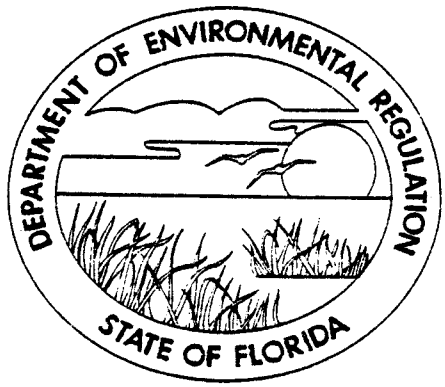


BIOASSAYS OF THE BUCKEYE CELLULOSE CORPORATION TAYLOR COUNTY, FLORIDA

NPDES #FL0000876

SAMPLED 5/14/84

Biological Section
Bureau of Water Analysis
July 3, 1984

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EXECUTIVE SUMMARY

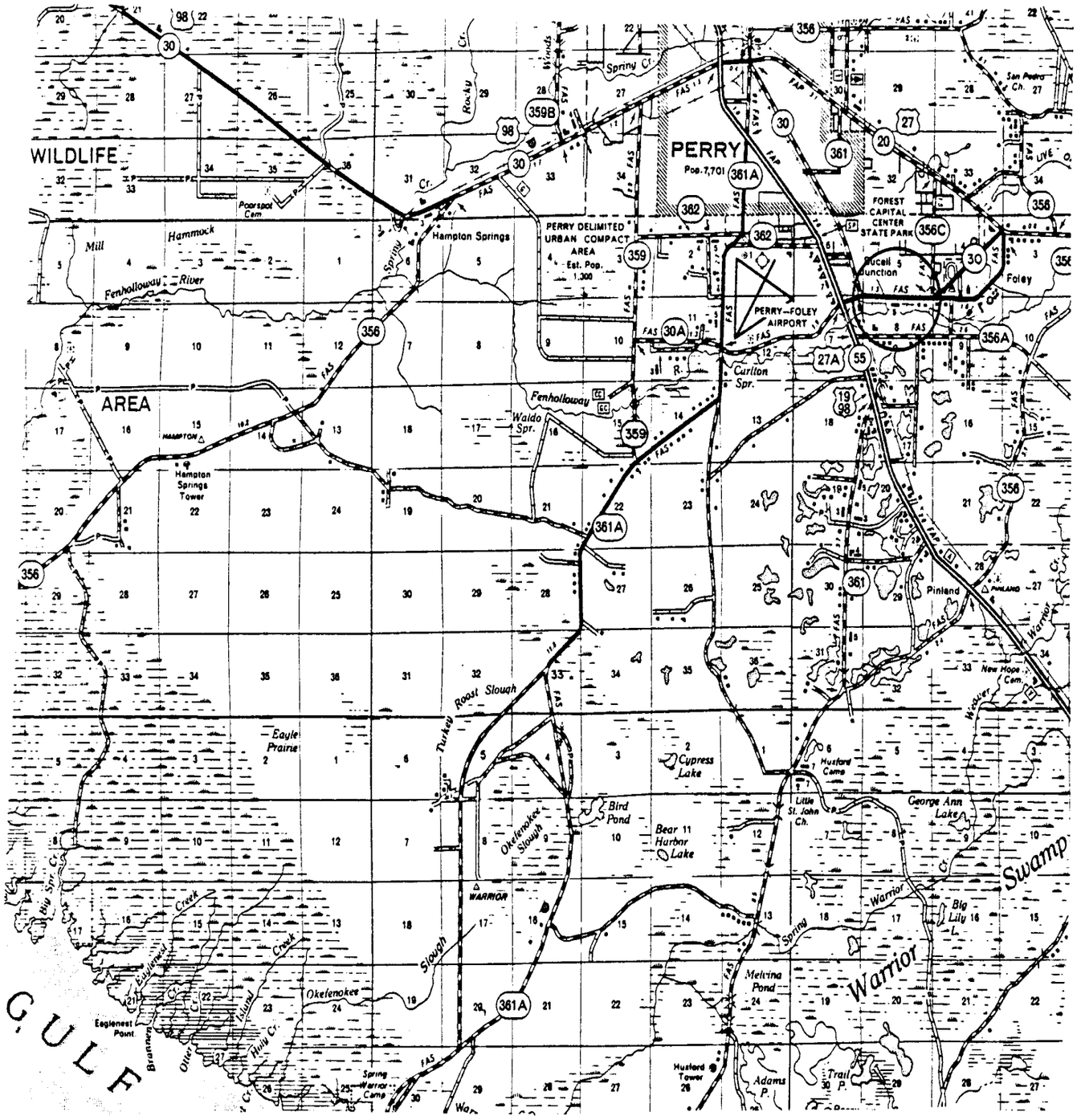
Bioassays of Buckeye Cellulose Corporation on 15 to 17 May 1984.

The effluent sample from Buckeye Cellulose Corporation proved non-toxic to Daphnia pulex and Pimephales promelas at both 24 and 48 hours. Only slight D. pulex mortality was noted in the 100% effluent concentration. Since the sample was not acutely toxic, results of chemical analyses will not be reported here.

INTRODUCTION

Buckeye Cellulose Corporation is located in Taylor County, Florida, 5 to 6 miles southeast of Perry, Florida (Fig. 1). According to DER's NPDES File, the plant is involved in the production of bleached grades of Kraft pulp and Kraft dissolving pulp. The industrial wastewater treatment facility has a designed operating capacity of 58 MGD, but is currently operating at approximately 56.1 MGD. Treatment consists of a primary waste clarifier, sludge pumps, and a 60 acre sludge storage lagoon (Fig. 2). Wastewater is then aerated in a series of 30 and 120 acre lagoons before being discharged to the Fenholloway River, approximately 20 miles from the Gulf of Mexico.

To determine the effects this discharge may have on the biota of the receiving waters, two static acute toxicity bioassays were performed on a grab sample from 15 to 17 May, 1984. The results of these bioassays are presented in this report. Those involved in performing these tests and the preparation of the report were: P. Brooks, C. Dye, R. Frydenborg, and M. Roll.



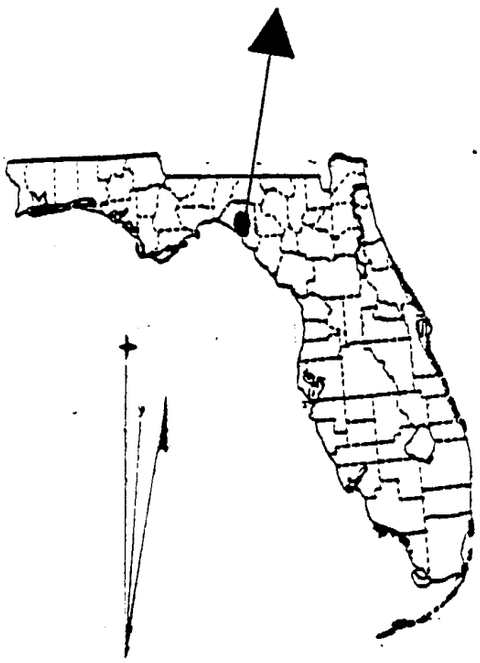
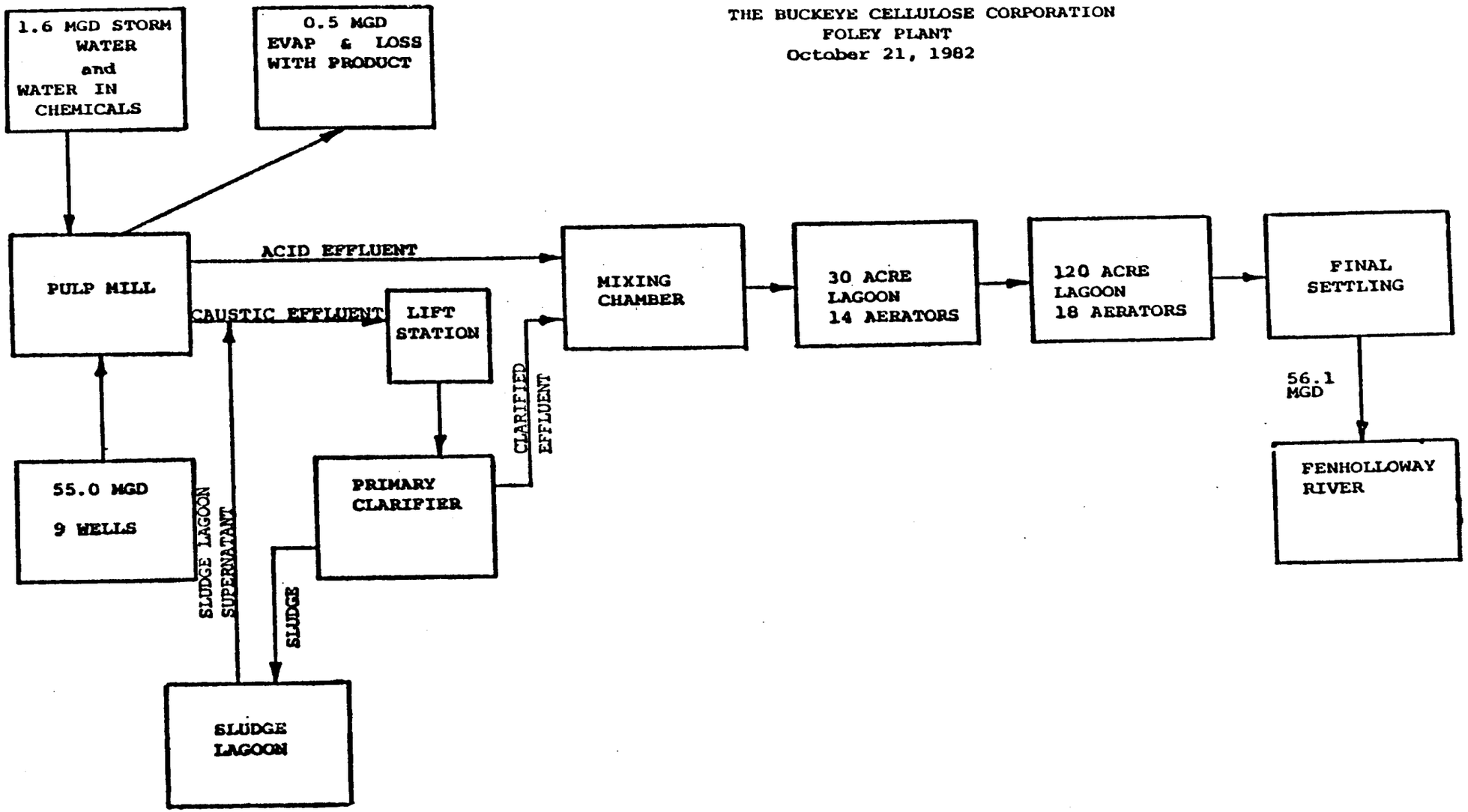


Figure 1. Portions of Taylor County, Florida, including location of Buckeye Cellulose Corporation.

Figure 2. Wastewater Generation and Treatment



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.

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. This breeding population is augmented with fry hatched in our laboratory and with additional adult fish from EPA as required. The fish are maintained in three 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 fathead minnows are reared at a temperature of 22° plus or minus 2°C under a 16:8 hour light-dark cycle. These fish are fed Glencoe Mills "#3 size enriched trout fry granules", Tetra-Min®, and frozen Artemia (brine shrimp) at a rate of 0.75g/30 fish, twice daily, and once daily on weekends. 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 14 to 22 days old at the time of the test.

To ensure the uniform sensitivity of these test organisms to toxic substances, the Biology Section conducts monthy 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 an effluent grab sample from Buckeye Cellulose. The tests were performed from 0915 hours on 15 May to 0915 hours on 17 May, 1984. The sample was collected by Mr. Jay Carver of DER's Northeast District at 1035 hours on 14 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.

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. These fleas 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 Pimephales promelas (fathead minnow) 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 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 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% 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

Pimephales promelas (fathead minnow)

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 Buckeye Cellulose Corporation, Taylor County, Florida, NPDES #FL0000876 on 15 to 17 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	9	9.0	8.8	8.5	7.4	8.0	8.1	92		124		22.2	21.4	19.5	0/0			
Control	10	10	10	9.0	8.8	8.5	7.4	8.0	8.1										208	210
5.6%	10	10	10	9.0	8.8	8.4	7.4	8.0	8.1					22.1	20.9	19.3				
5.6%	10	10	10	9.0	8.8	8.4	7.4	8.0	8.1										295	300
10%	10	10	10	8.8	8.6	8.4	7.4	8.0	8.1					22.2	20.8	19.2				
10%	10	10	10	8.8	8.6	8.4	7.5	8.0	8.1										388	380
18%	10	10	10	8.8	8.5	8.4	7.5	8.0	8.1					21.9	20.8	19.2				
18%	10	10[a]	10[a]	8.8	8.5	8.4	7.5	8.0	8.1										610	600
32%	10	10	10	8.6	8.1	8.2	7.5	8.0	8.1					21.7	20.8	19.1				
32%	10	10	10	8.6	8.1	8.2	7.5	8.0	8.1										805	900
56%	10	10	10	7.5	7.6	7.7	7.5	7.9	8.0					21.3	20.8	19.1				
56%	10	10	10	7.5	7.6	7.7	7.5	7.9	8.0										1400	1370
100%	10	10	8	5.3	6.5	7.0	7.4	7.8	8.0					20.5	20.8	19.9				
100%	10	10	9	5.3	6.5	7.0	7.4	7.8	8.0	180		258					.015/1.21		2220	2300

Remarks: [a]Additional young were observed in this chamber.

Table 3. Data recorded during 48 hour, Pimephales promelas, static acute toxicity bioassay of Buckeye Cellulose Corporation, Taylor County, Florida, NPDES #FL0000876 on 15 to 17 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	5	5	5	9.0	8.8	8.5	7.6	7.8	8.0	92		124		22.5	21.0	19.1	0/0			
Control	5	5	5	9.0	8.8	8.5	7.6	7.8	8.0										210	200
5.6%	5	5	5	9.0	8.8	8.4	7.6	7.8	8.0					22.5	20.8	18.8				
5.6%	5	5	5	8.9	8.8	8.4	7.6	7.8	8.0										322	300
10%	5	5	5	8.9	8.7	8.3	7.6	7.8	8.0					22.2	20.6	18.8				
10%	5	5	5	8.9	8.7	8.3	7.6	7.8	8.0										428	405
18%	5	5	5	8.5	8.7	8.1	7.6	7.9	8.0					21.9	20.5	18.7				
18%	5	5	5	8.6	8.7	8.1	7.6	7.9	8.0										630	600
32%	5	5	5	8.4	8.5	8.0	7.6	7.8	8.0					21.6	20.4	18.7				
32%	5	5	5	8.4	8.5	8.0	7.6	7.8	8.0										910	900
56%	5	5	5	7.1	7.8	7.7	7.6	7.8	7.9					20.9	20.5	18.7				
56%	5	5	5	6.8	7.8	7.7	7.6	7.8	7.9										1420	1350
100%	5	5	5	4.8	7.2	7.0	7.5	7.7	7.9	180		258		20.2	20.7	18.8	.018/1.21			
100%	5	5	5	4.8	7.2	7.0	7.5	7.7	7.9										2270	2210

REMARKS:

RESULTS

The results of two static acute toxicity bioassays performed the 15th to 17th of May, 1984 showed the effluent from Buckeye Cellulose Corporation of Taylor County, Florida to be nontoxic. Only a few D. pulex mortalities were noted in the 100% effluent concentration (Table 2). No death was noted in the Pimephales promelas assay. Since the sample was not acutely toxic, results of chemical analyses will not be reported here.

LITERATURE CITED

American Public Health Association. 1980. Standard Methods for the Examination of Water and Wastewater. 15th ed. 1134 p.

Florida Department of Environmental Regulation, Biology Section. 1983. Quality Assurance Manual for Performing Acute Toxicity Tests. FDER. 22 p.

Peltier, W. 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 p.

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. 121 p.