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December 16, 2014

Dr. Tomáš J. Oberding
NMOCD District 1
1625 French Drive
Hobbs, New Mexico 88240
VIA EMAIL

RE: Variance Request
Murchison Oil and Gas, Inc., Jackson Unit #17H temporary pit
API# 30-025-41087, Pit Permit #P1-05981

Dear Dr. Oberding:

The "In-place Burial" closure plan for the above referenced pit was submitted with the C-144 pit application on January 6, 2014 and approved on January 16, 2014. The rig was released from this well on April 14, 2014. Following the well completion of the Jackson Unit #17H well, NMOCD granted a variance to allow cuttings from a nearby well on a different lease, Brininstool 4 St. #4H, to be deposited into the #17H pit during the closed loop drilling. The last cuttings were deposited into the pit in September 2014. NMOCD recently approved a 3-month extension, created a new closure deadline of January 14, 2015.

Hicks Consultants requests a variance to allow TPH by Method 8015M (GRO+DRO+MRO) to substitute for the required method of TPH by 418.1 (2,500 mg/kg) when determining compliance with Table II Standards for in-place closure.

R.T. Hicks Consultants

Kristin Pope
Project Geologist

Enclosure: Variance Request

Copy: Murchison Oil and Gas, Inc.

New Mexico State Land Office, Ed Martin
PO Box 1148
Santa Fe, NM 87504-1148

Statement Explaining Why the Applicant Seeks a Variance

The prescriptive mandates of the Rule that are the subject of this variance request are the following subsections of 19.15.17.13.D:

(5) The operator shall collect, at a minimum, a five point composite of the contents of the temporary pit or drying pad/tank associated with a closed-loop system to demonstrate that, after the waste is solidified or stabilized with soil or other non-waste material at a ratio of no more than 3:1 soil or other non-waste material to waste, the concentration of any contaminant in the stabilized waste is not higher than the parameters listed in Table II of 19.15.17.13 NMAC.

Table II
Closure Criteria for Burial Trenches and Waste Left in Place in Temporary Pits

Depth below bottom of pit to groundwater less than 10,000 mg/l TDS	Constituent	Method*	Limit**
25-50 feet	Chloride	EPA Method 300.0	20,000 mg/kg
	TPH	EPA SW-846 Method 418.1	100 mg/kg
	BTEX	EPA SW-846 Method 8021B or 8260B	50 mg/kg
	Benzene	EPA SW-846 Method 8021B	10 mg/kg

		or 8015M	
51-100 feet	Chloride	EPA Method 300.0	40,000 mg/kg
	TPH	EPA SW-846 Method 418.1	2,500 mg/kg
	GRO+DRO	EPA SW-846 Method 8015M	1,000 mg/kg
	BTEX	EPA SW-846 Method 8021B or 8260B	50 mg/kg
	Benzene	EPA SW-846 Method 8021B or 8015M	10 mg/kg
> 100 feet	Chloride	EPA Method 300.0	80,000 mg/kg
	TPH	EPA SW-846 Method 418.1	2,500 mg/kg
	GRO+DRO	EPA SW-846 Method 8015M	1,000 mg/kg
	BTEX	EPA SW-846 Method 8021B or 8260B	50 mg/kg
	Benzene	EPA SW-846 Method 8021B or 8015M	10 mg/kg

*Or other test methods approved by the division
**Numerical limits or natural background level, whichever is greater
[19.15.17.13 NMAC - Rp, 19.15.17.13 NMAC, 6/28/13]

On October 28, 2014 composite samples were recovered from the Jackson Unit #17H pit, one from the inner and one from the outer cells, as well as a composite sample of available mixing dirt from the berms of the pit below the liner. These three composites were submitted for individual analyses for parameters listed in Table II of 19.15.17.13 NMAC. As approved previously by OCD, an accurate demonstration that "after the waste is solidified or stabilized with soil or other non-waste material at a ratio of no more than 3:1 soil or other non-waste material to waste, the concentration of any contaminant in the stabilized waste is not higher than

the parameters listed in Table II of 19.15.17.13 NMAC" may be derived by mathematically mixing the laboratory results. First, we calculated "pit composite" concentration based on the volume of cuttings of each cell (3.5 parts outer, 1 part inner cell) and the individual laboratory results. Next we mathematically mixed the composite pit concentration with the mixing dirt concentrations at a ratio of 3 parts mixing dirt to 1 part pit contents. When compared to Table II closure criteria, TPH (418.1) target concentrations were not met, as shown in the table below. TPH (418.1) is approximately 17% over the Pit Rule standard while TPH by 8015 (GRO+DRO+MRO) is 29% of the 2,500-mg/kg limit. All other constituents meet the in-place burial limits of the Rule.

Jackson Unit #17H	3:1 STABILIZED CUTTINGS CALCULATIONS	
Constituent	Table II Limit (GW>100')	10/28/2014 Samples*
Chloride	80,000 mg/kg	7302
TPH	2,500 mg/kg	**2927**
GRO+DRO	1,000 mg/kg	612
BTEX	50 mg/kg	3.15
Benzene	10 mg/kg	0.25
GRO+DRO+MRO		***735***

*Concentrations of stabilized cuttings determined using component concentrations inserted into the follow formula:

$$\text{3:1 Stabilized Cuttings} = \frac{[\text{inner pit cell} + (3.5 * \text{outer pit cell})/4.5] + (\text{mixing dirt} * 3)}{4}$$

EPA Method 418.1 measures carbon-hydrogen bonds (hydrocarbons) and is not specific to petroleum-based material. Several analytical laboratories have informed us that many non-petroleum organic additives used during drilling (e.g. cellulose, pine pulp, vegetable oils, cottonseed hulls, nut shells) will be captured by the 418.1 analytical method. Method 418.1 can also capture other naturally-occurring material in a sample such as dry grass and humic material in topsoil. For example, TPH concentrations of grass (14,000 mg/kg), pine needles (16,000 mg/kg), and oak leaves (18,000 mg/kg) [1] would not meet the Table II concentration limits and the Commission did not intend that the in-place burial limit for TPH include hydrocarbons associated with leaves or pine pulp.

We conclude that TPH by 418.1 captures a broader spectrum of hydrocarbons than was envisioned by the Commission when evaluating the burial standards for drilling solids. In contrast, TPH by 8015M (GRO+DRO+MRO) appears to better reflect the intent of the Commission as reflected in the Findings of Fact, which state (emphasis added):

> P. The Commission finds that constituents reflected in Tables I and II (other than chloride), benzene, and toluene, ethylbenzene and xylene (a compound commonly referred to as BTEX), as well as the *gasoline range organics ("GRO") and diesel range organics ("DRO"), which are compounds in the total petroleum hydrocarbons ("TPH"), are light aromatics.* While they are soluble and are able to travel to groundwater, they are slower than chlorides in unsaturated flow, which is why chlorides are used as the outer boundary marker for contaminates. Moreover, the light aromatics are volatile, particularly benzene, which is highly volatile. The resident time for light aromatics is very short, and they will evaporate quickly and degrade in the soil. This is

[1] "Frequently Asked Questions About TPH Analytical Methods for Crude Oil" see http://www.api.org/environment-health-and-safety/environmental-performance/~/~/media/cd8032db1be74914a6b3c816bab33786.ashx

particularly true during closure and mixing. The benzene level that is reflected in Tables I and II, is lower than the levels recommended by the American Petroleum Institute, and GRO and DRO, while they could affect the odor and taste of water, are not a matter of concern with respect to toxicity. *The other compounds in TPH, the oil range organics and asphaltenes, are made up of large molecules and are not sufficiently mobile to pose a concern for human health or fresh water.*

Demonstration that the Variance Will Provide Equal or Better Protection of Fresh Water, Public Health and the Environment

The modified Method 8015 uses solvent extraction followed by gas chromatography and is more widely used in the regulation of the petroleum industry than the 418.1. The evaluation of TPH using method 8015M (GRO+DRO+MRO) provide a more accurate representation of the *petroleum* hydrocarbons without interference from organic, biodegradable, drilling additives such as vegetable/pine oils, cottonseed hulls, and nuts shells, which we believe are not intended for regulation. Our analyses of drilling pit solids demonstrates how "total" TPH results from 418.1 do not contribute to the protection of fresh water relative to SPLP (synthetic precipitation leaching procedure) TPH analysis by 418.1 with respect to the potential of the hydrocarbon to migrate into the underlying groundwater via leaching or into the root zone via wicking upward.

Reviewing the analyses of seven sample sets from five Murchison pits in 2014, the percentage of TPH by SPLP relative to "total" TPH ranges from 0% to 1.42%. This is likely because nearly all of the TPH in the stabilized cutting samples at this site are from the insoluble (or nearly insoluble) matter. The TPH analysis using the SPLP sample preparation method provides a better understanding of the actual risks to human health and the environment than the "total" TPH analysis, but currently there are no regulatory standard concentrations established for samples prepared by SPLP.

GRO+DRO+MRO analysis by 8015M offers greater characterization of leacheability by reporting actual petroleum hydrocarbon concentrations by their known chromatograph fingerprints. TPH using Method 418.1 is not the best indicator for risk to human health or the environment and we do not believe it was the intent of the Pit Rule to preclude in-place closure of a temporary pit due to non-petroleum organic matter, either naturally-occurring or in drilling additives. We believe that the approval of a variance allowing the use of TPH by method 8015M (GRO+DRO+MRO) in place of TPH by method 418.1 for comparison to the existing TPH standard (2,500 mg/kg) will provide equal or better protection of fresh water, public health, and the environment.