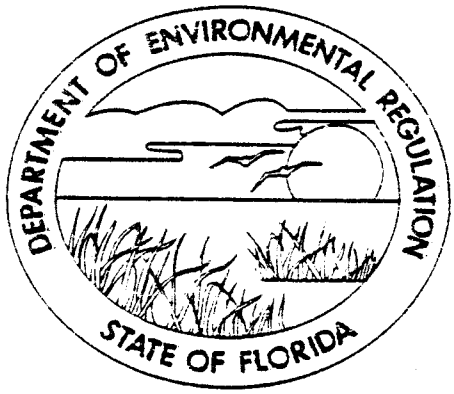


BIOASSAYS OF THE JACKSONVILLE BEACH

SEWAGE TREATMENT PLANT

DUVAL COUNTY, FLORIDA, NPDES #FL0020231

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Biology Section
Bureau of Water Analysis
February 4, 1983

BIOASSAYS OF THE JACKSONVILLE BEACH SEWAGE TREATMENT PLANT DUVAL COUNTY, FLORIDA, NPDES #FL0020231

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EXECUTIVE SUMMARY

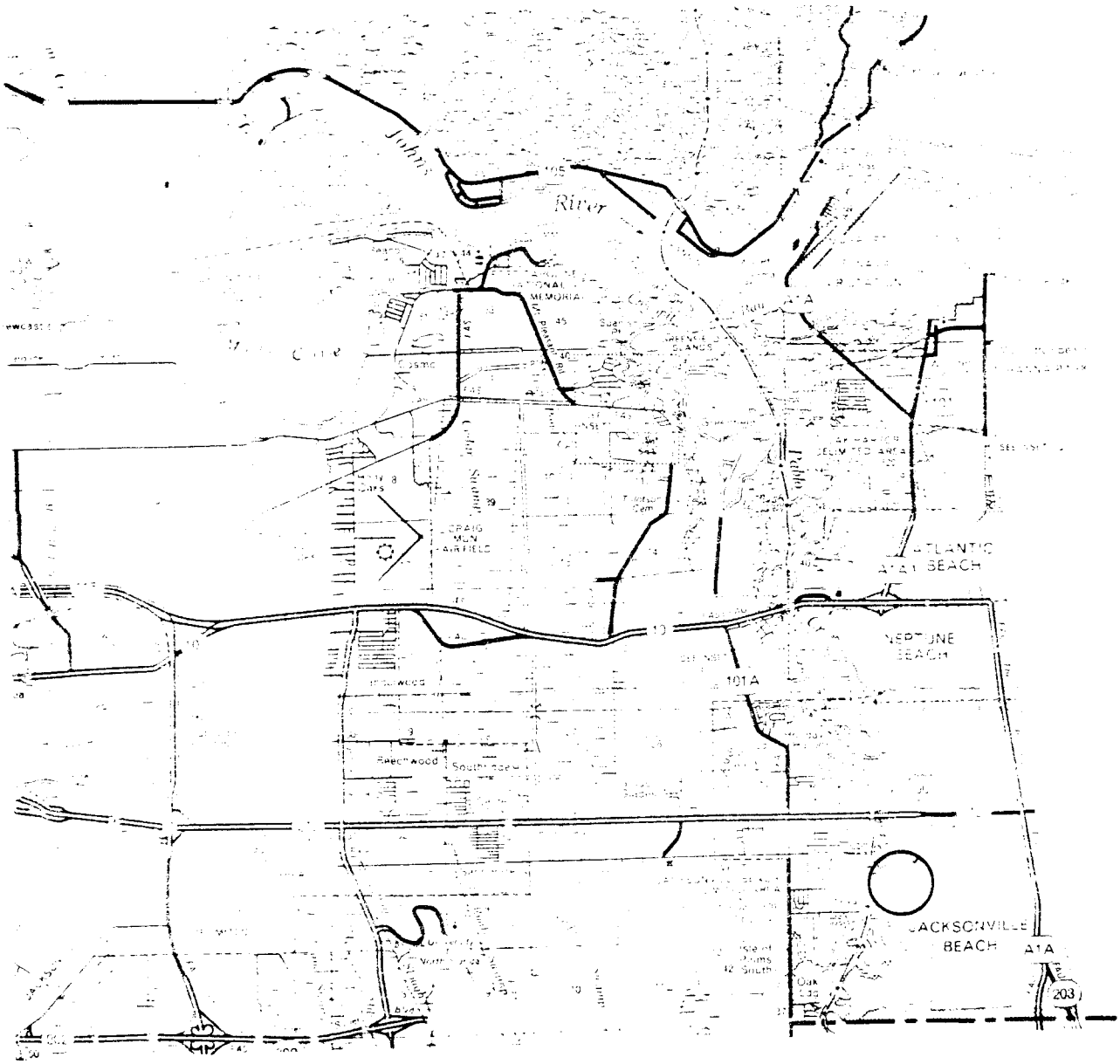
Jacksonville Beach STP, NPDES #FL0020231, on 17 to 19 November, 1982

The samples of pre-chlorinated, chlorinated and de-chlorinated effluents from this domestic waste treatment facility were all acutely toxic to Mysidopsis bahia, with 48 hour LC_{50} values of 38.6% to 40.8%, 39.8% to 43.6%, and 46.2% to 63.1%, respectively. A portion of the toxicity in these effluents can be attributed to the significant concentrations of total and unionized ammonia present (8.0 to 11.3 mg/l and .09 to .56 mg/l, respectively). The presence of total residual chlorine in the chlorinated sample (0.44 to 0.6 mg/l) apparently did not increase the toxicity over that of the pre-chlorinated sample. Chemical analyses indicated the presence of the pesticide Lindane (0.25 µg/l) and the metals copper (38 µg/l), silver (1.0 µg/l), and zinc (61 µg/l). These chemical constituents, specifically the Lindane and copper, may have caused the observed toxicity, since concentrations less then what were detected here have been shown to be acutely toxic to certain aquatic organisms.

INTRODUCTION

The Jacksonville Beach Sewage Treatment Plant is located at 822 10th Street in Jacksonville Beach, Duval County, Florida (Fig. 1). This facility has a permitted flow capacity of 3.0 MGD and treats an average flow of 2.87 MGD. Domestic waste from a population of approximately 20,000 is treated using contact stabilization and activated sludge (Fig. 2). There are no known industrial contributors to this facility. Final discharge of effluent is to San Pablo Creek, a tidal tributary of the Intracoastal Waterway. However, construction is scheduled to begin to relocate this discharge to the St. Johns River.

This facility has a record of toxicity problems with its effluent. In August, 1982, the EPA performed a Pimephales promelas 48 hour static bioassay on this effluent that produced an LC_{50} of 34% (from NPDES file). Additionally, a February, 1982, FDER BOD analysis on this effluent was invalidated due to interference caused by the presence of toxic material (from NPDES file). To further evaluate the toxicity of this effluent to biota of the receiving waters, the FDER Biology Section performed three 48 hour static bioassays, on pre-chlorinated, chlorinated and de-chlorinated samples, from 17 to 19 November, 1982. The results of these tests are presented in this report.



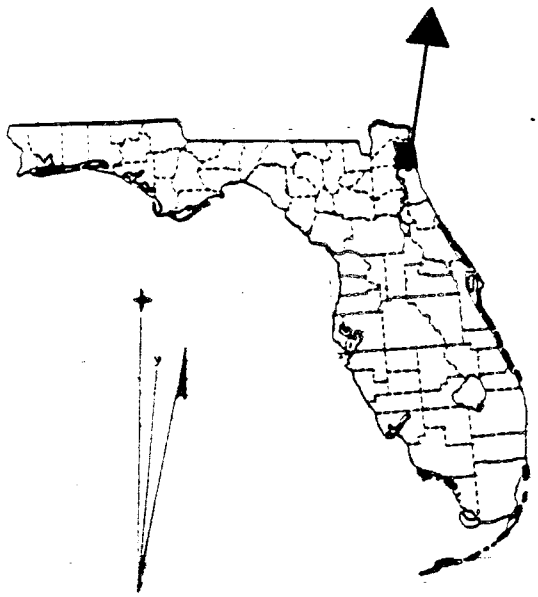


Figure 1. Portions of Duval County, Florida, including location of the Jacksonville Beach STP.

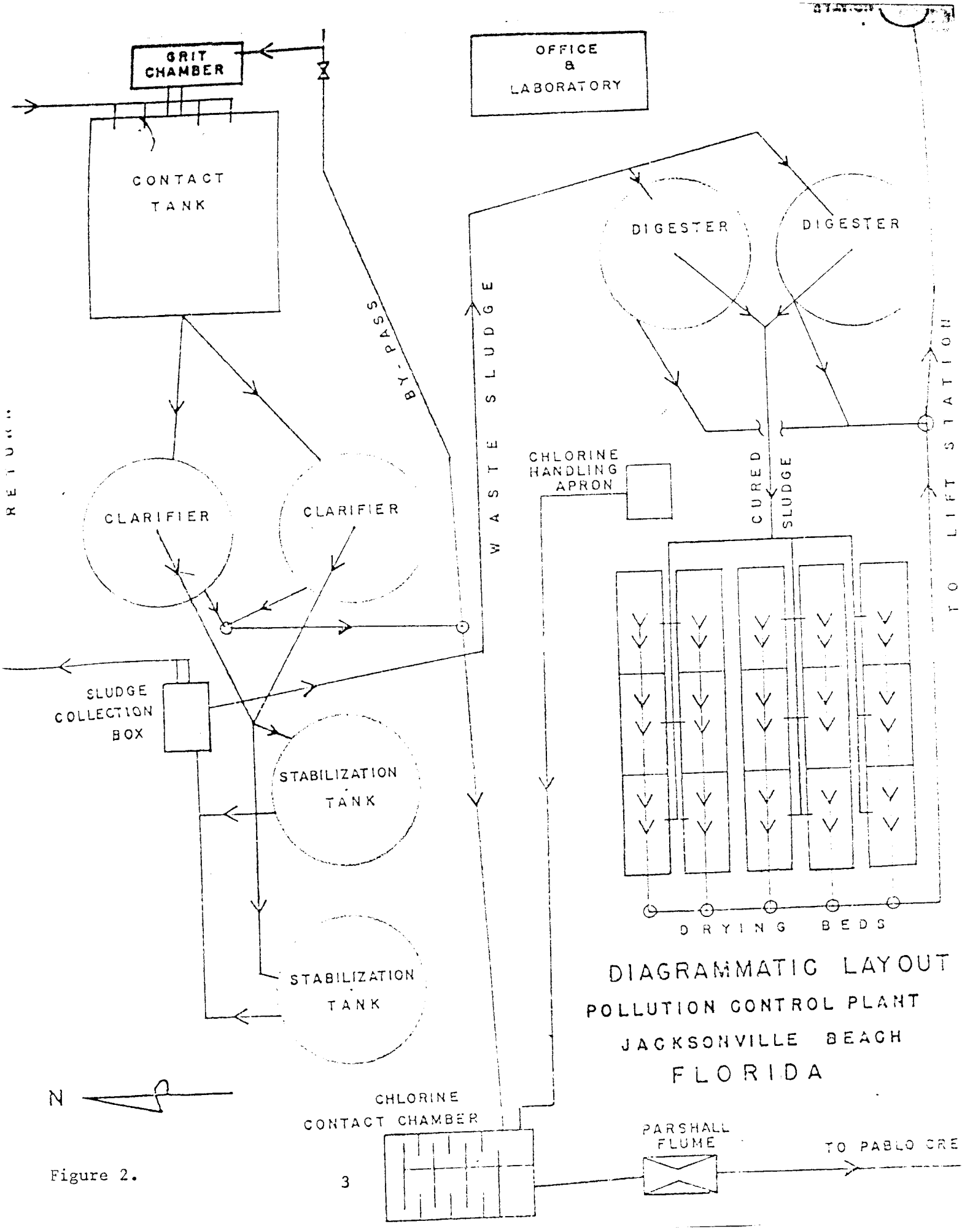

GRIT CHAMBER
OFFICE & LABORATORY
CONTACT TANK
DIGESTER
DIGESTER
BY-PASS
WASTE SLUDGE
CLARIFIER
CLARIFIER
CHLORINE HANDLING APRON
CURED SLUDGE
TO LIFT STATION
SLUDGE COLLECTION BOX
STABILIZATION TANK
STABILIZATION TANK
DRYING BEDS
DIAGRAMMATIC LAYOUT
POLLUTION CONTROL PLANT
JACKSONVILLE BEACH
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N
CHLORINE CONTACT CHAMBER
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Figure 2.

METHODS AND MATERIALS

Test methods used to conduct these static bioassays are extensively described by Peltier (1978). The organism selected for this study is among those recommended by Peltier (1978) and the U.S.EPA (1978). 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 1°C. Ten to fifteen day old (three-quarter adult size) mysids were used in this test.

To ensure the uniform sensitivity of these test organisms to toxic substances, the Biological Section conducts monthly standard reference toxicant bioassays using sodium lauryl sulfate as the reference toxicant.

Test Methods

Three separate 48 hour static acute toxicity bioassays were performed on samples of pre-chlorinated, chlorinated and de-chlorinated effluents from the Jacksonville Beach STP. The tests were performed from 1140 hours on 17 November to 1145 hours on 19 November, 1982. The samples were collected by Mr. Charles Love of DER's Northeast District at 1218 hours on 16 November, 1982 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.

To differentiate between the toxicity resulting from chlorine and the toxicity associated with some other component of the effluent, the Biology Section adopted the following test procedure:

Test #1. Pre-Chlorinated Effluent (Table 2). This test was performed on an effluent sample collected at the end of the treatment process but prior to chlorination, and was intended to evaluate the toxicity of the effluent without the added toxic effects of chlorine.

Test #2. Chlorinated Effluent (Table 3). This test was performed on an effluent sample collected at the point of discharge.

Test #3. De-chlorinated Effluent (Table 4). This test was performed on a subsample of the chlorinated effluent sample in which the chlorine had been neutralized. De-chlorination was accomplished by adding a calculated amount of 0.025 N sodium thiosulfate. This test was intended to evaluate the combined toxiity of the effluent and the chlorine reaction products.

Saltwater for dilution of the effluent samples was obtained from the FSU Marine Laboratory at Turkey Point (salinity = 30 ppt). This saltwater diluent was then adjusted to a moderate salinity (21 ppt) characteristic of the receiving body of water (Intracoastal Waterway) by adding an appropriate amount of DER well water. For test concentrations of 56% and below, this adjusted diluent was mixed directly with the effluents, achieving a range of final salinities (9.5 ppt to 19.5 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). A series of five control groups (Table 5) was 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: adjusted Turkey Point seawater (salinity = 21 ppt), artificial sea salt (Ocean 50®) adjusted well water (salinity = 7.5 ppt), and a salinity control consisting of Turkey Point seawater and well water (salinity = 10 ppt). Additionally, two control groups were added consisting of sea salt adjusted 100% pre-chlorinated sample and sea salt adjusted well water, with their pH's adjusted with hydrochloric acid to the original pH of the sample. Since sea salts increase the pH, thereby increasing the amount of toxic unionized ammonia, these additional controls were necessary to ensure that any mortality was not the result of an artificial rise in pH. The concentration series selected for this study (Table 1) is that recommended by the 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. Ten to fifteen day old (three-quarter adult size) mysids were used in these 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, pH, temperature, and the number of live organisms were recorded for each test chamber at 0 hours, 24 hours, and 48 hours. The salinity of each test concentration was recorded at the beginning and end of the test. Ammonia concentrations, including total and unionized fractions (expressed in mg/l as N and as NH_3, respectively), were recorded in the sea salts control 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 determined 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 5.

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

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, Mysidopsis bahia, static acute toxicity bioassay of Jacksonville Beach, STP, Duval County, Florida, NPDES #FL0020231, on 17 to 19 November, 1982.

Test #1 Pre-chlorinated Sample

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Temperature (°C)			NH_3/NH_3+NH_4 (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	7.6	7.6	6.5	8.2	8.0	7.8	20.6	19.0	19.0				
5.6%	5(4)[a]	4	4	7.6	7.6	6.5	8.2	8.0	7.8						19.5	21.2
10.0%	5	5	5	7.3	7.5	6.6	8.1	8.0	7.8	20.6	18.8	18.9				
10.0%	5	5	5	7.3	7.6	6.5	8.1	8.0	7.8						18.8	20.2
18.0%	5	5	4	7.1	7.2	6.6	8.0	8.0	7.8	20.6	18.5	18.8				
18.0%	5	5	5	7.1	7.2	6.6	8.0	8.0	7.8						18.0	19.0
32.0%	5	5	5	6.5	7.3	6.9	7.8	8.0	7.9	20.9	18.5	18.8				
32.0%	5	5	4	6.5	7.3	6.9	7.8	7.9	7.9						14.5	15.2
56.0%	5	4	0	5.6	7.4	7.0	7.6	7.9	8.0	21.4	18.8	18.8				
56.0%	5(4)[b]	4	0	5.6	7.4	7.0	7.6	7.9	7.9						10.0	10.2
100.0%	5	2	1	4.7	7.0	6.2	7.9	8.1	8.1	21.4	19.0	19.3	.29/8.6	--		
100.0%	5	3	0	7.8	6.9	6.2	7.9	8.1	8.0						7.2	7.4

Remarks: [a] Number in parentheses used in calculations since one organism was cannibalized between 0 and 24 hours.

[b] Number in parentheses used in calculations since one organism jumped out between 0 and 24 hours.

Table 3. Data recorded during 48 hour, Mysidopsis bahia, static acute toxicity bioassay of Jacksonville Beach STP, Duval County, Florida, NPDES #FL0020231, on 17 to 19 November, 1982.

Test #2 Chlorinated Sample[a]

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Temperature (°C)			NH_3/NH_3+NH_4 (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	8.0	7.5	6.4	8.1	8.0	7.9	20.5	18.8	19.2				
5.6%	5	5	5	8.0	7.5	6.6	8.2	8.0	7.9						19.2	21.2
10.0%	6[b]	6	6	7.9	7.5	6.7	8.2	8.0	7.9	20.4	18.5	19.1				
10.0%	5	5	5	7.9	7.5	6.7	8.2	8.0	7.9						18.8	20.2
18.0%	5	5	4	7.9	7.5	6.7	8.0	8.0	7.9	20.3	18.5	19.0				
18.0%	5	5	5	7.9	7.5	6.7	8.0	8.0	7.9						16.0	17.4
32.0%	5	5	4	8.0	7.9	6.9	7.9	8.0	7.9	20.3	18.5	19.0				
32.0%	5	5	3	8.0	7.9	6.9	7.9	8.0	7.9						14.2	15.0
56.0%	5	5	0	8.1	8.1	6.3	7.6	8.0	7.9	20.1	18.5	19.1				
56.0%	5	5	2	8.1	8.2	6.3	7.6	8.0	7.9						9.5	10.2
100.0%	5	3	0	8.0	8.4	5.4	8.0	8.1	8.0	20.1	18.8	19.3	.30/8.0	--		
100.0%	5	4	2	8.0	8.4	5.0	8.0	8.2	8.0						7.5	8.0

Remarks: [a]Total Residual Chlorine: 0.6 mg/l (HACH DPD Method), 0.44 mg/l (Iodometric Method I).

[b]Extra organism loaded by mistake, allowed to remain.

Table 4 . Data recorded during 48 hour, Mysidopsis bahia, static acute toxicity bioassay of Jacksonville Beach STP, Duval County, Florida NPDES #FL0020231, on 17 to 19 November, 1982.

Test #3 De-chlorinated Sample[a]

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Salinity (ppt)	
	0	24	48	0	24	48	0	24	48	0	24	48	0	48	0	48
5.6%	5	5	4	7.8	7.9	6.5	8.2	8.0	7.9	20.5	18.8	19.0				
5.6%	5	5	5	7.8	7.8	6.5	8.2	8.0	7.9						19.5	22.0
10.0%	5	5	5	7.7	7.5	6.6	8.2	8.0	7.9	20.4	18.8	19.0				
10.0%	5	5	5	7.7	7.6	6.6	8.2	8.0	7.9						18.8	20.4
18.0%	5	5	5	7.7	7.3	6.7	8.1	8.0	7.9	20.4	18.8	19.0				
18.0%	5	5	4	7.7	7.4	6.7	8.1	8.0	7.9						17.0	18.2
32.0%	5	5	3	8.0	7.1	6.8	8.0	7.9	7.9	20.4	18.8	19.0				
32.0%	5	5	5	8.0	7.1	6.8	8.0	7.9	7.9						14.8	15.8
56.0%	5(4)[b]	4	2	8.2	7.0	6.5	7.8	7.9	7.9	20.4	18.8	19.0				
56.0%	5	5	1	8.2	7.0	6.5	7.8	7.9	7.9						9.8	10.3
100.0%	5	4	1	8.3	6.1	5.6	8.1	8.1	8.0	20.7	18.8	19.2	.56/11.3	--		
100.0%	5	5	3	8.3	6.1	5.6	8.1	8.1	8.0						7.2	7.8

Remarks: [a] Total Residual Chlorine: <0.04 mg/l (HACH DPD Method).

[b] Number in parentheses used in calculations since one organism jumped out between 0 and 24 hours.

Table 5. Data recorded during 48 hour, Mysidopsis bahia, static acute toxicity bioassay of Jacksonville Beach STP, Duval County, Florida, NPDES #FL0020231, on 17 to 19 November, 1982.

Control Series

Concentration or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Salinity (ppt)	
	0	24	48	0	24	48	0	24	48	0	24	48	0	48	0	48
Seawater Control	5(4)[b]	4	4	7.7	7.5	6.9	8.2	8.1	7.9	20.6	19.0	19.5				
Seawater Control	5	5	5	7.7	7.6	6.9	8.2	8.1	7.9						21.0	23.2
Sea Salts Control	5	5	5	8.2	8.0	7.1	8.6	8.4	8.1	20.9	19.0	19.5	0/.03	--		
Sea Salts Control	5	5	5	8.2	8.2	7.1	8.6	8.4	8.1						7.5	7.8
Salinity Control	5	5	5	8.1	7.9	7.2	8.1	8.1	8.0	20.8	19.0	19.4				
Salinity Control	5	5	5	8.1	7.9	7.2	8.1	8.1	8.0						10.0	10.8
pH Adj. Sea Salts	5	5	4	8.3	8.2	7.1	7.4	8.0	7.9	21.1	19.0	19.4				
pH Adj. Sea Salts	5(4)[c]	4	4	8.3	8.2	7.1	7.4	8.0	7.9						7.2	7.4
pH Adj. Effluent[a]	5	3	0	5.5	6.8	5.6	7.4	7.9	7.9	21.3	19.0	19.3	.09/8.6	--		
pH Adj. Effluent[a]	5(4)[c]	3	0	5.5	6.8	5.7	7.4	7.9	7.9						7.2	7.6

Remarks:

[a] 100% pre-chlorinated effluent was used for this control.

[b] Number in parentheses used since one organism was cannibalized between 0 and 24 hours.

[c] Numbers in parentheses used since one organism each jumped out between 0 and 24 hours.

Table 6. LC_{50} Data for Bioassays of the Jacksonville Beach STP, NPDES #FL0020231, on 17 to 19 November, 1982.

Organism	Method of Data Analysis	24 Hour LC_{50} and 95% Confidence Intervals	48 Hour LC_{50} and 95% Confidence Intervals
Test #1: *M. bahia* Pre-chlorinated Sample	Binomial	100.0% (56 and ∞),b	40.0% (32 and 56)
	Moving Average	100.0% (72 and ∞),b	38.6% (28 and 59)
	Probit	99.1% (75 and 346),b	40.8% (31 and 55)
Test #2: *M. bahia* Chlorinated Sample	Binomial	a	39.8% (18 and ∞)
	Moving Average	a	40.9% (24 and 66)
	Probit	a	43.6% (32 and 63)
Test #3: *M. bahia* De-chlorinated Sample	Binomial	a	46.2% (18 and ∞)
	Moving Average	a	52.9% (0 and ∞)
	Probit	a	63.1% (39 and 178)

[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.

[b] Due to the distribution of mortality, the LC_{50} value calculated by this method of statistical analysis does not meet the criteria established by the Committee on Methods for Toxicity Tests with Aquatic Organisms.

RESULTS AND DISCUSSION

The bioassays performed on the samples of effluent from the Jacksonville Beach STP indicated that all three effluents were similar in their acute toxicity to Mysidopsis bahia. The pre-chlorinated effluent produced 48 hour LC_{50} values of 38.6% to 40.8% (Table 6). The chlorinated effluent produced similar 48 hour LC_{50}'s of 39.8% to 43.6% (Table 6). The de-chlorinated effluent produced slightly higher 48 hour LC_{50} values of 46.2% to 63.1% (Table 6). The 96 hour LC_{50}'s for these effluents would be less than or equal to their 48 hour values. The data also suggest that the toxicity of the pre-chlorinated effluent appeared earlier than the other two effluents, since the pre-chlorinated effluent also produced 24 hour LC_{50} values of 99.1% and 100.0% (Table 6). The total residual chlorine measured in the chlorinated effluent (0.44 mg/1 and 0.6 mg/1, Table 3) apparently did not increase the toxicity of that sample above the toxicity noted in the pre-chlorinated sample. These facts suggest the presence of toxic substances (other than chlorine) in the final effluent from this facility.

Some portion of the toxicity in these effluents may be attributed to the significant concentrations of total and unionized ammonia present (8.0 mg/1 to 11.3 mg/1 and .09 mg/1 to .56 mg/1, respectively). The toxicity cannot solely be attributed to ammonia, however, since the 0.09 mg/1 unionized ammonia measured in the pH adjusted effluent control (Table 5), where 100% mortality was noted, was considerably lower than the amount reported to be toxic to certain freshwater fish (Thurston et al., 1981).

The DER Chemistry Section has analyzed samples of this effluent for certain organic compounds and metals (Table 7). Present in the effluent were significant concentrations of the pesticide Lindane (0.25 µg/1) and the metals copper (38 µg/1), silver (1.0 µg/1) and zinc (61 µg/1). Since very small concentrations of Lindane have been shown to be acutely toxic to the brown shrimp, Penaeus aztecus, and to the pink shrimp, Penaeus duorarum (0.4 µg/1 and 0.17 µg/1 respectively, U.S. EPA 1976), the 0.25 µg/1 Lindane detected in this effluent may have caused the toxicity to the mysid shrimp noted in these tests. Additionally, since copper concentrations as low as 18 µg/1 and silver concentrations of 5.8 µg/1 have been reported to be acutely toxic to certain aquatic life (U.S. EPA 1976), the concentrations of these metals detected in this effluent may have contributed to the observed toxicity.

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 (3), 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, whether as 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)(o); that is, the concentrations cannot excceed 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 disharge, 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} standard. 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.

TABLE 7. Results of Chemical Analyses Performed on Effluent from the Jacksonville Beach STP, NPDES #FL0020231, collected on November 16, 1982.

Organics

Acid Extractables	N.D.
Base Neutral Extractables	N.D.
Pesticide Extractables	g-BHC (Lindane) at 0.25 µg/l

Metals

Antimony	N.D.
Arsenic	<10 µg/l[a]
Beryllium	N.D.
Cadmium	<0.1 µg/l[a]
Chromium	N.D.
Copper	38 µg/l
Lead	N.D.
Mercury	N.D.
Nickel	N.D.
Salenium	N.D.
Silver	1.0 µg/l
Thallium	N.D.
Zinc	61 µg/l

N.D. = None Detected

[a] Actual value in known to be less than the value given.

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