ENSOLUM

January 17, 2024

New Mexico Oil Conservation Division
New Mexico Energy, Minerals, and Natural Resources Department
1220 South St. Francis Drive
Santa Fe, New Mexico 87505

Re: **Dual Phase Extraction Pilot Test Summary**
San Juan 30-6 Unit 31A
Rio Arriba County, New Mexico
Hilcorp Energy Company
NMOCD Incident Number: NAPP2301160771

To Whom it May Concern:

Ensolum, LLC (Ensolum), on behalf of Hilcorp Energy Company (Hilcorp), presents this *Dual Phase Extraction Pilot Test Summary* performed at the San Juan 30-6 Unit 31A natural gas production well pad (Site). The Site is located on private land in Unit F, Section 33, Township 30 North, Range 6 West in Rio Arriba County, New Mexico.

SITE BACKGROUND

On December 27, 2022, Hilcorp personnel discovered a release of 92 barrels (bbls) of condensate originating from corrosion holes on the "J Leg" piping of the oil dump line. The release volume was determined based on the operator's monthly tank gauging data. Fluids stayed within the secondary containment berm, but none were recovered. Upon discovery, the tank was immediately emptied. Hilcorp reported the release via email to the New Mexico Oil Conservation Division (NMOCD) on December 28, 2022, and subsequently submitted a Form C-141, *Release Notification* to the NMOCD on January 11, 2023. The release was assigned NMOCD Incident Number NAPP2301160771.

Following the discovery of the release, Hilcorp conducted potholing and drilling activities to vertically and laterally delineate soil impacts at the Site. Pothole SS01 was initially advanced near the source of the release in January and February 2023. Based on the results from this work, drilling activities were subsequently performed in May 2023. Boreholes BH01 through BH07 were advanced at the Site to depths up to 52 feet below ground surface (bgs). Groundwater was encountered during drilling at depths of approximately 38 feet to 42 feet bgs. As such, wells were installed in all seven boreholes and were screened across the water table for groundwater assessment and monitoring. Based on the activities and analytical results collected during delineation activities, soil impacts had been delineated north and east of the release; however, total petroleum hydrocarbons (TPH) from boreholes west and south of the release (BH03 and BH04) exceeded the NMOCD Table I Closure Criteria in soil samples collected at depths between 39 feet and 41 feet. Additionally, samples collected from several Site wells indicate groundwater has been impacted by the release.

Additional details regarding the investigations and sampling performed at the Site are summarized in the *Site Investigation Report and Remediation Work Plan*, dated June 21, 2023 and prepared by Ensolum.

SITE CLOSURE CRITERIA

As presented in the June 21, 2023 work plan, the following Closure Criteria apply to the Site in accordance with *Table I, Closure Criteria for Soils Impacted by a Release* (Table I Closure Criteria), Title 19, Chapter 15, Part 29, Section 12 (19.15.29.12) of the New Mexico Administrative Code (NMAC):

- Benzene: 10 milligrams per kilogram (mg/kg)
- Benzene, toluene, ethylbenzene, and total xylenes (BTEX): 50 mg/kg
- TPH-gasoline range organics (GRO), TPH-diesel range organics (DRO), and TPH-motor oil range organics (MRO): 100 mg/kg
- Chloride: 600 mg/kg

Additionally, the NMOCD requires groundwater-quality standards be met as presented by the New Mexico Water Quality Control Commission (NMWQCC) and listed in Title 20, Chapter 6, Part 2, Section 3103 (20.6.2.3103) NMAC. The following standards are presented for the chemicals of concern (COCs) at the Site in micrograms per liter (µg/L).

- Benzene: 5.0 µg/L
- Toluene: 1,000 µg/L
- Ethylbenzene: 700 µg/L
- Total Xylenes: 620 µg/L

In addition, NMWQCC standards state light non-aqueous phase liquids (LNAPLs) or phase-separated hydrocarbons (PSH), as referenced in this report, shall not be present floating on the groundwater table.

PILOT TEST ACTIVITIES AND FINDINGS

Based on the nature and depth of the release and the proximity of impacted soil and groundwater to active equipment, Ensolum conducted a pilot study on October 20, 2023 to assess the potential use of dual-phase extraction (DPE) to recover PSH and remediate soil and groundwater at the Site. DPE is an in-situ technology used to remove various combinations of contaminated groundwater, PSH, and hydrocarbon vapor from the subsurface. The goal of DPE, in addition to recovering PSH, is to drawdown the groundwater table in order to expose submerged soil impacts and allow for the removal of volatile organic compounds (VOCs) and some semi-volatile organic compounds (SVOCs) from vadose zone soil through the application of vacuum to the subsurface (also known as soil vapor extraction, or SVE). When air is removed from the soil, contaminants are volatilized and also withdrawn from the subsurface. Depending on contaminant concentrations in the emissions, the DPE system may emit the exhaust directly to the atmosphere.

During pilot testing activities, monitoring well BH01D was used as the extraction well due to its location within the PSH plume and the varying distances from other, nearby monitoring wells used as observation wells for data collection. Existing monitoring wells BH02D and BH03 through BH07 were used as observation wells. These observation wells were chosen to provide varying distances from the point of extraction as well as varying well construction and screen intervals. An adjustable 1-inch polyvinyl chloride (PVC) stinger was installed in the pilot test well allowing the inlet to be adjusted if the water level in the well changed during the dewatering process, as necessary. The PVC stinger was connected to a vacuum truck. The well was sealed off to the atmosphere and vacuum was applied for the duration of the test. An adjustable manifold was used to incrementally increase the vacuum being applied to the extraction pilot test well in order to determine the minimum vacuum required to air lift the groundwater and PSH from within the well casing. Additionally, a clear site glass was located along the extraction piping in order to verify whether groundwater and PSH were actively being recovered at each vacuum interval. Flow, vacuum, and field headspace readings at the extraction pilot test well were recorded at

10- to 30-minute intervals throughout the test. Visual observations from within the sight glass and total fluid recovery volumes were also recorded at the same intervals.

During the pilot test, flow and vacuum were incrementally increased until the maximum capable vacuum was applied by the vacuum truck at 198 inches of water column (IWC). The maximum recorded flow when applying 198 IWC was 13.3 actual cubic feet per minute (acfm). Vacuum measurements were recorded during the pilot test from wells BH02D and BH03 through BH07. Vacuum response was only observed in wells BH02D and BH04 at a maximum 0.01 IWC in both wells, located approximately 25 feet and 40 feet away from the test well, respectively. Vacuum responses were not observed in any of the other observation wells during the test. As discussed in the textbook *Remediation Engineering: Design Concepts, Second Edition* (Sutherson, Horst, Schnobrich, Welty, & McDonough, 2017), a minimum vacuum response of 0.1 IWC in observations wells is required to provide sufficient airflow through the subsurface for SVE to be an effective remedial technology at the given distance. In addition, no measurable liquids were removed from the extraction well during the pilot test.

The pilot test results indicate DPE is not a viable remediation technique at the Site using the current configuration of wells. DPE could potentially be proven viable if additional “infill” wells are installed at the Site at closer distances and an additional pilot test is performed.

CONCLUSIONS AND RECOMMENDATIONS

Based on the May 2023 Site investigation and October 2023 pilot test results, Hilcorp is going to proceed with Site delineation activities. At this time, drilling work is scheduled to commence on January 15, 2024, to further delineate soil and groundwater impacts at the Site. An *Updated Remediation Work Plan* will be submitted to the NMOCD summarizing the results and data from the additional drilling and delineation activities. The updated work plan will also propose alternative remediation techniques that may be used to remediate soil and groundwater impacts at the Site.

We appreciate the opportunity to provide this document to the NMOCD. If you should have any questions or comments regarding this document, please contact the undersigned.

Sincerely,
Ensolum, LLC

Stuart Hyde, PG
Senior Geologist
(970) 903-1607
shyde@ensolum.com

Daniel R. Moir, PG
Senior Managing Geologist
(303) 887-2946
dmoir@ensolum.com

District I
1625 N. French Dr., Hobbs, NM 88240
Phone:(575) 393-6161 Fax:(575) 393-0720
District II
811 S. First St., Artesia, NM 88210
Phone:(575) 748-1283 Fax:(575) 748-9720
District III
1000 Rio Brazos Rd., Aztec, NM 87410
Phone:(505) 334-6178 Fax:(505) 334-6170
District IV
1220 S. St Francis Dr., Santa Fe, NM 87505
Phone:(505) 476-3470 Fax:(505) 476-3462

State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
Santa Fe, NM 87505

CONDITIONS

Action 321276

CONDITIONS

Operator: HILCORP ENERGY COMPANY 1111 Travis Street Houston, TX 77002	OGRID: 372171
	Action Number: 321276
	Action Type: [UF-GWA] Ground Water Abatement (GROUND WATER ABATEMENT)

CONDITIONS

Created By	Condition	Condition Date
nvelez	OCD approves of the amended remediation approach. Hilcorp has 45-days (due date: 04/22/2024) to submit its findings and alternative remediation plan. Since groundwater has been impacted (date of discovery: June 2, 2023), this release will be assigned to Mike Buchanan.	3/8/2024