual CASs.

As a result of activities described that are associated with each of the CAU 540 CASs, leaks and/or spills have resulted in the release of waste(s) of hazardous and/or radioactive constituents that may be present at concentrations that could potentially pose a threat to human health and the environment. In addition, contamination may be present at concentrations and locations without appropriate controls (e.g., use restrictions).

B.2.1 Data Quality Objective Planning Team Members

The investigation will be based on the DQOs presented in this appendix as developed with concurrence from representatives of the NDEP and the NNSA/NSO. The DQO participants are identified in Table B.2-1. The DQO planning team consists of representatives from NDEP, NNSA/NSO, SNJV, and BN. The primary decision-makers include NDEP and NNSA/NSO representatives. Decision-makers will receive notifications as work progresses and when decision points are reached within the SAFER process. Table B.2-1 lists the representatives from each organization in attendance for the DQO presentation held July 7, 2005.

B.2.2 Conceptual Site Model

The CSM describes the most probable current conditions at each CAS and defines the assumptions that are the basis for identifying appropriate CAS-specific sampling strategies and data collection methods. The CSM set the stage 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 receptors. Accurate CSMs are important because they serve as the basis for all subsequent inputs and decisions throughout the DQO process.

Table B.2-1
Data Quality Objective Participants

Participant	Affiliation	Department/Project Team Member's Role
Kevin Cabble	NNSA/NSO	Task Manager
Greg Raab	NDEP	Environmental Regulations
David Nacht	BN	Task Manager
Core Team Personnel		
Stacy Alderson	SNJV	Rad Physics Manager
Robert Boehlecke	SNJV	Project Manager
Jack Ellis	SNJV	Health & Safety Manager
Syl Hersh	SNJV	Quality Assurance Representative
John Jennings	SNJV	Chemical Analytical Services
Lynn Kidman	SNJV	Technical Support
Laura Pastor	SNJV	Task Manager
David Schrock	SNJV	Regulatory Support/Waste Management Lead
Steve Ward	SNJV	CAU Lead

BN = Bechtel Nevada
NDEP = Nevada Division of Environmental Protection
NNSA/NSO = U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
SNJV = Stoller-Navarro Joint Venture

Figure B.2-1 illustrates the CSM for the oil spill CASs included in this CAU. This diagram shows known and suspected locations of contaminants and potential pathways for physical transport.

B.2.2.1 Contaminant Release

Contamination, if present, is expected to be contiguous to the release points at most sites. Concentrations are expected to decrease with horizontal and vertical distance from the source. Based on the depth to groundwater, which varies for each CAS, groundwater contamination may or may not be considered a likely scenario. Surface migration may occur as a result of a spill or as runoff of precipitation. Surface migration is a biasing factor considered in the selection of sampling points.

The most likely locations of the contamination and releases to the environment are the soils directly below or adjacent to the CSM's surface and subsurface components. The CSM accounts for potential releases resulting from migration away from the sites of spills/releases that are present at the ground

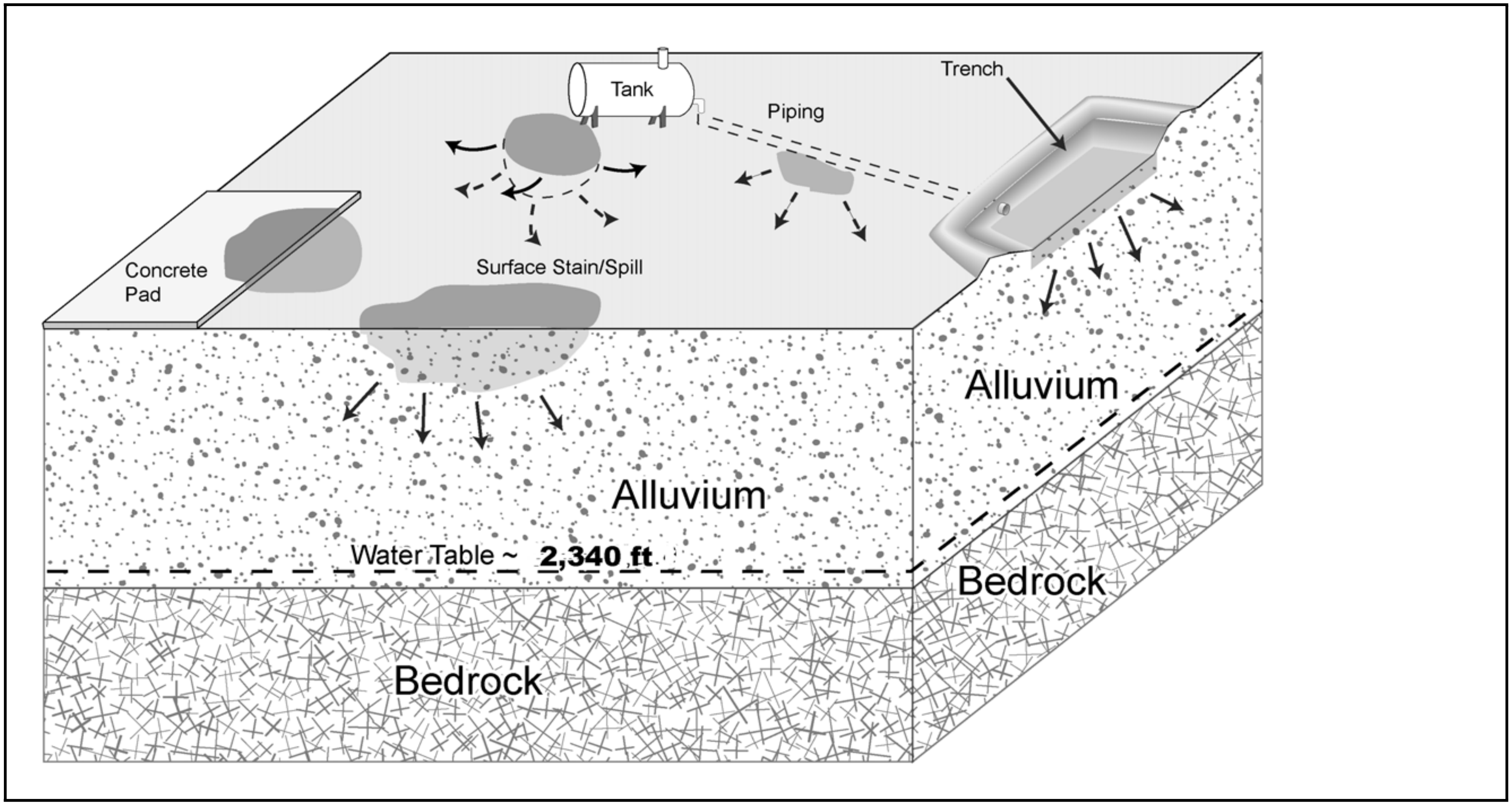

Figure B.2-1
CAU 540 Conceptual Site Model

surface. Any contaminants migrating from CASs, regardless of physical or chemical characteristics, are expected to exist at interfaces, and in the soil adjacent to the spill/release points in lateral and vertical directions.

Because of the expected limited mobility, the affected media is typically the surface and shallow subsurface soil. The native soil interface below and adjacent to the suspected release point is the most likely location for soil contamination. Any contaminants migrating from CASs, regardless of physical or chemical characteristics, are expected to be in soil adjacent to the source or release point.

The oil spill and release site specific items for this CSM include:

- The COPCs, if present, are associated with the (1) release of petroleum hydrocarbon products from leaking machinery, vehicles, etc.; (2) release of hydrocarbon products during mechanical operations (e.g., oil/water separator blow-off); and (3) overfilling of equipment or vehicles during refueling activities. Surface and shallow subsurface soils are the suspected affected media within each CAS. The volume of the hydrocarbon contaminant(s) at each location is unknown.

- Sample results from sampling conducted in 1997 at five of the spill site CASs (i.e., 19-25-02, 19-25-04, 19-25-05, 19-25-06, and 19-25-07) indicated detections of VOCs, SVOCs, RCRA metals, and TPH. The TPH results exceeded the PAL at these CASs, with values ranging from 29,000 to 50,000 mg/kg. Arsenic was identified above action levels but within NTS background levels (Bordelois, 1998; Forsgren, 1998).

- A sample of pure rock drill oil product associated with CAS 12-44-01 was analyzed and found to contain VOCs and metals. However, these results were all below action levels. No samples were obtained from the leak that occurred involving this oil, which was both used and diluted with water.

- Results from sampling conducted at CAS 19-25-08 indicated that VOCs, SVOCs, and RCRA metals were not detected above action levels. Total petroleum hydrocarbons were detected at the detection level of 2500 mg/kg. Additional sampling is necessary at this site.

- The VOC screening conducted using a photoionization detector indicated the presence of VOCs at concentrations of approximately 1.8 to 2.0 ppm at CASs 19-25-02 and 19-25-05.

Potential contaminants listed below are associated with the oil spills and releases:

- Petroleum hydrocarbons (e.g., lubricating oils, waste oils, diesel fuel) used in activities directly involving or supporting drilling or mining activities. Diesel fuel is expected to be the primary COPC (TPH-DRO) with the greatest potential for concentrations above action levels based on process knowledge gained from similar investigations of hydrocarbon spills. Other fuels, motor oil, antifreeze, and hydraulic fluids are compounds that may have leaked from equipment and trucks, or may have spilled directly onto the ground.

- Radionuclide contamination is not expected to be a major concern at these CASs based on historical information; however, the potential still exists based on process knowledge of the testing activities conducted in Areas 12 and 19 of the NTS.

B.2.2.2 Potential Contaminants

Potential contaminants within the CAU 540 CASs include the full suite of organic, inorganic and radionuclide analytes. Table B.2-2 lists the COPCs for each CAS within CAU 540. The only targeted analyte within the CAU 540 CASs is TPH-DRO. These contaminants were identified during the planning process through the review of site history, process knowledge, personal interviews, past investigation efforts, (where available), and inferred activities associated with these CASs. Because complete information regarding activities performed at the CAU 540 sites is not available, contaminants detected at other similar or other NTS sites were included in the contaminant lists to reduce the uncertainty.

During the review of site history documentation, process knowledge information, personal interviews, past investigation efforts, (where available), and inferred activities associated with the CASs, some of the COPCs were identified as targeted analytes at specific CASs. Targeted analytes are those COPCs for which evidence in the available site and process information suggests that they may be reasonably suspected to be present at a given CAS. The targeted analytes are required to meet a more stringent completeness criteria than other COPCs thus providing greater protection against a decision error (see Section B.7.0).

B.2.2.3 Contaminant Characteristics

Contaminant characteristics include, but are not limited to: solubility, density, and adsorption potential. 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 small particle size, high solubility, low density, and/or low affinity for media are found further from release points or in low areas where evaporation of ponding will concentrate dissolved constituents.

Table B.2-2
Contaminants of Potential Concern for CAU 540 CASs

Analyses[b]	12-44-01	12-99-01	19-25-02	19-25-04	19-25-05	19-25-06	19-25-07	19-25-08	19-44-03
Organic Contaminants of Potential Concern (COPCs)									
Total Petroleum Hydrocarbons-Diesel-Range Organics	X	X	X	X	X	X	X	X	X
Total Petroleum Hydrocarbons-Gasoline-Range Organics	X	X	X	X	X	X	X	X	X
Polychlorinated Biphenyls	X	X	X	X	X	X	X	X	X
Semivolatile Organic Compounds[c]	X	X	X	X	X	X	X	X	X
Volatile Organic Compounds[c]	X	X	X	X	X	X	X	X	X
Inorganic COPCs									
Total *Resource Conservation and Recovery Act* Metals[c]	X	X	X	X	X	X	X	X	X
Radionuclide COPCs									
Gamma Spectrometry[d]	X	X	X	X	X	X	X	X	X

X - Required analytical method

[a]The contaminants of potential concern are the analytes reported from the analytical methods listed.
[b]If the volume of material is limited, prioritization of the analyses will be necessary.
[c]May also include Toxicity Characteristic Leaching Procedure analytes if sample is collected for waste management purposes.
[d]Results of gamma analysis will be used to determine whether further radioanalytical analysis is warranted.

B.2.2.4 Site Characteristics

Site characteristics are defined by the interaction of physical, topographical, and meteorological attributes and properties. Physical properties include permeability, porosity, hydraulic conductivity, degree of saturation, sorting, chemical composition, and organic content. Topographical and meteorological properties and attributes include slope stability, precipitation frequency and amounts, precipitation runoff pathways, drainage channels and ephemeral streams, and evapotranspiration potential.

- Groundwater is not expected to be impacted in Areas 12 and 19 of the NTS for the following reasons. Infiltration of precipitation through subsurface media typically serves as the major driving force for migration of contaminants. However, due to the arid environment of the NTS, percolation of precipitation is small, and migration of contaminants has been shown to be limited. Evaporation potentials significantly exceed precipitation. The average annual precipitation across the CAU 540 sites ranges from 8 to 10 inches per year (DOE/NV, 1997).

- Depth to groundwater in Area 12 well (ER 12-1 Well Site Release and Oil Stained Dirt CASs) generally ranges from 2,400 to 4,200 ft below ground surface (bgs).

- Depth to groundwater in Area 19 well (six Oil Spill CASs and U-19bf Drill Site Release CAS) is approximately 2,340 ft bgs.

- Sloping of the surface at each of these CASs is negligible with the exception of CAS 12-99-01, which contains a gentle gradation, stabilized somewhat by engineering of the location in preparation for the placement of air compressors, stem generation tanks, etc.

B.2.2.5 Migration Pathways and Transport Mechanisms

In general, contaminants with low solubility, high density, and/or high affinity for adsorption to soils can be expected to be found relatively close to release points. Contaminants with small particle size, high solubility, low density, and/or low affinity for soil can be expected to be found further from release points, or in low areas where settling may occur and evaporation of ponding will concentrate dissolved constituents. The COPCs can impact various media (air, soil, water) dependent on the transport mechanism. Volatile COPCs may impact the air, and COPCs contained in a liquid media or are “dusts” dissolved by rainwater may infiltrate the subsoil and potentially impact groundwater. The COPCs that volatilize (VOCs) are not an anticipated concern at these CASs because of the age of the releases; therefore, if they were present in the past, they would be depleted over time. Infiltration of any COPC, beyond shallow substrate, is not a concern at these sites, as discussed in the groundwater impacts section.

Due to the nature of the suspected COPCs, the preferential pathways at the CASs are typically limited to vertical migration due to gravity and minor lateral migration due to localized porosity and permeability increases/changes within the substrate, or confining (impermeable) layers redirecting flow direction, which is always gravity driven, to low points.

Contaminants can be expected to be found relatively close to release points or in low areas where settling may occur and evaporation of ponding will concentrate dissolved constituents. COPC infiltration beyond shallow substrate is not a concern at these CAS sites.

The preferential pathway at these CASs is limited to vertical migration of COPCs due to gravity and the overland flow occurring with heavy precipitation.

While contaminants within a weathered hydrocarbon spill/release may cover a visible area, they will tend to be present in higher concentrations near the point of discharge, and decrease with increasing distance from the point of discharge both laterally and vertically. For example, petroleum-based fuels in soil would tend to be found in higher concentrations near the surface shortly after the spill/leak, then tend to decrease as environmental processes work to reduce the concentrations where such factors as volatilization, microbial degradation, and photodegradation are most effective (i.e., at the surface). Just below the surface, these environmental processes are retarded, thereby resulting in less natural attenuation and greater resulting concentration. Other factors such as adherence to soil particles and vertical transport with precipitation also enhance the hydrocarbon concentrations within the shallow subsurface. Sampling in these preferential locations will increase the probability of detecting contamination if it is present anywhere within the CAS boundary.

Vertical infiltration of COPCs are assumed to be limited in most cases, in part due to the minimal visual lateral area of contamination. In some cases, such as CAS 12-99-01, where release occurrences were likely to be repeated frequently over time, vertical infiltration is expected to be greater than areas that experienced a one-time spill.

- Because there is no physical barrier beneath the spills/releases and the CASs reside on generally flat topography, downward vertical migration will be predominant over lateral migration.

- Contamination, if present, is expected to be primarily confined to the immediate area covered by the spill/release. Unsaturated conditions due to arid climate limit the potential for lateral or vertical migration into surrounding soils.

B.2.2.6 Exposure Scenarios

Site workers may be exposed to COCs through oral ingestion, inhalation, external exposure to radiation, or dermal contact (by absorption) of COCs absorbed onto the soils. Exposure is due to inadvertent disturbance of the contaminated soils and/or contaminated structures.

Areas 12 and 19 are located within the Nuclear Test Zone (DOE/NV, 1998). This zone includes compatible defense and nondefense research, development, and testing projects and activities. These land-use scenarios limit future uses to industrial activities; therefore, future residential uses are not considered.

B.3.0 Step 2 - Identify the Decisions

Step 2 of the DQO process identifies the decision statements and defines appropriate alternative actions that may be taken, depending on the answer to the decision statements.

B.3.1 Decision Statements

Decision I: "Does any COC remain in environmental media within the CAS?" Any contaminant associated with a release from the CAS that is remaining at concentrations exceeding its corresponding FAL will be defined as a COC.

Decision II: "Is sufficient information available to confirm that closure objectives were met?" Sufficient information is defined to include:

- Identifying the lateral and vertical extent of COC contamination in media, if present
- The information needed to characterize IDW for disposal
- The information needed to determine remediation waste types

If sufficient information is not available to confirm that closure objectives were met, then site conditions will be re-evaluated and additional samples will be collected (as long as the scope of the investigation is not exceeded and any CSM assumption has not been shown to be incorrect).

B.3.1.1 Alternative Actions to Decision I

If no COC associated with a release from the CAS is detected, then further assessment of the CAS is not required. If a COC associated with a release from the CAS is detected, then the extent of COC contamination will be determined and additional information required to confirm that closure objectives were met. Media identified as contaminated with COCs above their respective FALs will be removed and confirmation samples will be collected. If confirmation sample results indicate that all contaminated media has been removed, then a clean closure determination will be made. If the confirmation sampling indicates the continued presence of COCs above their respective FALs, additional media will be removed and a second round of confirmation sampling will be conducted. If additional contamination still exists to the edges of the spatial boundaries of the CAS, work will be stopped and a more complex model will be applied (i.e., CAIP, CADD).

B.4.0 Step 3 - Identify the Inputs to the Decision

This step identifies the information needed, determines the sources for information, and identifies sampling and analysis methods that will allow reliable comparisons with FALs.

B.4.1 Information Needs

To resolve Decision I (determine whether a COC is present at a given CAS), samples need to be collected and analyzed following these two criteria: (1) samples must be collected in areas most likely to contain a COC; and (2) the analytical suite selected must be sufficient to identify any COCs present in the samples.

To resolve Decision II (determine whether sufficient information is available to confirm that closure objectives were met at each CAS), samples need to be collected and analyzed to meet the following criteria:

- Samples must be collected in areas contiguous to the contamination but where contaminant concentrations are below FALs.
- Samples of the waste or environmental media must provide sufficient information to characterize the IDW for disposal.
- Samples of the waste or environmental media must provide sufficient information to determine potential remediation waste types.
- The analytical suites selected must be sufficient to detect contaminants at concentrations equal to or less than their corresponding FALs.

B.4.2 Sources of Information

Information to satisfy Decision I and Decision II will be generated by collecting environmental samples using grab sampling, hand auguring, direct push, backhoe excavation, drilling, or other appropriate sampling methods. These samples will be submitted to analytical laboratories meeting the quality criteria stipulated in the Industrial Sites QAPP (NNSA/NV, 2002). Only validated data from analytical laboratories will be used to make DQO decisions. Sample collection and handling activities will follow standard procedures.

B.4.2.1 Sample Locations

Decision I samples must be collected at locations most likely to contain a COC, if present. These locations will be selected based on field-screening techniques, biasing factors, the CSM, and existing information. Analytical suites for Decision I samples will include all COPCs identified in Table B.2-2.

Biasing factors may be used to select samples to be submitted for laboratory analyses based on existing site information and site conditions discovered during the investigation. The following factors will be considered in selecting locations for analytical samples at CAU 540:

- Stains: Any spot or area on the soil surface that may indicate the presence of a potentially hazardous liquid. Typically, stains indicate an organic liquid such as an oil has reached the soil, and may have spread out vertically and horizontally.
- Elevated radiation: Any location identified during radiological surveys that had alpha/beta/gamma levels significantly higher than surrounding background soil.
- Preselected areas based on process knowledge of the site: Locations for which evidence such as historical photographs, experience from previous investigations, or interviewee’s input exists that a release of hazardous or radioactive substances may have occurred.
- Preselected areas based on process knowledge of the contaminant(s): Locations that may reasonably have received contamination, selected on the basis of the chemical and/or physical properties of the contaminant(s) in that environmental setting.
- Previous sample results: Locations that may reasonably have been contaminated based upon the results of previous field investigations.
- Experience and data from investigations of similar sites.
- Visual indicators such as discoloration, textural discontinuities, disturbance of native soils, or any other indication of potential contamination.
- Odor.
- Physical and chemical characteristics of contaminants.
- Other biasing factors: Factors not previously defined for the Corrective Action Investigation but become evident once the investigation of the site is under way.

Decision II sample step-out locations will be selected based on the CSM, biasing factors, and existing data. Analytical suites will include those parameters that exceeded FALs (i.e., COCs) in prior samples. Biasing factors to support Decision II sample locations include Decision I biasing factors plus available analytical results.

B.4.2.2 Analytical Methods

Analytical methods are available to provide the data needed to resolve the decision statements. The analytical methods and laboratory requirements (e.g., detection limits, precision, and accuracy) are provided in Table 7-2 and Table 7-3 along with specific analyses required for the disposal of IDW.

B.5.0 Step 4 - Define the Boundaries of the Study

The purpose of this step is to define the population of interest, define the spatial boundaries, determine practical constraints on data collection, and define the scale of decision making.

B.5.1 Populations of Interest

The population of interest to resolve Decision I ("Is any COC present in environmental media within the CAS?") is any single location within the site that contains a contaminant above a FAL. The populations of interest to resolve Decision II ("If a COC is present, is sufficient information available to confirm that closure objectives were met?") are:

- Each one of a set of locations bounding contamination in lateral and vertical directions
- IDW or environmental media that must be characterized for disposal
- Potential remediation waste

B.5.2 Spatial Boundaries

Spatial boundaries are the maximum lateral and vertical extent of expected contamination at each CAS, as shown in Table B.5-1. Contamination found beyond these boundaries may indicate a flaw in the CSM and may require re-evaluation of the CSM before the investigation could continue. Each CAS is considered geographically independent and intrusive activities are not intended to extend into the boundaries of neighboring CASs.

B.5.3 Practical Constraints

Access restrictions include scheduling conflicts on the NTS with other entities, areas posted as contamination areas requiring appropriate work controls, physical barriers (e.g., fences, buildings, steep slopes), and areas requiring authorized access. Underground utilities surveys will be conducted at each CAS before the start of investigation activities to determine whether utilities exist, and, if so, determine the limit of spatial boundaries for intrusive activities.

Table B.5-1
Spatial Boundaries of CAU 540 CASs

Corrective Action Site	Spatial Boundaries
12-44-01	The footprint of each visible area of stained soil plus a 50-foot lateral buffer; 14 feet below ground surface vertically.
12-99-01	
19-25-02	
19-25-04	
19-25-05	
19-25-06	
19-25-07	
19-25-08	
19-44-03	

B.5.4 Define the Scale of Decision Making

The scale of decision making in Decision I is defined as the CAS. Any COC detected at any location within the CAS will cause the determination that the CAS is contaminated and needs further evaluation. The scale of decision making for Decision II is defined as a contiguous area contaminated with any COC originating from the CAS. Resolution of Decision II requires this contiguous area to be bounded laterally and vertically.

B.6.0 Step 5 - Develop a Decision Rule

This step develops a decision rule ("If..., then...") statement that defines the conditions under which possible alternative actions will be chosen. In this step, we specify the statistical parameters that characterizes the population of interest, specify the FALs, confirm that detection limits are capable of detecting FALs, and present decision rules.

B.6.1 Population Parameters

Each sample result representing each population of interest defined in Step 4 will be compared to the FALs to determine the appropriate resolution to Decision I and Decision II. For the Decision I population of interest, a single analytical sample result above FALs would cause a determination that a COC is present within the CAS. For the Decision II population of interest, a single analytical sample result above FALs would cause a determination that the contamination is not bounded in one direction.

Because this approach does not use a statistical average for comparison to the FALs, but rather a point-by-point comparison, the population parameter for both populations of interest is the observed concentration of each analyte from individual analytical sample results.

B.6.2 Decision Rules

The decision rules applicable to both Decision I and Decision II are:

- If COC contamination is inconsistent with the CSM or extends beyond the spatial boundaries identified in Section B.5.2, then work will be suspended and the investigation strategy will be reconsidered. If a COC is present, is consistent with the CSM, and is within spatial boundaries, then the decision will be to continue sampling to define the extent.

The decision rules for Decision I are:

- If the population parameter (the observed concentration of each analyte) of any COPC in the Decision I population of interest (defined in Step 4) exceeds the corresponding FAL, then that analyte is identified as a COC, and additional samples will be collected until an estimate of the delineation of contaminated media volume has been made. Contaminated media within the confines of the delineated volume will be removed and verification samples will be collected.

If all COPC concentrations are less than the corresponding FALs, then the decision will be no further action.

The decision rules for Decision II are:

- If the population parameter (the observed concentration of any COC) in the Decision II verification population of interest (defined in Step 4) exceeds the corresponding FAL, then additional step-out samples will be collected to bound COC contamination. If all bounding COC concentrations are less than the corresponding FALs, then the decision will be that the extent of contamination has been defined in the corresponding lateral and/or vertical direction.

If valid analytical results are available for the waste characterization samples defined in Section B.8.0, then the decision will be that sufficient information exists to characterize the IDW for disposal, determine potential remediation waste types, and to confirm that closure objectives were met.

B.6.3 Action Levels

The PALs presented in this section are to be used for site screening purposes. They are not necessarily intended to be used as cleanup action levels or FALs. However, they are useful in screening out analytes that are not present in sufficient concentrations to warrant further evaluation and, therefore, streamline the consideration of remedial alternatives. The process that will be used to move from PALs to FALs is specified by NAC 445A (NAC, 2004). This regulation stipulates that determination of FALs shall be established by an evaluation of the site based on the risk it poses to public health and the environment. This evaluation will be conducted using Method E1739-95, adopted by the ASTM (ASTM, 1995). The ASTM's RBCA process is summarized in Section 3.2.1 of the SAFER Plan. The Tier I action levels for Decision I and Decision II are the PALs. The specific chemical PALs for CAU 540 are listed in Section 3.2.1.1 of the SAFER Plan. The PAL for TPH is 100 ppm as listed in NAC 445A.2272 (NAC, 2004). The specific radiological PALs for CAU 540 are listed in Section 3.2.1.3 of the SAFER Plan. The radiological PAL for solid media will be defined as the unrestricted-release criteria defined in the *NV/YMP Radiological Control Manual* (NNSA/NSO, 2005).

If necessary, a Tier 2 or Tier 3 evaluation will be conducted by calculating SSTLs. If a Tier 2 or Tier 3 evaluation is conducted for TPH, the hazardous constituents of TPH will be compared to the

SSTLs as the general measure of TPH provides insufficient information about the amounts of individual chemicals of concern within the TPH measurement.

The comparison of laboratory results to FALs and the evaluation of potential corrective actions will be included in the investigation report. The FALs will be defined (along with the basis for their definition) in the investigation report.

B.6.4 Measurement and Analysis Sensitivity

The measurement and analysis methods listed in Section 3.1 and in the Industrial Sites QAPP (NNSA/NV, 2002) are capable of measuring analyte concentrations at or below the corresponding FALs for each COPC. See Section 7.2 of the SAFER Plan for additional details.

B.7.0 Step 6 - Tolerable Limits on Decision Errors

The purpose of this step is to specify performance criteria for the decision rule. Setting tolerable limits on decision errors is neither obvious nor easy. It requires the planning team to weigh the relative effects of threat to human health and the environment, expenditure of resources, and consequences of an incorrect decision. Section 7.1 of the EPA QA/G-4HW guidance document states that if judgmental sampling approaches are used, quantitative statements about data quality will be limited to measurement error (EPA, 2000). Measurement error is influenced by imperfections in the measurement and analysis system. Random and systematic measurement errors are introduced in the measurement process during physical sample collection, sample handling, sample preparation, sample analysis, and data reduction. If measurement errors are not controlled they may lead to errors in making the DQO decisions.

This section provides an assessment of the possible outcomes of DQO decisions and the impact of those outcomes if the decisions are in error.

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

- Baseline condition - A COC is present.
- Alternative condition - A COC is not present.

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

- Baseline condition - The extent of a COC has not been defined and closure objectives were not met.

- Alternative condition - The extent of a COC has been defined and closure objectives were met.

Decisions and/or criteria have false negative or false positive errors associated with their determination. The impact of these decision errors and the methods that will be used to control these errors are discussed in the following subsections. In general terms, confidence in DQO decisions based on judgmental sampling results will be established qualitatively by:

- The development of and concurrence of CSMs (based on process knowledge) by stakeholder participants during the DQO process.

- Testing the validity of CSMs based on investigation results.
- Evaluating the quality of the data based on DQI parameters.

B.7.1 False Negative Decision Error

The false negative 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 has not (Decision II), or deciding that closure objectives were met when they were not (Decision II). In all of these cases the potential consequence is an increased risk to human health and environment.

The false negative decision error (where consequences are more severe) is controlled by meeting these criteria:

1. For Decision I, having a high degree of confidence that the sample locations selected will identify COCs if present anywhere within the CAS. For Decision II, having a high degree of confidence that the sample locations selected will identify the extent of COCs.
2. Having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.
3. Having a high degree of confidence that the dataset is of sufficient quality and completeness.

To satisfy the first criterion, Decision I samples must be collected in areas most likely to be contaminated by COCs (supplemented by random samples where appropriate). Decision II samples must be collected in areas that represent the lateral and vertical extent of contamination (above FALs). The following characteristics must be considered to control decision errors for the first criterion:

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

These characteristics were considered during the development of the CSM and the selection of sampling locations. The field-screening methods and biasing factors listed in Section 4.2 will be used to further ensure that appropriate sampling locations are selected to meet these criteria. Radiological survey instruments and field-screening equipment will be calibrated and checked in accordance with the manufacturer's instructions and approved procedures. The investigation report will present an assessment on the DQI of representativeness that samples were collected from those locations that best represent the populations of interest as defined in Section B.5.1.

To satisfy the second criterion, Decision I samples will be analyzed for the chemical and radiological parameters listed in Section 4.1 of the SAFER Plan. Decision II samples will be analyzed for those chemical and radiological parameters that identified unbounded COCs. The DQI of sensitivity will be assessed for all analytical results to ensure that all sample analyses had measurement sensitivities (detection limits) that were 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) in the investigation report.

To satisfy the third criterion, the entire dataset, as well as individual sample results, will be assessed against the DQIs of precision, accuracy, comparability, and completeness as defined in the Industrial Sites QAPP (NNSA/NV, 2002) and in Section 7.2 of the SAFER Plan. The DQIs of precision and accuracy will be used to assess overall analytical method performance as well as to assess the need to potentially "flag" (qualify) individual analyte results when corresponding QC sample results are not within the established control limits for precision and accuracy. Data qualified as estimated for reasons of precision or accuracy may be considered to meet the analyte performance criteria based on an assessment of the data. The DQI of completeness will be assessed to ensure that all data needs identified in the DQO have been met. The DQI of comparability will be assessed to ensure that all analytical methods used are equivalent to standard EPA methods so that results will be comparable to regulatory action levels that have been established using those procedures. Strict adherence to established procedures and QA/QC protocol protects against false negatives. To provide information for the assessment of the DQIs of precision and accuracy, the following quality control samples will be collected as required by the Industrial Sites QAPP (DOE/NV, 2002):

- Field duplicates (minimum of 1 per matrix per 20 environmental samples)
- Laboratory QC samples (minimum of 1 per matrix per 20 environmental samples or 1 per CAS per matrix, if less than 20 collected)

B.7.2 False Positive Decision Error

The false positive decision error would mean deciding that a COC is present when it is not, or a COC is unbounded when it is not, resulting in increased costs for unnecessary sampling and analysis.

The false positive decision error is controlled by implementing all the controls that protect against false negative decision errors. False positive results are typically attributed to laboratory and/or sampling/handling errors that could cause cross contamination. To control against cross contamination, decontamination of sampling equipment will be conducted according to established and approved procedures and only clean sample containers will be used. To determine whether a false positive analytical result may have occurred, the following quality control samples will be collected as required by the Industrial Sites QAPP (NNSA/NV, 2002):

- Trip blanks (1 per sample cooler containing VOC environmental samples)
- Equipment blanks (1 per sampling event for each type of decontamination procedure)
- Source blanks (1 per source lot per sampling event)
- Field blanks (minimum of 1 per CAS - additional if field conditions change)

B.8.0 Step 7 - Optimize the Design for Obtaining Data

This section provides the general approach for obtaining the information necessary to resolve Decision I and Decision II. A judgmental (nonprobabilistic) sampling scheme will be implemented to select sample locations and evaluate analytical results. Judgmental sampling allows the methodical selection of sample locations that target the populations of interest (defined in Step 4) rather than non-selective random locations. Random sample locations are used to generate average contaminant concentrations that estimate the true average ("characteristic") contaminant concentration of the site to some specified degree of confidence.

Because individual sample results, rather than an average concentration, will be used to compare to FALs, statistical methods to generate site characteristics will not be necessary. Section 0.4.4 of the EPA *Guidance for the Data Quality Objectives Process* (EPA, 2000) states that the use of statistical methods may not be warranted by program guidelines or site-specific sampling objectives. The need for statistical methods is dependent upon the decisions being made. Section 7.1 of the EPA QA/G-4HW guidance states that a nonprobabilistic (judgmental) sampling design is developed when there is sufficient information on the contamination sources and history to develop a valid CSM and to select specific sampling locations. This design is used to confirm the existence of contamination at specific locations and provide information (such as extent of contamination) about specific areas of the site.

All sample locations will be selected to satisfy the DQI of representativeness in that samples collected from selected locations will best represent the populations of interest as defined in Section B.5.1. To meet this criterion, a biased sampling strategy will be used for Decision I to target areas with the highest potential for contamination, if it is present anywhere in the CAS. Sample locations will be determined based on process knowledge, previously acquired data, or the field-screening and biasing factors listed in Section B.4.2.1. If biasing factors are present in soils below locations where Decision I samples were removed, additional Decision I soil samples will be collected at depth intervals selected by the Site Supervisor based on biasing factors to a depth where the biasing factors are no longer present. The Site Supervisor has the discretion to modify the sample locations, but only if the modified locations meet the decision needs and criteria stipulated in this DQO.

To meet the DQI of representativeness for step-out (Decision II) samples (that Decision II sample locations represent the population of interest as defined in Section B.5.1), sampling locations at each CAS will be selected based on the outer boundary sample locations where COCs were detected, the CSM, and other field-screening and biasing factors listed in Section 4.2. In general, sample locations will be arranged in a triangular pattern around the Decision I location at distances based on site conditions, process knowledge, and biasing factors. If COCs extend beyond the initial step-outs, Decision II samples will be collected from incremental step-outs. Initial step-outs will be at least as deep as the vertical extent of contamination defined at the Decision I location and the depth of the incremental step-outs will be based on the deepest contamination observed at all locations. A clean sample (i.e., COCs less than FALs) collected from each step-out direction (lateral or vertical) will define extent of contamination in that direction. The number, location, and spacing of step-outs may be modified by the Site Supervisor, as warranted by site conditions.

The following sections discuss CAS-specific investigation activities, including proposed sample locations. As the sampling strategy for each CAS is developed, specific biasing factors will be described.

B.8.1 Sampling Design

This section discusses the sampling design for all of the CASs located at CAU 540.

These CASs are combined for discussion of investigation activities. As discussed in Section B.2.0, radiological soil contamination at this site originating from nuclear testing is specifically excluded from this investigation. If such contamination exists, it will be addressed by the Soils Program.

B.8.1.1 Site Preparation

Several site preparation activities and preliminary investigation techniques must be completed prior to the initiation of sampling activities for the CASs. These activities include the following:

- Removing tumbleweeds from each location, if needed.
- Inspecting the surface features of each CAS for staining, debris, etc.

B.8.1.2 Sample Collection

Sampling locations will be selected in areas most likely to be contaminated based on the CSM and other biasing factors outlined in Step 3 (e.g., field screening). Exact sample locations will be determined in the field by the Site Supervisor. Figure B.2-1 provides a three-dimensional plan map view of the general CSM.

Subsurface samples will be collected from biased locations within the center of each identified anomaly and from area identified as being outside the area of visible staining. Locations with any biasing factors will be considered in selecting the sample point(s) for surface and subsurface sample collection and laboratory submittal.

Subsurface soil sampling may be conducted to determine the extent of COC above FALs. Hand augering, backhoe excavation, or direct-push sampling methods will be used during the investigation of these CASs. If the vertical extent of contamination is deeper than the limits of these techniques, then an appropriate drilling method will be used.

To investigate the vertical and lateral extent of contamination where COCs above FALs were detected in Decision I sample locations, subsurface samples will be collected after the removal of the suspected contaminated media to confirm that the extent of COCs has been identified and/or that all of the affected media has been removed. Each sample will be submitted to the laboratory for analysis for only the COCs identified in Decision I.

Vertical and lateral extent of contamination will be bounded by laboratory analytical results that show concentrations of COCs below FALs. If any of the step-out analytical results indicate COCs are still present, additional depth step-out locations (vertically and/or laterally) will be sampled until it can be demonstrated that COC concentrations below FALs have been achieved. If results indicate the extent of contamination extends beyond 50 ft of the suspected center of the stained areas, the conceptual model has failed and the investigation will need rescoping.

Housekeeping activities may involve the removal of various wood, metal, and other miscellaneous debris located within the boundaries of the CAS. Any surface debris that requires content identification will be sampled and then removed through housekeeping operations. Any additional housekeeping activities identified during the course of the investigation will be documented and implemented.

B.9.0 References

ASTM, see American Society for Testing and Materials.

American Society for Testing and Materials. 1995. *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites/American Society for Testing and Materials*, ASTM E1739-95 (reapproved 2002). Philadelphia, PA.

Bordelois, B., Science Applications International Corporation. 1998. Memorandum to R. Jackson (IT Corp.) entitled, "CAU 357, CAS 07-09-02, Sampling Report," 9 April. Livermore, CA.

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

EPA, see U.S. Environmental Protection Agency.

Forsgren, F., HSI GeoTrans, Inc. 1998. Memorandum to R. Jackson (IT Corp.), entitled: "CAU 356, CAS 03-09-05, Sampling Report," 14 April. Las Vegas, NV.

NAC, see *Nevada Administrative Code.*

NNSA/NSO, see U.S. Department of Energy, Nevada Site Office.

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

Nevada Administrative Code. 2004. NAC 445A.2272, "Contamination of Soil: Establishment of Action Levels." Carson City, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office. 2002. *Industrial Sites Quality Assurance Project Plan*, DOE/NV--372. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1997. *Regional Groundwater Flow and Tritium Transport Modeling and Risk Assessment of the Underground Test Area, Nevada Test Site, Nevada,* DOE/NV-477. Las Vegas, NV.

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U.S. Environmental Protection Agency. 2000. *Data Quality Objectives Process for Hazardous Waste Site Investigations*. EPA QA/G4-HW. Washington, DC.

Appendix C

Nevada Environmental Restoration Project

Document Review Sheets

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

1. Document Title/Number Draft Streamlined Approach for Environmental Restoration for Corrective Action Unit 540: Spill Sites, Nevada Test Site, Nevada
2. Document Date October 2005
3. Revision Number 0
4. Originator/Organization Stoller-Navarro
5. Responsible DOE/NV ERP Project Mgr. Janet Appenzeller-Wing
6. Date Comments Due November 14, 2005
7. Review Criteria Full
8. Reviewer/Organization/Phone No. Don Elle, NDEP, 486-2850, ext. 229
9. Reviewer's Signature

10. Comment Number/ Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept
1) Figure 1-2 CAU 540 SAFER Closure Decision Process		The decision diamond under Clean Closure had no direction for a no decision. Please correct or explain this.	Figure has been corrected to include direction (arrow).	Yes
2) Page 35 of 59 3rd Paragraph 1st Sentence		"..., contaminated media will be removed a set of confirmation samples will be obtained." This does not make sense; please clarify.	Text revised to state..."After remediation, if concentrations of COCs are below their respective PALs and FALs, a set of confirmation samples will be obtained".	Yes
3) Table 4-2 Referenced on Page 44 of 59 1st Paragraph 2nd Sentence		Referenced on page 44 of 59, first paragraph, second sentence, is missing.	Text revised to state..."Table 4-2 of the NV/YMP Radiological Control Manual (DOE/NV, 2005)".	Yes
4) Page B-5 of B-28 4th Bullet		"A samples...was found to be below action levels for all parameters, including TPH, although the method detection limit was 2,500 mg/kg, which is above the 100 mg/kg action level." There is no guarantee that TPH in this sample is below the 100 mg/kg action level with such a high method detection limit. Please provide your rationale for this approach.	Text revised to state, "Results from sampling conducted at CAS 19-25-08 indicated that VOCs, SVOCs, and RCRA metals were not detected above action levels. Total petroleum hydrocarbons were detected at the detection level of 2500 mg/kg. Additional sampling is necessary at this site."	Yes

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

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NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

Document Title/Number ______________________________ Revision Number 0

Reviewer/Organization ______________________________

10. Comment Number/ Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept
5) Page B-11 of B-28 Last Paragraph 4th Sentence		"A determination that the contaminated media has been removed the results in a determination of clean closure." This sentence does not make sense. Please re-write it for clarity.	Text was revised to state, "If confirmation sample results indicate that all contaminated media has been removed, then a clean closure determination will be made."	Yes

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

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