BIOASSAYS OF ANCHOR HOCKING CORPORATION

PLANT NO. 7

DUVAL COUNTY, FLORIDA

NPDES #FL0000981

SAMPLED 8/30/81

Biological Section
Bureau of Water Analysis
September 17, 1981

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EXECUTIVE SUMMARY

Bioassays of Anchor Hocking Corp. (1 to 3 September 1981)

This particular grab sample from the Anchor Hocking Corporation Plant No. 7 was not acutely toxic to the organisms tested. Several Daphnia pulex died during the course of this test. However, this mortality was not sufficient for the calculation of a statistically sound LC_{50} value. Possibly these deaths resulted from the high pH (9.1 standard units) and the oil slick observed in the higher test concentration. This oil trapped several water fleas on the surface layer and two of the Daphnia were washed onto the side of the container. None of the killifish died during this test.

INTRODUCTION

The Anchor Hocking Corporation Plant No. 7 is a glass container manufacturer located at 2121 Huron Street in Jacksonville, Duval County, Florida (Fig. 1). This facility's production rate is 693 tons per day of glass. It operates seven days per week. Wastewater generated in the glass making operation consists of 0.5MGD cooling water with biodegradable oil added for lubrication. The wastewater may also contain grease and machine oil leakage. Treatment, prior to discharge to a ditch which flows into McCoy Creek (a tributary of the St. Johns River), consists of an oil separation facility.

According to an Operation and Maintenance Inspection Report (August 1980), up to 251 pounds per day of oil and grease are used. Difficulties in removing these organics from the wastewater stream are reflected in the violations noted between December 1977 and March 1978, when NPDES permit limitations were exceeded for: chemical oxygen demand, bio-chemical oxygen demand, total suspended solids, and oil and grease (NPDES Permit Files).

To evaluate the existence and extent of toxicity of the Anchor Hocking discharge to the biota of the receiving waters, the Biological Section performed a series of static acute toxicity bioassays during 1 to 3 September 1981. The results of these tests are presented in this report.

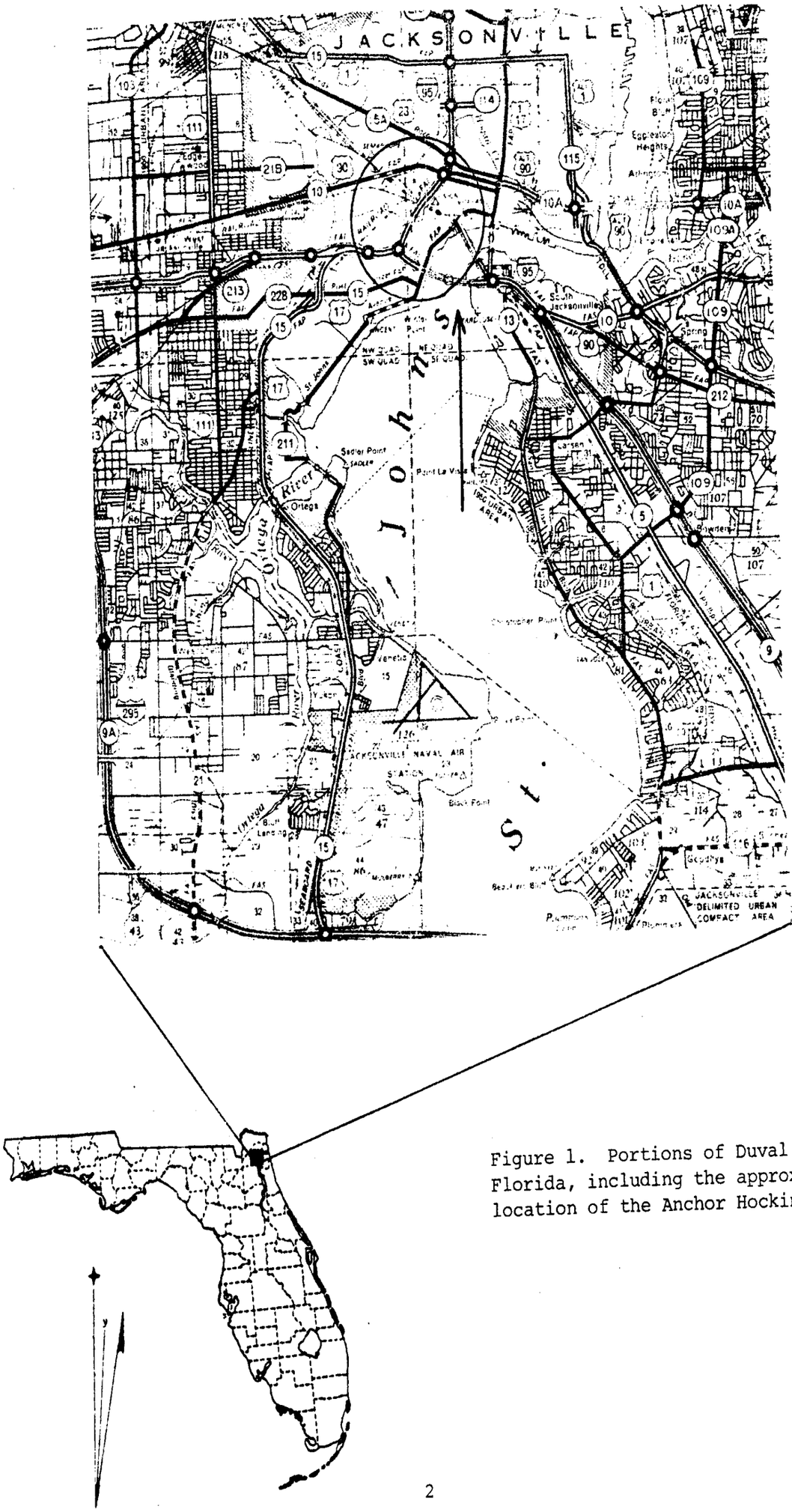


Figure 1. Portions of Duval County, Florida, including the approximate location of the Anchor Hocking Corp.

METHODS AND MATERIALS

Test methods used to conduct these static bioassays are extensively described by Peltier (1978). The organism 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. 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 2½ gallon all glass aquaria filled with unchlorinated DER well water, using 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° ± 1°C. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess daphnids. 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.

Simocephalus serrulatus (water flea) - An indigenous breeding population of S. serrulatus was collected from Lake Jackson, Leon County, Florida, in March, 1980, by personnel from DER's Biological Section. Positive identification of the organism was performed by Mr. Jeff Foran of the Department of Environmental Engineering Sciences, University of Florida in Gainesville. The cultures are maintained in 2½ gallon all glass aquaria, filled with unchlorinated DER well water, under a 16:8 hour light-dark cycle. The organisms are fed a liquified blend of Purina Trout Chow® and Cerophyl® twice daily, and are kept at a constant temperature of 22° ± 1°C. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess population. They are then refilled with fresh aerated well water. Additional measures are taken and/or new cultures started in the event of abnormal circumstances.

Heterandria formosa (least killifish) - Approximately 100 adult killifish were obtained from a wild population in the St. Marks Wildlife Refuge (Wakulla County, Florida) during August, 1980. The fish have been maintained in 2½ to 5 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 fish have been reared at 22° ± 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 two to four 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 bioassays were conducted from 1315 hours on 1 September to 1315 hours on 3 September, 1981, on a grab sample of effluent collected at the point of discharge. The sample was collected by Ms. Teresa Ashworth of the DER St. Johns River Subdistrict at 1430 hours on 31 August, 1981. The unpreserved sample is iced and transported to the DER laboratory in Tallahassee within 24 hours of collection.

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 (1976).

Two replicates, each with six concentrations and a control, were used to test with Daphnia pulex and Simocephalus serrulatus. 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. The Daphnia and Simocephalus were siphoned into respective large culture dishes through a stainless steel screen to isolate the proper size and age organisms (neonates). These neonates were then transferred individually by glass pipette, examined for injury, and were loaded 10 per chamber, resulting in 20 per test concentration.

Two replicates, of six concentrations and a control, were used for the Heterandria formosa bioassay. The fish were transferred individually or by twos, by net, into wide mouth quart jars containing 500 ml each of the appropriate test concentration. The Heterandria were loaded 5 per chamber resulting in 10 per concentration.

Dissolved oxygen, temperature, pH, and the number of live organisms were recorded for each test chamber at 0 hours, 24 hours, and 48 hours. Total alkalinity, a total hardness, total ammonia, and unionized ammonia[1] were recorded at the beginning of the test for the controls and the 100% effluent concentration. The specific conductance was also determined for each test concentration at 0 and 48 hours. These values were recorded on the bioassay data forms and are presented in Tables 2, 3 and 4. None of the organisms were fed during these tests.

[1] The total ammonia concentration was determined using an Orion specific ion probe and is expressed in mg/l as N. The unionized ammonia fraction was then calculated based on pH and temperature, and, it is expressed in mg/l as NH_3.

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

Water fleas (Daphnia pulex and Simocephalus serrulatus)

Concentration	Dilution Water	Effluent	Total Vol.
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%	----	200 ml	200 ml

Least killifish (Heterandria formosa)

Concentration	Dilution Water	Effluent	Total Vol.
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%	---	500 ml	500 ml

Table 2. Data recorded during 48 hour, Daphnia pulex, static acute toxicity bioassay of Anchor Hocking Corp., Plant No. 7, Jacksonville, Duval County, Florida, NPDES #FL0000981 on 1 to 3 September, 1981.

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	9	8.6	9.3	9.2	7.9	8.2	8.2	112		122		21.9	20.0	20.0	.01/.18	---		
Control	10	10	10	8.6	9.3	9.2	7.9	8.2	8.2										217	225
5.6%	10	10	10	8.6	9.0	9.0	7.9	8.2	8.2					21.7	19.8	19.8				
5.6%	10	10	10	8.6	9.0	9.0	7.9	8.2	8.2										239	245
10%	10	10	10	8.5	8.9	9.0	8.0	8.2	8.2					21.6	19.7	19.7				
10%	10	10	9	8.5	8.9	9.0	8.0	8.2	8.2										254	257
18%	10	10	10	8.2	8.8	9.0	8.3	8.2	8.2					21.5	19.7	19.7				
18%	10	10	10	8.2	8.8	9.0	8.3	8.2	8.2										282	288
32%	10	10	10	7.7	8.7	9.0	8.6	8.3	8.2					21.2	19.6	19.5				
32%	10	10	10	7.7	8.7	9.0	8.6	8.3	8.2										309	336
56%	10	10	10	6.8	8.3	8.8	8.9	8.4	8.2					20.6	19.6	19.4				
56%	10	10	10	6.8	8.3	8.8	8.9	8.4	8.2										404	424
100%	10	10	8(9)[a]	5.4	8.4	8.9	9.1	8.6	8.3	210		195		20.3	19.5	19.5	.11/.27	---		
100%	10	10	8(9)[a]	5.4	8.4	8.8	9.1	8.6	8.3										590	610

Remarks: Oil was observed in the effluent sample.

[a] Number in parentheses used in calculations since one organism was stuck to the side of the container, above the water line, between 24 and 48 hours.

Table 3 . Data recorded during 48 hour, Simocephalus serrulatus, static acute toxicity bioassay of Anchor Hocking Corp., Plant No. 7, Jacksonville, Duval County, Florida, NPDES #FL0000981 on 1 to 3 September 1981.

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[a]	0	24	48[a]	0	24	48[a]	0	48	0	48	0	24	48[a]	0	48	0
Control	10	9	6	8.4	9.2		8.0	8.2		112		122		21.8	20.3		.01/.18		
Control	10	10	7	8.5	9.2		8.0	8.2											214
5.6%	10	9		8.5	9.0		8.0	8.2						21.8	20.2				
5.6%	10	10		8.5	8.9		8.0	8.2											237
10%	10	8		8.4	8.9		8.1	8.2						21.7	20.0				
10%	10	8		8.4	8.9		8.1	8.2											252
18%	10	9		8.3	8.8		8.3	8.2						21.6	20.0				
18%	10	9		8.3	8.8		8.3	8.2											280
32%	10	10		7.6	8.6		8.6	8.3						21.3	19.9				
32%	10	9		7.6	8.6		8.6	8.3											330
56%	10	10		6.7	8.3		8.9	8.4						20.7	20.5				
56%	10	10		8.7	8.3		8.9	8.4											409
100%	10	10		5.4	8.3		9.1	8.6		210		195		20.4	20.0		.11/.27		
100%	10	9		5.5	8.3		9.1	8.6											590

Remarks: Oil was observed in the effluent sample.

[a] This test was invalidated at 48 hours due to excessive (>20%) control mortality, therefore, the remaining parameters are not reported.

Table 4. Data recorded during 48 hour, Heterandria formosa, static acute toxicity bioassay of Anchor Hocking Corp., Plant No. 7, Jacksonville, Duval County, Florida, NPDES #FL0000981 on 1 to 3 September 1981.

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	8.6	8.6	8.1	8.0	8.0	8.1	112		122		21.4	20.5	20.5	.01/.18			
Control	5	5	5	8.6	8.6	8.1	8.0	8.0	8.1										215	225
5.6%	5	5	5	8.6	8.0	8.2	8.1	8.1	8.1					21.4	20.3	20.4				
5.6%	5	5	5	8.6	7.9	8.2	8.1	8.1	8.1										237	245
10%	5	5	5	8.5	7.8	8.2	8.2	8.1	8.1					21.7	20.1	20.2				
10%	5	5	5	8.5	7.7	8.2	8.2	8.1	8.1										253	257
18%	5	5	5	8.2	7.6	8.0	8.4	8.1	8.1					21.6	19.9	20.0				
18%	5	5	5	8.2	7.7	8.2	8.4	8.1	8.1										282	288
32%	5	5	5	7.8	7.4	7.9	8.6	8.2	8.1					21.3	19.8	19.9				
32%	5	5	5	7.8	7.2	7.7	8.6	8.2	8.1										332	336
56%	5	5	5	6.8	6.9	7.6	8.9	8.4	8.1					20.9	19.7	19.6				
56%	5	5	5	6.8	6.9	7.5	8.9	8.4	8.1										412	424
100%	5	5	5	5.4	6.8	7.3	9.1	8.7	8.2	210		195		20.1	19.6	19.5	.11/.27			
100%	5	5	5	5.3	6.9	7.3	9.1	8.7	8.3										593	610

Remarks: The fish weighed an average of 0.0166g each at the conclusion of this test.

LITERATURE CITED

American Public Health Association. 1976. Standard Methods for the Examination of Water and Wastewater. 14th ed. 1193 pp.

Peltier, William. 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 pp.

U.S. Environmental Protection Agency. 1978. Bioassay procedures for the Ocean Disposal Permit Program. Environmental Research Laboratory. Gulf Breeze, Florida. EPA-600/9-78-010.