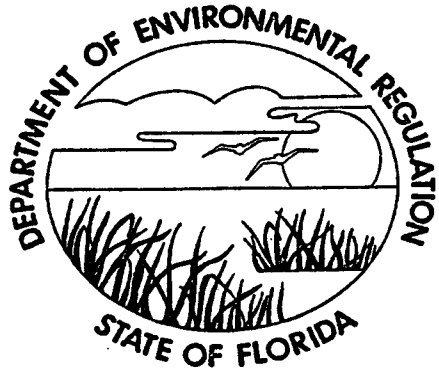


BIOASSAYS OF CHAMPION PAPER COMPANY

KRAFT DIVISION

CANTONMENT, ESCAMBIA COUNTY, FLORIDA

NPDES #FL0002526

SAMPLED 8/19/85

OCTOBER 16, 1985

Biology Section
Division of Environmental Programs

BIOASSAYS OF CHAMPION PAPER COMPANY

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CANTONMENT, ESCAMBIA COUNTY, FLORIDA

NPDES #FL0002526

Biology Section
Bureau of Laboratories and
Special Programs
October 16, 1985

EXECUTIVE SUMMARY

Champion Paper Company, Cantonment, NPDES #FL0002526, on 20 to 23 August, 1985.

The Biology Section performed six definitive 72 hour static acute toxicity bioassays on samples collected from Champion Paper Company's outfall #001 and from Eleven Mile Creek downstream of the outfall boil. The sample of effluent collected at the outfall was not acutely toxic to the water fleas, Daphnia pulex and Simocephalus serrulatus. In the D. pulex test, only 10% of the organisms died in the 100% concentration. In the S. serrulatus test, 25% died in the 100% concentration. Conversely, this sample was acutely toxic to the fish species tested, Notropis leedsi, resulting in a 24 hour LC_{50} of 80.3%. No additional mortality was noted during the remainder of the 72 hour test period. The sample collected downstream in Eleven Mile Creek was not toxic to D. pulex (no mortality at 72 hours). The S. serrulatus test was invalidated at 24 hours due to excessive control mortality (> 10%) and, therefore, no data for this test are given. However, as in the outfall sample, this downstream sample proved to be acutely toxic to the fish, N. leedsi, resulting in a 24 hour LC_{50} of 100%. However, since the distribution of mortality in this test was so uneven, the results should be viewed with some degree of question.

Moderate amounts of ammonia were detected in these samples, 12.4mg/l total and 0.42mg/l unionized at the outfall, and 5.1mg/l total and 0.16 mg/l unionized in the sample collected downstream. These ammonia concentrations probably contributed to the toxicities noted. Chemical analyses of the outfall sample indicated the presence of unidentified organic compounds, and the metals arsenic, iron, and zinc. These constituents may have contributed to the toxicity noted in the effluent.

INTRODUCTION

The Champion Paper Company, formerly the St. Regis Paper Company, is located at the intersection of U.S. Highway 29 and State Road 184 in Cantonment, Escambia County (Fig. 1). According to the NPDES Permit (#FL0002526, issued in June 1979), this facility operates continuously, processing 1000 tons per day of pulpwood into paper products. Raw material required for this operation include: pulpwood (pine or hardwood), salt cake, lime, caustic soda, chlorine, salt, sodium chlorate, rosin size, alum, sulfuric acid, and cornstarch.

Figure 2 depicts the water flow through the Champion Plant in Cantonment. The following compounds are associated with the paper manufacturing process and may be found in the wastewater stream: pimaric acid, isoprimaric acid, sandaracopimaric acid, abietic acid, dehydroabietic acid, 3, 4, 5, trichloroquaiacol, 3, 4, 5, 6, tetrachloroquaiacol, mono-chloro-dehydroabietic acid (2 isomers), 9, 10 epoxystearic acid, hudrogen sulfide, methyl mercaptan, glycol inks, and sodium sulfide. Prior to discharge to the headwaters of Eleven Mile Creek, the wastewater is treated by a clarifier, a series of mechanically aerated lagoons and final settling in an additional lagoon. This system is designed for a 28 MGD wastewater flow. Champions outfall #001 is located at State Road 186, approximately 2 miles from the plant site. Eleven Mile Creek eventually empties into the northern portion of Perdido Bay approximately 12 miles downstream of the plant outfall.

On 17 to 19 February, 1981, the Biology Section performed three separate static bioassays on an effluent sample from the Champion Paper Company, outfall #001. The results of those tests indicated that the sample was not toxic to the test organisms, Daphnia pulex, Simocephalus serrulatus, and Pimphales promelas.

To again determine the existence and extent of toxicity of this effluent, the Biology Section performed additional bioassays on samples of effluent collected from Champion Paper Company's outfall #001 and from Eleven Mile Creek downstream of the outfall boil. The tests were performed from 20 to 23 August, 1985. These tests, sampling locations, and 72 hour testing period were request by Mr. Robert Brazzell of DER's Northwest District office, to more accurately evaluate the impact of the discharge. The results of these tests are presented in this report. Those involved in performing the tests and in preparation of this report were: R. B. Frydenborg, M. L. Moultrie and M. L. Roll.



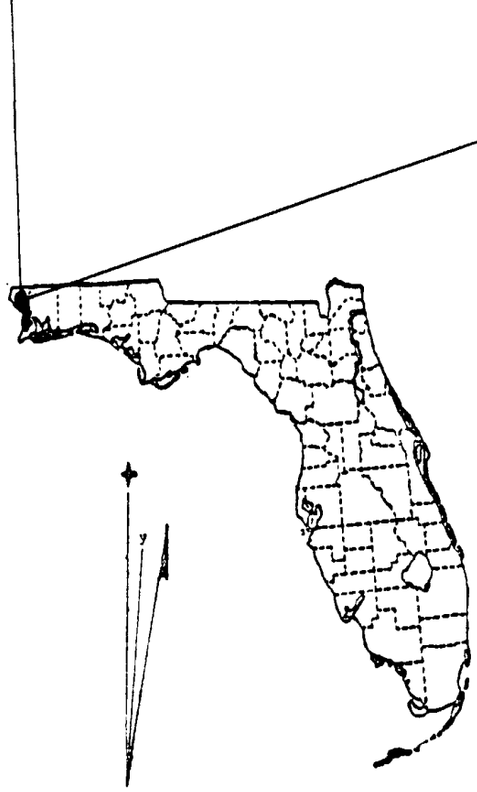


Figure 1. Portions of Escambia County, Florida, including the locations of the Champion facili near Cantonment and the sampling points at S.R. 186.

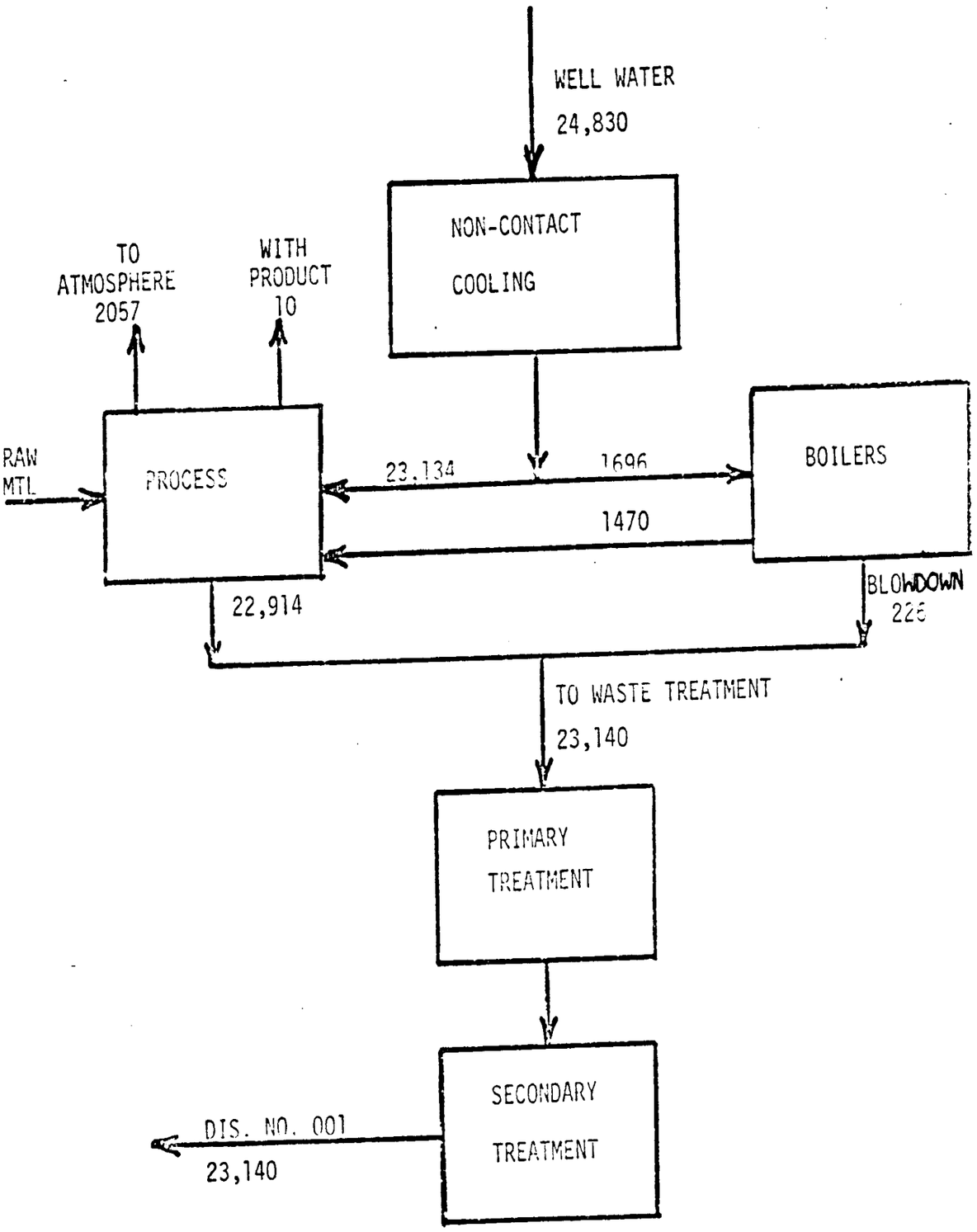

WELL WATER
24,830
NON-CONTACT
COOLING
TO
ATMOSPHERE
2057
WITH
PRODUCT
10
RAW
MTL
PROCESS
23,134
1696
BOILERS
1470
22,914
BLOWDOWN
226
TO WASTE TREATMENT
23,140
PRIMARY
TREATMENT
SECONDARY
TREATMENT
DIS. NO. 001
23,140
FLOW UNITS - 1000 GAL/DAY
SCHEMATIC OF WATER FLO
ST. REGIS PAPER COMPAN
CANTONMENT
ESCAMBIA COUNTY
FLORIDA
JUNE 20, 1978

Figure 2.

METHODS AND MATERIALS

Test methods used to conduct these static bioassays are extensively described by Peltier and Weber (1985) and the FDER Biology Section (1985). The organisms selected for this study include a species recommended by Peltier and Weber (1985), the U.S. EPA (1978), and the FDER Biology Section (1985). Additionally, the Biology Section maintains cultures of several species of organisms indigenous to the State of Florida. Two of these indigenous species were 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° ± 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.

Simocephalus serrulatus (water flea) - An indigenous breeding population of Simocephalus serrulatus was collected from Lake Jackson, Leon County, Florida, in March, 1980, by personnel from DER's Biology Section. Positive identification of the organisms was made by Mr. Jeff Foran of the University of Florida Department of Environmental Engineering Sciences. The cultures are maintained in two and one-half 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, once daily on weekends, and are kept at a constant temperature of 22° ± 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° ± 2°C under a 16:8 hour light-dark 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 three weeks 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

Methods used to perform acute toxicity bioassays are described by Peltier and Weber (1985) and the FDER Biology Section (1985). Some of the methods described below are more specific than those of Peltier and Weber. These will be noted in more detail.

Sampling Methods and Test Dates

A total of six separate 72 hour static acute toxicity bioassays were performed on samples collected from Champion Paper Company's outfall #001 and from immediately downstream in Eleven Mile Creek. The tests were performed from 0940 hours on 20 August to 1010 hours on 23 August, 1985.

The samples were collected by Mr. Glenn Butts of DER's Northwest District office from 1030 to 1120 hours on 19 August, 1985, using standard wastewater sampling procedures. At the outfall #001 location, 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. At the downstream location, only a bioassay sample was collected. The samples were iced and transported to the DER laboratory in Tallahassee for analyses within 24 hours of collection.

Test Temperature

Upon arrival of the iced (4°C) bioassay samples in the Tallahassee laboratory, the containers were placed in warm water and the temperature of the samples allowed to rise to 20° $\pm$ 2°C. Although this temperature may be different than the temperature of the sample during collection, it is the temperature range to which the test organisms are acclimatized and is the range recommended in the above referenced bioassay protocols. This avoids stressful effects caused by exposure to unusually cold or warm samples.

Aeration

Since many paper effluents contain a BOD which may reduce dissolved oxygen concentrations during a bioassay, the Champion effluents (100% concentrations and controls) were aerated during the first night of the test from hour 6 through hour 24. Aeration was stopped at hour 24 and was not resumed for the remainder of the tests since oxygen concentrations remained significantly above minimum recommended levels.

Freshwater Tests

Freshwater for dilution of the effluent samples was obtained from the same DER deep well that is used to culture the test organisms. The concentration series selected for this study is presented in Table 1.

Two replicates, of each concentration and a control, were used to test with the water fleas, 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. Simocephalus were siphoned into a large culture dish and neonates were transferred by glass pipette, and loaded 10 per chamber, resulting in 20 per test concentration. Daphnia and Simocephalus were siphoned into a large culture dish 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 these tests.

Two replicates, of each concentration and a control, were used for the Notropis leedsi (bannerfin shiner) bioassays. 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 these tests.

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% effluent concentrations. 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 concentrations 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 through 6.

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
10.0%	180.0 ml	20.0 ml	200 ml
50.0%	100.0 ml	100.0 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
10.0%	450 ml	50 ml	500 ml
50.0%	250 ml	250 ml	500 ml
100.0%	------	500 ml	500 ml

Daphnia pulex

Table 2. Champion Paper Company, Pensacola, Escambia County, Florida, NPDES #FL0002526 on 20 to 23 August, 1985.

OUTFALL #001

Concentration or %	Number of Live Organisms				Dissolved Oxygen (mg/l)				pH				Temperature (°C)				Conductivity (umhos)	
	0	24	48	72	0	24	48	72	0	24	48	72	0	24	48	72	0	72
Control	10	10	10	10	8.4[a]	8.7	8.6	8.4	7.7	7.9	7.9	7.7	22.5	20.9	22.8	21.0		
Control	10	10	10	10	8.4[a]	8.7	8.6	8.3	7.7	7.9	7.9	7.7					223	245
10.0%	10	10	10	10	8.1	8.5	8.3	8.4	7.6	7.8	7.9	7.7	22.6	20.7	22.7	20.9		
10.0%	10	10	10	10	8.1	8.5	8.3	8.4	7.6	7.8	7.9	7.7					342	345
50.0%	10	10	10	10	7.5	8.2	7.9	8.4	7.7	8.0	8.0	7.8	23.5	20.6	22.5	20.9		
50.0%	10	10	10	10	7.5	8.2	7.9	8.4	7.7	8.0	8.0	7.8					895	850
100.0%	10	10	10	10	6.6[a]	8.6	7.3	7.4	7.7	8.4	8.4	7.8	25.2	20.6	22.6	20.8		
100.0%	10	8	8	8	6.6[a]	8.7	7.3	7.4	7.7	8.4	8.4	7.8					1490	1450

Control Water

NH_3(as NH_3)(mg/l) 0

Total ammonia (as N)(mg/l) 0

Total Alkalinity 100 (mg/l $CaCO_3$)

Total Hardness 100 (mg/l $CaCO_3$)

100% Effluent

NH_3(as NH_3)(mg/l) 0.42

Total ammonia (as N)(mg/l) 12.4

Total Alkalinity 210 (mg/l $CaCO_3$)

Total Hardness 185 (mg/l $CaCO_3$)

[a] These chambers were slowly aerated from hour 6 through hour 24 of the test.

Simocephalus serrulatus

Table 3. Champion Paper Company, Pensacola, Escambia County, Florida, NPDES #FL0002526 on 20 to 23 August, 1985.

OUTFALL #001

Concentration or %	Number of Live Organisms				Dissolved Oxygen (mg/l)				pH				Temperature (°C)				Conductivity (umhos)	
	0	24	48	72	0	24	48	72	0	24	48	72	0	24	48	72	0	72
Control	10	10	10	9	8.2[a]	8.6	8.1	7.9	7.7	8.0	7.9	7.7	22.6	20.5	22.3	20.8		
Control	10	10	9	9	8.2[a]	8.6	8.1	7.9	7.7	8.0	7.9	7.7					214	271
10.0%	10	10	10	10	8.0	8.4	8.0	8.0	7.7	7.9	7.9	7.7	22.6	20.4	22.0	20.7		
10.0%	10	10	8	6	8.0	8.4	8.0	8.0	7.7	7.9	7.9	7.8					338	345
50.0%	10	10	10	10	7.5	8.3	7.9	8.0	7.7	8.0	8.0	7.8	23.7	20.3	21.9	20.5		
50.0%	10	10	10	9	7.5	8.3	7.9	8.0	7.7	8.0	8.0	7.8					880	875
100.0%	10	10	8	8	6.7[a]	7.6	7.3	7.6	7.7	8.1	8.1	7.8	25.1	20.3	22.0	20.5		
100.0%	10	10	7	7	6.7[a]	7.6	7.3	7.6	7.7	8.1	8.1	7.8					1490	1425

Control Water

NH_3(as NH_3)(mg/l) 0

Total Alkalinity (mg/l $CaCO_3$) 100

Total ammonia (as N)(mg/l) 0

Total Hardness (mg/l $CaCO_3$) 100

100% Effluent

NH_3(as NH_3)(mg/l) 0.42

Total Alkalinity (mg/l $CaCO_3$) 210

Total ammonia (as N)(mg/l) 12.4

Total Hardness (mg/l $CaCO_3$) 185

[a] These chambers were slowly aerated from hour 6 through hour 24 of the test.

Notropis leedsi

Table 4. Champion Paper Company, Pensacola, Escambia County, Florida, NPDES #FL0002526 on 20 to 23 August, 1985.
Outfall #001

Concentration or %	Number of Live Organisms 0	24	48	72	Dissolved Oxygen (mg/l) 0	24	48	72	pH 0	24	48	72	Temperature (°C) 0	24	48	72	Conductivity (umhos) 0	72
Control	5	5	5	5	8.3[a]	8.2	8.0	7.8	7.7	7.8	7.8	7.6	22.5	20.5	22.4	20.9		
Control	5	5	5	5	8.3[a]	8.2	8.0	7.9	7.7	7.8	7.8	7.6					219	225
10.0%	5	5	5	5	8.2	8.2	7.8	7.7	7.7	7.8	7.8	7.6	22.6	20.3	21.9	20.9		
10.0%	5	5	5	5	8.2	8.2	7.8	7.5	7.7	7.8	7.8	7.6					338	330
50.0%	5	5	5	5	7.5	7.9	7.5	7.7	7.7	7.9	7.9	7.7	23.7	20.1	21.9	20.5		
50.0%	5	5	5	5	7.5	7.9	7.5	7.7	7.7	7.9	7.9	7.7					900	850
100.0%	5	1	1	1	6.5[a]	8.5	6.2	6.4	7.7	8.4	8.1	7.7	25.2	20.1	21.9	20.5		
100.0%	5	1	1	1	6.5[a]	8.5	6.2	6.2	7.7	8.5	8.1	7.7					1510	1410

Control Water

NH_3(as NH_3)(mg/l) 0

Total ammonia (as N)(mg/l) 0

Total Alkalinity (mg/l $CaCO_3$) 100

Total Hardness (mg/l $CaCO_3$) 100

100% Effluent

NH_3(as NH_3)(mg/l) 0.42

Total ammonia (as N)(mg/l) 12.4

Total Alkalinity (mg/l $CaCO_3$) 210

Total Hardness (mg/l $CaCO_3$) 185

[a] These chambers were slowly aerated from hour 6 through hour 24 of the test.

Daphnia pulex

Table 5. Champion Paper Company, Pensacola, Escambia County, Florida, NPDES #FL0002526 on 20 to 23 August, 1985.

DOWNSTREAM

Concentration or %	Number of Live Organisms				Dissolved Oxygen (mg/l)				pH				Temperature (°C)				Conductivity (umhos)	
	0	24	48	72	0	24	48	72	0	24	48	72	0	24	48	72	0	72
Control	10	10	10	10	8.4[a]	9.0	8.2	8.2	7.7	8.1	8.0	7.7	22.4	20.6	22.6	21.0		
Control	10	10	10	10	8.4[a]	9.0	8.2	8.4	7.7	8.1	8.0	7.7					212	230
10.0%	10	10	10	10	8.1	8.6	8.1	8.2	7.7	7.9	7.9	7.6	22.6	20.5	22.4	20.9		
10.0%	10	10	10	10	8.1	8.6	8.1	8.1	7.7	7.9	7.9	7.6					333	321
50.0%	10	10	10	10	7.8	8.1	7.7	7.7	7.7	8.0	8.0	7.6	23.3	20.5	22.4	20.8		
50.0%	10	10	10	10	7.8	8.1	7.7	7.7	7.7	8.0	8.0	7.6					820	800
100.0%	10	10	10	10	7.1[a]	8.7	7.1	6.9	7.7	8.4	8.1	7.7	24.4	20.6	22.6	20.9		
100.0%	10	10	10	10	7.1[a]	8.7	7.1	6.8	7.7	8.4	8.0	7.7					1400	1352

Control Water

NH_3(as NH_3)(mg/l) 0

Total Alkalinity 100 (mg/l $CaCO_3$)

Total ammonia (as N)(mg/l) 0

Total Hardness 100 (mg/l $CaCO_3$)

100% Effluent

NH_3(as NH_3)(mg/l) 0.16

Total Alkalinity 190 (mg/l $CaCO_3$)

Total ammonia (as N)(mg/l) 5.1

Total Hardness 188 (mg/l $CaCO_3$)

[a] These chambers were slowly aerated from hour 6 through hour 24 of the test.

Notropis leedsi

Table 6. Champion Paper Company, Pensacola, Escambia County, Florida, NPDES #FL0002526 on 20 to 23 August, 1985.

DOWNSTREAM

Concentration or %	Number of Live Organisms				Dissolved Oxygen (mg/l)				pH				Temperature (°C)				Conductivity (umhos)	
	0	24	48	72	0	24	48	72	0	24	48	72	0	24	48	72	0	72
Control	5	5	5	5	8.3[a]	8.2	8.0	7.8	7.7	7.8	7.8	7.6	22.6	20.5	22.4	20.9		
Control	5	5	5	5	8.3[a]	8.2	8.0	7.9	7.7	7.8	7.8	7.6					219	225
10.0%	5	5	5	5	8.1	8.0	7.7	7.5	7.7	7.8	7.8	7.6	22.6	20.3	22.1	20.5		
10.0%	5	5	5	5	8.1	8.0	7.7	7.5	7.7	7.8	7.9	7.6					325	325
50.0%	5	5	5	5	7.8	7.8	7.5	7.5	7.7	7.9	7.9	7.7	23.5	20.3	21.4	20.5		
50.0%	5	5	5	5	7.8	7.8	7.5	7.5	7.7	7.9	7.9	7.7					820	800
100.0%	5	5[b]	5	5	7.0[a]	8.6	6.7	6.4	7.7	8.4	8.0	7.7	24.5	20.3	22.4	20.5		
100.0%	5	0[b]	0	0	7.0[a]	8.7	6.2	5.7	7.7	8.5	8.0	7.7					1410	1320

Control Water

NH_3(as NH_3)(mg/l) 0

Total ammonia (as N)(mg/l) 0

Total Alkalinity 100 (mg/l $CaOO_3$)

Total Hardness 100 (mg/l $CaOO_3$)

100% Effluent

NH_3(as NH_3)(mg/l) 0.16

Total ammonia (as N)(mg/l) 5.1

Total Alkalinity 190 (mg/l $CaOO_3$)

Total Hardness 188 (mg/l $CaOO_3$)

[a] These chambers were slowly aerated from hour 6 through hour 24 of the test.

[b] This uneven distribution of mortality in replicate test chambers is unusual, and therefore, should be viewed with some degree of question. However, no abnormalities were noted during the test (e.g. low DO).

Table 7. LC_{50} Data for Bioassays of Champion Paper Company, Cantonment, NPDES #FL0002526, Outfall #001 and Downstream, on 20 to 23 August, 1985.

Organism	Method of Data Analysis	24 Hour LC_{50} and 95% Confidence Intervals	72 Hour LC_{50} and 95% Confidence Intervals
Outfall #001:			
Daphnia pulex	Binomial	a	a
	Moving Average		
	Probit		
Simocephalus serrulatus	Binomial		
	Moving Average	a	a
	Probit		
Notropis leedsi	Binomial	80.3%(50 and00)	80.3%(50 and 00)
	Moving Average	a	a
	Probit	a	a
Downstream Sample:			
D. pulex	Binomial		
	Moving Average		
	Probit	No Mortality	No Mortality
N. leedsi	Binomial	100.0%(50 and 00)	100.0%(50 and 00)
	Moving Average	a	a
	Probit	a	a

[a] Due to an insufficient number of dead organisms, or to the irregular distribution of mortality, an LC_{50} value cannot be calculated using this method of statistical analysis.

Table 8. Results of Chemical Analyses Performed on Effluent from Champion Paper Company's outfall #001. NPDES #FL0002526, collected 19 August, 1985.

Organics	
Acid Extractables	N.D.
Base Neutral Extractables	Unidentified Compounds
Pesticide Extractables	N.D.

Metals	
Arsenic	12 ug/l
Barium	N.D.
Cadmium	N.D.
Chromium	N.D.
Copper	-[a]
Iron	2219 ug/l
Lead	-[a]
Mercury	< .2 ug/l[b]
Nickel	N.D.
Selenium	N.D.
Silver	-[a]
Zinc	33 ug/l

N.D. = None Detected
[a] Value invalidated because of contaminated blank
[b] Actual value is known to be less than value given.

RESULTS AND DISCUSSIONS

The Biology Section performed six definitive 72 hour static acute toxicity bioassays on samples collected from Champion Paper Company's Outfall #001 and from Eleven Mile Creek immediately downstream of the outfall boil. The sample of effluent collected at the outfall was not toxic to the water fleas, Daphnia pulex and Simocephalus serrulatus. In the D. pulex test, only 10% of the organisms died in the 100% concentration (Table 2). In the S. serrulatus bioassay, 25% of the organisms died in the 100% concentration (Table 3). Conversely, this sample was acutely toxic to the fish species tested, Notropis leedsi, resulting in a 24 hour LC_{50} of 80.3% (Table 7). No additional mortality was noted during the remainder of the 72 hour test period. The sample collected downstream in Eleven Mile Creek was not toxic to D. pulex (no mortality at 72 hours, Table 5). The S. serrulatus test was invalidated at 24 hours due to excessive control mortality (> 10%), and, therefore, no data for this test are given. As in the outfall bioassay, the downstream sample was acutely toxic to N. leedsi, producing a 24 hour LC_{50} of 100% (Table 7). However, the distribution of mortality in the test was uneven (Table 6), therefore, the results should be viewed with some degree of question.

Moderate amounts of ammonia were detected in these samples, 12.4 mg/l total and 0.42mg/l unionized at the outfall and 5.1mg/l total and 0.16mg/l unionized in the sample collected downstream (Tables 2 through 6). These Ammonia concentrations, especially the 0.42mg/l unionized concentration measured in the outfall sample, probably contributed to the toxicities noted. The results of chemical analyses performed on the outfall sample (Table 8) indicated the presence of unidentified organic compounds and the metals Arsenic (12 ug/l), Iron (2219 ug/l), and Zinc (33 ug/l). These constituents may have contributed to the toxicity noted.

Discussion of the Toxicity Criteria

The toxicity standards of Chapters 17-3 and 17-4, F.A.C., are complex. Because of this complexity, they will be briefly reviewed here so that these test results may be more readily compared with the standards. For legal purposes, however, the language of the Florida Administrative Code should be consulted directly.

The two basic concepts utilized in the standards are acute and chronic toxicity (defined in 17-3.021(1) and (4), respectively). Simplifying the actual F.A.C. language somewhat, acute toxicity is defined as the presence of a substance in a concentration one-third as great as that concentration which kills one-half of the test organisms in 96 hours, i.e., one-third of the 96 hour LC_{50}. Chronic toxicity is similarly defined as one-twentieth of the 96 hour LC_{50}. Therefore, if a test solution kills one-half or more of a group of test organisms in 96 hours, it must contain at least three times the defined "acutely toxic" concentration and at least twenty times the "chronically toxic" concentration of some substance or substances. If a test solution causes that same mortality in less than 96 hours, (for example, in 24 or 48 hours), it is at least as toxic as the example given above, and actually is probably considerably more toxic.

The particular restrictions applied to a given discharger depend upon the existence of a mixing zone, whetheras a specific part of the permit or based on the existence of a currently valid permit predating the language in Chapter 17-4 requiring mixing zone designation. In the absence of a mixing zone, the general criteria for surface waters [17-3.061] are applicable at all points, beginning at the point of discharge. This section prohibits the discharge of substances in concentrations which are chronically toxic [17-3.061(2)(p)]; that is, the concentrations cannot exceed one-twentieth of the 96 hour LC_{50} as discussed above. If a mixing zone does exist, then this chronic toxicity standard is only applicable from the edge of the mixing zone and beyond. Within the mixing zone, the less stringent acute toxicity standard of the minimum criteria for all waters [17-3.051(1)(d)] applies: one-third of the 96 hour LC_{50}. The acute toxicity standard does not apply, however, to each point within a mixing zone not designated for dredge and fill permitting, but rather to the average of a number of points within such a mixing zone, based on the provisions of the surface water mixing zones section of Chapter 17-4 [17-4.244(4)]. At the same time, though, this same rule prohibits waste concentrations within such a mixing zone (i.e., at any point within the mixing zone), from exceeding the 96 hour LC_{50}. Therefore, at any point within such a mixing zone, including the point of discharge, one-half of the test organisms cannot be killed in 96 hours. Within a mixing zone designated for dredge and fill permitting, the acute toxicity standard (one-third of the 96 hour LC_{50}) applies at all points, including the point of discharge.

From the above discussion, it should be clear that if the least stringent toxicity standard, the 96 hour LC_{50}, is exceeded at any point, from the point of discharge outwards, by any discharger, then a violation of the standards has occurred. This is an important consideration since the test procedure here reported involves the measurement of the 50% lethal concentration, and not some fraction of that concentration. Any discharger required to meet the one-twentieth of the 96 hour LC_{50} standard is therefore being tested very leniently. Any reduction in the test period from 96 hours provides an added degree of leniency to a discharger.

A number of different dilutions were examined in order to determine by how much, if any, the discharge exceeds the 96 hour LC_{50}. For example, if the sample, after two-fold dilution with diluent (a 33% concentration), kills one-half of the test organisms after 96 hours, then the sample is three times as toxic as is allowed by that standard. Similarly, if a 5% solution of the sample kills 50% of the organisms, the sample is twenty times as toxic as is allowed. Toxicities are reported here in that manner, i.e., in terms of the percentage dilution of the test sample. The smaller the percentage which is reported means a correspondingly greater toxicity.

Note that even if a discharger receives a very large mixing zone not designated for dredge and fill permitting, the regulations require that the maximum toxicity at any point within the mixing zone be restricted to the 96 hour LC_{50}. The results here reported are based on actual effluent samples, representative of the effluent concentration which enters waters of the state at the point of discharge. If it is demonstrated that, under the conditions existing at the point of discharge, effluent concentrations will be less than at the actual sampling point (if the two points are different), the reported bioassay results will reflect the reduced discharge concentration.

With respect to the species of organisms used in these tests, the language of the F.A.C. indicates that they should be "significant to the indigenous aquatic community". All species used in these tests are significant to the indigenous aquatic community since they are sensitive to toxic substances which may be expected to impact the indigenous community.

The toxicity reported here is in excess of allowable limits.

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