

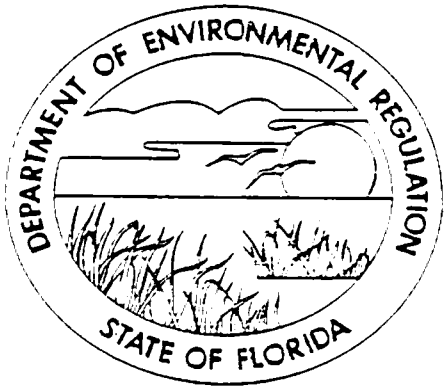
MOBIL OIL COMPANY - FORT MEADE MINE

POLK COUNTY, FLORIDA, NPDES #FL0000302

BIOASSAYS OF SETTLING POND DISCHARGE

TO THE PEACE RIVER

Biology Section
Bureau of Water Analysis
November 5, 1982



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EXECUTIVE SUMMARY

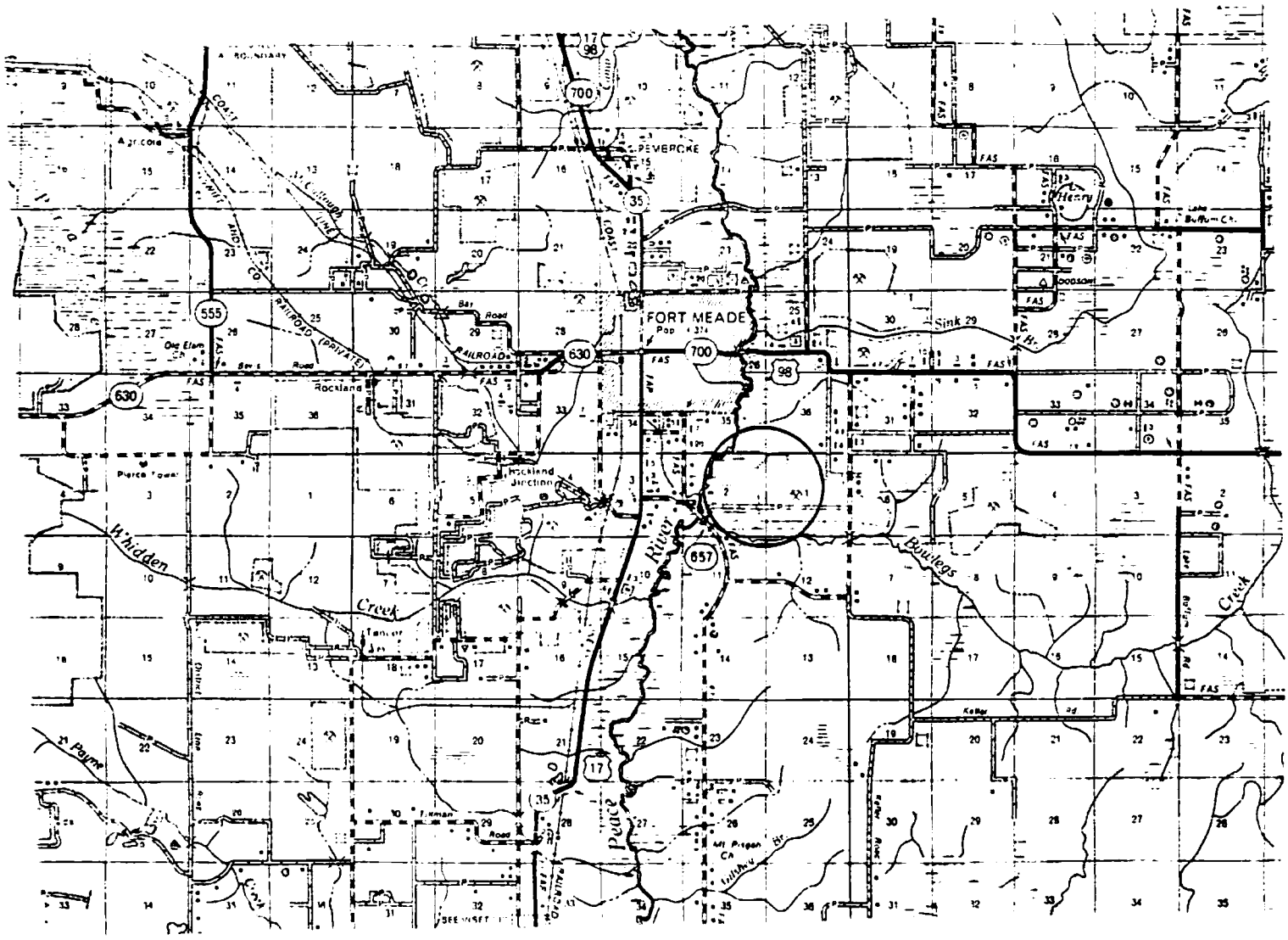
Mobil Oil Company, Fort Meade, discharge to Peace River, on 12 to 14 October, 1982

The sample of wastewater entering the Peace River from the Mobil Oil Company's settling pond was not toxic to the test organisms Daphnia pulex, Pimephales promelas and Heterandria formosa. No dead organisms were observed, except for a few apparently random mortalities of D. pulex in various test concentrations.

INTRODUCTION

The Mobil Oil Company, Fort Meade Mine, is located on U.S. Highway 17, Polk County, Florida (Fig. 1). This facility engages in the mining and beneficiation of phosphate rock. Production averages 10,000 tons per day from a 24 hours per day, 7 days per week operation. Recovery of phosphate from the mined phosphate matrix involves the use of fuel oil, fatty acids and amines, kerosene, sodium hydroxide and sulfuric acid. Wastewater from this operation, consisting of clay and sand slurries, is contained in large settling ponds.

Recently, one of these settling ponds has been discharging clay and sand slurries to the Peace River. Since these slurries may contain some of the organic material used in the production process, the Southwest District Office requested that a toxicity bioassay be performed on a sample of the material. Therefore, to evaluate the toxicity of the discharge to the biota of the receiving waters, the Biology Section performed three static acute toxicity bioassays, on 12 to 14 October, 1982. The results of these tests are presented in this report.



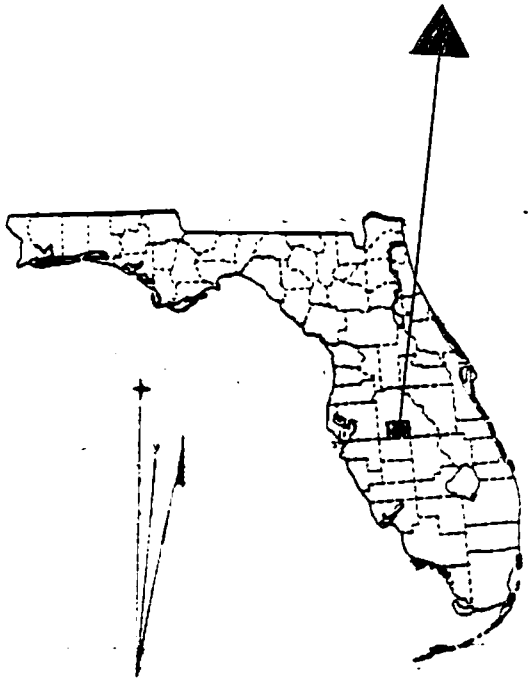


Figure 1. Portions of Polk County, Florida, including Fort Meade and approximate location of study area.

METHODS AND MATERIALS

Test methods used to conduct these static bioassays are extensively described by Peltier (1978). The organisms selected for this study include species recommended by Peltier (1978) and the U.S. EPA (1978). Additionally, the Biological Section maintains cultures of several species of organisms indigenous to the State of Florida. One of these indigenous species was also selected for testing. Life histories of these test organisms and maintenance procedures used to culture them are detailed below.

History and Maintenance of Bioassay Organisms

Daphnia pulex (water flea) - A breeding culture of Daphnia pulex was obtained from the EPA laboratory in Athens, Georgia, in March, 1979. This culture has been maintained since its arrival in 2 1/2 gallon all glass aquaria filled with unchlorinated DER well water, under a 16:8 hour light-dark cycle. Organisms are fed a liquified blend of Purina Trout Chow® and Cerophyl® twice daily, and are kept at a constant temperature of 21° plus or minus 1°C. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess organisms. They are then refilled with fresh aerated well water. Additional measures are taken and/or new cultures started in the event of abnormal circumstances such as: declining populations, ephippia formation, or excessive fungal or bacterial growth.

Pimephales promelas (fathead minnows) - A breeding culture of approximately 100 adult fathead minnows was obtained from the EPA laboratory in Cincinnati, Ohio, in May, 1979. This breeding population is augmented with fry hatched in our laboratory and with additional adult fish from EPA as required. The fish are maintained in four 125 gallon all glass aquaria equipped with a flow through water exchange system using unchlorinated well water obtained from a deep well near the DER laboratory. The fathead minnows are reared at a temperature of 22° plus minus 2°C under a 16:8 hour light-dark cycle. These fish are fed Glencoe Mills Trout Chow®, Tetra-Min®, and frozen Artemia (brine shrimp) at a rate of 0.75 g/30 fish, twice daily. Breeding has been encouraged by placing several halved clay pots in each tank to serve as substrates for eggs and to provide cover for the fish. Tanks are examined twice daily (at feeding time) for egg production. Clay pots containing egg clusters are immediately transferred to 15 gallon aerated aquaria for hatching. A new aquarium is prepared for each week's production of eggs, thereby segregating fish into even age groups to be used for testing. After hatching, fathead minnow fry are fed twice daily with freshly hatched Artemia. The fish used in this test were 1 to 4 weeks old at the time of the test.

Heterandria formosa (least killifish) - Approximately 100 adult least killifish were obtained from a wild population in the St. Marks Wildlife Refuge (Wakulla County, Florida) during August, 1980. The fish are maintained in two and one-half to 15 gallon all glass aquaria equipped with a flow through water exchange system. Water for this system is unchlorinated and is pumped from a deep well near the DER laboratory. The least killifish are reared at 22° plus or minus 2°C under a 16:8 hour light-dark cycle and are fed freshly hatched Artemia (brine shrimp) twice daily. New born fish are initially maintained in the adult tanks, but are removed at weekly intervals, thereby segregating fish into even age groups. The fish used in this test were 1 to 4 weeks old.

To ensure the uniform sensitivity of these test organisms to toxic substances, the Biological Section conducts monthly standard reference toxicant bioassays using sodium lauryl sulfate as the reference toxicant.

Test Methods

Three separate 48 hour static acute toxicity bioassays were performed on a sample of material discharged from the Mobil Oil Company's settling pond. The tests were performed from 1045 hours on 12 October to 1100 hours on 14 October, 1982. The sample was collected by Mr. Robert Stetler and Mr. David Demni of DER's Tampa Office at 1100 hours on 11 October, 1982, using standard wastewater sampling procedures. The sample was iced and transported to the DER laboratory in Tallahassee for analyses within 24 hours of collection.

Since the sample contained approximately 20% clay and sand slurries, the sample was agitated once to suspend the clay particles and to disassociate any organic material, then allowed to settle to separate the water and slurry layers. The water layer was then siphoned to a separate container and used for the bioassays.

Freshwater for dilution of the effluent sample was obtained from the same DER deep well that is used to culture the test organisms. The concentration series selected for this study (Table 1) is that recommended by APHA (1980).

Two replicates, each with six concentrations and a control, were used to test with the water flea, Daphnia pulex. Flint glass jars of 250 ml capacity were used as test chambers, and 200 ml of the appropriate test concentration was placed in each chamber. Daphnia were siphoned into a large culture dish to isolate the proper size and age organisms (neonates). To accomplish this, the Daphnia were siphoned through a stainless steel screen. The trapped adults were then discarded. These neonates were then transferred by glass pipette, examined for injury, and were loaded 10 per chamber, resulting in 20 per test concentration. Water fleas were not fed during this test.

Two replicates, of five or six concentrations and a control, were used for the Pimephales promelas (fathead minnow) and the Heterandria formosa (least killifish) bioassays. The fish were transferred individually or by twos, into wide mouth quart jars containing 500 ml each of the appropriate test concentration, and were loaded 5 per chamber, resulting in 10 per concentration. Due to a shortage of fathead minnows, a 100% test concentration was not used, and, only 8 fish, 4 in each chamber, were used in the 56% test concentration. Fish were not fed during these tests.

Dissolved oxygen, pH, temperature, and the number of live organisms were recorded for each test chamber at 0 hours, 24 hours, and 48 hours. The specific conductance of each test concentration was recorded at the beginning and end of the test. These values were recorded on the bioassay data forms and are presented in Tables 2, 3 and 4.

Table 1. Concentration Series and Volumes Used for These Static Bioassays

Daphnia pulex (water fleas)

Concentration	Dilution Water	Effluent	Total Volume
Control	200 ml	---	200 ml
5.6%	188.8 ml	11.2 ml	200 ml
10.0%	180 ml	20 ml	200 ml
18.0%	164 ml	36 ml	200 ml
32.0%	136 ml	64 ml	200 ml
56.0%	88 ml	112 ml	200 ml
100.0%	--	200 ml	200 ml

Pimephales promelas (fathead minnows)

Heterandria formosa (least killifish)

Concentration	Dilution Water	Effluent	Total Volume
Control	500 ml	---	500 ml
5.6%	472 ml	28 ml	500 ml
10.0%	450 ml	50 ml	500 ml
18.0%	410 ml	90 ml	500 ml
32.0%	340 ml	160 ml	500 ml
56.0%	220 ml	280 ml	500 ml
100.0%	--	500 ml	500 ml

Table 2. Data recorded during 48 hour, Daphnia pulex, static acute toxicity bioassay of Mobil Oil Company, Fort Meade, Leachate from Settling Pond to Peace River, on 12 to 14 October, 1982.

Conc. or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Total Alkalinity (mg/ℓ as $CaCO_3$)		Total Hardness (mg/ℓ as $CaCO_3$)		Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Conductivity (μmhos)	
	0	24	48	0	24	48	0	24	48	0	48	0	48	0	24	48	0	48	0	48
Control	10	10	7	8.5	9.1	9.0	7.6	8.0	8.0					21.8	20.6	20.5				
Control	10	10	9	8.5	9.1	9.0	7.6	8.0	8.0										200	230
5.6%	10	10	10	8.1	8.9	9.0	7.4	8.0	8.1					21.6	20.5	20.5				
5.6%	10	10	9(10)[a]	8.1	8.9	9.0	7.4	8.0	8.1										212	240
10.0%	10	10	9	7.8	8.8	8.9	7.3	8.0	8.2					21.3	20.5	20.4				
10.0%	10	10	8	7.8	8.8	8.9	7.3	8.0	8.2										220	248
18.0%	10	10	9	7.5	8.7	9.1	7.1	7.9	8.2					20.9	20.3	20.5				
18.0%	10	10	8(10)[a]	7.4	8.7	9.1	7.1	7.9	8.2										240	252
32.0%	10	10	9(10)[a]	6.3	8.3	8.9	7.0	7.8	8.1					20.6	20.3	20.6				
32.0%	10	10	9(10)[a]	6.3	8.3	8.9	7.0	7.8	8.1										268	280
56.0%	10	10	10	5.0	7.8	8.8	6.9	7.7	8.1					20.0	20.3	20.6				
56.0%	10	9(10)[a]	9(10)[a]	5.0	7.8	8.8	6.9	7.7	8.1										320	312
100.0%	10	9(10)[a]	10	2.9(8.1)[b]	7.7	8.5	6.8	7.8	8.2					19.0	20.2	20.6				
100.0%	10	10	10	2.6(8.2)[b]	7.7	8.5	6.8	7.9	8.2										410	412

Remarks:

[a] Numbers in parentheses used in calculations since some organisms were not found in the test chambers, due to the opacity of the sample.

[b] These test chambers were aerated to the values shown prior to loading the organisms.

Table 3. Data recorded during 48 hour, *Pimephales promelas*,[a] static acute toxicity bioassay of Mobil Oil Company, Fort Meade, Leachate from settling Pond to Peace River, on 12 to 14 October, 1982.

Conc. or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Total Alkalinity (mg/ℓ as $CaCO_3$)		Total Hardness (mg/ℓ as $CaCO_3$)		Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Conductivity (μmhos)	
	0	24	48	0	24	48	0	24	48	0	48	0	48	0	24	48	0	48	0	48
Control	5	5	5	9.0	8.3	8.6	7.6	7.9	8.0					21.7	20.2	20.3				
Control	5	5	5	9.0	8.3	8.6	7.6	7.9	8.0										212	198
5.6%	5	5	5	8.8	8.3	8.5	7.4	7.9	8.0					21.5	20.2	20.3				
5.6%	5	5	5	8.8	8.3	8.5	7.4	7.9	8.0										220	236
10.0%	5	5	5	8.6	8.0	8.4	7.3	7.8	7.9					21.3	20.2	20.3				
10.0%	5	5	5	8.6	5.7	7.0	7.3	7.6	7.8										230	248
18.0%	5	5	5	8.2	6.0	7.2	7.2	7.6	7.8					21.1	20.2	20.3				
18.0%	5	5	5	8.2	7.6	8.2	7.2	7.7	8.0										252	255
32.0%	5	5	5	7.3	6.3	7.3	7.0	7.6	7.9					20.7	20.2	20.3				
32.0%	5	5	5	7.3	7.6	8.0	7.0	7.7	8.0										268	280
56.0%	4	4	4	5.8	7.3	8.1	6.9	7.6	8.0					19.5	20.3	20.3				
56.0%	4	4	4	5.8	7.3	8.1	6.9	7.6	8.0										320	320

Remarks: [a] Weight of fish: 24.4 mg each, average of 10 fish

Table 4. Data recorded during 48 hour, *Heterandria formosa*[a], static acute toxicity bioassay of Mobil Oil Company, Fort Meade, Leachate from settling Pond to Peace River, on 12 to 14 October, 1982.

Conc. or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Total Alkalinity (mg/ℓ as $CaCO_3$)		Total Hardness (mg/ℓ as $CaCO_3$)		Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Conductivity (µmhos)	
	0	24	48	0	24	48	0	24	48	0	48	0	48	0	24	48	0	48	0	48
Control	5	5	5	9.0	8.6	8.4	7.6	7.9	8.0					21.7	20.1	20.0				
Control	5	5	5	9.0	8.6	8.4	7.6	7.9	8.0										212	220
5.6%	5	5	5	8.9	8.3	8.4	7.5	7.8	8.0					21.5	20.0	20.1				
5.6%	5	5	5	8.9	8.3	8.4	7.5	7.8	8.0										230	230
10.0%	5	5	5	8.7	8.2	8.5	7.3	7.8	8.0					21.4	20.0	19.9				
10.0%	5	5	5	8.7	8.2	8.5	7.3	7.8	8.0										238	240
18.0%	5	5	5	8.2	7.9	8.5	7.2	7.8	8.0					21.0	20.0	19.9				
18.0%	5	5	5	8.2	7.9	8.5	7.2	7.8	8.0										252	240
32.0%	5	5	5	7.5	7.7	8.4	7.1	7.7	8.0					20.7	20.0	19.9				
32.0%	5	5	5	7.5	7.7	8.4	7.1	7.6	7.9										280	260
56.0%	5	5	5	6.0	7.1	8.3	6.9	7.6	7.9					19.5	20.1	19.9				
56.0%	5	5	5	6.0	6.9	8.3	6.9	7.6	7.9										330	315
100.0%	5	5	5	3.5(6.3)[b]	6.5	8.1	6.8	7.6	8.0					19.0	20.2	20.1				
100.0%	5	5	5	3.3(7.0)[b]	6.5	7.7	6.8	7.7	8.0										410	390

Remarks:

[a] Weight of fish: 19.8 mg each, average of 10 fish.

[b] These chambers were aerated to the values shown prior to loading the organisms.

RESULTS AND DISCUSSION

The sample of material entering the Peace River from Mobil Oil Company's settling pond was not toxic to the test organisms, Daphnia pulex, Pimephales promelas and Heterandria formosa. No P. promelas or H. formosa died and only a few random D. pulex mortalities were noted during the 48 hour static tests. Additionally, a few D. pulex were not found in certain test chambers due to the opacity of the sample. Note that the water layer was separated from the sediment-slurry layer of the sample prior to the bioassays, therefore, the effects these sediments may have on aquatic organisms were not evaluated.

LITERATURE CITED

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