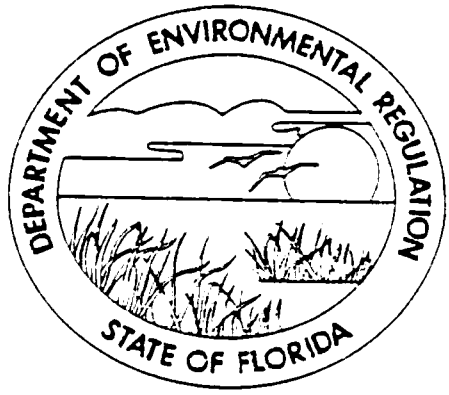


BIOASSAY OF BAY COUNTY WASTEWATER TREATMENT PLANT PANAMA CITY, FLORIDA

NPDES #FL0002631

Biology Section
Bureau of Water Analysis
August 10, 1983

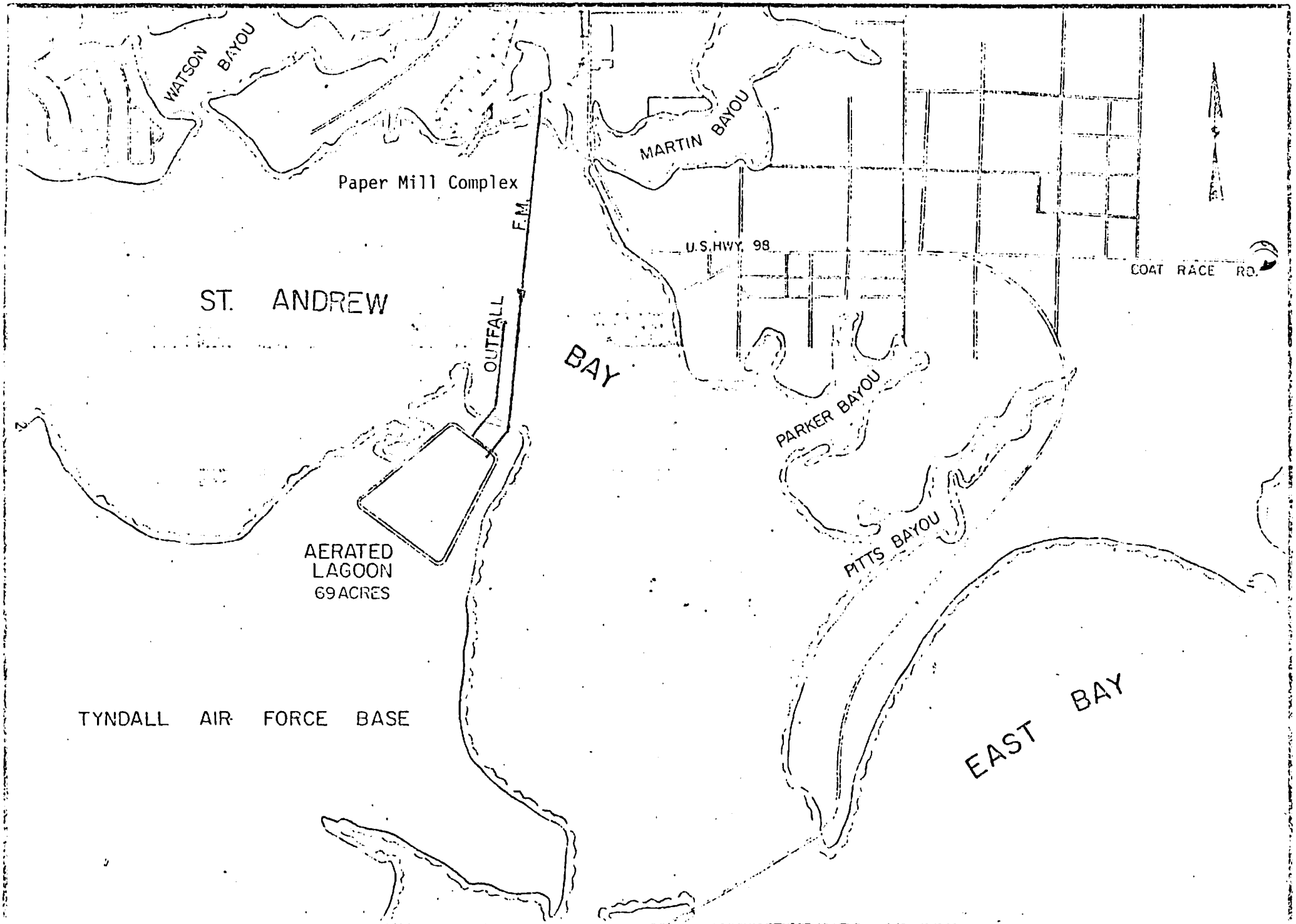
INTRODUCTION

The Bay County WWTP final treatment process, a 69 acre aerated lagoon, is located on Tyndall Air Force Base, across St. Andrew Bay from the Southwest Forest/Arizona Chemical Company paper mill complex (Fig. 1). The Bay County facility receives approximately 32 MGD of waste from the paper mill complex for treatment. Pre-treatment at the complex includes evaporator waste condensers, primary clarification, and nutrient addition (Fig. 2). Domestic wastes 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. Pre-treatment of these wastes may include degritting, primary treatment, and chlorination, prior to being pumped to the aerated lagoon for final treatment. No additional chlorination is used at the aerated lagoon (according to the NPDES file). After approximately 10 days retention in the aerated lagoon, the wastewater is discharged through a 1300' outfall to St. Andrew Bay at a depth of approximately 15 feet.

The Biology Section has previously evaluated the toxicity of the final effluent from the Bay County WWTP, by performing two static acute toxicity bioassays in September, 1980. The results of those tests, using Daphnia pulex and Mysidopsis bahia as test organisms, indicated that the effluent was not acutely toxic. However, the effluent holding time was exceeded, thereby invalidating the tests and no report was issued.

Since recent modifications at the paper mill complex had added certain wastewater components to the treatment process, an additional bioassay was performed on 12 to 14 July, 1983, to re-evaluate the toxicity of the effluent. The effluent sample was collected from the aeration lagoon's overflow point. It is most likely that any total residual chlorine remaining from the primary treatment of the domestic waste sources had dissipated by this time. Mysidopsis bahia was used as the test organism. The results of this latest test are presented in this report. Those involved in performing the test and in preparing this report were: C. W. Dye, R. B. Frydenborg, M. L. Roll, and K. A. Study.

Figure 1. Location of Bay County WWTP Aeration Lagoon



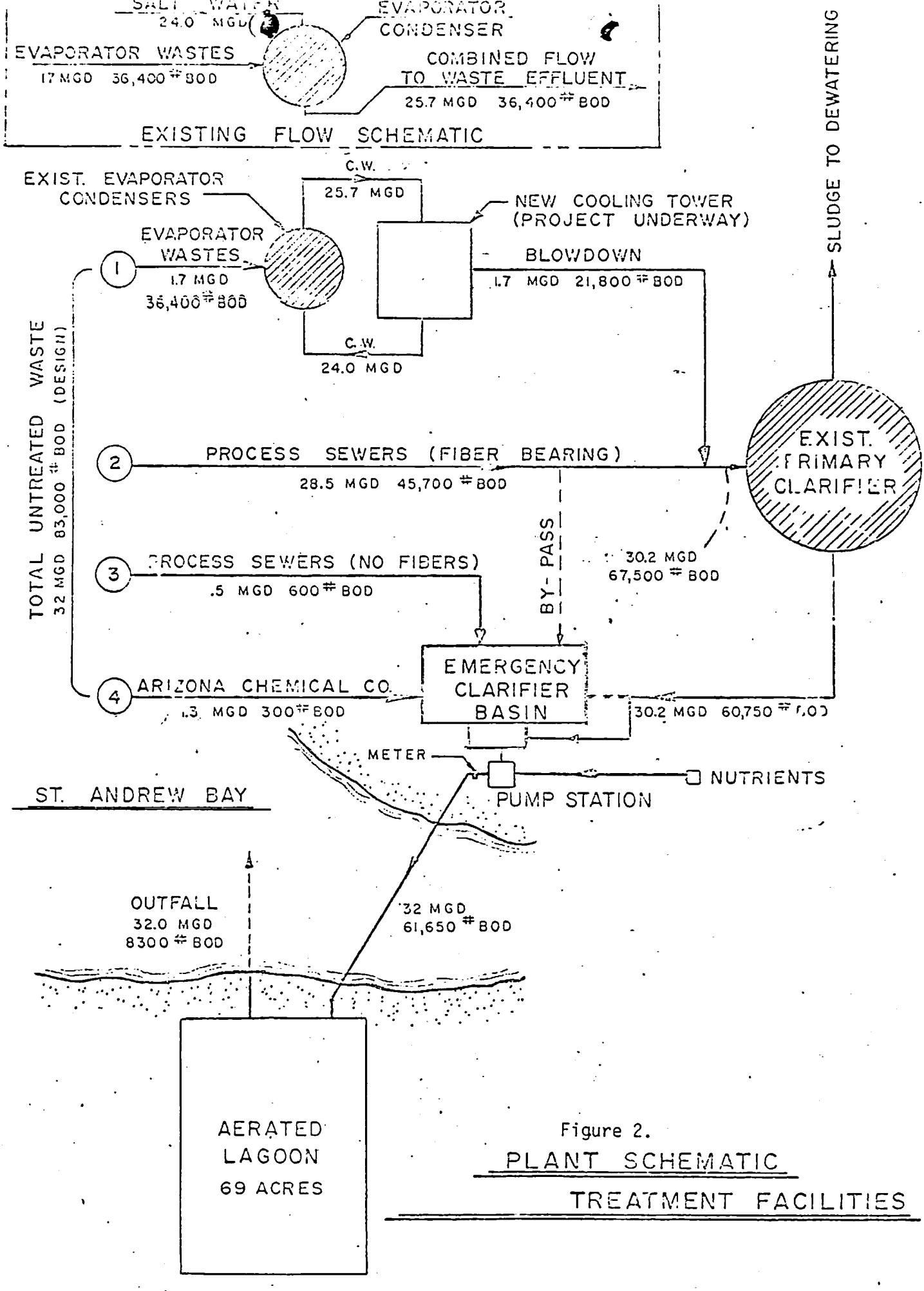


Figure 2.

PLANT SCHEMATIC

TREATMENT FACILITIES

METHODS AND MATERIALS

Test methods used to conduct this static bioassay are extensively described by Peltier (1978) and the FDER Biology Section (1983). The organism selected for this study is among those recommended by Peltier (1978), the U.S. EPA (1978), and the FDER Biology Section (1983). The life history and maintenance procedures used to culture the organism are detailed below.

History and Maintenance of Bioassay Organisms

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 with freshly hatched Artemia (brine shrimp) and are kept at a constant temperature of 22° plus or minus 2°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

A 48 hour static acute toxicity bioassay was performed on a sample of effluent collected from the Bay County WWTP aeration lagoon's overflow point. The test was performed from 1100 hours on 12 July to 1115 hours on 14 July, 1983. The sample was collected by Mr. Richard Sublette of DER's Panama City office at 1432 hours on 11 July, 1983, 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.

Saltwater for dilution of the effluent sample was obtained from the FSU Marine Laboratory at Turkey Point (salinity = 24.9 ppt). For test concentrations of 56% and below, this diluent was mixed directly with the effluent, achieving a range of final salinities (11.5 ppt to 23.0 ppt). For the 100% effluent test concentrations, freshly autoclaved artificial sea salts (Ocean 50®) were added until salinities of approximately 7 ppt were achieved (the lower limit of mysid shrimp salinity tolerance). Four 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 (24.9 ppt). This represents the highest concentrations of Turkey Point water used in the bioassay, and tests for toxicity in the diluent. This is also 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 (Ocean 50®) 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.

3) pH Adjusted Effluent Control - Effluent (100%) which has been adjusted to a salinity of approximately 7 ppt using Ocean 50®, and which has then been pH adjusted using hydrochloric acid to the original pH of the effluent prior to salinity adjustment. This test ensures that toxicity observed in the bioassay is not merely due to a change in pH caused by the sea salts.

4) Acid Control - Well water, adjusted with Ocean 50® to a salinity of approximately 7 ppt, with an amount of hydrochloric acid added equal to that added in the pH Adjusted Effluent Control. This tests for toxicity in the pH Adjusted Effluent Control due to the hydrochloric acid.

The concentration series selected for this study (Table 1) is that recommended by APHA (1980). Two replicates of each randomly arranged 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, 20 ppt, and 25 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 chamber at 0 hours, 24 hours, and 48 hours. The 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 Seawater diluent control 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 This Static Bioassay

Mydidopsis 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, Mysidopsis bahia, static acute toxicity bioassay of the Bay County WWTP, Panama City, Florida, NPDES #FL0002631, on 12 to 14 July, 1983.

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
5.6%	5	5	5	8.4	7.7	7.8	8.0	7.9	8.0	20.0	19.3	19.7				
5.6%	5	5	5	8.4	7.7	7.8	8.0	7.9	8.0						23.0	21.5
10.0%	5	5	5	8.3	7.8	7.7	7.9	7.9	8.0	19.7	19.3	19.8				
10.0%	5	5	5	8.3	7.8	7.7	7.9	7.9	8.0						22.0	21.0
18.0%	5	5	5	8.3	7.9	7.9	7.8	7.9	8.0	19.7	19.4	19.7				
18.0%	5	5	5	8.3	7.9	8.0	7.8	7.9	8.0						18.2	19.5
32.0%	5	5	5	7.7	7.9	7.8	7.7	7.9	8.0	19.7	19.3	19.7				
32.0%	5	5	5	7.7	7.9	7.8	7.7	7.9	8.0						17.0	16.8
56.0%	5	5	5	6.7	7.5	7.7	7.5	7.8	8.0	19.7	19.5	19.7				
56.0%	5	5	5	6.7	7.5	7.7	7.5	7.8	8.9						11.5	11.5
100.0%	5	5	5	6.0	8.0[a]	6.5	7.8	7.8	8.1	20.0	19.4	19.7	.13/4.7	--		
100.0%	5	5	5	5.9	8.2[a]	6.5	7.8	7.8	8.2						7.2	7.4

Remarks: [a]These test chambers were aerated overnight, from hour 5 to hour 21 of the test.

Table 3. Data recorded during 48 hour, Mysidopsis bahia, static acute toxicity bioassay of the Bay County WWTP, on 12 to 14 July, 1983.

Control Series

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	8.6	7.9	8.0	8.0	7.9	8.0	19.6	19.4	19.9	.02/.60	--		
Diluent Control	5	5	5	8.6	7.9	8.0	8.0	7.9	8.0						24.9	23.2
Sea Salts Control	5	5	5	9.1	8.7	8.6	8.6	8.4	8.3	21.0	19.4	19.9				
Sea Salts Control	5	5	5	9.1	8.7	8.6	8.6	8.3	8.3						8.0	7.5
pH Adj. Effluent	5	5	5	6.7	8.1[a]	6.4	7.4	7.9	8.1	19.9	19.3	19.9	.05/4.7	--		
pH Adj. Effluent	5	5	4	6.7	8.1[a]	6.4	7.4	7.9	8.1						7.3	7.0
Acid Control	5	5	5	8.8	8.8	8.6	7.4	8.3	8.0	21.8	19.5	19.7				
Acid Control	5	5	5	8.8	8.8	8.6	7.4	8.3	8.0						7.1	6.8

Remarks: [a]These test chambers were aerated overnight, from hour 5 to hour 21 of the test.

RESULTS AND DISCUSSION

The sample of wastewater effluent, collected from the Bay County WWTP aeration lagoon's overflow point, was not toxic to Mysidopsis bahia. Only one shrimp, in the pH adjusted 100% effluent, died during the 48 hour static test (Table 3). The moderate amount of total ammonia detected in the effluent (4.7 mg/l) apparently did not have a toxic effect on the test organisms. Since the effluent was not acutely toxic, chemical analyses were not performed.

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