

BIOASSAYS OF THE BEULAH LANDFILL

PENSACOLA, ESCAMBIA COUNTY, FLORIDA

NO NPDES PERMIT

SAMPLED 12/3/84

February 12, 1985

Biology Section
Division of Environmental Programs

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Bureau of Laboratories
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EXECUTIVE SUMMARY

Beulah Landfill, Escambia County, on 4 to 7 December, 1984.

The sample collected from an unnamed creek near the Beulah Landfill was not acutely toxic to the test organisms, Daphnia pulex or Notropis leedsi during the 72 hour static tests. Only random mortalities were noted during the D. pulex test, while no mortalities occurred in the N. leedsi test. Chemical analyses failed to detect the presence of any organic or metal contaminants in the sample.

INTRODUCTION

The Beulah Landfill is located near Pensacola, Escambia County, Florida (Fig. 1). According to district personnel, this site has received sludge from municipal waste facilities for decades. Leachate from this facility may enter an unnamed creek on site which flows into Eleven Mile Creek.

To evaluate the potential toxicity of this creek, DER's Northwest District requested that toxicity bioassays be performed. The Biology Section received a sample from this unnamed creek and performed two 72 hour static acute toxicity bioassays on 4 to 7 December, 1984. The results of these tests are presented in this report. Those involved in performing these tests and in preparation of this report were: R. B. Frydenborg, M. L. Moultrie, and M. L. Roll.

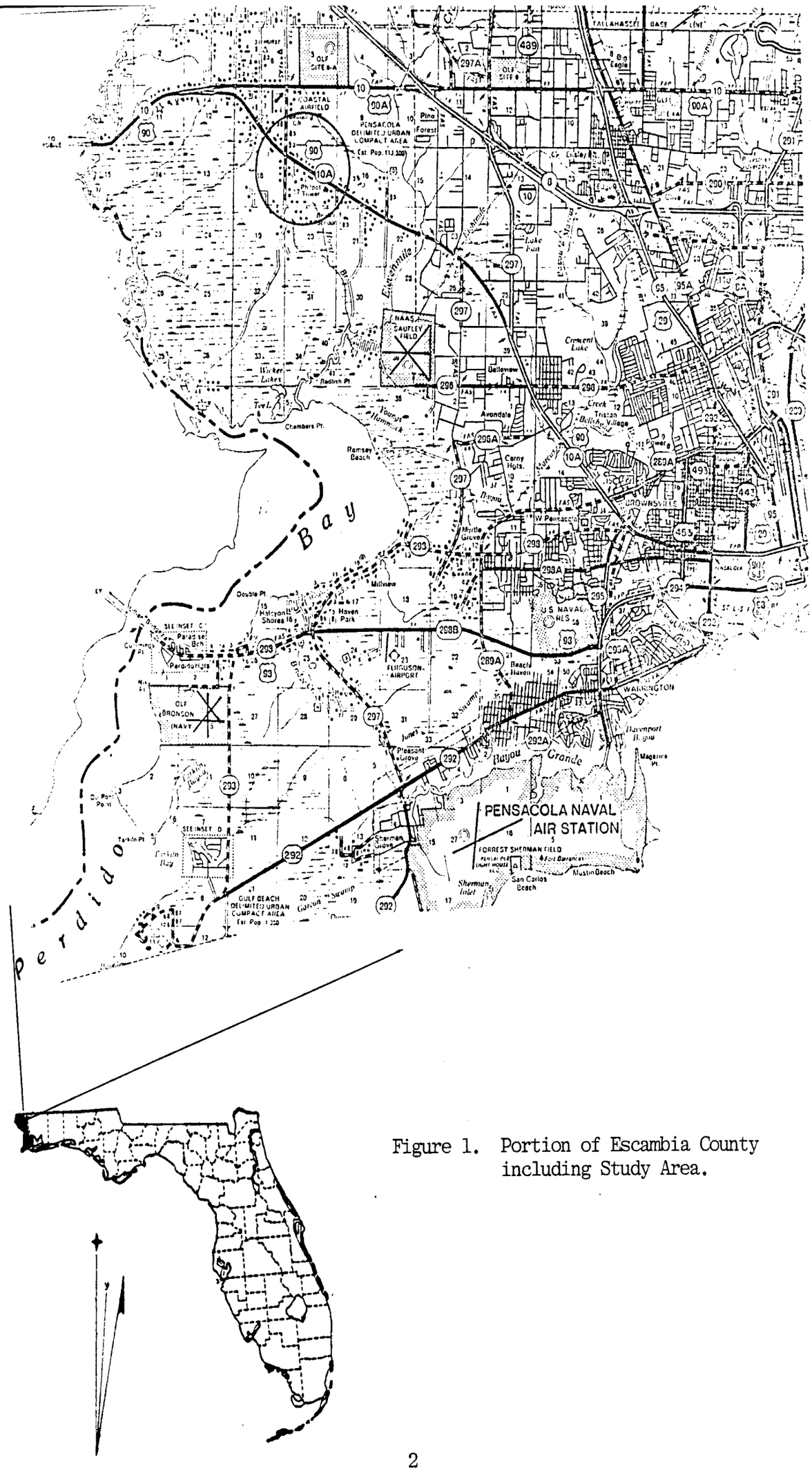


Figure 1. Portion of Escambia County including Study Area.

METHODS AND MATERIALS

Test methods used to conduct these static bioassays are extensively described by Peltier (1978) and the FDER Biology Section (1983). The organisms selected for this study include a species recommended by Peltier (1978), the U.S. EPA (1978), and the FDER Biology Section (1983). 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° plus or minus 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° plus or minus 2°C under a 16:8 hour light 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 14 days 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

Two 72 hour static bioassays were conducted on a sample collected from an unnamed creek at the Beulah Landfill from 0920 hours on 4 December to 0940 hours on 7 December, 1984.

The sample was collected by Ms. Lisa Milliman of DER's Northwest District at 1406 hours on 3 December, 1984, 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.

Freshwater for dilution of the 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 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 not fed during this test.

Two replicates, of six concentrations 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, 48 hours, and 72 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% 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 controls 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
5.6%	188.8 ml	11.2 ml	200 ml
10.0%	180.0 ml	20.0 ml	200 ml
18.0%	164.0 ml	36.0 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
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 72 hour, Daphnia pulex, static acute toxicity bioassay of Beulah Landfill, Escambia County, Florida, on 4 to 7 December, 1984.

Concentration or %	Number of Live Organisms				Dissolved Oxygen (mg/l)				pH				Temperature (°C)				Conductivity (umhos)		NH_3/N (mg/l)	
	0	24	48	72	0	24	48	72	0	24	48	72	0	24	48	72	0	72	0	48
Control	10	10	9	9	8.2	8.0	8.2	9.0	7.7	8.0	8.2	8.2	21.4	20.7	20.6	19.3				
Control	10	10	8	7	8.3	8.0	8.2	9.0	7.7	8.1	8.2	8.2					219	218	0	
5.6%	10	10	7	5	8.4	8.2	8.1	8.8	7.6	8.1	8.2	8.2	21.4	20.5	20.5	19.2				
5.6%	10	10	9	7	8.4	8.2	8.1	8.8	7.6	8.1	8.2	8.2					210	208		
10.0%	10	10	9	9	8.3	8.3	8.1	9.0	7.6	8.1	8.2	8.2	20.4	20.4	20.4	19.2				
10.0%	10	10	8	8	8.3	8.3	8.1	9.0	7.6	8.1	8.2	8.2					201	200		
18.0%	10	10	10	10	8.4	8.3	8.0	8.9	7.6	8.1	8.1	8.2	21.3	20.4	20.5	19.3				
18.0%	10	10	9	8	8.4	8.3	8.0	8.9	7.6	8.1	8.1	8.2					189	189		
32.0%	10	10	10	10	8.5	8.0	7.9	8.9	7.5	8.1	8.0	8.1	20.9	20.3	20.5	19.0				
32.0%	10	9	9	9	8.5	8.0	7.9	8.9	7.5	8.1	8.0	8.1					162	163		
56.0%	10	10	9	9	8.5	8.0	8.0	8.9	7.5	8.1	7.9	8.1	20.6	20.3	20.5	18.9				
56.0%	10	10	10	10	8.5	8.0	8.0	8.9	7.5	8.1	7.9	8.1					123	123		
100.0%	10	10	10	10	9.2	8.0	8.0	8.7	6.6	7.4	7.3	7.7	20.0	20.3	20.4	19.2				
100.0%	10	10	10	10	9.2	8.0	8.0	8.7	6.6	7.4	7.3	7.7					47	48	.00/.35	

Control Water

Total Alkalinity 83 (mg/l $CaCO_3$)

Total Hardness 105 (mg/l $CaCO_3$)

100% Sample

Total Alkalinity 0 (mg/l $CaCO_3$)

Total Hardness 20 (mg/l $CaCO_3$)

Table 3. Data recorded during 72 hour, Notropis leedsi, static acute toxicity bioassay of Beulah Landfill, Escambia County, Florida, on 4 to 7 December, 1984.

Concentration or %	Number of Live Organisms				Dissolved Oxygen (mg/l)				pH				Temperature (°C)				Conductivity (umhos)		NH_3/N (mg/l)	
	0	24	48	72	0	24	48	72	0	24	48	72	0	24	48	72	0	72	0	48
Control	5	5	5	5	8.4	7.8	7.8	8.7	7.7	8.0	8.0	8.2	21.4	20.5	20.6	19.1				
Control	5	3	3	3	8.4	7.8	7.8	8.7	7.7	8.0	8.0	8.2					220	219		
5.6%	5	5	5	5	8.4	8.0	8.0	8.7	7.7	8.0	8.1	8.2	21.3	20.2	20.4	18.7				
5.6%	5	5	5	5	8.4	8.0	8.0	8.7	7.7	8.0	8.1	8.2					212	209		
10.0%	5	5	5	5	8.5	8.0	8.1	8.6	7.7	8.0	8.1	8.2	21.0	19.9	20.2	18.6				
10.0%	5	5	5	5	8.5	8.0	8.1	8.6	7.7	8.0	8.1	8.2					204	200		
18.0%	5	5	5	5	8.6	8.0	8.1	8.6	7.6	8.0	8.1	8.2	20.9	19.8	20.0	18.6				
18.0%	5	5	5	5	8.6	8.0	8.1	8.6	7.6	8.0	8.1	8.2					191	191		
32.0%	5	5	5	5	8.7	8.0	8.1	8.5	7.6	8.0	8.0	8.1	20.8	19.8	20.1	18.6				
32.0%	5	5	5	5	8.7	8.0	8.1	8.5	7.6	8.0	8.0	8.1					168	165		
56.0%	5	5	5	5	9.0	7.9	8.0	8.5	7.4	8.0	7.9	8.0	20.4	19.8	20.1	18.7				
56.0%	5	5	5	5	9.0	7.8	8.0	8.5	7.4	8.0	7.9	8.0					123	123		
100.0%	5	5	5	5	9.1	8.0	7.9	8.4	6.6	7.4	7.3	7.7	19.9	19.9	20.2	18.9				
100.0%	5	5	5	5	9.1	8.0	7.9	8.4	6.6	7.3	7.3	7.7					45	49	0/.35	

Control Water

Total Alkalinity 83 (mg/l $CaCO_3$)

Total Hardness 105 (mg/l $CaCO_3$)

100% Sample

Total Alkalinity 0 (mg/l $CaCO_3$)

Total Hardness 20 (mg/l $CaCO_3$)

Table 4. Results of Chemical Analyses Performed on a Sample Collected Near the Beulah Landfill, Escambia County, on December 3, 1984.

Organics	
Acid Extractables:	N.D.
Base Neutral Extractables:	N.D.
Pesticide Extractables:	N.D.
Metals	
Aluminum	N.D.
Arsenic	N.D.
Cadmium	N.D.
Chromium	N.D.
Copper	N.D.
Lead	N.D.
Nickel	N.D.
Selenium	N.D.
Silver	N.D.
Zinc	N.D.

N.D. = None Detected

RESULTS AND DISCUSSION

The sample collected from an unnamed creek near the Beulah Landfill was not acutely toxic to the test organisms, Daphnia pulex or Notropis leedsi during the 72 hour static tests. Only random mortalities were noted during the D. pulex test (Table 2), while no mortalities occurred in the N. leedsi test (Table 3). Chemical analyses failed to detect the presence of any organic or metal contaminants in this sample (Table 4).

LITERATURE CITED

American Public Health Association. 1980. Standard Methods for the Examination of Water and Wastewater. 15th ed. 1134 p.

Florida Department of Environmental Regulation, Biology Section. 1983. Quality Assurance Manual for Performing Acute Toxicity Tests. FDER. 22 p.

Peltier, W. 1978. Methods for measuring the acute toxicity of effluents to aquatic organisms. Environmental Research Laboratory. Athens, Georgia. EPA-600/4-78-012 (Revised July 1978). 51 p.