

Nevada
Environmental
Restoration
Project

DOE/NV--840



Post-Closure Monitoring Report for
Corrective Action Unit 339:
Area 12 Fleet Operations
Steam Cleaning Effluent
Nevada Test Site, Nevada

UNCONTROLLED

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Environmental Restoration
Division

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

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**POST-CLOSURE MONITORING REPORT
FOR CORRECTIVE ACTION UNIT 339:
AREA 12 FLEET OPERATIONS
STEAM CLEANING EFFLUENT
NEVADA TEST SITE, NEVADA**

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**POST-CLOSURE MONITORING REPORT
FOR CORRECTIVE ACTION UNIT 339:
AREA 12 FLEET OPERATIONS
STEAM CLEANING EFFLUENT
NEVADA TEST SITE, NEVADA**

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ACRONYMS AND ABBREVIATIONS

C:N	carbon to nitrogen
C:P	carbon to phosphate
CAS	Corrective Action Site
CAU	Corrective Action Unit
CEA	Comparative Enumeration Assay
cm	centimeters
DOE/NV	U.S. Department of Energy, Nevada Operations Office
EPA	U.S. Environmental Protection Agency
FFACO	Federal Facility Agreement and Consent Order
in	inch
mg/kg	milligram per kilogram
mm	millimeter
NAC	Nevada Administrative Code
NDEP	Nevada Division of Environmental Protection
RPD	Relative Percent Difference
SNP	Standard Nutrient Panel
TON:OM	total organic nitrogen to organic matter
TPH	total petroleum hydrocarbon
WDNR	Wisconsin Division of Natural Resources

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EXECUTIVE SUMMARY

The Area 12 Fleet Operations Steam Cleaning Effluent is located in the southeast portion of the Area 12 Camp at the Nevada Test Site. This site is identified in the Federal Facility Agreement and Consent Order (1996) as Corrective Action Site (CAS) 12-19-01 and is the only CAS assigned to Corrective Action Unit (CAU) 339. Post-closure sampling and inspection of the site were completed on March 27, 2002.

As outlined in the Closure Report for CAU 339, post-closure monitoring for the site was originally scheduled biennially (every two years) (U.S. Department of Energy, Nevada Operations Office (1997)). For the 1997 sampling, three samples from each of three plots within the site were collected and composited. The composite sample from each plot was sieved, and the grain size exhibiting the highest concentration of total petroleum hydrocarbons (TPH) from each plot was analyzed. This grain size and associated TPH concentration were to be the baseline for monitoring the rate of TPH degradation in each plot in future sampling. Future post-closure sampling would follow the 1997 protocol for collection, but only the baseline grain size for each plot was to be analyzed. This sampling procedure was followed in 1999.

The 1999 monitoring results did not correlate well with the 1997 results and revealed that sieve size did not have a significant correlation with differing TPH concentrations. The 1999 post-closure monitoring report, therefore, recommended for additional sampling to be conducted in 2000 to better determine an appropriate baseline for the site. Rather than segregating grain size, the report recommended collecting three samples from each plot and analyzing each sample. This was the sampling method used for the 2000, 2001, and 2002 sampling activities.

Results of the 2000 sampling revealed that an average of several samples, including all grain sizes, may be more representative of the TPH concentration than an individual grain size. Though future sampling TPH results would not directly correlate with 1997 results due to differing sampling protocols, the 2000 post-closure monitoring report recommended that the 1997 results remain the baseline for TPH concentration. The 2000 post-closure monitoring report also recommended that soil samples continue to be collected biennially (every two years) and that the TPH sampling and analysis of future samples should be consistent with the methods used for the 2000 site activities.

The Nevada Division of Environmental Protection (NDEP) requested post-closure monitoring sampling to be conducted annually for the next two years, rather than biennial sampling as was recommended in the 2000 post-closure monitoring report. After two years of sampling, the data would be evaluated to determine if annual or biennial sampling should be conducted in future years. NDEP also approved using the 2000 sampling protocol for future sampling activity.

Annual post-closure sampling of the site was completed on March 27, 2002. TPH results show significant variation over time in all three plots. One of the plots has significantly higher TPH concentration compared to baseline, while the other two show small drops. Bio-characterization

data do support that the entire site is amenable to natural degradation. The possible exception is the very small amount of phosphate seen in the 2002 samples. Degradation may be occurring, but degradation rates may be masked by highly heterogeneous conditions in the soil. At best, TPH degradation may be occurring at a very slow rate throughout the site.

As required by the post-closure monitoring plan, results of post-closure monitoring will be evaluated after the 2003 monitoring event and either a degradation rate or a post-closure strategy will be identified.

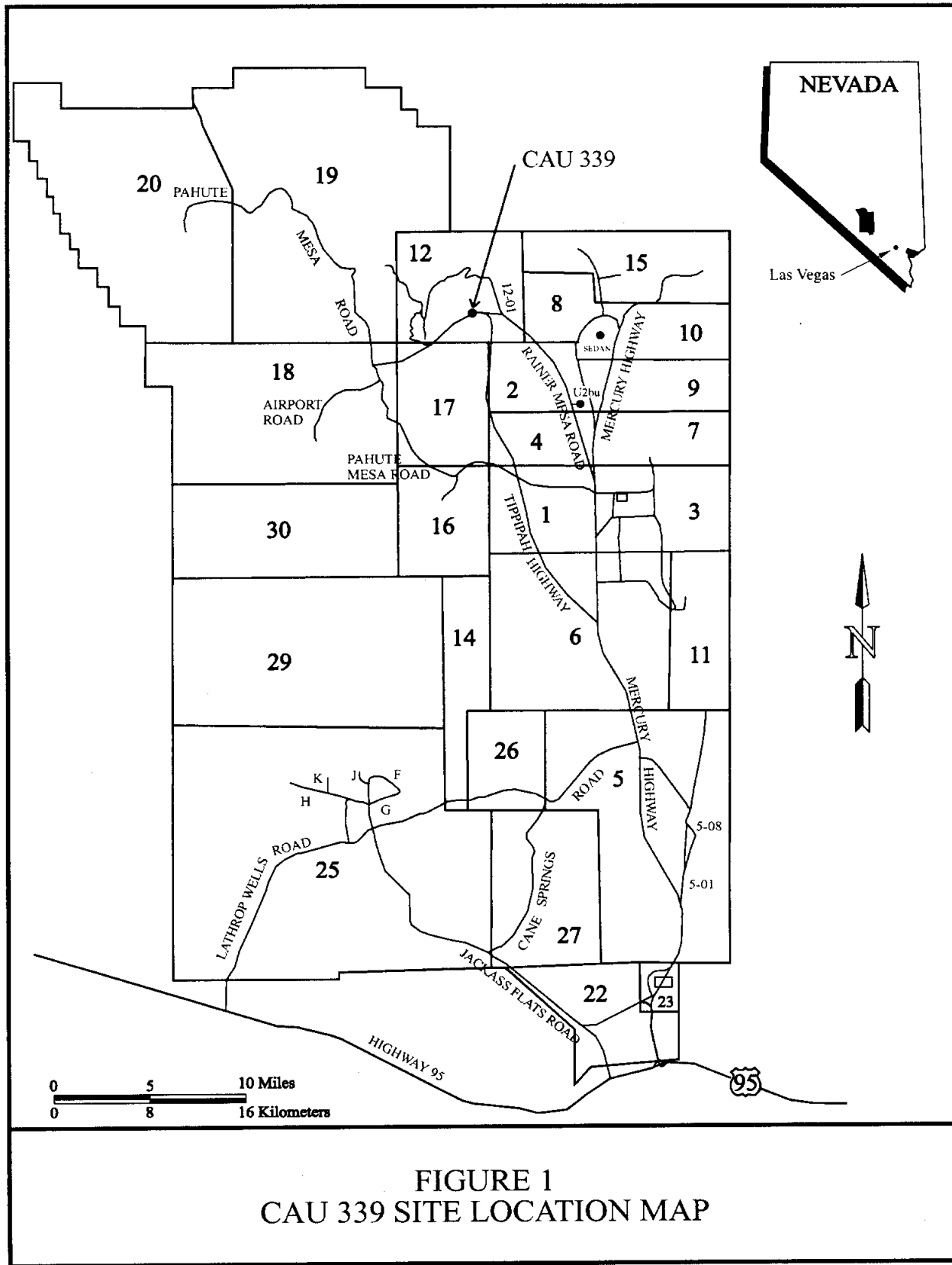
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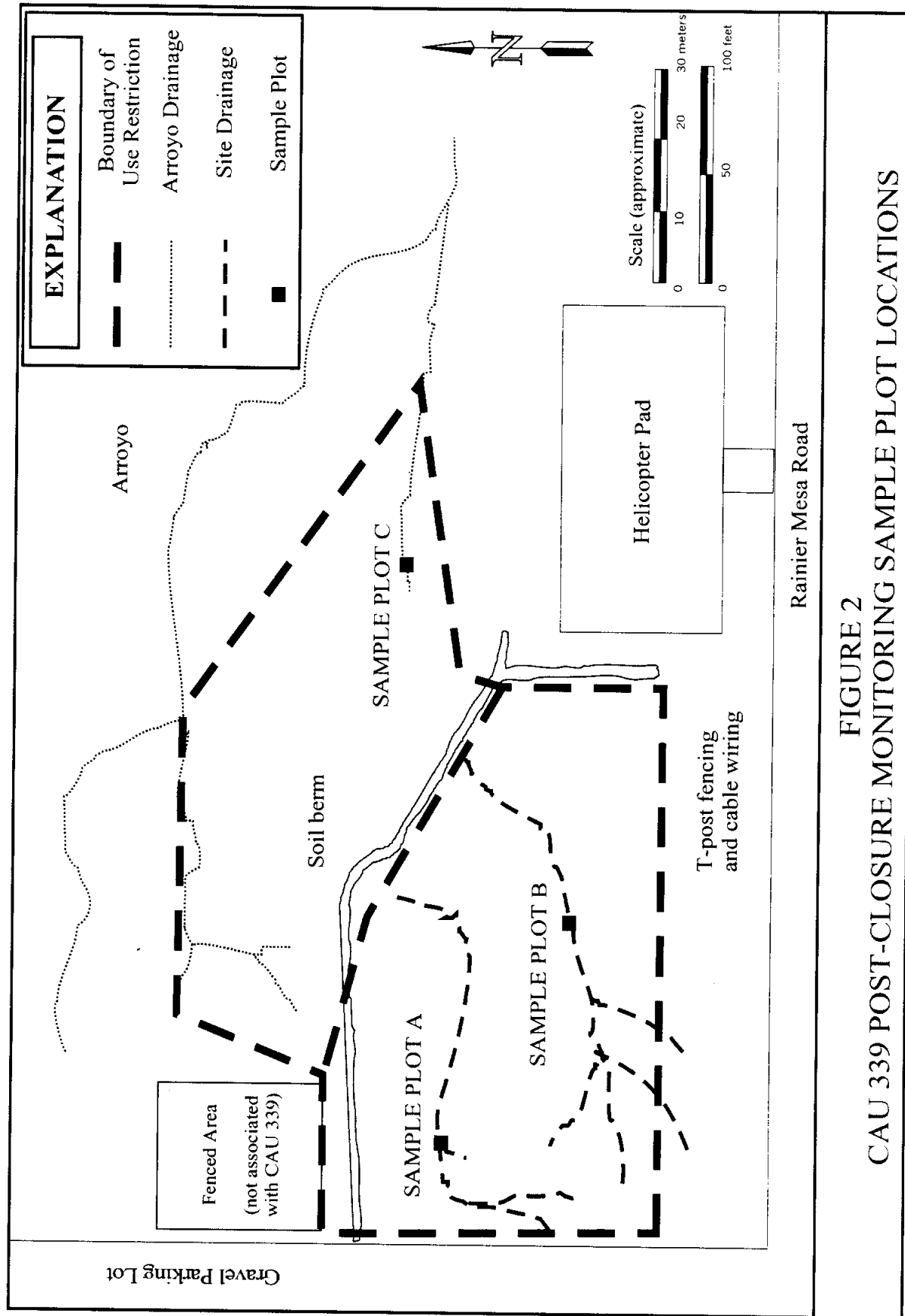
The Area 12 Fleet Operations Steam Cleaning Effluent site is located in the southeastern portion of the Area 12 Camp at the Nevada Test Site (Figure 1). This site is identified in the Federal Facility Agreement and Consent Order (1996) as Corrective Action Site (CAS) 12-19-01 and is the only CAS assigned to Corrective Action Unit (CAU) 339. Post-closure sampling and inspection of the site were completed on March 27, 2002.

Post-closure monitoring activities were scheduled biennially (every two years) in the Post-Closure Monitoring Plan provided in the Closure Report for CAU 339: Area 12 Fleet Operations Steam Cleaning Effluent, Nevada Test Site (U.S. Department of Energy, Nevada Operations Office [DOE/NV], 1997). A baseline for the site was established by sampling in 1997. Based on the recommendations from the 1999 post-closure monitoring report (DOE/NV, 1999), samples were collected in 2000, earlier than originally proposed, because the 1999 sample results did not provide the expected decrease in total petroleum hydrocarbon (TPH) concentrations at the site. Sampling results from 2000 (DOE/NV, 2000) and 2001 (DOE/NV, 2001) revealed favorable conditions for natural degradation at the CAU 339 site, but because of differing sample methods and heterogeneity of the soil, data results from 2000 and later were not directly correlated with previous results.

Post-closure monitoring activities for 2002 consisted of the following:

- Soil sample collection from three undisturbed plots (Plots A, B, and C, Figure 2).
- Sample analysis for TPH as oil and bio-characterization parameters (Comparative Enumeration Assay [CEA] and Standard Nutrient Panel [SNP]).
- Site inspection to evaluate the condition of the fencing and signs.
- Preparation and submittal of the Post-Closure Monitoring Report.





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2.0 INSPECTION RESULTS

Post-closure inspection of CAU 339 was conducted on March 27, 2002. The perimeter fencing around the upper discharge area was in good condition. The signs around the sample plots were partially down as well as part of the cable fence around Plot A. On July 2, 2002, the fencing was secured and the signs reposted. Vegetation growth in the upper discharge area where impacted soils were excavated in 1997 is strong and healthy. No additional maintenance or repairs are required at the site. The inspection report is provided as Appendix A.

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3.0 SUMMARY OF SOIL ANALYSIS

3.1 SAMPLE COLLECTION AND ANALYSIS FOR 1997 AND 1999

For the 1997 sampling activity, soil samples were collected using a clean hand auger and collected from a depth of approximately 5 to 20 centimeters (cm) (2 to 8 inches [in]) below surface grade. For TPH analysis, soil samples were collected from three locations within each sample plot (Figure 2) and combined. The single plot sample was then sieved into three grain-size samples. The No. 10 sample included soil passing through a No. 5 sieve (4.00 millimeters [mm]) and retained within the No. 10 sieve (2.00 mm). The No. 35 sample included soil passing through the No. 10 sieve and retained within the No. 35 sieve (500 micrometers). The >35 sample included soil passing through the No. 35 sieve and retained within the solid sieve bottom container. Each grain-size sample was transferred into laboratory-cleaned, glass, sample containers. Samples were then labeled with the sampler's name, date and time collected, sample identification, and analysis requested.

For the 1997 sampling activities, TPH sample identification was based on plot letter followed by grain size, resulting in A#10, A#35, A#>35, B#10, etc. The only exception to this procedure was the blind replicate sample which was designated D#>35. Each grain-size sample was then analyzed separately for TPH as oil. One sample was also taken from each plot and analyzed for bio-characterization parameters using CEA and SNP analyses. A bio-characterization sample was designated simply A, B, or C based on the plot where it originated.

In 1999, sample collection and identification remained the same as that used in 1997. The only modification to the 1997 sampling protocol was that only the grain-size sample with the highest reported TPH concentration in 1997, for each plot, was analyzed for TPH in 1999.

The 1999 monitoring results did not show the decrease in TPH concentrations that had been expected. A different sample method was therefore proposed to better understand what was occurring at the site. The 1999 post-closure monitoring report recommended collecting additional samples in 2000 to better identify an appropriate baseline for the site. It also recommended collecting three samples from each plot and analyzing every sample (DOE/NV, 1999). This is the method used for the 2000 sampling activity.

3.2 SAMPLE COLLECTION AND ANALYSIS FOR 2000

For the 2000 sampling activities, soil samples were collected using a clean hand auger from a depth of approximately 5 to 20 cm (2 to 8 in) below surface grade. TPH samples were collected from three locations within each sample plot. One sample (C-2) was split to be used as a blind replicate. In addition to the TPH samples, one bio-characterization sample was collected from each of the sample plots. All soil samples were placed directly into laboratory-cleaned, glass,

sample containers. Samples were labeled with the sampler's name, date and time collected, sample identification, and analysis requested. Samples were placed on ice in a cooler and chilled to approximately 4 degrees Celsius (39.2 degrees Fahrenheit). The auger was cleaned prior to sampling each plot by washing with soap and water and rinsing with distilled water. The small water volume generated was absorbed with absorbent towels.

For the 2000 sampling activities, TPH sample identification was based on plot letter followed by sequential numbering based on time collected from the plot, resulting in samples A-1, A-2, A-3, B-1, etc. The only exception to this procedure was the blind replicate sample which was designated D-1. The bio-characterization sample was designated simply A, B, or C based on the plot where it originated (DOE/NV, 2000).

3.3 SAMPLE COLLECTION AND ANALYSIS FOR 2001

On March 23, 2001, the Area 12 Fleet Operations Steam Cleaning Effluent site was sampled. The sample collection method remained the same as that used in 2000. One sample (CAU33901A3) was split and used as a blind replicate (DOE/NV, 2001).

For the March 2001 sampling event, TPH sample identification was based on CAU designation, then year sampled, and then plot letter followed by sequential numbering according to the time collected from the plot. This resulted in samples CAU33901A1, CAU33901A2, CAU33901A3, CAU33901B1, etc. The only exception to this procedure was the blind replicate sample which was designated CAU33901D1. The bio-characterization samples were designated as CAU, then year sampled, then the letter "B" (for bio) followed by the plot letter. This resulted in samples CAU33901BA, CAU33901BB, and CAU33901BC.

In March 2001, the 10 TPH samples were transported to Lionville Laboratory, Inc., in Lionville, Pennsylvania, following standard chain-of-custody procedures. These samples were analyzed for TPH as oil using U.S. Environmental Protection Agency (EPA) Method 8015, Modified (oil) (EPA, 1996). The three bio-characterization samples were transported to BioRenewal Technologies, Inc., located in Madison, Wisconsin, following standard chain-of-custody procedures. These samples were analyzed for CEA (total heterotroph and degrader microbial populations) and SNP (nitrogen, carbon, phosphate, and pH).

Because of questionable representativeness and precision of the TPH results (explained in Section 3.4), the site was resampled for TPH on June 12, 2001. The June 2001 sampling method remained the same as that used in the 2000 and March 2001 post-closure sampling. One TPH sample (3390601A3) was split to be used as a blind replicate.

For the June 2001 sampling event, TPH sample identification was based on CAU number, then month and year sampled, and then plot letter followed by sequential numbering based on time collected from the plot. This resulted in samples 3390601A1, 3390601A2, 3390601A3,

3390601B1, etc. The only exception to this procedure was the blind replicate sample which was designated 3390601D1. There were no biological samples taken in June 2001.

In June 2001, the 10 TPH samples were transported to NEL Laboratories in Las Vegas, Nevada, following standard chain-of-custody procedures. These samples were analyzed for TPH as oil using EPA Method 8015, Modified (oil) (DOE/NV, 2001).

3.4 SAMPLE COLLECTION AND ANALYSIS FOR 2002

On March 27, 2002, the Area 12 Fleet Operations Steam Cleaning site was sampled. The sample collection method remained the same as that used in 2001. One sample (CAU33902C2) was split to be used as a blind replicate.

For the March 2002 sampling event, TPH sample identification was based on CAU designation, then year sampled, and then plot letter followed by sequential numbering based on time collected from the plot. This resulted in samples CAU33902A1, CAU33902A2, CAU33902A3, CAU33902B1, etc. The only exception to this procedure was the blind replicate sample which was designated CAU33902D1. The bio-characterization samples were designated as CAU, then year sampled, then the letter "B" (for bio) followed by the plot letter. This resulted in samples CAU33902BA, CAU33902BB, and CAU33902BC.

The 10 TPH samples were transported to NEL Laboratories in Las Vegas, Nevada, using standard chain-of-custody procedures. These samples were analyzed for TPH as oil using EPA Method 8015, Modified (oil) (EPA, 1996). The three bio-characterization samples were submitted to Microbac Laboratories, Inc., in Hammond, Indiana, following standard chain-of-custody procedures. These samples were analyzed for CEA (total heterotroph and degrader microbial populations) and SNP (nitrogen, carbon, phosphate, and pH).

3.5 TPH RESULTS

TPH (as oil) results from the 1997 and 1999 sampling activities are presented in Table 1. The 1997 sampling results showed considerable heterogeneity in TPH concentration for differing grain sizes within the same sample plot. For Plot A, this ranged from 2,000 to 2,700 milligrams per kilogram (mg/kg) with an average of 2,433 mg/kg. For Plot B, TPH concentration ranged from 450 to 2,400 mg/kg with an average of 1,233 mg/kg. For Plot C, it ranged from 3,200 to 5,500 mg/kg with an average of 4,200 mg/kg. It is important to note that the average results of the 1997 plot samples will only be representative of the true average for the plot if the three different grain sizes are of equal proportion (33 percent each) within the soil matrix.

TABLE 1 - CAU 339 POST-CLOSURE SUMMARY OF TPH SOIL SAMPLE RESULTS FROM 1997 AND 1999 SAMPLING EVENTS

SAMPLE LOCATION	SAMPLE ID ^(A)	TPH AS OIL ^(B) (mg/kg)	
		JULY 30, 1997	AUGUST 10, 1999
PLOT A	A#10	2,000	-- ^(D)
	A#35	2,700	6,400
	A#>35	2,600	--
	Plot A Average	2,433	NA^(E)
PLOT B	B#10	450	--
	B#35	1,000	--
	B#>35	2,400	1,300
	D#>35 ^(C)	2,100	2,200
	Plot B Average^(F)	1,233	NA^(E)
PLOT C	C#10	5,500	8,500
	C#35	3,900	--
	C#>35	3,200	--
	Plot C Average	4,200	NA^(E)

A - Sample identifications are based on sieve size of sample. The No. 10 sample represents soil passing through a No. 5 sieve (4.00 mm) and retained within the No. 10 sieve (2.00 mm). The No. 35 sample represents soil passing through the No. 10 sieve and retained within the No. 35 sieve (500 micrometer). The >35 sample represents soil passing through the No. 35 sieve and retained within the solid sieve bottom container.

B - TPH: Total Petroleum Hydrocarbons as oil analyzed using EPA Method 8015 Modified (EPA, 1996) (mg/kg - milligrams per kilogram).

C - D#>35: Blind replicate of Sample B#>35. The sample collected in August 1999 did not meet the acceptable quality control Relative Percent Difference (RPD) of 35%, but the data are reported for comparison.

D - Sample not collected as discussed in post-closure plan (DOE/NV, 1997).

E - N/A: (Not Applicable) Average TPH concentration cannot be calculated because data are insufficient for this calculation.

F - The average of the replicate samples is used as one of the three sample concentrations for calculating the average TPH concentration for the plot.

G - Data taken from CAU 339 Post-Closure Monitoring Report for 1999 (DOE/NV, 1999).

In 1999, only the grain size that had the highest concentration of TPH in 1997 was analyzed for each sample plot. Because of this, the data are not directly comparable to 2000 or 2001 data. Results for 1999 sample analyses showed 6,400 mg/kg for Plot A (No. 35 sieve size), 1,300 and 2,200 mg/kg for Plot B (greater than No. 35 sieve size), and 8,500 mg/kg for Plot C (No. 10 sieve size).

TPH results from 2000 through 2002 are presented in Table 2. The 2000 sampling results showed considerable heterogeneity of TPH concentration within two of the three sampling plots. For Plot A, this ranged from 1,200 to 4,800 mg/kg with an average of 2,833 mg/kg; and for Plot C, it ranged from 1,200 to 5,300 mg/kg with an average of 3,083 mg/kg. Plot B TPH concentrations were homogeneous, ranging from less than the detection threshold of 20 mg/kg to 110 mg/kg with an average of less than 50 mg/kg.

The March 2001 sampling results showed significant heterogeneity of TPH concentration within two of the three sampling plots as well as exceptionally high TPH concentrations. Because of this, the representativeness of the results was in question. TPH results ranged from 360 to 24,000 mg/kg with an average of 9,185 mg/kg for Plot A and from 590 to 10,000 mg/kg with an average of 3,763 mg/kg for Plot C. Plot B TPH results were homogeneous and ranged from 160 to 210 mg/kg with an average of 187 mg/kg. The highest TPH concentration prior to the March 2001 sampling was 8,500 mg/kg. In addition, sample CAU33901D1 with a TPH concentration of 5,600 mg/kg was a blind replicate of CAU33901A3 which had a TPH concentration of 790 mg/kg. This resulted in a Relative Percent Difference (RPD) of 151 percent. In order to ensure satisfactory precision of the data, the closure report set the acceptable RPD at 35 percent (DOE/NV, 1997). Based on the questionable representativeness and precision of the March 2001 TPH samples, the site was resampled for TPH.

The June 2001 sampling results continued to show considerable heterogeneity of TPH concentration within two of the three sampling plots. For Plot A, this ranged from 911 to 8,300 mg/kg with an average of 5,630 mg/kg; and for Plot C, it ranged from 1,200 to 5,810 mg/kg with an average of 3,783 mg/kg. Plot B TPH concentrations were relatively homogeneous, ranging from 87 to 464 mg/kg with an average of 310 mg/kg. The June 2001 blind replicate showed 1,067 mg/kg (3390601A1) and 911 mg/kg (3390601D1). The RPD between the replicate samples is 16 percent, which meets the RPD quality assurance criteria of 35 percent (DOE/NV, 1997).

In the 2002 sample results, significant heterogeneity and high TPH concentrations continue to be seen in all three plots. TPH results ranged from 2,000 to 10,000 mg/kg with an average of 5,800 mg/kg for Plot A, 120 to 1,700 mg/kg with an average of 1,007 mg/kg for Plot B, and 1,900 to 3,500 mg/kg with an average of 2,667 mg/kg for Plot C. In addition, sample CAU33902D1 with a TPH concentration of 6,600 mg/kg was a blind replicate of CAU33901C2 which had a TPH concentration of 1,900 mg/kg. This resulted in a RPD of 110 percent. In order to ensure satisfactory precision of the data, the closure report set the acceptable RPD at 35 percent. This kind of large variation has been seen at this site for the history of its sampling events. It appears to be more a characteristic of the heterogeneity of the soil at this location.

TABLE 2 - CAU 339 POST-CLOSURE SUMMARY OF TPH SOIL SAMPLE RESULTS FROM 2000 - 2002 SAMPLING EVENTS

SAMPLE LOCATION	SAMPLE ID	TPH AS OIL ^(A) (mg/kg)			
		March 29, 2000	March 23, 2001	June 12, 2001	March 28, 2002
PLOT A	A-1	1,200	360	7,600	2,000
	A-2	4,800	24,000	8,300	10,000
	A-3	2,500	790	1,067	5,400
	Plot A Average	2,833	9,185	5,630	5,800
PLOT B	B-1	<20	210	464	120
	B-2	<20	190	87	1,700
	B-3	110	160	378	1,200
	Plot B Average	<50	187	310	1,007
PLOT C	C-1	5,300	590	5,810	2,600
	C-2	1,200	10,000	1,200	1,900
	C-3	2,500	700	4,340	3,500
	Plot C Average	3,083	3,763	3,783	2,667
Duplicates	D-1	1,700 ^(B)	5600 ^(C)	911 ^(C)	6,600 ^(D)

A - TPH: Total Petroleum Hydrocarbons as oil analyzed using EPA Method 8015 Modified, (EPA, 1996) (mg/kg - milligrams per kilogram).

B - D-1: March 2000 sample was a blind replicate of sample C-2.

C - The March and June 2001 sample was a blind replicate of sample A-3. The sample collected in June 2001 did not meet the acceptable quality control RPD of 35%, but the data are reported for comparison.

D - The March 2002 sample was a blind replicate of sample C-2. This sample also did not meet the acceptable RPD of 35%, but the data are reported for comparison.

Average TPH concentration results for all sampling events are summarized in Table 3. The average of the three Plot A samples for March 2002 is 5,800 mg/kg. This is 3 percent higher than the June 2001 average and significantly higher than the baseline average analytical result of the 1997 sampling event of 2,433 mg/kg. Similar large variations are seen for Plot B. The average for Plot B was 1,007 mg/kg, which is 225 percent higher than the 310 mg/kg value obtained for June 2001. The March 2002 value is a little lower than the 1997 baseline average value of 1,233 mg/kg. Plot C shows the best results with the March 2002 average value of 2,667 mg/kg below both the June 2001 value of 3,788 mg/kg and the 1997 baseline average value of 4,200 mg/kg.

Figure 3 depicts the general indication of sample concentrations over time for the comparison of all the average sample results. As this figure depicts, there is not a distinct reduction in TPH concentrations occurring at Plots A and B. Current data indicate a possible drop in TPH concentrations at Plot C. The March 2002 TPH analytical data package is provided in Appendix B.

3.6 BIO-CHARACTERIZATION RESULTS

Samples were analyzed 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 (WDNR, 1994) and bio-engineering norms (National Research Council, 1993). These guidelines are used as a reference for evaluation purposes only.

The CEA and SNP results continue to indicate favorable conditions for natural attenuation (Table 4). The exception to this was the large apparent reduction in the amount of phosphorous. It turned out Microbac Laboratories analyzed for ortho-phosphate rather than the total amount of phosphorous. Ortho-phosphate is the amount of phosphate available to bacteria. Previous analysis determined the total amount of phosphorous, regardless of its form. When questioned Microbac Laboratories said total phosphorous was an unusual analysis and only the ortho-phosphate was normally run. The laboratory previously used had run total phosphorous for their standard panel. Unfortunately this has caused a discrepancy in the results for 2002, making the phosphorous/phosphate results inconsistent with previous years. The following ratios, although good indicators of natural attenuation potential, should be used with caution since they do not indicate the availability of the carbon, nitrogen, or phosphate to microorganisms (WDNR, 1994). The biological laboratory report is included as Appendix C.

3.6.1 Microbial Populations

The bioengineering guideline level used to determine if microbial degrader populations are acceptable to potentially support biotransformation without supplementing the site is populations greater than 1×10^6 (WDNR, 1994).

TABLE 3 - CAU 339 POST-CLOSURE SUMMARY OF AVERAGE TPH SOIL SAMPLE RESULTS

SAMPLE LOCATION	AVERAGE TPH AS OIL ^(A) (mg/kg)			
	July 30, 1997	March 29, 2000	June 12, 2001	March 28, 2002
PLOT A	2,433	2,833	5,630	5,800
PLOT B	1,233	<50	310	1,007
PLOT C	4,200	3,083	3,783	2,667

A - TPH: Total Petroleum Hydrocarbons as oil analyzed using EPA Method 8015 Modified (EPA, 1996). (mg/kg - milligrams per kilogram).

FIGURE 3 - AVERAGE TPH CONCENTRATIONS (AS OIL) PER SAMPLING EVENT

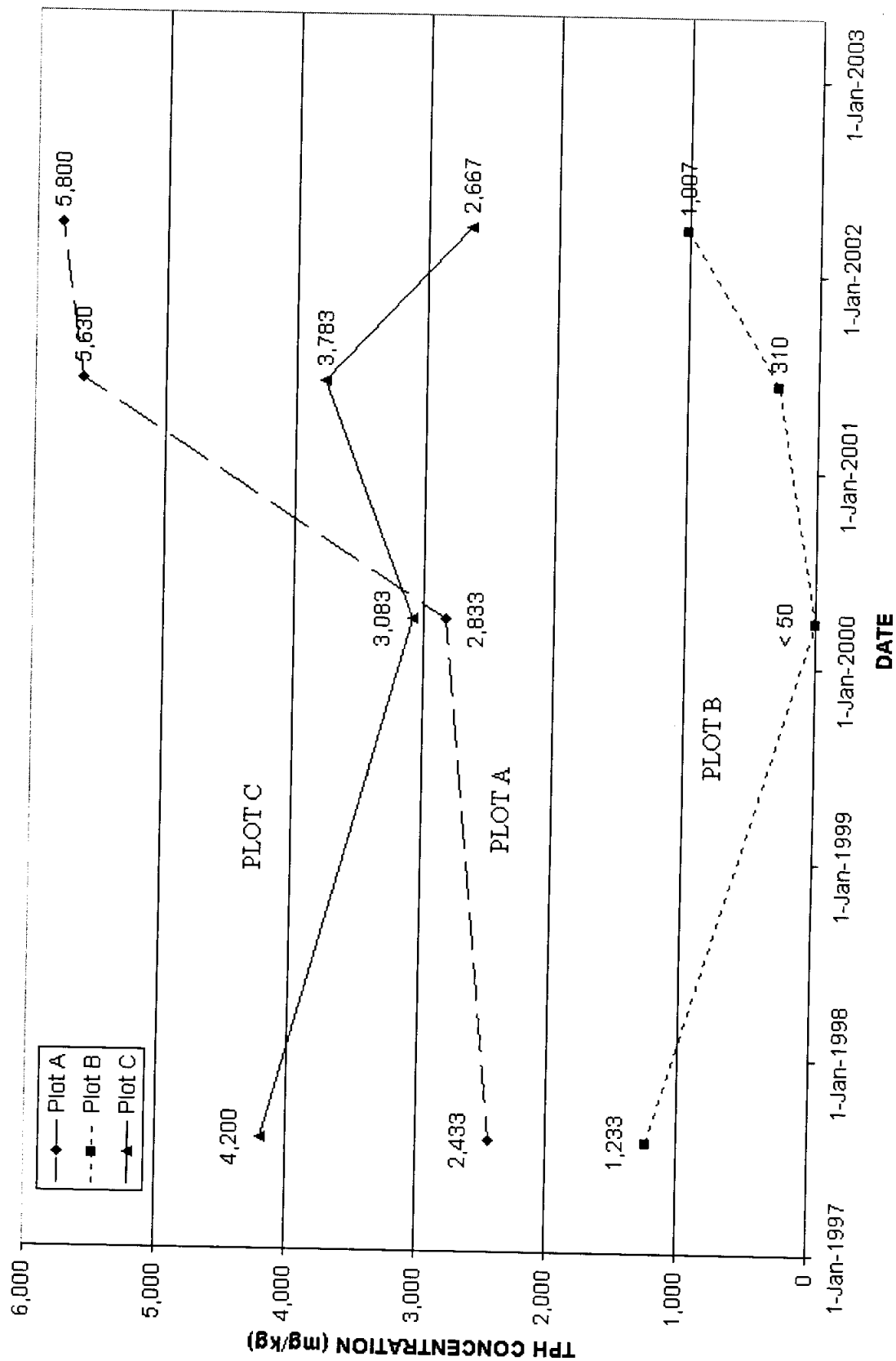


TABLE 4 - CAU 339 POST-CLOSURE SUMMARY OF BIO-CHARACTERIZATION SAMPLE RESULTS

SAMPLE ID	SAMPLE DATE	SOIL MICROBIAL POPULATIONS ^(A)		pH	%TON/ %OM ^(B)	C:N ^(C)	C:P ^(D)	SOIL MOISTURE BY MASS (%)
		TOTAL POPULATIONS (MEAN)	DEGRADER POPULATIONS (MEAN)					
Background	July 30, 1997	4.4E+06	3.3E+06	7.5	0.1	4	26372	2.8
Plot A	July 30, 1997	9.1E+06	3.4E+06	6.8	0.1	5	2093	4.2
	August 10, 1999	2.2E+06	1.3E+06	7.4	0.3	2	168	1.9
	March 29, 2000	2.3E+07	2.3E+07	7.2	1.9	0.2	124	11.8
	March 23, 2001	2.3E+06	1.9E+06	6.9	1.0	0.4	24	12.0
	March 27, 2002	6.0E+06	1.1E+05	6.9	0.4	1.1	50000	8.0
Plot B	July 30, 1997	1.6E+07	9.8E+06	6.9	0.1	3	2080	3.6
	August 10, 1999	2.4E+06	1.0E+06	7.0	0.4	1	149	1.7
	March 29, 2000	1.4E+07	9.6E+06	7.6	0.2	1.9	147	13.9
	March 23, 2001	2.1E+07	1.9E+07	7.9	0.5	0.8	14	19.0
	March 27, 2002	6.6E+06	1.5E+06	7.7	0.2	2.1	77000	10.0
Plot C	July 30, 1997	1.3E+07	4.6E+06	6.6	0.2	2	2143	3.1
	August 10, 1999	4.5E+05	2.5E+05	7.4	0.3	1	170	1.9
	March 29, 2000	1.3E+07	1.1E+07	7.1	0.6	0.6	99	10.8
	March 23, 2001	1.5E+06	1.2E+06	7.4	0.6	0.6	23	12.0
	March 27, 2002	1.3E+06	5.1E+05	7.5	0.07	5.4	48000	10.0
Guidelines/Norm (WDNR)			>1E+06	5.5-8.5	>1.5	<40	<120	Not Specified

A - Degradar 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 (Appendix B).

B - Total organic nitrogen (TON) divided by percent organic matter (OM). These are the corrected ratios for all three sampling events.

C - Carbon to nitrogen ratio

D - Carbon to phosphorous ratio. 2002 results are for ortho-phosphate.

Results from all three plots (A, B, and C) indicate that the total populations (6.0×10^6 , 6.6×10^6 , and 1.3×10^6) are adequate to support natural biodegradation.

The degrader populations for Plots A (1.1×10^5) and C (5.1×10^5) have fallen below the recommended microbial populations while Plot B (1.5×10^6) still has adequate values to support natural biodegradation.

3.6.2 pH and Carbon to Nitrogen Ratios

Each sample was within the acceptable range (5.5 to 8.5) for pH and meets the guideline (of less than 40) for the carbon to nitrogen (C:N) ratio (WDNR, 1994). This is consistent with what was found for previous sampling events.

3.6.3 Total Organic Nitrogen to Organic Matter Ratio

Results of the March 2002 sampling event showed that Plots A, B, and C (at 0.4, 0.2, and 0.07, respectively) do not meet the guideline for the total organic nitrogen to organic matter (TON:OM) ratio. This ratio has only been achieved once, in Plot A during the 2000 sampling activity.

3.6.4 Carbon to Phosphorous Ratio

As explained in section 3.6, a different analysis was performed in 2002 for the phosphorous. This makes comparison of results with previous years impossible. The amount of phosphorous in ortho-phosphate is only a fraction of the total phosphorous present. There is no factor which can be applied to estimate the total phosphorous from the ortho-phosphate. For March 2002, the ratio in Plot A was 50,000, Plot B was 77,000, and Plot C was 48,000.

3.6.5 Soil Moisture

Soil moisture levels were similar in this sampling event compared to March 2001 (DOE/NV, 2001). Since the presence of water affects microbial degradation efficiency, this indicates annual and seasonal variation in TPH degradation rates. This site is in an area of low annual precipitation (averages 12.1 in per year), which will contribute to very slow degradation, especially in shallow soil such as that present at this site.

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4.0 CONCLUSIONS

TPH concentrations show considerable heterogeneity in different areas within each plot and in different grain sizes within each plot. The better indication of overall TPH concentration for each plot is probably best identified by collecting several samples from each plot and averaging the TPH concentrations, as has been done since the 2000 sampling event. Because only one of the three grain sizes was analyzed for the 1999 sampling event, those results do not present a representative indication of what may be occurring overall in each of the three plots or correspondingly, throughout the site. Because samples of each grain size were analyzed in 1997, an average of samples from each plot provides a better indication of overall TPH concentrations. However, the 1997 results will also be biased to the extent that the proportions of grain sizes in the three sieved ranges (for the samples) differ from the actual distribution in the plot.

Conditions in the 2002 sampling activity show that there is less likelihood for natural attenuation of petroleum hydrocarbons compared to previous years. The microbial populations were of sufficient quantities to be conducive to natural attenuation in only one plot, and two of the evaluated parameters were outside WDNR guidelines. The moisture content was similar to the previous sampling event, but annual and seasonal fluctuations likely have caused this parameter to vary over time. Annual and seasonal fluctuations may have a significant effect on biological activity at the site because of varying precipitation rates.

The analytical results of this sampling event indicate that hydrocarbon degradation is possibly occurring in Plot C. Baseline petroleum hydrocarbon concentrations were at 4,200 mg/kg initially; however, the June 2002 results indicate that concentrations have reduced significantly to an average of 2,667 mg/kg.

Degradation is not as easily identified in Plots A and B. Degradation may be occurring, but degradation rates may be masked by fluctuations observed as a result of the soil heterogeneity and differences in sample collection methods. Biological analyses indicate that the biological parameters necessary for natural attenuation are marginally present at both sites. Nutrient enhancement of the site is not indicated at this time based on Plot C results. The entire site is in an area of low annual precipitation, which will limit the rate of degradation, especially in shallow soil such as what is present at this site. At best, natural attenuation may be progressing very slowly throughout the site.

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5.0 RECOMMENDATIONS

There needs to be additional data collected for this site to determine a degradation rate for the petroleum hydrocarbons remaining. The following are recommended actions for this site:

- Continue to inspect the site biennially (every two years).
- Continue with one more set of soil samples from each of the three plots. Collect samples in 2003. This time span is recommended because typical degradation rates in the desert are expected to be low, and this will allow for more time for the degradation rates to become more apparent.
- Soil samples should be collected in March or April. Samples should be collected at a consistent time of year to obtain correlatable data. Annual weather patterns will affect the biological parameters.
- Collect an additional bio-characterization sample from each of the sample plots to compare with the previous data. If bio-characterization data indicate that necessary nutrients are being depleted, the additional data will assist in determining if site augmentation needs to be further evaluated. This is especially true of the phosphorous, since a different analysis concerning this element was performed in 2002 compared to other years.
- Collect samples from three areas within each plot and analyze for TPH as oil using EPA Method 8015, Modified (EPA, 1996). Evaluate the mean concentration of these samples against the previous data. The mean concentration of at least three samples from each plot provides better accountability for the heterogeneity in each sample plot. Samples will be collected from 5 to 15 cm (2 to 6 in) below ground surface using a hand auger or shovel and placed directly into the laboratory sample containers.

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6.0 REFERENCES

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

EPA, see U.S. Environmental Protection Agency.

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.

FFACO, see Federal Facility Agreement and Consent Order.

National Research Council. 1993. In Situ Bioremediation, When Does it Work?

U.S. Department of Energy, Nevada Operations Office. 1997. Closure Report for CAU 339: Area 12 Fleet Operations Steam Cleaning Discharge Area, Nevada Test Site, DOE/NV/11718-167.

U.S. Department of Energy, Nevada Operations Office. 1999. Post-Closure Monitoring Report for Corrective Action Unit 339: Area 12 Fleet Operations Steam Cleaning Discharge Area Nevada Test Site, Nevada, DOE/NV--569.

U.S. Department of Energy, Nevada Operations Office. 2000. Post Closure Monitoring Report for Corrective Action Unit 339: Area 12 Fleet Operations Steam Cleaning Discharge Area Nevada Test Site, Nevada, DOE/NV--656.

U.S. Department of Energy, Nevada Operations Office. 2001. Post Closure Monitoring Report for Corrective Action Unit 339: Area 12 Fleet Operations Steam Cleaning Discharge Area Nevada Test Site, Nevada, DOE/NV--748.

U.S. Environmental Protection Agency. 1996. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Washington, D.C.

WDNR, see Wisconsin Division of Natural Resources.

Wisconsin Division of Natural Resources. 1994. Natural Biodegradation as a Remedial Alternative Option, Interim Guidance.

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APPENDIX A

INSPECTION REPORTS

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**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: March 28, 2002
2. Facility Manager (name and organization): Jeff Smith, BN
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):
cool and rainy 2 week prior
last week warm and sunny

DISCHARGE AREA

5. Condition of soil berm between discharge area and arroyo: Various scrub growing on berm but it is in good shape.
6. Condition of fencing (any breaks in cable wiring, posts still vertical): Fencing complete + all posts upright
7. Condition of signs (missing signs, fading, damaged): Plot signs missing except for B, which is on ground. Signs around CAU are OK.
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: Small gully near soil berm and plot A looks like water went through recently.
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. Everything looks unchanged.

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

15. Other comments or observations: Warm and sunny today with light breeze.

16. Recommendations: Continue regular inspections

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: Kraig Krupp Signed: Kraig Krupp Date: 3/28/02
Names of other persons on inspection (print): _____

**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: 4/18/02 11:00
2. Facility Manager (name and organization): Jeff Smith, BN
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):
High winds

DISCHARGE AREA

5. Condition of soil berm between discharge area and arroyo: good
6. Condition of fencing (any breaks in cable wiring, posts still vertical):
cable fence down on plot A
7. Condition of signs (missing signs, fading, damaged):
sign missing from plot B (sign was found but needs to be installed)
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. none

14. What is the (possible) effect of the change? N/A

15. Other comments or observations: none

16. Recommendations: Repair Fence (hang new wire around plot A)
Re hang sign at Plot B.

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: Jim Trayner Signed: Jim Trayner Date: 4/18/02

Names of other persons on inspection (print):

Mike Floyd

APPENDIX B

MARCH 2002 TPH ANALYTICAL DATA

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NEL LABORATORIES

Reno • Las Vegas
Phoenix • Burbank

Las Vegas Division
4208 Arcata Way, Suite A • Las Vegas, NV 89030
(702) 657-1010 • Fax: (702) 657-1577
1-888-368-3282

Ted Redding
Bechtel Nevada
P.O. Box 98521, M/S NTS273
Las Vegas, NV 89193-8521
TEL: 702-2957220

RE Project: V1504

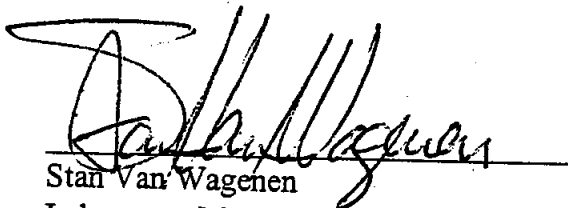
Order No.: L0203415

Dear Ted Redding:

NEL Laboratories, Las Vegas received 10 samples on 3/29/02 for the analyses presented in the following report.

There were no problems with the analyses and all data for associated QC met EPA or laboratory specifications unless noted in the Case Narrative.

If you have any questions regarding these tests results, please feel free to call.


Stan Van Wagenen
Laboratory Manager

4/16/02
Date

Certifications:	Reno	Las Vegas
Arizona	AZ0520	AZ0518
California	1707	2002
Idaho	Certified	Certified
Montana	Certified	Certified
Nevada	NV033	NV052
New Mexico	Certified	Certified
US Army Corps of Engineers		Certified

CLIENT: Bechtel Nevada
PROJECT ID: V1504
PROJECT #: 30033
MATRIX: SOIL

CLIENT ID: 3390302A1
DATE SAMPLED: 3/28/02
NEL SAMPLE ID: L0203415-001A

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Reporting Limit</u>	<u>DF</u>	<u>Method</u>	<u>Prep Date</u>	<u>Analyzed</u>	<u>Analyst</u>
Gasoline Range Organics (C8-C12)	ND	mg/Kg	100	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Diesel Range Organics (C12-C22)	ND	mg/Kg	100	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Oil Range Organics (C22-C34)	2000	mg/Kg	500	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Total TPH	2000	mg/Kg	100	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Surr: n-Octacosane	0	%REC	S 55-130	10	SW8015Ext	03/29/02	04/01/02	PXC-LV

ND - Not Detected at the Reporting Limit

DF - Dilution Factor

B - Analyte detected in the associated Method Blank

S - Spike Recovery outside accepted recovery limits

E - Value above quantitation range

Date: 10-Apr-02

Page 1 of 10

CLIENT: Bechtel Nevada
PROJECT ID: V1504
PROJECT #: 30033
MATRIX: SOIL

CLIENT ID: 3390302A2
DATE SAMPLED: 3/27/02
NEL SAMPLE ID: L0203415-002A

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Reporting Limit</u>	<u>DF</u>	<u>Method</u>	<u>Prep Date</u>	<u>Analyzed</u>	<u>Analyst</u>
Gasoline Range Organics (C8-C12)	ND	mg/Kg	200	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Diesel Range Organics (C12-C22)	1100	mg/Kg	200	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Oil Range Organics (C22-C34)	10000	mg/Kg	1000	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Total TPH	12000	mg/Kg	200	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Surr: n-Octacosane	0	%REC S	55-130	10	SW8015Ext	03/29/02	04/01/02	PXC-LV

ND - Not Detected at the Reporting Limit

DF - Dilution Factor

Date: 10-Apr-02

B - Analyte detected in the associated Method Blank

S - Spike Recovery outside accepted recovery limits

E - Value above quantitation range

CLIENT: Bechtel Nevada
PROJECT ID: V1504
PROJECT #: 30033
MATRIX: SOIL

CLIENT ID: 3390302A3
DATE SAMPLED: 3/27/02
NEL SAMPLE ID: L0203415-003A

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Reporting Limit</u>	<u>DF</u>	<u>Method</u>	<u>Prep Date</u>	<u>Analyzed</u>	<u>Analyst</u>
Gasoline Range Organics (C8-C12)	ND	mg/Kg	200	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Diesel Range Organics (C12-C22)	550	mg/Kg	200	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Oil Range Organics (C22-C34)	5400	mg/Kg	1000	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Total TPH	6000	mg/Kg	200	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Surr: n-Octacosane	0	%REC	S 55-130	10	SW8015Ext	03/29/02	04/01/02	PXC-LV

ND - Not Detected at the Reporting Limit

DF - Dilution Factor

B - Analyte detected in the associated Method Blank

S - Spike Recovery outside accepted recovery limits

E - Value above quantitation range

Date: 10-Apr-02

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CLIENT: Bechtel Nevada
PROJECT ID: V1504
PROJECT #: 30033
MATRIX: SOIL

CLIENT ID: 3390302B1
DATE SAMPLED: 3/27/02
NEL SAMPLE ID: L0203415-004A

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Reporting Limit</u>	<u>DF</u>	<u>Method</u>	<u>Prep Date</u>	<u>Analyzed</u>	<u>Analyst</u>
Gasoline Range Organics (C8-C12)	ND	mg/Kg	10	1	SW8015Ext	04/04/02	04/05/02	PXC-LV
Diesel Range Organics (C12-C22)	ND	mg/Kg	10	1	SW8015Ext	04/04/02	04/05/02	PXC-LV
Oil Range Organics (C22-C34)	120	mg/Kg	50	1	SW8015Ext	04/04/02	04/05/02	PXC-LV
Total TPH	120	mg/Kg	10	1	SW8015Ext	04/04/02	04/05/02	PXC-LV
Surr: n-Octacosane	72.1	%REC	55-130	1	SW8015Ext	04/04/02	04/05/02	PXC-LV

ND - Not Detected at the Reporting Limit

DF - Dilution Factor

B - Analyte detected in the associated Method Blank

S - Spike Recovery outside accepted recovery limits

E - Value above quantitation range

Date: 10-Apr-02

CLIENT: Bechtel Nevada
PROJECT ID: V1504
PROJECT #: 30033
MATRIX: SOIL

CLIENT ID: 3390302B2
DATE SAMPLED: 3/27/02
NEL SAMPLE ID: L0203415-005A

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Reporting Limit</u>	<u>DF</u>	<u>Method</u>	<u>Prep Date</u>	<u>Analyzed</u>	<u>Analyst</u>
Gasoline Range Organics (C8-C12)	ND	mg/Kg	10	1	SW8015Ext	04/05/02	04/09/02	PXC-LV
Diesel Range Organics (C12-C22)	150	mg/Kg	10	1	SW8015Ext	04/05/02	04/09/02	PXC-LV
Oil Range Organics (C22-C34)	1700	mg/Kg	50	1	SW8015Ext	04/05/02	04/09/02	PXC-LV
Total TPH	1900	mg/Kg	10	1	SW8015Ext	04/05/02	04/09/02	PXC-LV
Surr: n-Octacosane	59.1	%REC	55-130	1	SW8015Ext	04/05/02	04/09/02	PXC-LV

ND - Not Detected at the Reporting Limit

DF - Dilution Factor

B - Analyte detected in the associated Method Blank

S - Spike Recovery outside accepted recovery limits

E - Value above quantitation range

Date: 10-Apr-02

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CLIENT: Bechtel Nevada
PROJECT ID: V1504
PROJECT #: 30033
MATRIX: SOIL

CLIENT ID: 3390302B3
DATE SAMPLED: 3/27/02
NEL SAMPLE ID: L0203415-006A

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Reporting Limit</u>	<u>DF</u>	<u>Method</u>	<u>Prep Date</u>	<u>Analyzed</u>	<u>Analyst</u>
Gasoline Range Organics (C8-C12)	ND	mg/Kg	10	1	SW8015Ext	03/29/02	04/01/02	PXC-LV
Diesel Range Organics (C12-C22)	92	mg/Kg	10	1	SW8015Ext	03/29/02	04/01/02	PXC-LV
Oil Range Organics (C22-C34)	1100	mg/Kg	50	1	SW8015Ext	03/29/02	04/01/02	PXC-LV
Total TPH	1200	mg/Kg	10	1	SW8015Ext	03/29/02	04/01/02	PXC-LV
Surr: n-Octacosane	66.1	%REC	55-130	1	SW8015Ext	03/29/02	04/01/02	PXC-LV

ND - Not Detected at the Reporting Limit

DF - Dilution Factor

Date: 10-Apr-02

B - Analyte detected in the associated Method Blank

S - Spike Recovery outside accepted recovery limits

E - Value above quantitation range

CLIENT: Bechtel Nevada
PROJECT ID: V1504
PROJECT #: 30033
MATRIX: SOIL

CLIENT ID: 3390302C1
DATE SAMPLED: 3/27/02
NEL SAMPLE ID: L0203415-007A

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Reporting Limit</u>	<u>DF</u>	<u>Method</u>	<u>Prep Date</u>	<u>Analyzed</u>	<u>Analyst</u>
Gasoline Range Organics (C8-C12)	ND	mg/Kg	100	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Diesel Range Organics (C12-C22)	ND	mg/Kg	100	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Oil Range Organics (C22-C34)	2600	mg/Kg	500	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Total TPH	2600	mg/Kg	100	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Surr: n-Octacosane	0	%REC	S 55-130	10	SW8015Ext	03/29/02	04/01/02	PXC-LV

ND - Not Detected at the Reporting Limit

DF - Dilution Factor

B - Analyte detected in the associated Method Blank

S - Spike Recovery outside accepted recovery limits

E - Value above quantitation range

Date: 10-Apr-02

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CLIENT: Bechtel Nevada
 PROJECT ID: V1504
 PROJECT #: 30033
 MATRIX: SOIL

CLIENT ID: 3390302C2
 DATE SAMPLED: 3/27/02
 NEL SAMPLE ID: L0203415-008A

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Reporting Limit</u>	<u>DF</u>	<u>Method</u>	<u>Prep Date</u>	<u>Analyzed</u>	<u>Analyst</u>
Gasoline Range Organics (C8-C12)	ND	mg/Kg	100	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Diesel Range Organics (C12-C22)	ND	mg/Kg	100	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Oil Range Organics (C22-C34)	1900	mg/Kg	500	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Total TPH	1900	mg/Kg	100	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Surf: n-Octacosane	0	%REC S	55-130	10	SW8015Ext	03/29/02	04/01/02	PXC-LV

ND - Not Detected at the Reporting Limit

DF - Dilution Factor

Date: 10-Apr-02

B - Analyte detected in the associated Method Blank

S - Spike Recovery outside accepted recovery limits

E - Value above quantitation range

CLIENT: Bechtel Nevada
PROJECT ID: V1504
PROJECT #: 30033
MATRIX: SOIL

CLIENT ID: 3390302C3
DATE SAMPLED: 3/27/02
NEL SAMPLE ID: L0203415-009A

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Reporting Limit</u>	<u>DF</u>	<u>Method</u>	<u>Prep Date</u>	<u>Analyzed</u>	<u>Analyst</u>
Gasoline Range Organics (C8-C12)	ND	mg/Kg	200	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Diesel Range Organics (C12-C22)	ND	mg/Kg	200	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Oil Range Organics (C22-C34)	3500	mg/Kg	1000	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Total TPH	3500	mg/Kg	200	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Surr: n-Octacosane	0	%REC S	55-130	10	SW8015Ext	03/29/02	04/01/02	PXC-LV

ND - Not Detected at the Reporting Limit

DF - Dilution Factor

B - Analyte detected in the associated Method Blank

S - Spike Recovery outside accepted recovery limits

E - Value above quantitation range

Date: 10-Apr-02

Page 9 of 10

CLIENT: Bechtel Nevada
PROJECT ID: V1504
PROJECT #: 30033
MATRIX: SOIL

CLIENT ID: 3390302D1
DATE SAMPLED: 3/27/02
NEL SAMPLE ID: L0203415-010A

<u>Parameter</u>	<u>Result</u>	<u>Unit</u>	<u>Reporting Limit</u>	<u>DF</u>	<u>Method</u>	<u>Prep Date</u>	<u>Analyzed</u>	<u>Analyst</u>
Gasoline Range Organics (C8-C12)	ND	mg/Kg	200	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Diesel Range Organics (C12-C22)	470	mg/Kg	200	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Oil Range Organics (C22-C34)	6600	mg/Kg	1000	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Total TPH	7000	mg/Kg	200	10	SW8015Ext	03/29/02	04/01/02	PXC-LV
Surr: n-Octacosane	0	%REC S	55-130	10	SW8015Ext	03/29/02	04/01/02	PXC-LV

ND - Not Detected at the Reporting Limit

DF - Dilution Factor

Date: 10-Apr-02

B - Analyte detected in the associated Method Blank

S - Spike Recovery outside accepted recovery limits

E - Value above quantitation range

NEL LABORATORIES

CLIENT: Bechtel Nevada
Work Order: L0203415
Project: V1504

ANALYTICAL QC SUMMARY REPORT

8015ffp_s Test Method: SW8015Ext

Sample ID: MB-216	Sample Type: MBLK	Test Code: 8015ffp_s	Units: mg/Kg	Prep Date: 3/29/02	Run ID: L_FID-1_020401A
	Batch ID: 216	Test No: SW8015M		Analysis Date: 4/1/02	SeqNo: 12878
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPD Limit Qual

Gasoline Range Organics (C8-C12)	ND	10							
Diesel Range Organics (C12-C22)	ND	50							
Oil Range Organics (C22-C34)	ND	50							
Total TPH	ND	10							
Surr: n-Octacosane	2.633	0.010	3.33	0	79.1	55	130	0	0

Sample ID: MB-235	Sample Type: MBLK	Test Code: 8015ffp_s	Units: mg/Kg	Prep Date: 4/4/02	Run ID: L_FID-1_020405A
	Batch ID: 235	Test No: SW8015M		Analysis Date: 4/5/02	SeqNo: 14741
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPD Limit Qual

Gasoline Range Organics (C8-C12)	ND	10							
Diesel Range Organics (C12-C22)	ND	10							
Oil Range Organics (C22-C34)	ND	50							
Total TPH	ND	10							
Surr: n-Octacosane	3.07	0.010	3.33	0	92.1	55	130	0	0

Sample ID: MB-243	Sample Type: MBLK	Test Code: 8015ffp_s	Units: mg/Kg	Prep Date: 4/5/02	Run ID: L_FID-1_020409B
	Batch ID: 243	Test No: SW8015M		Analysis Date: 4/9/02	SeqNo: 15463
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPD Limit Qual

Gasoline Range Organics (C8-C12)	ND	10							
Diesel Range Organics (C12-C22)	ND	10							
Oil Range Organics (C22-C34)	ND	50							
Total TPH	ND	10							

Qualifiers: ND - Not Detected at the Reporting Limit

J1 - MS or MSD outside acceptance limits. LCS acceptable.

J - This concentration is considered an estimate due to LCS failure.

C - Unspiked sample >5 times the amount spiked

R - RPD outside accepted recovery limits

B - Analyte detected in the associated Method Blank

CLIENT: Bechtel Nevada
 Work Order: L0203415
 Project: V1504

ANALYTICAL QC SUMMARY REPORT

8015ffp_s Test Method: SW8015Ext

Sample ID: MB-243	SampType: MBLK	TestCode: 8015ffp_s	Units: mg/Kg	Prep Date: 4/5/02	Run ID: L_FID-1_020409B
	Batch ID: 243	TestNo: SW8015M		Analysis Date: 4/9/02	SeqNo: 15463
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Surr: n-Octacosane	2.632	0.010	3.328	0	79.1 55 130 0 0 0

Sample ID: LCS-216	SampType: LCS	TestCode: 8015ffp_s	Units: mg/Kg	Prep Date: 3/29/02	Run ID: L_FID-1_020401A
	Batch ID: 216	TestNo: SW8015M		Analysis Date: 4/1/02	SeqNo: 12877
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Diesel Range Organics (C12-C22)	139.5	50	166.8	0	83.6 54 91 0 0
Total TPH	139.5	10	166.8	0	83.6 54 91 0 0
Surr: n-Octacosane	2.802	0.010	3.332	0	84.1 55 130 0 0

Sample ID: LCS-235	SampType: LCS	TestCode: 8015ffp_s	Units: mg/Kg	Prep Date: 4/4/02	Run ID: L_FID-1_020405A
	Batch ID: 235	TestNo: SW8015M		Analysis Date: 4/5/02	SeqNo: 14740
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Diesel Range Organics (C12-C22)	138.5	10	166.6	0	83.2 54 91 0 0
Surr: n-Octacosane	2.632	0.010	3.328	0	79.1 55 130 0 0

Sample ID: LCS-243	SampType: LCS	TestCode: 8015ffp_s	Units: mg/Kg	Prep Date: 4/5/02	Run ID: L_FID-1_020409B
	Batch ID: 243	TestNo: SW8015M		Analysis Date: 4/9/02	SeqNo: 15462
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Diesel Range Organics (C12-C22)	122.4	10	166.8	0	73.4 54 91 0 0
Surr: n-Octacosane	2.869	0.010	3.332	0	86.1 55 130 0 0

Sample ID: LCS-216	SampType: LCS	TestCode: 8015FFP_S	Units: mg/Kg	Prep Date: 3/29/02	Run ID: L_FID-1_020401A
	Batch ID: 216	TestNo: SW8015M		Analysis Date: 4/1/02	SeqNo: 12879
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Diesel Range Organics (C12-C22)	126.1	50	166.5	0	75.7 54 91 139.5 10.1 0

Qualifiers: ND - Not Detected at the Reporting Limit C - Unspiked sample >5 times the amount spiked B - Analyte detected in the associated Method Blank
 J1 - MS or MSD outside acceptance limits. LCS acceptable. R - RPD outside accepted recovery limits
 J - This concentration is considered an estimate due to LCS failure.

CLIENT: Bechtel Nevada
 Work Order: L0203415
 Project: V1504

ANALYTICAL QC SUMMARY REPORT

8015ffp_s Test Method: SW8015Ext

Sample ID: LCSD-216	SampType: LCSD	TestCode: 8015FFP_S	Units: mg/Kg	Prep Date: 3/29/02	Run ID: L_FID-1_020401A
	Batch ID: 216	TestNo: SW8015M		Analysis Date: 4/1/02	SeqNo: 12879
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Total TPH	126.1	10	166.5	0	75.7 54 91 139.5 10.1 0
Surr: n-Octacosane	2.364	0.010	3.326	0	71.1 55 130 0 0 0

Sample ID: LCSD-235	SampType: LCSD	TestCode: 8015FFP_S	Units: mg/Kg	Prep Date: 4/4/02	Run ID: L_FID-1_020405A
	Batch ID: 235	TestNo: SW8015M		Analysis Date: 4/5/02	SeqNo: 14742
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Diesel Range Organics (C12-C22)	144.4	10	166.8	0	86.6 54 91 138.5 4.13 25
Surr: n-Octacosane	2.601	0.010	3.331	0	78.1 55 130 0 0 0

Sample ID: LCSD-243	SampType: LCSD	TestCode: 8015FFP_S	Units: mg/Kg	Prep Date: 4/5/02	Run ID: L_FID-1_020409B
	Batch ID: 243	TestNo: SW8015M		Analysis Date: 4/9/02	SeqNo: 15464
Analyte	Result	PQL	SPK value	SPK Ref Val	%REC LowLimit HighLimit RPD Ref Val %RPD RPDLimit Qual
Diesel Range Organics (C12-C22)	104.8	10	166.6	0	62.9 54 91 122.4 15.5 25
Surr: n-Octacosane	2.899	0.010	3.329	0	87.1 55 130 0 0 0

Qualifiers: ND - Not Detected at the Reporting Limit C - Unspiked sample >5 times the amount spiked B - Analyte detected in the associated Method Blank
 JI - MS or MSD outside acceptance limits. LCS acceptable. R - RPD outside accepted recovery limits Page 3 of 3
 J - This concentration is considered an estimate due to LCS failure. Date: 10-Apr-02

ANALYTICAL SERVICES LABORATORY
SERVICES REQUEST & CHAIN OF CUSTODY RECORD

Page 1 of 4

PROJECT/CLIENT INFORMATION			REPORT INFORMATION			SAMPLE INFORMATION											
Project: CAU 339	BN Orig#: A435	Send Report to: Allison Urban	Phone:	Fax: 295-7761	M/S: N7D306	Sampling Site: CAU 339	The samples submitted contain (check): <input checked="" type="checkbox"/> Hazardous () Radioactive () Unknown contamination. If known, attach a brief narrative summary identifying contaminants. This information will ensure compliance with applicable regulations and allow for the safe handling of the sample materials. Containing TPH										
Change No.: 5H15J97A	ASL Prog.:	Turnaround: X Standard - 30 days Non-rad, 60 Days Rad, Other: Rush Preliminary by: Final by:	Final report format: X Standard () NTS-WAC () Other:			SAMPLE RECEIPT INFORMATION											
Project Manager: Jeff Smith	Phone: 5-7775	Fax: 295-7761	M/S: N7D306	ANALYSES & METHOD			Are all sample containers received intact? <input checked="" type="checkbox"/> Yes () No										
Rad SGD: Non-Rad SGD: V1504	Rad Packet: Non-Rad Packet:	Client Services Representative:			Do the labels agree with this form? <input checked="" type="checkbox"/> Yes () No			Was a Material Clearance Tag submitted? <input checked="" type="checkbox"/> Yes () No									
Will these analyses be performed under a signed SOW? () YES () NO If so, do analyses entered here agree with the SOW? () YES () NO () NA If not, identify the variation _____ CSR initials indicating review and approval: _____ Date: _____						COMMENTS (Preservative, size/volume, MIS/MSD, special analysis, rad matrix code, count time, etc.) 250ml wide-mouth clear jar											
LAB USE ONLY						Transfer of samples submitted for analyses											
ID / DESCRIPTION						DATE / TIME						MATRIX					
0 3390302A1						2/28/02 8:46						501					
1 3390302A2						2/28/02 8:49											
2 3390302A3						8:50											
3 3390302B1						9:01											
4 3390302B2						9:03											
5 3390302B3						9:04											
6 3390302C1						8:50											
7 3390302C2						8:53											
8 3390302C3						8:55											
9 3390302D1						8:57											
Sampled/Relinquished (Signature/Organization)						DATE / TIME						Received by (Signature/Organization)					
Craig Kipp						2/28/02 27:00						Laura Clavin					
Relinquished (BN Representative Signature)						DATE / TIME						Received (Courier & Tracking Info.)					
CD Cantor						3/28/02 13:00						BA 20291022					
Relinquished (Courier & Tracking Info.)						DATE / TIME						Received (1st tier Subcontractor Rep)					
VIA Courier						3/28/02 17:00						3/28/02 17:00					
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APPENDIX C

MARCH 2002 BIOLOGICAL ANALYTICAL DATA

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CERTIFICATE OF ANALYSIS

Kraig K. Knapp
USDOE c/o Bechtel Nevada Corp
Nevada Test Site
BLDG 160 Central Receiving
Mercury, NV 89023Date Reported: 4/24/02
P.O. Number: 31448
Sample ID: 9940-00016
Date Received: 4/02/02
Time Received: 09:15

Permit Number CAU 339 A435

PARAMETERS	RESULTS	DATE	TECH	METHOD
SUBJECT: 33902BA, 3/27/02 @ 08:46 by Client				
Total Aerobic Bacteria	5,992,000. cfu/g	4/02/02	DJH	9215B MODIFIED
T.Aerobic Degradable Bacteria	107,000. cfu/g	4/02/02	DJH	9215B MODIFIED
Standard Nutrient Panel				
Total Kjeldahl Nitrogen	1,400. mg/kg	4/11/02	MTS	351.4
Ammonia Nitrogen	<5.0 mg/kg	4/11/02	MTS	350.2
Organic Nitrogen	1,400. mg/kg	4/11/02	MTS	351.3
pH 50% Slurry	6.9 pH units	4/02/02	DJH	SW846 9045
Ortho-Phosphate	0.03 mg/kg	4/04/02	DJH	4500P-E
Total Organic Carbon (LOI)	1500. mg/kg	4/03/02	DJH	2540E
% Solids	92. %	4/02/02	DJH	2540G
% Moisture	8.0 %	4/02/02	DJH	CALC
SUBJECT: 33902BB, 3/27/02 @ 09:01 by Client				
Total Aerobic Bacteria	6,634,000. cfu/g	4/02/02	DJH	9215B MODIFIED
T.Aerobic Degradable Bacteria	1,498,000. cfu/g	4/02/02	DJH	9215B MODIFIED
Standard Nutrient Panel				
Total Kjeldahl Nitrogen	1,100. mg/kg	4/11/02	MTS	351.4
Ammonia Nitrogen	<5.0 mg/kg	4/11/02	MTS	350.2
Organic Nitrogen	1,100. mg/kg	4/11/02	MTS	351.3
pH 50% Slurry	7.7 pH units	4/02/02	DJH	SW846 9045
Ortho-Phosphate	0.03 mg/kg	4/04/02	DJH	4500P-E
Total Organic Carbon (LOI)	2300. mg/kg	4/03/02	DJH	2540E
% Solids	90. %	4/02/02	DJH	2540G
% Moisture	10. %	4/02/02	DJH	CALC
SUBJECT: 33902BC, 3/27/02 @ 08:33 by Client				
Total Aerobic Bacteria	1,316,100. cfu/g	4/02/02	DJH	9215B MODIFIED
T.Aerobic Degradable Bacteria	513,600. cfu/g	4/02/02	DJH	9215B MODIFIED
Standard Nutrient Panel				
Total Kjeldahl Nitrogen	350. mg/kg	4/11/02	MTS	351.4

*** Certificate Continues On Next Page ***

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CERTIFICATE OF ANALYSIS

Kraig K. Knapp
USDOE c/o Bechtel Nevada Corp
Nevada Test Site
BLDG 160 Central Receiving
Mercury, NV 89023

Date Reported: 4/24/02
P.O. Number: 31448
Sample ID: 9940-00016
Date Received: 4/02/02
Time Received: 09:15

Permit Number CAU 339 A435

PARAMETERS	RESULTS	DATE	TECH	METHOD
SUBJECT: 33902BC, 3/27/02 @ 08:33 by Client				
Ammonia Nitrogen	<5.0 mg/kg	4/11/02	MTS	350.2
Organic Nitrogen	350. mg/kg	4/11/02	MTS	351.3
pH 50% Slurry	7.5 pH units	4/02/02	DJH	SW846 9045
Ortho-Phosphate	0.04 mg/kg	4/04/02	DJH	4500P-E
Total Organic Carbon (LOI)	1900. mg/kg	4/03/02	DJH	2540E
% Solids	90. %	4/02/02	DJH	2540G
% Moisture	10. %	4/02/02	DJH	CALC

This document has been reviewed and is electronically signed by:

Karen A. Ziolkowski
Laboratory Director

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49440-16

Page 1 of 2

PROJECT/CLIENT INFORMATION				REPORT INFORMATION				SAMPLE INFORMATION			
Project: CAU 339		BN Org#: A435		Send Report to: Allison Urban		MIS: NTJ306		Sampling Site: CAU 339		The samples submitted contain (check):	
Charge No.: 5H15J97A		ASL Prog.:		Phone: Fax: 5-7761		MIS: NTJ306		(X) Hazardous () Radioactive () Unknown		contamination. If known, attach a brief narrative summary identifying contaminants. This information will ensure compliance with applicable regulations and allow for the safe handling of the sample materials. TPH confirmed.	
Project Manager: Jeff Smith		MIS: NTJ306		Turnaround: () Standard - 30 days Non-rad, 60 Days Rad, Other: Rush Preliminary by: Final by:		Final report format: (X) Standard () NTS-WAC () Other:		Are all sample containers received intact (X) Yes () No		Comments:	
Phone: 5-7775		Fax: 5-7761		MIS: NTJ306		Final report format: (X) Standard () NTS-WAC () Other:		Do the labels agree with this form? (X) Yes () No		Comments:	
LAB USE ONLY				ANALYSES & METHOD							
Rad SGD: Non-Rad SDG: V1805		Rad Packet: Non-Rad Packet:		Client Services Representative:							
Will these analyses be performed under a signed SOW? () YES () NO				If so, do analyses entered here agree with the SOW? () YES () NO () N/A							
If not, identify the variation				CSR initials indicating review and approval: Date:							
ID / DESCRIPTION				SAMPLING DATE		TIME		MATRIX		COMMENTS	
0 339 020A				3/28/02		8:46		5011		(Preservative, size/volume, MS/MSD, special analysis, rad matrix code, count time, etc.)	
1 339 020B				24		9:01		↓		500 mL Nalgene	
2 339 020C				↓		8:33		↓			
3 keep store											
4											
5											
6											
7											
8											
9											
Transfer of samples submitted for analyses											
Sampled/Relinquished (Signature/Organization)				DATE / TIME		Received by (Signature/Organization)		DATE / TIME		Complete for samples shipped to an OFF-SITE Subcontract Laboratory	
Kris Ryzga				3/28/02 1304		Lina Lawson		3/28/02 1304		MICROBAC	
				37						Received (Courier & Tracking Info.)	
										Received (1st tier Subcontractor Rep)	
										Received (2nd tier Subcontractor Rep)	
										Received (1st tier Subcontractor Rep)	
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APPENDIX D

NDEP DOCUMENT COMMENT RESPONSE SHEET

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NEVADA ENVIRONMENTAL RESTORATION PROJECT

DOCUMENT REVIEW SHEET

1. Document Title/Number <u>Draft Closure Report for Corrective Action Unit 339: Area 12 Fleet Operations Steam Cleaning Discharge Area, Nevada Test Site, Nevada</u>				2. Document Date <u>September, 2002</u>	
3. Revision Number <u>0</u>				4. Originator/Organization <u>Bechtel Nevada</u>	
5. Responsible NNSA/NV ERP Project Mgr. <u>Janet Appenzeller-Wing</u>				6. Date Comments Due <u>September 30 2002</u>	
7. Review Criteria <u>Federal Facility Agreement and Consent Order</u>					
8. Reviewer/Organization/Phone No. <u>Ted Zaferatos, NDEP, 702-486-2856</u>				9. Reviewer's Signature _____	
10. Comment Number/ Location	11. Type ^a	12. Comment	13. Comment Response	14. Accept	
Table 2, Page 12		Most of the TPH values inserted in the March 23, 2001 and the June 12, 2001 columns are incorrect. Reexamine the past data and insert the correct numbers in each slot. (The discussion on pages 9-13 uses the correct numbers and is thus not affected).	TPH values in Table 2 have been corrected.	Yes	
Page 13, Section 3.5		"... <i>Current data indicate a possible drop in TPH concentrations at Plot B...</i> " should be changed to "... <i>Current data indicate a possible drop in TPH concentrations at Plot C...</i> ".	Text corrected.	Yes	
Page 1X, Section 3.6		NNSA should insure that the proper phosphorous test is conducted in the future as the test results can assist in influencing NDEP's decisions on the need to enhance the biodegradation process.	It was not realized that the type of phosphorous being analyzed was different for this test. This will be corrected in future analytical requests.	Yes	

10. Comment Number/ Location	11. Type ^a	12. Comment	13. Comment Response	14. Accept
Page 17, Section 3.6.1		The paragraph contains three degrader populations in parentheses while describing two plots; A and C. The value for Plot B must be made clear to the reader.	The paragraph has been modified to make it clear what the degrader population number is for each plot.	Yes
General		Collected data has not clearly demonstrated natural attenuation of petroleum hydrocarbons. Upon completion of review of the Final Post-Closure Monitoring Report, NDEP may suggest future sampling, in addition to the sampling already planned, as well as enrichment of impacted soils to enhance the degradation process.	No change to report necessary. It is agreed that natural attenuation of TPH has not yet been demonstrated.	Yes

^aComment Types: M = Mandatory, S = Suggested.

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