Nevada
Environmental
Restoration
Project

DOE/NV-11718-167
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Closure Report
for CAU 339:
Area 12 Fleet Operations
Steam Cleaning Discharge Area
Nevada Test Site

Controlled Copy No. _____

Revision: 0

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December 1997

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**CLOSURE REPORT 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**

Controlled Copy No.: _____

Revision: 0

**Prepared by
Bechtel Nevada
Environmental Restoration**

December 1997

**CLOSURE REPORT FOR CAU 339:
AREA 12 FLEET OPERATIONS
STEAM CLEANING DISCHARGE AREA
NEVADA TEST SITE**

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TABLE OF CONTENTS

FIGURES	iv
TABLES	iv
ACRONYMS AND ABBREVIATIONS	v
EXECUTIVE SUMMARY	ES-1
1.0 INTRODUCTION	1
1.1 Purpose	1
1.2 Scope	4
1.3 Closure Report Contents	4
2.0 CLOSURE ACTIVITIES	6
2.1 Description of Corrective Action Activities	6
2.2 Deviations From Corrective Action Plan	8
2.3 Corrective Action Schedule as Completed	8
2.4 Site Plan	9
3.0 WASTE DISPOSITION	10
4.0 CLOSURE RESULTS	11
4.1 Total Petroleum Hydrocarbon Results	12
4.2 Bio-Characterization Results	12
5.0 CONCLUSIONS	15
6.0 REFERENCES	16
APPENDIX A - POST-CLOSURE MONITORING PLAN	

TABLE OF CONTENTS (continued)

FIGURES

FIGURE 1 - SITE LOCATION MAP	2
FIGURE 2 - SITE VICINITY MAP	3
FIGURE 3 - CAU 339 CORRECTIVE ACTION BOUNDARY AND SAMPLE PLOT LOCATION	7

TABLES

TABLE 1 - AREA 12 DISCHARGE AREA SUMMARY OF TPH BASELINE SOIL SAMPLE RESULTS	13
TABLE 2 - AREA 12 DISCHARGE AREA SUMMARY OF BIO-CHARACTERIZATION BASELINE SOIL SAMPLE RESULTS	14

ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
C:P	Carbon to Phosphate
CADD	Corrective Action Decision Document
CAP	Corrective Action Plan
CAS	Corrective Action Site
CAU	Corrective Action Unit
CEA	Comparative Enumeration Assay
cm	centimeter
COC	Constituent(s) of Concern
CR	Closure Report
DOE	U.S. Department of Energy
ERD	Environmental Restoration Division
FFACO	Federal Facility Agreement and Consent Order
ft	feet
in	inch
IRIS	Integrated Risk Information System
m	meter
m ³	cubic meter
mg/kg	milligrams per kilogram
mL	milliliter
mm	millimeter

ACRONYMS AND ABBREVIATIONS (continued)

NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
NTS	Nevada Test Site
PRGs	Preliminary Remediation Goals
SNP	Standard Nutrient Panel
TPH	Total Petroleum Hydrocarbon
μm	micrometer
VOC	volatile organic compound
WDNR	Wisconsin Division of Natural Resources
yd^3	cubic yard

EXECUTIVE SUMMARY

This Closure Report (CR) provides documentation of the completed corrective action at the Area 12 Fleet Operations site located in the southeast portion of the Area 12 Camp at the Nevada Test Site (NTS). Field work was performed in July 1997 as outlined in the Corrective Action Plan (CAP). The CAP was approved by the Nevada Division of Environmental Protection (NDEP) in June 1997. 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 in Corrective Action Unit (CAU) 339. The former Area 12 Fleet Operations Building 12-16 functioned as a maintenance facility for light- and heavy-duty vehicles from approximately 1965 to January 1993. Services performed at the site included steam-cleaning, tire service, and preventative maintenance on vehicles and equipment. Past activities impacted the former steam-cleaning discharge area with volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH) as oil.

Closure activities at the former Area 12 steam-cleaning discharge area were completed in July 1997. Closure activities completed include excavating approximately 61 m³ (80 yd³) of hydrocarbon impacted soils, plugging the end of the discharge line, removing a sandbag berm constructed around the discharge line, regrading the site with imported Type II soils, and installing perimeter fencing.

As part of the closure activity, soil samples were also collected from three undisturbed sample plots to establish a baseline for future post-closure monitoring and to verify that active biodegradation is occurring on the site. Samples were analyzed for TPH and bio-characterization parameters. Analytical results indicated that the sample points identified will be suitable to monitor the natural degradation of the remaining on-site hydrocarbons and that active biodegradation is occurring.

The post-closure monitoring program established for the site consists of sampling three selected sample plots on a biennial (every two years) basis. 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 milligrams per kilogram (mg/kg) within 30 years, the site conditions will be re-evaluated. Post-closure monitoring and sampling will begin in the spring of 1999, approximately two years from the completion of the site closure activities.

Based upon the completion of the closure activities described within this document and the commitment for biennial post-closure monitoring of the former discharge area, it is requested that a Notice of Completion be provided by the NDEP and that CAU 339 be moved from Appendix III to Appendix IV in the FFACO.

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. Wastewater from the separator was gravity fed through a pipeline which discharged approximately 104 meters (m) (340 feet [ft]) east of the sand/oil interceptor into an open field. 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. A soil berm separates the upper discharge area from a down gradient arroyo; however, discharge into the arroyo occurred prior to placement of the soil berm. Past activities impacted the discharge area with volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH) as oil. A site vicinity map is provided as Figure 2.

Surface water 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

This Closure Report (CR) provides documentation of the completed corrective action as outlined in the Corrective Action Plan (CAP) (DOE, 1997). The corrective action was completed in accordance with recently adopted Nevada Division of Environmental Protection (NDEP) closure standards "Action Levels for Contaminated Sites" (Nevada Administrative Code [NAC] 445A, 1997). In addition, the selected corrective action was supported by the evaluation of remedial alternatives outlined 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, 1992), the Preliminary Investigation Report (DOE, 1996b), and the Phase 2 Characterization Report which was provided with the CADD (DOE, 1996a). Previous characterization investigations were completed as a condition of the Temporary Water Pollution Control Permit issued by the NDEP to the Department of Energy (DOE) on July 14, 1992 (NDEP, 1992).

FIGURE 2
SITE VICINITY MAP

1.2 SCOPE

Since the site was primarily closed in place, verification samples were not required. The selected remedial alternative for closure of the discharge area consisted of the following:

- Excavating the hydrocarbon-impacted soils in the areas of visibly stressed vegetation and where hardened hydrocarbon layers had formed.
- Removing the sandbag barrier surrounding the effluent line.
- Plugging the end of the effluent discharge line.
- Fencing and posting the area of hydrocarbon impact.
- Biennial post-closure sampling and monitoring of the remaining hydrocarbon-impacted area.

Using Preliminary Remediation Goals (PRGs) from the Integrated Risk Information System (IRIS) Database (EPA, 1996), removal of the VOC-impacted soils identified at the site was not required since the PRGs are well above maximum concentrations detected in the two previous site investigations (DOE, 1997). However, as a consequence of excavating the hydrocarbon-impacted areas, the majority of the VOC-impacted soils were removed.

The closure activities and the post-closure monitoring only address the former 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.

1.3 CLOSURE REPORT CONTENTS

This CR has been developed to sufficiently document the closure of the discharge effluent area. The format of the CR is:

- Section 1.0 - Introduction (Purpose, Scope, and CR Contents)
- Section 2.0 - Closure Activities (Description of Activities, Deviations from CAP, Completion Schedule, and Site Plan)
- Section 3.0 - Waste Disposition
- Section 4.0 - Analytical Results (baseline analytical results from biennial soil sampling)

- Section 5.0 - Conclusions
- Section 6.0 - References
- Appendix A - Post-Closure Monitoring Plan

The corrective action was implemented using information and guidance provided from the following documents:

- Corrective Action Plan for CAU No. 339: Area 12 Fleet Operations Steam-Cleaning Discharge Area Nevada Test Site (DOE, 1997).
- Site Specific Health and Safety Plan for Area 12 Fleet Operations Steam-Cleaning Discharge Area Nevada Test Site Corrective Action Unit 339 (BN, 1997a).
- Area 12 Steam-Cleaning Discharge Area Management Plan (BN, 1997b).
- 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 (DOE, 1994).
- Nevada Environmental Restoration Project, Health and Safety Plan (DOE, 1996c).
- Nevada Environmental Restoration Project, Industrial Sites, Quality Assurance Project Plan, Nevada Test Site (DOE, 1996).

2.0 CLOSURE ACTIVITIES

2.1. DESCRIPTION OF CORRECTIVE ACTION ACTIVITIES

Hydrocarbon-impacted soils were excavated using a front end loader to an approximate depth of 0.3 meters (m) (1.0 foot [ft]). The excavated areas were identified by the obvious stress to vegetation growth. Vegetation growth was inhibited in these areas by the hydrocarbon-impacted soils due to the development of a surficial hard layer of hydrocarbon crust. The majority of the excavation was completed in the vicinity of the effluent discharge line and the north eastern (lowest gradient point) area of the upper discharge area. Two locations within the arroyo were also excavated. The excavation areas are shown on Figure 3. Approximately 61 cubic meters (m^3) (80 cubic yards [yd^3]) of impacted soil was removed from the various portions of the upper discharge area and the arroyo.

The sandbag barrier surrounding the discharge effluent line was also removed. The soil generated from the sandbag removal (approximately 23 m^3 [30 yd^3]) was used to backfill the areas excavated in the arroyo. The former effluent discharge line was plugged with Sulfaset cement. The plug was placed approximately 0.9 m (3 ft.) into the end of the 15 centimeter (cm) (6 inch [in]) diameter metal line and packed firmly to fill the void spaces in the line.

Subsequent to excavation the upper discharge area was fenced using "T-Posts" with a double strand of plastic-coated cable wiring (Figure 3). The fence was installed to prevent unauthorized disturbance of the impacted soils, minimize the potential for an unauthorized release, and protect the sample areas identified for post-closure monitoring. Additional fencing was installed to identify the post-closure monitoring locations. Fencing was not installed in the arroyo (with exception of the post-closure sample plot) since access or disturbance to the area is unlikely. Signs were placed around the fence perimeter identifying the site as being impacted by petroleum hydrocarbons. Signs were also placed on the three post-closure sample plots identifying them as "Sample Plots A, B, and C," as appropriate.

Sample Plots A, B, and C were not disturbed by excavation activities and consist of an approximate 1.5 m by 1.5 m (5 ft by 5 ft) area enclosed by T-Posts and a single strand of cable wire (Figure 3). Soil samples were collected from each plot and analyzed for a Comparative Enumeration Assay (CEA), Standard Nutrient Panel (SNP) and TPH as oil. The soil sample results will be used as a baseline to evaluate the natural degradation of the impacted soils remaining on-site (refer to Section 4.0 Closure Results).

FIGURE 3
CAU 339 CORRECTIVE ACTION BOUNDARY
AND SAMPLE PLOT LOCATION

2.2 DEVIATIONS FROM CORRECTIVE ACTION PLAN

Very few deviations from the CAP were required. A summary of the changes made during the progress of the site closure are as follows:

- One CEA and SNP for bio-characterization analysis were collected from each sample plot instead of one composite sample from the three plots. Since variations in microbial activity are possible, better baseline controls will be realized by having a representative sample from each plot.
- The size of each sample plot was extended from 1.2 m by 1.2 m (4 ft by 4 ft) to 1.5 m by 1.5 m (5 ft by 5 ft). The extended dimensions will allow for the collection of enough soil samples in the posted plot throughout the post-closure monitoring period.
- Due to the shallow depth of gravel and rock, soil samples were collected from a depth range of 5 cm to 20 cm (2 in to 8 in) below ground surface (bgs). The CAP indicated that samples would be collected from 15 cm to 30 cm (6 in to 12 in) bgs.
- The southern fence boundary extent was reduced since impacted soils did not extend laterally beyond the southern limit of the former sandbag berm. The northern boundary was tied into an existing fenced area to reduce the labor and materials needed to complete the northern perimeter boundary. The fence boundary is shown on Figure 3.
- Decontamination of the front end loader was not warranted. Since soils were very dry, impacted soils were not affixed to the bucket or tires. In addition, backfilling with the imported Type II fill removed any soils which may have been remaining on the bucket or tires.
- Decontamination rinseate from the equipment was not placed into containers for disposal. The hand auger and soil sieves were washed with Alconox and water and rinsed with water over a stainless steel bowl. Due to the dryness of the soil, limited decontamination effort was required resulting in little residual. The residual generated evaporated quickly and in total amounted to no more than approximately 0.5 liters (16 ounces).

2.3 CORRECTIVE ACTION SCHEDULE AS COMPLETED

The corrective action was completed in a timely manner. The project activities were completed on the following dates:

Monday, July 28, 1997: The prefield kickoff meeting was held and the necessary equipment was mobilized to the site. Excavation of the lower arroyo areas (approximately 15 m³ [20 yd³]) was

completed and the sandbag berm was removed from around the former discharge line. The soils were used for backfilling the excavated areas in the lower arroyo.

Tuesday, July 29, 1997: Soil excavation continued within the upper discharge area. Removal of an additional 46 m³ (60 yd³) of soil was completed. Excavated soils were transported to the Area 6 Hydrocarbon Solid Waste Disposal Site. The end of the effluent discharge line was plugged and sealed with Sulfaset Cement. Site grading was completed using imported Type II soils.

Wednesday, July 30, 1997: Three sample plots locations were identified and locations were mapped for updating site figures. Soil samples were collected for TPH, CEA, and SNP analysis. The perimeter and sample plot locations were fenced and heavy equipment was demobilized.

2.4 SITE PLAN

A site plan reflecting the completed closure activities has been updated and provided as Figure 3 "Excavation and Fence Boundary." A copy of the site plan is on file at the Archives and Records Center located in Mercury, Nevada. The site plan provided to the record center is entitled, "Building 12-16 Discharge Area, Corrective Action Unit 339."

3.0 WASTE DISPOSITION

Waste generated from the closure activities consisted of hydrocarbon-impacted soils. Excavated soils were loaded directly into end-dump trucks located onsite. The soils were transported to the Area 6 Hydrocarbon Solid Waste Disposal Site.

A waste tracking number was assigned to each load and entered into the Bechtel Nevada Tracking System, creating a record which documents the date of generation along with the method and date of disposal. A weight ticket also accompanied each load. Only one bill of lading and radiological "green tag" were required for the disposal of the 61 m³ (80 yd³) of soil generated.

Landfill acceptance of the soil was based on the laboratory analysis of the soil samples collected during the Preliminary and Phase II Sampling activities. Therefore, additional sampling for waste characterization was not required.

Decontamination rinseate from the sampling equipment was not containerized for disposal. The hand auger and soil sieves were washed with Alconox and water and rinsed with water over a stainless steel bowl. Due to the dryness of the soil limited decontamination efforts were required resulting in little residual. The residual generated evaporated quickly and in total amounted to no more than approximately 0.5 liters (16 ounces).

4.0 CLOSURE RESULTS

Since the site was primarily closed in place with only a small volume of impacted soil requiring removal, verification samples were not required. However, in order to establish a baseline to monitor hydrocarbon degradation of the remaining impacted soils onsite, soil samples were collected from three sample plots (Plots A, B, and C). These sample plots will be used as the locations for post-closure monitoring (Figure 3). The post-closure monitoring program consists of sampling the three impacted locations 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 of petroleum hydrocarbons would not degrade below the Nevada Administrative Code Action Level of 100 mg/kg within 30 years, the site conditions will be re-evaluated (NAC, 1996). Consideration will be given to the possibility of enriching the impacted soils with nutrients to enhance the degradation process. Soil enrichment would be followed by an additional six years of post-closure monitoring. Post-closure monitoring and sampling will begin in spring of 1999, approximately two years from the completion of the site closure activities.

The sample plots were not disturbed by excavation activities and consist of an approximate 1.5 m by 1.5 m (5 ft by 5 ft) area enclosed by T-Posts and cable wire. Soil samples were collected from each plot and analyzed for TPH as oil. One replicate sample was also collected. The samples collected for TPH analysis were segregated through a field sieve into three grain sizes, Nos. 10, 35, and greater than (>) 35. The No. 10 sample represents soils passing through a No. 5 sieve (4.00 millimeter [mm]) and retained within the No. 10 sieve (2.00 mm). The No. 35 sample represents soils passing through the No. 10 sieve and retained within the No. 35 sieve (500 micrometer [μ m]). The > 35 sample represents soils passing through the No. 35 sieve and retained within the solid sieve bottom container. The samples were segregated to determine if one particular grain size exhibited a greater TPH concentration than another.

CEA (total heterotroph and degrader microbial populations) and SNP (nitrogen, carbon, phosphate, pH, etc.) samples were analyzed for bio-characterization from each sample plot as well as a background sample. The CEA and SNP were not segregated by grain size. Each TPH sample was composited from three locations within the plot. Bio-characterization samples were not composited.

All soil samples were collected using a clean hand auger and collected from approximately 5 cm to 20 cm, (2 in to 8 in) bgs. Samples were subsequently labeled with the samplers name, date and time collected, sample identification, and analysis requested. Samples were placed on ice in an cooler and chilled to approximately 4 degrees Celsius (39.2 degrees Fahrenheit). TPH samples were collected into 250 milliliter (mL) glass laboratory-cleaned jars and transported to Quanterra Analytical Laboratories. The CEA and SNP were collected into 120 mL glass laboratory-cleaned jars and transported to BioRenewal Technologies, Inc.

4.1 TOTAL PETROLEUM HYDROCARBON RESULTS

The TPH samples were identified by the sample plot designation followed by the sieve size sampled, where A#10 represents Sample Plot A, sieve size No. 10. TPH concentrations ranged from 450 mg/kg to 5,500 mg/kg. The presence of impacted soils in these samples indicates that the designated sample plots will be suitable locations for subsequent post-closure monitoring. The analytical results are summarized in Table 1. The laboratory analytical data (Packet No. V265) is available upon request from DOE Environmental Restoration Division (ERD).

Based on the limited analytical data collected, a specific grain size for the discharge area could not be associated with a higher concentration of petroleum hydrocarbons. However, the maximum concentration reported for each sample plot varied with grain size. Therefore, the grain size from each plot with the highest reported TPH concentration will be collected to monitor the rate of soil degradation in future post-closure sampling. Post-closure samples from Plot A will be from sieve size No. 35, Plot B will be from sieve size >35 and Plot C from sieve size No. 10. The Post-Closure Monitoring Plan is provided in Appendix A.

4.2 BIO-CHARACTERIZATION RESULTS

Samples were analyzed by BioRenewal Technologies, Inc. in Madison, Wisconsin, using waste oil as the carbon source for counting the "degrader" microbial populations. Soil sample results are compared with Wisconsin Division of Natural Resources (WDNR) guidelines and bio-engineering norms. These guidelines are used as a reference for evaluation purposes only.

Sample results indicate that the total and degrader populations are of sufficient magnitude to support measurable biotransformation without site augmentation. Each sample was within or exceeded the guidelines/norms for total and degrader populations, pH, total organic nitrogen/organic matter, and carbon to nitrogen ratios. However, samples were below the guideline for carbon to phosphate (C:P) ratios. It is likely that the C:P ratios did not fall within the WDNR guidelines due to the shallow sample depth and the characteristic of the native soils in Nevada versus Wisconsin. The data does indicate that reasonable phosphate amounts are present in the soils but are simply in lower quantities than the carbon resulting in offset ratios. It is recommended that ratios be used with caution since they do not indicate the availability of the carbon, nitrogen, or phosphate to microorganisms (WDNR, 1996). The bio-characterization data is summarized in Table 2. The laboratory analytical data (Packet No. BOI) is available upon request from DOE ERD.

TABLE 1 - AREA 12 DISCHARGE SUMMARY OF TPH BASELINE SOIL SAMPLE RESULTS

Notes:

TPH: Total Petroleum Hydrocarbons as oil analyzed using EPA Method 8015 Modified.

D#>35*: Blind replicate of Sample B#>35.

TABLE 2: SUMMARY OF BIO-CHARACTERIZATION BASELINE SOIL SAMPLE RESULTS

SAMPLE ID	SOIL MICROBIAL POPULATIONS ⁽¹⁾		pH	TOTAL ORGANIC NITROGEN/ORGANIC MATTER (%)	C:N ⁽²⁾	C:P ⁽³⁾
	TOTAL POPULATIONS (Mean)	DEGRADER POPULATIONS (Mean)				
Background	4.4E+06	3.3E+06	7.5	9.5	4	2,637
Plot A	9.1E+06	3.4E+06	6.8	8.6	5	2,093
Plot B	1.6E+07	9.8E+06	6.9	11.4	3	2,080
Plot C	1.3E+07	4.6E+06	6.6	22.8	2	2,143
<i>Guidelines/norm (WDNR)</i>	<i>>1E+06</i>		<i>5.5-8.5</i>	<i>>1.5%</i>	<i><40</i>	<i><120</i>

Notes:

Refer to Figure 3 for Sample Plot locations.

(1) Degradier populations greater than 1.0E+06 are generally of sufficient magnitude to support measurable biotransformation without site augmentation. However, site augmentation may still be required to attain desirable rates of transformation due to specific site conditions (BioRenewal Technologies Analysis Report).

(2) Carbon to nitrogen ratio.

(3) Carbon to phosphorous ratio.

WDNR: Wisconsin Division of Natural Resources

5.0 CONCLUSIONS

Closure activities at the former Area 12 Steam-Cleaning Discharge Area were completed in July 1997. The site was closed in place which dictates that post-closure monitoring be completed for the hydrocarbon-impacted soils not removed. The amount of soil removed was determined by field identification of areas where a dry hydrocarbon crust had formed and restricted the vegetation growth. Closure activities completed include excavating approximately 61 m³ (80 yd³) of hydrocarbon-impacted soils, plugging the end of the discharge line, removing the sandbag berm, regrading the site with imported Type II soils, and fencing the perimeter.

As part of the closure activity soil samples were also collected from three undisturbed sample plots to establish a baseline for future post-closure monitoring and to verify that active biodegradation is occurring on the site. Samples were analyzed for TPH as oil and bio-characterization (CEA and SNP). The results of the TPH analysis indicated that the selected sample points will be suitable to monitor the natural degradation of the remaining hydrocarbons. The CEA and SNP results indicate that biodegradation is occurring at the site.

The post-closure monitoring program consists of sampling the three identified sample plots on a biennial (every two years) basis. 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, 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 six years of post-closure monitoring. Post-closure monitoring and sampling will begin in the spring of 1999, approximately two years from the completion of the site closure activities. The Post-Closure Monitoring Plan is provided as Appendix A.

Based upon the completion of the closure activities described within this document and the commitment for biennial post-closure monitoring of the former discharge area, it is requested that a Notice of Completion be provided by the NDEP and that CAU 339 be moved from Appendix III to Appendix IV in the FFACO.

6.0 REFERENCES

- BN, 1997a, Site Specific Health and Safety Plan, Site Closure & Post Closure Monitoring for Area 12 Fleet Operations Steam-Cleaning Discharge Area, Nevada Test Site CAU 339, prepared by Bechtel Nevada, July 1997.
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- EPA, 1996, Integrated Risk Information System (IRIS), Soil Action Levels for Residential Land Use, Environmental Protection Agency, August 1, 1996.
- NAC, 1996, Hazardous Materials: Storage Tanks, Nevada Administrative Code 459.9921 through 459.999.
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- NDEP, 1992, Temporary Water Pollution Permit, Nevada Division of Environmental Protection, July 14, 1992.
- NDEP, 1997, Memorandum - Area 12 Steam-Cleaning Discharge Area CADD Review, Final, Nevada Division of Environmental Protection, February 7, 1997.

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WDNR, 1996, Natural Biodegradation as a Remedial Action Option. Interim Guidance, Wisconsin Division of Natural Resources, August 26, 1994.

APPENDIX A

POST CLOSURE MONITORING PLAN

**POST-CLOSURE MONITORING PLAN FOR CAU 339:
AREA 12 FLEET OPERATIONS
STEAM-CLEANING DISCHARGE AREA
NEVADA TEST SITE**

**Prepared for the
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**Prepared by
Bechtel Nevada
Remediation Projects**

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TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS	A-iii
1.0 INTRODUCTION	A-1
1.1 Sampling Strategy	A-1
1.1.1 Schedule	A-1
1.1.2 Location	A-2
1.1.3 Collection	A-2
1.1.4 Analysis	A-4
1.2 Quality Control	A-5
1.2.1 Precision	A-5
1.2.2 Accuracy	A-5
1.2.3 Representativeness	A-6
1.2.4 Comparability	A-6
1.2.5 Completeness	A-6
1.3 Post-Closure Inspection	A-6
1.4 Post-Closure Reporting	A-7
2.0 REFERENCES	A-8

ATTACHMENT 1: Inspection Checklist and Maintenance Record

FIGURE

FIGURE A-1 - CAU 339 CORRECTIVE ACTION BOUNDARY AND SAMPLE PLOT LOCATION	A-3
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TABLE

TABLE A-1: SUMMARY OF POST-CLOSURE MONITORING SAMPLE COLLECTION	A-4
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ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CEA	Comparative Enumeration Assay
cm	centimeter
COC	Constituent of Concern
EPA	U.S. Environmental Protection Agency
ft	feet
in	inch
m	meter
mg/kg	milligrams per kilogram
mL	milliliter
mm	millimeter
NDEP	Nevada Division of Environmental Protection
RPD	Relative Percent Difference
SNP	Standard Nutrient Panel
TPH	Total Petroleum Hydrocarbon
μ m	micro meter

1.0 INTRODUCTION

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 Nevada Division of Environmental Protection (NDEP) to establish the rate of decline and time frame in which the hydrocarbon concentrations decrease below the action level of 100 milligrams per kilogram (mg/kg) (NDEP, 1997).

Soil samples were collected during the completion of closure activities to determine a baseline concentration for the three selected monitoring areas (Sample Plots A, B, and C). Samples were analyzed for total petroleum hydrocarbons (TPH) as oil, Comparative Enumeration Assays (CEAs), and Standard Nutrient Panels (SNPs). The analysis of these parameters can indicate whether biological processes that are associated with natural attenuation of petroleum hydrocarbons are occurring at the site. The CEA identifies the total heterotroph (species dependant on organic matter for food) and petroleum degrader microbial populations (aerobic). The SNP identifies the availability of elements at the site that may favor or limit sufficient degradation (i.e., total organic nitrogen, total organic carbon, phosphorous, pH, etc.).

Post-closure monitoring and sampling is scheduled to occur biennially starting from the completion of site closure activities. The decline of the hydrocarbon concentrations will occur through natural degradation (intrinsic bioremediation). This is the ability of naturally occurring microbial communities to degrade constituents of concern (COC) without taking engineering steps to enhance the process. The following summarizes the discharge area site conditions which are favorable to natural degradation based upon the bio-characterization data:

- Site soils contain sufficient elemental nutrients (carbon, nitrogen, and phosphorus).
- Analysis indicates that active degradation levels are of sufficient magnitude to support biotransformation without site augmentation.
- The site has aerobic growth conditions so that the bacteria can oxidize the hydrocarbons.

In addition, the impacted soils are near surface and are porous. These factors are favorable to the rate of degradation.

1.1 SAMPLING STRATEGY

1.1.1 Schedule

Soil samples were collected concurrent with closure activities in order to establish a baseline for the sample plots identified for monitoring. Post-closure sampling will be conducted on a biennial basis for six years (three sampling events) from the completion of site closure activities.

The next sampling activity is proposed for the spring of 1999. By collecting samples in the spring months it will allow for sufficient time to receive analytical results, compile data, and prepare the monitoring report prior to the end of the budgetary fiscal year (September 30).

If after six years the degradation rate appears to be so slow that the greatest TPH concentrations would not decay to below 100 mg/kg within 30 years, 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 six years of post-closure monitoring.

1.1.2 Location

Soil samples will be collected from three sample plots (Plot A, B, and C). Sample Plots A and B are located in the upper discharge area. Sample Plot C is located in the arroyo down gradient of the discharge area. The locations of the sample plots are shown on Figure A-1. The sample locations consist of an approximate 1.5 meter (m) by 1.5 m (5 feet [ft] by 5 ft) area enclosed by "T-Posts" and cable wiring. The plots are identified with metal sign postings indicating their respective designations as Plots A, B, and C.

1.1.3 Collection

Soil for TPH analysis will be collected at three locations within each plot from a depth of approximately 5 centimeters (cm) to 20 cm (2 inch [in] to 8 in) below ground surface (bgs). In an effort to provide additional controls for the evaluation of soil degradation, soil will be segregated by placing the soil through a hand shaken field sieve set. Samples will be collected from screen sizes 10, 35 and greater than (>) 35. The No. 10 sample represents soils passing through a No. 5 sieve (4.00 millimeter [mm]) and retained within the No. 10 sieve (2.00 mm). The No. 35 sample represents soils passing through the No. 10 sieve and retained within the No. 35 sieve (500 micrometer [μ m]). The > 35 sample represents soils passing through the No. 35 sieve and retained within the solid sieve bottom container.

Prior analysis did not demonstrate that TPH concentrations could be correlated with a particular grain size at the site. However, the maximum concentration reported for each sample plot varied with grain size. Therefore, the grain size from each plot with the highest reported TPH concentration will be collected to monitor the rate of soil degradation in future post-closure sampling. Post-closure samples from Plot A will be from sieve size No. 35, Plot B will be from sieve size >35, and Plot C from sieve size No. 10 (Table A-1).

For collection of the post-closure soil samples, samples analyzed for TPH as oil will be composited from three areas within each sample plot and submitted for laboratory analysis. One blind replicate sample from a selected plot will also be collected and analyzed for TPH as oil.

FIGURE A-1
CAU 339 CORRECTIVE ACTION BOUNDARY
AND SAMPLE PLOT LOCATION

TABLE A-1: SUMMARY OF POST-CLOSURE MONITORING SAMPLE COLLECTION

SAMPLE LOCATION - ANALYSIS	SIEVE SIZE ⁽¹⁾	YEAR 1999	YEAR 2001	YEAR 2003
Plot A - TPH, CEA, SNP	35	1	1	1
Plot B - TPH, CEA, SNP	>35	1	1	1
Plot C - TPH, CEA, SNP	10	1	1	1
Blind Replicate - TPH	TBD ⁽²⁾	1	1	1

Notes:

- (1) Sieve size determined based on TPH concentrations of baseline samples collected.
- (2) TBD: To be determined based upon the selected blind replicate sample location.

One sample from each plot will also be collected for the CEA and SNP bio-characterization analysis. The bio-characterization samples will not be composited or segregated by grain size. All samples will be collected using a hand auger from an approximate depth of 5 cm to 20 cm (2 in to 8 in) bgs. Samples will be subsequently labeled with the samplers name, date and time collected, sample identification, and analysis requested. Samples will be placed on ice in an cooler and chilled to approximately four degrees Celsius (39.2 degrees Fahrenheit). Samples will be collected into 250 milliliter (mL) glass laboratory cleaned jars. The projected number of samples to be collected for the post-closure monitoring are summarized in Table A-1. The auger and sieves will be cleaned prior to sampling each plot by washing with soap and water, rinsing with clean water, and performing a final rinse with distilled water. Based on the limited volume of decontamination water anticipated (0.5 liters [16 ounces]), the water will be allowed to evaporate while on-site.

1.1.4 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 4 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. Samples will subsequently be transported to the appropriate subcontract laboratories for analysis of TPH as oil using U.S. Environmental Protection Agency (EPA) Method 8015 (Modified) and for bio-characterization parameters.

1.2 QUALITY CONTROL

1.2.1 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 RPD 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 determining 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.

1.2.2 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 EPA Method 8015 (Modified) (EPA, 1994).

Accuracy is also controlled through sampling procedures. The proper collection and custody of samples is recorded in field notes, use of appropriate sample equipment, collection of required sample volumes, appropriate sample location, and chain-of custody documentation.

1.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Sample representativeness for post-closure monitoring at CAU 339 shall be achieved through implementing the sampling program detailed in this Plan. This Plan identifies appropriate sampling locations to evaluate the natural degradation of the hydrocarbon impacted soils, details the number of samples to be collected, and the analysis to be completed. Representativeness shall be assessed by collecting and analyzing replicate samples (DOE, 1996).

1.2.4 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 with other similar data sets.

1.2.5 Completeness

Completeness is a quantitative measure of data quality expressed as the percentage of valid or acceptable data obtained. Completeness is affected by unexpected conditions that may occur during the data collection process. Completeness shall be determined by comparing the number of samples for which acceptable results were received. Sample data completeness shall be achieved through quality sampling practices and standard analytical techniques. A completeness objective for post-closure sampling at CAU 339 is set at 100 percent. The analytical program is designed to minimize the data collection effort; therefore, it is anticipated that rejection of data and subsequent resampling will be minimal (DOE, 1996).

1.3 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 60 days of discovery and documented in writing within the project file at the time of repair.

1.4 POST-CLOSURE REPORTING

A biennial report will be generated following each sampling event. The report will be submitted to the NDEP on a biennial basis for a period of six years and will include the following information:

- Summary of analytical data.
- Graphs showing TPH degradation (actual and extrapolated to the 30th year).
- Inspection checklist and maintenance record (Attachment 1).
- Conclusions and recommendations.

2.0 REFERENCES

DOE, 1996, Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada,
Department of Energy Environmental Restoration Project, July 1996.

NDEP, 1997, Memorandum - Area 12 Steam-Cleaning Discharge Area CADD Review, Final,
Nevada Division of Environmental Protection, February 7, 1997.

ATTACHMENT 1

**INSPECTION CHECKLIST AND MAINTENANCE
RECORD**

**AREA 12 FLEET OPERATIONS STEAM-CLEANING DISCHARGE AREA CAU 339
INSPECTION FORM**

Inspect the former discharge area and arroyo. Look for any change in the unit such as accumulation of water, vegetation growth, change in service of surrounding facilities, observation of spills, etc. Refer to the previous inspection of the unit in order to identify any changes. Inspections should be completed after a problem is reported by a contractor, DOE, NDEP, or other BN employees. At a minimum, inspections are to be done biennially (every two years) at the time of post-closure sampling.

GENERAL INFORMATION

1. Date of inspection: _____
2. Facility Manager (name and organization): _____
3. Reason for inspection: Biennial: ____ Problem Reported: ____ Unusual weather: ____
Details (Name, organization and telephone number of person reporting problem): _____
4. Describe weather conditions over the past few weeks (high winds, precipitation, local flooding):

DISCHARGE AREA

5. Condition of soil berm between discharge area and arroyo: _____

6. Condition of fencing (any breaks in cable wiring, posts still vertical): _____

7. Condition of signs (missing signs, fading, damaged): _____

8. Is standing water present in the discharge area: No ____ Yes ____ Depth: ____ Description (color, odor, sheen, etc.): _____

9. Signs of recent erosion indicating run-on (into) the discharge area?
No ____ Yes ____ If yes, explain: _____

10. Have Sample Plots been disturbed? No ____ Yes ____ If yes, explain: _____

AREA 12 FLEET OPERATIONS STEAM-CLEANING DISCHARGE AREA CAU 339 INSPECTION FORM

CHANGES TO SURROUNDING AREA

11. Describe any significant changes in the general area (within several hundred feet of the unit) from the previous inspection. Changes can include, change in land use, storage of materials nearby, soil piles, change in use of nearby facilities, etc. _____

14. What is the (possible) effect of the change? _____

15. Other comments or observations: _____

16. Recommendations: _____

17. Does the finding(s) of this inspection require another inspection prior to the scheduled biennial inspection?

No _____ Yes _____ If yes, date of next inspection: _____

Significant changes noted must be notified to the RP Assistant Project Manager and Task Manager upon return to the office.

Inspected by : _____ Signed: _____ Date: _____

Names of other persons on inspection (print): _____

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