

MEMORANDUM

76-eG4

July 26, 1976

To: Gary Rothwell

From: Douglas Houck

Subject: Mobil Oil (Ferndale) Class II Inspection

On June 16, 1976 we arrived at the Mobil Oil Refinery near Ferndale to conduct a scheduled Class II Inspection.

We set up a composite sampler to take a 250 ml aliquot every 30 minutes. The location of the sampler was just before the Parshall flume. Two grab samples for total oils, two grab samples for total sulfides, one grab sample for phenols along with a pH and temperature analysis were taken at different times throughout the day. The pH was 6.7, the temperature was 20½C and the results from the grab samples will be presented in a subsequent table.

The Parshall flume was checked and found to be non-standard, the main reason being a throat width of approximately 17.5 inches. Using the standard equation for a Parshall flume and taking a head measurement, a flow of 1.30 MGD was determined. At the same time Mobil Oil was recording in the control house a flow of 0.90 MGD and 1.14 MGD near the flume. Using the control house recording which is where the flow totalizer is located, an error of 30.8 percent is arrived at. On the 17th a flow of 1.22 MGD was determined. Mobil Oil was recording in the control house a flow of 0.96 MGD and 1.125 MGD near the flume. Again, using the control house reading, an error of 21.3 percent is arrived at. The following table presents DOE's calculated flows along with Mobil Oil's recorded flows and the corresponding errors. An error greater than 15-20 percent is considered excessive.

<u>Flow (MGD)</u>				
<u>Date</u>	<u>DOE</u>		<u>Mobil Oil</u>	<u>% Error</u>
16	1.30	near flume	1.14	12.3
		control house	0.90	30.8
17	1.22	near flume	1.125	7.8
		control house	0.96	21.3

The table shows that depending on which script chart recorder Mobil Oil's flow totalizer is connected to determines whether the total daily flow is acceptable or not. A total flow of 1.233 MGD over a 24.5 hour period was recorded by Mobil Oil's flow totalizer.

Memo to Gary Rothwell
 Mobil Oil (Ferndale)
 Class II Inspection

On the 17th Mike Morhous returned to pick up and split with Mobil Oil the composite samples. Grab samples for phenols, total oils, fecal coliform, total and hexavalent chromium, total sulfides and nutrients were taken. None of the grab samples were split with Mobil Oil. The following table gives DOE's and Mobil Oil's results along with their NPDES permit limitations.

<u>Parameter</u>	<u>DOE</u>		<u>Mobil Oil</u>		<u>NPDES</u>	
	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day
Total Oil	6.75*	69	6	62	10	250
Phenol	0.885*	9.1	0.435*	44.5		2.5
Sulfide	ND	0.0	ND	0.0		4.3
Mercaptan			ND		0.5	
Total Chromium	0.04*	0.41	ND	0.0		6.2
Cr(+6)	ND*	0.0	ND	0.0		0.13
NH ₃ -N	32.0	329	1.4	14		250
T.S.S.	20	206	16	164		500
BOD ₅	20	206	0.0	0.0		370
COD	116	1193	119	1224		2300
TOC			6	62		600
Total Flow			1.233(MGD)			
Total Coliforms	5500*		2500			
Fecal Coliforms	320*					
pH	7.1		7.4		6.0 - 9.0	

* Mean values

ND - None Detected

The table shows that at the time of the survey Mobil Oil was exceeding their NPDES permit limitations for phenols and ammonia. It should be pointed out that NPDES lbs/day limitations are monthly averages while the concentrations are a daily maximum. The flow used to compute lbs/day was the total flow over a 24.5 hour period.

Significant differences between DOE's reported values and Mobil Oil's reported values occurred for phenols, ammonia and BOD₅. DOE analyzed for phenols from a grab sample that was preserved with copper sulfate and phosphoric acid. Mobil Oil analyzed for phenols from DOE's composite sample that had been preserved with ice. I feel that this difference is the reason for the analysis discrepancy. Mobil Oil also analyzed for phenols from their own composite sample and found a concentration of 0.14 mg/l. This shows that the phenols should be analyzed from a grab sample or a composite sample which has been correctly preserved. There is no explanation for the large difference in the NH₃-N analysis. DOE analyzed for ammonia from both a grab sample and a composite. The grab sample showed a concentration of 31 mg/l while the composite sample showed a concentration of 33 mg/l. It is felt that a grab sample should be split again with Mobil Oil to be analyzed for NH₃-N.

The difference in the reported value for BOD₅ is very interesting. Mobil Oil arrives at their value by correlating BOD₅ to TOC and BOD₅ to COD values. DOE performed an actual BOD test as described in Standard Methods. Mobil Oil not wanting to wait five days to complete the BOD₅ test did a correlation study between COD and BOD₅ and TOC and BOD₅. Mobil Oil's COD and the TOC tests take less than 15 minutes to perform. By using linear regression analysis they correlated BOD₅ to COD and BOD₅ to TOC. The equations obtained are:

$$\text{BOD}_5 = 0.43 \text{ COD} - 20$$

$$\text{BOD}_5 = 1.30 \text{ TOC} - 19$$

Using these equations and Mobil Oil's data they should have reported a BOD₅ of 31 or -11.2 mg/l respectively.

It is felt that the correlation study is inadequate for three reasons. First, although they performed a linear regression analysis on their data no analysis-of-covariance was given to show the significance of the analysis. It is also felt that a correlation analysis should have been done to give the relationship of BOD₅ as a function of COD and TOC together. This would involve a multiple linear regression analysis. Lastly, since the time of the original correlation study extra treatment facilities have been added.

In summary, it is felt that the discrepancies in Mobil Oil's flow recorders should be looked into, another sample to be analyzed for NH₃-N should be taken, phenols should be analyzed from grab samples and another correlation study between BOD₅, COD and TOC should be performed.

DH:ee