

BIOASSAYS OF LYKES PASCO PACKING COMPANY

PASCO COUNTY, FLORIDA

(NPDES # FL0000485)

Biological Section
Bureau of Water Analysis
April 21, 1981

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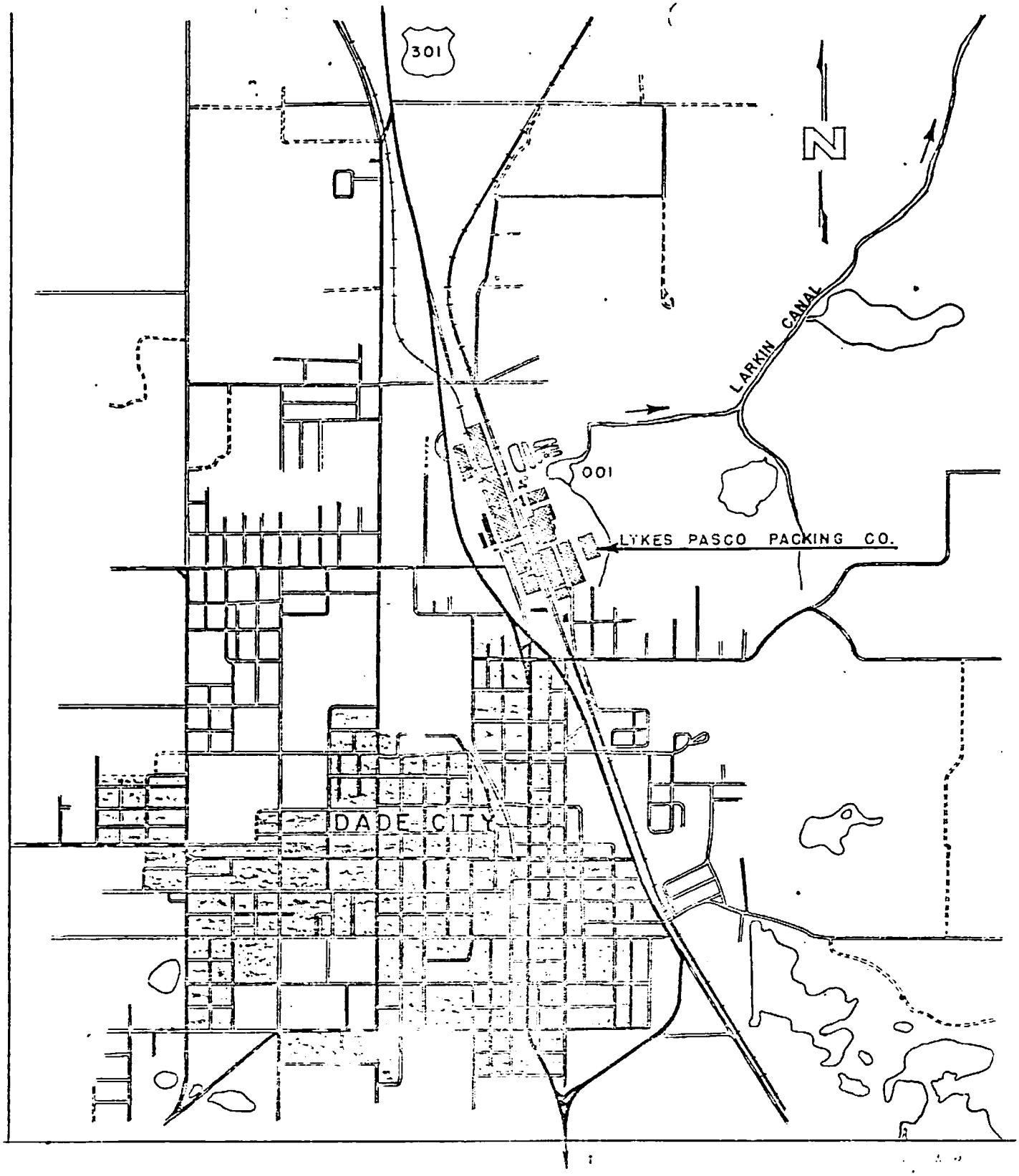
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INTRODUCTION

The Lykes Pasco Packing Company, located in Dade City, Florida, is a large manufacturer of citrus concentrate. The production rate averages 8370 tons per day, 24 hours a day, 6 or 7 days a week. Raw materials include various citrus fruits, lime, sodium hydroxide, methanol and associated citrus processing agents (KM-2, chlorine gas and direx). Treatment of the processing wastes includes retention in two aeration lagoons, one anaerobic lagoon, a mixing pond, a clarifier, a U-tube aerator and a sludge digestor. Residual sludge from the digestor is disposed of by land spreading. Wastewater is discharged through outfall #001 to Larkin Canal (man-made) which flows to the Withlacoochee River at Dobes Hole (Fig. 1).

Based upon a 1978 Compliance Inspection Report, the discharge from Lykes Pasco Company was satisfactory at that time. However, Lykes Pasco recently applied for, and was granted, an exception to allow a lower dissolved oxygen in the receiving body of water (Withlacoochee River) than Class III standards. On 10 to 12 February 1981, the Biological Section performed bioassays on a sample from Lykes Pasco Packing's effluent at Outfall #001 to determine the existence and extent of toxicity to biota of the receiving body of water. The results of these bioassays are presented in this report.



SCALE 1:24000

"LOCATION MAP"
DADE CITY QUADRANGLE
LACOOCHEE QUADRANGLE
FROM U.S. GEOLOGICAL SURVEY MAP, 1960
LYKES PASCO PACKING CO.
DADE CITY, PASCO, FLORIDA

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Figure 1. Map of Lykes Pasco Packing Company, Dade City, Pasco County, Florida, showing Outfall #001 to the Larkin Canal and eventually to the Withlacoochee River.

Test Methods

Two separate 48 hour static bioassays were conducted from 1015 hours, 10 February, 1981 to 1015 hours, 12 February, 1981, on a grab sample of effluent from Outfall # 001. The sample was collected by Ms. Janice Kroll of the DER's Southwest District at 1100 hours, 9 February, 1981, using standard wastewater sampling procedures. The sample was iced and transported to the DER laboratory in Tallahassee within 24 hours of collection.

Freshwater for dilution of the effluent sample was obtained from the same DER well that is used to culture the test organisms. The concentration series selected for this study (Table 1) is that recommended by APHA (1976).

Two replicates, each with six concentrations and a control, were used to test with Daphnia pulex and Simocephalus serrulatus. 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 and Simocephalus were siphoned into large culture dishes through nested stainless steel screens to isolate the proper size and age organisms (neonates). These neonates were then transferred individually by glass pipette and were loaded 10 per chamber, resulting in 20 per test concentration.

Dissolved oxygen, pH, temperature and the number of live organisms were recorded for each test chamber at 0 hours, 24 hours, and 48 hours. Total alkalinity, total hardness, total and unionized ammonia and conductivity were recorded at the beginning of the test for the controls and the 100% effluent concentration. These values were recorded on the data forms and are presented in Tables 2 and 3. Organisms were not fed during these tests.

METHODS AND MATERIALS

Test methods used to conduct these static bioassays are extensively described by Peltier (1978). The organisms selected for this study include species recommended by Peltier (1978) and the U.S. EPA (1978). Additionally, the Biological Section maintains cultures of several species of organisms indigenous to the State of Florida. 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 2½ gallon all glass aquaria filled with unchlorinated DER well water, using a 16:8 hour light-dark cycle. Organisms are fed a liquified blend of Purina Trout Chow® and Cerophyl® twice daily, and are kept at a constant temperature of $22^{\circ} \pm 1^{\circ}C$. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess daphnids. They are then refilled 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.

Simocephalus serrulatus (Water flea) - An indigenous breeding population of S. serrulatus was collected from Lake Jackson, Leon County, Florida, in March, 1980, by personnel from DER's Biological Section. Positive identification of the organism was performed by Mr. Jeff Foran of the Department of Environmental Engineering Sciences, University of Florida in Gainesville. The cultures are maintained in 2½ gallon all glass aquaria, filled with unchlorinated DER well water, under a 16:8 hour light-dark cycle. The organisms are fed a liquified blend of Purina Trout Chow® and Cerophyl® twice daily, and are kept at a constant temperature of $22^{\circ} \pm 1^{\circ}C$. The aquaria are cleaned weekly by siphoning off half the water along with the detritus and excess population. They are then refilled with fresh aerated well water. Additional measures are taken and/or new cultures started in the event of abnormal circumstances.

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.

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

Concentration	Dilution Water	Effluent	Total Vol.
Control	200 ml	-	200 ml
5.6%	188.8 ml	11.2 ml	200 ml
10.0%	180 ml	20 ml	200 ml
18.0%	164 ml	36 ml	200 ml
32.0%	136 ml	64 ml	200 ml
56.0%	88 ml	112 ml	200 ml
100%	-	200 ml	200 ml

Table 2. Data recorded during 48 hour, Daphnia pulex, static acute toxicity bioassay of Lykes Pasco Packing Company, Dade City, Pasco County, Florida, NPDES # FL0000485, Outfall # 001 on 10 to 12 February, 1981.

Conc. or %	Number of Live Organisms			Dissolved Oxygen (mg/ℓ)			pH			Total Alkalinity (mg/ℓ as $CaCO_3$)		Total Hardness (mg/ℓ as $CaCO_3$)		Temperature (°C)			NH_3/NH_3+NH_4 (mg/ℓ)		Conductivity (μmhos)
	0	24	48	0	24	48	0	24	48	0	48	0	48	0[a]	24	48	0	48	0
Control	10	10	10	8.7	8.7	8.2	8.0	8.2	8.2	111		116		21.1	21.2	20.5	.01/.118		
Control	10	10	10	8.6	8.7	8.2	8.0	8.2	8.2										205
5.6%	10	10	10	8.5	8.5	8.3	8.0	8.2	8.2					20.9	21.0	20.4			
5.6%	10	10	10	8.5	8.5	8.3	8.0	8.2	8.2										210
10.0%	10	10	10	8.5	8.4	8.3	8.0	8.2	8.2					20.8	20.9	20.3			
10.0%	10	10	10	8.5	8.4	8.3	8.0	8.2	8.2										215
18.0%	10	10	10	8.4	8.3	8.2	8.0	8.2	8.2					20.7	21.0	20.3			
18.0%	10	10	10	8.4	8.3	8.2	8.0	8.2	8.2										230
32.0%	10	10	10	8.3	8.2	8.1	8.1	8.2	8.2					20.5	21.1	20.3			
32.0%	10	9	9	8.3	8.2	8.1	8.1	8.2	8.2										250
56.0%	10	10	10	8.1	8.0	7.9	8.1	8.2	8.2					20.4	21.2	20.3			
56.0%	10	10	10	8.0	7.8	7.9	8.1	8.2	8.2										280
100%	10	10	10	7.5	7.5	7.3	8.1	8.1	8.2					20.2	21.2	20.3			
100%	10	9	8	7.4	7.4	7.4	8.1	8.1	8.2	160		151					.01/.095		340

Remarks: Flocculent material observed in higher test concentrations.

[a] Total ammonia is expressed as mg/l as N and unionized ammonia is expressed as mg/l as NH_3.

Table 3. Data recorded during 48 hour, Simocephalus serrulatus, static acute toxicity bioassay of Lykes Pasco Packing Company, Dade City, Pasco County, Fla., NPDES # FL0000485, Outfall # 001, on 10 to 12 February 1981.

Conc. or %	Number of Live Organisms			Dissolved Oxygen (mg/l)			pH			Total Alkalinity (mg/l as $CaCO_3$)		Total Hardness (mg/l as $CaCO_3$)		Temperature (°C)			NH_3/NH_3+NH_4 (mg/l)		Conductivity (µmhos)
	0	24	48	0	24	48	0	24	48	0	48	0	48	0	24	48	0[b]	48	0
Control	10	10	8	8.5	8.7	8.6	8.0	8.2	8.2	111		116		21.1	21.5	21.0	.01/.118		205
Control	10	10	9	8.5	8.7	8.9	8.0	8.2	8.3										
5.6%	10	10	10	8.4	8.5	8.9	8.0	8.3	8.3					20.8	21.3	20.7			210
5.6%	10	10	10	8.4	8.5	8.9	8.0	8.3	8.3										
10.0%	10	10	10	8.4	8.5	8.9	8.0	8.2	8.3					20.7	21.3	20.7			215
10.0%	10	10	8	8.4	8.4	8.9	8.0	8.2	8.3										
18.0%	10	10	9	8.3	8.3	8.9	8.0	8.2	8.3					20.7	21.3	20.7			230
18.0%	10	10	9	8.3	8.3	8.9	8.0	8.2	8.3										
32.0%	10	10	10	8.2	8.2	8.7	8.1	8.2	8.3					20.5	21.3	20.7			250
32.0%	10	10	8	8.2	8.2	8.7	8.1	8.2	8.3										
56.0%	10	10	7	8.0	8.0	8.5	8.1	8.2	8.3					20.3	21.4	20.8			280
56.0%	10	10	8	8.0	8.0	8.5	8.1	8.2	8.3										
100%	11[a]	11	1	7.3	7.4	8.0	8.1	8.1	8.2					20.3	21.6	20.9	.01/.095		340
100%	10	10	0	7.3	7.4	7.9	8.1	8.1	8.2	160		151							

Remarks: Flocculent material observed in higher test concentrations.

[a] An extra water flea was accidentally introduced into this test chamber.

[b] Total ammonia is expressed as mg/l as N and unionized ammonia is expressed as mg/l as NH_3.

RESULTS AND DISCUSSIONS

The effluent collected from Outfall #001 at the Lykes Pasco Packing Company was determined to be lethal to a number of Daphnia pulex in the highest concentration (Table 2). However, the LC_{50} value calculated for Daphnia (Table 4) is within the allowable toxicity stated in Chapter 17-3 of the Florida Administrative Code. The same effluent, however, was toxic at 48 hours to Simocephalus serrulatus (Table 3). The range of 48 hour LC_{50} values was 58.5 to 67.5% (Table 4). The 96 hour LC_{50} would therefore be $\leq$67.5%.

The cause of the observed toxicity to Simocephalus serrulatus cannot be determined at this time, especially since no chemical analyses were performed on the effluent. Results of field parameters, taken on the effluent at the time of collection, indicated nothing that would suggest possible toxicity (Table 5).

Chapter 17-3.051, Florida Administrative Code, indicates that "all waters of the State shall at all places and at all times be free from...components of discharges which...are acutely toxic." "Acute toxicity" is defined in Chapter 17-3.021(1) to mean "the presence of one or more substances...in amounts which are greater than one-third (1/3) of the amount lethal to 50% of the test organisms in 96 hours (96 hour LC_{50})...". In the absence of a mixing zone, this 1/3 of the 96 hour LC_{50} applies at the point of discharge. Chapter 17-4.244(4) states that "in no event shall the maximum concentration of wastes in the mixing zone exceed the amount lethal to 50% of the test organisms in 96 hours (96 hour LC_{50}) for a species significant to the indigenous aquatic community...". This criterion applies at the point of discharge if there is a mixing zone. The distinction between presence or absence of a mixing zone is not relevant here, however, since the testing procedure used does not involve effluent concentration. The 1/3 of the 96 hour LC_{50} criterion is three times as stringent as the 96 hour LC_{50} criterion, and therefore, in the absence of a mixing zone, the procedure used is very lenient. The procedure followed is also lenient in that testing is only done for 48 hours. The 96 hour LC_{50} derived from this testing is therefore reported as "less than or equal to" the 48 hour measurement. The value found after 48 hours can never be more restrictive than the value found after 96 hours. It must be noted that all organisms 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 4. LC_{50} Data for Bioassay of Lykes Pasco Packing Company, 10 to 12 February 1981.

Organism	Method of Data Analysis	24 hour LC_{50} and 95% confidence intervals	48 hour LC_{50} and 95% confidence intervals
Daphnia pulex	Binomial	A	A
	Moving average	A	A
	Probit	>100%, B	>100%, B
Simocephalus serrulatus	Binomial	No mortality	67.5%(56 and 100)
	Moving average		63.3%(54 and 76)
	Probit		58.5%(13 and ∞)C

A. Due to an insufficient number of dead organisms, or to the irregular distribution of mortality, an LC_{50} value cannot be calculated using the method of statistical analysis.

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

C. Due to the distribution of mortality, results using the probit method are not statistically sound.

Table 5. Field Parameters Taken on Lykes Pasco Packing Company's Effluent NPDES # FL0000385, Outfall # 001,on 9 February 1981.

Temperature:	26°C
Conductivity:	280 µmhos/cm
pH:	7.29
Dissolved Oxygen:	6.5
Total Residual Chlorine:	0 (field, Hach DPD)
Total Residual Chlorine:	0 (lab, Hach DPD)

Field Measurements by: Matthew G. McCann

Lab Measurements by: Charles Biedermann

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