Nevada
Environmental
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Project

DOE/NV--1167

National Nuclear Security Administration

# Closure Report for Corrective Action Unit 540: Spill Sites Nevada Test Site, Nevada

Controlled Copy No.: ___
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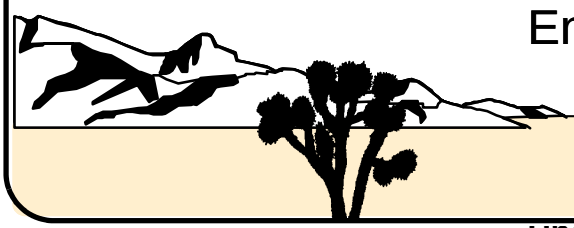
October 2006





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U.S. Department of Energy
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# CLOSURE REPORT FOR CORRECTIVE ACTION UNIT 540: SPILL SITES NEVADA TEST SITE, NEVADA

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

Controlled Copy No.: ___

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**CLOSURE REPORT FOR**
**CORRECTIVE ACTION UNIT 540: SPILL SITES,**
**NEVADA TEST SITE, NEVADA**

Approved by: APPROVED SIGNATURE Date: 10/19/2006

Kevin J. Cabble,
Federal Sub-Project Director
Industrial Sites Sub-Project

Approved by: APPROVED SIGNATURE Date: 10/19/2006

John B. Jones
Acting Federal Project Director
Environmental Restoration Project

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# List of Acronyms and Abbreviations

| | |
|---|---|
| bgs | Below ground surface |
| Bi | Bismuth |
| CAI | Corrective Action Investigation |
| CAS | Corrective Action Site |
| CAU | Corrective Action Unit |
| cm | Centimeter |
| COC | Contaminant of concern |
| COPC | Contaminant of potential concern |
| CR | Closure Report |
| CSM | Conceptual site model |
| DOE | U.S. Department of Energy |
| DQA | Data quality assessment |
| DQO | Data quality objective |
| DQI | Data quality indicator |
| DRO | Diesel-range organics |
| EPA | U.S. Environmental Protection Agency |
| FAL | Final action level |
| FD | Field duplicate |
| FFACO | *Federal Facility Agreement and Consent Order* |
| FSL | Field-screening level |
| FSR | Field-screening result |
| ft | Foot |
| gal | Gallon |
| GRO | Gasoline-range organics |
| IDW | Investigation-derived waste |
| LCS | Laboratory control sample |

## *List of Acronyms and Abbreviations (Continued)*

| | |
|---|---|
| LCSD | Laboratory control sample duplicate |
| MDC | Minimum detectable concentration |
| MDL | Method detection limit |
| mg/kg | Milligram per kilogram |
| mg/L | Milligram per liter |
| mi | Mile |
| mrem/yr | Millirem per year |
| MS | Matrix spike |
| MSD | Matrix spike duplicate |
| N/A | Not applicable |
| NAC | *Nevada Administrative Code* |
| NCRP | National Council for Radiation Protection and Measurement |
| ND | Normalize difference |
| NDEP | Nevada Division of Environmental Protection |
| NNSA/NSO | U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office |
| NTS | Nevada Test Site |
| PAL | Preliminary action level |
| Pb | Lead |
| PCB | Polychlorinated biphenyl |
| pCi/g | Picocuries per gram |
| pCi/L | Picocuries per liter |
| PPE | Personal protective equipment |
| ppm | Parts per million |
| PRG | Preliminary Remediation Goal |
| Pu | Plutonium |
| QA | Quality assurance |

## *List of Acronyms and Abbreviations (Continued)*

| | |
|---|---|
| QAPP | Quality Assurance Project Plan |
| QC | Quality control |
| RadCon | Radiological Control |
| RBCA | Risk-based corrective action |
| RBSL | Risk-based screening level |
| RCRA | *Resource Conservation and Recovery Act* |
| ROTC | Record of Technical Change |
| RPD | Relative percent difference |
| SAA | Satellite accumulation area |
| SAFER | *Streamlined Approach for Environmental Restoration* |
| SCL | Sample collection log |
| SSTL | Site-specific target level |
| SVOC | Semivolatile organic compound |
| TPH | Total petroleum hydrocarbons |
| U | Uranium |
| UGTA | Underground Test Area |
| VOC | Volatile organic compound |
| %R | Percent recovery |
| µg/kg | Micrograms per kilogram |

# *Executive Summary*

This Closure Report (CR) presents information supporting the closure of Corrective Action Unit (CAU) 540: Spill Sites, Nevada Test Site, Nevada. This CR complies with the requirements of the *Federal Facility Agreement and Consent Order* (1996) that was agreed to by the State of Nevada, the U.S. Department of Energy, and the U.S. Department of Defense. Corrective Action Unit 540 is located within Areas 12 and 19 of the Nevada Test Site and is comprised of the following Corrective Action Sites (CASs):

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

The purpose of this CR is to provide documentation supporting recommendations of no further action for the CASs within CAU 540. To achieve this, the following actions were performed:

- Reviewed the current site conditions, including the concentration and extent of contamination.
- Performed closure activities to address the presence of substances regulated by *Nevada Administrative Code* 445A.2272 (NAC, 2002).
- Documented Notice of Completion and closure of CAU 540 issued by the Nevada Division of Environmental Protection.

From April 12 through June 29, 2006, closure activities were performed as set forth in the *Streamlined Approach for Environmental Restoration (SAFER) Plan for CAU 540: Spill Sites, Nevada Test Site, Nevada* (NNSA/NSO, 2005). The purposes of the activities as defined during the data quality objectives process were to:

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

- Provide sufficient information and data to complete appropriate corrective actions for the CASs.

Analytes detected during the closure activities were evaluated against preliminary action levels (PALs) to determine COCs for CAU 540. Assessment of the data generated from closure activities indicate the PALs were exceeded in the soil of CAU 540 for total petroleum hydrocarbons (TPH) - diesel range organics (DRO). None of the locations in which TPH-DRO was identified were accompanied by any of the hazardous constituents of diesel as defined in the American Society for Testing and Materials (ASTM) Standard E1739-95, *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites* (ASTM, 1995). The lack of hazardous constituents of diesel as defined by the ASTM Standard reduces the potential for TPH-DRO as a COC to its status as a non-COC where it is identified during this investigation. No further action is necessary at the CASs where no COCs were found above PALs. No use restrictions are required to be placed on this CAU because the investigation showed no evidence of the presence of COCs upon completion of all investigation activities.

The U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office provides the following recommendations:

- No further corrective action is required at all CASs within CAU 540.
- No Corrective Action Plan is required.
- A Notice of Completion to the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office, is requested from the Nevada Division of Environmental Protection for closure of CAU 540.
- Corrective Action Unit 540 should be moved from Appendix III to Appendix IV of the *Federal Facility Agreement and Consent Order.*

# 1.0 Introduction

This Closure Report (CR) presents information supporting closure of Corrective Action Unit (CAU) 540, Spill Sites, Nevada Test Site (NTS), Nevada. This complies with the requirements of the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the State of Nevada, U.S. Department of Energy (DOE), and the U.S. Department of Defense (DoD) (FFACO, 1996). Corrective Action Unit 540 contains nine corrective action sites (CASs) located in Areas 12 and 19 of the NTS. The NTS is located approximately 65 miles (mi) northwest of Las Vegas, Nevada (Figure 1-1).

The nine CASs in CAU 540 are shown on Figure 1-2 and listed below:

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

This CR provides justification for the closure of CAU 540. This justification is based on process knowledge and the results of the closure activities conducted in accordance with the *Streamlined Approach for Environmental Restoration (SAFER) Plan for Corrective Action Unit 540: Spill Sites* (NNSA/NSO, 2005). The recommended corrective action at this CAU is no further action. The CR provides or references the specific information necessary to support these recommendations.

## 1.1 Purpose

This CR provides documentation and justification for the closure of CAU 540 without further corrective action. This justification is based on process knowledge and the results of the investigative activities conducted in accordance with the SAFER Plan (NNSA/NSO, 2005). The SAFER Plan provides additional information relating to the history, planning, and scope of the investigation; therefore, this information will not be repeated in this CR.

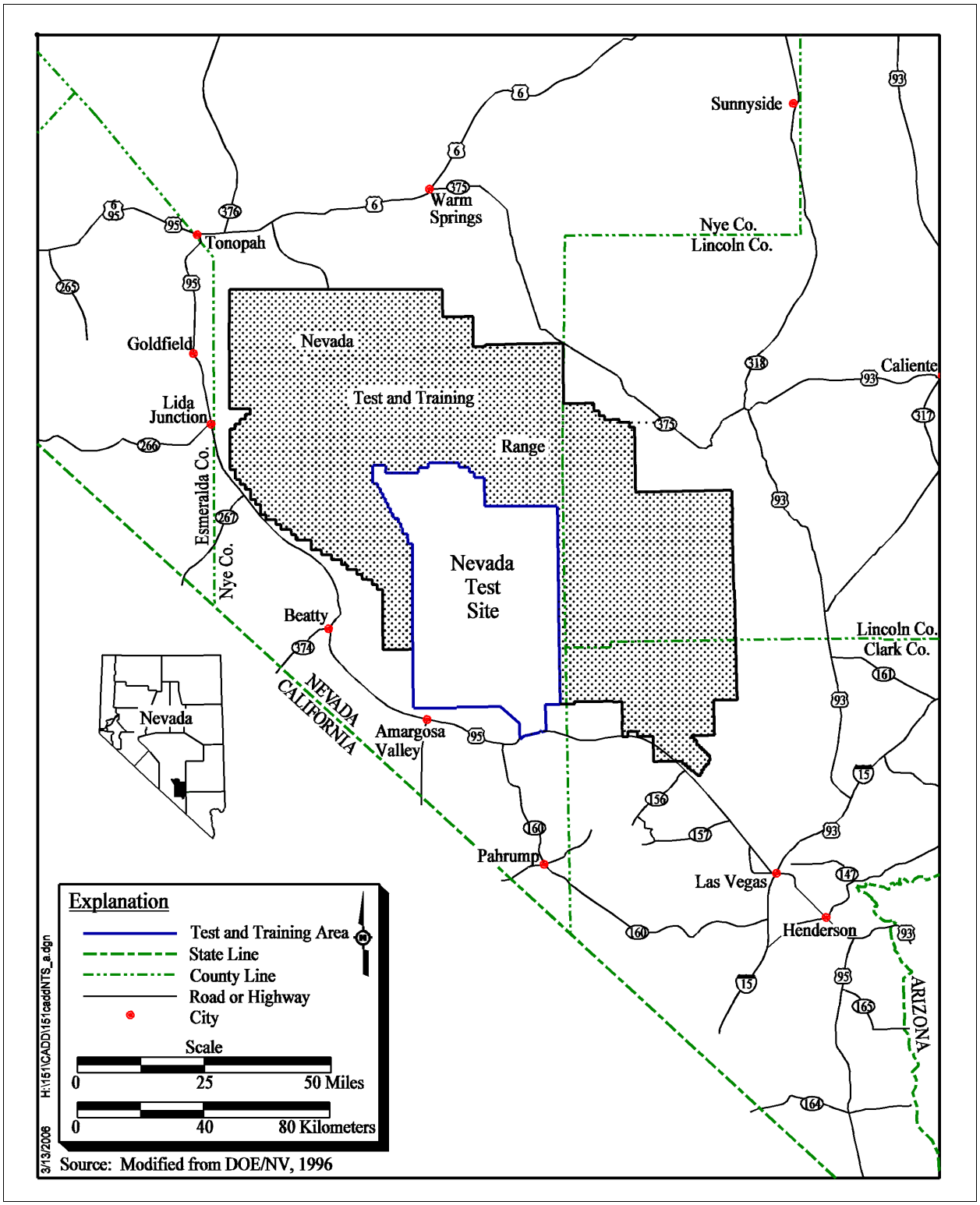


**Figure 1-1**
**Nevada Test Site**

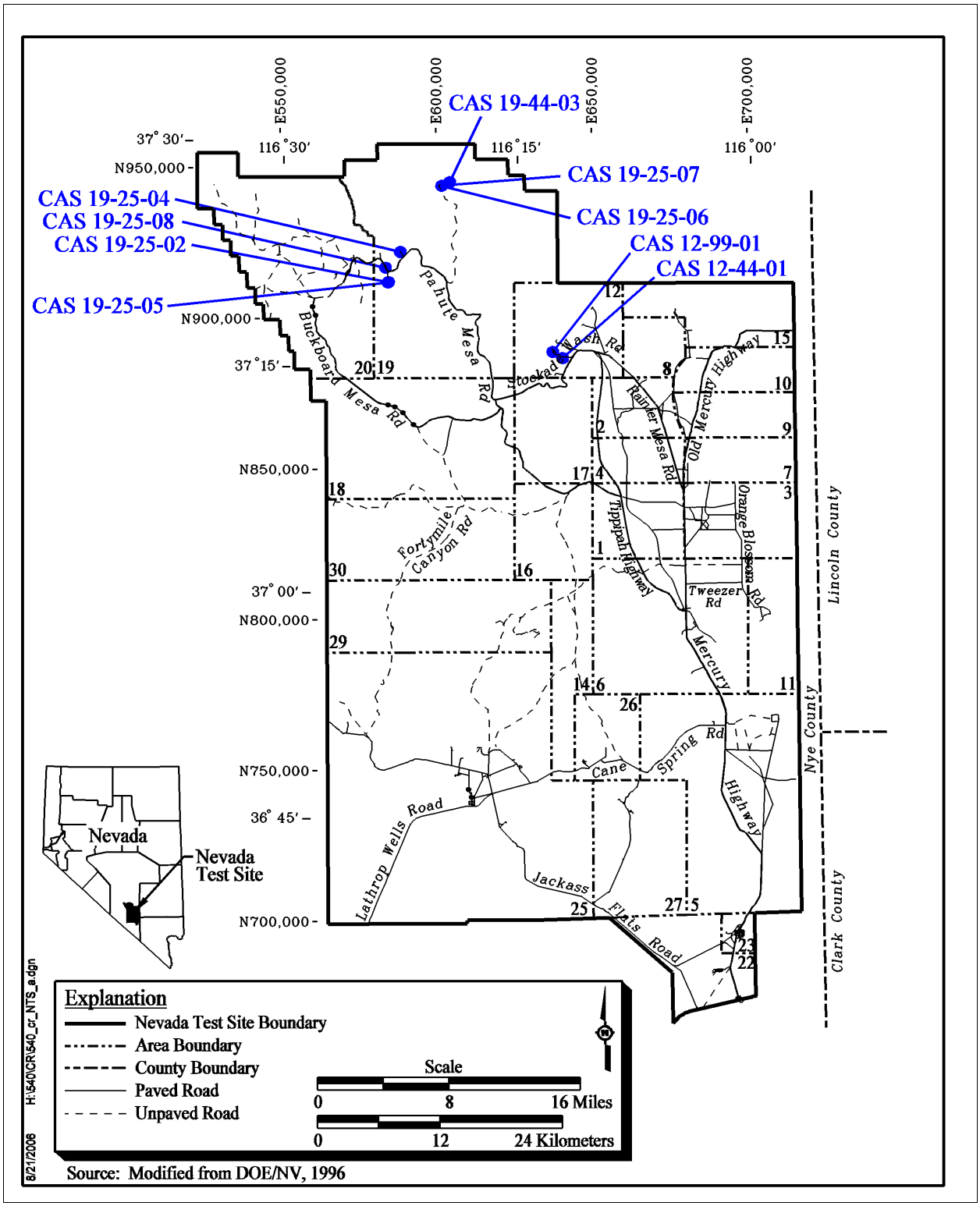


**Figure 1-2**
**CAU 540, CAS Location Map**

The CAU consists of two CASs in Area 12 and seven CASs in Area 19. All nine CASs consist of hydrocarbon spills/releases that are believed to be associated with drilling activities conducted at NTS in support of the underground nuclear weapons testing. Corrective Action Site 12-99-01, located in Area 12, consists of historic/cultural structures as part of a power generation station, historically called the Mission Generation Station. Additional information relating to the site history, planning, and scope of the closure is presented in the SAFER Plan (NNSA/NSO, 2005).

Corrective Action Site 12-44-01 is adjacent to an active well (ER 12-1) under the auspices of the Underground Test Area (UGTA) Program. Corrective Action Site 12-99-01 is a former power generation station (the Mission Generation Station) that is currently inactive and abandoned. Corrective Action Site 19-25-02 is adjacent to the U-19av cellar. The hydrocarbon stains at CAS 19-25-04 are believed to be associated with the U-19q drill hole, located nearby. Corrective Action Site 19-25-05 is adjacent to a mud pit that is within approximately 200 feet (ft) of the U-19av cellar. Corrective Action Site 19-25-06 is adjacent to the U-19j cellar, and CAS 19-25-07 is adjacent to a mud pit located approximately 200 ft to the east of the U-19j cellar on a peninsula-shaped piece of land bordered on two sides by steep slopes and the third side by a mud pit that is not part of the CAS. Corrective Action Site 19-25-08 is located in an area off of Pahute Mesa Road that appears to once have been a parking area along with a concrete pad for a small building. The three stains are in the same area but not in close proximity to the small concrete pad. The CAS itself is located approximately 100 ft north of the 19-02 road that leads to CASs 19-25-02 and 19-25-05. Corrective Action Site 19-44-03 is adjacent to the U-19bf post-test cellar.

## *1.2 Scope*

The scope of the activities used to justify that no further corrective action is required at CAU 540, Spill Sites, included the following:

- Removing surface debris and/or materials to facilitate sampling
- Conducting radiological surveys of areas to be sampled
- Performing field screening
- Collecting environmental samples for laboratory analysis

- Collecting step-out samples to define the lateral and vertical extent of the contamination
- Collecting waste management samples
- Collecting quality control (QC) samples
- Evaluating corrective action objectives based on the results of the investigation and the corrective action alternative screening criteria
- Recommending and justifying preferred corrective action alternatives
- Justifying why no further corrective action is necessary and the technical rationale for implemented closure activities
- Documenting the Notice of Completion and closure of CAU 540

### *1.3 CR Contents*

This CR is divided into the following sections and appendices:

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

Section 2.0 - Closure Activities: Summarizes the closure activities, deviations from the SAFER Plan, the actual schedule, and the site conditions following completion of corrective actions.

Section 3.0 - Waste Disposition: Discusses the wastes generated and entered into an approved waste management system as a result of the corrective action.

Section 4.0 - Closure Verification Results: Describes verification activities and the results of verification activities.

Section 5.0 - Conclusions and Recommendations: Provides the conclusions and recommendations along with the rationale for their determination.

Section 6.0 - References: Provides a list of all referenced documents used in the preparation of this CR.

Appendix A- *DQOs as Developed in the SAFER Plan*: Summarizes the analytical results as they meet the requirements set forth during the Data Quality Objective (DQO) process.

Appendix B - *Closure Certification*: Documents the specific closure activities completed for the CAU.

Appendix C - *As-Built Documentation*: Identifies the as-built drawings for each CAS.

Appendix D - *Confirmation Sampling Test Results*: Provides a description of the project objectives, field closure and sampling activities, and closure results.

Appendix E - *Waste Disposition Documentation*: Documents disposal of items removed during closure activities.

Appendix F - *Modifications to the Post Closure Plan*: Documents any modifications to the Post-Closure Plan.

Appendix G - *Closure Activity Summary.*

Appendix H - *Evaluation of Risk*: Summarizes risk assessment results.

### *1.3.1 Applicable Programmatic Plans and Documents*

To ensure all project objectives, health and safety requirements, and procedures were adhered to, all closure activities were performed in accordance with the following documents:

- *Streamlined Approach for Environmental Restoration (SAFER) Plan for CAU 540: Spill Sites, Nevada Test Site, Nevada* (NNSA/NSO, 2005)
- Errata Sheet issued on December 21, 2005 for the SAFER Plan for CAU 540, *Spill Sites*
- *Industrial Sites Quality Assurance Project Plan* (QAPP) (NNSA/NV, 2002)
- *Federal Facility Agreement and Consent Order* (1996), as amended
- *Project Management Plan* (DOE/NV, 1994)
- Approved standard quality practices and detailed operating procedures

### 1.3.2 Data Quality Objectives

This section contains a summary of the DQO process that is presented in Appendix A. The DQOs were developed to identify data needs, clearly define the intended use of the environmental data, and design a data collection program that will satisfy these purposes.

The problem statement for CAU 540 is: "Existing information on the nature and extent of potential contamination is insufficient to validate the assumptions used to select the corrective actions or to verify that closure objectives were met for the CASs in CAU 540." To address this statement, the resolution of two decisions statements is required:

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

The presence of a COC would require a corrective action. A corrective action may also be necessary if there is a potential for wastes that are present at a site to impose COCs into site environmental media if the wastes were to be released.

### 1.3.3 Data Quality Assessment Summary

The Data Quality Assessment (DQA) presented in Section 4.1 includes an evaluation of the DQIs to determine the degree of acceptability and usability of the reported data in the decision-making process. The DQO process ensures that the right type, quality, and quantity of data will be available to support the resolution of those decisions at an appropriate level of confidence. Using both the DQO and DQA processes help to ensure that DQO decisions are sound and defensible.

The DQA process as presented in Section 4.1 is comprised of the following steps:

- Step 1: Review DQOs and Sampling Design.
- Step 2: Conduct a Preliminary Data Review.
- Step 3: Select the Test.
- Step 4: Verify the Assumptions.
- Step 5: Draw Conclusions from the Data.

Based on the results of the DQA presented in Section 4.1, the nature and extent of COCs at CAU 540 have been adequately identified to implement corrective actions. The DQA also determined that information generated during the investigation supports the CSM assumptions, and the data collected met the DQOs and support their intended use in the decision-making process.

# 2.0 Closure Activities

The following sections summarize the CAU 540 closure activities and any deviations from the original scope of work. Results of confirmation sampling for individual CAU 540 CASs are presented in Appendix D of this document.

## 2.1 Description of Corrective Action Activities

The corrective actions were managed in accordance with the requirements set forth in the CAU 540 SAFER Plan (NNSA/NSO, 2005). Table 2-1 lists the corrective action activities that were conducted at each of the CASs.

**Table 2-1**
**Corrective Action Activities Conducted at Each Corrective Action Site**
**To Meet SAFER Plan Requirements**

| Corrective Action Activities | Corrective Action Sites | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 12-44-01 | 12-99-01 | 19-25-02 | 19-25-04 | 19-25-05 | 19-25-06 | 19-25-07 | 19-25-08 | 19-44-03 |
| Collected soil samples from biased locations | X | X | X | X | X | X | X | X | X |
| Field-screened samples for alpha and beta/gamma radiation | X | X | X | X | X | X | X | X | X |
| Field-screened soil samples for volatile organic compounds | X | X | X | X | X | X | X | X | X |
| Field-screened soil samples for total petroleum hydrocarbons via on-site gas chromatograph | X | X | X | X | X | X | X | X | X |
| Collected samples for waste characterization | X | X | X | X | X | X | X | X | X |
| Submitted select samples for off-site laboratory analysis | X | X | X | X | X | X | X | X | X |

Closure verification samples were collected from potential contaminant sources, surface, and subsurface soils. Surface soil samples were collected by hand excavation. Subsurface soil samples were collected using hand augering operations. Select soil samples were field screened for volatile organic compounds (VOCs), alpha and beta/gamma radiation, and total petroleum hydrocarbons (TPH)-diesel-range organics (DRO). The results were compared against screening levels to guide in the selection of CAS-specific verification sample locations. Resultant samples were shipped to off-site laboratories to be analyzed for appropriate chemical and radiological parameters.

A judgmental sampling scheme was implemented to select sample locations and evaluate analytical results, as outlined in the SAFER Plan. Judgmental sampling allows the methodical selection of sample locations that target the populations of interest (defined in the DQOs) rather than non-selective random locations.

For the judgmental sampling scheme, individual sample results (rather than average concentrations) are used to compare to FALs. Therefore, statistical methods to generate site characteristics (averages) are not necessary. Section 0.4.4 of the U.S. Environmental Protection Agency (EPA) *Data Quality Objectives Process for Hazardous Waste Site Investigations* (EPA QA/G-4HW) guidance states that the use of statistical methods may not be warranted by program guidelines or site-specific sampling objectives (EPA, 2000). The need for statistical methods is dependent upon the decisions being made. Section 7.1 of the EPA QA/G-4HW guidance states that a judgmental sampling design is developed when there is sufficient information on the contamination sources and history to develop a valid conceptual site model (CSM) and to select specific sampling locations. This design was used to confirm the existence of contamination at specific locations and provide information (such as extent of contamination) about specific areas of the site.

Confidence in judgmental sampling scheme decisions was established qualitatively by the validation of the CSM and justification that sampling locations are the most likely locations to contain a COC, if a COC exists.

### *2.1.1 CAS 12-44-01, ER 12-1 Well Site Release Closure Activities*

Eighteen Decision I soil samples (including field duplicates) were collected from seven locations (A01, A02, A03, A04, A05, A06, and A07) within and surrounding the area of hydrocarbon stained soil. Surface soil samples collected from sample locations A01, A02, and A03 were located in the identified area of hydrocarbon stained soil. Subsurface samples at sample locations A01, A02, and A03 were collected at depths ranging from 2.0 ft below ground surface (bgs) to 6.5 ft bgs, depending on location relative to the reported hydrocarbon spill, visual examination of the soil being collected, and field-screening results (FSRs). Sample locations A04, A05, A06, and A07 were collected from locations believed to be outside the hydrocarbon stained area, as defined by historical spill records and visual examination.

### 2.1.2 CAS 12-99-01, Oil Stained Dirt Closure Activities

Five Decision I soil samples (including field duplicates) were collected from four locations at the CAS. Sample location B01 was at the base of a 3-by-7-by-4-ft concrete trough. The base of the trough, beneath a very thin layer of deposited soil, was determined to be an impervious solid aggregation. No subsurface sample was collected from sample location B01. A surface soil sample was collected from each of the remaining three locations (B02, B03, and B04), and coincided with areas of hydrocarbon stained soils. Refusal was encountered at a depth of 0.5 ft bgs, which was the bedrock of the sloped area that was excavated for the placement of the energy generation station (formally named the Mission Generation Station) in order to provide energy to equipment used for the construction of tunnels used for detonation experiments.

Corrective Action Site 12-99-01 was determined to be a cultural/historical site, and the additional collection of samples would have required some modification of the features located on the site. In addition to the extensive cleanup of debris that was planned before the determination of the site as cultural/historical, it was determined that additional surface soil sampling would have provided essentially the same results as those found in the samples already collected.

### 2.1.3 CAS 19-25-02, Oil Spill Closure Activities

Fifteen Decision I soil samples (including field duplicates) were collected from seven locations (C01, C02, C03, C04, C05, C06, and C07) within the CAS. Three of the sample locations (C01, C02, and C03) are from within each of the three small hydrocarbon stained areas. The remaining four sample locations (C04, C05, C06, and C07) are from non-stained locations surrounding the closely clustered areas of hydrocarbon stained soil.

### 2.1.4 CAS 19-25-04, Oil Spill Closure Activities

Sixteen Decision I soil samples (including field duplicates) were collected from five locations (D01, D02, D03, D04, and D05) within the CAS. Four samples were collected from two locations (two samples each from two locations, D01 and D02) within each of the two areas of hydrocarbon stained soils. Six soil samples were collected from three locations (D03, D04, and D05) outside of the stained areas of soil. Subsurface soil samples were all collected to a maximum depth of 0.5 to 1.0 ft bgs owing to a thick caliche layer refusal at 1.0 ft bgs.

### 2.1.5 CAS 19-25-05, Oil Spill Closure Activities

Thirteen Decision I soil samples (including duplicates) were collected from six sample locations (E01, E02, E03, E04, E05, and E06) within the CAS. Six of the soil samples were collected from within the three small areas of hydrocarbon stained soils. Two samples (surface and subsurface) were collected from each of the hydrocarbon stained areas. The remaining seven samples (including one field duplicate sample) were collected from three locations outside of the three closely co-located areas of hydrocarbon staining.

### 2.1.6 CAS 19-25-06, Oil Spill Closure Activities

Nine Decision I soil samples (including field duplicates) were collected from four sample locations (F01, F02, F03, and F04) within the CAS. Two samples were collected from within the hydrocarbon stained area of soil (sample location F01), and seven samples (including a field duplicate) were collected from three locations (F02, F03, and F04) around the hydrocarbon stain.

### 2.1.7 CAS 19-25-07, Oil Spill Closure Activities

Thirteen Decision I samples (including field duplicates) were collected from six locations (G01, G02, G03, G04, G05, and G06) from the CAS. Two soil samples were collected from the hydrocarbon stained area (sample location G01) and 11 samples (including a field duplicate) were collected from sample locations (G02, G03, G04, and G05) outside the stained area of soil.

### 2.1.8 CAS 19-25-08, Oil Spills (3) Closure Activities

Seventeen Decision I soil samples were collected from eight sample locations (H01, H02, H03, H04, H05, H06, H07 and H08) from within the CAS. Seven samples (including a field duplicate) were collected from three sample locations (H01, H02, and H03) within the three hydrocarbon stained areas of soils. The remaining 10 samples were collected from five sample locations (H04, H05, H06, H07, and H08) outside of the area of hydrocarbon staining.

### 2.1.9 CAS 19-44-03, U-19bf Drill Site Release Closure Activities

Nine Decision I soil samples for chemical and radiological analysis were collected from four sample locations. Two samples were collected from within the hydrocarbon stained area of soil (sample

location I01). Seven soil samples (including a field duplicate) were collected from three sample locations (I02, I03, and I04) around the hydrocarbon stained area.

## 2.2 Deviations from SAFER Plan as Approved

One deviation from the SAFER Plan as approved involved the cleanup of surface debris and the removal of a dilapidated concrete pad cover at CAS 12-99-01. Before starting field work, it was determined that the site is classified as a historical/cultural site, resulting in the cancellation of plans for debris removal and concrete pad cover removal.

Additional sampling over and above the originally planned sampling locations occurred where judgmental decisions were made based on field observations (i.e., CAS 12-44-01 and 19-25-04).

## 2.3 Corrective Action Schedule as Completed

Sample collection began on April 12 and continued through June 29, 2006.

# 3.0 Waste Disposition

Wastes generated during the SAFER field activities include decontamination rinsate water, disposable sampling equipment, and housekeeping waste. The types, amounts, and disposal of the wastes are detailed in the following subsections. Newly generated wastes such as rinsate have been characterized based on the associated soil samples, direct sampling, and knowledge of the waste generating process. Site controls were in place to prevent the introduction of hazardous constituents to these waste streams.

## 3.1 Waste Streams

The waste generated by site closure activities at CAU 540 was segregated into the following waste streams:

- Sanitary waste including, but not limited to: personal protective equipment (PPE), disposable sampling equipment, glass sample jars, aluminum foil, and other debris
- Decontamination rinsate

Soil remaining from collection and sampling was returned to its original location. Soil collected for screening purposes was also returned to its point of collection.

Decontamination rinsate and the volumes collected for each CAS are listed below:

- CAS 12-44-01: Approximately 3.5 gallons (gal) of decontamination rinsate placed into one 5-gal lid-locking bucket, then placed into a 55-gal locking drum in a satellite accumulation area (SAA)
- CAS 12-99-01: None
- CAS 19-25-02: Approximately 3.5 gal of decontamination rinsate placed into a 10-gal lid-locking drum in an SAA
- CAS 19-25-04: Approximately 5 gal of decontamination rinsate in a 10-gal lid-locking drum in an SAA
- CAS 19-25-05: Approximately 3 gal of decontamination rinsate placed into a 10-gal lid-locking drum in an SAA

- CAS 19-25-06: Approximately 4 gal of decontamination rinsate placed into a 10-gal lid-locking drum in an SAA
- CAS 19-25-07: Approximately 4 gal of decontamination rinsate placed into a 10-gal lid-locking drum in an SAA
- CAS 19-25-08: Approximately 4 gal of decontamination rinsate placed into a 10-gal lid-locking drum in an SAA
- CAS 19-44-03: Approximately 3.5 gal of decontamination rinsate placed into a 10-gal lid-locking drum in an SAA

## *3.2 Waste Sampling*

Waste determinations were made utilizing process knowledge and media sample association. Direct sampling was performed to confirm the regulatory status of IDW at all SAAs. Analytical results of the direct sampling of the rinsate at each CAS (with the exception of CAS 12-99-01, where no rinsate was generated) are presented in Table 3-1. The following subsections provide the results of the waste characterization samples collected at each CAS. Waste disposition documentation is presented in Appendix E.

**Table 3-1**
**Waste Characterization Analytical Results (Rinsate Samples)**

| CAS No. | Gross Alpha (pCi/L) | Gross Beta (pCi/L) |
|---|---|---|
| 12-44-01 | 45 | 61 |
| 19-25-02 | 5.9 | 20.6 |
| 19-25-04 | 7.2 | 22.6 |
| 19-25-05 | 6.9 | -- |
| 19-25-06 | 9.8 | 28.4 |
| 19-25-07 | 8.6 | 44.2 |
| 19-25-08 | 3.9 | 4.9 |
| 19-44-03 | 3 | 15.1 |

CAS = Corrective action site
pCi/L = Picocuries per liter
-- = Not detected above instrument detection level

### 3.2.1 CAS 12-44-01, ER 12-1 Well Site Release

One waste characterization sample of the decontamination rinsate was collected from the SAA container located at this CAS and analyzed for the parameters gross alpha/beta and tritium. All analytical data were reviewed to determine a waste disposal path for this waste stream. The contents of the waste container will be solidified and placed in the Area 9 10C industrial waste landfill. Waste disposition documentation is presented in Appendix E.

### 3.2.2 CAS 12-99-01, Oil Stained Dirt

No waste characterization sample was collected from this CAS because no decontamination rinsate was generated and no SAA was established.

### 3.2.3 CAS 19-25-02, Oil Spill

One waste characterization sample of the decontamination rinsate was collected from the SAA container located at this CAS and analyzed for the parameters gross alpha/beta and tritium. All analytical data were reviewed to determine a waste disposal path for this waste stream. The results do not exceed the disposal criteria. Liquid rinsate will be placed in the Area 23 lagoon. The empty container will be placed in the Area 9 10C industrial waste landfill. Waste disposition documentation is presented in Appendix E.

### 3.2.4 CAS 19-25-04, Oil Spill

One waste characterization sample of the decontamination rinsate was collected from the SAA container located at this CAS and analyzed for the parameters gross alpha/beta and tritium. All analytical data were reviewed to determine a waste disposal path for this waste stream. The contents of the waste container will be solidified and placed in the Area 9 10C industrial waste landfill. Waste disposition documentation is presented in Appendix E.

### 3.2.5 CAS 19-25-05, Oil Spill

One waste characterization sample of the decontamination rinsate was collected from the SAA container located at this CAS and analyzed for the parameters gross alpha/beta and tritium. All analytical data were reviewed to determine a waste disposal path for this waste stream. The results do

not exceed the disposal criteria. The liquid rinsate will be placed in the Area 23 lagoon. The empty container will be placed in the Area 9 10C industrial waste landfill. Waste disposition documentation is presented in Appendix E.

### 3.2.6 CAS 19-25-06, Oil Spill

One waste characterization sample from the decontamination rinsate was collected from the SAA container located at this CAS and analyzed for the parameters gross alpha/beta and tritium. All analytical data were reviewed to determine a waste disposal path for this waste stream. The results do not exceed the disposal criteria. The liquid rinsate will be placed in the Area 23 lagoon. The empty container will be placed in the Area 9 10C industrial waste landfill. Waste disposition documentation is presented in Appendix E.

### 3.2.7 CAS 19-25-07, Oil Spill

One waste characterization sample from the decontamination rinsate was collected from the SAA container located at this CAS and analyzed for the parameters gross alpha/beta and tritium. All analytical data were reviewed to determine a waste disposal path for this waste stream. The results do not exceed the disposal criteria. The liquid rinsate will be placed in the Area 23 lagoon. The empty container will be placed in the Area 9 10C industrial waste landfill. Waste disposition documentation is presented in Appendix E.

### 3.2.8 CAS 19-25-08, Oil Spills (3)

One waste characterization sample from the decontamination rinsate was collected from the SAA container located at this CAS and analyzed for the parameters gross alpha/beta and tritium. All analytical data were reviewed to determine a waste disposal path for this waste stream. The results do not exceed the disposal criteria. The liquid rinsate will be placed in the Area 23 lagoon. The empty container will be placed in the Area 9 10C industrial waste landfill. Waste disposition documentation is presented in Appendix E.

### 3.2.9 CAS 19-44-03, U-19bf Drill Site Release

One waste characterization sample from the decontamination rinsate was collected from the SAA container located at this CAS and analyzed for the parameters gross alpha/beta and tritium. All analytical data were reviewed to determine a waste disposal path for this waste stream. The results do not exceed the disposal criteria. The liquid rinsate will be placed in the Area 23 lagoon. The empty container will be placed in the Area 9 10C industrial waste landfill. Waste disposition documentation is presented in Appendix E.

## 3.3 Waste Disposal

A total of eight containers of decontamination rinsate were generated and managed on-site during the investigation. The following paragraphs summarize the types and amounts of waste generated and disposed during the CAU 540 investigation:

- Eight containers of decontamination rinsate were generated and characterized as sanitary waste. Six containers are recommended for the sanitary lagoon and, when solidified, the remaining two containers meet the landfill disposal criteria and are recommended for the Area 9 10C industrial waste landfill.

All PPE and disposable sampling equipment generated during site closure activities was determined to be sanitary based on observations and process knowledge. The waste was bagged, labeled, and placed in a dumpster for disposal at the Area 9 10C industrial waste landfill.

Office waste and lunch trash was disposed of in designated sanitary waste bins allocated for disposal at the NTS sanitary landfill. Sanitary industrial waste was inspected and disposed of in designated sanitary industrial waste bins located at Building 23-153 and allocated for disposal at the Area 9 10C industrial waste landfill.

# 4.0 Closure Verification Results

All CAU 540 sampling locations were accessible, and sampling activities at planned locations were not restricted by buildings, storage areas, active operations, or above ground and underground utilities, with one exception. Planned removal of debris from CAS 12-99-01 was cancelled because the CAS was determined to be a historical/cultural area. No subsurface samples were collected from within the concrete trough at CAS 12-99-01 because the base of the trough just under the thin layer of stained soil was a solid aggregate. This was impenetrable by the hand tool sampling techniques used. All of the sample locations in CAS 12-99-01 were sampled to the depth of refusal, which was approximately 0.5 ft bgs. The site is located on the edge of a rocky outcrop levelled for the purpose of placement of an energy generation station.

Sampling at CAS 19-25-04 was conducted to the depth of refusal of approximately 1.0 ft bgs. Additional sampling occurred as a result of visual examination at CASs 12-44-01 and 19-25-04 while sampling was being conducted at the planned sampling locations. Because of the physical shape of CAS 19-25-07, physical limits to available sampling locations occurred in three of four directions around the target hydrocarbon stained soil due to steep slopes on two sides and a mud pit on the third side that was not a part of this CAS. Additional sampling was possible in only one direction (generally, westward towards CAS 19-25-06) from the peninsula-shaped area comprising CAS 19-25-07. The mud pit is CAS 19-09-07 which is in CAU 358. The following subsections provide a summary of the CAS-specific closure sampling results which are presented in Appendix D.

All of the samples collected during the CAU 540 field activities that contained TPH above the preliminary action level (PAL) (at least one sample in each CAS exceeded the PAL of 100 milligrams per kilogram [mg/kg] for TPH) did not contain any of the hazardous constituents of diesel as defined by the ASTM Method E 1739-95 (ASTM, 1995) and therefore are not COCs.

### *CAS 12-44-01, ER 12-1 Well Site Release*

No other analytes exceeded their respective PALs. The analytical data support no further action for this CAS.

***CAS 12-99-01, Oil Stained Dirt***

No other analytes exceeded their respective PALs. The analytical data supports no further action for this CAS.

***CAS 19-25-02, Oil Spill***

No other analytes exceeded their respective PALs. The analytical data supports no further action for this CAS.

***CAS 19-25-04, Oil Spill***

Total petroleum hydrocarbons were detected above the PAL, however, none of the hazardous constituents of diesel were detected above their respective PALs (see Appendix D). Therefore TPH-DRO is not a COC.

Sample 540D009 at sample location D04 at a depth of 0.5 to 1.0 ft bgs contained plutonium (Pu)-239 at a concentration of 104 picocuries per gram (pCi/g). Discussion of this Pu-239 identification can be found in Section D.5.7 in Appendix D. The result is that the Pu-239 appears to have been a particle that was removed during sampling. In addition, Pu-239 is not a COC as a result of release from the release pathways being investigated at this CAS. No other analytes exceeded their respective PALs.

The analytical data support no further action at this CAS.

***CAS 19-25-05, Oil Spill***

No other analytes exceeded their respective PALs. The analytical data support no further action for this CAS.

***CAS 19-25-06, Oil Spill***

No other analytes exceeded their respective PALs. The analytical data support no further action for this CAS.

***CAS 19-25-07, Oil Spill***

No other analytes exceeded their respective PALs. The analytical data support no further action for this CAS.

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

Total petroleum hydrocarbons were detected above the PAL; however, none of the hazardous constituents of diesel were detected above their respective PALs (see Appendix D). Therefore, TPH-DRO is not a COC.

Sample 540H014 at sample location H07 at a depth of 0.0 to 0.5 ft bgs contained Bismuth (Bi)-212 at a concentration of 5.2 pCi/g. Discussion of this Bi-212 identification can be found in Section D.9.6 in Appendix D. Based on laboratory-supplied information regarding sample density and the equilibrium between Bi-212 and Pb-212, Bi-212 is not a COC at this CAS. No other analytes exceeded their respective PALs.

The analytical data supports no further action for this CAS.

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

No other analytes exceeded their respective PALs. The analytical data support no further action for this CAS.

## *4.1 Data Quality Assessment*

The DQA process is the scientific evaluation of the actual investigation results to determine whether the DQO criteria established in the CAU 540 SAFER Plan (NNSA/NSO, 2005) were met and whether DQO decisions can be resolved at the desired level of confidence. The DQO process ensures that the right type, quality, and quantity of data will be available to support the resolution of those decisions at an appropriate level of confidence. Using both the DQO and DQA processes help to ensure that DQO decisions are sound and defensible.

The DQA involves five steps that begin with a review of the DQOs and end with an answer to the DQO decisions. The five steps are briefly summarized as follows:

Step 1: Review DQOs and Sampling Design – Review the DQO process to provide context for analyzing the data. State the primary statistical hypotheses; confirm the limits on decision errors for committing false negative (Type I) or false positive (Type II) decision errors; and review any special features, potential problems, or any deviations to the sampling design.

Step 2: Conduct a Preliminary Data Review – A preliminary data review should be performed by reviewing quality assurance (QA) reports and inspecting the data both numerically and graphically, validating and verifying the data to ensure that the measurement systems performed in accordance with the criteria specified, and using the validated dataset to determine whether the quality of the data is satisfactory.

Step 3: Select the Test – Select the test based on the population of interest, population parameter, and the hypotheses. Identify the key underlying assumptions that could cause a change in one of the DQO decisions.

Step 4: Verify the Assumptions – Perform tests of assumptions. If data are missing or are censored, determine the impact on DQO decision error.

Step 5: Draw Conclusions from the Data – Perform the calculations required for the test.

### *4.1.1 Review DQOs and Sampling Design*

This section contains a review of the DQO process presented in Appendix A. The DQO decisions are presented with the DQO provisions to limit false negative or false positive decision errors. Special features, potential problems, or any deviations to the sampling design are also presented.

#### *4.1.1.1 Decision I*

The Decision I statement as presented in the CAU 540 SAFER Plan is: "Is a contaminant present within a CAS at a concentration that could pose an unacceptable risk to human health and the environment."

***Decision I Rules:***

- If the population parameter of any contaminant of potential concern (COPC) in a target population exceeds the FAL for that COPC, then that COPC is identified as a COC.
- If a COC is detected, then the Decision II statement must be resolved.
- If COCs are not identified, then the investigation is complete.

Population Parameter: The maximum observed sample result.

#### *4.1.1.1.1 DQO Provisions To Limit False Negative Decision Error*

A false negative decision error (where consequences are more severe) was controlled by meeting the following criteria:

1. Having a high degree of confidence that locations selected will identify COCs if present anywhere within the CAS.

2. Having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.

3. Having a high degree of confidence that the dataset is of sufficient quality and completeness.

***Criterion 1:***

The following methods [stipulated in the CAU 540 DQOs (NNSA/NV, 2005)] were used in selecting sample locations.

1. Selection of sampling locations associated with FSRs was accomplished by analyzing samples for TPH-DRO using a gas chromatograph, VOCs using a photoionization detector, alpha and beta/gamma-emitting radionuclides using a hand-held NE Technology Electra, and gamma-emitting radionuclides using a gamma spectroscopy.

2. Selection of sampling locations associated with surface and subsurface staining, odors, presence of debris, and similar items was accomplished by visual field observations.

3. Selection of sampling locations associated with professional judgment based on acceptable knowledge was accomplished by:
   - Source and location of release
   - Chemical nature and fate properties
   - Physical transport pathways and properties
   - Transport drivers

***Criterion 2:***

All samples were analyzed using the analytical methods listed in Table 7-3 of the SAFER Plan and for the chemical and radiological parameters listed in Table 7-2 of the SAFER Plan. Table 4-1 provides a reconciliation of samples analyzed to the planned analytical program.

Samples were submitted for all of the analytical methods specified in the analytical program specified in Section 3.1 of the SAFER Plan.

**Table 4-1**
**CAU 540 Analyses Performed**

| CAS | ANALYTES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Total VOCs | Total SVOCs | PCBs | Metals | TPH-DRO | TPH-GRO | Gamma Spectroscopy | Isotopic Uranium | Isotopic Plutonium | Strontium-90 |
| 12-44-01 | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| 12-99-01 | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| 19-25-02 | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| 19-25-04 | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| 19-25-05 | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| 19-25-06 | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| 19-25-07 | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| 19-25-08 | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |
| 19-44-03 | RS | RS | RS | RS | RS | RS | RS | RS | RS | RS |

DRO = Diesel-range organics
GRO = Gasoline-range organics
PCB = Polychlorinated biphenyl
RS = Required and submitted
SVOC = Semivolatile organic compound
TPH = Total petroleum hydrocarbons
VOC = Volatile organic compound

Sample results were assessed against the acceptance criterion for the DQI of sensitivity as defined in the Industrial Sites QAPP (NNSA/NV, 2002). The sensitivity acceptance criterion defined in the SAFER Plan is that analytical detection limits will be less than or equal to the corresponding action level. This criterion was not achieved for the chemical analytical results listed in Table 4-2. Results not meeting the sensitivity acceptance criterion will not be used in making DQO decisions and will therefore be considered as rejected data. The impact on DQO decisions is addressed in the assessment of completeness.

**Criterion 3:**

To satisfy the third criterion, the entire dataset, as well as individual sample results, were assessed against the acceptance criteria for the DQIs of precision, accuracy, comparability, completeness, and representativeness, as defined in the Industrial Sites QAPP (NNSA/NV, 2002). The DQI acceptance

criteria are presented in Table 7-1 of the SAFER Plan. As presented in Tables 4-2 through 4-5, these criteria were met for each the DQIs.

**Table 4-2**
**Chemical Analytes Failing Sensitivity Criteria**
(Page 1 of 2)

| Sample Number | Parameter | Minimum Detection Concentration (µg/kg) | Preliminary Action Level (µg/kg) |
|---|---|---|---|
| 540B001RR1 | Dibenzo(a,h)anthracene | 610 | 210 |
| 540B004RR1 | Benzo(a)pyrene | 290 | 210 |
| 540B004RR1 | Dibenzo(a,h)anthracene | 830 | 210 |
| 540B005RR1 | Benzo(a)pyrene | 270 | 210 |
| 540B005RR1 | Dibenzo(a,h)anthracene | 780 | 210 |
| 540C001 | Benzo(a)pyrene | 550 | 210 |
| 540C001 | Dibenzo(a,h)anthracene | 1,600 | 210 |
| 540C001RR1 | N-nitroso-di-n-propylamine | 350 | 250 |
| 540C002 | Benzo(a)pyrene | 550 | 210 |
| 540C002 | Dibenzo(a,h)anthracene | 1,600 | 210 |
| 540C002RR1 | N-nitroso-di-n-propylamine | 350 | 250 |
| 540C003 | Benzo(a)pyrene | 530 | 210 |
| 540C003 | Dibenzo(a,h)anthracene | 1,500 | 210 |
| 540C004RR1 | Benzo(a)pyrene | 550 | 210 |
| 540C004RR1 | Dibenzo(a,h)anthracene | 1,600 | 210 |
| 540D001 | Benzo(a)pyrene | 280 | 210 |
| 540D001 | Dibenzo(a,h)anthracene | 820 | 210 |
| 540D002 | Benzo(a)pyrene | 300 | 210 |
| 540D002 | Dibenzo(a,h)anthracene | 870 | 210 |
| 540E001RR1 | Benzo(a)pyrene | 1,100 | 210 |
| 540E001RR1 | Dibenzo(a,h)anthracene | 3,200 | 210 |
| 540E001RR1 | Hexachlorobenzene | 3,800 | 1,100 |
| 540E001RR1 | Indeno(1,2,3-cd)pyrene | 2,400 | 2,100 |
| 540E002RR1 | Benzo(a)pyrene | 1,100 | 210 |
| 540E002RR1 | Dibenzo(a,h)anthracene | 3,100 | 210 |

**Table 4-2**
**Chemical Analytes Failing Sensitivity Criteria**
(Page 2 of 2)

| Sample Number | Parameter | Minimum Detection Concentration (µg/kg) | Preliminary Action Level (µg/kg) |
|---|---|---|---|
| 540E002RR1 | Indeno(1,2,3-cd)pyrene | 2,400 | 2,100 |
| 540E003RR1 | Benzo(a)pyrene | 1,100 | 210 |
| 540E003RR1 | Dibenzo(a,h)anthracene | 3,100 | 210 |
| 540E003RR1 | Indeno(1,2,3-cd)pyrene | 2,400 | 2,100 |
| 540E004RR1 | Dibenzo(a,h)anthracene | 220 | 210 |
| 540F001RR1 | Benzo(a)pyrene | 690 | 210 |
| 540F001RR1 | Dibenzo(a,h)anthracene | 2,000 | 210 |
| 540F002RR1 | Dibenzo(a,h)anthracene | 390 | 210 |
| 540G001RR1 | Benzo(a)pyrene | 650 | 210 |
| 540G001RR1 | Dibenzo(a,h)anthracene | 1,900 | 210 |
| 540G004RR1 | Benzo(a)anthracene | 280 | 210 |
| 540G004RR1 | Dibenzo(a,h)anthracene | 820 | 210 |
| 540G008RR1 | Dibenzo(a,h)anthracene | 440 | 210 |
| 540I001RR1 | Benzo(a)pyrene | 1,400 | 210 |
| 540I001RR1 | Benzo(b)fluoranthene | 2,300 | 2,100 |
| 540I001RR1 | Dibenzo(a,h)anthracene | 4,000 | 210 |
| 540I001RR1 | Indeno(1,2,3-cd)pyrene | 3,100 | 2,100 |
| 540I006RR1 | Dibenzo(a,h)anthracene | 400 | 210 |

µg/kg = Micrograms per kilogram

### *Precision*

The duplicate precision is evaluated using the relative percent difference (RPD) or normalized difference. For the purpose of determining the data precision of chemical analyses, the RPD between duplicate analyses was calculated. For radionuclides, the RPD was not calculated unless both the sample and its duplicate had concentrations of the target radionuclide exceeding five times their minimum detectable concentration (MDC). Otherwise radionuclide duplicate results were evaluated using the normalized difference. Table 4-3 provides the chemical and radiological precision analysis

results for all constituents that were qualified for precision. The chemical analytes qualified for precision were barium, chromium, and lead. Radionuclides qualified for precision were Pu-238 and Pu-239.

**Table 4-3**
**Precision Measurements**

| Parameter | CAS Number | User Test Panel | Number of Analytes Qualified | Number of Measurements Performed | Percent within Criteria |
|---|---|---|---|---|---|
| Barium | 7440-39-3 | EPA 6010B | 7 | 113 | 93.8 |
| Chromium | 7440-47-3 | EPA 6010B | 5 | 113 | 95.6 |
| Lead | 7439-92-1 | EPA 6010B | 12 | 113 | 89.4 |
| Plutonium-238 | 13981-16-3 | PLUTONIUM | 4 | 113 | 96.5 |
| Plutonium-239 | 15117-48-3 | PLUTONIUM | 4 | 113 | 96.5 |

CAS = Chemical Abstracts Service
EPA = Environmental Protection Agency, SW-846 methods (EPA, 1996, and ASTM, 2000)

As shown in Table 4-3, the precision rate for the three metals and the two radionuclides were above the SAFER Plan acceptance criterion of 80 percent. The precision rate for all other constituents is 100 percent.

***Accuracy***

For the purpose of determining data accuracy of sample analyses, environmental soil samples were evaluated and incorporated into the accuracy calculation. The results qualified for accuracy were associated with matrix spike (MS) recoveries that were outside control limits and could potentially be reported at concentrations lower or higher than actual concentrations. Table 4-4 provides the chemical accuracy analysis results for all constituents qualified for accuracy. Accuracy rates are above the SAFER Plan criterion of 80 percent, except for the Aroclor series, which has a rate of 77.9 percent. There were no radiological data qualified for accuracy.

The affected Aroclor series results compared to the PALs are significantly low; therefore, there is no reason to believe that the data will affect the decision making process. These results can be confidently used to support DQO decisions. As the accuracy rate for all other constituents exceed the acceptance criteria for accuracy, the dataset is determined to be acceptable for the DQI of accuracy.

**Table 4-4**
**Accuracy Measurements**

| Parameter | CAS Number | User Test Panel | Number of Analytes Qualified | Number of Measurements Performed | Percent within Criteria |
|---|---|---|---|---|---|
| 1,1-Dichloroethene | 75-35-4 | EPA 8260 | 2 | 113 | 98.2 |
| 2,4-Dinitrotoluene | 121-14-2 | EPA 8270 | 2 | 113 | 98.2 |
| Pyrene | 129-00-0 | EPA 8270 | 2 | 114 | 98.2 |
| Benzene | 71-43-2 | EPA 8260 | 4 | 113 | 96.5 |
| Chlorobenzene | 108-90-7 | EPA 8260 | 4 | 113 | 96.5 |
| Toluene | 108-88-3 | EPA 8260 | 5 | 113 | 95.6 |
| Gasoline Range Organics | 8006-61-9 | EPA 8015B | 6 | 113 | 94.7 |
| Trichloroethene | 79-01-6 | EPA 8260 | 6 | 113 | 94.7 |
| Lead | 7439-92-1 | EPA 6010 | 7 | 113 | 93.8 |
| Chromium | 7440-47-3 | EPA 6010 | 8 | 113 | 92.9 |
| Barium | 7440-39-3 | EPA 6010 | 12 | 113 | 89.4 |
| Aroclor-1016 | 12674-11-2 | EPA 8082 | 25 | 113 | 77.9 |
| Aroclor-1221 | 11104-28-2 | EPA 8082 | 25 | 113 | 77.9 |
| Aroclor-1232 | 11141-16-5 | EPA 8082 | 25 | 113 | 77.9 |
| Aroclor-1242 | 53469-21-9 | EPA 8082 | 25 | 113 | 77.9 |
| Aroclor-1248 | 12672-29-6 | EPA 8082 | 25 | 113 | 77.9 |
| Aroclor-1254 | 11097-69-1 | EPA 8082 | 25 | 113 | 77.9 |
| Aroclor-1260 | 11096-82-5 | EPA 8082 | 25 | 113 | 77.9 |
| Aroclor-1268 | 11100-14-4 | EPA 8082 | 25 | 113 | 77.9 |

CAS = Chemical Abstract Service
EPA = Environmental Protection Agency, SW-846 methods (EPA, 1996)

***Representativeness***

The DQO process as identified in Appendix A was used to address sampling and analytical requirements for CAU 540. During this process, appropriate locations were selected that enabled the samples collected to be representative of the population parameters identified in the DQO (the most likely locations to contain contamination and locations that bound COCs). The sampling locations identified in the Criterion 1 discussion meet this criterion. Therefore, the analytical data acquired

during the CAU 540 Corrective Action Investigation (CAI) are considered representative of the population parameters.

***Comparability***

Field sampling, as described in the CAU 540 SAFER Plan (NNSA/NSO, 2005), was performed and documented in accordance with approved procedures that are in conformance with standard industry practices. Analytical methods and procedures approved by DOE were used to analyze, report, and validate the data. These methods and procedures are in conformance with applicable methods used in industry and government practices. Therefore, project datasets are considered comparable to other datasets generated using standard industry procedures, thereby meeting DQO requirements.

Also, standard, approved field and analytical methods ensured that data were appropriate for comparison to the investigation action levels specified in the SAFER Plan.

***Completeness***

The CAU 540 SAFER Plan (NNSA/NSO, 2005) defines acceptable criteria for completeness to be 80 percent of CAS-specific non-critical analytes identified in the SAFER Plan having valid results and 100 percent of critical analytes having valid results. Also, the dataset must be sufficiently complete to be able to make the DQO decisions. Critical analytes for CAU 540 are identified as the hazardous constituents of TPH-DRO (see Table H.1-3).

Rejected data (either qualified as rejected or data that failed the criterion of sensitivity) were not used in the resolution of DQO decisions and are not counted toward meeting the completeness acceptance criterion. Table 4-5 provides the rejected data for the site. All of the listed analytes were qualified as rejected in one sample due to analytical quality issues. All data for all analytes were within the acceptable criteria of 80 percent for CAS-specific COPC constituents and the criteria of 100 percent was met for CAS-specific targeted analytes.

#### *4.1.1.1.2 DQO Provisions To Limit False Positive Decision Error*

The false positive decision error was controlled by assessing the potential for false positive analytical results. Quality assurance/QC samples such as field blanks, trip blanks, laboratory control samples

(LCSs), and method blanks were used to determine whether a false positive analytical result may have occurred. Of 34 QA/QC samples submitted, no false positive analytical results were detected.

**Table 4-5**
**Rejected Measurements**

| Parameter | CAS Number | User Test Panel | Number of Analytes Qualified | Number of Measurements Performed | Percent within Criteria |
|---|---|---|---|---|---|
| 1,1,2,2-tetrachloroethane | 79-34-5 | EPA 8260 | 1 | 113 | 99.1 |
| 1,2,4-trichlorobenzene | 120-82-1 | EPA 8260 | 1 | 113 | 99.1 |
| 1,2,4-trimethylbenzene | 95-63-6 | EPA 8260 | 1 | 113 | 99.1 |
| 1,2-dibromo-3-chloropropane | 96-12-8 | EPA 8260 | 1 | 113 | 99.1 |
| 1,2-dichlorobenzene | 95-50-1 | EPA 8260 | 1 | 113 | 99.1 |
| 1,3,5-trimethylbenzene | 108-67-8 | EPA 8260 | 1 | 113 | 99.1 |
| 1,3-dichlorobenzene | 541-73-1 | EPA 8260 | 1 | 113 | 99.1 |
| 1,4-dichlorobenzene | 106-46-7 | EPA 8260 | 1 | 113 | 99.1 |
| 2-chlorotoluene | 95-49-8 | EPA 8260 | 1 | 113 | 99.1 |
| N-butylbenzene | 104-51-8 | EPA 8260 | 1 | 113 | 99.1 |
| N-propylbenzene | 103-65-1 | EPA 8260 | 1 | 113 | 99.1 |
| p-isopropyltoluene | 99-87-6 | EPA 8260 | 1 | 113 | 99.1 |
| sec-butylbenzene | 135-98-8 | EPA 8260 | 1 | 113 | 99.1 |
| tert-butylbenzene | 98-06-6 | EPA 8260 | 1 | 113 | 99.1 |

CAS = Chemical Abstract Service
EPA = Environmental Protection Agency, SW-846 methods (EPA, 1996)

Proper decontamination of sampling equipment and the use of certified clean sampling equipment and containers also minimized the potential for cross contamination that could lead to a false positive analytical result.

#### *4.1.1.2 Decision II*

Decision II as presented in the CAU 540 SAFER Plan: "If a COC is present, is sufficient information available to evaluate appropriate corrective action alternatives?"

***Decision Rules:***

- If the observed concentration of any COC in a Decision II sample exceeds the PALs, then additional samples will be collected to complete the determination of the extent.

- If observed COC concentrations in a sample from all bounding directions are less than the PALs, then the decision will be that the extent of contamination has been defined in the lateral and/or vertical direction.

- If wastes are to be generated as part of a corrective action, samples will be collected to sufficiently characterize the potential wastes.

Population Parameters – The population parameters for Decision II data will be the observed concentration of each unbounded COC in any sample or the observed concentration of each sample used to characterize the potential waste streams.

#### *4.1.1.2.1 DQO Provisions To Limit False Negative Decision Error*

A false negative decision error (where consequences are more severe) is controlled by meeting the following criteria:

1. Having a high degree of confidence that the sample locations selected will identify the extent of the COCs.

2. Having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.

3. Having a high degree of confidence that the dataset is of sufficient quality and completeness.

4. Having a high degree of confidence that the potential waste streams are characterized.

***Criterion 1:***

The only potential COC identified in the CAU 540 investigation was Pu-239 in sample 540D009 at sample location D04 at a depth of 0.5 to 1 ft bgs at CAS 19-25-04. The surface sample contained no Pu-239 above the PAL, and other samples collected and analyzed at this CAS revealed no additional Pu-239 contamination, indicating the analysis consisted of a particle of Pu-239, which was removed from the CAS during sample collection. Laboratory reanalysis of the sample also supports this conclusion, as the result was below the PAL of 12.7 pCi/g.

As expected, TPH was identified at all CASs above the PAL at several locations. None of the hazardous constituents of diesel were identified above their respective PALs in any of the samples containing TPH above the PAL. Therefore, the TPH identified was not a COC, and no extent determinations were required.

***Criterion 2:***

All samples were analyzed for the COC present at the corresponding CAS:

- CAS 19-25-04 - Pu-239

The second criterion for extent (sensitivity) was accomplished for all analyses as demonstrated in Table 4-3. Plutonium-239 was not identified in any other samples collected within this CAU.

***Criterion 3:***

To satisfy the third criterion for extent, the entire dataset, as well as individual sample results, were assessed against the DQIs of precision, accuracy, comparability, completeness, and representativeness, as defined in the Industrial Sites QAPP (NNSA/NV, 2002). The DQI discussion is presented under Criterion 3 for Decision I.

#### *4.1.1.2.2 DQO Provisions To Limit False Positive Decision Error*

The false positive decision error was controlled by assessing the potential for false positive analytical results. Quality assurance/QC samples such as field blanks, trip blanks, LCSs, and method blanks were used to determine whether a false positive analytical result may have occurred. Of 42 QA/QC samples submitted, no false positive analytical results were detected.

Proper decontamination of sampling equipment and the use of certified clean sampling equipment and containers also minimized the potential for cross contamination that could lead to a false positive analytical result.

#### 4.1.1.3 Sampling Design

The SAFER Plan made the following commitments for sampling:

1. Judgmental sampling will be conducted at all CASs based on visualization, process knowledge, and records of known releases.

   Result: All sample locations were sampled according to the sampling design and analyzed for the appropriate COCs.

#### 4.1.1.4 Conduct a Preliminary Data Review

A preliminary data review was conducted by reviewing QA reports and inspecting the data. The contract analytical laboratories generate a QA non-conformance report when data quality does not meet contractual requirements. All data received from the analytical laboratories met contractual requirements, and a QA non-conformance report was not generated. Data were validated and verified to ensure that the measurement systems performed in accordance with the criteria specified. The validated dataset quality was found to be satisfactory.

#### 4.1.1.5 Select the Test and Identify Key Assumptions

The test for making DQO Decision I was the comparison of the maximum analyte result from each CAS to the corresponding PAL. The test for making DQO Decision II was not necessary as there were no COCs identified in any of the CASs.

The key assumptions that could impact a DQO decision are listed in Table 4-6.

#### 4.1.1.6 Verify the Assumptions

The results of the investigation support the key assumptions identified in the CAU 540 DQOs and Table 4-6.

##### 4.1.1.6.1 Other DQO Commitments

The SAFER Plan made the following commitments for sampling:

1. Decision I sampling will consist of defining the extent of contamination where COCs have been confirmed through FSRs. If COCs extend beyond Decision I locations, then additional

## Table 4-6
## Key Assumptions

| | |
|---|---|
| Exposure Scenario | Site workers are only exposed to contaminants of concern (COCs) through oral ingestion, inhalation, external exposure to radiation, or dermal contact (by absorption) of COCs absorbed onto the soils.<br>Exposure to contamination is limited to industrial site workers, construction/remediation workers, and military personnel conducting training.<br>The investigation results did not reveal any potential exposures than those identified in the conceptual site models (CSMs). |
| Affected Media | Surface soil, shallow subsurface soil, and potentially perched (shallow) groundwater.<br>Deep groundwater contamination is not a concern.<br>Contaminants migrating to regional aquifers are not considered.<br>The investigation results did not reveal any affected media other than those identified in the CSMs. |
| Location of Contamination/Release Points | The area of contamination is contiguous<br>The extent of COC concentration decreases away from the area of contamination.<br>The investigation results did not reveal any locations of contamination or release points other than those identified in the CSMs. |
| Transport Mechanisms | Surface transport may occur as a result of a spill or storm water runoff.<br>Surface transport beyond shallow substrate is not a concern.<br>The investigation results did not reveal any transport mechanisms other than those identified in the CSMs. |
| Preferential Pathways | None.<br>The investigation results did not reveal any preferential pathways other than those identified in the CSMs. |
| Lateral and Vertical Extent of Contamination | Subsurface contamination, if present, is contiguous and decreases with distance and depth from the source.<br>Surface contamination may occur laterally as a result of a spill or storm water runoff.<br>The investigation results did not reveal any lateral and vertical extent of contamination other than those identified in the CSMs. |
| Groundwater impacts | None.<br>The investigation results did not reveal groundwater impacts other than those identified in the CSMs. |
| Future Land Use | Nonresidential.<br>The investigation results did not reveal any future land uses other than those identified in the CSMs. |

Decision II samples will be collected from locations adjacent to and at comparable depths with the locations of the COCs. A minimum of one analytical result less than the PAL from the vertical direction will be required to define the depth of COC contamination, and the lateral extent of contamination may be defined by sample analysis or based on modeling. The contamination boundaries may need to be extrapolated to give an overall view of the lateral and vertical extent of COC concentrations at the site.

Result: No COCs were identified at any CAS, so there was no need to define COC extent.

#### 4.1.1.7 Draw Conclusions from the Data

This section resolves the two DQO decisions for each of the CAU 540 CASs.

##### 4.1.1.7.1 Decision Rules for Decision I

**Decision Rule:** If the concentration of any COPC in a target population exceeds the FAL for that COPC during the initial investigation, then that COPC is identified as a COC and Decision II sampling will be conducted.

**Result:** The following COCs were identified in the following CASs.

- CAS 12-44-01 - none
- CAS 12-99-01 - none
- CAS 19-25-02 - none
- CAS 19-25-04 - none
- CAS 19-25-05 - none
- CAS 19-25-06 - none
- CAS 19-25-07 - none
- CAS 19-25-08 - none
- CAS 19-44-03 - none

**Decision Rule:** If all COPC concentrations are less than the corresponding PALs, then the decision will be no further action.

**Result:** No COCs were identified in samples collected from all CASs in the CAU. No further action was identified as the recommended corrective action alternative for these CASs.

##### 4.1.1.7.2 Decision Rules for Decision II

**Decision Rule:** If the observed concentration of any COC in a Decision II sample exceeds the PALs, then additional samples will be collected to complete the determination of the extent.

**Result:** No COCs were identified at any of the CASs within CAU 540.

**Decision Rule:** If all observed COC population parameters are less than the PALs, then the decision will be that the extent of contamination has been defined in the lateral and/or vertical direction.

**Result:** Because none of the hazardous constituents of diesel were present above their respective PALs, in any of the samples in which TPH was present, no COCs were present and no delineation is required.

## *4.2 Use Restrictions*

Analytes detected in soil during the corrective action activities at the CASs of CAU 540 were evaluated against PALs and it was determined that no COCs were present. Therefore, no further action is recommended at the CASs of CAU 540, and no use restrictions are necessary.

# 5.0 Conclusions and Recommendations

Based on the results of the closure activities, no further closure activities are necessary for CAU 540.

The DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) provides the following recommendations:

- No further corrective action is required at all CAU 540 CASs.
- A Notice of Completion is requested from the NDEP for the closure of CAU 540.
- Corrective Action Unit 540 should be moved from Appendix III to Appendix IV of the FFACO.

# 6.0 References

ASTM, see American Society for Testing and Materials.

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

American Society for Testing and Materials. 2000. *Standard Test Method for Radiochemical Determination of Plutonium in Soil by Alpha Spectroscopy,* C1001-00. Philadelphia, PA.

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

EPA, see U.S. Environmental Protection Agency.

FFACO, see *Federal Facility Agreement and Consent Order.*

*Federal Facility Agreement and Consent Order.* 1996 (as amended). Agreed to by the State of Nevada, the U.S. Department of Energy, and the U.S. Department of Defense.

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

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

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 Site Office. 2005. *Streamlined Approach for Environmental Restoration (SAFER) Plan for Corrective Action Unit 540: Spill Sites, Nevada Test Site, Nevada*, Rev. 0. November 2005. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1994. *Project Management Plan*, Rev. 0. Las Vegas, NV.

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

U.S. Environmental Protection Agency. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, SW-846, 3rd Edition (which includes updates to 1986, 1992, and 1994 revisions), CD-ROM PB97-501928GEI. Washington, DC.

U.S. Environmental Protection Agency. 2000. *Guidance for the Data Quality Objectives Process*. EPA QA/G4. Washington, DC.

# Appendix A

# DQOs as Developed in the SAFER Plan

# A.1.0 Data Quality Objectives Process

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

# A.2.0 Step 1 - State the Problem

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

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

## A.2.1 Data Quality Objective Planning Team Members

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

## A.2.2 Conceptual Site Model

The CSM describes the most probable current conditions at each CAS and defines the assumptions that are the basis for identifying appropriate CAS-specific sampling strategies and data collection methods. The CSM set the stage for assessing how contaminants could reach receptors both in the present and future by addressing contaminant nature and extent, transport mechanisms and pathways, potential receptors, and potential exposures to receptors. Accurate CSMs are important because they serve as the basis for all subsequent inputs and decisions throughout the DQO process.

**Table A.2-1**
**Data Quality Objective Participants**

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

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

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

### *A.2.2.1 Contaminant Release*

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

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

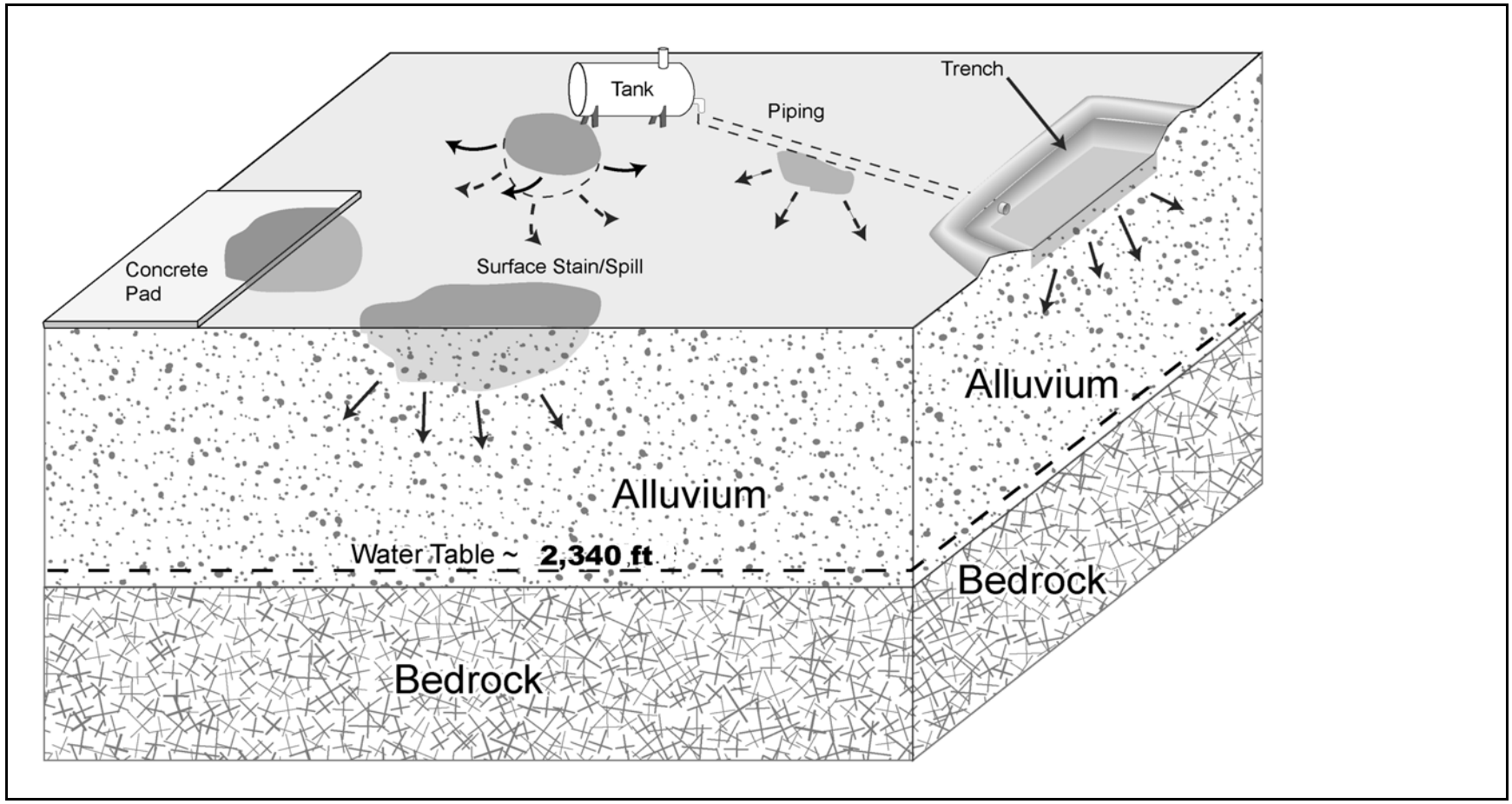


**Figure A.2-1**
**CAU 540 Conceptual Site Model**

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

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

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

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

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

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

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

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

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

- Petroleum hydrocarbons (e.g., lubricating oils, waste oils, diesel fuel) used in activities directly involving or supporting drilling or mining activities. Diesel fuel is expected to be the primary COPC (TPH-DRO) with the greatest potential for concentrations above action levels

based on process knowledge gained from similar investigations of hydrocarbon spills. Other fuels, motor oil, antifreeze, and hydraulic fluids are compounds that may have leaked from equipment and trucks, or may have spilled directly onto the ground.

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

### *A.2.2.2 Potential Contaminants*

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

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

### *A.2.2.3 Contaminant Characteristics*

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

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

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

X - Required analytical method

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

### *A.2.2.4 Site Characteristics*

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

- Groundwater is not expected to be impacted in Areas 12 and 19 of the NTS for the following reasons. Infiltration of precipitation through subsurface media typically serves as the major driving force for migration of contaminants. However, due to the arid environment of the NTS, percolation of precipitation is small, and migration of contaminants has been shown to

be limited. Evaporation potentials significantly exceed precipitation. The average annual precipitation across the CAU 540 sites ranges from 8 to 10 inches per year (DOE/NV, 1997).

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

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

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

### *A.2.2.5 Migration Pathways and Transport Mechanisms*

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

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

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

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

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

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

- Because there is no physical barrier beneath the spills/releases and the CASs reside on generally flat topography, downward vertical migration will be predominant over lateral migration.
- Contamination, if present, is expected to be primarily confined to the immediate area covered by the spill/release. Unsaturated conditions due to arid climate limit the potential for lateral or vertical migration into surrounding soils.

#### *A.2.2.6 Exposure Scenarios*

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

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

# A.3.0 Step 2 - Identify the Decisions

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

## A.3.1 Decision Statements

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

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

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

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

### A.3.1.1 Alternative Actions to Decision I

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

# A.4.0 Step 3 - Identify the Inputs to the Decision

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

## A.4.1 Information Needs

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

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

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

## A.4.2 Sources of Information

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

### *A.4.2.1 Sample Locations*

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

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

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

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

#### *A.4.2.2 Analytical Methods*

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

# A.5.0 Step 4 - Define the Boundaries of the Study

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

## A.5.1 Populations of Interest

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

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

## A.5.2 Spatial Boundaries

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

## A.5.3 Practical Constraints

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

**Table A.5-1**
**Spatial Boundaries of CAU 540 CASs**

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

### *A.5.4 Define the Scale of Decision Making*

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

# A.6.0 Step 5 - Develop a Decision Rule

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

## A.6.1 Population Parameters

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

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

## A.6.2 Decision Rules

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

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

The decision rules for Decision I are:

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

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

The decision rules for Decision II are:

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

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

### *A.6.3 Action Levels*

The PALs presented in this section are to be used for site screening purposes. They are not necessarily intended to be used as cleanup action levels or FALs. However, they are useful in screening out analytes that are not present in sufficient concentrations to warrant further evaluation and, therefore, streamline the consideration of remedial alternatives. The process that will be used to move from PALs to FALs is specified by NAC 445A (NAC, 2004). This regulation stipulates that determination of FALs shall be established by an evaluation of the site based on the risk it poses to public health and the environment. This evaluation will be conducted using Method E1739-95, adopted by the ASTM (ASTM, 1995). The ASTM's RBCA process is summarized in Section 3.2.1 of the SAFER Plan. The Tier 1 action levels for Decision I and Decision II are the PALs. The specific chemical PALs for CAU 540 are listed in Section 3.2.1.1 of the SAFER Plan. The PAL for TPH is 100 ppm as listed in NAC 445A.2272 (NAC, 2004). The specific radiological PALs for CAU 540 are listed in Section 3.2.1.3 of the SAFER Plan. The radiological PAL for solid media will be defined as the unrestricted-release criteria defined in the *NV/YMP Radiological Control Manual* (NNSA/NSO, 2005).

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

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

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

### *A.6.4 Measurement and Analysis Sensitivity*

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

## A.7.0 Step 6 - Tolerable Limits on Decision Errors

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

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

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

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

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

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

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

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

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

### *A.7.1 False Negative Decision Error*

The false negative decision error would mean deciding that a COC is not present when it actually is (Decision I), or deciding that the extent of a COC has been defined when it has not (Decision II), or deciding that closure objectives were met when they were not (Decision II). In all of these cases the potential consequence is an increased risk to human health and environment.

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

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

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

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

These characteristics were considered during the development of the CSM and the selection of sampling locations. The field-screening methods and biasing factors listed in Section 4.2 will be used to further ensure that appropriate sampling locations are selected to meet these criteria. Radiological survey instruments and field-screening equipment will be calibrated and checked in accordance with

the manufacturer's instructions and approved procedures. The investigation report will present an assessment on the DQI of representativeness that samples were collected from those locations that best represent the populations of interest as defined in Section A.5.1.

To satisfy the second criterion, Decision I samples will be analyzed for the chemical and radiological parameters listed in Section 4.1 of the SAFER Plan. Decision II samples will be analyzed for those chemical and radiological parameters that identified unbounded COCs. The DQI of sensitivity will be assessed for all analytical results to ensure that all sample analyses had measurement sensitivities (detection limits) that were less than or equal to the corresponding PALs. If this criterion is not achieved, the affected data will be assessed (for usability and potential impacts on meeting site characterization objectives) in the investigation report.

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

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

### *A.7.2 False Positive Decision Error*

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

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

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

## A.8.0 Step 7 - Optimize the Design for Obtaining Data

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

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

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

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

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

### *A.8.1 Sampling Design*

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

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

#### *A.8.1.1 Site Preparation*

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

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

### *A.8.1.2 Sample Collection*

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

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

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

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

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

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

## A.9.0 References

ASTM, see American Society for Testing and Materials.

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

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

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

EPA, see U.S. Environmental Protection Agency.

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

NAC, see *Nevada Administrative Code.*

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

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

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

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

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

U.S. Department of Energy, Nevada Operations Office. 1998. *Nevada Test Site Resource Management Plan*, DOE/NV--518. Las Vegas, NV.

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

U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2005. *NV/YMP Radiological Control Manual*, DOE/NV/11718--079, Rev. 5. Las Vegas, NV.

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

# Appendix B

# Closure Certification

# B.1.0 Closure Certification

Closure certification is not required for CAU 540.

# Appendix C

# As-Built Documentation

# C.1.0 As-Built Documentation

This section is not applicable to CAU 540.

# Appendix D

# Confirmation Sampling Test Results

# D.1.0 Introduction

This appendix presents the confirmation sampling test results for CAU 540. Information regarding the history of each site, planning, and the scope of the investigation is presented in the CAU 540 SAFER Plan (NNSA/NSO, 2005).

This appendix describes the investigation and presents the results. The contents of this appendix are as follows:

- Section D.1.0 is the Introduction.
- Section D.2.0 through D.10.0 provide CAS-specific information regarding the field activities, sampling methods, and laboratory analytical results from investigation sampling.
- Section D.11.0 provides a summary of the investigation results.
- Section D.12.0 lists the cited references.

The complete field documentation and laboratory data — including field activity daily logs, sample collection logs (SCLs), analysis request/chain-of-custody forms, soil sample descriptions, laboratory certificates of analyses, analytical results, and surveillance results — are retained in project files as hard copy files or electronic media.

The following sections provide analytical results from the samples collected to complete investigation activities as outlined in the SAFER Plan. Investigation samples were analyzed for the SAFER Plan-specified COPCs, which included VOCs; SVOCs; TPH-DRO and -GRO; PCBs; RCRA metals; gamma-emitting radionuclides; and isotopic uranium (U), isotopic plutonium (Pu), and strontium (Sr)-90 (collectively referred to as isotopic radionuclides). The analytical parameters and laboratory methods used to analyze the investigation samples are listed in Table A.1-2.

## D.2.0 CAS 12-44-01, ER 12-1 Well Site Release

Analytical results from the soil samples with concentrations exceeding MDLs are summarized in the following sections. An evaluation was conducted on all contaminants detected above MDLs by initially comparing individual concentration or activity results against the PALs. A summary of the soil samples collected at CAS 12-44-01 is provided in Table D.2-1. Sample locations are identified in Figure D.2-1.

**Table D.2-1**
**Samples Collected at CAS 12-44-01, ER 12-1 Well Site Release**
(Page 1 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose | Analyses |
|---|---|---|---|---|---|
| A01 | 540A001 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540A002 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| | 540A003 | 2.0 - 2.5 | Soil | Field Duplicate of #540A002 | Set 1 |
| | 540A004 | 6.0 - 6.5 | Soil | Environmental | Set 1 |
| A02 | 540A005 | 0.0 - 0.5 | Soil | Environmental, MS/MSD | Set 1 |
| | 540A006 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| | 540A007 | 3.0 - 3.5 | Soil | Environmental | Set 1 |
| A03 | 540A008 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540A009 | 2.5 - 3.0 | Soil | Environmental | Set 1 |
| A04 | 540A010 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540A011 | 1.5 - 2.0 | Soil | Environmental | Set 1 |
| | 540A012 | 2.5 - 3.0 | Soil | Environmental | Set 1 |

**Table D.2-1**
**Samples Collected at CAS 12-44-01, ER 12-1 Well Site Release**
(Page 2 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose | Analyses |
|---|---|---|---|---|---|
| A05 | 540A013 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540A014 | 1.5 - 2.0 | Soil | Environmental | Set 1 |
| A06 | 540A015 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540A016 | 1.5 - 2.0 | Soil | Environmental | Set 1 |
| A07 | 540A017 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540A018 | 1.5 - 2.0 | Soil | Environmental | Set 1 |
| N/A | 540A301 | N/A | Water | Trip Blank | VOCs only |
| N/A | 540A302 | N/A | Water | Trip Blank | VOCs only |
| N/A | 540A303 | N/A | Water | Field Blank | Set 1 |
| N/A | 540A501 | N/A | Liquid | Equipment Rinsate | Set 2 |

Set 1 = Total VOCs, Total SVOCs, Total RCRA Metals, TPH-DRO and -GRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90
Set 2 = Gross Alpha/Beta, Tritium

ft bgs = Feet below ground surface
MS/MSD = Matrix spike/matrix spike duplicate
N/A = Not applicable

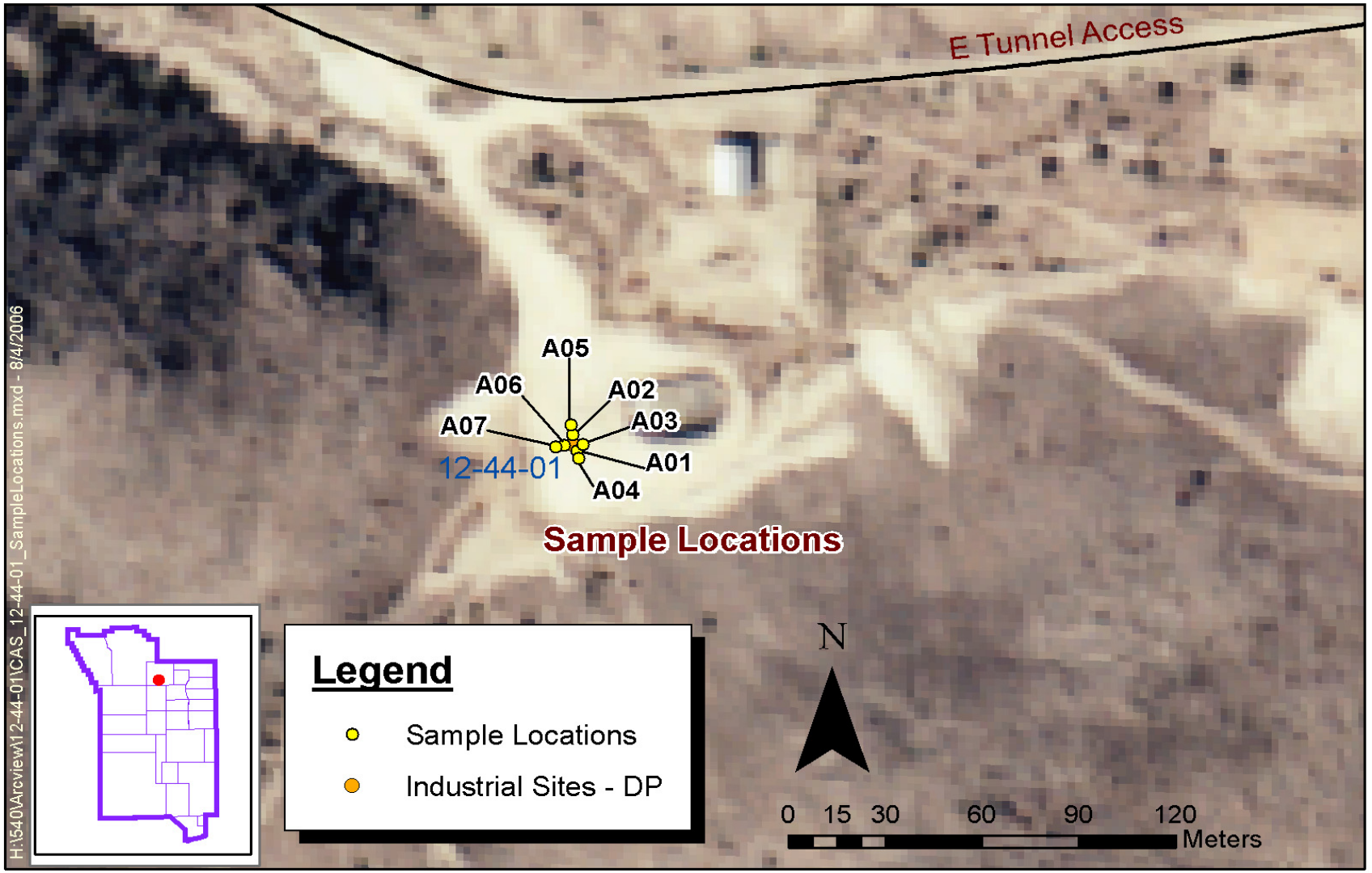


**Figure D.2-1**
**Sample Locations for CAS 12-44-01**

### D.2.1 Volatile Organic Compounds

No VOCs were detected with analytical results above their respective laboratory MDLs in any of the soil samples collected at this CAS.

### D.2.2 Semivolatile Organic Compounds

Analytical results for SVOCs in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.2-2. No SVOCs were detected at concentrations exceeding their respective PALs.

**Table D.2-2**
**Sample Results for Total SVOCs Detected Above Minimum Detectable Concentrations at CAS 12-44-01, ER 12-1 Well Site Release**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (µg/kg) | | |
|---|---|---|---|---|---|
| | | | Bis(2-Ethylhexyl)Phthalate | Diethylphthalate | Di-N-Butyphthalate |
| **Final Action Levels[a]** | | | **120,000** | **100,000,000** | **62,000,000** |
| A01 | 540A002 | 2.0 - 2.5 | 160 (J) | -- | -- |
| | 540A004 | 6.0 - 6.5 | 170 (J) | -- | -- |
| A03 | 540A008 | 0.0 - 0.5 | 220 (J) | -- | -- |
| | 540A009 | 2.5 - 3.0 | -- | 46 (J) | 120 (J) |
| A06 | 543A015 | 0.0 - 0.5 | 460 (J) | -- | -- |

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

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

### *D.2.3 Total Petroleum Hydrocarbons*

The TPH-DRO and -GRO analytical results for soil samples collected at this CAS that were detected above their respective laboratory MDLs are presented in Table D.2-3. For those samples whose analytical results exceeded the PAL of 100 mg/kg, a Tier 2 evaluation was conducted by evaluating the hazardous constituents of diesel (see Section H.1.10). This evaluation determined that none of the hazardous constituents of diesel were identified in the VOC or SVOC analyses at concentrations above their respective FALs; therefore, the TPH-DRO detected at this CAS is not considered a COC.

**Table D.2-3**
**Sample Results for TPH-DRO and TPH-GRO Detected Above Minimum Detectable Concentrations at CAS 12-44-01, ER 12-1 Well Site Release**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) |
|---|---|---|---|
| | | | Diesel-Range Organics |
| Preliminary Action Levels[a] | | | 100 |
| A01 | 540A002 | 2.0 - 2.5 | 44 (M) |
| | 540A003 | 2.0 - 2.5 | 42 (M) |
| | 540A004 | 6.0 - 6.5 | 24 (M) |
| A03 | 540A008 | 0.0 - 0.5 | 3.7 (J) |
| | 540A009 | 2.5 - 3.0 | 46 (M) |
| A05 | 540A013 | 0.0 - 0.5 | **120 (M)** |
| | 540A014 | 1.5 - 2.0 | 41 (M) |
| A06 | 540A015 | 0.0 - 0.5 | **270 (M)** |
| | 540A016 | 1.5 - 2.0 | 46 (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
J = Estimated value
M = Chromatographic pattern resembling motor oil detected

### D.2.4 Polychlorinated Biphenyls

No PCBs were detected above their respective laboratory MDLs in any of the soil samples collected at this CAS.

### D.2.5 RCRA Metals

Analytical results for the RCRA metals in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.2-4. None of the RCRA metals were detected at concentrations exceeding their respective PALs.

### D.2.6 Gamma-Emitting Radionuclides

Gamma-emitting radionuclides analytical results for soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.2-5. None of the gamma-emitting radionuclide concentrations exceeded their respective PALs.

### D.2.7 Plutonium, Strontium-90, and Uranium Isotopes

Isotopic Pu and isotopic U analytical results for soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.2-6. No isotopic Pu, U, or Sr-90 concentrations exceeded their respective PALs.

## Table D.2-4
## Sample Results for Total RCRA Metals Detected Above Minimum Detectable Concentrations at CAS 12-44-01, ER 12-1 Well Site Release

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Barium | Cadmium | Chromium | Lead | Mercury |
| **Final Action Levels** | | | **23[a]** | **67,000[b]** | **450[b]** | **450[b]** | **800[b]** | **310[b]** |
| A01 | 540A001 | 0.0 - 0.5 | 4.4 | 130 (J) | -- | 3.4 | 17 (J) | 0.016 (B) |
| | 540A002 | 2.0 - 2.5 | 5.8 | 110 (J) | 0.069 (B) | 5.2 | 12 (J) | 0.044 |
| | 540A003 | 2.0 - 2.5 | 6.4 | 150 (J) | 0.072 (B) | 4.4 | 13 (J) | 0.019 (B) |
| | 540A004 | 6.0 - 6.5 | 4.6 | 110 (J) | 0.15 (B) | 12 | 29 (J) | 0.075 |
| A02 | 540A005 | 0.0 - 0.5 | 2.2 | 64 (J) | -- | 2 | 6.3 (J) | 0.048 |
| | 540A006 | 2.0 - 2.5 | 3.3 | 98 (J) | -- | 5.2 | 10 (J) | 0.07 |
| | 540A007 | 3.0 - 3.5 | 3.1 | 86 (J) | -- | 4 | 9.2 (J) | 0.018 (B) |
| A03 | 540A008 | 0.0 - 0.5 | 3.7 | 140 | -- | 15 | 7.1 | 0.004 (J-) |
| | 540A009 | 2.5 - 3.0 | 3.6 | 140 | -- | 4.6 | 9.5 | 0.0071 (J-) |
| A04 | 540A010 | 0.0 - 0.5 | 3.2 | 100 | -- | 2.8 | 10 | 0.011 (J-) |
| | 540A011 | 1.5 - 2.0 | 2 | 110 | -- | 2.1 | 6.4 | 0.016 (J-) |
| | 540A012 | 2.5 - 3.0 | 2.1 | 76 | -- | 2.1 | 13 | 0.016 (J-) |
| A05 | 540A013 | 0.0 - 0.5 | 3.2 | 100 | -- | 2.7 | 13 | 0.0043 (J-) |
| | 540A014 | 1.5 - 2.0 | 2.9 | 100 | -- | 7.8 | 12 | 0.016 (J-) |
| A06 | 540A015 | 0.0 - 0.5 | 5.8 | 150 | -- | 12 | 27 | 0.023 (J-) |
| | 540A016 | 1.5 - 2.0 | 3 | 110 | -- | 15 | 12 | 0.024 (J-) |
| A07 | 540A017 | 0.0 - 0.5 | 3.6 | 150 | -- | 2.6 | 26 | 0.0066 (J-) |
| | 540A018 | 1.5 - 2.0 | 3.2 | 100 | -- | 4.1 | 11 | 0.023 (J-) |

[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 U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004)

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
-- = Not detected above minimum detectable concentrations
B = Value less than the contract required detection limit but greater than or equal to the instrument detection limit
J = Estimated value
J- = The result is an estimated quantity, but the result may be biased low

# Table D.2-5
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 12-44-01, ER 12-1 Well Site Release
(Page 1 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | | Bismuth-214[a] | | Cesium-137[b] | Lead-212[a] | | Lead-214[a] | | Thallium-208[a] | |
| **Final Action Levels** | | | **5** | **15** | **5** | **15** | **12.2** | **5** | **15** | **5** | **15** | **5** | **15** |
| **Depth bgs (cm)** | | | **<15** | **>15** | **<15** | **>15** | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** |
| A01 | 540A001 | 0.0 - 0.5 | 1.79 (G) | N/A | 1.09 (G, J) | N/A | -- | 2.25 (J) | N/A | 1.16 (G, J) | N/A | 0.69 (G) | N/A |
| | 540A002 | 2.0 - 2.5 | N/A | 1.66 (G) | N/A | 1.02 (G, J) | -- | N/A | 1.69 (J) | N/A | 1.04 (G, J) | N/A | 0.62 (G) |
| | 540A003 | 2.0 - 2.5 | N/A | 1.96 (G) | N/A | 1.21 (G, J) | -- | N/A | 1.82 (J) | N/A | 1.19 (G, J) | N/A | 0.55 (G) |
| | 540A004 | 6.0 - 6.5 | N/A | -- | N/A | 1.22 (G, J) | -- | N/A | 1.4 (J) | N/A | 1.15 (G, J) | N/A | 0.44 (G) |
| A02 | 540A005 | 0.0 - 0.5 | 1.72 (G) | N/A | 1.25 (G, J) | N/A | -- | 2.5 (J) | N/A | 1.21 (G, J) | N/A | 0.82 (G) | N/A |
| | 540A006 | 2.0 - 2.5 | N/A | 1.73 (G) | N/A | 1.25 (G, J) | 0.44 (G, LT) | N/A | 1.89 (J) | N/A | 1.43 (G, J) | N/A | 0.59 (G) |
| | 540A007 | 3.0 - 3.5 | N/A | 1.63 (G) | N/A | 1.1 (G, J) | 0.47 (G, LT) | N/A | 2.23 (J) | N/A | 1.34 (G, J) | N/A | 0.8 (G) |
| A03 | 540A008 | 0.0 - 0.5 | 1.93 (G) | N/A | 1.26 (G, J) | N/A | -- | 1.91 (J) | N/A | 1.19 (G, J) | N/A | 0.67 (G) | N/A |
| | 540A009 | 2.5 - 3.0 | N/A | 1.32 (G) | N/A | 0.74 (G, J) | -- | N/A | 1.35 (J) | N/A | 1.14 (G, J) | N/A | 0.49 (G) |

# Table D.2-5
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 12-44-01, ER 12-1 Well Site Release
(Page 2 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | | Bismuth-214[a] | | Cesium-137[b] | Lead-212[a] | | Lead-214[a] | | Thallium-208[a] | |
| **Final Action Levels** | | | **5** | **15** | **5** | **15** | **12.2** | **5** | **15** | **5** | **15** | **5** | **15** |
| **Depth bgs (cm)** | | | **<15** | **>15** | **<15** | **>15** | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** |
| A04 | 540A010 | 0.0 - 0.5 | 2.39 (G) | N/A | 0.96 (G, J) | N/A | -- | 2.25 (J) | N/A | 1.27 (G, J) | N/A | 0.78 (G) | N/A |
| | 540A011 | 1.5 - 2.0 | N/A | 2.05 (G) | N/A | 1.13 (G, J) | -- | N/A | 2.01 (J) | N/A | 1.24 (G, J) | N/A | 0.73 (G) |
| | 540A012 | 2.5 - 3.0 | N/A | 1.56 (G) | N/A | 1.1 (G, J) | -- | N/A | 1.67 (J) | N/A | 1.29 (G, J) | N/A | 0.55 (G) |
| A05 | 540A013 | 0.0 - 0.5 | 1.39 (G) | N/A | 1.22 (G, J) | N/A | -- | 2.54 (J) | N/A | 1.05 (G, J) | N/A | 0.54 (G) | N/A |
| | 540A014 | 1.5 - 2.0 | N/A | 2.02 (G) | N/A | 1.3 (G, J) | -- | N/A | 2.36 (J) | N/A | 1.19 (G, J) | N/A | 0.81 (G) |
| A06 | 540A015 | 0.0 - 0.5 | 1.82 (G) | N/A | 1.04 (G, J) | N/A | -- | 1.73 (J) | N/A | 1.38 (G, J) | N/A | 0.61 (G) | N/A |
| | 540A016 | 1.5 - 2.0 | N/A | 1.43 (G, TI) | N/A | 1.23 (G, J) | -- | N/A | 1.96 (J) | N/A | 1.26 (G, J) | N/A | 0.69 (G) |
| A07 | 540A017 | 0.0 - 0.5 | 2.19 (G) | N/A | 1.42 (G, J) | N/A | -- | 2.14 (J) | N/A | 1.4 (G, J) | N/A | 0.85 (G) | N/A |
| | 540A018 | 1.5 - 2.0 | N/A | 2.09 (G) | N/A | 1.04 (G, J) | -- | N/A | 2.34 (J) | N/A | 1.21 (G, J) | N/A | 0.64 (G) |

# Table D.2-5
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 12-44-01, ER 12-1 Well Site Release
(Page 3 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | | Bismuth-214[a] | | Cesium-137[b] | Lead-212[a] | | Lead-214[a] | | Thallium-208[a] | | |
| **Final Action Levels** | | | 5 | 15 | 5 | 15 | 12.2 | 5 | 15 | 5 | 15 | 5 | 15 | |
| **Depth bgs (cm)** | | | <15 | >15 | <15 | >15 | | <15 | >15 | <15 | >15 | <15 | >15 | |

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead-212, lead-214, 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 are 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 25-mrem/yr dose.

cm = Centimeter
ft bgs = Feet below ground surface
mrem/yr = Millirem per year
N/A = Not applicable
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
> = Greater than
< = Less than
G = Sample density differs by more than 15% of laboratory control sample density
J = Estimated value
LT = Result is less than the requested minimum detectable concentration, greater than the sample specific minimum detectable concentration
TI = Tentatively identified

# Table D.2-6
# Sample Results for Isotopic Uranium, Isotopic Plutonium, and Strontium-90 Detected Above Minimum Detectable Concentrations at CAS 12-44-01, ER 12-1 Well Site Release

| 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 |
| **Final Action Levels[a]** | | | **13** | **12.7** | **838** | **143** | **17.6** | **105** |
| A01 | 540A001 | 0.0 - 0.5 | -- | 0.248 | -- | 0.8 | 0.98 | -- |
| | 540A002 | 2.0 - 2.5 | -- | -- | 0.73 | 0.96 | -- | 0.99 |
| | 540A003 | 2.0 - 2.5 | -- | -- | -- | 0.97 | 0.066 | 0.98 |
| | 540A004 | 6.0 - 6.5 | -- | 0.018 (LT) | -- | 0.78 | 0.055 | 0.88 |
| A02 | 540A005 | 0.0 - 0.5 | -- | 0.042 (LT) | -- | 0.95 | 0.071 | 1 |
| | 540A006 | 2.0 - 2.5 | 0.51 | 2.17 | -- | 0.73 | 0.077 | 0.83 |
| | 540A007 | 3.0 - 3.5 | 0.039 (LT) | 0.391 | -- | 0.85 | -- | 1.01 |
| A03 | 540A008 | 0.0 - 0.5 | -- | -- | -- | 0.99 | -- | 0.86 |
| | 540A009 | 2.5 - 3.0 | -- | -- | -- | 1.14 | -- | 1.13 |
| A04 | 540A010 | 0.0 - 0.5 | -- | 0.03 (LT) | -- | 0.84 | 0.044 (LT) | 0.9 |
| | 540A011 | 1.5 - 2.0 | -- | -- | -- | 0.85 | 0.066 | 0.95 |
| | 540A012 | 2.5 - 3.0 | -- | -- | -- | 0.72 | -- | 0.77 |
| A05 | 540A013 | 0.0 - 0.5 | 0.097 | 0.234 | -- | 0.98 | -- | 0.92 |
| | 540A014 | 1.5 - 2.0 | -- | 0.128 | -- | 1.01 | 0.055 | 0.98 |
| A06 | 540A015 | 0.0 - 0.5 | 0.039 (LT) | 0.237 | -- | 0.9 | 0.049 (LT) | 1.02 |
| | 540A016 | 1.5 - 2.0 | 0.142 | 0.475 | -- | 0.73 | 0.064 | 0.88 |
| A07 | 540A017 | 0.0 - 0.5 | 0.027 (LT) | 0.499 | -- | 0.76 | 0.05 | 0.94 |
| | 540A018 | 1.5 - 2.0 | -- | 0.439 | -- | 0.79 | 0.074 | 0.89 |

[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 25-morn/yr dose.

ft bgs = Feet below ground surface
mrem/yr = Millirem per year
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
LT = Result is less than the requested minimum detectable concentration, greater than the sample specific minimum detectable concentration

## D.3.0 CAS 12-99-01, Oil Stained Dirt

The following sections provide analytical results from the samples collected to complete investigation activities as outlined in the SAFER Plan. Environmental investigation samples were analyzed for the SAFER Plan-specified COPCs, which included VOCs, SVOCs, TPH-DRO and -GRO, RCRA metals, gamma-emitting radionuclides, isotopic U, isotopic Pu, and Sr-90.

Analytical results from the soil samples with concentrations exceeding MDLs are summarized in the following sections. An evaluation was conducted on all contaminants detected above MDLs by initially comparing individual concentration or activity results against the PALs. Samples collected and the analyses performed are listed in Table D.3-1. Sample locations are identified in Figure D.3-1.

**Table D.3-1**
**Samples Collected at CAS 12-99-01, Oil Stained Dirt**

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose* | Analyses |
|---|---|---|---|---|---|
| B01 | 540B001 | 0.0 - 0.5 | Soil in trough | Environmental | Set 1 |
| B02 | 540B002 | 0.0 - 0.5 | Soil | Environmental, MS/MSD | Set 1 |
| B03 | 540B003 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540B004 | 0.0 - 0.5 | Soil | Field Duplicate of #540B003 | Set 1 |
| B04 | 540B005 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| N/A | 540B301 | N/A | Water | Trip Blank | VOCs only |
| N/A | 540B302 | N/A | Water | Field Blank | Set 1 |

* No equipment rinsate generated at this CAS; all disposable sampling equipment for surface samples only
Set 1 = Total VOCs, Total SVOCs, Total RCRA Metals, TPH-DRO and -GRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90

ft bgs = Feet below ground surface
MS/MSD = Matrix spike/matrix spike duplicate
N/A = Not applicable

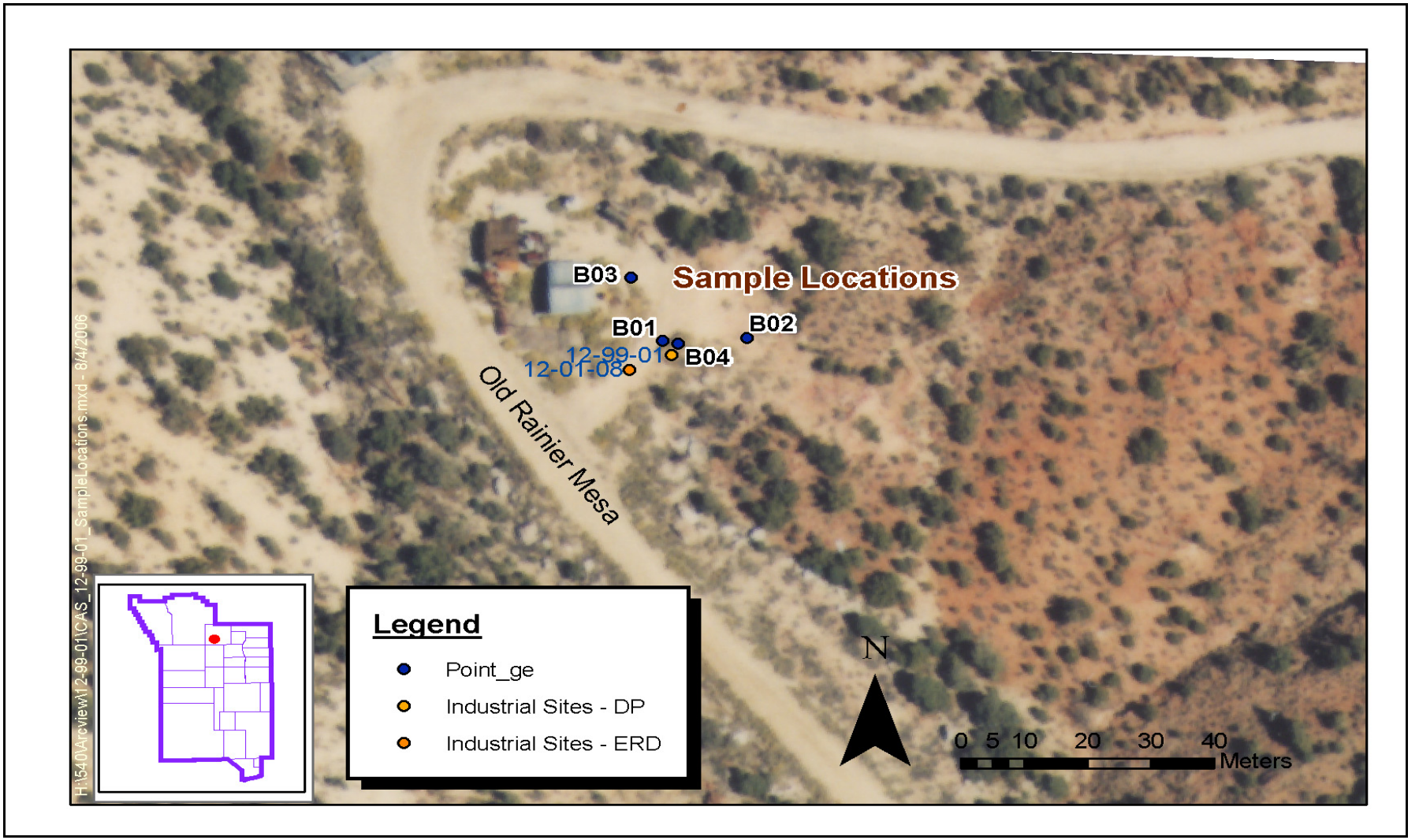


**Figure D.3-1**
**Sample Locations for CAS 12-99-01**

### D.3.1 Volatile Organic Compounds

No VOCs were detected with analytical results above the laboratory MDLs in any of the soil samples collected at this CAS.

### D.3.2 Semivolatile Organic Compounds

Analytical results for SVOCs in soil samples collected at this CAS detected with analytical results above their respective laboratory MDLs are presented in Table D.3-2. None of the SVOC concentrations exceeded their respective PALs.

**Table D.3-2**
**Sample Results for SVOCs Detected Above**
**Minimum Detectable Concentrations at CAS 12-99-01, Oil Stained Dirt**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (µg/kg) |
|---|---|---|---|
| | | | Bis(2-Ethylhexyl)Phthalate |
| Final Action Levels[a] | | | 120,000 |
| B02 | 540B002 | 0.0 - 0.5 | 600 (J) |

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals* (PRGs) (EPA, 2004).

ft bgs = Feet below ground surface
µg/kg = Micrograms per kilogram
J = Estimated value

### D.3.3 Total Petroleum Hydrocarbons

Total petroleum hydrocarbon-DRO analytical results for soil samples collected at this CAS that were detected above laboratory MDLs are presented in Table D.3-3. For those samples whose analytical results exceeded the PAL of 100 mg/kg, a Tier 2 evaluation was conducted by evaluating the hazardous constituents of diesel (see Section H.1.10). This evaluation determined that none of the hazardous constituents of diesel were identified in the VOC or SVOC analyses at concentrations above their respective FALs; therefore, the TPH-DRO detected at this CAS is not considered a COC.

**Table D.3-3**
**Sample Results for TPH-DRO Detected Above**
**Minimum Detectable Concentrations at CAS 12-99-01, Oil Stained Dirt**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) |
|---|---|---|---|
| | | | Diesel-Range Organics |
| **Preliminary Action Levels[a]** | | | **100** |
| B01 | 540B001 | 0.0 - 0.5 | **270 (M)** |
| B02 | 540B002 | 0.0 - 0.5 | **190 (M)** |
| B03 | 540B003 | 0.0 - 0.5 | **490 (M)** |
| | 540B004 | 0.0 - 0.5 | **540 (M)** |
| B04 | 540B005 | 0.0 - 0.5 | **2,000 (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
M = Chromatogram resembling motor oil identified

### *D.3.4 Polychlorinated Biphenyls*

Analytical results for PCBs in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.3-4. Polychlorinated biphenyl concentrations did not exceed their respective PALs.

**Table D.3-4**
**Sample Results for PCBs Detected Above Minimum**
**Detectable Concentrations at CAS 12-99-01, Oil Stained Dirt**
(Page 1 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (µg/kg) |
|---|---|---|---|
| | | | Aroclor 1260 |
| **Final Action Levels[a]** | | | **740** |
| B01 | 540B001 | 0.0 - 0.5 | 110 |
| B02 | 540B002 | 0.0 - 0.5 | 580 |
| B03 | 540B003 | 0.0 - 0.5 | 69 (J) |
| | 540B004 | 0.0 - 0.5 | 62 (J) |

**Table D.3-4**
**Sample Results for PCBs Detected Above Minimum Detectable Concentrations at CAS 12-99-01, Oil Stained Dirt**
(Page 2 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (µg/kg) |
|---|---|---|---|
| | | | Aroclor 1260 |
| Final Action Levels[a] | | | 740 |
| B04 | 540B005 | 0.0 - 0.5 | 28 (J) |

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
µg/kg = Micrograms per kilogram
J = Estimated value

### *D.3.5 RCRA Metals*

Analytical results for RCRA metals detected in soil samples collected at this CAS that are above their respective laboratory MDLs are presented in Table D.3-5. None of the RCRA metal concentrations exceeded their respective PALs.

### *D.3.6 Gamma-Emitting Radionuclides*

Gamma-emitting radionuclide analytical results for soil samples collected at this CAS that were detected above laboratory MDLs are presented in Table D.3-6. No gamma-emitting radionuclide concentrations exceeded their respective PALs.

### *D.3.7 Isotopic Radionuclides*

Isotopic radionuclide analytical results for soil samples collected at this CAS that were detected above MDLs are presented in Table D.3-7. No isotopic radionuclide concentrations exceeded their respective PALs.

## Table D.3-5
## Sample Results for Total RCRA Metals Detected Above Minimum Detectable Concentrations at CAS 12-99-01, Oil Stained Dirt

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Barium | Cadmium | Chromium | Lead | Mercury | Silver |
| **Final Action Levels** | | | **23[a]** | **67,000[b]** | **450[b]** | **450[b]** | **800[b]** | **310[b]** | **5,100[b]** |
| B01 | 540B001 | 0.0 - 0.5 | 14 | 260 (J) | 3.3 | 69 (J) | 480 (J) | 0.038 (J-) | 0.67 (B) |
| B02 | 540B002 | 0.0 - 0.5 | 5.8 | 250 (J) | 1.1 | 12 (J) | 120 (J) | 0.077 | -- |
| B03 | 540B003 | 0.0 - 0.5 | 5.1 | 110 (J) | 6.5 | 25 (J) | 46 (J) | 0.038 (J-) | -- |
| | 540B004 | 0.0 - 0.5 | 4.7 | 100 (J) | 5.9 | 21 (J) | 36 (J) | 0.055 | -- |
| B04 | 540B005 | 0.0 - 0.5 | 13 | 190 (J) | 1.3 (B) | 40 (J) | 200 (J) | 0.043 | 0.17 (B) |

[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 U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
-- = Not detected above minimum detectable concentrations
B = Value less than the contract required detection limit but greater than or equal to the instrument detection limit
J = Estimated value
J- = The result is an estimated quantity, but the result may be biased low

## Table D.3-6
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 12-99-01, Oil Stained Dirt
(Page 1 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | Americium-241[b] | Bismuth-214[a] | Cesium-137[b] | Lead-212[a] | Lead-214[a] | Thallium-208[a] |
| **Final Action Levels** | | | **5** | **12.7** | **5** | **12.2** | **5** | **5** | **5** |
| **Depth bgs (cm)** | | | **<15** | | **<15** | | **<15** | **<15** | **<15** |
| B01 | 540B001 | 0.0 - 0.5 | 1.37 (G) | 1.53 (J) | 0.76 (G, J) | 10 (G) | 1.51 (J) | 1.08 (G, J) | 0.44 (G) |
| B02 | 540B002 | 0.0 - 0.5 | 2.26 (G) | -- | 1.08 (G, J) | 3.23 (G) | 2.35 (J) | 1.13 (G, J) | 0.7 (G) |

# Table D.3-6
# Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 12-99-01, Oil Stained Dirt
(Page 2 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | Americium-241[b] | Bismuth-214[a] | Cesium-137[b] | Lead-212[a] | Lead-214[a] | Thallium-208[a] |
| **Final Action Levels** | | | **5** | **12.7** | **5** | **12.2** | **5** | **5** | **5** |
| **Depth bgs (cm)** | | | **<15** | | **<15** | | **<15** | **<15** | **<15** |
| B03 | 540B003 | 0.0 - 0.5 | 2.12 (G) | 0.94 (J) | 0.9 (G, J) | 2.95 (G) | 2.15 (J) | 1.06 (G, J) | 0.69 (G) |
| | 540B004 | 0.0 - 0.5 | 1.41 (G) | -- | 1.02 (G, J) | 2.81 (G) | 2.26 (J) | 1.37 (G, J) | 0.81 (G) |
| B04 | 540A005 | 0.0 - 0.5 | -- | -- | -- | 4.99 (G) | 0.8 (J) | 0.65 (G, J) | -- |

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead-212, lead-214, 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 are 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 25-mrem/yr dose.

cm = Centimeter
ft bgs = Feet below ground surface
mrem/yr = Millirem per year
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
G = Sample density differs by more than 15% of laboratory control sample density
J = Estimated value

## Table D.3-7
## Sample Results for Isotopic Uranium, Isotopic Plutonium, and Strontium-90 Detected Above Minimum Detectable Concentrations at CAS 12-99-01, Oil Stained Dirt

| 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 |
| **Final Action Levels[a]** | | | **13** | **12.7** | **838** | **143** | **17.6** | **105** |
| B01 | 540B001 | 0.0 - 0.5 | 0.189 | 7.2 | 0.42 (LT) | 0.83 | 0.076 | 0.8 |
| B02 | 540B002 | 0.0 - 0.5 | 0.126 | 2.88 | -- | 0.93 | -- | 0.9 |
| B03 | 540B003 | 0.0 - 0.5 | 0.372 | 5.2 | 0.269 (LT) | 0.86 | 0.063 | 0.99 |
| | 540B004 | 0.0 - 0.5 | 0.163 | 2.55 | 0.38 (LT) | 0.89 | -- | 0.95 |
| B04 | 540B005 | 0.0 - 0.5 | 0.264 | 9.6 | -- | 0.5 | -- | 0.56 |

[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 25-mrem/yr dose.

ft bgs = Feet below ground surface
mrem/yr = Millirem per year
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
LT = Result is less than the requested minimum detectable concentration, greater than the sample specific minimum detectable concentration

# D.4.0 CAS 19-25-02, Oil Spill

The following sections provide analytical results from the samples collected to complete investigation activities as outlined in the SAFER Plan. Environmental investigation samples were analyzed for the SAFER Plan-specified COPCs, which included VOCs, SVOCs, TPH-DRO and -GRO, RCRA metals, gamma-emitting radionuclides, isotopic U, isotopic Pu, and Sr-90.

Analytical results from the soil samples with concentrations exceeding MDLs are summarized in the following sections. An evaluation was conducted on all contaminants detected above MDLs by initially comparing individual concentration or activity results against the PALs. Samples collected and the analyses performed are listed in Table D.4-1. Sample locations are identified in Figure D.4-1.

**Table D.4-1**
**Samples Collected at CAS 19-25-02, Oil Spill**
(Page 1 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose | Analyses |
|---|---|---|---|---|---|
| C01 | 540C001 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540C002 | 0.0 - 0.5 | Soil | Field Duplicate of #540C001 | Set 1 |
| | 540C005 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| C02 | 540C003 | 0.0 - 0.5 | Soil | Environmental, MS/MSD | Set 1 |
| | 540C006 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| C03 | 540C004 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540C007 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| C04 | 540C008 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540C012 | 2.5 - 3.0 | Soil | Environmental | Set 1 |
| C05 | 540C009 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540C013 | 2.5 - 3.0 | Soil | Environmental | Set 1 |
| C06 | 540C010 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540C014 | 2.5 - 3.0 | Soil | Environmental | Set 1 |
| C07 | 540C011 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540C015 | 2.5 - 3.0 | Soil | Environmental | Set 1 |

**Table D.4-1**
**Samples Collected at CAS 19-25-02, Oil Spill**
(Page 2 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose | Analyses |
|---|---|---|---|---|---|
| N/A | 540C301 | N/A | Water | Trip Blank | VOCs only |
| N/A | 540C501 | N/A | Liquid | Equipment Rinsate | Set 2 |

Set 1 = Total VOCs, Total SVOCs, Total RCRA Metals, TPH-DRO and -GRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90
Set 2 = Gross Alpha/Beta, Tritium

ft bgs = Feet below ground surface
MS/MSD = Matrix spike/matrix spike duplicate
N/A = Not applicable

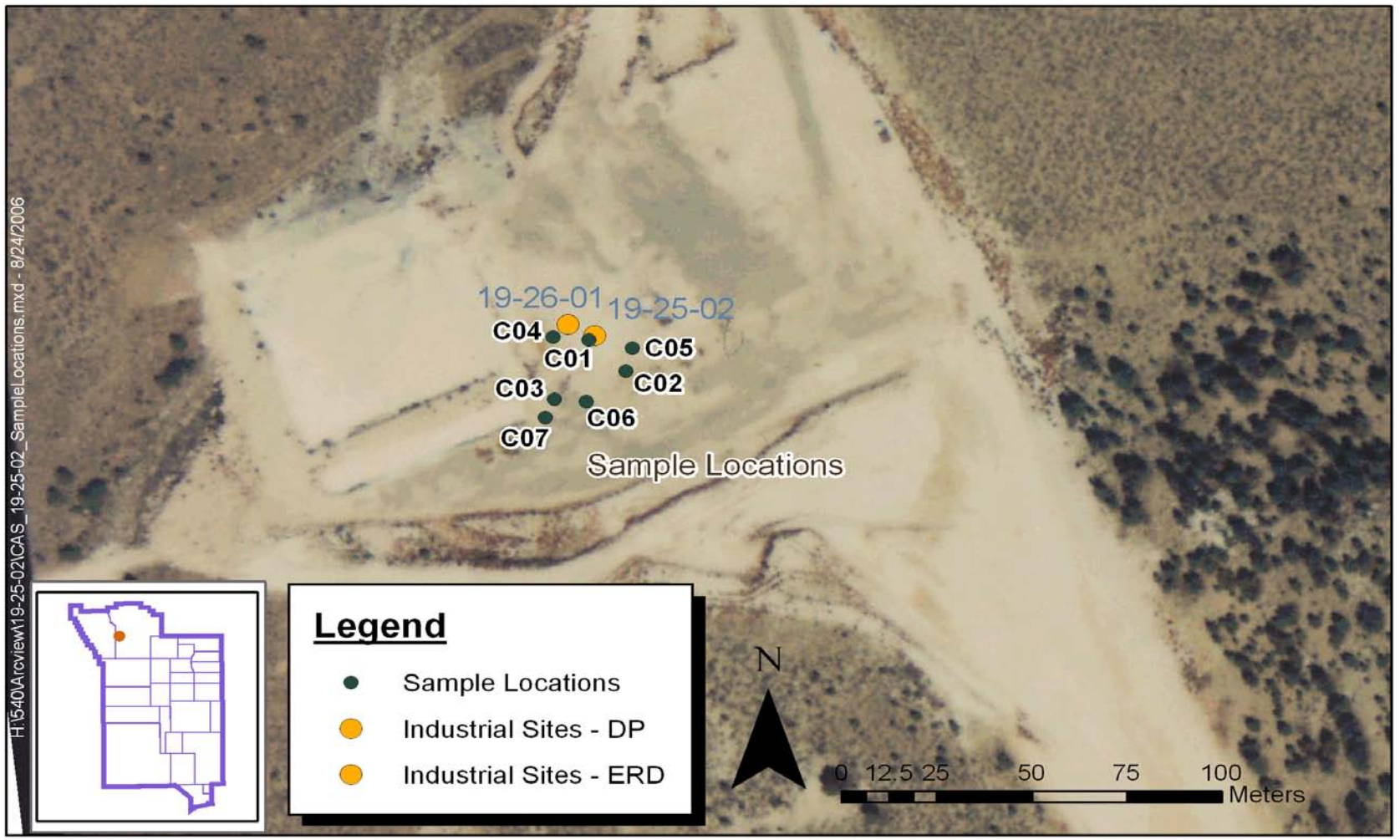


**Figure D.4-1**
**Sample Locations for CAS 19-25-02**

### *D.4.1 Volatile Organic Compounds*

Analytical results for VOCs detected in soil samples at this CAS that are above their respective laboratory MDLs are presented in Table D.4-2. No VOCs were detected above their respective PALS.

**Table D.4-2**
**Sample Results for Total VOCs Detected Above Minimum Detectable Concentrations at CAS 19-25-02, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) |
|---|---|---|---|
| | | | Acetone |
| **Final Action Levels[a]** | | | **54,000,000** |
| C06 | 540C014 | 0.0 - 0.5 | 13 (J) |

[a]Based on U.S. Environmental Protection Agency, Region 9 Preliminary Remediation Goals *(PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
mg/kg = Micrograms per kilogram
J = Estimated value

### *D.4.2 Semivolatile Organic Compounds*

Analytical results for SVOCs detected in soil samples collected at this CAS that are above their respective laboratory MDLs are presented in Table D.4-3. None of the SVOC concentrations exceeded their respective PALs.

# Table D.4-3
# Sample Results for Total SVOCs Detected Above Minimum Detectable Concentrations at CAS 19-25-02, Oil Spill

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (µg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Benzoic Acid | Bis(2-Ethylhexyl)Phthalate | Butylbenzylphthalate | Pyrene | Chrysene | Benzo(a)anthracene |
| **Final Action Levels[a]** | | | 100,000,000 | 120,000 | 100,000,000 | 29,000,000 | 210,000 | 2,100 |
| C02 | 540C003RR1 | 0.0 - 0.5 | 2,400 (J) | 2,700 (J) | 1,100 (J) | 250 (J) | 110 (J) | -- |
| C03 | 540C004 | 0.0 - 0.5 | -- | 1,700(J) | -- | -- | -- | 99 (J) |
| | 540C007 | 2.0 - 2.5 | 660 (J) | -- | -- | -- | -- | -- |
| C05 | 540C009 | 0.0 - 0.5 | 590 (J) | -- | -- | -- | 20 (J) | -- |

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

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

### *D.4.3 Total Petroleum Hydrocarbons*

The TPH-DRO and -GRO analytical results detected in soil samples collected at this CAS that are above the laboratory MDLs are presented in Table D.4-4. For those samples whose analytical results exceeded the PAL of 100 mg/kg, a Tier 2 evaluation was conducted by evaluating the hazardous constituents of diesel (see Section H.1.10). This evaluation determined that none of the hazardous constituents of diesel were identified in the VOC or SVOC analyses at concentrations above their respective FALs; therefore, the TPH-DRO detected at this CAS is not considered a COC.

**Table D.4-4**
**Sample Results for TPH-DRO Detected Above**
**Minimum Detectable Concentrations at CAS 19-25-02, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) |
|---|---|---|---|
| | | | Diesel-Range Organics |
| **Preliminary Action Levels[a]** | | | **100** |
| C01 | 540C001 | 0.0 - 0.5 | **34,000 (J)** |
| | 540C002 | 0.0 - 0.5 | **35,000 (J)** |
| | 540C005 | 2.0 - 2.5 | **110 (M)** |
| C02 | 540C003 | 0.0 - 0.5 | **6,400 (H, M)** |
| | 540C006 | 2.0 - 2.5 | 5.7 (J) |
| C03 | 540C004 | 0.0 - 0.5 | **2,700 (H)** |
| C05 | 540C009 | 0.0 - 0.5 | **340 (H)** |
| C07 | 540C011 | 0.0 - 0.5 | 17 (H) |

[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
J = Estimated value
M = Chromatogram resembles that of motor oil
H = Fuel pattern in the heavier end of retention time window

### D.4.4 Polychlorinated Biphenyls

No Polychlorinated biphenyls were detected above laboratory MDLs in any of the soil samples collected at this CAS.

### D.4.5 RCRA Metals

Analytical results for RCRA metals in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.4-5. None of the RCRA metal concentrations exceeded their respective PALs.

**Table D.4-5**
**Sample Results for Total RCRA Metals Detected Above Minimum Detectable Concentrations at CAS 19-25-02, Oil Spill**
(Page 1 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Barium | Cadmium | Chromium | Lead | Mercury |
| **Final Action Levels** | | | **23[a]** | **67,000[b]** | **450[b]** | **450[b]** | **800[b]** | **310[b]** |
| C01 | 540C001 | 0.0 - 0.5 | 1.6 | 85 | 0.091 (B) | 1.8 | 4.9 | 0.0083 (J-) |
| | 540C002 | 0.0 - 0.5 | 1.5 | 110 | 0.33 (B) | 2.2 | 4.9 | 0.0066 (J-) |
| | 540C005 | 2.0 - 2.5 | 3.2 | 100 | -- | 4.9 | 7.4 | 0.0068 (J-) |
| C02 | 540C003 | 0.0 - 0.5 | 2.9 | 94 | 0.091 (B) | 4.6 | 7.2 | -- |
| | 540C006 | 2.0 - 2.5 | 2.7 | 85 | -- | 4 | 6.4 | 0.0019 (J-) |
| C03 | 540C004 | 0.0 - 0.5 | 3.4 | 95 | -- | 5.4 | 7.9 | 0.0057 (J-) |
| | 540C007 | 2.0 - 2.5 | 2.5 | 97 | -- | 3.7 | 6.8 | 0.0025 (J-) |
| C04 | 540C008 | 0.0 - 0.5 | -- | 98 | -- | 2.3 | 4.8 | 0.013 (J-) |
| | 540C012 | 2.5 - 3.0 | 3.9 | 110 | -- | 6.1 | 8.6 | 0.0064 (J-) |

**Table D.4-5**
**Sample Results for Total RCRA Metals Detected Above Minimum Detectable Concentrations at CAS 19-25-02, Oil Spill**
(Page 2 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Barium | Cadmium | Chromium | Lead | Mercury |
| **Final Action Levels** | | | **23[a]** | **67,000[b]** | **450[b]** | **450[b]** | **800[b]** | **310[b]** |
| C05 | 540C009 | 0.0 - 0.5 | 2.8 | 91 | -- | 4 | 7 | 0.0054 (J-) |
| | 540C013 | 2.5 - 3.0 | 3.6 | 100 | -- | 4.5 | 7.9 | 0.0048 (J-) |
| C06 | 540C010 | 0.0 - 0.5 | 2.1 | 85 | -- | 3 | 6.1 | 0.007 (J-) |
| | 540C014 | 2.5 - 3.0 | -- | 62 | -- | 3.4 | 4.1 | -- |
| C07 | 540C011 | 0.0 - 0.5 | 3.2 | 110 | -- | 4.5 | 8.3 | 0.0054 (J-) |
| | 540C015 | 2.5 - 3.0 | -- | 110 | -- | 2 | 6.5 | 0.0064 (J-) |

[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 U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
-- = Not detected above minimum detectable concentrations
B = Value less than the contract required detection limit but greater than or equal to the instrument detection limit
J- = The result is an estimated quantity, but the result may be biased low

### *D.4.6 Gamma-Emitting Radionuclides*

Gamma-emitting radionuclide analytical results for soil samples collected at this CAS that were detected above their respective laboratory MDLs are presented in Table D.4-6. None of the gamma-emitting radionuclide concentrations exceeded their respective PALs.

# Table D.4-6
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-02, Oil Spill
(Page 1 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | | Bismuth-214[a] | | Lead-212[a] | | Lead-214[a] | | Thallium-208[a] | | Thorium-234[b] |
| **Final Action Levels** | | | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** | **105** |
| **Depth bgs (cm)** | | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | |
| C01 | 540C001 | 0.0 - 0.5 | 2.06 (G) | N/A | 1.75 (G, J) | N/A | 2.95 (J) | N/A | 1.8 (G, J) | N/A | 0.81 (G) | N/A | -- |
| | 540C002 | 0.0 - 0.5 | 2.78 (G) | N/A | 1.77 (G, J) | N/A | 2.81 (J) | N/A | 1.84 (G, J). | N/A | 1.02 (G) | N/A | -- |
| | 540C005 | 2.0 - 2.5 | N/A | 2.2 (G) | N/A | 1.58 (G, J) | N/A | 3.31 (J) | N/A | 1.89 (G, J) | N/A | 1.04 (G) | -- |
| C02 | 540C003 | 0.0 - 0.5 | 2.62 (G) | N/A | 1.28 (G, J) | N/A | 3.02 (J) | N/A | 1.41 (G, J) | N/A | 0.79 (G) | N/A | -- |
| | 540C006 | 2.0 - 2.5 | N/A | 2.8 (G) | N/A | 1.34 (G, J) | N/A | 3.47 (J) | N/A | 1.62 (G, J) | N/A | 0.96 (G) | -- |
| C03 | 540C004 | 0.0 - 0.5 | 2.33 (G) | N/A | 1.34 (G, J) | N/A | 2.73 (J) | N/A | 1.4 (G, J) | N/A | 0.89 (G) | N/A | -- |
| | 540C007 | 2.0 - 2.5 | N/A | 2.8 (G) | N/A | 1.09 (G, J) | N/A | 3.58 (J) | N/A | 1.57 (G, J) | N/A | 1.09 (G) | -- |
| C04 | 540C008 | 0.0 - 0.5 | 2.95 (G) | N/A | 1.42 (G, J) | N/A | 3.79 (J) | N/A | 1.66 (G, J) | N/A | 1.06 (G) | N/A | -- |
| | 540C012 | 2.5 - 3.0 | N/A | 2.82 (G) | N/A | 1.99 (G, J) | N/A | 3.1 (J) | N/A | 1.87 (G, J) | N/A | 1.03 (G) | -- |
| C05 | 540C009 | 0.0 - 0.5 | 2.6 (G) | N/A | 1.52 (G, J) | N/A | 3.16 (J) | N/A | 1.46 (G, J) | N/A | 0.91 (G) | N/A | 3.9 (G, TI) |
| | 540C013 | 2.5 - 3.0 | N/A | 3.37 (G) | N/A | 1.5 (G, J) | N/A | 3.75 (J) | N/A | 1.72 (G, J) | N/A | 0.88 (G) | -- |
| C06 | 540C010 | 0.0 - 0.5 | 3.13 (G) | N/A | 1.49 (G, J) | N/A | 3.13 (J) | N/A | 1.65 (G,J) | N/A | 1.02 (G) | N/A | -- |
| | 540C014 | 2.5 - 3.0 | N/A | 2.57 (G) | N/A | 0.89 (G, J) | N/A | 3.55 (J) | N/A | 1.32 (G, J) | N/A | 0.9 (G) | -- |
| C07 | 540C011 | 0.0 - 0.5 | 2.48 (G) | N/A | 1.23 (G, J) | N/A | 3.27 (J) | N/A | 1.59 (G, J) | N/A | 1.11 (G) | N/A | -- |
| | 540C015 | 2.5 - 3.0 | N/A | 2.96 (G) | N/A | 1.0 (G, J) | N/A | 3.51 (J) | N/A | 1.38 (G, J) | N/A | 1.12 (G) | 5.7 (G, TI) |

# Table D.4-6
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-02, Oil Spill
(Page 2 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | | Bismuth-214[a] | | Lead-212[a] | | Lead-214[a] | | Thallium-208[a] | | Thorium-234[b] |
| **Final Action Levels** | | | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 | 105 |
| **Depth bgs (cm)** | | | <15 | >15 | <15 | >15 | <15 | >15 | <15 | >15 | <15 | >15 | |

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead-212, lead-214, 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 are 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 25-mrem/yr dose.

cm = Centimeter
ft bgs = Feet below ground surface
mrem/yr = Millirem per year
N/A = Not applicable
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
< = Less than
> = Greater than
G = Sample density differs by more than 15% of laboratory control sample density
J = Estimated value
LT = Result is less than the requested minimum detectable concentration, greater than the sample specific minimum detectable concentration
TI = Tentatively identified

### *D.4.7 Isotopic Radionuclides*

Isotopic radionuclide analytical results for soil samples collected at this CAS that were detected above laboratory MDLs are presented in Table D.4-7. No isotopic radionuclides were detected at concentrations exceeding their respective PALs.

**Table D.4-7**
**Sample Results for Isotopic Uranium and Isotopic Plutonium Detected Above Minimum Detectable Concentrations at CAS 19-25-02, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | |
|---|---|---|---|---|---|---|---|
| | | | Plutonium-238 | Plutonium-239 | Uranium-234 | Uranium-235 | Uranium-238 |
| **Final Action Levels[a]** | | | **13** | **12.7** | **143** | **17.6** | **105** |
| C01 | 540C001 | 0.0 - 0.5 | -- | -- | 1.25 | 0.052 | 1.21 |
| | 540C002 | 0.0 - 0.5 | -- | -- | 1.33 | 0.109 | 1.46 |
| | 540C005 | 2.0 - 2.5 | -- | -- | 1.46 | 0.084 | 1.36 |
| C02 | 540C003 | 0.0 - 0.5 | -- | -- | 0.99 | 0.077 | 1.07 |
| | 540C006 | 2.0 - 2.5 | -- | -- | 1.18 | 0.116 | 1 |
| C03 | 540C004 | 0.0 - 0.5 | 0.046 (LT) | 0.054 | 1.15 | 0.086 | 1.07 |
| | 540C007 | 2.0 - 2.5 | -- | -- | 1.07 | 0.092 | 1.03 |
| C04 | 540C008 | 0.0 - 0.5 | -- | -- | 1.44 | 0.14 | 1.55 |
| | 540C012 | 2.5 - 3.0 | -- | -- | 1.56 | -- | 1.51 |
| C05 | 540C009 | 0.0 - 0.5 | -- | -- | 1.08 | -- | 1.15 |
| | 540C013 | 2.5 - 3.0 | -- | -- | 1.25 | -- | 1.27 |
| C06 | 540C010 | 0.0 - 0.5 | -- | 0.031 (LT) | 1.29 | 0.083 | 1.39 |
| | 540C014 | 2.5 - 3.0 | -- | -- | 1.08 | 0.087 | 1.05 |
| C07 | 540C011 | 0.0 - 0.5 | -- | -- | 1.16 | 0.067 | 1.05 |
| | 540C015 | 2.5 - 3.0 | -- | -- | 0.98 | 0.086 | 1.04 |

[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 25-mrem/yr dose.

ft bgs = Feet below ground surface
mrem/yr = Millirem per year
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
LT = Result is less than the requested minimum detectable concentration, greater than the sample specific minimum detectable concentration

# D.5.0 CAS 19-25-04, Oil Spill

The following sections provide analytical results from the samples collected to complete investigation activities as outlined in the SAFER Plan. Environmental investigation samples were analyzed for the SAFER Plan-specified COPCs, which included VOCs, SVOCs, TPH-DRO and -GRO, RCRA metals, gamma-emitting radionuclides, isotopic U, isotopic Pu, and Sr-90.

Analytical results from the soil samples with concentrations exceeding MDLs are summarized in the following sections. An evaluation was conducted on all contaminants detected above MDLs by initially comparing individual concentration or activity results against the PALs. Samples collected and the analyses performed are listed in Table D.5-1. Sample locations are identified in Figure D.5-1.

**Table D.5-1**
**Samples Collected at CAS 19-25-04, Oil Spill**
(Page 1 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose | Analyses |
|---|---|---|---|---|---|
| D01 | 540D001 | 0.0 - 0.5 | Soil | Environmental, MS/MSD | Set 1 |
| | 540D002 | 0.5 - 1.0 | Soil | Environmental | Set 1 |
| D02 | 540D003 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540D004 | 0.0 - 0.5 | Soil | Field Duplicate of #540D003 | Set 1 |
| | 540D005 | 0.5 - 1.0 | Soil | Environmental | Set 1 |
| D03 | 540D006 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540D007 | 0.5 - 1.0 | Soil | Environmental | Set 1 |
| D04 | 540D008 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540D009 | 0.5 - 1.0 | Soil | Environmental | Set 1 |
| D04A | 540D012 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540D013 | 0.5 - 1.0 | Soil | Environmental | Set 1 |
| D05 | 540D010 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540D011 | 0.5 - 1.0 | Soil | Environmental | Set 1 |
| D06 | 540D014 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540D015 | 0.5 - 1.0 | Soil | Environmental | Set 1 |

# Table D.5-1
# Samples Collected at CAS 19-25-04, Oil Spill
(Page 2 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose | Analyses |
|---|---|---|---|---|---|
| N/A | 540D301 | N/A | Water | Trip Blank | VOCs only |
| N/A | 540D302 | N/A | Water | Field Blank | Set 1 |
| N/A | 540D303 | N/A | Water | Trip Blank | VOCs only |
| N/A | 540D501 | N/A | Liquid | Equipment Rinsate | Set 2 |

Set 1 = Total VOCs, Total SVOCs, Total RCRA Metals, TPH-DRO and -GRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90
Set 2 = Gross Alpha/Beta, Tritium

ft bgs = Feet below ground surface
MS/MSD = Matrix spike/matrix spike duplicate
N/A = Not applicable

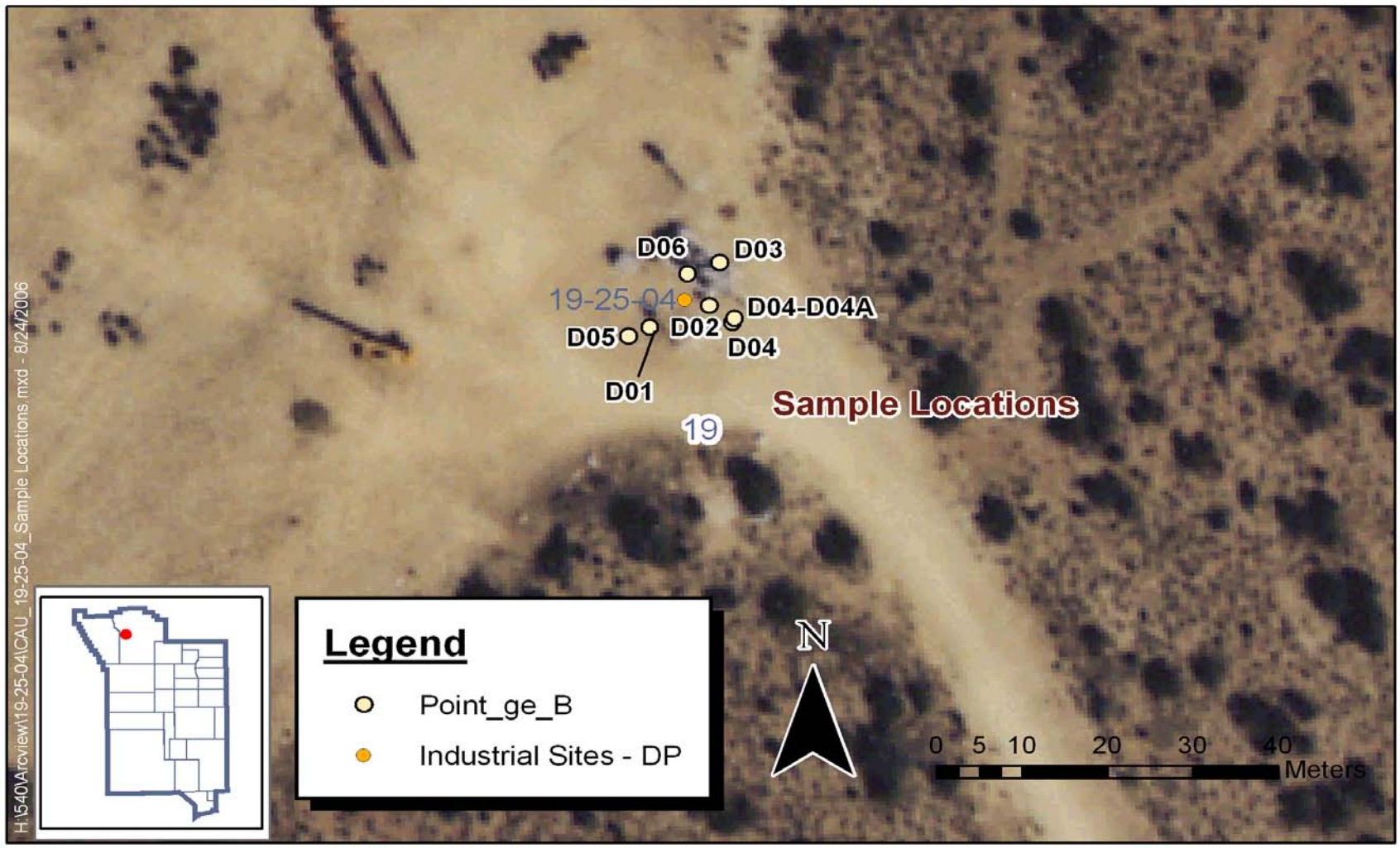


**Figure D.5-1**
**Sample Locations for CAS 19-25-04**

### D.5.1 Volatile Organic Compounds

Analytical results for VOCs in soil samples collected at this CAS that were detected above their respective MDLs are presented in Table D.5-2. No VOC concentrations exceeded their respective PALs.

**Table D.5-2**
**Sample Results for Total VOCs Detected Above**
**Minimum Detectable Concentrations at CAS 19-25-04, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | |
|---|---|---|---|---|
| | | | Benzene | Toluene |
| **Final Action Levelsa** | | | **1,400** | **520,000** |
| D01 | 540D002 | 0.5 - 1.0 | 1.3 (J) | 1.3 (J) |

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
µg/kg = Micrograms per kilogram
J = Estimated value

### D.5.2 Semivolatile Organic Compounds

Analytical results for SVOCs in soil samples collected at this CAS that were above the laboratory MDLs are presented in Table D.5-3. No SVOCs were at concentrations that exceeded their respective PALs.

### D.5.3 Total Petroleum Hydrocarbons

Total petroleum hydrocarbons-DRO and -GRO analytical results in soil samples collected at this CAS that were detected above their laboratory MDLs are presented in Table D.5-4. For those samples whose analytical results exceeded the PAL of 100 mg/kg, a Tier 2 evaluation was conducted by evaluating the hazardous constituents of diesel (see Section H.1.10). This evaluation determined that none of the hazardous constituents of diesel were identified in the VOC or SVOC analyses at concentrations above their respective FALs; therefore, the TPH-DRO detected at this CAS is not considered a COC.

## Table D.5-3
## Sample Results for Total SVOCs Detected Above Minimum Detectable Concentrations at 19-25-04, Oil Spill

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (µg/kg) |
|---|---|---|---|
| | | | Bis(2-Ethylhexyl)Phthalate |
| **Final Action Levels[a]** | | | **120,000** |
| D01 | 540D001RR1 | 0.0 - 0.5 | 1,100 (J) |
| | 540A002RR1 | 0.5 - 1.0 | 500 (J) |
| D04A | 540D013 | 0.5 - 1.0 | 150 (J) |

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
µg/kg = Micrograms per kilogram
J = Estimated value

## Table D.5-4
## Sample Results for TPH-DRO and TPH-GRO Detected Above Minimum Detectable Concentrations at CAS 19-25-04, Oil Spill

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | |
|---|---|---|---|---|
| | | | Diesel-Range Organics | Gasoline-Range Organics |
| **Preliminary Action Levels[a]** | | | **100** | **100** |
| D01 | 540D001 | 0.0 - 0.5 | **9,900** (J) | -- |
| | 540D002 | 0.5 - 1.0 | **3,900** (J) | 0.52 (J) |
| D02 | 540D003 | 0.0 - 0.5 | 4.3 (J) | -- |
| | 540D005 | 0.5 - 1.0 | 11 (H) | -- |
| D03 | 540D007 | 0.5 - 1.0 | 7 (H) | -- |
| D05 | 540D010 | 0.0 - 0.5 | 8.6 (M) | -- |
| D06 | 540D014 | 0.0 - 0.5 | **25,000** (J) | -- |
| | 540D015 | 0.5 - 1.0 | **880** (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
-- = Not detected above minimum detectable concentrations
H = Fuel pattern in the heavier end of retention time window
J = Estimated value
M = Chromatogram resembles that of motor oil

### D.5.4 Polychlorinated Biphenyls

Polychlorinated biphenyls were not detected above their respective laboratory MDLs in any of the soil samples collected at this CAS.

### D.5.5 RCRA Metals

Analytical results for RCRA metals in soil samples collected at this CAS that were detected above their respective laboratory MDLs are presented in Table D.5-5. None of the RCRA metal concentrations exceeded their respective PALs.

**Table D.5-5**
**Sample Results for Total RCRA Metals Detected Above Minimum Detectable Concentrations at CAS 19-25-04, Oil Spill**
(Page 1 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Barium | Cadmium | Chromium | Lead | Mercury |
| **Final Action Levels** | | | **23[a]** | **67,000[b]** | **450[b]** | **450[b]** | **800[b]** | **310[b]** |
| D01 | 540D001 | 0.0 - 0.5 | 5 | 110 | 0.24 (B) | 7.1 | 16 | 0.092 (J-) |
| | 540D002 | 0.5 - 1.0 | 6.3 | 110 | -- | 6.1 | 13 | 0.018 (J-) |
| D02 | 540D003 | 0.0 - 0.5 | 4.2 | 79 | -- | 3.7 | 13 | 0.021 (J-) |
| | 540D004 | 0.0 - 0.5 | 4.6 | 80 | -- | 3.8 | 11 | 0.019 (J-) |
| | 540D005 | 0.5 - 1.0 | 7.9 | 130 | -- | 5.1 | 10 | 0.025 (J-) |
| D03 | 540D006 | 0.0 - 0.5 | 5.3 | 110 | -- | 6.8 | 14 | 0.019 (J-) |
| | 540D007 | 0.5 - 1.0 | 6.3 | 120 | -- | 5.7 | 11 | 0.034 (J-) |
| D04 | 540D008 | 0.0 - 0.5 | 5.6 | 110 | -- | 4.7 | 12 | 0.03 (J-) |
| | 540D009 | 0.5 - 1.0 | 5.9 | 120 | -- | 7.1 | 15 | 0.024 (J-) |
| D04A | 540D012 | 0.0 - 0.5 | 5.6 | 110 | -- | 6.5 | 14 | 0.015 (J-) |
| | 540D013 | 0.5 - 1.0 | 5.6 | 110 | -- | 7.3 | 15 | 0.013 (J-) |
| D05 | 540D010 | 0.0 - 0.5 | 5.4 | 98 | -- | 4.6 | 14 | 0.024 (J-) |
| | 540D011 | 0.5 - 1.0 | 5.8 | 120 | -- | 6 | 12 | 0.027 (J-) |

**Table D.5-5**
**Sample Results for Total RCRA Metals Detected Above Minimum Detectable Concentrations at CAS 19-25-04, Oil Spill**
(Page 2 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Barium | Cadmium | Chromium | Lead | Mercury |
| **Final Action Levels** | | | **23[a]** | **67,000[b]** | **450[b]** | **450[b]** | **800[b]** | **310[b]** |
| D06 | 540A014 | 0.0 - 0.5 | 4.3 | 86 | -- | -- | 11 | 0.007 (J-) |
| | 540A015 | 0.5 - 1.0 | 6.1 | 120 | -- | 8.5 | 16 | 0.0073 (J-) |

[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 U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
-- = Not detected above minimum detectable concentrations
J- = The result is an estimated quantity, but the result may be biased low

### *D.5.6 Gamma-Emitting Radionuclides*

Gamma-emitting radionuclide results for soil samples collected at this CAS that were detected above their respective laboratory MDLs are presented in Table D.5-6. None of the gamma-emitting radionuclides exceeded their respective PALs.

# Table D.5-6
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-04, Oil Spill
(Page 1 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | | Bismuth-214[a] | | Cesium-137[b] | Lead-212[a] | | Lead-214[a] | | Thallium-208[a] | | Thorium-234[b] |
| **Final Action Levels** | | | **5** | **15** | **5** | **15** | **12.2** | **5** | **15** | **5** | **15** | **5** | **15** | **105** |
| **Depth bgs (cm)** | | | **<15** | **>15** | **<15** | **>15** | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | |
| D01 | 540D001 | 0.0 - 0.5 | 2.46 (G) | N/A | 1.76 (G, J) | N/A | 0.46 (LT, G) | 3.18 (J) | N/A | 2.19 (G, J) | N/A | 1.16 (G) | N/A | -- |
| | 540D002 | 0.5 - 1.0 | N/A | 2.69 (G) | N/A | 1.97 (G, J) | -- | N/A | 2.62 (J)) | N/A | 2.15 (G, J) | N/A | 0.91 (G) | -- |
| D02 | 540D003 | 0.0 - 0.5 | 4.03 (G) | N/A | 2.65 (G, J) | N/A | -- | 4.32 (J) | N/A | 2.82 (G, J) | N/A | 1.21 (G) | N/A | -- |
| | 540D004 | 0.0 - 0.5 | 3.44 (G) | N/A | 1.95 (G, J) | N/A | -- | 5.12 (J) | N/A | 2.83 (G, J) | N/A | 1.46 (G) | N/A | -- |
| | 540D005 | 0.5 - 1.0 | N/A | 1.96 (G) | N/A | 2.52 (G, J) | -- | N/A | 2.73 (J) | N/A | 2.68 (G, J) | N/A | 0.81 (G) | -- |
| D03 | 540C006 | 0.0 - 0.5 | 2.93 (G) | N/A | 1.74 (G, J) | N/A | -- | 2.95 (J) | N/A | 2.4 (G, J) | N/A | 0.94 (G) | N/A | -- |
| | 540D007 | 0.5 - 1.0 | N/A | 2.38 (G) | N/A | 2.09 (G, J) | -- | N/A | 2.58 (J) | N/A | 2.32 (G, J) | N/A | 0.76 (G) | -- |
| D04 | 540D008 | 0.0 - 0.5 | 3.22 (G) | N/A | 1.98 (G, J) | N/A | -- | 3.41 (J) | N/A | 2.19 (G, J) | N/A | 1.25 (G) | N/A | -- |
| | 540D009 | 0.5 - 1.0 | N/A | 2.46 (G) | N/A | 2.25 (G, J) | 0.61 (G) | N/A | 3.19 (J) | N/A | 2.36 (G, J) | N/A | 1.06 (G) | -- |

# Table D.5-6
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-04, Oil Spill
(Page 2 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | | Bismuth-214[a] | | Cesium-137[b] | Lead-212[a] | | Lead-214[a] | | Thallium-208[a] | | Thorium-234[b] |
| **Final Action Levels** | | | **5** | **15** | **5** | **15** | **12.2** | **5** | **15** | **5** | **15** | **5** | **15** | **105** |
| **Depth bgs (cm)** | | | **<15** | **>15** | **<15** | **>15** | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | |
| D04A | 540D012 | 0.0 - 0.5 | 2.85 (G) | N/A | 1.83 (G, J) | N/A | -- | 2.71 (J) | N/A | 1.91 (G, J) | N/A | 0.9 (G) | N/A | -- |
| | 540D013 | 0.5 - 1.0 | N/A | 3.02 (G) | N/A | 1.71 (G, J) | -- | N/A | 3.59 (J) | N/A | 1.9 (G, J) | N/A | 1.2 (G) | -- |
| D05 | 540D010 | 0.0 - 0.5 | 3.42 (G) | N/A | 2.11 (G, J) | N/A | -- | 3.88 (J) | N/A | 2.51 (G, J) | N/A | 1 (G) | N/A | 5.2 (J) |
| | 540D011 | 0.5 - 1.0 | N/A | 2.55 (G) | N/A | 2.06 (G, J) | -- | N/A | 2.54 (J) | N/A | 1.99 (G, J) | N/A | 0.73 (G) | -- |
| D06 | 540D014 | 0.0 - 0.5 | 3.11 (G) | N/A | 1.93 (G,J) | N/A | -- | 3.67 (J) | N/A | 1.98 (G, J) | N/A | 1.14 (G) | N/A | -- |
| | 540D015 | 0.5 - 1.0 | N/A | 2.88 (G) | N/A | 1.76 (G, J) | -- | N/A | 3.8 (J) | N/A | 2.07 (G, J) | N/A | 1.18 (G) | -- |

# Table D.5-6
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-04, Oil Spill
(Page 3 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | | Bismuth-214[a] | | Cesium-137[b] | Lead-212[a] | | Lead-214[a] | | Thallium-208[a] | | Thorium-234[b] |
| **Final Action Levels** | | | 5 | 15 | 5 | 15 | 12.2 | 5 | 15 | 5 | 15 | 5 | 15 | 105 |
| **Depth bgs (cm)** | | | <15 | >15 | <15 | >15 | | <15 | >15 | <15 | >15 | <15 | >15 | |

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead-212, lead-214, 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 are 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 25-mrem/yr dose.

cm = Centimeters
ft bgs = Feet below ground surface
mrem/yr = Millirem per year
N/A = Not applicable
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
< = Less than
> = Greater than
G = Sample density differs by more than 15% of laboratory control sample density
J = Estimated value
LT = Result is less than the requested minimum detectable concentration, greater than the sample specific minimum detectable concentration

### *D.5.7 Isotopic Radionuclides*

Analytical results for isotopic radionuclides that were detected above their respective laboratory MDLs are presented in Table D.5-7. Sample 540D009 (sample location D04) contained Pu-239 at a concentration of 104 pCi/g, above the PAL of 12.7 pCi/g. An additional sample collected at this location detected Pu-239 above the laboratory MDL but below the PAL. No other sample at this CAS contained Pu-239 above its PAL and the reanalysis of sample 540D009 showed a concentration of Pu-239 that was below the PAL (0.59 pCi/L). Because the presence of Pu-239 is not the result of the releases being investigated, it is not a COC. Also, sample results indicate that the positive result in sample 540D009 was likely a single particle that has been removed during sampling.

**Table D.5-7**
**Sample Results for Isotopic Uranium, Isotopic Plutonium, and Strontium-90 Detected Above Minimum Detectable Concentrations at CAS 19-25-04, Oil Spill**
(Page 1 of 2)

| 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 |
| **Final Action Levels[a]** | | | **13** | **12.7** | **838** | **143** | **17.6** | **105** |
| D01 | 540D001 | 0.0 - 0.5 | 0.066 | 0.4 | -- | 1.09 | -- | 1.1 |
| | 540D002 | 0.5 - 1.0 | -- | 0.113 | -- | 1.34 | 0.077 | 1.15 |
| D02 | 540D003 | 0.0 - 0.5 | 0.185 | 7.9 | -- | 1.8 | 0.096 | 1.68 |
| | 540D004 | 0.0 - 0.5 | 0.065 | 0.361 | -- | 1.77 | 0.1 | 1.72 |
| | 540D005 | 0.5 - 1.0 | -- | 0.198 | -- | 1.82 | 0.078 | 1.49 |
| D03 | 540D006 | 0.0 - 0.5 | 0.036 (LT) | 0.313 | -- | 1.36 | 0.057 | 1.36 |
| | 540D007 | 0.5 - 1.0 | -- | 0.095 | -- | 1.38 | 0.06 | 1.22 |
| D04 | 540D008 | 0.0 - 0.5 | -- | 0.089 | -- | 1.68 | 0.082 | 1.62 |
| | 540D009 | 0.5 - 1.0 | 1.75 (Y1) | **104** (Y1) | 0.236 (LT) | 1.13 | 0.065 | 1.02 |
| D04A | 540D012 | 0.0 - 0.5 | 0.144 (J) | 8.5 (J) | 0.31 (LT) | 1.47 | 0.092 | 1.45 |
| | 540D013 | 0.5 - 1.0 | 0.057 (J) | 0.48 (J) | -- | 1.13 | 0.062 | 0.97 |
| D05 | 540D010 | 0.0 - 0.5 | -- | 0.12 | -- | 1.52 | 0.081 | 1.59 |
| | 540D011 | 0.5 - 1.0 | -- | -- | -- | 1.62 | 0.059 | 1.27 |

## Table D.5-7
## Sample Results for Isotopic Uranium, Isotopic Plutonium, and Strontium-90 Detected Above Minimum Detectable Concentrations at CAS 19-25-04, Oil Spill
(Page 2 of 2)

| 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 |
| **Final Action Levels[a]** | | | **13** | **12.7** | **838** | **143** | **17.6** | **105** |
| D06 | 540D014 | 0.0 - 0.5 | -- | -- | -- | 1.82 | 0.103 | 1.61 |
| | 540D015 | 0.5 - 1.0 | 0.131 (J) | 0.41 (J) | -- | 1.15 | 0.076 | 1.07 |

[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 25-mrem/yr dose.

ft bgs = Feet below ground surface
mrem/yr = Millirem per year
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
J = Estimated value
LT = Result is less than the requested minimum detectable concentration, greater than the sample specific minimum detectable concentration
Y1 = Chemical yield is in control at 100 - 110%. Quantitation yield is assumed.

# D.6.0 CAS 19-25-05, Oil Spill

The following sections provide analytical results from the samples collected to complete investigation activities as outlined in the SAFER Plan. Environmental investigation samples were analyzed for the SAFER Plan-specified COPCs, which included VOCs, SVOCs, TPH-DRO and -GRO, RCRA metals, gamma-emitting radionuclides, isotopic U, isotopic Pu, and Sr-90.

Analytical results from the soil samples with concentrations exceeding MDLs are summarized in the following sections. An evaluation was conducted on all contaminants detected above MDLs by initially comparing individual concentration or activity results against the PALs. Samples collected and the analyses performed are listed in Table D.6-1. Sample locations are identified in Figure D.6-1.

**Table D.6-1**
**Samples Collected at CAS 19-25-05, Oil Spill**
(Page 1 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose | Analyses |
|---|---|---|---|---|---|
| E01 | 540E001 | 0.0 - 0.5 | Soil | Environmental, MS/MSD | Set 1 |
| | 540E004 | 1.5 - 2.0 | Soil | Environmental | Set 1 |
| E02 | 540E002 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540E005 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| E03 | 540E003 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540E006 | 1.5 - 2.0 | Soil | Environmental | Set 1 |
| E04 | 540E007 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540E008 | 1.5 - 2.0 | Soil | Environmental | Set 1 |
| E05 | 540E009 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540E010 | 0.0 - 0.5 | Soil | Field Duplicate of #540E009 | Set 1 |
| | 540E011 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| E06 | 540E012 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540E013 | 2.0 - 2.5 | Soil | Environmental | Set 1 |

**Table D.6-1**
**Samples Collected at CAS 19-25-05, Oil Spill**
(Page 2 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose | Analyses |
|---|---|---|---|---|---|
| N/A | 540E301 | N/A | Water | Trip Blank | VOCs only |
| N/A | 540E302 | N/A | Water | Field Blank | Set 1 |
| N/A | 540E501 | N/A | Liquid | Equipment Rinsate | Set 2 |

Set 1 = Total VOCs, Total SVOCs, Total RCRA Metals, TPH-DRO and -GRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90
Set 2 = Gross Alpha/Beta, Tritium

ft bgs = Feet below ground surface
MS/MSD = Matrix spike/matrix spike duplicate
N/A = Not applicable

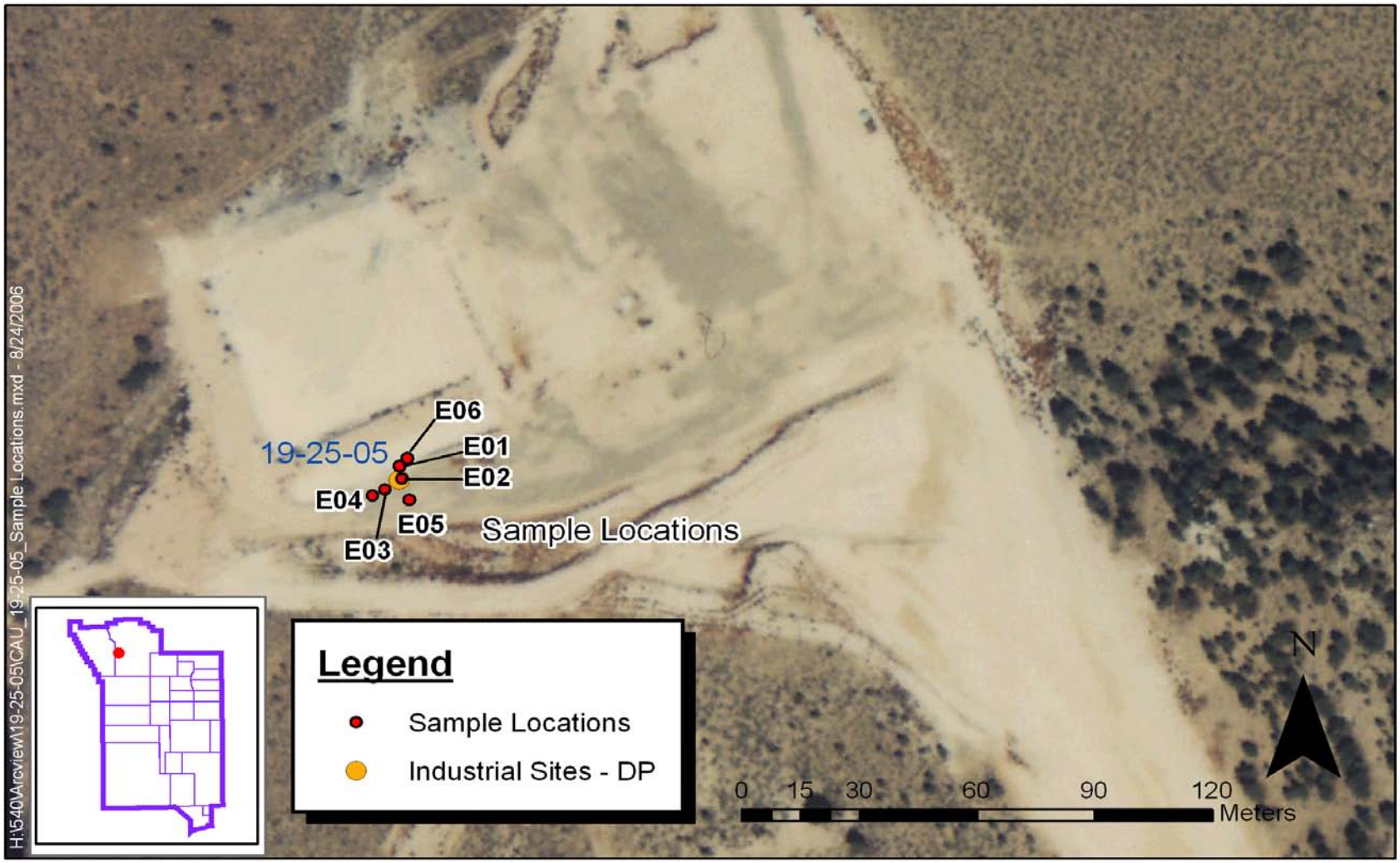


**Figure D.6-1**
**Sample Locations for CAS 19-25-05**

### D.6.1 Volatile Organic Compounds

Analytical results for VOCs in soil samples collected at this CAS that were detected above their respective laboratory MDLs are presented in Table D.6-2. None of the VOC concentrations exceeded their respective PALs.

**Table D.6-2**
**Sample Results for Total VOCs Detected Above**
**Minimum Detectable Concentrations at CAS 19-25-05, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) |
|---|---|---|---|
| | | | Styrene |
| Final Action Levelsa | | | 1,700,000 |
| E06 | 540E013 | 2.0 - 2.5 | 0.86 (J) |

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
µg/kg = Micrograms per kilogram
J = Estimated value

### D.6.2 Semivolatile Organic Compounds

Analytical results for SVOCs in soil samples collected at this CAS that were detected above their respective laboratory MDLs are presented in Table D.6-3. None of the SVOC concentrations exceeded their respective PALs.

### D.6.3 Total Petroleum Hydrocarbons

Samples containing TPH-DRO and -GRO in soil samples collected at this CAS that were detected above the laboratory MDLs are listed in Table D.6-4. For those samples whose analytical results exceeded the PAL of 100 mg/kg, a Tier 2 evaluation was conducted by evaluating the hazardous constituents of diesel (see Section H.1.10). This evaluation determined that none of the hazardous constituents of diesel were identified in the VOC or SVOC analyses at concentrations above their respective FALs; therefore, the TPH-DRO detected at this CAS is not considered a COC.

### D.6.4 Polychlorinated Biphenyls

No PCBs were identified in any of the soil samples collected at this CAS above the laboratory MDLs.

## Table D.6-3
## Sample Results for Total SVOCs Detected Above Minimum Detectable Concentrations at CAS 19-25-05, Oil Spill

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (µg/kg) | | |
|---|---|---|---|---|---|
| | | | Bis(2-Ethylhexyl)Phthalate | Pyrene | Di-N-Butyphthalate |
| **Final Action Levels[a]** | | | **120,000** | **29,000,000** | **62,000,000** |
| E01 | 540E001 | 0.0 - 0.5 | 3,700 (J) | -- | -- |
| | 540E004 | 1.5 - 2.0 | -- | 120 (J) | -- |
| E02 | 540E002 | 0.0 - 0.5 | -- | 3,100 (J) | 570 (J) |
| | 540E005 | 2.0 - 2.5 | -- | 54 (J) | -- |

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

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

## Table D.6-4
## Sample Results for TPH-DRO and TPH-GRO Detected Above Minimum Detectable Concentrations at CAS 19-25-05, Oil Spill
(Page 1 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | |
|---|---|---|---|---|
| | | | Diesel-Range Organics | Gasoline-Range Organics |
| **Preliminary Action Levels[a]** | | | **100** | **100** |
| E01 | 540E001 | 0.0 - 0.5 | **16,000** (J) | 0.14 (J) |
| | 540E004 | 1.5 - 2.0 | **2,400** (H) | 0.65 (H) |

**Table D.6-4**
**Sample Results for TPH-DRO and TPH-GRO Detected Above Minimum Detectable Concentrations at CAS 19-25-05, Oil Spill**
(Page 2 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | |
|---|---|---|---|---|
| | | | Diesel-Range Organics | Gasoline-Range Organics |
| **Preliminary Action Levels[a]** | | | **100** | **100** |
| E02 | 540E002 | 0.0 - 0.5 | **28,000** (J) | -- |
| | 540E005 | 2.0 - 2.5 | **2,200** (H, M) | -- |
| E03 | 540E003 | 0.0 - 0.5 | **25,000** (J) | -- |
| | 540E006 | 1.5 - 2.0 | **1,300** (M) | -- |
| E06 | 540E012 | 0.0 - 0.5 | 10 (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
-- = Not detected above minimum detectable concentrations
J = Estimated value
H = Fuel pattern in the heavier end of retention time window
M = Chromatogram resembles that of motor oil

### *D.6.5 RCRA Metals*

Analytical results for RCRA metals in soil samples collected at this CAS and detected above their respective laboratory MDLs are presented in Table D.6-5. None of the RCRA metal concentrations exceeded their respective PALs.

**Table D.6-5**
**Sample Results for Total RCRA Metals Detected Above Minimum Detectable Concentrations at CAS 19-25-05, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Barium | Cadmium | Chromium | Lead | Mercury |
| **Final Action Levels** | | | **23[a]** | **67,000[b]** | **450[b]** | **450[b]** | **800[b]** | **310[b]** |
| E01 | 540E001 | 0.0 - 0.5 | 1.6 | 100 | 0.25 (B) | 3.9 | 6.4 | 0.0043 (J-) |
| | 540E004 | 1.5 - 2.0 | 3.1 | 96 | -- | 5.1 | 7 | 0.01 (J-) |
| E02 | 540E002 | 0.0 - 0.5 | 1.9 | 130 | 0.18 (B) | 2.8 | 4.1 | 0.015 (J-) |
| | 540E005 | 2.0 - 2.5 | 2.6 | 82 | -- | 3.9 | 7 | 0.0085 (J-) |

**Table D.6-5**
**Sample Results for Total RCRA Metals Detected Above Minimum Detectable Concentrations at CAS 19-25-05, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Barium | Cadmium | Chromium | Lead | Mercury |
| **Final Action Levels** | | | **23[a]** | **67,000[b]** | **450[b]** | **450[b]** | **800[b]** | **310[b]** |
| E03 | 540E003 | 0.0 - 0.5 | 1.9 | 120 | -- | 2.6 | 4.1 | 0.013 (J-) |
| | 540E006 | 1.5 - 2.0 | 2.9 | 110 | -- | 3 | 4.2 | 0.0098 (J-) |
| E04 | 540E007 | 0.0 - 0.5 | 2 | 150 | -- | 2.5 | 4.7 | 0.016 (J-) |
| | 540E008 | 1.5 - 2.0 | 2.4 | 130 | -- | 3.3 | 3.9 | 0.017 (J-) |
| E05 | 540E009 | 0.0 - 0.5 | 1.5 | 110 | -- | 2.1 | 4.3 | 0.015 (J-) |
| | 540E010 | 0.0 - 0.5 | 2.1 | 100 | -- | 2.1 | 4.6 | 0.015 (J-) |
| | 540E011 | 2.0 - 2.5 | 2.9 | 100 | -- | 4.4 | 6.5 | 0.0059 (J-) |
| E06 | 540E012 | 0.0 - 0.5 | 1.5 | 91 | -- | 1.8 | 3.9 | 0.0063 (J-) |
| | 540E013 | 2.0 - 2.5 | 2.9 | 74 | -- | 4.5 | 8.1 | 0.0027 (J-) |

[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 U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
-- = Not detected above minimum detectable concentrations
B = Value less than the contract required detection limit but greater than or equal to the instrument detection limit
J- = The result is an estimated quantity, but the result may be biased low

### *D.6.6 Gamma-Emitting Radionuclides*

Gamma-emitting isotopes in soil samples collected at this CAS that were identified above their respective laboratory MDLs are presented in Table D.6-6. None of the gamma-emitting isotopes were detected above their respective PALs.

## Table D.6-6
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-05, Oil Spill
(Page 1 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | | Bismuth-212[a] | | Bismuth-214[a] | | Cesium-137[b] | Lead-212[a] | | Lead-214[a] | | Thallium-208[a] | |
| **Final Action Levels** | | | **5** | **15** | **5** | **15** | **5** | **15** | **12.2** | **5** | **15** | **5** | **15** | **5** | **15** |
| **Depth bgs (cm)** | | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** |
| E01 | 540E001 | 0.0 - 0.5 | 2.52 (G) | N/A | -- | N/A | 1.66 (G, J) | N/A | -- | 3.49 (J) | N/A | 1.76 (G, J) | N/A | 1.11 (G) | N/A |
| | 540E004 | 1.5 - 2.0 | N/A | 3.59 (G) | N/A | -- | N/A | 1.37 (G, J) | 0.44 (G, LT) | N/A | 3.17 (J) | N/A | 1.72 (G, J) | N/A | 1.22 (G) |
| E02 | 540E002 | 0.0 - 0.5 | 2.37 (G) | N/A | -- | N/A | 1.34 (G, J) | N/A | -- | 3.34 (J) | N/A | 1.43 (G, J) | N/A | 0.93 (G) | N/A |
| | 540E005 | 2.0 - 2.5 | N/A | 3.24 (G) | N/A | -- | N/A | 1.43 (G, J) | -- | N/A | 3.66 (G) | N/A | 1.61 (G, J) | N/A | 1.21 (G) |
| E03 | 540E003 | 0.0 - 0.5 | 2.59 (G) | N/A | -- | N/A | 1.48 (G, J) | N/A | -- | 2.97 (J) | N/A | 1.65 (G, J) | N/A | 0.92 (G) | N/A |
| | 540E006 | 1.5 - 2.0 | N/A | 3.08 (G) | N/A | -- | N/A | 1.45 (G, J) | -- | N/A | 3.19 (J) | N/A | 1.78 (G, J) | N/A | 0.95 (G) |
| E04 | 540E007 | 0.0 - 0.5 | 2.96 (G) | N/A | 4.5 (G) | N/A | 1.54 (G, J) | N/A | -- | 3.33 (J) | N/A | 1.52 (G, J) | N/A | 1 (G) | N/A |
| | 540E008 | 1.5 - 2.0 | N/A | 3.04 (G) | N/A | -- | N/A | 1.52 (G, J) | -- | N/A | 2.98 (J) | N/A | 1.66 (G, J) | N/A | 0.86 (G) |

**Table D.6-6**
**Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-05, Oil Spill**
(Page 2 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | | Bismuth-212[a] | | Bismuth-214[a] | | Cesium-137[b] | Lead-212[a] | | Lead-214[a] | | Thallium-208[a] | |
| **Final Action Levels** | | | **5** | **15** | **5** | **15** | **5** | **15** | **12.2** | **5** | **15** | **5** | **15** | **5** | **15** |
| **Depth bgs (cm)** | | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** |
| E05 | 540E009 | 0.0 - 0.5 | 3.12 (G) | N/A | -- | N/A | 1.86 (G, J) | N/A | -- | 3.25 (J) | N/A | 1.68 (G, J) | N/A | 0.94 (G) | N/A |
| | 540E010 | 0.0 - 0.5 | 3.15 (G) | N/A | -- | N/A | 1.52 (G, J) | N/A | -- | 3.19 (J) | N/A | 1.68 (G, J) | N/A | 1.11 (G) | N/A |
| | 540E011 | 2.0 - 2.5 | N/A | 2.8 (G) | N/A | -- | N/A | 1.38 (G, J) | -- | N/A | 3.35 (J) | N/A | 1.62 (G, J) | N/A | 1.14 (G) |
| E06 | 540E012 | 0.0 - 0.5 | 2.82 (G) | N/A | -- | N/A | 0.98 (G, J) | N/A | -- | 3.18 (J) | N/A | 1.26 (G, J) | N/A | 0.95 (G) | N/A |
| | 540E013 | 2.0 - 2.5 | N/A | 3.75 (G) | N/A | -- | N/A | 2.37 (G, J) | -- | N/A | 4.01 (J) | N/A | 2.25 (G, J) | N/A | 1.29 (G) |

# Table D.6-6
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-05, Oil Spill
(Page 3 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | | Bismuth-212[a] | | Bismuth-214[a] | | Cesium-137[b] | Lead-212[a] | | Lead-214[a] | | Thallium-208[a] | |
| **Final Action Levels** | | | 5 | 15 | 5 | 15 | 5 | 15 | 12.2 | 5 | 15 | 5 | 15 | 5 | 15 |
| **Depth bgs (cm)** | | | <15 | >15 | <15 | >15 | <15 | >15 | | <15 | >15 | <15 | >15 | <15 | >15 |

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead-212, lead-214, 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 are 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 25-mrem/yr dose.

cm = Centimeter
ft bgs = Feet below ground surface
mrem/yr = Millirem per year
N/A = Not applicable
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
< = Less than
> = Greater than
G = Sample density differs by more than 15% of laboratory control sample density
J = Estimated value
LT = Result is less than the requested minimum detectable concentration, greater than the sample specific minimum detectable concentration

### *D.6.7 Isotopic Radionuclides*

Isotopic radionuclides identified in soil samples collected at this CAS that were detected above their respective laboratory MDLs are presented in Table D.6-7. None of the isotopic radionuclide concentrations exceeded their respective PALs.

**Table D.6-7**
**Sample Results for Isotopic Uranium, Isotopic Plutonium, and Strontium-90 Detected Above Minimum Detectable Concentrations at CAS 19-25-05, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | |
|---|---|---|---|---|---|---|---|
| | | | Plutonium-238 | Plutonium-239 | Uranium-234 | Uranium-235 | Uranium-238 |
| **Final Action Levels[a]** | | | **13** | **12.7** | **143** | **17.6** | **105** |
| E01 | 540E001 | 0.0 - 0.5 | -- | -- | 1.59 | 0.093 | 1.4 |
| | 540E004 | 1.5 - 2.0 | 0.061 | 0.139 | 1.32 | -- | 1.29 |
| E02 | 540E002 | 0.0 - 0.5 | -- | -- | 1.27 | -- | 1.31 |
| | 540E005 | 2.0 - 2.5 | 0.057 | 0.214 | 1.08 | 0.05 | 1.09 |
| E03 | 540E003 | 0.0 - 0.5 | -- | -- | 1.29 | 0.082 | 1.32 |
| | 540E006 | 1.5 - 2.0 | -- | -- | 1.24 | 0.054 | 1.31 |
| E04 | 540E007 | 0.0 - 0.5 | -- | -- | 1.47 | 0.103 | 1.44 |
| | 540E008 | 1.5 - 2.0 | -- | -- | 1.07 | 0.063 | 1.13 |
| E05 | 540E009 | 0.0 - 0.5 | -- | -- | 1.36 | 0.082 | 1.54 |
| | 540E010 | 0.0 - 0.5 | -- | -- | 1.54 | 0.061 | 1.57 |
| | 540E011 | 2.0 - 2.5 | -- | -- | 1.14 | -- | 1.04 |
| E06 | 540E012 | 0.0 - 0.5 | -- | -- | 1.69 | 0.099 | 1.57 |
| | 540E013 | 2.0 - 2.5 | -- | 0.056 | 0.8 | -- | 0.82 |

[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 25-mrem/yr dose.

ft bgs = Feet below ground surface
mrem/yr = Millirem per year
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations

# D.7.0 CAS 19-25-06, Oil Spill

The following sections provide analytical results from the samples collected to complete investigation activities as outlined in the SAFER Plan. Environmental investigation samples were analyzed for the SAFER Plan-specified COPCs, which included VOCs, SVOCs, TPH-DRO and -GRO, RCRA metals, gamma-emitting radionuclides, isotopic U, isotopic Pu, and Sr-90.

Analytical results from the soil samples with concentrations exceeding MDLs are summarized in the following sections. An evaluation was conducted on all contaminants detected above MDLs by initially comparing individual concentration or activity results against the PALs. Samples collected and the analyses performed are listed in Table D.7-1. Sample locations are identified in Figure D.7-1.

**Table D.7-1**
**Samples Collected at CAS 19-25-06, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose | Analyses |
|---|---|---|---|---|---|
| F01 | 540F001 | 0.0 - 0.5 | Soil | Environmental, MS/MSD | Set 1 |
| | 540F006 | 1.5 - 2.0 | Soil | Environmental | Set 1 |
| F02 | 540F002 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540F003 | 0.0 - 0.5 | Soil | Field Duplicate of #540F002 | Set 1 |
| | 540F007 | 1.5 - 2.0 | Soil | Environmental | Set 1 |
| F03 | 540F004 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540F008 | 1.5 - 2.0 | Soil | Environmental | Set 1 |
| F04 | 540F005 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540F009 | 1.5 - 2.0 | Soil | Environmental | Set 1 |
| N/A | 540F301 | N/A | Water | Trip Blank | VOCs only |
| N/A | 540F501 | N/A | Liquid | Rinsate Sample | Set 2 |

Set 1 = Total VOCs, Total SVOCs, Total RCRA Metals, TPH-DRO and -GRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90
Set 2 = Gross Alpha/Beta, Tritium

ft bgs = Feet below ground surface
MS/MSD = Matrix spike/matrix spike duplicate
N/A = Not applicable

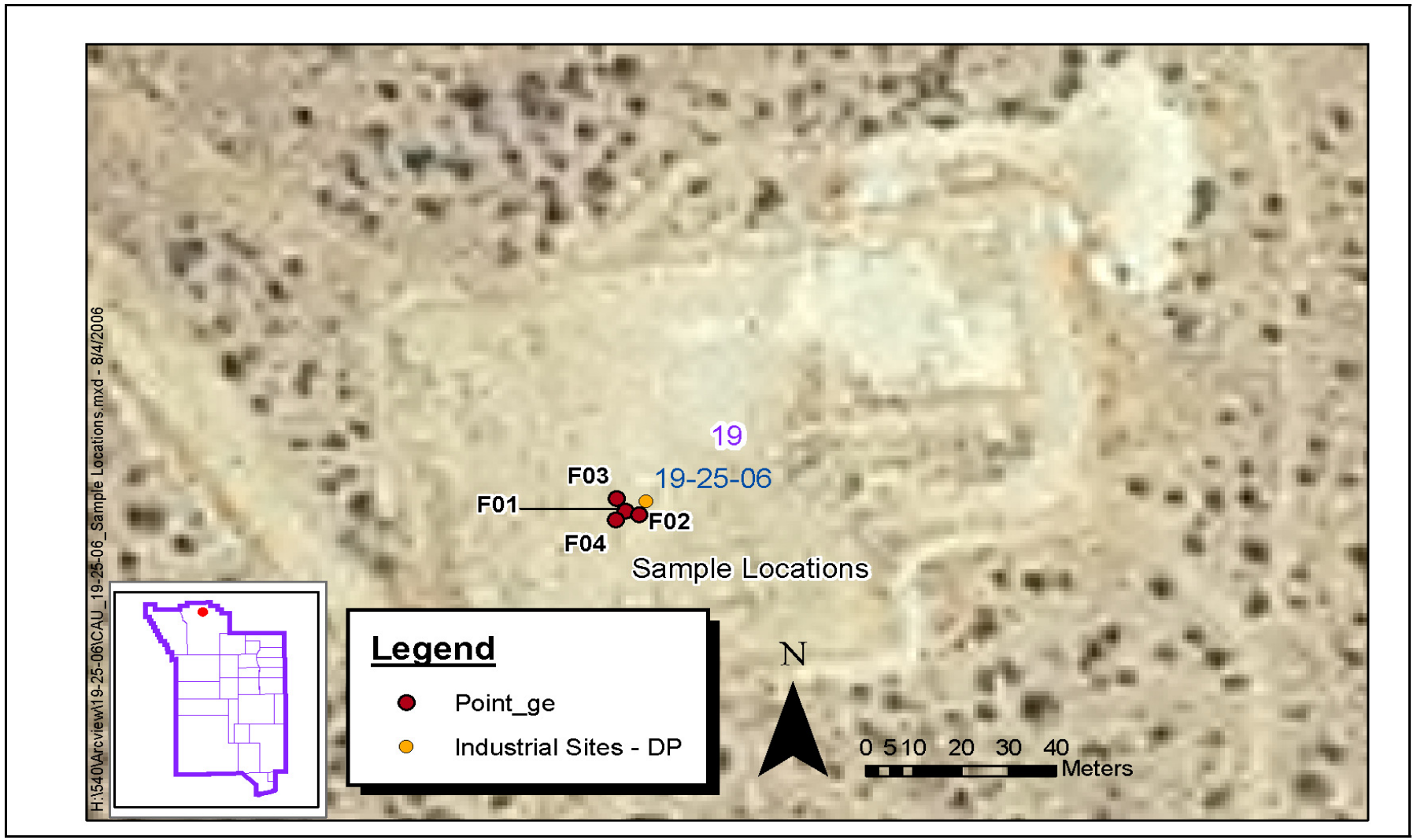


**Figure D.7-1**
**Sample Locations for CAS 19-25-06**

### D.7.1 Volatile Organic Compounds

No VOCs were detected above their respective laboratory MDLs in any of the soil samples collected at this CAS.

### D.7.2 Semivolatile Organic Compounds

No SVOCs were detected above their respective laboratory MDLs in any of the soil samples collected at this CAS.

### D.7.3 Total Petroleum Hydrocarbons

The TPH-DRO in soil samples collected at this CAS that were detected above the laboratory MDL is presented in Table D.7-2. For those samples whose analytical results exceeded the PAL of 100 mg/kg, a Tier 2 evaluation was conducted by evaluating the hazardous constituents of diesel (see Section H.1.10). This evaluation determined that none of the hazardous constituents of diesel were identified in the VOC or SVOC analyses at concentrations above their respective FALs; therefore, the TPH-DRO detected at this CAS is not considered a COC.

**Table D.7-2**
**Sample Results for TPH-DRO Detected Above**
**Minimum Detectable Concentrations at CAS 19-25-06, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) |
|---|---|---|---|
| | | | Diesel-Range Organics |
| Preliminary Action Levels[a] | | | 100 |
| F01 | 540F001 | 0.0 - 0.5 | **26,000** (J) |
| | 540F006 | 1.5 - 2.0 | **1,500** (M) |
| F02 | 540F002 | 0.0 - 0.5 | **3,800** (H) |
| | 540F003 | 0.0 - 0.5 | **3,600** (H) |

[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
H = Fuel pattern in the heavier end of retention time window
J = Estimated value
M = Chromatogram resembles that of motor oil

### D.7.4 Polychlorinated Biphenyl

No PCBs were detected above their respective laboratory MDLs in any of the soil samples collected at this CAS.

### D.7.5 RCRA Metals

Analytical results for RCRA metals in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.7-3. None of the RCRA metal concentrations exceeded their respective PALs.

**Table D.7-3**
**Sample Results for Total RCRA Metals Detected Above Minimum Detectable Concentrations at CAS 19-25-06, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Barium | Chromium | Lead | Mercury | Selenium |
| **Final Action Levels** | | | **23[a]** | **67,000[b]** | **450[b]** | **800[b]** | **310[b]** | **5,100[b]** |
| F01 | 540F001 | 0.0 - 0.5 | 3.2 | 130 | 5.2 | 12 | 0.0048 (J-) | -- |
| | 540F006 | 1.5 - 2.0 | 3.2 | 72 | 5 | 7.9 | 0.0037 (J-) | -- |
| F02 | 540F002 | 0.0 - 0.5 | 4 | 160 | 6.3 | 13 | 0.006 (J-) | 0.57 |
| | 540F003 | 0.0 - 0.5 | 3.4 | 190 | 5.7 | 12 | 0.0055 (J-) | -- |
| | 540F007 | 1.5 - 2.0 | 4.2 | 73 | 4.2 | 6.1 | 0.022 (J-) | -- |
| F03 | 540F004 | 0.0 - 0.5 | 4.2 | 190 | 6.2 | 12 | 0.02 (J-) | -- |
| | 540F008 | 1.5 - 2.0 | 2.9 | 90 | 3 | 7.5 | 0.0052 (J-) | -- |
| F04 | 540F005 | 0.0 - 0.5 | 3.8 | 120 | 5.4 | 11 | 0.008 (J-) | -- |
| | 540F009 | 1.5 - 2.0 | 3.1 | 61 | 5.7 | 7.3 | 0.0084 (J-) | -- |

[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 U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
-- = Not detected above minimum detectable concentrations
J- = The result is an estimated quantity, but the result may be biased low

### D.7.6 Gamma-Emitting Radionuclides

Analytical results for gamma-emitting radionuclides in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.7-4. None of the gamma-emitting radionuclide concentrations exceeded their respective PALs.

### D.7.7 Isotopic Radionuclides

Analytical results for isotopic radionuclides in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.7-5. None of the isotopic radionuclide concentrations exceeded their respective PALs.

# Table D.7-4
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-06, Oil Spill
(Page 1 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228 | | Bismuth-212 | | Bismuth-214 | | Lead-212 | | Lead-214 | | Thallium-208 | |
| **Final Action Levels[a]** | | | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** |
| **Depths bgs (cm)** | | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** |
| F01 | 540F001 | 0.0 - 0.5 | 2.16 (G) | N/A | -- | N/A | 1.32 (G, J) | N/A | 2.68 (J) | N/A | 1.1 (G, J) | N/A | 0.8 (G) | N/A |
| | 540F006 | 1.5 - 2.0 | N/A | 2.63 (G) | N/A | -- | N/A | 1.34 (G, J) | N/A | 3.35 (J) | N/A | 1.51 (G, J) | N/A | 1.01 (G) |
| F02 | 540F002 | 0.0 - 0.5 | 2.54 (G) | N/A | 3.4 (G) | N/A | 1.25 (G, J) | N/A | 2.92 (J) | N/A | 1.44 (G, J) | N/A | 0.74 (G) | N/A |
| | 540F003 | 0.0 - 0.5 | 2.2 (G) | N/A | -- | N/A | 1.1 (G, J) | N/A | 2.93 (J) | N/A | 1.29 (G, J) | N/A | 1.11 (G) | N/A |
| | 540F007 | 1.5 - 2.0 | N/A | 2.62 (G) | N/A | -- | N/A | 1.67 (G, J) | N/A | 2.86 (J) | N/A | 1.75 (G, J) | N/A | 0.96 (G) |
| F03 | 540F004 | 0.0 - 0.5 | 2.38 (G) | N/A | -- | N/A | 1.02 (G, J) | N/A | 2.61 (J) | N/A | 1.28 (G, J) | N/A | 0.72 (G) | N/A |
| | 540F008 | 1.5 - 2.0 | N/A | 2.74 (G) | N/A | -- | N/A | 1.22 (G, J) | N/A | 3.47 (J) | N/A | 1.53 (G, J) | N/A | 0.89 (G) |
| F04 | 540F005 | 0.0 - 0.5 | 2.18 (G) | N/A | -- | N/A | 1.09 (G, J) | N/A | 2.55 (J) | N/A | 1.22 (G, J) | N/A | 0.89 (G) | N/A |
| | 540F009 | 1.5 - 2.0 | N/A | 2.94 (G) | N/A | -- | N/A | 1.33 (G, J) | N/A | 3.84 (J) | N/A | 1.68 (G, J) | N/A | 0.99 (G) |

# Table D.7-4
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-06, Oil Spill
(Page 2 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228 | | Bismuth-212 | | Bismuth-214 | | Lead-212 | | Lead-214 | | Thallium-208 | |
| Final Action Levels[a] | | | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 |
| Depths bgs (cm) | | | <15 | >15 | <15 | >15 | <15 | >15 | <15 | >15 | <15 | >15 | <15 | >15 |

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead-212, lead-214, 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 are 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 25-mrem/yr dose.

cm = Centimeter
ft bgs = Feet below ground surface
mrem/yr = Millirem per year
N/A = Not applicable
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
< = Less than
> = Greater than
G = Sample density differs by more than 15% of laboratory control sample density
J = Estimated value

# Table D.7-5
# Sample Results for Isotopic Uranium Detected Above Minimum Detectable Concentrations at CAS 19-25-06, Oil Spill

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | |
|---|---|---|---|---|---|
| | | | Uranium-234 | Uranium-235 | Uranium-238 |
| **Final Action Levels[a]** | | | **143** | **17.6** | **105** |
| F01 | 540F001 | 0.0 - 0.5 | 1.01 | 0.064 | 0.97 |
| | 540F006 | 1.5 - 2.0 | 1.28 | -- | 1.18 |
| F02 | 540F002 | 0.0 - 0.5 | 1.06 | -- | 1.08 |
| | 540F003 | 0.0 - 0.5 | 1.15 | 0.056 | 1.03 |
| | 540F007 | 1.5 - 2.0 | 1.5 | 0.083 | 1.28 |
| F03 | 540F004 | 0.0 - 0.5 | 1.07 | -- | 1.16 |
| | 540F008 | 1.5 - 2.0 | 1.36 | 0.062 | 1.24 |
| F04 | 540F005 | 0.0 - 0.5 | 1.02 | -- | 1.02 |
| | 540F009 | 1.5 - 2.0 | 1.18 | 0.06 | 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 25-mrem/yr dose.

ft bgs = Feet below ground surface
mrem/yr = Millirem per year
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations

# D.8.0 CAS 19-25-07, Oil Spill

The following sections provide analytical results from the samples collected to complete investigation activities as outlined in the SAFER Plan. Environmental investigation samples were analyzed for the SAFER Plan-specified COPCs, which included VOCs, SVOCs, TPH-DRO and -GRO, RCRA metals, gamma-emitting radionuclides, isotopic U, isotopic Pu, and Sr-90.

Analytical results from the soil samples with concentrations exceeding MDLs are summarized in the following sections. An evaluation was conducted on all contaminants detected above MDLs by initially comparing individual concentration or activity results against the PALs. Samples collected and the analyses performed are listed in Table D.8-1. Sample locations are identified in Figure D.8-1.

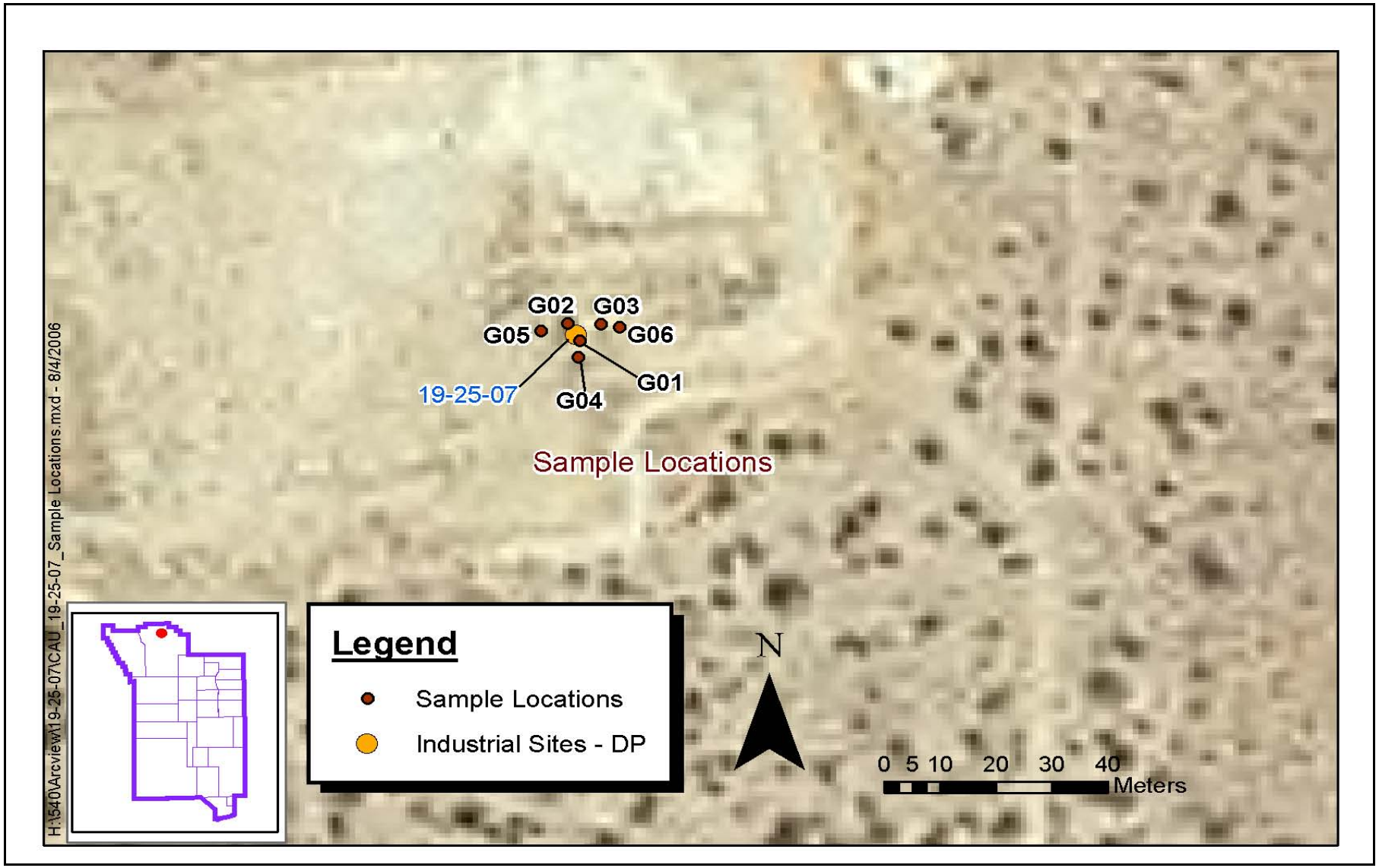


**Figure D.8-1**
**Sample Locations for CAS 19-25-07**

**Table D.8-1**
**Samples Collected at CAS 19-25-07, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose* | Analyses |
|---|---|---|---|---|---|
| G01 | 540G001 | 0.0 - 0.5 | Soil | Environmental, MS/MSD | Set 1 |
| | 540G006 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| G02 | 540G002 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540G003 | 0.0 - 0.5 | Soil | Field Duplicate of #540G002 | Set 1 |
| | 540G007 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| G03 | 540G004 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540G008 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| G04 | 540G005 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540G009 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| G05 | 540G010 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540G012 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| G06 | 540G011 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540G013 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| N/A | 540G301 | N/A | Water | Field Blank | Set 1 |
| N/A | 540G501 | N/A | Liquid | Equipment Rinsate | Set 2 |

*Trip blank for CAS 19-25-07 samples is 540F301 from CAS 19-25-06
Set 1 = Total VOCs, Total SVOCs, Total RCRA Metals, TPH-DRO and -GRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90
Set 2 = Gross Alpha/Beta, Tritium

ft bgs = Feet below ground surface
MS/MSD = Matrix spike/matrix spike duplicate
N/A = Not applicable

### *D.8.1 Volatile Organic Compounds*

No VOCs were detected in any of the soil samples collected at this CAS at concentrations above their respective laboratory MDLs.

### D.8.2 Semivolatile Organic Compounds

Analytical results for SVOCs in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.8-2. None of the SVOC concentrations exceeded their respective PALs.

**Table D.8-2**
**Sample Results for Total SVOCs Detected Above**
**Minimum Detectable Concentrations at CAS 19-25-07, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | |
|---|---|---|---|---|
| | | | Chrysene | Pyrene |
| **Final Action Levels[a]** | | | **210,000** | **29,000,000** |
| G02 | 540G002 | 0.0 - 0.5 | -- | 72 (J) |
| | 540G003 | 0.0 - 0.5 | -- | 100 (J) |
| | 540G007 | 2.0 - 2.5 | -- | 180 (J) |
| G03 | 540G008 | 2.0 - 2.5 | -- | 1,300 (J) |
| G06 | 540G011 | 0.0 - 0.5 | 18 (J) | 110 (J) |

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
mg/kg = Micrograms per kilogram
-- = Not detected above minimum detectable concentrations
J = Estimated value

### D.8.3 Total Petroleum Hydrocarbons

The TPH-DRO in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.8-3. For those samples whose analytical results exceeded the PAL of 100 mg/kg, a Tier 2 evaluation was conducted by evaluating the hazardous constituents of diesel (see Section H.1.10). This evaluation determined that none of the hazardous constituents of diesel were identified in the VOC or SVOC analyses at concentrations above their respective FALs; therefore, the TPH-DRO detected at this CAS is not considered a COC.

### D.8.4 Polychlorinated Biphenyls

No PCBs were detected above their respective laboratory MDLs in any of the soil samples collected at this CAS.

**Table D.8-3**
**Sample Results for TPH-DRO and TPH-GRO Detected**
**Above Minimum Detectable Concentrations at CAS 19-25-07, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | |
|---|---|---|---|---|
| | | | Diesel-Range Organics | Gasoline-Range Organics |
| **Preliminary Action Levels[a]** | | | **100** | **100** |
| G01 | 540G001 | 0.0 - 0.5 | **29,000** (J) | -- |
| | 540G006 | 2.0 - 2.5 | **370** (M) | -- |
| G02 | 540G002 | 0.0 - 0.5 | **1,300** (H) | -- |
| | 540G003 | 0.0 - 0.5 | **1,200** (H) | -- |
| | 540G007 | 2.0 - 2.5 | **5,000** (H) | 6.4 (H) |
| G03 | 540G004 | 0.0 - 0.5 | **9,900** (H, M) | -- |
| | 540G008 | 2.0 - 2.5 | **12,000** (J) | 19 (H) |
| G04 | 540G005 | 0.0 - 0.5 | **700** (H, M) | -- |
| | 540G009 | 2.0 - 2.5 | **170** (H) | 0.31 (J) |
| G05 | 540G010 | 0.0 - 0.5 | 38 (M) | -- |
| G06 | 540G011 | 0.0 - 0.5 | **1,100** (H) | -- |

[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
-- = Not detected above minimum detectable concentrations
J = Estimated value
H = Fuel pattern in the heavier end of retention time window
M = Chromatogram resembles that of motor oil

### *D.8.5 RCRA Metals*

Analytical results for RCRA metals in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.8-4. None of the RCRA metal concentrations exceeded their respective PALs.

### *D.8.6 Gamma-Emitting Radionuclides*

Analyses containing gamma-emitting radionuclides in soil samples collected at this CAS detected above their respective laboratory MDLs are listed in Table D.8-5. None of the gamma-emitting radionuclide concentrations exceeded their respective PALs.

**Table D.8-4**
**Sample Results for Total RCRA Metals Detected Above Minimum Detectable Concentrations at CAS 19-25-07, Oil Spill**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Barium | Cadmium | Chromium | Lead | Mercury |
| **Final Action Levels** | | | **23[a]** | **67,000[b]** | **450[b]** | **450[b]** | **800[b]** | **310[b]** |
| G01 | 540G001 | 0.0 - 0.5 | 1.6 | 76 | -- | 1.3 | 5.9 | -- |
| | 540G006 | 2.0 - 2.5 | 3.5 | 46 | -- | 2.6 | 3.9 | 0.024 (J-) |
| G02 | 540G002 | 0.0 - 0.5 | 2.6 | 58 | 0.18 (J-) | 2.1 | 5.9 | 0.0048 (J-) |
| | 540G003 | 0.0 - 0.5 | 2.5 | 64 | 0.18 (J-) | 2.1 | 5.9 | 0.0091 (J-) |
| | 540G007 | 2.0 - 2.5 | 3.2 | 42 | -- | 3 | 3.4 | 0.032 (J-) |
| G03 | 540G004 | 0.0 - 0.5 | 2.8 | 46 | -- | 2.7 | 4.4 | 0.012 (J-) |
| | 540G008 | 2.0 - 2.5 | 2.9 | 37 | -- | 2.1 | 3.3 | 0.031 (J-) |
| G04 | 540G005 | 0.0 - 0.5 | -- | 76 | -- | 0.97 (B) | 7.7 | 0.0055 (J-) |
| | 540G009 | 2.0 - 2.5 | 2.9 | 47 | -- | 3 | 3.8 | 0.032 (J-) |
| G05 | 540G010 | 0.0 - 0.5 | 2.3 | 81 | -- | 2.3 | 9.2 | 0.0032 (J-) |
| | 540G012 | 2.0 - 2.5 | 2.8 | 53 | -- | 5.3 | 4.3 | 0.019 (J-) |
| G06 | 540G011 | 0.0 - 0.5 | 3.4 | 55 | -- | 2.8 | 5.2 | 0.024 (J-) |
| | 540G013 | 2.0 - 2.5 | 3.3 | 47 | -- | 3.3 | 3.6 | 0.028 (J-) |

[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 U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
-- = Not detected above minimum detectable concentrations
B = Value less than the contract required detection limit but greater than or equal to the instrument detection limit
J- = The result is an estimated quantity, but the result may be biased low

### *D.8.7 Isotopic Radionuclides*

Analyses for isotopic radionuclides in soil samples collected at this CAS detected above their respective laboratory MDLs are listed in Table D.8-6. None of the isotopic radionuclide concentrations exceeded their respective PALs.

# Table D.8-5
# Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-07, Oil Spill
(Page 1 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | | Bismuth-214[a] | | Lead-212[a] | | Lead-214[a] | | Thallium-208[a] | | Thorium-234[b] |
| **Final Action Levels** | | | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** | **105** |
| **Depth ft (cm)** | | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | |
| G01 | 540G001 | 0.0 - 0.5 | 2.03 (G) | N/A | 1.16 (G, J) | N/A | 2.68 (J) | N/A | 1.37 (G, J) | N/A | 0.96 (G) | N/A | -- |
| | 540G006 | 2.0 - 2.5 | N/A | 2.8 (G) | N/A | 1.76 (G, J) | N/A | 3.7 (J) | N/A | 1.91 (G, J) | N/A | 0.97 (G) | 6.4 (G, TI) |
| G02 | 540G002 | 0.0 - 0.5 | 2.68 (G) | N/A | 1.81 (G, J) | N/A | 3.64 (J) | N/A | 1.5 (G, J) | N/A | 1 (G) | N/A | -- |
| | 540G003 | 0.0 - 0.5 | 2.23 (G) | N/A | 1.65 (G, J) | N/A | 3.51 (J) | N/A | 2.07 (G, J) | N/A | 0.97 (G) | N/A | -- |
| | 540G007 | 2.0 - 2.5 | N/A | 3.46 (G) | N/A | 1.82 (G, J) | N/A | 3.86 (J) | N/A | 2.21 (G, J) | N/A | 1.03 (G) | -- |
| G03 | 540G004 | 0.0 - 0.5 | 3.04 (G) | N/A | 2.12 (G, J) | N/A | 3.78 (J) | N/A | 2.24 (G, J) | N/A | 1 (G) | N/A | -- |
| | 540G008 | 2.0 - 2.5 | N/A | 2.85 (G) | N/A | 2.25 (G, J) | N/A | 4.01 (J) | N/A | 2.2 (G, J) | N/A | 1.13 (G) | -- |
| G04 | 540G005 | 0.0 - 0.5 | 2.29 (G) | N/A | 1.41 (G, J) | N/A | 2.69 (J) | N/A | 1.54 (G, J) | N/A | 0.84 (G) | N/A | -- |
| | 540G009 | 2.0 - 2.5 | N/A | 3.43 (G) | N/A | 1.74 (G, J) | N/A | 3.25 (J) | N/A | 2.04 (G, J) | N/A | 1.23 (G) | -- |

# Table D.8-5
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-07, Oil Spill
(Page 2 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | | Bismuth-214[a] | | Lead-212[a] | | Lead-214[a] | | Thallium-208[a] | | Thorium-234[b] |
| **Final Action Levels** | | | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** | **105** |
| **Depth ft (cm)** | | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | |
| G05 | 540G010 | 0.0 - 0.5 | 2.8 (G) | N/A | 1.26 (G, J) | N/A | 3.41 (J) | N/A | 1.36 (G, J) | N/A | 0.99 (G) | N/A | -- |
| | 540G012 | 2.0 - 2.5 | N/A | 2.9 (G) | N/A | 2.09 (G, J) | N/A | 3.49 (J) | N/A | 1.83 (G, J) | N/A | 1.05 (G) | -- |
| G06 | 540G011 | 0.0 - 0.5 | 3.01 (G) | N/A | 2.3 (G, J) | N/A | 3.79 (J) | N/A | 2.19 (G, J) | N/A | 1.15 (G) | N/A | -- |
| | 540G013 | 2.0 - 2.5 | N/A | 3.33 (G) | N/A | 2.22 (G, J) | N/A | 3.56 (J) | N/A | 2.12 (G, J) | N/A | 1.17 (G) | -- |

# Table D.8-5
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-07, Oil Spill
(Page 3 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228[a] | | Bismuth-214[a] | | Lead-212[a] | | Lead-214[a] | | Thallium-208[a] | | Thorium-234[b] |
| **Final Action Levels** | | | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 | 105 |
| **Depth ft (cm)** | | | <15 | >15 | <15 | >15 | <15 | >15 | <15 | >15 | <15 | >15 | |

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead-212, lead-214, 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 are 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 25-mrem/yr dose.

cm = Centimeter
mrem/yr = Millirem per year
N/A = Not applicable
ft bgs = Feet below ground surface
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
< = Less than
> = Greater than
G = Sample density differs by more than 15% of laboratory control sample density
J = Estimated value
TI = Tentatively identified

# Table D.8-6
# Sample Results for Isotopic Uranium and Isotopic Plutonium Detected Above Minimum Detectable Concentrations at CAS 19-25-07, Oil Spill

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | |
|---|---|---|---|---|---|---|
| | | | Plutonium-239 | Uranium-234 | Uranium-235 | Uranium-238 |
| **Final Action Levels[a]** | | | **12.7** | **143** | **17.6** | **105** |
| G01 | 540G001 | 0.0 - 0.5 | -- | 1.24 | 0.058 | 1.1 |
| | 540G006 | 2.0 - 2.5 | -- | 1.73 | 0.073 | 1.68 |
| G02 | 540G002 | 0.0 - 0.5 | -- | 1.35 | 0.103 | 1.51 |
| | 540G003 | 0.0 - 0.5 | -- | 1.38 | 0.049 (LT) | 1.37 |
| | 540G007 | 2.0 - 2.5 | -- | 1.72 | 0.124 | 1.53 |
| G03 | 540G004 | 0.0 - 0.5 | -- | 1.73 | 0.057 | 1.56 |
| | 540G008 | 2.0 - 2.5 | -- | 1.78 | 0.066 | 1.55 |
| G04 | 540G005 | 0.0 - 0.5 | -- | 1.25 | 0.073 | 1.3 |
| | 540G009 | 2.0 - 2.5 | 0.033 (LT) | 1.49 | 0.078 | 1.44 |
| G05 | 540G010 | 0.0 - 0.5 | -- | 1.3 | -- | 1.31 |
| | 540G012 | 2.0 - 2.5 | -- | 1.48 | 0.053 | 1.42 |
| G06 | 540G011 | 0.0 - 0.5 | -- | 1.74 | 0.066 | 1.6 |
| | 540G013 | 2.0 - 2.5 | -- | 1.48 | 0.115 | 1.49 |

[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 25-mrem/yr dose.

ft bgs = Feet below ground surface
mrem/yr = Millirem per year
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
LT = Result is less than the requested minimum detectable concentration, greater than the sample specific minimum detectable concentration

## D.9.0 CAS 19-25-08, Oil Spills (3)

The following sections provide analytical results from the samples collected to complete investigation activities as outlined in the SAFER Plan. Environmental investigation samples were analyzed for the SAFER Plan-specified COPCs, which included VOCs, SVOCs, TPH-DRO and -GRO, RCRA metals, gamma-emitting radionuclides, isotopic U, isotopic Pu, and Sr-90.

Analytical results from the soil samples with concentrations exceeding MDLs are summarized in the following sections. An evaluation was conducted on all contaminants detected above MDLs by initially comparing individual concentration or activity results against the PALs. Samples collected and the analyses performed are listed in Table D.9-1. Sample locations are identified in Figure D.9-1.

**Table D.9-1**
**Samples Collected at CAS 19-25-08, Oil Spills (3)**
(Page 1 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose | Analyses |
|---|---|---|---|---|---|
| H01 | 540H001 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540H002 | 0.0 - 0.5 | Soil | Field Duplicate of #540H001 | Set 1 |
| | 540H003 | 1.5 - 2.0 | Soil | Environmental | Set 1 |
| H02 | 540H004 | 0.0 - 0.5 | Soil | Environmental, MS/MSD | Set 1 |
| | 540H005 | 1.0 - 1.5 | Soil | Environmental | Set 1 |
| H03 | 540H006 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540H007 | 1.0 - 1.5 | Soil | Environmental | Set 1 |
| H04 | 540H008 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540H009 | 1.0 - 1.5 | Soil | Environmental | Set 1 |
| H05 | 540H010 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540H011 | 1.5 - 2.0 | Soil | Environmental | Set 1 |

**Table D.9-1**
**Samples Collected at CAS 19-25-08, Oil Spills (3)**
(Page 2 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose | Analyses |
|---|---|---|---|---|---|
| H06 | 540H012 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540H013 | 1.0 - 1.5 | Soil | Environmental | Set 1 |
| H07 | 540H014 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540H015 | 1.0 - 1.5 | Soil | Environmental | Set 1 |
| H08 | 540H016 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540H017 | 1.0 - 1.5 | Soil | Environmental | Set 1 |
| N/A | 540H301 | N/A | Water | Trip Blank | VOCs only |
| N/A | 540H302 | N/A | Water | Field Blank | Set 1 |
| N/A | 540H501 | N/A | Liquid | Equipment Rinsate | Set 2 |

Set 1 = Total VOCs, Total SVOCs, Total RCRA Metals, TPH-DRO and -GRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90
Set 2 = Gross Alpha/Beta, Tritium

ft bgs = Feet below ground surface
MS/MSD = Matrix spike/matrix spike duplicate
N/A = Not applicable

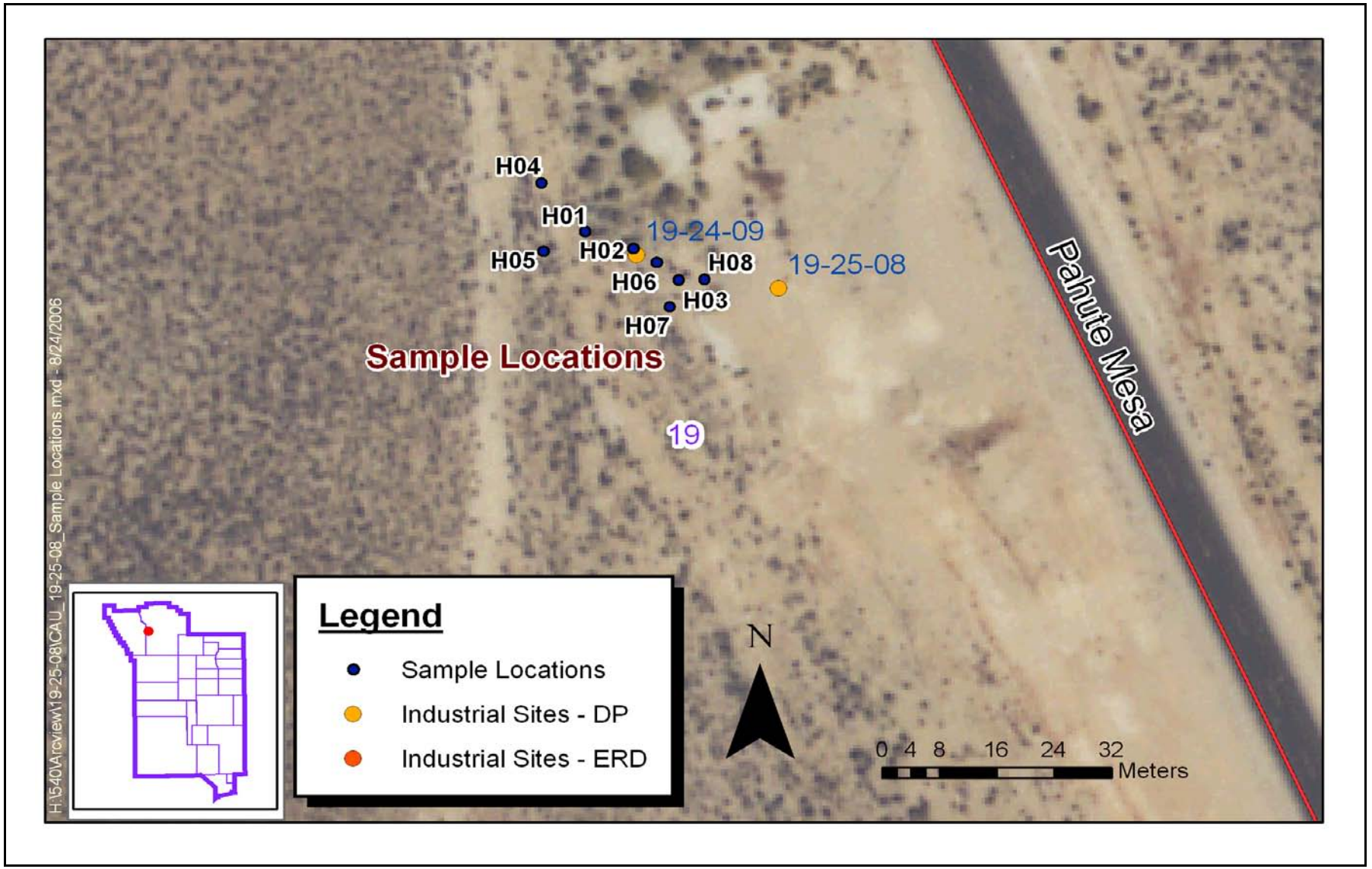


**Figure D.9-1**
**Sample Locations for CAS 19-25-08**

### *D.9.1 Volatile Organic Compounds*

Analytical results for VOCs detected in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.9-2. No VOC concentrations exceeded their respective PALs.

**Table D.9-2**
**Sample Results for Total VOCs Detected Above Minimum Detectable Concentrations at CAS 19-25-08, Oil Spills (3)**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) |
|---|---|---|---|
| | | | Methylene Chloride |
| Final Action Levels[a] | | | 21,000 |
| H02 | 540H004 | 0.0 - 0.5 | 2.6 (J) |
| H03 | 540H006 | 0.0 - 0.5 | 2.6 (J) |
| | 540H007 | 1.0 - 1.5 | 2.4 (J) |

[a]Based on U.S. Environmental Protection Agency, Region 9 Preliminary Remediation Goals *(PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
mg/kg = Micrograms per kilogram
J = Estimated value

### *D.9.2 Semivolatile Organic Compounds*

Analytical results for SVOCs detected in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.9-3. None of the SVOC concentrations exceeded their respective PALs.

# Table D.9-3
# Sample Results for Total SVOCs Detected Above Minimum Detectable Concentrations at CAS 19-25-08, Oil Spills (3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | | | | |
|---|---|---|---|---|---|---|---|
| | | | Benzoic Acid | Bis(2-Ethylhexyl)Phthalate | Benzo(b)fluoranthene | Benzo(a)pyrene | Di-N-Butyphthalate |
| **Final Action Levels[a]** | | | **100,000,000** | **120,000** | **2,100** | **210** | **62,000,000** |
| H02 | 540H004 | 0.0 - 0.5 | -- | 410 | -- | -- | -- |
| H03 | 540H006 | 0.0 - 0.5 | 720 (J) | -- | -- | -- | -- |
| H06 | 540H012 | 0.0 - 0.5 | -- | 350 (J) | -- | -- | -- |
| H07 | 540H014 | 0.0 - 0.5 | -- | -- | -- | -- | 31 (J) |
| H08 | 540H016 | 0.0 - 0.5 | -- | -- | 26 (J) | 14 (J) | -- |
| | 540H017 | 1.0 - 1.5 | 620 (J) | -- | -- | -- | -- |

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
mg/kg = Micrograms per kilogram
-- = Not detected above minimum detectable concentrations
J = Estimated value

### D.9.3 Total Petroleum Hydrocarbons

Analytical results for TPH-DRO in soil samples collected at this CAS detected above the laboratory MDLs are presented in Table D.9-4. For those samples whose analytical results exceeded the PAL of 100 mg/kg, a Tier 2 evaluation was conducted by evaluating the hazardous constituents of diesel (see Section H.1.10). This evaluation determined that none of the hazardous constituents of diesel were identified in the VOC or SVOC analyses at concentrations above their respective FALs; therefore, the TPH-DRO detected at this CAS is not considered a COC.

**Table D.9-4**
**Sample Results for TPH-DRO Detected Above Minimum Detectable Concentrations at CAS 19-25-08, Oil Spills (3)**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) |
|---|---|---|---|
| | | | Diesel-Range Organics |
| Preliminary Action Levels[a] | | | 100 |
| H02 | 540H004 | 0.0 - 0.5 | 3.8 (J) |
| H03 | 540H006 | 0.0 - 0.5 | 28 (H) |
| H06 | 540H012 | 0.0 - 0.5 | 6.8 (H) |
| | 540H013 | 1.0 - 1.5 | 97 (H) |
| H07 | 540H014 | 0.0 - 0.5 | 4.6 (J) |
| H08 | 540H016 | 0.0 - 0.5 | 5.2 (J) |
| | 540H017 | 1.0 - 1.5 | **880** (H) |

[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
H = Fuel pattern in the heavier end of retention time window
J = Estimated value

### D.9.4 Polychlorinated Biphenyls

Analytical results for PCBs in soil samples collected at this CAS detected above their respective laboratory MDLs are listed in Table D.9-5. None of the PCB concentrations exceeded their respective PALs.

**Table D.9-5**
**Sample Results for PCBs Detected Above Minimum Detectable Concentrations at CAS 19-25-08, Oil Spills (3)**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (µg/kg) |
|---|---|---|---|
| | | | Aroclor 1260 |
| Final Action Levels[a] | | | 740 |
| H02 | 540H004 | 0.0 - 0.5 | 13 (J) |
| H03 | 540H006 | 0.0 - 0.5 | 31 |
| H06 | 540H012 | 0.0 - 0.5 | 16 (J) |
| H07 | 540H014 | 0.0 - 0.5 | 11 (J) |
| H08 | 540H016 | 0.0 - 0.5 | 10 (J) |
| | 540H017 | 1.0 - 1.5 | 18 (J) |

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
µg/kg = Micrograms per kilogram
J = Estimated value

### *D.9.5 RCRA Metals*

Analytical results for RCRA metals in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.9-6. None of the RCRA metal concentrations exceeded their respective PALs.

# Table D.9-6
# Sample Results for Total RCRA Metals Detected Above Minimum Detectable Concentrations at CAS 19-25-08, Oil Spills (3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Barium | Cadmium | Chromium | Lead | Mercury |
| **Final Action Levels** | | | **23[a]** | **67,000[b]** | **450[b]** | **450[b]** | **800[b]** | **310[b]** |
| H01 | 540H001 | 0.0 - 0.5 | 2.3 | 26 | -- | 74 | 14 | -- |
| | 540H002 | 0.0 - 0.5 | 2.2 | 26 | -- | 78 | 14 | -- |
| | 540H003 | 1.5 - 2.0 | 4.6 | 91 | -- | 9.8 | 13 | 0.0051 (J-) |
| H02 | 540H004 | 0.0 - 0.5 | 4.6 | 110 | -- | 6 | 15 | 0.015 (J-) |
| | 540H005 | 1.0 - 1.5 | 4.7 | 100 | -- | 6.2 | 14 | 0.011 (J-) |
| H03 | 540H006 | 0.0 - 0.5 | 5.1 | 130 | 0.093 (B) | 7.7 | 22 | 0.011 (J-) |
| | 540H007 | 1.0 - 1.5 | 4.4 | 100 | -- | 6 | 12 | 0.023 (J-) |
| H04 | 540H008 | 0.0 - 0.5 | 3.1 | 58 | -- | 25 | 14 | 0.0021 (J-) |
| | 540H009 | 1.0 - 1.5 | 1.7 | 64 | -- | 1.4 | 11 | 0.0085 (J-) |
| H05 | 540H010 | 0.0 - 0.5 | 4.5 | 95 | -- | 6.6 | 13 | 0.011 (J-) |
| | 540H011 | 1.5 - 2.0 | 2.2 | 77 | -- | 1.8 | 4.7 | 0.0067 (J-) |
| H06 | 540H012 | 0.0 - 0.5 | 4.7 | 110 | -- | 6.2 | 12 | 0.019 (J-) |
| | 540H013 | 1.0 - 1.5 | 4.6 | 130 | -- | 5.4 | 11 | 0.012 (J-) |
| H07 | 540H014 | 0.0 - 0.5 | 5 | 110 | 0.97 | 6.6 | 28 | 0.016 (J-) |
| | 540H015 | 1.0 - 1.5 | 3.7 | 62 | -- | 2.3 | 8.1 | 0.013 (J-) |
| H08 | 540H016 | 0.0 - 0.5 | 1.8 | 28 | -- | 6.8 | 9.2 | -- |
| | 540H017 | 1.0 - 1.5 | 9.2 | 140 | -- | 4.4 | 16 | 0.0046 (J-) |

[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 U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
-- = Not detected above minimum detectable concentrations
B = Value less than the contract required detection limit but greater than or equal to the instrument detection limit
J- = The result is an estimated quantity, but the result may be biased low

# Table D.9-7
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-08, Oil Spills (3)
(Page 1 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228 | | Bismuth-212 | | Bismuth-214 | | Lead-212 | | Lead-214 | | Thallium-208 | |
| **Final Action Levels[a]** | | | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** |
| **Depth bgs (cm)** | | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** |
| H01 | 540H001 | 0.0 - 0.5 | 2.51 (G) | N/A | -- | N/A | 0.96 (G, J) | N/A | 2.29 (J) | N/A | 0.97 (G, J) | N/A | 0.81 (G) | N/A |
| | 540H002 | 0.0 - 0.5 | 2.31 (G) | N/A | 2.23 (G) | N/A | 1.01 (G, J) | N/A | 2.34 (J) | N/A | 0.98 (G, J) | N/A | 0.73 (G) | N/A |
| | 540H003 | 1.5 - 2.0 | N/A | 2.57 (G) | N/A | -- | N/A | 0.78 (G, J) | N/A | 3.61 (J) | N/A | 1.21 (G, J) | N/A | 0.95 (G) |
| H02 | 540H004 | 0.0 - 0.5 | 2.49 (G) | N/A | -- | N/A | 1.21 (G, J) | N/A | 2.96 (J) | N/A | 1.46 (G, J) | N/A | 0.8 (G) | N/A |
| | 540H005 | 1.0 - 1.5 | N/A | 2.72 (G) | N/A | -- | N/A | 1.76 (G, J) | N/A | 3.07 (J) | N/A | 1.73 (G, J) | N/A | 1.02 (G) |
| H03 | 540H006 | 0.0 - 0.5 | 2.63 (G) | N/A | -- | N/A | 1.5 (G, J) | N/A | 2.64 (J) | N/A | 1.6 (G, J) | N/A | 1.16 (G) | N/A |
| | 540H007 | 1.0 - 1.5 | N/A | 2.56 (G) | N/A | -- | N/A | 1.63 (G, J) | N/A | 2.72 (J) | N/A | 1.44 (G, J) | N/A | 1.15 (G) |
| H04 | 540H008 | 0.0 - 0.5 | 3.06 (G) | N/A | -- | N/A | 1.33 (G, J) | N/A | 3.04 (J) | N/A | 1.58 (G, J) | N/A | 1.06 (G) | N/A |
| | 540H009 | 1.0 - 1.5 | N/A | 3.47 (G) | N/A | -- | N/A | -- | N/A | 3.99 (J) | N/A | 1.48 (G, J) | N/A | 1.64 (G) |

# Table D.9-7
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-08, Oil Spills (3)
(Page 2 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228 | | Bismuth-212 | | Bismuth-214 | | Lead-212 | | Lead-214 | | Thallium-208 | |
| **Final Action Levels[a]** | | | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** |
| **Depth bgs (cm)** | | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** |
| H05 | 540H010 | 0.0 - 0.5 | 3.31 (G) | N/A | -- | N/A | 1.64 (G, J) | N/A | 2.84 (J) | N/A | 1.74 (G,J) | N/A | 1.03 (G) | N/A |
| | 540H011 | 1.5 - 2.0 | N/A | 2.72 (G) | N/A | -- | N/A | 1.33 (G, J) | N/A | 3.22 (J) | N/A | 1.2 (G, J) | N/A | 1.08 (G) |
| H06 | 540H012 | 0.0 - 0.5 | 2.95 (G) | N/A | 3.7 (G) | N/A | 1.33 (G, J) | N/A | 3.17 (J) | N/A | 1.21 (G, J) | N/A | 0.82 (G) | N/A |
| | 540H013 | 1.0 - 1.5 | N/A | 3.08 (G) | N/A | -- | N/A | 1.43 (G, J) | N/A | 3.26 (J) | N/A | 1.5 (G, J) | N/A | 1.08 (G) |
| H07 | 540H014 | 0.0 - 0.5 | 2.42 (G) | N/A | **5.2** (G) | N/A | 1.47 (G, J) | N/A | 2.89 (J) | N/A | 1.49 (G, J) | N/A | 0.77 (G) | N/A |
| | 540H015 | 1.0 - 1.5 | N/A | 2.59 (G) | N/A | -- | N/A | 1.05 (G, J) | N/A | 3.45 (J) | N/A | 1.27 (G, J) | N/A | 0.93 (G) |
| H08 | 540H016 | 0.0 - 0.5 | 2.2 (G) | N/A | -- | N/A | 0.77 (G, J) | N/A | 2.41 (J) | N/A | 1.2 (G, J) | N/A | 0.65 (G) | N/A |
| | 540H017 | 1.0 - 1.5 | N/A | 2.08 (G) | N/A | -- | N/A | 1.19 (G, J) | N/A | 2.22 (J) | N/A | 1.37 (G, J) | N/A | 0.65 (G) |

# Table D.9-7
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-25-08, Oil Spills (3)
(Page 3 of 3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228 | | Bismuth-212 | | Bismuth-214 | | Lead-212 | | Lead-214 | | Thallium-208 | |
| Final Action Levels[a] | | | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 |
| Depth bgs (cm) | | | <15 | >15 | <15 | >15 | <15 | >15 | <15 | >15 | <15 | >15 | <15 | >15 |

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead-212, lead-214, 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 25-mrem/yr dose.

cm = Centimeter
ft bgs = Feet below ground surface
mrem/yr = Millirem per year
N/A = Not applicable
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
< = Less than
> = Greater than
G = Sample density differs by more than 15% of laboratory control sample density
J = Estimated value

### D.9.6 Gamma-Emitting Radionuclides

Gamma-emitting radionuclides in soil samples collected at this CAS that were detected above their respective laboratory MDLs are presented in Table D.9-7. None of the gamma-emitting radionuclides were above their respective PALs, with the exception of sample 540H014 (sample location H07, depth 0.0 to 0.5 ft bgs) which had a Bi-212 concentration of 5.2 pCi/g. This determination is believed to be biased high due to laboratory protocol, which uses a standard of significantly higher density than the typical sample type received from the NTS. The laboratory qualifier of 'G' is an indication that there is a recognized density difference between the standard and the sample of greater than 15 percent. The significance of the density is related to the ability of the instrumentation to detect the target analyte. The lower density of the environmental sample allows for more of the target analyte to be detected than had the sample been of the same density as the standard used for calibration. The resulting environmental result is therefore biased high and is not believed to actually be above the PAL of 5.0 pCi/g. Another indication of the error in the Bi-212 result is the equilibrium that exists naturally between Bi-212 and lead (Pb)-212 (Bi-212 is the naturally occurring decay product of Pb-212), and the fact that the Pb-212 is the more precise measurement. The concentration of Pb-212 is only 2.89 pCi/g in sample 540H014, and this is further evidence that the Bi-212 result is biased high. Therefore, the Bi-212 in this sample is not a COC. Furthermore, Bi-212 is not the result of any release being investigated at this CAS.

### D.9.7 Isotopic Radionuclides

Analytical results for isotopic radionuclides in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.9-8. None of the isotopic radionuclide concentrations exceeded their respective PALs.

# Table D.9-8
# Sample Results for Isotopic Uranium, Isotopic Plutonium, and Strontium-90 Detected Above Minimum Detectable Concentrations at CAS 19-25-08, Oil Spills (3)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | |
|---|---|---|---|---|---|---|
| | | | Plutonium-239 | Uranium-234 | Uranium-235 | Uranium-238 |
| **Final Action Levels[a]** | | | **12.7** | **143** | **17.6** | **105** |
| H01 | 540H001 | 0.0 - 0.5 | -- | 1.05 (M3) | -- | 0.95 (M3) |
| | 540H002 | 0.0 - 0.5 | -- | 1.02 | 0.081 | 0.81 |
| | 540H003 | 1.5 - 2.0 | -- | 0.67 | 0.046 (LT) | 0.79 |
| H02 | 540H004 | 0.0 - 0.5 | -- | 1.1 | -- | 1.13 |
| | 540H005 | 1.0 - 1.5 | -- | 0.99 | 0.051 | 0.93 |
| H03 | 540H006 | 0.0 - 0.5 | -- | 0.97 | -- | 0.93 |
| | 540H007 | 1.0 - 1.5 | 0.083 | 1.12 | 0.047 (LT) | 1.08 |
| H04 | 540H008 | 0.0 - 0.5 | 0.126 | 0.87 | 0.062 | 0.94 |
| | 540H009 | 1.0 - 1.5 | -- | 1.03 | 0.061 | 0.97 |
| H05 | 540H010 | 0.0 - 0.5 | 0.095 | 1.09 | 0.05 (LT) | 1.04 |
| | 540H011 | 1.5 - 2.0 | -- | 1.31 | 0.078 | 1.33 |
| H06 | 540H012 | 0.0 - 0.5 | -- | 1.11 | 0.064 | 1.06 |
| | 540H013 | 1.0 - 1.5 | -- | 1.09 | -- | 0.96 |
| H07 | 540H014 | 0.0 - 0.5 | -- | 1.08 | 0.054 | 0.97 |
| | 540H015 | 1.0 - 1.5 | -- | 1.36 | 0.074 | 1.24 |
| H08 | 540H016 | 0.0 - 0.5 | -- | 0.82 | 0.061 | 0.94 |
| | 540H017 | 1.0 - 1.5 | -- | 1.02 | 0.056 | 0.89 |

[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 25-mrem/yr dose.

ft bgs = Feet below ground surface
mrem/yr = Millirem per year
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
LT = Result is less than the requested minimum detectable concentration, greater than the sample specific minimum detectable concentration
M3 = The requested minimum detectable concentration was not met, but the reported activity is greater than the reported minimum detectable concentration

# D.10.0 CAS 19-44-03, U-19bf Drill Site Release

The following sections provide analytical results from the samples collected to complete investigation activities as outlined in the SAFER Plan. Environmental investigation samples were analyzed for the SAFER Plan-specified COPCs, which included VOCs, SVOCs, TPH-DRO and -GRO, RCRA metals, gamma-emitting radionuclides, isotopic U, isotopic Pu, and Sr-90.

Analytical results from the soil samples with concentrations exceeding MDLs are summarized in the following sections. An evaluation was conducted on all contaminants detected above MDLs by initially comparing individual concentration or activity results against the PALs. Samples collected and the analyses performed are listed in Table D.10-1. Sample locations are identified in Figure D.10-1.

**Table D.10-1**
**Samples Collected at CAS 19-44-03, U-19bf Drill Site Release**
(Page 1 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose | Analyses |
|---|---|---|---|---|---|
| I01 | 540I001 | 0.0 - 0.5 | Soil | Environmental, MS/MSD | Set 1 |
| | 540I006 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| I02 | 540I002 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540I003 | 0.0 - 0.5 | Soil | Field Duplicate of #540I002 | Set 1 |
| | 540I007 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| I03 | 540I004 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540I008 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| I04 | 540I005 | 0.0 - 0.5 | Soil | Environmental | Set 1 |
| | 540I009 | 2.0 - 2.5 | Soil | Environmental | Set 1 |
| N/A | 540I301 | N/A | Water | Trip Blank | VOCs only |
| N/A | 540I302 | N/A | Water | Field Blank | Set 1 |
| N/A | 540I501 | N/A | Liquid | Rinsate Sample | Set 2 |

## Table D.10-1
## Samples Collected at CAS 19-44-03, U-19bf Drill Site Release
(Page 2 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Matrix | Purpose | Analyses |
|---|---|---|---|---|---|
| N/A | 540I303 | N/A | Water | Equipment Blank | Set 1 |

Set 1 = Total VOCs, Total SVOCs, Total RCRA Metals, TPH-DRO and -GRO, PCBs, Gamma Spectroscopy, Isotopic Uranium, Isotopic Plutonium, Strontium-90
Set 2 = Gross Alpha/Beta, Tritium

ft bgs = Feet below ground surface
MS/MSD = Matrix spike/matrix spike duplicate
N/A = Not applicable

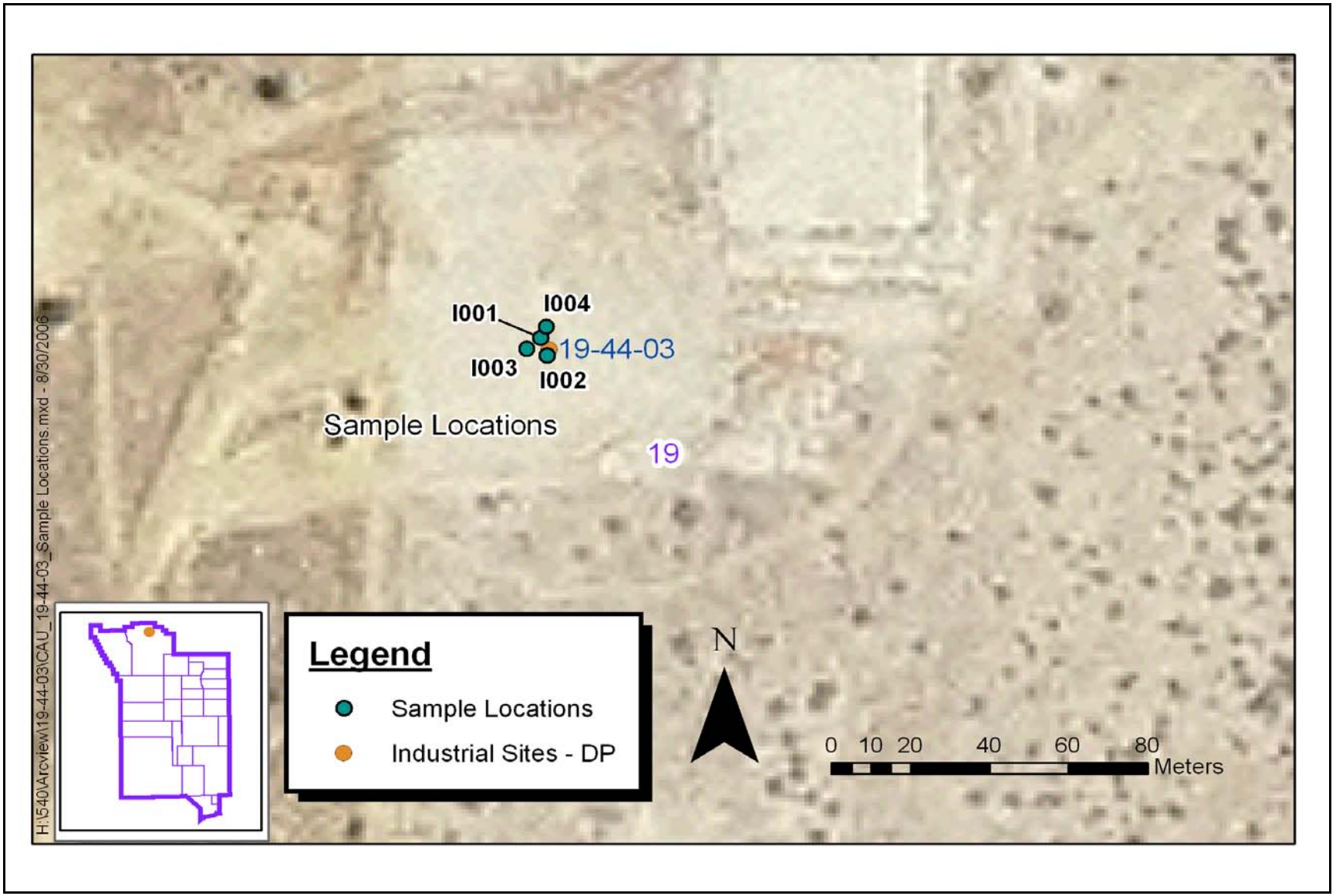


**Figure D.10-1**
**Sample Locations for CAS 19-44-03**

### *D.10.1 Volatile Organic Compounds*

Analytical results for VOCs in soil samples collected at this CAS detected above their respective laboratory MDLs are listed in Table D.10-2. None of the VOC concentrations exceeded their respective PALs.

**Table D.10-2**
**Sample Results for Total VOCs Detected Above Minimum Detectable Concentrations at CAS 19-44-03, U-19bf Drill Site Release**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) |
|---|---|---|---|
| | | | 2-Hexanone |
| Final Action Levels[a] | | | 110,000,000 |
| I02 | 540I007 | 2.0 - 2.5 | 22 |

[a]Based on U.S. Environmental Protection Agency, Region 9 Preliminary Remediation Goals *(PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
mg/kg = Micrograms per kilogram

### *D.10.2 Semivolatile Organic Compounds*

Analytical results for SVOCs in soil samples collected at this CAS detected above their respective laboratory MDLs are shown in Table D.10-3. None of the SVOC concentrations exceeded their respective PALs.

**Table D.10-3**
**Sample Results for Total SVOCs Detected Above Minimum Detectable Concentrations at CAS 19-44-03, U-19bf Drill Site Release**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (µg/kg) |
|---|---|---|---|
| | | | Bis(2-Ethylhexyl)Phthalate |
| Final Action Levels[a] | | | 120,000 |
| I01 | 540I001 | 0.0 - 0.5 | 2,400 (J) |
| | 540I006 | 2.0 - 2.5 | 480 (J) |

[a]Based on U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals (PRGs)* (EPA, 2004).

ft bgs = Feet below ground surface
µg/kg = Micrograms per kilogram
J = Estimated value

### D.10.3 Total Petroleum Hydrocarbons

Analytical results for TPH-DRO in soil samples collected at this CAS detected above their respective laboratory MDLs are shown in Table D.10-4. For those samples whose analytical results exceeded the PAL of 100 mg/kg, a Tier 2 evaluation was conducted by evaluating the hazardous constituents of diesel (see Section H.1.10). This evaluation determined that none of the hazardous constituents of diesel were identified in the VOC or SVOC analyses at concentrations above their respective FALs; therefore, the TPH-DRO detected at this CAS is not considered a COC.

**Table D.10-4**
**Sample Results for TPH-DRO and TPH-GRO Detected Above Minimum Detectable Concentrations at CAS 19-44-03, U-19bf Drill Site Release**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | |
|---|---|---|---|---|
| | | | Diesel-Range Organics | Gasoline-Range Organics |
| **Preliminary Action Levels[a]** | | | **100** | **100** |
| I01 | 540I001 | 0.0 - 0.5 | **13,000** (M) | -- |
| | 540I006 | 2.0 - 2.5 | **3,000** (M) | -- |
| I02 | 540I002 | 0.0 - 0.5 | -- | 0.089 (J) |
| | 540I007 | 2.0 - 2.5 | 4.3 (J) | -- |
| I04 | 540I005 | 0.0 - 0.5 | 11 (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
-- = Not detected above minimum detectable concentrations
J = Estimated value
M = Chromatogram resembles that of motor oil

### D.10.4 Polychlorinated Biphenyls

Polychlorinated biphenyls were not detected above their respective laboratory MDLs in the soil samples collected at this CAS.

### D.10.5 RCRA Metals

Analytical results for RCRA metals in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.10-5. None of the RCRA metal concentrations exceeded their respective PALs.

**Table D.10-5**
**Sample Results for Total RCRA Metals Detected Above Minimum Detectable Concentrations at CAS 19-44-03, U-19bf Drill Release Site**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (mg/kg) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Arsenic | Barium | Cadmium | Chromium | Lead | Mercury | Selenium |
| **Final Action Levels[a]** | | | **23[a]** | **67,000[b]** | **450[b]** | **450[b]** | **800[b]** | **310[b]** | **5,100[b]** |
| I01 | 540I001 | 0.0 - 0.5 | 3.2 | 97 | 0.053 (B) | 5 (J) | 8.4 | 0.021 (J-) | -- |
| | 540I006 | 2.0 - 2.5 | 2.9 | 49 | -- | 2.6 (J) | 4.7 | 0.036 (J-) | -- |
| I02 | 540I002 | 0.0 - 0.5 | 4.6 | 130 | -- | 7.1 (J) | 11 | 0.024 (J-) | 0.52 (B) |
| | 540I003 | 0.0 - 0.5 | 5 | 120 | -- | 8.4 (J) | 11 | 0.027 (J-) | -- |
| | 540I007 | 2.0 - 2.5 | 3 | 47 | -- | 4.2 (J) | 5.2 | 0.014 (J-) | -- |
| I03 | 540I004 | 0.0 - 0.5 | 4.1 | 120 | -- | 5.7 (J) | 9.5 | 0.025 (J-) | -- |
| | 540I008 | 2.0 - 2.5 | 3.6 | 47 | -- | 3.4 (J) | 5.5 | 0.0058 (J-) | -- |
| I04 | 540I005 | 0.0 - 0.5 | 3.3 | 88 | -- | 5 (J) | 8.9 | 0.0071 (J-) | -- |
| | 540I009 | 2.0 - 2.5 | 2.9 | 27 | -- | 3.3 (J) | 3.4 | 0.0063 (J-) | -- |

[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 U.S. Environmental Protection Agency, *Region 9 Preliminary Remediation Goals* (PRGs) (EPA, 2004).

ft bgs = Feet below ground surface
mg/kg = Milligrams per kilogram
-- = Not detected above minimum detectable concentrations
B = Value less than the contract required detection limit but greater than or equal to the instrument detection limit
J = Estimated value
J- = The result is an estimated quantity, but the result may be biased low

### *D.10.6 Gamma-Emitting Radionuclides*

Analytical results for gamma-emitting radionuclides in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.10-6. None of the gamma-emitting radionuclide concentrations exceeded their respective PALs.

# Table D.10-6
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-44-03, U-19bf Drill Site Release
(Page 1 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228 | | Bismuth-214 | | Lead-212 | | Lead-214 | | Thallium-208 | |
| **Final Action Levels[a]** | | | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** | **5** | **15** |
| **Depth bgs (cm)** | | | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** | **<15** | **>15** |
| I01 | 540I001 | 0.0 - 0.5 | 2.44 (G) | N/A | 1.53 (G, J) | N/A | 2.86 (J) | N/A | 1.57 (G, J) | N/A | 0.82 (G) | N/A |
| | 540I006 | 2.0 - 2.5 | N/A | 3.04 (G) | N/A | 1.73 (G, J) | N/A | 3.44 (J) | N/A | 1.79 (G, J) | N/A | 1.09 (G) |
| I02 | 540I002 | 0.0 - 0.5 | 2.38 (G) | N/A | 1.26 (G, J) | N/A | 2.73 (J) | N/A | 1.53 (G, J) | N/A | 0.91 (G) | N/A |
| | 540I003 | 0.0 - 0.5 | 2.16 (G) | N/A | 1.44 (G, J) | N/A | 2.55 (J) | N/A | 1.48 (G, J) | N/A | 0.9 (G) | N/A |
| | 540I007 | 2.0 - 2.5 | N/A | 2.91 (G) | N/A | 1.74 (G, J) | N/A | 3.2 (J) | N/A | 1.94 (G, J) | N/A | 0.94 (G) |
| I03 | 540I004 | 0.0 - 0.5 | 2.11 (G) | N/A | 1.22 (G, J) | N/A | 2.61 (J) | N/A | 1.5 (G, J) | N/A | 0.87 (G) | N/A |
| | 540I008 | 2.0 - 2.5 | N/A | 2.89 (G) | N/A | 1.96 (G, J) | N/A | 3.22 (J) | N/A | 1.66 (G, J) | N/A | 0.9 (G) |
| I04 | 540I005 | 0.0 - 0.5 | 2.7 (G) | N/A | 1.91 (G, J) | N/A | 2.9 (J) | N/A | 1.52 (G, J) | N/A | 0.96 (G) | N/A |
| | 540I009 | 2.0 - 2.5 | N/A | 3.21 (G) | N/A | 2.16 (G, J) | N/A | 3.47 (J) | N/A | 2.48 (G, J) | N/A | 1 (G) |

# Table D.10-6
## Sample Results for Gamma-Emitting Radionuclides Detected Above Minimum Detectable Concentrations at CAS 19-44-03, U-19bf Drill Site Release
(Page 2 of 2)

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Actinium-228 | | Bismuth-214 | | Lead-212 | | Lead-214 | | Thallium-208 | |
| **Final Action Levels[a]** | | | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 | 5 | 15 |
| **Depth bgs (cm)** | | | <15 | >15 | <15 | >15 | <15 | >15 | <15 | >15 | <15 | >15 |

[a]Taken from the generic guidelines for residual concentrations of actinium-228, bismuth-214, lead-212, lead-214, 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 25-mrem/yr dose.

cm = Centimeter
ft bgs = Feet below ground surface
mrem/yr = Millirem per year
N/A = Not applicable
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations
< = Less than
> = Greater than
G = Sample density differs by more than 15% of laboratory control sample density
J = Estimated value

### *D.10.7 Isotopic Radionuclides*

Analytical results for isotopic radionuclides in soil samples collected at this CAS detected above their respective laboratory MDLs are presented in Table D.10-7. None of the isotopic radionuclide concentrations exceeded their respective PALs.

**Table D.10-7**
**Sample Results for Isotopic Uranium and Isotopic Plutonium Detected Above Minimum Detectable Concentrations at CAS 19-44-03, U-19bf Drill Site Release**

| Sample Location | Sample Number | Depth (ft bgs) | Contaminants of Potential Concern (pCi/g) | | | |
|---|---|---|---|---|---|---|
| | | | Plutonium-239 | Uranium-234 | Uranium-235 | Uranium-238 |
| **Final Action Levels[a]** | | | **12.7** | **143** | **17.6** | **105** |
| I01 | 540I001 | 0.0 - 0.5 | -- | 1.34 | -- | 1.25 |
| | 540I006 | 2.0 - 2.5 | -- | 1.75 | 0.071 | 1.72 |
| I02 | 540I002 | 0.0 - 0.5 | -- | 1.23 | 0.05 | 1.11 |
| | 540I003 | 0.0 - 0.5 | 0.124 | 1.26 | -- | 1.14 |
| | 540I007 | 2.0 - 2.5 | -- | 1.5 | 0.078 | 1.38 |
| I03 | 540I004 | 0.0 - 0.5 | -- | 1.3 | 0.068 | 1.23 |
| | 540I008 | 2.0 - 2.5 | -- | 1.6 | 0.062 | 1.66 |
| I04 | 540I005 | 0.0 - 0.5 | -- | 1.29 | 0.055 | 1.26 |
| | 540I009 | 2.0 - 2.5 | -- | 1.95 | 0.085 | 1.76 |

[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 25-mrem/yr dose.

ft bgs = Feet below ground surface
mrem/yr = Millirem per year
pCi/g = Picocuries per gram
-- = Not detected above minimum detectable concentrations

## D.11.0 Summary

Organic, inorganics, and radionuclide contaminants detected in environmental samples during the CAI were evaluated against PALs to determine the nature and extent of COCs for CAU 540. Assessment of the data generated from investigation activities indicates the PALs were exceeded for TPH-DRO (the critical analyte for CAU 540) in at least one location at each CAS within CAU 540. However, when the hazardous constituents of diesel (according to the ASTM Method E1739-95 [ASTM, 1995]) are considered, none of the TPH concentrations are considered as hazardous (i.e., they are not COCs for the CAS in which they are found). The following summarizes the results for each CAS.

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

Based on field observations and analytical results for soil samples collected at this CAS, TPH-DRO is the only analyte detected above its PAL of 100 mg/kg. Application of the ASTM Method E1739-95 (ASTM, 1995) allows for the examination of the hazardous components of diesel in an effort to determine the potential hazard of the TPH-DRO contamination. For each location in which TPH-DRO was identified, the hazardous components of diesel were either non-detect (below the laboratory MDL for the hazardous constituent) or were well below the PAL for the hazardous component.

No other target analytes were identified above their respective PALs by the laboratory in any of the environmental samples collected for analysis; therefore, it is recommended that CAS 12-44-01 be closed with no further action.

***CAS 12-99-01, Oil Stained Dirt***

Based on field observations and analytical results for soil samples collected at this CAS, TPH-DRO is the only analyte detected above its PAL of 100 mg/kg. Application of the ASTM Method E1739-95 (ASTM, 1995) allows for the examination of the hazardous components of diesel in an effort to determine the potential hazard of the TPH-DRO contamination. For each location in which TPH-DRO was identified, the hazardous components of diesel were either non-detect (below the laboratory MDL for the hazardous constituent) or were well below the PAL for the hazardous component.

No other target analytes were identified above their respective PALs by the laboratory in any of the environmental samples collected for analysis; therefore, it is recommended that CAS 12-99-01 be closed with no further action.

***CAS 19-25-02, Oil Spill***

Based on field observations and analytical results for soil samples collected at this CAS, TPH-DRO is the only analyte detected above its PAL of 100 mg/kg. Application of the ASTM Method E1739-95 (ASTM, 1995) allows for the examination of the hazardous components of diesel in an effort to determine the potential hazard of the TPH-DRO contamination. For each location in which TPH-DRO was identified, the hazardous components of diesel were either non-detect (below the laboratory MDL for the hazardous constituent) or were well below the PAL for the hazardous component.

No other target analytes were identified above their respective PALs by the laboratory in any of the environmental samples collected for analysis; therefore, it is recommended that CAS 19-25-02 be closed with no further action.

***CAS 19-25-04, Oil Spill***

Based on field observations and analytical results for soil samples collected at this CAS, TPH-DRO is the only analyte detected above its PAL of 100 mg/kg. Application of the ASTM Method E1739-95 (ASTM, 1995) allows for the examination of the hazardous components of diesel in an effort to determine the potential hazard of the TPH-DRO contamination. For each location in which TPH-DRO was identified, the hazardous components of diesel were either non-detect (below the laboratory MDL for the hazardous constituent) or were well below the PAL for the hazardous component.

Plutonium-239 was identified in the surface sample at sample location D04 at a concentration of 104 pCi/g. No other samples collected in this CAS had any Pu-239 above the PAL, and the laboratory reanalysis of the sample was below the PAL for Pu-239. An additional sample collected at this location also detected Pu-239 above the laboratory MDL but below the PAL. It is believed that the Pu-239 was a particle that was collected and as a result was removed from the site with the

sample. Plutonium-239 is not a COC for this CAS. Furthermore, Pu-239 is not the result of the releases being investigated at this CAS.

No other target analytes were identified above their respective PALs by the laboratory in any of the environmental samples collected for analysis; therefore, it is recommended that CAS 19-25-04 be closed with no further action.

***CAS 19-25-05, Oil Spill***

Based on field observations and analytical results for soil samples collected at this CAS, TPH-DRO is the only analyte detected above its PAL of 100 mg/kg. Application of the ASTM Method E1739-95 (ASTM, 1995) allows for the examination of the hazardous components of diesel in an effort to determine the potential hazard of the TPH-DRO contamination. For each location in which TPH-DRO was identified, the hazardous components of diesel were either non-detect (below the laboratory MDL for the hazardous constituent) or were well below the PAL for the hazardous component.

No other target analytes were identified above their respective PALs by the laboratory in any of the environmental samples collected for analysis; therefore, it is recommended that CAS 19-25-05 be closed with no further action.

***CAS 19-25-06, Oil Spill***

Based on field observations and analytical results for soil samples collected at this CAS, TPH-DRO is the only analyte detected above its PAL of 100 mg/kg. Application of the ASTM Method E1739-95 (ASTM, 1995) allows for the examination of the hazardous components of diesel in an effort to determine the potential hazard of the TPH-DRO contamination. For each location in which TPH-DRO was identified, the hazardous components of diesel were either non-detect (below the laboratory MDL for the hazardous constituent) or were well below the PAL for the hazardous component.

No other target analytes were identified above their respective PALs by the laboratory in any of the environmental samples collected for analysis; therefore, it is recommended that CAS 19-25-06 be closed with no further action.

***CAS 19-25-07, Oil Spill***

Based on field observations and analytical results for soil samples collected at this CAS, TPH-DRO is the only analyte detected above its PAL of 100 mg/kg. Application of the ASTM Method E1739-95 (ASTM, 1995) allows for the examination of the hazardous components of diesel in an effort to determine the potential hazard of the TPH-DRO contamination. For each location in which TPH-DRO was identified, the hazardous components of diesel were either non-detect (below the laboratory MDL for the hazardous constituent) or were well below the PAL for the hazardous component.

No other target analytes were identified above their respective PALs by the laboratory in any of the environmental samples collected for analysis; therefore, it is recommended that CAS 19-25-07 be closed with no further action.

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

Based on field observations and analytical results for soil samples collected at this CAS, TPH-DRO is the only analyte detected above its PAL of 100 mg/kg. Application of the ASTM Method E1739-95 (ASTM, 1995) allows for the examination of the hazardous components of diesel in an effort to determine the potential hazard of the TPH-DRO contamination. For each location in which TPH-DRO was identified, the hazardous components of diesel were either non-detect (below the laboratory MDL for the hazardous constituent) or were well below the PAL for the hazardous component.

Sample 540H014 (sample location H07, 0.0 to 0.5 ft bgs) contains Bi-212 at a concentration of 5.2 pCi/g. As discussed in Section D.9.6 this result is believed to be biased high and is not reasonably expected to be above the PAL of 5.0 pCi/g. Bismuth-212 is not a COC at this CAS. Furthermore, Bi-212 is not the result of the releases being investigated at this CAS.

No other target analytes were identified above their respective PALs by the laboratory in any of the environmental samples collected for analysis; therefore, it is recommended that CAS 19-25-08 be closed with no further action.

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

Based on field observations and analytical results for soil samples collected at this CAS, TPH-DRO is the only analyte detected above its PAL of 100 mg/kg. Application of the ASTM Method E1739-95 (ASTM, 1995) allows for the examination of the hazardous components of diesel in an effort to determine the potential hazard of the TPH-DRO contamination. For each location in which TPH-DRO was identified, the hazardous components of diesel were either non-detect (below the laboratory MDL for the hazardous constituent) or were well below the PAL for the hazardous component.

No other target analytes were identified above their respective PALs by the laboratory in any of the environmental samples collected for analysis; therefore, it is recommended that CAS 19-44-03 be closed with no further action.

## D.12.0 References

ASTM, see American Society for Testing and Materials.

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

DOE, see U.S. Department of Energy.

EPA, see U.S. Environmental Protection Agency.

Moore, J., Science Applications International Corporation. 1999. Memorandum to M. Todd (SAIC), "Background Concentrations for NTS and TTR Soil Samples," 3 February. Las Vegas, NV.

NAC, see *Nevada Administrative Code*.

NBMG, see Nevada Bureau of Mines and Geology.

NCRP, see National Council on Radiation Protection and Measurements.

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

National Council on Radiation Protection and Measurements. 1999. *Recommended Screening Limits for Contaminated Surface Soil and Review of Factors Relevant to Site-Specific Studies*, Report No. 129. Bethesda, MD.

*Nevada Administrative Code*. 2002. NAC 445A.2272, "Contamination of Soil: Establishment of Action Levels." Carson City, NV.

Nevada Bureau of Mines and Geology. 1998. *Mineral and Energy Resource Assessment of the Nellis Air Force Range*, Open-File Report 98-1. Reno, NV.

U.S. Department of Energy. 1993. DOE Order 5400.5 Change 2, "Radiation Protection of the Public and the Environment." Washington, DC.

U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2005. *Streamlined Approach for Environmental Restoration (SAFER) Plan for Corrective Action Unit 540: Spill Sites, Nevada Test Site, Nevada*, Rev. 0. November 2005. Las Vegas, NV.

U.S. Environmental Protection Agency. 2004 (as revised). *Region 9 Preliminary Remediation Goals (PRGs).* As accessed at www.epa.gov/region09/waste/sfund/prg/htm on 26 July 2006.

# Appendix E

# Waste Disposition Documentation

Bechtel Nevada

# NTS LANDFILL LOAD VERIFICATION

**(Waste definitions are available on page 2)**

**SWO USE (Select One) AREA** ☐ 23 ☐ 6 ☑ 9 ☑ **LANDFILL**

*For waste characterization, approval, and/or assistance, contact Solid Waste Operation (SWO) at 5-7898.*

*REQUIRED:* ***WASTE GERERATOR INFORMATION***

*(This form is for rolloffs, dump trucks, and other onsite disposal of materials.)*

Waste Generator: Stoller-Navarro Joint Venture Phone Number: 5-2033

Location / Origin: CAU 540, NTS; 2 containers of solidified rinsate (SNN0617, and SNN0623)

**Waste Category:** (check one) ☐ Commercial ☒ Industrial

**Waste Type:** (check one) ☐ NTS ☐ Non-Putrescible ☐ Putrescible ☐ Asbestos Containing Material ☒ FFACO-onsite ☐ FFACO-offsite ☐ WAC Exception ☐ Historic DOE/NV

**Pollution Prevention Category:** (check one) ☒ Environmental management ☐ Defense Projects ☐ YMP

**Pollution Prevention Category:** (check one) ☒ Clean-Up ☐ Routine

**Method of Characterization:** (check one) ☒ Sampling & Analysis ☐ Process Knowledge ☐ Contents

**Prohibited Waste at all three NTS landfills:** Radioactive waste; RCRA waste; Hazardous waste; Free liquids, PCBs above TSCA regulatory levels, and Medical wastes (needles, sharps, bloody clothing).

**Additional Prohibited Waste at the Area 9 U10C Landfill:** Sewage Sludge, Animal carcasses, Wet garbage (food waste); and Friable asbestos

*REQUIRED:* ***WASTE CONTENTS ALLOWABLE WASTES***

*Check all allowable wastes that are contained within this load:*

**NOTE:** Waste disposal at the Area 6 Hydrocarbon Landfill must have come into contact with petroleum hydrocarbons or coolants such as: gasoline (no benzene, lead); jet fuel; diesel fuel; lubricants and hydraulics' kerosene; asphaltic petroleum hydrocarbon; and ethylene glycol.

**Acceptable waste at any NTS landfill:**

☐ Asphalt ☒ Metal ☐ Wood ☒ Soil ☐ Paper ☐ Rocks / unaltered geologic materials ☐ Rubber (excluding tires) ☐ Empty containers ☐ Demolition debris ☐ Plastic ☐ Wire ☐ Cable ☐ Cloth ☐ Insulation (non-Asbestosform) ☐ Cement & concrete

☐ Manufactured items: (swamp coolers, furniture, rugs, carpet, electronic components, PPE, etc.)

**Additional waste accepted at the Area 23 Mercury Landfill:** ☐ Office Waste ☐ Food Waste ☐ Animal Carcasses

☐ Asbestos ☐ Friable ☐ Non-Friable (contact SWO if regulated load) Quantity: _____

**Additional waste accepted at the Area 9 U10c Landfill:**

☐ Non-friable asbestos ☐ Drained automobiles and military vehicles ☐ Solid fractions from sand/oil/water separators

☐ Light ballasts (contact SWO) ☐ Drained fuel filters (gas & diesel) ☐ Deconned Underground and Above Ground Tanks

☐ Hydrocarbons (contact SWO) ☒ Other Aquaset (absorbent)

**Additional waste accepted at the Area 6 Hydrocarbon Landfill:** ☐ Other _____

☐ Septic sludge ☐ Rags ☐ Drained fuel filters (gas & diesel) ☐ Crushed non-teme plated oil filters

☐ Plants ☐ Soil ☐ Sludge from sand/oil/water separators ☐ PCBs below 50 parts per million

*REQUIRED:* ***WASTE GENERATOR SIGNATURE***

**Initials: _____ (if initialed, no radiological clearance is necessary.)**

**The above mentioned waste was generated outside of a Controlled Waste Management Area (CWMA) and to the best of my knowledge, does not contain radiological materials.**

**To the best of my knowledge, the waste described above contains only those materials have verified this through the waste characterization method identified above and a rev and allowable waste items. I have contacted Property Management and have verified th disposal in the landfill.**

Print Name: DAVID SCHROCK

Signature: David Schrock Date: 7/28/06

Note: Food waste, office trash and/or animal carcasses are considered not to contain ad require a radiological clearance.

**Radiological Survey Release for Waste Disposal**

**RCT Initials**

____ **This container/load meets the criteria for no added man-made radioactive material**

__✓__ **This container/load meets the criteria for Radcon Manual Table 4.2 release limits.**

____ **This container/load is exempt from survey due to process knowledge and origin.**

**SIGNATURE:** [signature] **DATE:** 7/28/06

BN-0646 (10/05)

**SWO USE ONLY**

Load Weight (net from scale or estimate): 75 Signature of Certifier: [signature]

BN-0918 (10/05)

Shipper: ***BECHTEL NEVADA FOR USDOE***

Shipper No.: _____

Date: _____

Purchase/Customer Order No. _____

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading the property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown) marked, consigned, and destined shown below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination, if on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any said property over all or any portion of said route to destination, and as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the Uniform Domestic Straight Bill of Lading set forth (1) in Uniform Freight Classification in effect on the date hereof, if this is a rail or rail-water shipment, or (2) in the applicable motor carrier classification or tariff if this is a motor carrier shipment.

Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, including those on the back thereof, set forth in the classification or tariff which governs the transportation of this shipment and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

**Consignee:**

**Stoller-Navarro Joint Venture**
**CAU 540, Non-hazardous and non-rad. rinsate IDW**

**Carrier:** **NSTec Sanitary Waste Operations**

**PRO NO.:**

**CAR OR VEHICLE INITIALS & NO.:** **SEAL #:**

**Route:** **CARRIER NO.** **SECTION 13712 TENDER NO.:**

| No. PKGS. | HM | Description of Articles (Subject to Correction), Kind of Package, Special Marks and Exemptions (See NMFC Item (Rule) 360) | Weight (Subject to Correction) | Class | Rate | Charges |
|---|---|---|---|---|---|---|
| 6 | | IDW Rinsate, 10 gallon DM<br>Drum Numbers:<br>SNN0621<br>SNN0625<br>SNN0627<br>SNN0629<br>SNN0631<br>SNN0633 | | | | |

Subject to Section 7 of conditions, if this shipment is to be delivered to the consignee without recourse on the consignor, the consignor shall sign the following statement: The carrier shall not make delivery of this shipment without payment of freight and all other lawful charges

**Bechtel Nevada**
Signature of Consignor

If freight charges are to be prepaid write or stamp here **"TO BE PREPAID"**

Note: Where the rate is dependent on value, shippers are required to state specifically in writing the agreed or declared value of the property. The agreed or declared value of the property is hereby specifically stated by the shipper to be not exceeding

$_____ per lb.

*Job order, reference, account, or work order number

Savings:
$ _____

**IN THE EVENT OF AN EMERGENCY, PHONE** _____ **- 24 HOUR**

| ITEM NO. | NMFC 100- | NPM NO. | | |
|---|---|---|---|---|
| | | | | |

*Label(s) applied

**Remarks: (If you receive this shipment damaged, please note on delivery receipt. Contact Bechtel Nevada Traffic at (702) 295-3266, Reference Shippers Number).**

NOTE: This form is used for SNJV Tracking purposes only

*** Placard(s) Required**

TECHNICAL CONTACT: _____

This is to certify that the above named materials are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation. (Applicable for Hazardous Materials Only.)

Shipper: **BECHTEL NEVADA for USDOE, P.O. Box 98521, Las Vegas, NV 89193**

Acting under contract DCACO896NV11718 with U.S. Dept of Energy

Per: _____ Date: _____

P. O. Box 98521, Las Vegas, NV 89193
**TRANSPORTATION DEPT.** - Permanent Post Office Address Of Shipper

This shipment is for U.S. Department of Energy and the actual total transportation charges paid to the carrier(s) by the consignor or consignee are assignable to, and shall be reimbursed by, the U.S. Government and is subject to the terms and conditions set forth in the standard form of the U.S. Government Bill of Lading and to any available special rates or changes (41 CFR 109-40.50 and 41 CFR 40.3)

☐ YES ☐ NO

* The addition on the face hereof and to the terms and conditions are here by noted:

Carrier: _____

Per: _____ Date: _____

Page 1 of 1

BN-0948 (05/00)

Nevada

# NTS LANDFILL LOAD VERIFICATION

**(Waste definitions are available on page 2)**

**SWO USE (Select One) AREA** ☐ 23 ☐ 6 ☑ 9 ☑ **LANDFILL**

*For waste characterization, approval, and/or assistance, contact Solid Waste Operation (SWO) at 5-7898.*

***REQUIRED: WASTE GERERATOR INFORMATION***

*(This form is for rolloffs, dump trucks, and other onsite disposal of materials.)*

Waste Generator: Stoller-Navarro Joint Venture Phone Number: 5-2033

Location / Origin: CAU 540, NTS; 6 empty drums (SNN0621, SNN0625, SNN0627, SNN0629, SNN0631, and SNN0633)

| | | | | |
|---|---|---|---|---|
| **Waste Category:** (check one) | | ☐ Commercial | ☒ Industrial | |
| **Waste Type:** | ☐ NTS | ☐ Putrescrible | ☒ FFACO-onsite | ☐ WAC Exception |
| **(check one)** | ☐ Non-Putrescible | ☐ Asbestos Containing Material | ☐ FFACO-offsite | ☐ Historic DOE/NV |
| **Pollution Prevention Category:** (check one) | | ☒ Environmental management | ☐ Defense Projects | ☐ YMP |
| **Pollution Prevention Category:** (check one) | | ☒ Clean-Up | ☐ Routine | |
| **Method of Characterization:** (check one) | | ☒ Sampling & Analysis | ☐ Process Knowledge | ☐ Contents |

**Prohibited Waste at all three NTS landfills:** Radioactive waste; RCRA waste; Hazardous waste; Free liquids, PCBs above TSCA regulatory levels, and Medical wastes (needles, sharps, bloody clothing).

**Additional Prohibited Waste at the Area 9 U10C Landfill:** Sewage Sludge, Animal carcasses, Wet garbage (food waste); and Friable asbestos

***REQUIRED: WASTE CONTENTS ALLOWABLE WASTES***

*Check all allowable wastes that are contained within this load:*

**NOTE:** Waste disposal at the Area 6 Hydrocarbon Landfill must have come into contact with petroleum hydrocarbons or coolants such as: gasoline (no benzene, lead); jet fuel; diesel fuel; lubricants and hydraulics' kerosene; asphaltic petroleum hydrocarbon; and ethylene glycol.

**Acceptable waste at any NTS landfill:** ☐ Paper ☐ Rocks / unaltered geologic materials ☒ Empty containers

☐ Asphalt ☒ Metal ☐ Wood ☐ Soil ☐ Rubber (excluding tires) ☐ Demolition debris

☐ Plastic ☐ Wire ☐ Cable ☐ Cloth ☐ Insulation (non-Asbestosform) ☐ Cement & concrete

☐ Manufactured items: (swamp coolers, furniture, rugs, carpet, electronic components, PPE, etc.)

**Additional waste accepted at the Area 23 Mercury Landfill:** ☐ Office Waste ☐ Food Waste ☐ Animal Carcasses

☐ Asbestos ☐ Friable ☐ Non-Friable (contact SWO if regulated load) Quantity: _____

**Additional waste accepted at the Area 9 U10c Landfill:**

☐ Non-friable asbestos ☐ Drained automobiles and military vehicles ☐ Solid fractions from sand/oil/water separators

☐ Light ballasts (contact SWO) ☐ Drained fuel filters (gas & diesel) ☐ Deconned Underground and Above Ground Tanks

☐ Hydrocarbons (contact SWO) ☐ Other _____

**Additional waste accepted at the Area 6 Hydrocarbon Landfill:** ☐ Other _____

☐ Septic sludge ☐ Rags ☐ Drained fuel filters (gas & diesel) ☐ Crushed non-teme plated oil filters

☐ Plants ☐ Soil ☐ Sludge from sand/oil/water separators ☐ PCBs below 50 parts per million

***REQUIRED: WASTE GENERATOR SIGNATURE***

**Initials: _____ (if initialed, no radiological clearance is necessary.)**

**The above mentioned waste was generated outside of a Controlled Waste Management Area (CWMA) and to the best of my knowledge, does not contain radiological materials.**

**To the best of my knowledge, the waste described above contains only those materia have verified this through the waste characterization method identified above and a r and allowable waste items. I have contacted Property Management and have verified disposal in the landfill.**

Print Name: DAVID SCHROCK

Signature: David Schrock Date: 7/28/06

Note: Food waste, office trash and/or animal carcasses are considered not to contain require a radiological clearance.

**Radiological Survey Release for Waste Disposal**
**RCT Initials**

✓ **This container/load meets the criteria for no added man-made radioactive material**

**This container/load meets the criteria for Radcon Manual Table 4.2 release limits.**

**This container/load is exempt from survey due to process knowledge and origin.**

**SIGNATURE:** [signature] **DATE** 7/28/06

BN-0646 (10/05)

**SWO USE ONLY**

Load Weight (net from scale or estimate) 50 Signature of Certifier: [signature]

BN-0918 (10/05)

# Appendix F

# Modifications to the Post Closure Plan

# F.1.0 Introduction

This section does not apply to CAU 540.

# Appendix G

# Closure Activity Summary

# G.1.0 Closure Activity Summary

Closure activities were not necessary at any of the CASs of CAU 540.

# Appendix H

# Evaluation of Risk

# H 1.0 Introduction

The RBCA process used to establish FALs is described in the *Industrial Sites Project Establishment of Final Action Levels* (NNSA/NSO, 2006). This process conforms with NAC Section 445A.227, which lists the requirements for sites with soil contamination (NAC, 2004b). For the evaluation of corrective actions, NAC Section 445A.22705 (NAC, 2004a) requires the use of ASTM Method E1739-95 (ASTM, 1995) to "conduct an evaluation of the site, based on the risk it poses to public health and the environment, to determine the necessary remediation standards (i.e., FALs) or to establish that corrective action is not necessary."

The evaluation of the need for corrective action will include the potential for wastes that are present at a site to cause the future contamination of site environmental media if the wastes were to be released.

This section contains documentation of the RBCA process used to establish FALs described in the *Industrial Sites Project Establishment of Final Action Levels* (NNSA/NSO, 2006) and summarized in Figure H.1-1. This process defines three tiers (or levels) to establish FALs used to evaluate DQO decisions:

- Tier 1 – sample results from source areas (highest concentrations) compared to risk-based screening levels (RBSLs) (i.e., PALs) based on generic (non-site-specific) conditions.
- Tier 2 – sample results from exposure points compared to SSTLs calculated using site-specific inputs and Tier 1 formulas.
- Tier 3 – sample results from exposure points compared to SSTLs and points of compliance calculated using chemical fate/transport and probabilistic modeling.

## H.1.1 Scenario

Corrective Action Unit 540, Spill Sites, consists of the following nine inactive sites within Area 12 and Area 19 of the NTS:

- 12-44-01, ER 12-1 Well Site Release
- 12-99-01, Oil Stained Dirt
- 19-25-02, Oil Spill
- 19-25-04, Oil Spill
- 19-25-05, Oil Spill

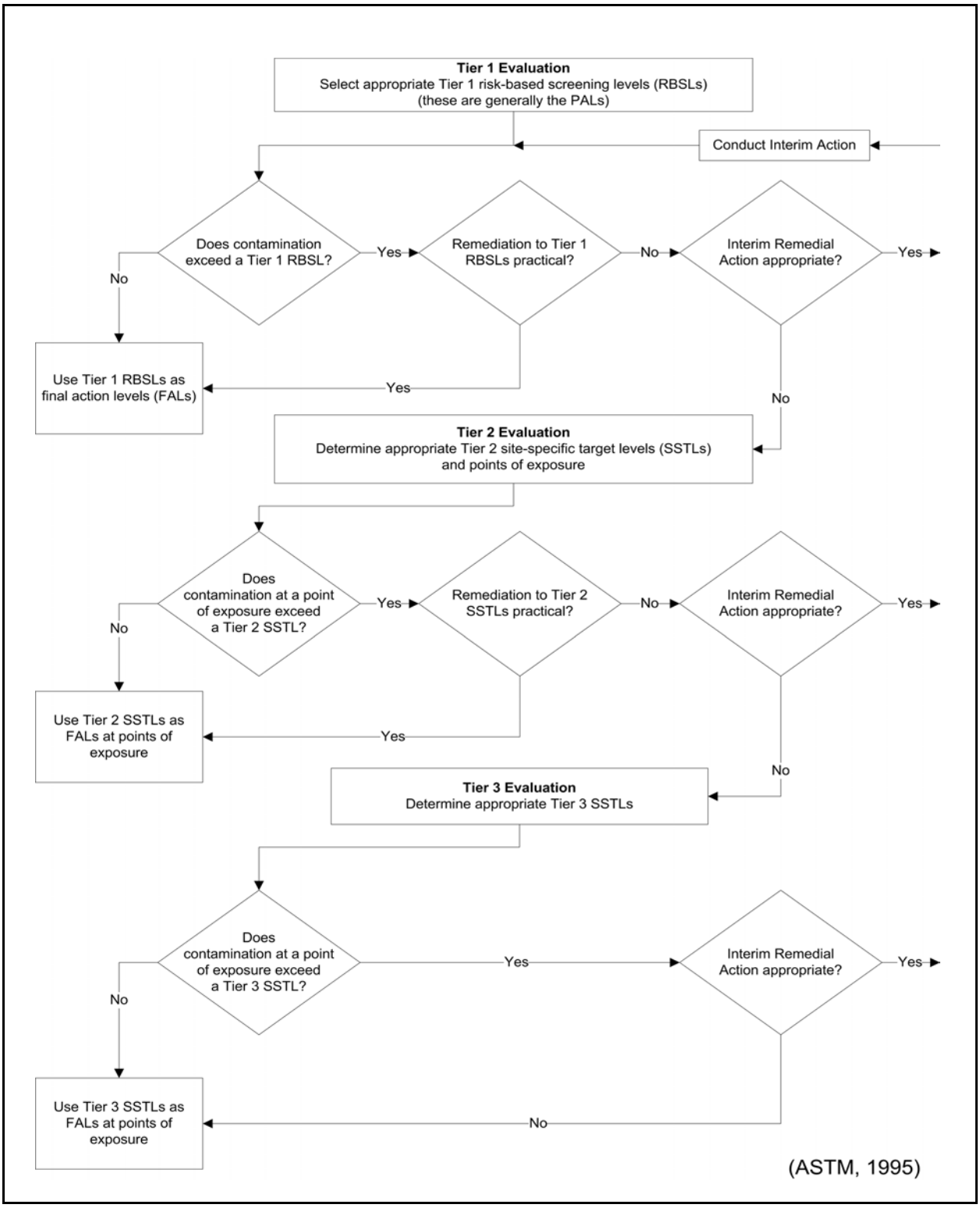


**Figure H.1-1**
**Risk-Based Corrective Action Decision Process**

- 19-25-06, Oil Spill
- 19-25-07, Oil Spill
- 19-25-08, Oil Spills (3)
- 19-44-03, U-19bf Drill Site Release

The corrective action sites within CAU 540 are all associated with visible surface hydrocarbon staining. Corrective Action Site 12-99-01 is a cultural/historic site and some of the originally planned activities (e.g., debris removal, concrete pad canopy removal) were cancelled. Many of the corrective action sites contained very shallow soil horizons overlying bedrock owing to their locations. Corrective Action Site 12-44-01 contains an active well (ER 12-1) that was not scheduled for monitoring activities during the investigation (scheduled for activity in 2007). The remainder of the CASs were located in open areas in Area 19, with wells or cellars nearby that were believed to be the source of the hydrocarbon staining discovered in their proximity. Some of the stained areas were considerably smaller than originally reported (likely due to natural attenuation processes), and some were not visible at all. At these locations, estimates of the locations of the hydrocarbon contamination was derived from maps, drawings, and reports that provided distances from either a landmark (such as a well or cellar) or from the CAS marker.

### *H.1.2 Site Assessment*

The SAFER at the CASs in CAU 540 required soil sampling of the hydrocarbon stained areas identified as potential sources for contaminant releases. The original source (i.e., cause) of the hydrocarbon staining is no longer present in any of the CASs. Investigation involved sampling of the results of the spills or leaks that created the areas of stained soil in an effort to assess their potential to cause present and future harm to human health and the environment. The SAFER investigation results indicate the presence of TPH within the visible areas of stained soil. No other COPCs were identified above their respective PALs, with the exception of Pu-239 at one subsurface location in CAS 19-25-04. None of the hydrocarbon stains at any of the CASs are anticipated to allow for the further expansion of the hydrocarbons from their current locations and configurations.

The maximum concentration of contaminant identified at each CAS, and their corresponding PALs are presented in Table H.1-1.

**Table H.1-1**
**Maximum Reported Value for Tier 1 Comparison**

| CAS No. | Parameter | Preliminary Action Level | Units | Maximum Reported Value |
|---|---|---|---|---|
| 12-44-01 | TPH-DRO | 100 | mg/kg | 270 (M) |
| 12-99-01 | TPH-DRO | 100 | mg/kg | 2000 (M) |
| 19-25-02 | TPH-DRO | 100 | mg/kg | 34,000 (J) |
| 19-25-04 | TPH-DRO | 100 | mg/kg | 25,000 (J) |
| 19-25-05 | TPH-DRO | 100 | mg/kg | 28,000 (J) |
| 19-25-06 | TPH-DRO | 100 | mg/kg | 26,000 (J) |
| 19-25-07 | TPH-DRO | 100 | mg/kg | 29,000 (J) |
| 19-25-08 | TPH-DRO | 100 | mg/kg | 880 (H) |
| 19-44-03 | TPH-DRO | 100 | mg/kg | 13,000 (M) |

mg/kg = Milligrams per kilogram
M = Chromatographic response resembles that of motor oil
J = Estimated value
H = Response toward the heavier components of the chromatogram

### *H.1.3 Site Classification and Initial Response Action*

The four major site classifications listed in Table 3 of the ASTM Standard are: (1) immediate threat to human health, safety, and the environment; (2) short-term (0 to 2 years) threat to human health, safety, and the environment; (3) long-term (greater than 2 years) threat to human health, safety, or the environment; and (4) no demonstrated long-term threats.

Based on this information, all of the nine CASs are determined to be Classification 4 sites as defined by ASTM Method E1739-95 (ASTM,1995) and pose no demonstrated near- or long-term threats.

### *H.1.4 Development of Tier 1 Look-Up Table of Risk-Based Screening Levels*

Tier 1 action levels have been defined as the PALs established during the DQO process. The PALs are a tabulation of chemical-specific (but not site-specific) screening levels based on the type of media (soil) and potential exposure scenarios (industrial). These are very conservative estimates of risk, are preliminary in nature, and are used as action levels for site screening purposes. Although the PALs are not intended to be used as FALs, a FAL may be defined as the Tier 1 action level (i.e., PAL)

value if individual contaminant analytical results are below the corresponding Tier 1 action level value. The FAL may also be established as the Tier 1 action level value if individual contaminant analytical results exceed the corresponding Tier 1 action level value and implementing a corrective action based on the FAL is practical. The PALs are defined as:

- EPA *Region 9 Risk-Based Preliminary Remediation Goals (PRGs) for Industrial Soils* (2004).
- Background concentrations for RCRA metals will be evaluated when natural background exceeds the PAL, as is often the case with arsenic. Background is considered the mean plus two times the standard deviation of the mean based on data published in Mineral and Energy Resource Assessment of the Nellis Air Force Range (NBMG, 1998; Moore, 1999).
- TPH concentrations above the action level of 100 mg/kg per NAC 445A.2272 (NAC, 2003).
- For COPCs without established PRGs, a protocol similar to EPA Region 9 will be used to establish an action level; otherwise, an established PRG from another EPA region may be chosen.
- The PALs for material, equipment, and structures with residual surface contamination are the allowable total residual surface contamination values for unrestricted release of material and equipment listed in the DOE Order 5400.5 (DOE, 1993), which is also Table 4-2 of the NV/YMP Radcon Manual (NNSA/NSO, 2004).
- The PALs for radioactive contaminants are based on the NCRP Report No. 129 recommended screening limits for construction, commercial, industrial land-use scenarios (NCRP, 1999) scaled to 25 mrem/yr dose constraint (Appenzeller-Wing, 2004) and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993).

The PALs were developed based on an industrial scenario. Because the CAU 540 CASs in Areas 12 and 19 are not assigned work stations and are considered to be in remote or occasional use areas, the use of industrial reuse based PALs is conservative. The Tier 1 lookup table is defined as the PAL concentrations or activities defined in the SAFER Plan.

### *H.1.5 Exposure Pathway Evaluation*

The DQOs stated that site workers would only be exposed to COCs through oral ingestion, inhalation, or dermal contact (absorption) due to exposure to potentially contaminated media (i.e., soil) at the CASs. The results of the SAFER showed that all COCs identified at CASs within CAU 540 are localized near the release point and have not migrated more than 15 ft vertically or laterally from their

area of hydrocarbon staining. Two exceptions are CAS 12-99-01, where the type of site (Mission Generation Station) and the necessary use of hydrocarbon products make the likelihood of hydrocarbon contamination ubiquitous throughout the site, and CAS 19-25-07, where the hydrocarbon lateral extent of contamination covers the peninsula-shaped CAS where sampling was restricted in three directions by unsafe slopes and a mud pit that is not a part of the CAS. Hydrocarbon contamination was defined in the one direction in which unlimited step-out sample locations were available. In all cases at all CASs, the only potential exposure pathways would be through worker contact with the contaminated soil. The limited migration demonstrated by the analytical results, elapsed time since the suspected release, and depth to groundwater supports the selection and evaluation only surface and shallow subsurface contact as the complete exposure pathways. Groundwater is not considered to be a significant exposure pathway.

### H.1.6 Comparison of Site Conditions with Tier 1 Risk-Based Screening Levels

All analytical results from CAU 540 samples were less than corresponding Tier 1 action levels (i.e., PALs) except for those listed in Table H.1-2.

### H.1.7 Evaluation of Tier 1 Results

For all contaminants at all CASs not listed in Table H.1-2, the FALs were established as the Tier 1 RBSLs. It was determined that no further action is required for these contaminants at these CASs.

It was determined by NNSA/NSO that remediation to the remaining contaminants listed in Table H.1-2 was not practical. Therefore, a Tier 2 SSTL will be calculated for these contaminants at these CASs.

### H.1.8 Tier 1 Remedial Action Evaluation

#### *TPH-DRO Evaluation*

The TPH-DRO contamination was not practical or technically feasible to remediate to Tier 1 action levels due to the widespread and discontinuous nature of contamination at the various CASs (e.g., isolated locations under leach field rock or surface). Therefore, TPH-DRO was moved to a Tier 2 evaluation.

**Table H.1-2**
**Contaminants of Potential Concern Detected**
**Above Preliminary Action Levels**
(Page 1 of 2)

| CAS No. | Sample No. | TPH-DRO (mg/kg) | Pu-239 (pCi/g) | Bi-212 (pCi/g) |
|---|---|---|---|---|
| CAS 12-44-01 | 540A013 | 120 (M) | -- | -- |
| | 540A015 | 270 (M) | -- | -- |
| CAS 12-99-01 | 540B001 | 270 (M) | -- | -- |
| | 540B002 | 190 (M) | -- | -- |
| | 540B003 | 490 (M) | -- | -- |
| | 540B004 | 540 (M) | -- | -- |
| | 540B005 | 2,000 (M) | -- | -- |
| CAS 19-25-02 | 540C001 | 34,000 (J) | -- | -- |
| | 540C002 | 35,000 (J) | -- | -- |
| | 540C003 | 6,400 (H, M) | -- | -- |
| | 540C004 | 2,700 (H) | -- | -- |
| | 540C005 | 110 (M) | -- | -- |
| | 540C009 | 340 (H) | -- | -- |
| CAS 19-25-04 | 540D001 | 9,900 (J) | -- | -- |
| | 540D002 | 3,900 (J) | -- | -- |
| | 540D009 | -- | 104 | -- |
| | 540D014 | 25,000 (J) | -- | -- |
| | 540D015 | 880 (M) | -- | -- |
| CAS 19-25-05 | 540E001 | 16,000 (J) | -- | -- |
| | 540E002 | 28,000 (J) | -- | -- |
| | 540E003 | 25,000 (J) | -- | -- |
| | 540E004 | 2,400 (H) | -- | -- |
| | 540E005 | 2,200 (H, M) | -- | -- |
| | 540E006 | 1,300 (M) | -- | -- |
| CAS 19-25-06 | 540F001 | 26,000 (J) | -- | -- |
| | 540F002 | 3,800 (H) | -- | -- |
| | 540F003 | 3,600 (H) | -- | -- |
| | 540F006 | 1,500 (M) | -- | -- |

**Table H.1-2**
**Contaminants of Potential Concern Detected**
**Above Preliminary Action Levels**
(Page 2 of 2)

| CAS No. | Sample No. | TPH-DRO (mg/kg) | Pu-239 (pCi/g) | Bi-212 (pCi/g) |
|---|---|---|---|---|
| CAS 19-25-07 | 540G001 | 29,000 (J) | -- | -- |
| | 540G002 | 1,300 (H) | -- | -- |
| | 540G003 | 1,200 (H) | -- | -- |
| | 540G004 | 9,900 (H, M) | -- | -- |
| | 540G005 | 700 (H, M) | -- | -- |
| | 540G006 | 370 (M) | -- | -- |
| | 540G007 | 5,000 (H) | -- | -- |
| | 540G008 | 12,000 (J) | -- | -- |
| | 540G009 | 170 (H) | -- | -- |
| | 540G011 | 1,100 (H) | -- | -- |
| CAS 19-25-08 | 540H017 | 880 (H) | -- | -- |
| | 540H014 | -- | -- | 5.2 |
| CAS 19-44-03 | 540I001 | 13,000 (M) | -- | -- |
| | 540I006 | 3,000 (M) | -- | -- |

Bi-212 = Bismuth 212
DRO = Diesel-range organics
mg/kg = milligrams per kilograms
pCi/g = Picocuries per gram
Pu-239 = Plutonium 239
TPH = Total petroleum hydrocarbons
-- = Not detected above Preliminary Action Levels (in this table)
H = Chromatogram response at heavier end of diesel range
J = Estimated value
M = Chromatogram resembles that of motor oil

### *H.1.9 Tier 2 Evaluation*

No additional data were needed to complete a Tier 2 evaluation.

### *H.1.10 Development of Tier 2 Table of Site-Specific Target Levels*

#### *Evaluation of TPH-DRO SSTLs*

The ASTM Method E1739-95 stipulates that risk evaluations for TPH-DRO contamination be calculated and evaluated based on the risk posed by the potentially hazardous constituents of TPH-DRO. Section 6.4.3 ("Use of Total Petroleum Hydrocarbon Measurements") of ASTM Method

E1739-95 states: “TPHs should not be used for risk assessment because the general measure of TPH-DRO provides insufficient information about the amounts of individual chemical(s) of concern present” (see also Sections X1.5.4 and X1.42 of Method E1739-95 in ASTM, 1995). Therefore, the individual potentially hazardous constituents in TPH-DRO were compared to corresponding Tier 2 SSTLs to evaluate the need for corrective action at each individual CAS at CAU 540. None of the hazardous constituents of diesel were identified in the VOC or SVOC analyses of samples containing TPH-DRO, reducing the risk of TPH-DRO contamination in these remote CASs to none. The TPH-DRO identified at the CASs within CAU 540 are not COCs as a result of the lack of presence of hazardous constituents. The hazardous constituents for diesel according to the ASTM Method E1739-95 are shown in Table H.1-3.

**Table H.1-3**
**Hazardous Constituents of Diesel According to ASTM Method E1739-95**
(Page 1 of 2)

| CAS No. | Name | Ave. ppm | Min. ppm | Max. ppm | 2004 PRG | Methods |
|---|---|---|---|---|---|---|
| 71-43-2 | Benzene | 290 | 26 | 1,000 | 1.4 | EPA 8260 |
| 91-20-3 | Naphthalene | 2,600 | 100 | 8,000 | 190 | EPA 8270 |
| 50-32-8 | Benzo(a)pyrene | 2.2 | 0.05 | 8.4 | 0.21 | EPA 8270 |
| 108-88-3 | Toluene | 1,800 | 69 | 7,000 | 520 | EPA 8260 |
| 108-38-3 | m-Xylene | 2,200 | 180 | 5,120 | 420 | EPA 8260 |
| 95-47-6 | o-Xylene | 430 | 12 | 850 | 420 | EPA 8260 |
| 106-42-3 | p-Xylene | 2,200 | 180 | 5,120 | 420 | EPA 8260 |
| 100-41-4 | Ethylbenzene | 680 | 70 | 2,000 | 400 | EPA 8260 |
| 56-55-3 | Benz(a)anthracene | 0.96 | 0.02 | 6.7 | 2.1 | EPA 8270 |
| 207-08-9 | Benzo(k)fluoranthene | N/A | 0.003 | 1.95 | 21 | EPA 8270 |
| 205-99-2 | Benzo(b)fluoranthene | N/A | 0.003 | 1.94 | 21 | EPA 8270 |
| 86-73-7 | Fluorene | 860 | 340 | 1,500 | 26,000 | EPA 8270 |
| 85-01-8 | Phenanthrene | 880 | 0.27 | 3,000 | 100,000 | EPA 8270 |
| 129-00-0 | Pyrene | 46 | 0.18 | 150 | 29,000 | EPA 8270 |
| 218-01-9 | Chrysene | N/A | 0 | 0.45 | 210 | EPA 8270 |

**Table H.1-3**
**Hazardous Constituents of Diesel According to ASTM Method E1739-95**
(Page 2 of 2)

| CAS No. | Name | Ave. ppm | Min. ppm | Max. ppm | 2004 PRG | Methods |
|---|---|---|---|---|---|---|
| 120-12-7 | Anthracene | 58 | 0.03 | 200 | 100,000 | EPA 8270 |
| 191-24-2 | Benzo(g,h,i)perylene | 0.12 | 0.0091 | 0.4 | 29,000 | EPA 8270 |

ASTM = American Society of Testing and Materials
CAS No = Chemical Abstract Service registry number
N/A = Not applicable
PRG = Preliminary Remediation Goal

### *H.1.11 Comparison of Site Conditions with Tier 2 Table Site-Specific Target Levels*

The Tier 2 action levels are typically compared to individual sample results from reasonable points of exposure (as opposed to the source areas as is done in Tier 1) on a point-by-point basis. Points of exposure are defined as those locations or areas at which an individual or population may come in contact with a COC originating from a CAS. For CAU 540, the Tier 2 action levels were compared to maximum contaminant concentrations from each sample location.

### *H.1.12 Tier 2 Remedial Action Evaluation*

Based on the Tier 2 evaluation of the TPH-DRO hazardous constituents, the TPH-DRO does not pose an unacceptable risk to human health and the environment. Therefore, no further action concerning TPH-DRO required at the CASs within CAU 540.

As all contaminant FALs were established as Tier 1 or Tier 2 action levels, a Tier 3 evaluation was not considered necessary.

## H 2.0 Recommendations

As all of the site contaminant concentrations in soils from the analysis of CAU 540 samples were less than the corresponding FALs at all locations, it was determined that contamination at these locations does not pose a significant risk to human health or the environment and therefore, do not warrant corrective actions and are recommended to be closed as no further action.

## H 3.0 References

ASTM, see American Society for Testing and Materials.

American Society for Testing and Materials. 1995. *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*, Method E 1739-95 (Reapproved 2002). Philadelphia, PA.

Appenzeller-Wing, J., U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2004. Letter to T.A. Maize (NDEP) entitled, "Submittal of Proposed Radiological Preliminary Action Levels (PALs) for the Industrial Sites Project," 15 January. Las Vegas, NV.

DOE, see U.S. Department of Energy.

EPA, see U.S. Environmental Protection Agency.

Moore, J., Science Applications International Corporation. 1999. Memorandum to M. Todd (SAIC), "Background Concentrations for NTS and TTR Soil Samples," 3 February. Las Vegas, NV.

NAC, see *Nevada Administrative Code*

NBMG, see Nevada Bureau of Mines and Geology.

NCRP, see National Council on Radiation Protection and Measurements.

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

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# Appendix I

# Nevada Division of Environmental Protection Comments

(3 Pages)

# NEVADA ENVIRONMENTAL RESTORATION PROJECT
## DOCUMENT REVIEW SHEET

| | |
|---|---|
| **1. Document Title/Number:** Draft Draft Closure Report for Corrective Action Unit 540: Spill Sites, Nevada Test Site, Nevada | **2. Document Date:** 09/28/2006 |
| **3. Revision Number:** 0 | **4. Originator/Organization:** Stoller-Navarro |
| **5. Responsible NNSA/NV ERP Project Manager:** Kevin Cabble | **6. Date Comments Due:** 09/29/2006 |
| **7. Review Criteria:** Full | |
| **8. Reviewer/Organization/Phone No:** Don Elle, Greg Raab, NDEP, 486-2850 | **9. Reviewer's Signature:** |

| 10. Comment Number/Location | 11. Type* | 12. Comment | 13. Comment Response | 14. Accept |
|---|---|---|---|---|
| 1.) Page 29 of 39, Comparability | Mandatory | This paragraph implies the methods used for field sampling are not standard industry methods, but declares them standardized DOE procedures. If these are performance based methods, describe them. If they are not, please clarify what they are. | The text in the Comparability section was revised as follows:<br><br>"Field sampling, as described in the CAU 540 SAFER Plan (NNSA/NSO, 2005), was performed and documented in accordance with approved procedures that are in conformance with standard industry practices. Analytical methods and procedures approved by DOE were used to analyze, report, and validate the data. These methods and procedures are in conformance with applicable methods used in industry and government practices. Therefore, project datasets are considered comparable to other datasets generated using standard industry procedures, thereby meeting DQO requirements." | |

## NEVADA ENVIRONMENTAL RESTORATION PROJECT

### DOCUMENT REVIEW SHEET

| 10. Comment Number/Location | 11. Type* | 12. Comment | 13. Comment Response | 14. Accept |
|---|---|---|---|---|
| 2.) Page A-10 of A-21, Last Sentence after Last Bullet | Mandatory | "The FALs...will be proposed in the investigation report..." Please indicate which investigation report, when it was published, and where it is located. | Comments 2, 3 and 4 are all on Appendix A (DQOs as Developed in the Safer Plan). The current approved FFACO outline for Closure Reports stipulates that the DQOs as developed in the CAIP must be included in the CR appendices or referenced in the CR. To comply with this requirement the DQOs are typically provided verbatim. However, in the production of the CAU 540 Draft Closure Report the wrong template was used and the DQOs did not appear verbatim as approved in the SAFER report. This has been corrected.<br><br>Comment 2 secifically refers to the fact that the DQOs indicate that the "FALS... will be established in the investigation report" and questions what this report is. This investigation report the statement is referring to is the CAU 540 Closure Report. Although, NNSA/NSO recognizes that as written the statement is a bit confusing (i.e., a more accurate statement would be "the FALs ... have been established in Appendix H of this Report), because the DQOs are reproduced verbatim from the SAFER, changes have not been made. The statement in question now appears at the end of Section A.6.3 which corresponds to Section B.6.3 of the approved SAFER Report. | |
| 3.) Page A-11 of A-21, Section A.1.1.3 Statistical Model, Last Sentence | Mandatory | "...and that the statistical test will be to compare results to a fixed threshold (FALs)." As stated in the following section, "...the use of statistical methods may not be warranted by program guidelines or site-specific sampling objectives." There is no statistical test as such to compare results to a fixed threshold. Correct and clarify. | See response to comment 2. The specific text this comment refers to was not part of the approved DQOs as presented in the CAU 540 SAFER Report and is therefore no longer present in the document. The information covered by this passage is now presented in Section A.6.0 Step 5 - Develop a Decision Rule. | |

## NEVADA ENVIRONMENTAL RESTORATION PROJECT

### DOCUMENT REVIEW SHEET

| 10. Comment Number/Location | 11. Type* | 12. Comment | 13. Comment Response | 14. Accept |
|---|---|---|---|---|
| 4.) Page A-17 of A-21, Last Paragraph, 2nd Sentence | Mandatory | "However, due to high potential evapotranspiration." This is not a complete sentence. Correct this. | See response to comment 2. The specific text this comment refers to was not part of the approved DQOs and is therefore no longer present in the document. The information covered by this passage is now presented in Section A.2.2.5 Migration Pathways and Transport Mechanisms. | |
| 5.) In Sections D.2.3, D.3.3, D.4.3, D.5.3, D.6.3, D.7.3, D.8.3, D.9.3, D.10.3, and their corresponding tables, the text, and data in the tables are contradictory | Mandatory | The texts allude to the individual components of the total petroleum hydrocarbons (TPH) not exceeding the individual PALs. However, the data in the tables exceed the overall PALs for TPH. Correct these discrepancies to clarify that NNSA/NSO evaluates the individual components against the risk and these components are the drivers for corrective action. Reference Appendix H, Section H.1.10 and Table H.1-3. | The standard text has been revised to clarify these sections. The specific text for section D.2.3 is provided below as an example.<br><br>"The TPH-DRO and -GRO for soil samples collected at this CAS that were detected above their respective laboratory MDCs are presented in Table D.2-3. Two soil samples collected at the surface (samples 540A013 and 540A015) exceeded the PAL of 100 mg/kg for TPH-DRO with concentrations of 120 and 270 mg/kg respectively. Because these concentrations exceeded the PAL a Tier 2 evaluation was conducted by evaluating the hazardous constituents of diesel (see Section H.1.10). This evaluation determined that none of the concentrations of the hazardous constituents of diesel were identified in the VOC or SVOC analyses at concentrations above their respective FALS, therefore, the TPH-DRO dectected at this CAS is not considered a COC. | |

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