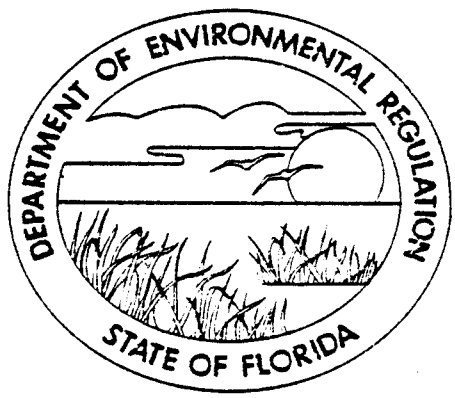


BIOASSAYS OF LEACHATE WASTEWATER

FROM SKIMMER POND

JACKSONVILLE NAVAL AIR STATION

DUVAL COUNTY, FLORIDA

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Biology Section
Bureau of Water Analysis
January 31, 1984

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EXECUTIVE SUMMARY

Skimmer Pond Wastewater, Jacksonville N.A.S., on 7 to 9 December, 1983.

The sample of leachate contaminated wastewater from an oil, grease and organic type skimmer pond, located at the Jacksonville Naval Air Station, was not toxic to the test organisms, Notropis leedsi and Daphnia pulex. No N. leedsi, and only one of 20 D. pulex in the 56% test concentration, died during the 48 hour static tests. However, since the sample had an oily and organic odor, and the facility had applied for a permit to discharge this wastewater, certain chemical analyses were requested to further characterize the sample. However, these analyses failed to indicate the presence of any organic contaminant.

INTRODUCTION

The Jacksonville Naval Air Station is located south of the city of Jacksonville on the St. Johns River, Duval County, Florida (Fig. 1). The facility apparently has one or more landfills containing oil, grease, organic and other wastes. Perimeter ditches surround these landfills and receive leachate and other waste material seeping from the landfill. The Naval Air Station apparently wishes to discharge water from at least one of these perimeter ditches and has applied for a permit from the local authorities to do so.

To evaluate the toxicity potential of wastewater from these perimeter ditches to aquatic organisms, Mr. Dennis Murrin of DER's Northeast District requested acute toxicity bioassays be performed. A sample was collected on December 6, 1983, from one of these perimeter ditches just downstream from an oil skimmer. It was noted during sampling that fish and aquatic vegetation were living in the perimeter ditch wastewater (Ms. Teresa Rhodes, personal communication). Two 48 hour static acute toxicity bioassays were performed on December 7 to 9, 1983. The results of these tests are presented in this report. Those involved in performing these tests and in preparation of this report were: C. W. Dye, R. B. Frydenborg, and M. L. Roll.

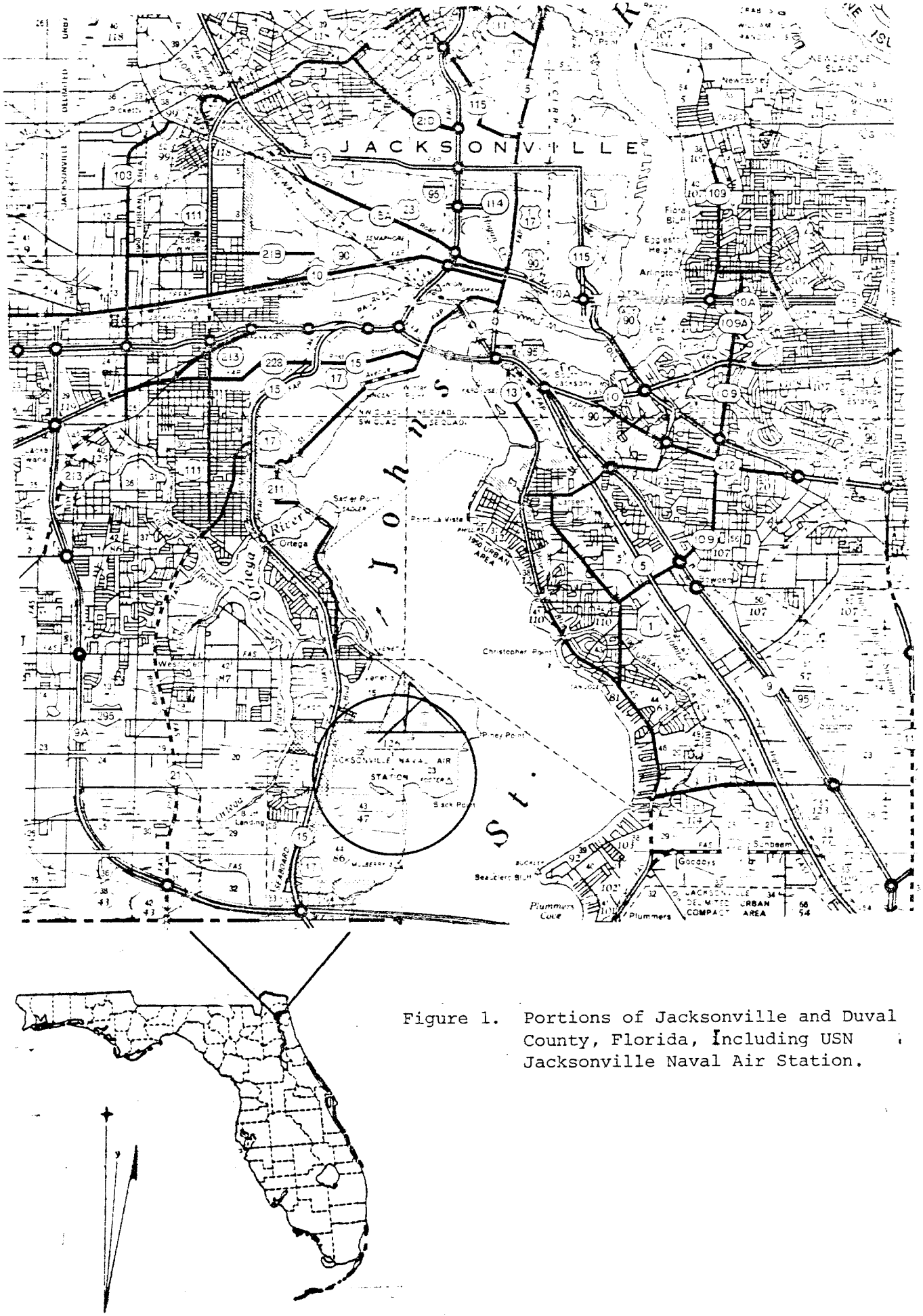


Figure 1. Portions of Jacksonville and Duval County, Florida, Including USN Jacksonville Naval Air Station.

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, 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. 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.

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. Breeding and egg hatching are encouraged at 25°C. The eggs are laid under a 1" thick slab of marble raised 3 mm above a removable horizontal pane of glass. Most of the eggs adhere to the glass and are easily removed to an aerated hatching tank. The narrow space between the marble slab and glass eliminates egg predation by adult fish. New hatching tanks are started weekly 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 approximately 30 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 48 hour static acute toxicity bioassays were performed on a sample of perimeter ditch wastewater surrounding a landfill at the Jacksonville Naval Air Station. The tests were performed from 0930 hours on 7 December to 0930 hours on 9 December, 1983.

The sample was collected by Ms. Teresa Rhodes of DER's Northeast District at 1030 hours on 6 December, 1983, using standard wastewater sampling procedures. Separate samples were obtained for chemical and biological testing. 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 wastewater 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 chamber 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 controls and the 100% 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 48 hour, Daphnia pulex, static acute toxicity bioassay of Jacksonville N.A.S., perimeter ditch wastewater, on 7 to 9 December, 1983.

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 (^oc)			NH_3/N (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	10	8.6	8.9	8.7	7.8	7.8	8.2	85		130		20.6	19.5	19.5	0/0	--		
Control	10	10	10	8.6	8.9	8.7	7.8	7.8	8.2										205	202
5.6%	10	10	10	8.6	8.9	8.7	7.8	7.9	8.2					20.5	19.4	19.4				
5.6%	10	10	10	8.6	8.9	8.7	7.8	7.9	8.2										232	225
10.0%	10	10	10	8.7	8.9	8.7	7.8	8.1	8.2					20.5	19.4	19.4				
10.0%	10	10	10	8.7	8.9	8.7	7.8	8.1	8.2										255	248
18.0%	10	10	10	8.7	8.9	8.7	7.8	8.1	8.3					20.5	19.4	19.4				
18.0%	10	10	10	8.7	8.9	8.7	7.8	8.1	8.3										298	283
32.0%	10	10	10	8.7	8.7	8.7	7.8	8.2	8.3					20.5	19.3	19.3				
32.0%	10	10	10	8.7	8.7	8.7	7.8	8.2	8.3										368	350
56.0%	10	10	9	8.8	8.7	8.7	7.7	8.2	8.4					20.3	19.4	19.3				
56.0%	10	10	10	8.8	8.7	8.7	7.7	8.2	8.4										480	458
100.0%	10	10	10	8.9	8.6	8.7	7.7	8.2	8.4	210		280		203	19.5	19.4	.03/1.4	--		
100.0%	10	10	10	8.9	8.6	8.7	7.7	8.2	8.4										740	720

Remarks:

Table 3. Data recorded during 48 hour, Notropis leedsi[a], static acute toxicity bioassay of Jacksonville N.A.S., perimeter ditch wastewater, on 7 to 9 December, 1983.

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/N (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	8.5	8.5	8.2	7.8	8.2	8.3	85		130		20.9	19.4	19.5	0/0	--		
Control	5	5	5	8.5	8.5	8.2	7.8	8.2	8.3										208	200
5.6%	5	5	5	8.6	8.5	8.4	7.8	8.2	8.3					20.7	19.4	19.4				
5.6%	5	5	5	8.6	8.5	8.4	7.8	8.2	8.3										235	225
10.0%	5	5	5	8.7	8.6	8.5	7.8	8.2	8.3					20.6	19.4	19.4				
10.0%	5	5	5	8.7	8.6	8.5	7.8	8.2	8.3										260	248
18.0%	5	5	5	8.7	8.5	8.5	7.8	8.2	8.3					20.6	19.4	19.4				
18.0%	5	5	5	8.7	8.5	8.5	7.8	8.2	8.3										302	285
32.0%	5	5	5	8.7	8.4	8.5	7.8	8.2	8.3					20.5	19.2	19.4				
32.0%	5	5	5	8.7	8.4	8.5	7.8	8.2	8.3										370	350
56.0%	5	5	5	8.8	8.2	8.4	7.7	8.2	8.3					20.4	19.2	19.4				
56.0%	5	5	5	8.8	8.2	8.4	7.7	8.2	8.3										488	459
100.0%	5	5	5[b]	8.9	8.1	8.2	7.7	8.2	8.3	210		280		20,4	19.4	19.4	.03/1.4	--		
100.0%	5	5	5[b]	8.9	8.1	8.2	7.7	8.2	8.3										760	720

Remarks: [a] Weight of fish: 5.04 mg each, average of 9 fish.
[b] Organisms stressed, swimming erratically.

Table 4. Results of Organic Analyses Performed on a Sample of Perimeter Ditch Wastewater Surrounding Landfill, Jacksonville N.A.S., collected December 6, 1983.

Base Neutral Extractables:	None Detected
Pesticide Extractables:	None Detected

RESULTS AND DISCUSSION

The sample of perimeter ditch wastewater, surrounding a landfill at the Jacksonville Naval Air Station, was not toxic to the test organisms, Daphnia pulex and Notropis leedsi. No N. leedsi, and only one of 20 D. pulex in the 56% test concentration, died during the 48 hour static tests. However, it was noted that the fish in the 100% test concentration were stressed and swimming erratically (Table 3). Because of this erratic fish behavior and since the sample had an oily and organic odor, chemical analyses for certain organics were requested to further characterize the sample. These analyses, however, failed to indicate the presence of any organic contaminant.

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