

March 15, 2019

**Re: Remediation Summary Attachment
Kerr-McGee Oil and Gas Onshore, LP
Dubach 16-4, Thesing 9-4
Form 27 Document # 401926622
COGCC Remediation # 5719
Location # 328116
NESE Sec 4-T3N-R66W
Weld County, Colorado**

Prior to backfilling the 2011 excavation, five gallons of MicroBlaze[®], a concentrated solution of facultative microbes, nutrients, and surfactants designed to bioremediate petroleum hydrocarbons, were applied to the groundwater and exposed smear zone soils in the excavation.

As of the June 2018 quarterly monitoring event, the benzene concentrations in monitoring wells MW01 and MW03R exceeded the COGCC Table 910-1 allowable level at 66.6 micrograms per liter ($\mu\text{g/L}$) and 49.8 $\mu\text{g/L}$, respectively. Following the June 2018 quarterly monitoring event, Kerr-McGee Oil and Gas Onshore LP (Kerr-McGee) contracted LT Environmental, Inc. (LTE) to design and implement a biological amendment program and 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 September 28, 2018, that was subsequently approved on October 30, 2018. A copy of the September 2018 UIC Permit Application and the October 2018 *Rule Authorization: Aquifer Remediation Well* approval letter from USEPA Region 8 are included as attachments to the eForm 27.

Biological Amendment Program

In November 2018, six passive remediation wells (IW01 through IW06) were installed at the site, as outlined in the UIC Permit Application, with the objective of reducing the residual dissolved-phase BTEX concentrations in the area surrounding MW03R to compliance with the COGCC Table 910-1 allowable levels. A biological amendment, BioStryke[®] TPHENHANCED[™], is delivered via passive socks that promote dissolution into the aquifer through the six passive remediation wells. BioStryke[®] TPHENHANCED[™] is a proprietary formulation of inorganic micro-accelerants and additives that accelerate the biodegradation of petroleum hydrocarbons. The socks were deployed in all six passive remediation wells in early February 2019. The passive remediation wells are depicted on Figure 1. Soil boring logs with well completion diagrams are included as an attachment to the eForm 27.

Carbon Slurry Injection Program

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 MW01 to compliance with the COGCC allowable levels. Between January 21 and 25, 2019, LTE oversaw the injection of approximately 1,000 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. Post-injection groundwater monitoring will continue on a quarterly basis. The injection area is depicted on Figure 1.