

BIOASSAYS OF EAST COAST ASPHALT

OAKLAND PARK, BROWARD COUNTY, FLORIDA

NO NPDES PERMIT

SAMPLED 10/21/85

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Biology Section
Division of Environmental Programs

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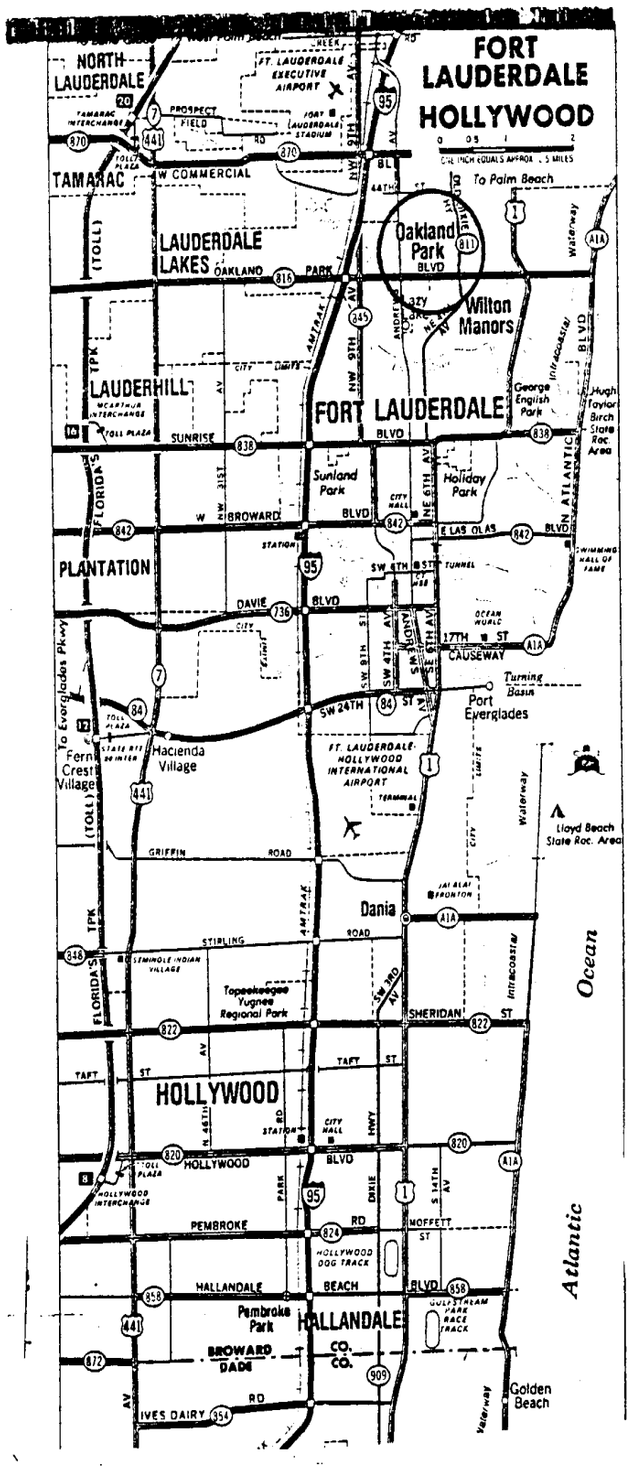
EXECUTIVE SUMMARY

East Coast Asphalt, Broward County, on 22 to 24 October, 1985.

The Biology Section performed two 48 hour static acute toxicity bioassys on a sample of wastewater collected from a discharge pipe leading to a receiving pond. The sample was lethal to a significant number of Daphnia pulex, but no LC_{50} is reported due to the unusual distribution of mortality. The sample was not lethal to any Notropis leedsi. Chemical analyses indicated the presence of small concentrations of silver (0.3 ug/l) and zinc (14 ug/l) in this sample. No organic compounds were detected.

INTRODUCTION

The East Coast Asphalt facility is located at 1790 NW 27th Street, Oakland Park, Broward County, Florida (Fig. 1). The company apparently produces asphalt for road construction. Wastewater from this process is discharged to a holding pond. At the request of DER's Southeast District, the Biology Section performed two 48 hour static acute toxicity bioassays to evaluate the toxicity of this wastewater discharge. The tests were performed from 22 to 24 October, 1985. The results are presented in this report. Those involved in performing the tests and in preparation of this report were: R. B. Frydenborg, M. L. Moultrie, and M. L. Roll.



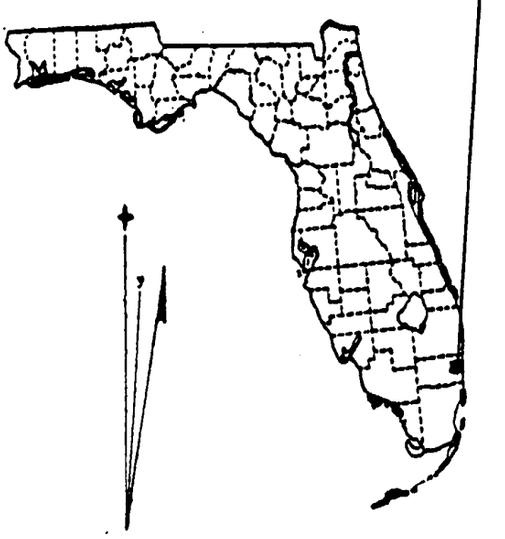


Figure 1. Portions of Broward County, Florida, including the study area.

METHODS AND MATERIALS

Test methods used to conduct these static bioassays are extensively described by Peltier and Weber (1985) and the FDER Biology Section (1985). The organisms selected for this study include a species recommended by Peltier and Weber (1985), the U.S. EPA (1978), and the FDER Biology Section (1985). Additionally, the Biology 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, once daily on weekends, and are kept at a constant temperature of 22° ± 2°C. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess organisms, and then refilling 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.

Notropis leedsi (bannerfin shiner) - Approximately 40 adult bannerfin shiners were obtained from an indigenous population in the upper Suwannee River during October, 1981. The breeding stock is maintained in 30 and 125 gallon all-glass aquaria equipped with a flow-through water exchange system. Water for this system is unchlorinated and is pumped from the DER deep well. The bannerfin shiners are reared at 22° ± 2°C under a 16:8 hour light-dark cycle and are fed Tetra-Min® and frozen Artemia (brine shrimp) twice daily, and once daily on weekends. Breeding and egg hatching are encouraged at 25°C. The eggs are laid between stacked red ceramic tiles separated by a 3mm bead of silicone. Most of the eggs adhere to the tiles and are easily removed to heated, aerated hatching tanks. The narrow space between the tiles eliminates egg predation by adult fish. New hatching tanks are started regularly to segregate fry into even age groups. Newly hatched fry are fed a liquefied blend of Purina Trout Chow® and Cerophyl® twice daily. After one week, feeding is augmented with newly hatched Artemia nauplii and finely crushed Tetra Min®. The fish used in this test were less than 4 weeks old at the time of the test.

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

Test Methods

Methods used to perform acute toxicity bioassays are described by Peltier and Weber (1985) and the FDER Biology Section (1985). Some of the methods described below are more specific than those of Peltier and Weber. These will be noted in more detail.

Sampling Methods and Test Dates

Two separate 48 hour static acute toxicity bioassays were performed on a sample of East Coast Asphalt's discharge pipe. The tests were performed from 1050 hours on 22 October to 1105 hours on 24 October, 1985.

The sample was collected by Mr. Brad Rieck of DER's Southeast District at 1405 hours on 21 October, 1985, using standard wastewater sampling procedures. Separate samples were obtained for chemical and biological testing. Samples for metal analyses were preserved with HNO_3. Samples for organic chemical analyses and for the bioassays were unpreserved. The samples were iced and transported to the DER laboratory in Tallahassee for analyses within 24 hours of collection.

Test Temperature

Upon arrival of the iced (4°C) bioassay sample in the Tallahassee laboratory, the containers were placed in warm water and the temperature of the sample allowed to rise to 20° $\pm$ 2°C. Although this temperature may be different than the temperature of the sample during collection, it is the temperature range to which the test organisms are acclimatized and is the range recommended in the above referenced bioassay protocols. This avoids stressful effects caused by exposure to unusually cold or warm samples.

Freshwater Tests

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 an abbreviated version of that recommended by APHA (1980).

Two replicates, of each concentration 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 pulex were siphoned into a large culture dish to isolate the proper size and age organisms (neonates). To accomplish this, the water fleas 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 fed during this test.

Two replicates, of each concentration and a control, were used for the Notropis leedsi (bannerfin shiner) bioassay. 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. Fish were not fed during this test.

Dissolved oxygen (YSI Model 57 oxygen meter), pH (Corning Model 7 pH meter with Orion Ross® combination electrode), temperature (NBS calibrated glass thermometer), and the number of live organisms were recorded for each test concentration at 0 hours, 24 hours, and 48 hours. Total alkalinity and total hardness (measured as $CaCO_3$ using HACH Chemical Company reagents) were recorded at the beginning of the test for the controls and the 100% effluent concentration. The specific conductance (YSI Model 33 S-C-T meter) of each test concentration was recorded at the beginning and end of the test. All instruments were calibrated daily according to manufacturer's recommendations. Ammonia concentrations, including the total and unionized fraction (expressed in mg/l as N and as NH_3, respectively), were recorded in the control and the 100% effluent test concentration at the beginning of the test. Total ammonia concentrations were determined using an Orion® specific ion probe and an Orion Ionalyzer®. The unionized fraction was then calculated based on the total ammonia concentration, and the pH, temperature, and salinity of the sample. These values were recorded on the bioassay data forms and are presented in Tables 2 and 3.

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

Daphnia pulex (water flea)

Concentration	Dilution Water	Effluent	Total Volume
Control	200.0 ml	-------	200 ml
10.0%	180.0 ml	20.0 ml	200 ml
32.0%	136.0 ml	64.0 ml	200 ml
56.0%	88.0 ml	112.0 ml	200 ml
100.0%	--------	200.0 ml	200 ml

Notropis leedsi (bannerfin shiner)

Concentration	Dilution Water	Effluent	Total Volume
Control	500 ml	-------	500 ml
10.0%	450 ml	50 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 East Coast Asphalt, Oakland Park, Broward County, Florida, on 22 to 24 October, 1985.

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Temperature (°C)			Conductivity (umhos)	
	0	24	48	0	24	48	0	24	48	0	24	48	0	48
Control	10	10	10	8.0	8.0	8.4	7.8	8.1	7.9	22.7	21.2	20.9		
Control	10	9	8	8.0	8.0	8.4	7.9	8.1	7.9				205	210
10.0%	10	9	3	8.1	8.0	8.4	8.1	8.2	7.9	22.3	21.2	20.8		
10.0%	10	8	6	8.1	8.0	8.5	8.1	8.2	7.9				230	260
32.0%	10	8	6	8.1	8.0	8.4	8.1	8.2	8.0	21.9	21.2	20.8		
32.0%	10	9	3	8.1	8.0	8.2	8.1	8.2	8.0				300	315
56.0%	10	9	9	8.0	7.9	8.2	8.0	8.2	8.0	21.7	21.3	20.8		
56.0%	10	9	5	8.0	7.9	8.3	8.0	8.2	8.0				360	370
100.0%	10	8	5	7.7	7.8	7.9	8.0	8.1	8.0	21.3	21.3	20.8		
100.0%	10	7	7	7.7	7.8	8.0	8.0	8.1	8.0				460	480

Control Water

NH_3(as NH_3)(mg/l) 0

Total ammonia (as N)(mg/l) 0

Total Alkalinity 115 (mg/l $CaCO_3$)

Total Hardness 120 (mg/l $CaCO_3$)

100% Effluent

NH_3(as NH_3)(mg/l) 0.03

Total ammonia (as N)(mg/l) 0.56

Total Alkalinity >1000 (mg/l $CaCO_3$)

Total Hardness -a (mg/l $CaCO_3$)

[a] Unable to measure due to opacity of sample.

Table 3. Data recorded during 48 hour, Notropis leedsi, static acute toxicity bioassay of East Coast Asphalt, Oakland Park, Broward County, Florida on 22 to 24 October, 1985.

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Temperature (°C)			Conductivity (umhos)	
	0	24	48	0	24	48	0	24	48	0	24	48	0	48
Control	5	5	5	8.1	7.9	8.4	7.8	8.0	7.9	22.4	21.3	20.9		
Control	5	5	5	8.1	7.9	8.4	7.8	8.0	7.9				215	220
10.0%	5	5	5	8.1	7.9	8.4	8.0	8.1	8.0	22.2	21.3	20.9		
10.0%	5	5	5	8.1	7.9	8.5	8.0	8.1	8.0				240	230
32.0%	5	5	5	8.1	7.8	8.5	8.1	8.1	8.1	22.0	21.2	20.8		
32.0%	5	5	5	8.1	7.8	8.4	8.1	8.1	8.0				290	300
56.0%	5	5	5	8.0	7.8	8.2	8.0	8.1	8.0	21.9	21.0	20.5		
56.0%	5	5	5	8.0	7.8	8.2	8.0	8.1	8.0				370	370
100.0%	5	5	5	7.5	7.6	8.0	8.0	8.1	7.9	21.3	21.0	20.5		
100.0%	5	5	5	7.5	7.6	8.2	8.0	8.1	7.9				470	475

Control Water

NH_3(as NH_3)(mg/l): 0

Total ammonia (as N)(mg/l): 0

Total Alkalinity 115 (mg/l $CaCO_3$)

Total Hardness 120 (mg/l $CaCO_3$)

100% Effluent

NH_3(as NH_3)(mg/l): 0.03

Total ammonia (as N)(mg/l): 0.56

Total Alkalinity ≥ 1000 (mg/l $CaCO_3$)

Total Hardness -a (mg/l $CaCO_3$)

[a] Unable to measure due to opacity of sample.

Table 4. Results of Chemical Analyses performed on Wastewater from East Coast Asphalt, Oakland Park, Broward County, collected 21 October, 1985.

Organics	
Acid Extractable:	N.D.
Base Neutral Extractables:	N.D.
Metals	
Arsenic	< 3 ug/l[a]
Cadmium	N.D.
Chromium	N.D.
Copper	N.D.
Lead	-[b]
Mercury	N.D.
Nickel	N.D.
Selenium	N.D.
Silver	0.3 ug/l
Zinc	14 ug/l

N.D = None Detected

a Actual value is know to be less than value given

b Lead Analysis was invalidated

RESULTS AND DISCUSSION

The sample of East Coast Asphalt's wastewater discharge to a holding pond was lethal to a significant number of Daphnia pulex (Table 2). Most of the mortality occurred in the low test concentrations. However, an LC_{50} for this test is not reported due to the unusual distribution of mortality. This sample was not toxic to any Notropis leedsi (Table 3). A small amount of ammonia (0.56 mg/l and 0.03 mg/l unionized) was detected in this sample. Chemical analyses (Table 4) indicated the presence of small concentrations of silver (0.03 ug/l) and zinc (14 ug/l) in this sample. No organic compounds were detected.

LITERATURE CITED

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