BIOASSAYS OF GEORGIA PACIFIC (HUDSON PULP AND PAPER MILL)

PALATKA, PUTNAM COUNTY, FLORIDA

NPDES #FL0002763

SAMPLED 6/22/81

Biological Section
Bureau of Water Analysis
July 13, 1981

BIOASSAYS OF GEORGIA PACIFIC (HUDSON PULP AND PAPER MILL)

PALATKA, PUTNAM COUNTY, FLORIDA

NPDES #FL0002763

Biological Section
Bureau of Water Analysis
July 13, 1981

INTRODUCTION

The Georgia Pacific Pulp and Paper Mill, formerly Hudson Pulp and Paper, is located on State Road 216, approximately 3 miles north of Palatka, Putnam County, Florida (Figure 1). The mill produces approximately 950 tons of paper products per day using an unbleached Kraft and bleached pulp process. Effluent of from 37 to 50 MGD is discharged, with approximately one half of this consisting of process wastewater. Treatment prior to discharge includes primary clarification and 40 days retention in four oxidation ponds. The effluent is aerated in the last pond using several mechanical aerators. Discharge is to Rice Creek, a tributary of the St. Johns River. A schematic of the mill and treatment system is presented in Figure 2.

In 1975 and 1976 the mill was in violation for exceeding its permit limitations for Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS). It has also had chronic problems maintaining acceptable levels of dissolved oxygen in the receiving waters (Rice Creek). However, because Rice Creek has a low initial dissolved oxygen concentration, the mill has recently been granted a variance for this parameter. Additionally, from 5 to 30 MGD groundwater is pumped into Rice Creek to supplement its flow.

To evaluate the effects of this effluent on the biota of the receiving waters, the Biological Section performed static acute toxicity bioassays on a grab sample from Outfall #001, on 23 to 25 June, 1981. The results of these tests are presented in this report.

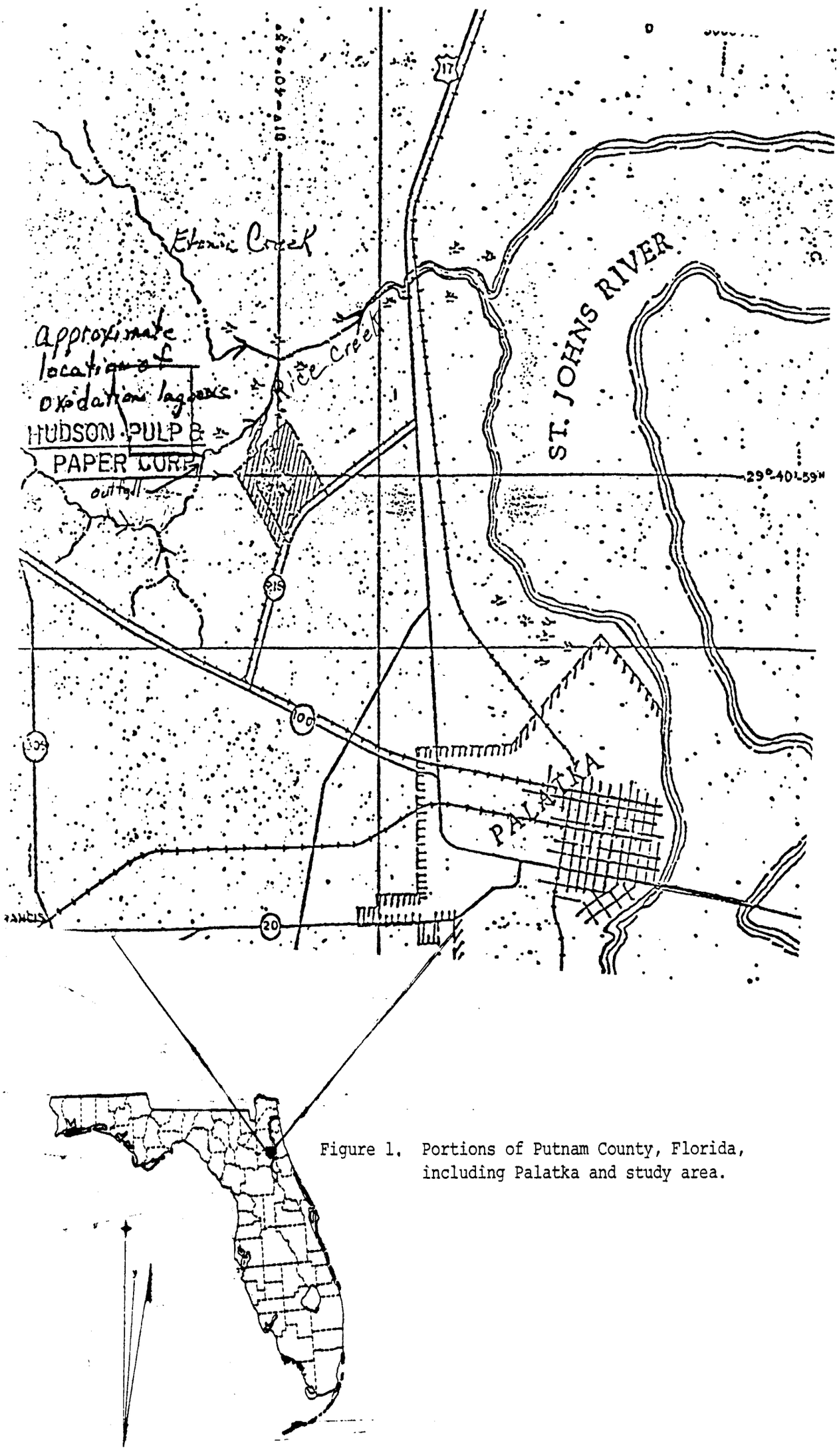
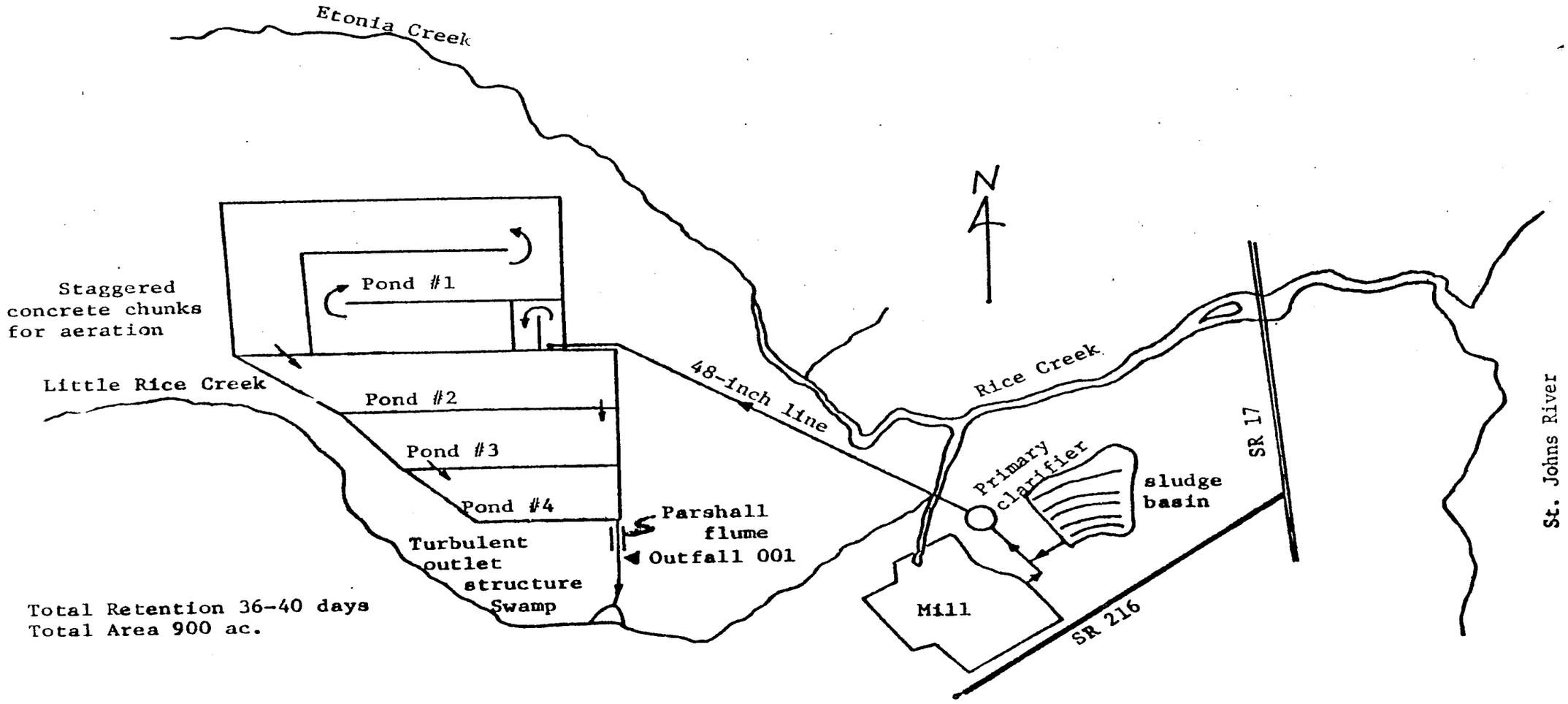


Figure 1. Portions of Putnam County, Florida, including Palatka and study area.

FIGURE 2
Hudson Pulp and Paper Company
Palatka, Florida



METHODS AND MATERIALS

Test methods used to conduct these static bioassays are extensively described by Peltier (1978). The organisms selected for this study are among those recommended by Peltier (1978) and the U.S. EPA (1978). 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.

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. The fish have been 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 fish have been reared at a temperature of 22° ± 2°C under a 16:8 hour light-dark cycle. These fish are fed Glencoe Mills Trout Chow® and frozen Artemia (bring 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 all 2 to 4 weeks old at the time of the test.

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

Two separate 48 hour static bioassays were conducted from 0955 hours on 23 June, 1981 to 0955 hours on 25 June, 1981, on a grab sample of effluent from Outfall #001. The sample was collected by Ms. Teresa Ashworth, of DER's St. Johns River Subdistrict at 0955 hours on 22 June, 1981, using standard wastewater sampling procedures. The sample was 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. 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 through a stainless steel screen to isolate the proper size and age organism (neonates). These neonates were then transferred individually by glass pipette and were loaded 10 per chamber, resulting in 20 per test concentration.

Two replicates, of six concentrations and a control, were used for the fathead minnow 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. Fathead minnows were loaded 5 per chamber resulting in 10 per concentration.

Dissolved oxygen, pH, temperature 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 were recorded at the beginning and end of the test for the controls and the 100% effluent concentration. Specific conductance was recorded for each test concentration at the beginning and end of the test. Additionally, ammonia concentrations, including total and unionized fractions[1] were recorded for the controls and 100% concentrations at 0 and 48 hours. These values were recorded on the bioassay data forms and are presented in Tables 2 and 3. Organisms were not fed during these tests.

[1] Total fraction expressed in mg/l as N, unionized fraction expressed in mg/l as NH_3. Measurements were performed with an Orion specific ion probe and a Corning pH/millivolt meter.

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

Daphnia pulex (water flea)

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

Pimephales promelas (fathead minnow)

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 Georgia Pacific Pulp and Paper, Palatka, Putnam County, Florida. NPDES #FL0002763, Outfall #001 on 23 to 25 June, 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	10	8.5	8.3	8.5	7.9	8.0	8.1	113		123		21.7	19.8	20.5	0/.06	.02/.26	210	210
Control	10	10	9	8.5	8.4	8.6	7.9	8.0	8.1											
5.6%	10	10	10	8.3	8.4	8.5	7.9	8.0	8.1					21.7	19.6	20.5			275	260
5.6%	11[a]	11	11	8.4	8.4	8.5	7.9	8.0	8.1											
10%	10	10	10	8.2	8.3	8.3	7.9	8.0	8.2					21.6	19.6	20.5			325	300
10%	10	10	10	8.2	8.3	8.4	7.9	8.0	8.2											
18%	10	10	10	8.0	8.3	8.5	7.9	8.0	8.2					21.6	19.5	20.5			415	400
18%	10	10	10	8.0	8.3	8.5	7.9	8.0	8.2											
32%	10	10	10	7.5	8.1	8.5	7.8	8.0	8.2					21.6	19.6	20.4			610	600
32%	10	10	10	7.6	8.1	8.5	7.8	8.0	8.2											
56%	10	10	10	6.9	7.7	8.4	7.8	8.0	8.3					21.5	19.6	20.5			990	900
56%	10	10	10	6.8	7.5	8.4	7.8	8.0	8.3											
100%	10	10	10	4.4	7.2	7.9	7.7	8.1	8.3	212		190		21.5	19.6	20.6	.01/.39	.02/.22	1200	1325
100%	10	10	10	4.6	7.2	7.9	7.7	8.1	8.3											

Remarks: a. Extra organism loaded by mistake

Table 3. Data recorded during 48 hour, Pimephales promelas, static acute toxicity bioassay of Georgia Pacific Pulp and Paper, Palatka, Putnam County, Florida. NPDES #FL0002763, Outfall #001 on 23 to 25 June, 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	8.4	7.0	7.5	7.9	7.8	8.0	113		123		21.9	19.8	20.6	0/.06	.02/.26	210	215
Control	5	5	5	8.4	6.6	6.9	7.9	7.8	8.0											
5.6%	5	5	5	8.4	6.7	7.3	7.9	7.8	8.0					21.9	19.7	20.6			275	275
5.6%	5	5	5	8.4	6.4	7.2	7.9	7.8	8.0											
10%	5	5	5	8.4	6.2	7.2	7.9	7.7	7.9					21.9	19.7	20.5			325	330
10%	5	5	5	8.3	6.1	6.8	7.9	7.7	7.9											
18%	5	5	5	8.2	6.4	7.5	7.8	7.7	8.0					21.8	19.7	20.6			415	417
18%	5	5	5	8.1	6.1	6.9	7.8	7.7	8.0											
32%	5	5	5	7.7	6.2	7.2	7.8	7.8	8.0					21.7	19.8	20.6			610	610
32%	5	5	5	7.7	5.8	6.9	7.8	7.7	8.0											
56%	5	5	5	6.4	5.4	6.5	7.8	7.8	8.1					21.4	19.8	20.8			900	900
56%	5	5	5	6.5	5.9	7.1	7.8	7.8	8.1											
100%	5	5	5	4.6	5.8	6.5	7.7	8.0	8.2	212		190		21.0	20.0	20.9	.01/.39	.05/1.02	1280	1350
100%	5	5	5	4.6	6.0	7.0	7.7	8.0	8.2											

Remarks: Average weight of each fish: 0.0424 g. (Average of 10 fish).

RESULTS AND DISCUSSION

This particular grab sample of effluent collected from the Georgia Pacific Pulp and Paper Mill was not acutely toxic to the organisms tested. In fact, not a single organism died in any test concentration.

LITERATURE CITED

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

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). 51pp.

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.