BIOASSAY OF ALTON BOX BOARD PACKAGING COMPANY

JACKSONVILLE, DUVAL COUNTY, FLORIDA

NPDES #FL0000892

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Biological Section
Bureau of Water Analysis
May 5, 1982

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EXECUTIVE SUMMARY

Alton Box Board Packaging Company, NPDES #FL0000892, on 30 March to 1 April, 1982.

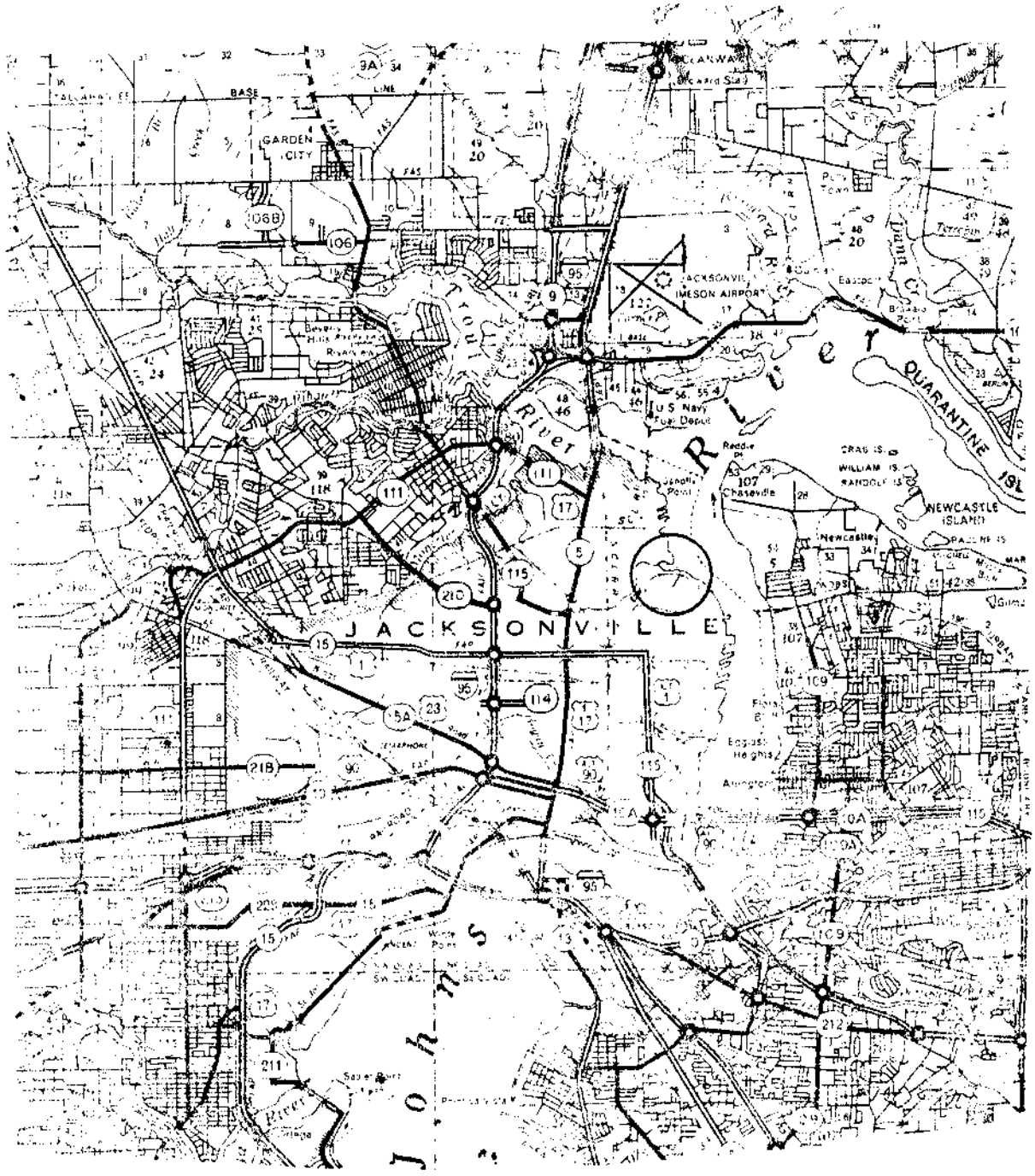
The sample of wastewater effluent from this discharger, a manufacturer of paper products located in Jacksonville, was toxic to the test organism, Mysidopsis bahia. However, the shrimp mortality noted in the test was attributed to a substantial decrease in dissolved oxygen towards the end of the test which was likely due to the high biochemical oxygen demand of the effluent. Therefore, this test was inconclusive with respect to determining toxic aspects of the effluent. Unlike the previous test performed on this facility (September 1981), absolutely no ammonia was determined in this effluent. We recommend, therefore, that this test be repeated.

INTRODUCTION

The Alton Box Board Packaging Company is located at 1915 Wigmore Street, Jacksonville, Duval County, Florida (Figure 1). This paper industry facility uses pine wood to produce approximately 707 tons per day of Kraft pulp and linerboard. In the production process, 5 MGD of wastewater is generated which is discharged to the St. Johns River. Prior to discharge, the wastewater is treated by retention in a settling pond and by a Unox® treatment system. The wastewater is also fertilized with ammonia to promote the growth of microorganisms to aid in the degradation of wood fibers present in the wastewater. Sludges are separated from the wastewater prior to discharge. A diagram of the facility is presented in Figure 2.

This facility has, on occasion, been in violation for exceeding certain NPDES permit limitations. Additionally, the FDER Biological Section had previously performed a toxicity test on effluent from this facility, in September, 1981. The results of that test indicated that the effluent was extremely toxic to the test organism, Mysidopsis bahia, with a 48 hour LC_{50} of 15.7% (FDER 1981). Toxicity was attributed, in part, to the large concentrations of total and unionized ammonia determined in the sample at that time. However, Alton Company officials claimed that an ammonia spill ocurred the same day that the sample was collected.

To further evaluate the existence and extent of toxicity of this effluent to the biota of the receiving waters, the Biological Section performed a static acute toxicity bioassay on a grab sample, on 30 March to 1 April, 1982. The results of this latest test are presented in this report.



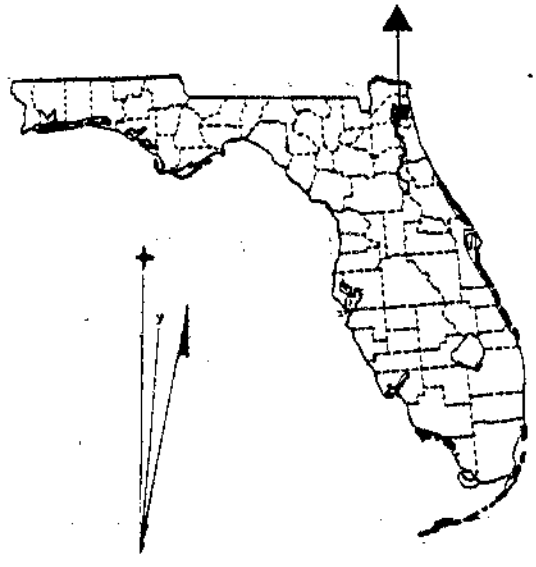


Figure 1. Portions of Jacksonville, Duval County, Florida, including study area.

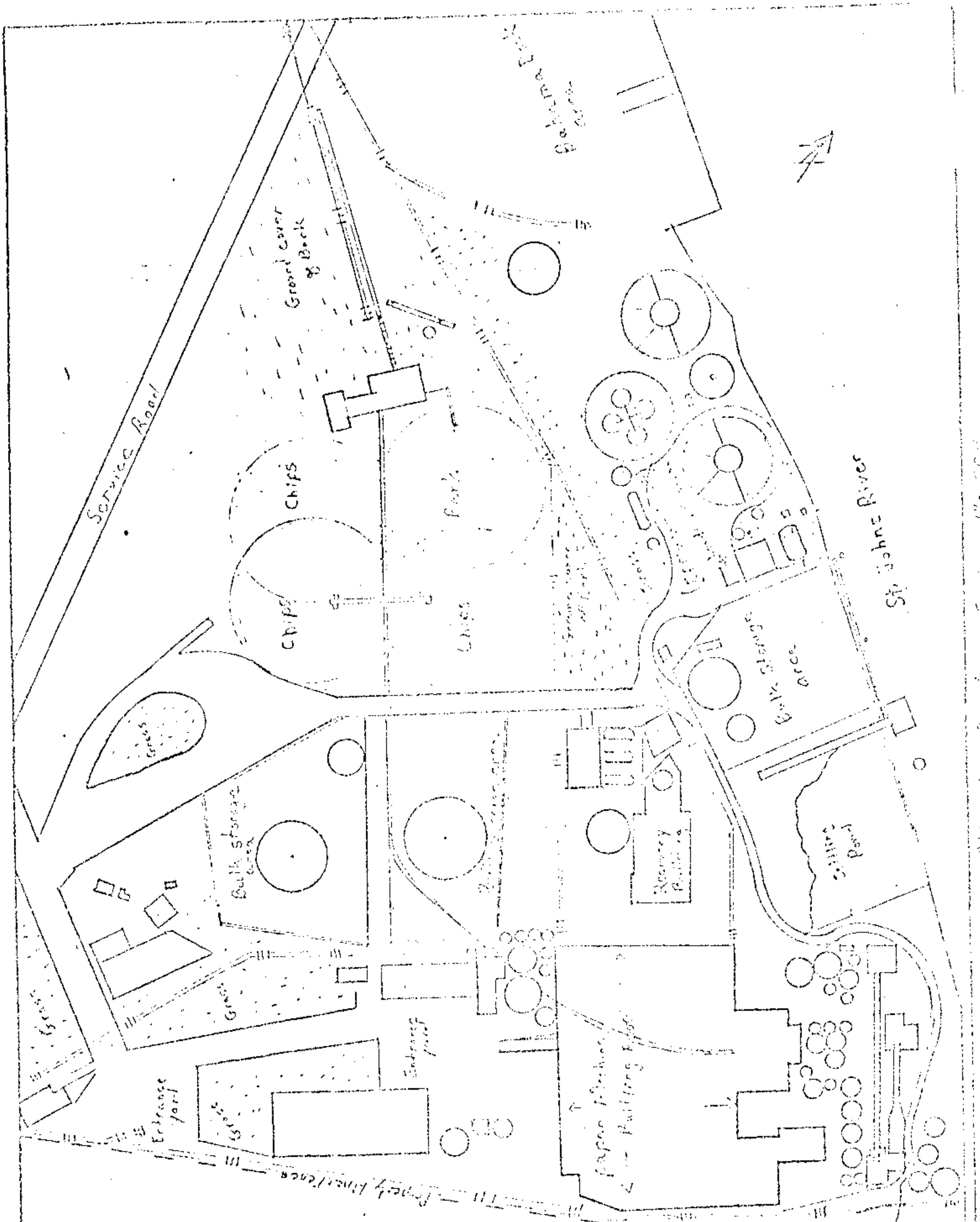

Service Road
Gravel cover & Bark
Chips
Chips
Chips
Bark
Grass
Bulk storage area
Bulk Storage area
Recovery Building
Settling Pond
St. Johns River
Entrance park
Entrance park
Grass
Grass
Paper Machine Building
Property line/fence

Figure 2.

METHODS AND MATERIALS

Test methods used to conduct this static bioassay 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/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

A 48 hour static acute toxicity bioassay was performed on a grab sample of wastewater effluent from Alton's Outfall #001. The test was performed from 1115 hours on 30 March to 1115 hours on 1 April, 1982.

The sample was collected by Mr. Jay Carver of DER's Jacksonville office at 1200 hours on 29 March, 1982 using standard wastewater sampling procedures. The sample was iced and transported to the DER laboratory in Tallahassee for analysis within 24 hours of collection.

Saltwater for dilution of the effluent sample was obtained from the FSU Marine Laboratory at Turkey Point (salinity = 26 ppt). This saltwater diluent was then adjusted to the salinity of the receiving body of water (St. Johns River = 16 ppt) by adding an appropriate amount of DER well water. For test concentrations of 56% and below, this adjusted diluent was mixed directly with the effluent, achieving a range of final salinities (8 ppt to 15 ppt). For the 100% effluent test concentration, 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 3 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: adjusted Turkey Point seawater (salinity = 16 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 = 8 ppt). 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 bioassay, a suitable number of mysids were transferred by net from the 10 ppt and 15 ppt salinity aquaria to culture dishes for observation and selection of individuals for the test. Ten to fifteen day old (three-quarter adult size) mysids were used in this test. 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 a 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 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 and 3.

Table 1. Concentration Series and Volumes Used for This Static Bioassay

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 Alton Box Board Packaging Company, Jacksonville, Duval County, Florida, NPDES #FL0000892, on 30 March to 1 April, 1982.

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	7.0	6.8	7.9	7.9	8.0	21.7	20.5	20.7				
5.6%	5	5	5	8.0	7.0	6.8	7.9	7.9	7.9						15	15
10.0%	5	5	5	7.9	7.1	6.6	7.8	7.9	7.9	21.6	20.4	20.6				
10.0%	6[a]	6	6	7.5	7.1	6.5	7.8	7.9	7.9						14.5	14
18.0%	5	5	5	7.5	6.8	6.1	7.7	7.9	7.8	21.4	20.3	20.6				
18.0%	5	5	5	7.5	6.8	6.1	7.7	7.9	7.8						13.3	12
32.0%	5	5	4(5)[b]	6.9	6.3	3.3	7.5	7.8	7.7	21.3	20.4	20.7				
32.0%	5	5	5	6.9	6.2	3.3	7.5	7.8	7.7						12	11.5
56.0%	5	5	0	5.7	7.2[d]	2.9	7.3	7.9	7.7	21.3	20.5	20.8				
56.0%	5	5	0	5.5	7.3[d]	1.6	7.3	7.9	7.7						8	8
100.0%	5	5	2	3.3[c]	7.2[d]	2.0	7.4	8.1	8.0	21.6	20.6	21.5	0/0	0/.04		
100.0%	5	5	5	3.3[c]	7.2[d]	3.4	7.5	8.1	8.2						7	7.5

Remarks:

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

[b] Number in parentheses used in calculations since one organism was cannibalized between 24 and 48 hours.

[c] These test chambers were aerated to 7.5 and 7.0 mg/1, respectively, prior to loading the organisms.

[d] These test chambers were aerated to the values shown.

Table 3. Data recorded during 48 hour, Mysidopsis bahia, static acute toxicity bioassay of Alton Box Board Packaging Company, on 30 March to 1 April, 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	5	5	7.9	7.5	7.3	7.8	7.9	8.0	21.8	21.0	21.1	0/0	0/.07		
Seawater Control	5	5	5	8.0	7.5	7.3	7.9	7.9	8.0						16	15.8
Sea Salt Control	5	5	5	8.4	8.0	7.1	8.5	8.4	8.1	21.6	20.8	21.0				
Sea Salt Control	5	5	5	8.4	8.0	7.1	8.5	8.4	8.2						7	7.5
Salinity Control	5	5	5	8.3	8.0	7.1	7.9	8.1	8.1	21.5	20.8	21.0				
Salinity Control	5	5	5	8.3	8.0	7.1	7.9	8.1	8.1						8	8

Remarks:

RESULTS AND DISCUSSION

The results of this test were inconclusive with respect to determining if effluent from the Alton Box Board Packaging Company was toxic or not toxic at the time of the test. Although a significant number of test organisms (*Mysidopsis bahia*) died by hour 48, the mortality was attributed to depleted dissolved oxygen in the test chambers. This may suggest that the effluent exerted a substantial biochemical oxygen demand during the last 24 hours of the test. This biochemical oxygen demand rapidly depleted the dissolved oxygen in unaerated test chambers, resulting in organism mortality. Test chambers with depleted dissolved oxygen levels are invalidated according to the bioassay test methods used by the Biological Section.

Ammonia was not detected at the start of the test, and only background readings were recorded at the end (Tables 2 and 3). This may suggest some change in the waste treatment system at the time of sampling.

Based on these facts, we recommend that a bioassay be repeated on effluent from this facility, with emphasis on the operation of the wastewater treatment system at the time of sampling, and on the biochemical oxygen demand potential of the effluent.

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