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WORK PLAN

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Work Plan

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Corrective Action Plan for B-32 Boot Site

Hobbs Salt Water Disposal System
NMOCD Case #: 1R0428-57

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Table of Contents

List of Figures, Tables & Plates

1.0 EXECUTIVE SUMMARY

This Corrective Action Plan presents the results of the characterization activities performed by R.T. Hicks Consultants (Hicks Consultants) and Rice Operating Company (ROC) at the B-32 Boot site located in the Hobbs Salt Water Disposal System (SWD) and proposes closure of the site after implementation of the selected remedy and submission of a final closure report.

The selected remedy is revegetation of the ground surface followed by four quarters of ground water monitoring. This remedy protects ground water, human health and the environment.

Data Summary

1. Field data and laboratory results indicate that chloride concentrations do not exceed 600 mg/kg in samples obtained from the entire thickness of the vadose zone.
2. Field data and laboratory results indicate that past releases of produced water may have corroded an adjacent crude oil gathering line and caused periodic releases of crude originating at a nearby oil well.
3. Petroleum hydrocarbons released from this oil gathering line reside in the vadose zone. PID readings of soil samples exceed 200 ppm from 10-feet below ground surface (bgs) to the water table.
4. Three recent ground water sampling events indicate that benzene, ethylbenzene, and xylene concentrations are slightly above the laboratory practical quanitation limit (PQL) and are one order of magnitude less than the Water Quality Control Commission (WQCC) standards and the laboratory did not detect toluene.
5. Chloride and total dissolved solid (TDS) concentrations in ground water are below WQCC standards.

Conclusions

1. Because residual chloride concentrations in the vadose zone are less than 1,000 mg/kg, the residual chloride mass does not represent a threat to ground water, human health or the environment.

2. Low concentrations of petroleum hydrocarbons (BTEX) are present in the vadose zone and will naturally biodegrade.

3. Ground water that is in direct contact with petroleum hydrocarbons (e.g. the capillary fringe) exhibits concentrations of BTEX that are many times lower than the health-based WQCC standards. The fact that vadose zone contains petroleum hydrocarbons yet laboratory analysis of ground water in contact with this soil does not detect BTEX (two sampling events) or shows BTEX well below health based standards permits a conclusion that the released crude has aged to the degree that regulated hydrocarbon constituents should not partition from the soil to ground water in sufficient mass to cause ground water to exceed health based standards.

Recommendations

1. R.T. Hicks Consultants recommends that ROC implement a remedy consisting of the creation of an infiltration barrier through surface restoration and re-vegetation of the site. This remedy will effectively allow natural volatilization and biodegradation of the hydrocarbons in the vadose zone. This proposed remedy is protective of ground water quality and human health and the environment.

2. If four (4) quarters of ground water monitoring continue to demonstrate that ground water will not be impaired (above WQCC Standards) by past site operation, ROC will submit a final closure report and request closure of the regulatory file.

2.0 Background

The B-32 Boot was a component of the Hobbs SWD system. With the abandonment of the system in 2002, Rice Operating Company (ROC) excavated 3 feet below ground surface, removing the B-32 Boot and the uppermost portion of the vadose zone in conformance with the NMOCD-approved Junction Box Closure Plan. At the time of this investigation, the excavation was partially filled with a mixture of sand-caliche and soil.

The Hobbs Salt Water Disposal System (SWD), which managed produced water from the late 1950s to the present, is now closed. Future releases from the system infrastructure are not possible. Closure of facilities like the B-32 Boot within Hobbs SWD, followed the July 16, 2003 NMOCD-approved junction box investigation plan. This plan calls for delineation of any impact from these sites during the closure process and states:

> *If 12 feet vertical delineation at the source reveals Target Concentrations for TPH or BTEX will not meet NMOCD guidelines or TPH and BTEX will meet guidelines but there is not a significant decline vs. depth in chloride concentration, the site-impact is judged to be outside the scope of this work plan and will become a risk-based corrective action (RBCA) project-site.*

The B-32 Boot site meets this criteria set forth in the junction box investigation plan.

2.1 LOCATION

Plate 1 is an aerial photograph of the site when it was active, taken between 1996 and 1998. Plate 1 shows the location of the boring and nearby roads.

The site is within unit letter B, Section 32, Township 18S Range 38E. To access the site from the intersection of French Drive and Sanger proceed south on French Drive (unpaved) through the locked gate. Continue approximately 0.3 miles south and turn right heading southwest (1/4 mile) and then west (1,000 ft). Turn right and proceed approximately ¼ mile north towards "State A" tank battery location. The B-32 Boot site is located 30 feet east of the southeast corner of the tank battery.

2.2 Characterization Activities

In May 2006, Hicks Consultants, ROC, and Atkins Drilling mobilized to conduct a series of exploratory drilling at five sites within the Hobbs SWD System. The field protocols were consistent with The NMOCD-approved Investigation Characterization Plan (ICP) submitted for the site (see Appendix A). In order to permit comparison of the results from this boring with the ambient chloride concentrations in the vadose zone, collection of samples from a background soil boring was a critical element of the ICP. Appendix B shows the results of field chloride measurements from the background soil boring, located in northeast of the B-32 site in Section 32, Unit A.

Figure 1: Soil boring taken May 2, 2006 immediately over the former junction box at the B-32 site.

At the B-32 site, one soil boring was advanced immediately over the former junction box on May 2, 2006 (Figure 1). Also shown in Figure 1 is an excavation showing where a crude gathering line crossed the produced water line near the junction box. Corrosion of the crude gathering line was observed.

In the field, ROC evaluated samples from each depth for chloride and used the heated headspace method to measure total organic vapors by PID. One sample was submitted to the laboratory from depths showing the highest field chloride measurements (29-30 feet bgs) and four samples showing PID levels above the ICP screening level were also sent to the laboratory for analysis.

The boring was completed as a monitoring well due to chloride field tests and photoionization detector (PID) readings indicating levels above the threshold specified in the ICP. The total depth of the boring is 70 feet bgs and the depth to water is about 54 feet.

3.0 CHARACTERISTICS OF THE VADOSE ZONE

The upper 20 feet of the vadose zone at the site is composed primarily of a fine sand with some caliche layers. A one-foot thick hard caliche layers exists from 19 feet to 20 feet bgs. Below 20 feet, a fine grained sand composes the majority of the vadose zone profile (See Appendix C which presents the lithologic log for this boring).

Field chloride concentrations varied from a minimum of 60 ppm at the 4-6 ft interval to a maximum of 560 ppm at the 29-30 ft interval. The chloride center of mass resides from 25-40 feet below ground surface (see Figure 2). The laboratory result from the 29-30 depth interval (476 mg/kg) agree favorably with the field analysis.

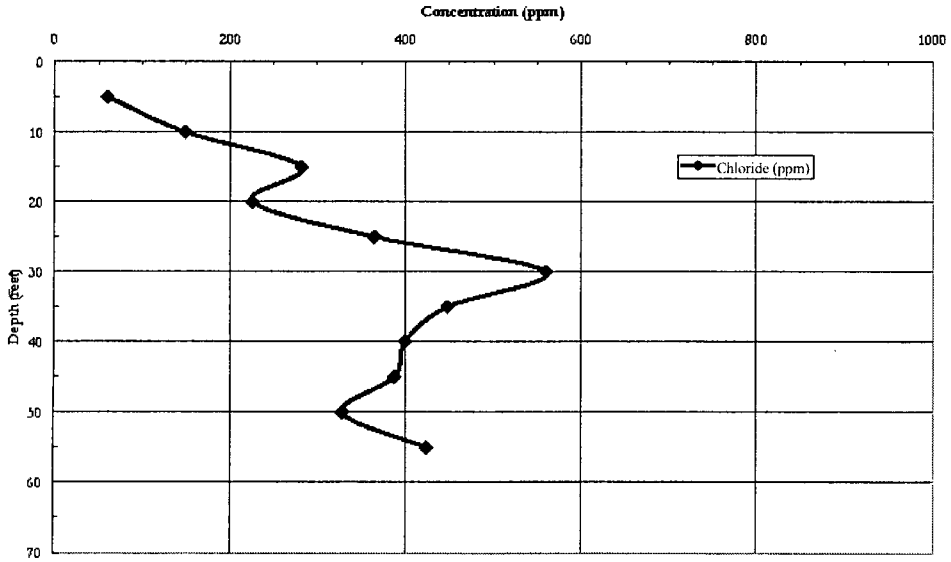

Figure 2: Chloride Concentration vs. Depth for B-32 Boot Site

PID readings in the soil boring varied from a minimum of 136 ppm at the 4-6 ft interval to a maximum of 769 ppm at the 39-39.5 ft interval. Results of the hydrocarbon analyses for four soil samples from the boring are summarized in Table 1. Appendix D contains the analytical reports from the laboratory as well as a summary of TPH analytical results.

The soil sample obtained from 14 to 16-feet bgs contained 455 ppm total organic vapors by the heated headspace method of analysis using the photo-ionization detector (PID). Laboratory analyses confirm that benzene and other hydrocarbons are present.

Depth (ft bgs)	Regulated Hydrocarbons (mg/kg)			
	Benzene	Toluene	Ethlybenze	Xylenes
14'-16'	0.573	<0.200	12.5	20.2
29'-30'	<0.200	<0.200	3.67	9.49
39'-39.5'	<0.100	<0.100	5.27	9.34
49'	<0.100	<0.100	4.98	9.10

Table 1: Analytical Data from Soil Boring

At greater depths (30 feet bgs, 39 feet bgs and 49 foot bgs), benzene was not detected by laboratory analysis (Table 1) toluene was not detected in any sample. Ethylbenzene and xylene concentrations were less than 10 ppm at sample depths greater than 16 feet bgs.

4.0 CHARACTERISTICS OF THE SATURATED ZONE

Three ground water sampling events demonstrate that chloride, total dissolved solids (TDS) and BTEX concentrations are below WQCC standards for ground water. The sampling events show that chloride concentrations are within the range of values in nearby domestic supply wells, in which chloride concentrations range from 60 mg/L to more than 300 mg/L. Ground water monitoring data is summarized in Table 2.

Date Sampled	Depth to Ground Water (Feet bgs)	Chloride (mg/L)	TDS (mg/L)	Regulated Hydrocarbons (mg/L)			
				B	T	E	X
5/17/06	57.03	143	742	<0.001	<0.001	<0.001	<0.001
8/14/06	57.33	138	646	<0.001	<0.001	<0.001	<0.001
10/05/06	56.88	NA	NA	0.004	<0.001	0.002	0.002
WQCC Standard		250	1000	0.01	0.75	0.75	0.62

Table 2: Ground Water Monitoring Data

PID field tests and physical observations in the capillary fringe and underlying saturated zone show little difference with respect to odor, appearance or PID readings from the sample taken below the water table. Despite the documented presence of hydrocarbons in the vadose zone, no regulated hydrocarbons were detected in ground water in the first two sampling events. The third sampling event detected benzene, ethylbenzene, and xylene well below WQCC drinking water Standards. From these data Hicks Consultants concludes that with the implementation of the selected remedy and ongoing natural biodegradation, the regulated hydrocarbons should not partition from the solid matrix into ground water in sufficient mass to cause ground water to exceed the WQCC Standards.

5.0 PROPOSED REMEDY

ROC Proposes the following selected remedy for the B-32 Boot site:

1. Creation of an infiltration barrier through restoration of the ground surface and re-vegetation. This action is protective of ground water quality, human health and the environment.

2. Perform four quarters of ground water monitoring (ending the second quarter of 2007).

If four quarters of ground water sampling confirm that ground water quality will not exceed WQCC standards, ROC will submit a closure report and request closure of the regulatory file.

6.0 CRITERIA FOR CLOSURE

After re-vegetation of the infiltration barrier surface and four quarters of ground water samples (to be completed in August 2007) that confirm no impairment of ground water, ROC will submit a final closure report and request closure of the regulatory file for the site.