

October 3, 2017

**Re: Remediation Summary
Kerr-McGee Oil and Gas Onshore, LP
HSR-Vasser 8-30, HSR-Schreiber 1-30
Form 27 Document # 401414746
COGCC Remediation # 3281
Facility ID # 328055
API # 05-123-15484
NWNE & NENE Sec 30-T4N-R65W
Weld County, Colorado**

2014-2015 Carbon Slurry Injections

As of the April 2014 quarterly monitoring event, the benzene concentrations in monitoring wells MW02 and MW11 exceeded the Colorado Oil and Gas Conservation Commission (COGCC) Table 910-1 allowable level for benzene at concentrations of 112 micrograms per liter ($\mu\text{g/L}$) and 24.7 $\mu\text{g/L}$, respectively. Following the April 2014 quarterly monitoring event, Kerr-McGee Oil and Gas Onshore LP (Kerr-McGee) contracted LT Environmental, Inc. (LTE) to design and implement a carbon slurry injection program to remediate the residual dissolved-phase benzene, toluene, ethylbenzene, and total xylenes (BTEX) impacts to groundwater. Kerr-McGee submitted an Underground Injection Control (UIC) Permit Application to Region 8 of the United States Environmental Protection Agency (USEPA) on July 2, 2014. A copy of the July 23, 2014, Rule Authorization: Aquifer Remediation Well approval letter from Region 8 is attached.

The carbon slurry injection program was implemented, as outlined in the UIC Permit Application, with the objective of reducing the residual dissolved-phase BTEX concentrations in the injection area surrounding monitoring wells MW02 and MW11 to less than the COGCC Table 910-1 allowable levels. On September 23 and 24, 2014, LTE oversaw the injection of approximately 1,350 pounds (dry weight) of BOS 200[®] that was mixed with potable water and cultured facultative microbes to form an injectable carbon slurry. The BOS 200[®] product is designed to enhance petroleum hydrocarbon degradation by capturing the dissolved-phase petroleum hydrocarbons in a carbon matrix and promoting microbial metabolism of the hydrocarbons under both aerobic and anaerobic conditions.

As of the January 2015 quarterly monitoring event, the benzene concentration in monitoring well MW02 exceeded the COGCC Table 910-1 allowable level for benzene at a concentration of 49.1 $\mu\text{g/L}$. On April 22, 2015, the area surrounding monitoring well MW02 was polished by injecting 180 pounds (dry weight) of BOS 200[®] carbon slurry via direct-push injection technology.

As of the July 2015 quarterly monitoring event, the benzene concentration in monitoring well MW11 exceeded the COGCC Table 910-1 allowable level for benzene at a concentration of 30.2 $\mu\text{g/L}$. On August 27, 2015, the areas surrounding monitoring wells MW02 and MW11 were

polished by injecting 300 pounds (dry weight) of BOS 200[®] carbon slurry via direct-push injection technology.

Static groundwater monitoring continued on a quarterly basis following completion of the injection programs. The September 2014, April 2015, and August 2015 injection areas are depicted on the Site Map provided as Figure 2.

2016 Excavation and Carbon Application

Due to persistent, elevated benzene concentrations in monitoring well MW11, a shallow excavation was completed around MW11 on November 16, 2016. The excavation was completed to a depth of 5 feet below ground surface, and monitoring well MW11 was excavated out. While backfilling the excavation, 100 pounds of COGAC[®], a carbon-based groundwater remediation product, was applied to the clean backfill in a series of lifts in the capillary and phreatic horizons. On November 17, 2016, replacement monitoring well MW11R was installed. Static groundwater monitoring continued on a quarterly basis. Site-wide compliance was achieved as of the January 2017 groundwater monitoring event. The excavation footprint and replacement monitoring well MW11R are depicted on Figure 2.

Conclusions

Based on post-remedial analytical data, BTEX concentrations in groundwater have been in compliance with COGCC Table 910-1 allowable levels for four consecutive monitoring events. Kerr-McGee is requesting a No Further Action status for this site.