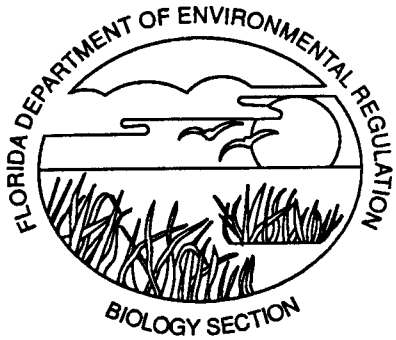


Bioassays of

Bay County Wastewater Treatment Plant

Bay County, Florida

NPDES #FL0002631

Sampled 7/25/88

March 16, 1989

Biology Section
Division of Administrative and Technical Services

Bioassays of

Bay County Wastewater Treatment Plant

Bay County, Florida

NPDES #FL0002631

Biology Section
Bureau of Laboratories
March 16, 1989

Executive Summary

Bay County Wastewater Treatment Plant, Bay County, Florida NPDES #FL0002631, on 26 to 28 July, 1988.

The DER Biology Section performed a trial Phase 1 Toxicity Identification Evaluation (TIE) using a sample from Bay County Wastewater Treatment Plant as a step in developing their TIE program. The TIE provides information on the causes of acute toxicity. As a first step in this protocol, acute toxicity bioassays to characterize the sample are performed. The sample collected from the Bay County Wastewater Treatment Plant was not toxic to the bioassay test organisms, *Ceriodaphnia dubia* and *Notropis leedsi*. The sample adversely affected the Microtox® assay organism, *Photobacterium phosphoreum*, producing an EC_{50} of 187%. Because this was a practice TIE and there was no toxicity in the higher organisms, the results of the TIE are not further reported.

The cause of the adverse effect observed in the Microtox® assay was not determined.

Introduction

The Bay County Wastewater Treatment Plant final treatment process, a 59 acre aerated lagoon, is located on Tyndall Air Force Base, across St. Andrew Bay from the Southwest Forest/Arizona Chemical Company paper mill complex (Figure 1). The Bay County facility receives approximately 32 MGD of discharge from the paper mill complex for treatment. Pre-treatment at the complex includes evaporator waste condensers, primary clarification, and nutrient addition (Figure 2). Domestic discharges from at least three sources, the Millville STP, the Bay County System, and Tyndall AFB, may also be treated at the Bay County final aerated lagoon. Treatment of these discharges may include degritting, primary treatment, and chlorination, prior to being pumped to the aerated lagoon (according to the NPDES file). After approximately 10 days retention in the aerated lagoon, the recovered water is pumped through a 1,300 ft-long outfall to St. Andrew Bay at a discharge depth of approximately 15 feet. Additionally, this facility has a designated mixing zone in the bay (Stephen Baisden, personal communication) (FDER 1987).

The Biology Section had performed bioassays on samples from this facility in 1980, 1983, 1986 and 1988. In September, 1980, the tests using *Daphnia pulex* and *Mysidopsis bahia* indicated the sample was not acutely toxic. However, these tests were invalidated because the holding time of the samples was exceeded. No report was issued for this set of tests. In July, 1983, a sample was acutely toxic to the test organism *M. bahia* (FDER 1983).

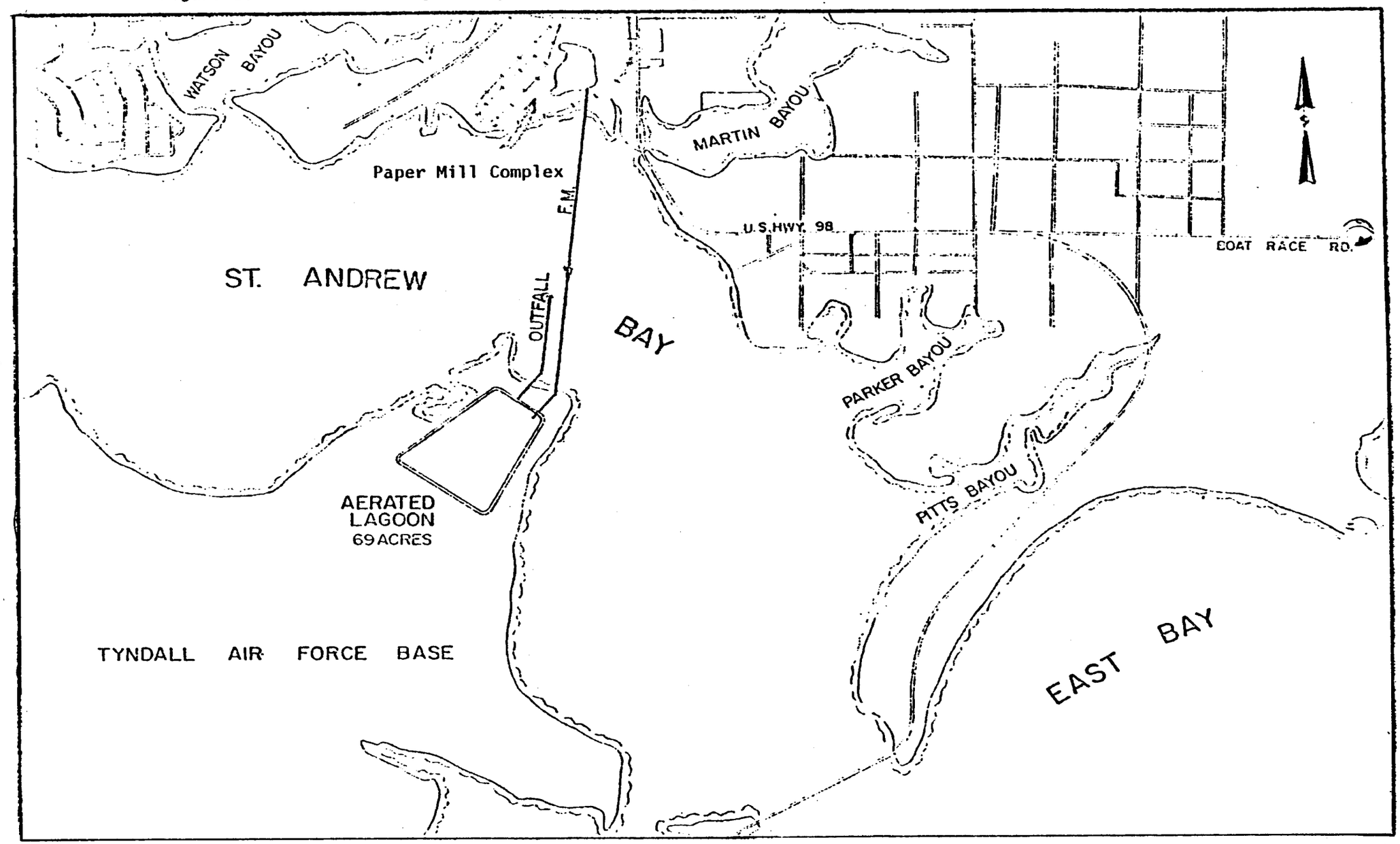
In September, 1985, a sample was not acutely toxic to the test organisms *Notropis leedsi, D. pulex*, and *M. bahia*. In these tests, 15% of the *N. leedsi* died in the 100% sample test. No mortality occurred in the *M. bahia* test. The *D. pulex* test was invalidated due to excessive control mortality, but no mortality had occurred in the 100% sample at 24 hours (FDER 1985). Chemical analyses detected ammonia (maximum measured = 2.3 mg/l total and 0.01 mg/l unionized), several unidentified organic compounds, diethylphthalate (11 µg/l), lubricating oils, and the metals chromium (72 µg/l) and zinc (64 µg/l) (FDER 1985).

In December, 1986, the Biology Section performed bioassays on a sample from the facility using *D. pulex, N. leedsi, M. bahia*, and *Ceriodaphnia dubia* as the test organisms. The sample was not acutely toxic to the test organisms, *C. dubia, D. pulex,* and *N. leedsi*, but was sufficiently toxic to *M. bahia* to produce an LC_{50} of 118.6% sample. However, since this facility has a mixing zone, that LC_{50} was in compliance with Chapter 17-4 end-of-pipe toxicity standards (FDER 1987).

In June, 1988, the discharge was not acutely toxic to the bioassay test organisms, *Ceriodaphnia dubia, Daphnia pulex,* and *Notropis leedsi*. The sample was toxic to the Microtox® assay test organism, *Photobacterium phosphoreum,* producing an EC_{50} of 95.5% sample. Chemical analyses found trace amounts of possible petroleum hydrocarbons and low concentrations of numerous unidentified pesticide components, as well as the metals, arsenic (8.6 µg/l), chromium (57 µg/l), lead (6 µg/l), and zinc (27 µg/l) (FDER 1988).

The Biology Section performed a trial Phase 1 Toxicity Identification Evaluation (TIE) using a sample from Bay County Wastewater Treatment Plant as a step in developing their TIE program. The TIE provides information on the causes of acute toxicity. As a first step in this protocol to determine the sample toxicity, the Biology Section performed two acute toxicity bioassays and one Microtox® assay on a sample from this facility on 26 to 28 July, 1988. The results of those tests are presented in this report. Those involved in performing the tests and in preparation of this report were: J. M. Faircloth, R. B. Frydenborg, K. M. Lurding, L. A. Williams, and S. H. Wolfe.

Figure 1. Location of Bay County WWTP Aeration Lagoon



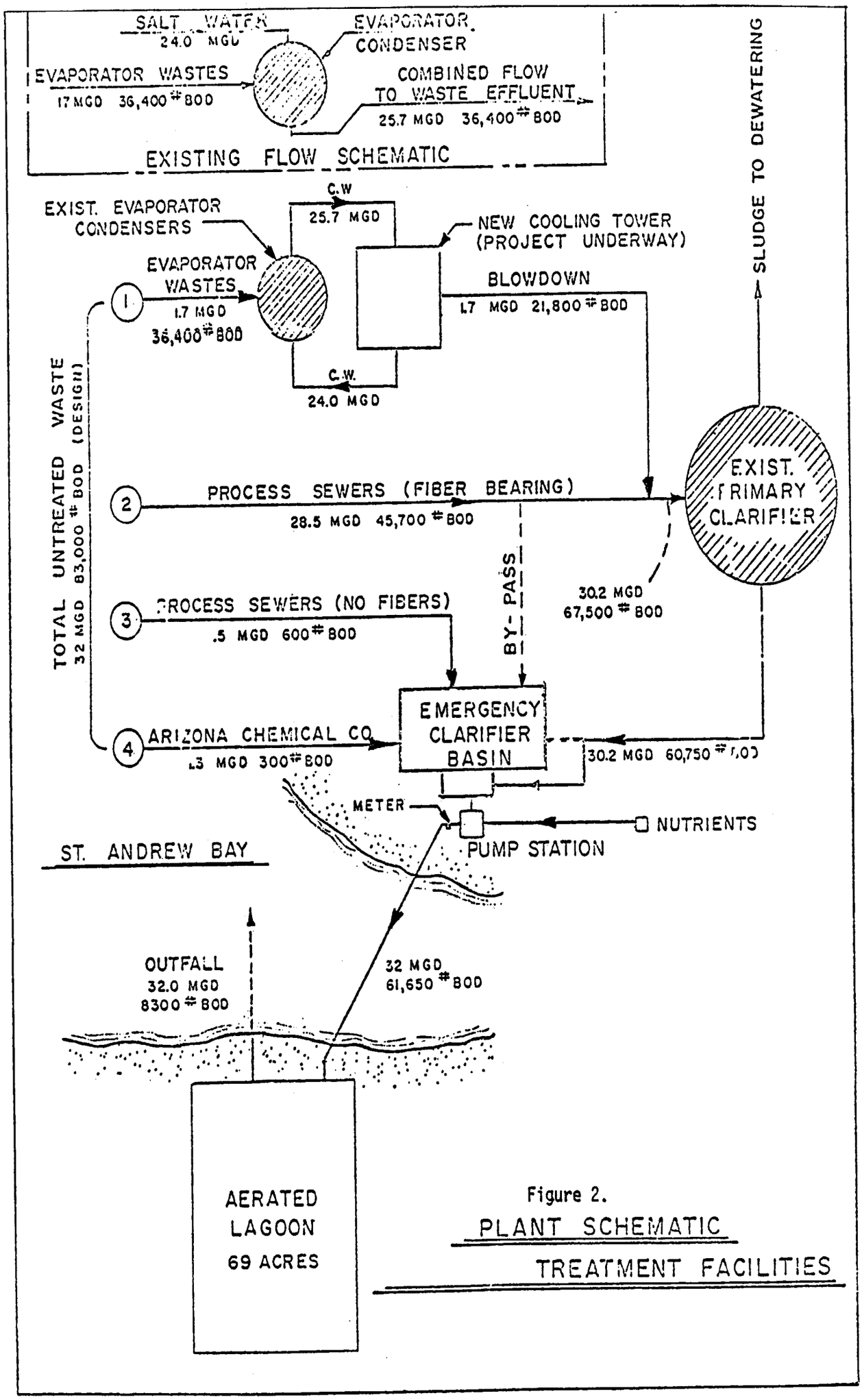


Figure 2.

PLANT SCHEMATIC

TREATMENT FACILITIES

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) and the FDER Biology Section (1985). Additionally, the Biology Section maintains cultures of several species of organisms indigenous to the State of Florida. One of these indigenous species was also selected for testing. Life histories of these test organisms and maintenance procedures used to culture them are detailed below.

The Microtox® assay was run according to the manufacturer's protocol described in the Microtox® System Operating Manual (Beckman 1982).

1. History and Maintenance of Bioassay Organisms

Ceriodaphnia dubia (water flea)—A breeding culture of *Ceriodaphnia dubia* was obtained from the EPA laboratory in Athens, Georgia, in June, 1985. The culture is maintained 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®, Cerophyl® and Fleischmann's® yeast twice daily, once daily on weekends, and are kept at a constant temperature of 26 ±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 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 Aquarian® flake food 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 Aquarian® flake food. The fish used were < 30 days old when the test commenced.

Photobacterium phosphoreum, a luminescent marine bacterium, is maintained as a freeze-dried culture, purchased from Microbics Corporation. Immediately prior to the assay, the culture is rehydrated with 1.0 ml of specially purified water (Microtox Reconstitution Solution).

2. Standard Reference Toxicity Assays

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.

3. 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

Two separate 48 hour acute toxicity bioassays and eighteen Microtox® assay was performed on a sample from the Bay County Wastewater Treatment Plant facility. The tests were performed from 26 to 28 July, 1988.

The samples were collected by personnel of the FDER Northwest District office using standard wastewater sampling procedures. The samples were iced and transported to the DER laboratory in Tallahassee for analysis 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 ± 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.

Total Residual Chlorine

Since the goal of this trial Toxicity Identification Evaluation was to identify toxic components in the sample aside from chlorine, these tests were all carried out on a sample in which the chlorine had been neutralized. Dechlorination was accomplished by adding a calculated amount of 0.025N sodium thiosulfate. The total residual chlorine concentrations of the tested sample of reclaimed water are given on the bioassay data forms.

Method

Freshwater for diluting the water samples being tested was obtained from the same DER deep well that is used to culture the test organisms. The concentration series selected for this study is given in Table 1.

Two replicates consisting of 30 ml plastic vials containing 15 mls of the control and each test concentration were used in bioassays with the water flea, *Ceriodaphnia dubia*. Adult *Ceriodaphnia* were separated using a nylon mesh sieve and placed into large culture dishes 18 hrs before the beginning of the test. Neonates produced during the intervening period (i.e., <18 hr old) were then captured by glass pipette, examined for injury, and transferred into the test chambers. Five individuals were loaded per chamber, resulting in 10 per test concentration. The water fleas were not fed during these tests.

Two replicates of each concentration and a control were used for the *Notropis leedsi* (bannerfin shiner) bioassay. The fish were transferred individually or by twos using a pipette into wide mouth quart jars containing 500 ml each of the appropriate test concentration. Five were loaded per chamber, resulting in 10 per concentration. Fish were not fed during this test.

Test Parameters

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% reclaimed water concentration. The specific conductance (YSI Model 35 Conductance meter) of each test concentration was recorded at the beginning and end of the test. All instruments were calibrated before use 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% reclaimed water 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 Table 2.

Microtox® Test

Upon receipt at the DER laboratory, a 20 ml subsample was collected for Microtox® analysis. Additional tests were performed on a subsample after each of the TIE treatments. These samples was adjusted to 2% salinity with reagent grade dry sodium chloride to maintain the osmotic balance of the test bacterium during the assay. Four two-fold dilutions were made of the test sample resulting in a test range of 99%, 49.5%, 24.75%, 12.38%, and 0%. An incubation temperature of 15 °C was maintained throughout the assay. Ten µl of bacterial suspension was added to each of the 1.0 ml test dilutions. Light output (luminescence) was read after 5 and 15 minutes incubation, using the Microtox® analyzer and recorded on a Perkin-Elmer strip chart recorder. In the presence of a toxicant, the luminescence of the test organisms will decrease. In the presence of a stimulant, the luminescence will increase. Toxicity is calculated as a function of the light lost in the test sample, normalized to the control, and is reported as the effective concentration at which a 50% reduction, of light output is determined in 15 minutes (EC_{50}). Results are given in Table 3.

Results and Discussion

Two 48 hour acute toxicity bioassays were performed on a sample from the Bay County WWTP. The sample was not toxic to the bioassay test organisms, *Ceriodaphnia dubia, Daphnia pulex,* and *Notropis leedsi.* The sample adversely affected the Microtox® assay test organism, *Photobacterium phosphoreum,* producing on EC50 of 187%. The cause of this effect was not determined.

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

Ceriodaphnia dubia (water flea)

Control	15.0 ml	0.0 ml	15 ml
10.0%	13.5 ml	1.5 ml	15 ml
30.0%	10.5 ml	4.5 ml	15 ml
50.0%	7.5 ml	7.5 ml	15 ml
70.0%	4.5 ml	10.5 ml	15 ml
85.0%	2.25 ml	12.75 ml	15 ml
100.0%	0.0 ml	15.0 ml	15 ml

Notropis leedsi (bannerfin shiner)

Concentration	Dilution Water	Sample	Total Volume
Control	500 ml	0 ml	500 ml
10.0%	450 ml	50 ml	500 ml
30.0%	350 ml	150 ml	500 ml
50.0%	250 ml	250 ml	500 ml
70.0%	150 ml	350 ml	500 ml
85.0%	75 ml	425 ml	500 ml
100.0%	0 ml	500 ml	500 ml

Table 2. Data recorded during 48-hour static acute toxicity bioassays of a sample from the Bay County Wastewater Treatment Plant, Bay County, Florida, NPDES #FL0002631, on 26 to 28 July, 1988.

Facility: **Bay County WWTP** NPDES # **FL00002631** Facility Type: **municipal/paper mill**
Location: - Contact/District: Bob Brazzell/NW
County: Bay County Test type: Static Definitive
Sample Collection Date: **7/25/88** Time: - # tests: 2 Receiving Water: **St. Andrew Bay**
Test Beginning Date: 7/26/88 Time: 1440 Chlorination Type: **Unchlorinated**
Test Ending Date: 7/28/88 Time: -

Total Residual Cl2	mg/l	Method
Field:	0.0	-
Lab:	0.0	-
Lab:	-	-

Ammonia	Total (mg/l)	Unionized (mg/l)
Control Water (fish):	-	-
Cond. Control Water (daphnids):	-	-
100% Sample:	-	-

Alk & Hardness	Alkalinity (mg/l)	Hardness (mg/l)
Control Water (fish):	-	-
Cond. Control Water (daphnids):	-	-
100% Sample:	-	-
Control Water:	-	
100% Sample:	-	

Organism: ***Ceriodaphnia dubia*** Life stage: neonate
LC50: - Binomial: - Moving Average: - Probit: -

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control	5	5	4	8.6	-	-	7.9	-	-	20.1	-	-	-	-
Control	5	5	5	8.7	-	-	7.9	-	-	-	-	-	224	-
10%	5	5	5	8.9	-	-	7.9	-	-	20.0	-	-	-	-
10%	5	5	5	9.0	-	-	7.9	-	-	-	-	-	342	-
30%	5	5	5	9.1	-	-	7.8	-	-	19.9	-	-	-	-
30%	5	5	5	9.1	-	-	7.8	-	-	-	-	-	557	-
50%	5	5	5	9.1	-	-	7.7	-	-	19.9	-	-	-	-
50%	5	5	5	9.1	-	-	7.7	-	-	-	-	-	807	-
70%	5	5	5	9.0	-	-	7.6	-	-	19.8	-	-	-	-
70%	5	5	5	8.9	-	-	7.6	-	-	-	-	-	1014	-
85%	5	5	5	8.8	-	-	7.6	-	-	19.9	-	-	-	-
85%	5	5	5	8.7	-	-	7.6	-	-	-	-	-	1191	-
100%	5	5	5	8.3	-	-	7.5	-	-	19.8	-	-	-	-
100%	5	5	5	8.3	-	-	7.5	-	-	-	-	-	1347	-

Organism: ***Notropis leedsi*** Age: <30 days
LC50: - Binomial: - Moving Average: - Probit: -

	SURVIVAL			Dissolved Oxygen			pH			Temperature			Conductivity	
Concentrations	# at 0 hr	Live at 24 hr	Live at 48 hr	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	24 hour	48 hour	0 hour	48 hour
Control	5	5	5	9.1	9.2	-	7.7	7.8	-	20.2	19.2	-	-	-
Control	5	5	5	9.1	9.2	-	7.7	7.8	-	-	-	-	220	-
10%	5	5	5	9.0	9.1	-	7.6	7.7	-	20.2	19.3	-	-	-
10%	5	5	5	9.0	9.1	-	7.6	7.7	-	-	-	-	332	-
30%	5	5	5	8.9	8.7	-	7.5	7.7	-	20.1	19.3	-	-	-
30%	5	5	5	8.9	8.7	-	7.5	7.7	-	-	-	-	578	-
50%	5	5	5	7.5	8.1	-	7.4	7.7	-	20.1	19.2	-	-	-
50%	5	5	5	7.5	8.1	-	7.4	7.7	-	-	-	-	881	-
70%	5	5	5	6.9	7.6	-	7.4	7.6	-	20.0	19.2	-	-	-
70%	5	5	5	6.9	7.5	-	7.4	7.6	-	-	-	-	1072	-
85%	5	5	5	6.0	7.0	-	7.3	7.6	-	20.0	19.3	-	-	-
85%	5	4	4	5.9	6.8	-	7.3	7.6	-	-	-	-	1259	-
100%	5	5	5	5.6	6.8	-	7.2	7.6	-	20.0	19.7	-	-	-
100%	5	4	4	5.5	6.8	-	7.2	7.6	-	-	-	-	1448	-

Table 3. Microtox test results, Bay County WWTP, Bay County, NPDES #FL0002631, on 7 June, 1988.

Microtox Test — Culture Lot # M-606

% Sample	Final Reclaimed Water nonchlorinated	
	5-min	15-min
0	94	68
0	100	73
0	96	70
12.38	93	65
12.38	93	59
12.38	98	68
24.75	91	61
24.75	91	60
24.75	97	64
49.5	80	54
49.5	82	54
49.5	81	54
99	67	41
99	73	47
99	73	45

EC_{50} Nonchlorinated (15 minute, 15 °C) = 187% sample

EC_{50} (15 minute, 15 °C) is calculated using the Data Reduction Computer Program developed by Microbics Corporation for the Sharp Model EL-5100 (Microbics) Systems Operating Manual, 1982.

Literature Cited

Beckman Instruments, Inc. 1982. Microtox system operating manual.

Florida Department of Environmental Regulation. 1985. Quality assurance manual for performing acute toxicity tests (Second Edition). Biology Section, Tallahassee.

Florida Department of Environmental Regulation. 1983. Bioassay of Bay County Wastewater Treatment Plant, Panama City Florida, NPDES #FL0002631. Biology Section. 11 p.

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_____. 1987. Bioassays of Bay County Wastewater Treatment Plant, Panama City, Bay County, Florida, NPDES #FL0002631. Biology Section. 13 p.

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Peltier, W. and C. I. Weber. 1985. Methods for measuring the acute toxicity of effluents to aquatic organisms (Third Edition). Environmental Research Laboratory. Athens, Georgia. EPA-600/4-85-012. 217 p.

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. Applicable portions of the F.A.C. are: 17-3.021(1), 17-3.021(4), 17-3.051(1)(d), 17-3.061(3)(p), 17-3.402(1), 17-4.244(4), and 17-4.244(6).

The particular restrictions applied to a given discharger depend upon the type of discharge, the type of water body which is impacted, and the type of mixing zone, if any, which has been permitted. The most stringent toxicity limitations which apply to the various combinations of these factors are listed below, specified in terms of the most dilute concentration of effluent which is allowed to kill 50% of the test organisms in 96 hours. Note that any listed concentration greater than 100% is extrapolated from toxicity curves determined from testing various effluent concentrations of 100% or less. Violations of the toxicity standards occur in the following conditions.

I. Discharges to Surface Water

   A. With no mixing zone, or with only a dredge and fill mixing zone the discharge may not exhibit an $LC_{50} < 2000\%$ at the point of discharge.

   B. With a non-dredge and fill mixing zone the discharge may not exhibit an $LC_{50} < 100\%$ at the point of discharge and may not exhibit an $LC_{50} < 2000\%$ at the edge of the mixing zone.

   C. With a non-dredge and fill mixing zone, and either discharging to the open ocean through multiport diffusers or meeting the provisions of 17-4.244(4)(b) the LC_{50} at the point of discharge cannot exceed 30% sample concentration.

II. Discharges to ground water may not exceed an LC_{50} of 300% at the point of contact with surface waters

A violation of these provisions occurs if toxicity is found at a more dilute concentration of the sampled discharge than allowed above.

C. dubia baseline

BAY Co. COWTP

Part Number: 1 of 2

Test Material: Acute Renewal, Secondary + Conventional

Test Beginning: Date 7/26/88 Time 1045

Test Organism:

Age/Life Stage:

%	Replicate Number	Number Dead 0	24	48	72	96	Chemical Oxygen Demand (mg/l) 0	24	48	72	96	pH 0	24	48	72	96	Temperature °C 0	24	48	72	96	Conductivity 0	24	48	72	96
Control		5	5	4			8.6					7.9					20.1									
"		5	5	5			8.7					7.9										224				
10%		5	5	5			8.9					7.9					20.0									
"		5	5	5			9.0					7.9										342				
30%		5	5	5			9.1					7.9					19.9									
"		5	5	5			9.1					7.8										557				
50%		5	5	5			9.1					7.7					19.9									
"		5	5	5			9.1					7.7										807				
70%		5	5	5			9.0					7.6					19.8									
"		5	5	5			8.9					7.6										1014				
85%		5	5	5			8.8					7.6					19.9									
"		5	5	5			8.7					7.6										1191				
100%		5	5	5			8.3					7.5					19.8									
"		5	5	5			8.3					7.5										1247				
Initial of Investigator				mf			RPF					RPF					RPF					RPF				

Alkalinity/Hardness (mg/l as CaCO3)

Control Water:
100% Sample:
Other:
Measured by:

Ammonia unionized/total (mg/l as NH3/N)
Hour 0

Control Water:
100% Sample:
Other:

Hour

Control Water:
100% Sample:
Other:
Measured by:

Signatures:
Russel Frydenborg
Mark Hamblett

Instrument Calibrations:

	pH Meter:	DO Meter:	S-C-T Meter:
0 Hours	7.01, 7.01	9.41 at 20.5	
24 Hours			
48 Hours			
72 Hours			
96 Hours			

Remarks: Cond. meter

Total Residual Chlorine:

Field data: Method:
Lab: Method:
Lab: Method:

De-chlorinated:
Measurements by:

Reviewed by:

Date: 3/27/89

N. Leedsi Baseline 1988

Industry/Toxicant BAT Co. WWTP
Address
Contact/District
Effluent Serial Number
NPDES Permit Number

BIOASSAY DATA FORM

Test Number: 2 of 2
Test Type: Static Renewal, Screening Conventional
Other:

Sample Collection: Date Time
Test Beginning: Date 7/26/88 Time 1440
Test Ending: Date Time
Test Organism
Age/Life Stage

Conc. or %	Test Container Number	Number of Live Organisms 0	24	48	72	96	Dissolved Oxygen (mg/l) 0	24	48	72	96	pH 0	24	48	72	96	Temperature °C 0	24	48	72	96	Conductivity 0	24	48	72	96
Control	67	5	5	5			9.1	9.2				7.7	7.8				20.2	19.2								
"	64	5	5	5			9.1	9.2				7.7	7.8									220				
10%	16	5	5	5			9.0	9.1				7.6	7.7				20.2	19.3								
"	—	5	5	5			9.0	9.1				7.6	7.7									332				
30%	38	5	5	5			8.9	8.7				7.5	7.7				20.1	19.3								
"	14	5	5	5			8.9	8.7				7.5	7.7									578				
50%	7	5	5	5			7.5	8.1				7.4	7.7				20.1	19.2								
"	11	5	5	5			7.5	8.1				7.4	7.7									831				
70%	72	5	5	5			6.9	7.6				7.4	7.6				20.0	19.2								
"	42	5	5	5			6.9	7.5				7.4	7.6									1072				
85%	41	5	5	5			6.0	7.0				7.3	7.6				20.0	19.3								
"	119	5	4	4			5.7	6.9				7.3	7.6									1259				
100%	12	5	4	5*			5.6	6.8				7.2	7.6				20.0	19.7								
"	2	5	4	4			5.5	6.8				7.2	7.6									1442				
Initial of Investigator		RF	RF	MF			RF	MF				RF	MF				RF	MF				Ref				

Alkalinity/Hardness (mg/l as $CaCO_3$)

Control Water:
100% Sample:
Other:
Measured by:

Ammonia unionized/total (mg/l as NH_3/N)
Hour 0

Control Water:
100% Sample:
Other:

Hour

Control Water:
100% Sample:
Other:
Measured by:

Signature: Russel Snyderberg
Mark Hancock

Intermittent Calibrations:

	pH Meter:	°C Meter:	D.O. Meter:
0 Hours	7.2	18.3	
24 Hours			
48 Hours			
72 Hours			
96 Hours			

Total Residual Chlorine:

Initial data: Method:
Day: Method:
Day: Method:

Intermittent:
Measurements by:

Reviewed by:
Date: 3/27/89

* Fed fish - [illegible]

MICROTOX™ Data Reduction Sheet

SOURCE: Bay County - TI #1

GRAPH CALC EC 50 (15 MIN, 15 °C) = 187 (%SAMPLE) mg/L

SAMPLE DATA:

SAMPLE TYPE (EFFLUENT, LEACHATE, ETC.): effluent

DATE ASSAYED: 7-26-88 TIME: 8:30AM

VISUAL COLOR: lt. tannin CORRECTION REQUIRED: YES (NO)

VISUAL TURBIDITY: none SEPARATION REQUIRED: YES (~~NO~~)

INITIAL pH: pH ADJUSTED TO: WITH:

OSMOTICALLY ADJUSTED WITH: MOAS (DRY NaCl) OTHER

PRIMARY DILUTION OF SAMPLE:

OPERATOR: L. Williams REAGENT VIAL LOT NO. M-606

REMARKS:

MICROTOX™ 99% TEST

SAMPLE CUVETTE	% SAMPLE	READINGS 5 MIN	READINGS 15 MIN	Γ5	Γ15	NOTES
A1	0	94	68	X	X	
B1		100	73			
C1		96	70			
A2	12.38	93	65	.02	.10	
B2		93	59			
C2		98	68			
A3	24.75	91	61	.04	.14	
B3		91	60			
C3		97	64			
A4	49.5	80	54	.19	.30	
B4		82	54			
C4		81	54			
A5	99	67	41	.36	.59	
B5		73	47			
C5		73	45			
EC_{50} (MIN, °C)				175.91	186.79	

REVIEWED BY:

DATE: 3/27/89