ERRATA SHEET

The Following Corrections and Clarifications Apply to: *Corrective Action Decision Document for Corrective Action Unit 536, Area 3 Release Site, Nevada Test Site, Nevada*

DOE Document Number: DOE/NV—1021

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Subsequent to the distribution of the *Corrective Action Decision Document for Corrective Action Unit 536: Area 3 Release Site, Nevada Test Site, Nevada*, Revision 0, DOE/NV—1021 the following discrepancies/errors were identified:

Appendix A. Section A.3.2.2. Concrete Pad, Decision I Sampling (Page A-17): The third sentence incorrectly states " ...19 borings (A05 to A23)." Change the number 19 to the number 23, and the sample location number A05 to A01. The forth sentence incorrectly states, "All 19 Decision I locations..." Change the number 19 to the number 23.

Appendix A, Figure A.3-4: There is an incorrect value in the text box under DiB for sample 536A145. Change the number 250 to the capital letter "R."

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Corrective Action Decision Document for Corrective Action Unit 536: Area 3 Release Site, Nevada Test Site, Nevada

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CORRECTIVE ACTION DECISION DOCUMENT FOR CORRECTIVE ACTION UNIT 536: AREA 3 RELEASE SITE, NEVADA TEST SITE, NEVADA

U.S. Department of Energy
National Nuclear Security Administration
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CORRECTIVE ACTION DECISION DOCUMENT
FOR CORRECTIVE ACTION UNIT 536: AREA 3 RELEASE SITE,
NEVADA TEST SITE, NEVADA

Approved by: Signature Approved Date: 11/18/04

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List of Acronyms and Abbreviations

BAP	Benzo(a)pyrene
bgs	Below ground surface
CADD	Corrective Action Decision Document
CAI	Corrective Action Investigation
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CFR	*Code of Federal Regulations*
CLP	Contract Laboratory Program
COC	Contaminant of concern
COPC	Contaminant of potential concern
CRDL	Contract-required detection limit
CSM	Conceptual site model
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DQI	Data quality indicators
DQO	Data quality objective
DRO	Diesel-range organics
EPA	U.S. Environmental Protection Agency
FADL	Field Activity Daily Log
FD	Field duplicate
FFACO	*Federal Facility Agreement and Consent Order*
FSL	Field-screening level
FSR	Field-screening result
ft	Foot
GPS	Global positioning system

List of Acronyms and Abbreviations *(Continued)*

GRO	Gasoline-range organics
HWAA	Hazardous waste accumulation area
ICP	Inductively coupled plasma
IDW	Investigation-derived waste
in.	Inch(es)
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
M&O	Management and Operating
MDC	Minimum detectable concentration
MDL	Method detection limit
mg/kg	Milligram per kilogram
mi	Mile
mrem/yr	Millirem per year
MRL	Minimum reporting limit
MS/MSD	Matrix spike/matrix spike duplicate
NAC	Nevada Administrative Code
NCRP	National Council on Radiation Protection and Measurements
NDEP	Nevada Division of Environmental Protection
NEPA	*National Environmental Policy Act*
NIST	National Institute for Standards and Technology
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NRS	Nevada Revised Statute
NTS	Nevada Test Site
NTSWAC	Nevada Test Site Waste Acceptance Criteria
PAH	Polyaromatic hydrocarbons
PAL	Preliminary action level

List of Acronyms and Abbreviations *(Continued)*

PB	Preparation blank
PCB	Polychlorinated biphenyls
pCi/g	Picocurie per gram
PID	Photoionization detector
POC	Performance Objective for Certification of Nonradioactive Hazardous Waste
ppm	Part per million
PRG	Preliminary Remediation Goals
Pu	Plutonium
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RCRA	*Resource Conservation and Recovery Act*
ROTC	Record of Technical Change
RPD	Relative percent difference
SCL	Sample collection log
SDG	Sample delivery group
SVOC	Semivolatile organic compound
TPH	Total petroleum hydrocarbons
U	Uranium
USGS	U.S. Geological Survey
VOC	Volatile organic compound
WM	Waste Management
yd^3	Cubic yard
%R	Percent recovery
µg/kg	Micrograms per kilograms

Executive Summary

This Corrective Action Decision Document (CADD) has been prepared for Corrective Action Unit (CAU) 536: Area 3 Release Site. The purpose of the CADD is to identify and provide a rationale for the recommendation of a corrective action alternative for the corrective action site (CAS) within CAU 536. This CADD complies with the requirements of the *Federal Facility Agreement and Consent Order* (1996). A single CAS, 03-44-02 (Steam Jenny Discharge), comprises CAU 536 and includes a large concrete pad, a sump on the eastern side and a smaller concrete pad adjacent to the western side of the larger concrete pad, a drainage ditch running along the southern edge of the CAS footprint, and the surrounding soil. Corrective Action Unit 536 is located in Area 3 of the Nevada Test Site (NTS), Nevada. The NTS is approximately 65 miles northwest of Las Vegas, Nevada.

Corrective action investigation activities were conducted from March to August 2004 at CAS 03-44-02. Corrective action investigation activities were performed as set forth in the *Corrective Action Investigation Plan for Corrective Action Unit 536: Area 3 Release Site, Nevada Test Site, Nevada* (NNSA/NSO, 2003), and Record of Technical Change No. 1.

Analytes detected during the corrective action investigation activities were evaluated against appropriate preliminary action levels (PALs) to determine the contaminants of concern (COCs) for CAU 536. Assessment of the data generated from the activities at CAS 03-44-02 revealed the following:

- COCs include total petroleum hydrocarbons (TPH) (diesel- and oil- range organics); five polyaromatic hydrocarbons (PAHs), which include benzo(a)pyrene, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene, and plutonium (Pu)-239/240.

- The COCs were bounded vertically and laterally. Data show that there are multiple locations of surface and subsurface TPH and PAH contamination. The vertical extent of TPH/PAH contamination is limited to the upper 2 feet (ft) of soil across most of the site except near the sump located on the eastern side of the main concrete pad and the area west of the main concrete pad where COCs extend to depths between 6.5 ft and 10 ft below ground surface. The Pu-239/240 is limited to the upper 1 ft of soil. Because Pu-239/240 is attributed to atmospheric testing fallout it was not further delineated beyond that achieved with Decision I sample results.

Clean Closure is the recommended alternative for Corrective Action Site 03-44-02. This recommendation is based on the evaluation of analytical data from the corrective action investigation, review of current and future operations in Area 3 of the Nevada Test Site, written directives from the Nevada Division of Environmental Protection, and the detailed and comparative analysis of the potential corrective action alternatives.

The preferred corrective action alternative was evaluated on technical merit focusing on performance, reliability, feasibility, and safety. The alternative was judged to meet all requirements for the technical components evaluated. The alternative meets all applicable state and federal regulations for closure of the site and will eliminate potential future exposure pathways to the contaminated media at CAU 536.

1.0 Introduction

This Corrective Action Decision Document (CADD) has been prepared for Corrective Action Unit (CAU) 536: Area 3 Release Site, Nevada Test Site (NTS), Nevada, in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the State of Nevada, the U.S. Department of Energy (DOE), and the U.S Department of Defense (FFACO, 1996).

The NTS is approximately 65 miles (mi) northwest of Las Vegas, Nevada (Figure 1-1). Corrective Action Unit 536 is comprised of a single Corrective Action Site (CAS), 03-44-02, Steam Jenny Discharge, and is located in Area 3 of the NTS (Figure 1-2). The CAU was investigated in accordance with the Corrective Action Investigation Plan (CAIP) and Record of Technical Change (ROTC) No. 1 (NNSA/NV, 2003).

The CADD provides or references the specific information necessary to support the recommended corrective action alternative selected to complete closure of the site.

1.1 Purpose

The CAU 536, Area 3 Release Site, includes the Steam Jenny Discharge (CAS 03-44-02) that was historically used for steam cleaning equipment in the Area 3 Camp. Concerns at this CAS include contaminants commonly associated with steam cleaning operations and Area 3 Camp activities that include total petroleum hydrocarbons (TPH), unspecified solvents, radionuclides, metals, and polychlorinated biphenyls (PCBs). The CAIP for *Corrective Action Unit 536: Area 3 Release Site, Nevada Test Site, Nevada* (NNSA/NV, 2003), provides additional information relating to the history, planning, and scope of the investigation; therefore, it will not be repeated in this CADD.

This CADD identifies potential corrective action alternatives and provides a rationale for the selection of a recommended corrective action alternative for the CAS within CAU 536. The evaluation of corrective action alternatives is based on process knowledge and the results of the investigative activities conducted in accordance with the CAIP (NNSA/NV, 2003) that was approved prior to the start of the corrective action investigation (CAI). Record of Technical Change No. 1 to the CAIP documents changes to the PALs agreed to by the Nevada Division of

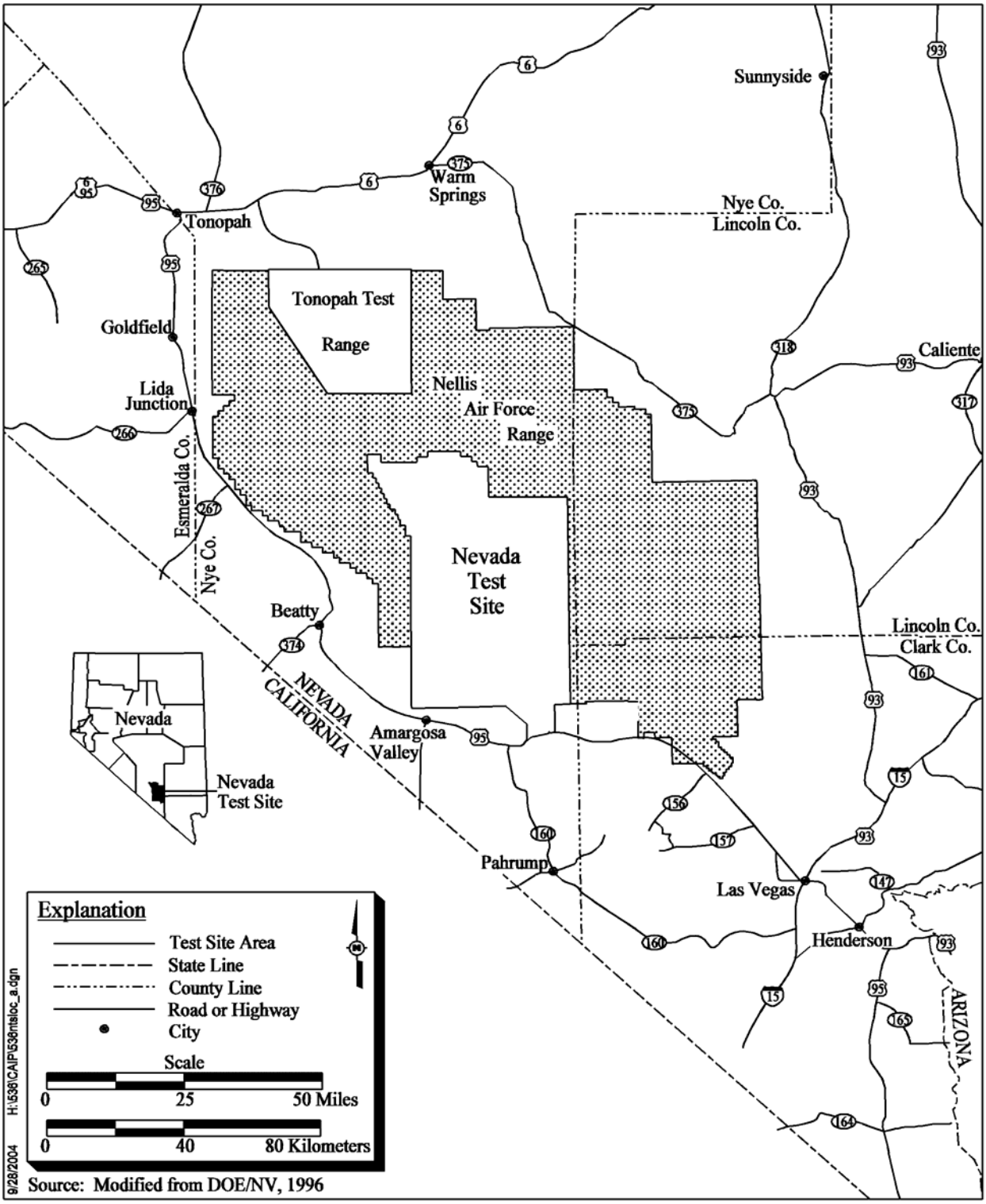

Figure 1-1
Nevada Test Site Location Map

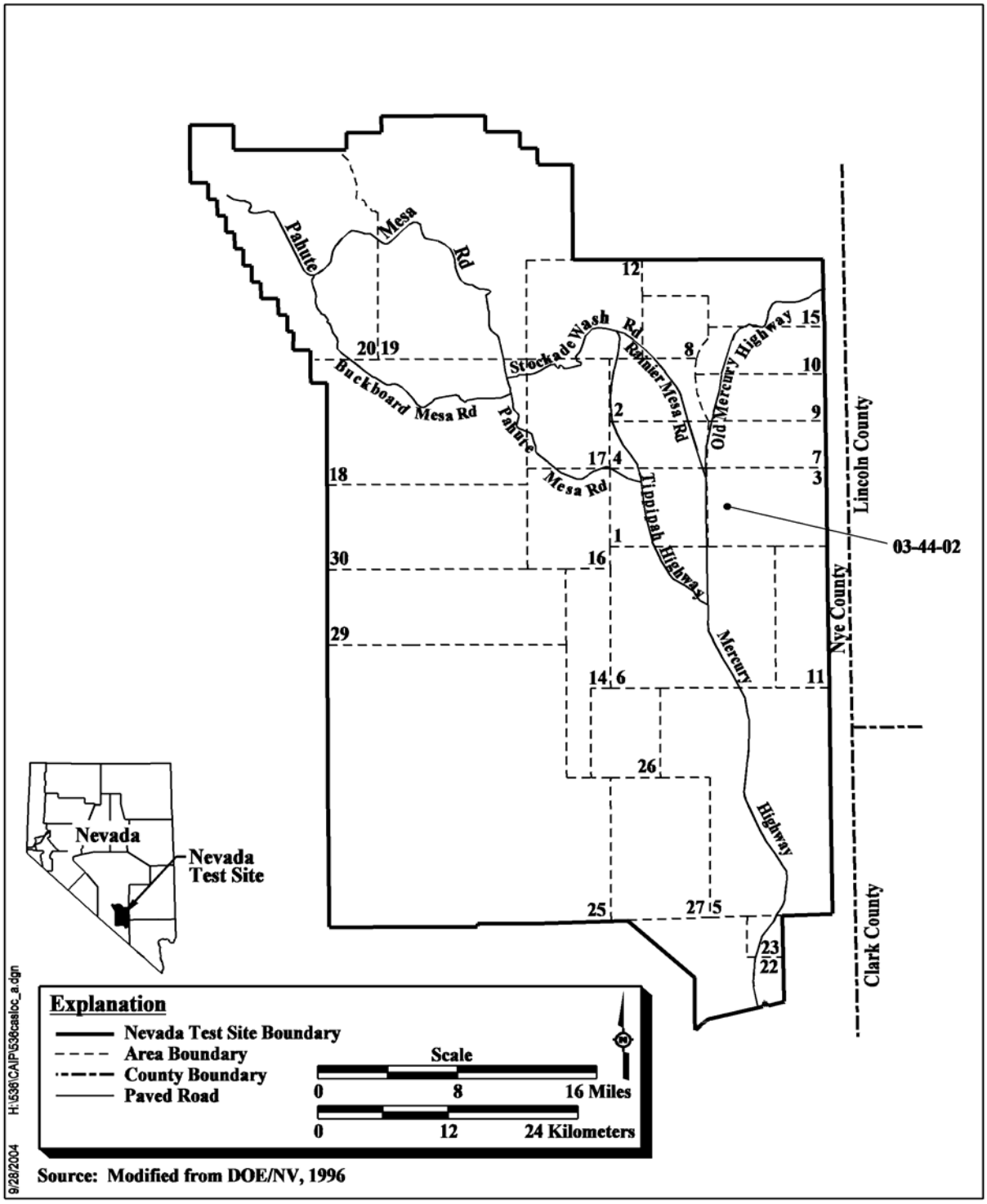

Figure 1-2
CAS 03-44-02 Location Map

Environmental Protection (NDEP) and DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO). This ROTC provides the justification for changing from background -based to dose-based radiological PALs. This ROTC was approved and the dose-based PAL comparison implemented on March 9, 2004.

1.2 Scope

The scope of this CADD consists of the following:

- Develop corrective action objectives.
- Identify corrective action alternative screening criteria.
- Develop corrective action alternatives.
- Perform detailed and comparative evaluation of corrective action alternatives in relation to corrective action objectives and screening criteria.
- Recommend and justify a preferred corrective action alternative for CAS 03-44-02 within CAU 536.

1.3 CADD Contents

This CADD is divided into the following sections:

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

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

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

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

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

Appendix A - *Corrective Action Investigation Results for CAU 536:* Provides a description of the project objectives, field investigation and sampling activities, investigation results, waste management, and quality assurance.

Appendix B - *Data Assessment for CAU 536*: Summarizes the investigation results as they meet the requirements set forth during the data quality assessment process.

Appendix C - *Cost Estimates for CAU 536*: Provides an estimate of the costs to be incurred during the closure activities at CAS 03-44-02.

Appendix D - *Sample Location Coordinates for CAU 536*: Provides coordinates for CAU 536 investigation sample locations.

Appendix E - *Evaluation of Risk for CAU 536*.

Appendix F - *Project Organization for CAU 536.*

1.3.1 Supporting Documentation

All work was performed in accordance with the following documents:

- *Corrective Action Investigation Plan for Corrective Action Unit 536: Area 3 Release Site, Nevada Test Site, Nevada,* and ROTC No. 1 (NNSA/NSO, 2003)
- *Industrial Sites Quality Assurance Project Plan* (QAPP) (NNSA/NV, 2002)
- *Federal Facility Agreement and Consent Order* (1996)
- *Project Management Plan* (DOE/NV, 1994)

1.3.2 Data Quality Objectives

The Data Quality Objectives (DQOs) identified in the CAIP are as follows:

- Determine if contaminants of concern (COCs) are present.
- If COCs are present, determine their nature and extent.

The Data Quality Indicators (DQIs) as discussed in Appendix B, were achieved and the lateral and vertical extent of the contamination was determined. The DQOs, established in the CAIP, were met.

2.0 Corrective Action Investigation Summary

Corrective action investigation activities were performed as set forth in the CAU 536 CAIP (NNSA/NV, 2003) from March 18 to March 24, 2004. Further investigation activities were performed on three additional days on May 7, June 30, and August 25, 2004. The following sections describe and summarize the CAU 536 investigation activities, investigation results, and identify the need for corrective action at the CAS level. For detailed investigation results, refer to Appendix A.

2.1 Investigation Activities

The primary purpose of the CAU 536 CAI was to:

- Determine if COPCs are present within the soils associated with the decontamination pad
- Determine whether the COPCs, if present, exceed preliminary action levels (PALs) thereby becoming COCs.
- Define the lateral and vertical extent of identified COCs.
- Collect information and data to satisfy DQOs and evaluate corrective action alternatives for CAS 03-44-02.
- Ensure adequate data have been collected to close the site under the National Environmental Policy Act (NEPA), *Resource Conservation and Recovery Act* (RCRA), and DOE requirements.

The scope of the CAI for CAU 536 included:

- Conduct prefield activities, including construction of hazardous waste accumulation areas (HWAAs) and utility clearances
- Conduct radiological surveys
- Collect biased surface and subsurface soil samples
- Collect soil samples at step-out locations, as necessary, to further define the extent of contamination

- Submit select soil samples for off-site laboratory analysis
- Conduct discrete field screening of select samples for characterization and health and safety purposes
- Collect quality control (QC) samples
- Collect waste management samples, as necessary
- Collect Global Positioning System (GPS) coordinates of sampling locations

Field Screening

Field-screening activities were performed as specified in the CAIP on all Decision I samples. Field screening was conducted using a photoionization detector for volatile organic compounds (VOCs), a gas chromatograph for TPH, and an NE Technologies Electra for alpha and beta/gamma radiation. Field screening for VOCs and alpha and beta/gamma radiation was not conducted during Decision II step-out sampling as these analytes were not identified as COCs. Field screening for TPH was not conducted during Decision II sampling. Instead, process knowledge, visual observations and/or other biasing factors were used to identify appropriate sampling locations.

Intrusive Investigation

Investigation activities conducted March through August 2004 consisted of collecting surface and subsurface samples from biased locations for laboratory analysis. A total of 23 locations were sampled during the Decision I phase of the investigation. Based on the analytical results of the Decision I sampling, an additional 30 locations were sampled as step-out locations to define the lateral and vertical extent of identified COCs. A total of 53 locations had one or more soil samples collected and analyzed to determine the nature and extent of contamination associated with the concrete pad as well as the drainage ditch (see Figure A.2-1). Surface samples were collected by hand using a "scoop or trowel" from a depth of 0 to 6 inches (in.) below ground surface (bgs). However, at several locations along the western side of the concrete pad, significant amounts of pea gravel were identified at the surface (ranging from 6- to 12- in. thick). At these locations, a hand auger was used to access the original ground surface to collect the first native soil sample. Subsurface sample intervals were accessed either by sonic drilling methods or a stainless-steel, 3-in.

diameter hand auger. Subsurface soil, including samples from beneath the concrete pad, was collected from the drill/auger barrel.

Site observations of stained soil and field screening results (FSRs) were used to guide the extent of intrusive activities and determine sampling horizons. The FSRs were compared against field screening levels (FSLs) to guide the investigation and selection of samples for laboratory analysis. In addition to FSRs, other biasing factors used in the selection of sample locations were visible debris, soil staining, site conditions, and professional judgement. Sample containers were filled with soil according to the following sequence: total VOCs and TPH-gasoline range organics (GRO) sample containers were filled directly from the surface location or core, followed by the collection of soil for VOC and TPH field screening. Additional soil was transferred into a stainless-steel bowl, homogenized, and screened for alpha and beta/gamma radiation. All remaining sample containers were then filled. If VOCs and TPH-GRO were not required, the soil was immediately transferred to the stainless-steel bowl. Selected samples were shipped to an off-site laboratory for analysis to determine the presence and concentrations of COPCs. Sample media collected but not submitted to the laboratory was returned to the collection site.

Based on drilling activities, the main concrete pad is 12 in. thick. The center drain appears to be the same thickness as the pad. The concrete sump located on the eastern side of the concrete pad was investigated by augering down the outer edge to determine the depth and physical condition of the sump. Results indicate the sump is approximately 6.5 feet (ft) deep with no unusual characteristics. Both the center and eastern sump are backfilled with cement and the presence of any connecting or discharging pipes could not be verified.

The only specific waste characterization sample collected was standing rainwater removed from the concrete pad prior to the commencement of sampling activities. A 20-gallon drum present within the drainage ditch was determined to be RCRA empty; therefore, it was not necessary to collect a waste sample prior to disposal.

2.2 Results

Section 2.2.1 summarizes characterization data from the CAI. This information illustrates the degree of characterization accomplished through the field effort and identifies the lateral and

vertical extent of the COCs present. Section 2.2.2 summarizes the assessment made in Appendix B, which demonstrates the correlation between the investigation results and the DQOs. Results of the investigation validated the CSMs presented in the CAIP (NNSA/NSO, 2003).

2.2.1 Summary of Analytical Data

Chemical and radiological analytical results for characterization sample concentrations exceeding PALs at CAS 03-44-02 are summarized in this section. Details of the methods used during the investigation and a comparison of environmental sample results to the PALs are presented in Appendix A. Based on these results, the nature and extent of COCs at CAU 536 have been adequately identified to support the evaluation of corrective action alternatives. All rejected data are addressed in Appendix B.

The PALs for the CAU 536 investigation were determined during the DQO process. For chemical COPCs, PALs are based on U.S. Environmental Protection Agency (EPA) *Region 9 Industrial Preliminary Remediation Goals* (PRGs) (EPA, 2002) and 100 milligrams per kilogram (mg/kg) for TPH per the *Nevada Administrative Code* (NAC) 445A (NAC, 2003). Radionuclide concentrations measured in CAU 536 environmental samples were compared to isotope-specific, dose-based PALs as presented in ROTC No. 1 to the CAIP (NNSA/NSO, 2003).

Background concentrations for metals have been used instead of PRGs when the natural background concentration exceeds the PRG, as is often the case with arsenic. Background is considered the mean plus two times the standard deviation 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).

All initial (i.e., Decision I) soil samples were submitted for the following analyses: VOCs, total semivolatile organic compounds (SVOCs), total RCRA metals, total beryllium, total zinc, explosives, polychlorinated biphenyls, TPH-DRO and -GRO, gamma spectroscopy, isotopic uranium (U), isotopic plutonium, and strontium-90.

There were no detections above PALs for the following analyses: VOCs, PCBs, RCRA metals, beryllium, zinc, TPH-GRO, explosives, isotopic uranium, strontium-90. The only analyses with

detections above PALs are isotopic plutonium (Pu)-239/240, TPH-DRO, and five polyaromatic hydrocarbons (PAHs).

Plutonium-239/240 was detected at concentrations greater than the PALs at two surface sample locations within the CAS boundaries; therefore, Pu-239/240 is a COC by definition. However, the concentrations of these detections is attributed to atmospheric testing fallout common in the Area 3 Camp (McArthur and Mead, 1987). The random nature of the two detections further suggest that the presence of Pu-239/240 is a result of atmospheric testing fallout rather than a release related to historical decontamination processes. As described in the CAIP, contamination associated with atmospheric testing will be addressed by the Soils Project. Therefore, further delineation of Pu-239/240, beyond that achieved with Decision I sample results, was considered to be outside the scope of the CAS investigation. Because the Pu-239/240 contamination is attributed to fallout from atmospheric testing, it was not included in the corrective action evaluation logic but will be involved in future waste management decisions regarding the closure of this CAS.

Analytical results for soil samples collected at CAS 03-44-02 indicated that the following COCs are present in the soil at this site: TPH in both the diesel and oil range, benzo(a)pyrene (BAP), benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Following the identification of these COCs, subsequent soil samples collected to define lateral and vertical extent of contamination (i.e., Decision II) were analyzed only for TPH-DRO and PAHs. The results of step-out sampling indicate that the lateral extent of TPH and PAHs is not contiguous across the site but rather from localized areas of contamination. The depths of COCs associated with various areas of contamination also vary across the site ranging from the surface to depths of approximately 7 to 10 ft bgs. Analytical results are listed in Table A.3-3 and Table A.3-5 and the distribution of the COCs are shown in Figures A.3-4, A.3-5, A.3-6, A3-7, A.3-8.

The characterization data for the standing rainwater collected from the concrete pad did not indicate the presence of radioactive or hazardous waste characteristics. However, Decision I soil analytical results indicate the presence of radionuclides above landfill criteria (BN, 1995).

2.2.2 Summary of Data Assessment

An assessment of CAU 536 corrective action investigation results was performed to determine whether the data collected met the DQOs and could support their intended use in the decision making process. The data assessment, provided in Appendix B, includes an evaluation of the DQIs to determine the degree of acceptability and usability of the reported data in the decision making process. Additionally, a reconciliation of the data with the CSM established for this project was conducted. Conclusions were validated based on the results of the quality assurance (QA)/QC measurements provided in Appendix B and discussed in Section A.4.0 of Appendix A.

The overall results of the assessment indicate that the DQI goals for precision, accuracy, completeness, representativeness, and comparability have been achieved. Precision and accuracy of the data sets were demonstrated to be high. Evaluation of completeness indicates that sufficient information was collected to support decisions and to meet the DQOs. Representativeness of site characteristics was demonstrated with the CAU 536 data. An evaluation of comparability provides a high confidence that the data sets for the project are comparable to all other data sets generated by accepted industry standard practices (e.g., EPA SW-846). Meeting DQI goals supports acceptance of the CAU 536 data sets for meeting the DQOs established for this project and the subsequent use of this data in the decision-making process.

The evaluation criterion for sensitivity has been achieved. With the exception of two PAHs, the minimum reporting limits (MRLs) and minimum detection concentrations (MDCs) for each identified organic, inorganic or radioactive contaminant are less than or equal to its corresponding PAL. Although the MRLs for BAP and dibenzo(a,h)anthracene were above the PALs, the analytical method detection limits (MDL) for these two PAHs were below their corresponding PALs and consequently have been reported.

The CSMs presented in the CAU 536 CAIP were the basis for the sample collection designs used for the site investigation. If information generated during the investigation had required a significant change in the CSMs, the sampling design may not have been adequate to meet the DQOs. The reconciliation of CAU 536 corrective action investigation results to the established CSMs supports the assumptions documented in the models and demonstrates completeness,

representativeness, and comparability. The sampling configuration generated sufficient information to support the corrective action decision presented in Section 2.3.

2.3 Need for Corrective Action

Analytes detected in soil during the corrective action investigation were evaluated against PALs to determine the COCs for CAS 03-44-02. The identification of COCs above PALs in surface and subsurface soils require that corrective action alternatives be considered and evaluated. The impacted volume and site-specific constraints are provided here. The corrective action alternatives are identified in Section 3.0 and evaluated for their ability to ensure protection of the public and the environment in accordance with NAC 445A (NAC, 2002a), feasibility, and cost effectiveness.

The COCs identified as a result of CAS processes are TPH within the diesel and oil range at concentrations up to 2,500 mg/kg and various combinations of five individual PAHs. As discussed in Section 2.2.1, Pu-239/240 is not considered to originate from CAS processes. The most prevalent PAH is BAP with concentrations as high as 11,000 micrograms per kilogram (µg/kg). There is a correlation between higher concentrations of TPH and the highest concentrations of the PAHs. The nature of contamination is not laterally contiguous and the vertical depth of contamination varies from 0 to 10 ft bgs.

The main concrete pad is approximately 12 in. thick. A drain/sump located within the center of the main pad and a sump on the eastern side have been filled with concrete. The center sump appears to be the same thickness as the pad. Based on process knowledge, a metal pipe may be present between the center sump and eastern sump; however, the presence of the pipe could not be verified. The eastern sump is approximately 6.5 ft deep. It is unknown if the sump was cleaned of contaminants prior to backfilling.

The clean closure alternative will involve the excavation and disposal of approximately 1,690 cubic yards (yd^3) of soil based on the most conservative estimate and approximately 108 yd^3 of concrete. Soil analytical results indicate radionuclides are present in concentrations above the NTS U10c and hydrocarbon landfill disposal criteria; therefore, remediated soil must be disposed as low-level waste. No other RCRA constituents were identified in the soil. A radiological walk-over survey

was conducted prior to the investigation and results indicate the pad is free of radioactivity. No scabbed concrete samples were collected as part of the investigation.

Site-specific characteristics that may constrain remedial actions are the presence of a metal culvert and ditch which currently diverts runoff from the surrounding Area 3 Camp west of the CAS, through the culvert, to the U3du crater. The ramp above the metal culvert and the ditch would be partially removed in the clean closure alternative. Engineering controls for run-off should be considered if the metal culvert and/or ditch is altered from original configuration during remediation for clean closure. An evaluation should be completed to determine if the engineering controls for the culvert and drainage ditch would be required upon the removal of the concrete pad and associated soils from the area. There are reportedly four buried underground utility lines located adjacent to the western side of the concrete pad. The type of utility lines and the active/inactive status are unknown.

3.0 Evaluation of Alternatives

The purpose of this section is to present the corrective action objectives for CAU 536, describe the general standards and decision factors used to screen the various corrective action alternatives, and develop and evaluate a set of corrective action alternatives that will meet the corrective action objectives.

3.1 Corrective Action Objectives

The corrective action objectives are media-specific goals for protecting human health and the environment. Based on the potential exposure pathways, the following regulatory and risk-based corrective action objectives have been identified for CAU 536:

- Prevent or mitigate exposure to media containing COCs at concentrations exceeding PALs as defined in the CAU 536 CAIP (NNSA/NSO, 2003).
- Implement an effective source control measures that will reduce future impacts to the environment.
- Prevent the migration of COCs beyond the CAS.

As identified in the CAIP, the future use for CAU 536 will be industrial, similar to current use (DOE/NV, 1998). Two CSMs were developed as part of the CAIP (NNSA/NSO, 2003). The models identified the potential exposure mechanism as disturbance (excavation) of contaminated soil by site workers. This implies a potential exposure pathway through ingestion, inhalation, and/or dermal contact with contaminated media under industrial scenarios.

Depth to groundwater was obtained for water wells located in the vicinity of CAS 03-44-02 in Yucca Flat. At Well ER-3-2, located 1,347 ft northwest of the site, the depth to groundwater measures consistently around 1,604 ft bgs on a quarterly basis. At Water Well A, located 1,622 ft southwest of the site, the depth to groundwater measures consistently around 1,602 ft bgs on a quarterly basis. Average annual precipitation has been measured at stations in Yucca Flat and surrounding ranges from 4.85 to 6.66 in. (ARL, 2003). The total potential evapotranspiration at the Area 3 Radiological Waste Management Site has been estimated at 62.6 in. (Shott et al., 1997).

Thus, the potential annual evapotranspiration is approximately 10 times greater than annual precipitation. These data indicate that evaporation is the dominant factor influencing the movement of water in the upper unsaturated zone. The rate of potential lateral migration of contaminants is unknown; however, if migration has occurred its confined to the shallow subsurface and is confined within the boundaries of the CAS. The vertical and lateral extent of potential contamination has been established through soil sampling. These factors, along with others presented in Section 3.3, support the determination that contaminant migration to groundwater is not considered to be a complete exposure pathway.

3.2 Screening Criteria

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

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

The general corrective action standards are as follows:

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

The remedy selection decision factors are as follows:

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

3.2.1 Corrective Action Standards

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

Protection of Human Health and the Environment

Protection of human health and the environment is a general mandate of the *Resource Conservation and Recovery Act* (RCRA) statute (EPA, 1994). This mandate requires that the corrective action include any necessary protective measures. These measures may or may not be directly related to media cleanup, source control, or management of wastes. The corrective action alternatives are evaluated for the ability to meet corrective action objectives as defined in Section 3.1.

Compliance With Media Cleanup Standards

Each corrective action alternative must meet the proposed media cleanup standards as set forth in applicable state and federal regulations, and as specified in the CAU 536 CAIP (NNSA/NSO, 2003) and ROTC No. 1 to the CAIP. For this CAU, EPA Region IX Preliminary Remediation Goals (PRGs) (EPA, 2002), which are derived from the Integrated Risk Information System, are the basis for establishing the PALs for chemical contaminants under NAC 445A.2272 (NAC, 2002a). The PAL for petroleum hydrocarbon substances in soil is 100 mg/kg in accordance with NAC 445A.2272 (NAC, 2002a). The PALs for radiological contaminants are based on the National Council on Radiation Protection and Measurement (NCRP) recommended screening limits for construction, commercial, industrial land use scenario (NCRP, 1999) scaled to 15 millirem (mrem) per year dose and the generic guidelines for residual concentrations of radionuclides in DOE Order 5400.5 (DOE, 1993). Laboratory results above PALs indicate the presence of COCs at levels that may require corrective action.

Control the Source(s) of the Release

An objective of a corrective action remedy is to stop further environmental degradation by controlling or eliminating additional releases that may pose a threat to human health and the environment. Unless source control measures are taken, efforts to clean up releases may be ineffective or, at best, will essentially involve a perpetual cleanup. Therefore, each corrective

action alternative must use an effective source control program to ensure the long-term effectiveness and protectiveness of the corrective action.

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

During implementation of any corrective action alternative, all waste management activities must be conducted in accordance with applicable state and federal regulations (e.g., *Nevada Revised Statues* [NRS] 459.400-459.600, "Disposal of Hazardous Waste" [NRS, 1998]; Title 40 *Code of Federal Regulations* (CFR) Parts 260-282, "Hazardous Waste Management" [CFR, 2002]; and NAC 459.9974, "Disposal and Evaluation of Contaminated Soil" [NAC, 2002b]).

The requirements for management of the waste, if any, derived from the corrective action will be determined based on applicable state and federal regulations, field observations, process knowledge, characterization data, and data collected and analyzed during corrective action implementation. Administrative controls (e.g., decontamination procedures and corrective action strategies) will minimize waste generated during site corrective action activities. Decontamination activities will be performed in accordance with approved procedures and will be designated according to the COCs present at the site.

3.2.2 Remedy Selection Decision Factors

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

Short-Term Reliability and Effectiveness

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

- Protection of the community from potential risks associated with implementation, such as fugitive dusts, transportation of hazardous materials, and explosion
- Protection of workers during implementation

- Environmental impacts that may result from implementation
- The amount of time until the corrective action objectives are achieved

Reduction of Toxicity, Mobility, and/or Volume

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

Long-Term Reliability and Effectiveness

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

Feasibility

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

- Construction and Operation: Refers to the feasibility of implementing a corrective action alternative given the existing set of waste and site-specific conditions.
- Administrative Feasibility: Refers to the administrative activities needed to implement the corrective action alternative (e.g., permits, public acceptance, rights of way, off-site approval).
- Availability of Services and Materials: Refers to the availability of adequate off-site and on-site treatment, storage capacity, disposal services, necessary technical services and materials, and prospective technologies for each corrective action alternative.

Cost

Costs for each alternative are estimated for comparison purposes only. The cost estimate for each corrective action alternative includes both capital and operation and maintenance costs, as applicable. The following is a brief description of each component:

- Capital Costs: These costs include both direct and indirect costs. Direct costs may consist of materials, labor, mobilization, demobilization, site preparation, construction materials, equipment purchase and rental, sampling and analysis, waste disposal, and health and safety measures. Indirect costs include such items as engineering design, permits and/or fees, start-up costs, and any contingency allowances.

- Operation and Maintenance: These costs include labor, training, sampling and analysis, maintenance materials, utilities, and health and safety measures.

Cost estimates for the corrective action alternatives are provided in Appendix C.

3.3 Development of Corrective Action Alternatives

This section identifies and briefly describes the viable corrective action technologies and the corrective action alternatives considered for the affected media at CAS 03-44-02 within CAU 536. Based on the review of existing data, future use, and current operations at the NTS, the following alternatives have been developed for consideration at CAU 536, CAS 03-44-02:

- Alternative 1 - No Further Action
- Alternative 2 - Clean Closure
- Alternative 3 - Closure in Place with Administrative Controls

Other technologies, such as bioremediation, were considered; however, it would not be effective because of the limited volume and concentrations of contaminated material. These technologies will not receive further consideration in this CADD. The following sections summarize the corrective action alternatives evaluated for CAS 03-44-02.

3.3.1 Alternative 1 - No Further Action

Under the No Further Action Alternative, no corrective action activities will be implemented. This alternative is a baseline case with which to compare and assess the other corrective action alternatives and their ability to meet the corrective action standards. This alternative does not meet the corrective action objectives for CAS 03-44-02 as there is soil contamination present in the soil; therefore, this alternative was not considered for recommendation.

3.3.2 Alternative 2 - Clean Closure

For contaminated surface and subsurface soil, Alternative 2 includes excavating and disposing of soil impacted by CAS-related COCs of TPH and PAH beneath and surrounding the concrete pad as well as impacted soil within the drainage ditch located within the CAS boundary. Due to the presence of contamination beneath and adjacent to the concrete pad, the pad would be removed and disposed, as appropriate. The volume of concrete is 108 yd^3.

Based on a conservative estimate using the lateral and vertical bounding sample results for TPH and PAHs, the volume of contaminated soil to be removed is approximately 1,692 yd^3. This volume estimate includes the removal of soil to a depth of 4 ft bgs for surface contamination associated with A31, A33, A48, A53 and locations on the western side of the pad. Additionally, soil would be removed to a depth of 7 ft bgs for a limited area of subsurface contamination associated with the eastern sump and the small generator pad. Based on process knowledge of the contaminants and the nature of vertical migration of hydrocarbons, soil removal to a general depth of 2 ft bgs followed by verification sampling may be appropriate when excavating surface contamination. This approach would meet the closure objectives of removing soil with TPH and/or PAH concentrations above PALs while reducing the volume of soil to be excavated and removed for disposal. The same approach could be utilized for the subsurface contamination where confirmation samples vary between 7 ft bgs and 10 ft bgs. Although not considered a CAS-related COC as discussed in Section 2.2.1, the two locations with Pu-239/240 concentrations exceeding PALs are included within this volume of contaminated soil.

A visual inspection will be conducted to ensure that concrete and visible contamination have been removed. Verification samples will be collected from the excavation floor and sidewalls and analyzed for site-specific COCs to ensure adequate removal of the contaminated soil.

Any material that is removed (including soil and concrete) will be disposed of at an appropriate disposal facility. All excavated areas will be returned to surface conditions compatible with the intended future use of the site. Clean fill will be used to backfill excavations after removal of the contaminated soil. As feasible, clean borrow soil will be removed from a nearby location for

placement in voids. This CAS will be closed in accordance with the administrative requirements identified in NAC 445A (NAC, 2002a), as described in this section.

3.3.3 Alternative 3 - Close in Place with Administrative Controls

Alternative 3 will leave contaminated soil in place and use administrative controls to prevent inadvertent contact with chemical COCs. These controls would consist of use restrictions (e.g., fencing and signage) to minimize access and prevent unauthorized intrusive activities. The future use of the CAS would be restricted from any activity that would alter or modify the containment control unless appropriate concurrence was obtained from the NDEP. The combination of these measures will effectively prevent inadvertent intrusive activities by humans and native wildlife and the potential subsequent mobilization of COCs.

Alternative 3 includes administrative activities and costs associated with the use restriction for the concrete pad and surrounding soil including a portion of the drainage ditch. Additionally, appropriate signage around the concrete pad and drainage ditch is recommended for this alternative.

3.4 Evaluation and Comparison of Alternatives

The general corrective action standards and remedy selection decision factors described in Section 3.2 were used to conduct detailed and comparative analyses of each corrective action alternative presented in Section 3.3. The advantages and disadvantages of each alternative were assessed to select preferred alternatives for CAU 536. Table 3-1 and Table 3-2 present the detailed comparative evaluation of closure alternatives for each CAS requiring corrective action. The cost estimates listed in Table 3-1 and Table 3-2 are detailed in Appendix C.

Table 3-1
Detailed Evaluation of Alternatives for Corrective Action Unit 536
(Page 1 of 3)

Evaluation Criteria	Alternative 1 No Further Action	Alternative 2 Clean Closure	Alternative 3 Closure in Place with Administrative Controls
Closure Standards			
Protection of Human Health and the Environment	• Does not meet corrective action objective of preventing or mitigating exposure to surface and subsurface soil containing COCs or media exceeding unrestricted release criteria. • Does not meet corrective action objective of preventing or mitigating exposure to contamination with concentrations exceeding unrestricted release criteria. • Does not prevent potential spread of COCs. • NAC 445.227 (2) (a-k) analysis shows the contaminants are not expected to impact groundwater. • No worker exposure associated with implementation.	• Meets corrective action objectives. • Low to moderate risk to workers associated with heavy equipment and potential contact with impacted media during excavation, transportation, and closure activities. • Low risk to public due to remote location and controlled access to NTS. Low to moderate risk to public during transportation off NTS. • NAC 445.227 (2) (a-k) analysis shows the contaminants are not expected to impact groundwater. • Moving contaminated media to an appropriate disposal facility mitigates exposure to impacted media after closure.	• Meets corrective action objectives. • Prevents inadvertent intrusion into the contaminated media. • Low risk to workers associated with heavy equipment and potential contact with impacted media during closure activities. • Low risk to public because of remote location and controlled access to the NTS. • NAC 445.227 (2) (a-k) analysis shows the contaminants are not expected to impact groundwater.
Compliance with Media Cleanup Standards	• Does not comply with media cleanup standards because COCs exceeding unrestricted release criteria remain. • NAC 445.227 (2) (a-k) analysis shows the contaminants are not expected to impact groundwater.	• Complies with media cleanup standards because media containing COCs will be excavated and disposed of at an appropriate facility. • Removal of COCs will be verified with confirmation sampling. • NAC 445.227 (2) (a-k) analysis shows the contaminants are not expected to impact groundwater.	• Complies with media cleanup standards by controlling exposure pathways. • NAC 445.227 (2) (a-k) analysis shows the contaminants are not expected to impact groundwater.
Control the Source(s) of Release	• The sources of the CAS have been discontinued.	• The sources of the CAS have been discontinued.	• The sources of the CAS have been discontinued.

Table 3-1
Detailed Evaluation of Alternatives for Corrective Action Unit 536
(Page 2 of 3)

Evaluation Criteria	Alternative 1 No Further Action	Alternative 2 Clean Closure	Alternative 3 Closure in Place with Administrative Controls
Comply with Applicable Federal, State, and Local Standards for Waste Management	• No waste generated	• All waste (primarily contaminated soil, CAS components, and disposable personal protective equipment) will be handled and disposed of in accordance with applicable standards.	• All waste (primarily disposable personal protective equipment, system components) will be handled and disposed of in accordance with applicable standards.
Remedy Selection Decision Factors			
Short-Term Reliability and Effectiveness	Not evaluated	• Low to moderate risk to workers associated with heavy equipment and potential contact with impacted media during excavation, transportation, and closure activities. • Public protected during removal by remote location and NTS site access controls. • Low to moderate risk to public during transportation off NTS. • Environmental impacts are not anticipated due to implementation. Appropriate measures will be taken at the site to protect desert tortoises. • Implementation should not require an extended period of time.	• Low risk to workers associated with heavy equipment and potential contact with impacted media during closure activities. • Public protected by remote location and NTS site access controls. • Environmental impacts are not anticipated due to implementation. Appropriate measures will be taken at the site to protect desert tortoises. • Implementation should not require an extended period of time.

Table 3-1
Detailed Evaluation of Alternatives for Corrective Action Unit 536
(Page 3 of 3)

Evaluation Criteria	Alternative 1 No Further Action	Alternative 2 Clean Closure	Alternative 3 Closure in Place with Administrative Controls
Reduction of Toxicity, Mobility, and/or Volume	Not evaluated	• Clean closure would effectively eliminate associated toxicity, mobility, and volume of wastes at each CAS. • Proper disposal of the waste will result in an ultimate reduction of mobility.	• The mobility of the remaining soil contamination is significantly reduced by administrative controls and lack of viable driving forces. • Toxicity and volume of the soil contamination are effectively unchanged. • The mobility of the remaining subsurface soil contamination is significantly reduced by administrative controls and lack of viable driving forces.
Long-Term Reliability and Effectiveness	Not evaluated	• All risk will be eliminated on site upon completion. • No maintenance required. • Moving contaminated media to an appropriate disposal media facility addresses the persistent adsorption of contaminants.	• Controls inadvertent intrusion to remaining contaminated media. • Administrative controls must be monitored and maintained.
Feasibility	Not evaluated	• Removal of contaminated media requires controls to protect workers. • Options for disposal of contaminated media is limited and require coordination with multiple entities.	• Easily implemented • Coordination of all entities is necessary to ensure compliance with administrative controls to prevent intrusion into contaminated zones.
Cost	CAS 03-44-02: $0	CAS 03-44-02: $372,542	CAS 03-44-02: $50,221

NA = Not applicable

Table 3-2
Comparative Evaluation of Alternatives for Corrective Action Unit 536

Evaluation Criteria	Comparative Evaluation		
Closure Standards			
Protection of Human Health and the Environment	Alternatives 2 and 3 meet corrective action objectives; Alternative 1 does not. No worker exposures to risks are associated with Alternative 1. Low risks are associated with Alternative 3 and slightly higher risks with Alternative 2 due to risks from excavation activities. *Nevada Administrative Code* 445A.227 (2) (a-k) analysis shows the contaminants are not threatening groundwater.		
Compliance with Media Cleanup Standards	Alternative 1 does not comply with media cleanup standards. Alternative 2 meets media cleanup standards by removing contaminated soil and CAS components exceeding unrestricted release criteria and eliminating exposure pathways at the site. Alternative 3 controls access to contaminants, effectively eliminating exposure pathways.		
Control the Source(s) of Release	The sources at each Corrective Action Site (CAS) have been discontinued.		
Comply with Applicable Federal, State, and Local Standards for Waste Management	Alternative 1 does not generate waste. Alternatives 2 and 3 will generate waste that will be handled in accordance with applicable standards, with Alternative 2 generating significantly more.		
Remedy Selection Decision Factors			
Short-Term Reliability and Effectiveness	Low risks are associated with Alternative 3 and slightly higher risks with Alternative 2.		
Reduction of Toxicity, Mobility, and/or Volume	Alternative 2 results in an immediate reduction of all three characteristics at each CAS. Alternative 3 results in a reduction of mobility, but does not reduce toxicity or volume. Worker exposure to risks associated with Alternative 2.		
Long-Term Reliability and Effectiveness	Residual risk at each CAS is low for Alternative 3 and nonexistent for Alternative 2. Alternative 3 requires administrative measures to control intrusive activities.		
Feasibility	Alternatives 2 and 3 are feasible; however, Alternative 2 will be more resource intensive.		
Cost	CAS 03-44-02: $0	CAS 03-44-02: $372,542	CAS 03-44-02: $50,221

NA = Not applicable

4.0 Recommended Alternative

Alternative 2, Clean Closure, is the preferred corrective action for CAS 03-44-02, Steam Jenny Discharge. The Clean Closure alternative eliminates the cost and uncertainty associated with managing use restrictions. The preferred corrective action alternatives were evaluated on their technical merits, focusing on performance, reliability, feasibility, and safety. The selected alternative was judged to meet all requirements for the technical components evaluated. The selected alternative meets all applicable state and federal regulations for closure of the site and will eliminate potential future exposure pathways to the contaminated media at CAU 536. Cost estimates were used to support the selection of preferred corrective action alternatives.

The Corrective Action Plan will provide details on the clean closure activities to be undertaken. Implementation of corrective actions may potentially present risk to site workers. Therefore, appropriate health and safety procedures will be developed and implemented.

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Appendix A

Corrective Action Investigation Results for CAU 536: Area 3 Release Site Nevada Test Site, Nevada

A.1.0 Introduction

This appendix presents the CAI activities and analytical results for CAU 536, Area 3 Release Site, Nevada Test Site, Nevada, located approximately 65 mi northwest of Las Vegas, Nevada (Figure 1-1). The CAI was conducted in accordance with the requirements set forth in the CAIP for CAU 536 (NNSA/NSO, 2003), as developed under the FFACO (1996).

Corrective Action Site 03-44-02, Steam Jenny Discharge, comprises CAU 536 and is located along the eastern edge of Yucca Flat within the Area 3 Camp at the NTS (Figure 1-2). The CAS consists of a 70- by 40-ft concrete pad with a drain located in the center leading to a sump present on the eastern edge of the pad. A smaller concrete pad is located on the western edge of the main concrete pad and is believed to have been the generator pad. A drainage ditch and metal culvert are present south of the main concrete pad. The ditch diverts run-off from the Area 3 Camp to the U3du crater located 640 ft east of the CAS. The site is reported to have been used to steam clean equipment in the Area 3 Camp (NNSA/NSO, 2003). This CAU was investigated because process knowledge indicated that hazardous and/or radioactive constituents may have been released to the environment.

Additional information relating to the site history, planning, and scope of the investigation is presented in the CAIP (NNSA/NSO, 2003) and will not be repeated in this appendix.

A.1.1 Project Objectives

The objectives of the investigation was to provide sufficient information and data to ensure that all NDEP, RCRA, and DOE data needs for closure were met in order to develop appropriate corrective action alternatives for CAS 03-44-02, Steam Jenny. This objective was achieved by identifying the nature and extent of COCs (COPCs at concentrations greater than PALs).

The investigation strategy was developed during the DQO process and is presented in the CAIP (NNSA/NSO, 2003). The DQO process identified the potential sampling locations, analytical suite, and provided the logic and rationale that supported the sampling strategy. The strategy was agreed to and approved by NDEP prior to initiating sampling activities.

A.1.2 Report Content

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

- Section A.1.0 describes the investigation background, objectives, and the report content.
- Section A.2.0 provides information regarding field activities and sampling methods.
- Section A.3.0 summarizes the investigation results for CAS 03-44-02, Steam Jenny Discharge.
- Section A.4.0 discusses the QA and QC procedures that were followed and the results of the QA and QC activities.
- Section A.5.0 is a summary of the investigation results for CAU 536.
- Section A.6.0 lists the cited references.

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

A.2.0 Investigation Overview

The CAU 536 field investigation and sampling activities were conducted between March 18 and August 25, 2004 and consisted of surface soil screening and sampling, subsurface soil screening and sampling from boreholes, and waste characterization sampling. Based on the analytical results of Decision I samples collected between March 18-24, 2004, it was determined that additional Decision II samples were needed to adequately define the extent of TPH and PAH contamination in the soil. Additional Decision II samples were collected on May 7, June 30, and August 25, 2004 at selected areas of the CAS. Sonic drilling techniques, surface sampling, and hand augering were the primary methods used to collect samples at CAS 03-44-02.

The investigation and sampling program was managed in accordance with the requirements set forth in the CAIP and ROTC No. 1 (NNSA/NSO, 2003). Field activities were performed under an approved site-specific health and safety plan (SNJV, 2004b). Samples were collected by following approved protocols and procedures for sample collection, decontamination, chain of custody, shipping, and field screening as indicated in the CAIP (NNSA/NSO, 2003) and documented using FADLs, soil boring logs, and sample collection logs. The QC samples (e.g., field blanks, equipment rinsate blanks, trip blanks, and sample duplicates) were collected as required by the CAIP (NNSA/NSO, 2003), the Industrial Sites QAPP (NNSA/NV, 2002), and approved procedures.

A.2.1 Deviations

There were no deviations from the investigation activities specified in the CAIP.

A.2.2 Preliminary Conceptual Model

Two CSMs were developed for CAU 536 using assumptions formulated from historical background information, knowledge from studies of similar sites, geophysical surveys, and data from previous sampling efforts. Conceptual Site Model #1 (Before Pad Construction) represents the conditions at the site before the construction of the concrete pad. This CSM represents the uncontrolled release of chemical constituents at various and unknown locations within site boundaries where steam cleaning activities may have occurred. It is assumed in CSM #1 that wastewater was released

directly to the ground surface and allowed to infiltrate surrounding soils. Conceptual Site Model #2 (After Pad Construction) represents conditions after the construction of the concrete pad where releases of chemical constituents were contained and/or restricted by both the pad and the sumps. Wastewater may have potentially been released to surrounding soils through cracks/leaks in the concrete pad or sumps, overspray during steam cleaning, or overflow of the sumps; however, it is assumed in CSM #2 that the volume of wastewater released to the environment would be significantly less than what is represented by CSM #1. Appendix A of the CAIP provides detailed information on the CSMs as presented for DQO formulation.

A.2.3 Sample Locations

Sample locations were identified and marked prior to intrusive activities. A site walkover was performed and a visual inspection of the concrete pad and areas surrounding the pad was conducted to identify and document biasing factors and preferential pathways that would aid in selecting sample locations. The final sample locations were chosen based on biasing factors (e.g., staining), utility clearances, and the locations identified in Figure 4-1 of the CAIP.

In general, Decision I sample locations were selected as planned in the CAIP which included the following locations: beneath the concrete pad, adjacent to the two identified sumps, areas immediately surrounding the pad, and within the drainage ditch leading to the U3du Crater. The actual sample locations are depicted in Figure A.2-1. Additional step-out locations were added during the initial investigation conducted in March, 2004 after identifying biasing factors at the small concrete pad located on the western side of the concrete pad. Decision II sample locations collected during the May 7, June 30, and August 25, 2004 field activities focused on defining lateral and/or vertical extent of contaminated soil based on Decision I analytical results. The step-out locations were based on Decision I analytical results, visual observations (i.e., staining and odor), and site conditions (e.g., utility locations). The selection of soil sample intervals at each location were based on field screening, site conditions, and the strategy devised in the DQO process as outlined in the CAIP (NNSA/NSO, 2003).

Sample locations were documented on sample collection logs and by utilizing GPS technology. The locations were recorded using the Universal Transverse Mercator Zone 11, North American Datum 1927 coordinate system in meters.

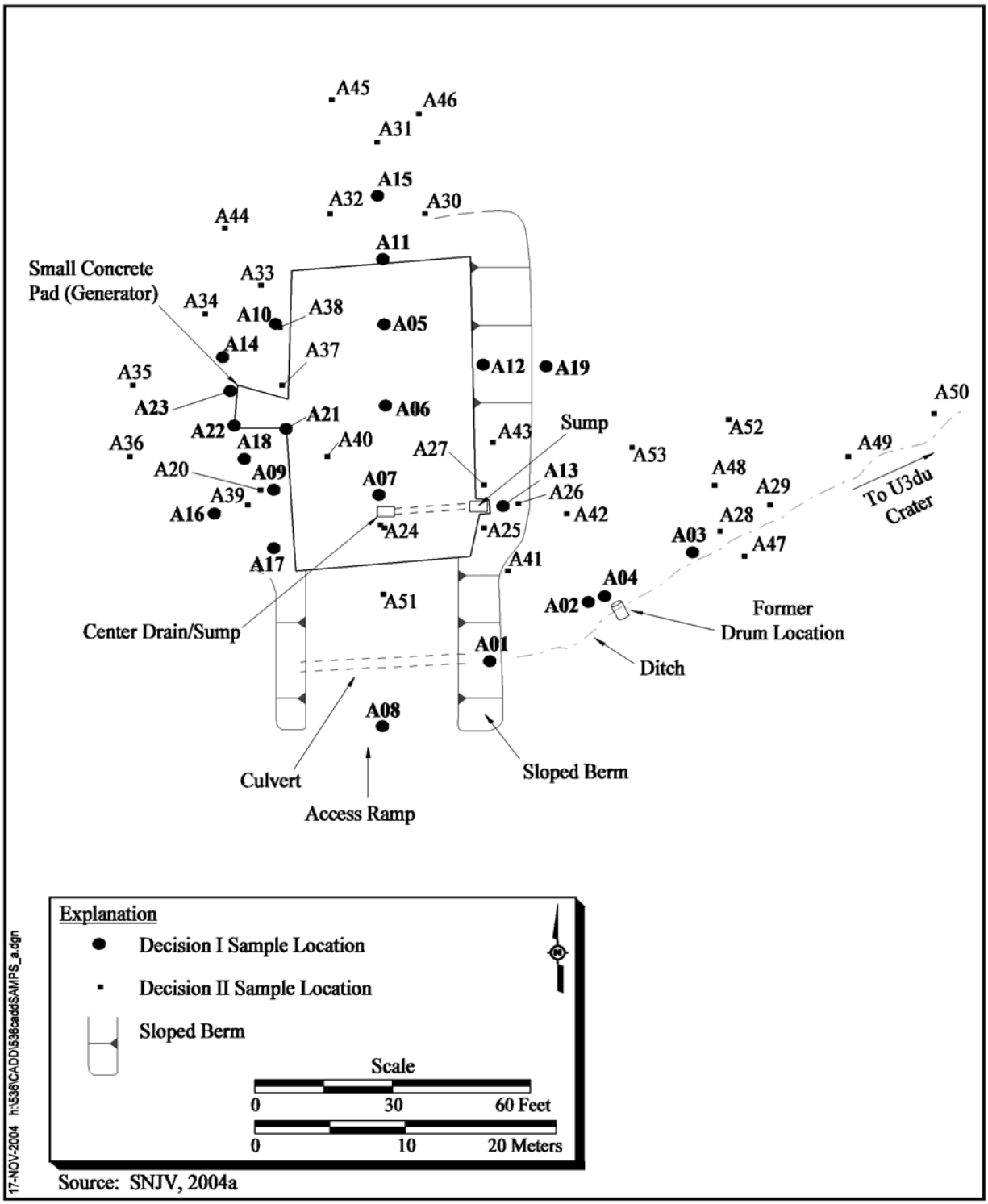

Figure A.2-1
CAU 536, CAS 03-44-02, Sample Locations

A.2.4 Investigation Activities

Investigation activities included the collection of environmental sampling using hand augering, sonic drilling, and hand (surface) sampling. Some waste characterization activities were also performed.

A.2.4.1 Field Screening

Field-screening activities for VOC, TPH, and alpha and beta/gamma radiation were performed as specified in the CAIP on all Decision I samples. The FSL for VOC headspace and TPH were established at 20 and 75 parts per million (ppm), respectively. The site-specific FSLs for alpha and beta/gamma radiation were defined as the mean background activity level plus two times the standard deviation. The background levels were established daily using soil collected from 10 distinct background locations beyond the potential influences of CAS-specific releases. Field screening was conducted using a photoionization detector (PID) for VOCs, gas chromatograph for TPH, and an NE Technologies Electra for alpha and beta/gamma radiation.

Field screening for VOCs and alpha and beta/gamma radiation was not conducted during Decision II step-out sampling as these constituents were not identified as COCs. Field screening for TPH during Decision II sampling was not conducted. Instead, visual observations and site conditions were used to identify appropriate sampling locations.

A.2.4.2 Intrusive Investigation Activities

The CAS was characterized by surface and/or subsurface soil sampling. Soil samples were collected using “scoop and trowel” or grab-sampling, hand auger, and sonic drilling. Observations of stained soil and FSRs were used to guide the extent of intrusive activities and determine sampling horizons. Investigation intervals and soil samples were field screened for one or more of the following: VOCs, TPH, and alpha and beta/gamma radiation. The FSRs were compared against FSLs to guide the investigation and selection of samples for laboratory analysis. In addition to FSRs, other biasing factors used in the selection of biased sample locations include visible debris, soil staining, site conditions, and professional judgement. Sample containers were filled with soil according to the following sequence: total VOCs and TPH-GRO sample containers were filled directly from the surface location or core, followed by the collection of soil for VOC and TPH field

screening. Additional soil was transferred into a stainless-steel bowl, homogenized, and screened for alpha and beta/gamma radiation. All remaining sample containers were then filled. If VOCs and TPH-GRO were not required, the soil was immediately transferred to the stainless-steel bowl and the appropriate containers were filled according to the previous discussion. Selected samples were shipped to the off-site laboratory to be analyzed for selected chemical and radiological parameters. Sample media collected but not submitted to the laboratory was returned to the collection site.

A.2.5 Waste Characterization Sampling

The only specific waste characterization sample collected was standing rainwater removed from the concrete pad prior to the commencement of sampling activities. The specific analyses are provided in Table A.3-1. Analytical results from both the waste characterization sample and all soil samples used to support waste disposal decisions are compared to the Federal limits for hazardous waste, NDEP hydrocarbon action limit, landfill acceptance criteria, and the limits in the NTS POC (BN, 1995). The POC limits have been established for NTS hazardous waste generators to ensure that all hazardous waste being shipped off-site contains no "added radioactivity."

A.2.6 Laboratory Analytical Information

All radiological and chemical analyses were performed by Paragon Analytics in Fort Collins, Colorado. The analytical parameters and laboratory analytical methods used to analyze CAU 536 investigation samples are listed in Table A.2-1. Organic and inorganic results are reported in this appendix if they detected at or above the MRLs established in the CAIP (NNSA/NV, 2003). Two SVOCs (BAP and dibenzo(a,h)anthracene) were identified as having MRLs greater than their respective PALs. The MDLs of the SVOC analysis, however, are lower than PALs so these two analytes are reported in this appendix based on the MDLs. Radioanalytical results are reported if they were detected at or above MDCs.

Validated analytical data for CAU 536 investigation samples have been compiled and evaluated to confirm the presence and define the extent of contamination, if present. The analytical results are presented in Section A.3.0. The complete laboratory data packages are available in the project files.

Table A.2-1
Laboratory Analytical Parameters and Methods, CAU 536 Samples

Analytical Parameter	Analytical Method
Total volatile organic compounds	SW-846 8260B[a]
Total semivolatile organic compound	SW-846 8270C[a]
Total petroleum hydrocarbons - gasoline-range organics	SW-846 8015B (modified)[a]
Total petroleum hydrocarbons - diesel-range organics	SW-846 8015B (modified)[a]
Total RCRA metals, beryllium, and zinc	Water - SW-846 6010B or 6020/7470A[a,b] Soil - SW-846 6010B or 6020/7471A[a,b]
High Explosives	SW-846 8330[a]
Polychlorinated biphenyls	SW-846 8082[a]
TCLP volatile organic compounds	SW-846 1311/8260B[a]
TCLP semivolatile organic compounds	SW-846 1311/8270C[a]
TCLP RCRA metals	SW-846 1311/6010B/7470A[a,b]
Gamma spectroscopy	Water - EPA901.1 Soil - HASL 300
Isotopic uranium	Water - ASTM D3972-97 Soil - ASTM C1000-90
Isotopic plutonium	Water - ASTM D3865-02 Soil - ASTM C1001-90
Strontium-90	Water - ASTM D5811-00 Soil - HASL 300

[a]EPA *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, 3rd Edition, Parts 1-4, SW-846 CD ROM. Washington, DC. (EPA, 1996)
[b]Arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver

The analytical parameters for CAS 03-44-02 were selected based on site process knowledge according to the *Guidance for the Data Quality Objectives Process* (EPA, 1994b). Samples collected during Decision II step-out sampling were only analyzed for the COCs that exceeded PALs in the original samples. Bioassessment and geotechnical samples were not collected because field investigation activities, analytical results, and the evaluation of alternatives did not indicate the need for these data.

A.2.7 Comparison to Preliminary Action Levels

Chemicals and radionuclides detected in samples at concentrations greater than PALs are identified as COCs. If COCs are present, corrective action must be considered for the CAS. The PALs for the

CAU 536 investigation were identified and agreed to during the DQO process. For organic and inorganic COPCs (except TPH), the PALs are the EPA Region 9 PRGs under the industrial land use scenario (EPA, 2002). The PAL for TPH is 100 mg/kg per the NAC 445A.2272 (NAC, 2002).

Background concentrations for metals have been used instead of PRGs when the natural background concentration exceeds the PRG, as is often the case with arsenic. Background is considered the mean plus two times the standard deviation 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).

Radionuclide concentrations measured in CAU 536 environmental samples were compared to isotope-specific, dose-based PALs as presented in ROTC #1 to the CAIP (NNSA/NSO, 2003) which specifies "the PALs for radiological contaminants are based on the National Council on Radiation Protection and Measurement (NCRP) Report No. 129 recommended on the screening limits for construction, commercial, industrial land use scenario (NCRP, 1999) scaled from 25 to 15 mrem per year dose and the generic guideline for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993)."

Sample data that exceed MRLs (organic and inorganic constituents) and MDCs (radiological constituents) are tabulated and presented in Section A.3.0. Analytical results that are greater than PALs (a subset of those that exceed MRLs and MDCs) are identified by bold text in the corresponding tables and are further discussed in Section A.3.0. Nondetected results and results below MRLs and MDCs have been excluded to minimize the size of this document. However, the complete data set for CAU 536 is retained in an electronic format in project files.

A.2.8 Geology

Native surface soil within Area 3 of the NTS consists of poorly graded, moderately consolidated, alluvial silty sands with gravel, and some cobble-sized volcanic and sedimentary detritus. Subsurface soils range from gravelly and silty sands with fines to well-graded sands. The percentage of organic matter in the soil is low and decreases with depth. Field records indicate that a 1- to 6-in. thick layer of pea gravel was encountered in several areas along the western boundary of the decontamination pad. Asphaltic-type material was also encountered in surface locations

down to about 8 in. primarily along the western side of the small generator pad located on the western side of the decontamination pad. Surface asphalt was also noted on the surface near the drainage ditch.

Generally, refusal was not met in the subsurface soils surrounding the cement pad, allowing depths of up to 8 ft bgs to be hand augered and sampled when necessary. Because of the similarity between the fill beneath the concrete decontamination pad and the underlying native soil, the interface was difficult to identify. However, a lithology change was observed consistently between 7-8 ft bgs.

A field description was recorded on each sample collection log. A more detailed description of the regional geology of the NTS is provided in the CAU 536 CAIP (NNSA/NSO, 2003).

A.2.9 Hydrology

Surface topography at the CAS is generally flat surrounding the sloped sides of the decontamination pad. A narrow drainage ditch, with a metal culvert under the southern soil access ramp, diverts runoff from areas west of the pad towards the U3du crater located about 640 ft to the east. There are no natural dry washes or perennial water sources within CAS boundaries.

Corrective Action Site 03-44-02 is located within the Yucca Flat Hydrographic Area of the NTS. Uplift and erosion of the surrounding terrain has resulted in over 1,000 ft of alluvial deposits within Yucca Flat. Groundwater occurs within alluvial and volcanic aquifers that overlie the deeper, regional carbonate aquifer that generally flows from the northeast to southwest. Depth to groundwater in the vicinity of the CAS occurs about 1,604 ft bgs (USGS, 2003) within valley fill. Due to the depth to groundwater and climatic conditions, groundwater at the CAS is not expected to have been impacted by site-specific activities. No saturated zones (e.g., perched water, contaminant saturation) were encountered in the subsurface adjacent to or below the CAS during sampling activities.

A.3.0 CAS 03-44-02, Steam Jenny Discharge

Corrective Action Site 03-44-02 consists of a 70- by 40- ft concrete decontamination pad located in the Area 3 Camp on the NTS near the eastern edge of Yucca Flat. Adjacent to the eastern edge of the main pad is a concrete filled sump and on the western edge is a small concrete pad suspected to be the former location of the steam cleaner or generator. The site is approximately 216 ft north of the former magnetite storage hut and yellow dispenser hopper and 640 ft west of the U3du Crater. The original land surface slopes gently to the east and during construction, fill was placed under the concrete to level the pad. This resulted in a slope extending downward along the northern and eastern edges of the concrete pad. The site is reported to have been used to steam clean equipment in the Area 3 Camp (NNSA/NSO, 2003). The CAS is located within an area potentially affected by the atmospheric testing conducted at the NTS. Additional detail regarding the operational history of the CAS is provided in the CAIP (NNSA/NSO, 2003).

A.3.1 Corrective Action Investigation

A total of 127 environmental soil samples (including five duplicates and one asphalt sample; excluding trip, field, equipment rinsate and source blanks, and waste management) were collected using a combination of sonic drilling, hand augering, and hand sampling methods and submitted for laboratory analyses. The sample identification numbers, locations, depth, types, and analyses are presented in Table A.3-1. The sample locations are shown in Figure A.2-1. The specific CAI activities conducted to satisfy the CAIP requirements for this CAS are described in the following sections.

Table A.3-1
Samples Collected at CAS 03-44-02
(Page 1 of 6)

Sample Location	Sample Number	Depth (ft bgs)	Sample Matrix	Purpose	Analyses
A01	536A001	0.0 - 0.5	Soil	SC	Set 1
A02	536A002	0.0 - 0.5	Soil	SC	Set 1
A03	536A003	0.0 - 0.5	Soil	SC	Set 1
A04	536A004	0.0 - 0.5	Soil	SC	Set 1
	536A005	1.5 - 2.0	Soil	SC	Set 1

Table A.3-1
Samples Collected at CAS 03-44-02
(Page 2 of 6)

Sample Location	Sample Number	Depth (ft bgs)	Sample Matrix	Purpose	Analyses
A05	536A006	1.0 - 1.5	Soil	SC	Set 1
	536A007	4.0 - 5.0	Soil	SC	Set 1
	536A008	7.0 - 8.0	Soil	SC	Set 1
	536A009*	10.0 - 11.0	Soil	SC	Set 1
A06	536A010	1.0 - 1.5	Soil	SC	Set 1
	536A011	4.0 - 5.0	Soil	SC, Lab QC	Set 1
	536A012	7.0 - 8.0	Soil	SC	Set 1
	536A013*	10.0 - 11.0	Soil	SC	Set 1
A07	535A014	1.0 - 1.5	Soil	SC	Set 1
	536A015	4.0 - 5.0	Soil	SC	Set 1
	536A016	4.0 - 5.0	Soil	Field Duplicate of #536A015	Set 1
	536A017	7.0 - 8.0	Soil	SC	Set 1
	536A018*	10.0 - 11.0	Soil	SC	Set 1
A08	536A019	0.0 - 0.5	Soil	SC	Set 1
	536A020	3.0 - 4.0	Soil	SC	Set 1
	536A021	6.0 - 7.0	Soil	SC	Set 1
A09	536A023	1.0 - 2.0	Soil	SC	Set 1
	536A024	4.5 - 5.5	Soil	SC	Set 1
	536A025	7.0 - 8.0	Soil	SC	Set 1
	536A045	10.0 - 11.0	Soil	SC	Set 1
	536A046	10.0 - 11.0	Soil	Field Duplicate of #536A045	Set 1
	536A047*	13.0 - 14.0	Soil	SC	Set 1
A10	536A026	1.0 - 2.0	Soil	SC	Set 1
	536A027	4.0 - 5.0	Soil	SC	Set 1
	536A028	6.5 - 7.5	Soil	SC	Set 1
A11	536A029	0.0 - 0.5	Soil	SC	Set 1
	536A030	3.0 - 4.0	Soil	SC	Set 1
	536A031	7.0 - 8.0	Soil	SC	Set 1

Table A.3-1
Samples Collected at CAS 03-44-02
(Page 3 of 6)

Sample Location	Sample Number	Depth (ft bgs)	Sample Matrix	Purpose	Analyses
A12	536A032	0.0 - 0.5	Soil	SC	Set 1
	536A033	3.0 - 4.0	Soil	SC	Set 1
	536A034	3.0 - 4.0	Soil	Field Duplicate of #536A033	Set 1
	536A035	6.5 - 7.5	Soil	SC	Set 1
A13	536A022	0.0 - 0.5	Soil	SC	Set 1
	536A036	6.5 - 7.5	Soil	SC	Set 1
	536A037	9.0 - 10.0	Soil	SC	Set 1
	536A038	11.5 - 12.5	Soil	SC	Set 1
A14	536A039	0.0 - 1.0	Soil	SC	Set 1
	536A040	4.0 - 5.0	Soil	SC	Set 1
	536A041	7.0 - 8.0	Soil	SC	Set 1
A15	536A042	0.0 - 0.5	Soil	SC	Set 1
	536A043	4.0 - 5.0	Soil	SC, Lab QC	Set 1
	536A044	7.0 - 8.0	Soil	SC	Set 1
A16	536A048	0.0 - 0.5	Soil	SC	Set 1
	536A049	4.0 - 5.0	Soil	SC	Set 1
	536A050	7.0 - 8.0	Soil	SC	Set 1
A17	536A051	0.0 - 0.5	Soil	SC	Set 1
	536A052	4.0 - 5.0	Soil	SC	Set 1
	536A053	7.0 - 8.0	Soil	SC	Set 1
A18	536A054	0.0 - 0.5	Soil	SC	Set 1
	536A055	4.0 - 5.0	Soil	SC	Set 1
	536A056	7.0 - 8.0	Soil	SC	Set 1
A19	536A057	0.0 - 0.5	Soil	SC	Set 1
	536A058	4.0 - 5.0	Soil	SC	Set 1
	536A059	7.0 - 8.0	Soil	SC	Set 1
A20	536A060	0.5 - 1.0	Soil	SC	Set 1
	536A061	4.0 - 5.0	Soil	SC	Set 1
	536A062	7.0 - 8.0	Soil	SC	Set 1
A21	536A063	0.5 - 1.5	Soil	SC	SVOCs, TPH-DRO
	536A064	4.0 - 5.0	Soil	SC	SVOCs, TPH-DRO
	536A065	7.0 - 8.0	Soil	SC	SVOCs, TPH-DRO

Table A.3-1
Samples Collected at CAS 03-44-02
(Page 4 of 6)

Sample Location	Sample Number	Depth (ft bgs)	Sample Matrix	Purpose	Analyses
A22	536A066	0.5 - 1.5	Soil	SC, Lab QC	SVOCs, TPH-DRO
	536A067	4.0 - 5.0	Soil	SC	SVOCs, TPH-DRO
	536A068	7.0 - 8.0	Soil	SC	SVOCs, TPH-DRO
A23	536A069	0.5 - 1.5	Soil	SC	SVOCs, TPH-DRO
	536A070	4.0 - 5.0	Soil	SC	SVOCs, TPH-DRO
	536A071	7.0 - 8.0	Soil	SC	SVOCs, TPH-DRO
	536A072	7.0 - 8.0	Soil	Field Duplicate of #536A071	SVOCs, TPH-DRO
A24	536A101	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
	536A102	4.0 - 5.0	Soil	SC	SVOCs, TPH-DRO
A25	536A103	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
	536A104	4.5 - 5.0	Soil	SC	SVOCs, TPH-DRO
A26	536A105	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
	536A106	4.5 - 5.0	Soil	SC	SVOCs, TPH-DRO
A27	536A107	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
	536A108	4.5 - 5.0	Soil	SC	SVOCs, TPH-DRO
A28	536A109	0.0 - 0.5	Soil	SC	SVOCs, TPH-DRO
A29	536A110	0.0 - 0.5	Soil	SC	SVOCs, TPH-DRO
A30	536A111	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
	536A112	3.0 - 4.0	Soil	SC	SVOCs, TPH-DRO
A31	536A113	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
	536A114	3.0 - 4.0	Soil	SC	SVOCs, TPH-DRO
A32	536A115	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
	536A116	3.0 - 4.0	Soil	SC	SVOCs, TPH-DRO
A33	536A117	0.5 - 1.5	Soil	SC	SVOCs, TPH-DRO
	536A118	4.0 - 5.0	Soil	SC	SVOCs, TPH-DRO
A34	536A119	0.5 - 1.5	Soil	SC	SVOCs, TPH-DRO
	536A120	4.0 - 5.0	Soil	SC	SVOCs, TPH-DRO
A35	536A121	0.5 - 1.5	Soil	SC	SVOCs, TPH-DRO
	536A122	4.0 - 5.0	Soil	SC	SVOCs, TPH-DRO
A36	536A123	0.5 - 1.5	Soil	SC	SVOCs, TPH-DRO
	536A124	4.0 - 5.0	Soil	SC	SVOCs, TPH-DRO

Table A.3-1
Samples Collected at CAS 03-44-02
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Sample Location	Sample Number	Depth (ft bgs)	Sample Matrix	Purpose	Analyses
A37	536A125	0.5 - 1.5	Soil	SC	SVOCs, TPH-DRO
	536A126	4.0 - 5.0	Soil	SC	SVOCs, TPH-DRO
	536A127	10.0 - 11.0	Soil	SC	SVOCs, TPH-DRO
	536A128*	15.0 - 16.0	Soil	SC	SVOCs, TPH-DRO
	536A129	19.0 - 20.0	Soil	SC	SVOCs, TPH-DRO
A38	536A130	19.0 - 20.0	Soil	SC	SVOCs, TPH-DRO
A39	536A131	19.0 - 20.0	Soil	SC	SVOCs, TPH-DRO
A40	536A132	19.0 - 20.0	Soil	SC	SVOCs, TPH-DRO
A41	536A133	0.0 - 1.0	Soil	SC Lab QC	SVOCs, TPH-DRO
	536A134	4.0 - 5.0	Soil	SC	SVOCs, TPH-DRO
A42	536A135	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
	536A136	0.0 - 1.0	Soil	Field Duplicate of #536A135	SVOCs, TPH-DRO
	536A137	2.0 - 3.0	Soil	SC	SVOCs, TPH-DRO
	536A138	4.0 - 5.0	Soil	SC	SVOCs, TPH-DRO
A43	536A139	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
	536A140	4.0 - 5.0	Soil	SC	SVOCs, TPH-DRO
A44	536A141	0.5 - 1.5	Soil	SC	SVOCs, TPH-DRO
A45	536A142	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
A46	536A143	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
A47	536A144	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
A48	536A145	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
	536A153	3.0 - 4.0	Soil	SC	SVOCs, TPH-DRO
A49	536A146	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
A50	536A147	0.0 - 1.0	Soil	SC	SVOCs, TPH-DRO
A51	536A148	0.0 - 0.5	Soil	SC	SVOCs, TPH-DRO
	536A149	1.0 - 2.0	Soil	SC	SVOCs, TPH-DRO
A52	536A150	0.0 - 0.5	Soil	SC	SVOCs, TPH-DRO
	536A151	2.0 - 3.0	Soil	SC	SVOCs, TPH-DRO
A53	536A152	0.0 - 0.5	Soil	SC	SVOCs, TPH-DRO
	536A155	3.0 - 4.0	Soil	SC	SVOCs, TPH-DRO
NA	536A154	0.0 - 0.5	Soil/Asphalt	Background	SVOCs, TPH-DRO
NA	536A301	NA	Water	Trip Blank	VOCs
NA	536A302	NA	Water	Trip Blank	VOCs

Table A.3-1
Samples Collected at CAS 03-44-02
(Page 6 of 6)

Sample Location	Sample Number	Depth (ft bgs)	Sample Matrix	Purpose	Analyses
NA	536A303	NA	Water	Trip Blank	VOCs
NA	536A304	NA	Water	Trip Blank	VOCs
NA	536A305	NA	Water	Trip Blank	VOCs
NA	536A306	NA	Water	Trip Blank	VOCs
NA	536A307	NA	Water	Trip Blank	VOCs
NA	536A308	NA	Water	Field Blank	Set 1
NA	536A309	NA	Water	Equipment Rinsate Blank	Set 1
NA	536A310	NA	Water	Source Blank	Set 1
NA	536A311	NA	Water	Equipment Rinsate Blank	Set 1
NA	536A312*	NA	Water	Trip Blank	VOCs
NA	536A313*	NA	Water	Trip Blank	VOCs
NA	536A314	NA	Water	Trip Blank	VOCs
NA	536A315	NA	Water	Source Blank	Set 1
NA	536A316	NA	Water	Trip Blank	VOCs
NA	536A501	NA	Liquid	WM	Gross Alpha/Beta, SVOCs, RCRA Metals, Tritium

Set 1 = VOCs, TPH (DRO and GRO), SVOCs, RCRA Metals, Beryllium, Zinc, PCBs, Explosives, Gamma Spectrometry, Isotopic Uranium, Isotopic Plutonium, Strontium-90

ft bgs = Feet below ground surface
NA = Not applicable
QC = Quality control
SC = Site characterization
WM = Waste management

*Sample not submitted to laboratory for analysis, returned to site.

A.3.1.1 Deviations

There were no deviations from the CAIP requirements for this CAS.

A.3.2 Investigation Results

The following sections provide the CAS-specific details of the field investigation which include field screening and sample selection and analysis. Due to the nature of the site, discussions of the

sampling activities have been separated into two areas: the concrete pad and the drainage ditch leading to the U3du Crater.

A.3.2.1 Site Inspection and Sample Location

Prior to intrusive activities, a utility clearance survey was conducted to identify underground and overhead utility hazards. Identified underground utility lines were marked on the ground and a blind penetration/excavation permit was issued by the M&O contractor. The underground utilities present on the western boundary of the decontamination pad did not interfere with Decision I sample locations; however, their presence did affect the placement of Decision II step-out locations.

Prior to Decision I sampling activities, the surface of the drainage ditch, the concrete decontamination pad, and the surface soils surrounding the pad were visually inspected and photodocumented. The visual inspection focused on identifying obvious biasing factors (e.g., staining) as well as preferential pathways that may have transported or accumulated contamination associated with the steam-cleaning operations. No obvious releases of contaminants were identified on surface soils or the concrete pad so initial Decision I locations were not changed from the proposed locations in Figure 4-1 of the CAIP. The only exception is within the drainage ditch where a biased sample location was added due to the presence of an empty 20-gallon drum.

Decision II sampling activities included step-out locations at areas west, north, and east of the concrete decontamination pad as well as within the drainage ditch leading the U3du Crater where COCs of TPH and PAHs were identified at concentrations that exceeded PALs. Figure A.2-1 depicts all Decision I and Decision II locations that were sampled during the CAI.

A.3.2.2 Concrete Pad

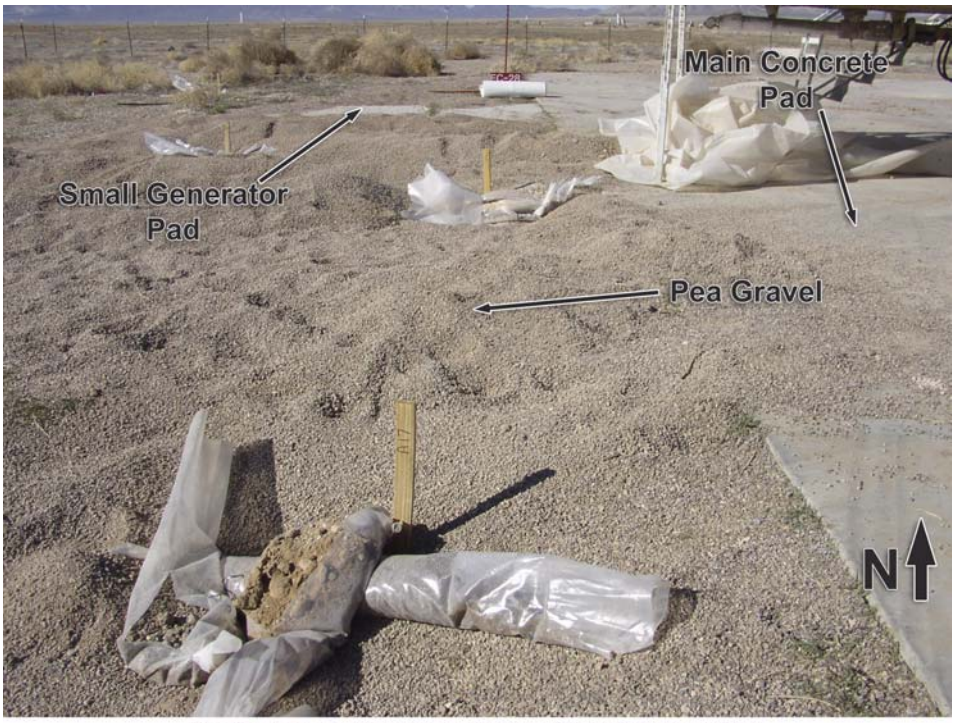
Decision I Sampling

The CAIP identified nine initial boring locations to be sampled within and immediately surrounding the concrete pad. Based on site conditions, step-out borings were added for each of nine initial boring locations. A total of 19 borings (A05 to A23) were sampled during Decision I activities for the concrete pad (see Figure A.2-1). All 19 Decision I locations were sampled at a minimum of three intervals; one surface and two subsurface intervals and submitted for laboratory analysis. The

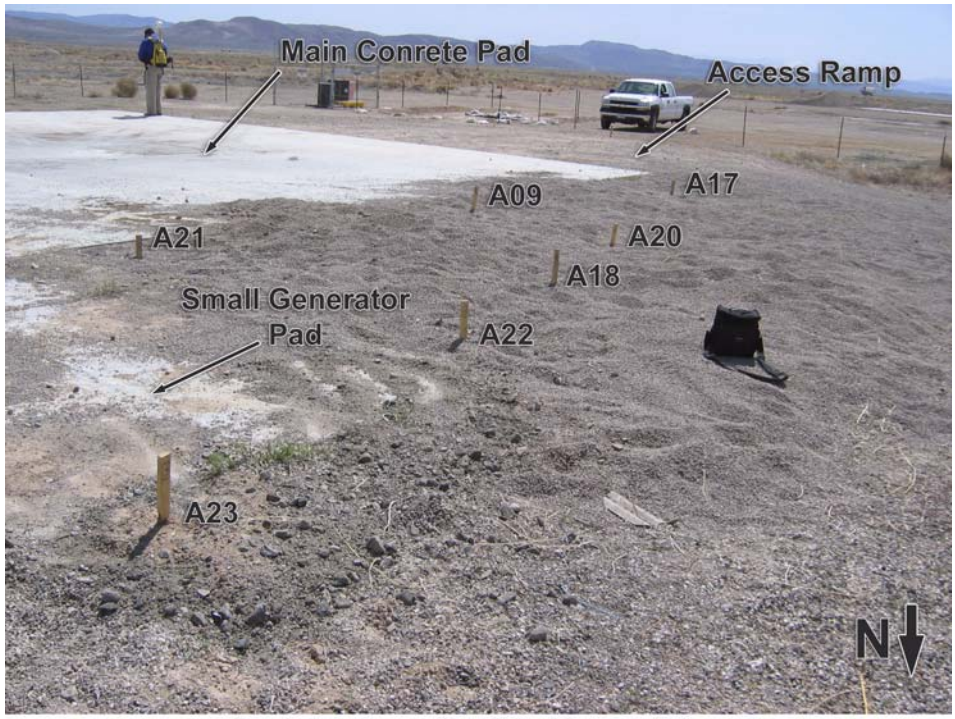
actual depths of each boring are provided in Table A.3-1. Most surface samples were collected by hand using a "scoop or trowel" from a depth of 0 to 6 in. bgs. However, at several locations along the western side of the concrete pad, significant amounts of pea gravel (possible fill from the construction of the pad) were identified at the surface ranging from 6- to 12- in. thick. At these locations, a hand auger was used to access the original ground surface to collect the first sample interval (i.e., A10, A14, A18, A20, A21, A22, A23). Subsurface sample intervals were accessed by sonic drilling methods with the exception of samples at locations A21-A23 which were accessed with a stainless-steel, 3-in. diameter hand auger. The only sample locations with FSRs above FSLs were A07 and A09. Other sample locations had detections of TPH but not above FSLs. Sample location A09, west of the concrete pad, had FSRs and visual screening results suggesting TPH contamination; therefore, sample locations A16, A17, and A18 were added to further define the nature of potential contamination. Based on site conditions, samples were collected at three additional locations (A21-A23) to determine if a release of contaminants may have occurred at the small pad along the western side of the larger pad. Figure A.3-1 provides views of the investigation locations on the western side of the concrete pad where significant amounts of pea gravel are present on the surface.

Decision I analytical results indicate COCs are present at locations A07 (center drain within pad), A09, A14, A18, A21, A22, and A23 (west side of pad), A11 and A15 (north side of pad), and A13 (sump location on east side of pad). Decision I analytical results identified the following COCs in soils beneath and surrounding the concrete pad: Pu-239/240, TPH within the diesel and oil range, and five PAHs [BAP, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene]. The presence of TPH and PAHs required Decision II step-out sampling to define the extent of contamination. The presence of Pu-239/240 at concentrations exceeding PALs at only two locations (A14 and A01) is attributed to atmospheric testing fallout rather than a release related to historical decontamination processes (McArthur and Mead, 1987). As described in the CAIP, contamination associated with atmospheric testing will be addressed under another program. Therefore, further delineation beyond the Decision I sample results was considered outside the scope of the CAS investigation and Decision II samples were not collected.

As part of the CAI, the center drain of the concrete pad and the sump located east of the main concrete pad were investigated to determine the nature and thickness of these features. The center



Pea Gravel on Surface Along Western Edge of Concrete Pad
(Photograph Taken on 03/20/2004)



Sample Locations on West Side of Concrete Pad
(Photograph Taken on 03/30/2004)

Figure A.3-1
Investigation on Western Side of Concrete Pad, CAS 03-44-02

drain appears to be the same thickness as the decontamination pad at approximately 12 in. The eastern sump was determined to be approximately 6.5 ft deep by drilling a 6-in. auger down the outer edge of the sump. Both features have been filled with concrete. Any other associated features such as metal piping connecting the sumps could not be identified with the investigation methods used. Figure A.3-2 shows the eastern sump wall inside the auger hole.

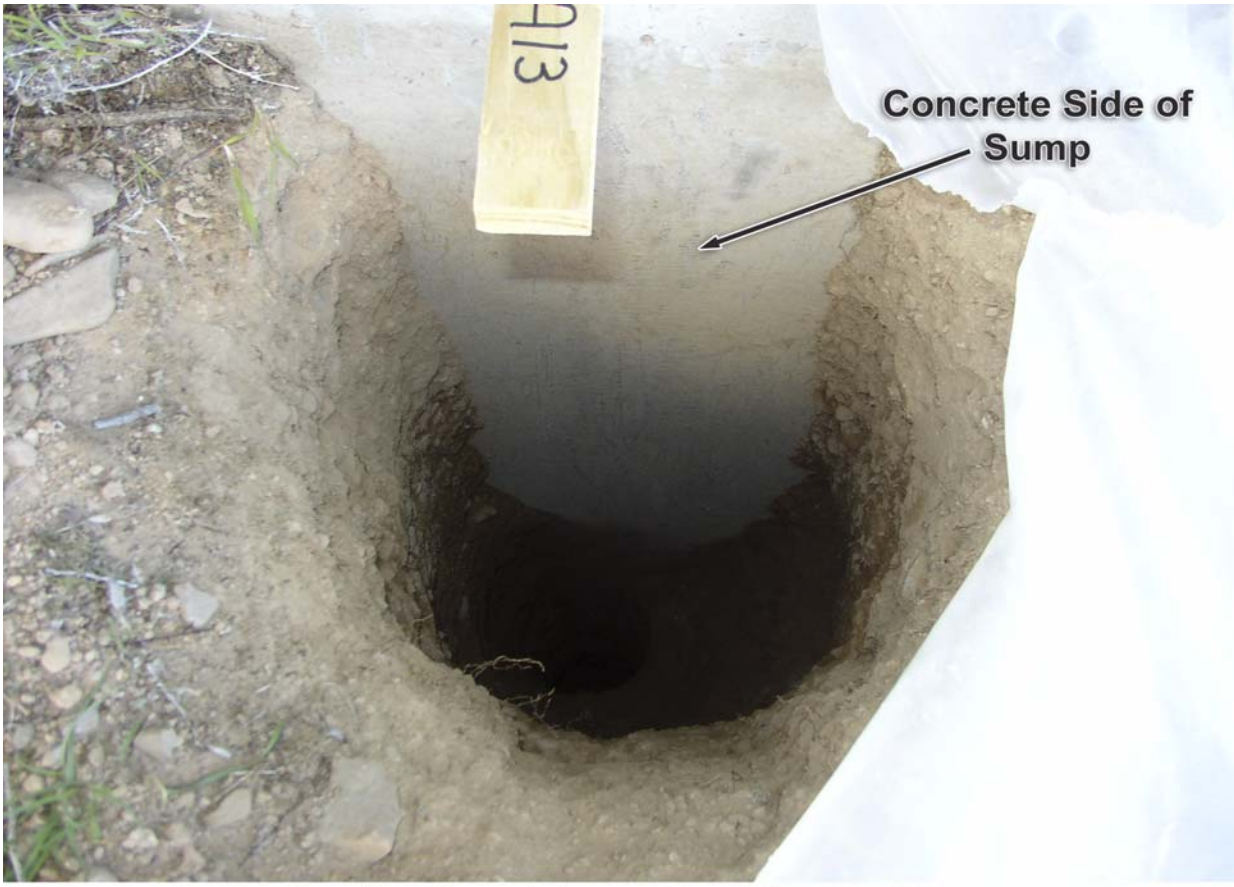


Figure A.3-2
Close-Up of Concrete Sump at Sample Location A13, CAS 03-44-02
(Photograph Taken on 03/20/2004)

Decision II Sampling

Two Decision II sampling events, conducted May 7 and June 30, 2004, were required to adequately define the lateral and vertical extent of contamination. The May 7, 2004, event consisted of step-out sampling to define both lateral and vertical extent of contamination based on Decision I

analytical results collected March 18-24, 2004. The second sampling event on June 30, 2004, was necessary to further define the lateral extent of contamination based on the May 7, 2004, analytical results that had not adequately defined the lateral extent of the contamination.

Decision II sampling conducted on May 7, 2004, involved sonic drilling at 15 additional soil boring locations. Step-out boring A24 was drilled south of A07 to define the southern lateral extent of COCs from the central drain within the pad. Step-out borings A25, A26, and A27 were drilled and samples were collected at depths of 0 to1 ft and 4 to 5 ft bgs to define the lateral extent of COCs identified at the eastern sump (A13). Step-out borings A30, A31, and A32 were drilled and samples were collected at depths of 0 to 1 ft and 3 to 4 ft bgs to define the lateral extent of COCs identified at A11 and A15 north of the concrete pad. Step-out borings A33 through A37 were drilled and samples were collected at depths of 0.5 to 1.5 ft and 4 to 5 ft bgs to define the lateral extent of COCs identified along the western side of both the decontamination pad and around the smaller concrete pad. Location A37, located on the northeast corner of the generator pad, had apparent contamination (i.e., odor and staining); therefore, additional sample depth intervals were collected at 10 ft and 19 ft bgs. Step-out borings A38, A39, and A40 were drilled and sampled at a depth of 19 ft bgs to show the lateral extent of the contamination encountered at A37 is adequately defined. Based on analytical results, COCs were identified at the following step-out locations: A24, A25, A26, A27, A31, A33, and A37 (see Figure A.2-1).

Decision II sampling conducted on June 30, 2004 involved hand sampling and/or hand augering at 6 additional locations. Step-out locations A41, A42, and A43 were sampled to define the lateral extent of COCs at locations A25, A26, A27 near the eastern sump. Samples were collected at 0 to 1 ft and 4 to 5 ft bgs at each location. The position of A42 was near the base of the eastern slope; therefore, an additional sample interval was collected from 2 to 3 ft bgs to represent the same horizon (4 to 5 ft bgs) that was sampled at location A26. To define the lateral extent of COCs at location A33, northwest of the concrete pad, a surface sample was collected between 0.5 to 1.5 ft bgs from step-out location A44 (beneath pea gravel). To define the lateral extent of COCs at location A31, north of the concrete pad, a surface sample was collected between 0 to 1 ft bgs from step-out locations A45 and A46. Visual observations of the soil samples collected did not identify apparent contamination (i.e., staining or odor). Analytical results indicate these step-out locations have adequately defined the lateral extent of COCs.

On August 25, 2004 two additional samples (536A148 and 536A149) were collected at location A51 by hand sampling. Location A51 was selected for the purpose of further refining the southern boundary of the concrete pad to aid in the evaluation of corrective action alternatives. Sample 536A148 was collected from the surface. Sample 536A149 was collected at a depth of 1 to 2 ft bgs to represent the sample interval sampled directly below the concrete pad at A07 and A24. Sample results indicate the COCs are below PALs except for a slightly elevated BAP result (280 µg/kg). Because of the nondetect results of other PAHs and the low concentration of the associated TPH result, the extent of contamination is adequately bound.

A.3.2.3 Drainage Ditch

Decision I Sampling

In accordance with the CAIP, a minimum of three surface samples were collected from locations A01, A02, and A03 within the drainage ditch leading to U3du Crater. Location A01 was biased to the downgradient end of the culvert pipe where COPCs may be expected to accumulate. Locations A02 and A03 were spaced equidistant in a downgradient direction from A01. One additional biased location (A04) was identified under an empty 20-gallon metal drum lying in the ditch which may have leaked COPCs into underlying soils (see Figure A.3-3). The drum was determined to be empty. Sample locations are depicted in Figure A.2-1.

Analytical results from Decision I samples indicate the presence of TPH concentrations exceeding PALs in soils directly below the empty drum (A04). The other three locations within the ditch indicate the presence of TPH below PALs; however, the concentration at the downgradient location A03 (86 mg/kg) is close enough to the PAL to warrant step-out sampling to confirm that concentrations are decreasing away from the drum. Based on the analytical data and site conditions, the presence of TPH within the ditch may represent a separate contaminant source in addition to the decontamination pad runoff. The presence of Pu-239/240 at a concentration exceeding PALs at location A01 is attributed to fallout from atmospheric testing rather than a release related to historical decontamination activities so further delineation beyond the Decision I sample results was not conducted.

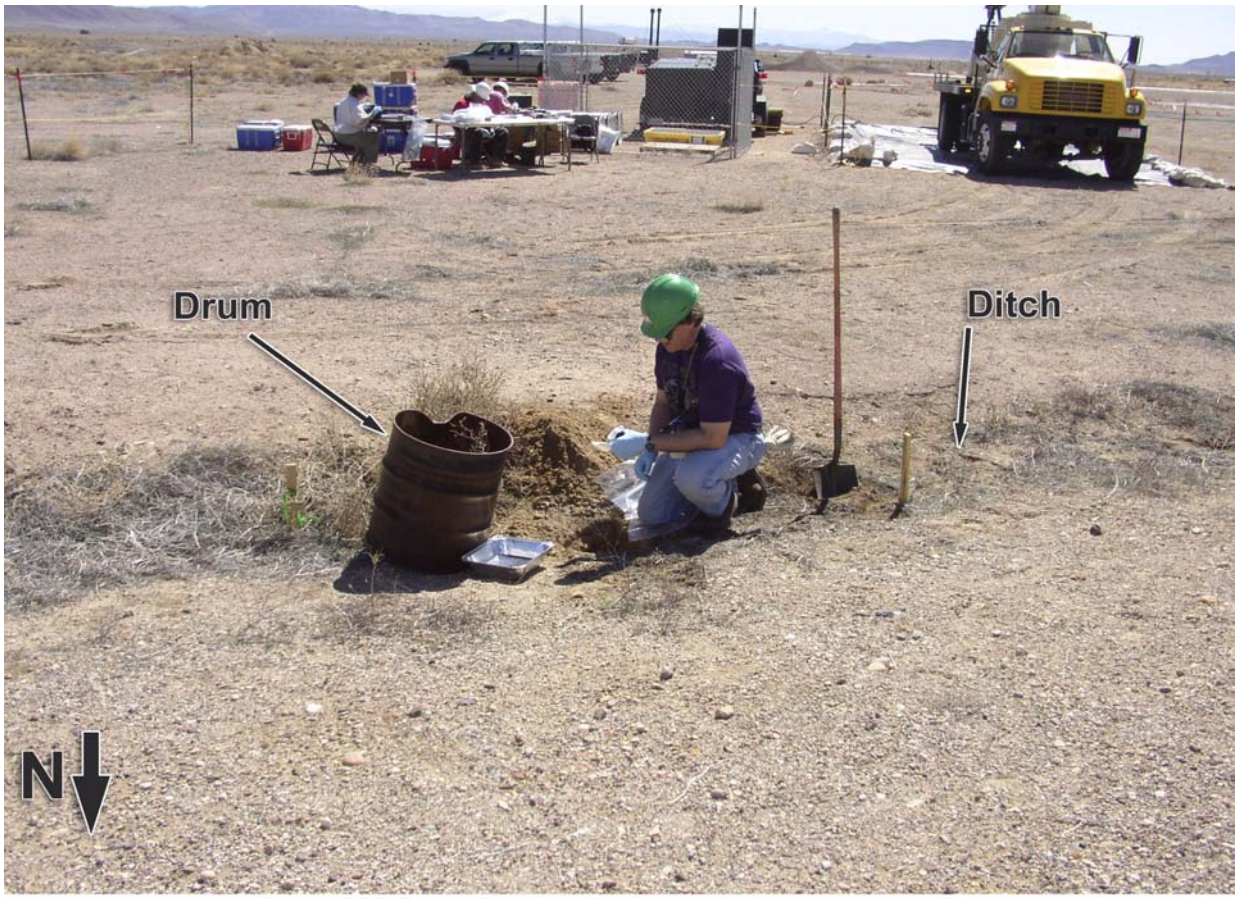


Figure A.3-3
View of 20-Gallon Drum in Drainage Ditch, CAS 03-44-02, Location A04
(Photograph Taken on 03/18/2004)

Decision II Sampling

Two step-out locations (A28 and A29) were sampled on May 7, 2004 downgradient of A03 to delineate the extent of TPH contamination. Decision II samples were collected from the surface (0 to 0.5 ft bgs). Analytical results from these locations indicate an increase in TPH-DRO concentrations above PALs downgradient from A03.

To complete the delineation of contamination downgradient, two additional step-out locations were identified 20 ft and 40 ft downgradient of A29 which are identified as A49 and A50, respectively (see Figure A.2-1). Surface samples (536A145 and 536A146) were collected from 0-1 ft bgs at each location and submitted for analysis. To confirm that contamination is not migrating outside the

lateral boundaries of the ditch, step-out locations A47 and A48 were sampled to the south and north, respectively, of location A28. The locations were stepped out from A28 instead of A04 (highest TPH concentration) because a hard asphalt surface was present directly south of A04 that would not be representative of surrounding soils. The surface samples were collected from 0 to 1 ft bgs and analyzed for TPH-DRO and SVOCs.

Analytical results at location A48, north of the ditch, indicate the presence of BAP and TPH within the diesel and oil range above PALs. The SCL indicates particles of broken asphalt may have been present in the soil matrix, which would result in elevated PAH concentrations as well as DRO. On August 25, 2004 five additional samples were collected at and near A48 to define the vertical and lateral extent of COCs. Sample 536A153 (3 to 4 ft bgs) was collected with a hand auger at location A48 to define the vertical extent of COCs. Locations A52 and A53 were selected to further bound the lateral extent of COCs to the north of A48. Sample results from A52 indicate COCs are below PALs. Surface samples 536A145 and 536A152 at location A48 and A53, respectively, had TPH and PAH concentrations above PALs. The vertical bounding samples from A48, A52, and A53 show that the concentrations of these COCs decrease to levels below PALs. No additional samples were collected to further refine the northern lateral boundary because location A19 analytical results adequately define the boundary as evidenced by a decreasing trend of BAP concentrations, TPH concentrations below PALs, and the nondetections of all other PAHs detected at locations A48 and A53. This decreasing trend in TPH and PAH concentrations from A53 is also supported by analytical data from locations A12, A28, A29, A48, and A52.

A.3.2.4 Sample Analysis

Decision I investigation samples were submitted to an off-site laboratory for total VOCs, total SVOCs, total RCRA metals, beryllium, zinc, PCBs, explosives, TPH-DRO and -GRO, gamma spectrometry, isotopic uranium, isotopic plutonium, and strontium-90 analyses. Decision II step-out samples were only submitted for TPH-DRO and total SVOCs analyses. Because PAHs are the only SVOCs identified as COCs, only the PAHs were reported for Decision II samples.

A.3.2.5 Waste Characterization Analysis

Analytical results for sample 536A501 were compared to regulatory limits for hazardous and radioactive constituents. Results indicate the rainwater was nonhazardous and consequently was eliminated as a potential source of soil contamination surrounding the concrete pad.

A.3.3 Analytes Detected Above Minimum Reporting Limits

The analytical results for soil samples collected at CAS 03-44-02 that were detected at concentrations exceeding MRLs for organic and inorganic constituents and MDCs for radiological constituents are summarized in the following sections.

A.3.3.1 Total VOCs

Results for total VOCs detected above MRLs are presented in Table A.3-2. None of the detections exceed PALs.

Table A.3-2
Soil Sample Results for Total VOCs Detected Above Minimum Reporting Limits

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (µg/kg)	
			Acetone	Methylene Chloride
Preliminary Action Level[a]			6,000,000	21,000
A02	536A002	0.0 - 0.5	--	14
A03	536A003	0.0 - 0.5	--	5.7 (J)
A09	536A024	4.5 - 5.5	43	--
A14	536A039	0.0 - 1.0	--	8.1
	536A040	4.0 - 5.0	--	6.4
	536A041	7.0 - 8.0	--	6.7

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals* (PRGs) (EPA, 2002)

ft bgs = Feet below ground surface
µg/kg = Micrograms per kilogram
J = Estimated value
-- = Not detected above minimum reporting limits

A.3.3.2 Total SVOCs

Results for total SVOCs detected above MRLs are presented in Table A.3-3. A total of five analytes exceed their corresponding PALs at various sample locations and depth intervals. All five analytes are categorized as PAHs and are typically associated with the presence of TPH and/or asphalt. The five PAHs are BAP, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. At location A09, PAHs are present above PALs at 1-2 ft. The PAHs for depth 4.5 to 5.5 ft bgs were rejected so determination of presence cannot be made. Benzo(a)pyrene was detected above PALs at 10 to 11 ft; however, a decreasing trend of concentrations in BAP, all other PAHs, and TPH is evident within this boring so additional depth intervals were not collected. Additionally, the surrounding borings A39 and A40 show no indication of PAHs at the 19 to 20 ft depth. Benzo(a)pyrene was detected at concentrations above PALs in the near-surface at locations A19 and A51. A decreasing trend in BAP concentrations, all other PAHs, and TPH concentrations below PALs is evident so additional lateral bounding samples were not collected. Additional sample locations north of A19 (i.e., A11, A30) and south of A51 (i.e., A08) support the decreasing trend of PAHs even in the presence of lower TPH concentrations. The PAHs are ubiquitous throughout the CAS and may reflect remnant concentrations of old and/or reworked asphalt surfaces for both the pre-pad and post-pad construction surfaces; however, a direct correlation to an asphalt origin cannot be conclusively made. A comparison to the asphalt background sample 536A154 was inconclusive because the PAH data was rejected due to matrix interference.

A.3.3.3 Total Metals Results

Results for total RCRA metals, beryllium, and zinc detected above MRLs are presented in Table A.3-4. None of the detections exceed PALs.

A.3.3.4 Polychlorinated Biphenyls

There were no detections of PCBs above MRLs.

A.3.3.5 Explosives

There were no detections of explosives above MRLs.

Table A.3-3
Soil Sample Results for Total SVOCs Detected Above Minimum Reporting Limits
(Page 1 of 3)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (µg/kg)																					
			2-Methylnaphthalene	3,3'-Dichlorobenzidine	Acenaphthene	Anthracene	Benzo(A)Anthracene	Benzo(A)Pyrene	Benzo(B)Fluoranthene	Benzo(G,H,I)Perylene	Benzo(K)Fluoranthene	Bis(2-Ethylhexyl)Phthalate	Butyl Benzyl Phthalate	Carbazole	Chrysene	Dibenzo(A,H)Anthracene	Dibenzofuran	Di-N-Butyl Phthalate	Di-N-Octyl Phthalate	Fluoranthene	Fluorene	Indeno(1,2,3-CD)Pyrene	Phenanthrene	Pyrene
Preliminary Action Level[a]			**NI**	**3,800**	**29,000,000**	**100,000,000**	**2,100**	**210**	**2,100**	**NI**	**21,000**	**120,000**	**100,000,000**	**86,000**	**210,000**	**210**	**3,100,000**	**62,000,000**	**25,000,000**	**22,000,000**	**26,000,000**	**2,100**	**NI**	**29,000,000**
A01	536A001	0.0 - 0.5	--	--	--	--	--	160 (J)[b]	--	R	--	--	--	--	--	R	--	1,400	--	690	--	R	590	1,000 (J)[c]
A02	536A002	0.0 - 0.5	--	--	--	--	--	R	R	R	R	--	--	--	--	R	--	--	--	--	--	R	--	--
A03	536A003	0.0 - 0.5	--	--	--	--	--	R	R	R	R	--	--	--	--	R	--	--	--	--	--	R	--	--
A04	536A004	0.0 - 0.5	--	R	--	--	--	190 (J)[b]	--	--	R	R	R	--	--	R	--	--	R	--	--	R	--	450 (J)[b]
A05	536A006	1.0 - 1.5	--	--	--	--	--	R	R	R	R	--	--	--	--	R	--	--	--	--	--	R	--	--
	536A008	7.0 - 8.0	--	1,800 (J)[c]	--	--	350 (J)[c]	R	R	R	R	350 (J)[c]	350 (J)[c]	--	350 (J)[c]	R	--	--	350 (J)[c]	--	--	R	--	--
A07	536A014	1.0 - 1.5	--	R	810	460	1,200 (J)[b]	**1,100** (J)[b]	1,300 (J)[b]	2,800 (J)[b]	570 (J)[b]	580 (J)[b]	R	--	980 (J)[b]	R	--	6,100	R	2,000	--	1,600 (J)[b]	2,400	6,900 (J)[b]
A09	536A023	1.0 - 2.0	1,800 (J)	--	2,400	2,000	**3,400**	**3,200** (J)[c]	**4,900** (J)[c]	2,400 (J)[b]	1,700 (J)[b]	--	--	810	3,200	**450** (J)[b]	1,300	14,000	--	9,100	1,800 (J)	1,800 (J)[b]	7,900	8,100
	536A024	4.5 - 5.5	--	--	--	--	--	R	R	--	R	--	--	--	--	R	--	--	--	--	--	R	--	--
	536A045	10.0 - 11.0	--	--	--	--	420	**330** (J)	490	--	--	--	--	--	410	--	--	1,000	--	1,000	--	--	630	1,000
	536A046	10.0 - 11.0	--	--	--	--	--	**280** (J)	400	--	--	--	--	--	--	--	--	920	--	820	--	--	520	840
A10	536A026	1.0 - 2.0	--	--	1,500	1,800 (J)	**3,500**	**2,700**	**4,100**	1,300 (J)[b]	1,800 (J)[b]	--	--	1,400	3,400	**340** (J)[b]	650 (J)	19,000	--	10,000	920	1,100 (J)[b]	8,900	8,300
A11	536A029	0.0 - 0.5	--	--	--	--	--	96 (J)[c]	--	--	--	--	--	--	--	--	--	370	--	--	--	--	--	--
A13	536A022	0.0 - 0.5	--	--	--	--	--	72 (J)[b]	--	R	R	--	--	--	--	R	--	390	--	--	--	R	--	--
	536A036	6.5 - 7.5	--	--	--	--	--	150 (J)[c]	--	--	--	--	--	--	--	--	--	420	--	--	--	--	--	--
A14	536A039	0.0 - 1.0	--	--	--	--	--	**240** (J)	370	--	--	--	--	--	--	--	--	1,600	--	800	--	--	500	840
A17	536A051	0.0 - 0.5	--	--	--	--	--	--	--	--	--	770	--	--	--	--	--	--	--	--	--	--	--	--
A18	536A054	0.0 - 0.5	--	--	--	--	--	79 (J)[b]	--	R	R	--	--	--	--	R	--	--	--	--	--	R	--	410 (J)[c]
A19	536A057	0.0 - 0.5	--	--	--	--	--	**250** (J)[b]	--	--	--	--	--	--	--	R	--	1,100	--	530	--	--	420	930 (J)[c]
A21	536A063	0.5 - 1.5	--	--	--	--	--	110 (J)[b]	--	R	R	--	--	--	--	R	--	460	--	--	--	R	--	630 (J)[c]
	536A065	7.0 - 8.0	--	--	--	--	--	**240** (J)	--	--	--	--	--	--	--	--	--	630	--	500	--	--	--	410
A22	536A066	0.5 - 1.5	--	--	1,100 (J)[d]	1,400	**4,200**	**3,100** (J)[c]	**6,100** (J)[c]	3,200	2,400 (J)[c]	--	--	710	3,800	**560**(J)[b]	430	11,000	--	11,000	750	**2,400**	7,100	11,000 (J)[d]
A23	536A069	0.5 - 1.5	--	--	--	--	--	160 (J)[c]	--	--	--	--	--	--	--	--	--	740	--	400	--	--	--	470
A24	536A101	0.0 - 1.0	--	--	--	--	--	**320** (J)[b]	460 (J)[b]	860 (J)[e]	--	--	--	--	--	R	--	--	--	400	--	380 (J)[e]	--	900 (J)[c]
A25	536A103	0.0 - 1.0	--	--	--	--	--	88 (J)[c]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	536A104	4.5 - 5.0	--	--	--	--	900	**860** (J)[b]	1,300 (J)[b]	840 (J)[e]	370 (J)[b]	--	--	--	850	R	--	--	--	2,500	--	660 (J)[e]	1,400	4,200 (J)[c]
A26	536A106	4.5 - 5.0	--	--	--	--	--	130 (J)[b]	--	--	--	--	--	--	--	R	--	--	--	--	--	--	--	--
A27	536A107	0.0 - 1.0	--	--	--	--	--	**260** (J)[c]	--	380 (J)[e]	--	--	--	--	--	--	--	--	--	--	--	--	--	350 (J)
	536A108	4.5 - 5.0	510	--	2,300	4,800	**9,800**	**7,400** (J)[b]	**11,000** (J)[b]	4,200 (J)[c]	4,200 (J)[b]	--	--	--	8,800	R	--	--	--	32,000	2,800	**5,600** (J)[f]	26,000	27,000

Table A.3-3
Soil Sample Results for Total SVOCs Detected Above Minimum Reporting Limits
(Page 2 of 3)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (µg/kg)																					
			2-Methylnaphthalene	3,3'-Dichlorobenzidine	Acenaphthene	Anthracene	Benzo(A)Anthracene	Benzo(A)Pyrene	Benzo(B)Fluoranthene	Benzo(G,H,I)Perylene	Benzo(K)Fluoranthene	Bis(2-Ethylhexyl)Phthalate	Butyl Benzyl Phthalate	Carbazole	Chrysene	Dibenzo(A,H)Anthracene	Dibenzofuran	Di-N-Butyl Phthalate	Di-N-Octyl Phthalate	Fluoranthene	Fluorene	Indeno(1,2,3-CD)Pyrene	Phenanthrene	Pyrene
Preliminary Action Level[a]			**NI**	**3,800**	**29,000,000**	**100,000,000**	**2,100**	**210**	**2,100**	**NI**	**21,000**	**120,000**	**100,000,000**	**86,000**	**210,000**	**210**	**3,100,000**	**62,000,000**	**25,000,000**	**22,000,000**	**26,000,000**	**2,100**	**NI**	**29,000,000**
A28	536A109	0.0 - 0.5	--	--	--	--	--	42 (J)[b]	--	--	--	--	--	--	--	R	--	--	--	--	--	--	--	--
A29	536A110	0.0 - 0.5	--	--	--	--	--	66 (J)[b]	--	--	--	-	--	--	--	R	--	--	--	--	--	--	--	--
A30	536A111	0.0 - 1.0	--	--	--	--	--	25 (J)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	536A112	3.0 - 4.0	--	--	--	--	--	120 (J)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A31	536A113	0.0 - 1.0	--	--	--	--	--	100 (J)[b]	--	--	--	--	--	--	--	R	--	--	--	--	--	R	--	620 (J)[b]
A32	536A115	0.0 - 1.0	--	--	--	--	--	52 (J)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A33	536A117	0.5 - 1.5	--	--	--	--	--	**330** (J)[b]	500 (J)[c]	1,400 (J)[e]	--	--	--	--	--	R	--	--	--	--	--	540 (J)[e]	--	2,400 (J)[b]
A36	536A123	0.5 - 1.5	--	--	--	--	--	55 (J)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A37	536A125	0.5 - 1.5	--	--	--	--	--	150 (J)[b]	--	--	--	--	--	--	--	--	--	--	--	410	--	--	--	620
	536A126	4.0 - 5.0	--	--	--	--	--	R	R	R	R	--	--	--	--	R	--	--	--	--	--	R	--	--
A42	536A135	0.0 - 1.0	--	--	--	--	--	19 (J)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	536A136	0.0 - 1.0	--	--	--	--	--	85 (J)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	---	--
	536A137	2.0 - 3.0	--	--	--	--	--	33 (J)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A44	536A141	0.5 - 1.5	--	--	--	--	--	180 (J)	--	--	--	--	--	--	--	--	--	--	--	380	--	--	--	--
A45	536A142	0.0 - 1.0	--	--	--	--	--	23 (J)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A46	536A143	0.0 - 1.0	--	--	--	--	--	56 (J)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A47	536A144	0.0 - 1.0	--	--	--	--	--	38 (J)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A48	536A145	0.0 - 1.0	--	--	--	--	920 (J)[c]	**1,100** (J)[b]	1,500 (J)[b]	1,500 (J)[b]	620 (J)[b]	--	--	--	890 (J)[c]	R	--	--	--	2,000	--	860 (J)[b]	600	3,600 (J)[c]
A49	536A146	0.0 - 1.0	--	--	--	--	--	82 (J)[c]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A50	536A147	0.0 - 1.0	--	--	--	--	--	79 (J)[c]	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
A51	536A148	0.0 - 0.5	--	--	--	--	--	23 (J)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	536A149	1.0 - 2.0	--	--	--	--	--	**280** (J)[b]	410 (J)[b]	--	--	--	--	--	--	R	--	--	--	820	--	--	890	2,000 (J)[c]
A52	536A150	0.0 - 0.5	--	--	--	--	--	15 (J)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table A.3-3
Soil Sample Results for Total SVOCs Detected Above Minimum Reporting Limits
(Page 3 of 3)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (µg/kg)																					
			2-Methylnaphthalene	3,3'-Dichlorobenzidine	Acenaphthene	Anthracene	Benzo(A)Anthracene	Benzo(A)Pyrene	Benzo(B)Fluoranthene	Benzo(G,H,I)Perylene	Benzo(K)Fluoranthene	Bis(2-Ethylhexyl)Phthalate	Butyl Benzyl Phthalate	Carbazole	Chrysene	Dibenzo(A,H)Anthracene	Dibenzofuran	Di-N-Butyl Phthalate	Di-N-Octyl Phthalate	Fluoranthene	Fluorene	Indeno(1,2,3-CD)Pyrene	Phenanthrene	Pyrene
Preliminary Action Level[a]			**NI**	**3,800**	**29,000,000**	**100,000,000**	**2,100**	**210**	**2,100**	**NI**	**21,000**	**120,000**	**100,000,000**	**86,000**	**210,000**	**210**	**3,100,000**	**62,000,000**	**25,000,000**	**22,000,000**	**26,000,000**	**2,100**	**NI**	**29,000,000**
A53	536A152	0.0 - 0.5	960	--	7,600 (J)[g]	5,700 (J)[g]	11,000 (J)[h]	**11,000** (J)[h]	**15,000** (J)[h]	13,000 (J)[h]	3,200 (J)[b]	--	--	--	9,800 (J)[h]	R	--	--	--	19,000 (J)[g]	2,500	**9,200** (J)[h]	23,000 (J)[g]	50,000 (J)[h]
N/A	536A154	0.0 - 0.5	--	--	--	--	R	R	R	R	R	--	--	--	R	R	--	--	--	--	--	R	--	--

[a]Based on EPA, Region 9 PRGs (EPA, 2002)
[b]Qualifier added to laboratory data; record accepted. Matrix effects may exist. Internal area response show extremely low count.
[c]Qualifier added to laboratory data; record accepted. Matrix effects may exist. Internal standard area count outside control limits.
[d]Qualifier added to laboratory data; record accepted. Matrix spike recovery outside control limits. Matrix effects may exist.
[e]Qualifier added to laboratory data; record accepted. Matrix effects may exist. Calibration verification did not meet criteria or was not performed. Internal area response show extremely low count.
[f]Qualifier added to laboratory data; record accepted. Value exceeded linear/calibration range of instrument. Matrix effects may exist. Calibration verification did not meet criteria or was not performed. Internal area response show extremely low count.
[g]Qualifier added to laboratory data; record accepted. Surrogates diluted out.
[h]Qualifier added to laboratory data; record accepted. Matrix effects may exist. Surrogates diluted out. Internal area response show extremely low count.

ft bgs = Feet below ground surface
µg/kg = Micrograms per kilogram
J = Estimate value
-- = Not detected above minimum reporting limits
NI = Not identified
R = Rejected value, see Table B.1-7 in Appendix B for reason codes

Table A.3-4
Soil Samples for Metals Detected Above Minimum Reporting Limits
(Page 1 of 4)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)								
			Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Selenium	Silver	Zinc
Preliminary Action Level			23[a]	67,000[b]	1,900[b]	450[b]	450[b]	750[b]	5,100[b]	5,100[b]	100,000[b]
A01	536A001	0.0 - 0.5	3.6	180	0.63	--	6.3	15	--	--	38
A02	536A002	0.0 - 0.5	3.2	180	0.61	--	7	14	--	--	41
A03	536A003	0.0 - 0.5	4.4	170	0.79	--	6.9	14	--	--	46
A04	536A004	0.0 - 0.5	3.3	150	0.69	--	5.7	11	--	--	45
	536A005	1.5 - 2.0	5.2	130	0.85	--	6.3	10	--	--	36
A05	536A006	1.0 - 1.5	3.7	160	0.71	--	6	10	--	--	34
	536A007	4.0 - 5.0	4.9	150	0.81	--	6.1	10	--	--	35
	536A008	7.0 - 8.0	3.9	180	0.55	--	4.9	9.3	--	--	27
A06	536A010	1.0 - 1.5	3.5	190	0.72	--	4.8	9.7	0.55	--	30
	536A011	4.0 - 5.0	4.3	150	0.77	--	8.5	10	--	--	34
	536A012	7.0 - 8.0	5.3	140	0.83	--	6.5	11	--	--	36
A07	536A014	1.0 - 1.5	4.8	210	0.68	--	7.1	14	--	2.1	47
	536A015	4.0 - 5.0	5.5	150	0.87	--	6.5	10	--	--	37
	536A016	4.0 - 5.0	5.2	150	0.83	--	6.5	10	--	--	35
	536A017	7.0 - 8.0	3.5	150	--	--	4	8.5	--	--	25
A08	536A019	0.0 - 0.5	4.4	190	0.79	--	6.8	10	--	--	36
	536A020	3.0 - 4.0	4.1	170	0.77	--	5.8	9.5	--	--	33
	536A021	6.0 - 7.0	5.5	140	1.1	--	7.8	13	0.74	--	45

Table A.3-4
Soil Samples for Metals Detected Above Minimum Reporting Limits
(Page 2 of 4)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)								
			Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Selenium	Silver	Zinc
Preliminary Action Level			23[a]	67,000[b]	1,900[b]	450[b]	450[b]	750[b]	5,100[b]	5,100[b]	100,000[b]
A09	536A023	1.0 - 2.0	5.1	220	0.65	1.2	8.5 (J)	18	--	--	52
	536A024	4.5 - 5.5	4.4	160	0.74	--	6.4 (J)	15	--	--	43
	536A025	7.0 - 8.0	4.7	140	0.78	--	7.3 (J)	13	--	--	37
	536A045	10.0 - 11.0	4.5	140	--	--	8.1	9.1	--	--	32
	536A046	10.0 - 11.0	5	170	0.56	--	8.4	10	--	--	32
A10	536A026	1.0 - 2.0	6.6	280	0.71	0.96	11 (J)	21	--	2.7	63
	536A027	4.0 - 5.0	4.2	170	0.8	--	5.6 (J)	10	--	--	33
	536A028	6.5 - 7.5	5	200	0.65	--	8.8 (J)	16	--	3.8	38
A11	536A029	0.0 - 0.5	4.9	180	0.78	--	7.2 (J)	12	--	--	40
	536A030	3.0 - 4.0	4.3	150	0.8	--	6.3 (J)	10	--	--	36
	536A031	7.0 - 8.0	3.5	120	--	--	4.8 (J)	9.1	--	--	30
A12	536A032	0.0 - 0.5	4.3	130	0.8	--	6.3 (J)	9.2	--	--	36
	536A033	3.0 - 4.0	4.3	150	0.77	--	6.1 (J)	10	--	--	35
	536A034	3.0 - 4.0	4.1	150	0.76	--	6.1 (J)	9.5	--	--	34
	536A035	6.5 - 7.5	3.3	120	0.6	--	5 (J)	8.6	--	--	29
A13	536A022	0.0 - 0.5	4.1	160	0.8	--	7 (J)	12	--	--	48
	536A036	6.5 - 7.5	4.4	150	0.81	--	6.4 (J)	13	--	--	39
	536A037	9.0 - 10.0	3.5	120	0.58	--	5.7 (J)	7.7	--	--	34
	536A038	11.5 - 12.5	2.8	110	0.55	--	4.8 (J)	11	--	--	28

Table A.3-4
Soil Samples for Metals Detected Above Minimum Reporting Limits
(Page 3 of 4)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)								
			Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Selenium	Silver	Zinc
Preliminary Action Level			23[a]	67,000[b]	1,900[b]	450[b]	450[b]	750[b]	5,100[b]	5,100[b]	100,000[b]
A14	536A039	0.0 - 1.0	3.8	180	0.66	0.67	6.6	74	--	--	85
	536A040	4.0 - 5.0	4.1	130	0.63	--	5.1	11	--	--	27
	536A041	7.0 - 8.0	4.7	140	0.82	--	7.3	12	--	--	38
A15	536A042	0.0 - 0.5	4.3	190	0.82	--	6.4	11	--	--	42
	536A043	4.0 - 5.0	5.3	150	0.84	--	7.7	11	--	--	36
	536A044	7.0 - 8.0	3.8	150	--	--	4	8.8	--	--	24
A16	536A048	0.0 - 0.5	4.8	160	0.71	--	6.3	9.6	--	--	39
	536A049	4.0 - 5.0	4.4	160	0.76	--	6	13	--	--	33
	536A050	7.0 - 8.0	5.4	130	0.91	--	7.4	11	--	--	38
A17	536A051	0.0 - 0.5	4.9	230	0.66	--	7.1	12	--	--	33
	536A052	4.0 - 5.0	4.1	120	0.69	--	5.9	9.1	--	--	32
	536A053	7.0 - 8.0	5.1	120	0.85	--	7.7	10	--	--	37
A18	536A054	0.0 - 0.5	3.2	150	--	0.77	7.6	20	--	--	81
	536A055	4.0 - 5.0	4	150	0.64	--	5.5	13	--	--	32
	536A056	7.0 - 8.0	3.9	140	0.75	--	5.5	12	--	--	32
A19	536A057	0.0 - 0.5	4.5	180	0.76	--	6.5	20	--	--	36
	536A058	4.0 - 5.0	3.9	110	0.58	--	4.5	9.1	--	--	28
	536A059	7.0 - 8.0	4	180	0.57	--	5.4	9.1	--	--	30

Table A.3-4
Soil Samples for Metals Detected Above Minimum Reporting Limits
(Page 4 of 4)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)								
			Arsenic	Barium	Beryllium	Cadmium	Chromium	Lead	Selenium	Silver	Zinc
Preliminary Action Level			**23[a]**	**67,000[b]**	**1,900[b]**	**450[b]**	**450[b]**	**750[b]**	**5,100[b]**	**5,100[b]**	**100,000[b]**
A20	536A060	0.5 - 1.0	4.9	200	0.67	--	5.7	11	--	--	39
	536A061	4.0 - 5.0	4.5	160	0.68	--	5.6	12	--	--	33
	536A062	7.0 - 8.0	4.8	130	0.75	--	6	9.9	--	--	35

[a]Based on the background concentrations for metals. Background is considered the mean plus two times the standard deviation for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (NBMG, 1998; Moore, 1999).
[b]Based on EPA Region 9 PRGs (EPA, 2002)

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
J = Estimated value. Qualifier added to laboratory data; record accepted. Serial dilution %D outside control limits. Matrix effects may exist.
-- = Not detected above minimum reporting limits

A.3.3.6 Total Petroleum Hydrocarbons

Results for TPH detected above MRLs are presented in Table A.3-5. Several sample locations indicate the presence of TPH within the diesel and oil ranges (C_8 - C_{38}) in concentrations exceeding the PAL of 100 mg/kg. Sample depths ranged from surface (0 to 1 ft) to 10 ft bgs. Each location where TPH exceeded PALs were bounded with additional step-out samples.

A.3.3.7 Gamma-Emitting Radionuclides Results

The gamma-emitting radionuclides results for soil samples detected above MDCs are presented in Table A.3-6. None of the detections exceed PALs.

A.3.3.8 Isotopic Results

The isotopic uranium, plutonium, and strontium-90 results for soil samples detected above MDCs are presented on Table A.3-7. Except for two detections of Pu-239, all other detections are below PALs. The Pu-239 detections in sample numbers 536A001 and 536A039 are consistent with Area 3 fallout concentrations from historic atmospheric testing (McArthur and Mead, 1987). Although these detections are considered COCs by definition, for the purpose of the CAU 536 field investigation, adequate delineation was achieved with Decision I samples. Additional detections of Pu-239/240 beyond this delineation is not within the scope of the investigation and will be addressed in the future under another program.

A.3.4 Contaminants of Concern

Based on analytical results, the following COCs were identified within the soils of CAS 03-44-02: Pu-239/240; TPH; and a limited number of PAHs including BAP, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Figure A.3-4 provides information on the sample number, depth, and analytical results for associated sample locations where COCs were identified above PALs.

A.3.5 Nature and Extent of Contamination

The data provided in Table A.3-3 and Table A.3-5 show that there are multiple locations of surface and subsurface TPH and PAH contamination within the CAS boundary. The data in Table A.3-5

Table A.3-5
Soil Sample Results for TPH-DRO Detected Above Minimum Reporting Limits
(Page 1 of 2)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)
			Total Petroleum Hydrocarbons
Preliminary Action Level[a]			100
A01	536A001	0.0 - 0.5	58 (D, H, M)
A02	536A002	0.0 - 0.5	43 (D, H, M)
A03	536A003	0.0 - 0.5	87 (D, H, M)
A04	536A004	0.0 - 0.5	**340** (D, H, M)
	536A005	1.5 - 2.0	51 (D)
A05	536A006	1.0 - 1.5	40 (H, M)
A06	536A011	4.0 - 5.0	28 (D, H, M)
A07	536A014	1.0 - 1.5	**1,000** (D, H, M)
A08	536A019	0.0 - 0.5	42 (H, M)
A09	536A023	1.0 - 2.0	**230** (D, H, M)
	536A024	4.5 - 5.5	**440** (D, H, M)
	536A045	10.0 - 11.0	53 (D, H, M)
	536A046	10.0 - 11.0	56 (D, H, M)
A10	536A026	1.0 - 2.0	68 (H, M)
A11	536A029	0.0 - 0.5	96 (H, M)
A13	536A022	0.0 - 0.5	**240** (H, M)
	536A036	6.5 - 7.5	56 (D, H, M)
A15	536A042	0.0 - 0.5	**120** (H, M)
A18	536A054	0.0 - 0.5	**180** (H, M)
	536A055	4.0 - 5.0	48 (D, H, M)
A19	536A057	0.0 - 0.5	54 (H, M)
A20	536A060	0.5 - 1.0	45 (H, M)
	536A061	4.0 - 5.0	45 (D, H, M)
A21	536A063	0.5 - 1.5	**190** (D, H, M)
A22	536A066	0.5 - 1.5	**340** (D, H, M)
	536A067	4.0 - 5.0	46 (H, M)
A23	536A069	0.5 - 1.5	97 (H, M)
A24	536A101	0.0 - 1.0	**500** (H, M, Y)

Table A.3-5
Soil Sample Results for TPH-DRO Detected Above Minimum Reporting Limits
(Page 2 of 2)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (mg/kg)
			Total Petroleum Hydrocarbons
Preliminary Action Level[a]			100
A25	536A103	0.0 - 1.0	37 (H, M)
	536A104	4.5 - 5.0	**140** (H, M)
A26	536A106	4.5 - 5.0	94 (H, M)
A27	536A107	0.0 - 1.0	69 (H, M)
	536A108	4.5 - 5.0	**110** (H, M)
A28	536A109	0.0 - 0.5	**110** (H, M)
A29	536A110	0.0 - 0.5	**190** (H, M)
A31	536A113	0.0 - 1.0	**770** (H, M)
A33	536A117	0.5 - 1.5	**1,800** (H, M, Y)
A37	536A125	0.5 - 1.5	**150** (D, H, M)
	536A126	4.0 - 5.0	**2,500** (Y)
A48	536A145	0.0 - 1.0	**920** (H)
A49	536A146	0.0 - 1.0	68 (D, M)
A50	536A147	0.0 - 1.0	78 (D, M)
A51	536A149	1.0 - 2.0	26 (H, M)
A53	536A152	0.0 - 0.5	**460** (M)
NA	536A154	0.0 - 0.5	**1,000** (H, M)

[a]Based on *Nevada Administrative Code*; Contamination of soil: Establishment of action levels (NAC, 2002)

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
D = A pattern resembling diesel was detected in the sample.
H = The fuel pattern was in the heavier end of the retention time window for the Analyte of interest
M = A pattern resembling motor oil was detected.
Y = Multipeak chromatogram does not match target analyte.

Table A.3-6
Soil Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Reporting Limits
(Page 1 of 5)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)														
			Actinium-228[a]		Americium-241[b]	Bismuth-212[a]		Bismuth-214[a]		Cesium-137[b]	Europium-152[b]	Lead-212[a]		Lead-214[a]		Thallium-208[a]	
Preliminary Action Levels			**5**	**15**	**7.62**	**5**	**15**	**5**	**15**	**7.3**	**3.4**	**5**	**15**	**5**	**15**	**5**	**15**
Depth bgs (cm)			**<15**	**>15**		**<15**	**>15**	**<15**	**>15**			**<15**	**>15**	**<15**	**>15**	**<15**	**>15**
A01	536A001	0.0 - 0.5	1.58 (G)	NA	5.1 (J)	--	NA	1.13 (G)	NA	1.07 (G)	0.96 (G, TI)	1.93 (J)	NA	1.1 (J)	NA	0.66 (G)	NA
A02	536A002	0.0 - 0.5	1.47 (G)	NA	2.01 (J)	--	NA	1.19 (G)	NA	1.24 (G)	1.01 (G)	1.91 (J)	NA	1.27 (J)	NA	0.59 (G)	NA
A03	536A003	0.0 - 0.5	1.78 (G)	NA	--	--	NA	1.08 (G)	NA	1.27 (G)	--	1.95 (J)	NA	1.48 (J)	NA	0.54 (G)	NA
A04	536A004	0.0 - 0.5	1.4 (G)	NA	--	--	NA	1.19 (G)	NA	0.55 (G)	--	1.3 (J)	NA	1.21 (J)	NA	0.61 (G)	NA
	536A005	1.5 - 2.0	NA	1.97 (G)	--	NA	--	NA	1.24 (G)	--	--	NA	1.79 (J)	NA	1.36 (J)	NA	0.67 (G)
A05	536A006	1.0 - 1.5	NA	1.9 (G)	--	NA	--	NA	1.27 (G)	2.36 (G)	3.03 (G)	NA	1.72 (J)	NA	1.52 (J)	NA	0.71 (G)
	536A007	4.0 - 5.0	NA	1.76 (G)	--	NA	--	NA	1.18 (G)	--	--	NA	2.08 (J)	NA	1.31 (J)	NA	0.61 (G)
	536A008	7.0 - 8.0	NA	1.49 (G)	--	NA	--	NA	1.12 (G)	--	--	NA	2.02 (J)	NA	1.13 (J)	NA	0.77 (G)
A06	536A010	1.0 - 1.5	NA	1.66 (G)	--	NA	--	NA	1.02 (G)	--	1.94 (G)	NA	1.81 (J)	NA	1.19 (J)	NA	0.48 (G)
	536A011	4.0 - 5.0	NA	1.51 (G)	--	NA	--	NA	0.98 (G)	0.37 (G, LT)	0.87 (G)	NA	1.91 (J)	NA	1.29 (J)	NA	0.58 (G)
	536A012	7.0 - 8.0	NA	2.01 (G)	--	NA	--	NA	1.12 (G)	--	--	NA	2.21 (J)	NA	1.24 (J)	NA	0.71 (G)

Table A.3-6
Soil Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Reporting Limits
(Page 2 of 5)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)														
			Actinium-228[a]		Americium-241[b]	Bismuth-212[a]		Bismuth-214[a]		Cesium-137[b]	Europium-152[b]	Lead-212[a]		Lead-214[a]		Thallium-208[a]	
Preliminary Action Levels			5	15	7.62	5	15	5	15	7.3	3.4	5	15	5	15	5	15
Depth bgs (cm)			<15	>15		<15	>15	<15	>15			<15	>15	<15	>15	<15	>15
A07	536A014	1.0 - 1.5	NA	1.18 (G)	--	NA	--	NA	1.07 (G)	0.64 (G)	2.77 (G)	NA	2.06 (J)	NA	1.22 (J)	NA	0.49 (G)
	536A015	4.0 - 5.0	NA	2.08 (G)	--	NA	--	NA	1.17 (G)	--	--	NA	2.18 (J)	NA	1.32 (J)	NA	0.68 (G)
	536A016	4.0 - 5.0	NA	1.72 (G)	--	NA	--	NA	1.25 (G)	--	--	NA	2.02 (J)	NA	1.27 (J)	NA	0.61 (G)
	536A017	7.0 - 8.0	NA	1.65 (G)	--	NA	--	NA	1.16 (G)	--	--	NA	2 (J)	NA	1.06 (J)	NA	0.63 (G)
A08	536A019	0.0 - 0.5	1.89 (G)	NA	--	--	NA	1.2 (G)	NA	--	--	1.74 (J)	NA	1.15 (J)	NA	0.52 (G)	NA
	536A020	3.0 - 4.0	NA	1.58 (G)	--	NA	--	NA	1.07 (G)	--	--	NA	1.92 (J)	NA	1.16 (J)	NA	0.6 (G)
	536A021	6.0 - 7.0	NA	2.24 (G)	--	NA	--	NA	1.34 (G)	--	--	NA	2.14 (J)	NA	1.41 (J)	NA	0.88 (G)
A09	536A023	1.0 - 2.0	NA	1.07 (G)	--	NA	--	NA	0.89 (G)	--	--	NA	1.28 (J)	NA	1.02 (J)	NA	0.36 (G)
	536A024	4.5 - 5.5	NA	1.64 (G)	1.17 (J)	NA	--	NA	1.26 (G)	2.05 (G)	2.8 (G)	NA	1.75 (J)	NA	1.2 (J)	NA	0.51 (G)
	536A025	7.0 - 8.0	NA	1.91 (G)	--	NA	--	NA	0.93 (G)	--	--	NA	2.24 (J)	NA	1.14 (J)	NA	0.66 (G)
	536A045	10.0 - 11.0	NA	1.56 (G)		NA	--	NA	0.85 (G)	--	--	NA	1.8 (J)	NA	1.12 (J)	NA	0.49 (G)
	536A046	10.0 - 11.0	NA	1.63 (G)		NA	--	NA	1.09 (G)	--	--	NA	1.89 (J)	NA	1.28 (J)	NA	0.56 (G)
A10	536A026	1.0 - 2.0	NA	1.2 (G)	1.2 (J)	NA	--	NA	0.79 (G)	1.02 (G)	0.76 (G, TI)	NA	1.62 (J)	NA	0.9 (J)	NA	0.51 (G)
	536A027	4.0 - 5.0	NA	1.92 (G)	--	NA	--	NA	1.01 (G)	--	1.78 (G)	NA	2 (J)	NA	1.43 (J)	NA	0.51 (G)
	536A028	6.5 - 7.5	NA	1.53 (G)	--	NA	--	NA	1.24 (G)	--	0.62 (G, TI)	NA	1.53 (J)	NA	0.97 (J)	NA	0.53 (G)

Table A.3-6
Soil Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Reporting Limits
(Page 3 of 5)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)														
			Actinium-228[a]		Americium-241[b]	Bismuth-212[a]		Bismuth-214[a]		Cesium-137[b]	Europium-152[b]	Lead-212[a]		Lead-214[a]		Thallium-208[a]	
Preliminary Action Levels			5	15	7.62	5	15	5	15	7.3	3.4	5	15	5	15	5	15
Depth bgs (cm)			<15	>15		<15	>15	<15	>15			<15	>15	<15	>15	<15	>15
A11	536A029	0.0 - 0.5	1.92 (G)	NA	--	--	NA	0.83 (G)	NA	--	--	2.07 (J)	NA	1.08 (J)	NA	0.48 (G)	NA
	536A030	3.0 - 4.0	NA	2.06 (G)	--	NA	--	NA	0.97 (G)	0.78 (G)	1.83 (G)	NA	1.94 (J)	NA	1.28 (J)	NA	0.7 (G)
	536A031	7.0 - 8.0	NA	1.61 (G)	--	NA	--	NA	0.93 (G)	--	--	NA	1.66 (J)	NA	0.92 (J)	NA	0.6 (G)
A12	536A032	0.0 - 0.5	1.78 (G)	NA	--	--	NA	1.04 (G)	NA	--	--	1.96 (J)	NA	1.17 (J)	NA	0.63 (G)	NA
	536A033	3.0 - 4.0	NA	1.81 (G)	--	NA	--	NA	0.95 (G)	--	1.28 (G)	NA	2.33 (J)	NA	1.19 (J)	NA	0.59 (G)
	536A034	3.0 - 4.0	NA	1.66 (G)	--	NA	--	NA	1.06 (G)	--	1.34 (G)	NA	1.72 (J)	NA	1.19 (J)	NA	0.62 (G)
	536A035	6.5 - 7.5	NA	1.78 (G)	--	NA	--	NA	1 (G)	--	--	NA	1.75 (J)	NA	0.93 (J)	NA	0.44 (G)
A13	536A022	0.0 - 0.5	1.77 (G)	NA	--	--	NA	0.99 (G)	NA	--	--	2 (J)	NA	1.31 (J)	NA	0.63 (G)	NA
	536A036	6.5 - 7.5	NA	1.42 (G)	--	NA	--	NA	1.22 (G)	0.33 (G, LT)	--	NA	1.88 (J)	NA	1.22 (J)	NA	0.63 (G)
	536A037	9.0 - 10.0	NA	1.88 (G)	--	NA	2.5 (G)	NA	1.02 (G)	--	--	NA	2.03 (J)	NA	1.13 (J)	NA	0.63 (G)
	536A038	11.5 - 12.5	NA	1.62 (G)	--	NA	--	NA	0.82 (G)	--	--	NA	1.79 (J)	NA	0.82 (J)	NA	0.58 (G)
A14	536A039	0.0 - 1.0	NA	1.65 (G)	5.6 (J)	NA	--	NA	0.88 (G)	4.76 (G)	2.89 (G)	NA	1.98 (J)	NA	1.11 (J)	NA	0.55 (G)
	536A040	4.0 - 5.0	NA	1.66	--	NA	--	NA	0.91	--	--	NA	1.78	NA	1.03	NA	0.53
	536A041	7.0 - 8.0	NA	2.02 (G)	--	NA	--	NA	1.1 (G)	--	--	NA	2.15 (J)	NA	1.21 (J)	NA	0.74 (G)

Table A.3-6
Soil Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Reporting Limits
(Page 4 of 5)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)														
			Actinium-228[a]		Americium-241[b]	Bismuth-212[a]		Bismuth-214[a]		Cesium-137[b]	Europium-152[b]	Lead-212[a]		Lead-214[a]		Thallium-208[a]	
Preliminary Action Levels			5	15	7.62	5	15	5	15	7.3	3.4	5	15	5	15	5	15
Depth bgs (cm)			<15	>15		<15	>15	<15	>15			<15	>15	<15	>15	<15	>15
A15	536A042	0.0 - 0.5	1.83 (G)	NA	--	--	NA	1.09 (G)	NA	--	--	2.14 (J)	NA	1.01 (J)	NA	0.46 (G)	NA
	536A043	4.0 - 5.0	NA	1.65 (G)	--	NA	--	NA	1.02 (G)	0.27 (G, LT)	--	NA	2.34 (J)	NA	1.48 (J)	NA	0.56 (G)
	536A044	7.0 - 8.0	NA	1.66 (G)	--	NA	--	NA	0.91 (G)	--	--	NA	1.83 (J)	NA	1.1 (J)	NA	0.63 (G)
A16	536A048	0.0 - 0.5	1.53 (G)	NA	--	--	NA	1.01 (G)	NA	--	--	1.86 (J)	NA	1.24 (J)	NA	0.55 (G)	NA
	536A049	4.0 - 5.0	NA	1.7 (G)	--	NA	--	NA	1.04 (G)	--	--	NA	2.06 (J)	NA	1.42 (J)	NA	0.57 (G)
	536A050	7.0 - 8.0	NA	1.8 (G)	--	NA	--	NA	1.18 (G)	--	--	NA	2.42 (J)	NA	1.19 (J)	NA	0.73 (G)
A17	536A051	0.0 - 0.5	2.03 (G)	NA	--	--	NA	1.21 (G)	NA	--	--	2.02 (J)	NA	1 (J)	NA	0.47 (G)	NA
	536A052	4.0 - 5.0	NA	1.98 (G)	--	NA	--	NA	1.11 (G)	--	--	NA	1.89 (J)	NA	1.3 (J)	NA	0.64 (G)
	536A053	7.0 - 8.0	NA	1.9 (G)	--	NA	--	NA	1.19 (G)	--	--	NA	1.91 (J)	NA	1.35 (J)	NA	0.5 (G)
A18	536A054	0.0 - 0.5	1.77 (G)	NA	--	--	NA	1.18 (G)	NA	0.31 (G, LT)	--	2.25 (J)	NA	1.47 (J)	NA	0.67 (G)	NA
	536A055	4.0 - 5.0	NA	2.09 (G)	--	NA	--	NA	1.01 (G)	--	0.79 (J)	NA	1.83 (J)	NA	1 (J)	NA	0.54 (G)
	536A056	7.0 - 8.0	NA	1.63 (G)	--	NA.	--	NA	1.03 (G)	--	--	NA	1.98 (J)	NA	1.1 (J)	NA	0.74 (G)

Table A.3-6
Soil Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Reporting Limits
(Page 5 of 5)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)														
			Actinium-228[a]		Americium-241[b]	Bismuth-212[a]		Bismuth-214[a]		Cesium-137[b]	Europium-152[b]	Lead-212[a]		Lead-214[a]		Thallium-208[a]	
Preliminary Action Levels			**5**	**15**	**7.62**	**5**	**15**	**5**	**15**	**7.3**	**3.4**	**5**	**15**	**5**	**15**	**5**	**15**
Depth bgs (cm)			**<15**	**>15**		**<15**	**>15**	**<15**	**>15**			**<15**	**>15**	**<15**	**>15**	**<15**	**>15**
A19	536A057	0.0 - 0.5	1.48 (G)	NA	--	--	NA	1.17 (G)	NA	--	--	1.5 (J)	NA	1.14 (J)	NA	0.51 (G)	NA
	536A058	4.0 - 5.0	NA	1.44 (G)	--	NA	--	NA	1.06 (G)	--	--	NA	1.71 (J)	NA	1.05 (J)	NA	0.69 (G)
	536A059	7.0 - 8.0	NA	1.65 (G)	--	NA	--	NA	1.15 (G)	--	--	NA	2.09 (J)	NA	1.04 (J)	NA	0.57 (G)
A20	536A060	0.5 - 1.0	NA	1.62 (G)	--	NA	--	NA	1.28 (G)	0.3 (G, LT)	--	NA	2.1 (J)	NA	1.23 (J)	NA	0.41 (G)
	536A061	4.0 - 5.0	NA	1.48 (G)	--	NA	--	NA	1.16 (G)	--	--	NA	1.81 (J)	NA	1.24 (J)	NA	0.59 (G)
	536A062	7.0 - 8.0	NA	1.9 (G)	--	NA	--	NA	1.2 (G)	--	--	NA	2.38 (J)	NA	1.44 (J)	NA	0.76 (G)

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead 212, thallium-208, and thorium-232, as found in Chapter IV of DOE Order 5400.5, Change 2, "Radiation Protection of the Public and Environment." (DOE, 1993). The PALs for these isotopes is specified as 5 pCi/g averaged over the first 15 cm of soil and 15 pCi/g for deeper soils (DOE, 1993). For purposes of this document, 15 cm is assumed to be equivalent to 0.5 ft (6 inches); therefore, 5 pCi/g represents the PALs for these radionuclides in the surface soil (0 to 0.5 ft depth).
[b]Taken from the construction, commercial, industrial land use scenario in Table 2.1 of the NCRP Report No. 129, *Recommended Screening Limits for Contaminated Surface Soil and Review Factors Relevant to Site-Specific Studies* (NCRP, 1999). The values provided in this source document were scaled to a 15-mrem/yr. dose.

ft bgs = Feet below ground surface
cm = Centimeter
pCi/g = Picocuries per gram
-- = Not detected above minimum reporting limits
> = Greater than
< = Less than
G = Sample density differs by more than 15% of laboratory control sample density.
J = Estimated value. Qualifier added to laboratory data; record accepted. Sample does not meet counting geometry requirements.
LT = Result is less than the requested minimum detectable concentration, greater than the specific minimum detectable concentration.
NA = Not applicable

Table A.3-7
Soil Sample Results for Isotopes Detected Above Minimum Reporting Limits
(Page 1 of 4)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)					
			Plutonium-238	Plutonium-239	Strontium-90	Uranium-234	Uranium-235	Uranium-238
Preliminary Action Level[a]			**7.78**	**7.62**	**503**	**85.9**	**10.5**	**63.2**
A01	536A001	0.0 - 0.5	0.74 (J)	**15.1**	0.49 (LT)	1.02	--	0.98
A02	536A002	0.0 - 0.5	0.313 (J)	4.15	--	0.88	0.056	0.94
A03	536A003	0.0 - 0.5	0.076 (J)	1.39	--	1.08	0.068	0.85
A04	536A004	0.0 - 0.5	1.02 (J)	3.75	--	1.03	0.062	0.95
	536A005	1.5 - 2.0	--	--	--	1.16	0.054	1.05
A05	536A006	1.0 - 1.5	0.325	2.03	--	0.89	--	1.09
	536A007	4.0 - 5.0	--	--	--	0.92	--	1.06
	536A008	7.0 - 8.0	--	--	--	1.05	--	1.05
A06	536A010	1.0 - 1.5	--	0.078	--	0.92	--	0.98
	536A011	4.0 - 5.0	--	0.53	--	0.97	--	0.95
	536A012	7.0 - 8.0	--	--	--	1.04	0.048 (LT)	1.17
A07	536A014	1.0 - 1.5	0.254	1.75	--	0.88	0.043 (LT)	0.92
	536A015	4.0 - 5.0	--	--	--	1.1	--	0.97
	536A016	4.0 - 5.0	--	--	--	1.2	0.064	1.18
	536A017	7.0 - 8.0	--	--	--	1.2	0.08	1.05
A08	536A019	0.0 - 0.5	--	1.5	--	1.01	--	0.93
	536A020	3.0 - 4.0	--	--	--	1.03	--	0.94
	536A021	6.0 - 7.0	--	--	--	1.29	--	1.27

Table A.3-7
Soil Sample Results for Isotopes Detected Above Minimum Reporting Limits
(Page 2 of 4)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)					
			Plutonium-238	Plutonium-239	Strontium-90	Uranium-234	Uranium-235	Uranium-238
Preliminary Action Level[a]			**7.78**	**7.62**	**503**	**85.9**	**10.5**	**63.2**
A09	536A023	1.0 - 2.0	0.03 (LT)	0.393	--	0.86	--	0.88
	536A024	4.5 - 5.5	0.371	3.66	--	0.87	0.057	0.9
	536A025	7.0 - 8.0	--	--	--	0.97	0.063	1.08
	536A045	10.0 - 11.0	0.161	1.16	--	1.2	--	1.25
	536A046	10.0 - 11.0	--	0.063	--	1.02	--	1.07
A10	536A026	1.0 - 2.0	0.326	5.64	--	1	0.086	0.95
	536A027	4.0 - 5.0	--	--	--	1.02	--	0.95
	536A028	6.5 - 7.5	--	0.168	--	1.09	0.082	1.06
A11	536A029	0.0 - 0.5	--	0.355	--	1.23	0.087	1.16
	536A030	3.0 - 4.0	--	0.084	--	0.84	--	0.9
	536A031	7.0 - 8.0	--	--	--	1.21	--	1.24
A12	536A032	0.0 - 0.5	--	--	--	1.08	0.059	1.12
	536A033	3.0 - 4.0	--	0.04 (LT)	--	0.95	--	1.01
	536A034	3.0 - 4.0	--	--	--	0.92	0.061	0.98
	536A035	6.5 - 7.5	--	--	--	1.27	0.074	1.15
A13	536A022	0.0 - 0.5	--	0.324	--	1.17	0.07	1.1
	536A036	6.5 - 7.5	0.157	0.63	--	0.96	0.043 (LT)	0.9
	536A037	9.0 - 10.0	--	--	--	1.04	--	0.89
	536A038	11.5 - 12.5	--	--	--	1.07	0.119	0.92

Table A.3-7
Soil Sample Results for Isotopes Detected Above Minimum Reporting Limits
(Page 3 of 4)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)					
			Plutonium-238	Plutonium-239	Strontium-90	Uranium-234	Uranium-235	Uranium-238
Preliminary Action Level[a]			**7.78**	**7.62**	**503**	**85.9**	**10.5**	**63.2**
A14	536A039	0.0 - 1.0	2.43	**16.9**	0.45 (LT)	0.85	0.058	0.84
	536A040	4.0 - 5.0	--	--	--	1	--	1.17
	536A041	7.0 - 8.0	--	--	--	0.98	--	0.95
A15	536A042	0.0 - 0.5	0.169	0.7	--	1.13	--	1.21
	536A043	4.0 - 5.0	--	--	--	1.08	--	0.97
	536A044	7.0 - 8.0	--	--	--	1	--	0.96
A16	536A048	0.0 - 0.5	--	0.088	--	1.13	0.066	1.24
	536A049	4.0 - 5.0	--	--	--	0.99	0.042 (LT)	0.99
	536A050	7.0 - 8.0	--	--	--	1.07	0.054	1.01
A17	536A051	0.0 - 0.5	--	0.253	--	1	0.056	0.9
	536A052	4.0 - 5.0	--	--	--	0.84	0.053	0.88
	536A053	7.0 - 8.0	--	--	--	1.39	0.06	1.16
A18	536A054	0.0 - 0.5	0.07	4.85	--	1.14	--	1.15
	536A055	4.0 - 5.0	--	--	--	0.9	--	0.92
	536A056	7.0 - 8.0	--	--	--	1.08	--	1.01
A19	536A057	0.0 - 0.5	--	0.77	--	1.05	--	1.09
	536A058	4.0 - 5.0	--	--	--	0.83	--	0.84
	536A059	7.0 - 8.0	--	--	--	1.04	0.077	1.05

Table A.3-7
Soil Sample Results for Isotopes Detected Above Minimum Reporting Limits
(Page 4 of 4)

Sample Location	Sample Number	Depth (ft bgs)	Contaminants of Potential Concern (pCi/g)					
			Plutonium-238	Plutonium-239	Strontium-90	Uranium-234	Uranium-235	Uranium-238
Preliminary Action Level[a]			**7.78**	**7.62**	**503**	**85.9**	**10.5**	**63.2**
A20	536A060	0.5 - 1.0	--	0.53	--	1.15	0.088	1.24
	536A061	4.0 - 5.0	--	0.214	--	1.03	--	1.01
	536A062	7.0 - 8.0	--	--	--	1.17	--	1.19

[a]Taken from the construction, commercial, industrial land use scenario in Table 2.1 of the NCRP Report No. 129, *Recommended Screening Limits for Contaminated Surface Soil and Review Factors Relevant to Site-Specific Studies* (NCRP, 1999). The values provided in this source document were scaled to a 15-mrem/yr dose.

ft bgs = Feet below ground surface
pCi/g = Picocuries per gram
J = Estimated value. Qualifier added to laboratory data; record accepted. Duplicate precision analysis (relative percent difference) outside control limits.
LT = Result is less than the requested minimum detectable concentration, greater than the specific minimum detectable concentration.
-- = Not detected above minimum reporting limits

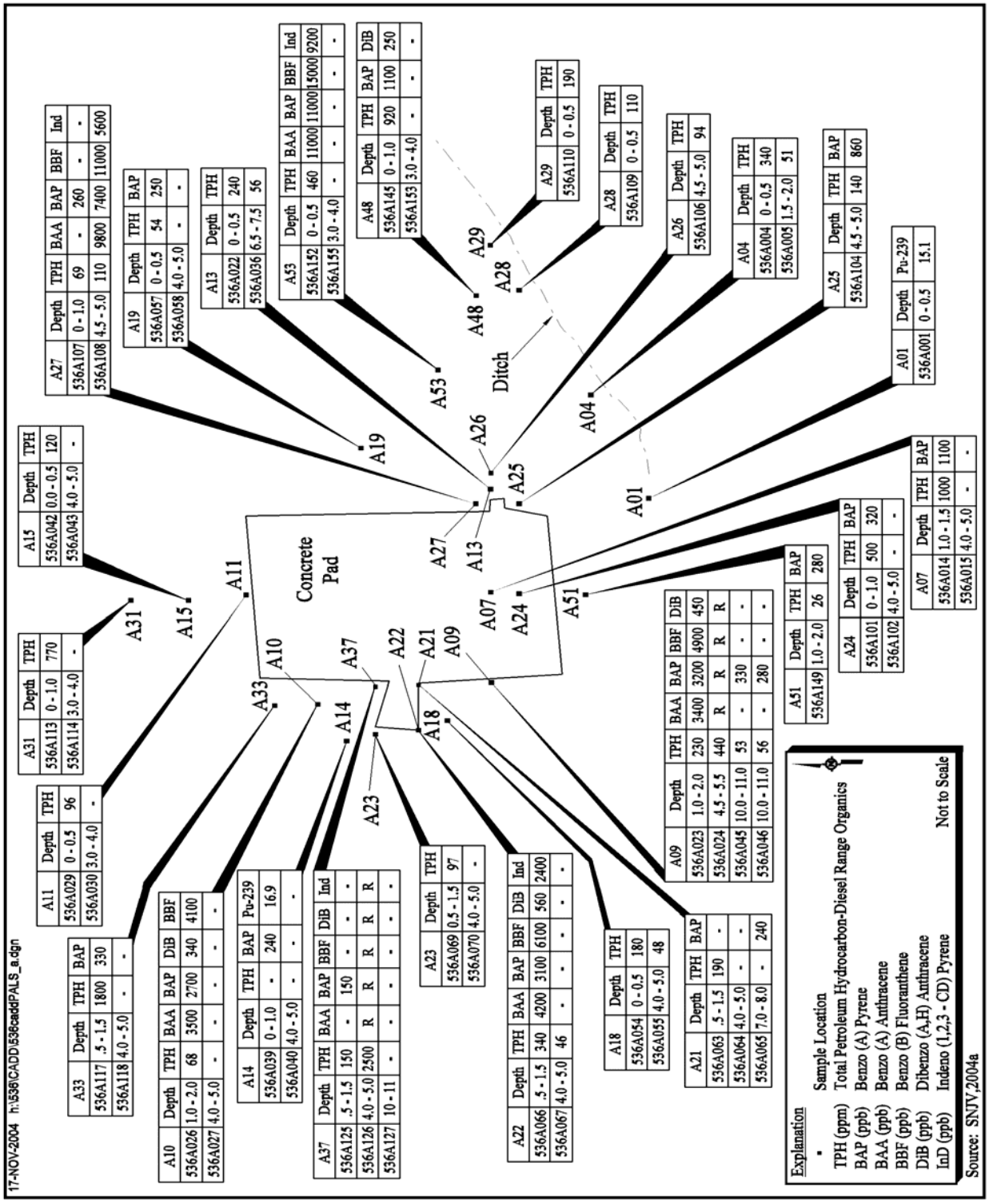


Figure A.3-4
Contaminants of Concern Above PALs for CAS 03-44-02

show that the TPH concentrations in the upper two ft of the soil ranged from below the detection limit to a maximum concentration of 1,800 mg/kg. The highest concentration of TPH in the surface interval was identified just off the northwest corner of the decontamination pad at location A33 (see Figure A.3-4 and Figure A.3-5). Other surface areas having TPH at concentrations exceeding the PAL are located at the smaller concrete pad on the western edge of the main concrete pad; the center drain of the main concrete pad; a small area around the eastern sump; and two areas near, but not directly adjacent to, the main concrete pad (locations A33 and A48). The isocontour plots representing areas of surface contamination for TPH are shown on Figure A.3-5. The distribution of the TPH suggests that there may have been multiple releases at various locations throughout the CAS boundary, some associated with the activities at the steam-cleaning pad while the others seem to be associated with steam-cleaning activities conducted before the construction of the pad. The lateral extent of these areas have been delineated to the level of the PALs. It should be noted that there is some conservative biasing in the isocontours of the TPH contamination resulting from the krieging of the data by the statistical program. Therefore, these isocontour plots overstate the lateral extent of the contamination to some degree.

The data in Table A.3-5 and depicted in Figure A.3-4 show the vertical extent of the TPH contamination is limited to the upper 2 ft of soil at the two areas not adjacent to the large decontamination pad. The areas where the TPH PAL is exceeded at depth are limited to the small pad on the western side of the main concrete pad; a small area directly adjacent to the main concrete pad; and the sump on the eastern side. Figure A.3-6 shows the isocontour plots of the subsurface TPH contamination within these areas. The data presented in Table A.3-5 show the TPH contamination in these three areas is limited to the upper 10 ft of the soil. As shown in Figure A.3-5 and Figure A.3-6 the lateral and vertical extent of the TPH contamination has been delineated. The distribution of the TPH contamination is consistent with the CSM.

In summary, the vertical extent of TPH contamination was defined by locations A09 and A37 on the western side of the steam-cleaning pad and varies between 5 and 10 ft bgs. Contaminants on the north end of the pad appear to be confined to the surface (A11, A15, and A31). The TPH associated with the eastern sump has a vertical extent of about 6.5 ft bgs as defined by A13; whereas, vertical extent of contaminants of the central sump located beneath the pad reach a depth of only 2 ft bgs

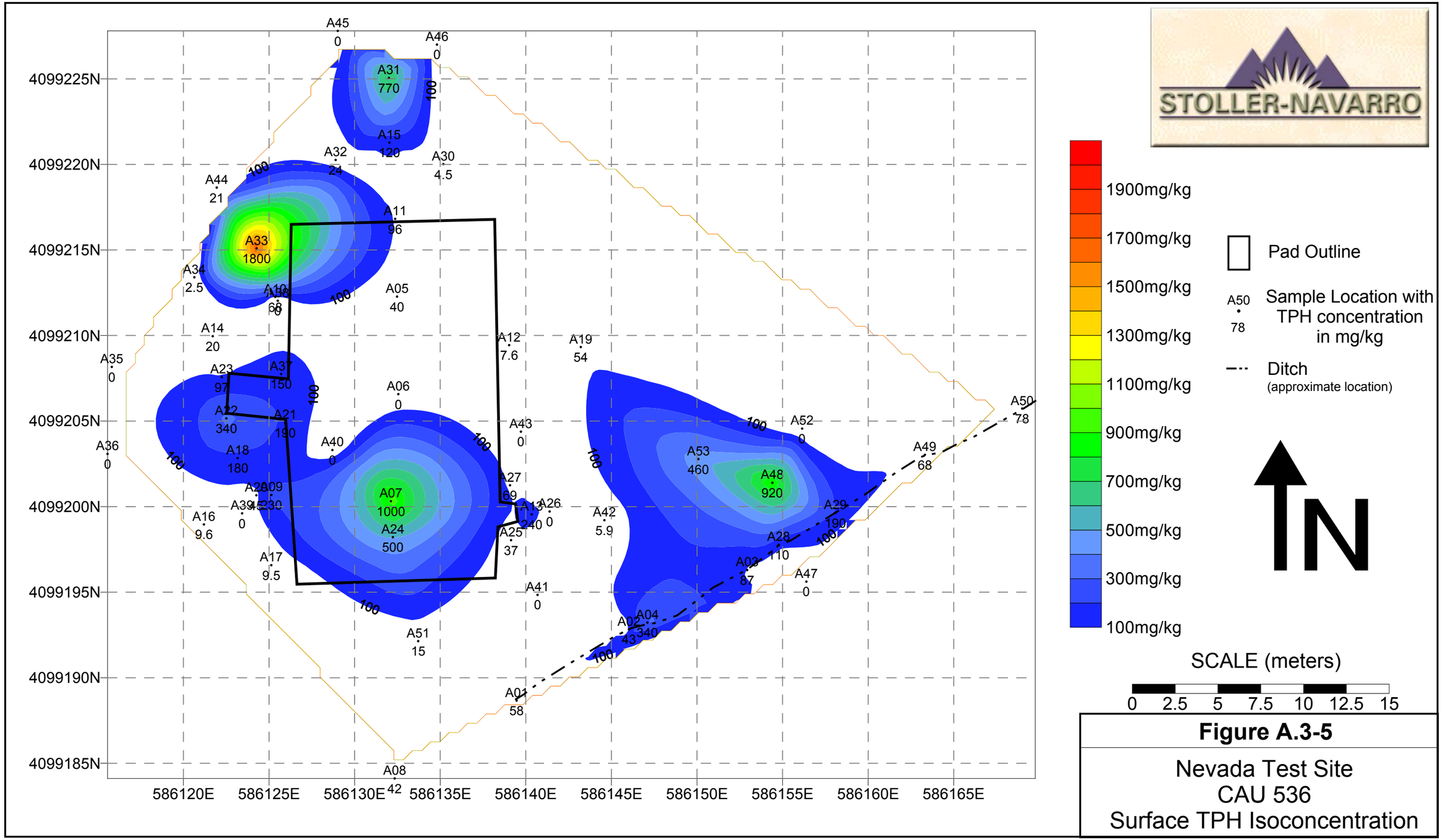


Figure A.3-5

Nevada Test Site
CAU 536
Surface TPH Isoconcentration

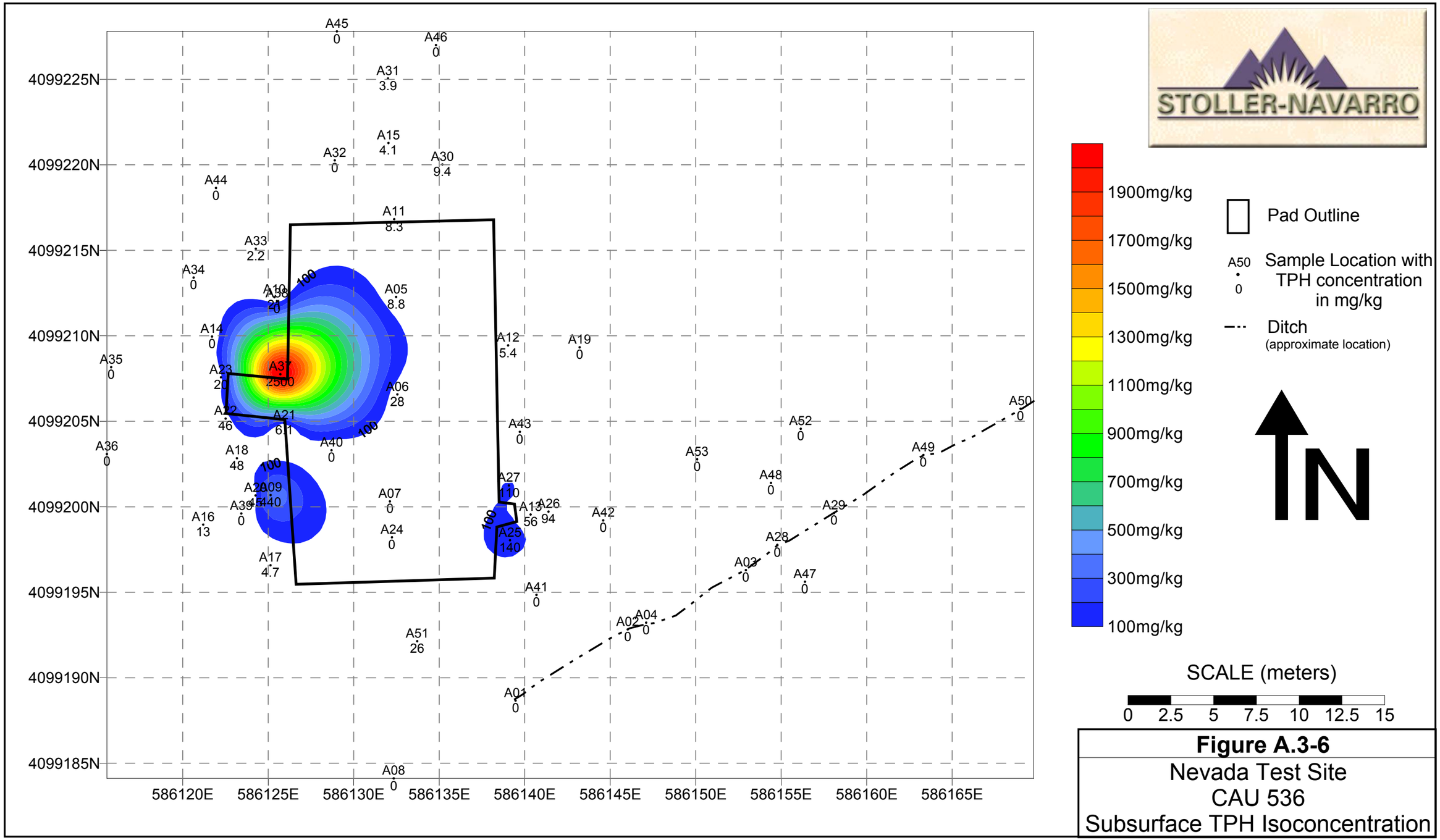


Figure A.3-6
Nevada Test Site
CAU 536
Subsurface TPH Isoconcentration

(A07). The lateral extent of TPH contamination has been defined for each discontinuous area and is limited to the assumed release or source location.

The BAP was the most frequently detected PAH above PALs during the CAI and has the most restrictive PAL of the five PAHs. Therefore, BAP is used to represent the distribution of all the PAHs for the discussion of nature and extent of contamination. The BAP concentrations ranged from 15 µg/kg to a high concentration of 11,000 µg/kg (Table A.3-3).

Figure A.3-7 is an isocontour plot of the BAP concentrations that exceed the PAL for the surface. The analytical data and these contour plots show discontinuous areas of PAH contamination adjacent to and surrounding the concrete pad and located in the same areas where the TPH contamination was identified. As with the TPH, these data suggest that there has been a series of releases over time through various mechanisms. The only area where the BAP concentrations exceed the PAL and are not associated with the decontamination pad is the area east of the pad and adjacent to the drainage ditch (A48 and A53). During sampling in this area, small pieces of asphalt were observed in the soil and this may be the source of the BAP and other PAHs. Figure A.3-8 is an isocontour plot of BAP concentrations exceeding PALs for the subsurface. The figure shows the highest concentration of BAP in the subsurface is located at the sump east of the decontamination pad. The vertical extent of the BAP contamination extends to depths between 6.5 ft and 10 ft bgs. Figure A.3-7 and Figure A.3-8 show the lateral and vertical extent of the BAP contamination. The other PAHs follow the similar trend and do not extend laterally or vertically beyond the bounding for BAP.

The nature and extent of contamination identified within the drainage ditch suggest the potential for a different or additional contaminant source other than overflow from the pad. The ubiquitous presence of PAHs commonly associated with location of elevated TPH-DRO are not seen within the drainage ditch where the only COC is TPH-DRO. The TPH-DRO may have leaked and migrated from the 20-gallon drum that was present at the time of sampling; alternatively, contaminants may have migrated through the ditch from other locations within the Area 3 Camp. Contaminants above PALs within the drainage ditch are confined to the surface (< 1 ft) as defined by location A04.

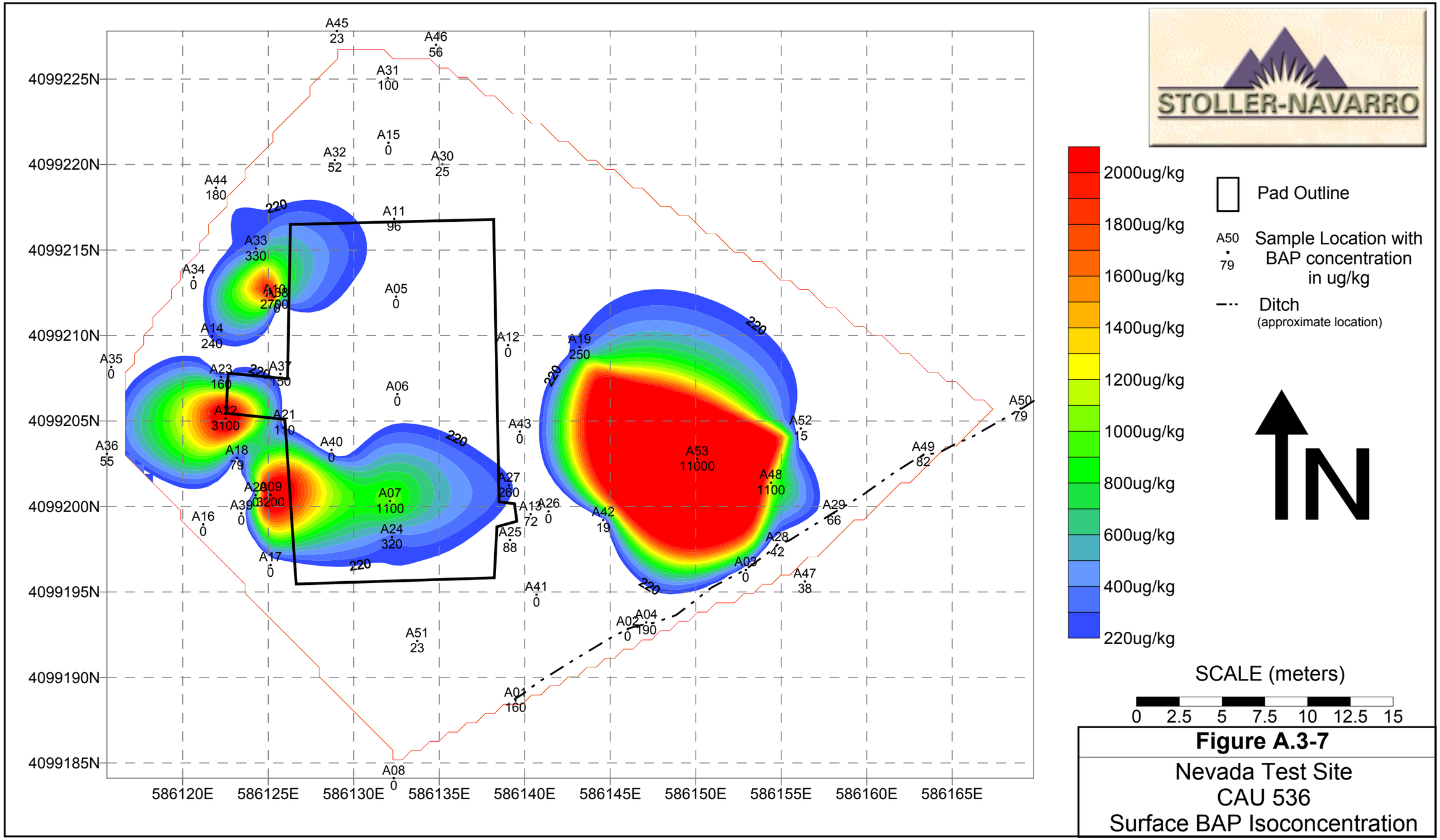


Figure A.3-7

Nevada Test Site
CAU 536
Surface BAP Isoconcentration

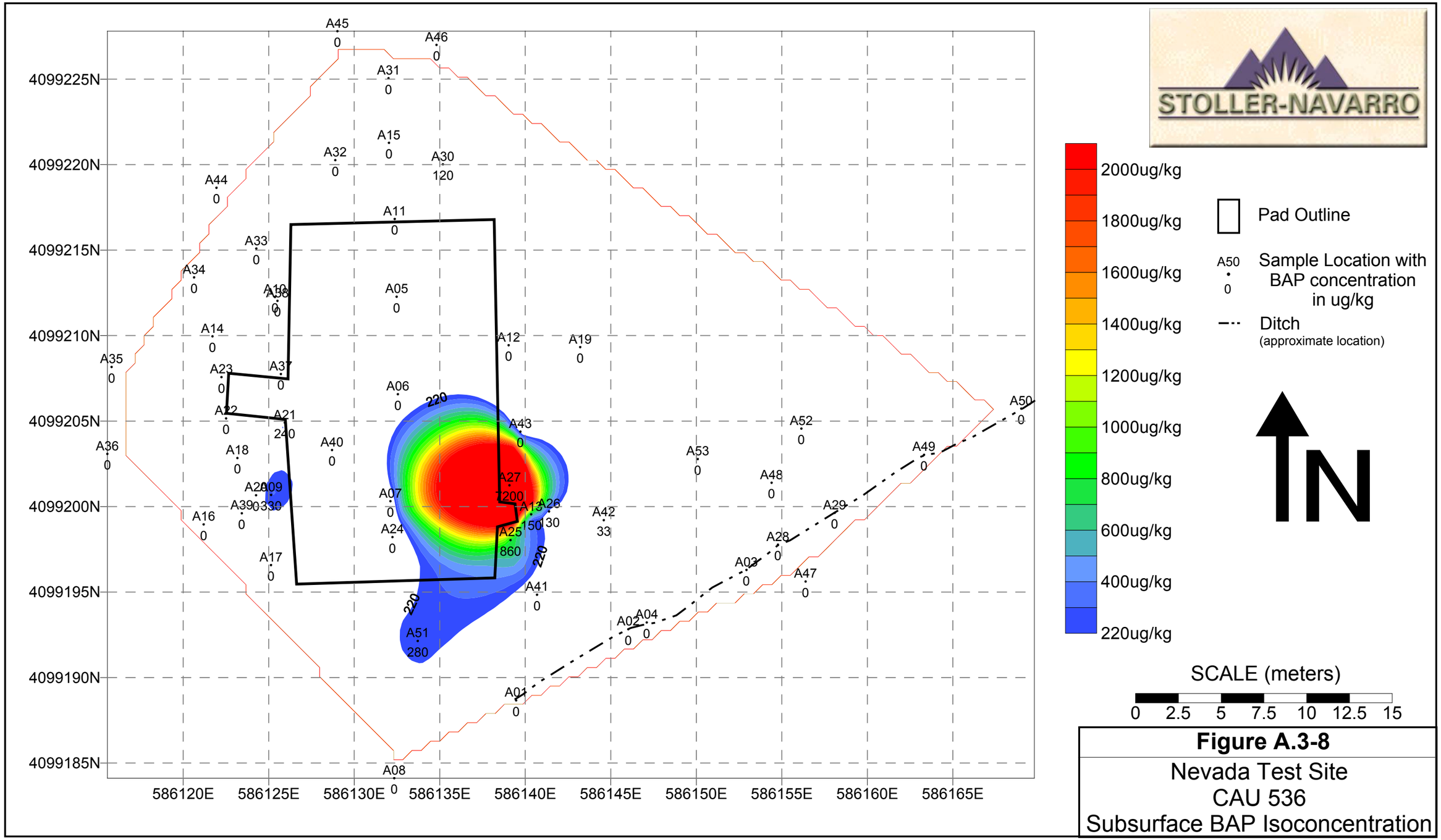


Figure A.3-8

Nevada Test Site
CAU 536
Subsurface BAP Isoconcentration

The data in Table A.3-7 and depicted in Figure A.3-4 show that detections of Pu-239/240 above PALs are located at two isolated locations (A01 and A14). The data show the vertical extent of Pu-239/240 at these locations is limited to the upper 1 ft of soil. The source of Pu-239/240 contamination is attributed to fallout from atmospheric testing rather than a release from decontamination processes. Therefore, Pu-239/240 was not investigated further during Decision II delineation sampling.

A.3.6 Revised Conceptual Site Model

The nature of contamination identified at the site indicates that elements of both CSM #1 and CSM #2 are applicable to this site. Discontinuous locations of contamination identified at locations away from the pad do not appear to be associated with the sumps or breaks in the concrete pad and are more consistent with the release mechanisms identified in CSM #1. Contamination identified underneath and along the western and eastern edges of the pad appear to be consistent with the release mechanisms identified in CSM #2.

A.4.0 Quality Assurance

This section contains a summary of the QA/QC measures implemented during the sampling, analysis, and investigation activities for CAU 536 corrective action investigation. The following sections of this appendix discuss the data validation process and the quality control samples. Appendix B provides a detailed evaluation of the DQIs of precision, accuracy, completeness, representativeness, sensitivity, and comparability for analytical results.

Laboratory analyses were conducted for samples used in the decision-making process to provide a quantitative measurement of any COPCs present. The QA/QC was implemented for all laboratory samples including documentation, data verification and validation of analytical results, and affirmation of DQI requirements related to laboratory analysis. Detailed information regarding the QA program is contained in the Industrial Sites QAPP (NNSA/NV, 2002).

A.4.1 Data Validation

Data validation was performed in accordance with the Industrial Sites QAPP (NNSA/NV, 2002) and approved procedures. All laboratory data from samples collected and analyzed for CAU 536 were evaluated for data quality according to the U.S. Environmental Protection Agency (EPA) Functional Guidelines (EPA, 1994a and 2000a). These guidelines are implemented in a tiered process and are presented in Section A.4.1.1 through Section A.4.1.3. Data were reviewed to ensure that samples were appropriately processed and analyzed, and the results were acceptable in accordance with the data-validation criteria. Documentation of the data qualifications resulting from these reviews is retained in project files as a hard copy and electronic media.

One hundred percent of the data analyzed as part of this investigation were subjected to Tier I and Tier II evaluations. A Tier III evaluation was performed on 7 samples.

A.4.1.1 Tier I Evaluation

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

- Sample count/type consistent with chain of custody
- Analysis count/type consistent with chain of custody

- Correct sample matrix
- Significant problems stated in cover letter or case narrative
- Completeness of certificates of analysis
- Completeness of contract laboratory program (CLP) or CLP-like packages
- Completeness of signatures, dates, and times on chain of custody
- Condition-upon-receipt variance form included
- Requested analyses performed on all samples
- Date received/analyzed given for each sample
- Correct concentration units indicated
- Electronic data transfer supplied
- Results reported for field and laboratory QC samples
- Whether or not the deliverable met the overall objectives of the project
- Proper field documentation accompanies project packages

A.4.1.2 Tier II Evaluation

Tier II evaluation for both chemical and radiological analysis examines, but is not limited to, the following areas.

Chemical:

- Correct detection limits achieved
- Sample date, preparation date, and analysis date for each sample
- Holding time criteria met
- QC batch association for each sample
- Cooler temperature upon receipt
- Sample pH for aqueous samples, as required
- Detection limits properly adjusted for dilution, as required
- Blank contamination evaluated and applied to sample results/qualifiers
- Matrix spike/matrix spike duplicate (MS/MSD) percent recovery (%R) and relative percent difference (RPDs) evaluated and applied to laboratory results/qualifiers

- Field duplicate RPDs evaluated using professional judgement and applied to laboratory results/qualifiers
- Laboratory duplicate RPDs evaluated and applied to laboratory results/qualifiers
- Surrogate %Rs evaluated and applied to laboratory results/qualifiers
- Laboratory control sample %R evaluated and applied to laboratory results/qualifiers
- Initial and continuing calibration evaluated and applied to laboratory results/qualifiers
- Internal standard evaluated and applied to laboratory results/qualifiers
- Mass spectrometer tuning criteria
- Organic compound quantitation
- Inductively coupled plasma (ICP) interference check sample evaluation
- Graphite furnace atomic absorption quality control
- ICP serial dilution effects
- Recalculation of 10 percent of laboratory results from raw data

Radioanalytical:

- Correct detection limits achieved
- Blank contamination evaluated and applied to sample results/qualifiers
- Certificate of Analysis consistent with data package documentation
- Quality control sample results (duplicates, laboratory control samples, laboratory blanks) evaluated and applied to laboratory result qualifiers

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

A.4.1.3 Tier III Evaluation

A Tier III evaluation looks at all the items evaluated in the Tier II evaluation, but for only a limited number of samples (typically 5 percent). It is conducted by an independent validator and serves as a check on the Tier II process. The Tier III review includes the additional evaluations:

Chemical:

- Recalculation of laboratory results from raw data

Radioanalytical:

- Radionuclides and their concentration appropriate considering their decay schemes and half-lives
- Each identified line in spectra verified against emission libraries and calibration results
- Independent identification of spectra lines, area under the peaks, and quantification of radionuclide concentration in a random number of sample results
- Recalculation of laboratory results from raw data

A Tier III review of 7 samples was conducted by TechLaw, Inc. in Lakewood, Colorado. The qualifiers for the samples analyzed for radiochemical analysis did not change based on the Tier III review. The qualifier for chemical analysis regarding one sample (536A066) was changed for 11 SVOC analytes based on the review, results should have been estimated J or UJ at the Tier II level. This review has been reflected for that sample delivery group (SDG).

A.4.2 Quality Control Samples

There were 11 trip blanks, one field blank, two source blanks, two equipment rinsate blanks, four full lab QC, and five field duplicates collected and submitted for laboratory analysis as shown in Table A.3-1. The quality control samples and duplicates were assigned individual sample numbers and sent to the laboratory "blind." Additional samples were selected by the laboratory to be analyzed as laboratory duplicates. Documentation related to the collection and analysis of these samples is retained in project files.

A.4.2.1 Field Quality Control Samples

Review of the field-blank analytical data for the CAU 536 soil sampling indicates that cross contamination from field methods did not occur during sample collection. Field, equipment rinsate, and source blanks were analyzed for the same parameters as the Decision I environmental samples as listed in Table A.3-1. Trip blanks were analyzed for VOCs only. Several different analytes were

detected in some of the samples but they were below or only slightly above the contract-required detection limit (CRDLs).

During the sampling events, 5 field duplicate soil samples were sent as blind samples to the laboratory to be analyzed for the investigation parameters listed in each CAS-specific table. For these samples, the duplicate results precision (i.e., RPDs between the environmental sample results and their corresponding field duplicate sample results) were evaluated to the guidelines set forth in EPA Functional Guidelines (EPA, 1994a and 2000a). Samples 536A072 and 536A136 were designated as field duplicates of parent samples 536A071 and 536A135, respectively.

One sample, 536A011, was initially designated as a Full Lab QC (MS/MSD). However, due to a lack of soil volume the Iso-U and Iso-Pu analyses required the use of soil samples from the same SDG rather than sample 536A011. This deviation did not affect the quality control of the sample set.

A.4.2.2 Laboratory Quality Control Samples

Analysis of method QC blanks were performed on each SDG for inorganics. Analysis for surrogate spikes and preparation blanks (PBs) were performed on each SDG for organics only. Initial and continuing calibration and laboratory control samples (LCS) analyses were performed for each SDG. The results of these analyses were used to qualify associated environmental sample results according to EPA Functional Guidelines (EPA, 1994a and 2000a). Documentation of data qualifications resulting from the application of these guidelines is retained in project files as both hard copy and electronic media.

A.4.3 Field Nonconformances

No field nonconformances were identified for this project.

A.4.4 Laboratory Nonconformances

Laboratory nonconformances are generally due to inconsistencies in analytical instrumentation operation, sample preparation, extractions, and fluctuations in internal standard and calibration results. A total of 3 laboratory nonconformances were identified. The nonconformances have been

accounted for in the data qualification process. Documentation of the nonconformances are retained in project files.

A.5.0 Summary

Analytes detected in soil samples during the CAI were evaluated against PALs to determine the nature and extent of COCs for CAU 536. Assessment of the data generated from investigation activities indicated the PALs were exceeded in soil samples at various locations within the CAS boundary for TPH, five PAHs, and Pu-239/240. Data generated from CAI activities at CAU 536 indicate the following:

- Based on field observations during drilling activities, the decontamination pad and center sump are approximately 12-in. thick, while the eastern sump extends approximately 6.5 ft bgs. A thickness was not determined for the small generator pad but is assumed to be similar to the main concrete pad (i.e., 12-in.).

- No other sump features (i.e., metal pipe) could be identified based on the investigation methods used during the CAI

- The 20-gallon drum present within the drainage ditch was determined to be RCRA-empty and was subsequently disposed as IDW.

- TPH-DRO has been identified as a COC with concentrations up to 2,500 mg/kg (sample number 536A126). Analytical results indicate heavier end hydrocarbons primarily diesel- and oil- range organics.

- Five PAHs were identified as COCs through the SVOC analysis. The five PAHs include BAP, benzo(a)anthracene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. The most prevalent PAH is BAP with concentrations up to 11,000 µg/kg (sample number 536A152). The elevated PAHs are typically associated with elevated concentrations of TPH-DRO.

- Pu-239/240 was identified within CAS boundaries and is considered a COC by definition of exceeding PALs. However, the source of Pu-239/240 is attributed to fallout from atmospheric testing rather than historical decontamination activities.

- Based on the analytical results obtained during the CAI, the lateral and vertical extent of contamination has been adequately bounded at CAS 03-44-02.

The analytical data generated during the CAI for CAS 03-44-02 indicate that contamination does not extend beyond the defined CAS boundary. In addition, contaminants appear to be limited to discrete areas with minimal vertical or lateral migration occurring since the steam-cleaning activities were discontinued.

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Appendix B

Data Assessment for CAU 536

B.1.0 Data Assessment

This appendix provides a summary of the assessment of CAU 536 data validation results for each DQI. In addition, a reconciliation of the data with generalized CSMs established for this project is provided.

B.1.1 Statement of Acceptability and Usability

This section provides an evaluation of the DQIs in determining the degree of acceptability and usability of the reported data in the decision-making process.

Data were evaluated against specific criteria to verify the achievement of DQI goals established to meet the project DQOs as provided in the Industrial Sites QAPP (NNSA/NV, 2002b) and the CAU 536 CAIP (NNSA/NV, 2002a). The DQIs for this project include precision, accuracy, completeness, representativeness, and comparability.

B.1.1.1 Precision

Precision is a measure of agreement among a replicate set of measurements of the same property under similar conditions. This agreement is expressed as the relative percent difference (RPD) between duplicate measurements (EPA, 1996). The RPD is determined by dividing the difference between the replicate measurement values by the average measurement value and multiplying the result by 100, or:

$$RPD = *100 \times [((a_1 - a_2)/(a_1 + a_2)/ 2)]*,$$

where

a_1 = The sample value, and
a_2 = The duplicate sample value.

Determinations of precision can be made for field samples, laboratory duplicates, or both. For field samples, duplicates are collected simultaneously with a sample from the same source under similar conditions in separate containers. The duplicate sample is treated independently of the original sample in order to assess field impacts and laboratory performance on precision through a

comparison of results. Laboratory precision is evaluated as part of the required laboratory internal QC program to assess performance of analytical procedures. The laboratory sample duplicates are an aliquot or subset of a field sample generated in the laboratory. They are not a separate sample but portions of an existing sample. Typically, other laboratory duplicate QC samples include MSD and laboratory control sample duplicate (LCSD) samples.

The variability in the results from the analysis of field duplicates is generally greater than the variability in the results of laboratory duplicates. This higher variability for field duplicates results from the increased potential to introduce factors influencing the analytical results during sampling, sample preparation, containerization, handling, packaging, preservation, and environmental conditions before the samples reach the laboratory. Laboratory QC samples assess only the variability of results introduced by sample handling and preparation in the laboratory and by the analytical procedure, which also impacts field duplicates. In addition, the variability in duplicate results is expected to be greater for soil samples than water samples, primarily due to the inherent nonhomogeneous nature of soil samples, despite sample preparation methods that include mixing to improve sample homogeneity.

B.1.1.1.1 Precision for Chemical Analyses

The RPD criteria used for assessment of laboratory sample duplicate precision for analytical results of samples collected at CAU 536 were established as follows:

- Inorganic analysis RPD criteria is obtained from the EPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, 1994).
- Organic analysis RPD criteria is established by the laboratory to evaluate precision for MSD and LCSD analyses.
- The control limits are evaluated at the laboratory on a quarterly basis by monitoring the historical data and performance for each method.
- No review criteria for organic field duplicate RPD comparability have been established; therefore, the laboratory MSD RPD criteria is applied for precision evaluation of field duplicates.

Precision values for organic and inorganic analysis that are within the established control criteria indicate that analytical results for associated samples are valid. Laboratory duplicate RPD values that

are outside the criteria for organic analysis do not necessarily result in the qualification of analytical data. It is only one factor in making an overall judgment about the quality of the reported analytical results. Inorganic laboratory duplicate RPD values outside the established control criteria do result in the qualification of associated analytical results as estimated. Field duplicate RPD values that are outside the criteria for organic and inorganic analyses do not result in the qualification of analytical data. Out of control RPD values do not necessarily indicate that the data are not useful for the purpose intended; however, it is an indication data precision should be considered for the overall assessment of the data quality and potential impact on data application in meeting project site characterization objectives. Method-specific precision as RPD is determined by taking the number of measurements within criteria, dividing that by the number of measurements analyzed, and multiplying by 100.

For the purpose of determining data precision of sample analyses for CAU 536, all water and soil samples, including field QC samples (i.e., trip blanks, equipment rinsate samples, field blanks) were evaluated and incorporated into the precision calculation.

Precision for the measurement of target compounds or analytes collected at CAU 536 was determined for RCRA metals, beryllium, zinc, VOCs, SVOCs, TPH-DRO and TPH-GRO, explosives, and PCBs.

Table B.1-1 provides the field and laboratory duplicate precision analysis results.

Inorganic laboratory duplicate RPD values outside the established control criteria result in estimation for that measurement of all associated samples in the SDG. For example, if a laboratory duplicate had an RPD value for lead outside the established control criteria, lead results for all of the samples in that SDG would be qualified as estimated.

Out of control RPD values do not necessarily indicate that the data is not useful for the purpose intended. It does indicate that precision should be considered for the overall assessment of the data quality and impact to the application of associated data to meeting project's objectives.

B.1.1.1.2 Precision for Radiological Analysis

The precision of radiochemical measurements is evaluated by measuring two aliquots of a sample and comparing the results. A laboratory duplicate is measured with every batch of samples analyzed by

Table B.1-1
Chemical Precision Measurements for CAU 536

	ORGANICS						INORGANICS	
	VOCs	SVOCs	TPH-DRO	TPH-GRO	Explosive	PCBs	Metals	Mercury
Matrix Spike Duplicate (MSD) Precision								
Total Number of MSD Measurements	25	76	9	5	56	8	34	4
Total Number of RPDs within Criteria	25	74	9	3	42	8	34	4
MSD % Precision	100	97.4	100	60	75	100	100	100
Laboratory Control Sample Duplicate (LCSD) Precision								
Total Number of LCSD Measurements	35	122	10	5	84	12	61	6
Total Number of RPDs within Criteria	35	122	10	5	84	12	61	6
LCSD % Precision	100	100	100	100	100	100	100	100
Field Sample Duplicate (FD) Precision								
Total Number of FD Measurements	207	301	5	3	42	21	27	3
Total Number of RPDs within Criteria	207	294	5	3	42	21	26	1
FD % Precision	100	97.7	100	100	100	100	96.3	33.3
Laboratory Sample Duplicate (Lab-Dup) Precision								
Total Number of Lab-Dup Measurements	NA	NA	NA	NA	NA	NA	78	10
Laboratory Sample Duplicate (Lab-Dup) Precision								
Total Number of RPDs within Criteria	NA	NA	NA	NA	NA	NA	78	10
Lab-Dup % Precision	NA	NA	NA	NA	NA	NA	100	100

Arsenic, barium, beryllium, cadmium, chromium, lead, selenium, silver, and zinc

the laboratory. Field duplicate data is available when two aliquots of a sample are submitted to the laboratory for analysis. Laboratory control sample duplicates are measured by the laboratory when there is insufficient sample to measure a duplicate of a field sample. Matrix spike duplicates, also used to evaluate precision, are performed by the laboratory upon request.

The duplicate precision is evaluated using the RPD or normalized difference. The RPD is applicable when both the sample and its duplicate have concentrations of the target radionuclide exceeding five times their minimum detectable concentration. This excludes many measurements because the samples contain nondetectable or low levels of the target radionuclide. In situations where the RPD does not apply, duplicate results are evaluated using the normalized difference which is expressed by:

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

Where:

S	=	Sample result
D	=	Duplicate Result
TPU_S	=	2σ TPU of the sample
TPU_D	=	2σ TPU of the duplicate
σ	=	Standard deviation

The control limit for the normalized difference is -1.96 to 1.96, which represent a confidence level of 95 percent. Depending on the sample concentration, only one duplicate evaluation needs to be performed.

Samples are qualified based on laboratory prepared duplicates, but not field duplicates or MSDs.

A duplicate comparison that is outside control limits does not necessarily indicate that the data is not useful for the purpose intended; however, it is an indication that data precision should be considered for the overall assessment of the data quality and potential impact on data application in meeting project site characterization objectives.

The isotopic gamma analysis provides results for 22-24 radionuclides. Only two or three of these radionuclides are usually present in sufficient concentrations to allow the determination of their

RPDs. The duplicate data for the remaining radionuclides is compared using the normalized difference. The isotopic uranium analysis provides results for three uranium isotopes while the isotopic plutonium (Pu) analysis gives results for Pu-238 and Pu-239/240.

For the purpose of determining data precision of sample analyses for CAU 536, all water and soil duplicates were evaluated and incorporated into Table B.1-2. The comparisons of field duplicates are included in this table. All of the field duplicate comparisons were within the control limits except for one plutonium RPD. No field samples were qualified based on the RPD being outside control limits.

B.1.1.1.3 Precision Summary

Overall, the precision for CAU 536 measurements were within the DQI specifications. Accounting for sample heterogeneity, the precision of the dataset for chemical analyses is demonstrated to be very high. Laboratory measurement error associated with analytical measurement variability is well within acceptable limits. FD% Precision for Mercury is 33.3 percent. Based on the sample concentration (< Contract Required Detection Limit), the variability (RPD >35%) does not indicate poor field or laboratory precision. No field sample results were qualified based on the RPD being outside the control limits. MSD % Precision for TPH-GRO is 60 percent. No samples were qualified due to poor MS/MSD RPDs for gasoline range organics. Laboratory and field precision tests were performed for gamma spectroscopy, isotopic uranium, and isotopic plutonium. All the measurements were within the control limits except one plutonium RPD.

B.1.1.2 Accuracy

Accuracy is a measure of the closeness of an individual measurement or the average of a number of measurements to the true value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that result from sampling and analytical operations.

B.1.1.2.1 Accuracy for Chemical Analyses

Accuracy is determined by analyzing a reference material of known pollutant concentration or by reanalyzing a sample to which a material of known concentration or amount of pollutant has been added (spiked). Accuracy is expressed as %R for the purposes of evaluating the quality of data reported for CAU 536.

Table B.1-2
Radiological Precision Measurements for CAU 536

	Gamma Spectroscopy	Isotopic Uranium	Isotopic Plutonium	Strontium-90	Gross Alpha	Gross Beta
Laboratory Sample Duplicate (Lab-Dup) Precision						
Relative Percent Difference						
Total Number of Measurements	17	19	8	1	0	0
Total Number of RPDs within criteria	17	19	7	1	0	0
% Precision	100	100	87.5	100	NA	NA
Normalized Difference						
Total Number of Measurements	181	11	12	8	1	1
Total Number of NDs within Criteria	181	11	12	8	1	1
% Precision	100	100	100	100	100	100
Field Sample Duplicate (FD) Precision						
Relative Percent Difference						
Total Number of Measurements	6	6	1	0	0	0
Total Number of RPDs within criteria	6	6	0	0	0	0
% Precision	100	100	0	NA	NA	NA
Normalized Difference						
Total Number of Measurements	60	3	5	3	0	0
Total Number of NDs within Criteria	60	3	4	3	0	0
% Precision	100	100	80	100	NA	NA

NA = Not Applicable

Matrix spike samples are prepared by adding a known concentration of a target analyte to a specified amount of matrix sample for which an independent estimate of the target analyte concentration is available. Spiked samples are used to determine the laboratory's overall efficiency by comparing the percent recovered to the known true value. For example, a sample that is spiked with 10 ppm of a known analyte should produce a reported result of 10 ppm greater than the value of the sample itself. Consequently, the accuracy for this analysis would be reported as 100 percent. Matrix spike recoveries within the specified criteria for organic and inorganic analyses indicate the laboratory is operating within established controls and producing valid, quality results. Matrix spike results outside the control limits for organic analyses may not result in qualification of the data. An assessment of the entire analytical process is performed to determine the quality of the data and whether qualification is necessary.

Laboratory control samples are generated to provide accuracy of analytical methods and laboratory performance. They are prepared, extracted (as required by method), analyzed, and reported once per SDG, per matrix. For organic analyses, laboratory control limits are used to evaluate the accuracy of all analyses. The control limits are evaluated at the laboratory quarterly by monitoring the historical data and performance for each method. The acceptable limits for inorganic analyses are established in the EPA *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, 1994). Sample results within established control ranges for organic and inorganic analyses show that the analytical method is accurate and the data provided are valid.

Surrogates (System Monitoring Compounds) are used to assess the method performance for each sample analyzed for organic analyses. Control limits established by the laboratory are used to evaluate the accuracy of the surrogate recoveries. Factors beyond the laboratory's control, such as sample matrix effects, can cause the measured values to be outside of the established criteria. Therefore, the entire sampling and analytical process must be evaluated when determining the quality of the analytical data provided.

Table B.1-3 identifies the number of matrix spike, laboratory control, and surrogate measurements performed for CAU 536. The table presents the total number of measurements analyzed, the number of measurements within the specified criteria, and the percent-accuracy of each method. Method-specific accuracy is determined by taking the number of measurements within criteria, dividing that

by the total number of measurements analyzed, and multiplying by 100. For organic analyses, each sample had surrogates analyzed; therefore, the number of surrogates is significantly greater than the number of matrix spike and laboratory control samples.

The MS accuracy results for organic analyses in Table B.1-3 include the total number of MS measurements per analysis and the number of MS measurements within criteria. All samples for organic analyses within the associated SDG are not qualified, only the native sample in which the spike was added. Inorganic MS results outside of the established control criteria do result in data qualified as estimated for all the samples in that batch. However, only the analyte(s) outside of control requires qualification.

Table B.1-3 includes the total number of LCS measurements per analysis and the number of LCS measurements within criteria. Laboratory control samples within the specified criteria for organic and inorganic analyses indicate the laboratory is producing valid data. Laboratory control samples outside of the established criteria result in the qualification of inorganic data and may result in the qualification of organic data. For organic analyses, an evaluation of the overall analytical process is performed to determine if data qualification is necessary. Inorganic LCS recoveries outside of established controls require data to be qualified for the individual analyte out of control. If the LCS criteria are not met, the laboratory performance and method accuracy are in question.

Surrogates reported within established control criteria indicate good laboratory method performance and the absence of matrix influences on the samples and result in quality, valid data. Table B.1-3 includes the total number of sample measurements performed for each method and the total number of sample measurements qualified for surrogate recoveries exceeding criteria. The estimated organic data in this CAU do not necessarily indicate the data is not useful. Data qualification is one factor to be considered in the overall assessment of the data quality and the impact to the project's objectives.

Accuracy for the measurement of target analytes collected at CAU 536 was determined for RCRA metals, beryllium, zinc, VOCs, SVOCs, TPH-DRO and TPH-GRO, explosives, and PCBs.

For the purpose of determining data accuracy of sample analysis for CAU 536, all water and soil samples including field QC samples (i.e., trip blanks, equipment rinsate samples, field blanks) were evaluated and incorporated into the accuracy calculation.

Table B.1-3
Laboratory Accuracy Measurements for CAU 536

	ORGANICS						INORGANICS	
	VOCs	SVOCs	TPH-DRO	TPH-GRO	Explosives	PCBS	Metals*	Mercury
Matrix Spike (MS) Accuracy								
Total Number of MS Measurements	50	152	18	10	112	16	68	8
Total Number of MS Measurements Within Criteria	48	145	18	6	101	16	68	8
MS % Accuracy	96	95.4	100	60	90.2	100	100	100
Laboratory Control Sample (LCS) Accuracy								
Total Number of LCS Measurements	70	244	20	10	168	24	122	12
Total Number of LCS Measurements Within Criteria	70	243	20	10	168	24	122	12
LCS % Accuracy	100	99.6	100	100	100	100	100	100
Surrogate Accuracy								
Total Number of Measurements Analyzed	5,244	6,595	127	63	882	441	NA	NA
Total Number of Measurements not Affected by Out-of-Control Surrogates	5,244	6,579	127	63	882	392	NA	NA
Surrogate % Accuracy	100	99.8	100	100	100	88.9	NA	NA

*Measurements include arsenic, barium, beryllium, cadmium, chromium, lead, selenium, silver, and zinc
NA = Not Applicable

B.1.1.2.2 Accuracy for Radiological Analyses

Laboratory control samples are used to determine the accuracy of radioanalytical measurements. The LCS is prepared by adding a known concentration of the radionuclide being measured to a sample that does not contain radioactivity (i.e., distilled water). This sample is analyzed with the field samples using the same sample preparation, reagents, and analytical methods employed for the samples. One LCS is prepared with each batch of samples for analysis by a specific measurement.

The accuracy of the LCS determination is expressed as a percent recovery by the following:

$$\% \text{ Recovery } (\%R) = \frac{\text{Amount of Analyte Measured}}{\text{Amount of Analyte Added}} \times 100$$

If the LCS results are outside acceptable control limits, qualifiers will be added to the field samples analyzed with the LCS. Table B.1-4 gives the number of laboratory control samples, including soil and water matrices, measured for each radiochemical measurement for CAU 536. The percent accuracy for the procedure is determined as the number of LCS measurements that are within the control limits divided by the total number of analyses, multiplied by 100.

Table B.1-4
Radiological Accuracy Measurements

	Gamma Spectroscopy	Isotopic Uranium	Isotopic Plutonium	Strontium-90	Gross Alpha	Gross Beta
Laboratory Control Sample (LCS) Accuracy						
Total Number of Measurements	28	14	8	6	1	1
Total Number of %R within Criteria	28	14	8	6	1	1
% Accuracy	100	100	100	100	100	100

Laboratory control samples within the specified criteria for radiological analyses indicate the laboratory is producing valid data. If the LCS criteria are not met, the laboratory performance and method accuracy are in question. Radiological LCS recoveries outside of established controls require data to be qualified for the individual radionuclide that is out of control. Since LCS recoveries were 100 percent for all analyses, no field samples were qualified based on LCS performance.

B.1.1.2.3 Accuracy Summary

Overall, the accuracy for CAU 536 was within acceptable limits. Of the 13,191 chemical surrogate measurements, 13,126 or 99.5 percent were not affected by out of control surrogates. Of the 1,024 chemical MS and LCS measurements, 1,009 or 98.5 percent were within criteria. MS % Accuracy

for GROs is 60 percent. Only one sample (536A043) was qualified as estimated due to low matrix spike recoveries for gasoline range organics. All other samples were not affected by matrix spike recoveries. All of the radioanalyte LCSs were within criteria. Therefore, the measurements for CAU 536 are considered valid in regard to accuracy.

B.1.1.3 Completeness

Completeness is defined as the acquisition of sufficient data of the appropriate quality to satisfy DQO decision data requirements. A measure of completeness is the amount of data that are judged to be valid. Percent completeness for sample analyses was determined by dividing the total number of samples analyzed (per method) by the total number of samples sent to the lab and multiplied by 100. Percent completeness for measurement usability (not rejected) was determined by dividing the total number of unrejected measurements by the total number measurements (per method) and multiplied by 100. All measurements for completeness include reanalyses. Table B.1-5 and Table B.1-6 contain results of completeness per analytical method.

The specified sampling locations were used as planned and all samples were collected as specified in the CAU 536 CAIP (NNSA/NV, 2002a).

In accordance with the CAU 536 CAIP (Table 6-1), 80 percent of CAS-specific noncritical samples and analyses had valid results. Ninety percent of CAS-specific critical parameters had valid results. The CAU 536 dataset provides sufficient information to support the decisions and meets the data quality objectives for completeness stipulated in the CAIP.

B.1.1.3.1 Rejected Data

Data identified as unusable and qualified as rejected “R” during Tier II data validation is presented in Table B.1-7 along with reason codes. Low internal standard counts and/or poor surrogate recovery attributable to a sample matrix interference are the reasons for rejecting the data. In the case where an observed internal standard abundance is extremely low or the surrogate recovery is extremely low and an associated analyte was not detected by the instrument, it cannot be concluded that the analyte is present or absent; therefore, resulting in the rejection of the data point. These rejected data do not affect closure decisions because data from other depths and/or locations are sufficient to support

Table B.1-5
Chemical Completeness Measurements for CAU 536

Completeness Parameters	ORGANICS						INORGANICS	
	VOCs	SVOCs	TPH-DRO	TPH-GRO	Explosives	PCBs	Metals*	Mercury
Sample Analysis Completeness								
Total samples sent to lab	76	128	127	63	63	63	64	64
Total samples analyzed	76	128	127	63	63	63	64	64
Total samples not analyzed by the lab	0	0	0	0	0	0	0	0
Percent Completeness	100	100	100	100	100	100	100	100
Measurement Usability Completeness								
Total measurements **	5,244	6,595	127	63	882	441	574	64
Total measurements rejected - Field	0	0	0	0	0	0	0	0
Total measurements rejected - Lab/Matrix	0	142	0	0	0	0	0	0
Percent Completeness	100	97.8	100	100	100	100	100	100

*Arsenic, barium, beryllium, cadmium, chromium, lead, selenium, silver
**Measurements include re-analyses

conclusions on the nature and extent of contamination which are used to recommend a closure alternative.

B.1.1.4 Representativeness

A seven-step DQO process was utilized to identify CAU 536 requirements. During the process, locations were selected that enabled the samples collected to be representative of the media being evaluated. Samples were collected as planned. Quality control blanks are used as a way of measuring outside factors that could impact sample results. No data was rejected due to QC blanks. Therefore, the analytical data acquired during the CAU 536 investigation are representative of site characteristics and the dataset satisfies the data quality objectives for representativeness stipulated in the CAIP.

Table B.1-6
Radiological Completeness Measurements for CAU 536

Completeness Parameters	Gamma Spectroscopy	Isotopic Uranium	Isotopic Plutonium	Strontium-90	Gross Alpha/Beta
Sample Analysis Completeness					
Total samples sent to Lab	63	63	63	63	1
Total samples analyzed	63	63	63	63	1
Total samples not analyzed by the Lab	0	0	0	0	0
Percent Completeness	100	100	100	100	100
Measurement Usability Completeness					
Total measurements *	1386	189	126	63	2
Total measurements rejected - Field	0	0	0	0	0
Total measurements rejected - Lab/Matrix	0	0	0	0	0
Percent Completeness	100	100	100	100	100

*Measurements include reanalyses

Table B.1-7
CAU 536 Rejected Data
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Sample Number	Laboratory Method	Parameter	Matrix	Qualifier	Reason 1	Reason 2	Reason 3
536A001	EPA8270	Benzo(G,H,I)Perylene	Soil	R	117	153	41
536A001	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	153	41	
536A001	EPA8270	Indeno(1,2,3-Cd)Pyrene	Soil	R	153	41	
536A002	EPA8270	Benzo(A)Pyrene	Soil	R	153	41	
536A002	EPA8270	Benzo(B)Fluoranthene	Soil	R	153	41	
536A002	EPA8270	Benzo(G,H,I)Perylene	Soil	R	153	41	
536A002	EPA8270	Benzo(K)Fluoranthene	Soil	R	153	41	
536A002	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	153	41	
536A002	EPA8270	Indeno(1,2,3-Cd)Pyrene	Soil	R	153	41	
536A003	EPA8270	Benzo(A)Pyrene	Soil	R	153	41	
536A003	EPA8270	Benzo(B)Fluoranthene	Soil	R	153	41	
536A003	EPA8270	Benzo(G,H,I)Perylene	Soil	R	153	41	

Table B.1-7
CAU 536 Rejected Data
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Sample Number	Laboratory Method	Parameter	Matrix	Qualifier	Reason 1	Reason 2	Reason 3
536A003	EPA8270	Benzo(K)Fluoranthene	Soil	R	153	41	
536A003	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	153	41	
536A003	EPA8270	Indeno(1,2,3-Cd)Pyrene	Soil	R	153	41	
536A004	EPA8270	3,3'-Dichlorobenzidine	Soil	R	153	41	
536A004	EPA8270	Benzo(K)Fluoranthene	Soil	R	153	41	
536A004	EPA8270	Bis(2-Ethylhexyl)Phthalate	Soil	R	153	41	
536A004	EPA8270	Butyl Benzyl Phthalate	Soil	R	153	41	
536A004	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	153	41	
536A004	EPA8270	Di-N-Octyl Phthalate	Soil	R	153	41	
536A004	EPA8270	Indeno(1,2,3-Cd)Pyrene	Soil	R	153	41	
536A006	EPA8270	Benzo(A)Pyrene	Soil	R	41	153	
536A006	EPA8270	Benzo(B)Fluoranthene	Soil	R	41	153	
536A006	EPA8270	Benzo(G,H,I)Perylene	Soil	R	41	153	
536A006	EPA8270	Benzo(K)Fluoranthene	Soil	R	41	153	
536A006	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	41	153	
536A006	EPA8270	Indeno(1,2,3-Cd)Pyrene	Soil	R	41	153	
536A008	EPA8270	Benzo(A)Pyrene	Soil	R	41	153	
536A008	EPA8270	Benzo(B)Fluoranthene	Soil	R	41	153	
536A008	EPA8270	Benzo(G,H,I)Perylene	Soil	R	41	153	
536A008	EPA8270	Benzo(K)Fluoranthene	Soil	R	41	153	
536A008	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	41	153	
536A008	EPA8270	Indeno(1,2,3-Cd)Pyrene	Soil	R	41	153	
536A014	EPA8270	3,3'-Dichlorobenzidine	Soil	R	41	153	
536A014	EPA8270	Butyl Benzyl Phthalate	Soil	R	41	153	
536A014	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	41	153	
536A014	EPA8270	Di-N-Octyl Phthalate	Soil	R	41	153	
536A014RR1	EPA8270	3,3'-Dichlorobenzidine	Soil	R	41	153	
536A014RR1	EPA8270	Butyl Benzyl Phthalate	Soil	R	41	153	
536A014RR1	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	41	153	
536A014RR1	EPA8270	Di-N-Octyl Phthalate	Soil	R	41	153	

Table B.1-7
CAU 536 Rejected Data
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Sample Number	Laboratory Method	Parameter	Matrix	Qualifier	Reason 1	Reason 2	Reason 3
536A022	EPA8270	Benzo(G,H,I)Perylene	Soil	R	153	41	
536A022	EPA8270	Benzo(K)Fluoranthene	Soil	R	153	41	
536A022	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	153	41	
536A022	EPA8270	Indeno(1,2,3-Cd)Pyrene	Soil	R	153	41	
536A024	EPA8270	Benzo(A)Pyrene	Soil	R	153	41	
536A024	EPA8270	Benzo(B)Fluoranthene	Soil	R	153	41	
536A024	EPA8270	Benzo(K)Fluoranthene	Soil	R	153	41	
536A024	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	153	41	
536A024	EPA8270	Indeno(1,2,3-Cd)Pyrene	Soil	R	153	41	
536A054	EPA8270	Benzo(G,H,I)Perylene	Soil	R	153	41	117
536A054	EPA8270	Benzo(K)Fluoranthene	Soil	R	153	41	
536A054	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	153	41	
536A054	EPA8270	Indeno(1,2,3-Cd)Pyrene	Soil	R	153	41	
536A057	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	117	153	41
536A063	EPA8270	Benzo(G,H,I)Perylene	Soil	R	153	41	
536A063	EPA8270	Benzo(K)Fluoranthene	Soil	R	153	41	
536A063	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	153	41	
536A063	EPA8270	Indeno(1,2,3-Cd)Pyrene	Soil	R	153	41	
536A066	EPA8270	2,3,4,6-Tetrachlorophenol	Soil	R	127	41	
536A066	EPA8270	2,4,5-Trichlorophenol	Soil	R	127	41	
536A066	EPA8270	2,4,6-Trichlorophenol	Soil	R	127	41	
536A066	EPA8270	2,4-Dichlorophenol	Soil	R	127	41	
536A066	EPA8270	2,4-Dimethylphenol	Soil	R	127	41	
536A066	EPA8270	2,4-Dinitrophenol	Soil	R	127	41	
536A066	EPA8270	2-Chlorophenol	Soil	R	127	41	
536A066	EPA8270	2-Methylphenol	Soil	R	127	41	
536A066	EPA8270	2-Nitrophenol	Soil	R	127	41	
536A066	EPA8270	4,6-Dinitro-2-Methylphenol	Soil	R	127	41	
536A066	EPA8270	4-Chloro-3-Methylphenol	Soil	R	127	41	
536A066	EPA8270	4-Methylphenol	Soil	R	127	41	

Table B.1-7
CAU 536 Rejected Data
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Sample Number	Laboratory Method	Parameter	Matrix	Qualifier	Reason 1	Reason 2	Reason 3
536A066	EPA8270	4-Nitrophenol	Soil	R	127	41	
536A066	EPA8270	Benzoic Acid	Soil	R	127	41	
536A066	EPA8270	Pentachlorophenol	Soil	R	127	41	
536A066	EPA8270	Phenol	Soil	R	127	41	
536A066RR1	EPA8270	2,3,4,6-Tetrachlorophenol	Soil	R	127	41	
536A066RR1	EPA8270	2,4,5-Trichlorophenol	Soil	R	127	41	
536A066RR1	EPA8270	2,4,6-Trichlorophenol	Soil	R	127	41	
536A066RR1	EPA8270	2,4-Dichlorophenol	Soil	R	127	41	
536A066RR1	EPA8270	2,4-Dimethylphenol	Soil	R	127	41	
536A066RR1	EPA8270	2,4-Dinitrophenol	Soil	R	127	41	
536A066RR1	EPA8270	2-Chlorophenol	Soil	R	127	41	
536A066RR1	EPA8270	2-Methylphenol	Soil	R	127	41	
536A066RR1	EPA8270	2-Nitrophenol	Soil	R	127	41	
536A066RR1	EPA8270	4,6-Dinitro-2-Methylphenol	Soil	R	127	41	
536A066RR1	EPA8270	4-Chloro-3-Methylphenol	Soil	R	127	41	
536A066RR1	EPA8270	4-Methylphenol	Soil	R	127	41	
536A066RR1	EPA8270	4-Nitrophenol	Soil	R	127	41	
536A066RR1	EPA8270	Benzoic Acid	Soil	R	127	41	
536A066RR1	EPA8270	Pentachlorophenol	Soil	R	127	41	
536A066RR1	EPA8270	Phenol	Soil	R	127	41	
536A101	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	117	153	41
536A104	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	117	153	41
536A106	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	117	153	41
536A108	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	117	153	41
536A109	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	117	153	41
536A110	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	117	153	41
536A113	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	117	153	41
536A113	EPA8270	Indeno(1,2,3-Cd)Pyrene	Soil	R	117	153	41
536A117	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	117	153	41
536A126	EPA8270	Benzo(A)Pyrene	Soil	R	41	153	

Table B.1-7
CAU 536 Rejected Data
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Sample Number	Laboratory Method	Parameter	Matrix	Qualifier	Reason 1	Reason 2	Reason 3
536A126	EPA8270	Benzo(B)Fluoranthene	Soil	R	41	153	
536A126	EPA8270	Benzo(G,H,I)Perylene	Soil	R	41	153	117
536A126	EPA8270	Benzo(K)Fluoranthene	Soil	R	41	153	
536A126	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	41	153	117
536A126	EPA8270	Indeno(1,2,3-Cd)Pyrene	Soil	R	41	153	117
536A145	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	153	41	
536A149	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	153	41	117
536A152	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	153	41	117
536A152RR1	EPA8270	Dibenzo(A,H)Anthracene	Soil	R	126	153	41
536A154	EPA8270	Benzo(A)Anthracene	Asphalt	R	153	41	
536A154	EPA8270	Benzo(A)Pyrene	Asphalt	R	153	41	
536A154	EPA8270	Benzo(B)Fluoranthene	Asphalt	R	153	41	
536A154	EPA8270	Benzo(G,H,I)Perylene	Asphalt	R	153	41	
536A154	EPA8270	Benzo(K)Fluoranthene	Asphalt	R	153	41	
536A154	EPA8270	Chrysene	Asphalt	R	153	41	
536A154	EPA8270	Dibenzo(A,H)Anthracene	Asphalt	R	153	41	
536A154	EPA8270	Indeno(1,2,3-Cd)Pyrene	Asphalt	R	153	41	

Reason 41 = Matrix effects may exist.
Reason 117 = Calibration verification did not meet criteria or was not performed.
Reason 127 = Surrogate recovery < 10 percent.
Reason 153 = Internal area response show extremely low count.

B.1.1.5 Comparability

Field sampling activities were performed and documented in accordance with approved procedures that are comparable to standard industry practices. Approved standardized methods and procedures were also used to analyze, report, and validate the data. Therefore, datasets within this project are comparable to all other datasets generated using standardized quality procedures.

B.1.2 Reconciliation of DQOs to Conceptual Site Model

This section provides a reconciliation of the data collected and analyzed during this investigation with the preliminary conceptual site models established in the DQO process.

B.1.2.1 Initial Conceptual Site Models

Two CSMs were developed for CAU 536 as presented in the CAIP (NNSA/NSO, 2003) using assumptions formulated from historical background information, knowledge from studies of similar sites, geophysical surveys, and data from previous sampling efforts. This data assessment reconciles the investigation results with the CSMs.

Conceptual Site Model No. 1 represents site conditions before the construction of the concrete pad. This CSM represents the uncontrolled release of chemical constituents at various and unknown locations within site boundaries and assumes wastewater was released directly to the ground surface and allowed to infiltrate surrounding soils. Conceptual Site Model No. 2 represents site conditions after the construction of the concrete pad. This CSM represents the contained and/or restricted release of chemical constituents into sumps located in the concrete pad. This CSM assumes wastewater may have been released to surrounding soils through cracks/leaks in the concrete pad and/or sump, overspray during steam-cleaning activities, or overflow of the sumps. However, CSM No. 2 assumes the volume of wastewater released to the environment would be significantly less than what is represented in CSM No. 1.

B.1.2.2 Investigation Design and Contaminant Identification

The CSMs were used as the basis for developing the investigation design, which includes identifying appropriate sampling strategies and data collection methods.

To address the CSM, surface and subsurface samples were collected for analyses designed to define the extent of the anomalies identified in the CAIP. A biased strategy was developed to focus the investigation on areas of potential contamination. The CSMs assumed that the contamination would be limited to the boundaries of the site due to the minimal potential for migration based on the geological and historical information for the site.

Implementation of the investigation design has shown that contamination did not extend beyond the boundaries of the CAS. This is reasonable because the model predicts that the extent of impact of any contaminated effluent released to soil is limited (NNSA/NSO, 2003).

B.1.2.3 Contaminant Nature and Extent

The model assumed that the contamination would be limited to the boundaries of the site due to the minimal potential for migration based on the geological and historical information for the site. The investigation was performed according to design concepts and has shown the extent of the contamination did not exceed the boundaries of the CAS.

B.1.3 Conclusions

The DQIs (e.g., precision, accuracy, completeness, representativeness, and comparability) were all evaluated for quality and impact to the data. All of the data, except data qualified as rejected, can be used in project decisions.

B.2.0 References

U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office. 2002. *Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada*, Rev. 3, DOE/NV--372. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office. 2003. *Corrective Action Investigation Plan for Corrective Action Unit 300: Area 3 Release Site, Nevada Test Site, Nevada*, Rev. 0, DOE/NV--900. Las Vegas, NV.

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

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

Appendix C

Cost Estimates for CAU 536

(3 Pages)

BECHTEL NEVADA
COST ESTIMATE PROPOSAL DATA SHEET

EST ID: CAU 536
03-44-02

Date: 9-Nov-04

TO: Kathryn Umbarger

FROM: Charles Denson

SUBJECT: CADD Alternative Cost Estimates for CAU-536 Area 3 - Release Site (DP), Nevada Test Site

ESTIMATOR: Charles Denson

REF #:

TYPE OF ESTIMATE:

X	ORDER OF MAGNITUDE		TITLE II
	PRELIMINARY / PLANNING / STUDY		WORK ORDER
	CONCEPTUAL / BUDGET		COMPARATIVE
	TITLE I		OTHER

TYPE OF WORK:

	NON-MANUAL ONLY
	MANUAL ONLY
X	MANUAL & NON-MANUAL
	OTHER

PROJECT WORK SCOPE IS EXPECTED TO BE PERFORMED BY:

DOE PRIME (LUMP SUM)		SUBCONTRACT	
BN CONSTRUCTION	X	GPP	
BN MAINTENANCE		OTHER	

STATEMENT OF WORK

This estimate has been prepared to provide remedial alternative costs for the closure of Corrective Action Site (CAS) 03-44-02, which is included within Corrective Action Unit (CAU) 536. CAU 536 CAS 03-44-02 is an environmental restoration site listed in the Federal Facility Agreement and Consent Order (FFACO). CAS 03-44-02 is specifically described within the FFACO as the Steam Jenny Discharge. The CAS is located along the eastern edge of Yucca Flat within the Area 3 Camp. A drainage ditch runs through south ramp to U3du crater located 640 ft west of site, which consists of a 70- by 40-ft decontamination pad with a concrete sump and small generator pad. The depth of the eastern sump is approximately 6 ft below ground surface. The site was previously used for decontamination of vehicles and equipment.

Three alternatives have been evaluated for closure of the CAS: I. No Further Action; II. Clean Closure; and III Closure in Place with Administrative Controls. This estimate will be used to identify the most cost effective alternative for closure of the site while remaining protective of human health and the environment. The total estimated costs are intended for comparative analysis of remedial fieldwork cost only.

SCOPE:

Provide site closure using one of the following alternatives:

I) NO FURTHER ACTION
II) CLEAN CLOSURE BY EXCAVATION AND REMOVAL
III) CLOSURE IN PLACE WITH ADMINISTRATIVE CONTROLS

BASIS:

The characterization contractor recently completed field measurements at the Steam Jenny Discharge concrete pad and related sump, generator pad, associated drainage ditch, and surrounding soils. Surface and subsurface soils have been impacted to depths of approximately 11 feet below ground surface (bgs). Area and volume estimates were calculated from data generated during the site characterization phase. Radiation contamination has impacted soils in selected areas that are above preliminary action levels (PALs) and are considered contaminants of concern (COCs) although they are consistent with background for Area 3 Camp. However, radionuclides U-234, Pu-239/240, Am-241and Cs-137 are present at levels greater than NTS Performance Objective Criteria for landfill disposal. Total petroleum hydrocarbons (TPH) diesel range organic (DRO) contaminants are present at levels that exceed their respective preliminary action levels (PALs). In addition, polyaromatic hydrocarbons (PAHs) that include benzo(a) pyrene, benzo(a) anthracene, benz(b) fluoranthene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene are identified as COCs.

Alternative I – No Further Action: This alternative is not applicable due to the presence of chemical COCs, unless a risk assessment were to be conducted showing that there is no risk from hydrocarbon contamination. This alternative will not be considered further for this CAU.

Alternative II - Clean Closure: Under Alternative II, the various depths and non-continuous lateral nature of TPH DRO-, PAH- and rad-impacted soils are considered. Clean closure would involve the removal of impacted soils, concrete pad and associated asphalt at levels of contamination > PALs. The maximum types and amounts of materials requiring remedial action are conservatively estimated as follows: 780.6 cubic yards (cy) (597 m^3) of surface soils; 912 cy 598 m^3) subsurface soils; 108 cy concrete; and miscellaneous housekeeping debris.

Alternative III – Closure in Place: Administrative controls would prevent inadvertent contact with chemical COCs. Use restrictions for the site (fencing and signage) would be imposed. The exposure pathway of surface contamination currently is partially eliminated by pea gravel and concrete pads. PAHs have a very limited migration potential.

Each alternative was evaluated with knowledge of TPH, hazardous and low level waste at the surface and sub-surface of the soil. Site closure estimates for each alternative were priced using standard construction references such as RS Means, Richardson's, and the BN estimating database. There is no estimate required for evaluation of the No Further Action alternative since no cost is incurred.

BECHTEL NEVADA

EST ID: CAU 536
03-44-02

COST ESTIMATE PROPOSAL DATA SHEET

Date: 9-Nov-04

TO: Kathryn Umbarger

FROM: Charles Denson

ALTERNATIVE-SPECIFIC BASIS OF ESTIMATE/ASSUMPTIONS

Alternative II: Clean Closure

- Excavate and remove not to exceed 2,116 cy of TPH DRO- & PAH-impacted soils, concrete and asphalt at CAS 03-44-02. Includes 25% expansion factor.
- Collect verification samples at the excavations.
- Backfill the excavated area to natural existing grade with clean fill material and restore as needed.
- Remove construction and miscellaneous debris as needed.
- Waste management, transportation, and disposal.

Alternative III: Closure in Place with Administrative Controls

- Install appropriate administrative controls (i.e. postings, signs, existing fence, etc.).
- Develop and document appropriate use restrictions.

ASSUMPTIONS:

General:

- All COCs at the site have been identified during the site investigation and analytical data accurately represents site conditions and waste characteristics.
- Area 3 CAS 03-44-02 is not a beryllium legacy site.
- Equipment will remain operational to support the planned/scheduled completion of each CADD alternative.
- Waste volumes are based on field measurements collected during the Corrective Action Investigation and may be affected by weather events prior to completing the corrective actions.
- Work to be performed by BN during a "normal" workday (no provision for overtime has been provided). Shifts are based on 10-hour days / 4-days per week.
- This estimate does not include the efficiencies that may be realized if work for similar activities at similar sites can be completed concurrently.
- This estimate does not include costs for preparation of required project plans, permits, reports, or project management.
- There is no soil borrow area located within one mile of the site; the closest is approximately 30 minutes away at Area 5.
- Dimensions, volumes, measurements, and analytical data provided by the characterization contractor accurately represent site conditions and waste characteristics.

Alternative II (Clean Closure):

- Field work consists of characterization, excavation and disposal of DRO- and PAH-impacted soils, concrete and asphalt, haul and dispose at appropriate landfills; collection of verification soil samples from base of excavation and analysis for contaminant of concern (COC); backfilling of excavation with clean fill and regrade or restoration of area.
- Scope includes excavation of up to a maximum of 2,116 cy of PAH- and TPH DRO-contaminated soil (plus 25% expansion factor).
- TPH concentrations above 100 ppm for hydrocarbon waste
- Four (4) radionuclides identified above the NTS Performance Objective Criteria (POC) for landfill criteria; therefore, assume 10% of waste is low-level / hydrocarbon waste (~212 cy).
- Assumes low level waste (LLW), if any, will go to Area 5 LLW disposal; assumes PAH- and TPH DRO-impacted soils will go to Area 6, hydrocarbon landfill.
- Concrete pad is 12 inches thick in all areas except east sump which is 6 ft thick.
- Concrete pad was not sampled directly; however radiological surveys indicate below release criteria; assumes that the concrete pad is not a TSCA waste and can be disposed as construction rubble.
- Use of graded approach with confirmation sampling for estimates using vertical depth not confirmed through lab data (i.e., 2 ft depth).
- Concrete pad is raised in elevation relative to the surrounding area; vertical confirmation depth is measured from surface without regard to artificial elevation.
- Detections of Pu-239/240 that were above Preliminary Action Levels (PALs) are consistent with concentrations encountered in the Area 3 Camp as a result of atmospheric testing but are still considered COC.
- Assumes removal of surface debris (e.g. wood, asphalt, concrete, construction rubble) under housekeeping activities.
- Basis does not include field planning or field preparation activities, only the cost to do the actual field work.
- Excavation of soils may impact utility corridors containing sewer lines, communications lines, and electrical lines. BN will need to confirm this before proceeding with activities. Assumes that any abandoned utilities will be excavated and disposed and will not be replaced, and that sewer lines, if any, will not contain any sewage as this will not fit the waste profile.
- Existing EZ fencing may need to be moved, based on OSHA and BN excavation safety requirements and location of contaminated soil. This may require additional utility surveys prior to moving these items. Location and depth of soil to be excavated may impact existing chain link fence. Cost not included in this estimate as field conditions remain as yet unknown.
- Assumes that administrative controls (i.e. postings, signs, etc.) will not be required, installed or maintained by Industrial Sites upon completion of the clean closure activities identified.
- Provides for backfill of excavation with a maximum of ~2,116 cy of clean fill that will be obtained from a local borrow pit.

Alternative III (Close in Place with Administrative Controls)

- Assumes that fencing and postings will be needed for selected areas within the CAS due to potential for chemical and/or rad contamination (based on rad survey).

BECHTEL NEVADA
COST ESTIMATE PROPOSAL DATA SHEET

EST ID: CAU 536
03-44-02

Date: 9-Nov-04

TO: Kathryn Umbarger

FROM: Charles Denson

ESCALATION:

No escalation factors have been applied. All costs are in FY05 dollars.

CONTINGENCY:

Contingency costs are not included in this estimate.

RATES:

Rates are based on FY05 Final rates **(Rev 0)** effective 09/13/04 and were applied using the BN FY05 cost model.

COST ALTERNATIVES SUMMARY:

Alternative I:	**No Further Action**	$0
Alternative II:	**Clean Closure CAS 03-44-02**	$372,542
Alternative III:	**Closure in Place with Administrative Controls CAS 03-44-02**	$50,221

REVIEW / CONCURRENCE:

For SES — 11/9/04
Project Manager — Date

Charles W. Denson — 11-09-04
Estimating — Date

Virginia L. Bills — 11/9/04
Project Controls — Date

Appendix D

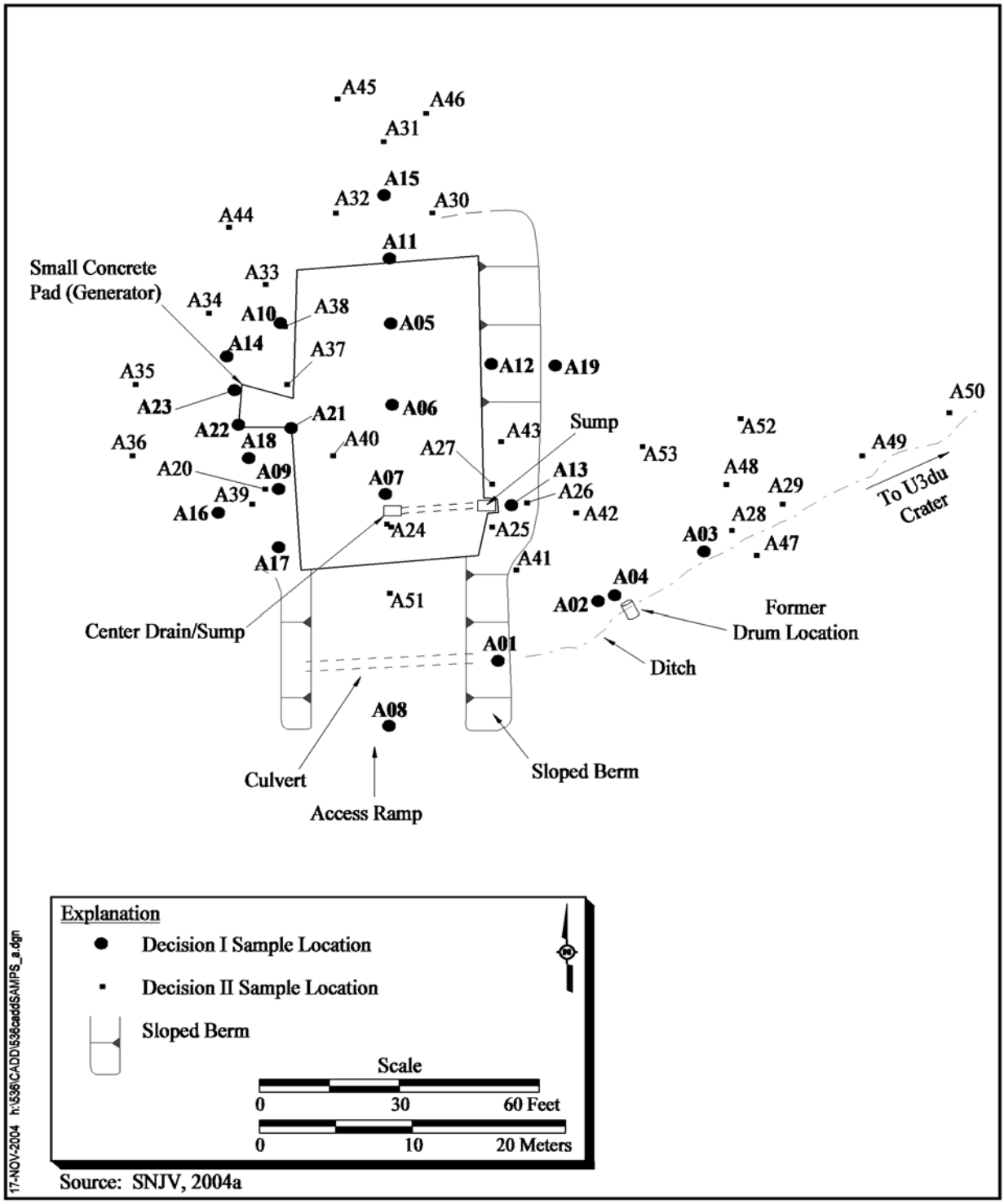
Sample Location Coordinates for CAU 536

D.1.0 Sample Location Coordinates

Sample location coordinates were collected during the corrective action investigation using a Trimble GPS, Model TSCI. These coordinates identify the field sampling locations and corner points of interest at CAS 03-44-02. Coordinates are presented in easting and northing.

D.1.1 CAS 03-44-02, Steam Jenny Discharge

The sample locations for CAS 03-44-02 are shown in Figure A.3-1. Corner points of interest of the concrete pad and drainage ditch are shown in Figure D.1-1. The corresponding GPS coordinates for locations are listed in Table D.1-1. Northing and easting coordinates are provided in Universal Transverse Mercator (UTM) Zone 11, North American Datum (NAD) 27.



Source: SNJV, 2004a

Figure D.1-1
Points of Interest at CAS 03-44-02, Steam Jenny Discharge

Table D.1-1
Sample Location Coordinates for Steam Jenny Discharge, CAS 03-44-02
(Page 1 of 2)

Latitude	Longitude	Northing[a]	Easting[a]	HAE (meters)	Location	Vertical Precision	Lateral Precision
N/A	N/A	4099188.7	586139.5	N/A	A01	N/A	N/A
N/A	N/A	4099192.8	586146	N/A	A02	N/A	N/A
N/A	N/A	4099196.3	586152.9	N/A	A03	N/A	N/A
N/A	N/A	4099193.2	586147.1	N/A	A04	N/A	N/A
N/A	N/A	4099212.3	586132.5	N/A	A05	N/A	N/A
N/A	N/A	4099206.6	586132.6	N/A	A06	N/A	N/A
N/A	N/A	4099200.3	586132.1	N/A	A07	N/A	N/A
N/A	N/A	4099184.1	586132.3	N/A	A08	N/A	N/A
N/A	N/A	4099200.7	586125.1	N/A	A09	N/A	N/A
N/A	N/A	4099212.3	586125.4	N/A	A10	N/A	N/A
N/A	N/A	4099216.8	586132.4	N/A	A11	N/A	N/A
N/A	N/A	4099209.4	586139	N/A	A12	N/A	N/A
N/A	N/A	4099199.6	586140.3	N/A	A13	N/A	N/A
N/A	N/A	4099210	586121.7	N/A	A14	N/A	N/A
N/A	N/A	4099221.3	586132	N/A	A15	N/A	N/A
N/A	N/A	4099199	586121.2	N/A	A16	N/A	N/A
N/A	N/A	4099196.6	586125.1	N/A	A17	N/A	N/A
N/A	N/A	4099202.8	586123.2	N/A	A18	N/A	N/A
N/A	N/A	4099209.3	586143.2	N/A	A19	N/A	N/A
N/A	N/A	4099200.7	586124.3	N/A	A20	N/A	N/A
N/A	N/A	4099204.9	586125.9	N/A	A21	N/A	N/A
N/A	N/A	4099205.2	586122.5	N/A	A22	N/A	N/A
N/A	N/A	4099207.6	586122.2	N/A	A23	N/A	N/A
N/A	N/A	4099198.2	586132.2	N/A	A24	N/A	N/A
N/A	N/A	4099198	586139.1	N/A	A25	N/A	N/A
N/A	N/A	4099199.7	586141.4	N/A	A26	N/A	N/A
N/A	N/A	4099201.3	586139.1	N/A	A27	N/A	N/A
N/A	N/A	409197.8	586154.8	N/A	A28	N/A	N/A

Table D.1-1
Sample Location Coordinates for Steam Jenny Discharge, CAS 03-44-02
(Page 2 of 2)

Latitude	Longitude	Northing[a]	Easting[a]	HAE (meters)	Location	Vertical Precision	Lateral Precision
N/A	N/A	4099200	586158.1	N/A	A29	N/A	N/A
N/A	N/A	4099220	586135.2	N/A	A30	N/A	N/A
N/A	N/A	4099225.1	586132	N/A	A31	N/A	N/A
N/A	N/A	4099220.3	586128.9	N/A	A32	N/A	N/A
N/A	N/A	4099215.1	586124.3	N/A	A33	N/A	N/A
N/A	N/A	4099213.4	586120.6	N/A	A34	N/A	N/A
N/A	N/A	4099208.2	586115.8	N/A	A35	N/A	N/A
N/A	N/A	4099203.1	586115.6	N/A	A36	N/A	N/A
N/A	N/A	4099207.8	586125.7	N/A	A37	N/A	N/A
N/A	N/A	4099212	586125.5	N/A	A38	N/A	N/A
N/A	N/A	4099199.6	586123.4	N/A	A39	N/A	N/A
N/A	N/A	4099203.3	586128.7	N/A	A40	N/A	N/A
N/A	N/A	4099194.8	586140.7	N/A	A41	N/A	N/A
N/A	N/A	4099199.2	586144.6	N/A	A42	N/A	N/A
N/A	N/A	4099204.4	586139.7	N/A	A43	N/A	N/A
N/A	N/A	4099218.6	586121.9	N/A	A44	N/A	N/A
N/A	N/A	4099227.8	586129	N/A	A45	N/A	N/A
N/A	N/A	4099227	586134.8	N/A	A46	N/A	N/A
N/A	N/A	4099195.6	586156.4	N/A	A47	N/A	N/A
N/A	N/A	4099201.4	586154.4	N/A	A48	N/A	N/A
N/A	N/A	4099203	586163.3	N/A	A49	N/A	N/A
N/A	N/A	4099205.7	586169	N/A	A50	N/A	N/A
N/A	N/A	4099193	586132.4	N/A	A51	N/A	N/A
N/A	N/A	4099206	586155.3	N/A	A52	N/A	N/A
N/A	N/A	4099204	586148.9	N/A	A53	N/A	N/A

[a]Universal Transverse Mercator (UTM) Zone 11, North American Datum (NAD) 27

HAE = Height above ellipsoid

Appendix E

Evaluation of Risk for CAU 536

E.1.0 Evaluation of Risk

A detailed assessment of risk for no further action and evaluated alternatives was not performed because COCs exceeding PALs are not present or will not be left in place without appropriate controls.

Appendix F

Project Organization for CAU 536

F.1.0 Project Organization

The NNSA/NSO Project Manager is Janet Appenzeller-Wing and her telephone number is (702) 295-0461.

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

Appendix G

NDEP Responses

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

1. Document Title/Number: Draft Corrective Action Decision Document for Corrective Action Unit 536: Area 3 Release Site, Nevada Test Site, Nevada	2. Document Date: September 2004
3. Revision Number: 0	4. Originator/Organization: Stoller-Navarro
5. Responsible NNSA/NV ERP Project Mgr.: Janet Appenzeller-Wing	6. Date Comments Due: October 21, 2004
7. Review Criteria: Full	
8. Reviewer/Organization/Phone No.: Chris Andres, NDEP, 486-2858	9. Reviewer's Signature:

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
1) Section 2.2.1 Summary of Analytical Data Page 11 of 29 1st Paragraph		It is stated in Section 1.2, Scope, of the Corrective Action Investigation Plan for Corrective Action Unit 536: Area 3 Release Site, Nevada Test Site, Nevada, dated June 2003 (CAIP), Page 8, last paragraph, that, "The investigation of radiological and beryllium contamination associated with the site will be limited to the concrete pad and surrounding soil as well as the soil within and directly adjacent to the drainage ditch leading from the concrete pad to crater U3du. Radiological contamination will not be delineated beyond the boundary of the CAS identified in Figure 1.3. Radiological contamination beyond this area will not be addressed in this investigation because contamination associated with atmospheric testing will be addressed by the Soils Project." According to the CADD, Plutonium-239/240 detected above Preliminary Action Levels (PALs) in two surface sample locations (Locations A01 and A14) is within the CAS boundary outlined in Figure 1.3 of the CAIP and therefore are Contaminants of Concern (COCs) for this CAS. Please amend the CADD narrative to include Pu-239/240 as a COC in all applicable Sections.	It is agreed that Pu-239/240 within the CAS boundaries should be considered a COC by definition in that the concentrations exceed PALs. However, the concentrations are consistent with Area 3 background concentrations resulting from atmospheric testing fallout. The random nature of the two detections further suggest that the presence of Pu-239/240 is a result of atmospheric testing fallout rather than a release related to historical decontamination processes; therefore, further delineation beyond the Decision I sample results for Pu-239/249 is not considered to be within the scope of the CAS investigation. Applicable sections with the CADD will have text amended to reflect the definition of Pu-239/240 as a COC within the site boundaries. The Pu contamination will be addressed under the waste management and potential disposal alternatives but should not increase the area or volume of soil excavated or remediated.	Yes

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
1) Section 2.2.1 Summary of Analytical Data Page 11 of 29 1st Paragraph (continued)			The first paragraph on page 11 has been amended to the following: "Plutonium 239/240 was detected at concentrations greater than the PALs at two surface sample locations within the CAS boundaries; therefore, Pu-239/240 is a COC by definition. However, the concentrations of these detections are attributed to atmospheric testing fallout common in the Area 3 Camp (McArthur and Mead, 1987). The random nature of the two detections further suggest that the presence of Pu-239/240 is a result of atmospheric testing fallout rather than a release related to historical decontamination processes. As described in the CAIP, contamination associated with atmospheric testing will be addressed by the Soils Project. Therefore, further delineation of Pu-239/240, beyond that achieved with the Decision I sample results, was considered to be outside the scope of the CAS investigation. Because the Pu-239/240 contamination is attributed to fallout from atmospheric testing, it was not included in the corrective action evaluation logic but will be involved in future waste management decisions regarding the closure of the CAS."	
2) Section 2.2.1 Summary of Analytical Data Page 11 of 29 Last Paragraph		The waste characterization data for the wastewater collected on the concrete pad is not included in the draft CADD. Please provide this data in the final CADD.	The characterization data is for the standing rainwater, not wastewater, collected from the concrete pad. The text has been modified to correct this misstatement. Section A.3.2.5 was added to Appendix A to specifically address analytical results of the rainwater separately from soil characterization data.	Yes
3) Section 2.3 Need for Corrective Action Page 13 of 29 1st Paragraph		The highest concentration of BAP is 11,000 ug/kg at Sample Location A53 according to Table A.3-3, not 7,400 ug/kg as listed in this paragraph. Please amend this discrepancy.	The text was corrected to reflect the highest concentration of 11,000 Fg/kg.	Yes

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
4) Section 2.3 Need for Corrective Action Page 13 of 29 3rd Paragraph		Please provide in the final CADD an approved Waste Profile for the remediated soil which is to be disposed of as low-level waste.	Once a decision is made on the corrective action alternative, waste profiles are developed and submitted for approval in the Corrective Action Plan. The waste profiles historically have not been included in CADD document.	No
5) Appendix A Table A.2-1 Page A-8 of A-60		Please document that the method detection limits for each of the analytical methods listed in this Table do not exceed either the applicable PAL or Waste Acceptance Criteria for the landfill.	The comparison of MDLs, MRLs (organic and inorganic constituents), and MDCs (radiological constituents) is a major part of the DQO process and is included in the CAIP. Historically this information has not been repeated in the CADD. However, a statement has been added to Section A.2.6, first paragraph, to document that two SVOC analytes (benzo(a)pyrene and dibenzo(a,h)anthracene) were reported in Appendix A based on the MDLs rather than MRLs established in the CAIP because the MRL was discovered to be higher than the respective PALs during data compilation and evaluation. Documentation of MDLs against regulatory levels for waste characterization and profiling is provided in the Industrial Sites QAPP. The analytical methods to be used in comparing against Waste Acceptance Criteria for closure-related wastes will be addressed in the CAP.	No
6) Appendix A Section A.2.7 Comparison to Preliminary Action Levels Page A-9 of A-60 Last Paragraph		Please provide NDEP with a copy of the complete data set for CAU 536 in an electronic format since non-detected results and results below MRLs and MDCs have not been included in the CADD.	An electronic copy of the CAU 536 dataset was submitted to NDEP under separate cover on November 9, 2004.	Yes

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7) Appendix A Section A.3.1 Corrective Action Investigation Page A-11 of A-60 1st Paragraph		A total of 127 soil samples (including five duplicates; excluding trip, field, equipment rinsate and source blanks) is listed in Table A.3-1. The text of this paragraph states that a total of 114 soil samples (including five duplicates) were collected for laboratory analyses. Please correct this discrepancy.	The total of 127 environmental soil samples is correct and the discrepancy has been corrected so the first sentence now reads: "A total of 127 environmental soil samples (including five duplicates and one asphalt sample; excluding trip, field, equipment rinsate and source blanks, and waste management) were collected..."	Yes
8) Appendix A Section A.3.2.2 Concrete Pad Decision I Sampling Page A-17 of A-60 1st Paragraph		Please denote by use of different color or different font which of the borings depicted on Figure A.2-1 were the 19 sampled during Decision I activities for the concrete pad.	The symbols and font for all Decision I sample locations for both the concrete pad and the drainage ditch were modified on Figure A.2-1 as requested.	Yes
9) Appendix A Section A.3.2.3 Drainage Ditch Decision I Sampling Page A-22 of A-60 2nd Paragraph		To more accurately reflect the data presented in the various Tables of Appendix A, please change "...indicate the presence of COCs in soils directly..." to "...indicate the presence of TPH in soils directly..." in the first sentence of this paragraph.	The sentence was changed to read "...indicate the presence of TPH concentrations exceeding PALs in soils directly..."	Yes
10) Appendix A Section A.3.2.3 Drainage Ditch Decision II Sampling Page A-22 of A-60 1st Paragraph		To more accurately reflect the data presented in Table A.3-5 of Appendix A, please change "...were collected from surface (0 to 1 ft bgs)." to "...were collected from the surface (0 to 0.5 ft bgs)." in the first sentence of this paragraph.	The sentence was changed to read "...were collected from the surface (0 to 0.5 ft bgs)."	Yes

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11) Appendix A Section A.3.2.3 Drainage Ditch Decision II Sampling Page A-24 of A-60 1st Paragraph		To more accurately reflect the data presented in Tables A.3-3 and A.3-5 of Appendix A, please change "Surface sampling 536A152 at location A53 had elevated TPH and PAHs above PALs." to "Surface samples 536A145 and 536A152 at locations A48 and A53, respectively, had elevated TPH and PAHs above PALs." in the fifth sentence of this paragraph.	The sentence was changed to read "Surface samples 536A145 and 536A152 at locations A48 and A53, respectively, had TPH and PAH concentrations above PALs."	Yes
12) Appendix A Section A.3.2.3 Drainage Ditch Decision II Sampling Page A-24 of A-60 1st Paragraph Last Sentence		Table A.3-3 and Figure A.3-4 both denote that 250 ug/kg of BAP was present in the surface sample at location A19. Please explain how this analytical result adequately defines a northern lateral boundary as stated in this sentence.	An initial explanation was provided in Section A.3.3.2, Total SVOCs, page A-25; however, this explanation was modified (see response to Comment 13). In line with this explanation, the last five sentences of the last paragraph of Section A.3.2.3 was replaced with the following text: "Locations A52 and A53 were selected to further bound the lateral extent of COCs to the north of A48. Sample results from A52 indicate COCs are below PALs. Surface samples 536A145 and 536A152 at locations A48 and A53, respectively, had TPH and PAH concentrations above PALs. The vertical bounding samples from A48, A52, and A53 show that the concentrations of these COCs decrease to levels below the PALs. No additional samples were collected to further refine the northern lateral boundary because location A19 analytical results adequately define the boundary as evidenced by a decreasing trend of BAP concentrations, TPH concentrations below PALs, as well as the nondetections of all other PAHs detected at locations A48 and A53. This decreasing trend in TPH and PAH concentrations from A53 is also supported by analytical data from locations A12, A28, A29, A42, A48, and A52."	Yes

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13) Appendix A Section A.3.3.2 Total SVOCs Page A-25 of A-60 1st Paragraph		The last sentence of this paragraph contradict each other. It is stated that the presence of BAP at locations A19 and A51 in the near surface appears to be anomalous because there were no other COPCs detected above PALs at these locations. The last sentence then states that the PAHs are ubiquitous throughout the CAS and may reflect remnant concentrations of old and/or reworked asphalt surfaces for both the pre-pad and post-pad construction surfaces. The ubiquitous presence of a COC does not lend itself to anomalous presence of the COC. Please correct or further explain this discrepancy in the text.	The following text replaces the third and fourth sentences in the paragraph: "Benzo(a)pyrene was detected at concentrations above PALs in the near surface at locations A19 and A51. A decreasing trend in BAP concentrations, all other PAHs, and TPH concentrations below PALs is evident so additional lateral bounding samples were not collected. Additional sample locations north of A19 (i.e., A11, A30) and south of A51 (i.e., A08) support the decreasing trend of PAHs even in the presence of lower TPH concentrations. The PAHs are ubiquitous throughout the CAS and may reflect remnant concentrations of old and/or reworked asphalt surfaces for both pre-pad and post-pad construction; however, a direct correlation to an asphalt origin cannot be conclusively made. A comparison to the asphalt background sample 536A154 was inconclusive because the PAH data was rejected due to matrix interference."	Yes

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14) Appendix A Table A.3-3 and Figure A.3-4 Pages A-26, A-27, and A-44 of A-60		The following discrepancies were noted between the Table and Figure: a) Sample Location A10, Sample Number 536A026 - Table A.3-3 lists BBF at a concentration of 4,100 ug/kg at this location. This is <u>not</u> noted on Figure A.3-4. Also, the box on Figure A.3-4 for Sample Location A10 notes DiB at a concentration of 640 ug/kg, yet the concentration for this compound is listed as ND on Table A.3-3. Please correct these discrepancies for this Sample Location. b) Sample Location A48, Sample Number 536A145 - Table A.3-3 lists BAP at a concentration of 1,100 ug/kg at this location. The box on Figure A.3-4 lists this compound at 1,000 ug/kg. Also, the box on Figure A.3-4 for Sample Location A48 notes DiB at a concentration of 250 ug/kg, yet the concentration for this compound is listed as ND on Table A.3-3. Please correct these discrepancies for this Sample Location. c) Sample Location A51, Sample Number 536A149 - BAP is listed at a concentration of 280 ug/kg at this location on Table A.3-3. However, this sample location is not depicted on Figure A.3-4 nor is a corresponding sample result box. Please add this sample location to Figure A.3-4. d) Sample Location A53, Sample Number 536A152 - Table A.3-3 lists InD at a concentration of 10,000 ug/kg at this location. The box on Figure A.3-4 lists this compound at 9,200 ug/kg. Please correct this discrepancy for this Sample Location.	a. Figure A.3-4 was modified. BBF at a concentration of 4,100 Fg/kg has been added to the text box in Figure A.3-4 for Location A10, Sample Number 536A026. The result for DiB was incorrect in Table A.3-3 and has been corrected to a concentration of 340 Fg/kg. The A10 text box in Figure A.3-4 has also been changed to reflect this corrected concentration. b. Figure A.3-4 was modified. The BAP concentration for Location A48, Sample Number 536A145 was changed to 1,100 in accordance with Table A.3-3. The reference to DiB was deleted from the same text box. c. Figure A.3-4 was modified. A text box and location designation has been added to Figure A.3-4 for Location A51, Sample Number 536A149. The BAP concentration of 280 Fg/kg was added to the text box. d. Table A.3-3 was modified. The InD concentration for Location A53, Sample Number 536A152 was incorrect in Table A.3-3 and has been changed to 9,200 Fg/kg. Figure A.3-4 was not changed. For clarification purposes, the text boxes for A14, A19, and A51 in Figure A.3-4 were modified to show the associated TPH concentration for any PAH detection above PALs. The TPH data is relevant in that it shows the trend in PAH concentrations that are above PALs and the presence of TPH at the same locations. The vertical bounding analytical data was also added to each text box in Figure A.3-4.	Yes

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15) Appendix A Section A.3.3.8 Isotopic Results Page A-32 of A-60		Please provide a reference for the Area 3 fallout concentrations from historic atmospheric testing. Additionally, please refer to Comment 1, above for a discussion on the need to include Pu-239 as a COC within this CAU.	The reference is: McArthur, R.D., and S.W. Mead. 1987. *Nevada Test Site Radionuclide Inventory and Distribution Program: Report #3, Areas 3,7,8,9, and 10*, DOE/NV/10384-15, Publication 45056. Las Vegas, NV: Desert Research Institute. This source has been referenced in Section A.3.3.8 and added to the Reference Sections 5.0 and A.6.0. The last sentence of Section A.3.3.8 was amended to read: "Although these detections are considered COCs by definition, for the purpose of the CAU 536 field investigation, adequate delineation was achieved with Decision I samples. Additional detections of Pu-239/240 beyond this delineation is not within the scope of the investigation and will be addressed in the future under another program."	Yes
16) Appendix A Table A.3-5 Page A-33 of A-60		The depth for Sample Location A15 is listed as 0.5 - 0.5 ft bgs. The depth for this sample location on Figure A.3-4 is listed as 0.5 - 1.5 ft bgs. Please correct this discrepancy.	The correct depth for location A15, Sample Number 536A042 is 0.0 to 0.5 ft bgs. Figure A.3-4 and Table A.3-5 have both been modified to correct the discrepancy.	Yes
17) Appendix A Table A.3-6 Pages A-35 through A-39 of A-60		Please include documentation that the pCi/g levels in the Table do not exceed the Bq/m^{-3} levels of waste characterization and reporting in the NTS Waste Acceptance Criteria.	The analytical data presented in this table are intended for the purpose of determining the nature and extent of contamination at the site using preliminary action levels. Additional use of the data for reasons other than this purpose is beyond the scope of Appendix A. Waste characterization reporting of investigation-derived waste are tasks that are reported separately. Documentation related to future waste characterization of remediation wastes due to a clean closure alternative will be addressed in the CAP.	No

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18) Appendix A Section A.3.4 Contamination of Concern Pages A-32 and A-45 of A-60		Please refer to Comment 1, above, for a discussion on the need to include Pu-239 as a COC within this CAU. Therefore, please add the locations where Pu-239 exceeded PALs to Figure A.3-4.	The first paragraph referencing the Pu-239/240 has been deleted. The second paragraph has been revised to include Pu-239/240 as a COC and now reads: "Based on analytical results, the following COCs were identified within the soils of CAS 03-44-02: Pu-239/240, TPH, …" The locations and relevant information for Pu-239 has been added to Figure A.3-4.	Yes
19) Appendix A Section A.3-5 Nature and Extent of Contamination Page A-48 of A-60 2nd Paragraph		The lowest concentration of BAP is 15 ug/kg at Sample Location A52 according to Table A.3-3, not 19 ug/kg as listed in this paragraph. Please amend this discrepancy.	The text has been modified to “15 Fg/kg” in accordance with Table A.3-3.	Yes
20) Appendix B Table B.1-7 CAU 536 Rejected Data Pages B-14 through B-19 of B-22		Please provide an explanation as to why the data listed was rejected (i.e., sample location, blank contamination, etc.).	Table B.1-7 has been modified to include the reasons for qualifying data as rejected. Additional text has been added to Section B.1.1.3.1 and now reads: "Data identified as unusable and qualified as rejected “R” during the Tier II data validation is presented in Table B.1-7 along with the reason codes. Low internal standard counts and/or poor surrogate recovery attributable to a sample matrix interference are the reasons for rejecting the data. In the case where an observed internal standard abundance is extremely low or the surrogate recovery is extremely low and an associated analyte was not detected by the instrument, it cannot be concluded that the analyte is present or absent; therefore, resulting in the rejection of the data point. These rejected data do not affect closure decisions because data from other depths and/or locations are sufficient to support conclusions on the nature and extent of contamination which are used to recommend a closure alternative.”	Yes

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21) Cost Estimates for CAU 536 Page 1 of 3 Basis		As per the discussion in Comment 1, above, please change the fourth sentence of this section to reflect that Pu-239/24 is a COC.	The sentence has been modified to reflect that Pu-239/240 is a COC.	Yes

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

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