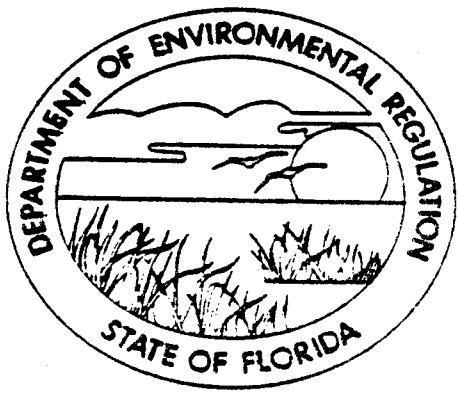


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BIOASSAYS OF JACKSONVILLE PAPER CORPORATION

(FORMERLY ST. REGIS PAPER COMPANY)

DUVAL COUNTY, FLORIDA, NPDES #FL0000400

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Biology Section
Bureau of Water Analysis
July 12, 1984

BIOASSAYS OF JACKSONVILLE PAPER CORPORATION

(FORMERLY ST. REGIS PAPER COMPANY)

DUVAL COUNTY, FLORIDA, NPDES #FL0000400

Biology Section
Bureau of Water Analysis
July 12, 1984

EXECUTIVE SUMMARY

Jacksonville Paper Corporation, NPDES #FL0000400, on 25 to 27 May 1984.

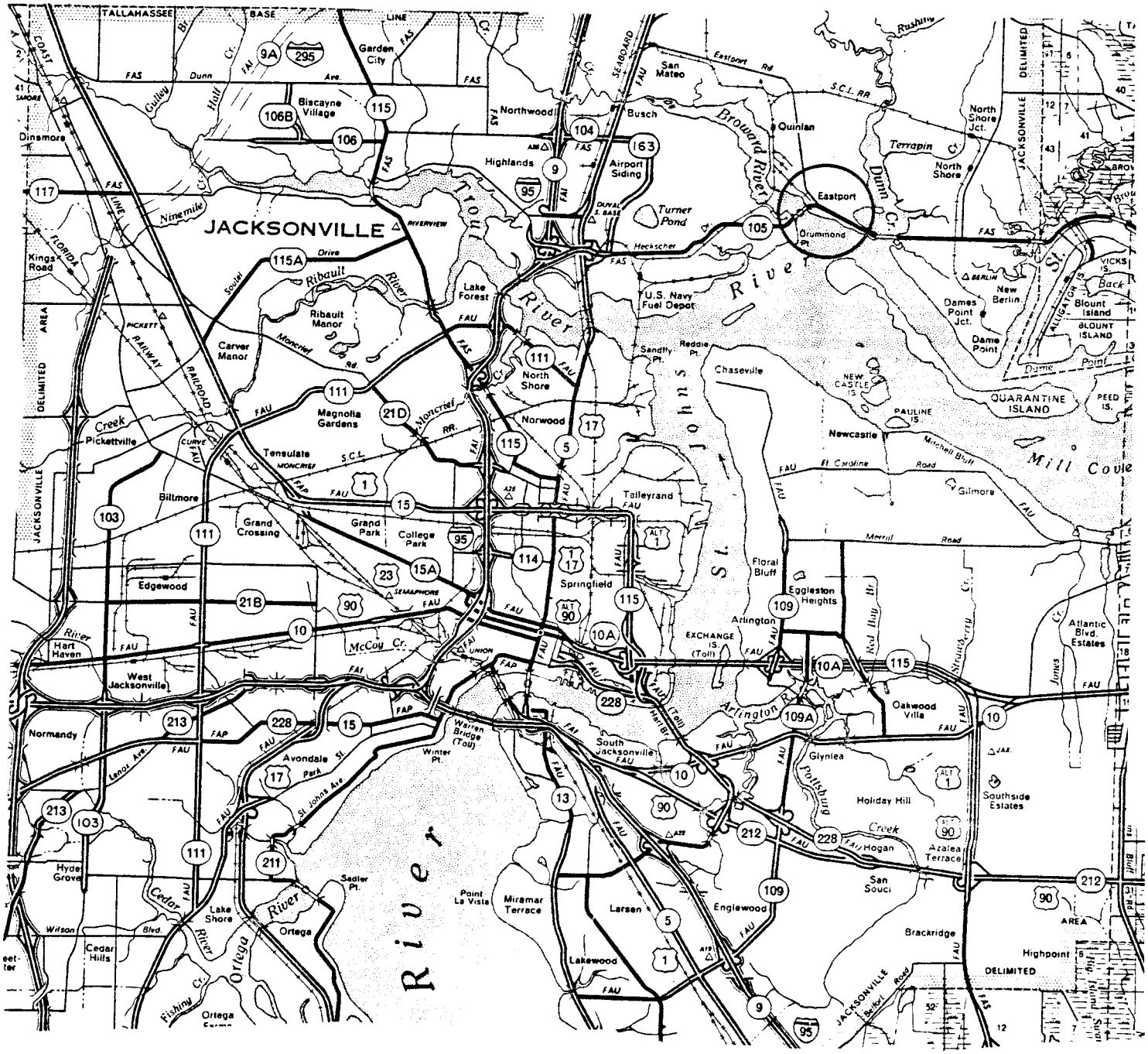
The effluent from Jacksonville Paper Corporation proved to be non-toxic to the test organisms, Daphnia pulex and Mysidopsis bahia, during the 48 hour static tests. Since the sample was not acutely toxic, results of chemical analyses will not be presented in this report.

INTRODUCTION

Jacksonville Paper Corporation (formerly St. Regis Paper) is located at 9469 Eastport Road, Jacksonville, Florida (Fig. 1). According to DER's NPDES Section, the facility is involved in the production of unbleached Kraft pulp and paper. Discharge includes 43.0 MGD of once through cooling water which is not treated and 19.0 MGD of process wastewater. Treatment of process water is handled by a 20.0 MGD designed capacity industrial wastewater treatment facility involving primary clarification, two settling ponds, and a final aeration pond (Fig. 2). Discharge is to the St. Johns River through a pipe approximately 1900 feet off shore.

The DER Biology Section has previously performed a toxicity test on effluent from this facility (St. Regis Paper), in August, 1981. The results of that test indicated that the effluent was not toxic to the test organism, Mysidopsis bahia (FDER 1981).

Since the facility has changed ownership and it has been a considerable time since the previous bioassay test, the Northeast District requested that additional bioassays be performed to evaluate the toxicity of the effluent. Therefore, two static acute toxicity bioassays were performed on the treated process wastewater on 22 to 24 of May, 1984. Daphnia pulex was used to test the freshwater effluent, while Mysidopsis bahia was used in salinity adjusted effluent to test toxicity of the effluent to organisms indigenous to the receiving body of water. The results of these latest bioassays are presented in this report. Those involved in performing the tests and in preparation of this report were: P. D. Brooks, C. W. Dye, R. B. Frydenborg, and M. L. Roll.



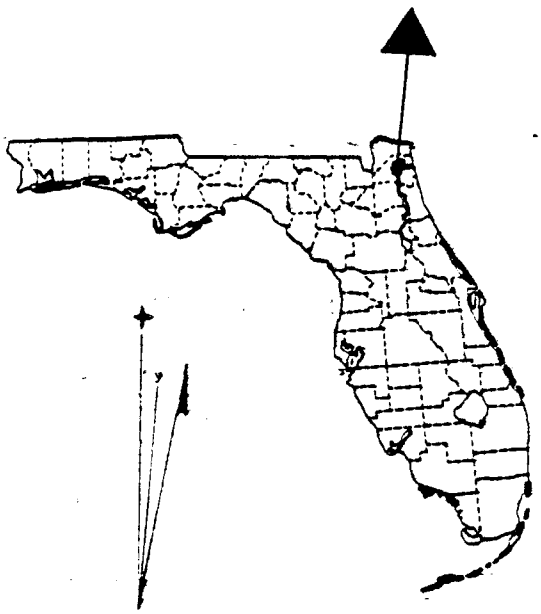
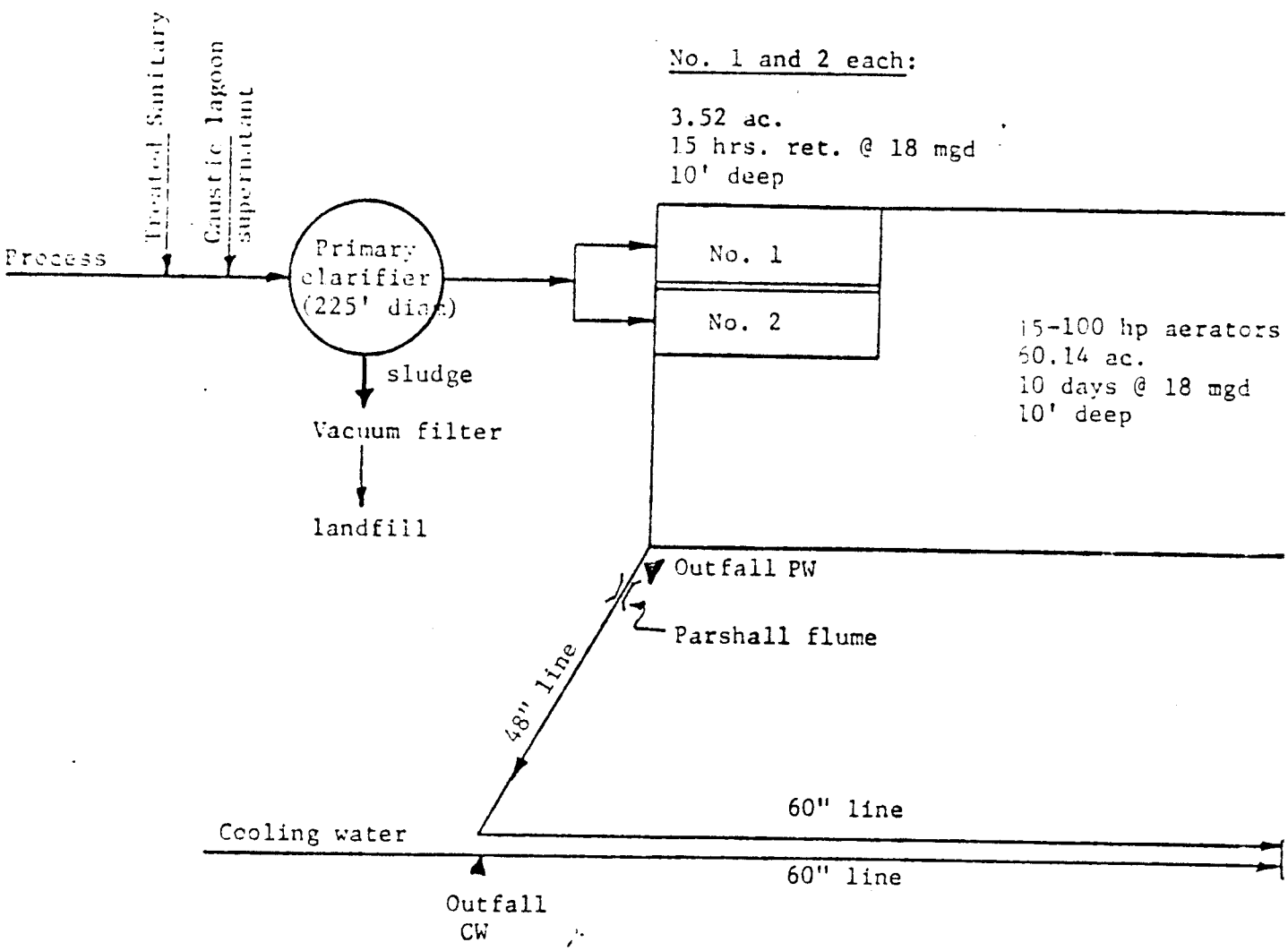


Figure 1. Portions of Jacksonville, Duval County, Florida, including the location of the Jacksonville Paper Corporation.

FIGURE 2.
Jacksonville Paper Co.
Jacksonville, FL



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 are among those recommended by Peltier (1978), the U.S. EPA (1978), and the FDER Biology Section (1983). 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.

Mysidopsis bahia (mysid shrimp) - In September, 1978, approximately 300 adult mysid shrimp were obtained from the EPA laboratory in Gulf Breeze, Florida. The mysids are cultured under a 16:8 hour light-dark cycle in 10 and 15 gallon all-glass aquaria equipped with undergravel filtration and aeration. The mysid shrimp are cultured over a wide range of salinities (10-30 ppt) to minimize acclimation periods to low or high salinity effluents. Seawater is obtained from the FSU Marine Laboratory located at Turkey Point, Florida (salinity range 17-31 ppt) and partial water changes are performed weekly. Freshwater, for dilution of the seawater as necessary, is obtained from a deep well near the DER laboratory. The mysids are fed twice daily and once daily on weekends with freshly hatched Artemia (brine shrimp) and are kept at a constant temperature of 23° plus or minus 3°C. Adult or large juvenile mysids were used in this 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 separate 48 hour static acute toxicity bioassays were performed on a grab sample of Jacksonville Paper Company's wastewater effluent. The tests were performed from 0930 hours on 22 May to 0940 hours on 24 May, 1984. The sample was collected by Mr. Jay Carver of DER's Northeast District at 0940 hours on 21 May, 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.

1. Freshwater Test

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 (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.

2. Saltwater Test

Saltwater for dilution of the effluent sample was obtained from the FSU Marine Laboratory at Turkey Point (salinity = 20.8 ppt). For test concentrations of 56% and below, this diluent was mixed directly with the effluent, achieving a range of final salinities (10.5 ppt to 19.9 ppt). For the 100% effluent test concentration, freshly autoclaved artificial sea salts were added until a salinity of approximately 7 ppt was achieved (the lower limit of mysid shrimp salinity tolerance). Two control groups (Table 3) were then used to ensure that any mortality in the test organisms was not the result of toxic properties associated with the diluent, the artificial sea salts, or the salinity range. The control groups included:

1) Diluent Control - Turkey Point water (20.8 ppt). This is the highest salinity used in the bioassay, and therefore tests the tolerance of the organisms to this salinity.

2) Sea Salts Control - Well water, adjusted with artificial sea salts to approximately 7 ppt salinity. This tests for toxicity of the highest concentration of artificial sea salts used in the bioassay, as well as for tolerance of the organisms to the lowest salinity used in the bioassay.

The concentration series selected for this study (Table 1) is that recommended by APHA (1980). Two replicates of each test concentration and of the controls were used to test with Mysidopsis bahia. Immediately prior to the bioassays, a suitable number of mysids were transferred by net from the 10 ppt, 15 ppt and 20 ppt salinity aquaria to culture dishes for observation

and selection of individuals for the tests. Individual mysid shrimp were siphoned using a glass tube, carefully examined for injury, and transferred to wide mouth quart jars, each containing 500 ml of the appropriate concentration. For each concentration, the mysid shrimp were pre-acclimated to within 4 ppt salinity. Five organisms were loaded per test chamber, giving ten per concentration. Based on the recommendations of EPA (1978), the mysids were fed brine shrimp (Artemia) nauplii at the rate of approximately 10 to 20 nauplii per mysid per day to minimize cannibalism.

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 freshwater test for the control and the 100% effluent concentration. The specific conductance or salinity (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

Mysidopsis bahia (mysid shrimp)

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 Paper Corporation, Duval County, Florida, NPDES #FL0000400 on 22 to 24 May 1984.

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Total Alakalinity (mg/l as $CaCO_3$)		Total Hardness (mg/l as $CaCO_3$)		Temperature (°c)			NH_3/N (mg/l)		Conductivity (umhos)	
	0	24	48	0	24	48	0	24	48	0	48	0	48	0	24	48	0	48	0	48
Control	10	10	10	8.3	8.8	8.6	7.3	8.0	7.6	93		132		20.6	19.0	19.0	0/0			
Control	[a] 9	9	9	8.3	8.8	8.6	7.3	8.0	7.6										189	190
5.6%	10	10	10	8.1	8.6	8.6	7.5	8.0	7.8					20.8	19.0	18.8				
5.6%	[a] 9	9	9	8.1	8.6	8.6	7.5	8.0	7.8										236	222
10%	10	10	10	8.0	8.3	8.5	7.6	8.0	7.9					20.9	18.8	18.8				
10%	10	10	10	8.0	8.3	8.5	7.6	8.0	7.9										277	278
18%	10	10	10	7.8	7.9	8.2	7.6	8.0	7.9					20.9	18.8	18.8				
18%	10	10	10	7.8	7.9	8.2	7.6	8.0	7.9										353	339
32%	10	10	10	7.7	7.5	7.9	7.6	8.0	8.0					20.9	18.9	18.8				
32%	10	10	10	7.7	7.5	7.9	7.6	8.0	8.0										481	460
56%	10	10	10	7.1	6.6	7.2	7.6	7.9	8.0					21.2	18.9	18.7				
56%	10	10	10	7.1	6.6	7.2	7.6	7.9	8.0										830	780
100%	10	10	10	6.2	5.7	6.0	7.6	7.9	8.0	235		198		21.6	18.9	18.8	0/0			
100%	10	10	10	6.2	5.7	6.0	7.6	8.0	8.0										1270	1180

Remarks: Total Residual Chlorine: None Detected

[a] Only 9 organisms were loaded into these chambers by mistake.

Table 3. Data recorded during 48 hour, Mysidopsis bahia, static acute toxicity bioassay of Jacksonville Paper Corporation, Duval County, Florida, NPDES #FL0000400 on 22 to 24 May 1984.

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Temperature (°C)			NH_3/N (mg/l)		Salinity (ppt)	
	0	24	48	0	24	48	0	24	48	0	24	48	0	48	0	48
Diluent Control	5	5	5	8.5	7.2	6.7	8.1	8.0	7.7	20.6	18.8	18.9	0/0			
Diluent Control	5	5	5	8.5	7.2	6.7	8.1	8.0	7.7						20.8	20.2
Sea Salt Control	5	5	5	7.5	7.7	7.1	8.3	8.2	8.0		18.9	18.9				
Sea Salt Control	5	5	5	7.5	7.7	7.1	8.3	8.2	8.0						7.0	7.0
5.6%	5	5	5	8.4	7.3	6.4	8.1	8.0	7.7	20.7	18.5	18.7				
5.6%	5	5	5	8.4	7.3	6.4	8.1	8.0	7.7						19.9	19.3
10%	5	5	5	8.3	7.1	6.4	8.1	8.0	7.8	20.8	18.5	18.6				
10%	5	5	5	8.3	7.1	6.4	8.1	7.9	7.8						19.1	18.7
18%	5	5	5	8.0	6.9	6.2	8.0	7.9	7.8	20.8	18.4	18.6				
18%	5	5	5	8.0	6.9	6.2	8.0	7.9	7.8						17.8	17.1
32%	5	5	5	7.8	6.5	5.9	7.8	7.9	7.8	20.9	18.5	18.5				
32%	5	5	5	7.8	6.5	5.9	7.8	7.9	7.8						15.1	14.7
56%	5	5	4	7.1	5.7	5.8	7.7	7.8	7.9	21.2	18.6	18.6				
56%	5	5	5	7.1	5.7	5.8	7.7	7.8	7.9						10.5	10.1
100%	5	5	5	6.1	4.2	4.5	7.8	7.9	7.9	21.2	18.6	18.8	0/0			
100%	5	5	5	6.1	4.2	4.5	7.8	7.9	7.9						7.1	7.1

Remarks: Total Residual Chlorine: None Detected.

RESULTS AND DISCUSSION

The process wastewater effluent from Jacksonville Paper Corporation proved to be non-toxic to either Daphnia pulex or Mysidopsis bahia during the 48 hour static tests. No D. pulex mortality was noted and only one M. bahia died, in the 56% test concentration (Table 3). Ammonia was not detected in this effluent. Since the sample was not acutely toxic, results of chemical analyses will not be presented in this report.

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