Nevada
Environmental
Restoration
Project

Corrective Action Plan
for CAU No. 339:
Area 12 Fleet Operations
Steam Cleaning Discharge Area
Nevada Test Site

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Environmental Restoration
Division

U.S. Department of Energy
Nevada Operations Office

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**CORRECTIVE ACTION PLAN FOR CAU 339:
AREA 12 FLEET OPERATIONS
STEAM CLEANING DISCHARGE AREA
NEVADA TEST SITE**

**Prepared for the
U. S. Department of Energy
Nevada Operations Office
Under Contract No. DE-AC08-96NV11718**

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**Prepared by
Bechtel Nevada
Remediation Projects**

May 1997

MASTER

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AREA 12 FLEET OPERATIONS
STEAM CLEANING DISCHARGE AREA
NEVADA TEST SITE**

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ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CADD	Corrective Action Decision Document
CAP	Corrective Action Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CEA	Comparative Enumeration Assay
CFR	Code of Federal Regulations
COC	Constituent(s) of Concern
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FFACO	Federal Facility Agreement and Consent Order
ft	feet
IRIS	Integrated Risk Information System
LCB	Legislative Council Bureau
LDR	Land Disposal Restrictions
MEK	Methyl-ethyl-ketone (2-butanone)
m	meter
m ³	cubic meter
MIBK	Methyl-isobutyl-ketone (4-methyl-2-pentanone)
mg/kg	milligrams per kilogram
NAC	Nevada Administrative Code

ACRONYMS AND ABBREVIATIONS (continued)

NDEP	Nevada Division of Environmental Protection
NTS	Nevada Test Site
PRG	Preliminary Remediation Goals
RCRA	Resource Conservation and Recovery Act
RPD	Relative Percent Difference
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total Petroleum Hydrocarbon
VOC	volatile organic compound
yd ³	cubic yard

1.0 INTRODUCTION

The Area 12 Fleet Operations site is located in the southeast portion of the Area 12 Camp at the Nevada Test Site (NTS) (Figure 1). The former Area 12 Fleet Operations Building 12-16 was constructed in approximately 1965 and functioned as a maintenance facility for light- and heavy-duty vehicles up to January 1993. Services performed at the Fleet Operations site included steam cleaning, tire service, and preventative maintenance on vehicles and special purpose equipment.

A sand/oil interceptor, which segregated the materials generated from the steam cleaning activities, is located at the southeast side of the Fleet Operations Building. The separator effluent discharge line is located approximately 104 meters (340 feet) east of the sand/oil interceptor. The effluent discharge line is presently surrounded by a sandbag barrier. Physical boundaries of the discharge area include the Rainier Mesa Road to the south, a helicopter pad to the east, a natural erosional channel (arroyo) to the north, and a former parking area to the west. The discharge area is separated from a down gradient arroyo by a soil berm to the east. A site vicinity map is provided as Figure 2.

Surface flow from the discharge pipe and other Fleet Maintenance activities appears to follow the natural topography which slopes predominantly to the east and northeast. Approximate Nevada coordinates for the site are N 890,000 and E 650,000 (from NTS Road and Facility Map, Holmes and Narver, 1986 update). This site is identified in the Federal Facility Agreement and Consent Order (FFACO) as Corrective Action Site (CAS) Number 12-19-01 and is the only CAS assigned to Corrective Action Unit (CAU) 339.

1.1 PURPOSE

The purpose of this Corrective Action Plan (CAP) is to provide the method for implementing the corrective action alternative as provided in the Corrective Action Decision Document (CADD) (DOE, 1996a). Detailed information of the site history and results of previous characterizations can be found in the Work Plan (REECo, 1992a), the Preliminary Investigation Report (DOE, 1996b), and the Phase 2 Characterization Report (DOE, 1996a). Previous characterization investigations were completed as a condition of the Temporary Water Pollution Control Permit issued by the Nevada Division of Environmental Protection (NDEP) on July 14, 1992 (NDEP, 1992).

This document includes the closure activities and the Post-Closure Monitoring Plan of only the release area east of the effluent discharge. Building 12-16, the former vehicle dispatch parking area, the sand/oil interceptor, and helicopter pad are not considered part of this closure as they are considered serviceable infrastructure.

FIGURE 1
SITE LOCATION

SOURCE: USGS RAINIER MESA, NEV. 7.5' QUADRANGLE 1986

FIGURE 2
SITE VICINITY MAP

1.2 SCOPE

The scope of this report is to prepare a CAP based upon the selected remedial alternative for closure of the Area 12, Building 12-16 Fleet Operations steam cleaning discharge area. The effluent discharge area has been impacted by volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH) as oil. The maximum hydrocarbon and VOC concentrations detected in the Preliminary and Phase II Site Characterization Investigations are summarized in Table 1.

Sample collection areas from the Preliminary and Phase II Site Characterization Investigations are shown on Figure 3. Figure 3 also depicts the approximate extent of soil impact (identified by discolored soil) which constitutes the CAU 339 boundary. Based on the findings of the previous investigations, the selected remedial alternative, as presented in the CADD report, was to:

- Complete excavation of the VOC impacted soil.
- Remove the sandbag barrier surrounding the effluent line and use the resulting soils for area grading and backfill.
- Plug the effluent discharge line.
- Fence and post the area of hydrocarbon impact.

Based on a re-evaluation of the source of the VOCs identified on-site and Environmental Protection Agency (EPA) regulations recently adopted by NDEP, the selected remedial alternative for closure of the discharge area has been modified to consist of the following:

- Leave VOC impacted soil in place, as supported by the Integrated Risk Information System (IRIS) Action Levels.
- Excavate hydrocarbon impacted soils in the areas of visibly stressed vegetation and where a hardened crust of hydrocarbon waste has formed.
- Fence and post the area of hydrocarbon impact.
- Remove the sandbag barrier surrounding the effluent line and use the resulting soils for area grading and backfill.
- Plug the effluent discharge line.
- Complete biennial post-closure monitoring of the hydrocarbon-impacted area identified as CAU 339.

TABLE 1 - AREA 12 DISCHARGE AREA MAXIMUM HYDROCARBON AND VOC CONCENTRATIONS DETECTED

SAMPLE AREA¹	TOTAL PETROLEUM HYDROCARBONS AS OIL² (mg/kg)	VOLATILE ORGANIC COMPOUNDS³ (mg/kg)
1	3,400	ND
2	6,100	ND
3	830	ND
4	ND	Acetone 0.110 Methylene Chloride 0.009B Toluene 0.004B
5	90	ND
6	490	ND
7	84	ND
8	1,300	ND
9	4,800	Acetone 1.2 Methyl Ethyl Ketone 0.550 Methyl-isobutyl-ketone 0.061 2-Hexanone 0.360 Methylene Chloride 0.056B Toluene 0.024 B
10	ND	ND
11 (Phase 1 Duplicate of Sample Area 9)	7,200	Methylene Chloride 0.006 Methyl-isobutyl-ketone 0.010 2-Hexanone 0.012
12	6,000	Acetone 0.017B
13	8,600	ND

¹ The Sample Areas consist of one or more sample locations from the Phase 1 and Phase 2 Site Investigations (refer to Figure 3).

² TPH as oil was the only hydrocarbon identified above laboratory detection limits within the discharge area.

³ VOCs listed represent the maximum concentrations detected including those analytes reported as being identified in the laboratory method or trip blanks.

ND: Not detected above the laboratory detection limits.

B: Analyte was identified in the blank as well as the sample.

mg/kg: milligrams per kilogram

FIGURE 3
CAU 339 SITE BOUNDARY

1.3 CORRECTIVE ACTION PLAN CONTENTS

This CAP has been developed in a manner to support the proposed closure of the discharge effluent area. The format of the CAP is as follows:

- Site description and history (Section 1.0).
- Summary of previous activities (Section 1.1).
- Evaluation of the proposed corrective action (Section 2.0).
- Closure strategy for the CAU (Section 3.0).
- Waste management and disposal (Section 3.2).
- Schedule of closure activities (Section 4.0).
- Post-Closure Sample and Monitoring Plan for the hydrocarbon impacted area (Section 5.0).

This plan was developed using information and guidance provided from the following documents:

- Corrective Action Decision Document-Area 12 Fleet Operations Steam Cleaning Discharge Area Nevada Test Site Corrective Action Unit 339, DOE, 1996a.
- Preliminary Investigation-Area 12 Fleet Operations Steam Cleaning Discharge Area Nevada Test Site, DOE, 1996b.
- Nevada Environmental Restoration Project. Project Management Plan, Revision 0, DOE, 1994.
- Nevada Environmental Restoration Project. Health and Safety Plan, Revision 2, DOE, 1996.
- Nevada Environmental Restoration Project. Project Management Plan, Revision 0, DOE, 1994.
- Nevada Environmental Restoration Project. Industrial Sites. Quality Assurance Project Plan. Nevada Test Site, Revision 1, DOE, 1996.

2.0 CORRECTIVE ACTION EVALUATION

The NDEP provided comments on the CADD in a Memorandum dated February 7, 1997 (NDEP, 1997). The comments addressed the proposed corrective action in reference to the hydrocarbon-impacted soils and VOC-impacted soils. The selected alternative proposed in the CADD was to leave the hydrocarbon soils in place (based on an A through K risk-based analysis) and remove the VOC-impacted soils (DOE, 1997). Although the VOC concentrations in the soil were very low (a maximum of 1.2 milligrams per kilogram [mg/kg] for acetone), they were identified as being Resource Conservation and Recovery (RCRA) "F Listed" wastes based upon the use of solvents in past Fleet Operation steam cleaning activities.

In the memorandum, NDEP did not accept the assumption made in the CADD that the VOCs identified in the Preliminary and Phase II Site Characterizations were "F Listed" wastes. This determination was made based on the followings conclusions:

- VOC-impacted areas do not coincide with the pattern of TPH-impacted areas.
- VOCs are only identified up gradient of the soil berm and not in the arroyo.
- Lack of definitive process knowledge that the VOCs identified were used in the Fleet Operation steam cleaning process.
- The likelihood that other discharges occurred in the vicinity separate from the Fleet Operations discharge (former storage areas, helicopter pad, etc.).

In addition, recently adopted Legislative Council Bureau (LCB) regulations were identified as being applicable to identifying closure standards for the site (LCB, 1996, Section 2.2).

The A through K risk-based analysis of the hydrocarbon-impacted soil was determined insufficient to support leaving the soils in place without corrective action. NDEP recommended that heavily impacted areas, identified by lack of vegetation growth and soil staining, be excavated (NDEP, 1997). The remaining impacted areas will be left in place and sampled biennially (every two years) to monitor the natural degradation of the hydrocarbon-impacted soils.

2.1 EVALUATION OF VOC CONSTITUENTS

Since the NDEP does not consider the VOCs to be RCRA "F Listed" wastes, an evaluation of their hazardous characteristics is warranted. The characteristics of corrosivity (40CFR 261.22) and reactivity (40CFR 261.23) are not considered applicable to the site by definition. Even though ignitability was not analyzed in the previous samples collected, the very low

concentrations of VOCs in the soil (a maximum of 1.2 mg/kg for acetone), under standard temperature and pressure, would not support ignition. The only VOC exhibiting the toxicity characteristic was methyl ethyl ketone (MEK). The maximum concentration detected (0.550 mg/kg total VOC analysis) is significantly below the Toxicity Characteristic Leaching Procedure (TCLP) Action Level of 200 mg/l. In evaluating the concentrations of VOCs in relation to the Nonwastewater Treatment Standards (40CFR 268.40) for Land Disposal Restrictions (LDRs), they are found to be below the listed LDRs. Therefore, the VOC constituents exhibit neither a listed nor a characteristic waste (NDEP, 1997).

2.2 REGULATORY ACTION LEVELS

The Nevada Administrative Code (NAC) Action Level for petroleum hydrocarbons is 100 mg/kg (NAC 459.9973). Soils within the discharge area exceed the NAC Action Level, however, all impacted soils will not be removed as part of the closure activity. This is supported by the following:

- The A through K Risk-Based Analysis for the site.
- Limited vertical migration of the hydrocarbon release.
- Minimal environmental impact.

The natural in-situ degradation of the hydrocarbon-impacted soils will be monitored in a Post-Closure Monitoring Program (Section 5.0).

Since hazardous waste regulations are not applicable to the VOCs present, the uncoded corrective action regulations found in LCB File R119-96 may be applied. The appropriate levels used must be based on the protection of public health and safety and the environment. The appropriate levels are determined using the Integrated Risk Information System (IRIS) (LCB File Section 26d). The IRIS Action Levels are summarized in Table 2. The IRIS levels represent those listed for residential use since they provide the most conservative values. Other Action Levels have been included in Table 2 for comparison and reference.

Based on the re-evaluation of the VOC source and concentrations, in relation to available action levels, excavation of the VOC impacted soils is not warranted or required by NDEP (NDEP, 1997). In addition, the presence of acetone, toluene, methylene chloride, and MEK are suspect since they are common laboratory contaminants and they were identified as laboratory contaminants in the Phase 1 and/or the Phase 2 Site Investigations (DOE, 1996a).

TABLE 2 - REGULATORY ACTION LEVELS FOR VOCS IDENTIFIED IN THE DISCHARGE AREA

VOLATILE ORGANIC COMPOUND	IRIS ACTION LEVEL¹ (mg/kg)	OTHER ACTION LEVELS² (mg/kg)	MAXIMUM CONCENTRATION DETECTED³ (mg/kg)
Acetone	2,100	8,000 ^{B1}	1.2
Methyl-ethyl-ketone (MEK)	7,100	200 ^{B2} /4,000 ^{B1}	0.550
Methyl-isobutyl-ketone (MIBK)	770	4,000 ^{B1}	0.061
Toluene	790	20,000 ^{B1}	0.024
Methylene Chloride	7.8	90 ^{B1}	0.56

¹ Integrated Risk Information System (IRIS) soil Action Levels for Residential Land Use, August 1, 1996.

² Action Levels for soils as found in ^{B1} Proposed Subpart S (55FR 30798) or ^{B2} Toxicity Characteristic Leaching Procedure (40CFR 261.24) reported in milligrams per liter.

³ Maximum concentrations detected during Preliminary and Phase 2 Site Investigations.

2.3 VOC SOURCE INVESTIGATION

Due to the lack of definitive process knowledge that the VOCs originated from steam cleaning operations at the Fleet Operations Building, other potential release sources were investigated. The investigation consisted of evaluating available site engineering drawings, personal interviews, and use of adjacent infrastructure.

Site Drawings

Available engineering records were investigated to determine if other potential VOC sources were previously located at the site. One site plan drawing depicted the discharge area as a former storage area. The area was bounded by barbed wire fencing on four sides, had three trailers, a portable generator, and bottled gas storage. Identification is not provided of the type of items stored or the period of time this occurred.

Personal Interviews

As a result of the reduced mission at the NTS, support facilities in Area 12 have been closed and many of the personnel familiar with past operations the Area 12 Fleet Operations and helicopter pad are no longer available for interviewing. Two people familiar with past Area 12 operations were interviewed regarding the facility and surrounding area. The first was contacted on March 10, 1997, but knew of no past use which would have contributed to the

presence of VOCs within the former discharge area. The second was contacted on March 12, 1997 and knew only of the potential for solvents to have been discharged as part of typical fleet operations. Neither person knew of the discharge area as having been formally used for storage (BN, 1997).

Evaluation of Adjacent Infrastructure

The nearest infrastructure to the discharge area is shown on Figure 2 and consists of the following:

- A helicopter pad located down gradient to the east.
- A former vehicle parking area located up gradient to the west.
- Building 12-16 located west of the parking area.

The helicopter pad is a potential source for the VOCs identified in Sample Area 4. This sample area is located approximately 15 meters (m) to 18 m (50 feet [ft] to 60 ft) from the pad. There is a possibility that at some point in the operation of the helicopter pad, solvents containing VOCs were used for minor cleaning and/or maintenance. However, there is no physical evidence (discarded cans of cleaning fluids, staged work area, staining, etc.) to support the use of the helicopter pad in this manner. In addition, personnel interviewed indicated that the helicopter pad was typically used for short periods of time and that only a fuel truck was parked on the pad to service the helicopter.

In summary, the additional investigation did not reveal a specific source for the VOCs identified at the site. Disposition of the VOCs may have been from one or more related or unrelated activities. The VOCs identified in the heavily stained hydrocarbon areas (Sample Area 9) may be from a historic release and are captured within the heavy oil constituents (Figure 3). This may account for the long retention period of the VOCs identified.

The VOCs identified in the area not impacted from hydrocarbons (Sample Area 4) may be a result of a discharge associated with the helicopter pad operations or may represent sample contamination (Figure 3). Each of the VOCs identified in this area, acetone, toluene, and methylene chloride, were identified in the Phase 1 and/or Phase 2 Site Investigations as laboratory contaminants. Therefore, it is suspected that the low VOC concentrations detected in areas not impacted by hydrocarbons are the result of contamination derived during the sampling and/or analysis process. In addition, the high volatility of the VOCs identified, and their presence in surface samples, further support suspicions that their presence does not reflect actual site conditions.

3.0 DETAILED STATEMENT OF WORK

As discussed in Section 2.0, the selected closure alternative is modified to reflect recently adopted LCB regulations by the NDEP. It has also been modified based upon comments provided by NDEP on the CADD (NDEP, 1997). Since the modified alternative varies little from the selected alternative proposed within the CADD, the evaluation of the general decision factors (proposed Title 40 CFR Part 264.525, Subpart S) and risk-based corrective action (NAC "A through K" analysis) still supports the implementation of the modified closure alternative.

3.1 APPROVED ALTERNATIVE IMPLEMENTATION

Using Preliminary Remediation Goals (PRGs) generated from the IRIS Database, removal of the VOC impacted soils identified at the site will not be required since the PRGs are well above maximum concentrations detected in the two previous site investigations. However, as a consequence of excavating the hydrocarbon-impacted areas, the majority of the VOC-impacted soils will be removed.

The selected remedial alternative for closure of the discharge area will consist of the following:

- Excavating the hydrocarbon impacted soils in the area of visible stressed vegetation and where hardened hydrocarbon layers have formed (predominant in Sample Area 9 and Sample Area 13).
- Fencing and posting the area of hydrocarbon impact.
- Remove the sandbag barrier surrounding the effluent line.
- Plug the effluent discharge line.
- Biennial post-closure sampling and monitoring of the hydrocarbon impacted area.

3.1.1 Excavating the Hydrocarbon Impacted Soils

Hydrocarbon-impacted soils in the vicinity of Sample Areas 9 and 13 will be excavated using a backhoe or front end loader to a depth of approximately 0.3 meters (1.0 foot). These areas have been identified for removal due to the obvious stress to vegetation growth. The vegetation growth has been inhibited in these areas by the hydrocarbon impacted soils and the development of a surficial hard layer of hydrocarbon crust. The majority of the excavation will be completed at Sample Area 9. It is estimated that approximately 65 cubic meters (m^3) (85 cubic yards [yd^3]) will be removed from this area (Figure 4). The exact dimensions of the excavated area will be determined based on observations made in the field. Other areas of visual stressed vegetation will be evaluated in the field and limited excavation will be completed as warranted.

FIGURE 4
PROPOSED EXCAVATION AND FENCE BOUNDARIES

3.1.2 Fencing and Posting the Area of Hydrocarbon Impact

The discharge area, east of the effluent line and west of the soil berm, will be fenced using "T Posts" with cable wiring. Installation of the fence will prevent unauthorized disturbance of the impacted soils, minimize the potential for unauthorized release, and protect the sample areas identified for post-closure monitoring. The fenced area will be approximately 43 m by 61 m (140 ft by 200 ft) (Figure 4). Signs will be placed to indicate that the area is impacted by petroleum hydrocarbons. The arroyo area will not be fence since the likelihood for soil disturbance in that area is minimal.

3.1.3 Removing the Sandbag Barrier and Plugging the Effluent Discharge Line

The sandbag barrier surrounding the discharge effluent line will be removed. The soils will be used for site grading and backfill. Based upon various monthly monitoring discharge reports and verbal communication with the NDEP, the sandbag berm was installed after discharges from the sand/oil interceptor were discontinued (REECo, 1992b). Therefore, the sandbags were not impacted from effluent discharge and will not require segregation or laboratory analysis prior to use as backfill at the site.

The effluent line, located within the sandbag barrier, will be plugged with Sulfaset Cement (or equivalent). A plug will be placed into the effluent discharge line a minimum of 0.9 m (3 ft). Cement will be placed into the end of the line and packed firmly to fill the void spaces within the line.

3.1.4 Biennial Post-Closure Monitoring of the Hydrocarbon-Impacted Area.

The hydrocarbon-impacted area, east of the discharge line and west of the soil berm, will be sampled and monitored biennially (once every two years). NDEP has accepted the monitoring in lieu of completing a clean closure at the site (NDEP, 1997). The post-closure monitoring program consists of sampling three impacted locations (excluding any excavated areas) to determine the rate of natural biodegradation of the hydrocarbons. If after six years (three sampling episodes) the rate of degradation appears to be so slow that the greatest concentrations would not decay below 100 mg/kg within 30 years, a more aggressive means of contaminant management will be proposed. The first samples will be collected concurrent with closure activities in order to establish a baseline for the areas to be monitored. Post-closure monitoring and sampling will begin two years from the completion of site closure activities. The Post-Closure Monitoring Plan is provided in Section 5.0.

3.2 WASTE MANAGEMENT

Waste generated from the closure activities will consist of hydrocarbon impacted soils and decontamination rinseate water. Soils will be managed by one of the following methods:

- Soil will be excavated and loaded directly into a truck(s) on-site for transport to the Area 6 Hydrocarbon Landfill or the U10c Landfill. This is contingent on the availability of labor and equipment support; or
- Soil will be stored at the site on the level parking area. The soil will be placed on and covered with plastic sheeting at the end of each work day. The plastic sheeting will be secured with sandbags. Soils will remain on-site pending disposal coordination. The soil pile will be tracked using the NTS Waste Tracking System. A Waste Tracking Number will be assigned to the pile and entered into the Tracking System creating a record which documents the date of generation along with the method and date of disposal. Once coordination with Waste Management Project personnel is completed, the soils will be transported to the Area 6 Hydrocarbon Landfill or the Area 9 U10c Landfill.

Rinseate water will be generated from decontamination of the excavation and sampling equipment. Decontamination of the sampling equipment will be completed using an Alconox wash and tap water rinse. Decontamination of the backhoe or loader bucket will be completed using a high pressure steam cleaner or pressurized sprayer with stiff brushes. The rinseate will be managed for disposal by first containerizing it into 208 L (55 gal) drums. Since the sampling equipment and excavation buckets will be in contact with hydrocarbon-impacted soils, the rinseate will be solidified as a best management practice. The rinseate will be solidified using on-site soils or bentonite. For solidification purposes, each drum will not be filled with rinseate beyond 114 L (30 gal). An NTS Waste Tracking Number will be assigned to each drum generated.

Landfill acceptance of the soil and solidified rinseate will be based on the laboratory analysis of the soil samples collected during the Preliminary and Phase II Sampling activities. Additional characterization sampling will not be required. It is anticipated that approximately 65 m³ (85 yd³) of soil will be generated. However, based upon field observations, additional soil may be excavated. The total volume is not anticipated to exceed 76 m³ (100 yd³). A radiological "green tag", bill of lading, and weight ticket will accompany each load of soil to the landfill. Volume and location of soil disposal will be documented in the Closure Report.

4.0 SCHEDULE

The Area 12 Fleet Operations Discharge Area closure activities are anticipated to begin within 60 days of the date that NDEP grants approval of the CAP and are outlined as follows:

- Begin field closure activities within 60 days of CAP approval.
- Complete excavation, disposal, and field closure activities in a one week period.
- Collect soil samples to establish degradation baseline for required post-closure monitoring.
- Prepare the Closure Report for submittal to NDEP by the FFACO deadline of December 31, 1997.

Even though the site will not be "clean closed" it is anticipated that a public comment period will not be required since the only constituent of concern (COC) is petroleum hydrocarbons (as oil). The schedule will require modification if conditions exist that are outside the assumptions on which the schedule was developed. Flexibility has been placed in the project schedule to account for minor difficulties (weather, equipment breakdowns, etc.). The DOE will keep the NDEP apprised of any condition that may impact the project schedule.

5.0 POST-CLOSURE MONITORING PLAN

This plan addresses the post-closure activities to be conducted at the Area 12 Fleet Operations Steam Cleaning Discharge Area. Post-closure monitoring has been accepted by the NDEP to establish the rate of decline and time frame in which the hydrocarbon concentrations decrease below the Action Level of 100 mg/kg (NDEP, 1997).

5.1 INTRODUCTION

Soil samples will initially be collected after completion of closure activities in order to determine a baseline concentration for the selected monitoring areas. Post-closure monitoring and sampling will begin two years from the completion of site closure activities.

The decline of the hydrocarbon concentrations will occur through natural attenuation or intrinsic bioremediation. Intrinsic bioremediation is the ability of naturally-occurring microbial communities to degrade COCs without taking engineering steps to enhance the process. In order to support successful intrinsic bioremediation some of the favorable site conditions are as follows:

- Sufficient elemental nutrients (nitrogen and phosphorus) or high concentrations of electron acceptors such as oxygen, nitrate, sulfate, or ferric iron.
- Permeable soils.
- Aerobic soil conditions so that the bacteria can oxidize the hydrocarbons.

In order to evaluate the potential success of intrinsic bioremediation at the site, additional sample analysis is required. In addition to the analysis of TPH as oil, a Comparative Enumeration Assay (CEA) will be completed. The CEA identifies the total heterotroph (species dependant on organic matter for food) and petroleum degrader microbial populations (aerobic). In addition, other analysis may include total organic nitrogen, total organic carbon, nitrate, sulfate, and pH.

The analysis of these parameters can indicate whether or not biological processes that are associated with natural attenuation of petroleum hydrocarbons are occurring at the site. By completing the additional analysis, the evaluation of the hydrocarbon degradation rate will be better substantiated. After a period of six years if it does not appear that hydrocarbon degradation is declining at a rate to be below 100 mg/kg in 30 years, the site conditions will be re-evaluated. Consideration will be given to the possibility of enriching the impacted soils to enhance the degradation process. Soil enrichment would be followed by an additional 6 years of post-closure monitoring.

5.2 SAMPLING STRATEGY

5.2.1 Schedule

Soil samples will initially be collected concurrent with closure activities in order to establish a baseline for the areas to be monitored. Post-closure sampling will be conducted on a biennial basis for six years (three sampling events) following the completion of site closure activities. If the degradation rate appears to be so slow that the greatest TPH concentrations would not decay to below 100 mg/kg within 30 years, a more aggressive means of management for the hydrocarbon impacted area will be proposed.

5.2.2 Location

Soil samples will be collected from three locations within the steam cleaning discharge area south of the effluent line. The proposed sample locations are within the upper, central, and lower portions of the impacted areas as shown on Figure 5. The sample locations may be modified based upon field conditions identified at the time of closure. The sample locations will consist of an approximate 1.2 m by 1.2 m (4 ft by 4 ft) area enclosed by "T-Posts" and cable wiring.

5.2.3 Collection

Soil for TPH analysis will be collected at three locations within each plot from a depth of 15 cm to 30 cm (6 in to 12 in). In an effort to provide additional controls for the evaluation of soil degradation, soil will first be segregated by placing the soil through a sieve. Soil will be segregated into three grain sizes and analyzed for TPH as oil. By segregating the soil by grain size, TPH concentration ratios can be developed. This is based on soil studies which have found that one grain size will attract higher concentrations of a contaminant than another. The grain size exhibiting the highest TPH concentration will be used as the baseline for monitoring the rate of soil degradation in future post-closure sampling.

For collection of the baseline soil samples, three composite samples, representing each of the three segregated grain sizes, will be submitted for laboratory analysis from each sample plot. Once it is determined which grain size exhibits the highest TPH concentrations, then only that grain size will be analyzed in subsequent post-closure sampling. One blind replicate sample from a selected plot will also be collected. The samples will be collected using a hand auger. The auger and sieves will be cleaned prior to sampling each plot by washing with soap and water, rinsing with clean water, and a final rinse with distilled water.

FIGURE 5
PROPOSED POST-CLOSURE SAMPLE LOCATIONS

One composite soil sample will be collected for the CEA during each monitoring period. The sample will be composited from the three monitoring plots selected and will be collected from a depth of 15 cm to 30 cm (6 in to 12 in) using a hand auger. The sample will not be segregated by grain size since the bio-characterization results should represent general site conditions as to whether or not natural attenuation is occurring. A background sample, collected from a non-impacted area, will be collected for the CEA in order to compare the percent petroleum degrader microbial populations. The projected number of samples to be collected for the post-closure monitoring are summarized in Table 3.

TABLE 3 - POST-CLOSURE MONITORING SAMPLES

SAMPLE LOCATION - ANALYSIS	YEAR 1997 (Baseline)	YEAR 1999	YEAR 2001	YEAR 2003
Plot A - TPH	3	1	1	1
Plot B - TPH	3	1	1	1
Plot C - TPH	3	1	1	1
Blind Replicate - TPH	3	1	1	1
Plot A, B, C - CEA	1	1	1	1
Background - CEA	1	0	0	0

5.2.4 Analysis

Samples will be placed in clean laboratory-grade glass jars with Teflon lined lids, sealed, labeled, placed on ice in an ice chest, and cooled to approximately four degrees Centigrade (39.2 degrees Fahrenheit). Samples will then be transported to the Bechtel Nevada Analytical Services Laboratory in Mercury, Nevada following standard chain-of-custody procedures.

The analysis of samples for TPH as oil using EPA Method 8015, Modified will be performed by a subcontract laboratory. Analysis of the bio-characterization parameters will be completed by BioRenewal Technologies located in Madison, Wisconsin.

5.3 QUALITY CONTROL

5.3.1 Precision

Precision is a quantitative measure of data quality that refers to the reproducibility or degree of agreement among replicate or duplicate measurements of a parameter. Data precision is a function of field sampling precision and laboratory analytical precision. Precision can be determined by calculating the relative percent difference (RPD) between a sample and its duplicate. The RPD is calculated using the following formula where:

$$RPD = \frac{|C_1 - C_2|}{(C_1 + C_2)/2} \times 100$$

C_1 = Total analyte concentration in actual sample
 C_2 = Total analyte concentration in duplicate

The acceptable relative percent difference that will be used for this project is set at 35 percent. If the RPD using the above formula for each sample and duplicate pair is less than 35 percent, the sample will be considered valid and the sample value will be used in the determination of the mean.

If sample data precision cannot be established from the sample and sample duplicate, then a decision will be made on the use of the data based on the proximity of the data value to the regulatory threshold and the added value that would be obtained from additional sampling.

5.3.2 Accuracy

Accuracy is a quantitative measure of data quality that refers to the degree of difference between the measured or calculated values of a parameter and the true value of that parameter. The closer the measurement is to the true value, the more accurate the measurement.

Accuracy is controlled primarily by the analytical laboratory through the preparation and analysis of laboratory quality control samples, including matrix spikes and standard reference materials. Analytical accuracy is dependent on the method of analysis, the analyte of interest, and the sample matrix.

The acceptable measures of analytical accuracy (as determined by percent recovery) for this project shall be consistent with the quality control limits established for Method 8015, Modified referenced in SW-846 (EPA, 1994).

5.3.3 Representativeness

Representativeness is a qualitative measure of the degree to which the sampling effort achieves accuracy and precision. Representativeness of samples and data will be ensured by adhering to the sampling and analytical protocols presented in this plan and the sampling, sample handling, and analytical procedures described.

5.3.4 Comparability

Comparability is a qualitative measure that expresses the confidence with which one data set can be compared to another. It will be achieved by adhering to the specified analytical method and laboratory and field sampling procedures. It is anticipated that the same analytical laboratory will perform the specific analysis for all samples. Sample results will be reported in standard units to allow for comparison of the data.

5.3.5 Completeness

Completeness is a quantitative measure of data quality expressed as the percentage of valid or acceptable data obtained. The three samples and one duplicate sample collected for each sampling event should provide sufficient data for completeness. It is necessary for all of the data returned from the sampling effort to be of acceptable quality to provide for determination of degradation rates. If the data is not of acceptable quality, then resampling will be required.

5.4 POST-CLOSURE INSPECTION

The site will be inspected biennially at the time of sampling to determine if maintenance and repairs to the fence are required. Additional, nonscheduled inspections may be required after severe weather events such as heavy rainfall, flash flooding, and high winds. Any identified maintenance and repair requirements will be remedied within 30 days of discovery and documented in writing at the time of repair.

5.5 POST-CLOSURE REPORTING

A biennial report will be generated following each sampling event. The report will include the following information:

- Sampling field notes.
- Summary of analytical data.

- Quality Assurance Checklist validating analytical results.
- Graphs showing TPH degradation (actual and extrapolated).
- Inspection checklist and maintenance record.
- Conclusions and recommendations.

A copy of each biennial report will be submitted to the NDEP. Information and data collected from the baseline sampling, completed at the time of closure activities, will be provided with the Closure Report due to NDEP by December 31, 1997. Subsequent reports will be provided on a biennial basis thereafter for a period of six years.

6.0 REFERENCES

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REEC Co, 1992a, Work Plan - Phase 1 Preliminary Characterization of Building 12-16 Wastewater Discharge Area, Reynolds Electrical and Engineering Company, Inc.

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APPENDIX

DOCUMENT REVIEW SHEET

DOCUMENT REVIEW SHEET

Document Title/Number: Draft - Corrective Action Plan for CAU339: Area 12 Fleet Operations Steam Cleaning Discharge Area, Nevada Test Site/ DOE/NV/11718-106

Document Date: April 10, 1997

Revision Number: 0

Originator/Organization: Jerry Bonn/ Bechtel Nevada Remediation Projects NTS306

Date Comments Due: May 9, 1997

Reviewer/Organization: Harry van Drielen/ NDEP

Comment Number/ Location	Type ^a	Comment	Comment Response	Accept
Sect. 3.1.4	S	NDEP does not "require" this (post-closure) monitoring but accepts the monitoring as an alternative to clean closure of all the impacted areas.	Verbiage was revised to state that NDEP has accepted the monitoring in lieu of completing a clean closure at the site.	
Sect. 3.2	S	The NDEP has no objection to the careful disposal of the excavated oily soil in U10c. Documentation of quantity of oily soil removed and the place where it was disposed of is necessary for the Closure Report.	Disposal into U10c will be considered. BN Waste Management personnel will determine which landfill is appropriate based upon anticipated volume and concentrations of soil.	
Sect. 5.1	S	Analysis for the presence or abundance of the basic nutrients for protein synthesis implies that any deficiency will be erased by the addition of missing elements. After the third iteration (6th year), if no decline is perceived, the plan could stipulate that the soils be enriched and another set of sample episodes programmed. If after the 12th year the hydrocarbon shows no discernable decay with 6 years of nutrient rich dirt, the post-closure monitoring must be re-examined.	If after 6 years the decline in concentration is not at a rate to be below 100 mg/kg in 30 years, consideration will be given to enrich the soils and continue with additional post-closure monitoring.	

^aComment Types: M = Mandatory S = Suggested

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